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MECCANO MAGAZINE

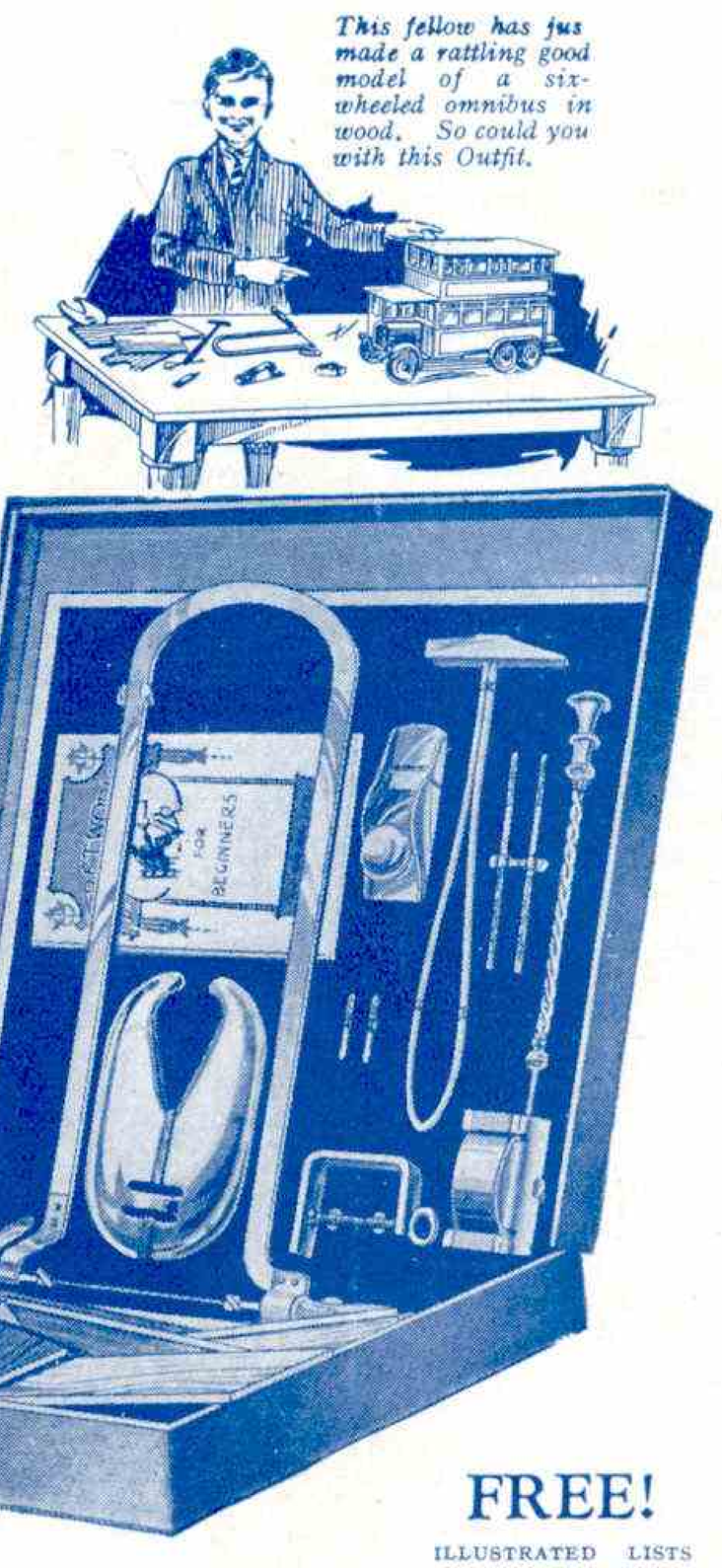


BUILDING A GREAT BRIDGE
(See page 977)

1/-

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MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool

Vol. XIII. No. 12.
December, 1928

With the Editor

Christmas Greetings to All!

Once again the time has come when I must wish you all a Merry Christmas. My greetings are necessarily some three weeks ahead of Christmas itself, and when you receive them you will be in the midst of the busy season of preparation. All your thoughts will be pleasant anticipations of the coming festivities, and I hope that your dreams of wonderful presents and a jolly time will come true.

I wish I could visit the homes of all Meccano boys on Christmas day morning in order to greet them and join in their fun. As this is impossible, I must be content to learn all about it from the enormous number of after-Christmas letters that I shall certainly receive. These will come to me from old friends in all quarters of the earth, and also from new ones who have received their first Meccano Outfit or Hornby Train Set as a Christmas present.

I feel sure that the majority of my readers will tell me that they have never had a better Christmas, and I think they will also be able to say that they have never read a better Christmas number of the "*M.M.*" This issue is a record in more ways than one. It contains 112 pages, and is thus the largest magazine that has yet appeared and it is also the greatest number in another sense, for over 91,000 copies have been printed. This figure—11,000 more than were printed a year ago and an increase of nearly 20,000 on the figures for December 1926—shows very clearly the amazing growth in the popularity of the Magazine. It is very encouraging both to myself and my staff to see that our efforts on behalf of our readers are appreciated, and that we are gaining thousands of new friends every year.

30 Tons of Magazines!

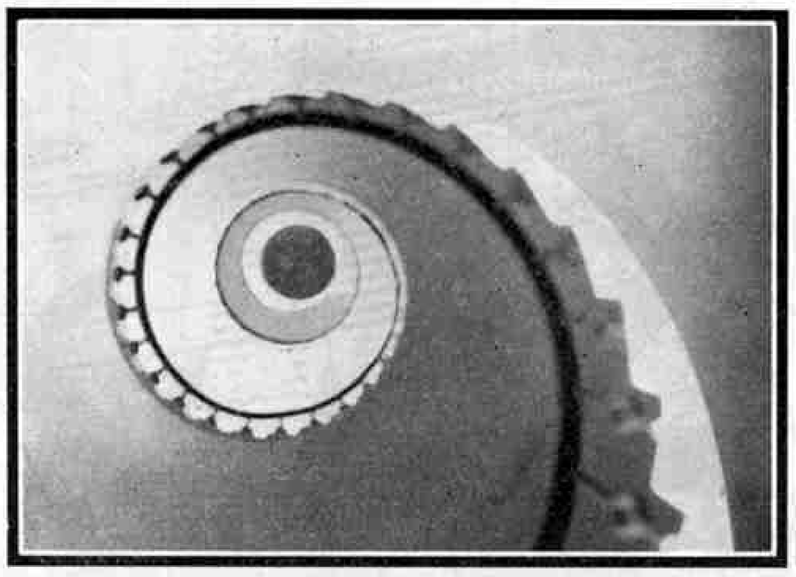
I have been trying to realise exactly what 91,000 copies of the Christmas number would look like if they were all brought together in one place, and as many of our readers are interested in comparisons I am giving them the result of my calculations. Knowing that a large amount of space would be required to store the 91,000 magazines, I imagined them all taken to Waterloo—the largest station in the British Isles—and there placed on top of each other. The pile soon reached to the roof, and it was necessary to take out some panes of glass. It then grew steadily until it was 986 ft. in height, or more than three times the height of the famous clock tower at St. Stephens that contains "*Big Ben.*" An equally well-known landmark is the cross on the dome of St. Paul's Cathedral, which is 370 ft. above the ground and is the highest point in the city of London. If three buildings, each the size of St. Paul's Cathedral, were placed on top of one another they would only exceed the height of the pile of December magazines by a little more than 100 ft.

An equally impressive idea of the proportions to which the circulation of the "*M.M.*" has grown may be obtained by supposing the pages to be spread out over Waterloo station, the area of which is 24½ acres. After all pages had been spread out there would be a sufficient number of sheets left over to cover the stations at Clapham Junction and Crewe also. Thus the paper required for printing the present issue has an area equal to that of the three largest stations in Great Britain combined. The actual printed surface amounts to no less than 145 acres, and the paper used weighs nearly 30 tons.

Besides being the largest station in Great Britain, Waterloo possesses the greatest length of platforms, of which there are 21, totalling almost three miles in length. If Magazines were placed end to end along the edges of these platforms, it would be necessary to make the line six copies deep in order to exhaust the Christmas edition. If a single layer only were laid down, there would remain enough magazines to line the platforms of Victoria, Liverpool Street and Euston, as well as Edinburgh (Waverley), and York, two provincial stations that are famous for the enormous lengths of their platforms.

If the entire issue were printed on a paper ribbon of the width of a page, its length would be no less than 1,792 miles. The gigantic strip would thus be long enough to bridge the Atlantic Ocean between Ireland and Newfoundland. If the total lines of type were printed in reading order, there would be a strip of paper long enough to go twice around the Equator. After this had been done there would remain a strip of paper of sufficient length to stretch all the way from Liverpool to the Rocky Mountains in America!

WHAT EVER IS IT?



Here is a little puzzle for you! What is this queer object? Is it the eye of some prehistoric animal or a photomicrograph of some malignant disease?

To the first reader to send an exact answer—or to the reader who gets nearest—the Editor will send an autographed copy of his book "Engineering for Boys."

Solutions should be written on postcards only, and addressed "Editor's Competition." Closing date 1st January next (Overseas 1st April).

Our Plans for 1929

The figures I have given show a remarkable advance in the number of Magazine readers, but I feel sure that next year the "*M.M.*" will be even more popular than ever. If possible, I want to pass the 100,000 mark with December 1929, and in this matter readers can help me considerably by bringing the Magazine to the notice of their friends.

As far as the coming year is concerned, I shall do my utmost to make the Magazine more attractive than ever. All the popular features will be continued, and I am planning new series of articles that promise to rival in favour those that have gone before. I have often been asked to publish articles dealing with the story of the sea, and I am glad to be able to announce that ships and shipping will figure prominently in future numbers of the "*M.M.*" In addition, I hope to publish current notes and news dealing with motoring, another subject in which readers show great interest.

In addition, I have made arrangements for the appearance of many interesting articles that will help members to make their layouts and operations as realistic as possible. These will be written by experts and are planned on such a scale that will, I hope, result in the "*M.M.*" becoming the standard publication for all model railway enthusiasts.

The Dials of Some Famous Clocks

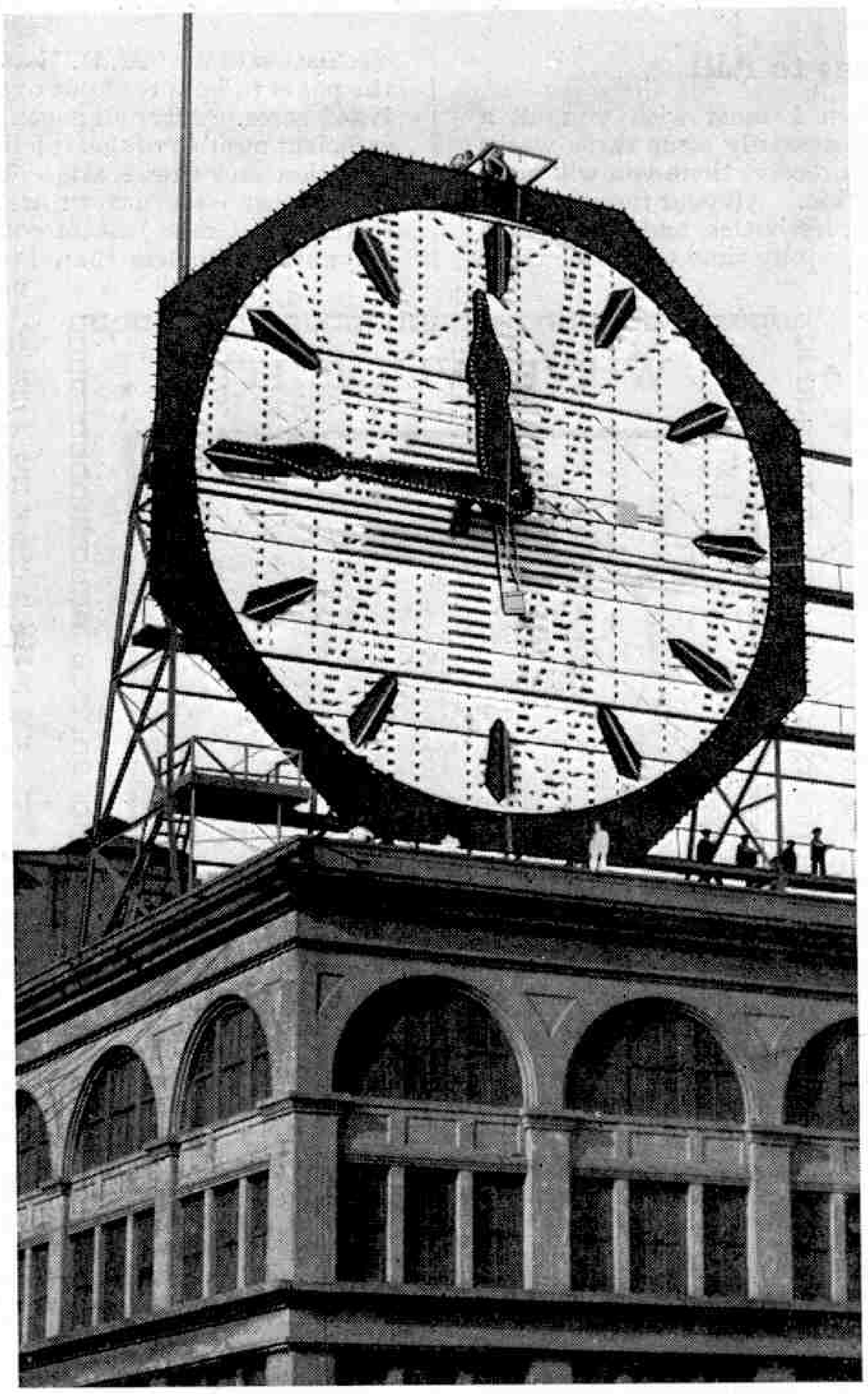
Dimensions That Deceive The Eye

DURING recent years there has been a very notable increase in the height of buildings erected for commercial, municipal or government purposes. Although this tendency has been most noticeable in the United States, it has been observable in all the great towns and cities of the world. These giant buildings have not followed any one particular style of architecture—apart from being mostly steel-framed structures—but most of them have the common feature of being surmounted by a clock, in some cases with a single dial but more often with four.

Few things are more deceptive than the apparent size of a clock of this nature. Although the observer is perfectly aware that a certain clock must be of enormous size to appear to him as large as it does, he usually fails to make sufficient allowance for the height, and if asked to guess the diameter of the dial he is probably many feet wrong. Take, for instance, the clock illustrated on this and the next page. This is erected on the roof of the Colgate factory at Jersey City, U.S.A. On a clear day the dial of this clock can be read from New York on the opposite bank of the Hudson River, and it furnishes correct time to the enormous mass of river traffic. It is obvious that the dial of such a clock must be immense, but probably few people would guess that it is 38 ft. in diameter!

The dial is made up of white enamelled steel plates, each approximately 4 in. in width and placed 2 in. apart, and surrounded by a huge octagonal framework of structural steel. The hands of the clock are constructed of seven-ply wood reinforced with steel and are of huge dimensions, the hour hand being approximately 14 ft. in length and the minute hand 20 ft. in length. The weight of the minute hand, including the counterbalance is 2,200 lb., and that of the hour hand with counterbalance is 1,275 lb. The entire weight of the movement and the hands is approximately four tons.

There is another curiously deceptive feature about most large public clocks. If the average person is asked to say whether the hours on a certain clock are indicated in ordinary figures or in Roman numerals he will probably think the matter over carefully and then decide upon one or the other. Yet it is a fact that the dials of the majority of such clocks have no figures at all!



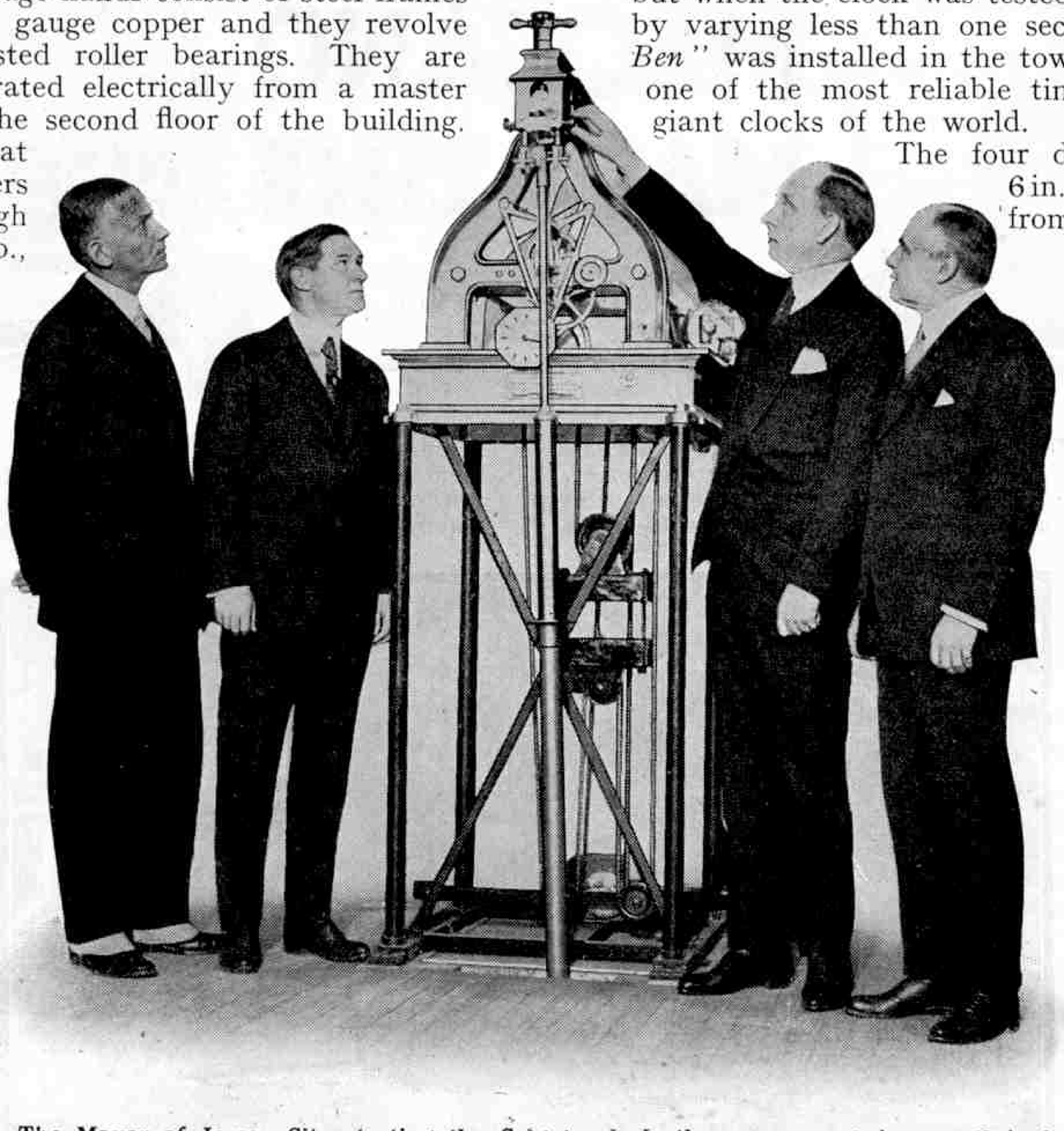
The monster clock that surmounts the Colgate Factory in Jersey City, U.S.A. The dial is visible for miles out in New York Harbour

At first sight this may appear very surprising but as a matter of fact figures are not at all necessary. Although our watches and domestic clocks have figures for the hours, we do not really read these figures when we take a quick glance to ascertain the time. We judge the time almost entirely from the relative positions of the two hands, and we have carried out this mental process so often that we are able to estimate the time just as accurately as if we took the necessary time to read the figures.

To return to the Colgate clock, the hours are indicated on the dial by large blocks shaped like arrow heads and painted black. At night the dial is illuminated by a large number of electric light bulbs placed along the inner and the outer edges of the octagonal frame and also around the edges of the hands. This illumination is so brilliant that the time can be read at a distance of over a mile from the factory.

In the case of another American giant clock, that in the tower of the Paramount Building, New York City, the hour marks on the two 26 ft. dials are shown in the form of stars each 4 ft. in height and placed 6 ft. 3 in. apart around the circumference of the dials. The minute marks are approximately 1 ft. apart. The stars representing the hours are illuminated at night by 200-watt lamps mounted at the rear and the minute marks by 50-watt lamps spaced 6 in. apart. Two automatic light switches control the lights for the hands and dials and flash the quarters and the hours from a huge lantern situated at the extreme top of the building, 450 ft. above the street level. The quarters are indicated by red flashes and the hours by white flashes.

Another interesting clock is situated high up in the Metropolitan Tower on the east side of Madison Square, New York City. This clock has four dials, each 26½ ft. in diameter. The huge hands consist of steel frames covered with heavy gauge copper and they revolve on delicately adjusted roller bearings. They are controlled and operated electrically from a master clock situated on the second floor of the building. The four chimes that announce the quarters and hours weigh 7,000 lb., 3,000 lb., 2,000 lb. and 1,500 lb. respectively, and mercifully they are automatically silenced after ten o'clock each night in order that residents in the neighbourhood may have a chance of undisturbed rest! The clock is 346 ft. above the pavement, and the bells, which are situated on the 46th floor of the building, are said to be twice as high as any other bells of similar size in the world. At night the four faces of the clock are illuminated by hundreds of electric lights and when the chimes are silenced an electric lantern 8 ft. in diameter and situated on the top of the 700 ft. tower gives out the time by flash signals.



The Mayor of Jersey City starting the Colgate clock, the ceremony being scrutinised keenly by the maker of the clock, Seth Thomas

The Tower of the City Hall at Philadelphia, U.S.A. carries a four-dial clock in which steel bars of graded width are fitted on the dials to indicate the various hours. The minute hand is 225 lb. in weight and the hour hand 175 lb. in weight. The entire clock weighs 50 tons and it is surmounted by a huge statue of William Penn, who founded the State of Pennsylvania in 1682.

The most famous clock in England, and indeed in the world, is *"Big Ben,"* the four-dial clock in the tower of the Houses of Parliament. The installation of this clock was officially authorised in 1844 and the Astronomer Royal stipulated that the clock must not vary more than one second per day. Such degrees of exactitude in a timepiece were then unknown, and the London Company of Clockmakers protested violently against the restriction, declaring that it was impossible to make any clock—far less a giant one—that would be capable of such accuracy. The Astronomer Royal stuck to his point, however, and eventually a clockmaker came forward and expressed his willingness to undertake the task. Not only did he succeed in carrying out the stipulated condition, but when the clock was tested it amazed everybody by varying less than one second per week! *"Big Ben"* was installed in the tower in 1859 and is still one of the most reliable time-keepers among the giant clocks of the world.

The four dials are each 22 ft. 6 in. in diameter and 180 ft. from the ground. They have a cast-iron framework filled with opalescent glass, and are illuminated at night. The hour hands are solid and are made of gunmetal, but the minute hands, to make them lighter, are hollow copper tubes reinforced with internal diaphragms. The hands are 9 ft. and 14 ft. in length respectively. The pendulum, which requires two seconds to complete each swing, is 13 ft. in length.

"Great George," the clock on the Royal Liver Building at Liverpool, has four dials each 25 ft. in diameter; that is to say they are 2 ft. 6 in. larger than those of *"Big Ben."* Each minute hand is 14 ft. in length and 3 ft. in width at the centre. Some idea of the enormous size of *"Great George"* may be gained from the fact that a party of 39 people lunched around one of the dials in 1910 shortly before its erection.



Another view of the clock showing its position on the roof of the immense factory

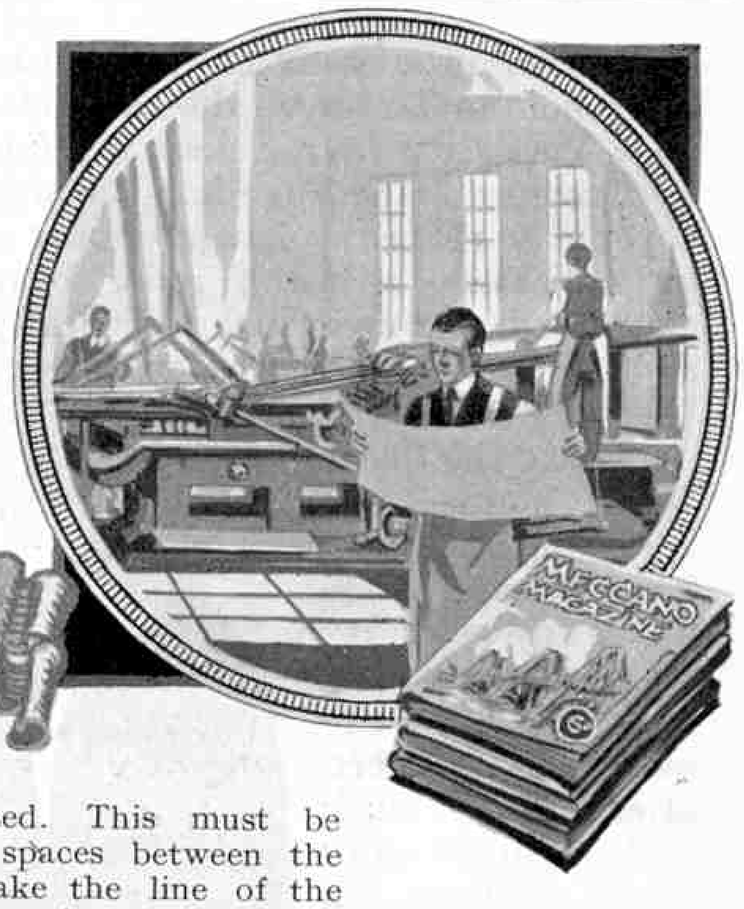
Each of the four dials of this clock is lit up at night by four powerful electric lamps. An even lighting is obtained by causing the light from the lamps to be reflected on to a white wall from which a beautifully diffused light is reflected on to the dial. Special electric mechanism is fitted for switching on these lights at a certain time at night and off again at a certain hour in the morning. This mechanism is automatic and performs its work without any attention.

The total weight of the clock mechanism is four tons, and yet it is automatically driven by a small battery without any winding or attention. The control is so perfect that the clock keeps accurate time to one second per week. The controlling transmitter is synchronised by electric current direct from Greenwich Observatory every day.



Producing the MECCANO MAGAZINE

VI.—THE MONOTYPE AT WORK



THE printer's work begins when he receives copy from the Editorial office. As we explained in an earlier article in this series, the layout accompanies it, and pulls from blocks of the illustrations have been placed in the positions that they are to occupy. The blocks required are prepared beforehand if possible, but if this cannot be done, their exact shapes and sizes are marked on the layout.

On arrival the copy is handed over to the Monotype operator, and while he is making preparations to set it up in type we may examine his machine. It is in two sections, one being a keyboard and the other a casting machine.

The Monotype keyboard has the appearance of an enlarged typewriter, for it contains banks of keys representing the letters of the alphabet, with all the usual punctuation signs and accents. The operator sits in front of it and fixes the copy in a holder on the left in order that he may read it without effort. Noting the length of line required—this is usually half-page width—he sets his machine accordingly, and commences to press the keys as if he were using a typewriter.

From this point the similarity ends, for on the Monotype keyboard the task is to punch holes in a roll of paper, and not to print through an inked ribbon, as in a typewriter. This requires more effort and therefore compressed air is used to operate the working parts, to which it is conducted by means of valves controlled by the keys. Thus when the operator presses a key, he merely opens one of the valves and the air does the rest.

The action is more deliberate than that of a typist and none of the rattle characteristic of typewriting is heard. The depression of each key is followed by a momentary pause and then the slight noise caused by the punching mechanism is heard. As the operator releases his finger from the key, the strip of paper in which the holes are punched is advanced, and the action is repeated with the succeeding characters.

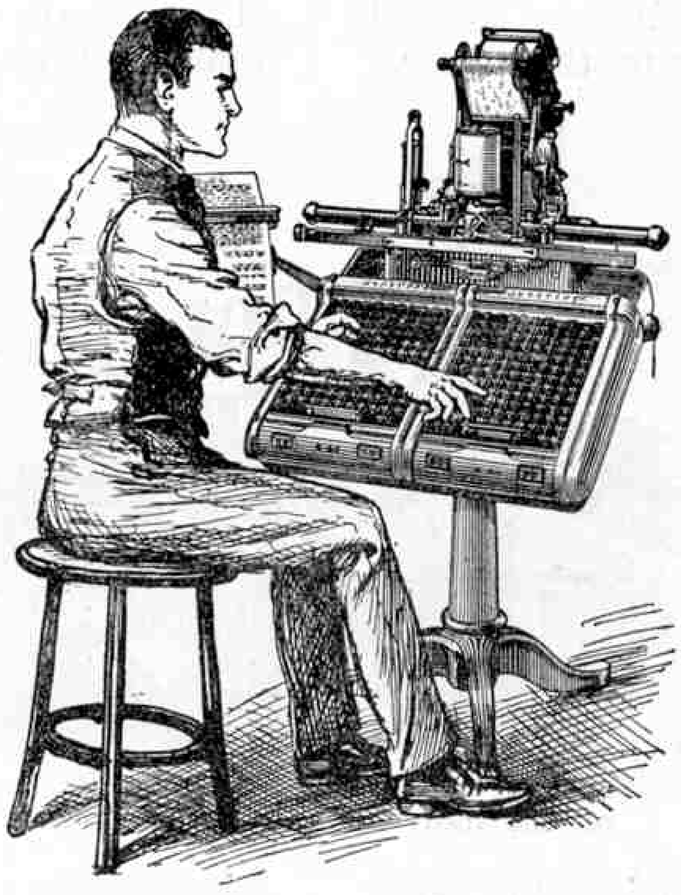
The ringing of a bell indicates when a line is almost complete. The operator continues until he has reached the end of a word or a convenient break, and then examines a counting mechanism that tells him how much space remains unused. This must be divided among the spaces between the words in order to make the line of the required length. The printer calls this "justifying" his line.



Making corrections in the formes before the final printing. This photograph and those on the opposite page were taken at the works of Stembridge & Co. Ltd., Leeds, where the "M.M." is printed

At the top of the keyboard are two rows of red keys. They represent spaces of various widths, and the operator presses those that will justify his line. The actual justification is made when the type is cast. All that happens now is that a hole is punched in the roll in such a position that the spaces cast later will be of the required width. The operator then presses a key that brings the counting mechanism back to zero and begins a new line.

After setting up a number of lines in this manner he finds that the next falls at the side of an illustration, and makes an adjustment to the keyboard that enables him to set up the shorter line now required. The setting is continued until the lower edge of the block is passed, when the length of the line must be changed once more. Thus the operator continues to work through his copy, until it is all set or the spool of paper exhausted.



At work on the Monotype Keyboard. As the keys are depressed holes are punched in the paper ribbon on top of the machine. From "Remarkable Machinery," by courtesy of the publishers, G. G. Harrap & Co. Ltd.

The roll is now removed from the keyboard in order to transfer it to the caster, and this gives us a convenient opportunity of examining it. When a portion is unwound its appearance reminds us of one of the wider perforated rolls used in player pianos. In both cases the holes are scattered over the width of the paper, but their distribution is not meaningless. The positions of the perforations in the pianola roll determine the notes that are played, and similarly the casting of the characters in the Monotype depends on the positions of the holes punched in the roll while it is on the keyboard. A further point of resemblance is that in both cases compressed air is used to operate the mechanism.

The roll is placed in a part of the mechanism of the caster known as the paper tower and operations commenced. The paper ribbon advances step by step over a hollow cylinder containing a series of holes, and on the further side of the machine newly-cast type may be seen rapidly coming out in lines. The operation is quite automatic. Type is

cast at the rate of 9,000 characters per hour and is arranged in its correct order, line by line, ready for printing.

The lower illustration on the opposite page shows two of these remarkable machines in use at the works of Stembridge & Co. Ltd., Albion Street, Leeds, where the "*Meccano Magazine*" is printed. When this photograph was taken type for the "*M.M.*" was actually being cast on both machines. The paper ribbon that controls their movements is visible on one of them. It is easy to see that the Monotype caster is very complicated and when we try to follow its action more closely we soon find that it really consists of several machines in one.



Where type is composed by hand. The sloping boxes divided into compartments are cases containing types

It embodies a casting machine that to some extent resembles those referred to last month. In it is a metal pot containing type-metal, which has been melted by gas burners that heat it to a temperature of 680°F. Since our photographs were taken, our printers have had electric heating apparatus fitted to their monotype casters. The heating is controlled by thermostat, which regulates the heat between two temperatures. When the higher one is reached the current is automatically switched off, and then when the metal cools to the lower temperature, the electric current again comes into operation. Waste of current is thus avoided. A most useful accessory, made possible by the change-over to electricity, is a time clock. This is set at one hour before the factory starting time, and immediately the metal-melting commences, so that when the operator arrives the machine is all ready for work. The clock also cuts off the supply of electricity at the end of the day, and is fully automatic in its operation. In order to make the actual casting, a pump forces the molten metal into a mould covered by a matrix. A stream of running water chills the mould immediately and the solidified type is then pushed out.

In an ordinary type-casting machine one matrix is used to produce thousands of types in succession. In the Monotype, however, the letters are cast in order of composition and thus a different matrix is required at every revolution of the machine. The changes must be made very rapidly, as the rate of casting is 150 characters per minute. The matrices required are therefore grouped together in a case, three inches square, in which there are no fewer than 225 characters. The matrix case is mounted in a carrier, and as we stand by the side of the machine we see it moving rapidly over the mould in order to bring different characters in succession over the opening.

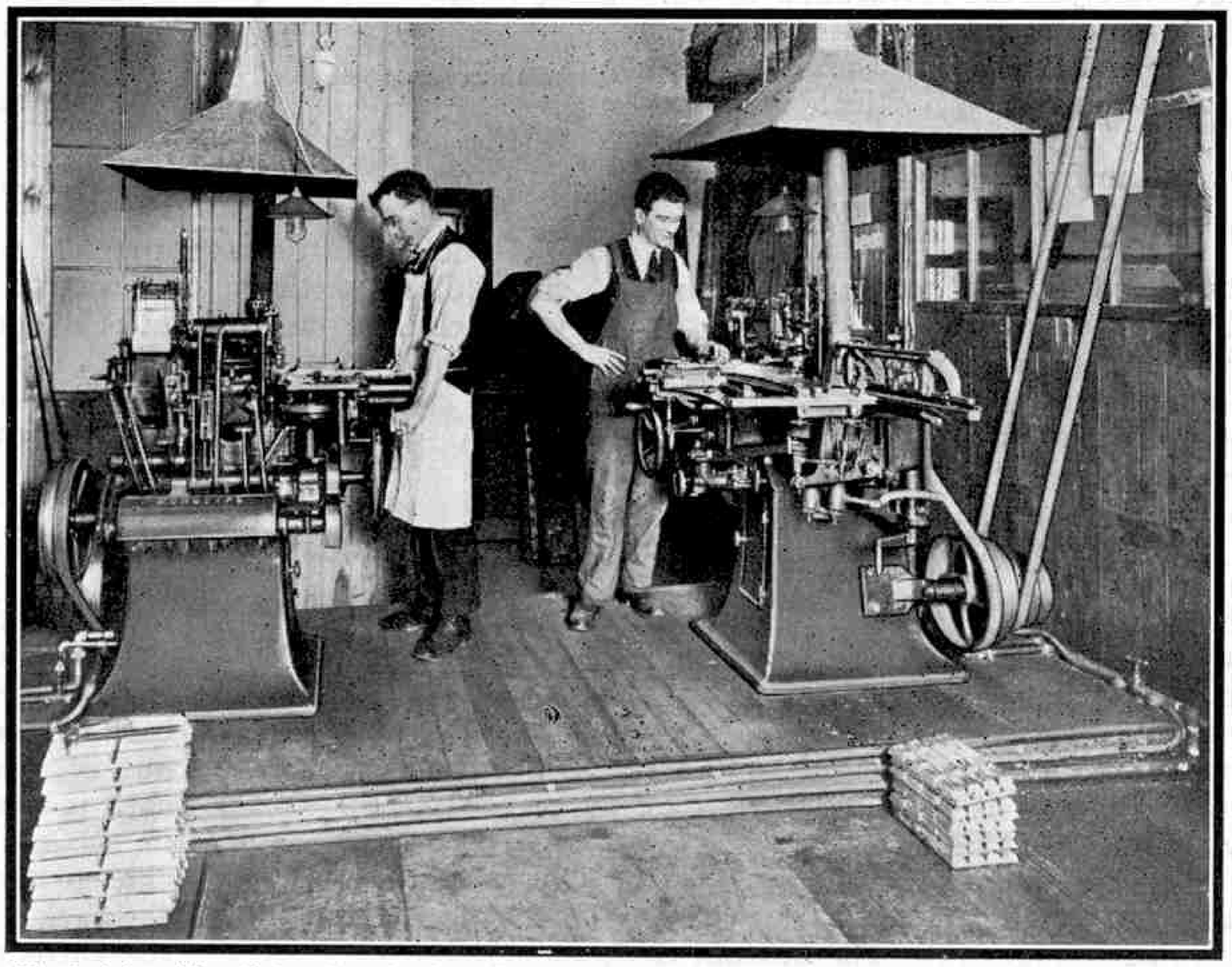
The order in which the matrices are brought to the mould is controlled by the positions of the perforations in the paper ribbon. Compressed air is liberated when a hole in the paper coincides with one on the cylinder over which it moves. This operates the mechanism that moves the matrix holder in order to bring the required character over the mould. The case is then pressed down and the molten type-metal pumped into the mould orifice.

The newly formed type is ejected into a carrying mechanism for removal to a storage channel. This continues until a line is complete, when it is automatically pushed forward to make room for the next one.

One peculiarity of the caster is that it works backwards way, the last letter of the last line coming out of the machine first. The reason for this is that when the perforated roll is transferred to the caster it unwinds from the end.

Another interesting point about this complicated machine is that it automatically adjusts the width of the mould to suit each letter. When an "i" or an "l" is being cast the width of the mould should be less than in the case of such letters as "m" or "w." Otherwise the smaller letters would appear in print with a noticeable white space around them.

Both the mould and the matrices are examples of fine precision in their manufacture. All the moving parts of the mould are most accurately fitted, so that every joint is a metal-tight fit even when under the influence of expansion caused by the heat of casting. We have already mentioned that the matrix-case contains 225 characters. This means that the matrices are about one-fifth of an inch square in section, so that we can easily understand that there are many operations needing great precision in their manufacture.



Wonderful machines that cast type for the "M.M." at the rate of 9,000 per hour. They are worked by compressed air and their movements are controlled by the perforated roll of paper seen on top of one of them

Composition on the Monotype is much speedier than hand-work. A good workman using a composing stick is able to set up 1,200 characters per hour, but a speed of 8,000 to 10,000 letters per hour may be easily maintained on the keyboard. The introduction of this remarkable machine has also improved the quality of printing, for now all work may be done from new and unused type. In addition, the printer can easily cast type of different size by changing the mould and matrix case. In printing the "*M.M.*" for instance, three sizes of type known as "10 pt.," "8 pt.," and "6 pt." are used. A different style of type of the same size as the one being cast can be produced by changing the matrix case only.

When the setting of the copy has been completed, the type required to make up each of the pages is brought together on a metal galley and the blocks of the illustrations placed in position. Except when a heading block is used.

(*Continued on page* 1033)

Puzzle Your Sharp-Eyed Friends!

Conjuring Tricks For Christmas

By Norman Hunter

BEFORE I proceed to deal with actual tricks I should like to emphasise the fact that there are two rules to be borne in mind by everyone who sets out to learn conjuring. The first rule is never to repeat the same trick before the same audience; the second is to try over even the simplest trick several times in private before showing it to an audience.

It is obviously unwise to show the same trick a second time to the same people because, knowing what is coming, they will have a very much better chance of discovering the secret than would be the case if the effect were a surprise. It is also obvious that nobody can expect to do even the simplest thing perfectly without practice. Even an apparently easy thing such as walking on to a platform to take part in a tableau needs rehearsal if you are to do it comfortably and without looking awkward.

It is a good plan to entertain your audience with a few jokes and witty sayings while you are performing tricks. This not only keeps them amused and prevents the show from falling flat, but it also serves the very useful purpose of distracting their attention at a critical moment during a trick.

Now we may proceed to our first trick. This is called:

A BAG OF TEA

This trick derives its name from the fact that tea is the principal article used by the conjuror. He uses also a small bowl or basin, which he shows empty. Then, having demonstrated that the tea is really tea, and that there is nothing in the bag but tea—which he does by pouring all the tea into the basin—he dips his fingers into the tea and pulls out half-a-dozen bright-coloured flags, which are hung on chairs and make quite an attractive show. This is a good trick with which to commence a performance because it is over fairly quickly and it gives the audience something bright to look at.

THE SECRET: The basin used is not prepared in any way, so that any fairly deep pudding basin will do. The bag that contains the tea is a stiff paper bag of the kind that grocers pack sugar in. The bottom is pushed up to form a sort of hollow under the bag, and it is in this hollow that the flags are concealed (Fig. 1).

To prepare the flags, which should be silk ones if you can get them, take each flag separately and fold it in pleats like the pleats of a concertina, making a long strip; then pleat the strip in the same way. Fold all the flags like this, put them together and wrap them in a small piece of black material, holding the corners of this material together with a small paper clip. Place this packet under the bag so that it is concealed in the pushed-up part, then fill the bag proper with tea. Care should be taken to see that the basin used is large enough to hold all the tea in the bag.





To perform the trick, have the bag and basin on a tray. Show the basin empty, then stand the bag in it while you unfasten the top of the bag and take out some tea, letting it trickle on to the tray to show that it really is tea. Now take the bag out of the basin, leaving the packet of flags hidden snugly in the basin as shown in Fig. 2. Pour the whole of the tea into the basin and throw the bag aside when empty.

You can now show the basin full of tea to the audience because the flags will be covered. Dip your hand into the tea, find the clip on the bundle of flags and release it. All you now have to do is to pull the flags out one at a time, and owing to the manner of folding them they will come out quite easily. Some of the tea will be spilled on to the tray as you do this, but that will only add to the effect of the trick.

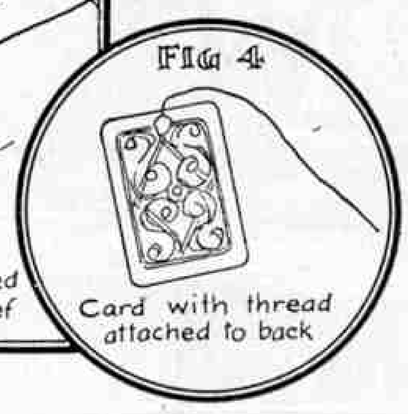
The next trick is quite different in effect. I call it:

THE INTELLIGENT CARDS

A pack of cards is thoroughly shuffled and handed to the audience with the request that three or four persons will each take one card out of the pack and keep it. The magician then places the pack in a glass and, taking the cards from the people who have chosen them, he pushes them down into the pack one at a time.

"Now," he says, "the cards that have been chosen have got to know you in the short time you have been holding them. If you will call them, they will come out of the pack to you."





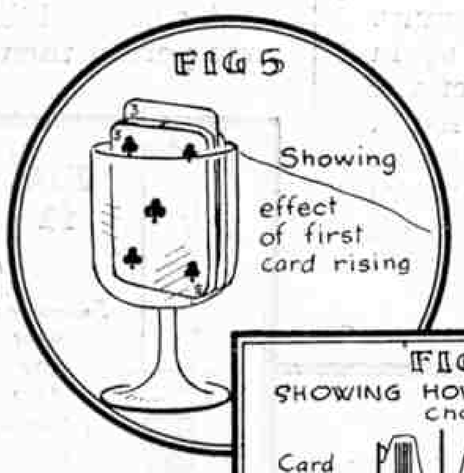
The person who chose the first card names it and the correct card is seen to rise mysteriously out of the pack. The second card is named and that appears in the same way, until all the chosen cards have risen out of the pack. The persons choosing the cards may put their initials on them if they desire, so that they may see that the actual card rises each time and not a duplicate.

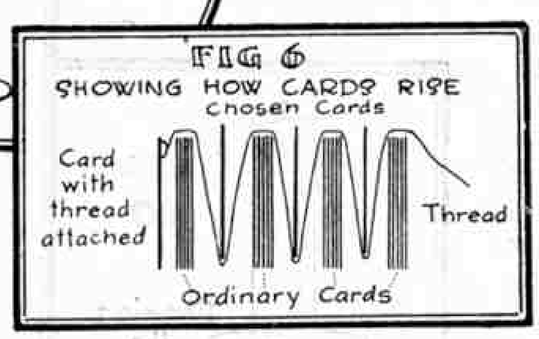
THE SECRET: You need not use playing cards for this trick. "Happy Families" cards will do just as well, or any other pack of cards, as long as all the cards are different. Take one card, it doesn't matter which, and fix the end of a length of fine black thread to one of the short sides by means of a piece of wax on the back of the card (Fig. 4). Lay this card face down on your table and place a crumpled up handkerchief over the card (Fig. 3).

Lead the free end of the thread behind a screen or to some convenient place where your assistant can be concealed. If you are performing alone, tie a bent pin to the free end of the thread and stick it in the tablecloth at the back.

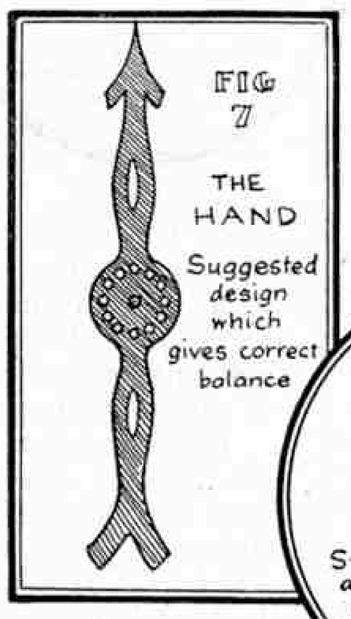
When the cards have been chosen, take back the pack and return to your table. Pick up the handkerchief with one hand and place the pack face down on top of the card with the thread attached. The audience of course know nothing of this card or the thread.

Now pick up the glass, which must be large enough to hold the pack comfortably, and wipe it out with the handkerchief to show that there is nothing concealed in it. Pick up the pack with the threaded card on the bottom and drop it into the glass so that the face of the threaded card is towards the audience, the thread running from front to back across the top of the cards.





Ask the *last* person to choose a card to give it to you, and push it down into the pack so that it takes some of the thread down with it. Now ask the second person for his or her card and push that into the pack just behind the first one, leaving a few cards between them. This second card takes more thread in with it, and you must keep a finger on the first card to prevent it being pushed up when you push the second card in. Finally take the *first* card chosen and push that in behind the others in the same manner. You can have more than three cards chosen if you like, but remember to take them back in the reverse order to that in which they were selected, because the first card put into the pack now will be the last to rise when the thread is pulled.



Ask the chooser of the first card to name it (see Fig. 5). This is the signal for your assistant to pull the thread. If you have no assistant you get the bent pin from the tablecloth while you are pushing down the last card and fix it in your trouser-leg on the side furthest from the audience. You can then pull the thread by drawing your leg back slightly. The exact length of the thread required must be determined by experiment beforehand.

Fig. 6 shows how the thread causes the cards to rise one at a time as they are called for. After the last card has risen and been handed out for identification, the cards may be poured out of the glass in a heap to show that they are not prepared in any way.

Do not omit to make mysterious passes towards the glass as the cards rise!

THE TIME TELLER

"I have a very convenient clock here," announces the conjuror next. "It doesn't just tell the time, it tells whatever time you ask it to. Very useful when you get up late!"

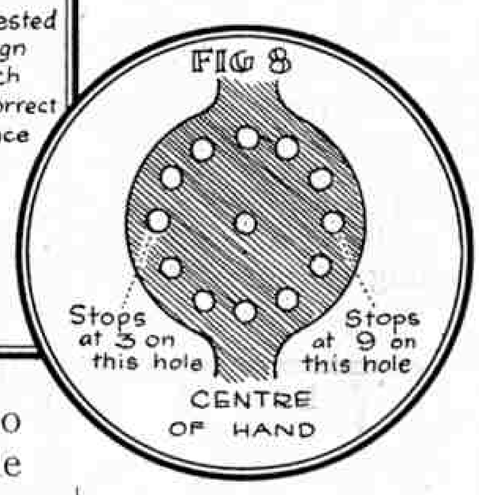
The clock proves to be nothing more than a piece of cardboard or thin wood with the figures painted round the edge. There is a headless nail in the centre, and on this nail the conjuror places an ornamental wooden hand.

The audience are asked to name any hour they like. The hand is then set spinning round and it always stops exactly at the hour named. The clock face and hand may be thoroughly examined both before and after the trick and, if you wish, a member of the audience can hold the clock while the hand is spinning.

THE SECRET: The clock face is nothing more than it appears to be—just a square or disc of cardboard or thin wood having the 12 hours painted round the edge. A headless nail is driven into the exact centre and this nail is made to point very slightly upwards, that is towards the number 12, so that when the hand is spun it will not run off the nail (see Fig. 9). A loop of cord is provided at the top of the clock dial to hold it by.

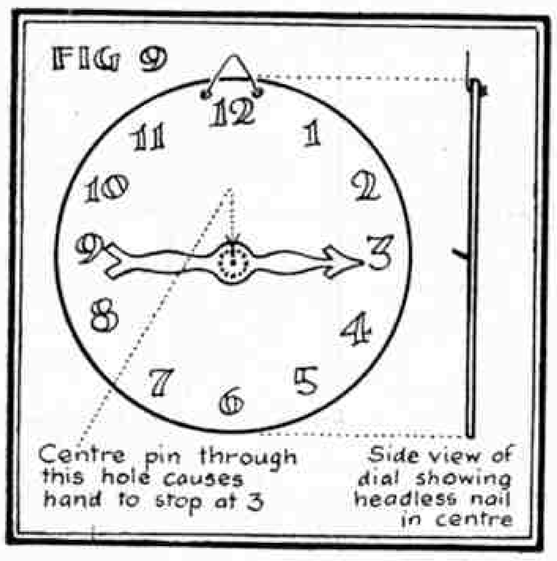
The hand is not so innocent, although its secret is so well hidden that it is almost impossible to detect it. Cut a fancy hand, similar to that shown in Fig. 7, from thin wood, and drill a hole in the exact centre. Now drill 12 other holes at equal distances apart round this central hole, as shown in Fig. 8. It is best to make the hand before you paint the numbers on the dial, as will be seen later.

Now if the hand is placed with the centre hole on the nail and spun, it may stop anywhere, so that in this condition the clock can be freely handed for inspection. If the hand is put on with the nail through one of the side holes, however, the hand will stop at the corresponding hour on the clock face, except that the order will be reversed. Thus, if the hole in the position of 1 on the hand is used, the hand will stop at 11 on the dial; if the hole in the position of 9 is used, the hand will stop at 3 on the dial (Fig. 9). The holes at 12 and 6 positions will cause the hand to stop at those exact figures on the dial.



It is possible that the holes drilled in the hand may not all be exactly the same distance apart, so make the hand first, then spin it on the dial in one hole after another, marking the positions at which it stops. The figures can then be painted on the dial in these positions and you will thus make certain of the hand stopping at the right position.

When performing the trick, spin the hand and let it stop once or twice while it is on the middle hole, so that the audience may be convinced that it stops anywhere by chance. Now remove the hand and ask someone to name an hour. Replace the hand on the corresponding hole as already described, spin it, and it will stop at the right figure.



THROUGH THE TABLE

This is a very simple little trick that needs only two pennies and an ordinary table for its performance. It will be found very mysterious when neatly executed.

Two pennies are placed side by side on top of the table and the conjuror sits behind the table. He takes a penny in each hand and places one hand under the table. He then strikes the other hand on the centre of the table and the penny in that hand apparently passes right through the table top, for it is heard to clink against the other

penny in the hand underneath. The hand on the table is at once shown empty, and the same two pennies, which may be marked for identification, are found in the hand under the table.

THE SECRET: Sit down behind the table and place the pennies side by side. Pick up one in each hand by drawing the penny off the edge of the table, a perfectly natural way to pick up a penny. Show the pennies one in each hand, put them on the table again and then pick them up once more. This is done just to get the audience used to the idea of a penny being taken in each hand.

The second time you pick up the pennies you actually do pick up one penny with the right hand, but the other penny is drawn off the edge of the table and, instead of being picked up by the left hand, is allowed to fall on your lap, the fingers of the left hand being closed as if the penny were there.

Place the empty, closed left hand on the middle of the table, at the same time quietly picking up the penny from your lap with the right hand. Hold the right hand under the table. Rap the table sharply with the left hand and open it at once, showing that the penny has gone. At the same moment allow the penny that you have just picked up to drop against the one that is already in your right hand. The illusion is perfect; it seems exactly as if one passed through the table!

THE CRAZY CANDLE

A plain white candle is seen burning in a candlestick. The conjuror blows out the flame and covers the candle with a large handkerchief. When he removes the handkerchief the plain white candle has changed to a bright red twisted candle, which is again lighted to show that it is really a genuine candle.

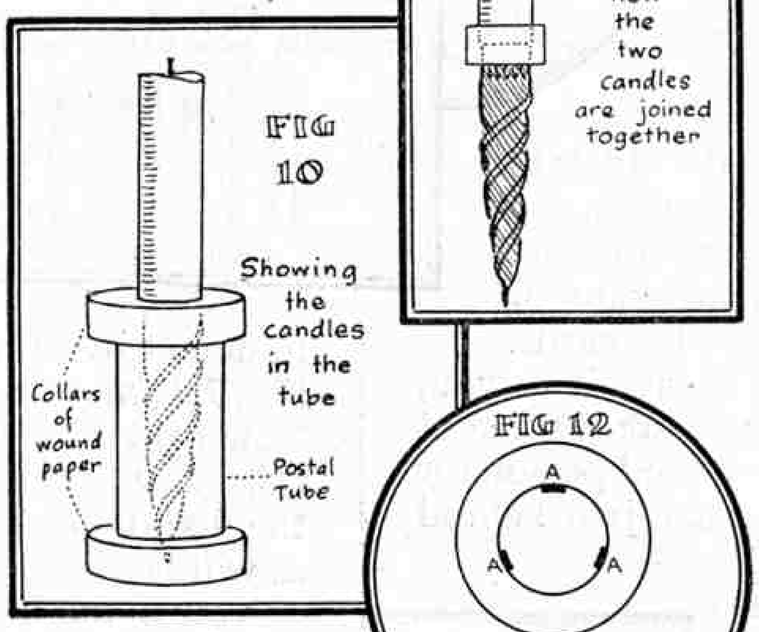
THE SECRET: If you will study Figs. 10 and 11 you will see that two candles are used, both of them ordinary in themselves, and a candlestick of rather unusual construction.

The easiest way to make the candlestick is to get a length of cardboard postal tube. The tube should be an inch or so longer than the candles, both the candles being the same length. Next paste a long strip of paper round each end of the tube, winding the paper round and pasting it down until you have a sort of collar round each end of the tube. Now enamel the whole affair in colours or paint it with gold paint. This candlestick will look exactly the same whichever way up you stand it. This is an important point.

The next thing to do is to make a tube by rolling up and pasting a strip of brown paper. This tube should be two inches in length and it must be just the right size to slide easily, but not loosely, up and down inside the candlestick. Fix a plain white candle into one end of the tube and a twisted red candle into the other end, as shown in Fig. 11. Now place the tube inside the hollow candlestick and glue little pieces of card inside the candlestick top and bottom, as shown at A in Fig. 12. These will prevent the tube from coming out again.

It will now be clear that, stood on the table one way up, the candlestick contains a white candle. If you turn it upside down the white candle will be pushed inside the candlestick and the red one will appear in its place. The candlestick, you will remember, looks the same either way up, so that nobody knows you have turned it over.

To perform the trick, have the candle standing on the table with the white candle showing. Light the candle and blow it out again. Pick up a big coloured handkerchief and spread it over your left hand. Pick up the candlestick, placing one finger underneath to prevent the candle falling through. Now as you bring the handkerchief in front of the candle remove your finger and allow the white candle to drop down, when the red candle will appear at the other end. Put your finger on top and turn the candlestick right over. The red candle is now visible, and your finger prevents the white one from falling out. It is a matter of a second or so to do this, and the handkerchief is thrown over the candlestick as you complete the move so that as soon as you take away the handkerchief again the red candle is seen. Fig. 13 and 14 will make everything clear.





MAGICAL MATHEMATICS

This trick is much more interesting than the name sounds. It begins with the performer bringing forward a bag half full of pennies or large counters. He tips the coins or counters out of the bag and turns the bag inside out several times to show that nothing is hidden in it. The counters are then poured back into the bag, the magician dips his hand in and takes out a handful, which he gives to a member of the audience, asking him to hold the counters in his hand and not to let anyone see or touch them until the end of the trick.

A small scribbling pad is then brought into use and, going first to one person then another, the conjuror asks each of them to write down a number under 10. Another person is then asked to add up the numbers and announce the total. We will suppose the answer to be 15. The person holding the counters is now asked to count them, and to the surprise of everyone there are exactly 15 counters there.

THE SECRET: This trick will puzzle even those who know something of the ways of conjurors, for it seems impossible for the conjuror to know what the total of the numbers written down by the audience will be. However, he does know that total, or at least he knows what total will be read out, which is near enough for his purpose. This is how he manages it.

The scribbling pad has no back; it is simply paper both sides so that both look alike. On one side the conjuror has already written down three or four numbers which, when added together, will make 15. The other side is blank.

When the pad is held for different people to write down their figures, the conjuror is careful to hold it low down so that nobody can catch a glimpse of the figures written on the other side. After three or four people have written down their numbers the performer goes to someone sitting a good way from those who have written the figures, so that they cannot look over his shoulder and discover that the figures he is adding up are not the figures they wrote. On the way the conjuror secretly turns the scribbling pad over, and it is therefore his own figures, amounting to 15, that the volunteer assistant adds up. As soon as the addition is complete the magician asks his helper to read it out; then he takes the pad away and lays it aside, so that no inquiring person shall get a look at it.

It is important to remember that, in writing down the numbers on the reverse side of the pad, the conjuror should alter his figures so that the three or four numbers look as if they have been written by different people. The reason for asking for numbers under 10 is obvious. If more than about 20 coins were needed they could not be held in one hand, and besides this the simple expedient of asking for numbers under 10 ensures that everyone will write a single figure, and nobody can write a bigger number than the performer's predetermined total—a catastrophe that would spoil the trick.

Now for the way in which the conjuror manages to take out exactly 15 counters from the bag. The bag is unprepared and should be made of some soft material. It is half full of counters, and in the hand that holds the bag the conjuror has a packet of 15 counters concealed. It will be found an easy matter to hold these counters in the hand while tipping the others from the bag because the bag itself covers the hand most of the time. The bag can then be turned inside out several times, the hand holding the counters keeping hold of the mouth while the other hand pulls the bag in and out. Finally the bag is put right way out and the counters are poured in again from the plate on which they were emptied.

The conjuror now holds the bag at the mouth with both hands. Then, retaining hold of it with his empty hand, he plunges the other hand into the bag, rattles the counters about and brings up his closed hand, still containing the 15 counters. These counters are placed in the hands of a member of the audience as already described, and the trick proceeds.

If the conjuror has rather small hands and doubts his ability to conceal 15 pennies or large counters in one hand, he should use smaller counters. It is not wise to use too small a number, in fact the higher it is, as long as it is not above 40, the better. If a very small number is chosen, and everyone writes down an eight or a nine, the sum of their figures will be so much greater that the last person to write a number may be sufficiently wide awake to notice the difference. This would completely ruin a very effective trick.

How the Quebec Bridge was Built

One of the World's Greatest Engineering Feats

THERE is a peculiar fascination attached to engineering work on a huge scale. We feel interested in a structure of medium size, but when we look upon one of gigantic dimensions the interest is intensified enormously and, in addition, we experience a feeling of something like awe as the gigantic size of the structure impresses itself upon us.

This is particularly the case with the huge bridges that stretch themselves across great expanses of water and settle their feet on the land at each side as though they were holding the two shores together in a relentless grip. Among such bridges a foremost place must be given to the giant structure that crosses the St. Lawrence at Quebec. Not only does this mighty bridge impress us by the fact that it is the largest cantilever bridge in the world, but also it has a history of tragedy on the one hand and rugged determination on the other that makes it unique even among the wonderful bridges of modern times.

The charter authorising the construction of the Quebec Bridge was obtained from the Dominion Parliament in 1882, but no definite action was taken until 1887, in which year the Quebec Bridge and Railway Company was incorporated. Tenders for a cantilever bridge were invited and the contract was awarded in 1899, to the Phœnix Bridge Company.

According to the contract the bridge was to have a total length of 3,239 ft., including two anchor arms each 500 ft. in length, two cantilever spans of 562 ft. each, and a central suspended span of 675 ft. It was to be provided with a single deck 150 ft. in width, and this was to accommodate a road, two pavements and two tramway and two railway tracks. At the place selected for building the bridge the river is nearly 2,000 ft. in width, 200 ft. in depth, and flows between banks 200 ft. in height.

In due course operations were commenced. The working season extended from about the end of April until the early part of December, operations during the remaining months being at a standstill owing to the river being frozen over. By the summer of 1907 the south anchor arm and about one third of its cantilever span had been erected, the whole extending over the river for some 200 ft.

So far all had gone well, but on 29th August of that year came swift and terrible disaster. Shortly before work was due to cease for the day the compression chords of the south anchor arm suddenly crumpled up. The entire cantilever rocked violently, and with a fearful crash collapsed upon its pier, carrying with it the 86 men who had been at work upon the erection at the time. Only 11 men were rescued.

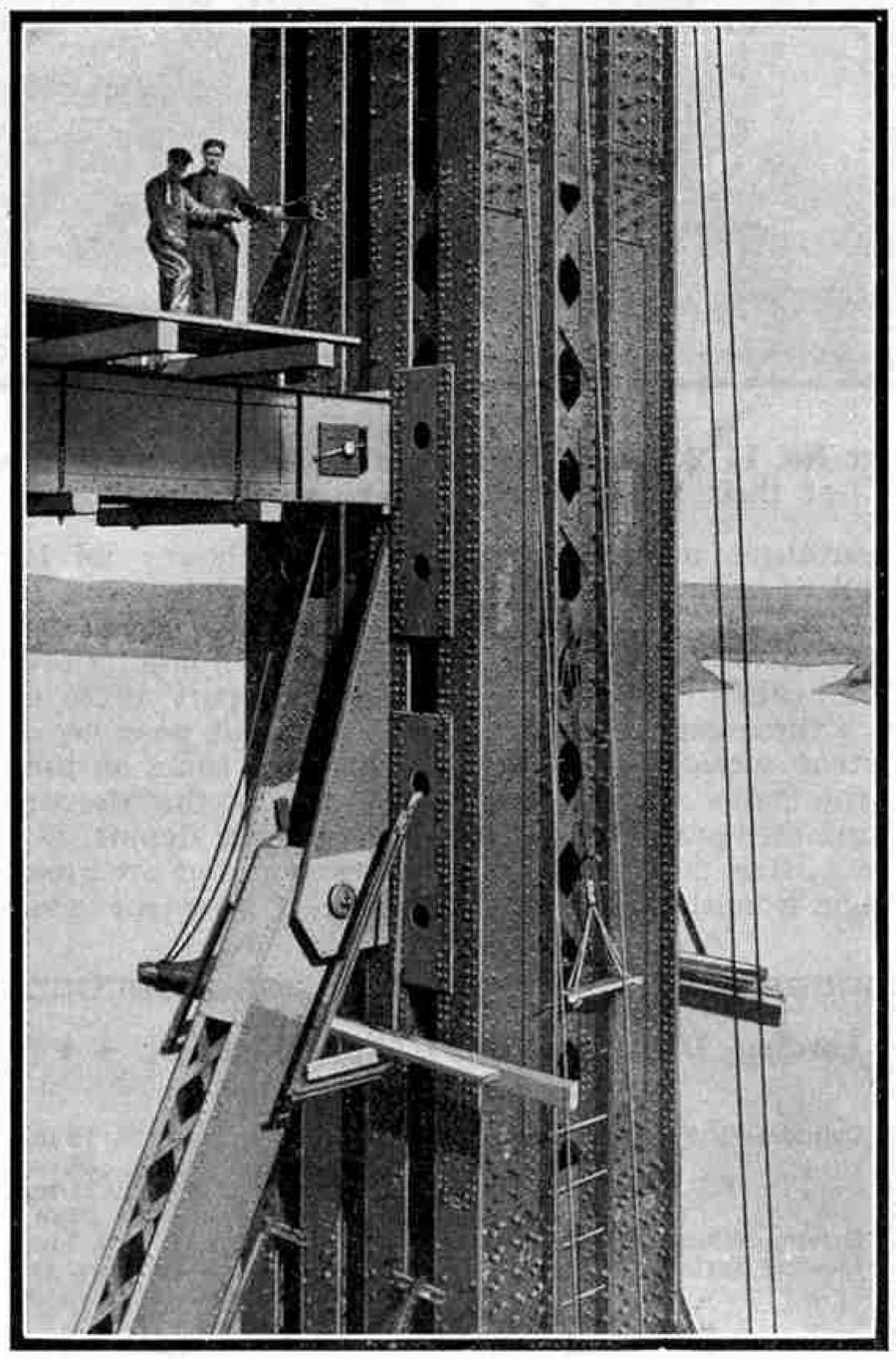
This terrible catastrophe cast a gloom over the country and created utter consternation among bridge-building engineers. A searching inquiry into the cause of the disaster was instituted at once by the Government, and a Royal Commission was appointed to examine the wreckage. In their report the Commission expressed the opinion that the accident had been due to errors in the design and building of the bridge, attributable mainly to lack of practical knowledge of how to plan and prepare for a structure on such a huge scale.

The Canadian Government now took the matter in hand and a Technical Board was appointed to design a new cantilever bridge. Tenders were then invited and that submitted by the St. Lawrence Bridge Company was accepted. This tender was for a steel cantilever bridge estimated to cost £1,750,000. It was to have an overall length of 3,239 ft., comprising two approach spans 140 ft. and 269 ft. in length respectively, two anchor arms each 515 ft. in length, two cantilever arms each 580 ft. in length and a central span of 640 ft. The side walks were to be 5 ft. in width and the two railway tracks were placed 32½ ft. apart.

The two piers erected by the Phœnix Bridge Company had to be demolished and new ones, differently situated, erected. When the wreckage of the old bridge had been disposed of and the new piers built the bridge began to take shape. Month by month the mass of steelwork rose higher and higher, and gradually projected farther out over the river.

By the close of the 1913 season the approach arm of the north cantilever was completed, and when operations were resumed in the spring of 1914, work was immediately commenced on building up the anchor arm and cantilever. The early part of the 1915 season saw this work finished, and the north cantilever span was then built up. At the south side of the river construction was not so far advanced, but by the close of the 1915 season the south anchor arm was completed. Some idea of the progress made during that period may be obtained from the fact that 1,823 tons of steel were set in position on the south anchor arm in one week. The record for a single day's work was 670 tons. The south cantilever was completed by the beginning of September, 1916.

While this work was in progress the huge centre span for linking up the two cantilevers was being built at Sillery Cove, about 3½ miles downstream from the site of the bridge. When the bridge cantilevers were ready to receive this span it was conveyed by pontoons and tugs to the bridge site. The span was brought to a standstill directly beneath the gap between the two cantilevers and, by means of steel ropes, was secured to two cantilever mooring frames.



Connecting up one of the web members of the Quebec Bridge. This photograph gives an excellent idea of the immense thickness of the upright girders

The span had been raised about 32 ft. when suddenly at the south end there was a loud report followed by the sound of ripping metal and, almost before anyone realised what had happened, the great span had partially twisted over and the south-west corner was in contact with the river. With an appalling rumble and splash the structure then lurched downward and disappeared into the river, bearing with it 90 men who had been engaged upon it in the hoisting operations. Of these men 81, including the chief engineer, were saved.

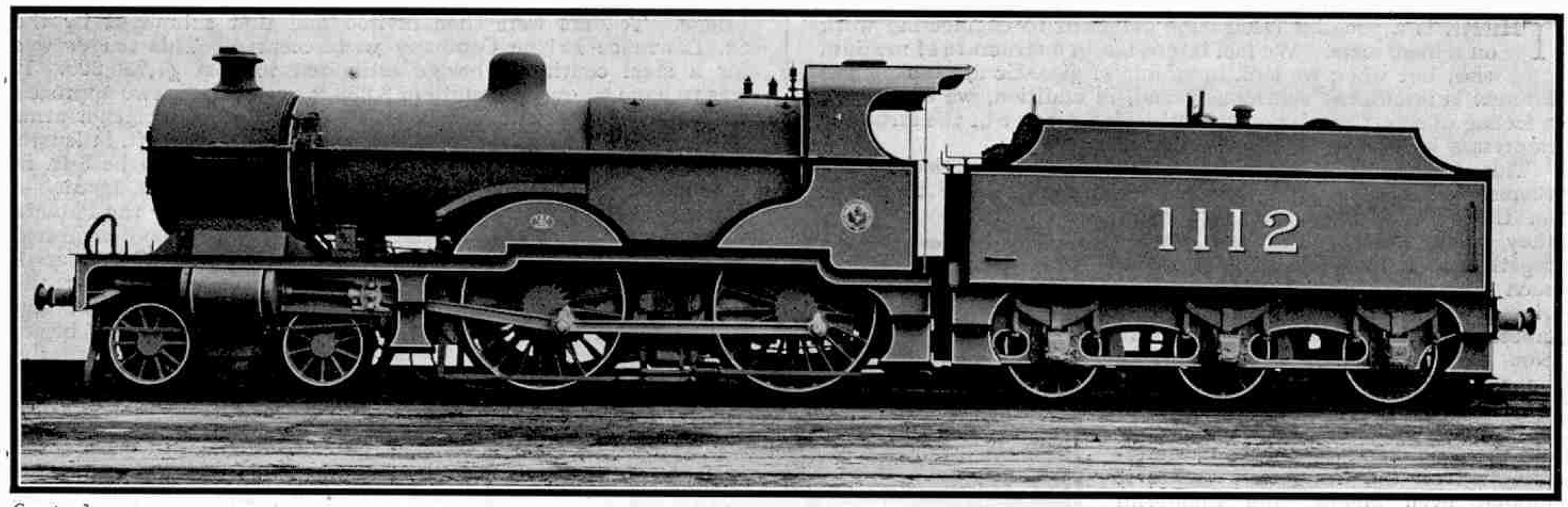
Although the engineers were greatly dismayed by this fresh disaster, they were not defeated, and another centre span was built. On 17th September, 1917, pontoons and tugs conveyed it to the site, where it was in due course safely hoisted into position. One month later the first train passed safely over the bridge and on 3rd December, 1917, the structure was completed.

The thrilling story of this great engineering feat is related in full in the "*Meccano Book of Engineering*" and illustrated by a unique series of photographs. In addition, the book contains fascinating accounts of many other triumphs of the engineer, and gives a striking picture of the world of the future that shows how greatly civilisation will benefit from his work.

FAMOUS TRAINS: XXIII.

The "Twenty Fives," L.M.S. Rly.

By Cecil J. Allen, M.Inst.T., etc.



Courtesy] [*L.M.S.*

L.M.S. Standard Compound 4–4–0 locomotive No. 1112. Considerable numbers of these locomotives have been built recently by the L.M.S. at their Derby Works and by outside builders

SUCH a title as this, if announced two or three months ago, would, I fancy, have aroused no small speculation among railwayist readers of the "*M.M.*" as to what particular trains could be referred to. It was suggested to me by the name of a booklet recently published by the L.M.S., called "The Track of the 25's," describing the route over which these expresses run. I will relieve your curiosity to some extent straightaway by explaining that "25" refers to minutes; the trains about to be described leave their terminal station at 25 minutes past the hour.

"Systematic" timetables are no novelty. Their purpose is to relieve as far as possible the intending passenger from the trouble of consulting timetables by giving him a train service at exactly even intervals. On a suburban route, and especially a route without many branches, this is a comparatively simple matter, but on a main line it is not so easy. Connections and through carriages, the necessity of giving better services to some intermediate towns than to others (involving more stops in some schedules than in others), freight train movements, and many other factors, all tend to upset systematic working.

One of the oldest systematic train services in existence in this country is that connecting Liverpool and Manchester on the Cheshire Lines. For many years an express has been provided over this route in both directions at even hourly intervals, leaving the two extremities at half-past each hour and taking 45 minutes on the journey. In more recent years other railways have extended the practice to long-distance main line services. First of all the London and South Western Railway tried it, expresses being arranged to leave Waterloo for the West Country at the even hours; for Southampton and Bournemouth at the half-hours, and for Portsmouth at 10 minutes to the hour. Since the Southern group has been formed, similar arrangements have been made on the Central and Eastern Divisions, with trains from Victoria to Brighton at 35 minutes past the hour; from Charing Cross to Folkestone and Dover at a quarter past, and so on.

Then the Great Western followed suit, establishing what is in some respects the most completely systematic timetable of all the groups, seeing that departures from many important towns for London are as systematically arranged as those out of Paddington. For the West of England you leave London at 30 minutes past the hour; for Birmingham and the North at 10 past; for South Wales at five minutes to, and for the West Midlands at a quarter to. Similarly you leave Birmingham for Paddington at the even hours; Cardiff and Bristol at a quarter past the hour, and Newport at 35 minutes past, with certain exceptions.

It is not possible, of course, to make all these expresses take the same times on their journeys, as some make more stops than others; so that the arrivals are not as systematic as the departures. Systematic departure times are the more important of the two, however, and are greatly appreciated by business men and others making frequent use of the trains.

Leading Dimensions of L.M.S. 3-Cylinder 4–4–0 Compounds. (Latest Series).

Cylinders H.P. (1), Diameter	19 in.
,, Stroke	26 in.
,, L.P. (2), Diameter	21 in.
,, Stroke	26 in.
Driving Wheels, Diameter	6 ft. 9 in.
Heating Surface, Tubes	1,170 sq. ft.
,, ,, Firebox	147 ,,
,, ,, Superheater	291 ,,
,, ,, Total	1,608 ,,
Firegrate Area	28.4 ,,
Working Steam Pressure	200 lb. per sq. in.
Tractive Effort (at 85% working pressure)	24,065 lb.
Water Capacity of Tender	3,500 gals.
Coal ,, ,,	5½ tons
Weight of Engine and Tender (in working order)	104 tons 8 cwts.

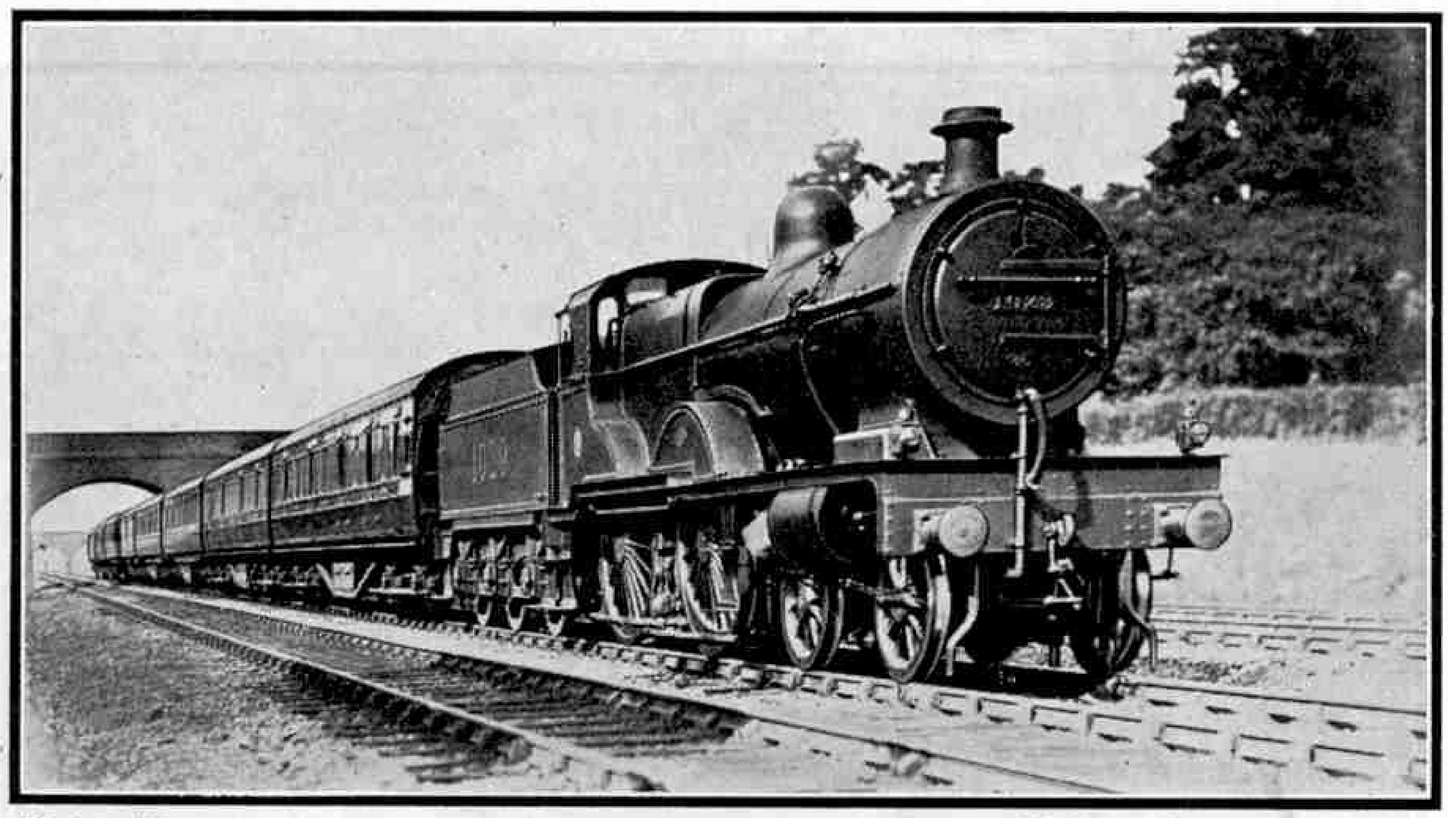
Thus far the two Northern railway groups have not been seized with the desirability of this arrangement of timetables—although it could certainly be put into force without great difficulty on some of the most important business services between London and the Midlands and North—save only for the train service that I am about to describe. A good many years ago the Midland Railway, whose express trains from London to Manchester left at fairly even intervals, decided to reduce the down service to systematic departures and the departure time selected was 25 minutes past the hour. So now you can leave St. Pancras for Manchester at 2.25 a.m. (the newspaper train); 4.25, 8.25, 10.25 in the morning, and 12.25, 2.25, 4.25 and 6.25 in the afternoon and evening. Three of these expresses—the 10.25, 12.25, and 2.25—are booked to take exactly four hours on the journey of 190 miles; the others, with additional stops, take longer.

Every one of the "25's" stops at both Leicester and Derby. In pre-war days the 10.15 a.m. from Manchester to London for a long period ran non-stop over the 170 miles from Chinley to St. Pancras, while various other expresses made a non-stop break between Manchester and Leicester, in all these cases using the avoiding line at Derby between Nottingham Road and Spondon stations. In this manner the best pre-war time between St. Pancras and Manchester was 3 hours, 40 minutes. But since the grouping, with the easier and faster Western Division route from Euston to Manchester available to L.M.S. passengers, there has not been the same need for haste over the Midland route; and the growing importance of both Leicester and Derby makes it undesirable that either of these towns should be given the "go-by."

Thus it is, as mentioned in the last paragraph, that the best Midland time to Manchester has now gone up to four hours.

The set of coaches used on the chief Midland Manchester trains is usually of the same formation. From the engine backward on the down journey, you will find a third-class brake, two open third-class coaches, a kitchen car, an open first-class coach, and a first-class brake—six vehicles in all. The open cars flanking the kitchen on each side form the restaurant accommodation, but passengers are allowed to travel in them throughout the journey if they so desire.

On many of the "25's" additional vehicles are provided. For instance, the 10.25 a.m. and 12.25 p.m. carry portions for Manchester (Victoria) and Liverpool. This in the former case comes off at Derby, to be transferred to the slower 9.25 a.m. from St. Pancras, which the 10.25 has overhauled *en route* at Kettering. The 12.25 and the 2.25 p.m. have through coaches for Buxton detached from the former at Derby and from the latter at Chinley. The 4.25 p.m. works on the rear an additional dining car for Manchester; the car has come south from Manchester to London at 8.55 a.m., and as there are more dining-car trains in the southbound than in the northbound direction, this is the only convenient way of returning the car concerned to its starting point. And then the 8.25 a.m., dignified in consequence by the high-sounding title of "*Continental Boat Express*," carries next the engine a through coach from Tilbury Marine Station, in connection with the steamer from Dunkerque. In front of this, again, there is attached at Derby a through vehicle from Nottingham.



Photograph] [*Railway Photographs, Liverpool*

Up Manchester-London Express hauled by L.M.S. 4–4–0 Compound locomotive No. 1029

Generally speaking, therefore, the "25's" are heavier south of Derby than they are north of that point. This is fortunate, as, although all the fastest running of the journey must be performed between Derby and St. Pancras, and more especially south of Leicester, by far the hardest climbing has to be performed between Derby and Manchester. Here the "25's" have to penetrate the heart of the Peak District, breasting a maximum altitude above the sea of no less than 880 ft. at Peak Forest Station. It is of interest to note that this summit falls short of the more famous Shap, on the West Coast main line to Scotland, by only 35 ft. and, what is more, the worst of the climbing is spread over no more than 14½ miles, from Rowsley, as compared with the 24½ miles from Milnthorpe up to Shap Summit.

Seeing that nothing of greater power than the 4–4–0 Midland compounds are employed for working these trains, the merit of the locomotive work entailed on these journeys is further enhanced. In order to enable time to be maintained, however, the loads per engine have to be rigidly restricted. Between St. Pancras and Derby the compounds are not generally allowed to work more than nine or ten bogie vehicles on the fastest timings; between Derby and Manchester about eight going north and seven coming south constitute a maximum load. With Driver Poole—one of the best-known men at Derby shed—I have known nine worked south from Cheadle Heath to Derby to time by an unpiloted compound, over the hardest gradients of the whole route, but this is quite an exception and none but an expert crew could have done it.

We have now to make our customary trip over the route of the "25's," and with such a wealth of trains at our command, it is perhaps difficult to choose the one that will give us the most interesting journey. On the whole I am inclined to favour the 12.25 p.m. down. The load out of St. Pancras is regularly nine bogie coaches, and as only one of these is dropped at Derby—the through coach for Matlock and Buxton which follows us on a slower train—there are still eight to haul over the mountains of the Peak. Two more, for Liverpool, come off when we stop at Cheadle Heath, eight miles short of Manchester, so that we finish the journey with one of the standard sets of six vehicles, to which reference has already been made. As it is now mid-winter, also, we shall have the advantage of completing the whole trip in daylight, which will enable us to see some of the finest scenery in England that can be commanded from the window of a railway carriage.



Courtesy] [*L.M.S.*

An imposing view of the St. Pancras Hotel. The Railway Station may be seen on the extreme left of this fine Gothic structure

Arriving at St. Pancras just after midday, we ascend into what is, in reality, the roof of the station, in order to find our train. As I explained in a previous article, the ties of the magnificent "all-over" roof at St. Pancras are beneath the platforms, so that the trains are virtually running up in the attic! The main portion of the building, beneath the platforms, is an enormous beer storage. It is said that one of the units of measurement employed in the design of the lower portion of the station was the dimensions of a barrel of beer, in order that the maximum possible accommodation might be available for the liquid products of the town of Burton-on-Trent! We find our train at No. 3 platform, and must be careful not to get into the three rear coaches, or we may get left behind at Derby or Cheadle Heath.

The engine is, of course, one of the familiar Midland compounds. The high-speed services of the Midland have been developed with the use of 4–4–0 locomotives exclusively, and the Midland main lines have now the distinction of being the only ones in Britain on which—except on rare occasions—no more powerful engines than those of this wheel arrangement appear on the express trains. Fast and frequent service has always been the Midland motto, and, as we have already seen, rigid load limitation is necessary over such grades in order to make time-keeping possible in these conditions. But for a train such as that on which we are about to travel it would be difficult to find a more suitable type of engine, both for efficiency and for economy, than our 4–4–0 compound.

The run now before us falls short of the "century" in its length

by just under a mile. For this distance of 99 miles and a fraction the faster "25's" are allowed 109 minutes, which means an average speed of 54.6 m.p.h. Before the War the best down trains made the run in three minutes less, but they were considerably lighter than the nine-coach formation behind our engine, which weighs empty about 250 tons, and with passengers and luggage fully 265 or 270 tons. We are enabled to make a good start, however, by the aid of the locomotive that has brought in our empty coaches. This gives us a good "shove" in rear until we are well clear of the platform at St. Pancras.

There is plenty of "collar-work" before the engine in the first 21 miles of the run, but fortunately there are several breaks in the continuity of the climbing, which act as "breathers" for our hard-worked locomotive. First we rise, largely through tunnel (Haverstock Hill Tunnel is just over a mile in length), for five miles to Cricklewood, on a gradient mostly between 1 in 160 and 180. Then there follow 1½ miles falling at 196 to the point of crossing the reservoir which, from its peculiar shape, is known as the "Welsh Harp." Just before Hendon we shall attain our first maximum of 60 miles an hour, or slightly under. Beyond Hendon there begins a rise at between 1 in 161 and 176 for five miles to Elstree Station, which we should top at between 45 and 48 m.p.h. or so, in preparation for the second brief descent, dropping at 1 in 200 for three miles to just beyond Radlett. Here the speed may be expected to reach 67 or 68 m.p.h. Once again there is climbing ahead. Between mile-posts 16 and 21 we rise, mostly at 1 in 176, passing on the way the Cathedral City of St. Albans, 20 miles distant from St. Pancras. With our load on this train the time out to St. Albans is not likely to be less than 26 minutes.

Once past mile-post 21 we have to look forward to sharp undulations for the next 13 miles, on which an average gait but little short of a mile-a-minute will be maintained. The chief "dips" occur just beyond Harpenden, to the point where the line crosses the Lea Valley on a high embankment, and down to Luton, which we shall dash through at about 65 miles an hour. Luton is 30¼ miles from St. Pancras, and we should get through in 37 minutes, or slightly less.

From mile-post 34 we have immediately ahead the most glorious "racing-ground" of the whole journey. For 15 miles the line falls almost uninterruptedly, chiefly on a grade of 1 in 200, and is very largely free from curvature as well, so that the highest possible speeds may be developed with safety. My own record here was one of 88 m.p.h.—singularly enough, behind one of the "Class 3" simple 4-4-0 engines, and not behind a compound—but in the ordinary course the maximum sustained speed over this length generally lies between 75 and 78 m.p.h., with a slight decrease along the short level break from Flitwick to Ampthill. It is unlikely that the 19½ miles from Luton to Bedford will take more than 17 minutes. We may, indeed, cut the time over this stretch to 16 minutes, so that passing Bedford, 49¾ miles from London, in the 54 minutes allowed, is not a difficult matter.



Courtesy] [*L.M.S.*

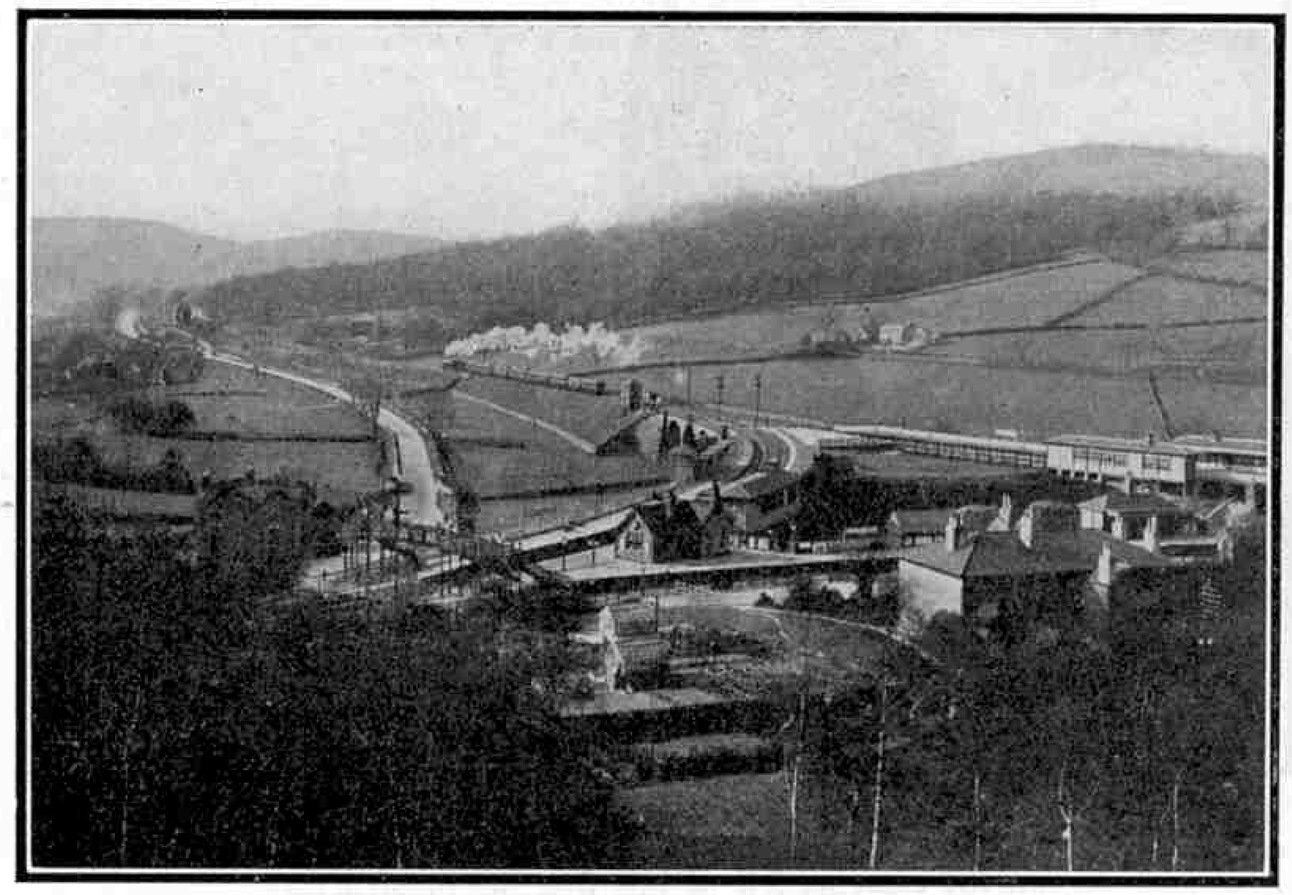
One of the "25's" at full speed, near Mill Hill. As will be seen, the Standard Compound Locomotive No. 1100 was fitted as an oil burner. This was done for experimental purposes, and the apparatus has since been removed

Non-stop expresses do not pass through Bedford Station, as the main line leaves the passenger station on the right. This arrangement is a reminder of the fact that originally, before the extension of the Midland into St. Pancras terminus was opened in 1868, Midland trains for London ran through the station and straight on to Hitchin, whence they made use of the metals of the Great Northern Railway into King's Cross for a considerable period.

The winding valley of the Ouse is now responsible for undulations in the main line for some miles beyond Bedford, during the course of which our engine takes water from Oakley troughs. Then the high ground between the Ouse and Nene Valleys involves us in the hardest of all the climbs between London and Leicester, known as Sharnbrook bank. This is 5½ miles in length, and for the upper 3½ miles is at 1 in 119, which will cause a drop in our speed to but little over 40 m.p.h. Meanwhile we notice the goods lines on our right, first of all rising above us from a point beyond Oakley troughs, and then falling below us, finally into Sharnbrook Tunnel, which accommodates the goods lines only and is over a mile in length. In this way the goods lines (which after the tunnel follow a different location entirely as far as Irchester South Junction, to reduce to a minimum the amount of cutting necessary), have been kept down to a maximum steepness of 1 in 200.

Sharnbrook Summit is 59¾ miles from St. Pancras, and is dignified to the extent of figuring in the working timetables, the express trains being given definite times to passing this point. The 10 miles from Bedford to the top will probably not take us more than 11 minutes, and a swift descent of Irchester bank should bring us over the wide curve through Wellingborough Station, 65 miles from London, in a shade under 70 minutes. Here are very important marshalling sidings, chiefly on the east side of the line; and here also we are reminded of the iron ore beds of Northamptonshire by seeing blast-furnaces both to right and left of the train.

Seven minutes later we are running through the important junction of Kettering, 72 miles out. A couple of miles further on the direct line to Nottingham leaves us on the right, and 74½ miles from St. Pancras (Glendon Junction) the goods lines, which have



Courtesy] [*L.M.S.*

A striking view of the triangular station at Ambergate, L.M.S. The "25's" take the left hand curve

accompanied us uninterruptedly to this point, come to an end, the freight traffic for Leicester direction being passed on to the main lines.

There is another long climb from before Kettering to Desborough Summit, at mile-post 78½, as steep in parts as 1 in 120 to 136; a speedy descent of the subsequent steep downgrade to Market Harborough is cut short by the necessity of slacking to 45 m.p.h. over the sharp curve through that station. We are 16 miles from Leicester now, and should have about 19 minutes left. There is yet another sharp rise from East Langton to Kibworth Summit, at mile-post 89½, and then gently falling grades lie ahead all the way to Leicester. North of Wigston we slacken round the curve on to the Rugby and Leicester line—which carried the Midland trains to Rugby and Euston even before they sought the hospitality of King's Cross—and just about 2.14 p.m. we make a smart stop in the fine Midland Station at Leicester. This particular express, however, is not booked into Leicester until 2.15 p.m., in 110 minutes from St. Pancras.

Five minutes suffice for the station work here, and at 2.20 p.m. we are away for Derby. This is one of the most level stretches on the Midland system, and a schedule of 34 minutes proves more than ample. Between Loughborough and Hathern we pass over the second set of track-troughs and shortly we are threading the Red Hill Tunnels and crossing the wide River Trent. After this we negotiate at speed the complicated Trent Junctions. Continuing, we pass on the left the vast Celanese works at Spondon, working day and night to produce artificial silk, and having travelled round the long reverse curve from Spondon Junction, passing on the right-hand side the great Derby Locomotive works, we halt in the large station at Derby at 2.54 p.m. Here the engine that has brought us 128½ miles from St. Pancras is detached, and another compound 4–4–0 is provided to haul us over the 61½ miles remaining to Manchester. The loss of the Buxton coach from the rear of the train brings the load down to about 235 or 240 tons in all.



Photograph [*Railway Photographs, Liverpool*

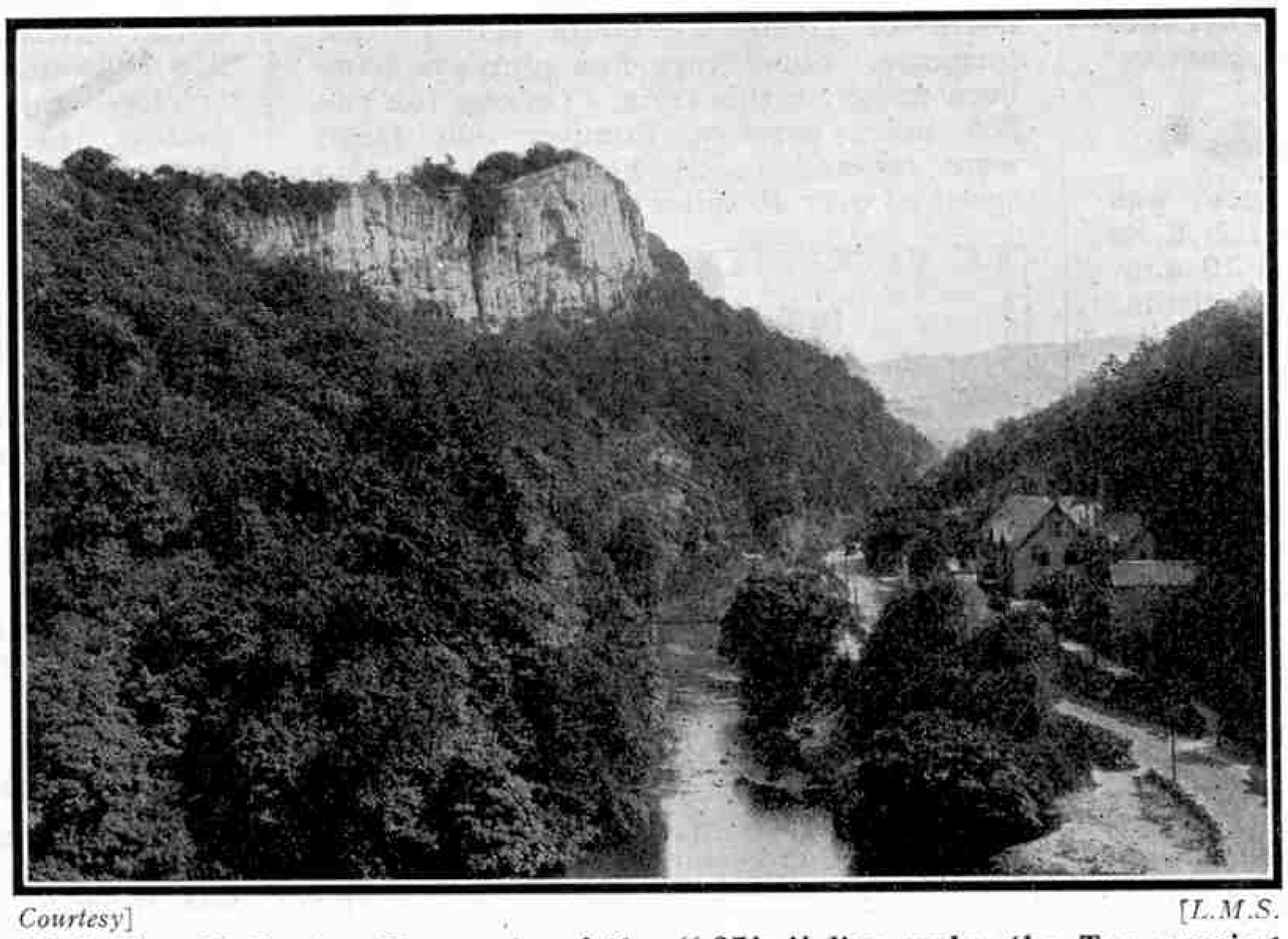
2-25 p.m. Down Manchester Express near Mill Hill. L.M.S. 4–4–0 Standard Compound locomotive No. 1102

Promptly at 3 p.m.—promptness has always been the keyword of Midland operation—we get away from Derby. Again we have no serious grades for some 20 miles, the tendency of the road being but slightly against the engine as far as Rowsley. We shall just about reach 60 m.p.h. past Duffield and Belper, but speed has to be drastically reduced, to 15 m.p.h., to enable us to pass round the exceedingly sharp curve through Ambergate. This is a most singular station, being laid out in the form of a triangle with platforms on each of the three sides—the only true example of its type, to my knowledge, in the country, with the possible exception of Rutherglen, in Scotland. From the train you should particularly notice, at the London end of the station, the new "upper quadrant" signals, which are to be the future standard for all the railways in Great Britain, instead of the falling arms to which we have so long been accustomed.

Ambergate is like the "gateway" of the Peak District of Derbyshire. Through fine scenery and many tunnels we pass on to Cromford and Matlock Bath, and then under the "nose" of High Tor to Matlock, whence we hurry on to Rowsley. Here we note large and important marshalling sidings on the left of the train, where the loads of northbound trains are rearranged in preparation for the heavy climbing ahead. From Derby we should take about 14 minutes over the 10¼ miles to Ambergate, and 27 minutes to clear Rowsley, 21½ miles distant.

Now our train begins to mount rapidly, and the speed falls in proportion. For 15 miles from Rowsley to Peak Forest the gradient but seldom falls below 1 in 105 in steepness, and for the last 3¼ miles it increases to 1 in 90. There are three short downhill "breathers"; one just before Bakewell; one through the tunnel that ushers us into the magnificent scenery of Monsal Dale, and one before Miller's Dale Station—in all cases leading to the crossing of valleys, and none more than one-third of a mile in length. The effect is slightly to raise the speed in each case, but the bulk of the ascent will not be compassed at a much greater rate than 35 m.p.h. or so, and at Peak Forest, up the final 1 in 90, we may drop more nearly to 30. For the 14¼ miles from Rowsley to Peak Forest the time allowance is 22 min., and with such a load as this it is none too ample.

Wonderful views are obtained as the train runs high above Miller's Dale. The final climb is then accomplished in a deep and treeless—and also apparently waterless—valley to Peak Forest Station, which is situated amid the extensive quarries and limeworks of the Buxton Lime Firms, now part of the great Imperial Chemical Industries combine.



Courtesy [*L.M.S.*

High Tor, Matlock. The route of the "25's" lies under the Tor, passing through to Manchester

Up till now we have passed through many tunnels, but none to compare in length with the 1¾ miles of Dove Holes, which we thread immediately the descent begins. On emerging we get fine and extensive views of the Peak Country, as we dash down through Chapel-en-le-Frith and Chinley to New Mills, where the original line to Manchester, through Stockport, leaves us on the right. But we hurry into another long tunnel—Disley, 2¼ miles—which brings us down to Hazel Grove and Cheadle Heath. Owing to a winding track and the necessity for moderated speed, it is not until we are through Disley Tunnel that the driver really lets his engine go, and we may now touch 75 m.p.h. or over ere we make our stop at Cheadle Heath. This we are booked to do at 4.8 p.m., 68 minutes after leaving Derby, now 53½ miles away.

At Cheadle Heath the Liverpool coaches are dropped off the rear, to continue their journey over the Cheshire Lines Committee's tracks to Warrington and Liverpool. We have now 13 minutes left from our re-start, at 4.12 p.m., to cover the eight miles through the Southern suburbs of Manchester. At (*Continued on page* 1010)



More Locomotives for Canadian National Railways

The Canadian National Railways recently announced their intention of spending approximately £3,000,000 on new equipment, and two Canadian locomotive-constructing firms have secured contracts for a total of 55 new locomotives. Of this number the Montreal Locomotive Works Ltd., are to supply 20 of the 4–8–4 Northern type, together with ten 8-wheel switching locomotives. The Canadian Locomotive Company at Kingston are to supply the remainder, consisting of 15 locomotives of the Santa Fé 2–10–2 type, and ten 8-wheel switching locomotives.

The Northern type, known as the "6100" class, is a product of Canadian National Railway engineers. It was designed for long-distance service combined with speed and power, and has proved entirely satisfactory. The Santa Fé type is a powerful freight locomotive.

* * * *

L.N.E.R. Engine Performances

A very creditable performance was recorded a short time ago on the L.N.E.R. by two engines that worked the 10 a.m. through Edinburgh to London train. The train left Edinburgh hauled by engine 2580, but mechanical trouble developed, and on reaching Grantham it was found necessary to replace this engine by engine 2561. The change caused a slight delay, but although the train was 20 minutes behind time on leaving Grantham, it was actually two minutes early when it arrived at King's Cross.

Another interesting engine performance on the L.N.E.R. was afforded by the 5.12 p.m. Edinburgh to Leeds which left Darlington four minutes late but was only two minutes behind time on arriving at York. In order to make up this time an average speed of 64.5 m.p.h. over the distance of 44 miles was necessary. The train was worked by Atlantic No. 705, and was carrying a load of 46 tons in excess of the stipulations.

The 9.38 a.m York to Glasgow train also made a noteworthy journey on a recent occasion. The train was hauled by engine 256 (D.49) and left York nine minutes behind time, arriving at Newcastle only three minutes late, having covered the 80.1 miles at an average speed of 56 m.p.h.

NEW L.N.E.R. PACIFICS

The first of a new series of 10 Pacific locomotives with corridor tenders has been built at Doncaster. These engines will be given the following names of racehorses :—"Felstead," "Flamingo," "Grand Parade," "Papyrus," "Captain Cuttle," "Humorist," "Coronach," "Spion Kop," "Colorado" and "Fairway."

The leading dimensions of these locomotives are as follows :—

Boiler pressure	220 lb.	Heating Surface ...	706 sq. ft.
Heating Surface—		Total Heating Surface ...	3,442.6 ,,
Firebox	215 sq. ft.	Grate Area	41.25 ,,
Tubes	1,398.8 ,,	Cylinders	(three) 19 in. dia. by 26 in. stroke
Flues	1,122.8 ,,	Tractive effort at 85 per cent.	
Total Evaporative H.S.	2,736.6 ,,	Boiler Pressure	32,909 lb.
Superheater—		Adhesive weight ...	66 tons 3 cwt.
Number of elements	43	Weight of Engine in W.O.	96 ,, 5 ,,
		,, Tender ,,	62 ,, 8 ,,

"The Frontier Mail"

A new train, designated "*The Frontier Mail*," is now running on the Indian Railways between Bombay, the capital city of the Bombay Presidency, and Peshawar, the capital city of the Punjab region. The train runs via Delhi, and has been the cause of the English mails arriving at Delhi, and other towns and cities to the north of Delhi, 24 hours earlier than formerly. Some very fine journeys have been made by this train. On one run the 865 miles between Bombay and Delhi were covered in 21 hours, an average speed of over 40 miles an hour.

Difficulties Explained

5.—THE "D" ON SIGNAL POSTS

A number of inquiries have recently been received from readers as to the meaning of the 'D' sometimes seen on signal posts.

This 'D' is fixed to posts that are in close proximity to electric bells and plungers, or where it is possible for the fireman to communicate with the signalman by means of a telephone, and thereby conform with the regulations laid down in the well-known rule 55 without the necessity of journeying to the signal box.

Arrangements have been made to enable telegrams and ordinary letters to be sent off by passengers travelling in the train while daily newspapers are provided free of charge in addition to a daily news bulletin. The train is not made up of corridor coaches as they are regarded as tending to lessen the privacy desirable on a long journey.

New Type of Locomotive for New York

A new battery-oil-electric locomotive has recently been subjected to a number of tests by the New York Central Railroad Company. The engine is intended for service in freight yards and city streets, and will be able to run either from its own batteries, from batteries and engine generator combined, from the orthodox third rail, or from an overhead collector. The change of power is automatically controlled, and in order to enable the driver to tell under which operating condition the engine is running a series of lights are fitted in the cabin.

The locomotive weighs 128 tons, measures 46 ft. 8 in. over the couplings, and is able to carry 200 gallons of oil in the tanks. This supply of oil would enable it to be run at a constant speed and with a full load for approximately 10 hours. The electric battery fitted in the engine is composed of 218 cells and weighs 17 tons, while the tractive unit consists of four 600-volt motors, each developing a maximum horse-power of 415.

* * * *

Extension of Automatic Train Control

The G.W.R. have decided to extend the automatic train control system at present in operation on the main line between Paddington and Reading and on certain branches between Reading, Swindon and Oxford, and between London and High Wycombe. The system has been found to be specially valuable in the handling of traffic during foggy weather, as drivers are given audible warning of the state of the signals, whether they can see them or not.

* * * *

A 365-Ton Load

A 14 in. gun, with its carriage, making a total weight of approximately 365 tons, was recently carried on the New York, New Haven and Hartford Railway, from Worcester, Mass., to Maybrook, N.Y. The gun carriage had 14 pairs of wheels and was 85 ft. in total length, while the axle loads ranged from 49,750 lb. to 54,000 lb. The train was limited to a maximum speed of 20 m.p.h., 15 m.p.h. over steel bridges, and 10 m.p.h. over timber bridges, and the load was 150 tons heavier than any other similar load previously carried on this railway.

New French Railways

The new Franco-Italian railway joining Nice in France and Coni in Italy has recently been opened. The line is approximately 63 miles in length and runs through French territory over about 39 miles of its total length, passing through the three French communes of Fontan, Saorge, and Breil en route.

In the construction of the line a great number of engineering difficulties had to be overcome on account of the nature of the country. In the French portion 14¾ miles of the total 39 are taken up by tunnels, 45 in number, of which the longest is under the Col de Braus and stretches over 3¾ miles. The second largest cuts through Mont Grazien and carries the railway underground for 2½ miles. It was also found necessary to construct three bridges, one over the Bévèra and two over the Roya. The bridge at Bévèra has two 147 ft. 8 in. spans supported by a brick arch, and the Saorge bridge is constructed over the Roya at a height of 197 ft.

The construction was carried out by the Paris-Lyons-Mediterranean Railway, and cost approximately £3,622,000 or about £90,665 per mile.

Another line recently opened joins Strasbourg, the capital of Alsace Lorraine, and Saint Dié, through the Vosges. The line is 62 miles in length and effects a saving of 43 miles as prior to its construction it was necessary to make a detour of 105 miles when journeying from one town to the other.

* * * *

Empire's Largest Passenger Locomotive

The largest passenger locomotive in the British Empire has been constructed at Montreal for service on the Canadian Pacific Railway. This locomotive weighs 424,000 lb. and has a tractive effort of 60,800 lb. It is of the 4–8–4 type and has driving wheels 75 in. in diameter and cylinders 25½ in. by 30 in. The total length of engine and tender is 97 ft. 5 in. A mechanical stoker is fitted on the engine. The tender has a coal capacity of 18½ tons and is able to carry 12,000 gallons of water in a special bottom under-frame. The boiler pressure is 275 lb. per sq. in.

* * * *

A number of experiments with a new type of Diesel-electric locomotive have been carried out by a firm of railway engineers at Copenhagen. The engine produces its own electricity by means of a generator, and thereby saves the cost of overhead wires, or third rails. The running costs are also stated to be remarkably low.

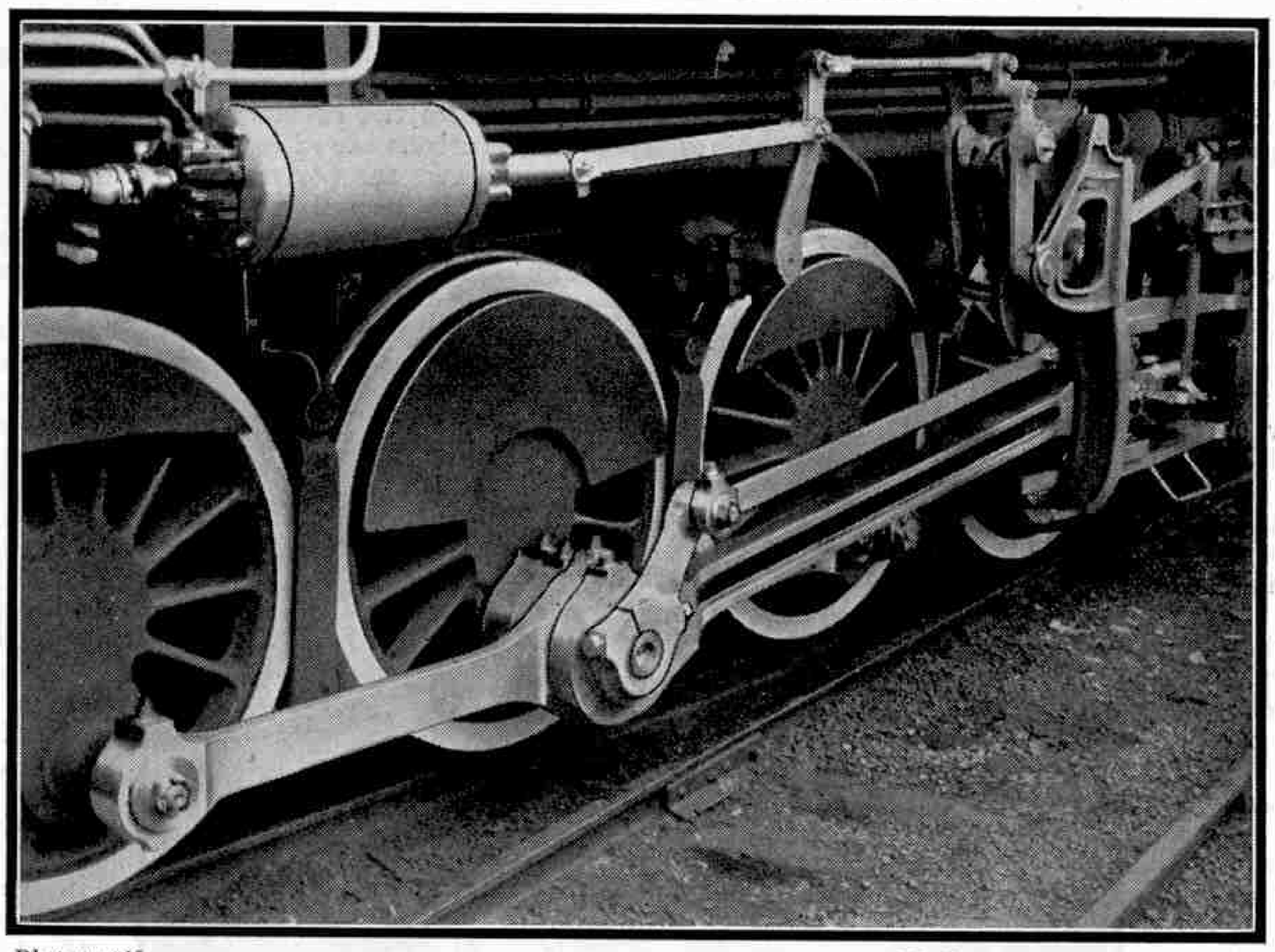
Shortest Station Names

With regard to the claim of a station on the Cahu Railway in Hawaii to possess the shortest name of all railway stations in the world, which was referred to in the July "*M.M.*," the "*Railway Gazette*" in conjunction with the "*Railway Age*" have compiled what is probably a complete list of the very shortest station names. There are six short named stations in Sweden, "Ed," "Fu," "Le," "Ra," "Ro" and "Od." France comes second in the list with "Us," "Ay" and "Ev," the first two being on the Chemin de Fer de l'Est, and the third on the Chemin de Fer du Nord. Hawaii has its one contribution of "Ii," while "Lu" is found on the Argentine Railways. North America has two representatives, both in Kentucky. One is "Oz," which is on the Kentucky-Tennessee railway, and the other is "Uz," on the Louisville-Nashville railway.

* * * *

Two Classes for German Railways

The German railways have now practically replaced the three-class system that has previously been in operation on their lines by a two-class system, and the trains are now usually made up of only second and third-class compartments. The latter have plain wooden seats but the second-class compartments are upholstered. A few richly furnished first-class carriages will be run on certain expresses.



Photograph [*Railway Photographs, Liverpool*

The "Lima" patent drive used on giant American Locomotives. The joint between the forked big-end and the rear section of the coupling rod enables the drive to be transmitted directly to the main and rear driving wheels without excessive stress on the crank pin

G.W.R. Road and Rail Service

The G.W.R. Company have put into operation a long-distance road and rail service between Cheltenham and Paddington. The road portion of the journey operates between Cheltenham and Oxford and the rail portion between Oxford and Paddington. Four daily and two Sunday services are run, and the combined road and rail 3rd-class fare is 12/– single, and 15/– return. The road service is operated by the latest type 6-cylinder Thornycroft all-weather-body cars, and will run between the G.W.R. stations and the receiving offices in the two towns. No intermediate stops are made, and tickets are not issued on the cars, but only at the G.W.R. stations and offices in the usual way.

The Company have also announced their intention of purchasing 122 new omnibuses, together with 170 additional goods motor vehicles, which will be used to link-up outlying country districts with the railway.

* * *

Timetables for Goods Trains

The L.N.E.R. have announced their intention of publishing a timetable for their express goods trains. This is quite a new departure in railway administration and will prove of particular value to traders and others who regularly despatch quantities of perishable goods by rail.

The timetable is not being compiled on exactly similar lines to the ordinary passenger train timetable, but will contain information as to the latest time that freight can be handed in and the time it will be delivered at its destination. Circulars containing a certain amount of information of this kind have already been issued by the other companies for some time, but this is the first attempt that has been made to arrive at anything in the nature of a complete and official goods timetable.

* * *

L.M.S.R. Extensions at Edge Hill

Work is now proceeding rapidly on the extensions at the L.M.S. Edge Hill Marshalling Depot, where all goods traffic bound to or from Liverpool and the outlying districts is assembled and sorted. Approximately £50,000 is being spent on this work, which will result in a considerable speeding-up of traffic.

The L.M.S. also recently spent £250,000 on the widening of the main line between Crewe and Weaver Junction, and the extensions at Edge Hill will allow the best use to be made of this improvement,

THIS MONTH'S RAILWAY STORY

A party was being conducted round a locomotive works.
"And what is that big thing?" asked a lady visitor.
"That, Madam," replied the guide, "is a locomotive boiler."
"And why do they boil the locomotive?" was the further question.
"Must be to make the locomotive tender," came a small voice from the rear!

Famous Aero Engines

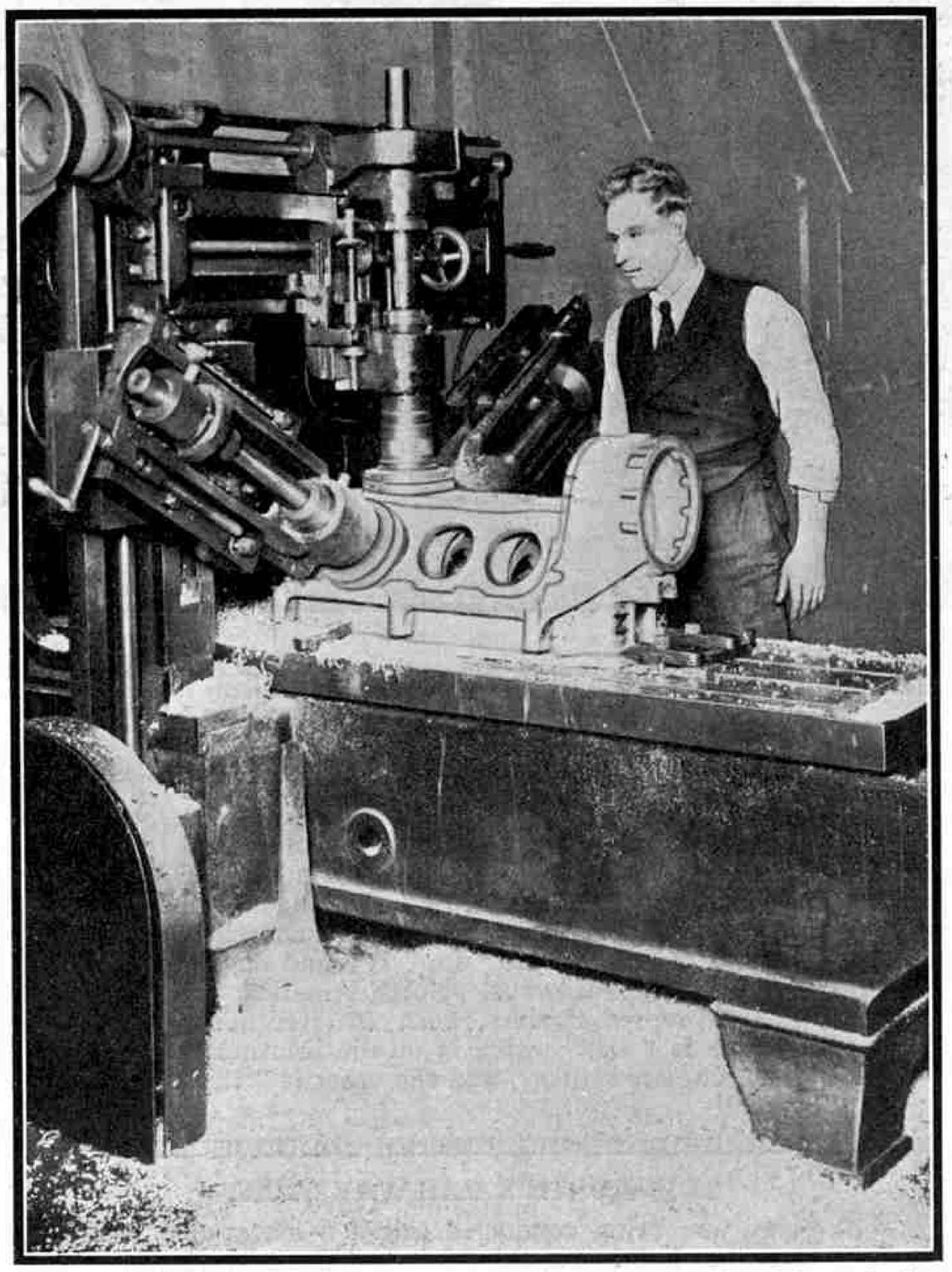
V.—Napier 530 h.p. "Lion"

THE Napier Company have been engaged in engineering for over a century. They first built an internal combustion engine in 1899, when they entered the motor industry, and it was a natural development that, when the need for aero engines arose, they should turn their attention to this highly technical and fascinating branch of engineering.

It was in 1916 that ideas for the now famous Napier "Lion" engine were first evolved, but on account of the very large amount of special war production the Napier Company were then engaged upon for the British Government, it was not until the latter part of the war that the first engine was passed by the British Air Ministry. Development stages of the Napier engine—which had received its designation of "Lion" from the British Air Ministry—were carefully and quickly dealt with, and at once the engine gave evidence of the position and popularity that it was destined to attain.

The design of this engine makes it particularly compact, which is a great advantage to aeroplane designers on account of the fact that it facilitates installation in aircraft of greatly varied types. The 12 cylinders are arranged fan-shaped in three blocks of four cylinders each. This means that a particularly short, stiff crankshaft is used, thereby reducing vibration, increasing reliability and lessening wear and tear. As a matter of fact smoothness of running is a noticeable feature of the "Lion."

Perhaps the most remarkable feature of the Napier engine is its light weight in proportion to power developed, consistent with the greatest reliability. This feature is important because, naturally, the lower the ratio of engine weight to power developed the greater will be the useful load-carrying capacity of the machine in which the engine is installed.



Machining the crankcase of a "Lion" engine. For this and the other photographs illustrating this article we are indebted to D. Napier and Sons Ltd.

Before an engine is officially accepted by the British Air Ministry it has to undergo very severe tests supervised by inspectors of the Ministry. The Napier engine has run several hundred hours of testing under the official type test conditions. The latest test was of a particularly strenuous nature, and during this the engine ran for 104 hours without any part being changed throughout. The type test included 10 non-stop periods of 10 hours duration, each at 2,350 r.p.m. at an average b.h.p. of 477. This was followed by 10 minutes slow running at 400 r.p.m. The engine was then opened up to 2,715 r.p.m. and run for one hour at this speed. A further hour at 2,585 r.p.m. was run at full throttle, the engine developing approximately 573 b.h.p. This was the first occasion on which an aero engine of such high power has undergone so long and exacting a test successfully.

The "Lion" engine has a stroke of $5\frac{1}{8}$ in. and a bore of $5\frac{1}{2}$ in. Each cylinder is of all-steel construction, as also are the water jackets. The detachable cylinder head is cast in aluminium and contains the inlet and exhaust passages, valves and valve actuating mechanism. There are two inlet and two exhaust valves per cylinder, each fitted with two coil springs and operated direct by overhead camshafts driven through bevel gearing by vertical shafts from the crankshaft.

The pistons are of cast aluminium alloy and are fitted with two gas and two scraper rings. The hollow gudgeon pins are of large diameter and are fixed in steel bushes.

Special high grade steel is used for the connecting rods, which are machined all over to ensure each rod being of uniform weight. The master rod, coupled to the pistons of the vertical block of cylinders, is formed with lugs on either side to which are attached short auxiliary rods for the pistons of the right and left groups of cylinders. The big ends are lined with white metal, while the anchor pins and other parts work in bushes of ample size.

The crankshaft is machined from a solid steel forging. The four throws of the shaft are in one plane, and all journalled bearings and crankpins are of large diameter and bored out. The crankshaft is carried in five substantial roller bearings and a large plain bearing at the forward end.

The direction of rotation of the airscrew shaft is clockwise when viewed from the airscrew end. The shaft is carried on two roller bearings and is fitted with a large double thrust ball-bearing to take the thrust of either a "tractor" or "pusher" airscrew. Reduction between the airscrew and crankshaft is effected through high grade alloy steel spur gears and is in the ratio of 1 to 1.885 of the crankshaft. The airscrew shaft and its gear and cover can be readily withdrawn from the crankcase for the purpose of inspection.

The crankcase is of aluminium and is made with arms on either side for attachment to the aircraft. It is suitably stiffened at all necessary points. The front end of the case encloses the reduction gear for the airscrew shaft, together with the shaft and bearings. The rear end cover contains the two "scavenger" oil pumps and the pressure oil pump. In addition, the cover accommodates the drive for the camshafts, magnetos, water and oil pumps.

Ignition is supplied by means of two special 12-cylinder magnetos that rotate in an anti-clockwise direction and are mounted on platforms at the rear end of the engine. The metal braided ignition cable is carried in aluminium troughs, while the advance and retard links and levers are interconnected with the throttle lever in order to make control automatic.

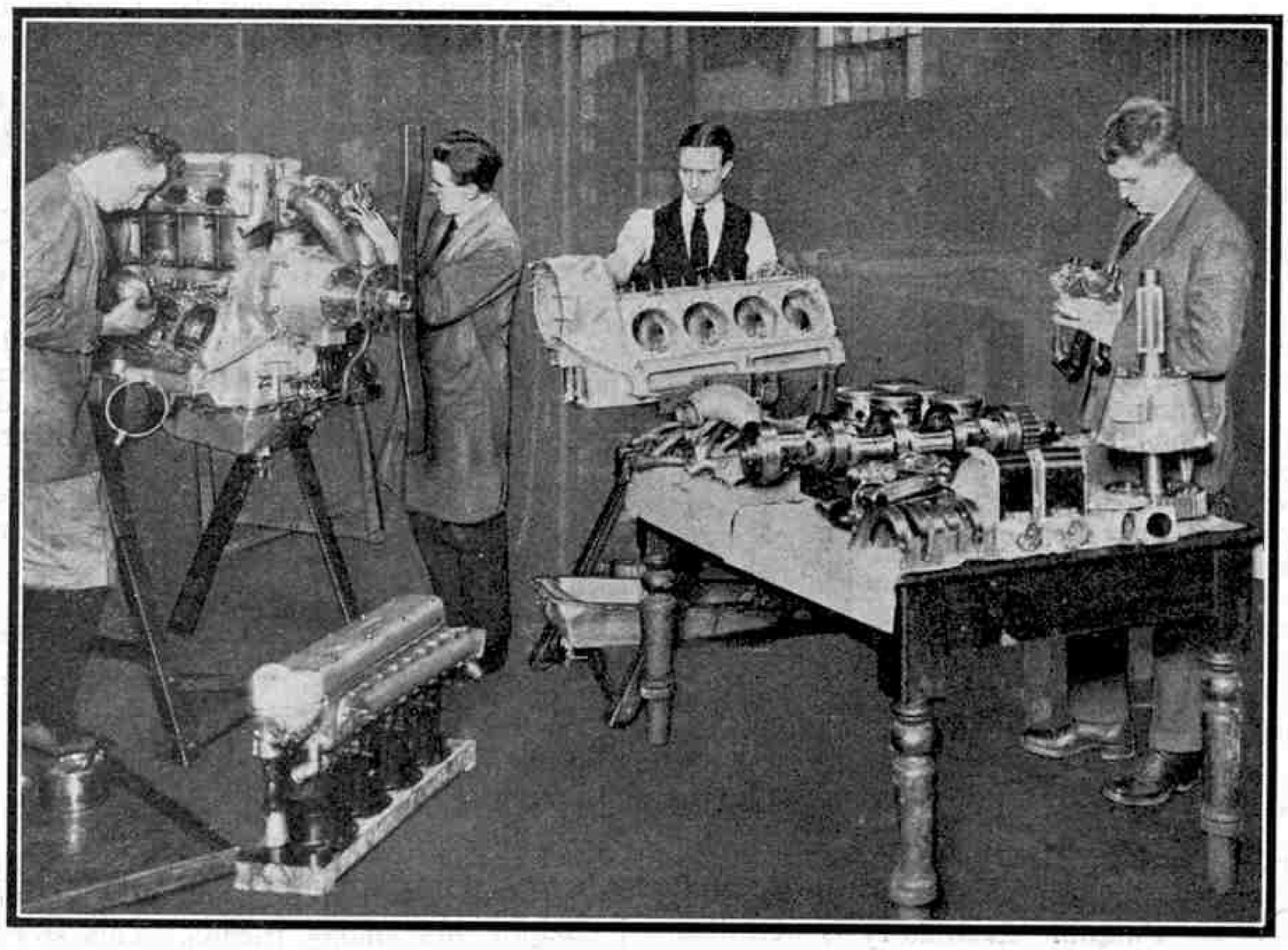
The engine is provided with a Napier petrol starter by means of which fuel is pumped into the cylinders and ignited by a hand-started magneto that operates through the special distributors of the engine magnetos. Hand-turning gear having a 16 to 1 reduction between the starting handle shaft and the crankshaft is provided, together with throw-out gear to prevent any damage being caused by backfires.

A triple carburetter is provided. The carburetter is water

jacketted and is carried on a bracket on the rear end cover. The induction pipes leading to the cylinder heads are of steel and are water jacketted. Altitude control cocks are provided and are interconnected with the throttle control.

A centrifugal water circulating pump is mounted at the rear end of the engine and is run at crankshaft speed. The spindle of the pump is fitted with a gland and screw-down greaser. Water is delivered direct to each of the three cylinder blocks through separate outlets.

Lubrication is effected by means of two scavenger pumps and one pressure pump driven at half engine speed through reduction gears. The scavenger pumps draw oil from the crankcase and deliver it to the service tank from which the pressure pump obtains its supply through a suitable filter. The pressure pump delivers the oil to the big ends, gudgeon pins, camshaft bearings and forward bearings of the crankshaft, while the reduction gears are lubricated by oil ejected on to the teeth from a pipe that is connected to the crankshaft lubricating system. The oil that escapes from the camshaft bearings lubricates the valve tappets and cams, after which it drains into the sump and is delivered thence to the service tank by the scavenger pumps. An adjustable pressure relief valve is incorporated in the system.



Inspecting the parts of an engine dissembled after undergoing a two-hour endurance test

The average oil consumption of the Napier "Lion" is .0235 lb. per b.h.p. hour, with a maximum consumption of .030 lb. per b.h.p. hour. These figures are based on the two-hour endurance test conducted by the Air Ministry. The fuel consumption, in relation to load carried and power developed, is very moderate, and does not exceed .55 pints per b.h.p. hour at full load and normal speed.

The Napier "Lion" was originally designed for naval and military purposes, but its reliability, freedom from vibration, and economical running soon marked it out as eminently suitable for commercial flying. This fact was early realised by Imperial Airways Limited, and many of this type of engine are now in daily use on this company's air services. One particular "Lion" employed thus has already covered more than 300,000 miles—3,000 hours of flying. This distance is equivalent to more than twelve times round the world, and is a remarkable testimony to the excellence of the engine.

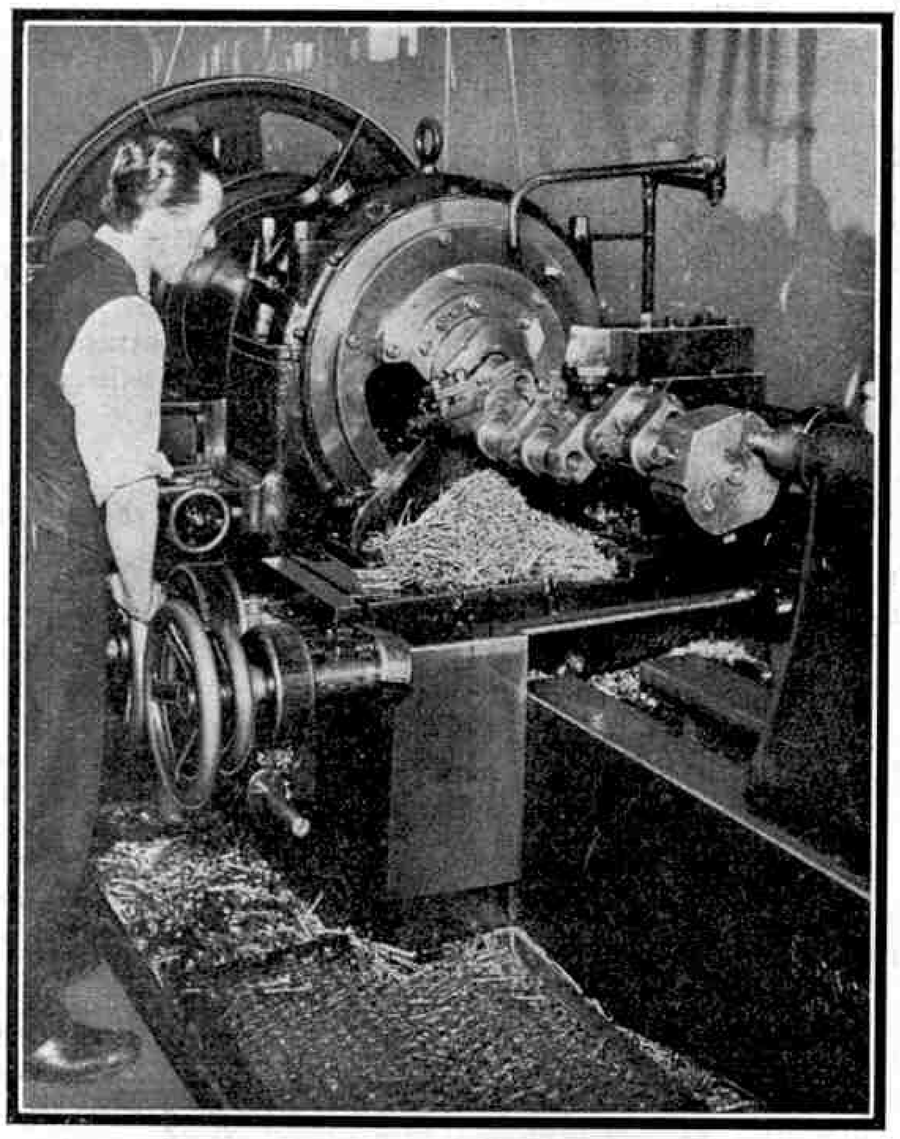
The "Lion" has taken part in many long distance flights, in addition to those of air services. One of the most interesting of these private enterprises was a remarkable flight from Spain to Buenos Aires made in 1926 by a Spanish airman, Commandante Franco. The machine used for this journey of 6,259 miles was a Dornier Wal Flying Boat, built in Italy and equipped with two Napier "Lion" engines sent from England.

The Commandante's object was to reach Buenos Aires with as few stops as possible and so well did he carry out his plan that he reached his destination in 59 hours 35 mins. actual flying time, making the whole journey in seven flights varying from 150 to 1,440 miles. This was the first occasion on which the South Atlantic had been flown without change of machine or engine.

On arrival at Buenos Aires Commandante Franco stated that the engines had been run at or near maximum power for the greater part of the journey and had not given the slightest trouble. During the latter part of the flight the propeller of the rear engine was damaged by rough seas and the last 100 miles or so of the journey was carried out with only one engine at work and this running at full capacity. On conclusion of the flight many tributes were paid by the Italian air officials to the fine performance of the engines.

The British Royal Air Force have selected the Napier engine for the majority of their long distance flights and complete success has always resulted. Twice have four Royal Air Force aircraft flown in formation from Cairo to Cape Town and back—a total of 100,000 engine miles. On both occasions each machine was fitted with the Napier engine and not the slightest mechanical trouble was experienced throughout the long and strenuous journeys.

The greatest formation flight ever made has just been completed by four Supermarine-Napier flying boats. These aircraft, each fitted with two Napier "Lion" engines, flew from England to Australia, round Australia and back to Singapore—a total of 184,000 engine miles. Again the flight was carried out to a carefully prearranged time table and no engine trouble was experienced.



The crankshaft being turned on the lathe

In civil flying contests the Napier "Lion" has achieved many successes. The Gloster machines that won the Aerial Derby in 1921, 1922 and 1923 were all equipped with Napier engines, while a Napier engined Supermarine Flying Boat won the Schneider cup in 1922. The pilot of the machine on this occasion afterward remarked that "throughout the race (1 hour 20 minutes) the engine never faltered and the complete absence of vibration was most marked. At the finish the engine was doing exactly the same speed as at the beginning, and sounded as if she would go on indefinitely . . ."

A Napier racing engine of slightly different type from the 530 h.p. "Lion" and developing approximately 1,000 h.p. was used in the Supermarine—Napier "S5" racing monoplane that won the Schneider Trophy last year.

The same machine, equipped with a new Napier racing engine, was used by Lieut. D'Arcy Grieg last month to beat the world's flying record of 318.62 m.p.h., held by the famous Italian airman, Major de Bernhardi. The successful attempt was carried out in the Solent and was witnessed by a large crowd of people around the aerodrome. Thousands also congregated in the streets of Southampton, from which they had a magnificent view of the machine aloft. Grieg flew several times over a measured course 1¾ miles in length, and attained an average speed of 319.57 m.p.h. On his fastest lap he registered the remarkable speed of 322.63 m.p.h.

New Books for Christmas

"The Boy's Own Annual"

(R.T.S. 12/6 net)

This well-known annual attains its 50th birthday this year but shows no signs of having lost any of its youthful freshness. Although this volume follows the lines of previous issues, it appears to have changed a little in regard to its non-fiction features. The general articles, and especially those of the "How To Make" variety, are certainly better than ever. The range covered is extremely wide and caters for practically every hobby in which boys are interested.

The serial stories are of first-rate quality and they achieve the none too easy task of being thrilling without becoming sensational. "The Secret Squadron" is a rattling good story of adventure in the Far East, and "The Fugitive's Treasure" has a real outdoor atmosphere and is full of stirring episodes. The shorter stories are well chosen for variety and one feels, indeed, that some of them might well have been longer.

The illustrations as usual are provided on a lavish scale and are of excellent quality, especially the photogravure plates.

* * * *

"The Schoolboy's Annual"

(R.T.S. 3/6 net)

This annual consists of a collection of well-written stories of the type that make a strong appeal to all boys. The school stories are particularly good, and the remainder deal with exciting adventures in all parts of the world from Canada to the Punjab. Each story is well illustrated and the book contains four excellent plates in colour. This annual is remarkably good value and is certain to prove a very acceptable Christmas gift.

* * * *



"Lawless Days"

By MONA TRACY (Harrap & Co. Ltd. 3/6 net)

Dick Arden went to sea as a stowaway and thereby commenced a series of exciting adventures in old New Zealand and the South Seas. The story tells of Dick's wanderings in quest of safety, his life on the shores of stormy sealing islands, his voyage in a scurvy-stricken ship, and his experiences among the Maoris. The author's knowledge of the period has enabled her to present a most realistic picture of New Zealand in the days when it was No Man's Land. Dick is often down and sometimes nearly out, but by sheer courage he overcomes all obstacles and wins through to freedom and happiness. The book has a coloured frontispiece and other illustrations that greatly add to the interest of the story.

* * * *

"The Pleasure Book for Boys"

Edited by W. J. GORDON (Warne & Co. Ltd. 2/6 net)

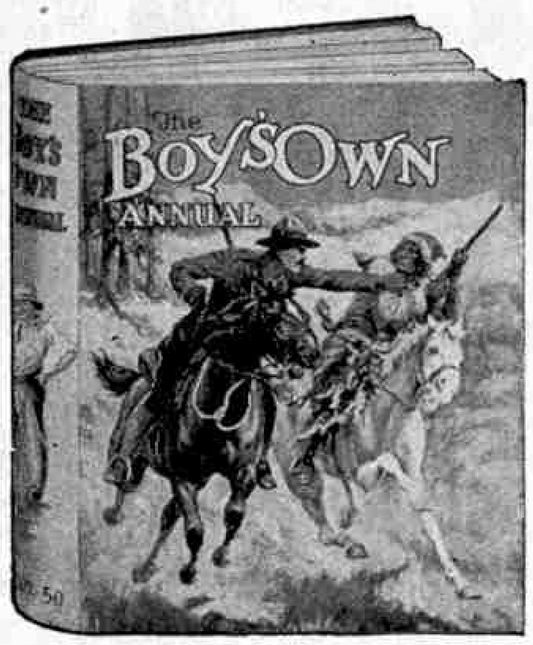
This is a volume that will provide many hours of happiness for any boy who is interested in well-written stories of adventure, both at home and abroad. The stories are by various popular authors and each one is well illustrated. There are tales of hidden treasure, of exciting incidents in India and thrilling adventure in the Kashmir Valley, in addition to scarcely less absorbing tales of adventure at home and, of course, the inevitable school stories. Altogether this is a book that can be thoroughly recommended as a Christmas present.

* * * *

"The Jolly Book For Boys"

(NELSON & SONS LTD. 3/6 net)

The title of this book is well borne out by its contents. It certainly contains a really jolly collection of stories dealing with a great variety of scenes, and well illustrated. There are also interesting articles showing how birds, beasts and reptiles will forecast the weather for us if only we understand their signs, and explaining how we came to have the penny post through the efforts of the great pioneer Rowland Hill.



* * * *

"The Tip-Top Annual"

(J. A. SHARP, Epworth Press. 3/6 net)

It would be difficult to imagine a more suitable Christmas present than this annual for a small boy. Its 240 pages include an astonishing variety of charming little stories with well-drawn illustrations. Scattered about here and there are some of the quaintest little poems imaginable and, in fact, there is something of interest on every page. The coloured plates are well reproduced and the volume has an attractive cover in colours.

* * * *

"The Hermit of Lihou"

By DAVID KER (R.T.S. 3/6 net)

This interesting story tells how two boy cousins visit the Channel Islands and discover, living in a small hut wedged high up in the cliffs, a man who has hidden himself in the belief that he has committed a murder. After a series of exciting adventures the boys are instrumental in proving that no murder was ever committed, and in bringing the hermit back to a normal, happy life among friends. This story will appeal particularly to boys who are fond of wild and rugged coasts, and, in particular, the description of a great storm is very well written.

* * * *

"The Empire Annual for Boys"

(R.T.S. 7/6 net)



This interesting annual, which this year makes its 20th appearance, is framed on similar lines to its big brother the "Boy's Own Annual." It contains an excellent collection of really exciting stories and, in addition, a series of articles on various popular hobbies. The volume is well illustrated and the coloured plates in particular are very attractive.

* * * *

"Joseph the Pioneer"

By G. A. PARKINSON (R.T.S. 3/6 net)

In this well-written book there is placed before us in a fascinating manner the story of Joseph. We follow his career from the time of his coming of age to his return home after his re-construction of Egypt, and few readers will want to lay down the book before the end. The description of every-day-life in the Egypt of those days is cleverly written, and the interest increases steadily as one well-known character after another comes on the scene. A subject of this kind is not by any means easy to handle, but the author has undoubtedly succeeded.

* * * *



"The Sword of The House of De Marillac"

By T. A. H. MAWHINNEY (Harrap & Co. Price 3/6 net)

This is a story of seventeenth-century France, and concerns the fortunes of a boy who is a faithful follower of the last member of the House of De Marillac. His fidelity to what proves to be an utterly lost cause carries him into the thick of fierce fights in the Mediterranean and ultimately to the slave galleys. We follow him through a succession of sea fights and adventures on unknown islands, and finally back to France where his loyalty and courage meet with well-deserved reward. The descriptions of the desperate battles



that one cannot read without at sea, and in particular of the hand-to-hand fighting, are unusually good, and almost persuade us that the author must have been there at the time!

* * * *

"Stories of the Backwoods"

(R.T.S. 3/6 net)

This collection of 26 stories of the backwoods, by various popular authors, is one of the best we remember reading. The term "backwoods" is treated in a very broad sense, and we are taken to wild and remote regions in Canada, Mexico, the Charlotte Islands, Australia, and elsewhere. Each of the stories is complete in itself and describes an adventure a thrill. We are given an insight into what life is like on the outskirts of civilisation and we realise something of the skill, strength and bulldog tenacity of the pioneers in these regions. Perhaps the best stories of all are those that deal with the Canadian wilds and in which Red Indians play a prominent and exciting part. The volume has an excellent coloured frontispiece and numerous full-page illustrations in black and white.

* * * *

"Stand Fast Wymondham!"

By A. L. HAYDON (Warne & Co. Ltd. 3/6 net)

"Stand Fast Wymondham!" is planned on conventional lines but is nevertheless well written and interesting. The plot centres around an Australian boy who is brought to England by his father and who finds himself in a small and rather despised house of a public school. His boundless energy leads him on to try to arouse the sporting instincts of his house and, with the assistance of a few staunch friends, he succeeds. There is no lack of interest in the shape of cricket matches, impromptu fights and so on, and the necessary humour is provided by the valiant but misguided efforts of a section of the juniors to form a musical society.



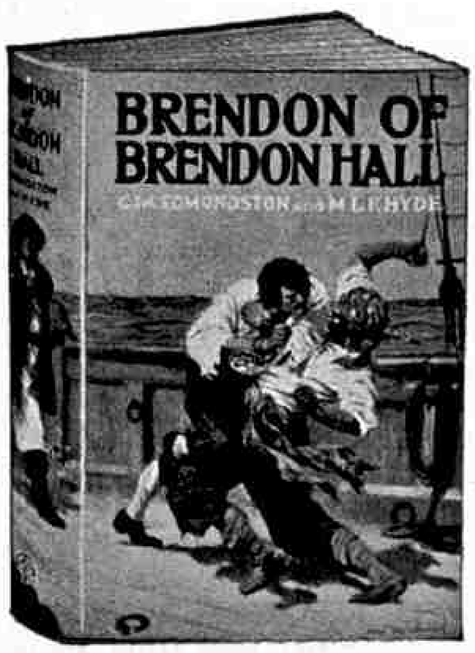
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"Brendon of Brendon Hall"

By C. M. EDMONDSTON and M. L. F. HYDE (R.T.S. 3/6 net)

A more interesting and vigorous story than "Brendon of Brendon Hall" could scarcely be desired. Young Brendon, following in his father's footsteps, is a staunch Royalist and, as the result of helping Prince Charles to escape, is arrested, tried, and sentenced to be transported to Virginia as a slave. He and his fellow slaves are herded together on the ship in conditions of almost indescribable misery and at first Brendon's only hope is that death will release him from his sufferings. The outlook brightens, however, as the result of his being able to save the life of the captain.

On landing he is bought by a well-to-do planter who, though strict, is a thoroughly good-hearted man and, by a fortunate chance, had known young Brendon's father in England in days gone by. The hero passes through much misery and many dramatic and thrilling experiences, but his splendid personality brings him safely through. In the end he is freed from slavery, and able to return to his home in Cornwall.



There is not a dull page throughout this book and many of the incidents, in particular one in which Indian tribes take the warpath, are of quite unusual excitement.

* * * *

A Batch of School Stories:—

"The Outside House"

By H. E. ELRINGTON (Sampson Low. 2/6 net)

"Master Valentine Bucket"

By ROWLAND WALKER (Sampson Low. 2/6 net)

"The Outside House" is an excellent school story of rather an unusual type. It tells of a house, outside the gates of a big public school, that was founded for the sons of gentlemen in poor circumstances. The house fell on evil days and became ignored and practically outlawed by the rest of the school. The arrival of a new boy of real grit and spirit gradually changes this state of affairs and in due course the foundation house comes into its own as an integral and respected section of the school. One of the best features of this story is the vivid description of a football match upon which great issues depend.



Most schools from time to time receive a shock at the hands of a new boy who, on arrival, appears meek and mild, but quickly shows that he is exactly the reverse. When "Master Valentine Bucket" arrived at Chudleigh-St.-Giles he appeared utterly harmless and inoffensive, but he was neither, and that was where the trouble began. Commencing by putting on the gloves with the school bully and giving him a sound thrashing, he proceeds to one extraordinary exploit after another until everyone, from the Dominie downward, begins to wonder what is going to happen next! We follow the young hero into and out of scrapes with almost breathless rapidity up to the final exploit in which, at the risk of his life, he saves the old school from dishonour.

* * * *

"The Flying Squad"

By Colonel W. A. BISHOP, V.C. and Major R. STUART-WORTLEY (Harrap & Co. Price 6/- net)

In many respects "The Flying Squad" is a unique book. It is the story of two Canadian lads who are determined to learn to fly, and of their tuition at the hands of a pilot whose skill is equalled only by his enthusiasm. We accompany the lads on their first flights and pass with them through the various trying experiences that must be faced by every would-be pilot. The descriptions of this preliminary tuition are so graphic and detailed, indeed, that no one who reads them can fail to have learned something of the problems that face a pilot and of the mental and physical qualities that he must acquire.

By accident our two heroes become involved in the operations of a particularly unscrupulous gang of thieves and discover a plot to rob an important bank. They decide not to call in assistance but to defeat the plot themselves, and this they succeed in doing. A desperate fight between the thieves and the police is followed by the most exciting episode of the book, in which the two lads find themselves in the cockpit of an aeroplane and in the hands of their enemies. To describe how they finally escape would be to spoil the climax of an unusually well-written book.

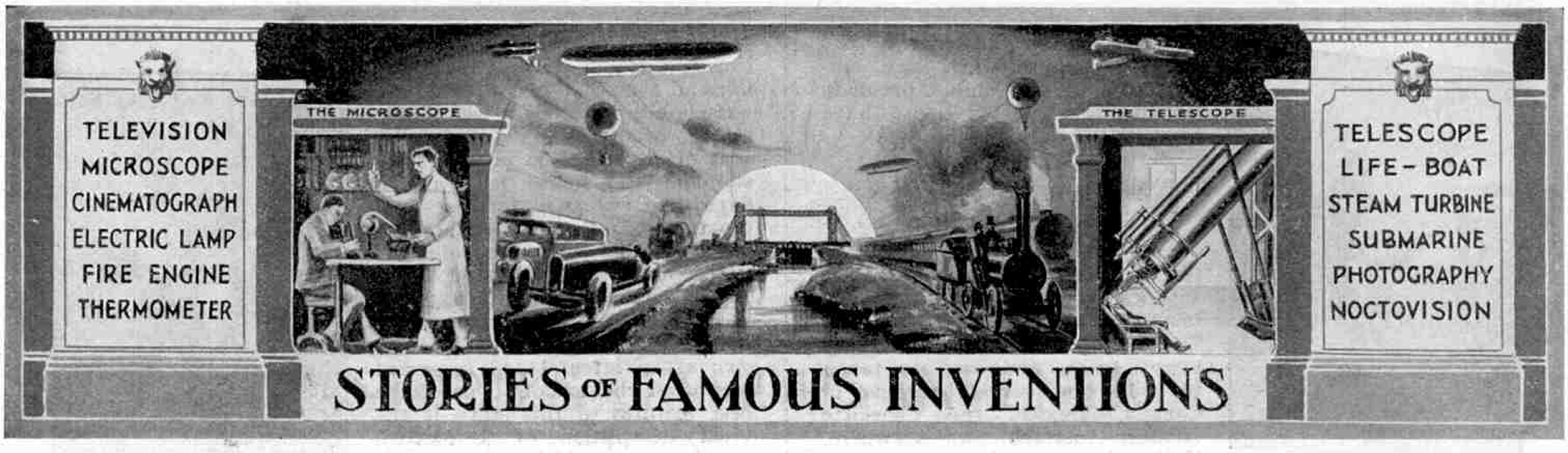
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Christmas Books for Younger Readers

Frederick Warne & Company Ltd. are always well to the fore with Christmas books for younger children and this year their productions seem more varied and attractive than ever.

Under the title of "*Bonnie Books*" (6d. each net) are three attractive little volumes each containing an interesting and amusing collection of stories of the type so dear to the hearts of small people. The illustrations are good and—a matter of some little importance—the covers are thick board and will stand a good deal of rough usage. On a rather more ambitious scale is the "Joyfun" series of books (1/- each net) of pictures, stories and rhymes. Each of the eight volumes has a coloured frontispiece and many black-and-white illustrations, and is bound in strong picture boards.

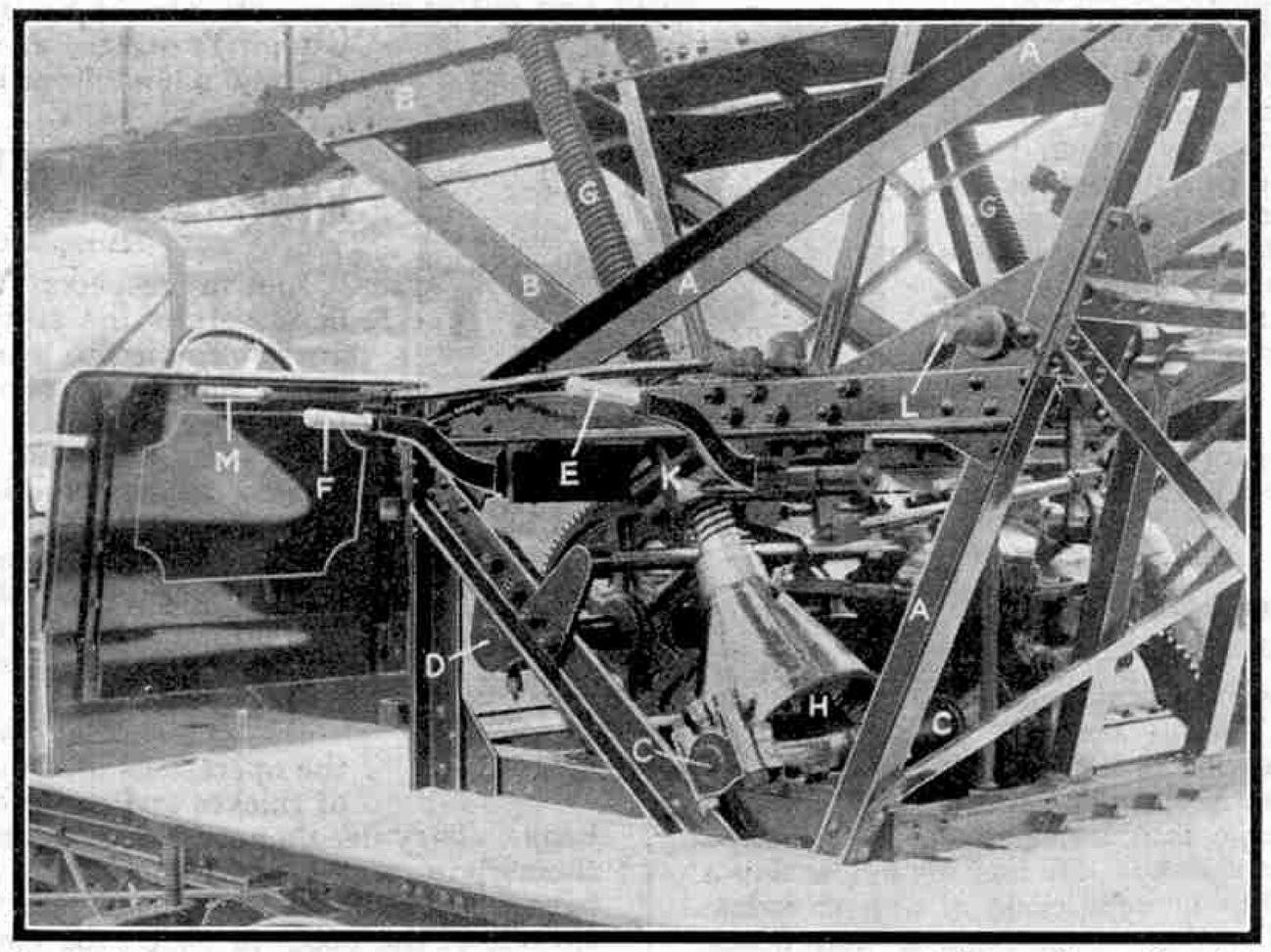




VIII.—A MODERN MOTOR FIRE ENGINE

A MODERN fire engine is a combination of a motor car and a pumping plant. The essential features of the motor car are speed and reliability, while in regard to the pump, or pumps, delivery pressure and regularity of flow are the important factors. A fire engine has to be capable of transporting safely heavy loads of men and material over the worst of roads at a high speed without any risk of a breakdown, and on this account the chassis is of specially strong construction.

The body of a fire engine is built of mahogany or oak and is in the form of a large rectangular box that is situated immediately behind the driver's seat and is divided into two compartments. One of these compartments has seating accommodation for several firemen, while the other provides storage space for 1,000 or so feet of canvas hose and other gear. At each side of the box is a footboard and between the footboard and the box are troughs to carry lengths of suction hose. Below this footboard and extending along the side of the chassis is a narrow box in which are kept the standpipes, etc., and the lid of this box provides standing room for a number of firemen. The bodywork is painted bright vermillion, and the name of the fire brigade owning the machine is painted in gold lettering on the side of the main box.



Courtesy [*Merryweather & Sons Ltd.*

A close-up of the turntable ladder mechanism

The motor power of a fire engine has a direct bearing upon the size of pumps that can safely be installed, for a low powered chassis cannot carry as heavy a weight as one of high power. Motor fire engines in use to-day range from 50 h.p. to 110 h.p., with corresponding variation in pumping capacity. A motor fire engine of 110 h.p. owned by the Edinburgh fire brigade, for example, is provided with two powerful pumps each capable of delivering 500 gall. per min. This fire engine, which is one of the most powerful in the country, was built by Merryweather & Sons Ltd., and the pumps are of the "Hatfield" reciprocating type, patented by that firm. The pumps are driven by a crankshaft arranged at right angles to the centre of the chassis through a specially designed worm-wheel speed-reducing gear running totally enclosed.

The two pumps are arranged in such a manner as to allow of their being used together when a sufficient water supply is available for the full capacity to be maintained, in which case they are capable of delivering eight jets simultaneously at high pressure. Where very long lines of hose are in use, however, the whole of the engine power can be applied to one pump, giving a corresponding increase in delivery pressure.

The suction and delivery valves of each pump are of rubber and are so arranged that the space between them is almost entirely filled by the plunger on the completion of the delivery stroke. A remarkably high vacuum is obtained by this means during the suction stroke and this vacuum enables water to be drawn into the pump from the greatest depth possible.

The flow of the water between the suction and delivery valves across the plunger chamber is continuous and direct, and the area and position of the passages around the body of the pump are such that no undue friction loss is caused by any violent change in the direction of the stream of water. By means of an automatic by-pass valve that is fitted between the suction and delivery passages, any quantity of water less than the full amount displaced by the plungers can be effectually delivered. This feature enables the pump to work equally well when delivering a "first-aid" jet of only $\frac{1}{4}$ in. diameter or when pumping its maximum quantity through a number of much larger nozzles.

Polished copper air vessels are arranged over the suction and delivery branches of the pumps, and four separate valve outlets are fitted, two for hose of $2\frac{3}{4}$ in. diameter and two for hose of $3\frac{1}{4}$ in. diameter. The suction inlet is conveniently placed in the centre of the pumping plant. The body of each pump is of gunmetal.

The projection of water from the Edinburgh fire engine can be varied from eight jets (nozzle, $\frac{3}{4}$ in. in diameter) to one full-power jet (nozzle, $1\frac{3}{4}$ in. in diameter). Some idea of the immense power of the pump when operating at full capacity may be gained from the fact that it requires five firemen at the nozzle to hold the hose steadily in position when the single full-power jet is being used.

The engine is provided with two standards that are fixed over the centre of the body and accommodate a set of scale ladders.

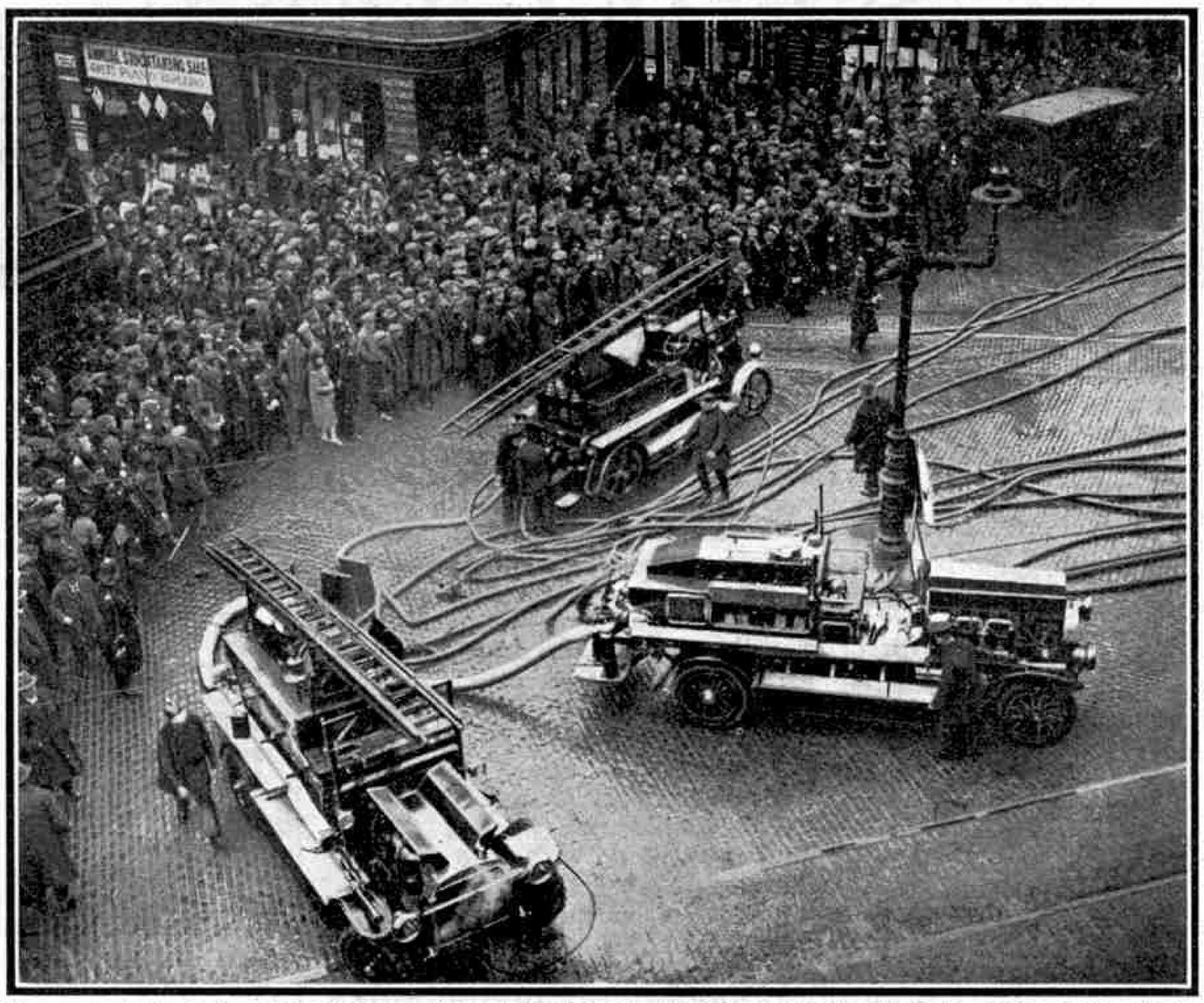
Some fire engines are equipped with a ladder carriage that is mounted on a pair of high wheels for transit when detached from the motor chassis. These carriages vary in length from 40 ft. to about 70 ft. When free of the chassis they stand in an upright position ready for use either as a life-saving appliance or as a self-supporting water tower from the top of which a jet of water can be directed on to a fire. After use the carriage is wheeled back to the fire engine and re-secured to the chassis. The attachment of the escape is a very simple operation. The ladder carriage has two hooked members that engage with a pair of trunnion pins fixed to the side frame of the chassis at its rear extremity, and the weight of the ladder is so evenly balanced on the trunnion pins that two or three men can easily detach it for service.

As mentioned last month, the fire fighters' task of rescuing people trapped in burning premises has become increasingly difficult with the growth in the height of buildings, and the urgent necessity of being able to reach quickly the upper storeys has resulted in the development of mechanically operated fire escapes, capable of rapid extension to a height of 80 ft. or more.

The first patent in this country for a motor fire ladder was taken out by Merryweather & Sons Ltd. in 1908. Since that time many

important improvements have been effected both in the design and construction of this type of apparatus. This year a further advance has been achieved by the production of a motor turntable ladder equipped with a reciprocating pump mounted on the same chassis. In addition, there is provided a telephone and loud speaker for the use of the firemen at the top of the ladder, and a searchlight by means of which a light can be thrown on the ladder in whatever position it may be. The machine is equipped with a motor capable of developing 60 b.h.p., and is provided with specially designed brakes that enable it to be pulled up very quickly when travelling at high speed.

The fire escape ladder is in four sections and when fully extended reaches to a height of 85 ft. The ladder sides are of specially selected Oregon pine, the adjustable rungs being of oak. The method of trussing such ladders to render them sufficiently rigid is of the greatest importance. Each of the three lower sections is trussed with steel tension rods to give additional strength, while the top section is made equally rigid in both directions, the trussing being designed to take both tensile and compression strains.



The scene at a large fire at Nottingham. The suction hose leading from a street main to the engine in the background is clearly shown. Note the several unconnected lengths of hose laid out in reserve

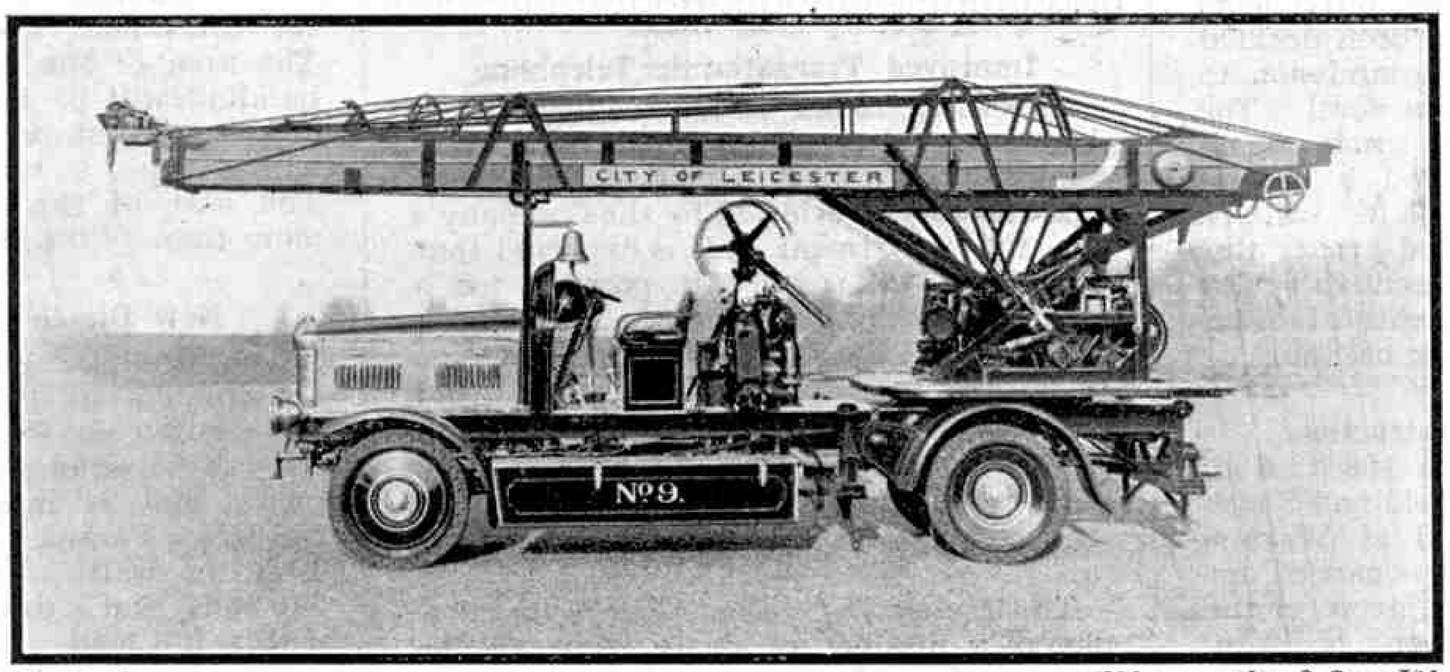
In the motor fire ladder in question the top portion is fixed with a tubular truss of solid drawn weldless steel. The lower section is pivoted on the swinging frame marked B on the accompanying illustration, and is adjusted laterally to it by a screw gearing. This swinging framework is itself carried by the framework A. This ensures the ladder being always plumb sideways when the motor chassis is standing on uneven ground. The framework supporting the ladders is entirely of steel and includes four hinged struts with adjusting screws for supporting the chassis frame above direct from the ground, instead of through the wheels and springs, when the ladders are in operation.

On the upper side of the chassis framing, directly over the rear axle, is fixed a steel forged ring upon which revolves an angle steel ring that carries the whole of the ladder unit. Upon the upper ring is constructed a section-steel framework carrying the fulcrum upon which the sections of the ladder are swung, and the wlfole of the details of the operating mechanisms for working the ladder. This mechanism consists of a vertical spindle in the centre of the turntable rings, driven direct from the crankshaft of the motor through the change-speed gear box by bevel toothed wheel gearing mounted on the base of the turntable. The mechanism is thrown in and out of action with the transmission gear of the chassis by a hand lever that is operated from the driver's seat.

The vertical spindle, through a worm and wheel gearing, drives double cone clutches that revolve on two horizontal shafts C and D, mounted on the upper turntable ring. The clutch gear is mounted on ball bearings and runs totally enclosed in a grease-tight casing, while the clutches are made to engage with the horizontal shafts by the action of two hand levers which, by a change in their position, affect the direction of revolution of the shafts.

The horizontal shaft C operates the gear for raising the ladders from a horizontal to a vertical position, and the shaft D operates the gearing for extending the ladder. The gear for raising the ladder consists of a pair of screwed shafts G, driven through bevel wheels H by the horizontal shaft C. These screwed shafts revolve in the swivel nuts K that are fixed to the swinging framework B carrying the ladder, and hold it at any desired angle relative to the fulcrum frame on which it is pivoted. The gear for raising and lowering the sliding sections of the ladder consists of a revolving drum, driven by a toothed wheel speed reduction gearing from the horizontal shaft D. On this drum is wound a flexible steel rope running over a pulley on the fulcrum spindle and attached to the foot of the first section of the ladder. Automatic safety pawls are fitted to each section, and other safety devices that are provided make it impossible for any over-winding of the mechanism to take place.

The ladder is revolved around the turntable in either direction by worm wheel gearing, through a vertical spindle, a toothed pinion engaging with a toothed ring fixed to the lower turntable ring. This gear is driven through double cone clutches in the same manner as the raising and extending gear and is controlled by the hand lever M.



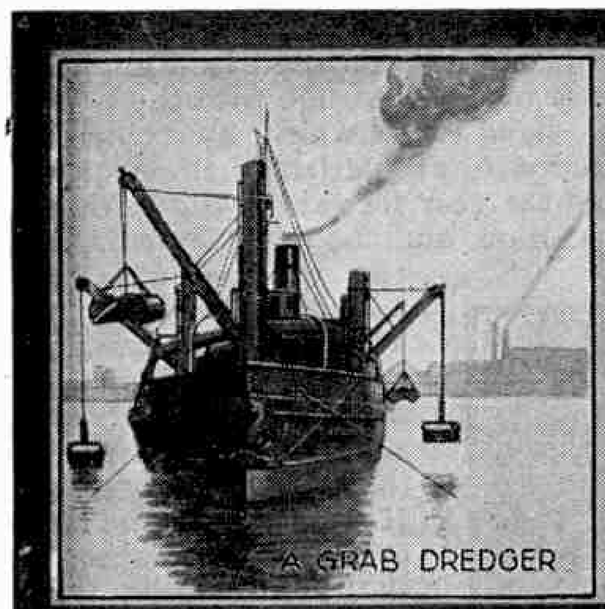
Courtesy [*Merryweather & Sons Ltd.*

The combination motor turntable fire ladder and pump owned by Leicester Fire Brigade

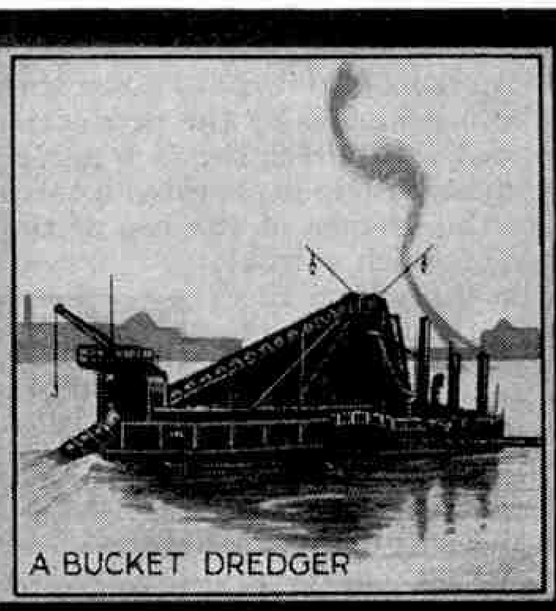
By the operation of the three levers, E, F and M, one man has entire control of the mechanism for raising, extending and revolving the ladder sections in any direction. Moreover, these operations can be carried out simultaneously. In addition, auxiliary gearing, operated by hand at L, is provided for carrying out these operations.

An entirely separate slow-speed ladder-adjusted gear is provided for effecting fine adjustments to the ladder sections if necessary, after they have been moved into approximately the most convenient position for working. Indicator plates, showing the extension of the ladder and the safe angle at which it can be worked, are placed in full view of the man operating the levers. A nozzle for hose is fitted at the top of the ladder.

In the centre of the chassis is fitted a Merryweather-Hatfield reciprocating fire pump, capable of delivering 250 gall. per min. The jet of water is delivered through a gun-metal double-swivel monitor-nozzle at the top of the pump. This nozzle can be swung around and elevated to any angle required. A capacious box for carrying fire brigade gear is fitted along each side of the chassis and the lids of the boxes provide standing accommodation for the firemen. The equipment of the machine includes a loud-sounding carill n bell.



ENGINEERING NEWS



The Institute of Marine Engineers

Among a number of awards offered by the Institute of Marine Engineers there are two that are open to non-members this session. The Institute silver medal is awarded annually for the best paper read by a non-member, during the session, and the Herbert Akroyd Stuart award, which is approximately £56 in value, is open both to members of all grades and to non-members. This award is made for the best paper on "The Origin and Development of Heavy Oil Engines," read at the Institute before 30th April, 1930. In the case of the Stuart award competition all entries must be received at the Institute by 30th April, 1929, the selected paper being read during the winter session 1929-30, and the award presented at the annual meeting in 1930.

There are also three Lloyd's Register Scholarships offered for apprentices and junior engineers, one being available each year for three years at £100 per year. Intending candidates should make application to the Institute not later than 7th March, 1929, in order that arrangements may be made for the examination to be held in May of that year.

* * * *

Owing to the effect of the Chicago drainage canal of lowering the water level in Montreal Harbour, it has been decided by the Montreal Harbour Commission to construct a submerged dam at Sorel. The dam will consist of two stone arms, one on either side of the river, and a central channel-way of at least 35 ft. will be maintained. It is expected that this scheme will get over the present difficulty of maintaining a sufficient depth of water for navigation purposes in the harbour.

* * * *

L.N.E.R. Bridge Reconstruction

The reconstruction of the 108 ft. 6 in. span bridge across the Sheffield and South Yorkshire Navigation Canal at Warmsworth, near Conisborough, was carried out a short time ago by the engineers of the London and North Eastern Railway. This bridge is referred to locally as the Rainbow Bridge. Its reconstruction called for the replacing of the three existing girders by four steel plate girders each 113 ft. in length and 9 ft. in depth, one being placed directly under each of the four rails.

The work was carried out in two parts, and on Sundays, one line at a time being blocked while the work was proceeding. The new girders, which are approximately 50 tons in weight, were carried to the bridge on special wagons and lowered into position by two cranes, one situated at each end of the bridge. The old cast iron girders were removed as soon as the new steel ones were in place.

New Type of Train Ferry

A new type of train ferry has recently been constructed at Wallsend-on-Tyne, for the Overseas Railway Incorporated, New York. The train-carrying steamer has been named the "*Seatrain*" and is to be used to transport fully-loaded freight trains between the terminal station at New Orleans and the terminal station at Havana. The freight wagons are not run direct from the railway line on to the ship in the usual way but are lifted up and lowered on board by large cranes situated on the quayside. Wagons will be carried in the hold, both the upper and lower deck and also a part of the superstructure. In order to enable the wagons to be loaded and unloaded with the utmost rapidity, the ship is fitted with a huge hatchway, 53 ft. in length and 45 ft. 8 in. in breadth.

THIS MONTH'S ENGINEERING STORY

Officer (at Board of Trade examination): "What steps would you take if you saw water entering the engine-room?"

Stoker: "The ladder, sir."

Improved Transatlantic Telephone

According to an announcement of the American Telegraph and Telephone Company an extremely sensitive submarine cable has been perfected by the Company's research department. It is expected that this cable will render it possible for a really effective telephonic service between England and the United States of America to be maintained, and it is even claimed that the cable will give better results than any obtainable by using wireless methods.

* * * *

New British Cruiser

The cruiser "*London*," has now completed a number of trials, and will be sent out for a final test early in January. It is expected that she will be ready for duty as flag ship in the First Cruiser Squadron of the Mediterranean Fleet by 31st January. The "*London*" is the first of four sister ships, the names of the remaining three being the "*Devonshire*," "*Sussex*" and "*Shropshire*." These are still undergoing preliminary trials and are not expected to be ready until after March. The ships are similar in their more important details to cruisers of the "Kent" class, but they have been designed to enable them to attain a speed of 32 knots, as against the maximum speed of 31½ knots developed by ships of the older type.

The World's Largest Building

In less than a year there will be completed in Boston, U.S.A., a skyscraper that will exceed in size, if not in height, the famous buildings of New York and Detroit. When the rooms on all its floors are occupied it will house a population of about 25,000 and will thus be large enough to constitute a city in itself.

The New England Building, as it will be called, will have three stories below ground, one of which is to be a garage that will provide room for between 3,000 and 5,000 cars. Their owners will simply drive into the basement and after leaving their cars will ascend to the upper floors in lifts. A huge department store will occupy the lower part of the building, and an interesting feature of this establishment will be an underground tunnel communicating with a distant warehouse and delivery centre. A similar tunnel will give access to the Boston Underground Railway.

Above the department store will be a space occupied by a permanent exhibit of New England products, and the remaining floors will be let off for office purposes.

The municipal regulations of Boston restrict the height of the building to 300 ft., but in spite of the limitation of the number of stories thus imposed, the total floor space will be enormous. The area of the ground covered by the building will be 130,000 sq. ft., and the department store on the lower floors will occupy a total area of 10 acres. The cost of the huge building will be more than £4,000,000.

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New Diesel-Electric Ferryboat

The first Diesel-electric vessel to be constructed in England is now ready for regular service. The boat has been built to the order of the Argentine Government, and is intended for service on the River Parana. It is 145 ft. in length, 40 ft. in width, has a displacement of 340 tons, and a draught of only 4 ft. 5 in. with a full load.

The vessel will be able to carry 20 motor cars on the main deck, while on the upper deck accommodation for 150 passengers has been provided. It is double ended, and may be propelled in either direction by means of twin screws situated at each end of the vessel. Each of the four screws is directly coupled to a separate motor developing 200 h.p. at 350 r.p.m.

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There is every prospect that a second great bridge, designed for road traffic, will cross the Firth of Forth alongside the world-famed railway bridge. A road bridge at this point is urgently needed, as it would save road traffic a detour of more than 50 miles.

England's Largest Tramway Depot

The new tramway and omnibus depot of the Liverpool Corporation, which was opened recently by the Minister of Transport, is the largest of its kind in England. It has taken nearly four years to build and occupies an area of 15 acres.

The works portion of the depot is built of reinforced concrete over a steel framework, and some 3,000 tons of steel is incorporated in the structure. The main building is divided into a series of bays by stanchions erected at regular intervals. Each bay is 45 ft. by 44 ft. 6 in. The stanchions carry the roof trusses and, in some cases, also support the girders bearing the overhead cranes. A conveyor that extends the full length of the main block enables vehicles under repair to be transferred to any part of the building. This conveyor is operated by a 25 h.p. motor and can cope with vehicles weighing up to 15 tons. It has a maximum rate of travel of six miles per hour, and is entirely independent of the movable overhead cranes.

The eastern section of the main building contains the smithy, foundry, electrical shop and, situated in a gallery above the latter, a test room. The smithy is equipped with 15 blacksmith's hearths, power cutting shears, power hammers, etc., while beaten ashes have been used for the floor on account of their low conductivity of heat. In the foundry 12 furnaces have been erected, and lead, steel and aluminium castings required for any purpose can be made at short notice.

The electrical shop covers an area of 23,670 sq. ft., and is fitted up with coil winding and testing machines, a rotary converter for testing up to 2,000 volts, and all the various other necessities for the construction of tramcar electrical parts.

The remaining 87,750 sq. ft. of the eastern half of the main block is taken up by the car repair and overhaul shop, and the fitting shop. The repair shop is provided with 10 inspection pits and a complete plant, while one acetylene and three electric welding sets are installed in the fitting shop.

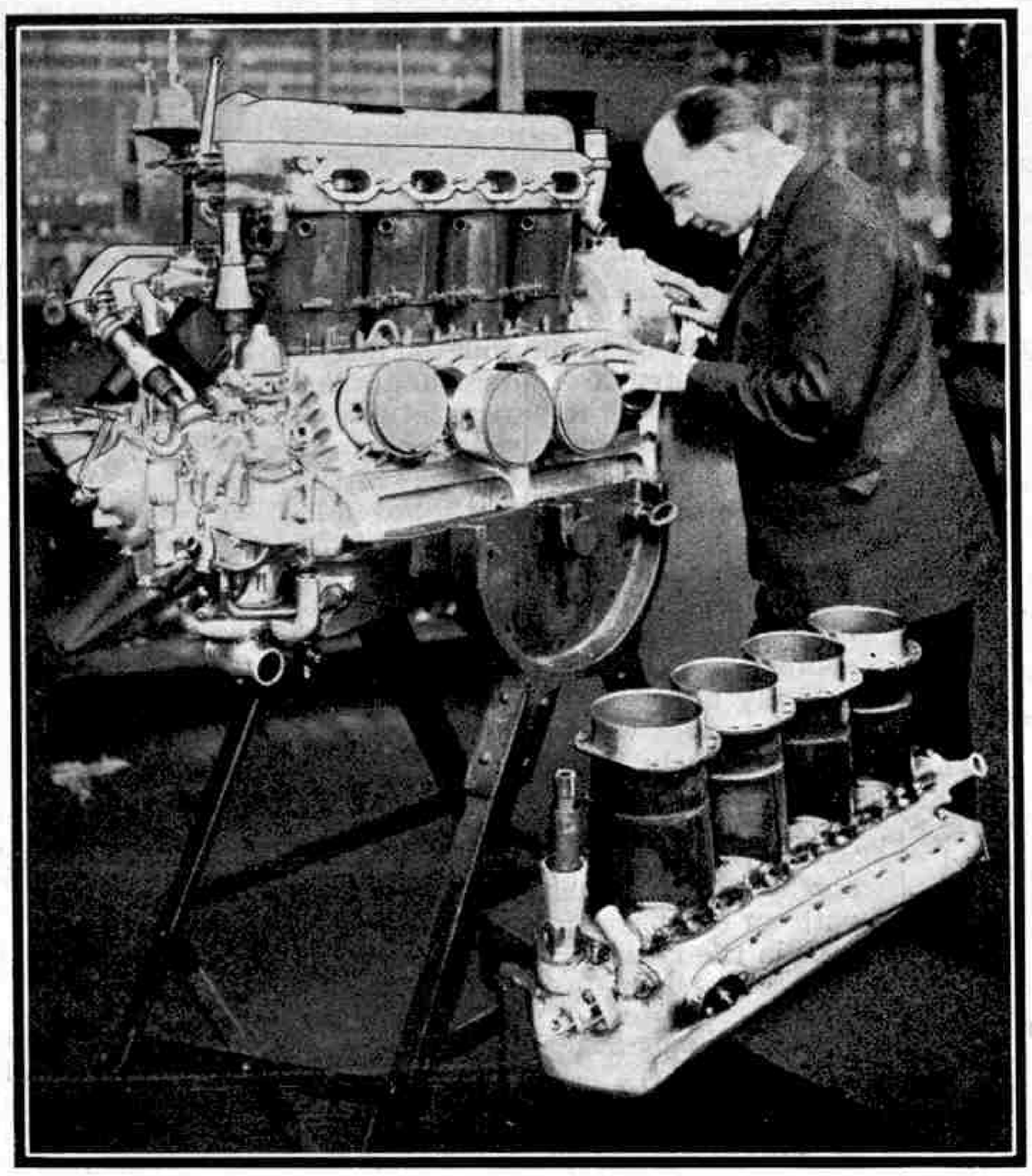
In the western half of the main building are the body-building, painting, and body repair shops. The first-named department is equipped sufficiently for 24 cars or bus bodies to be dealt with at the same time, while the repair shop contains six pits, providing accommodation for a total of 30 cars. Special hot-water car-washing arrangements are fitted in this department.

The painting shop is 32,210 sq. ft. in area and work can be carried out on 40 cars simultaneously. All air entering the department first passes through a washing and heating plant as a precaution against any particles of dust settling on newly-varnished vehicles while the coating is still moist.

The 19,400 sq. ft. motor omnibus repair shop is equipped with gear and inspection pits in a similar manner to the other repair shops, and is adjacent to the underground oil tanks. These tanks have a capacity of 24,000 gallons of oil and are fitted with special internal auto-filling valves so that they can be filled up direct from oil tank wagons in the railway siding.

The saw mill, separated from the body-building shop by concrete walls, contains all necessary tools for dealing with wood from the moment it enters the mill in the form of logs until it is ready to be used in the body-building shops.

A private siding from the adjacent L.M.S. Railway enables supplies of various kinds to be delivered with the minimum of handling.



The Supervisor examining the Napier "Lion" engine during erection. (See article on page 984)

New C.P.R. Passenger Ship

The Canadian Pacific Railway Company have recently let a contract to a British firm of engineers for the construction of a 40,000-ton passenger ship. The vessel, which will be named the "*Empress of Britain*," and is expected to be ready for service early in 1931, is to be used on the route between Southampton and Quebec via Cherbourg. She will be 730 ft. in length with a beam of 97 ft., and will be capable of attaining a maximum speed of 24 knots. The "*Empress of Britain*" will be the largest liner operating on this route and will be capable of completing the Southampton-Cherbourg-Quebec trip in five days with a full complement of 1,100 passengers.

* * * *

New Bridge in Malaya

Work is soon to be commenced on the construction of a new bridge over the Perak, Malaya. The bridge will render obsolete a ferry service that is now in operation, and will carry the main Kuala Kangar-Engor road over the river. It will be 928 ft. in length between abutments and will consist of seven steel arch girder spans carrying a road with a minimum width of 70 ft. The concrete piers to carry the steelwork will be sunk to a depth of at least 32 ft. below the level of the river bed and the steelwork itself will weigh approximately 1,500 tons.

The World's Greatest Dam

The Lloyd Dam, which was opened recently by the Governor of Bombay, is the greatest structure of its kind in the world. It is built across the River Indus at Bhatgar, 50 miles from Poona, and is part of the Sukkur irrigation scheme that is to provide for the watering of six million acres of land. The dam is 190 ft. in height, nearly a mile in length and includes over 21 million cu. ft. of masonry—two million more than the famous Assuan Dam in Egypt. The work has cost £1,250,000, that is 50 per cent. less than the smaller Assuan Dam.

The Lloyd Dam itself consists of a series of large piers, regularly placed at intervals of 60 ft. and carrying two bridges across the river. One of the bridges is at a high level, and from this 36 steel sluice gates each weighing 50 tons are operated, while the low level bridge is used for vehicular and passenger traffic.

An area of over 800,000 acres is commanded by the dam and 300 miles of this will be irrigated annually, causing an increase in the output of crop to the value of approximately £2,400,000. When the whole scheme is completed it is expected that the canals will enable 823,000 acres of rice, 1,739,000 acres of cotton and 3,380,000 acres of miscellaneous Indian crops to be cultivated.

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An engineering project unique in Canadian industry has been found successful at Port Arthur, Ontario. This consists of a pipeline by means of which wood pulp is carried from a grinding mill owned by the Thunder Bay Paper Company at Current River to the company's paper mill, two miles away. The tests are stated to have been highly satisfactory. The pipe used is made of cast iron and is 10 in. in diameter.

* * * *

Tidal Power Development in New Brunswick

A Canadian company have recently applied to the Minister of Public Works at Ottawa for permission to proceed with a project for the development of tidal power in Passamaquoddy Bay, New Brunswick. The basis of the proposition is the remarkable rise of the tides in the Bay of Fundy. In Passamaquoddy Bay the rise and fall is some 28 ft. and by means of dams, bridging various islands, it is proposed to utilize the energy made available by the tides to develop electrical energy. The estimated cost of the undertaking is placed at between £10,000,000 and £15,000,000, and the initial power development would range from 400,000 h.p. to 500,000 h.p. and ultimately reach from 700,000 h.p. to 800,000 h.p. The construction would require 42 months with 3,000 to 4,000 workmen.

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The Great Western Railway Company have placed with Vickers-Armstrong Limited an order for a pair of steel lock gates for Penarth Dock.



Photograph Broadcast from Aeroplane

For the first time a photograph has been broadcast from a moving aeroplane. The machine was flying over Philadelphia and a photograph of Colonel Lindberg was broadcast and received on 100 sets in the city. The waves were also picked up by special apparatus and re-broadcast to enable ordinary listeners-in to hear the crackle of the wireless waves.

* * * *

Bristol Jupiter Series VIII Engine

The Bristol Aeroplane Company have recently completed tests covering 150 hours' flying on their new type of Jupiter Series VIII geared engine. It was fitted in a Bristol "Bloodhound" biplane and the tests were carried out with the idea of ascertaining the most suitable compression ratio for a high-compression geared air-cooled engine, and also of ascertaining a suitable exhaust system for a geared engine. As a result of these tests the 5.8 compression ratio was selected.

Considerable development work was found to be necessary in regard to the exhaust ring, owing to the fact that with the 2 : 1 reduction gear the cooling slip stream was not as efficient as with the ungeared engine. Accordingly the area of the exhaust ring and outlet pipes had to be considerably increased and modified as compared with the ungeared engine, in order to meet the official requirements of the Fire Prevention Committee. As a result the exhaust ring area has been increased to 24½ sq. in. and double outlet pipes have been provided for each cylinder.

It is interesting to note that with the "Bloodhound" machine a considerable increase in performance was registered with the geared engine as compared with the ungeared type. For instance, at 5,000 ft. the increase in speed was over 12 miles per hour, or approximately 10 per cent.

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Interchangeable Parts for Aeroplane

A light aeroplane in which many of the parts are interchangeable has been designed to enable the very minimum of spares to be purchased. The machine has been named the "Simmonds Spartan," after its designer Mr. Simmonds, formerly a member of the Supermarine Aviation Works, Southampton. A biplane built on this scheme was flown by Flight-Lieut. S. N. Webster in the King's Cup Race.

The "Spartan" is designed with a symmetrical wing section and with wing roots that enable any plane to serve as either upper or lower wing on either side. The elevators are interchangeable with the rudder, and the horizontal tail plane is constructed of three parts, each of which is interchangeable with the vertical fin connected to the rudder. Several other smaller accessories are standardised in this manner, making the machine an ideal one for private owners and flying clubs who do not wish to invest in a great number of spares, some of which may never be actually needed.

The service weight of the "Spartan" is approximately 1,400 lb., but it is designed for an Aerobatic Certificate of Airworthiness at 1,680 lb. Each cockpit is fitted with a door, and in the fuselage a large luggage compartment has been arranged with an extension for golf clubs or fishing rods in the fairing.

* * * *

Single-Seater Aeroplanes

For some time there has been a considerable demand among owner-pilots for a light aeroplane at a lower price than any machine at present on the market. With this demand in view a correspondent of "*Flight*" has designed a small completely enclosed single-seater monoplane. The machine is intended to be fitted with an A.B.C. "Scorpion" Mark II engine and possesses a folding wing with a span of 25 ft. 8 in., giving housing width of 7 ft. 6 in. The tare and gross weights of the machine are respectively 425 lb. and 700 lb. A landing speed of 40 m.p.h. and a maximum speed of 105 m.p.h. are aimed at while the cruising range at 85 m.p.h. is expected to be about 340 miles. The petrol consumption at this cruising speed will be 40 miles per gallon and allowance has been made for the carriage of 20 lb. of luggage. This aerial motor cycle is not yet in production but it is estimated that the total cost of the machine will not exceed £300.

THIS MONTH'S AIR STORY

"Yes," said the timid passenger to the aeroplane pilot. "I understand I'm to sit still and not be afraid, and all that; but tell me, if something happens and we fall, what do I do?"

"Oh, that's easy," said the pilot, "Just grab anything we're passing and hang on tight!"

The New Rohrbach "Romar"

According to a report recently issued, a regular air service between Germany and South America will be inaugurated next summer. The route will be worked by the Rohrbach Company's new "Romar" flying boats. These boats are manned by a crew of five, consisting of navigator or captain, wireless operator, two pilots, and a mechanic. The wings are so constructed that the mechanic is able to crawl inside them while the machine is in flight in order to examine the pipe lines leading to the three engines. The "Romar" has a total weight of about 10 tons, and is capable of carrying a paying load of approximately nine tons.

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Liverpool-Belfast Service

It has now been definitely decided to inaugurate a regular air service between Liverpool and Belfast next spring. As mentioned in our October issue, the Aerial Taxis (Glasgow) Company will be the operating company, and a fleet of eight-seater de Havilland Canberra aeroplanes will be used. The aeroplanes will land at the Malone Aerodrome at the Belfast end, and at Hooton Aerodrome for Liverpool. The machines will be capable of completing the journey in one hour and 30 minutes, and even with a head wind the maximum time taken would only be about two-and-a-half hours.

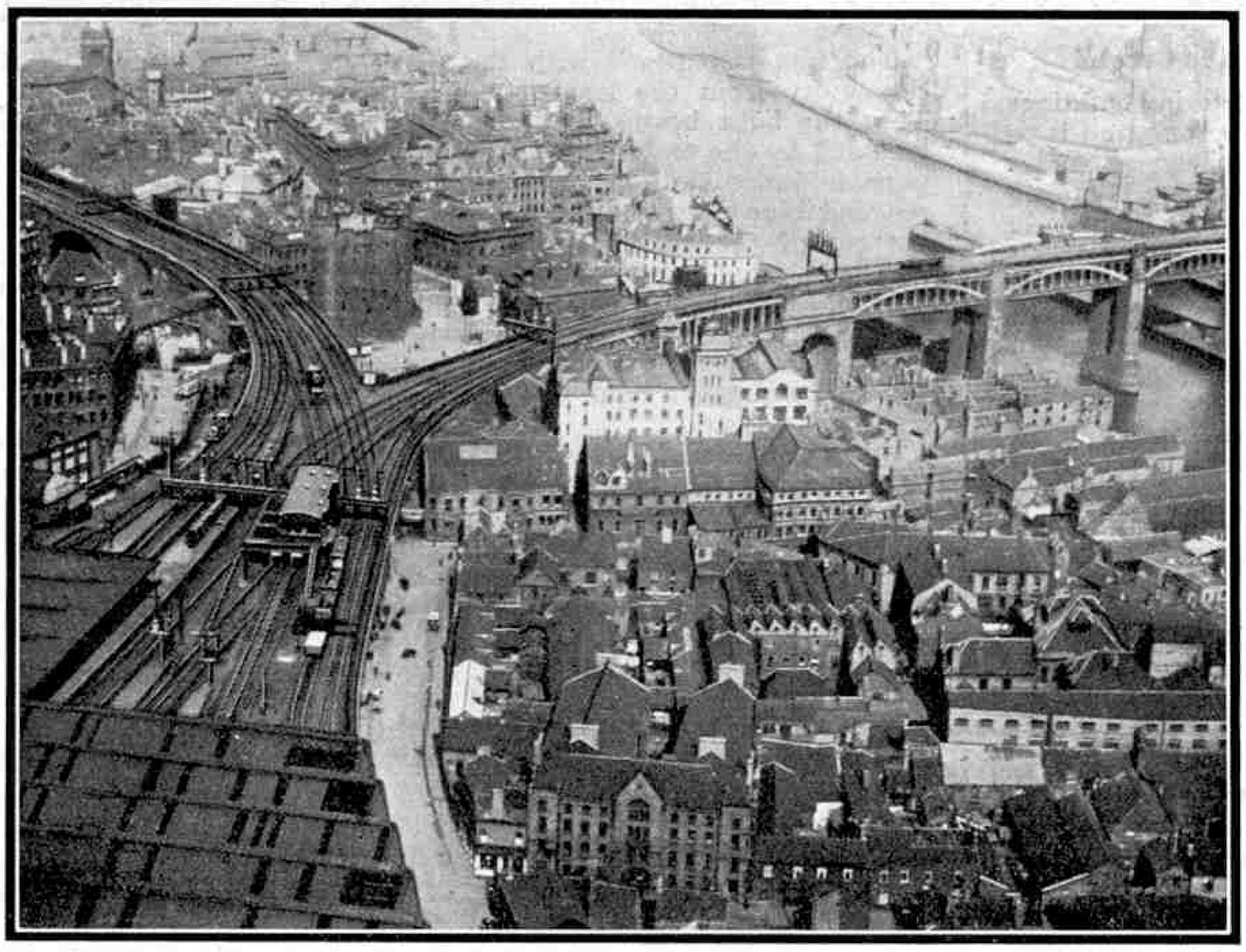
The Imperial Airways Calcutta flying-boat service that was inaugurated between Liverpool and Belfast during Liverpool Civic Week has been discontinued during the winter months, partly owing to a slight injury to one of the wing floats sustained by the Calcutta. This service was hampered a good deal by the prevalence of early morning fogs on the Mersey.

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Proposed Berlin-Pekin Air Route

Major Van Schroeder, a German airman, has recently carried out on behalf of the Luft-Hansa Company and the Russian airways company, Deruluft, a series of experimental flights from Berlin to Irkutsk in Siberia. These flights have been so successful that the two companies have decided to inaugurate in the spring of next year a joint regular air service to the Far East. There will be twelve machines on the service and the 5,000-mile journey from Berlin to Pekin is scheduled to take 2½ days, as against 17 days by rail and six weeks by boat. The journey from Berlin to Shanghai is expected to occupy approximately three days.

Stations from the Air—No. 2



Photo] [*Aerofilms Ltd.*

On page 475 of the June issue of the "M.M.," we showed an illustration of the amazing network of crossings outside Newcastle Central Station. The above aerial photograph of the station, which is the second largest on the L.N.E.R. system, shows an even more interesting view of the crossings. The photograph in the June issue was taken from the signal gantry to be seen at the end of the station platforms. The bridge on the right is the famous High Level Bridge over the Tyne, and the Swing Bridge is seen beyond and just above the second span. Our photograph was taken before the building of the new High Level Road Bridge, which was recently completed.

Airways and Imperial Unity

Sir Samuel Hoare, Secretary for Air, in the course of a recent address to the Royal Geographical Society of Scotland, at Glasgow, said that the heart of the British Empire was no longer an unapproachable island. Year by year we must give our minds and our money to building up an Air Force and an organisation strong enough to deter any would-be enemy from an attack upon us.

Alluding to Imperial defence, Sir Samuel said that the greatest enemy of Imperial solidarity was distance. The aeroplane and the airship, entering into an alliance with the cable, the telephone and wireless, could almost eliminate this enemy. Little more than a hundred years ago it took four or five days to make the journey between Edinburgh and London. There was no reason today why the aeroplane should not bring Bombay as near in time to London as Edinburgh was at the beginning of the nineteenth century.

Speaking of the pioneer flights of the Royal Air Force, Sir Samuel gave some interesting quotations from the description from an African native chief who saw an Air Force unit for the first time: "We went to Bauchi and we saw something that everybody declares he has never seen. It came to us travelling in the sky, making a noise like the sound of a great rushing wind. 0-0-0-0-0-. There was a large piece of cleared ground and we, a great multitude, surrounded it. The thing came circling the air, receding and returning as a bird tracks the sky. . . I do not see how anyone could fight with the white man who uses that thing. Supposing someone should want to shoot him with a gun, he would just fly off and the shot could not reach him. Ah! a man of that kind cannot be classed with men—he is greater than all men. From of old, indeed, our people have been sitting in the dark, but now the eyes of our people are beginning to clear with partial knowledge."

The following quaint passages were also quoted by Sir Samuel from a description from an inhabitant of Southern India: "As I was hastily getting out of my room I saw my grandmother in the act of pious genuflection. As at this time of the day (10 a.m.) such exhibitions of piety were unusual with her, I asked her what the matter was. . . She told me in sublimated accents that four heavenly cars were descending on the earth to bear bodily to Paradise the good and pious people of the place. There was no hint of any surprise in her words. It was all as it should be!"

In a reference to commercial air services Sir Samuel said that the Imperial Airways Company had proved the safety and regularity of air travel, and the data that had been accumulated during the existence of the company went to show that we were within measurable distance of making commercial flying self-supporting and independent of subsidies. It was sufficient to say that the company had flown, since the beginning of 1925, three million miles without injury to a single passenger; and that its latest service, between Cairo and Basra, a distance of 1,135 miles, over a desert that a few years ago would have taken months to cross, often completed the flight in the course of a single day.

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Croydon to Berlin for Thirty Shillings!

An interesting flight from Croydon to Berlin has been made by Capt. Neville Stack who, with Mr. B. S. Leete, accomplished the first British flight to India in a light aeroplane. Capt. Stack, flying his own 85 h.p. Avro Avian, travelled by way of Brussels and Hanover. The flight was accomplished in four hours 53 minutes and the total expenditure for fuel and oil was only thirty shillings. The regular passenger aeroplane that leaves Croydon every morning takes eight hours to cover the distance.

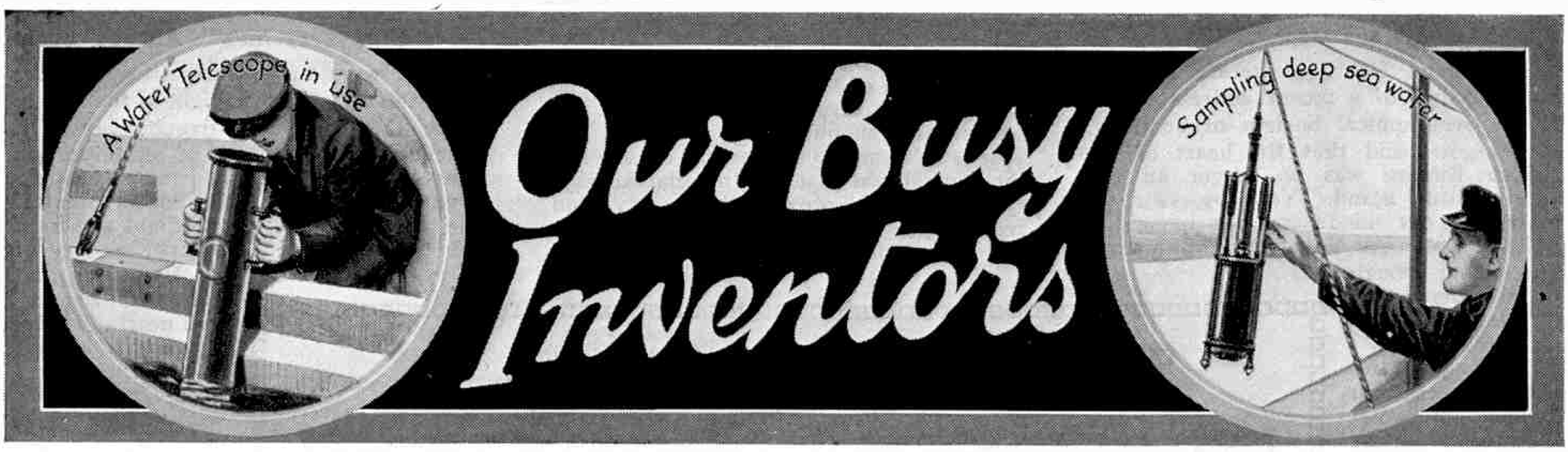
The "*Graf Zeppelin's*" Atlantic Flight

There were many interesting features about the first Atlantic flight of the airship "*Graf Zeppelin,*" constructed by Dr. Eckener with the object of establishing a trans-Atlantic air mail and passenger service between Spain and South America. The course followed on this flight was from Lake Constance to Lakehurst by way of the Bermudas, and the journey occupied nearly 111 flying hours instead of the three days that Dr. Eckener was confident would be sufficient.

At an early period in the flight the airship received an injury to one of the stabilising rudders, but it was found possible to repair the damage temporarily. Another check was experienced in the neighbourhood of the Bermudas when the vessel was fighting against a head wind for some 17 hours without making any appreciable headway. If the vessel had been flying in still air it would have been possible to keep a straight course and the trip would have been completed within 60 hours. As it was, nearly five days were taken, and during most of the time a disconcerting element of danger was present.

The "*Graf Zeppelin*" cost approximately £225,000 to construct and the cost of the trip was £10,000. It is an interesting fact that the vessel is slightly longer than the "*Mauretania,*" and yet is capable of carrying a paying load of only 15 tons! Obviously, therefore, this airship is an utterly uneconomic proposition and cannot in any sense compete with water-borne traffic. This fact was freely admitted by her Commander on his return.

The voyage of the "*Graf Zeppelin*" has revived the controversy as to the relative merits of the airship and the aeroplane. It certainly appears to demonstrate that at present airships are less capable than aeroplanes of maintaining a regular trans-Atlantic service. In view of the keenness of this airship-aeroplane controversy additional interest is lent to the British experimental airship R 100, now approaching completion at Howden, near Selby. Visitors to the shed at Howden are steadily increasing in numbers and it is a curious fact that among them women considerably outnumber men. It is interesting to note that a frequent remark made by visitors as they enter the shed is: "How like a huge Meccano model!"



Concrete Piles Exploded in Ground

An interesting method of giving buildings a good foundation in swampy ground is to use explosive concrete piles, a recent American invention. It is well known that ordinary piles are simply driven in by a ram until firm soil is reached. This is not always satisfactory, for the piles may sink further when the weight of the building is placed on them. This would not happen easily if the foot of the pile were made wider in order to spread the weight over a larger area, and it is for that purpose that the explosive pile has been invented.

The first step in making one is to drive a wooden pile contained in an iron sheath to the desired depth. The wood is then drawn out and an explosive charge lowered to the bottom of the space thus left. The iron sheath is then drawn up a little and concrete poured in to take the place of the original wooden pile.

The charge is then exploded by means of an electric detonator. The earth around the foot of the pile is driven sideways by the force of the explosion and the concrete flows outward to take its place. More concrete is then rammed in. When set, the foot of the pile is mushroom-shaped, and it is thus able to support a greater weight than an ordinary pile.

* * * *

Colour on the Cinema Screen

A process that enables pictures in colour to be projected on the cinema screen has been devised in the laboratories of the Eastman Kodak Company. It is simple to work, and cannot be described as expensive. It is, in fact, exactly what moving-picture producers have dreamed of for years, but unfortunately it will be of no use to them, because reprints cannot be made from the original film. For the present, therefore, it will be used by amateurs only, who will find in it a fascinating variation from ordinary work with the small cinematograph cameras now becoming popular.

In the new process it is only necessary to use a special film and to place a colour screen in front of the camera lens. The screen is divided into three horizontal strips that allow red, green and blue light respectively to pass through them. Thus a third of the light entering the camera passes through each section of the lens.

One side of the film is coated with sensitive emulsion in the ordinary manner, but on the other side millions of tiny lenses are embossed. These are so small that it would take seven of them to make one of the tiny dots thay may be seen in pictures in a newspaper. They are less than one-fifth of an inch in depth and are placed so close together that they cover the surface.

The film is exposed with the sensitive side away from the lens of the camera. Thus the light beams that act on it are focussed by the embossed lenses on to the portion immediately behind them. As the red and blue rays come from the top and bottom of the screen respectively, they will reach any one lens on the film at different angles. The image produced by the red rays is thus separated slightly from that formed by the blue rays, and similarly the image in green light will be formed in a different place.

When the film is developed and reversed it does not differ in appearance from an ordinary film, the image being in black and white; but when it is run through a projector the embossed lenses reverse the original process. They focus the rays from their own part of the film to pass through the proper section of a second colour filter placed in front of the projector lens. Thus the rays of light that passed through the red of the filter when the photograph was taken also pass through the same colour during projection on the screen. The same thing happens to the green and blue rays. They are combined after passing through the colour screen and the original scene is therefore reproduced in colour. Red, green and blue are chosen, because these three primary colours and their combinations cover the whole range of colour as seen by the eye.

Former attempts to produce colour films have always relied upon the presence of dyes in the sensitive emulsion. It will be seen that the process now discovered is very much simpler and that taking colour pictures with it will be as easy as ordinary photography.

* * * *

A Fountain Shaving Brush

On the list of "Inventions Wanted" issued by the British Institute of Patentees is a paint brush that carries a reservoir of paint in the same manner as a fountain pen carries its own ink. A fountain shaving brush invented in America works on similar lines and may lead to the production of the desired paint brush.

In the handle of the shaving brush is a hollow for the soap, which is in the form of a cream. The upper end of this reservoir is closed by a plate that may be moved downward by a slight pressure of the finger on a piston. This action expels a little of the cream to mix with the bristles. A sliding plate near the opening through which the cream is discharged may be used to cut off the reservoir, in order that the brush may be washed without wasting soap. By keeping the opening closed when the brush is not in use it also prevents the cream from hardening by evaporation.

Key That Requires No Turning

A key has been invented that acts immediately it is placed in the lock. In appearance it is similar to a Yale key, but it is made from hard steel and is permanently magnetised. Hinged to it is a soft iron key blank that acts as a keeper for the magnet when the key is not in use.

The lock for which the key is made contains several sliding steel rods. These prevent the opening of the door to which the lock is fitted, but are pulled from their recesses when the key is inserted. Each rod must be raised to a certain height in order to release the door, and this is settled by the shape of the edge of the key with which they come in contact. Any magnetic key that can be placed in the lock will raise the rods, but unless the right key is used they will not be raised sufficiently to enable the door to open.

* * * *

Monel Metal Saved from Scrap

A little while ago a large engineering firm in America was scrapping nearly a ton and a half of mixed turnings of iron, steel and monel metal every week. Monel metal is a valuable alloy containing nickel and is worth £60 per ton. It could not easily be separated from the iron and steel because nickel is also magnetic, and it was therefore being sold with the scrap for about £3 per ton.

An ingenious device has now been invented that makes use of the greater attraction of a magnet for iron than for a nickel alloy. The machine consists of an electro-magnet and a rheostat to control the current passing through its windings. The current is reduced by means of the rheostat, until a point is reached when the magnet will take up iron and steel, but leaves the nickel alloy behind. Some difficulty was at first experienced in practice because oil that congealed on the turnings in cold weather caused them to stick to each other. This was overcome by drying them on steel plates heated by a fire, and the successful application of a simple electrical principle is now saving the company £4,000 a year.

Another interesting new use for electro-magnets is clearing roads of nails and iron scrap, the necessary current being supplied from a generator on the lorry that carries the device. On one trip over a mile of streets in a small American town 14 lbs. of nails were collected.

* * * *

A New Form of Rivet

Riveting is often necessary in places where access to both sides of the plates to be joined is difficult. This is particularly the case with aeroplanes, into the construction of which duralumin enters to a

considerable extent, for this valuable alloy cannot be welded. To meet these conditions a new form of rivet has been invented that may be fixed in position by hammering on one side only.

In the rivet itself a hole ending in a conical point is bored from the head downward, the bore being cylindrical to the depth of the plates through which the rivet passes. The end beyond the conical point of the boring is then slotted by two cuts at right-angles to each other. When the rivet has been passed through the rivet holes, a cylindrical pin also having a conical point is fitted into the boring and lightly tapped into position. A few blows then drive it through the rivet, when it causes the four segments formed by the cuts to spread out on the undersurface of the plates.

* * * *

A Tree-climbing Bicycle

A German inventor has designed a bicycle on which a rider may climb trees! The two wheels are set side by side on a short axle, and a framework that passes round the tree extends upward to support a train of toothed wheels that grip the tree trunk. The motive power is derived from two levers worked by hand and is transmitted to the tree wheels by a ratchet mechanism.

This contrivance may possibly be of practical value for climbing telegraph poles when undertaking the necessary wiring repairs, and its use in this manner may be further extended as the method of transmission of electric power by overhead wires is developed.

* * * *

A Book to Hear!

In the days of our forefathers the place occupied in present-day life by books was filled by professional tale-tellers, who recited stories and legends of the past. This method fell into disuse with the spread of learning, and the invention of printing seemed to abolish all possibility of its revival. But the changes that can be brought about by scientific discoveries are often startling, as is shown by the fact that we are now threatened with the abolition of books as we know them to-day!

The inventor responsible for the threat is Dr. W. R. Whitney, of the General Electric Company of America, who has produced a book that reads itself aloud when a switch is turned! It looks like a camera with a loud-speaker attached. Inside is a roll of film with sound waves photographed on it. These waves have been produced by a reader who recites the contents of a book for the special purpose of recording them, and they are made to give an impression on a photographic film by exactly the same method as is used to produce the speaking films that are becoming familiar in picture theatres. The method involves the use of a photo-electric cell that translates the variations in current in the microphone used by the reciter into light of varying intensity, which is made to act on the moving film.

When a film so prepared is run through the camera-like apparatus, the variations in the density of the image on the film produce corresponding variations in the intensity of a beam of light that passes through it to a second photo-electric cell, which in turn produces variations of current in an electrical circuit containing the loud-speaker. The result is that the voice of the reader is reproduced.

It almost seems, therefore, that the professional story-teller will find a modern counterpart in the professional reader of books. To read a book in future will be as easy as listening to wirelesss or to an electric pianola. All that will be necessary will be to insert a selected roll of film into Dr. Whitney's machine and press a switch; electricity will do the rest. Whether this ever becomes practicable on a large scale or not, the invention is bound to be of great value to the blind, especially if some method of turning up selected passages or chapters can be devised.



A German inventor has patented a bicycle that can climb trees and can also be used as a paddleboat

* * * *

Motor Car Horn Switches on Danger Signal

Another ingenious apparatus for ensuring the safety of traffic has been suggested in America. Its working may be best understood by considering the case of a motorist who wishes to turn from a side road into a main thoroughfare. Approaching the corner he sounds his horn, and the sound waves thus produced immediately act on a microphone placed in a suitable position in front of the car. Through a relay the microphone current then causes a red light to be switched on. The light is directed along the main road in both directions and remains red for 30 seconds, or any other length of time that may be found suitable for giving drivers of cars sufficient warning to pull up and allow the car from the side road to take its place in the main stream of traffic. The colour of the light then reverts to its normal green.

Tests of the device are being made in the suburbs of Baltimore. Increased speed and safety of traffic may follow its adoption, but at first glance it seems as if it gives an impatient motorist in a side road power to cause much confusion and annoyance in busy main thoroughfares.

* * * *

Periscope and Camera in One

An interesting and useful addition to photographic instruments is a cinematograph camera that exposes films under water, but is controlled from the surface. Its primary purpose is to take motion pictures of under-water scenes, such as the rescue of a swimmer from the clutches of an octopus, for instance; but it may be of value also in obtaining pictures in their natural surroundings of the creatures that inhabit the ocean.

The central feature of the device is a long tube made in sections, so that any length desired may be used, gaskets to prevent leakage of water being used at the joints. Near the bottom of the tube is a lens placed in the side wall to focus an image of the scene on a film passing through a mechanism of the usual kind. At the top the tube widens out into a hemispherical bowl that is supported in a socket in such a manner that it may rotate or tilt. The mechanism mounted on top of the tube includes the film box, an electric motor for winding purposes, and a shaft, the rotation of which alters the distance between the lens and the film at the bottom of the tube, thus giving focusing control.

In order that the operator shall see what is happening a view-finder is attached. This is an under-water periscope, consisting of a tube similar to the film tube but narrower, as it contains no mechanism. The image produced by the lens of the finder tube is reflected by mirrors to a ground-glass screen at the top and, as the two tubes are parallel and very close to each other, it is practically the same as that photographed.

When an under-water scene is to be photographed the tubes are rotated and tilted until the required view is visible on the ground-glass screen. The operator then fixes the position of the lens to suit the particular scene, making use of a focusing scale, and sets the electric motor in operation, at the same time releasing the shutter. The film passes down the tube, through the exposure mechanism, and then up once more to be rewound.

The invention may be adapted also to take photographs from aeroplanes, or from boats, when direct views are not required. As an example of its use in this manner, it will be seen that by extending the tube sideways rear views of the passage of a boat through the water may be taken from one running parallel to it and at some distance away. No doubt other uses will be discovered from time to time, but it will be especially useful for photography from view points that would be otherwise inaccessible.

* * * *

Can You Invent These?

A recent list of needed inventions includes a motor car engine that does not require decarbonisation and a photographic negative that can be developed in daylight. If these are too difficult try to devise a paint brush on the lines of a fountain pen or a silent lawn mower.

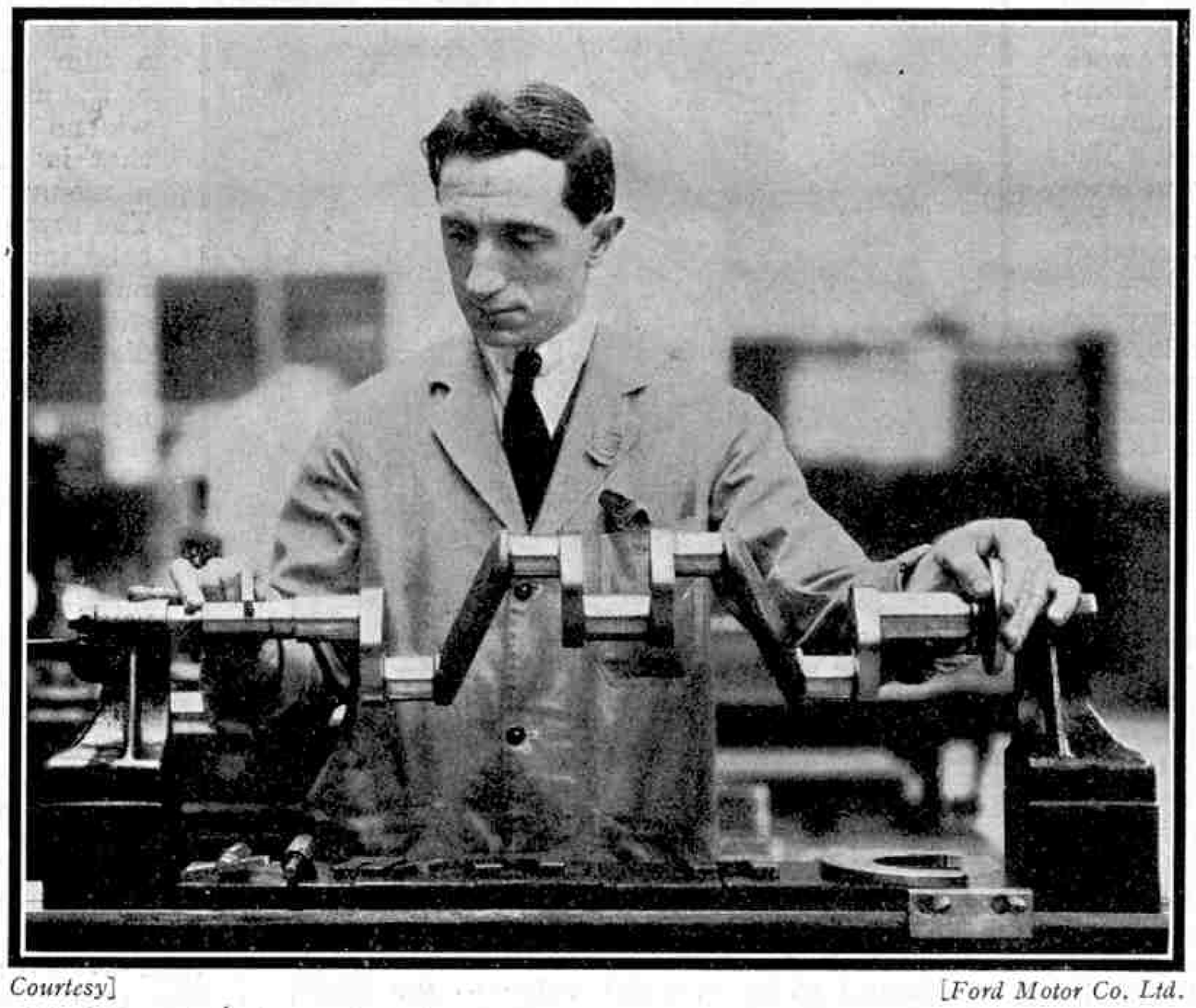
The Story of the Motor Car

X.—Producing Cars by the Million

LAST month we explained how mass production of motor cars began, and described the general layout of the Ford works at Manchester. The most interesting part of such a factory is the moving line on which the cars are built, as the products of every department must be brought to it in order to be assembled into complete cars. Some of the parts arrive on hooks suspended from overhead chains; others travel on roller conveyors; a few simply slide down chutes. By whatever means they are brought to the line, however, they always go directly to the place where they become part of the car.

The process really begins with the assembly of the frame. The cross and side members are riveted together and the frame is then carried by an overhead conveyor into the enamelling room, where it is suspended over a pit. Into this it is allowed to descend slowly while a workman standing on the edge directs on to it a stream of quick-drying black enamel from a compressed-air gun. Meanwhile the front and rear axles are assembled and also sprayed.

Ten minutes later the frame and axles are dried, and from them is built what may be described as the skeleton of a car. This is hoisted on to the final assembly line, where the ends of the axles rest on two rails that are at a sufficient height above the ground to enable the men to work without stooping. Between the rails is an endless chain that runs the entire length of the line. Ratchets attached to it at intervals fit behind the drums of the rear axles of the skeleton cars and carry them forward at a rate that depends on the number of men at work. When the factory is in full working order the line of cars travels at a pace of six feet per minute.



Courtesy [*Ford Motor Co. Ltd.*

Testing a Ford crankshaft. The gauges detect errors of one-thousandth of an inch above or below standard size

No sooner has a frame been placed on the rails than work on it is commenced. The first operation is to fasten on brackets for the mudguards. While this and similar minor additions are being made, the frame moves down to the point where it meets the engine and gear box unit. This has already been assembled and tested in another department, and is ready for instant use. It is lowered into position by means of a pneumatic crane, and is bolted down as the framework into which it is fitted is carried along.

The brake drums and the steering column are then placed loosely in position. They are not immediately adjusted, this task being performed by other workmen a little further along. This is characteristic of the work of the assembly line. A part may not be fully in place until after several operations. For instance, one man puts in a bolt, another puts on the nut, and a third is responsible for the necessary tightening up.

The chassis then moves on to the place where the wheels arrive. The tyres have already been fitted and inflated, and it is only necessary to slip the wheel on its spindle and to tighten the nuts that hold it in position. The bumpers and running boards are next added and the usual identification numbers are then stamped on the engine and chassis.

The rapidly growing car continues down the line, with only short rests to allow new parts to be fitted. There is no break between operations. At every step something is added or a part already in position is finally bolted on. Bulky additions are made with surprising speed, and even the fitting of the body causes no delay. A crane swings it over the chassis and lowers it quickly into a position already marked out on the framework by jigs.

As the bolts that hold the body down are being rapidly pushed in and the nuts on them tightened, work begins on such accessories as the starting and lighting outfit. The electrical parts are the last to be fitted. The assembly line from which they come ends in a test bench where a complete outfit may be tried out under severe conditions. The efficiency of the coil is tested on plugs in glass-fronted boxes in which the air is under pressures of 60 and 100 lb. per square inch, the second of these pressures representing an overload of 50 per cent. During these tests the distributor is run at the speeds it would have in a car travelling at five and 35 miles per hour.

Satisfactory outfits are passed along to the car assembly line and rapidly fixed into the chassis. When the last screw has been driven into the clips that hold the wiring in position, a tester steps forward and makes sure that the lamps will light and the starter operate. Meanwhile the radiator is being filled with water. Oil and petrol have already been added, and the electrician steps into the driver's seat and starts the engine. While he is doing so the last man in the crowded line of workers places the bonnet over the engine. The car is now complete and is driven away. The electrician returns to the assembly line to find the next car waiting for him and the process is repeated.

A look backward along the assembly line at one of the Ford factories gives a wonderful idea of what mass production can do. A finished car is just being driven off and another is moving up to receive the final touches; at the farther end workmen are swinging a new frame into position on the rails, and in between is a continuous line of unfinished vehicles at all stages of construction.

The real marvel of the Ford factories is not the speed with which the cars are assembled, however, but the wonderful organisation that makes it possible. Behind the assembly line itself is a plant that is capable of feeding it with a continual supply of parts. No fewer than 5,000 of these go to the making of a single chassis. Some of them are bulky, while others are almost the size of watch parts; but all must be produced on an enormous scale in order to maintain an output that runs into millions a year.

The secret of making parts in such enormous numbers is to be found in the great use made of assembly lines. In the great Ford factories in America, not only the assembly of the car itself, but the manufacture of practically every part is carried out by this method. It was first used in 1913, when it was tried out in a crude form on the assembly of a single component. So great a saving in time was effected that first the engine, and later the chassis also, were assembled in a similar manner. The results were amazing. When cars were built by the old method of assembly, in which everything required was carried to a fixed spot on the floor, the average time required for each car was 12½ hours. By the new method eight cars could be completed in the same time!

An even more striking instance of the saving effected by the use of an assembly line is the simple operation of attaching the

connecting rod to the piston. This originally occupied a few seconds over three minutes, and it did not seem worth while to attempt to reduce the time further. One day the foreman in charge of the job calculated the time spent in the various movements necessary to collect materials and to push away the finished assembly, and it was then revealed that very little more than half of the three minutes was actually spent in doing the work. In order to prevent this waste of time the whole operation was then divided into three parts and the men who were to carry them out were arranged in line. On the working bench was fixed a slide to carry the work to and from the workers, each of whom had only as much to do as he could accomplish without moving his feet. These apparently simple changes increased the output to 15 times its former level, in spite of the fact that the number of men was cut down from 28 to 7. The seventh man was an inspector, who made sure that the assembly was fit for use in the engine. Before the new method was introduced there had been no inspection and parts were very often returned as unfit for use.

When the advantages of the endless chain method were realised, the scheme was extended very greatly, and to-day almost every piece of work in the Ford factory is done on these lines. This applies even to casting. The moulds required for making cylinder blocks, for instance, are made on little platforms suspended from an overhead railway. While this is being done the platforms are approaching the furnace from which the metal is poured into them, and by the time a mould reaches the end of the line the casting is cool enough to start on its automatic way to the machining line.

The great secrets of the success of the line assembly method are the division of labour and the automatic movements of the part being made, both of which cut out unnecessary movements. There is the further advantage that the men become so familiar with their work that their movements are made with ease and certainty. A definite job is given to each man, and sufficient time is allowed to enable him to carry out his work thoroughly and efficiently.



The weekly output of frames from one American motor car factory. The travelling crane on the right is adding another batch to the 50,000 already present !

Many of the employees are engaged in very monotonous tasks, but the man who spends day after day putting in a particular bolt has only himself to blame. Mr. Ford tells us of one man employed at the Detroit factory who has spent years gently shaking one gear wheel after another in a vat of oil, and who is so satisfied with his work that he stubbornly resists all efforts to find him a better job ! Others endeavour to make themselves useful and efficient anywhere. This is not difficult, as the work has been so simplified that 79 per cent. of the tasks can be learned in less than a week by a man of ordinary intelligence.

The care and thought that have been spent in planning the work have made the operations almost fool-proof. The machines take care of accuracy, and the workers' task is merely to guide and control them. In spite of this every part is very carefully examined before it goes into production, in order to make sure that it will fit into its place and will act efficiently when the finished car is driven off the assembly line.

Every crankshaft is rotated in a special jig in order to ascertain whether it has been machined to size within the narrow limits of accuracy allowed. Gear wheels are compared with very accurately made master wheels, and any that fail to come within one-thousandth of an inch of the required size are rejected. Wheels that pass this test may be slightly over or under size. The testing machine shows which, and this enables them to be paired to give the best contact when in actual use.

An ingenious instrument is used for testing piston rings. It is a cylinder, of exactly standard Ford size, and almost closed by a concentric disc of slightly less diameter. At the back of the instrument is an electric lamp, the light from which shows through the space between the cylinder and the disc. The ring to be tested is sprung in the cylinder and any points where it is not in contact with the cylinder wall are immediately shown up. If any light is seen from the front the piston ring is rejected immediately. A similar instrument is used for testing the seating of the valves which must be accurate if engines are to be efficient.

In addition to tests of this kind a careful watch is kept by trained chemists and metallurgists on the materials themselves. The steels used are alloys containing different proportions of such metals as vanadium, chromium and tungsten. The quality of steel is changed to a surprising extent if the percentage of one of the metals present is altered, and samples are therefore tested for hardness, tensile strength and resistance to compression. If they are not satisfactory they are analysed in order to discover the reason.

The work of the chemist also goes beyond ordinary testing of this kind. Very often baffling problems that arise in the works are brought to him for solution. At one period, for instance, great difficulty was experienced in working brass, although ordinary tests and analysis showed that it was in accordance with the specification.

At length a suitable sample was discovered and the problem was then solved by a careful comparison with the brass in stock. The two showed very little difference except in their behaviour when submitted to what is called an elongation test, in which rods of the samples were pulled apart until they broke. The brass that had been found suitable for use could be stretched much further before breaking than the other. After this discovery no brass was accepted until a similar test had shown it to be satisfactory.



Courtesy] [*Ford Motor Co. Ltd.*

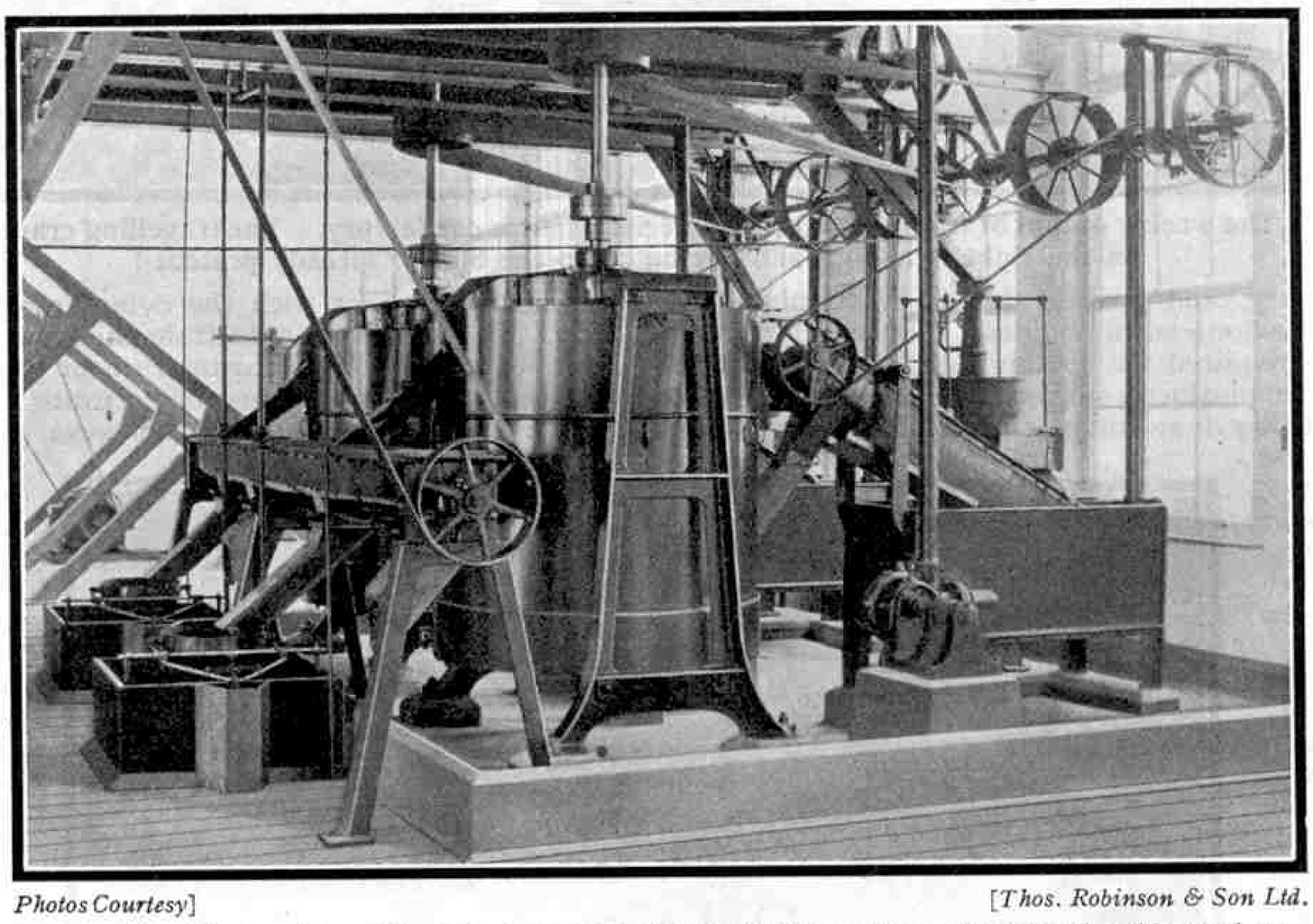
Ready to be driven off ! A finished car on the end of the assembly line. Behind it is a line of cars in all stages of construction



VI.—INSIDE A MODERN FLOUR MILL

LAST month we traced the progress of the world's wheat from the harvest field to the flour mill. The huge buildings in which flour is now made differ greatly in outward appearance from the mills that have been described in earlier articles, and the contrast extends even more strongly to the machinery.

In an old-time mill, whether driven by wind or by water, the miller had little space in which to move about, and the rumble of the machinery sounded mysterious in the comparative darkness that prevailed. An unaccustomed visitor would remark on the pleasant smell of the warm wheat, but would probably complain of the dusty atmosphere. There was never any doubt about the presence of dust. It penetrated everywhere in a manner that would be regarded with horror in these days of strict factory regulations, and it certainly was not good for the miller's health. But there were compensations even for the dust, and one was the peculiar sweet flavour of the bread made from stone-ground flour. A modern miller once said that this was due to the presence of dirt. If every person must eat the proverbial peck of dirt before he dies, to take it in the form of the stone-ground wholemeal loaf is one of the most pleasant ways it is possible to find!



Photos Courtesy] [*Thos. Robinson & Son Ltd.*

The wheat washing machine. The grain is cleaned in the troughs on the right and dried in the whizzers shown in the foreground

A visit to a modern mill reveals a very different state of things. The rooms are large and lofty, the atmosphere is buoyant and healthy—and there is no dust! Practically every machine is enclosed, and the dust that is inevitably present in the wheat or is produced in milling is taken away by a powerful stream of air. It is not even allowed to reach the outer atmosphere, for the exhaust from the mill is passed through expansion chambers, where its speed is checked sufficiently to allow most of the dust to settle, and is filtered through woven sleeves that retain the rest before it is finally discharged.

The general appearance of the mill would surprise the rustic miller of last century. All metal work is bright, and the wooden casings of the machines are varnished. Even the floor is polished, and there is a general air of cleanliness that would not disgrace the most careful of housewives.

Another peculiarity is the small number of workmen encountered. A visitor may walk through a flour mill without seeing more than an occasional attendant, and on some floors the only visible signs of human agency are the samples of the products of the various machines that are spread out on convenient ledges.

The remarkable scarcity of workmen is due to the fact that milling is now entirely automatic. The grain is never touched by hand. Conveyors take it from storage bins to the mill itself, and it is transferred from one machine to the next by chutes and elevators. The operations are carefully organised, and the rates of working of the machines are adjusted to enable them to keep pace with each other. The wheat thus flows through the mill at an even pace and without interruption, for work commences early on Monday morning and the machines are not stopped until Saturday night.

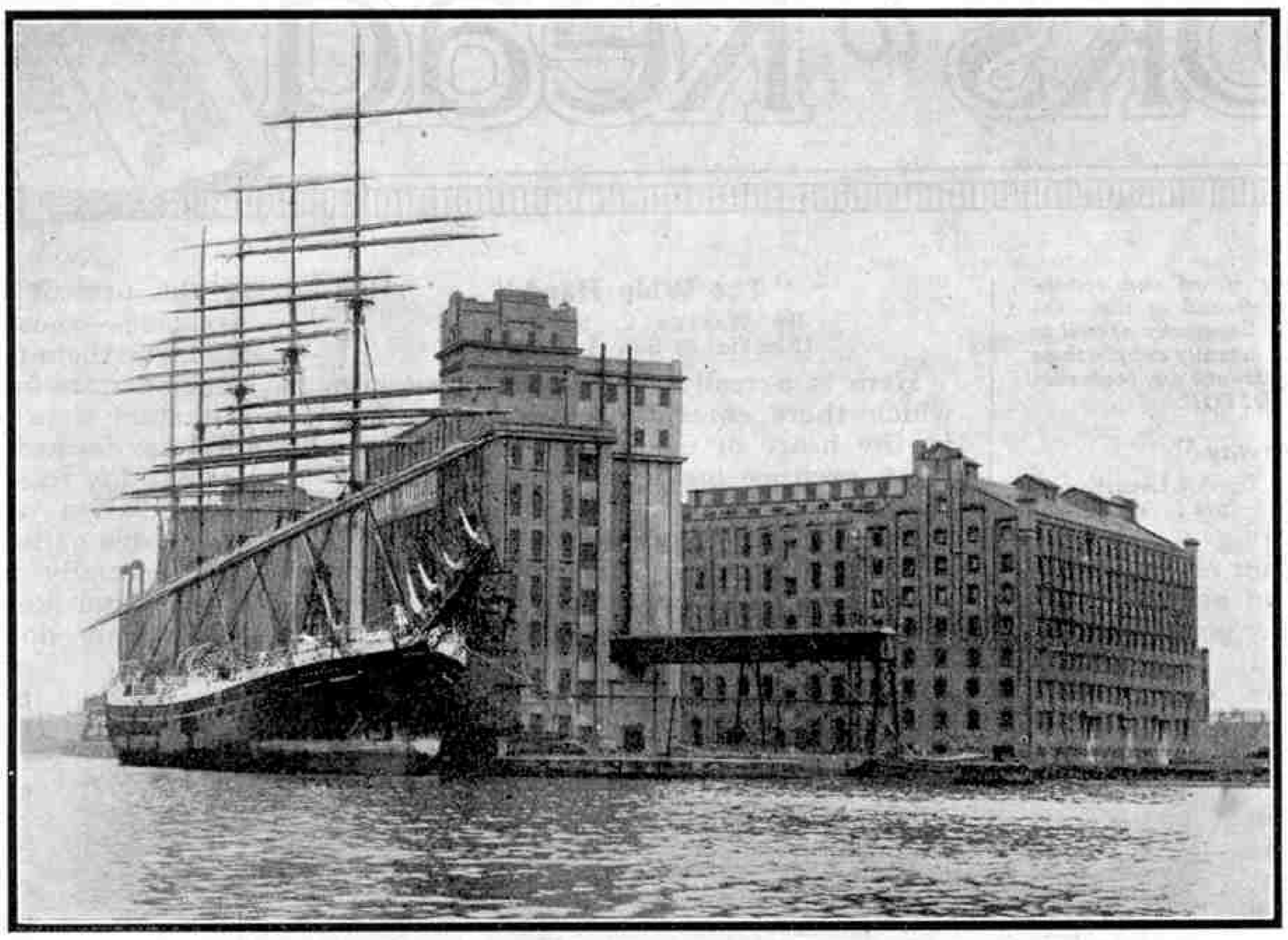
In a modern mill the wheat is very carefully cleaned before milling commences, and the part of the building in which this is done is as large as that in which the flour is actually made. Millers usually call it the screen side, as screening, or sieving, is the basis of most of the work carried on in it. It is separated from the milling side by a section in which there are no floor divisions. This is the machine room, and it contains the powerful engines that drive the whole of the machinery of the mill. Above them a perfect maze of shafts, belts and pulleys extends to the extreme height of the building.

Galleries passing across the machine room connect corresponding floors on the two sides of the mill. Heavy sliding doors made of fireproof material shut off each department, but although they are self-closing, the mechanism is not allowed to act. To each door is attached a rope that passes over a pulley and has a weight hung on its end. This is sufficiently heavy to keep the door open and it is necessary to use a certain amount of force to close it. This seems a little absurd, but it is done for the convenience of the workmen, who find self-closing doors awkward to deal with when their hands are fully occupied.

It is only in the event of fire that quick and automatic closing of these important doors is really necessary, and an ingenious device makes this possible. The rope is fixed to the door by a short length of an alloy that melts at 140°F. If an outbreak of fire causes the temperature near the door to rise above that level, the metal is fused and the weight released. The door closes immediately, and not only shuts off an entire section of the mill, but prevents draughts that would fan the flames.

In order to follow the progress of the grain through the two

sections of the mill we must begin at the wharf on which it is discharged. It is no longer transferred to the mill by shovelling it into skips that are lifted by cranes, and even the use of band conveyors is now out of date. Instead the grain is sucked out in the same manner as dust is collected by an electric vacuum cleaner. On the wharves are unloading towers that run on rails. In each is a huge fan that draws a powerful stream of air through flexible pipes suspended from overhead booms. The nozzles of the pipes are dropped into the wheat, which is sucked up into the towers as easily as if it were a liquid. No time is wasted in the process. A typical plant with two towers will handle 200 tons of wheat per hour and is thus capable of unloading a cargo of 8,000 tons in 40 hours!



Discharging a cargo of Australian grain from the "Kobenhavn," the largest sailing ship in the world

The grain is discharged through an airlock to a band conveyor that carries it to the silo in which it is stored until required for milling purposes. It is then drawn from the bins, and other conveyors and elevators take it to the top floor of the section of the mill in which it is cleaned by screening and washing.

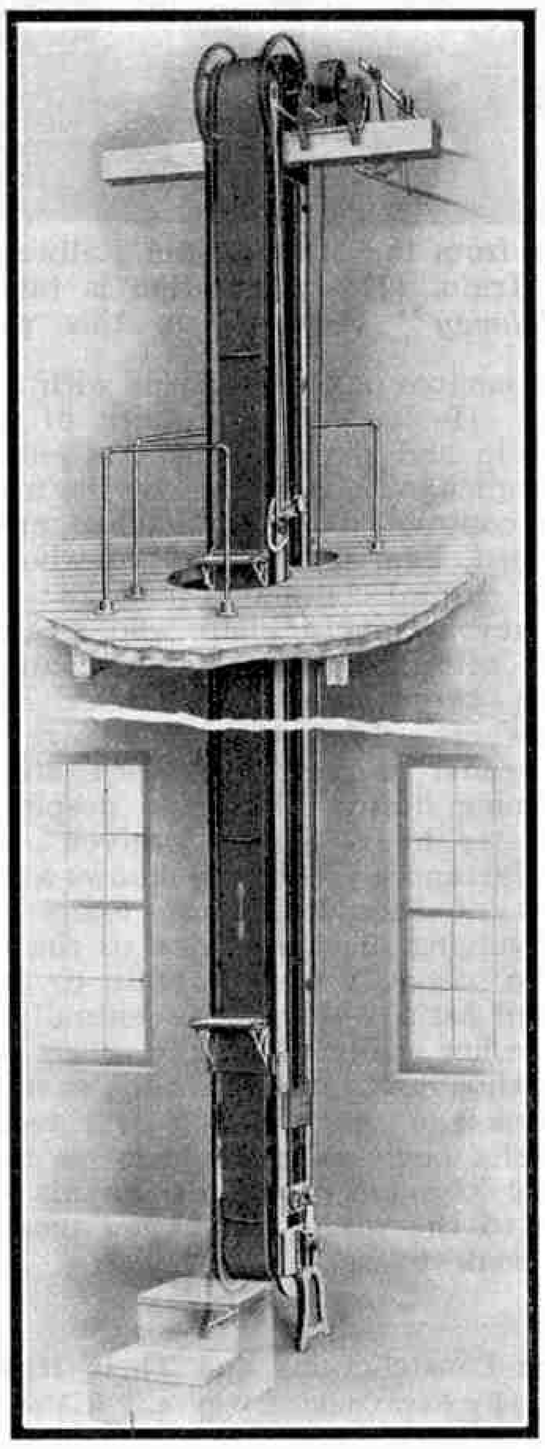
The preliminary cleaning of wheat is very important, and good white flour can only be obtained if it is thoroughly carried out. The grain is not dirty in the ordinary sense of the word. Naturally it contains bits of straw, chaff and unthreshed ears, in addition to seeds of other plants that have grown along with it. Small stones thrown up by the wheels of tractors, or by the hoofs of the horses that pull the reapers, also find their way into the sheaves and many of them remain in the grain when threshed. Still more remarkable finds are nails, screws, bolts and nuts, and pieces of wire and leather. Some of them get into the grain accidentally during farming operations, and others are accumulated on the long journey from the harvest field to the mills. These and other foreign substances must be removed before the wheat is ground into flour.

The grain is carried to the highest floor of the mill by an elevator, and works its way downward through the various machines that are used for cleaning it. In order to follow the process we also must ascend to the top floor. Climbing up several flights of stairs is a strenuous exercise and an elevator is therefore provided for the use of the workmen. It is not an elaborate lift, but rather resembles the primitive contrivances used for raising miners from the depths of a Cornish tin mine. An endless rubber belt travels vertically upward and downward, passing over pulleys at the top and bottom of the building. At intervals handles and steps are fitted. The belt does not move very quickly, and the workmen simply step on to the small platforms and are carried upward through an opening in the ceiling or downward through a similar hole in the floor.

As a rule the grain is passed through coarse sieves on entering or leaving the silo, in order to get rid of large pieces of straw or stick. The first machine through which it is passed in cleaning operations contains a further series of sieves. Each of these slopes downward, and is continually shaken in order that wheat may travel through the machine while unwanted particles fall through the holes. The openings in successive sieves are made smaller, and are usually oval-shaped like the grain that falls through them. Those in the last sieve are too small to allow the whole wheat to fall through, and smaller particles, including broken wheat berries, are thus removed.

Dust also falls through the last sieve. Most of this is removed by a stream of air that flows in the opposite direction to that taken by the wheat. We have noted the extensive use made of air currents in modern flour milling. In passing through the cleaning section of the mill the visitor realises how powerful are the air blasts used. Some of the machines are fitted with inspection windows and through them it can be seen that the draught is almost strong enough to blow the wheat berries themselves away!

Small seeds such as cockle, barley and oats still remain in the grain after the preliminary treatment. These are removed by passing it through revolving cylinders set on a slight incline. On the inner surface of each cylinder tiny pockets are punched. These are large enough to contain the seeds that are to be removed, but will not hold a full-sized wheat berry. As the grain moves slowly down the cylinder, therefore, the smaller seeds are picked out and carried upward. When the pocket reaches a certain height, the seed in it falls out into a worm conveyor that runs down the centre of the cylinder.



Employees' lift in a flour mill

Oats and barley are removed in this manner, any by using several machines with pockets of different sizes drilled in them these by-products may be separated from each other.

We have already remarked on the presence of fragments of iron and steel in the wheat. They must be removed in order to prevent damage to the machines that reduce the grain to flour. This is done most easily by making use of the magnetic properties of the metal. The grain is allowed to flow down an inclined steel plate, beneath which are powerful electro-magnets. Any nuts, bolts or other fragments of iron or steel are arrested by the magnets and are pushed to one side by a scraper. In a large mill a day's work may yield a truly astonishing collection of old iron!

When foreign substances have been removed the wheat is washed. The machine in which this is done is at once the most important and the most interesting of those used for cleaning the grain. It consists of a circular copper tank, surrounded at the rim by an outer compartment. On looking inside water may be seen flowing over the edge of the tank into the outer compartment, carrying with it a torrent of wheat. The grain falls into the tank through a vertical spout and is met by the upward rush of a swirling current of water. The berries are tossed about and receive a thorough washing before being swept over the edge. Stones and similar heavier materials fall to the bottom of the inner tank and are removed through a valve.

The wheat that is washed over into the outer compartment disappears down an exit pipe that leads to an inclined trough. Here a rotating worm carries it upward against a stream of clean water that completes the washing. It is then partly dried by whirling it round at high speed.

If any further drying is necessary the grain is allowed to trickle slowly down a tower in which it meets an ascending current of warm air. A final brushing removes dust from the grain.

(To be continued)

Books to Read

Readers frequently write asking if we can recommend books that are both of interest and of use. On these pages we review books that will specially appeal to readers of the "M.M." We do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

"The Steel Highway"

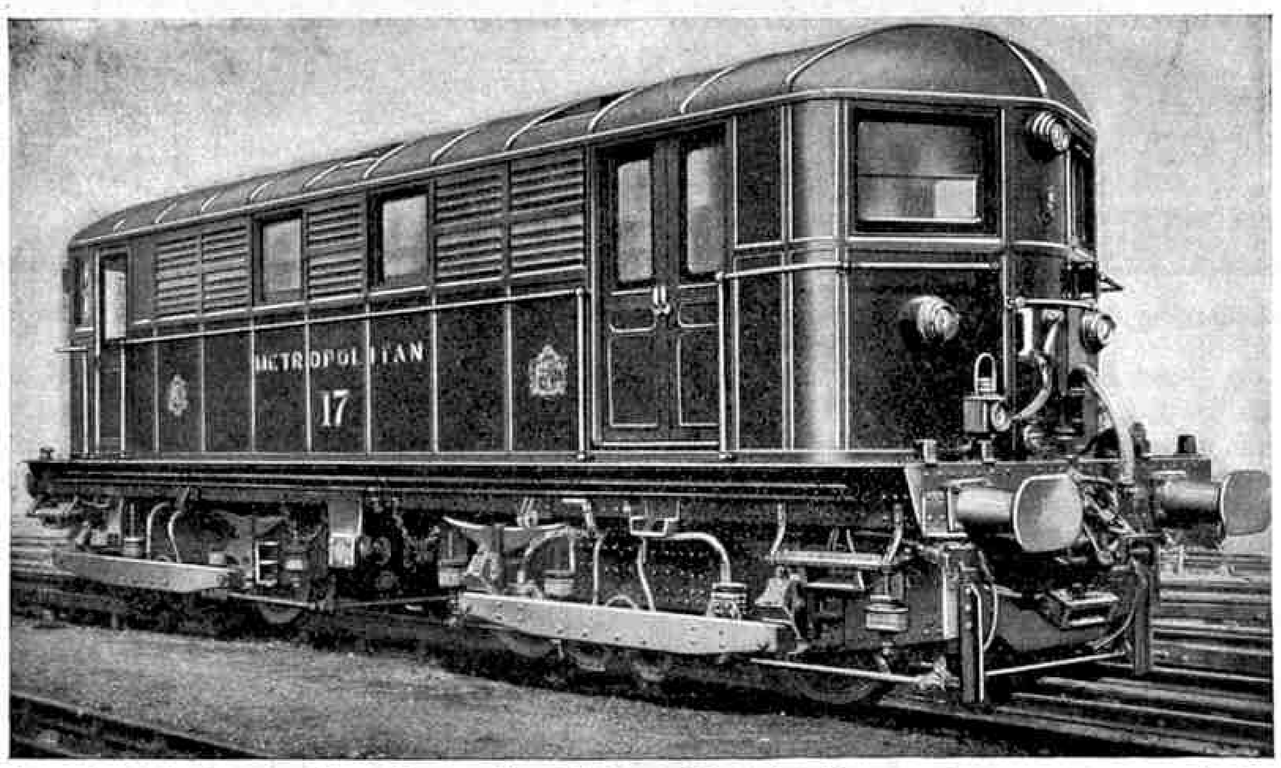
By CECIL J. ALLEN, M.Inst.T., A.I.Loco.E.
(Longmans, Green & Co. Ltd. 6/– net; or in two parts, 3/6 each)

The appearance of another railway book by Mr. Cecil J. Allen is an event of outstanding interest. So many popular books on railways have been issued during the past few years that it might be thought that all had been said that could be said. In "*The Steel Highway*" Mr. Allen shows that this is not the case, and he finds a great deal to say that is both new and interesting.

The book is divided into two parts. The first deals with the planning and location of railways and describes how the engineer overcomes difficulties of every description and ultimately succeeds in laying down yet another highway of steel. The second portion of the book deals with locomotives and rolling stock and explains in detail how trains are operated and controlled. The author describes the building of a modern locomotive, shows us how the monster is housed, fed and cared for, and outlines for us its daily work. A particularly interesting chapter deals with the handling of freight and the latest methods of operation that have been introduced to secure efficiency and economy in working.

The great charm of this book lies in the new points of view that are presented and in the refreshing style of the writing. One feels instinctively that the author is an enthusiast in regard to his subject, and his enthusiasm conveys itself to the reader. The book cannot be described as a boy's book nor yet as a man's book—it is, as a matter of fact, a book for everyone, old or young, to whom railways appeal.

One naturally expects a book of this nature to be well illustrated, but "*The Steel Highway*" is unexpectedly good in this respect. The coloured plates are well reproduced, without the exaggeration that is not unfamiliar in present-day books. As regards the half-tone illustrations, with which the pages are packed, these cover an enormously wide range. They obviously have been carefully selected with a view to assisting the descriptive matter and as most are unusual views they add greatly both to the value and interest of the book.



An electric locomotive from the Metropolitan Railway, the prototype of the Hornby Metropolitan Train. (This illustration is taken from "*The Steel Highway*" reviewed on this page)

"The Whip Hand"

By WALTER C. RHOADES
(Blackie & Son Ltd. 6/–)

Here is a really fine school story into which there enter those sports so dear to the heart of every boy, some of the most exciting incidents being staged in the playing fields.

The story centres round Franklin, a pleasant character always ready for pranks and rags but straight and honest in all his dealings and accepting the consequences of his misdeeds with a good grace. He has the true spirit of sportsmanship and pays sufficient attention to his studies to be well liked by the masters.

In contrast with him is the perfectly-groomed, ever-smiling boy of whom one of the shrewd characters remarks: "You can never trust a chap who wears two clean collars a day and manicures his hands—there must be a kink in him somewhere. It's against nature!" If the reader is burdened with an overwhelming desire to kick so despicable a character he is surely forgiven!

Unfortunately this boy knows a family secret of Franklin's, and under threat of divulging his knowledge to the others in the school, forces Franklin to act the part of cat's-paw, which eventually lands him in hot water. Franklin rebels at last, even though it means that his enemy will disclose the secret which will result in Franklin being expelled from his beloved School through no fault of his own.

As to the result—well, you must read the book to see!

* * * *

"The Constellations and Their History"

By Rev. CHARLES WHYTE, F.R.A.S.
(Charles Griffen Co. Ltd. 10/6)

Although many of the star names in use at the present day originated with the Arabians—whose clear skies and desert life made them familiar with the stars—the remainder are from Greek or Latin sources. The stars were first named by herdsmen, hunters, farmers and travellers, and our present-day records are merely the gradual accumulation of several thousand years' knowledge gathered from various nations, but especially from Chaldea and Egypt, Greece, and Rome.

Not only does the book describe the origin of the constellations but it also deals with the motion and distances of the stars, and the signs of the zodiac. The last two chapters are devoted to a description of constellations north and south of the equator respectively. To those who are interested in identifying the constellations and individual stars, this book will be of great interest. Special charts of the heavens and star maps for every month of the year help to make things clear.

* * * *

"A Frolic Round the Zoo"

By J. A. SHEPHERD
(The Bodley Head. 7/6)

This is another of Mr. Shepherd's books of humorous sketches and deals with the adventures of Blinx and Bunda. Blinx, a stray cat, and Bunda, an escaped monkey, form a friendship, and the adventures that follow are truly amusing.

Moreover, there is often a moral attached to these episodes, as for instance in the case of the adventure of the banana. Bunda airily remarks to Blinx: "We will drop into breakfast with the Chimp—an old friend of mine—met him in Africa. I will ask him to give you some milk and I will take a piece of his banana!" This was an empty boast and a bit of a fib as well, as subsequent events showed, for the ape on whom they called for breakfast was not a chimpanzee at all but an orang-outang, who hailed from Borneo and not from the dark continent. The result of Bunda "talking big" was that Blinx drank the milk, Bunda himself being offered only the skin of the banana and had to go without his breakfast in consequence. Thus we learn that those who talk familiarly of their acquaintance with great people are often proved to have been drawing the long bow!

* * * *

"Hermes—or the Future of Chemistry"

By T. W. JONES, B. Sc., F.C.S. (Kegan Paul. 2/6 net)

This little book is one of a series in which well-known people explain their

ideas of the future of many things, ranging from sleep and music to war and engineering. All of them are very interesting, as is usually the case with books that attempt to forecast the future.

The present volume is particularly attractive, as in it the author shows that we are now far more dependent on chemistry than we think, and that this science will become still more important for civilisation. Chemists have taught us how to extract hundreds of valuable industrial materials from the earth, and have discovered also how to make many that formerly were obtained only from natural sources. These latter include fertilisers, silk and indigo, to name only a few that show how closely chemists have been concerned in recent years with our food and clothing.

Now chemists are going even further and are beginning to study the chemical changes of life itself. Mr. Jones has many interesting things to say on this matter, and prophesies that the future inhabitants of the earth will thrive on wonderful foods provided by chemists, who also will make them resistant to disease.

The book is written in simple language and every page contains something of interest. Those who read it will gain an excellent idea of the real meaning and value of chemistry.

* * * *

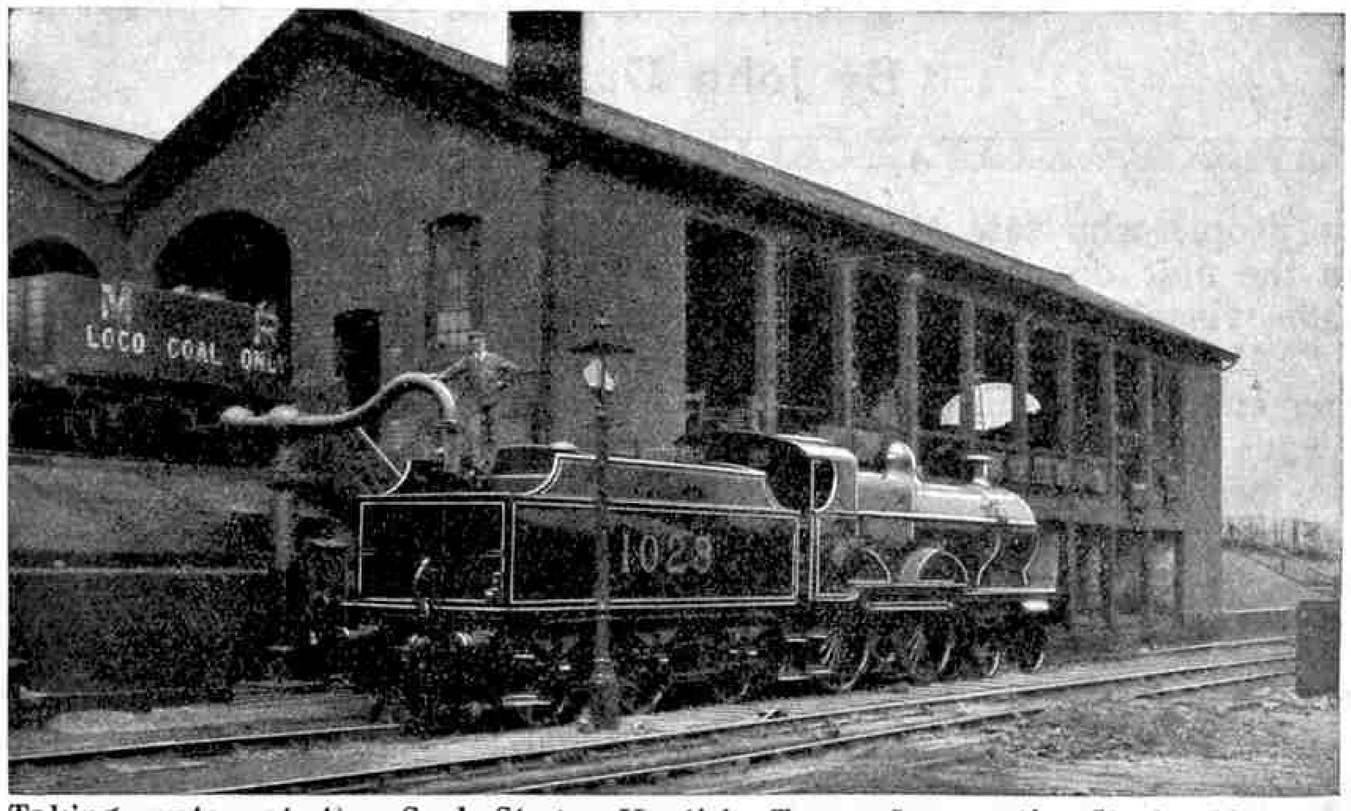
"Children, Can you Answer This?"

By George A. Birmingham
(Fisher Unwin. 2/6)

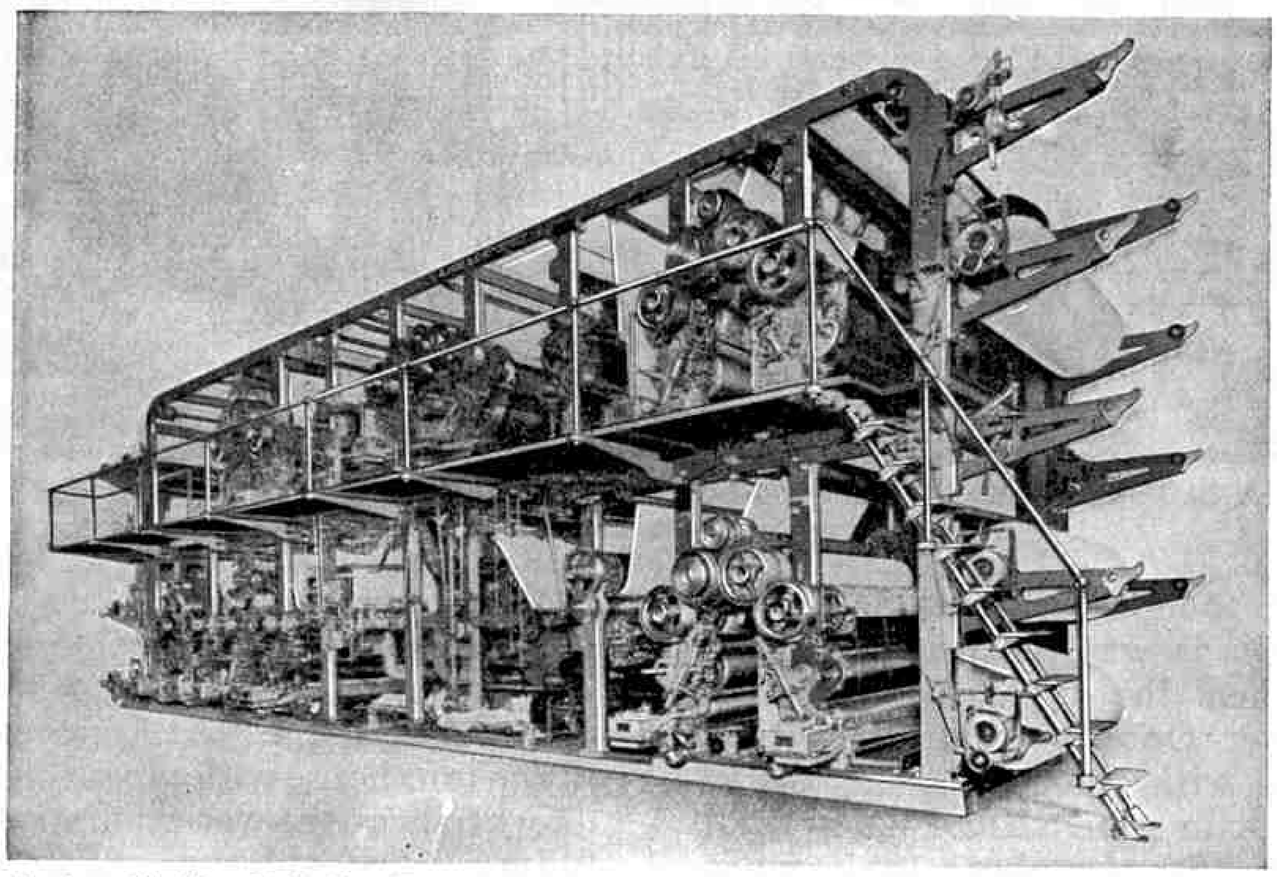
Described as being the basis of a delightful new game, this book consists of a large number of questions on general knowledge. As Mr. Birmingham says in his introduction, when he first began to collect these questions, it seemed to him that he was doing a very cruel thing—that he was engaged in preparing for school teachers, conscientious parents and other troublesome people, an instrument of torture that they could use upon the children. This view, he speedily discovered by experience, was entirely wrong, for he found that children like being asked questions.

He tried some of his questions on several schools of boys and girls and found that he was giving pleasure, not pain. So he compiled the present book, which he even thinks may be helpful to parents. He argues that if parents asked plenty of questions, children would have less time left for asking them questions they cannot answer—and, of course, this is the type of question that all boys and girls like to put to their parents! So it is that the book will be of interest to parents as well as to our younger readers.

Specially do we commend the book to those people who go about thinking they know all about everything and everybody. If you know any such person, and want to take two or three inches off the height of their stature at any time, just produce the "*Can You Answer This?*" book and we will guarantee that in five minutes you will have reduced them to normal proportions—in ten minutes you have them completely at your mercy!



Taking water at the Coal Stage, Kentish Town Locomotive Sheds. (**Another illustration from "*The Steel Highway*"**)



A gigantic Hoe Printing Press that prints from six reels of paper simultaneously and will turn out 144,000 12-page papers in an hour. (**From the Editor's book "*Remarkable Machinery*" reviewed on page 1011**)

"The Railways of The Isle of Wight"

By P. C. Allen (Published by The Locomotive Publishing Co. Price 5/-)

Railway history in the Isle of Wight began in 1859 when the first company, the Cowes and Newport Railway, was incorporated. This line connected the capital of the Island with the coast, a distance of 4½ miles. Since that time there have been many extensions and changes, culminating in the amalgamation of the lines into the Southern Railway under the railway grouping of 1923.

In this book Mr. Allen deals with a fascinating story and there is probably no place in the British Isles that can offer a more attractive study in railway-working than the Isle of Wight. The book is well illustrated and fills a blank in our bookshelves, for in the many histories that have been compiled concerning the famous systems of the British mainland the railways of the Isle of Wight have not been included.

* * * *

"Workshop Practice"

(Sir Isaac Pitman & Sons Ltd.) in 30 1/- Parts

A complete guide to workshop operations intended for apprentices, improvers and skilled men in the engineering industry is being issued in weekly parts by Sir Isaac Pitman & Sons Ltd. The scope of the work is very wide and covers practically all phases of everyday workshop practice. The contributors are well-known engineers and, judging from the volumes already to hand, the instruction combines accuracy and completeness with an unusual degree of simplicity. The diagrams, which are very numerous, are of particular interest in that every unnecessary line has been omitted so that the essential features stand out with great prominence.

Works of this nature are as a rule very costly and frequently beyond the means of young apprentices. The cheapness of this guide is therefore strongly in its favour and, as it lacks nothing in quality, it should meet with a very favourable reception.

* * * *

"Engineering Workshop Manual"

By Ernest Pull
(Crosbie Lockwood & Son. 2/6 net)

The youth who is commencing his career in an engineering workshop is often in need of a book of practical information sufficiently small to be carried in the pocket. Mr. Pull has produced a book of this kind that appears to us to meet these requirements adequately. It contains in a very concise form a vast amount of information that is constantly required by fitters, turners, and general machinists, and includes a series of notes, rules and tables.

Interesting New Books

"The Wonder World" *by* Adam Gowans Whyte (Watts & Co.), 2/6
"Living Machinery" *by* A. V. Hill (G. Bell & Sons), 7/6
"The Ant People" *by* H. H. Ewers (The Bodley Head), 8/6
"Social Life in the Animal World" *by* Alverdes (Kegan Paul), 10/6
"Cricket" *by* Coverpoint (Frederick Warne), 6d.
"Engineering Workshop Manual" *by* Ernest Pull (Crosby Lockwood), 2/6
"How to Secure a Good Job" *by* W. L. Ivey (Pitman), 3/6

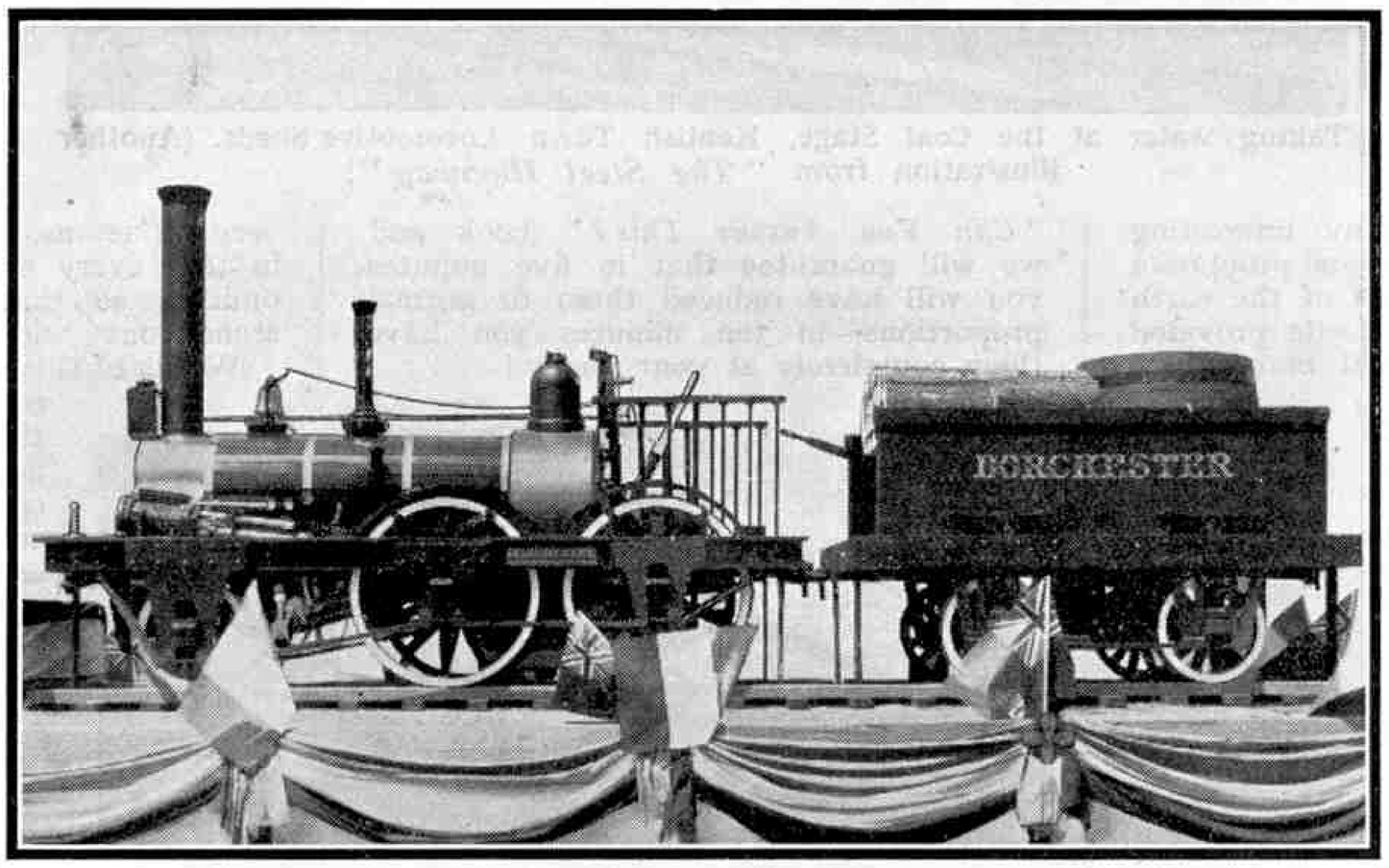
Early Railroad Days in Canada

When Steam Competed With The Stage Coach

By John Duncan

I WONDER how many people who saw the wood-burner locomotives in the first days of railroading in Canada could have visualised such monsters of motive power as the "4100" freight locomotives and the "6000" passenger engines now in use on the Canadian National Railways! The development in steam transportation has been so tremendous that we are apt to look back upon the beginnings of the railways as ancient history. I think, however, that the great strides made in construction and motive power give a fictitious background of time. Actually there are men living to-day who can re-call the operation of the first steam train in Upper Canada, and the building of the first locomotive in Toronto.

The conditions under which the first railroaders of Canada operated would seem very strange to-day. The stage coach is now looked upon as but a faint memory of a dim past—something to be resurrected for the decoration of a Christmas card or to give a quaint touch to a fictional story. Yet back in the early fifties it was the principal form of transportation and when the little wood-burners were bravely steaming over Ontario's first lines they were in active competition with the stages.



A half-size model of the wood-burner "*Dorchester*," the first locomotive used in Canada

The beginning of the steam road that I knew best was made at Toronto on 15th October, 1851, when Lady Elgin, wife of the Governor General, turned the first sod of the Ontario, Simcoe and Huron Union Railway. Operation of the railway actually commenced on 16th May, 1853, when the line was opened to Aurora, then known as Machell's Corners. Before the end of 1854 the line was completed to Collingwood, a distance of 94 miles, and subsequently was extended to its terminus at Meaford, a total distance of 115 miles.

The gauge was originally made 5 ft. 6 in. but in later years it was changed to the standard gauge of 4 ft. 8½ in. The track at first was laid with what was called the "U" rail pattern and the ends were secured in cast or wrought iron chairs. Subsequently the "T" rail was introduced, which was secured with fishplates, making a greatly improved road. The station platforms were made of planks, but they were unusually high and made it dangerous for passengers getting on to and off the cars. For this reason the platforms were lowered when they came to be renewed.

The fuel for locomotives for many years was wood, and the cordwood supplied to the stations in those days had to be re-cut once more. This was done by a circular saw driven by a horse walking on an inclined tread machine that had a belt to the saw. Later a portable steam power machine was used, and when its work at one station was finished it was placed on the main track and its power used to propel it to another station. The cut wood had to be piled in cord racks for the engines, and was accounted for by the station agent and, if possible, made to tally with the original quantity received. This feat was a difficult one owing to many of the freight trains passing north in the night or very early in the morning, when no one was in charge at the stations. The temptation to take from the wood pile was too great for many of the train crews to resist.

Water for the engines was pumped by hand out of large wells immediately behind the tank houses at Concord, Aurora and Lefroy. These stations also kept supplies of wood on hand. At Concord station a boiler was put in the tankhouse with pipes running up into the tank, in an effort to heat the water pumped, but the system proved a failure. An explosion occurred and heating was abandoned.

Frequently examinations were made to see that the tanks were well filled, as they had no indicators outside in those days to show the quantity of water in the tanks. A story was told that at Lefroy station the pump man was asked to see how much water was in the tank. He was gone longer than was necessary, and the agent went to look for him and found him hanging head downward and helpless. He had slipped and his feet got hooked in the ladder which, no doubt, saved him from a broken neck.

Up to 1864 seventeen engines had been bought by the railway. No. 1, "*Lady Elgin*," had two pairs of driving wheels 5 ft. in diameter, and a truck, the inside cylinders being 14 in. by 20 in. This engine had hook motion and an exceedingly sweet-toned bell. No. 2, "*Toronto*," built in Toronto by James Good, had two pairs of driving

wheels 5 ft. in diameter and a truck. It had outside cylinders 16 in. by 22 in. and link motion. Nos. 6 and 11 were similar to No. 2 and were built by Good.

Nos. 9 and 10, known as "*Hercules*" and "*Samson,*" had three pairs of driving wheels, 4 ft. 6 in. in diameter. They had inside cylinders 18 in. by 20 in. and link motion, and were specially strong freight engines. These also were built by James Good.

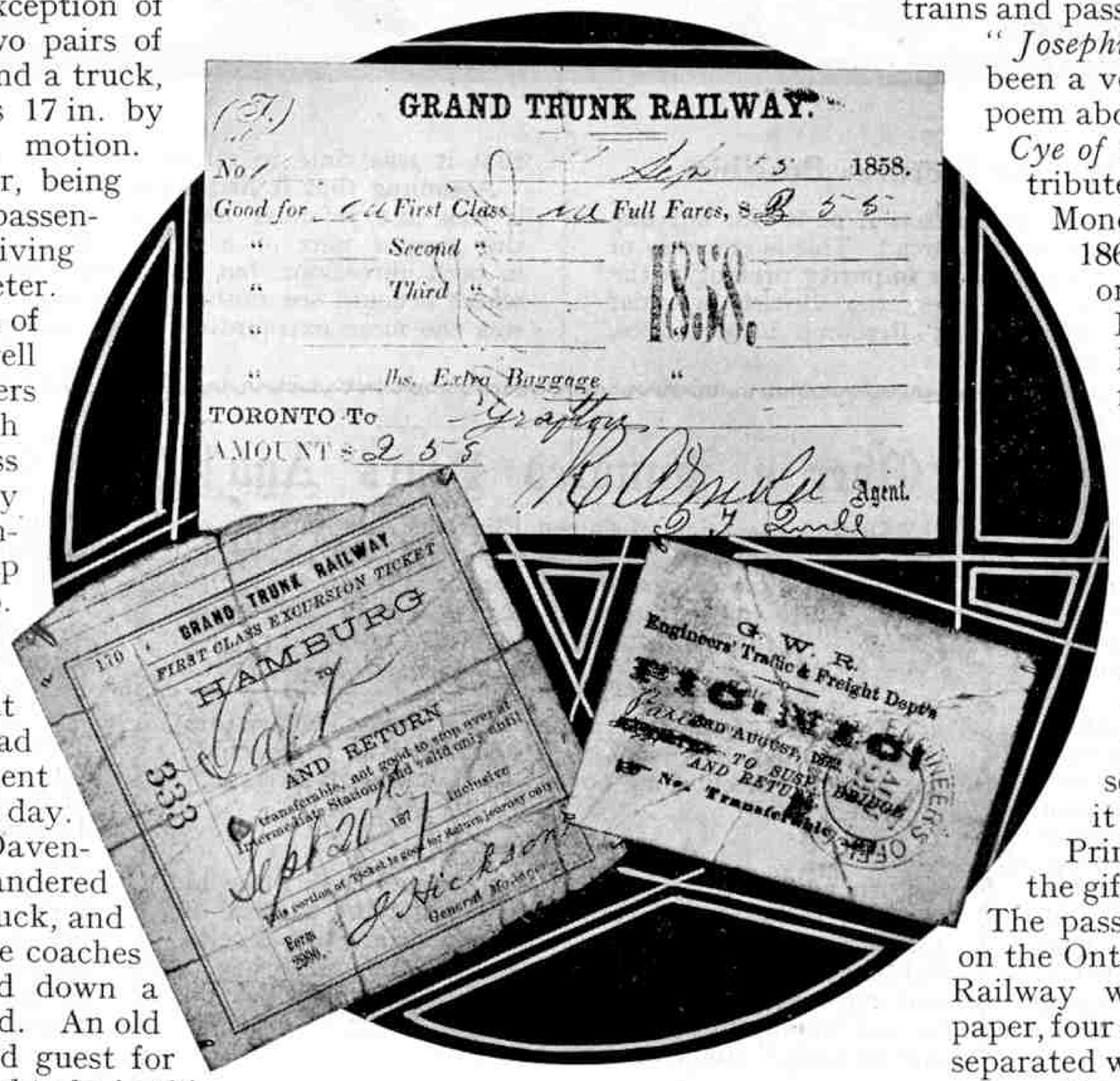
The remaining eleven engines were built either in Toronto by James Good or in Paterson, N.J. One of these engines was No. 3, the famous "*Josephine.*" All of them, with the exception of "*Josephine,*" had two pairs of 5 ft. driving wheels and a truck, with inside cylinders 17 in. by 20 in., and link motion. "*Josephine,*" however, being intended strictly for passenger service, had driving wheels 6 ft. in diameter.

Most of the engines of those days were well painted and the boilers were covered with Russian iron and brass bands. Needless to say all this decoration entailed much cleaning up at the end of each trip.

In order to make the first trip from Aurora to Toronto at the opening of the road a trial train was sent out on the preceding day. When just north of Davenport a cow that had wandered on to the line was struck, and as a result one of the coaches left the track, rolled down a bank and was wrecked. An old gentleman, an invited guest for the occasion, happened to be in this coach, and although he escaped injury he was very much put out over the loss of his gold eyeglasses!

Soon after the opening of the railway, passenger business began to increase rapidly and freight traffic in the shape of lumber, square timber, cordwood, grain and flour soon began to move in considerable quantities. For a short time large pine masts probably 125 ft. to 150 ft. in length were brought to Toronto from a northern station. For this purpose special trucks were used to which the masts were chained at each end. Between trucks long couplings were employed and the whole made an unusually long train. They were called "spar" trains, and were brought down in the morning for safety, making an interesting sight as they passed.

Among the first employees of the railway were two Englishmen named respectively William and Cyrus Huckitt. William became the first mechanical superintendent, and Cyrus, or "Cye" as he was nicknamed, became engineer of the "*Josephine.*" In those early days of the railroad swarms of girls from the towns and villages used to visit the stations either to see the trains and passengers or "Cye" of the "*Josephine.*" He must have been a very attractive man for a poem about him, called "*Dandy Cye of the Josephine,*" was distributed all over the line. Monday, 10th September, 1860, was an eventful day on the road, as the then Prince of Wales, the late King Edward VII, rode to Collingwood and back. A platform car was fitted up for the occasion as an observation car and placed at the rear of the train. At Concord station my youngest sister, then a small child, tossed a bouquet on the floor of the car as the train passed. An attendant picked it up and handed it to the Prince, who acknowledged the gift by a wave of his hand. The passenger tickets first used on the Ontario, Simcoe and Huron Railway were printed on plain paper, four on a sheet, and had to be separated when received. Daily returns of all tickets issued were made in a duplicate book that was sent to Toronto on the following morning and received back the same evening.



Interesting examples of early Canadian Railway Tickets

There were no snow ploughs in my time but on the passenger engines there were two attachments like large white spades, resting on supports on the pilot. They had hinged levers to which were attached wire cords to the cab. When the snow was heavy the spades could be let down and by their vigorous action they speedily cleared a path.

* * * *

[We have to thank the Editor of the "*Canadian National Railways Magazine*" for permission to reprint the above article, and for the loan of the blocks.—EDITOR, "*M.M.*"]

The Deepest Mine in the World

The distinction of possessing the world's deepest mine now belongs to the British Empire, for one shaft of the Village Deep gold mine, near Johannesburg, has reached a depth of 7,264 ft. This is nearly one-and-a-half miles, and is 538 ft. more than the depth of the St. John del Rey mine in Brazil. The deepest artificial hole in the Earth is still in America, however, borings in the Pennsylvanian oilfields having reached a depth of 7,756 ft.

The descent into the Village Deep mine is made in four stages, the final 69 ft. consisting of concrete steps, and twenty minutes are required for the trip. No fewer than 3,500 native workers and 260 white men are lowered daily, and in spite of the fact that all do not work in the deepest part of the mine, the average depth to which they descend is 6,500 ft.

The chief obstacle to efficient working in deep mines is the high temperature encountered. If the rate at which the temperature increases underground were the same in the Village Deep mine as in borings made in California, the temperature at the bottom would be approximately 180°F., which is only 32°F. less than the boiling point of water! Fortunately the increase in the Rand gold mines is only one degree F. for every 255 ft., and the natural temperature at the foot of the shaft is only 97°F. But even this is far too high for comfort, and it is necessary to force thousands of cubic feet of air through the workings every minute. Before entering the galleries the air passes over blocks of ice that reduce its temperature to 85°F., and four tons of ice are lowered into the mine daily in the effort to make work easier for the miners.



Of General Interest

Mustard Makes Moving Pictures Possible

The latest photographic discovery is that if cows did not like mustard there would be no moving pictures! This is one way of expressing the importance of a particular impurity present in the gelatine used in film-making. Dr. Mees, the British scientist who is Director of the Eastman Kodak Research Laboratories, has proved that no photographic image can be obtained on films made from absolutely pure gelatine. The impurity that makes photography possible turns out to be sulphur, and Dr. Mees traces its origin to wild mustard and similar plants containing small proportions of this element. These are eaten by cattle, the sulphur in them finds its way into the hides, and thence into the gelatine made from them.

The association of cows, mustard and "movies" recalls Darwin's famous story of cats and clover. The fertilisation and production of new seed from red clover requires the aid of humble bees, as ordinary bees are unable to reach the nectar and therefore do not visit the plant. The greatest enemy of the humble bee is the field-mouse and, of course, the greatest enemy of the field-mouse is the cat. In a district where the number of cats is large the number of field-mice is proportionately small, and in consequence there is almost certain to be an increase in the number of humble bees. Strange though it may appear, it is therefore quite reasonable to say that red clover grows best where cats are most abundant!

Ferret's Homing Instinct

It has probably never occurred to anyone to make a test of the homing instinct of a ferret, but at least one case is known in which one of these animals found its way home from a wood nearly two miles away. This happened when the ferret had been despatched after young rabbits and had failed to reappear. The owner dug for some time in the hope of reaching the run in which it had stopped, but was compelled eventually to give up, while digging operations on subsequent days also ended in failure.

A month later, while sitting in his kitchen with the door open, the ferret's owner was suddenly surprised to see the lost animal enter the room and run under his chair. It was quickly caught and returned to its old quarters, where it seemed to show signs of pleasure at being home once more. Apparently it had become satiated with freedom, even in the rabbit warren, where it could give full play to its bloodthirsty instincts, and had decided that it was time to return to its former life.

Assuming that it had come directly from the warren in which it was lost, it must have crossed several fields and traversed the greater part of a wood. It had often made the journey in both directions, but had always been carried in a game-bag, where it could see nothing. In these circumstances its return was the more extraordinary and unexpected.

Over a Hundred Years Ago!

"During the reign of Queen Elizabeth, the burning of coal was prohibited in London during the sitting of Parliament, lest the health of the Knights of the Shire should suffer injury during their residence in the metropolis."—"HANTS. ADVERTISER," 17th May, 1828.

"Sweep! Sweep!"

"The flues of the new palace in St. James's Park are so constructed, by desire of His Majesty, as to preclude the necessity of climbing boys."—"HANTS. ADVERTISER," 24th Nov., 1827.

A Mariner's Beacon

"An adjourned meeting of ship owners took place at the City of London Tavern yesterday, for the purpose of taking into consideration propositions for erecting several lighthouses on the coast of the English Channel, when it was resolved that a lighthouse on Beachy Head would be an important acquisition to the trade."—"HANTS. ADVERTISER," 24th Nov., 1827.

The First Steam Carriages

"A gentleman of Somerset has contracted with Mr. Gurney, for three of his steam carriages, to run in each of the lines of road from London to Exeter, as soon as the machinery shall be brought into safe operation."—"HANTS. ADVERTISER," 26th Jan., 1828.

Off to the Arctic

"On Tuesday the boats built with wheels and sledges for Captain Parry's expedition to the North Pole, were transported by means of horses on their own wheels, from Woolwich to Deptford. Each is provided with three wheels, two in the centre, while the third, under the forepart, serves as a rudder. On Friday the Lords of the Admiralty went on board the discovery ship with the view of seeing all the arrangements complete."—"SUNDAY TIMES," 25th Mar., 1827.

Youngest Atlantic Flyer

At the end of July last year an Arctic tern between one and five days old was caught at a station in Labrador and released after an identification band had been attached to it. Nine weeks later it was found near La Rochelle in France, having thus earned the distinction of being the youngest known Atlantic flyer!

It is not known whether the bird crossed the Atlantic direct or flew by way of Greenland and Iceland, but in any case the flight is remarkable for a bird of this age. Other instances of birds crossing the Atlantic have occurred, but the records of the society whose mark was carried by this bird show only one previous trans-oceanic flyer. In this case also the bird crossed from west to east, but it required four years for the journey.

A Bird that Makes Speeches!

After studying the sounds made by an African finch that he possesses, an American has come to the conclusion that when a bird opens its mouth it does not sing a little song but makes a little speech! He believes that his bird uses about 300 "words," built up from 24 different sounds that are equivalent to the letters of our alphabet. Some of the combinations of sounds are repeated frequently, an instance of this being the bird's morning greeting to the world, which never varies and is alleged to be a short sentence of about 20 words. Other words are only used at long intervals and in special circumstances.

The owner of the finch declares that the methods used by the bird in building up words is very similar to that of the Hopi, a primitive race of Indians. He further claims that the bird speaks in prose that is comparable to Sanskrit, Chinese and English!

The Centre of North America

On a ranch in the State of Kansas in North America there is a block of concrete on which is engraved a metal plate. The words

on the plate indicates that the latitude and longitude of the position marked by the block have been very accurately determined by United States Government surveyors, and that it is the central point of the large scale maps of the country that they have constructed. The measured triangles by which surveyors cover the surface of the land start from this point, and it serves this purpose for Canada and for Mexico also.

This block of concrete may be regarded as marking in a sense the centre of North America, and is in fact practically the centre of area of the United States. It is not, however, the geographical centre of the enormous land-surface of which the three countries consist, for this is situated near the point of junction of the western border of the province of Manitoba with the boundary line between Canada and the United States.



Courtesy *[Canadian National Railways*

MISCHIEF BRUIN !
A ' flap-jack ' buffet luncheon in Jasper National Park, Canada's 4,000 square miles game sanctuary

As Extinct as the Dodo

It is difficult to say why the dodo is always chosen as a type of something dead or extinct unless, to use an Irishism, we know it to be extinct because it has been seen alive by human beings, while the only evidence that most extinct creatures ever existed is a collection of fossilized bones. The dodo was a clumsy, flightless bird about the size of a small turkey. It inhabited Mauritius when that island was first visited by the Portuguese in the 16th century, and it continued to live there, but in constantly diminishing numbers, until as late as 1861. Its disappearance was due partly to the fact that it was edible and very easily caught, but still more to the liking for dodo eggs developed by the pigs introduced to the island from Europe. Natural increase was completely checked and the dodo is now to be met with only as a museum specimen.

A list of birds that have been exterminated by human activities within the last few hundred years would be of astonishing length. Many species have lost their homes through the destruction of the forests in which they and their ancestors had lived for ages ; others have been killed for food ; while in cultivated lands many kinds of birds have diminished in numbers and even disappeared because improved methods of forestry have resulted in the decrease of the supply of insects on which they depended for food.

How the Siamese Distinguish the Days of the Week

In Siam it is impossible to make any mistake regarding the day of the week, for a glance at the dress of the people settles the question immediately. The main feature of Siamese dress is the " panung." This consists of a strip of cloth 7 ft. in length and about 2½ ft. in width, draped around the body from the waist downward so as to resemble a short skirt. It is worn by both men and women, and according to a curious ancient custom a special colour is assigned to it for each day of the week. The colour order from Monday to Saturday is cream, purple, orange, green, grey or blue, and black.

The Siamese are of Mongolian origin and have perserved their independence against Burmese invaders from the west, and from the Chinese, whose empire borders their country, on the east. The chief city is Bangkok, which is one of the great cities of Asia. Its inhabitants number some 650,000 and it has been described as the Venice of the East. This description is by no means undeserved, for the city is intersected by numerous " klongs " or streams, thickly covered with house-boats and other craft in which large numbers of the population live.

Bangkok, like many other cities in eastern countries where western ideas are spreading, offers remarkable contrasts. Beside the mat huts and thatched dwellings of the poor—remaining over from times that were less enlightened from a sanitary point of view, and in which terrible epidemics of cholera were frequent—there are buildings erected in the European style, and in the streets are mingled tramcars, buffalo-carts, rickshaws, and motor cars. There is also the great Throne Hall which is built throughout of marble and magnificently adorned with costly mosaics.

The most striking feature of the city is perhaps the great number of temples, for the Siamese are devout Buddhists. The education of a Siamese youth is not considered complete until he has entered a monastery attached to one of the " wats," as the temples are called, and worn the yellow robe of a Buddhist monk for at least a month or two. No obstacle is placed in the way of a monk who wishes to return to normal life.

The World's Rarest Wood

A collector who has explored the jungle of western Panama has brought back several hundred specimens of various kinds of wood, some of which are believed to be of entirely new species. Among the samples are two pieces of the world's rarest wood. The name given to this by the Indians of Panama is bloodwood cacique, and only one small fragment a few inches in length was previously known outside that country. It does not come directly from a living tree, but is formed from logs that have been rotting in the jungle for many years. Only the hard centre of a fallen trunk is left, this having been picked clean of bark and softer sap-wood by ants and worms.

The cacique is called bloodwood because of its ruby glow. In some lights it wears a golden sheen, and the value placed upon it by the natives of the country in which it grows is indicated by its name cacique, which means chieftain.

In order to obtain the two specimens the explorer made an adventurous journey through thick bush, ploughing a way through yellow slimy mud that came up to his knees and swamps 3 ft. in depth. Rock and mud slides had to be risked, and at times it rained so hard that the track was like a steam bath. When at last the tree was found, the native labourers had been left far behind and the explorer had to hack away pieces of the tough wood with an Indian machete.

What Cleaning a Liner Means

The domestic affairs of a large ocean liner are necessarily conducted on a scale calculated to strike terror into the heart of a housewife. For example, no less than 5,000 gallons of liquid soap, 170,000 lb. of soft soap, 63,000 lb. of soap powder and 45,000 lb. of soda are used each year for the purpose of washing the three great White Star liners "*Majestic*," " *Olympic* " and " *Homeric*." The process of cleaning necessitates also an annual supply of 35,000 sponges and floor cloths, while for polishing brass-work such as stair rods, door handles, taps, etc., 15,000 tins of polishing paste are used up every year.

Paint is also a considerable item. When the paintwork of the " *Majestic* " is renewed, 270 gallons of cream enamel and white paint are needed for interior decoration, while 30 gallons of black paint are used on the hull and the ring round the top of the funnel. The main surfaces of the four huge funnels require no less than 20 gallons of buff paint.

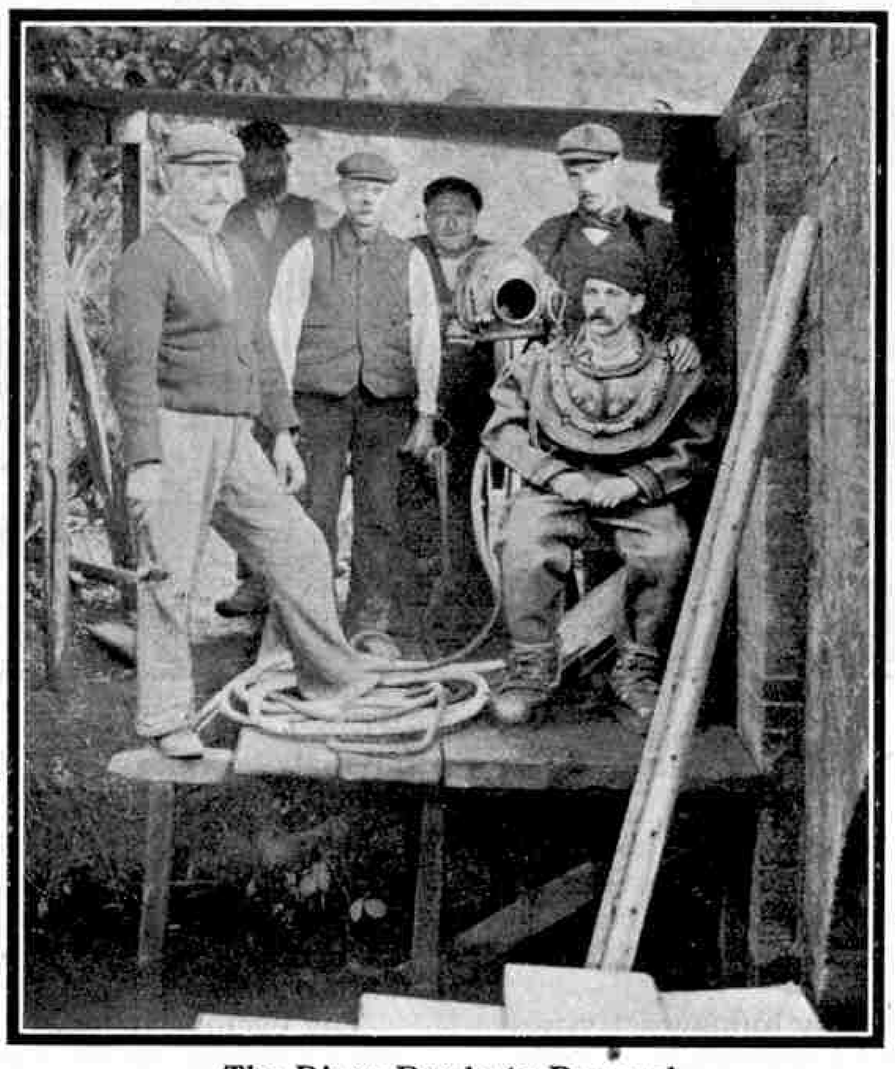
From Our Readers

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Underpinning a Bridge

A short time ago my father, who is a surveyor, had the job of supervising the underpinning of a bridge. It was a small rural bridge, built before the days of concrete piles, and the increase of heavy traffic had weakened its foundations. Piles of green elm-wood had been used as supports for the bridge. The action of the water had caused these piles to rot, with the result that the brickwork built over them subsided and a small warning crack appeared on the surface of the road. The crack gradually increased until underpinning could no longer be safely deferred.

The stream over which the bridge is built is shallow in most places but at this particular point is very deep. There is a mill close by and the bridge actually crosses the mill-head. As the owner of this mill required a considerable amount of compensation if his mill pond were drained, it was necessary to employ a diver. It was the diver's business to scrape out the decayed supports from beneath the platform and replace the wood by small sacks filled with cement. This work was done in sections, one section being filled up before another was prepared, otherwise the bridge would have collapsed.



The Diver Ready to Descend

The sacks were let down from above by means of ropes, and the diver was able to place them in position unaided as their apparent weight in the water is less than in air. The bags were placed one on top of the other in the prepared hole, the cement, which was not quite dry, oozing out and forming an adherent by which they fixed themselves together. The top layer had to be fixed artificially to the underpart of the supporting platform by cement poured down through a tube.

Operations were delayed for a short time on account of the annual army manœuvres that were taking place in the district. One day the foreman and a hot-tempered sergeant had a battle of words that lasted some time. The sergeant had marched his men, horses and guns a considerable distance, and on arriving at the bridge was told that if he attempted to cross he might repent it. After a while he was made to see reason, and with many remarks about the stupidity and pig-headedness of some people he turned his men and his guns around and retraced his steps!

N. E. Tebbitt (Wokingham).

Twenty-nine Bumps per Quarter-Mile!

All "*M.M.*" readers are familiar with the rhythmical "bump-bump-bump" of the wheels as railway coaches pass over the gaps between the sections of line. I wonder, however, how many know that there are 29 "bumps" in a quarter of a mile of track? I found this out accidentally when counting the bumps between different quarter-mile posts alongside the line. I do not know whether this holds good with all lines, but at any rate I have tested the number 29 over various different sections of line between London and Sheffield, Sheffield and Sunderland, and Sheffield and Oldham, and every time the result has been the same.

Here is another curious fact that probably very many railway enthusiasts have not observed. If you ask anyone to tell you the colour of the glass used on signal lamps for danger and safety indications respectively, he is almost certain to say red and green. This is wrong, however. The glasses that are actually used are red and blue. This latter colour is employed because the yellow flame behind the blue glass produces a bright green effect which is ideal for its purpose. On the other hand a yellow light behind a green glass would give a very pale green colour.

Harry Page (Oldham).

A Wire-Netting Factory (*continued from next page*)

spun round each other on the first operation, but in the next the second spindle would be rotated with the first, and the third with the fourth. It would be very difficult to design efficient machinery that would effect this. In practice, therefore, the pairs of spindles to be twisted are always the same, and the wires are changed over by automatic guides instead. Slots are cut along the full length of the spindles to allow the change to be made.

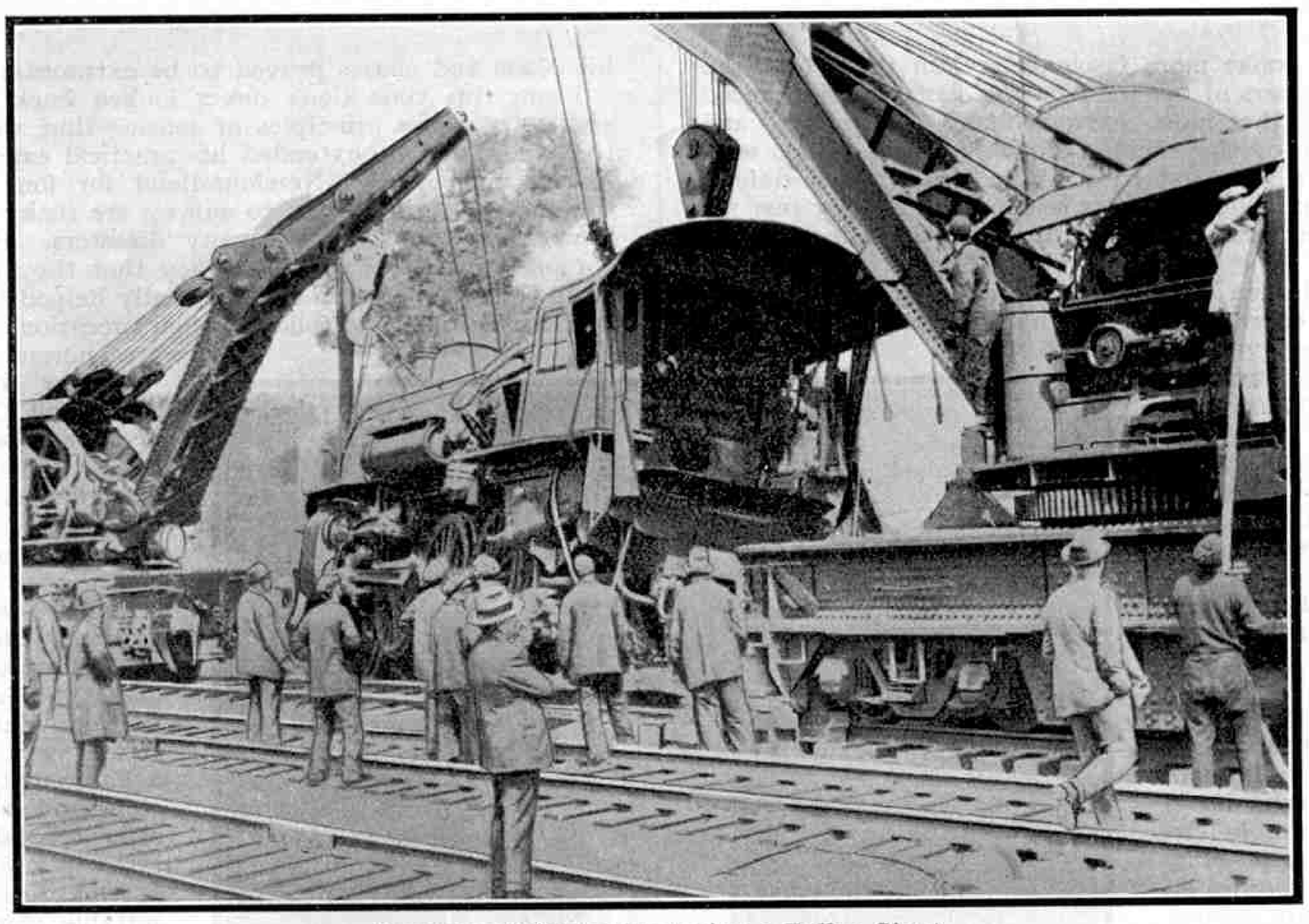
The netting subsequently passes into a room where it is dipped in hydrochloric acid to remove rust, after which it is passed through a tank of molten spelter. The netting that goes into the bath is dark and dull. It gleams like silver on emerging, but when cool it has the appearance of ordinary galvanised iron. The netting is coiled tightly in rolls and weighed ready for despatch.

Mark Appleby (Bristol).

An Incident on an American Railroad

There is a remarkable fascination about an accident to any huge piece of mechanism and this is particularly the case with regard to locomotives. The accompanying illustration showing a mishap to an American locomotive will therefore be of interest to readers of the "*M.M.*" The accident occurred on 12th September of last year and the train involved was the Western Night Mail which leaves Boston, Mass., at 11.30 p.m.

On the night in question the train got away from Boston on time and as it drew from the environs of the city steadily gained speed. As it rushed through Auburndale, about nine miles west of Allston, the driver observed the "all clear" signal ahead change to the "caution" position, and he immediately applied his brakes. During this operation a defective fulcrum lever snapped, derailing the engine bogie. This caused "549" to topple over on to her side. The driver and fireman narrowly escaped death and owe their lives entirely to the fact that when they felt the engine going over they jumped clear.



Breakdown Cranes Restoring a Fallen Giant

The breakdown crane—or "wrecker" as it is called in America—seen on the right of the photograph, came from Allston. This was the first opportunity of trying it out as it had been delivered new only a week prior to this accident. It represented the very last word in heavy "wreckers" and created a sensation by hauling itself and the cars constituting the breakdown train to the scene of the accident. In addition to this it subsequently returned to Allston under its own steam, towing "549" along!

A few words on its construction may be of interest. The control levers that operate the boom, etc., are only two inches in height! This sounds extraordinary, but it is explained by the fact that every operation is controlled by compressed air, furnished by a single-stage 9½ in. air compressor. It takes three men to run the machine—a fireman, a driver and a man to transmit, by whistle, instructions from the foreman to the driver. Electric light is provided from a turbo-generator using steam from the boiler. The water and coal capacity exceed that of the tender on "*King George V*," being 6,500 gallons of water and 10 tons of coal. The boiler is pressed at 190 lb. per square inch.

The crane on the left is stationed at Worcester, 44 miles from Boston. It was called into action to expedite the clearing of the main line and, although not so modern as its companion, it did its part well in co-operating in lifting the forward end of "549." When this photograph was taken both cranes were in the act of lifting together, and it is interesting to note the intense attitudes of the officials.

Fortunately, no other chance has occurred since for the cranes to distinguish themselves, but they are always ready for action at a moment's notice.

H. W. PONTIN
(Boston, Mass., U.S.A.).

A Wire-Netting Factory

One of my most interesting experiences was a visit to one of the largest wire-netting factories in the British Isles. Before entering the factory I passed through the adjoining iron-works of the company, where I saw oxy-acetylene flames cutting steel girders as though they were cheese, and I felt that nothing more marvellous was possible. To my surprise I found that the machinery that turned rusty iron wire into shining wire-netting was even more remarkable.

The wire arrives in coils, rough and dirty from its journey, and passes straight to the reeling machines. These wind it tightly round long rods to form the huge reels that go to feed the monsters in the next department. So far it had been quiet after the turmoil of the busy works we had just left behind, but now we entered a veritable inferno of sound. Clanging machines whirled their spindles rapidly right and left, and all the time the wire from the reels went in at one side and netting came out at the other.

The machines used are so complicated and work at such a high speed that it is difficult to follow the operations. They consist of a row of vertical spindles in the form of hollow cylindrical tubes; a roller on which the finished netting is wound, and gearing to enable the necessary movements to be carried out.

The wires from two neighbouring spindles are twisted together by revolving the spindles rapidly round each other several times. The rollers pull the netting away from the spindles during this process, and very soon it is necessary to carry out the next twisting operation. Examination of a piece of finished wire-netting will show that the wires previously twisted together must now be twisted with the adjacent wires on the other side. This means that alternate pairs of spindles would have to be rotated round each other. Of four spindles, for instance, the second and third would be

(*Continued in column 2 on previous page*)

A Great British Navigator

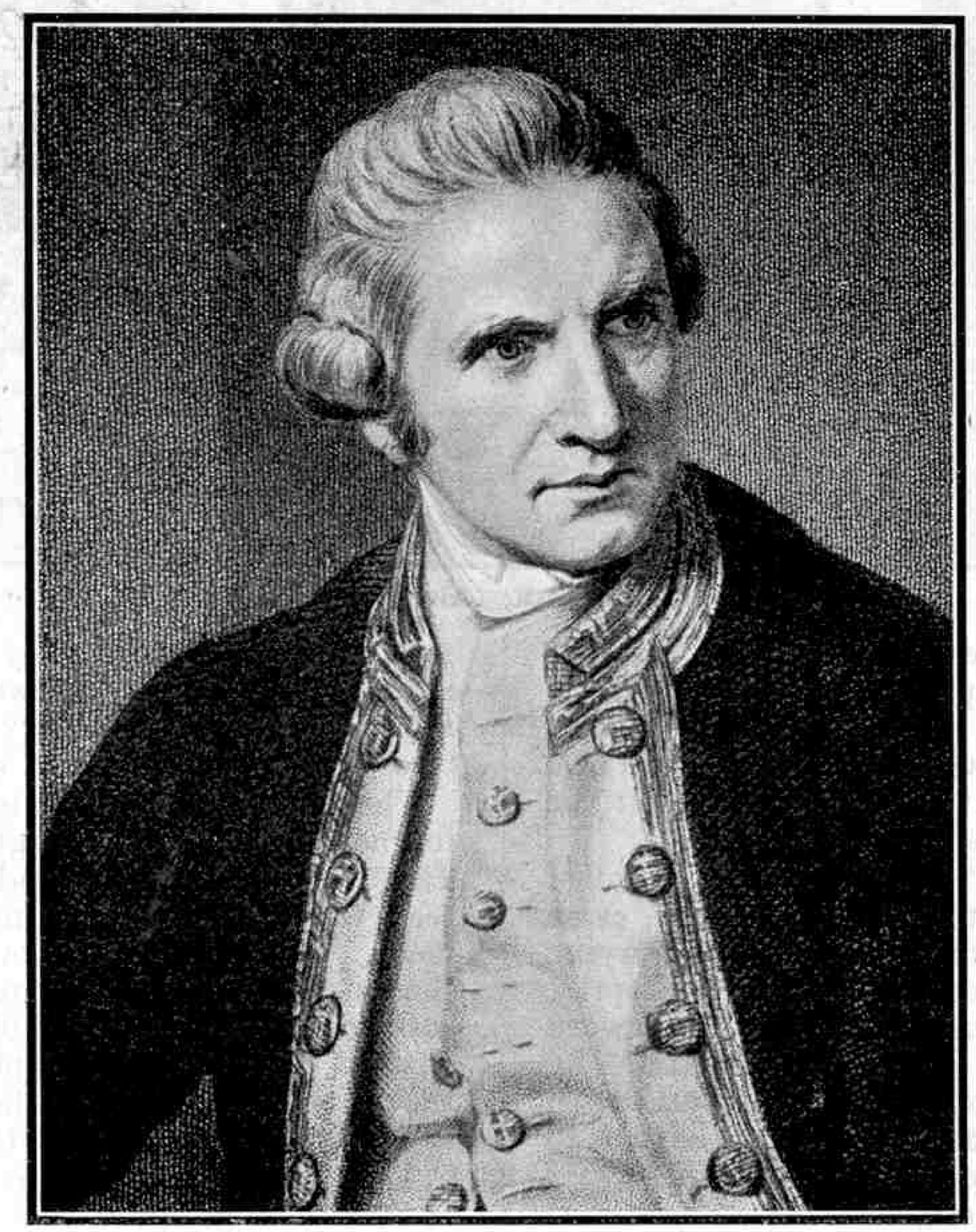
The Life Story of Captain James Cook

THERE are few books more fascinating than those that tell us of the explorers of bygone days and of how they faced and overcame the most extraordinary difficulties and dangers. The secret of the success of these pioneers lay very largely in the simple fact that they would never admit defeat. No matter how gloomy the prospects seemed to be, they just set their teeth and went ahead and nothing short of death itself could stop them.

These great-souled men do not all appeal to us in the same manner. Many of them repel us by their hardness or even brutality, while others seem to have been quite uninteresting characters apart from their exploits. Among those who make an immediate appeal to all who read of them, a very high place must be assigned to Captain James Cook, the Yorkshireman who added Australia and New Zealand to the British Empire, and discovered a greater length of new coast line than any other explorer.

Cook was born on 27th October, 1728, at the village of Marton near Middlesbrough, his father being an agricultural labourer in quite humble circumstances. James appears to have been regarded as quite an ordinary boy and his schoolmaster did not regard him as being at all promising. In due course he was taken from school and apprenticed to a draper at Staithes, a quaint fishing village a few miles north of Whitby. Drapery did not appeal to him at all, however, and his thoughts were continually turning to ships and the sea.

Day by day the humdrum shop life became more irksome, and finally an incident occurred that brought his discontent to a climax. His master missed a certain coin that had been placed in the shop till. A search was made and after a while the coin was found in the possession of the young apprentice. Everything pointed to the boy's guilt, but fortunately he was able to establish his innocence beyond doubt and to the complete satisfaction of his master. The unjustness of the accusation rankled in his mind, however, and he determined, come what might, that he would go to sea at the first opportunity.



Captain James Cook (1728-79), Britain's greatest explorer

It was easier to make this resolution than to carry it out, but Cook had the good fortune to make the acquaintance of a member of a coal-shipping firm in Whitby, and this resulted in his being given a place on board a coasting vessel. This was a very modest beginning and the life was hard, but Cook resolutely set himself to learn everything that he possibly could in regard to practical seamanship. In addition he spent every spare moment in studying navigation in order to fit himself for higher rank in his profession.

The reward of this hard work came with the outbreak of war with France in 1755. He joined the Navy, and his skill and efficiency attracted so much attention that in an unusually short time he was given the command of a small vessel. In this capacity he served in the famous campaign in which Wolfe captured Quebec. He did splendid work in the St. Lawrence River in regard to carrying out surveys and, in spite of having had little or no training, his plans and charts proved to be extraordinarily accurate.

From this time Cook never looked back. He continued his studies of those principles of science that were of special value to seamen and he extended his practical experience by acting as Marine Surveyor of Newfoundland for four years. The coasts that he was called upon to survey are rocky and dangerous and have been the scene of many disasters. By steady work he compiled charts of such accuracy that they remained in use for more than 70 years and undoubtedly helped to preserve the lives of the fishermen who followed their precarious calling around these treacherous shores.

During his stay in Newfoundland Cook was fortunate enough to see an eclipse of the Sun and the skill with which he carried out observations won for him a great opportunity. In 1767 the Government had commenced preparations for sending a scientific expedition to the Pacific Ocean to observe the transit of the planet Venus across the Sun's disc, which was to take place 3rd June, 1769. It was very important to secure a thoroughly efficient man to command the expedition and after careful consideration the task was entrusted to Cook. It was decided that the most suitable place for the observations was Tahiti, and the expedition sailed for this island on 23rd August, 1768, in the barque "*Endeavour*," a vessel of only 370 tons.

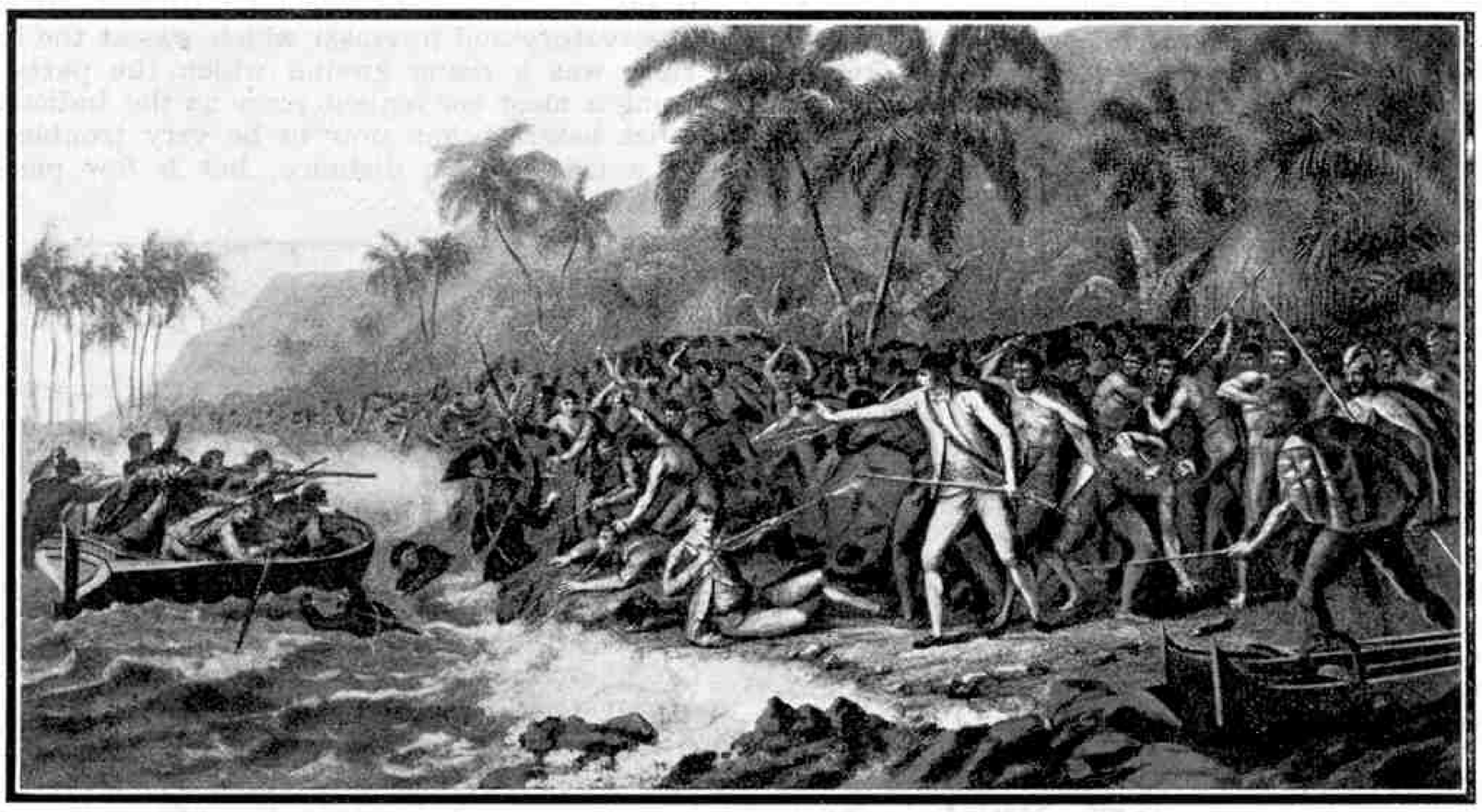
Cape Horn was rounded without any particular incident, and Tahiti was reached about eight months after leaving Plymouth. Cook quickly made friends with the natives and he and the scientists who accompanied him were able to carry out their tasks under favourable conditions and without difficulty. The only trouble encountered was due to the thieving propensities of the natives. Sometimes these thefts were too trivial to worry about, but as time went on more valuable articles, including scientific instruments, began to disappear daily. In very many cases, however, the stolen goods were returned through the good offices of the chiefs. This aspect of the expedition seems to have made a strong impression upon Cook, who declared that the natives were "prodigious expert" in the art of thieving!

On leaving Tahiti the "*Endeavour*" was steered west and eventually arrived on the east coast of New Zealand. The famous navigator Tasman had visited the west coast of this country more than 100 years previously, but he did not land nor did he make anything like a thorough exploration. It was vaguely supposed that he had discovered part of an extensive continent. Cook, on the other hand, landed, and was the first European to set foot in New Zealand. The Maoris were so astonished by the unaccustomed and, to them, alarming appearance of his large vessel that they fled inland and refused to respond to his friendly overtures. This was one of the very few occasions upon which Cook failed to arouse friendly feelings in the natives of the Pacific islands immediately he came in contact with them.

Cook was anxious to avoid hostilities of any kind and he went

on board again and sailed along the coast. The natives followed in their war canoes, but the occasional discharge of a musket was sufficient to keep them at a safe distance. Attempts at trading were occasionally made, but on the few occasions when they allowed themselves to be approached the Maoris proved keen bargainers and not too particular in the matter of stealing.

The coast line of New Zealand was thoroughly explored and the existence of two large islands was proved. Cook then sailed west and made equally important discoveries in Australia, then known as New Holland. Previous explorers had touched the north and the west coasts of the continent and had reported it to be arid and inhospitable. Cook was more fortunate. The east coast that he explored was rich in vegetation, and although he was not the actual discoverer of Australia he was certainly the first to recognise that it was a land in which Europeans could settle.



The scene at Cook's death. Two of his men are already overpowered and a native is about to strike him from behind as he turns to order the boats to come closer to the shore

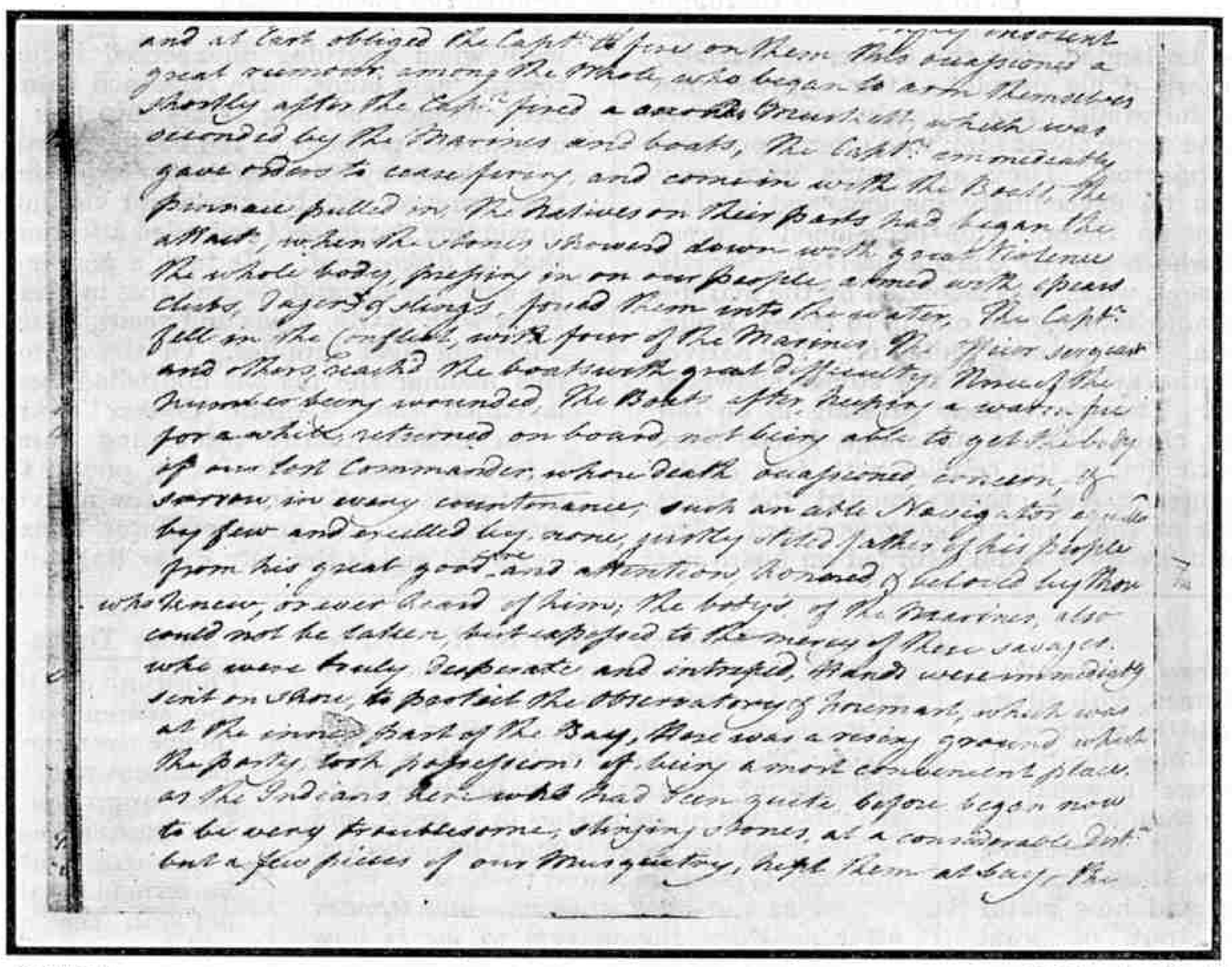
His first anchorage was in a bay to which he gave the name of Botany Bay on account of the number and variety of plants that grew there. He was unable to land, however, on account of opposition from the natives, and was compelled to sail farther north before he could go ashore. When the landing was made he hoisted the British flag and gave the country the name of New South Wales.

This great discovery resulted in a disaster that almost cost Cook and his companions their lives. While sailing along the unknown coast the "*Endeavour*" struck on a coral reef. She floated off two tides later, but she then leaked so badly that it was necessary to keep the pumps at work day and night. The men were rapidly becoming worn out by this incessant labour when an attempt was made to cover the hole by passing a sail beneath the keel, and this proved successful. When the ship was examined later it was found that a large fragment of coral had penetrated her timbers and had become wedged in the hole. If this piece had fallen out nothing could have kept the ship afloat.

The voyage was continued through better known waters without further mishap and the "*Endeavour*" reached England safely on 12th June, 1771.

Cook's mastery of navigation and his remarkable power of conciliating the natives of the Pacific Islands marked him out for further exploration and, with the exception of a brief interval spent ashore in an official post, the remainder of his life was devoted to work of this kind. His extensive voyages carried him on the one hand far south of the Antarctic Circle in search of the fabled extensive Antarctic Continent, and on the other to the ice-bound Arctic Sea, across which he hoped to find a north-east passage from Great Britain to the Pacific Ocean. Many new islands were discovered by him and the South Seas were entirely re-mapped.

An achievement of a totally different kind is noteworthy as showing the minute care and thought that Cook devoted to everything connected with his voyages. This was his success in discovering an effective method of preventing scurvy. Ships making long voyages in those days could only obtain fresh foods at long intervals and their crews suffered terribly from this disease. Cook's method of combating scurvy consisted in the use of vegetable soup and malt, combined with the greatest possible cleanliness and thorough ventilation of the ship. He valued his success in this direction more highly than all his geographical discoveries, and the fact that his work was appreciated is shown by the fact that the Royal Society presented him with the Copley Gold Medal.



Courtesy] ["*Morning Post*"

Photograph of part of the page of the "*Discovery's*" log, recording Cook's death

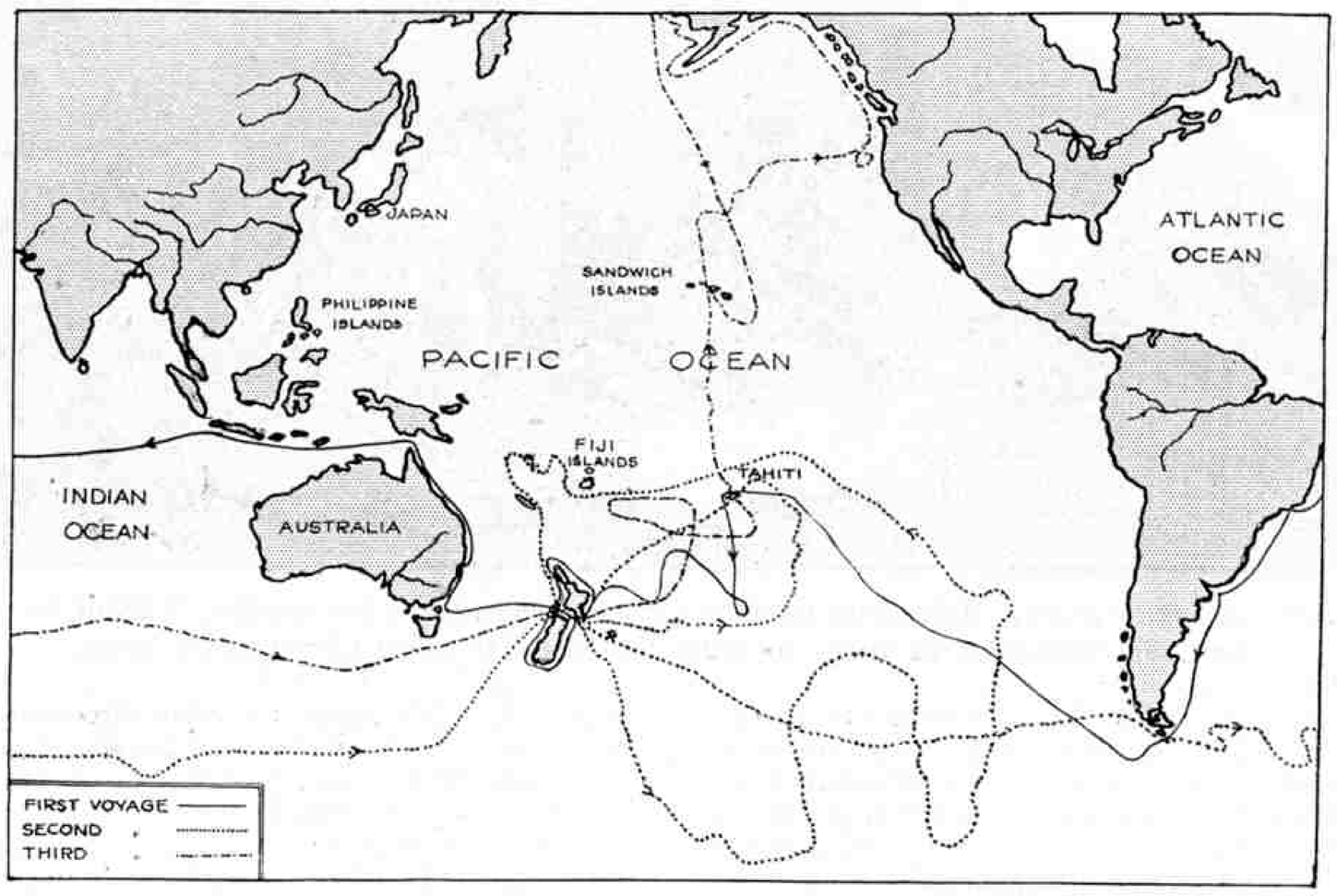
The great explorer met with a tragic end at the comparatively early age of 51. Returning from Bering Strait, he decided to spend the winter of 1778-79 at Hawai, one of the Sandwich Islands discovered by him. Unfortunately he arrived at the island at a period when food was scarce. The natives were by no means pleased to see the white men return, for they had scarcely sufficient food for their own needs and were dismayed at the prospect of having to provide in addition for a crew of hungry men. Minor quarrels soon broke out and the natives began to indulge freely in the habit of pilfering that seemed to be common throughout the Pacific Islands. Finally they became so bold that they actually stole one of the ship's boats!

Cook went ashore with the intention of taking the king of the island prisoner until the boat was returned. Unfortunately, in some manner not altogether clear, a fight began and a crowd of excited islanders forced the white men to retreat to the boats. Four of Cook's men were killed on the way. He himself was the last to reach the shore and he remained facing the natives while the boat was pushed off. So long as he faced them, the natives did not dare to attack him, but when finally he turned to reach the boat one of them summed up sufficient courage to strike him down with a club. He fell

into the water, but rose immediately and fought hard. He was hopelessly outnumbered, however, and was overcome before his men could assist him. Thus the great explorer perished in what was little more than a miserable squabble over a stolen boat.

Cook's body had to be abandoned at the time and when efforts at recovery were made subsequently only the bones could be found. These were buried at sea with full military honours. A monument marks the scene of the fatal struggle, while a bronze tablet has been fixed on the spot where he fell in the water when first struck. This spot is only uncovered at the lowest tides.

The task of recording the tragedy of Cook's death in the log of the "*Discovery*" was carried out by the mate, and by the courtesy of the "*Morning Post*" we are able to reproduce a photograph of part of the page on which the story is told. As the writing in the illustration is too small to be read easily, we give the following reprint of this interesting entry. ". . . . . the "Discovery's" large cutter was missing from the buoy where she was moored. Boats sent from each ship in search of her, with orders to keep every canoe in the bay from paddling off, till there was a likelihood of her being returned, as it was well known that the natives had taken her away. In order to make it more secure Captn. Cook went in the pinnace, manned and armed, with the launch, under the command of the third Lieut., in company to the village on the Nn. point of the bay, with an intention to get the Chief Kerrei-Oboo on board, for which purpose he landed with the Officer of Marines, the Sergeant and Or (other) of his people. After a little time they found the Chief and he would have willingly come off, but was hindered by his wife and those about him, who offered presents of hogs, etc. but were rejected. They afterwards were very troublesome and began to be exceedingly insolent and at last obliged the Captn. to fire on them. This occasioned a great rumour among the whole who began to arm themselves. Shortly after the Captn. fired a musket, which was seconded by the marines and boats. The Captn. immediately gave orders to cease firing, and come in with the boats. The pinnace pulled in. The natives on their part had begun the attack, when the stones showered down with great violence. The whole body pressing in on our people, armed with spears, clubs, daggers and slings, forced them into the water. The Captn. fell in the conflict with four of the marines. The officer, sergeant and others reached the boats with great difficulty, none of the number being wounded. The boats after keeping a warm fire for a while returned on board not being able to get the body of our lost commander, whose death occasioned concern and sorrow in every countenance. Such an able navigator, equalled by few and excelled by none, justly styled 'father of his people' from his great good care and attention, honoured and beloved by those who knew or ever heard of him. The bodies of the marines also could not be taken, but exposed to the mercy of those savages who were truly desperate and intrepid. Hands were immediately sent on shore to protect the observatory and foremast which was at the inner part of the bay. Here was a rising ground which the party took possession of, being a most convenient place as the Indians here who had been quiet before began now to be very troublesome, slinging stones at a considerable distance, but a few pieces of our musketry kept them at bay . . . ."



The lines on our map show the tracks of Captain Cook's three voyages, and enable us to realise how thoroughly he explored the Pacific Ocean

Cook was a man of striking appearance. He was over 6 ft. in height and had a fine head with rather small, piercing eyes and heavy eyebrows. He was regarded with respect and admiration by everybody with whom he had any dealings. His influence over the men under his command was extraordinary, and his officers have recorded their unfailing confidence in his sure judgment and cool courage. One of his most striking characteristics was the cheerful perseverance that he brought to every task. Throughout the longest and the most tedious voyage he was always active and eager, and the only occasions on which he showed any impatience were when anything unexpected occurred to delay his progress toward new lands. He remained calm and unruffled under any circumstances so long as his ship was ploughing its way through unexplored portions of the Pacific Ocean.

Unlike many other explorers of his day, Cook knew how to combine firmness with tolerance and kindliness, and thus he succeeded in winning the respect and even affection of the natives of the lands that he discovered. He took a genuine interest in the welfare of his new friends, and showed this in practical fashion by presenting them with cattle, fowls and seeds, in order to increase their often uncertain food supplies. Of the animals that he distributed in this manner the pig has flourished best, and to-day this animal is called the "Captain Cooker" throughout the South Seas.

An extraordinarily interesting namesake of the explorer is a tortoise that lives in Tonga, one of the Friendly Islands. This creature is greatly prized by the natives for it was given to their ancestors by the great explorer himself. It is more than 150 years old and is the only living link with Cook.

Remarkable Machinery

(*Continued from page* 1011)

on one of the latest machines, with all its ingenious mechanism, is little short of a miracle. One of the machines described, prints 144,000 twelve-page newspapers every hour! From these wonders we are introduced to a variety of interesting machines. We learn how brass rods are squeezed out of an ingot, and how motor car parts are stamped out of solid blocks of metal. Then there is a toffee-wrapping machine that wraps 150 pieces of toffee a minute, and a cigarette-making machine that turns out 1,200 cigarettes per minute. Cash registers that record every transaction in print, and calculators that do all kinds of arithmetic, make for greater efficiency. The Torque Converter, which eliminates the gears in motor cars, is also described, and there are instructions for making a Meccano model of it. Bottle-making by machinery looks too complicated to understand at first sight, but it is simple to follow as described in this book. The wonderful machine that is explained and illustrated can produce more than 600,000 quart bottles in a week, and is designed to make simultaneously ten different types if required to do so.

And as the book goes on—one wonder after another—the marvel to me is how the author ever got all the details together, and how he writes of them in such a way that any normal man or boy can follow and understand. Yes! Machinery gives more leisure, greater spending power, eliminates drudgery, and this amazing record of how it is done is the finest gift any mechanically-minded boy can have. Thank you, Mr. Hawks, for your fascinating book!

Famous Trains

—(*continued from page* 981)

Chorlton-cum-Hardy we also pass on to the system of the Cheshire Lines, and thence over the complicated Throstle Nest Junctions and up a 1 in 100 rise on to the great approach viaduct that ushers us into Manchester Central Station.

On arrival at 4.25 p.m., we cannot but be struck by the extraordinary similarity between the interior of the station from which we started and that of the one at which we have now arrived. Both were built on a very similar plan. And if we want to go back to renew our acquaintance with St. Pancras, we have but to cross the platform at Manchester and board a return express leaving at 4.35 p.m.—10 minutes later—which will run us back to London in the same time of four hours that we have taken to come north.

Some Remarkable Machinery

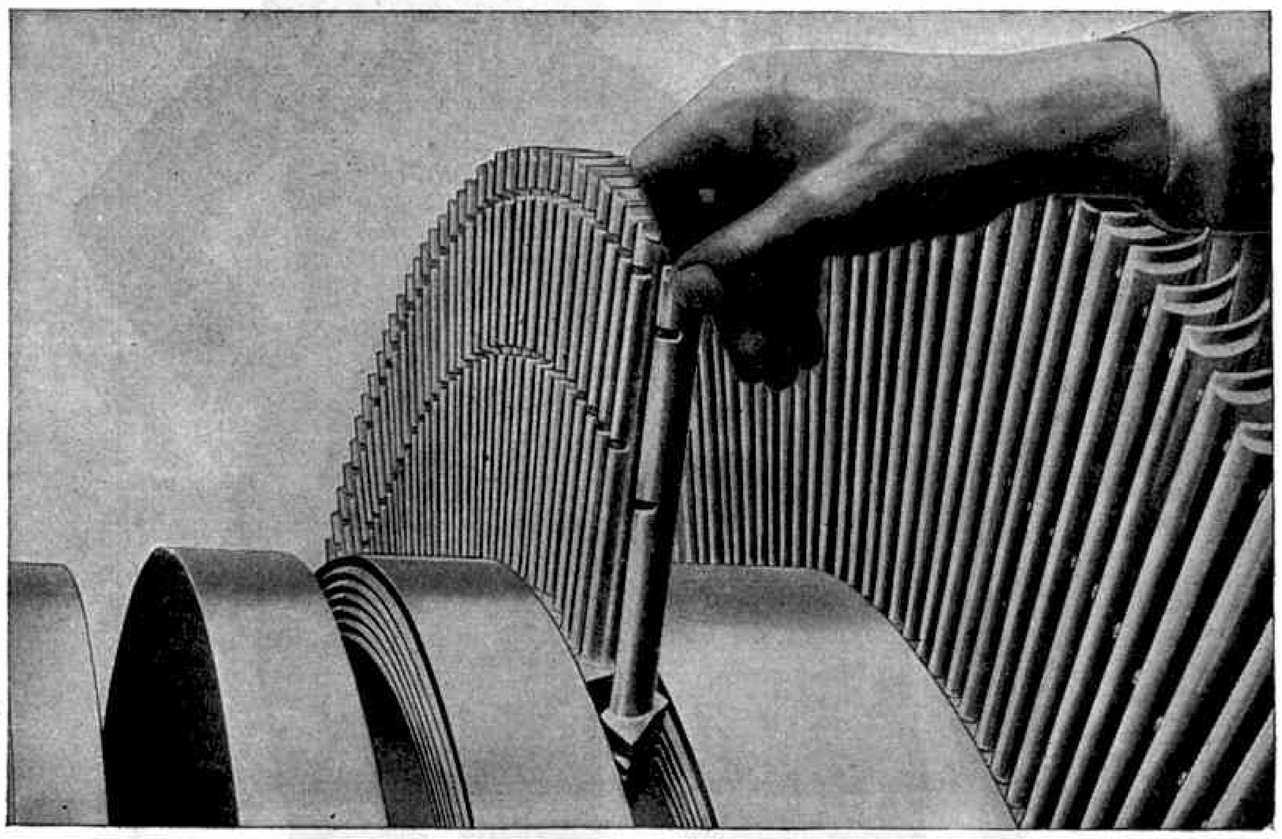
Marvels and Ingenuity of Modern Mechanics

By Rev. J. Henry Martin

WE are told that this is the Mechanical Age and it is certainly true that Man is weaker than the things he makes and controls. To-day, the work done by machines is marvellous and is well expressed by Kipling, who in one of his poems makes the Machines say:

"We can pull and haul and push and lift and drive
We can see and hear and count and read and write."

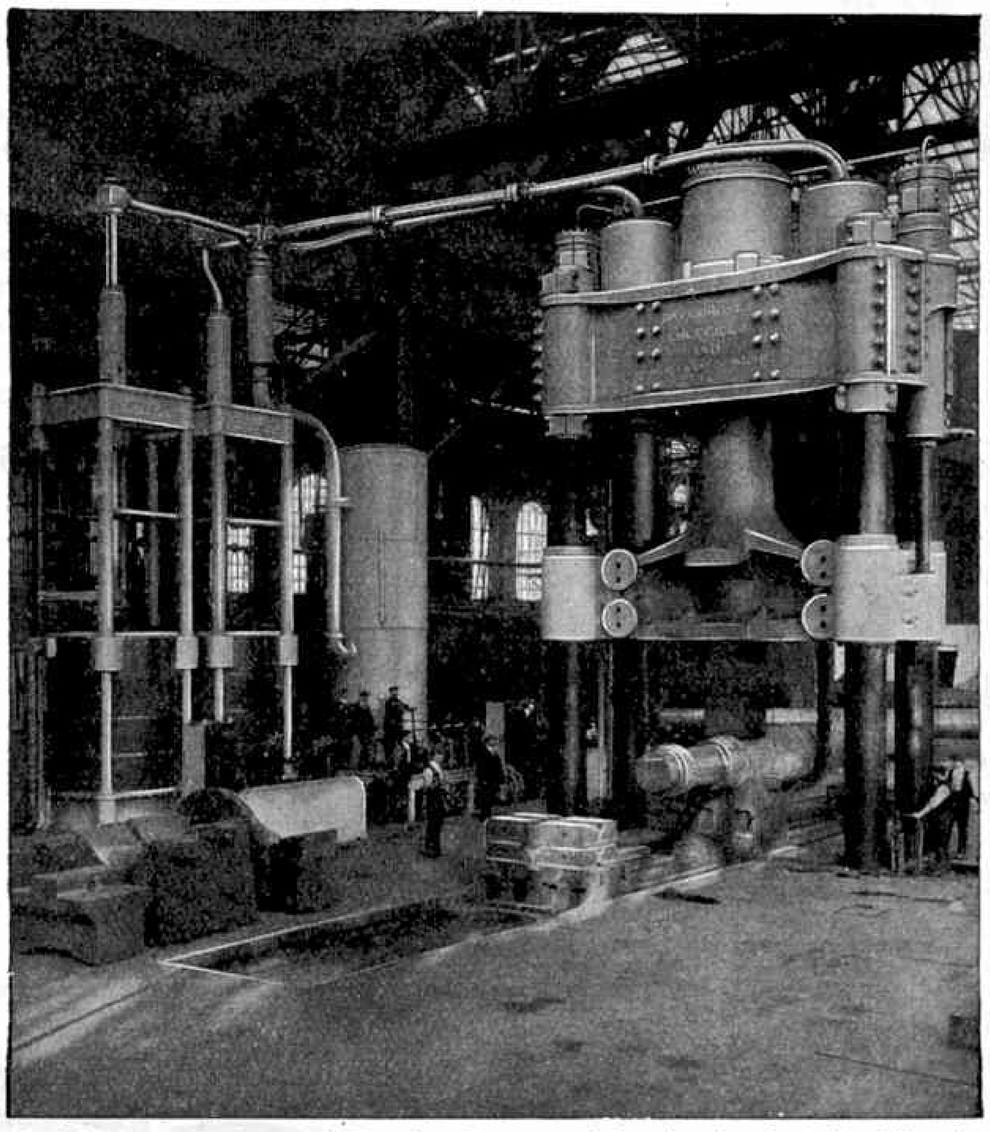
Man first made tools and now under his direction these tools achieve things that each previous age would have counted impossible. As machinery has transformed our life to-day, it is only natural that all thinking people are interested in it. In the midst of his busy life, the big brother of countless boys everywhere (the Editor of the "*M.M.*") has thrilled us this autumn by writing another book*, which I have just read. This volume deals with the fascinating subject of the marvels and ingenuity of modern machinery, and it was because I thought the book so interesting that I decided to write this article about it.



This illustration shows a method of attaching the blades to a turbine-shaft. There are 1,500,000 blades in the turbines of the "Mauretania." The total weight of each turbine drum is 130 tons

The first chapter deals with the story of the steam-engine, and the author shows how it is connected with almost everything we make, wear, cook or use. Steam was first used as power by Hero, a hundred years before Christ. This Greek mathematician tried to open Egyptian temple doors by steam. Frenchmen and Englishmen in the 17th century studied the use of steam before Watt—in the 18th century—invented the separate condenser. Next comes the story of reciprocating and rotary engines and an explanation of the value of superheated steam. The history of the locomotive began with Cugnot, a Frenchman, who, in 1763, built the first steam carriage. Trevithick and Blenkinsop followed in quick succession, and to-day the result of their labours links up the countries of the earth.

Steam on road and rail is wonderful, but in a ship it is epoch-making. From the first steam vessel (brought out in 1543 by a Spaniard) down to the "*Majestic*" of to-day is a far cry and a fascinating record. Paddle-propelled boats were used in China long ago, but the first paddle-steamer was built at Edinburgh in 1785, and travelled five miles an hour. Then came the crossing of the Atlantic by an American steamship the "*Savannah*" in 1819, the voyage lasting 27 days! The invention of the screw and the development of the compound engine was a great advance, but the rotary engine, or turbine, marks the most recent progress. The coming of oil as a power, with its saving of time and space, is well told and a section on the rotorship brings the story of the development of marine machinery up to date. The submarine, a class by itself, constitutes a remarkable story of progress from Bushnell's submarine of 1775 to the XI, the world's largest in 1924, with a crew of 100 and a canteen on board. This fascinating chapter is concluded by the story of the remarkable ingenuity displayed in the development of the torpedo.



A 6,000-ton High-speed Forging Press used for forging hot Steel Ingots into solid or hollow shafts, gun forgings or turbine drums

Perhaps the greatest progress in machinery has been made in internal combustion engines, as may be realised by two of the illustrations, showing a Wolseley car of 1900 and a Sunbeam racer of 1928. The details of the various types of petrol engines, including aero engines, show particularly the wonder of achievement in every way. The Diesel engine is quickly overcoming its disadvantages of weight in relation to power, and is becoming more and more popular with shipping companies and even railways are giving it some attention.

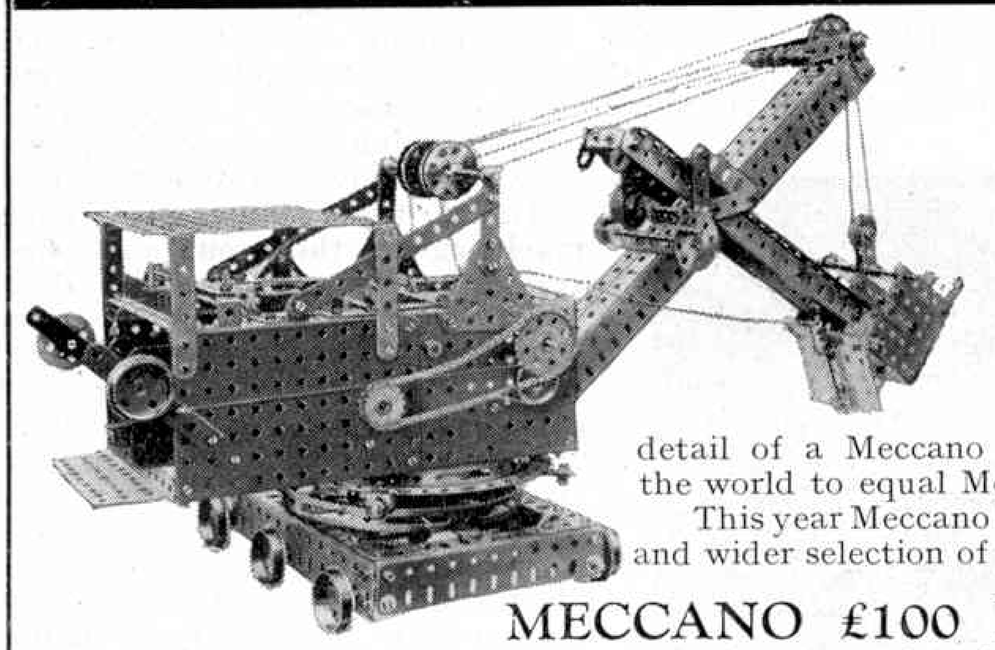
There are many remarkable machines in the iron and steel trades, and these are fully dealt with. Steel-making by the Bessemer process is described, and the methods of charging and emptying furnaces are well illustrated. A great chapter is the one describing forging with steam and hydraulic hammers, as well as the method of cutting steel plates. One illustration shows the heaviest armour plate being bent in a 12,000 ton press, which press also corrects distortion in cold plates caused by hardening.

When we think of the four million watertight rivets in the "*Mauretania*" and the thousands that must be leak-proof in a gasometer, we realise the importance of a riveter. The secret of precision in punching successive plates is interesting in the extreme, and leads us to the survey of machine tools—comparatively recent inventions and the result of a demand for accuracy not known before. In a chapter on the development of machine tools, which began with Maudslay in the 18th century and was carried further by Brunel, we find concise descriptions of the working of screw-cutting and turret-lathes and of planing and gear-cutting machinery of various types.

The progress from Caxton's days in the 15th century to the production of a great daily newspaper (*Continued at foot of previous page*)

* "REMARKABLE MACHINERY" by Ellison Hawks (G. G. Harrap & Co. Ltd. 7/6)





Meccano Week

30th NOVEMBER to 7th DECEMBER

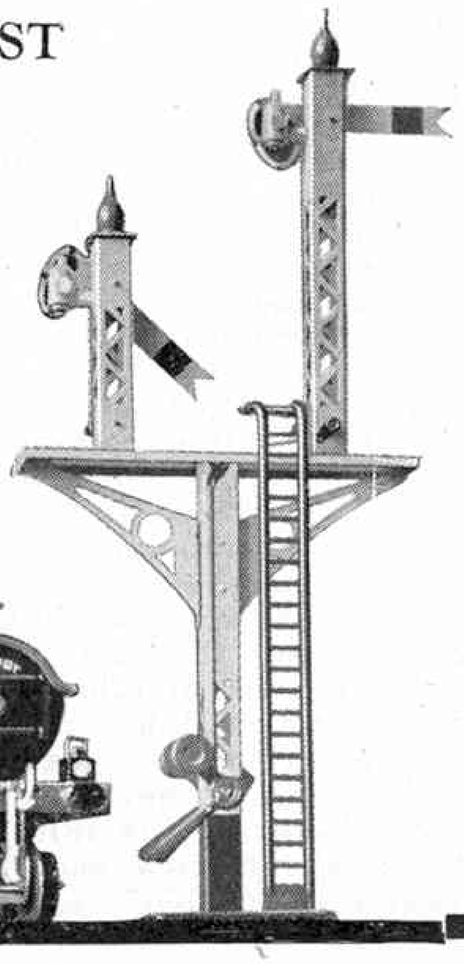
This is the greatest week in the year for boys interested in engineering. Everywhere there is talk of Gears and Girders, Cranks and Couplings, and all over the country Meccano dealers are making displays of Meccano models. Visit your dealer's shop at the first opportunity and see how much better Meccano is this year.

Boys build with Meccano just as real engineers build, and every detail of a Meccano model follows correct engineering practice. There is no hobby in the world to equal Meccano model-building, and there is no other hobby so full of interest.

This year Meccano Outfits are bigger and better than ever. They contain a greater number and wider selection of parts than previously, enabling hundreds of new models to be built.

MECCANO £100 MODEL-BUILDING CONTEST

This week also marks the opening of another important event—the new Meccano Model-Building Contest, full details of which are given on the opposite page. When you call to see the special Meccano displays at your dealer's shop do not forget to ask for an entry form.

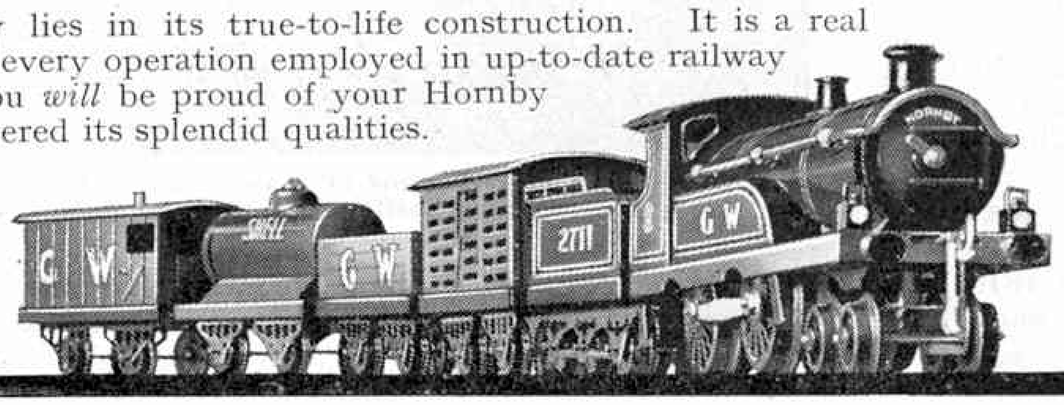


Hornby Train Week

7th to 14th DECEMBER

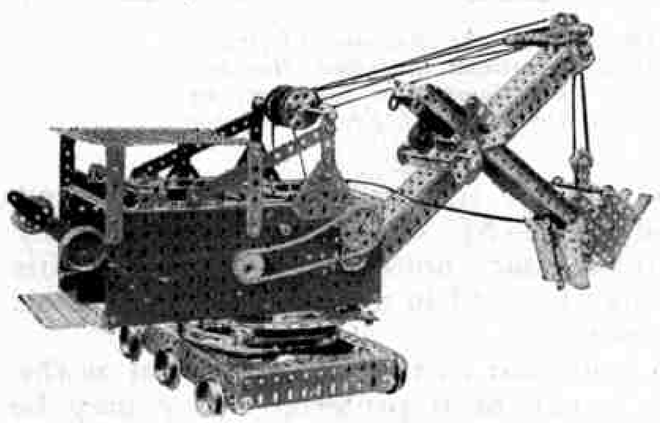
From the 7th to 14th December there will be special displays of Hornby Trains in all the shops. Make a careful note of the dates and ask Dad to take you to see these splendid trains demonstrated. Tell him that playing the great game of railways with a Hornby Train is the best fun in the world.

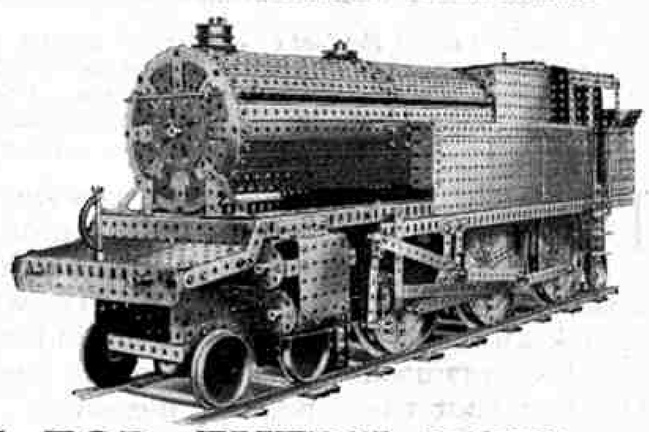
The fascination of a Hornby Railway lies in its true-to-life construction. It is a real railway in miniature, for it enables almost every operation employed in up-to-date railway practice to be carried out realistically. You *will* be proud of your Hornby Railway when you have tested it and discovered its splendid qualities.



MECCANO LIMITED
Old Swan, LIVERPOOL

Model £100 Building Contest





SCORES OF PRIZES MUST BE WON!

EVERY year thousands of Meccano models are invented and built by Meccano boys. We want to encourage the inventive boys in every possible way, and accordingly we have arranged a grand Model-building Competition for the Christmas season and we are offering prizes to the value of £100.

Every Meccano boy has an equal chance in this contest, no matter what Outfit he may possess. The conditions of entry have been made as simple as possible. All you have to do is to think of a new and original model, no matter how simple, and construct it as neatly as possible. Then have a photograph taken of the complete model or, if you are unable to obtain a photograph, a clear drawing will do just as well. Next obtain and fill in a special entry form from your dealer and send this along with your photo or drawing to us. Neither photographs or drawings need be your own work, but you must build your model without assistance from anyone.

Where to Obtain Entry Forms

Every competition entry must be accompanied by an official entry form, which can only be obtained from your dealer. You should be careful to see when asking for a copy that the dealer's name and address is either stamped or written on the form (a space for the dealer's name and address will be found on the back; make sure that it is filled in correctly, for if the dealer's name does not appear your entry will be disqualified).

The entry forms will be available throughout Meccano Week, which takes place from November 30th to December 7th. Entries may be sent in any time during Meccano Week or afterwards until the closing date, but competitors will assist the judges considerably in their task if they forward their entries as soon as they are ready, thus avoiding a last minute rush. You should make a point of obtaining your entry form as early as possible so as to avoid disappointment through stocks running out.

If you have any difficulty in obtaining your form, we shall be pleased to supply the name and address of your nearest dealer, or alternatively, send you an entry form, on receipt of your request enclosing a 1½d. stamp to cover the cost of postage.

Boys and girls of any age may enter the Contest, and a competitor may submit more than one model for consideration.

Hints to Intending Entrants

All you have to do is to build an original Meccano model and send us a photograph or a neat sketch of it, together with an explanation of the original points in its mechanism and design if such are not shown clearly in the illustration. These details, together with your entry form should be attached to the photograph or sketch. Neither photograph or drawings need be your own work, *but the model itself must be the result of your own unaided efforts.*

A CHANCE FOR EVERY BOY!

Try to be as original as possible in the choice of your subject. Models that really "work," or that may be put to some practical use, will naturally attract the judges more than models that are not built to work or fail to reproduce the movements of their prototypes. Any number of parts may be used in your model, but it should be borne in mind that a simple model of straightforward design and construction stands a better chance of winning a prize than a "scrappy-looking" model, no matter how complicated its mechanism may be. Good, sturdy construction will weigh heavily in the favour of any model.

How the Entries will be Judged

In making the awards, the judges will pay special attention to the following points:—

ORIGINALITY:—Special points will be given to those models showing initiative and originality and which are not simple variations of those illustrated in the Manual of Instructions.

CORRECT CONSTRUCTION:—Models which in their details are constructed on correct mechanical and engineering principles will receive higher marks than those that are built incorrectly or carelessly. No special knowledge is necessary to build models correctly, other than that which may be easily acquired from the Meccano Manuals of Instructions.

GENERAL INTEREST:—Preference will be given to those models that are likely to prove most interesting to Meccano users throughout the world.

Instructions for Overseas Competitors

Model-builders residing overseas may obtain their entry forms from their dealers or from the official Meccano Agents for their particular country.

Every overseas reader has an excellent chance of obtaining one of the valuable prizes offered in Sections D and E.

Closing Dates

Readers residing in Great Britain and Ireland must forward their entries not later than 31st January, 1929.

In order to give overseas entrants plenty of time in which to build the models we have extended the closing date for Sections D and E to 30th April, 1929.

All rules and any further particulars of the Contest will be found on the entry form. The results will be published in the *"M.M."* as soon after the closing dates as possible.

LIST OF PRIZES

Section A: For Competitors over 16 years of age on 31st January, 1929.
First Prize £12. Second Prize £8. Third Prize £5.

Section B: For Competitors over 12 and under 16 years of age on 31st January, 1929.
First Prize £8. Second Prize £5. Third Prize £3.

Section C: For Competitors under 12 years of age on 31st January, 1929.
First Prize £5. Second Prize £3. Third Prize £2.

Section D: For Overseas Competitors who are over 16 years of age on 30th April, 1929.
First Prize £5. Second Prize £3. Third Prize £2.

Section E: For Overseas Competitors under 16 years of age on 30th April, 1929.

For models showing special merit, there will also be 100 special prizes, consisting of Meccano Outfits, Hornby Train Sets, Electric Motors, Clockwork Motors, Inventor's Outfits, Meccano Radio Sets, and Earphones, etc., and 100 copies of the "Meccano Standard Mechanisms" Manual as Consolation Prizes, bringing the total value of the prizes up to ONE HUNDRED POUNDS.

Electricity Applied to Meccano

XIV.—Crystal Receiving Set

This is the last of a series of articles intended to draw every Meccano boy's attention to the numerous fascinating uses to which the Meccano Electrical parts may be put. The first two articles of the series dealt with the elementary principles of electricity, and subsequent articles described Meccano switches, a coil winding machine, a telegraph system, electro magnets, a galvanometer, motors, an electric locomotive, bells, lamps, an ammeter, an electric sign, an electrically-controlled railway, electric engines, a drop hammer, a remote control for radio sets, and electric clocks. This month we describe an efficient wireless receiving set made principally from Meccano parts.

IT is little more than twenty years since Senator Marconi attained success in transmitting telegraphic messages without the aid of wires. The value of the new invention was soon proved, although by tragic means. In 1912, when the R.M.S. "*Titanic*" struck an iceberg in the Atlantic and rapidly commenced to sink, wireless was used to summon other vessels to its aid, and but for the fact that the "S.O.S." messages were heard and quickly answered, the loss of life—although terrible—would have been much greater.

The development of broadcasting is one of the wonders of the present day. Ten years ago wireless enthusiasts listened-in to telephony with instruments of the crudest description. First came crystal sets tuned with inductance coils, and then valve detector sets with a similar means of tuning, which hardly could be described as "low loss."

Since these early days broadcasting has grown apace. The improvements at the transmitting end have been great and the receiving set, which is now an almost indispensable feature in most homes, also has been improved beyond recognition, both as regards appearance, reception and reproduction. Radio sets may now be obtained for every purpose and to suit every pocket. There is the superheterodyne, for those whose ambition is to "get" Mars (and who also have plenty of money!); the ordinary three or four-valve receiver in its many forms; entirely self-contained "portables" (ideal for the river, picnics, etc.); and lastly, the humble pioneer crystal set.

The crystal set has not much to be ashamed of even in these days, for although its range is strictly limited, it is well known that for clarity of reproduction—as pure as its name implies—the crystal as a means of rectification has never been excelled. Moreover, it costs nothing to maintain—a consideration which, we believe, is of no little importance to most, if not all, Meccano boys!

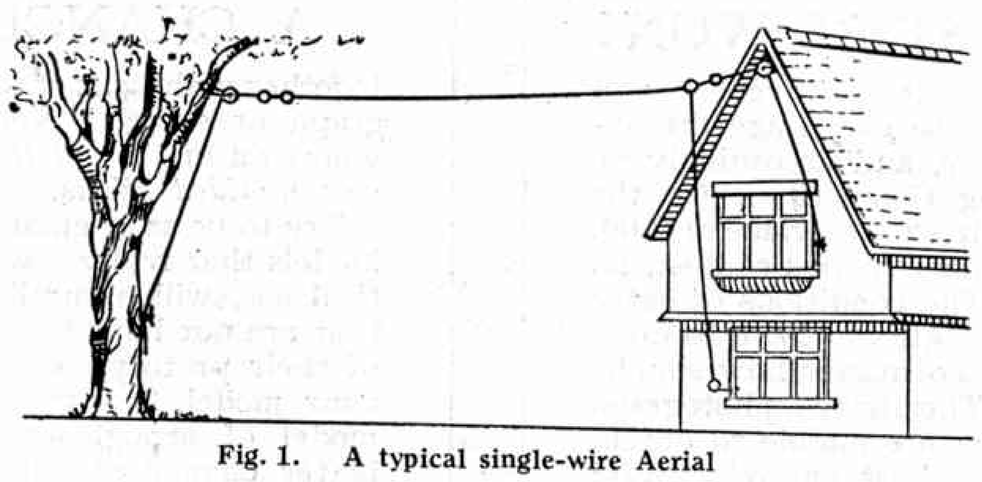


Fig. 1. A typical single-wire Aerial

Parts required to build the Crystal Receiving Set

2 of No. 5	28 of No. 37	1 of No. 80A
6 „ „ 11	5 „ „ 37A	1 „ „ 81
2 „ „ 12A	1 „ „ 44	4 „ „ 304
1 „ „ 16B	1 „ „ 47	4 „ „ 305
1 „ „ 27A	1 „ „ 48A	4 „ „ 306
1 „ „ 32	4 „ „ 59	1 „ „ 313

The following items will be required, but are not included in the Meccano system.

Strip of fibre or stout cardboard, approximately 15″ × 5″.

2 Ebonite Knobs (not essential).

1 Crystal. **1 Catwhisker.**

Building the Meccano Model

The Meccano crystal set is of very simple construction, as will be seen from Fig. 1, but this fact does not detract from its efficiency. It will receive telephony within a radius of approximately 15 miles. With a high power station, such as Daventry (5XX), the range is much greater, but as such stations transmit on a wave length much higher than the normal range of the set, a loading coil is necessary. The latter is connected in series with the variometer. That is to say, one end of the loading coil is connected to the aerial terminal of the set and the other directly to the aerial lead-in. Approximately 150 turns of 26 S.C.C. Wire will be required, wound on a suitable former. The former will of necessity be rather larger than those used for the variometer.

The plates forming the "panel" may be made from stout cardboard or fibre strip. The best way to make the holes is to place the material between two 5½″ × 2½″ Flat Plates; a Meccano Rod may then be punched through the fibre, the holes in the Meccano Plates acting as a guide for the Rod. After the holes have been punched, the edges of the fibre plate may be trimmed. It may be asked why the panel should be made of two 5½″ × 2½″ Plates and why they have so many apparently unnecessary holes. The reason for this is that the plates so made may be used in numerous other models and for a variety of purposes.

The coil formers may be made out of the same material as the panel, or if preferred, they may be bought already shaped in various sizes. If cardboard is used it should be soaked in melted paraffin wax. Sufficient fibre for the panel and formers should be obtainable for about sixpence.

On each of the coil formers 25 turns of 26 S.C.C. Copper Wire are wound. In order to secure its end, the wire is first passed through two small holes that are made near the centre of the former. The winding is then commenced, the wire being laid on alternate sides of each of the segments of the former until the 25 turns have been completed, and the coil is finished off by passing the end of the wire through two other small holes near the circumference.

The coil 1 is attached by a nut and bolt to a 57-teeth Gear Wheel that is secured to a 3″ Rod journalled in a 2½″ × 1½″ Double Angle Strip 3. The latter is bolted to the fibre plates forming the base of the model. The 57-teeth Gear meshes with a Worm on a 3½″ Threaded Rod that is journalled in a 2½″ × ½″ Double Angle Strip, and this Strip is secured to the base at right angles to the Double Angle Strip 3. By rotating the insulating knob that is locked by a nut on the end of the Threaded Rod, the coil 1 may be moved slowly round, thus altering the position in relation to the fixed coil 2. This alteration of the coils tunes the set to the desired wave length.

The fixed coil is attached to a 1″ × 1″ Angle Bracket secured to the base. The 57-teeth Gear with the coil 1 attached should be now adjusted on its Rod so that the two coils are as close to each other as possible without actually touching. The 1″ × 1″ Angle Bracket is provided with a terminal to which the aerial lead-in is attached and the commencement of the winding of the fixed coil 2 should be secured to the bolt that holds the coil to the Angle Bracket.

The crystal is mounted in two Double Brackets that are bolted to 1″ × 1″ Angle Brackets 4. Suitable crystals with catwhisker may easily be obtained, but we recommend readers to use only the best. Several well-known and reliable makes of crystal are on the market.

A Cranked Bent Strip 5, pivotally mounted by a lock-nutted bolt (see Standard Mechanism 263) on the panel, carries at its upper end a Threaded Boss that is attached to the Cranked Bent Strip by bolts. The bolts are inserted in the tapped transverse holes of the Threaded Boss and are locked in position by nuts so that they do not grip the 2″ Threaded Rod passing through the longitudinal bore of the Boss. This Rod carries the catwhisker at one end and an insulating knob at the other. (A suitable knob may be purchased from any wireless stores or, if appearance is of secondary importance, a 1″ fast Pulley fitted with a small Rubber Ring (part

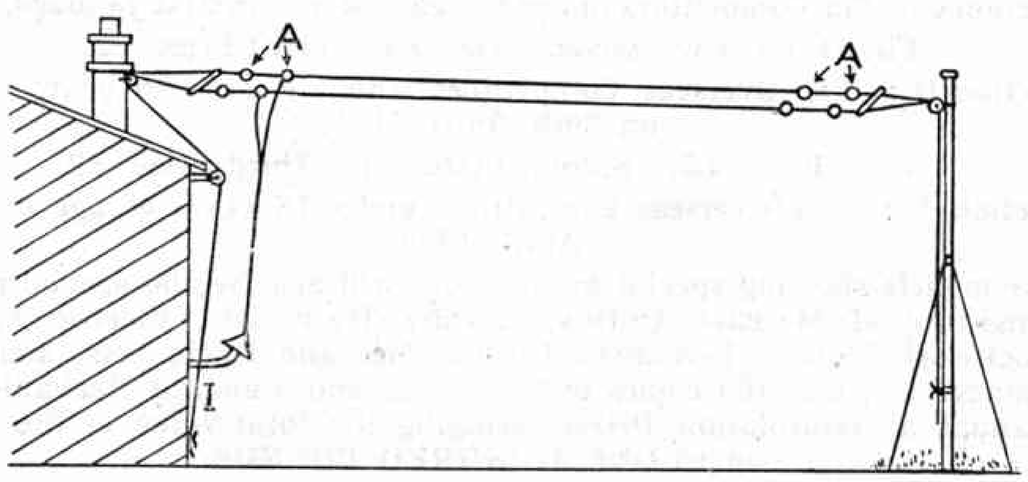


Fig. 2. A two-wire Aerial, for use where space is restricted

No. 155) may be used in its place).

The theoretical diagram of the set (Fig. 4) should make the following description of the wiring perfectly clear. The "aerial terminal" attached to the Angle Bracket carrying the fixed coil, is connected by a short length of wire to the retaining bolt of the Cranked Bent Strip 5, and a wire from the 1″×1″ Angle Bracket 4 carrying the crystal leads to one of the phone terminals 6, the other phone terminal being connected to one of the bolts fixing the 2½″×1½″ Double Angle Strip 3 to the base and also to the "earth" terminal (the latter can just be seen in Fig. 3; it is secured to the base to the right of the 57-teeth Gear Wheel). The wires of the remaining ends of the variometer coils should be connected together. It only remains now to connect the aerial and earth wires and phones to their respective terminals and the set is ready for use.

It may be found on trying out the set that it does not tune effectively. By turning one of the coils round so that the original outside face of the coil is now inside and facing the other coil, the trouble will be remedied.

In order to find the most sensitive spot of the crystal a buzzer is a very useful adjunct to the Meccano crystal set. A buzzer is really a miniature spark transmitter and will effect the receiver as such. It should be held in close proximity to the lead-in and the catwhisker adjusted until the note of the buzzer is heard at its loudest. A suitable buzzer was described in the fourth article of this series (see "*M.M.*" for February, 1928).

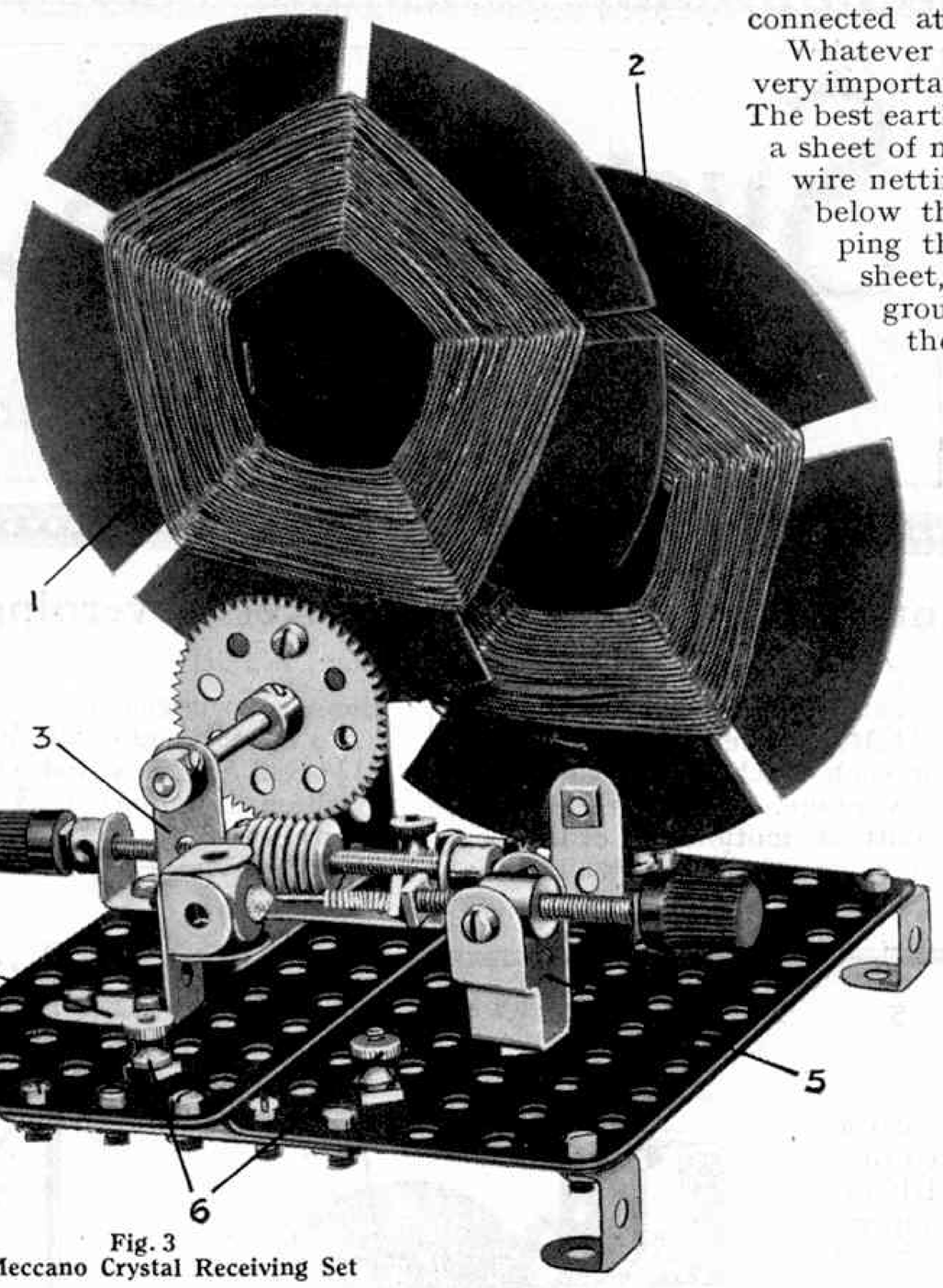


Fig. 3
The Meccano Crystal Receiving Set

Aerial and Earth

Of course it is very important that an efficient aerial and earth be used, otherwise adequate signal strength cannot be expected. To obtain the best results the aerial should be as high and as long as possible, especially the former, for the strength of the currents received increases very rapidly in proportion to the height.

It is impossible to give explicit instructions for the erection of an aerial, for its design and dimensions must naturally vary according to local conditions. Commonsense plays a great part in such matters, however. For example, if the garden and house be surrounded by other houses and trees, it is obviously the best policy to erect the aerial between masts mounted on the roof itself.

The aerial is insulated by means of porcelain insulators that may be obtained from any electrical supply stores. These insulators are attached at each end of the horizontal length of wire to prevent leakage to earth of the received signals through the supporting ropes, etc. The down lead, or lead-in, is, of course, a continuation of the horizontal length of wire forming the aerial proper and has to be as carefully insulated therefore, where it passes into the house. For this purpose a lead-in insulator may be obtained; it is fixed in position by pushing it through a hole bored in the woodwork of the window frame (I, Fig. 2).

An aerial of the single wire type is shown in Fig. 1. This type should be used where there is sufficient space to obtain the necessary length (it should be remembered that according to the Postmaster-General's regulations, an aerial must not exceed a total length of 100 feet, including the lead-in). If the full length of 100 ft. (less the height) cannot be obtained for a single wire, a shorter wire may be used, or, as an alternative a double antennae wire may be erected. This consists of two lengths of wire, say 30 ft. each, or whatever other length is convenient. Each length is separated by a spreader formed by a light piece of wood or bamboo, from which it must be insulated at A (see Fig. 2), and the two lengths are connected at one end to the lead-in.

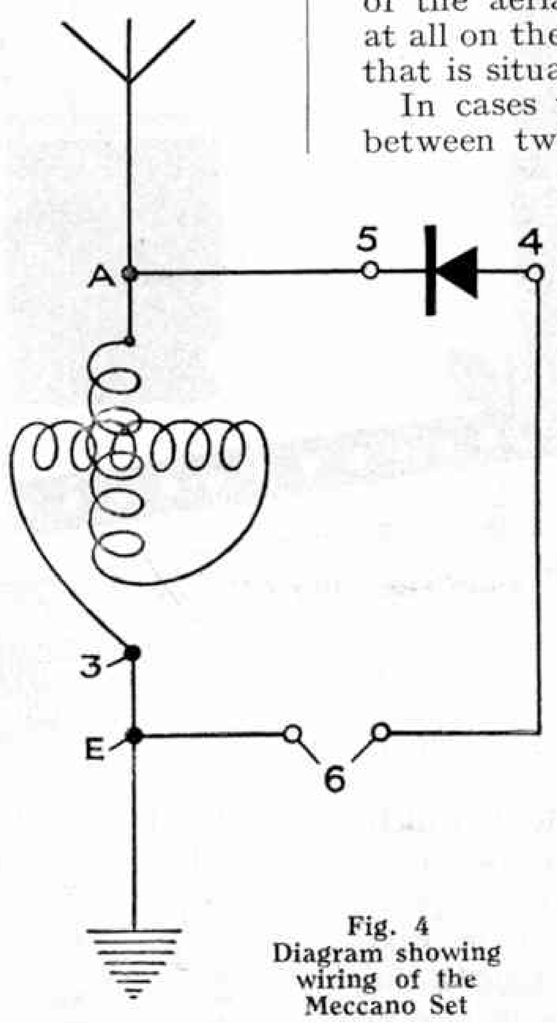


Fig. 4
Diagram showing wiring of the Meccano Set

Whatever form of aerial is employed it is very important to have a good earth connection. The best earth connection is formed by burying a sheet of metal, an old bucket, or a piece of wire netting (about 6 ft. square) a few feet below the ground, and soldering or clipping the earth wire to it. The metal sheet, etc., should be laid flat in moist ground if possible, for it is principally the moisture in the earth that acts as a conductor for electricity.

Another and simpler earth connection can be made by soldering or clipping the earth wire to a water pipe, previously scraped clean from dirt or paint before the contact is made. Bind the wire tightly around the pipe a dozen times and make the connection permanent by clipping the two together with a Meccano strip. Earth connections should not be made to gas-pipes, as very often the conductivity of the pipe is broken by the red lead used in the joints.

It has been found that the "orientation," or the direction of the compass in which an aerial lies, affects the strength of reception. To obtain the maximum strength the end of the aerial should be "end-on" to the transmitting station from which signals are being received. That is to say, if an aerial points due north and south it will be most efficient in receiving from transmitting stations in the north and in the south, rather than from stations in the east and west. Such an aerial is called "directive," because it is most sensitive to signals from the particular direction in which it points.

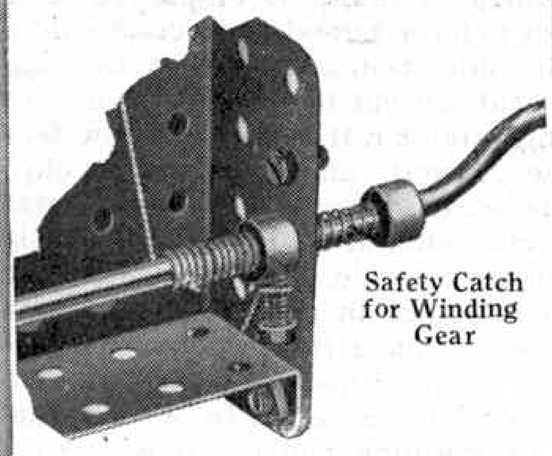
Greater signal-strength is obtained by taking the lead-in wire from the end of the aerial that is nearest to the transmitting station. Thus, if you are due north of London, and wish to receive broadcast at the greatest possible strength from London, your aerial should be oriented north and south and your lead-in wire taken from the south end of the aerial.

The fact that an aerial is directed towards one particular broadcasting station does not mean that signals will not be received from other stations. Much depends on the local surroundings, but it may be said that, as a general rule, a directive aerial will enable signals that would otherwise only be faintly heard, to be heard clearly or even loudly. At the same time the orientation of the aerial for this purpose may have no detrimental effect at all on the loudness of signals from another broadcasting station that is situated at a shorter distance.

In cases where the receiving station is approximately midway between two broadcasting stations, and it is desired to receive signals of equal strength from each, a slight modification of the type of aerial will give better results. The alteration consists in connecting the lead-in to the centre of the horizontal span, thus forming what is known as a T-aerial, a name coined from the fact that the aerial somewhat resembles a T in outline. Similarly, the type of aerial illustrated in Figs. 1 and 2 is termed an "inverted L aerial."

We thus see that the type of aerial is governed firstly by the circumstances in which it is situated—whether it is in a long or short garden and attached to a flag-pole or house chimneys, etc. Secondly, where the greatest efficiency is desired, the aerial is governed by the orientation, depending on the direction of the broadcasting station from which it is desired to receive the loudest signals.

The most suitable wire to use for the aerial is enamelled 7/22 phosphor bronze wire—the prefix "7/22" indicating that it is made up of seven strands of 22 S.W.G. wire. Any of the well known makes of patent aerials will also answer admirably. The joint between the lead-in and the horizontal span should be made by scraping the wires clean and bright and soldering them.



Safety Catch for Winding Gear

Suggestions Section

Edited by "Spanner"

(142)—Intermittent Motion; A Novel Governing Device

(E. J. Wright, London, W.C.1)

INTERMITTENT motion devices of various types have received a great deal of attention from "*M.M.*" readers from time to time, for the simple reason that such mechanisms show off many models to the best possible advantage. One of the most reliable methods of obtaining intermittent motion by ordinary mechanical means was shown under Suggestion No. 94 in the August, 1927, "*M.M.*" In this mechanism, a pin secured to a wheel that is driven at a slow speed by the Motor, throws over a pivoted lever. The latter is connected to a clutch and thus disconnects the driving shaft from the driven shaft. This happens once in every revolution of the wheel carrying the pin.

A neat and very efficient electrical intermittent motion was given in the May, 1928, "Suggestions Section" (Suggestion No. 121). This device employs two Motors, one of the Motors operating a rotary switch that alternately stops and starts the other, which forms the main driving Motor.

The device shown in Fig. 142 is quite different from these two examples, however. It involves a principle that was employed in some ancient clocks in place of the now more usual pendulum escapement mechanism, and can be used only where a very light driving power is required. It will also serve excellently as a speed governor or regulator for a weight-driven or clockwork mechanism. It should be quite possible to make a very interesting model clock incorporating this device and driven either by weights (as in the accompanying illustration) or by the Meccano Clockwork Motor.

Construction of the Model

The demonstration framework (Fig. 142) is strongly constructed from Angle Girders, but it may, of course, be altered to suit individual requirements.

The 3½" Gear Wheel 1 is secured to a 3½" Rod that is journalled in a 2½" × ½" Double Angle Strip attached to the top Angle Girders of the frame. One end of a length of cord is wound round this Rod and the other end is attached to a lead weight of approximately 4 lbs., which provides the necessary driving power.

The 3½" Gear meshes with a ½" Pinion on a short Rod, which also carries a ½" Bevel that is in engagement with a 1½" Bevel on the vertical Rod 2. A Coupling is placed loosely on the Rod 2, beneath the 1½" Bevel, to form a bearing for one end of the Rod carrying the ½" Bevel and Pinion. The Coupling is spaced the necessary distance from the 1½" Bevel by Washers to ensure the correct engagement of the two Bevels and to prevent binding.

To the top end of the Rod 2 is secured a Coupling that carries an 11½" Rod 5. This Rod 5 carries a Coupling at each end, and to one of these Couplings a 25 gramme Weight is attached by a short length of cord. The other Coupling has a 25-gramme Weight attached rigidly to it to balance the effect of the suspended Weight.

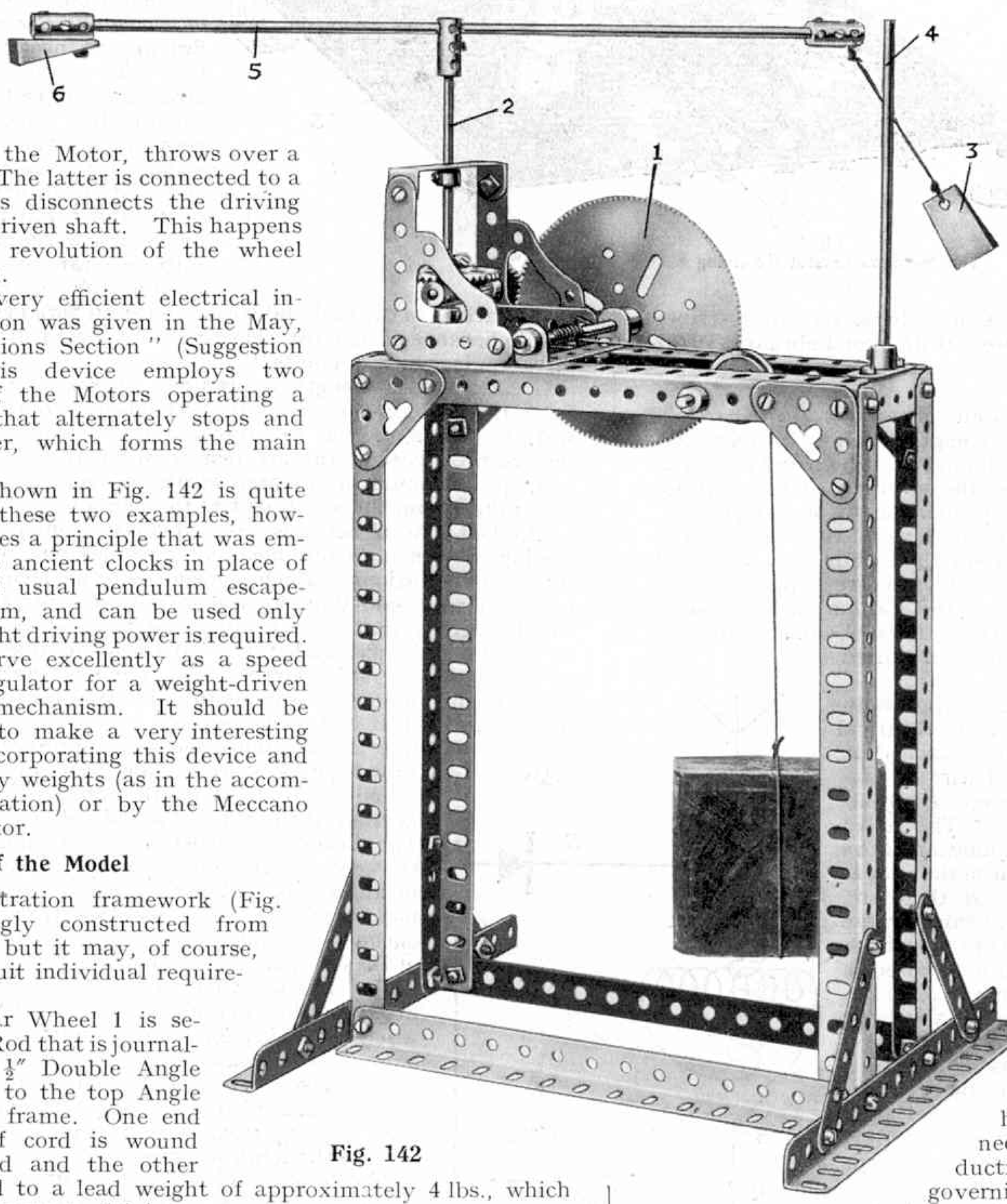


Fig. 142

A 4½" Rod 4 should now be secured in the boss of a Double Arm Crank, and the latter bolted to the top of the framework in the position shown.

Action of the Model

The effect of the large weight is, of course, to rotate the Gear 1 and therefore the arm 5. When this happens the 25-gramme Weight 3 flies out under the action of centrifugal force, and when the cord by which it is attached to the Rod 5 hits the Rod 4, it wraps itself round the latter, owing to the momentum of the weight 3, thus bringing the Rod 5 to a standstill. The weight 3 then unwraps itself from the Rod 4 and the horizontal Rod 5 is free to make another revolution.

This cycle of events continues until the propelling weight has descended to the bottom, when it will be necessary to wind it up by turning the Gear 1 in the required direction. To simplify the latter operation a ratchet winding mechanism, of the type included in the Meccano Grandfather Clock, should be employed. A typical Meccano ratchet gear was described in the August, 1926, "Suggestions Section" (Suggestion No. 54).

By using this form of intermittent motion as a speed governor, it should be possible to so govern the speed of a Meccano Clockwork Motor that it will run for two or three hours from a single winding. If this is done the Clockwork Motor will of course replace the heavy lead weight, and it will be necessary to include a very large reduction gear between the Motor and the governing device. Care must also be taken to ascertain the correct weight to be suspended from the revolving arm 5.

The parts required to build the complete model as illustrated are as follows:—

4 of No. 4	2 of No. 9E	1 of No. 22	34 of No. 36	7 of No. 59
1 „ „ 5	1 „ „ 13	1 „ „ 26	1 „ „ 37B	1 „ „ 62B
4 „ „ 8A	2 „ „ 15A	1 „ „ 27B	3 „ „ 38	4 „ „ 63
6 „ „ 8B	2 „ „ 16	1 „ „ 30A	1 „ „ 40	2 „ „ 67
2 „ „ 9D	1 „ „ 17	1 „ „ 30C	1 „ „ 48A	2 „ „ 108

(143)—Syphon Wick Lubricator

(Philip E. Moston, Wolverhampton)

In model building, as in real engineering practice, the lubrication of bearings, etc., is a very important matter if wear and tear is to be reduced to an absolute minimum and a machine made to operate by the least possible expenditure of power. A means whereby a constant supply of oil may be delivered to the working parts of a model is much to be preferred to the occasional use of an oil can. In practice there are many systems of lubrication in use, but perhaps the simplest and most adaptable to Meccano models is the "syphon wick" system, in which the oil flows to the bearings along "wicks" or "worsteds."

Fig. 143 shows lubricators of this type applied to a two-bearing crankshaft. The illustration clearly indicates the general layout of the system and it should enable any reader to instal a complete lubrication system in a model.

The crankshaft is journalled in Double Arm Cranks bolted to Flat Trunnions that, in turn, are bolted to 2½" Triangular Plates. A second Double Arm Crank 1 is secured at right angles by means of ½" × ½" Angle Brackets to each of the first-mentioned Cranks. A Chimney Adaptor 2, attached to one end of the Double Arm Crank 1, forms a neat oil cup. A length of worsted should now be threaded through a length of Spring Cord 3 and its upper end dipped into the oil cup and the lower end inserted in the set-screw hole of the Double Arm Crank that forms the bearing of the crankshaft. The Spring Cord, besides forming a convenient means to lead the oil-conveying worsted wherever it is needed, gives a neat appearance to the whole system (in the example illustrated it is held in position by the set-screw of the Crank 1).

It should be noted that the device will only function satisfactorily when the oil cup is above the level of, and not below, the parts requiring lubrication. The great advantage of the device is that it will supply oil to the working parts of a model continuously until the oil in the cups is exhausted. The amount of oil delivered is regulated by varying the number of strands of worsted; for example, two strands will supply oil at a greater rate than one.

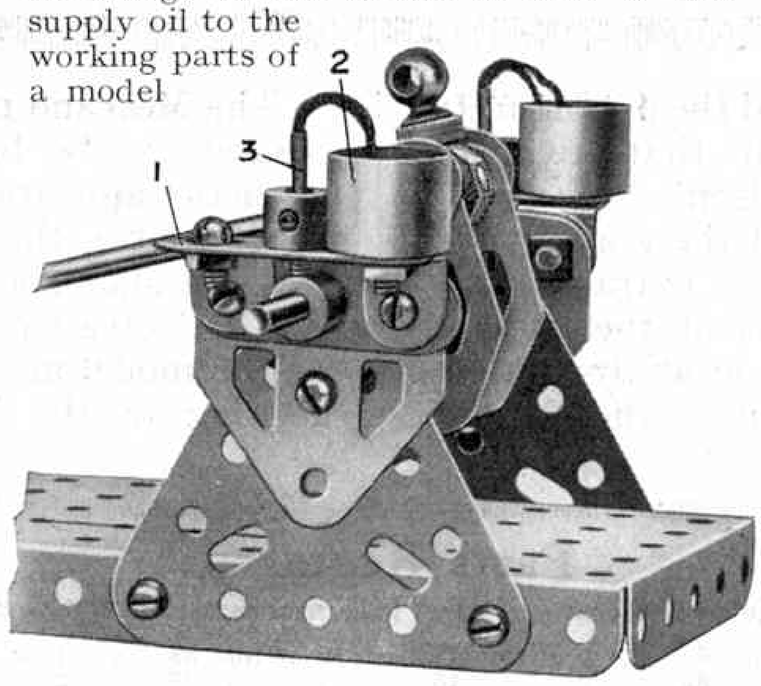


Fig. 143

(144)—Weight-lifting Device

(Seavax Framoze Desai, Navsari, India)

The interesting device shown in Fig. 144 represents a lift employed in up-to-date garages for hoisting cars a few feet from the floor, thus enabling the mechanics to make adjustments to the chassis without lying on their backs in all sorts of uncomfortable positions underneath the car.

Four 5½" Strips 1 are attached pivotally by lock-nutted bolts to the two 12½" Angle Girders that form the base and also to the carrier 2, which receives the car. The carrier is built up from two pairs of 12½" Angle Girders spaced apart by 2½" Strips.

The Crank Handle 3 carries a ½" Pinion that meshes with a 57-teeth Gear Wheel on the Rod 4, and a length of cord, wound on the latter, is attached to the end of the carrier, so that by turning the handle the carrier may be raised or lowered.

An effective brake for the Rod 4 is provided by a Coupling 6, in one of the end lateral bores of which the Rod runs freely. The Coupling is secured to the upright Strip by means of a ⅜" Bolt, which passes through a hole in the Strip and thence into the upper lateral bore of the Coupling. A Threaded Pin, with a 1" fast Pulley 7 attached, is inserted in the lower tapped hole of the Coupling so that when the Pulley is turned in the requisite direction the end of the Threaded Pin nips the Rod 4.

In order to return the carrier to the normal position a length of Spring Cord is attached to one end of the base and to a 3" Rod carried by the 5½" Strips 5; these latter Strips are attached pivotally by lock-nutted bolts to the Strips 1.

The parallel lifting mechanism employed in this model is of particular interest, for it may be used in many other models. Its principle is well illustrated by the parallel rule—a familiar instrument to those who are interested in mechanical drawing.

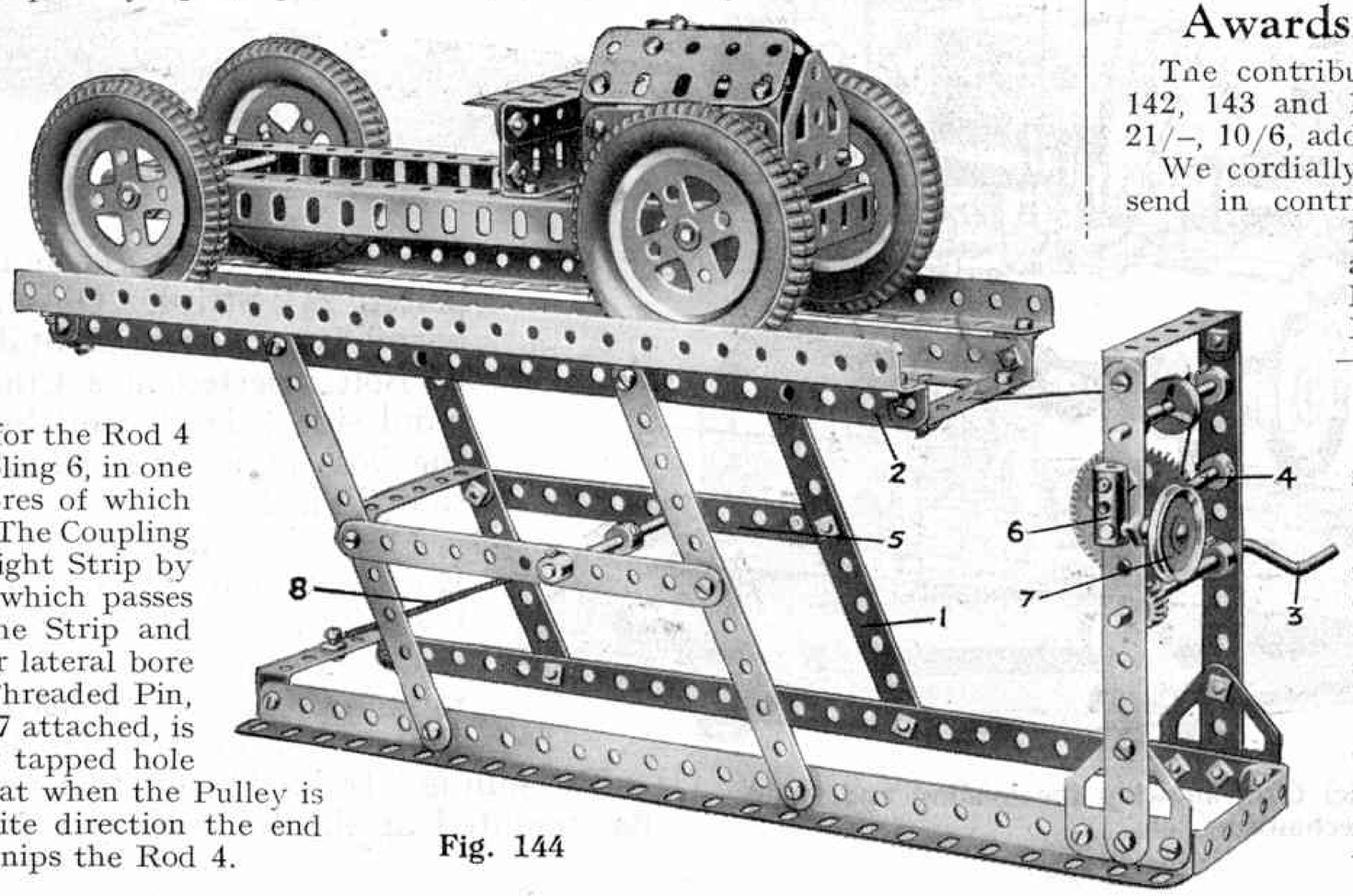


Fig. 144

SUGGESTIONS VOTING COMPETITION

Which Were the Best?

"*M.M.*" readers can have little idea of the difficulties that beset "Spanner's" task of choosing three or four contributions for publication in the "Suggestions Section" each month. Some of the numerous ideas that pour in every day are so good that it is impossible to decide which should receive the greater prominence. Therefore, to help him in his future selections, and in order to ascertain whether Meccano boys have made really good use of those suggestions that have been published during the past year, the Suggestions Voting Competition is announced.

Competitors are asked to write down the four suggestions that they consider the best published during the twelve months January-December, 1928. It is only necessary for the voter to write on a post card the numbers of the four suggestions, in their order of merit. There are thirty-seven suggestions concerned in the Competition, for the first suggestion in the January, 1928, "*M.M.*" was No. 108.

Entries will be divided into two Sections, Section A for competitors residing in the British Isles, and Section B for competitors residing Overseas.

Every vote received in Section A will be recorded so that the suggestions may be classified in their order of popularity. The voter whose entry is then found to coincide most nearly with the result so obtained will be presented with a cheque for one guinea, while the voter who is next nearest to the general concensus of opinion will be awarded a cheque for half a guinea. Twelve other voters who are "runners-up" will receive consolation prizes.

The same method will be adopted with the entries in Section B, and a duplicate set of prizes will be awarded to successful overseas boys.

A contributor who sent in a suggestion that is voted best in one of the Sections will receive a cheque for half-a-guinea and the three contributors whose suggestions are voted to be the next best in order will receive special Certificates of Merit. Post cards must be addressed to "Suggestions Voting" Competition, Meccano Ltd., Binns Road, Liverpool. The closing date for Section A is 31st January, 1929, and for Section B, 30th March, 1929.

Awards for Suggestions

The contributors of Suggestions Nos. 142, 143 and 144 will receive cheques for 21/–, 10/6, add 7/6 respectively.

We cordially invite all Meccano boys to send in contributions for this section. Envelopes should be addressed to "Spanner," c/o Meccano Ltd., Old Swan, Liverpool.

Correction

In connection with Suggestion No. M.27 in the October, 1928, "Suggestions Section," we regret that we omitted to mention D. Clark, of Bedford, who worked in conjunction with J. Anderson in devising a Bowden Wire brake control with the aid of Meccano Spring Cord. These two competitors, together with B. Adams, will receive special awards for their work.

This Month's Special New Model:

A Naval 4.7 Gun

That Actually Shoots!

THOSE fortunate boys who have had the opportunity of inspecting the quaint old guns that are to be found on such famous ships as Nelson's "*Victory*," or which may be seen dotted here and there about old forts, must have been impressed by the extraordinary difference between them and the guns of the present day. The old weapons were very crude affairs which, after being loaded—with much trouble and labour—from the muzzle end of the barrel, threw solid iron cannon balls with no great certainty of ever hitting the target! Looking at them to-day it seems scarcely possible that these clumsy instruments of war could ever have struck awe and even terror into an opposing army.

Although the efficiency and deadly power of the modern gun cannot be said to reflect credit on our present-day civilisation, it must be acknowledged that it is a marvellous mechanism—a fact that is brought home fully by inspecting the multitude of dials and handles and wonderful instruments with which it is equipped. The art of gunnery is highly specialised, and those engaged in it have to possess a knowledge of advanced mathematics and must pass severe examinations. Let us hasten to add that "*M.M.*" boys need not bother their heads about these matters when using the Meccano model gun!

The Meccano model represents a small but formidable weapon to be found on most ships of war. It is of realistic appearance, and its most attractive feature is, of course, the fact that it will actually fire "shells"—in the shape of Washers—quite a respectable distance. "*M.M.*" readers will notice that the working parts of the model are based on a somewhat similar principle to that of the Meccano Spring Gun described under Suggestion No. 23 (see "*M.M.*" for March, 1926).

Parts Required:

The following is a complete list of parts necessary to build the model Gun:

2 of No.	5	1 of No.	15a	16 of No.	38	1 of No.	114
2 „ „	6a	2 „ „	16	1 „ „	45	2 „ „	115
1 „ „	8	1 „ „	16a	1 „ „	52a	1 „ „	118
1 „ „	8a	2 „ „	17	10 „ „	59	1 „ „	120b
2 „ „	9a	3 „ „	18b	4 „ „	62	2 „ „	126a
2 „ „	9f	4 „ „	22	1 „ „	63	1 „ „	129
2 „ „	10	1 „ „	24	1 „ „	103c	6 „ „	136
2 „ „	11	1 „ „	32	1 „ „	103g	1 „ „	146
3 „ „	12	49 „ „	37	1 „ „	103h	1 „ „	155
1 „ „	13	1 „ „	37a	2 „ „	111c		

Construction of the Model

The "barrel" of the gun is composed of a $12\frac{1}{2}$" Angle Girder 1 and a $9\frac{1}{2}$" Angle Girder 2 arranged to form a "square tube." A $4\frac{1}{2}$" Flat Girder is bolted to one end of the $12\frac{1}{2}$" Girder and a $1\frac{1}{2}$" Flat Girder is secured to the corresponding end of the $9\frac{1}{2}$" Angle Girder (see Fig. 1). Two $4\frac{1}{2}$" Angle Girders—bolted together to form a channel section girder—are next secured to the top edges of the $4\frac{1}{2}$" and $1\frac{1}{2}$" Flat Girders, and on the same side of the barrel as the $1\frac{1}{2}$" Flat Girder a 2" Flat Girder is attached to the $4\frac{1}{2}$" Angle Girder. Thus there is a gap on this side of the gun through which the release mechanism will be inserted.

The swivelling portion of the base consists of a $5\frac{1}{2}" \times 3\frac{1}{2}"$ Flat Plate secured to a Hub Disc. The Plate carries, in the positions shown, two Flat Trunnions to which are bolted $2\frac{1}{2}$" Strips. On these latter the gun barrel is mounted pivotally, by means of a $\frac{3}{8}$" Bolt inserted in a Crank 3 on the right-hand side (Fig. 1) and by a 1" Rod held in the boss of another Crank 3 on the reverse side (Fig. 2).

The swivelling base turns about the short Rod 5, which is secured in a Bush Wheel bolted to a Circular Plate that forms the lower fixed portion of the base. Four Hand-rail Supports are attached beneath the Circular Plate to form supports for the model.

The gun is "trained" by means of the 1" fast Pulley 6a mounted at the top end of a Rod carrying the 1"

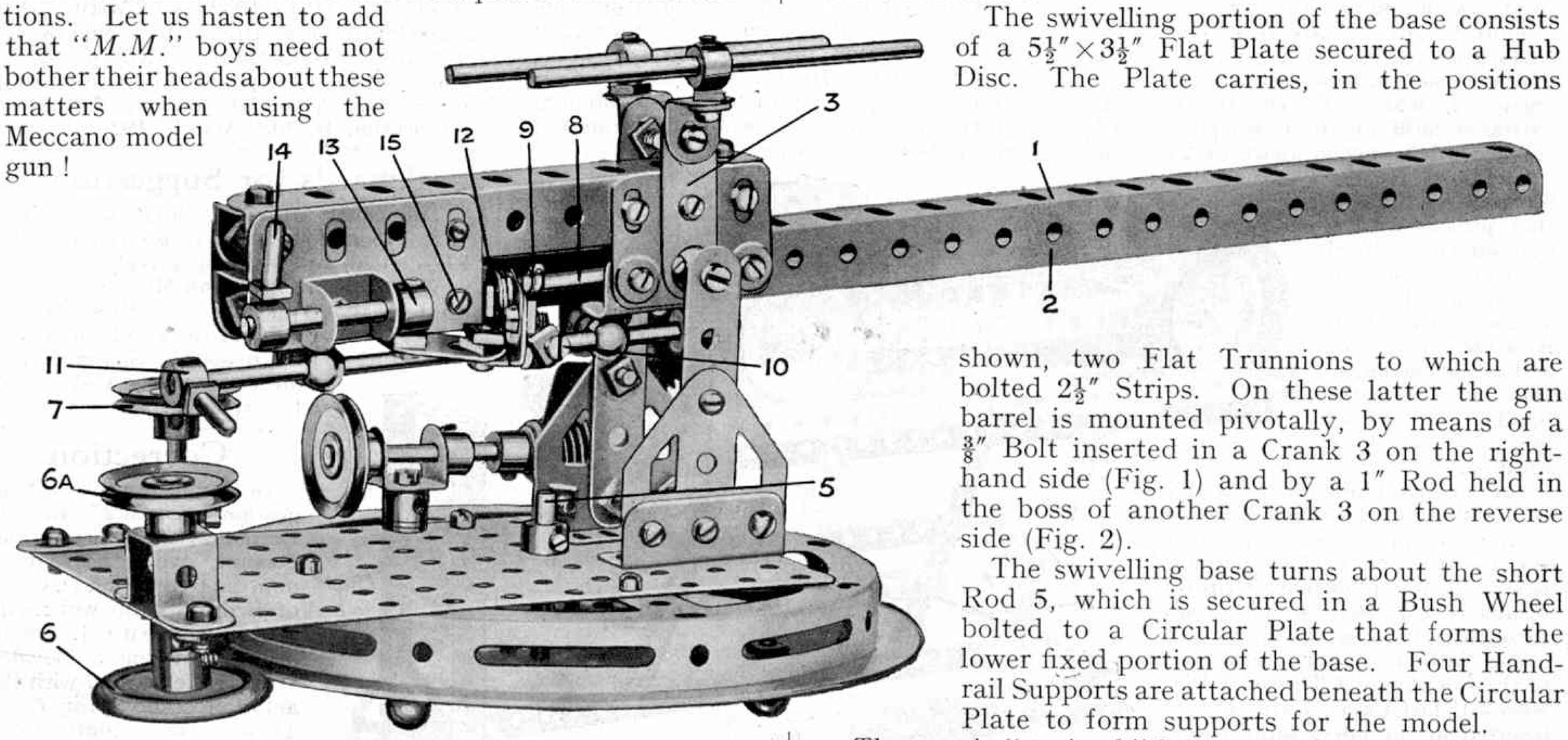


Fig. 1. The Meccano Model Gun, showing the loading and firing mechanisms, etc.

Pulley 6, which is shod with a small Rubber Ring (part No. 155). The Rubber Ring is arranged to press on the periphery of the Circular Plate, so that by turning the Pulley 6 the entire gun is moved about the central pivot 5. It will be seen on reference to the illustrations that the Rod carrying the two Pulleys is journalled in a reinforced bearing consisting of a Double Bent Strip secured to the base.

The barrel of the gun is elevated or depressed by means of the 1″ fast Pulley 4. This Pulley is secured to the end of a Rod that is journalled in a Double Bracket and carries a Worm at its other end. The Worm meshes with a Rack Segment that is bolted to a Crank which, in turn, is secured rigidly to the 1″ Rod held in the boss of the Crank 3 (Fig. 2). The gun layer's seat is formed by the 1″ Pulley 7, which is secured to the top of a short Rod that is mounted on the base Plate by means of a Crank.

Two 3½″ Rods—representing the telescopic sights—are mounted in new style Collars that are secured to Angle Brackets bolted to the top ends of the Cranks 3.

Firing Mechanism

Attention may now be paid to the actual firing mechanism. An 11½″ Rod 8 is placed inside the barrel and attached to the rear end by means of a Coupling. This Coupling is secured to the 2″ and 4½″ Flat Girders by ordinary bolts that are passed through the holes of the Flat Girders and inserted in the tapped holes of the Coupling, and the latter is spaced from the Flat Girders by two Washers on each retaining bolt.

The loading mechanism consists of a bolt 10 (Fig. 1) locked by a nut in the tapped hole of a Collar, which is secured to a Rod that is free to turn and slide in its bearings (formed by two Handrail Supports). The Rod is fitted with a handle 11.

The trigger mechanism is assembled as follows. A Hinge secured by the bolt 15 to the front hole of the 2″ Flat Girder, has a Flat Bracket secured to it by the slotted hole, two Washers being placed on the retaining bolt between the Flat Bracket and the Hinge. A ½″×½″ Angle Bracket 12 is secured in the round hole of the Flat Bracket, and is connected pivotally by means of a second Flat Bracket to the Collar 13. This Collar is secured to a short Rod carrying the handle 14, by means of which the Rod may be moved to and fro in the Double Bracket forming its bearings.

Working the Model

To load the gun, the Washer forming the projectile is placed on the front end of the 11½″ Rod 8 (Fig. 1) and the barrel of the gun tilted up to allow it to slide down the Rod to the compression Springs 9. Next the handle 11 is pushed away from the operator, turned so that the head of the bolt 10 engages with the Washer, and then pulled back—or toward the operator—so that the Washer compresses the Spring 9.

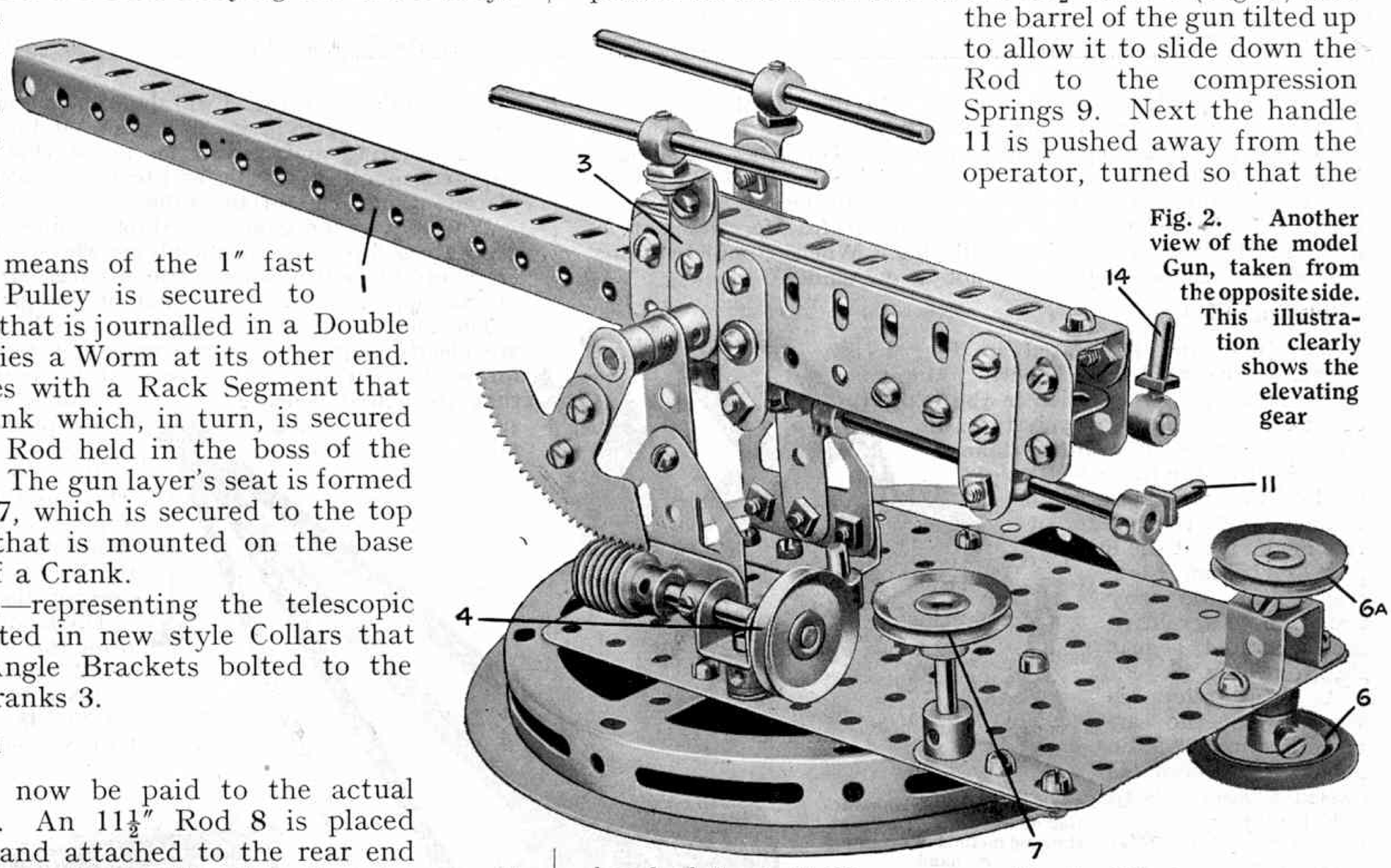


Fig. 2. Another view of the model Gun, taken from the opposite side. This illustration clearly shows the elevating gear

Previous to this, however, the handle 14 controlling the trigger should be pulled toward the operator. This has the effect of moving the tip of the Flat Bracket attached to the Hinge away from the Rod 8, thus allowing the Washer to be moved past it. The handle may now be pushed outward so that the Flat Bracket engages with the Washer. Finally, the handle 11 is turned in a clockwise direction in order that the bolt 10 shall not foul the Washer when the latter is released, and the gun is ready to fire. A slight pull on the trigger handle despatches the Washer on its "message of destruction"!

Of course, the model has not a great range but this may be increased by employing two Compression Springs on the Rod instead of only one. With the two Springs (which should be interlaced so that they occupy the same space as one) the range is about six yards. With one Spring, it averages four yards.

Meccano Jerseys and Handkerchiefs

Some years ago, in response to very widespread requests, we made arrangements with Jaeger & Co. Ltd., 352/54, Oxford Street, W.1, to produce a Jersey of a distinctive pattern that associated itself definitely with the Meccano hobby. The popularity of this Jersey has led to a demand for further developments in a similar direction.

We now have pleasure in announcing that we have arranged with E. M. Bell Ltd., of 53, Aldermanbury, London, E.C.2, to place on sale two special styles of handkerchiefs, one for the use of Meccano boys generally and the other for members of the Meccano Guild.

The Meccano handkerchiefs are prepared in fine quality mercerised cotton with check borders, while the Guild handkerchiefs have narrow self-colour borders, with the badge of the Meccano Guild neatly embroidered in one corner. The checks and borders are made in three distinct colour varieties to tone with the Meccano Jersey, and each box of six handkerchiefs contains two of each colour.

Details of prices and stockists are given in Messrs. Bell's advertisement that appears on another page.

Pennants for Meccano Cyclists

Meccano cyclists, and particularly those who are members of the Meccano Guild, will be pleased to know that a special Meccano pennant is now available.

This pennant is made in strong baize in the standard Meccano colours, red and green, and will stand exposure to rain. It is fitted to a strong steel standard attached to clips to grip the handlebars. The manufacturers are Messrs. R. Crook & Co., 1 and 2, The Arches, Kew Bridge, Chiswick, London, W.4, who will be pleased to supply our readers at the price of 11d. post free. Further details of the pennant are given in our advertisement pages.

New Meccano Models

Jib Crane—Indoor Games—Roundabout—Bacon Slicer—Bullock Cart—Man and Dog

IT is a very mixed fare that we are able to offer Meccano boys this month; a Swivelling Jib Crane (this fine model should appeal to the serious model-builder), a Box Ball Alley and Bagatelle Table (two seasonable models), a Roundabout, Bacon Slicer (we cannot advise readers to put this model to practical use!), a Bullock Cart, and a representation of a Meccano man in undignified flight before a small dog. When completed this last model will, we hope, raise not a few smiles.

Swivelling Jib Crane

The jib crane illustrated in Fig. 1 is operated by a 4-volt Electric Motor, which is compactly installed in the rear of the swivelling superstructure, where it serves to counterbalance the weight of the jib as well as of the load that may be suspended from it. If the builder of this model is not the lucky possessor of an Electric Motor, he may use the alternative hand-operated gear shown in Fig. 2.

A 1″ Pulley is secured to the armature spindle of the Motor and cord is passed around this to a 3″ Pulley secured to the $3\frac{1}{2}$″ Axle Rod journalled in the Motor side plates. This Rod also carries a 1″ Pulley which, in turn, drives a further 3″ Pulley, the latter being secured to an Axle Rod journalled in a $2\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strip. The hoisting cord secured to this Rod passes over the $\frac{1}{2}$″ Pulley at the end of the jib and is fastened to a Hook and weighted by means of a 1″ Pulley Wheel.

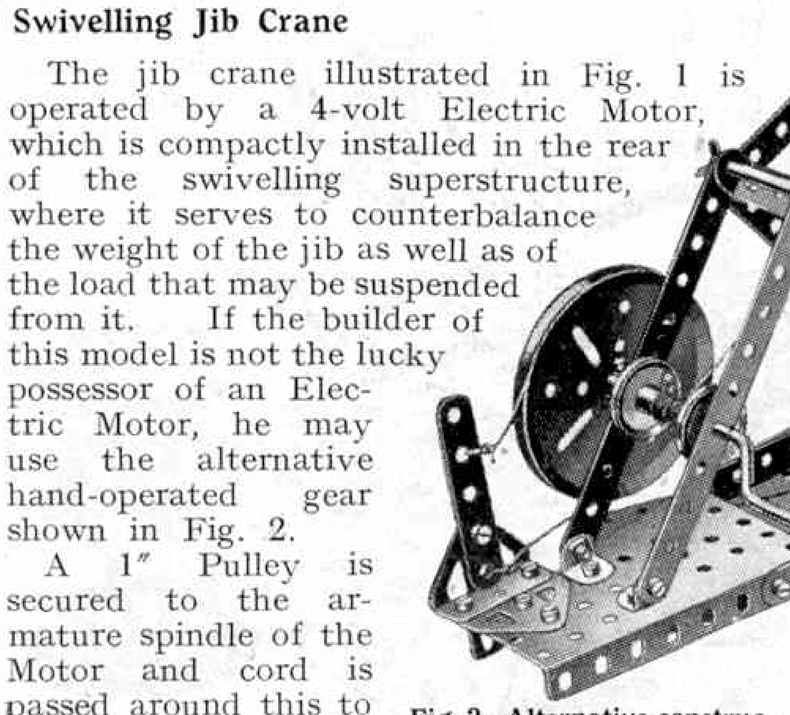


Fig. 2. Alternative construction of Swivelling Jib Crane, showing method of operating by hand

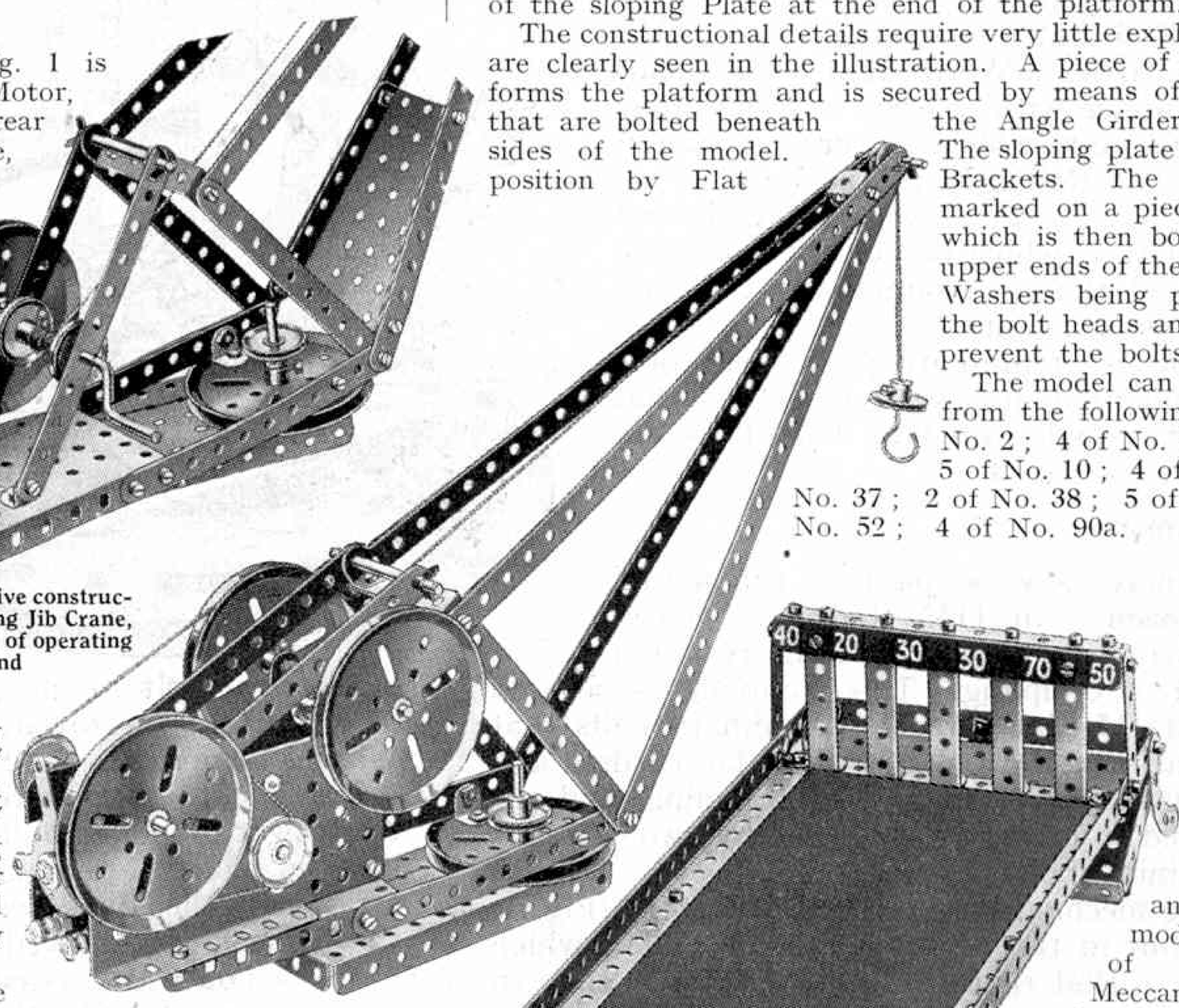


Fig. 1. Electrically-operated Swivelling Jib Crane

The swivelling superstructure of the model is secured to a 3″ Pulley by means of Angle Brackets, the Pulley being fastened to the $5\frac{1}{2}$″ × $2\frac{1}{2}$″ Flanged Plate by a 2″ Axle Rod. If a new Ball Bearing (part No. 168) is in the possession of the constructor, it should of course be used here, for it will enable the superstructure of the crane to be rotated much more smoothly. The construction of the remainder of the crane is quite clear from the accompanying illustration. When completed the model will afford hours of fun, especially if it is used to load miniature merchandise into the wagons of a Hornby Railway or into model ships, etc.

The parts required to build the Crane as illustrated in Fig. 1 are: 4 of No. 1; 6 of No. 2; 1 of No. 3; 1 of No. 11; 6 of No. 12; 2 of No. 16; 2 of No. 17; 1 of No. 18a; 4 of No. 19b; 4 of No. 22; 1 of No. 23; 1 of No. 24; 6 of No. 35; 30 of No. 37; 1 of No. 40; 2 of No. 48a; 1 of No. 52; 1 of No. 54; 1 of No. 57; 1 Electric Motor.

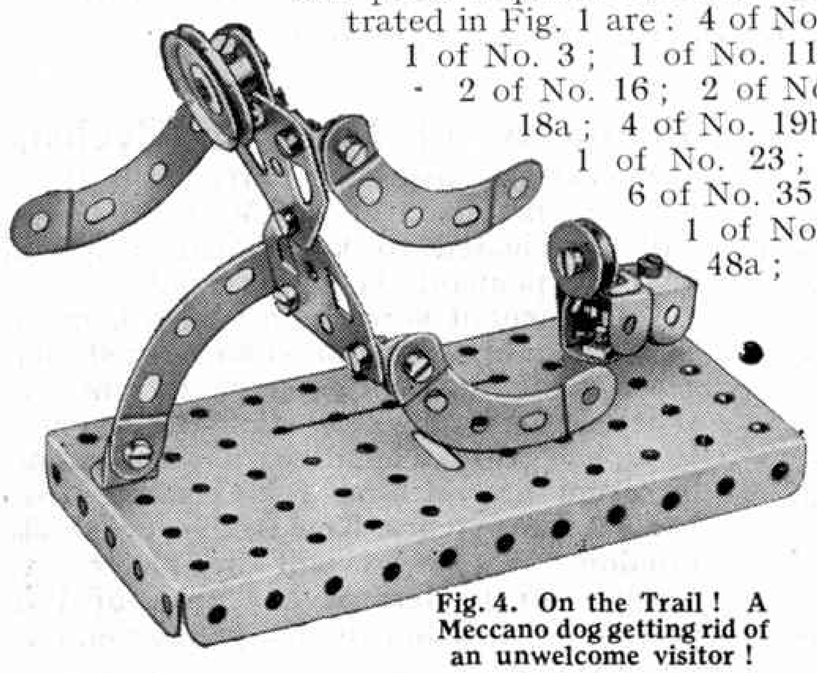


Fig. 4. On the Trail! A Meccano dog getting rid of an unwelcome visitor!

Box Ball Alley

Games of skill constructed with Meccano parts are comparatively rare and the model shown in Fig. 3 will therefore come in very useful during the Christmas festivities. The game of Box Ball Alley is simple yet fascinating and it will be found that considerable skill is required to roll a marble or Steel Ball into the numbered slots placed at one end of the table.

When using the game a certain number of marbles should be given to each player, and the player who scores the highest number of points of course wins. The marbles are returned by means of the sloping Plate at the end of the platform.

The constructional details require very little explanation as they are clearly seen in the illustration. A piece of stiff cardboard forms the platform and is secured by means of Flat Brackets that are bolted beneath the Angle Girders forming the sides of the model. The sloping plate is also held in position by Flat Brackets. The numbers are marked on a piece of cardboard which is then bolted across the upper ends of the Angle Girders, Washers being placed between the bolt heads and the board to prevent the bolts "sinking in."

The model can be constructed from the following parts; 4 of No. 2; 4 of No. 5; 2 of No. 8; 5 of No. 10; 4 of No. 12; 36 of No. 37; 2 of No. 38; 5 of No. 48a; 1 of No. 52; 4 of No. 90a.



Fig. 3. Much fun can be obtained with the Box Ball Alley illustrated above

Man and Dog

From time to time we have illustrated in these columns various figures constructed from Meccano parts. Fig. 4 shows another humorous model, this time of an ardent Meccanitian openly fleeing before the face of a small dog of not over terrifying appearance! This model is sure to amuse the Meccano boy's small brothers and sisters.

The man's body consists of two Flat Trunnions bolted together as shown, with $2\frac{1}{2}$″ Curved Strips secured to them by means of Angle Brackets to form his legs and arms. A 1″ fast Pulley forming his head is secured to these Trunnions by means of a Flat Bracket.

The dog is built up of two Double Brackets secured together by means of a Flat Bracket, with a $\frac{1}{2}$″ Pulley secured to an Angle Bracket for his head. The complete figures may then be mounted on a $5\frac{1}{2}$″ × $2\frac{1}{2}$″ Flanged Plate by means of Angle Brackets.

To build this amusing model the following parts are required: 2 of No. 10; 2 of No. 11; 7 of No. 12; 1 of No. 22; 1 of No. 23; 16 of No. 37; 1 of No. 37a; 1 of No. 52; 4 of No. 90a; 2 of No. 111; 2 of No. 126a.

Another Game of Skill: Bagatelle Table

The model shown in Fig. 5 will provide as much amusement to its constructor and his friends as the Box Ball Alley previously described. In this game however, instead of rolling the ball through vertical slots at the end of the table the object is to roll it so that it falls through one of the holes cut in the table. It is then returned to the player by means of the sloping tray (a $5\frac{1}{2}$″ × $2\frac{1}{2}$″ Flanged Plate) secured beneath the holes. The score

is arranged according to the hole through which the ball passes.

The sides of the model consist of 12½″ Angle Girders which are secured to 5½″ Strips at each end. If Angle Girders are unavailable, 12½″ Strips can be used as shown in Fig. 5. At the four corners of the table 2½″ × ½″ Double Angle Strips are secured, these being bolted to additional 5½″ Strips at their lower ends. The 5½″ × 2½″ Flanged Plate is secured by means of Angle Brackets to the 5½″ Strip at the end of the table, in such a manner that it will return the ball when the latter falls through one of the holes in the table.

The following parts are required to build the Bagatelle Table ; 4 of No. 1 ; 7 of No. 2 ; 8 of No. 12 ; 25 of No. 37 ; 4 of No. 48a ; 1 of No. 52.

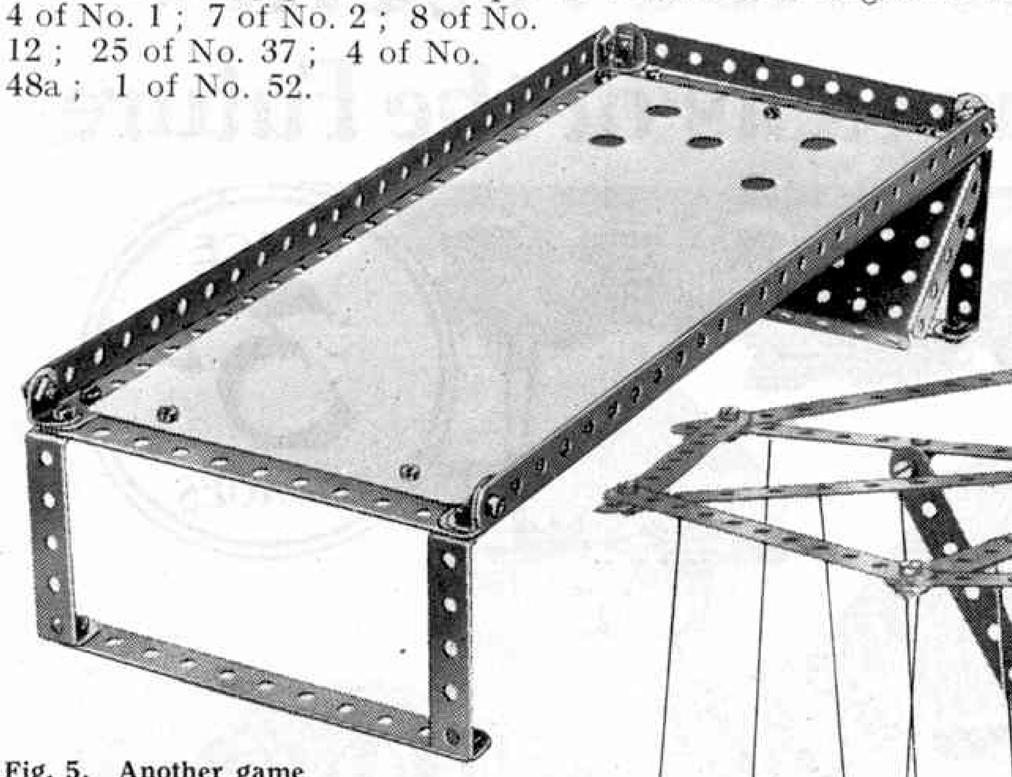


Fig. 5. Another game of skill—the Bagatelle Table

Roundabout

The Model Roundabout shown in Fig. 6 appears most realistic when set in motion. The model is shown with hand operating gear but if desired, it can be worked from a Motor, providing that suitable reduction gearing is employed.

Two 12½″ Angle Girders are spaced apart by means of 3½″ × 2½″ Flanged Plates to form the base of the model. Two 5½″ × 2½″ Flanged Plates are bolted vertically to the Girders, and a further 3½″ × 2½″ Flanged Plate is bolted between these. The construction of the revolving superstructure will be clear from the accompanying illustration and no description is necessary.

A 4½″ Axle Rod is journalled in two Flat Trunnions bolted to the flanges of the 3½″ × 2½″ Flanged Plate as shown, and a Bush Wheel to which a Threaded Pin is secured is fastened on the end of this Rod. Two 1″ Pulleys secured to the Rod transmit the drive by means of Cord, to two 1″ Pulleys on a 3½″ Rod journalled in the 5½″ × 2½″ Flanged Plates. This Axle Rod carries a Worm Wheel, which drives a vertical shaft through a ½″ Pinion, the drive being transmitted from the latter shaft to the Axle Rod carrying the superstructure by means of a 57-teeth Gear Wheel and a ½″ Pinion.

The parts required to build the model are : 4 of No. 1 ; 12 of No. 2 ; 2 of No. 8 ; 8 of No. 12 ; 1 of No. 15 ; 3 of No. 15a ; 1 of No. 16 ; 2 of No. 19b ; 4 of No. 22 ; 1 of No. 24 ; 2 of No. 26 ; 1 of No. 27a ; 1 of No. 32 ; 2 of No. 35 ; 36 of No. 37 ; 8 of No. 48a ; 2 of No. 52 ; 3 of No. 53 ; 2 of No. 59 ; 1 of No. 115 ; 2 of No. 126a.

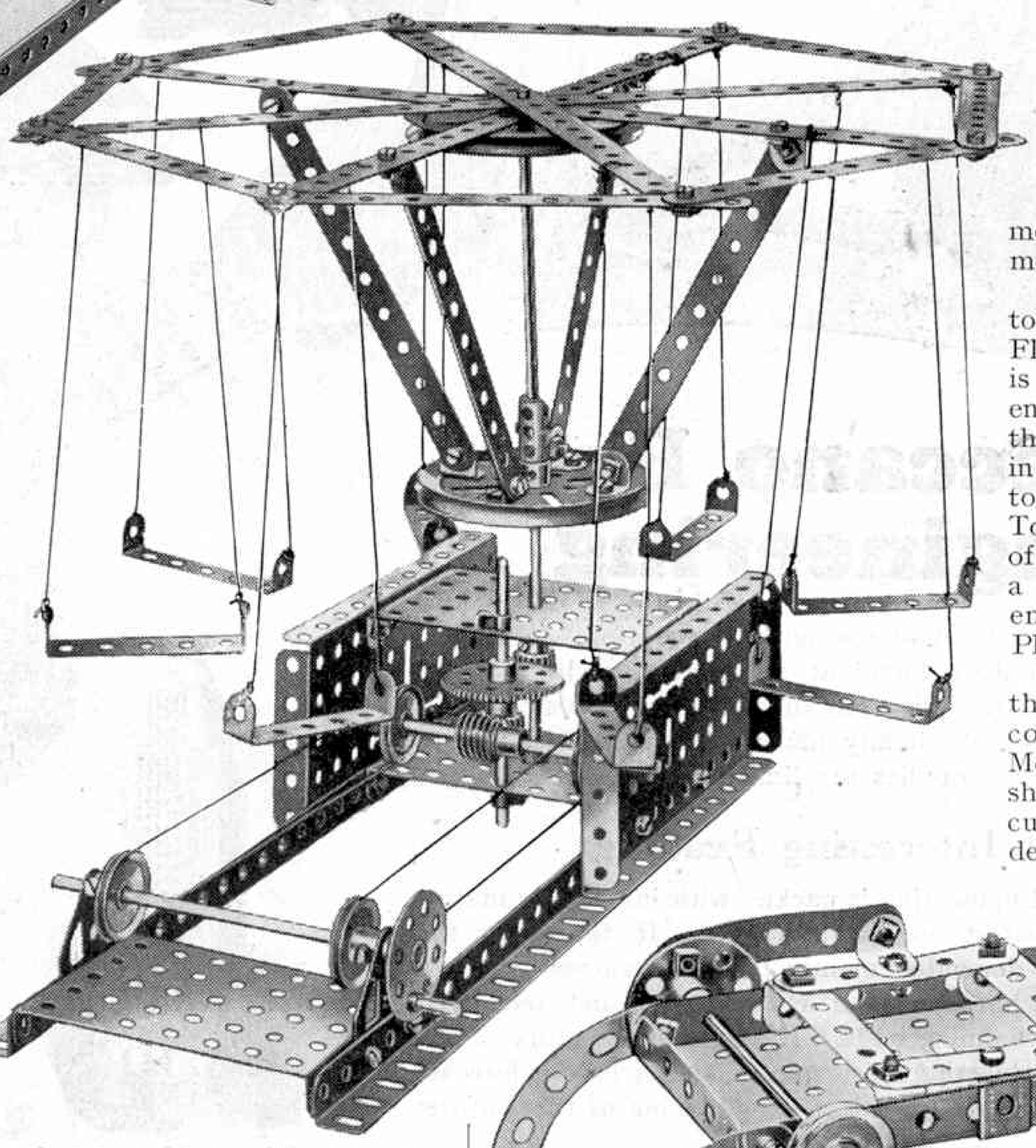


Fig. 6. This model Roundabout may be constructed with a No. 3 Outfit

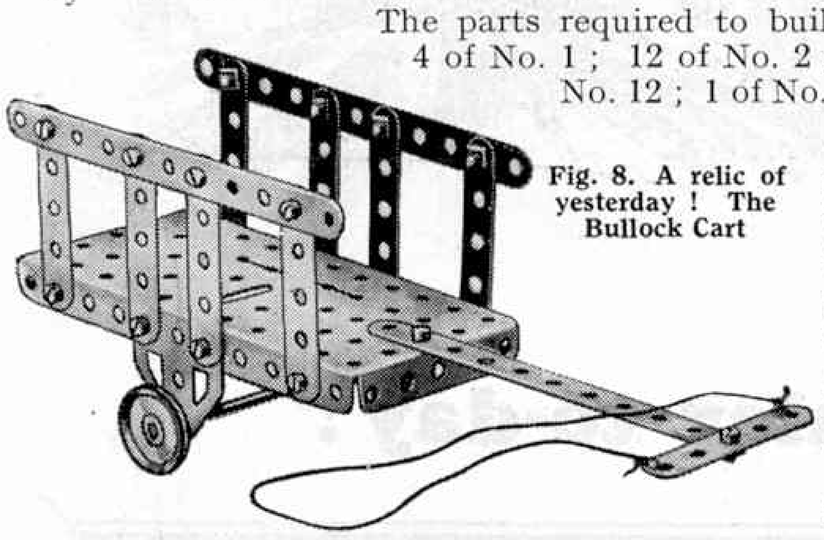


Fig. 8. A relic of yesterday ! The Bullock Cart

A Working Model of a Bacon Slicer

This model works in a very realistic manner when the Crank Handle is rotated, the table moving toward and from the revolving cutter as in the prototype.

The model consists essentially of a 5½″ × 2½″ Flanged Plate to which four 2½″ Curved Strips are bolted to form "legs." The sliding table is built up of two 2½″ × ½″ Double Angle Strips, spaced apart by means of 2½″ Strips. A Double Bracket is bolted to each of the latter in such a manner that it holds the table to the plate. The reciprocating motion is obtained by means of a Bush Wheel and 2½″ Strip, the latter being connected pivotally by means of lock-nuts. The cutting wheel consists of a disc of cardboard secured by a dab of gum to a 1″ Pulley, which is driven from a further Pulley secured to the Crank Handle, the Pulleys being connected by an endless cord.

The parts required are : 3 of No. 5 ; 2 of No. 11 ; 1 of No. 12 ; 1 of No. 16 ; 1 of No. 19s ; 2 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 1 of No. 35 ; 12 of No. 37 ; 2 of No. 37a ; 2 of No. 48a ; 1 of No. 52 ; 4 of No. 90a.

Bullock Cart

The remarkably faithful reproduction of a Bullock Cart shown in Fig. 8 can be constructed from a very small Outfit, and when completed it will add a most realistic effect to any model farmyard.

Four 2½″ Strips are bolted to each side of a 5½″ × 2½″ Flanged Plate and a 5½″ Strip is bolted across their upper ends. The Axle Rod carrying the road wheels is journalled in two Flat Trunnions bolted to the side flanges of the Plate. To complete the construction of the model a 5½″ Strip having a 2½″ Strip attached to one end, is fastened to the Flanged Plate in the position shown.

If extra parts are available, the model could be improved considerably by harnessing Meccano "bullocks" in the shafts of the cart. Little difficulty should be experienced in devising suitable quadrupeds,

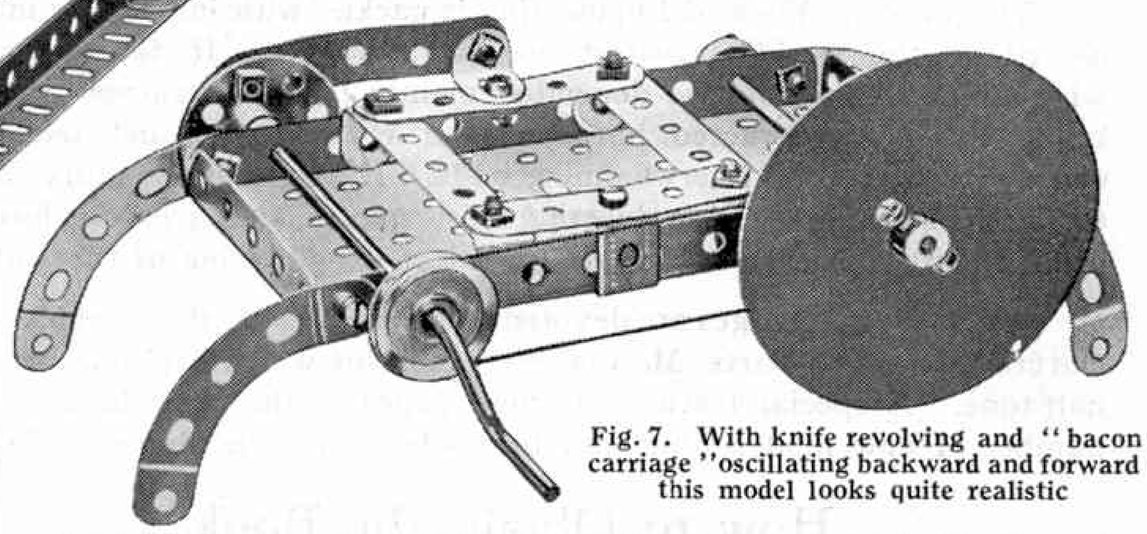


Fig. 7. With knife revolving and "bacon carriage" oscillating backward and forward this model looks quite realistic

as examples have been shown in these pages and also in the Manuals. We trust model-builders will be successful in their efforts in constructing a complete "turn-out" !

The following list shows that very few parts are required for the Bullock Cart : 3 of No. 2 ; 9 of No. 5 ; 1 of No. 16 ; 2 of No. 22 ; 18 of No. 37 ; 1 of No. 52 ; 2 of No. 126a.

MECCANO ENAMEL

In the November "*M.M.*" we announced the introduction of tins of Meccano enamel in red and green. A third colour—namely, grey—is now available. This new colour is identical to that in which several of the newer parts, such as the Digger Bucket, Boiler, Roller Race, etc., are finished. It has a distinctly blue tinge—a real engineering colour.



The Meccano enamel has been introduced to enable model-builders to convert nickelled parts to coloured or to touch up coloured parts should such treatment become necessary through mishandling. Price per tin, 8d. (each colour).

Triumphs of the Past
Marvels of the Present
Forecasts of the Future



PRICE 3D 48 PAGES

The Meccano Book of Engineering

This splendid new book has had a wonderful reception. Although it has been in circulation only a fortnight we have already received hundreds of letters from boys all over the country, praising it in glowing terms. If you have not already had a copy we advise you to purchase one immediately, as supplies are limited.

A Feast of Interesting Reading

The Meccano Book of Engineering is packed with interesting matter describing the world's greatest engineering feats. It tells how the advance of civilisation has depended mainly on the engineer, who has built bridges, constructed harbours and breakwaters, and reclaimed deserts in the face of overwhelming odds. It also tells the story of the Quebec Bridge and other engineering masterpieces, and includes a forecast dealing with that most fascinating subject, Engineering of the Future.

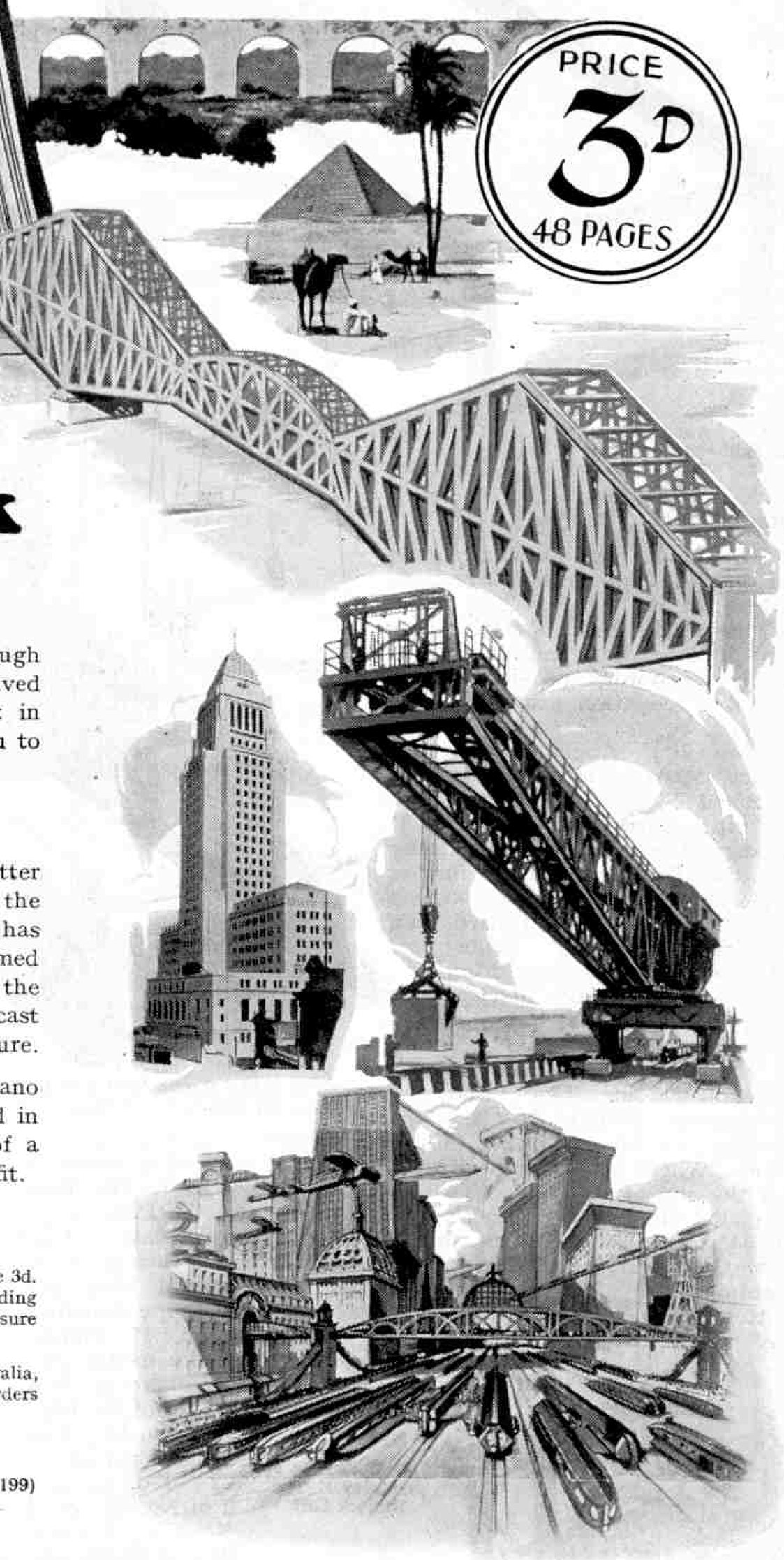
In addition, 16 pages are devoted to a complete catalogue of Meccano Outfits, Accessory Parts, Motors, etc., most of which are illustrated in half-tone. A special feature of these pages is the reproduction of a number of new models that can be made with each Meccano Outfit.

How to Obtain the Book

You can obtain a copy of the Meccano Book of Engineering from your dealer, price 3d. If you prefer it, send us three penny stamps and we will send you a copy, post free, providing you send us the names and addresses of three of your chums. Write clearly and be sure to put No. 70 after your own name for reference.

The price Overseas is 6d. post free (Canada 12 cents post free). Readers in Australia, New Zealand, South Africa or Canada who require copies should address their orders to our agencies as detailed below.

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NEW ZEALAND—Models Ltd., Kingston Street, Auckland. (P.O. Box 129).
SOUTH AFRICA—Arthur E. Harris, 142, Market Street, Johannesburg. (P.O Box 1199)
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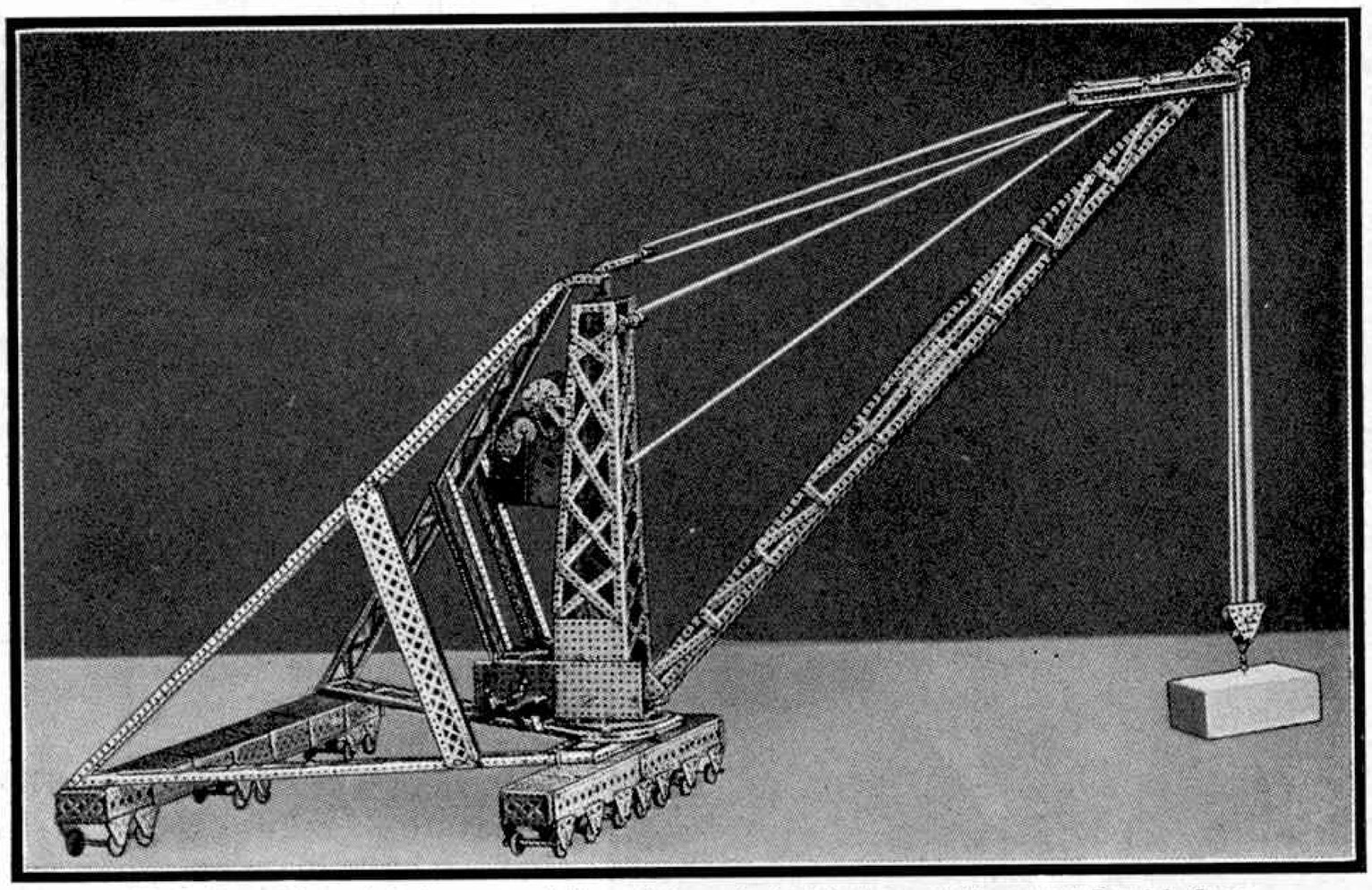
Result of Meccano Model-Building Contest

By Frank Hornby

SPECIAL "DERRICK CRANE" COMPETITION

MANY of our readers will remember that this contest centred around a 62-ton steam derrick crane that was fully described in the May, 1927 *"M.M."* The crane is of such massive proportions that it is capable of lifting a load of 62 tons, while on test a weight of 72 tons was raised—a remarkable achievement for one of its type.

It was thought that the crane would afford a good opportunity for model-builders to test their skill and therefore prizes were offered for the best reproductions in Meccano. The names of the prize-winners are as follows:—



W. G. Barrett's model gives a good idea of the principal features of the actual Derrick Crane

Section A (Competitors in British Isles).

FIRST PRIZE (Meccano products to value £3-3s.): W. O. Sharp, Haywards Heath, Sussex. SECOND PRIZE (Meccano products to value £2-2s.): R. S. Weaver, Prestwich, Manchester. THIRD PRIZE (Meccano products to value £1-1s.): L. Hollyoak, Earlsdon, Coventry.

SIX PRIZES, each consisting of Meccano products to value 10/6: F. S. Bridson-Jones, Liverpool; C. Garlick, Gatley, Cheshire; C. P. Buckle, Great Ashfield, near Bury St. Edmunds; Clarence Wells, Bletchley; A. W. Stephen, Aberdeen; B.E. Smith, Dunstable.

SPECIALLY COMMENDED (Certificate of Merit): L. Todd, Parham, near Wickham Market; W. Parks, Dublin; J. Redfern, Salford; G. Harland, London, S.W.3; R. Esherworth, Cardiff; T. B. Roberts, Malvern.

Section B (Competitors residing overseas):

FIRST PRIZE (Meccano products to value £3-3s.): R. Muñoz, Santa Fé, Argentine. SECOND PRIZE (Meccano Products to value £2-2s.): W. G. Barrett, Observatory, S. Africa; THIRD PRIZE (Meccano products to value £1-1s.): F. Van Bulck, Paris.

SIX PRIZES, each consisting of Meccano products to value 10/6: E. G. Hannaford, Belair, S. Australia; B. Bolitho, Parramatta, Australia; S. Eriksson, Matau, Taranaki, New Zealand; W. L. Holcroft, East London, S. Africa; F. Edgeworth, East London, S. Africa; L. Honderll, Belmont, Loire, France.

SPECIALLY COMMENDED (Certificate of Merit): H. R. Malari, Calcutta, India; S. Johnston, Port Darwin, S. Australia; Edward E. Greir, Detroit, Michigan, U.S.A.; P. T. Hewitt, Geneva; O. Sanderson, Johannesburg; Stanley Johnson, Melbourne.

The entries comprised many very fine models, those submitted by overseas readers being particularly noteworthy. The framework of the actual crane is naturally of generous proportions and it therefore offered plenty of scope for model-builders who were in possession of a considerable number of parts. It was mentioned when the contest was announced, however, that the number of parts used in constructing the model would not influence the judges when awarding the prizes, and I was pleased to find many simple, but none the less interesting, models amongst the entries.

The First Prize-winner in Section A of the Contest was W. O. Sharp, whose well-proportioned model shows that he spent a considerable amount of time in studying the photographs and description of the actual derrick. My only regret is that I am unable to reproduce a photograph of this excellent model. The Second Prize-winner, R. S. Weaver, also submitted a very fine crane.

I was particularly interested in L. Hollyoak's entry. In this model the various units of the crane have been very cleverly devised, but the way in which the builder has connected each unit together is open to criticism, the complete model having a somewhat untidy appearance. This is regrettable, for I feel that if a little more care had been given to the final assembly, the complete model would have proved one of the finest of the Meccano cranes that have been built recently.

In the "Overseas" Section the most outstanding entry was that submitted by Rafael Muñoz, and he was therefore awarded the First Prize. The model has been most carefully built and it would be difficult to find points where it deviates from scale.

The crane entered by W. G. Barrett and illustrated on this page is also of considerable interest, for it shows how an effective working model of the prototype can be devised without using an excessive number of parts. Barrett has not, however, followed closely the design of the original bogie mechanism and an improvement might be made here. In other respects the crane conforms accurately to the original derrick and is a very creditable achievement. Mention should also be made of F. Van Bulck's entry, which has been carried out on very sound lines and forms an imposing model.

Notes on the Meccano Traction Engine

Those of our readers who have built the Meccano Traction Engine, which was described in detail in the *"M.M."* for October and November, or have contemplated its construction, will know that the motive power is obtained from a 4-volt Motor of the latest type having the armature spindle extended on either side of the Motor plates. As the additional projection of the armature shaft has been utilised in taking the drive from the Motor to the driving wheels via the reduction gearing, many boys in possession of the older type Motors have experienced difficulty in completing their models on account of the fact that the armature spindle of their Motor projects only on one side of the frame. The following hints on how the old style Motor can be used may therefore be appreciated by many boys.

In using the old style Motor the best plan is to transpose the gears marked 21, 19, 22, 24, 23 and 12 in the illustrations from the right-hand side to the left, and the gears 45, 44, 47 and 48 from the left side to the right. These alterations will of course mean that the Flywheel 17 and the Eccentric 52 with its connecting rod and valve rod will have to be moved to the right-hand side also. In placing the 3½" Gear Wheel 12 on the left-hand side of the model, it will be necessary to mount the brake drum 30 in the position formally occupied by the 3½" Gear on the right side of the model.

These alterations will not affect either the efficiency or appearance of the Engine.



A MESSAGE TO THE HORNBY RA

FROM THE GENERAL MANAGER OF THE

All Owners of Hornby Train Sets Should Join the H

IN last month's "*M.M.*" we published a selection of photographs of the first members to join the Hornby Railway Company and also a series of extracts from their letters. Since then we have received such heavy H.R.C. mails that we should have no difficulty in filling a whole Magazine with extracts from further letters of appreciation, but our space is too valuable to print even these most interesting messages.

We can only say that, without exception, all our correspondents are unanimous in their praise for the new Hornby Railway Company and all wish it success. It is particularly interesting to find that the movement has also received a remarkable welcome from many practical railwaymen, who are keenly enthusiastic about encouraging the spread of railway knowledge among the general public.

What cheered us even more than we can describe in print, however, was the accompanying message from Sir Felix J. C. Pole, General Manager of the Great Western Railway—the most enterprising of all our railway groups. We feel sure that our readers will greatly appreciate the fact that, in the midst of his unending activities, Sir Felix found time to pause for a moment to send a kindly message to the members of the Hornby Railway Company.



Sir Felix J. C. Pole, General Manager of the G.W.R.

This is a typical instance of the manner in which the Great Western Railway is always ready to help any movement that possesses a basis of genuine railway interest. Nearly a century ago the great engineer I. K. Brunel was grappling with difficulties of all kinds and found opposition in all quarters to his determination, not only to build the Great Western Railway, but to make it the best railway in the world. From that time up to the present day what might be called the "Brunel spirit" has persisted, and as a result the G.W.R. is famed throughout the world for its high speeds, its non-stop runs, and its care for the comfort and safety of the traveller.

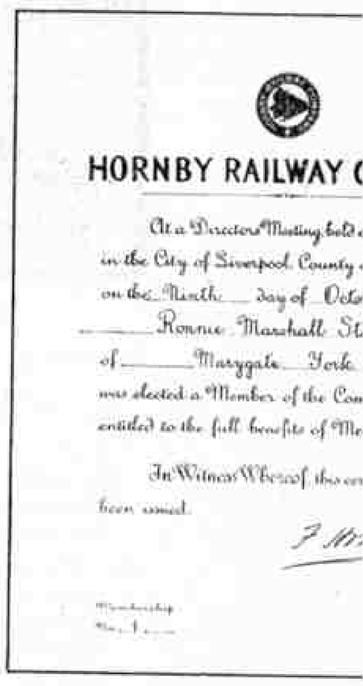
Sir Felix Pole joined the G.W.R. service in the Telegraph Department at Swindon in 1891. From 1896 to 1904 he was attached to the staff of the Chief Engineer and during this period he became Editor of the "*Great Western Railway Magazine.*" Subsequently he was transferred to the General Manager's Office and in 1921 he succeeded Mr. C. Aldington as General Manager. He received the honour of Knighthood in February, 1924, and his encouraging message should fire the mind of every Hornby Train owner.

The Hornby Railway Company was first announced in the October Magazine and, as we pointed out in that issue, although there are hundreds of thousands of boys who own Hornby Trains and take a pride in the possession of them, there is a large number who do not know how to run a Railway System in miniature on correct lines. It is in order to look after the interests of these Hornby Railway Owners, and so that they may get the best fun from their miniature railways, that we have inaugurated the Hornby Railway Company.



The H.R.C. booklet containing working a miniature railw

Any owner of a Hornby Train Set no matter what is its size may become a member. All he has to do is to fill in the official application form, have his signature witnessed, and send the form to Headquarters with 6d. in stamps in payment for the official badge, which he will wear in his buttonhole. This badge, which is illustrated in the top corners of these pages, is beautifully finished in red and green enamel and bears a representation of a locomotive surrounded with the words "HORNBY RAILWAY COMPANY." By means of this badge all members will be able to recognise each other when they meet. Their badges will indicate at once that they have something in common—an interest in railways. Whether in your own town, or at the seaside or in the country on holiday, always look out for the badge of



This is a reproduction of the Membership Certificate. R York, was the first boy to H.R.C., and the certificat replica of the one issu

TO MEMBERS OF

AILWAY COMPANY

HE GREAT WESTERN RAILWAY COMPANY

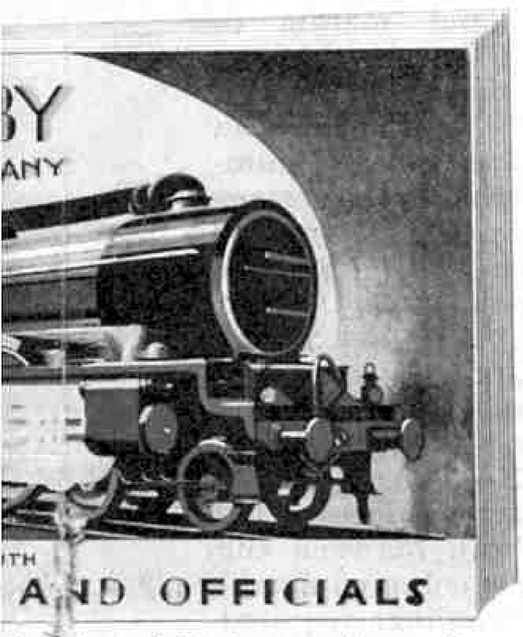
HORNBY RAILWAY COMPANY

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

e H.R.C. and so Get More Fun from Their Hobby

the Hornby Railway Company.

Members in any town, village, or district, meet together to form a Local Branch of the "HORNBY RAILWAY COMPANY," in the formation of which they are assisted by the staff at Headquarters. Each Local Branch is controlled by the members themselves, who appoint from among their number their own General Manager, Engineer, Traffic Superintendent, Stationmasters, Signalmen, Drivers, and any other officials that are considered necessary for the adequate operation of the Branch.



ntai ng full instructions for ure railway to timetable

When a Local Branch has a membership of not less than four (in addition to a permanent Branch Chairman and a Branch Secretary elected by a vote of the members) and is holding regular meetings, application may be made for incorporation with the parent company. Every incorporated Branch will be given advice regarding the best means of extracting the utmost fun from the material at its disposal. For example, special track layouts will be prepared by Headquarters and special working time-tables drafted, if so desired. All the necessary forms and documents—miniatures of those used by the big railway companies—may be purchased at a small cost, and their use adds enormously to the fun and excitement of operating any model railway layout.


RAILWAY COMPANY

ctors' Meeting held at Headquarters
iverpool, County of Lancaster,
day of October 1928
Marshall Stead
ygate York
Member of the Company and is
ll benefits of Membership
ss Whereof the certificate has

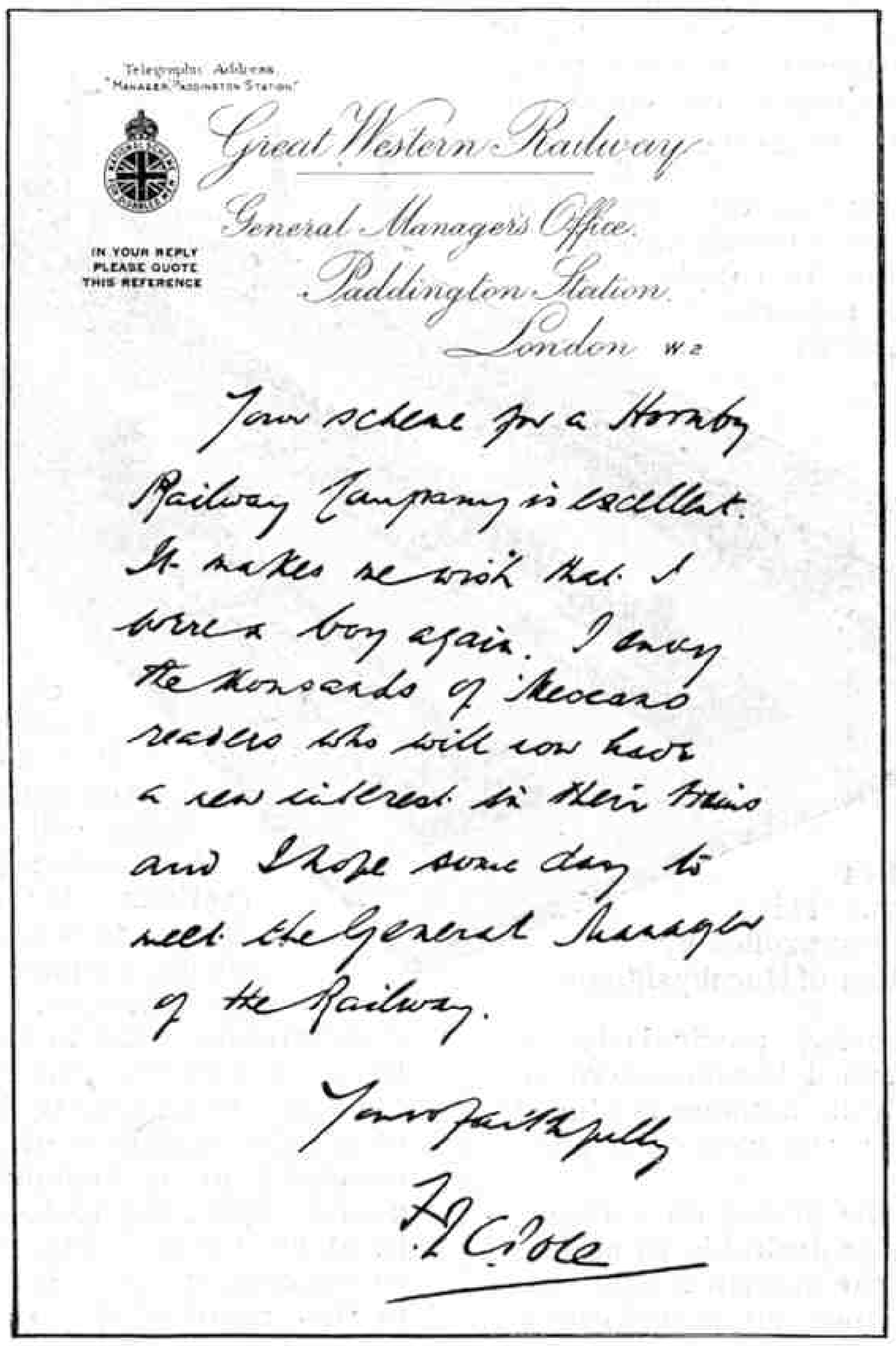
F. Hornby
Chairman

uction of the H.R.C. Special rtificate. R. M. Stead of first boy to enrol in the he certificate above is a the one issued to him

The details of each Local Branch are left entirely in the hands of members. Headquarters does not interfere in any way with such matters as the time and place of meeting, the subscription, or the rules that may be considered advisable for the successful working of the Branch. In addition, it is a matter for the consideration of each individual Branch as to whether it shall purchase material for the general use of its members, or whether members shall combine their own material to form a basis of the layouts, supplementing this from time to time by additions purchased out of Branch funds.

The duty of the Branch Chairman is to supervise the general organisation and operation of the Branch and to do his utmost to assist the members to secure the best possible results. Where possible he should be an adult—fathers or uncles generally make the best Chairmen! The duty of the Branch Secretary will be to communicate with the members of the Branch in regard to meetings and any other matters that may arise from time to time, and to forward to Headquarters on the first of each month a record of the operations of the Branch during that month, for which purpose special forms are provided by Headquarters.

The official organ of the "HORNBY RAILWAY COMPANY" is the "*Meccano Magazine*," which, as our readers know, has always devoted considerable space to model railway matters. Certain pages are devoted every month to the "HORNBY RAILWAY COMPANY" and brief reports are given of any developments of interest. Every month there will be articles on miniature railway working in all its aspects, and layouts will be illustrated and described in detail with suggestions for their modification in case of need to suit special circumstances.


Telegraphic Address
"MANAGER, PADDINGTON STATION"

Great Western Railway

IN YOUR REPLY PLEASE QUOTE THIS REFERENCE

General Manager's Office,
Paddington Station,
London W 2

Your scheme for a Hornby Railway Company is excellent. It makes me wish that I were a boy again. I envy the thousands of Meccano readers who will now have a new interest in their lives and I hope some day to meet the General Manager of the Railway.

Yours faithfully

F. C. Pole

Sir Felix Pole's encouraging message to the H.R.C.

The special booklet, prepared in connection with the "H.R.C.," is now ready—it is illustrated on this page. Every model railway enthusiast should have a copy, for it deals with the planning, laying out and operating of a miniature railway on real railway-like principles, and shows how to obtain the utmost possible fun and excitement. Timetable working, one of the most fascinating branches of the hobby, is specially dealt with and instructions are given that will enable a timetable to be worked out for any layout. A section that will be of special interest to the beginner deals with the care and treatment of locomotives and rolling stock.

When you send in to Headquarters your application for membership of the Hornby Railway Company, enclose 2d. for a copy of this booklet.

How to Get More Fun from your Hornby Railway

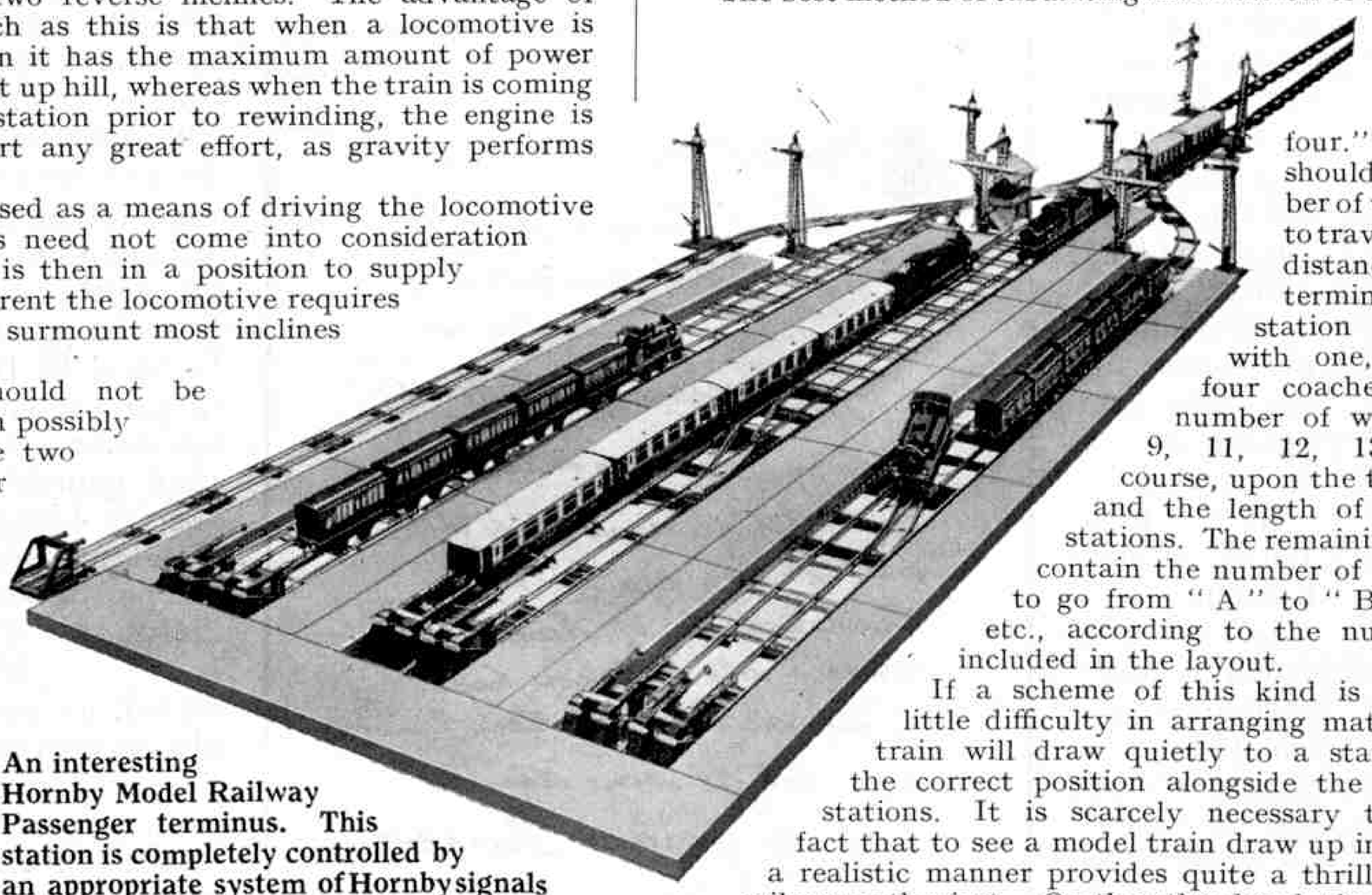
II.—PASSENGER STATION LAYOUTS AND THEIR WORKING

LAST month the subject of Goods Yard operation was dealt with, and one or two problems of model Goods Train operation that commonly confront the model railway engineer were discussed in detail. In this article the laying out of Passenger Stations will be reviewed carefully, with the object of enabling Hornby Railway enthusiasts, and particularly members of the Hornby Railway Company, to derive the utmost possible enjoyment from their model systems.

The first matter for consideration is the question of situating 'through' stations. In order to obtain the maximum amount of interest from such stations on model railways it is necessary to consider their location very carefully. If clockwork is to be the motive power, then it is undoubtedly most advisable to place through stations at the bottom of inclines or better still, at the lowest point between two reverse inclines. The advantage of selecting a position such as this is that when a locomotive is wound up at the station it has the maximum amount of power in reserve for starting out up hill, whereas when the train is coming to a final stop in the station prior to rewinding, the engine is not called upon to exert any great effort, as gravity performs most of the work.

Where electricity is used as a means of driving the locomotive the question of inclines need not come into consideration at all, as the operator is then in a position to supply the exact amount of current the locomotive requires in order to enable it to surmount most inclines at a reasonable speed.

Through stations should not be placed on curves if it can possibly be avoided. There are two important reasons for this. First of all a through station on a curve looks quite unrealistic because in order to ensure that the coaches and locomotives will have ample room for clearing the platforms it is necessary to arrange for these to be placed at quite a considerable distance from the line. In the second place accidents are bound to happen occasionally, particularly on curves; and if a train travelling at high speed becomes derailed in a station situated on a curve the resultant damage is almost certain to be greater than would have been the case on a piece of straight main line.



An interesting Hornby Model Railway Passenger terminus. This station is completely controlled by an appropriate system of Hornby signals

Although a through station should not be placed on a curve, especially if this is a sharp one, it is usually desirable to situate it close to a corner of the room in which the system is laid out. If this plan is adopted, any sheds, shunting lines and, in particular, carriage sidings, may be arranged to run into the corner space that otherwise would be wasted. In this connection it is important to remember that every square inch of space on an indoor model railway is of value.

Usually it is desirable to include a small goods yard behind a model station of this kind in order to increase the interest of the working and also to serve as an overflow for the main goods yard of the system in case this should become overcrowded.

Where a goods yard is to be run off the main line it is a great advantage if the points can be arranged to be trailing. Our second photograph clearly shows a typical example of a passenger station with a small but very useful goods yard attached to it. The approaches to these points are suitably guarded by signals both in the goods yard and on the main line. For the up line goods trains a crossover is provided which also is trailing to ensure safety in the running of fast main line trains. A crossover of this kind should be guarded by signals and our photograph shows the best manner of disposing the signals on such a section of main line.

It is very rarely, however, that through stations are used for purposes of shunting and goods train operation on model railways. The main idea of introducing a station of this kind on a main line of a model system is to provide a suitable stopping place for the purpose of re-winding the locomotives. In addition the station improves considerably the realistic appearance of the whole layout.

Many interesting hours may be spent in experimenting with a model locomotive with the object of ascertaining the exact number of winds that are necessary to carry it light or with one, two or three coaches from the terminus a certain definite distance—for example, from the terminus of the layout to the first through station on the line. In cases where there is a large stud of engines, details of this kind cannot be remembered conveniently. It is then a very useful plan to make the necessary notes on a small tab of cardboard which should be tied inside the cabs of the locomotives.

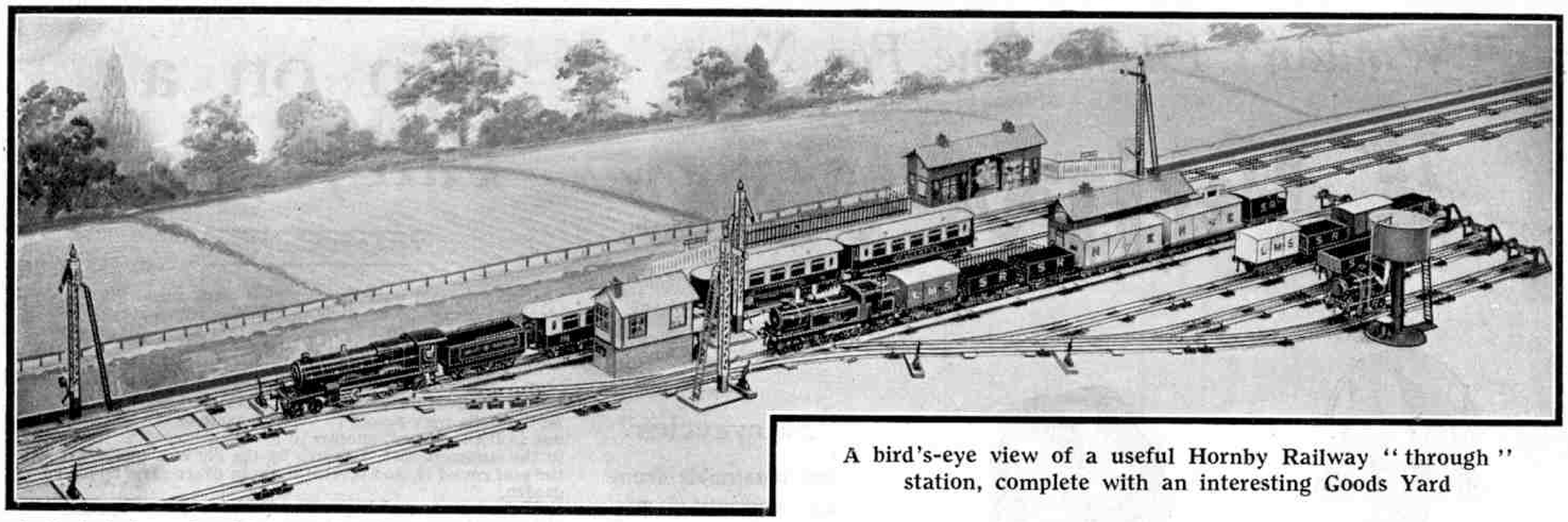
The best method of tabulating information of this kind is to write down in the left-hand margin of the tab, "Light, one, two, three, four." The next column should include the number of windings necessary to travel the pre-arranged distance, say, from the terminus to through station "A" light, and with one, two, three and four coaches. Possibly the number of winds might be 7, 9, 11, 12, 13—depending, of course, upon the type of locomotive and the length of run between the stations. The remaining columns should contain the number of windings required to go from "A" to "B," "B" to "C," etc., according to the number of stations included in the layout.

If a scheme of this kind is adopted there is little difficulty in arranging matters so that each train will draw quietly to a standstill exactly in the correct position alongside the platforms of the stations. It is scarcely necessary to emphasise the fact that to see a model train draw up in a station in such a realistic manner provides quite a thrill for a real model railway enthusiast. On the other hand, there is nothing more disheartening than to see a train come gently to a standstill in between stations—just nowhere in particular!

In almost every case the terminal stations are the central points of all the activities of a model railway. The number of such terminals to be included in any particular layout depends, of course, upon the taste of the owner and the amount of space available for the system. Some model railway engineers prefer to concentrate all their efforts on one large terminus situated in the centre of the layout with the main lines simply running completely around the main station. Others prefer to run a "terminus to terminus" railway, in some cases from one room to another and in others making use of a continuous oval with two terminals in the centre. The "terminus to terminus" type of layout is particularly suitable for outdoor working where a timetable may be arranged so that trains travel from one end of the garden to the other at regular intervals conveying consignments of goods.

More often than not, however, the space available for a model railway is confined to one room only, and in such cases probably the most interesting of all plans and the one from which the maximum amount of enjoyment may be obtained is that which includes the two terminals in the centre space and a long continuous run around the room. The necessary goods yard may, of course, be attached to the terminal if goods working is to form part of the programme.

The planning of a terminus requires perhaps more care and consideration than anything else on a model railway system. In the first place all roads should be arranged so that traffic can be dealt with as quickly as possible. The accessibility of the roads and especially of locomotive departments should also be subjects for primary consideration. Where carriage sheds are to be



A bird's-eye view of a useful Hornby Railway "through" station, complete with an interesting Goods Yard

included they should be arranged so that trains of empties may be backed straight into the sheds from the main line without any intricate shunting operations being necessary.

Our first illustration shows an excellent example of a typical model railway terminus layout. In this, standard Hornby tin-plate track has been used throughout. In order to simplify matters, no carriage sidings or engine sheds are in the close vicinity, but these are presumed to be situated farther up the line.

For convenience, the platforms of any station should all be numbered and, in the case of termini, preferably from the right, looking outward. Platforms 1, 2 and 3 of our model terminus are intended to be used mostly as arrival platforms, and for this reason, provision has been made to enable the locomotives of incoming trains to be uncoupled immediately on arrival, to run round their trains, and thus be released without any undue delay through being trapped. A tank locomotive has just arrived at platform No. 1, in charge of a suburban train and, as will be seen, it is crossing over to No. 2 road and will eventually proceed to the sheds, or possibly on to the rear of the incoming express that may be seen approaching at the far end of No. 3 road.

It will be noticed that the two main lines lead straight through into the express arrival and departure platforms, whereas the suburban traffic is dealt with at the platforms on the right and left of the station.

The subject of Model Railways, with details of their layout and operation, will be discussed from various viewpoints in the special series of interesting articles of which this is the second.

Any problems readers care to submit will also be dealt with by the writer, who is a model railway expert of long experience.

The third article, which will appear next month, deals with *"Signalling on a Hornby Railway."*

An important express is about to leave the main express departure platform No. 4. When this train has departed, it will be a simple matter for the locomotive of the arriving Pullman Car train to be released by means of the crossover from No. 3 to No. 4 roads.

The importance of arranging crossover roads of this kind at important arrival platforms can hardly be over emphasised. Of course, as will be seen from the photograph, provision of this kind is not absolutely necessary to departure roads, as trains are more often than not backed into these platforms, and the engines in charge are thus free to run clear of the roads immediately.

The next subject for consideration in laying out a model railway terminus is the arrangement of the signals. The correct signalling of a terminal station similar to the one illustrated may be carried out without any great expense being involved and it really increases interest in its operation considerably.

The main point to be noticed about this arrangement of signals is that a separate signal is necessary to authorise exit from each road, whereas only one signal is necessary to authorise entry into the whole station. In this case, of course, the signalman in charge of the signal box controlling the station knows exactly the position of every train and the state of every road in his station, and therefore, as long as he has arranged to clear the passage for the incoming train through to the arrival platform, it is only necessary for him to signal the engine driver through. The engine driver knows by this signal that provision has been made for his train and that there is a clear platform awaiting its arrival.

In the case of outgoing trains the signalman might have to communicate to any one of seven trains, as there are seven platforms; and it is for this reason that it is necessary to signal each road separately. Our photograph shows that the line from the No. 4 road is clear right through to the commencement of the first section, and the train is signalled accordingly.

Both of the following two sections are clear, as will be seen from the signals in the distance; and the express at No. 4 platform is simply waiting for the signal from the guard to start out with a clear run before it. On the left-hand side of the up line in the distance will be seen the signal giving admittance to the incoming express.

If this kind of signalling scheme is installed in a model terminal station, a very great deal of enjoyment may be obtained by controlling the movements of trains by signals just as in actual practice.

However well-planned a model railway station may be, it never really looks railway-like unless some kind of scenery is arranged as a background. In addition, ugly corners and untidy sections of base board should be treated in such a manner as to hide their deficiencies and as far as possible do away with their rough-and-ready appearance.

Many model railway enthusiasts appear to neglect to provide their layouts with any kind of background under the mistaken impression that scenery involves considerable expenditure. This is far from being the case, however, for a really effective background can be provided at very small cost. A few minutes' search at any good wallpaper shop will disclose various frieze papers depicting country scenes that form quite useful backgrounds, and a roll of such paper will be found to provide thoroughly effective scenery. In the above illustration, for instance, the through passenger station is made to look very realistic by the use of a section of a frieze representing a country scene with ploughed fields in the foreground. Before this scenery was placed in position the background consisted of a rather unusually ugly wall!

No station is complete without one or two piles of luggage. In an actual station it is customary for luggage to be concentrated at certain definite points on the platforms, according to its destination. In order therefore to make a model station appear realistic the luggage should not be spread casually all over the platforms. Miniature porters should be made to appear to be running their trolleys towards a certain point, and some luggage should already be accumulated there. A little farther down the platform a collection of miniature milk churns would fill an empty space effectively. Here again, in order to obtain a good effect, the churns should be grouped closely together as would be the case in actual practice.

The use of scenery is not, of course, confined to stations, but is equally desirable throughout the whole length of the line. It is not always possible to do this, but advantage should be taken of every opportunity. Small ugly corners in a layout may be filled in quite successfully by piling up imitation rocks made of crumpled brown paper, soaked in a weak solution of glue, shaped into position and painted when dry and stiff. Moss and undergrowth may be represented excellently by obtaining some old sponges, either of the real or the "Sorbo" type, and cutting them up into small pieces, subsequently colouring them from a brownish-green to yellow. Larger pieces make very effective imitations of bushes and shrubs.

If a stretch of grass is required, a piece of felt brushed the wrong way and painted green is surprisingly effective. A small field of this kind is particularly valuable for covering an ugly little patch of base-board that cannot be dealt with in any other way.

"Wouldn't I Like One For Xmas"

The No. 8 Fairycycle

REGD TRADE MARK



"Fairycycle" Association

All "Fairycycle" owners are eligible for membership without fee. Every "Fairycycle" has a badge attached. The membership forms, which are given with every "Fairycycle," should be filled up and sent to Lines Bros. Ltd.

"Fairycycles" are obtainable from all high-class Toy Dealers everywhere. If you are interested in model Motor Cars, Cranes, etc., ask for free folder illustrated in colours.

The price of the No. 8 Model, which is illustrated above, is 87/6. The specification includes real Dunlop Balloon Tyres (2¼" buttressed tread), nickel-plated rims, upturned handle bars, rim brake, cycle stand and carrier.

OTHER FAIRYCYCLE MODELS

No. 1, with tangent spoke wheels, ½" ribbed tyres, stand and carrier	39/6
No. 2, with stand and carrier, ⅜" ribbed tyres, rim brake, upturned handlebars, tangent spoke wheels.	49/6
No. 3, De Luxe Model, with ball bearing wheels, 1" ribbed tyres, plated rims, etc.	59/6
No. 4, Super Fairycycle with ball bearings throughout and spring saddle, 1" cushion tyres	65/-
No. 6, Senior Model with 16" wheels, 1" ribbed tyres, ball bearings throughout	70/-
No. 7, as Model 6, but with 16" × 1⅜" pneumatic tyres	75/-

Fun on a "Fairycycle"

CHAPTER FOUR

Last month, you were asked if you could guess Mary's idea for a game with her dolls and Johnny's "Fairycycle." Well Johnny was just as curious as you were—although you probably guessed it in the end.

"Let's play at shops," she said. "I'll look after the shop. The dolls can be the customers and, Johnny, you can deliver the goods on your 'Fairycycle.'"

So the dolls were placed in various parts of the garden, one in the tool shed, another in the greenhouse, a third in the summerhouse, a fourth by the big oak tree with the seat round it, and several more in other parts of the garden.

Next they made the shop. The kitchen window opened and the sill became a counter.

"Now what kind of a shop shall it be"? asked Johnny.

"Oh, a Grocer's, of course," replied Mary, "Because people will be wanting to buy all their good things for the Christmas parties."

Mother lent them things from the larder—and Johnny helped Mary to lay out the "stock" upon the counter. Then Mary said: "Let's go into the garden and gather some evergreens, and get some white cotton wool, to represent snow and ice." In this way they gave their shop quite a bright and cheerful Xmas air.

It was a great temptation to Johnny to eat some of those delicious biscuits—but Mother had told him not to—so he didn't.

In a short time everything was ready, and so they started. Mary was behind the counter. A doll had been placed in front of it—and Mary was speaking.

"A pound of almonds and raisins, half-a-pound of icing sugar, a box of bonbons, and a tin of syrup. That's 10/8½ please. Thank you. Good morning ma'am. I'll have them sent round at once. We deliver by 'Fairycycle' you know."

"Johnny! Take these at once to Mrs. Jones of the Greenhouse," said Mary, handing him a parcel tied up in brown paper. "Mrs. Jones wants them at once because she is going to ice her cake this afternoon."

Johnny was delighted with his first errand—and he had great fun every time he took things for Mary. Of course, he didn't come straight back always, and Mary often told him he should be quicker, but the temptation to go for a little extra ride on his "Fairycycle" was so strong that he could not resist it.

Johnny soon discovered a new idea. He found a small box and tied it on the carrier at the back of the "Fairycycle." In this way he could take out two or three orders at one time.

Well, they went on playing for quite a long time but at last they found that their stock of currants, raisins, candied peel and icing sugar had nearly run out. You see the fact is that every time Mary offered a sample to one of the customers either Johnny or Mary devoured it. Of course in this way they convinced the customers that the raisins were the best that could be bought, but the stock became lower and lower.

Sometimes trade was "slack." Then Johnny started out on his "Fairycycle" to call upon the various customers.

So both he and Mary thoroughly enjoyed the game of shops and they agreed that a "Fairycycle" was the most useful and sensible present that a boy or girl could have. Mary hopes that "Father Xmas" will bring her one this year. She is going to write him a note just before Xmas reminding him that a real "Fairycycle" has a Red Triangle Trade Mark on the head.

L. BROS. LTD. LONDON BROS. ENGLAND

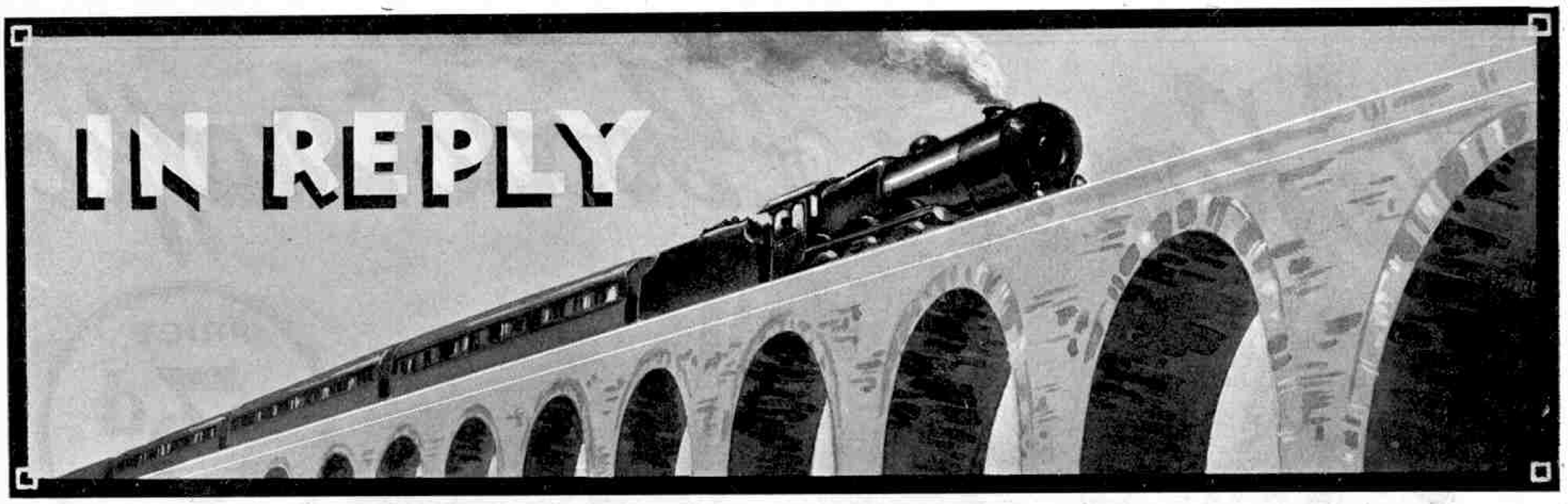
Regd. Trade Mark.

The Red Triangle Trade Mark on the "head" makes a genuine "FAIRYCYCLE" easily distinguishable.

"Fairycycles" are made by

LINES BROS. LTD.

114, Morden Rd., Merton, S.W.19



Suggested Hornby Train Improvements

REVISED PLAN FOR No. 2 LOCOMOTIVE.—Although your drawing of a new type of cab that you suggest should be fitted to our No. 2 engine is interesting, you are adopting a distinct L.N.W.R. outline, which would not be suitable for models representing engines of the G.W.R., S.R. and L.N.E.R. (*Reply to A. W. Griffith, Burton-on-Trent*).

McVITIE AND PRICE BISCUIT VAN.—We will file this idea in case we decide to increase the present range of our Rolling Stock. (*Reply to S. Wilkinson, Newcastle-on-Tyne*).

2-4-2 TANK ENGINE.—As we have often remarked in these pages, the difference between our present type of No. 2 4-4-4 Tank Locomotive and a 2-4-2 Tank Engine would hardly be great enough to warrant our undertaking to manufacture the model you suggest. (*Reply to J. D. Shackleton, Blackpool*).

2-10-0 BANKING ENGINE.—The question of introducing a locomotive with more than six coupled wheels has been dealt with in these pages very frequently. It should be remembered that on most gauge '0' layouts the radius of the standard curves is 2 ft., and it would be impossible for a locomotive with 10 coupled wheels to negotiate such sharp curves successfully. (*Reply to J. Jeffers, Sunderland*).

SCALE VALVE GEAR.—We agree that model locomotives fitted with scale model Walschaerts' valve gear would be very effective when running. On the other hand, models of this kind would be extremely expensive to manufacture, and we feel that they would not be in demand owing to their necessarily high price. (*Reply to P. Ware, Rugby*).

LARGER HOPPER WAGONS.—We have considered your proposal for the introduction of larger Hopper Wagons. We cannot see any advantage to be gained by applying your idea, however, as we think the present size of the Hornby Hopper Wagon is quite adequate. (*Reply to R. Michell, Honiton*).

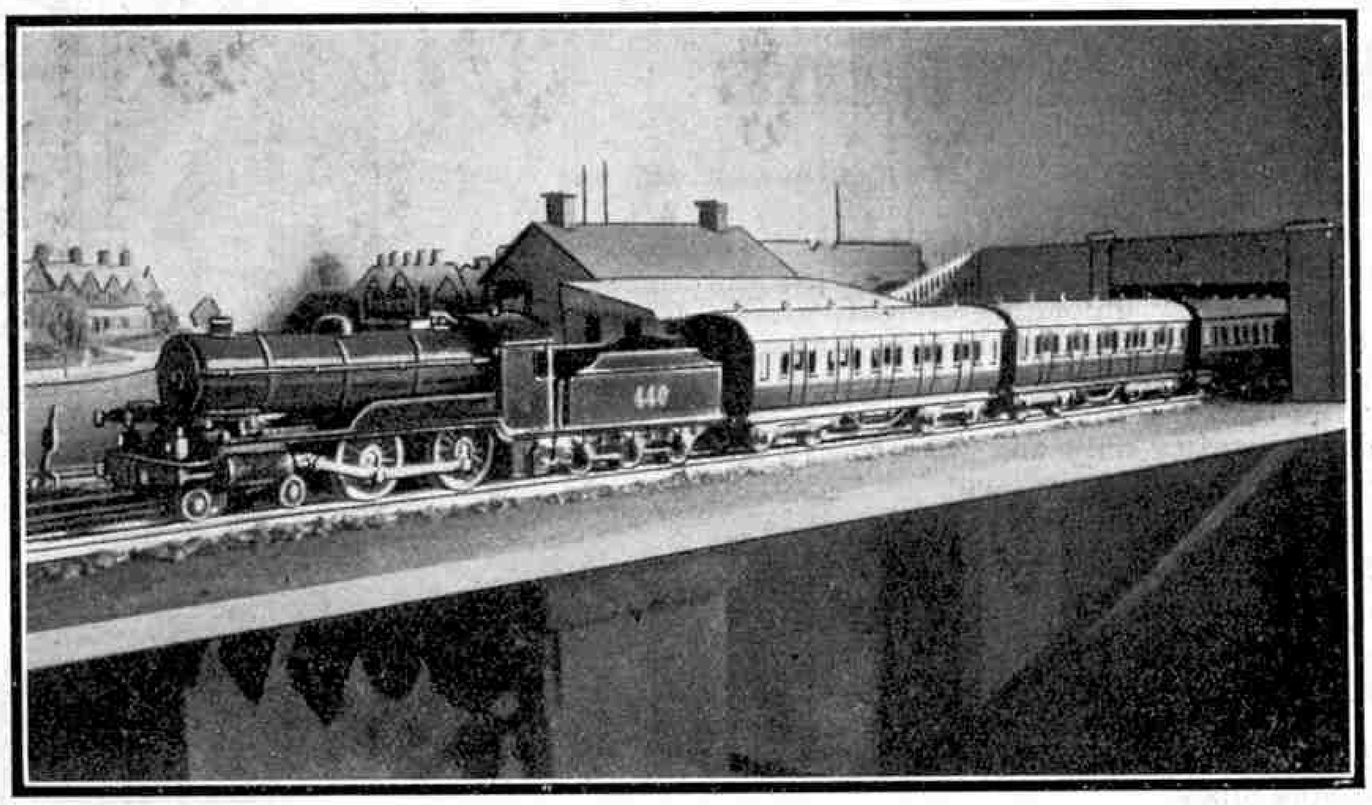
A 'FORCE' VAN.—We are afraid that this idea is not quite suitable for introduction into the Hornby Train system, owing to the fact that actual prototypes of this kind of van are very rarely, if ever, seen on actual railways. (*Reply to G. Nelson, Blackpool*).

REVISED BREAKDOWN VAN AND CRANE.—We do not consider that the design of our present model of a Breakdown Van and Crane needs revision and therefore we regret we are unable to adopt your idea. (*Reply to J. C. Blundell, New Plymouth, N.Z., N. Bruce, Palmerston, N.Z.; A. Nicoll, New Plymouth, N.Z.*).

LARGER GOODS SETS.—The component parts of your proposed goods set may very easily be purchased separately. For this reason we do not consider that it would be worth while adopting your idea. (*Reply to D. Logan, Glasgow*).

BOGIE PASSENGER COACHES.—Numerous suggestions reach us daily regarding the introduction of bogie passenger coaches. We have definitely decided to introduce these as soon as possible, but we cannot commence work on their production for a considerable time yet. (*Reply to J. Badlam, Oxford; A. Nicoll, New Plymouth, N.Z.; G. Johnson, Fishguard, and many others*).

HORNBY ENAMEL.—Boys who are anxious to re-enamel their models of L.M.S. and L.N.E.R. locomotives should purchase the Meccano Enamel, which may be obtained from any Meccano dealer price 8d. per tin, either red or green. (*Reply to J. D. Sewill, Southend*).



An express passenger train arriving at a through station on the interesting model railway system of C. McLean (Ayr, N.B.). In addition to ballasting his track McLean has succeeded in obtaining a very realistic effect by coating the bare parts of the baseboards, to which the track is attached, with a thin layer of glue and then sprinkling fine sand over it.

CORRIDOR TENDERS.—At present this suggestion is extremely popular, but we would remind Hornby Train enthusiasts that a tender of this kind would be very costly to produce and would really serve no more useful purpose on a Hornby layout than the ordinary type. In any case the number of locomotives fitted with corridor tenders running on the actual railways is very small. (*Reply to W. Fraser, Hastings; H. Parcell, Leicester, and many others*).

TIMETABLE BOARD.—This is an interesting suggestion. A blank board of suitable size for miniature railway timetables would be found very useful in a model station and we propose to file your idea for further reference. (*Reply to J. Aikman, Glasgow*).

No. 3 CHIMNEYS.—This question has aroused considerable interest in the circle of Hornby Railway enthusiasts. As we have already stated, we have given this matter consideration and we have decided to produce No. 3 Locomotives fitted with more suitable chimneys. (*Reply to D. Shadbolt, Cambridge; T. S. Ware, Evesham; H. C. Williams, Evesham*).

SCALE MODEL 4-4-0 "PRECURSOR" ENGINES.—We understand that L.M.S. locomotives of the "Precursor" type are gradually being rebuilt as "George V's," and it is possible that shortly the class will be non-existent. (*Reply to D. J. Badlam, Oxford*).

HORNBY LOCOMOTIVE TRANSFERS.—You are apparently under a misapprehension. We are unable to supply separately any of the transfers used on Hornby Trains. (*Reply to T. Adderley, Birmingham*).

NEW GAUGE.—A standard rail gauge of 2¼ in. would not be suitable for indoor model railway work in the average house, on account of the large amount of space taken up by even a simple layout. (*Reply to E. Myers, Illinois, U.S.A.*).

HORNBY WEIGH-BRIDGE.—Even if we adopted your idea it would be very awkward to include a model weigh-bridge in the average model railway layout. A further objection is that such an accessory would necessarily be very costly to produce and the resultant price would be too high to be popular. (*Reply to K. Rogers, Colwick Vale*).

MINIATURE TIME-TABLE.—The preparation and use of timetables for model railways has already been dealt with in the "*M.M.*" Further practical hints and suggestions are contained in the new Hornby Railway Company booklet which may be obtained from this office, price 2d. post free. (*Reply to G. W. Pearce, Bristol*).

PRIVATE OWNERS WAGONS.—We have already stated that we will consider the production of wagons of this kind. (*Reply to J. Ballantyne, Midlothian; J. C. Owen, Belfast; G. C. Phillips, Conway, N.W.*).

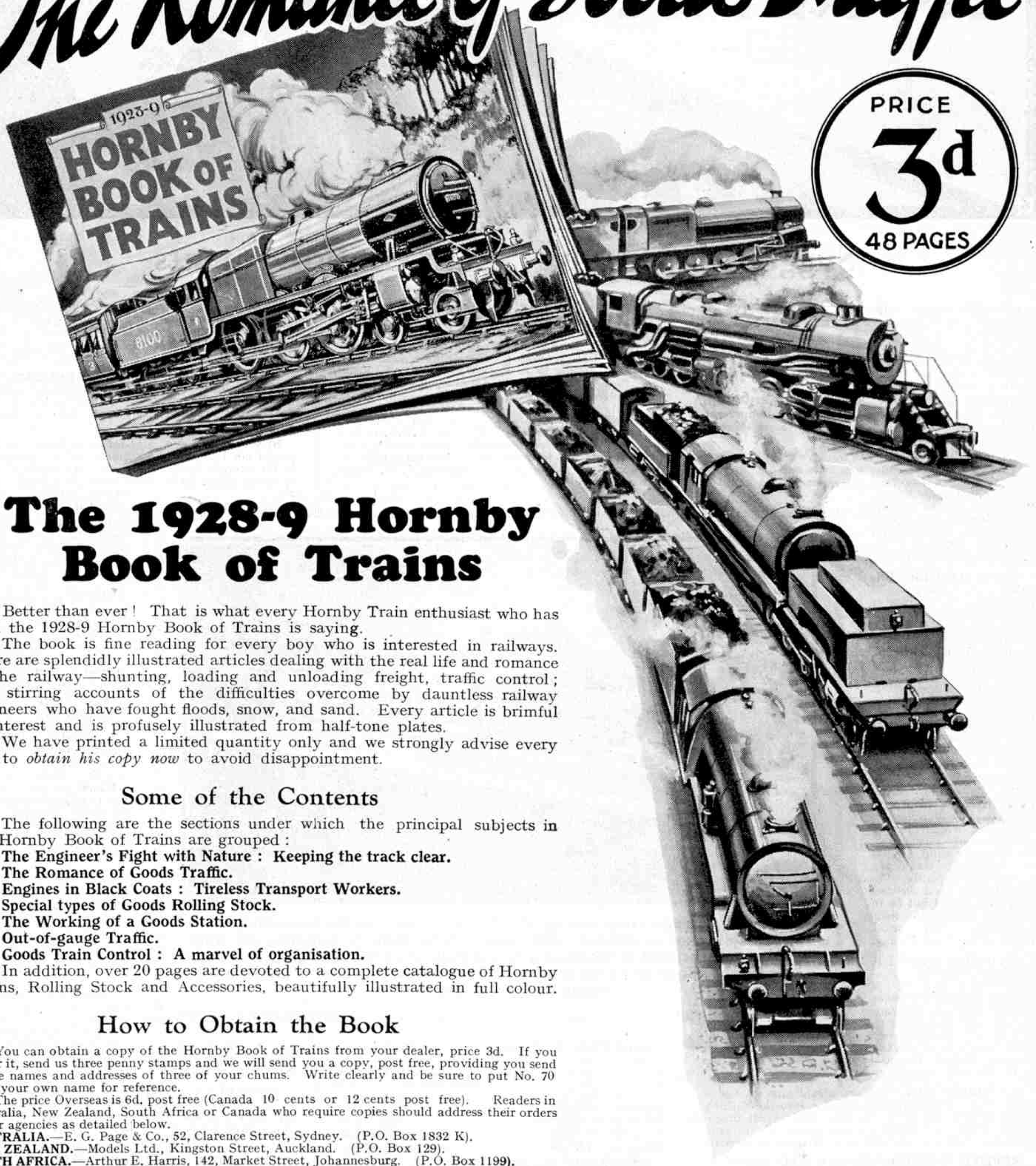
SEPARATE MECHANISMS.—Any type of Hornby locomotive can be fitted with a new mechanism if it is forwarded to the Returns Department, Meccano Ltd., Old Swan, Liverpool. (*Reply to D. Nicoll, New Plymouth, N.Z.*).

TUNNELS.—Your design for a long model tunnel to be supplied in separate sections is very interesting but not practicable. We are afraid that few Hornby Train enthusiasts would welcome this idea. (*Reply to A. N. Fearnside, Hastings*).

VARNISHING OF HORNBY LOCOMOTIVES.—Your suggestion regarding the finish of Hornby Goods Locomotives is quite interesting. We agree that in actual practice goods engines have a matt finish, and we will therefore file your idea for further consideration. (*Reply to C. Dawe, Walworth, S.E.17*).

NEW BRAKING DEVICE.—It is almost impossible to devise a braking apparatus that would ensure the gradual stopping of a clockwork mechanism. One or two means of effecting a realistic stop have been suggested to us but none has been of any practical value. (*Reply to C. Griggs, Chiswick, W.4*).

The Romance of Goods Traffic



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Special types of Goods Rolling Stock.
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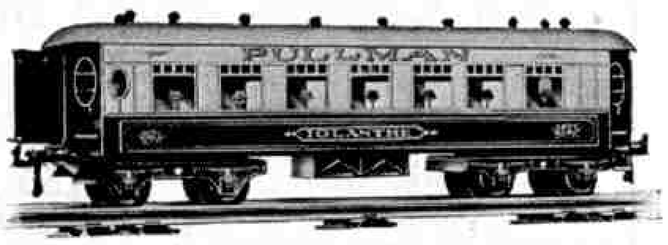
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Additions to the Hornby Series

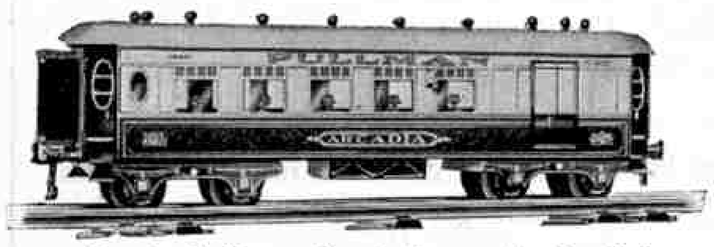
By 'Tommy Dodd'

This season sees the introduction of a great number of entirely new Hornby train accessories. First and foremost come the new designs of the No. 2–3 Pullman coach and composite. These models are perfect in every way, and are the most realistic guage '0' Pullman cars that have ever appeared on the market at anything like the price.



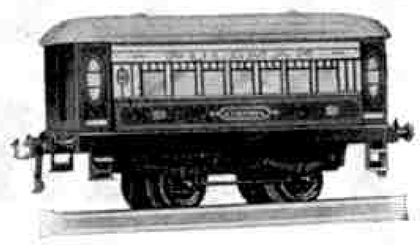
Hornby Pullman Coach No. 2-3

The colour scheme adopted is the standard chocolate and cream of the Pullman Car Company, and the finish imparted by the lettering, lining and scale crests makes these cars perfect representations of those running on the actual Railways. The Pullman coach is named after the *"Iolanthe"* and the composite after the *"Arcadia,"* both of these cars being famous in actual railway practice. In order to ensure perfect running qualities, equalising bogies and Mansel wheels are fitted, and details such as ventilators on the roofs and opening doors with perfect little handles fitted to them, give the finishing touches of realism to these beautiful model coaches.



Hornby Pullman Coach Composite No. 2-3

Next in the way of rolling stock come the No. 1 Pullman Coach and Composite Coach, which are of an entirely new design. These No. 1 Coaches are fitted with four wheels only, in order to enable them to be run on layouts including curves of 1 ft. radius, but their appearance is quite realistic and their finish perfect. Three famous Pullman names have been chosen for the No. 1 Pullman Coach, namely, *"Cynthia," "Corsair"* and *"Niobe"*; while the composite coach is named *"Ansonia."*


No. 1 Pullman Coach

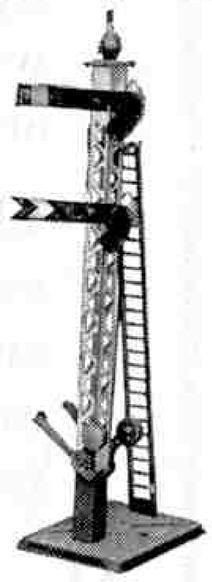
The new "Redline" Petrol Tank Wagon will give a bright touch to any model goods train. It is correctly finished in a blue that is a perfect match to the royal blue used by the Redline Motor Spirit Company, and it is lettered in correct accordance with their standard design. In construction, this tank is similar to the other petrol wagons that are now so well known to Hornby enthusiasts and without one of which no goods train is complete.

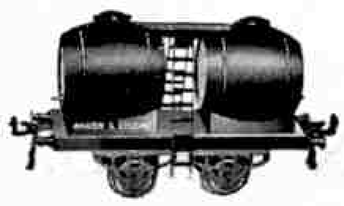


Petrol Tank Wagon "Redline"

A Wine Wagon can now be obtained. This is a particularly interesting and attractive model and is an excellent reproduction of the wagons that are such a familiar feature on the railways of France.

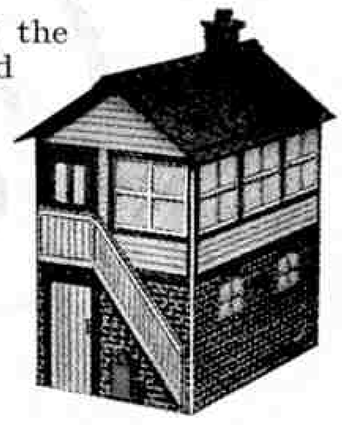
The range of signalling apparatus has also been increased considerably this season. The new type of double arm signal No. 2 will satisfy a long-felt want, as this combination is perhaps the most common arrangement of signals to be seen on actual railways. The double arm signal No. 1 is also an innovation and is a simplified version of the double arm signal No. 2, details such as lamps and transparent spectacles being omitted. No. 1 "Home" and No. 1 "Distant" Signals are now available and no doubt will be highly popular on account of their remarkably low price.


Double Arm Signal No. 2

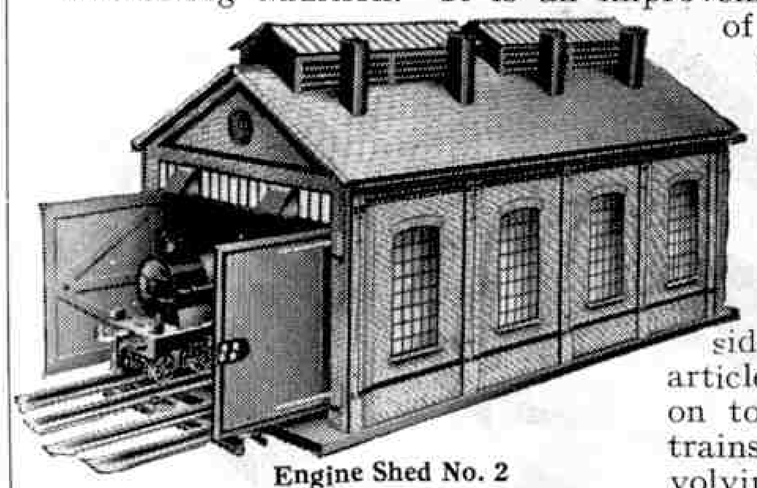

Wine Wagon

A new Signal Cabin, No. 1, has been introduced to meet the demand for a well-made cabin at a lower price than the No. 2 model. This new cabin is excellently finished and is very attractive in appearance, but it should be noted that it is not possible to insert a lever frame in this model.

One of the most popular innovations of the year will undoubtedly be the Engine Shed No. 2. The design of this is particularly realistic. It is fitted with double track and will accommodate comfortably No. 2 Locomotives and Tenders. The shed not only provides an extremely useful shelter for engines but also it adds enormously to the railway-like appearance of any layout. In addition, there is the Engine Shed No. 1 which is very similar to the No. 2 model but is intended for use with the smaller No. 1, No. 0 and "M" Locomotives.

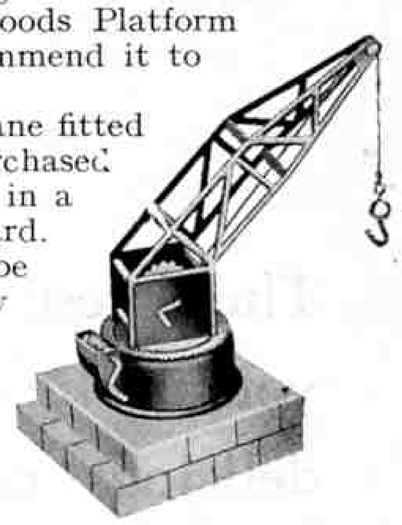

Signal Cabin No. 1

A new type of Goods Platform is another interesting addition. It is an improvement upon the old type of Goods Platform in that it is complete with a Warehouse instead of being fitted only with a shelter. The doors of this Warehouse are made to slide open and there is ample room inside for the storage of small articles, which can be loaded on to or unloaded from the trains by means of the revolving crane attached to the platform. The possibilities of this Goods Platform are very great and I can strongly recommend it to Hornby enthusiasts.


Engine Shed No. 2

It should be mentioned here that the crane fitted to the new goods platform may be purchased separately and it will be found very useful in a suitable place in a busy model goods yard.

The new No. 1 Level Crossing will be welcomed by large numbers of Hornby Train users. It has been produced in response to widespread requests for a single track crossing and it is designed on the same lines as the Level Crossing No. 2, the main difference being its smaller size.


Platform Crane

Among smaller accessories there are the Shunter's Pole, Miniature Tarpaulins, and the Railway Accessory Sets 5, 6 and 7, containing Gradient Posts, Station Names, Watchmen's Huts, etc. These small items are remarkably effective in providing the necessary touch of realism that gives a railway-like appearance to a model layout.



Oil Can No. 2 ("K" Type)

I find the shunter's pole most useful, especially in a goods yard, where the shunting of wagons is constantly in progress. Until the introduction of this accessory, coupling and uncoupling of miniature wagons was always a very awkward business, but now it is possible to perform these operations with suitable delicacy and greater realism.

The miniature tarpaulins may be obtained lettered in accordance with either G.W., L.M.S., S.R. or L.N.E.R. practice. A long train of open wagons covered with these tarpaulins looks very realistic.

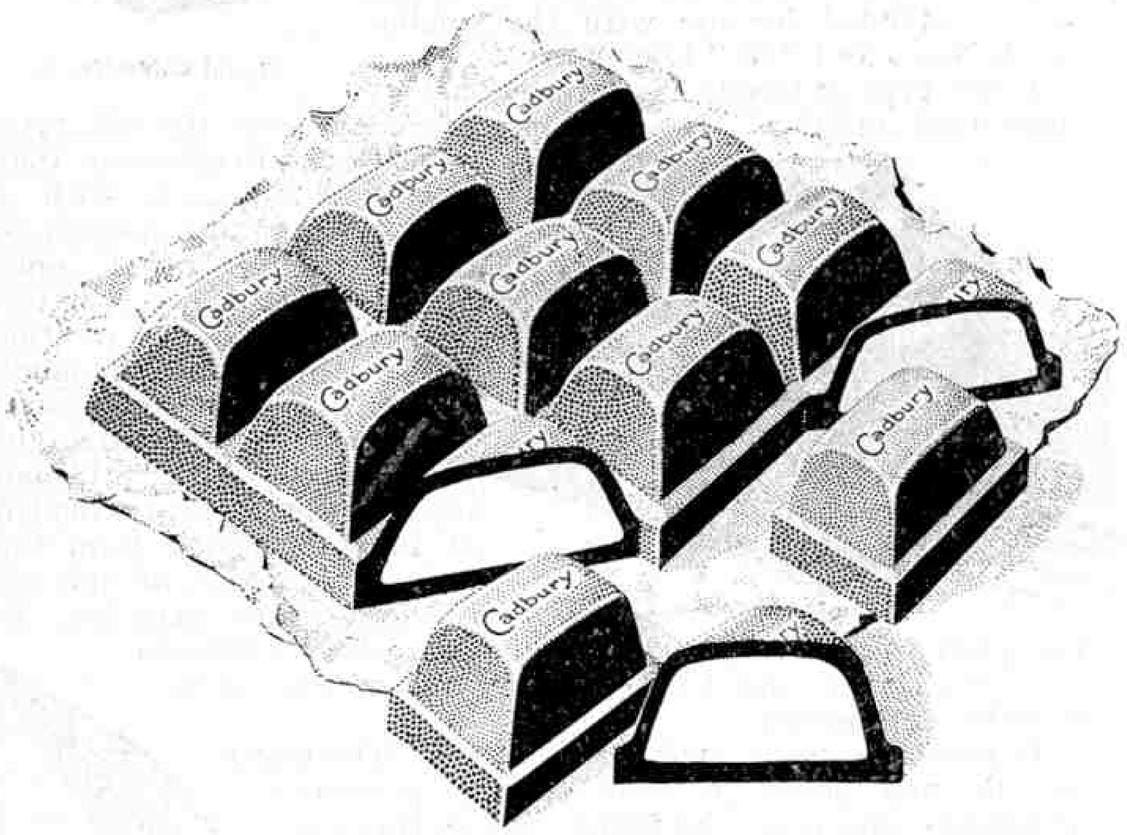


Tarpaulin Sheets

I can recommend the use of the gradient posts. Few model railway layouts are level throughout, and these posts come in very useful for indicating the various inclines and declines of the track.

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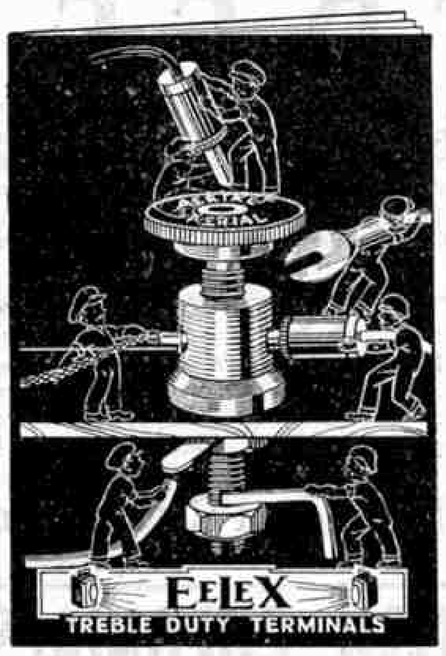
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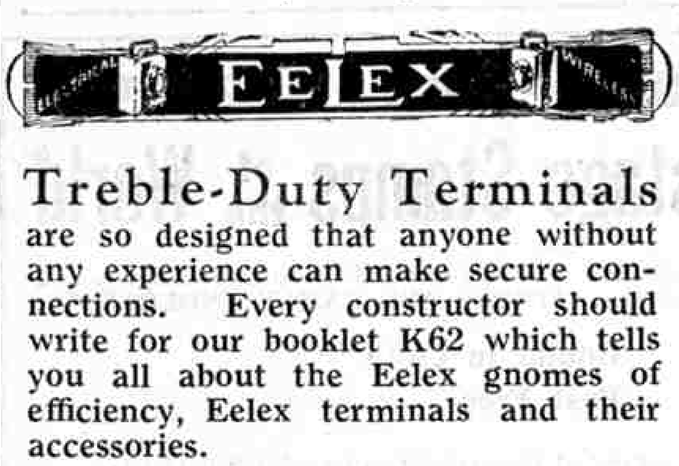
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Announcing a

New Railway Book

We have pleasure in announcing the publication, in book form, of the articles on "Famous Trains and the Routes over which they Run," by Mr. C. J. Allen, which have appeared in past issues of the "*M.M.*" In a voting contest we held a short time ago these articles were judged to be the most popular articles in the Magazine, and large numbers of our readers have constantly requested that they should be reprinted in book form. We have been able to arrange this and copies of the book are now available.

The book, which consists of 200 pages, tells the story of some of the famous expresses of Great Britain. Mr. C. J. Allen is one of the best known writers on railway matters and his lectures and B.B.C. talks are always well received.

The trains dealt with in this book are as follows:—"Flying Scotsman," "Cornish Riviera," "Atlantic Coast Express," "Hook of Holland Continental," "Fishguard Boat Express," "West Coast Postal," "Midland Scotsman," "Southern Belle," "Folkestone Flyer," "Dover Pullman," "Royal Scot," "Birkenhead Diner" and the "3.20 Down Manchester."



In each case the story is told in detail of the ground covered by each train, and there are full particulars and leading dimensions of the locomotives that draw the trains, as well as schedules of the trains themselves. The book is beautifully printed on art paper, cloth bound, and there are 58 illustrations. It is enclosed in a fine coloured wrapper showing the famous Great Western "*King George V*" and, on the back, a reproduction of the special Commemorative Bell that was presented to "*King George V*" at the Baltimore and Ohio Centenary.

The book may be obtained through any Meccano dealer or bookseller, price 2/6, or direct from this office, price 2/9 post free. Meccano Limited, Book Dept., Binns Road, Old Swan, Liverpool.

Producing the "*M.M.*"

(*Continued from page* 973)

the title and sub-title of the article are set in larger and bolder type, which is usually cast from separate matrices and composed by hand. Round them the printer places strips of type metal that have a suitable design engraved on their printing surfaces. These form the border that is used to give prominence to the title of an article.

The columns of type are separated by "rules," or strips of metal of various lengths that print lines. Other strips called "leads" are very useful and necessary to the printer. When fixed in the forme their surfaces do not stand as high as type and they make no marks on the paper during printing. They are used to space out the pages.

When the necessary rules and borders have been inserted, and all spaces have been filled up by leads, the type is ready for "proofing."

At this stage only one impression is taken. This is used for testing the work of the compositor and is always known as a "proof." It is sent to the "printer's reader," whose task is to detect errors and to make sure that the original copy has been followed.

The work of the printer's reader is monotonous, but not entirely uninteresting. He must be quick to detect such mistakes as wrong spellings or omission of punctuation marks. In the days of hand composition he also had to be continually on the alert for battered types, or characters that had been placed in the galley the wrong way round. Some of the latter errors were very difficult to detect. When the letter "d" is inverted it is not easy to distinguish it from a "p," for instance, and to do so while reading quickly requires long practice. The introduction of the Monotype has simplified the task of the reader considerably. In printing shops where this machine is used the types are always new and they are placed automatically in the correct position. Misspellings and omissions are therefore the chief errors that the reader must now look for.

Any corrections that are necessary are marked on the proof by the reader and the alterations are made by hand. One of our photographs of the works of Stembridge & Co. Ltd. shows wrong type being picked out of a large forme by means of a pair of tweezers. Further proofs are then pulled, and three copies sent to the Editorial office of the "*M.M.*," together with the layout and the original copy. They are carefully checked to make quite certain that no errors have been overlooked, and the general appearance of the page also is studied. The corrected proofs are returned to the printer, who makes the necessary changes.

The pages are now ready for imposing in the forme, and for printing the thousands of copies that are required. Sixteen pages make one forme, and they must be laid down so that when the sheet is folded the pages appear in proper sequence, and with correct margins. The spaces between the pages are filled with wooden "furniture" and the whole fixed tightly in a steel frame called a "chase," being wedged by means of steel "quoins," a pair of which are shown in the forme illustrated on page 878 last month.

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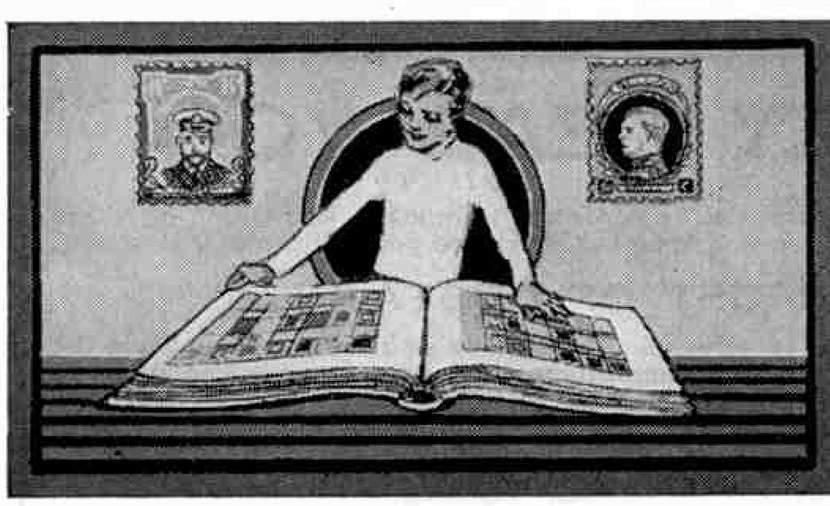
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In addition, all purchasers of the Packet asking for approval sheets and sending 1½d. postage will be presented with two splendid sets—**8 MALAY** (tigers) usually sold at 10d. and **12 HUNGARY** (Turul—the mystic bird of the Magyars) catalogued 1/–. Send addresses of stamp collecting friends and receive an extra set free.

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Stamp Collecting

ENGINEERING STAMPS

DURING the past twelve months or so our stamp articles have been devoted mainly to pointing out the various directions in which young collectors may specialise in order to gain the greatest possible enjoyment from stamps yet without involving themselves in great expenditure. We have dealt successively with ancient warships, big game animals, sports and charity stamps and stamps bearing portraits of famous musicians.



We now come to another specialised section from which every Meccano enthusiast who is a stamp collector will derive very considerable enjoyment, for it links together the two subjects in which he is most interested—engineering and stamp collecting. A glance through any stamp catalogue shows us a wealth of engineering stamp designs. Aviation, bridge-building, railways, docks and harbours, canals, various industries, and shipping are all represented. In this article we propose to give a general outline of the possibilities and in later articles we hope to deal with the various sections in more detail. Our illustrations this month show the wide scope that exists.



The article in the *"M.M."* last month dealing with the gradual recession of the Niagara Falls naturally focusses interest on the two stamps that head this page, both of which are taken from the U.S.A. 1901 set issued to commemorate the Pan-American Exhibition at Buffalo. One stamp shows the bridge spanning the river below the Niagara Falls. In the reproduction the view of the Falls themselves is lost, but reference to the illustrations that appeared on pages 904 and 905 of last month's *"M.M."* will help readers to place their position with regard to the bridge.



The companion stamp shows the locks of the canal at Sault Ste. Marie, or the Falls of St. Mary, in the United States. This famous waterway connects Lakes Superior and Huron. It is the world's greatest inland waterway, and the traffic passing through it in a year equals the whole annual traffic of the Panama, Suez, Kiel and Manchester ship canals combined. The locks themselves were completed in 1919 and are the largest ever built. They have a usable length of 1,350 ft., a width of 80 ft. and a depth of 24½ ft. of water.



On this page also we illustrate a view of the Corinth Canal that is taken from the 50 lepta value of the current Greek issue. This particular design is also the subject of the 5 and 80 lepta values of the same issue. The canal is one of the most remarkable engineering feats in Europe. It is four miles in length, 69 ft. in breadth and has a depth of water of 26 ft. Sandstone cliffs rise sheer to a height of 170 ft. on each side of the canal, which cuts through the peninsula of the Peloponnesus to connect the Gulf of Corinth with the Gulf of Aegina and shortens the journey between the Adriatic and the Aegean Seas by over 200 miles. It is available only for the use of vessels drawing less than 23½ ft. of water. Julius Cæsar and other Roman Emperors contemplated cutting a canal at this point many years before the birth of Christ, but the project was not realised until 1882 and the canal was finally opened to traffic in 1894.



The current Greek issue displays several interesting examples of early architecture, a subject that is allied to our present topic. We have not the space to illustrate the stamps here, but the 1 drachma and 15 drachmae values are worthy of a place in any special engineering collection. These show respectively the ancient Theseion and the Athenian Academy of Science, both of which were built throughout of marble.

Also on this page we show the 200 milliemes stamp of the Egyptian 1914 issue, which shows the great Assouan barrage across the Nile. There could not be a more impressive monument to the enterprise of British rule in Egypt, and to the skill of British engineers. From its lowest foundation to its parapet the dam stands 120 ft. in height, and the total weight of the masonry comprising its 1¼ miles of length is over one million tons. No less than 180 sluice openings, varying in height from 12 ft. to 23 ft., and all 6 ft. 6 in. in width, are employed to pass the flood water, and (*Continued on page* 1037)



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For further Stamp Adverts. see also page 1074

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Stamp Collecting—(*continued from page* 1035)

when all these gates are open, they can pass the entire volume of a fully flooded River Nile at the rate of 15,000 tons per second! Our illustration conveys an impression of the force of flood water streaming through the gates, and also shows the great bulk of the dam.



The water held back by the barrage forms a lake extending 150 miles up the Nile valley. It is difficult to appreciate just what this means, but if we state that this reservoir holds enough water to give a full supply to the whole of the British Isles, and that in flood time the quantity of water passing through the sluices every 24 hours is equivalent to the whole capacity of the reservoir, then some small idea of the might of the Nile is gathered!

One of the most interesting of our illustrations is the 45 cent denomination of the Chinese 1921 air post issue. It shows a curious combination of ancient and modern engineering, for a single-engined biplane is depicted flying over the famous Great Wall of China, which was built more than 2,000 years ago as a measure of protection against raiders from the North.

This great wall crosses the country westward from the sea for a distance of over 1,500 miles. It was built of solid granite masonry and is 30 ft. in thickness at its base and 30 ft. in height. Every 200 or 300 yards a turret, approximately 60 ft. in height, and originally built for the accommodation of defenders, was placed, and several of these can be seen in the illustration. Considering that it runs over bleak and inhospitable mountain ranges, the building of the wall was a remarkable engineering feat. It scarcely deviates from its straight course, but, as the stamp shows, it climbs up the most rugged mountain sides and plunges into deep ravines and gorges.

It may be added that the wall proved practically useless for its intended purpose. Time and again invaders broke through and ravaged the prosperous country to the South.

The two Saar Valley stamps illustrated are representative of colliery engineering, and are taken from the industrial issue of 1921. The one mark value is particularly interesting, for it shows an overhead conveyor in full swing. This method of carrying coal will be familiar to readers who live in colliery districts, where short lines have been in use for many years. As our stamp shows, it may be used for transportation over greater distances. An overhead line of this kind, built by the Tillmanstone Colliery in Kent, stretches several miles across country from the colliery to Dover Harbour. Parliamentary sanction had to be obtained before it could be constructed, and in the course of the inquiry into the colliery company's application, it was stated that overhead carriage from the colliery to Dover would save at least one shilling per ton in comparison with the charges for rail or road haulage. The Tillmanstone equipment is able to handle 4,000 tons per day. The Saar 1.25 mark value gives a splendid illustration of a block of pithead buildings.



The Guatemala 30 cent denomination of the 1919 issue is noteworthy as being the only stamp on which a land wireless transmitting plant is illustrated. The twin posts holding the aerial, and the aerial itself, are picked out very clearly, and running past the foot of the masts is a steam train. The design in reality is symbolical of two methods of distributing news—by wireless and by mail train.



The remaining illustration is of the 1/- denomination of the Maltese current issue. It shows the harbour of Valletta, the capital of the Island. Although Malta is comparatively a tiny island, its situation in the Mediterranean Sea gives to it a stragetic importance. It is, in consequence, a port of call for many vessels passing to and from Britain and the East.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with this article have been prepared.

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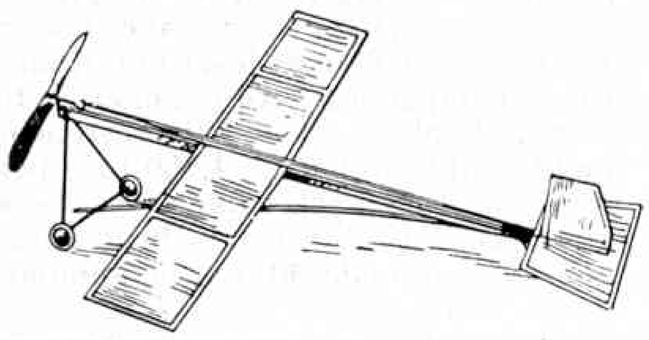
Look carefully at all the advertisements and decide which article you would like the postman to hand to you on Christmas morning. Write the name of it on the top of your postcard, marking it No. 1. Then write the name of the article that you would like second best and mark it No. 2. Do this with six articles altogether, write your own name and address at the bottom in very plain letters, and send the postcard to "Christmas Presents, Meccano Magazine, Binns Road, Liverpool."

To the sender of the list that corresponds most nearly in order of merit with the total voting we will post the article that heads his list, to reach him on Christmas morning.

"Christmas Presents" postcards must reach us not later than 19th December.

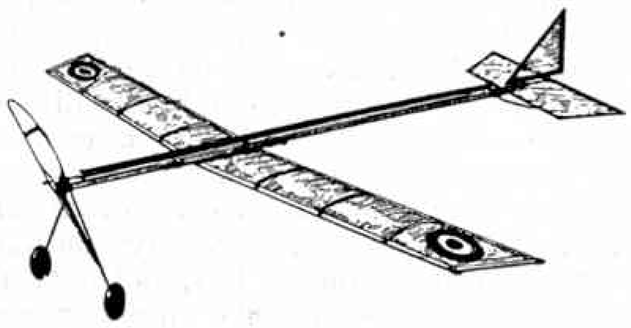
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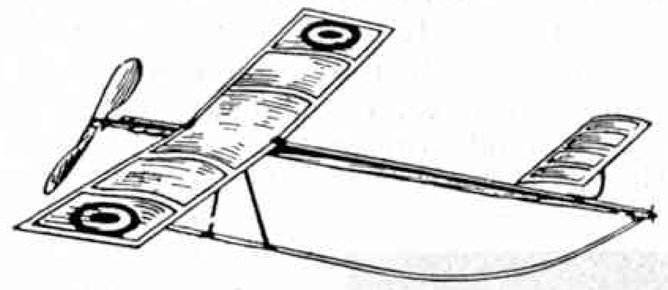
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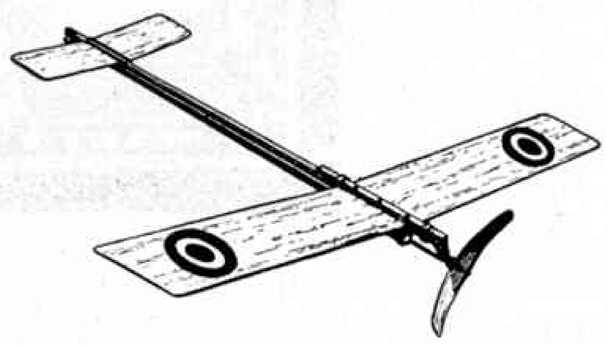


No. 0 PUSHER MONO

Length 20". Span 18¾". Price **5/6**

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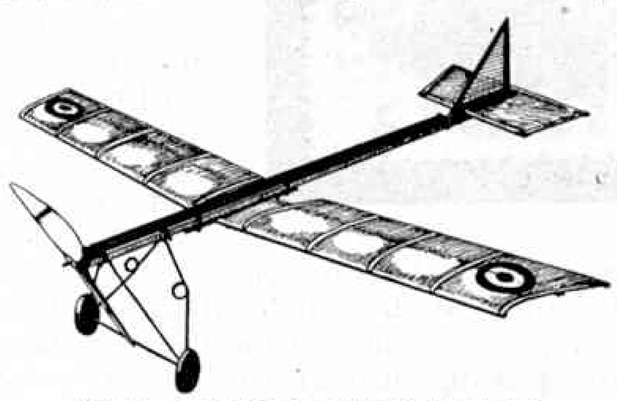


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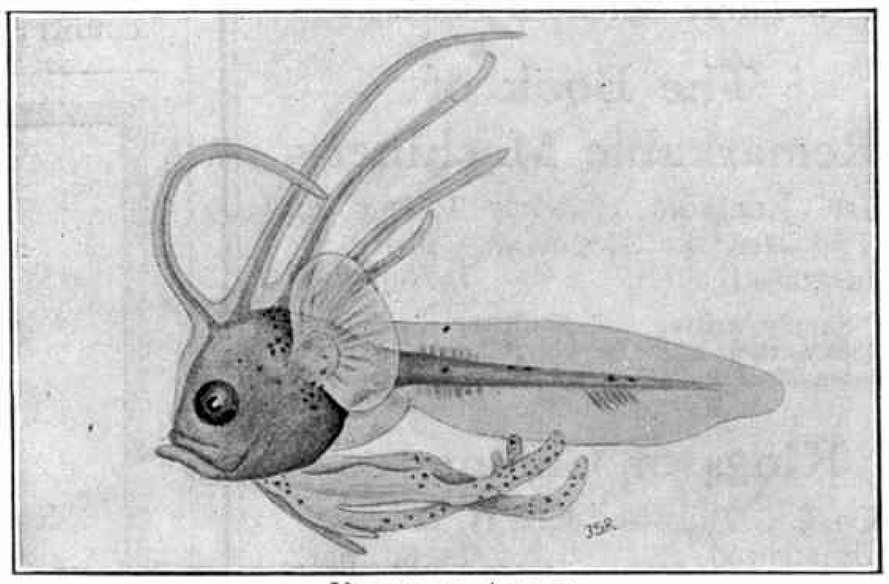
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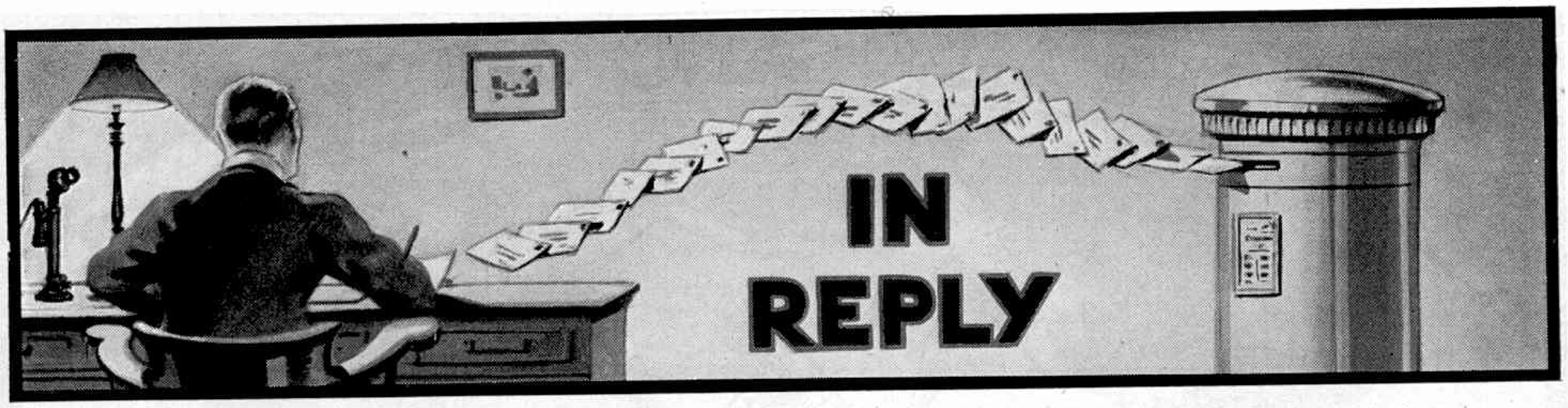
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In this page we reply to suggestions and criticisms regarding improvements or additions to the Meccano system. We receive many hundreds of such suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on separate sheets of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Liverpool.

Suggested Meccano Improvements

IMPROVED FLANGED WHEEL.—We have given careful consideration to your suggested improvement to the Flanged Wheel (part No. 20). To drill a number of holes around its flange (see sketch) would of course enable other Meccano parts such as Threaded Pins, Bolts, etc., to be attached, and the wheel might then be used in some form of cam mechanism. We do not, however, think that this addition would be justified, as smooth working when the wheel was required to run on rails would be difficult to obtain if the flange were perforated. We will, however, keep your idea in mind. (*Reply to A. E. F. Spence, Manchester*).



NEW ACCESSORY OUTFITS.—With the introduction of the new season's "double value" Outfits, we have received numerous suggestions from readers in possession of old style Outfits, that we should introduce a series of "B" Accessory Outfits, which would bring the old Outfits up to date with the new ones. The idea is good but we are unable to adopt it at present on account of the tremendous amount of additional work that would be involved. Moreover, if we introduce an accessory set to convert a 1928 to a 1929 Outfit, we would be compelled to introduce special Outfits to convert 1927, 1926, 1925, etc. sets—a procedure which we could not possibly undertake. It is quite a simple matter for readers to modernise their Outfits for themselves, by comparing the new contents of Outfits lists with the old ones found in the 1927 Manuals. (Latest contents of Outfits parts list can be obtained either from dealers or direct from us). (*Reply to J. R. Garratt and Ll. M. Franklin, Farnham; J. W. Rich, Birkenhead; S. R. Roland, Hailsham*).

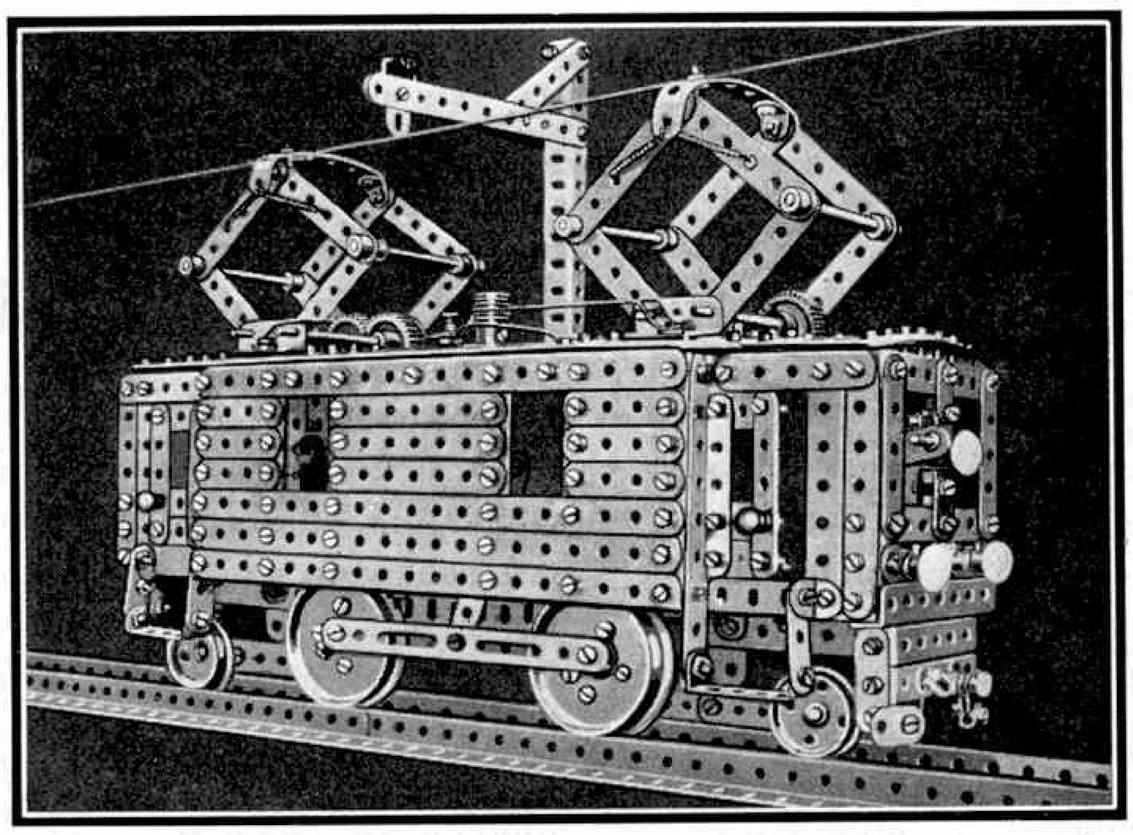
NEW COUPLING.—We were very interested in your suggested method of coupling two Rods together, the idea being that the ends of the Rods should be so shaped that they slide into each other in a similar manner to a "dove-tail" joint. This method would give a neat and fairly strong connection for two Rods, and would certainly be simpler than if a Coupling were used to join them. We will give further attention to your idea. (*Reply to R. Brotherton, Huddersfield*).

LARGER BOILER.—We have not received, up to the present, any suggestions that a larger boiler should be manufactured, as the existing boiler fulfils all requirements in the construction of model locomotives, donkey engines, etc. Where an extremely large boiler is required, however, as in the Meccano Tank Locomotive, it is quite a simple matter to build up a boiler from Hub Discs and Strips. (*Reply to R. Emberton, North Kensington, London, N.W.10*).

MINIATURE TOOLS.—Special miniature tools, such as taps, drills, etc., for use in certain model machines are hardly suitable additions to the Meccano range. We may mention that the Centre Fork (Part No. 65), forms a very effective "bit" for use in many models. (*Reply to L. Blake, Geelong, Victoria, Australia*).

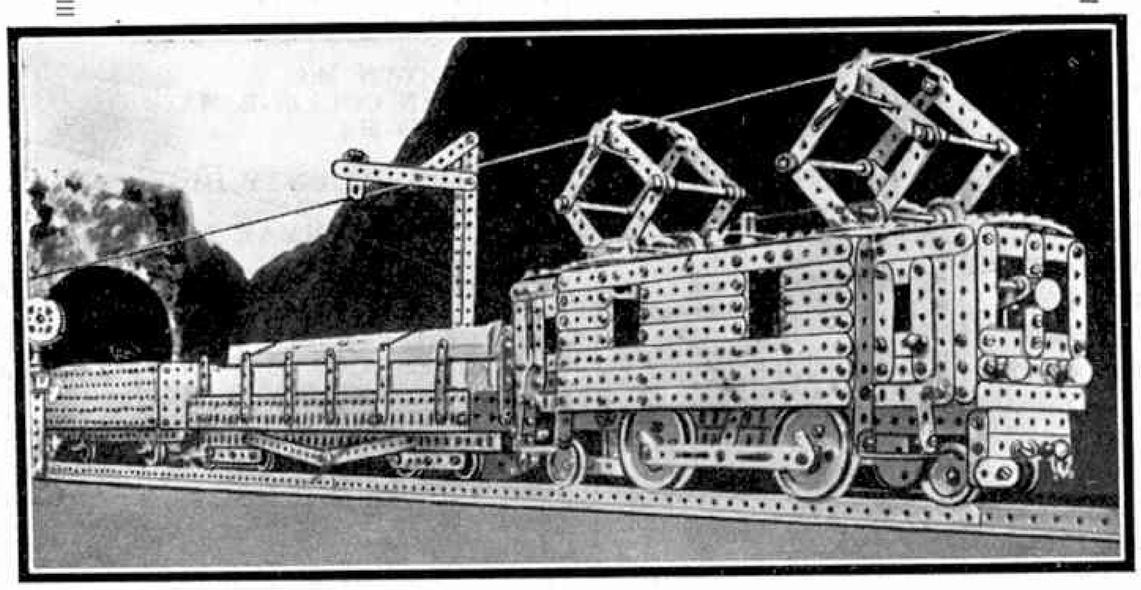
SPRING WASHERS.—We agree that washers of this type would be of considerable use in the construction of spring tensioning devices, and also for effectively locking nuts on bolts. The introduction of these parts will be considered. (*Reply to T. H. Lloyd, Newcastle-on-Tyne*).

SWISS RAILWAY IN MINIATURE



The photographs reproduced herewith are of a Brown-Boveri 300 h.p. Electric locomotive of the Rhaetian Railway, Switzerland, constructed from Meccano parts by M. Hauri, of Zurich, Switzerland, and readers will agree that it is indeed an excellent piece of constructional work.

Hauri has made use of an overhead wire, which carries one pole of the feed current to the Electric Motor in the locomotive, while the return current passes through the wheels and rails to the second pole of the battery. Every portion of the locomotive has been carefully and solidly designed and constructed and the Meccano goods wagons, rails, standards, and signals (see lower photograph) give the complete system a very realistic appearance—surely a splendid tribute to what can be done with Meccano!



LONGER POINTER.—We note that you consider that a useful introduction would be a pointer having one of its arms considerably longer than the other. Your suggestion appears to be quite sound and will receive attention accordingly. (*Reply to N. Williams, Farnworth, and F. Knowles, Perth*).

COMPRESSED AIR MOTOR.—We were interested to hear that you consider a small air motor, complete with compression tank, suitable for introduction to the system. We are giving your idea attention, although we would point out that the efficiency of a motor of this type is considerably lower than that of either a steam engine or electric motor. (*Reply to J. S. Greebe, Fulham, S.W.6*).

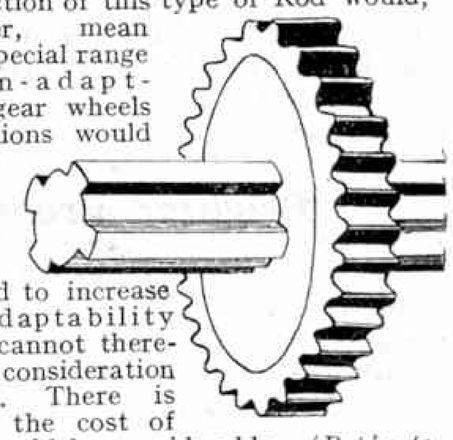
IMPROVED THREADED PIN.—Although we have recently increased the adaptability of the Threaded Pin by manufacturing the shoulder in the shape of a standard nut, we continue to receive numerous suggestions that a slot should be cut in the top of the Pin so that it can be tightened by means of a screwdriver. As we are always anxious to increase the adaptability of every part as much as possible we will consider cutting a slot in this article in the near future. (*Reply to A. Lindsley, Heaton, Newcastle-on-Tyne; D. G. Grayer, Eastbourne; and others*).

RIGHT ANGLE RODS.—A standard Meccano Axle Rod bent at right angles would be a useful part and could be used in cases where two Axle Rods and a Coupling have at present to be used. We are making special note of your idea and will comment upon it later on this page. (*Reply to G. Meiklejohn, Burntisland*).

"CLAM SHELL" BUCKET.—This is an interesting mechanism and if incorporated would certainly add to the realism of many models as such materials as small stones, etc., could be transported by means of this bucket attached to a crane. It is, however, possible to construct a very efficient bucket from existing parts, and an excellent example of this can be found in the Ship Coaler, the only other material necessary in the construction of the bucket being a small quantity of stiff cardboard or tin plate. (*Reply to F. J. Langfield, Highbury, London, N.5; W. P. Baker, Rochester*).

NEW WEIGHTS.—We have not found any considerable demand for an increase in the present range of gramme Weights, as the existing 25 and 50 gramme Weights fulfil most requirements. (*Reply to L. Blake, Geelong, Victoria, Australia*).

"FEATHERED" SHAFT.—The introduction of "feathered" shafts and a corresponding range of special gears to fit (as in sketch) would doubtless be popular amongst some model-builders for constructing gear-boxes, etc. The idea is, however, open to a grave objection, namely that a shaft having a number of projections upon its surface could not be made to work smoothly if journalled in a standard Meccano hole. This would mean that a special coupling would have to be introduced. The introduction of this type of Rod would, moreover, mean that a special range of "non-adaptable" gear wheels and pinions would have to be added, and this would not tend to increase the adaptability of the system. We cannot therefore give any further consideration to your suggestion. There is also the question of the cost of these parts, which would be considerable. (*Reply to R. Holman, Clapham Common, S.W.*).





With the Secretary

My first task this month is to wish a Merry Christmas to all members of the Meccano Guild and of Meccano clubs. To send greetings that will pass round the world is a privilege that very few possess, and I cannot resist a feeling of pride when I think that my message of goodwill is a personal one to Meccano boys in almost every country on earth.

Guild Progress in 1928

It is natural at this time of the year to review the changes that the past twelve months have brought. A year ago I was able to say that from every point of view the progress of the Guild had been satisfactory. It is encouraging to note that 1928 has been a period of even greater activity. The membership has been very largely increased, and both old and new members have made great efforts to realise the aims of the Guild. My mail-bag is evidence of this. It is becoming recognised more and more that the Guild Secretary is not a mere official, but is the friend of all Meccano boys, and that he is always ready to give help and advice. In consequence the number of letters I receive is increasing week by week. Most of them come from English-speaking countries throughout the world, but every European nation is strongly represented, and I am in constant touch with members in far distant lands such as Egypt, the South American Republics, China, Japan, and even Iceland. Each correspondent receives individual replies to his letters and I hope that those members who have not yet commenced regular correspondence with me will join this ever-growing band.

The progress of the club movement has been even more satisfactory. I have often pointed out that Meccano boys miss a great deal of the best possible fun by not joining an existing club or trying to form a new one in their own neighbourhood. This has been taken to heart during 1928. Not only have many new clubs been formed, but old ones have been revived, with the result that there has been a great increase in the number of active club members.

Brighter Programmes

It is even more gratifying to note that clubs have extended their activities in almost every direction. Meccano Model-building still forms the chief common interest, of course, and the standard of work has been very much higher than in past years. This has been made evident by the splendid models on view at Exhibitions, which have this year been more successful than ever. In addition, many new hobbies have been introduced and in practically all clubs every member is now able to find something of special interest to himself.

The growing tendency to exchange visits with other Meccano clubs has helped greatly in developing club spirit among members. I have been very pleased to note an increase in the number of inter-club contests in debates and in both indoor and outdoor games. I hope that these visits will continue and that their scope will be extended, for every club concerned will benefit from the brighter programmes and wider outlook that will follow.

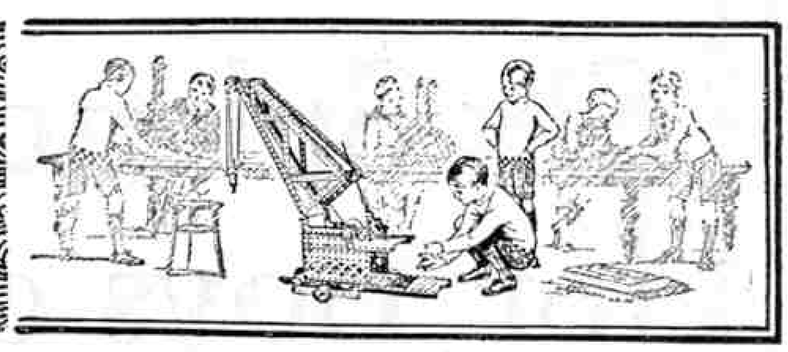
For many months past I have been asked to publish a complete list of Meccano Clubs, together with the names and addresses of their secretaries. Lack of space has prevented me from doing so until now, and on this page will be found the first instalment. I hope to continue this in future numbers of the "*M.M.*" until the complete list of active clubs at home and abroad has been given.

Affiliated Meccano Clubs:—First List

Town	Club	Secretary
ACCRINGTON	ACCRINGTON M.C.	V. Waterhouse, 45, Ramsbottom Street.
ALLOA	CHALMERS CHURCH M.C.	G. Campbell, Grange Manse, Alloa.
ANNAN	ANNAN M.C.	W. F. Duff, 10, Hecklegirth, Annan.
ASHBY-DE-LA ZOUCHE	ASHBY BOYS' GRAMMAR SCHOOL M.C.	R. W. T. Moore, "Summerfield," Wilmot Road, Swadlincote, Burton-on-Trent.
ATHERSTONE	ATHERSTONE GRAMMAR SCHOOL M.C.	W. C. Stokes, 11, Stafford Street.
BAILIEBOROUGH (Ireland)	BAILIEBOROUGH M.C.	R. Laven, Bank House, Bailieborough, Co. Cavan.
BARNET	BARNET M.C.	T. Kingsmill, Dundreddan, Hadley Road, New Barnet.
BARNETBY	BARNETBY ST. BARNABAS M.C.	R. H. Ward, Laurel Villas, Victoria Road.
BARNSLEY	ST. MARY'S M.C.	E. Medley, 32, Queens Road, Barnsley.
BARROW	BARROW M.C.	W. E. Kelly, 157, Abbey Road.
BECCLES	BECCLES EXCELSIOR M.C.	B. J. Andrews, 30, Station Road.
BECKENHAM	ELM ROAD M.C.	C. Price, 52, Queens Road.
BERKHAMSTEAD	NORTHCHURCH M.C.	C. Cole, 4, High Street, Northchurch.
BIRKENHEAD	BIRKENHEAD SCHOOL M.C.	C. G. Jones, 39, Waterpark Road, Prenton.
BIRMINGHAM	SPARKHILL M.C.	E. Stewart, 44, Benton Road, Sparkhill.
,,	BEARWOOD M.C.	C. White, 72, Katherine Road, Bearwood.
,,	KING EDWARD'S M.C.	D. H. Lewis, The Mount, Bilston, Staffs.
,,	KING EDWARD VI SCHOOL M.C.	A. L. Noke, 90, Trinity Road, Birchfield.
,,	MOSELEY SCHOOL M.C.	S. Fletcher, Moseley School.
,,	ST. PAUL'S M.C.	E. Cunningham, 93, William Street, Lozells.
BLACKBURN	HOLY TRINITY M.C.	T. Donald, 6, Camden Street.
BLACKPOOL	BLACKPOOL M.C.	M. Naylor, 220, St. Annes Road.
BLANTYRE	STONEFIELD PARISH CHURCH M.C.	T. Kerr, 2, Hardie Street, Blantyre.
BLYTH	BLYTH Y.M.C.A. M.C.	R. Carr, 135, Hambledon Street.
BOLTON	BEVERLEY ROAD M.C.	H. Henshaw, 35, Kendal Road.
BOURNEMOUTH	BOURNEMOUTH M.C.	R. Robertson, Garden Flat, St. Annes, Surrey Road.
,,	WALLISDOWN M.C.	G. Hoddinott, Bryants Cross, High Road.
BRACKLEY	MAGDALEN COLLEGE M.C.	E. O. Dayus, Magdalen College School.
BRADFORD	BRADFORD M.C.	Mr. A. L. Schofield, 16, Fairbank Terrace, Manningham.
BRAINTREE	BRAINTREE COUNTY HIGH SCHOOL M.C.	P. Allen, St. Edmund's, Bradford Street, Bocking.
BRIDPORT	BRIDPORT GRAMMAR SCHOOL M.C.	E. E. C. Marsh, Uploders.
BRISTOL	BLAGDON ST. ANDREWS M.C.	Miss K. R. Day, Seymour Arms, Blagdon, Nr. Bristol.
,,	BRISTOL GRAMMAR SCHOOL M.C.	J. C. N. Salter, 88, Hampton Road, Redland.
,,	FISHPONDS AND DISTRICT M.C.	R. George, 42, Victoria Park, Fishponds.
BROADWEY	UPWEY & BROADWEY M.C.	W. O. Doylend, Cranford, Jesty's Avenue.
BROMLEY	BROMLEY COUNTY SCHOOL M.C.	E. Dunford, 74, Havelock Road, Bromley.
BUCKHURST HILL	BUCKHURST HILL M.C.	D. Mason, 17, Palmerston Road, Buckhurst Hill.
BURTON-ON-TRENT	ALBERT VILLAGE M.C.	L. C. Adey, 239, Occupation Road, Woodville.
,,	ASHBY ROAD M.C.	C. Ward, Milfield Street, Woodville.
CARLISLE	CARLISLE M.C.	D. Carey, 7, Strand Road.
CASTLE DOUGLAS	CASTLE DOUGLAS M.C.	R. Haugh, 26a, King Street.
CHARD	COOMBE ST. NICHOLAS M.C.	J. Canever, Coombe Head, Coombe St. Nicholas.
CHELMSFORD	CHELMSFORD M.C.	Mr. H. Gratze, 25, Bishops Road.
CHELTENHAM	CHELTENHAM GRAMMAR SCHOOL M.C.	E. W. Griffiths, Hadleigh, Naunton Park Road.
COLWYN BAY	RHOS-ON-SEA COLLEGE M.C.	B. G. Woodcliffe, Rhos-on-Sea College.
COVENTRY	WARWICK ROAD M.C.	Mr. J. Hardie, 27, Caldecote Road.



CLUB NOTES



Royal Grammar School (High Wycombe) M.C.—Model-building and Lectures given by the members themselves figure largely in the work of the club. Visits have been paid to a Paper Mill and to the Royal Mint, while a party of 58 boys spent an enjoyable day at the Zoo. A Ciné Camera has been purchased and several good films have been secured. Club roll: 170. Leader: Mr. G. A. Grant, Royal Grammar School, High Wycombe, Bucks.

Herne Bay Meccano and Hobbies M.C.—The club celebrated its sixth birthday by a Social Evening held in the club room. A full programme of Indoor Games included many Competitions, in which the prizes were copies of the "*M.M.*" During the evening the Leader gave a short address on the aims and history of the club, and a splendid Birthday Cake adorned with six candles was cut by the youngest member present. This was presented by Mrs. Russell, whose kindness is much appreciated. Club Roll: 48. *Secretary*: Clifford W. Russell, 4, Clifton Villas, Herne Bay, Kent.

Ludlow M.C.—The varied programme now being followed includes Model-building Contests, Hornby Train Nights, Lectures and Boxing. Many very creepy tales were told by members at a Ghost Story Evening. An Exhibition and a Whist Drive and Dance are to be held before Christmas. Club roll: 15. *Secretary*: A. T. Chester, 8, Castle View, Ludlow.

Parkstone M.C.—Attendance has improved greatly and the members are very enthusiastic. At many of the meetings light refreshments are provided out of club funds. Recent interesting models include a Hammerhead Crane, Aeroplanes and a Liner 3 ft. 6 ins. in length. The future programme includes Electrical work, which is becoming increasingly popular, and a Lecture by the secretary, while several Entertainments also are being planned. Club roll: 14. *Secretary*: Eric Bath, 165, Ashley Road, Parkstone, Dorset.

St. Alban's M.C.—Winter activities are in full swing, the members being busily engaged in building Models for the forthcoming Exhibition. Hornby Train Nights and Puzzles Evenings have been arranged, and application has been made to the de Havilland Aircraft Company for the loan of their interesting Lantern Lecture on Aeroplanes. Club roll: 27. *Secretary*: A. H. Powell, 5, Alma Road, St. Albans.

Sedgley Park (Manchester) M.C.—A Motor Excursion to Buxton was greatly enjoyed, the remarkable rock formations in the caves exciting great interest. First prize in the Model-building Contest was won by a Swivelling Jib Crane. Models of a Locomotive and an Electric Tramcar gained the other prizes. The standard of work of all the competitors was remarkably high. Club roll: 11. *Secretary*: W. A. Robinson, 9, Queen's Drive, Sedgley Park, Prestwich.

Sittingbourne Pioneer M.C.—Contractors' Nights are specially attractive to members. Tasks set by the Leader on these evenings have included the construction of a machine to shake cement slurry, and of a model to contain not more than 40 bolts. Members have been greatly interested in engineering books loaned by the Leader. Club roll: 10. *Secretary*: R. Hampshire, 2, Charlotte Street, Milton Regis.

Blackpool M.C.—Has recommenced weekly meetings after having been closed down for a period. The officials are enthusiastic and a good session is expected. Intending members will be made welcome and should write to the secretary for particulars. *Secretary*: Maurice Naylor, 220, St. Anne's Road, Blackpool.

Whitgift Middle School M.C.—A visit was paid to London Docks, where the members saw many interesting Cranes, etc., that they intend to reproduce in Meccano. Model-building Contests and a Competition for the best Hornby Train Layout have been arranged and a joint meeting with the School Scientific Society is to be held, at which a Lecture and Demonstration on "*The Gyroscope*" will be given. A Social Evening a few days before Christmas will end the present session. Club roll: 30. *Secretary*: F. T. Brockes, 14, Addiscombe Court Road, East Croydon.

Weymouth Central School M.C.—A party of members visited the Great Western Railway Sheds and were fortunately able to inspect a Breakdown Van. They were greatly interested in the Hydraulic Jacks and other equipment. The rivalry between "Bolts" and "Nuts" has been extended to entertainments. The "Nuts" invited their rivals to a Lecture on "*How to Make Model Aeroplanes*," given by W. Doyland, secretary of the Broadway M.C., and provided their guests with cakes and lemonade on an almost unlimited scale. The "Bolts" intend to return the compliment and are sure that their entertainment will hopelessly outclass that of the "Nuts." Club roll: 28. *Secretary*: R. Mogg, 26, Chelmsford Street, Weymouth.

Central Hackney M.C.—New Headquarters have been secured and members are very busy making necessary alterations. When these are completed a Model Railway with 400 ft. of track is to be laid down. It will be fitted with Signals, Points, etc., and even with Block Indicators. The club room is open every night in the week for Model-building, Wood-work and other hobbies. Saturday evenings are devoted to Games. Leader: Mr. C. H. Moss, 191, Dalston Lane, London, E.8.

Annan M.C.—Has secured an excellent club room and is making good progress. A splendid wood-working bench has been installed, and a set of tools is to be purchased to enable members to make models for sale at the Annual Exhibition. A Junior Section for boys under 12 years of age has been formed, and the older members are very keen to make it successful. Physical Exercises are popular, the Leader, Captain Gibbons, acting as Instructor. Club roll: 28. *Secretary*: William Duff, 10, Hecklegirth, Annan.

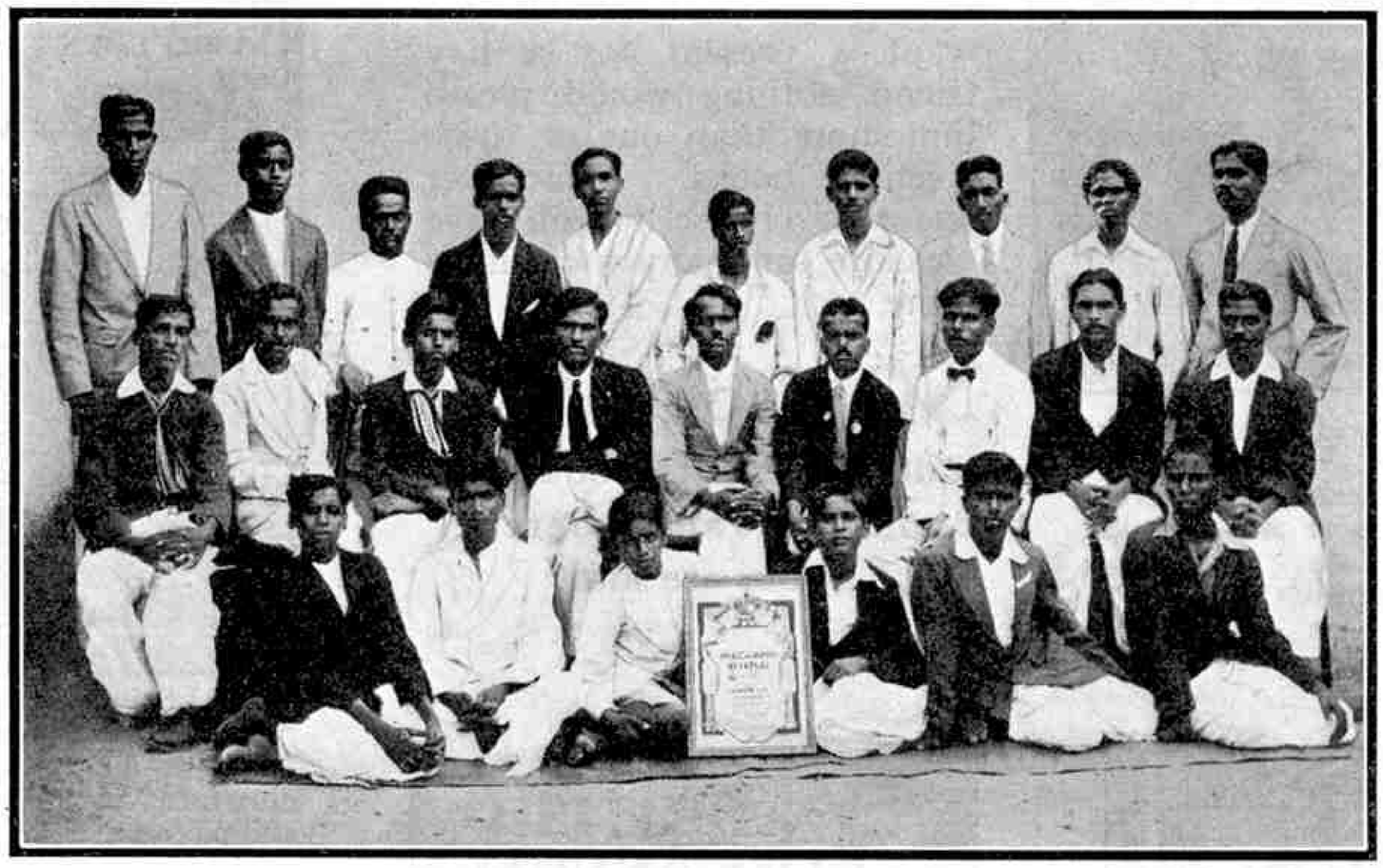
Woolwich and Plumstead M.C.—Two pairs of Boxing Gloves have been presented to the club. Mr. J. Hewitt has very kindly consented to act as Assistant Leader, and has taken charge of the Indoor Games Section. Fretwork Models are being made and will be sold in aid of club funds. Model-building Competitions and Stamp Evenings are held regularly. Several Lantern Lectures on visits to Paris, Egypt and other interesting places have been given. Club roll: 80. *Secretary*: S. E. Weller, 22, Woodhurst Road, Plumstead, London, S.E. 18.

Earlsfield (Grantham) M.C.—Has held a successful Dance in aid of the club funds. The attendance was 120 and many more tickets were sold. Models made by the members and a Motor Chassis loaned from Headquarters were on view, and during the interval their working was demonstrated by one of the members, who was described in the local newspaper report as the "junior brain" of the club. The members are very keen on Model-building and meetings are well attended. Club roll: 3[illegible] Leader: Mr. E. M. Dye, 15, The Drive, Grantham.

Heavitree (Exeter) M.C.—Is now an affiliated club and is making good progress. An interesting syllabus has been arranged, in which Model-building figures very largely, and a Football Team is being formed. Club roll: 16. *Secretary*: W. J. Wills, 3, Park Street, Heavitree, Exeter.

Oundle M.C.—The enthusiasm of the members has grown steadily since the club was affiliated. The entries in the Model-building Competition were judged by the President, V. E. Leayton, Esq., who gave Meccano parts as prizes. The club has a fine selection of books and a steadily growing Meccano Outfit, and a Wireless Set also is being built. A Club Flag is being made. This will be hoisted over the club room when meetings are being held. Club roll: 12. *Secretary*: E. J. Straw, "Ewelme," South Road, Oundle.

Excelsior (Madras) M.C.



This enterprising Indian club was affiliated in June, 1926, and its membership has increased steadily under the able leadership of Mr. P. Bhoopathy, B.A., B.L., who is seen in our photograph immediately behind the certificate. The club is divided into four sections, which meet regularly for Model-building and Lectures, and the excellent spirit of comradeship among the members is also encouraged by the playing of games.

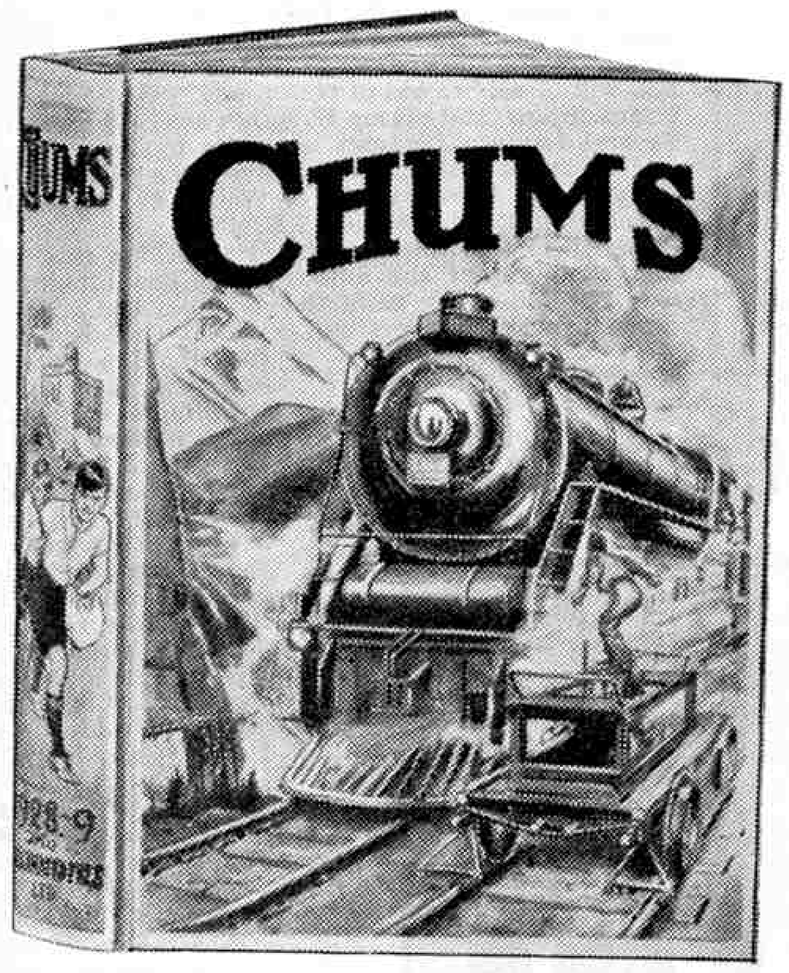
South Africa

Malvern Wesleyan (Johannesburg) M.C.—The excellent models sent in for the Model-building Competition included fine examples of Tipping Lorries, and Motor Cycles and Sidecars. The prizes were presented at the Annual Exhibition by Mr. A. E. Harris, the agent for Meccano in South Africa. The visitors numbered about 60, and refreshments and an excellent Musical Programme were provided. An instructive Lecture on "*Health and Strength*" was highly appreciated by the members, who are greatly interested in outdoor life. Football and Cycling are the most popular sports and programmes of cycle races are frequently arranged. The Girls' Section is flourishing, and the club also has an Honorary Members' Section consisting chiefly of former members, who revisit the club and give active support. Club roll: 59. Leader: Mr. E. Sykes, P.O. Box 8, Cleveland, Johannesburg.

Denmark

Odin M.C.—Is now settling down to a regular programme. Model-building has been actively carried on at all meetings, with the exception of one at which the secretary gave an account of his Scout trip to Norway. The sets of the members are being combined for use in the construction of large club models. Club roll: 12. *Secretary:* A. Thiele, Langelinie 53, Odense, Denmark.

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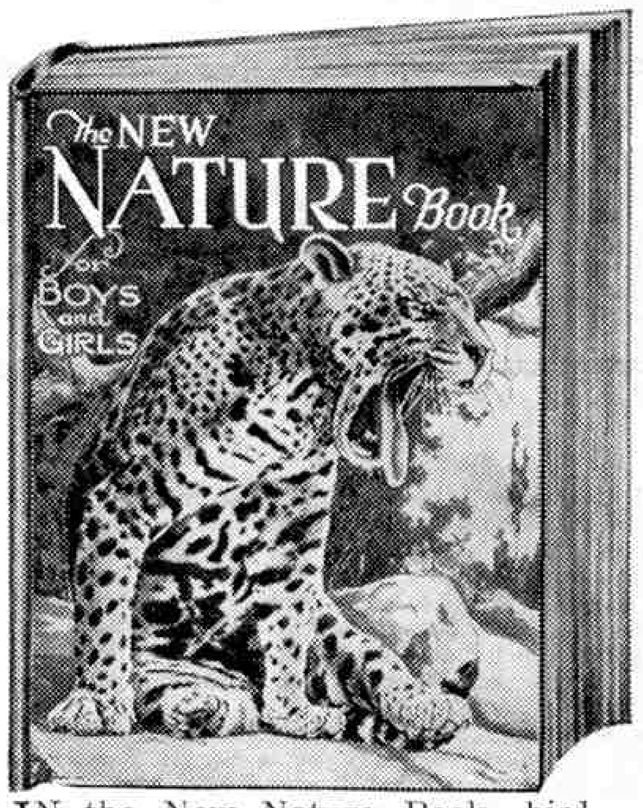


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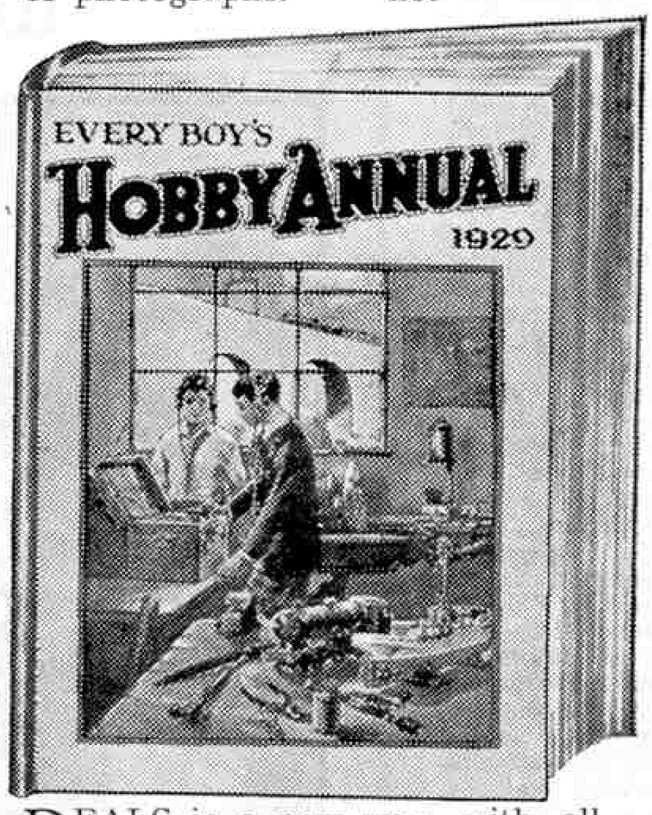
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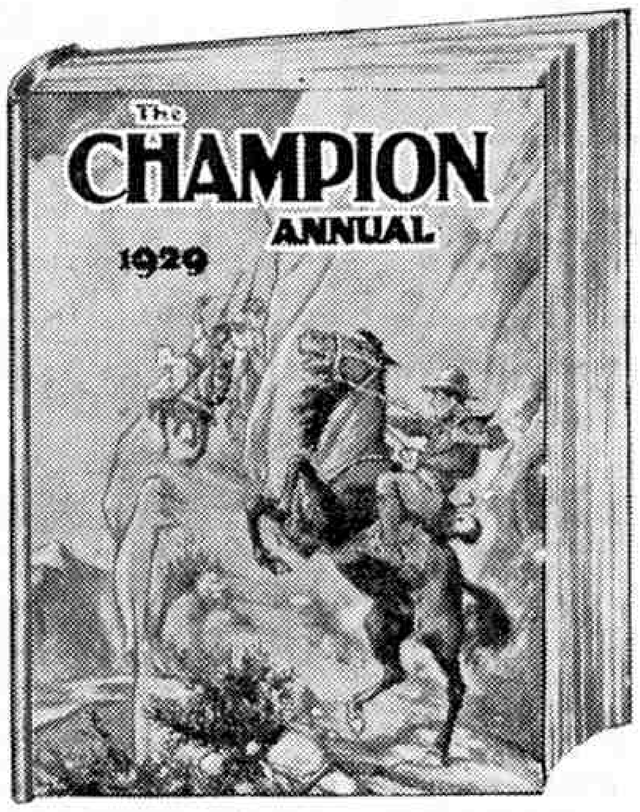
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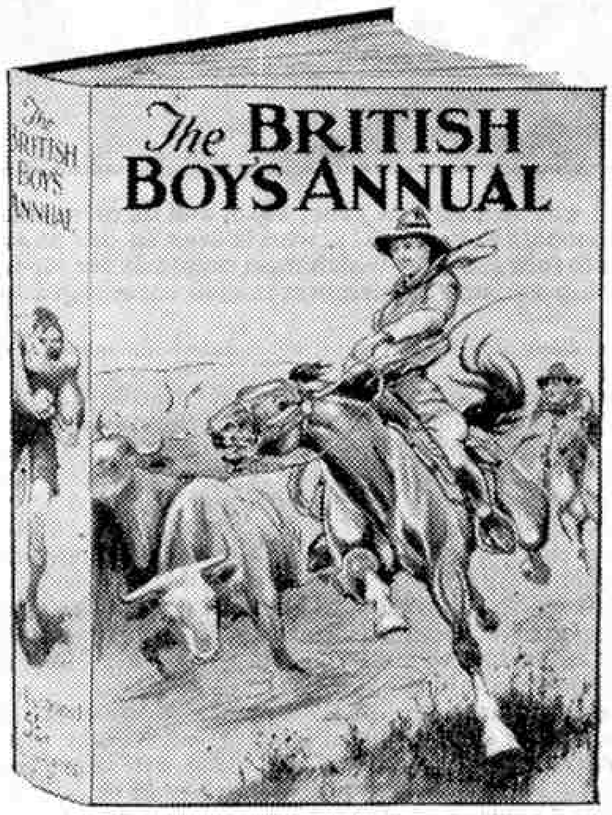
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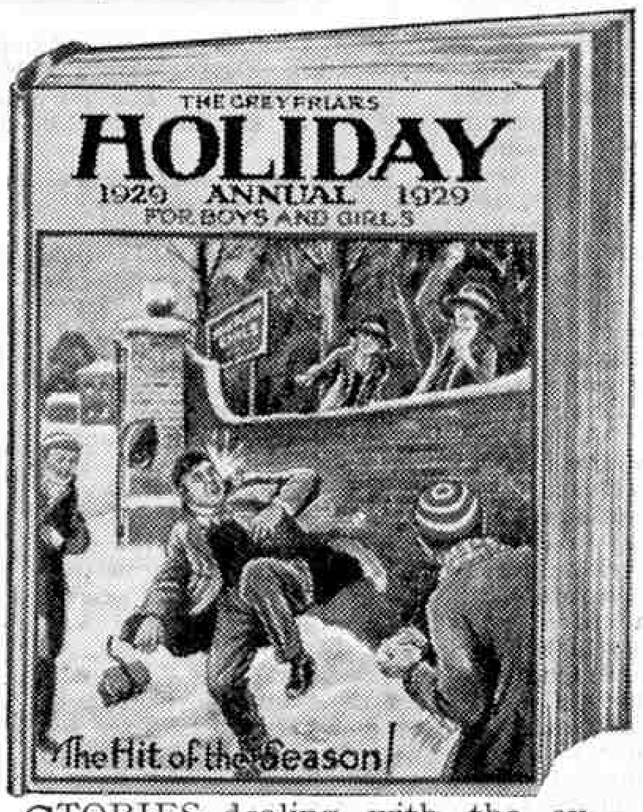
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JOIN THE MECCANO GUILD

A Great Fellowship of Boys



President: Mr. Frank Hornby—Inventor of Meccano

What the Guild Means — The Meccano Guild is an organisation for boys, started at the request of boys, and conducted as far as possible by boys. In joining the Guild a Meccano boy becomes a member of a great brotherhood of world-wide extent, every member of which has promised to observe its three great objects; wherever he happens to be—even in strange countries—he will know he has met a friend whenever he sees the little triangular badge. The Meccano Guild is bringing together Meccano boys all over the world, and is helping them to get the very best out of life.

How it Commenced — More than a million boys in Great Britain derive their greatest indoor pleasure from Meccano. Before the Guild was formed, hundreds of these Meccano boys wrote to us every week. They told us how they wished they could be put into communication with other Meccano boys and how they longed to be able to meet them. They asked if arrangements could be made so that their wishes might become an accomplished fact. We responded to their repeated and increasingly numerous appeals, and as a result the Meccano Guild came into being.

Why You Should Join — Every Meccano boy should be a member of the Meccano Guild. All who have studied its objects must agree that the Guild cannot fail to have a profound effect for good on the lives of its members. It is ready to be of service to each individual member—to help or give advice whenever requested. At the head—guiding and controlling, and taking a personal interest in this great movement—is the President, Mr. Frank Hornby, Inventor of Meccano and Managing Director of Meccano Limited.

The Headquarters of the Meccano Guild are at the Head Offices of Meccano Ltd., Binns Road, Liverpool.

HOW TO BECOME A MEMBER

Membership of the Guild is open to every boy possessing a Meccano Outfit, or Hornby Train Set, who satisfactorily fills in the prescribed application form. The only conditions are that members promise to observe the objects of the Guild and to wear their badges on all possible occasions.

The price of the Guild membership badge is 7d. post free in the United Kingdom, and 1/- post free abroad. A remittance for the necessary amount should be sent along with the form of application. The Guild badge is beautifully enamelled in blue and white and is made for wearing in the lapel of the coat.

In addition to the badge, each member receives a membership certificate, measuring 7" × 9½". This certificate is printed in orange and sepia and is a smaller edition of the large club certificate.

Write to the Secretary of the Meccano Guild, Binns Road, Liverpool, asking for an application form and full particulars. Then fill in the form and return it to Headquarters, when your badge and certificate will be sent you.

Boys living overseas should write to one of the Meccano agents at the following addresses: CANADA: Meccano Ltd., 45, Colborne Street, Toronto. AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W. NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland. SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.



MECCANO CLUBS

Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters. At the present time there are nearly 250 affiliated clubs in various towns and villages in this country and abroad, together with a number not yet affiliated. If the nearest club to you is too far away for you to join, or if you are unable to join for any other reason, consider the possibility of forming a new club in your own district. A special booklet explaining "How to run a Meccano Club" is now ready, and will be sent to any reader (post free) on receipt of 2d. in stamps.

When a Meccano Club has been successfully launched and good progress is being made, affiliation with the Guild is granted. A beautiful club certificate, suitable for framing and hanging in the club room, is presented, and the club becomes entitled to many privileges, including the loan of interesting lectures.

All members of the Guild are eligible for the Merit Medallion, which is awarded to those who display special ability in connection with club work, or in helping the Guild.

THE CORRESPONDENCE CLUB

Members of the Guild are able to join the Correspondence Club, by which they are placed in communication with other Guild members of similar age and interests who live in some other part of the country or abroad.

THE GUILD RECRUITING CAMPAIGN

Every Meccano boy should become a member of the Guild and do his utmost to help to make the objects of the Guild widely known. With this end in view, a Special Medallion is presented to each member of the Guild who obtains three new recruits. As a mark of further merit the medallion is engraved with the name of the recipient and with the words "Special Award" when six more members are recruited, making nine in all. Full particulars of the Recruiting Campaign, together with a supply of application forms, will be sent on request.

THE THREE GREAT OBJECTS OF THE GUILD

(1) **To make every boy's life brighter and happier.**

(2) **To foster clean-mindedness, truthfulness, ambition, and initiative in boys.**

(3) **To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.**

BADGE OF MEMBERSHIP

CLUB LEADER'S BADGE

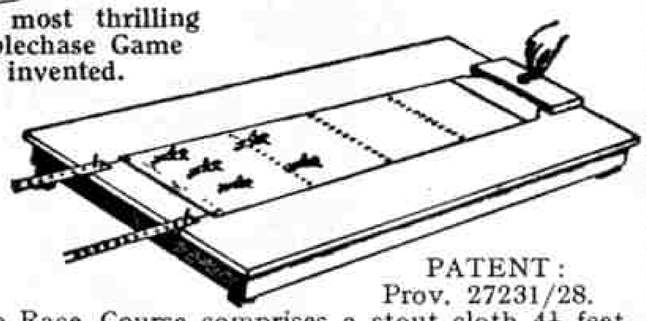


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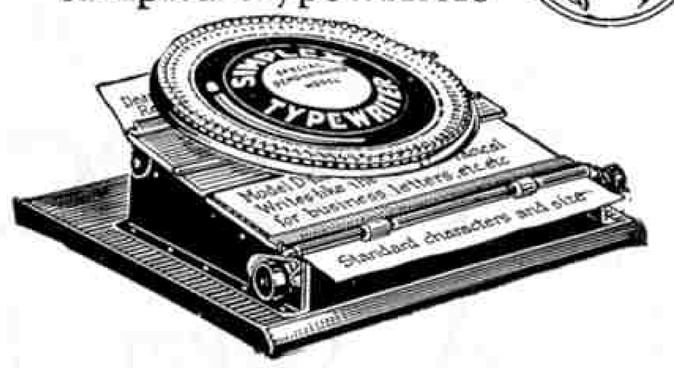
PATENT: Prov. 27231/28.

The Race Course comprises a stout cloth 4½ feet long and 12 inches wide, provided with obstacles or fences, and with spring and clamp ends adjustable for any dining table.
Horses are cast in metal and variously coloured.
MADE IN THREE QUALITIES:—
As above, **7/6**, better Quality, **10/6**
Size 72″ × 18″ **21/–**

We illustrate on this page a small selection from our extensive range of good things for boys. We always carry complete stocks of Meccano, Hornby Trains and Accessories, Hobbies Boats, Lott's Bricks, Daisy Air Guns, etc.

We are sole Birmingham and District Agents for Bassett-Lowke.

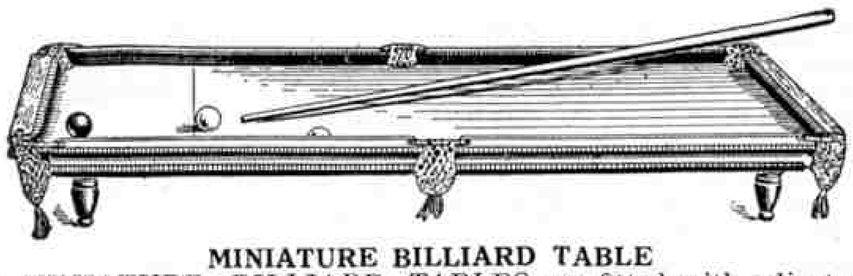
Simplex Typewriters



Each Model writes in sight and each takes any length paper, card or envelope.
Simplex Model E, 36 characters. Takes 5 inch width paper, card or envelope. Simple and practical for the beginner, for school-work, for home or business uses, addressing envelopes, tags, etc. ... ... Price **5/–**, Postage 6d.
Other Models **F 10/–, G 15/–, H 20/–, C 12/6.**

MINIATURE BILLIARD AND BAGATELLE TABLES

Scientific reproduction of full-sized Tables

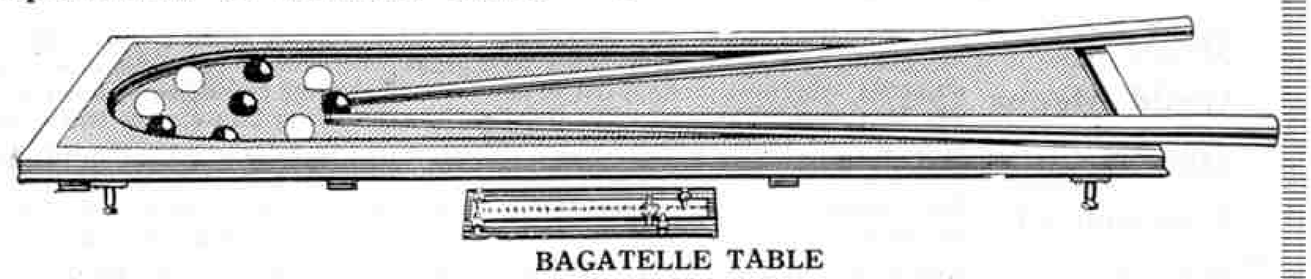


MINIATURE BILLIARD TABLE

MINIATURE BILLIARD TABLES are fitted with adjustable feet to ensure a perfect level. Each table is complete with two cues, marking board, chalk, rules and three composition balls.

Size.	Ball.	Cue.	Price.
3 ft. 6 in.	1¼ in.	3 ft. 3 in.	**32/6**
4 ft.	1¼ in.	3 ft. 5 in.	**39/6**
4 ft. 6 in.	1⅜ in.	3 ft. 7 in.	**55/–**
5 ft.	1⅜ in.	3 ft. 9 in.	**66/6**

Carriage Paid.



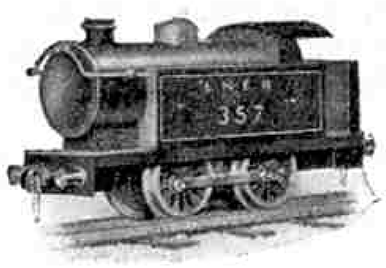
BAGATELLE TABLE

Size 4 ft. 3 in. by 1 ft. 6 in. ... ... Price **42/–** *Carriage Paid.*
Complete with two cues, nine balls, marking board, chalk, rules, etc.

ACCESSORIES

The following additional Accessories for "DAISY" Billiard Tables are also available;
SNOOKER BALLS. Complete set of 17 balls, with triangle:
1¼ in. for 3 ft. 6 in. and 4 ft. tables **19/6**
1⅜ in. for 4 ft. 6 in. and 5 ft. tables **28/–**

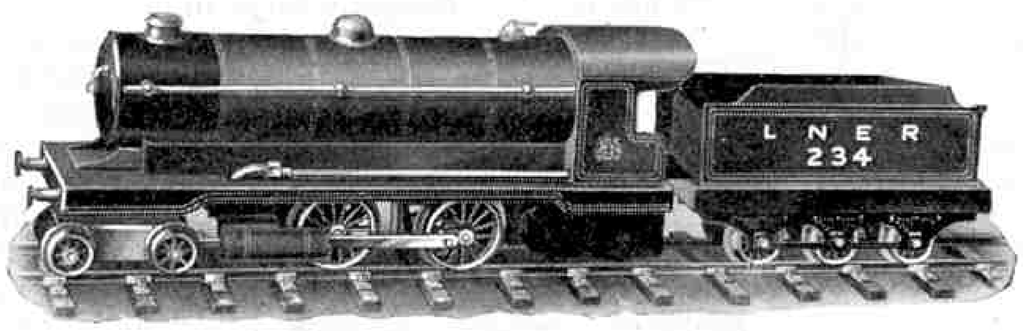
British Locomotives



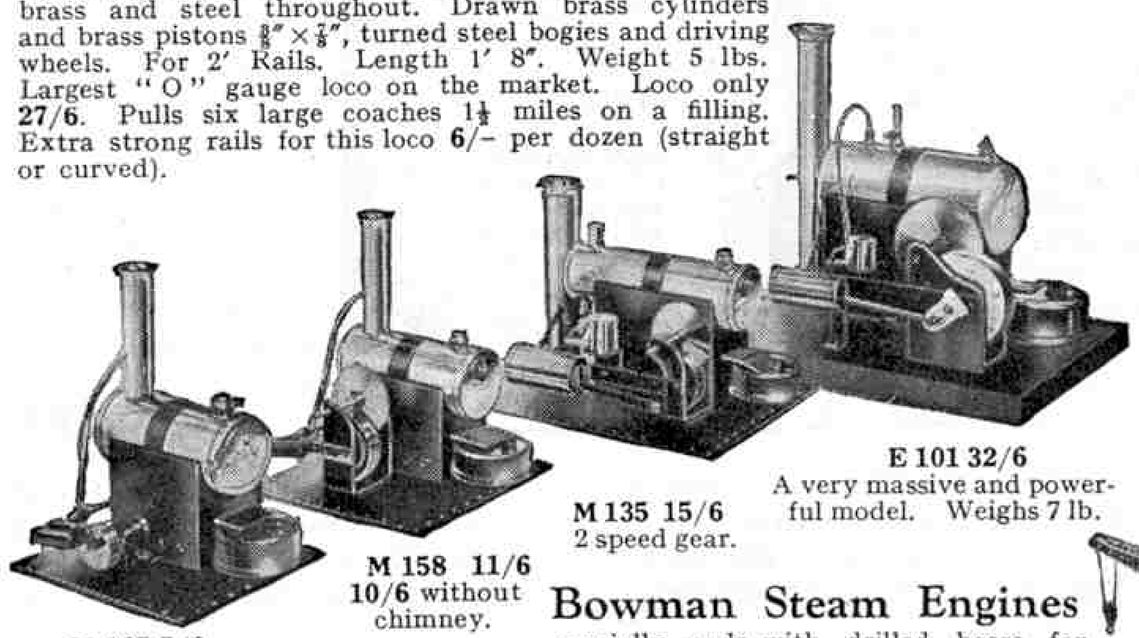
31 E. Reversing Tank Electric Locomotive. With powerful 4-volt motor. Length 8½ ins. L.M.S. or L.N.E.R. colours. Gauge 0–1¼ ins. Fully guaranteed.
Price **25/–** Post Free.

35 E. Reversing Bogie Tank Electric Locomotive. The popular 4–4–0 type, fitted with powerful 4 to 6-volt motor. Length, 10½ ins. Gauge 0–1¼ ins. L.M.S. or L.N.E.R. colours. Price **33/6.** Post Free.

Hornby Electric Rails suitable for these Locos.
Straight, 7/– per doz.
Curved, 8/– per doz.



EXPRESS STEAM LOCO AND TENDER (Mod. 234) 35/– Post Free.
The same size and power as usual **£6** models. Solid brass and steel throughout. Drawn brass cylinders and brass pistons ⅜″ × ⅞″, turned steel bogies and driving wheels. For 2′ Rails. Length 1′ 8″. Weight 5 lbs. Largest "O" gauge loco on the market. Loco only **27/6**. Pulls six large coaches 1⅛ miles on a filling. Extra strong rails for this loco **6/–** per dozen (straight or curved).



M 167 7/6
6/6 without chimney

M 158 11/6
10/6 without chimney

M 135 15/6
2 speed gear.

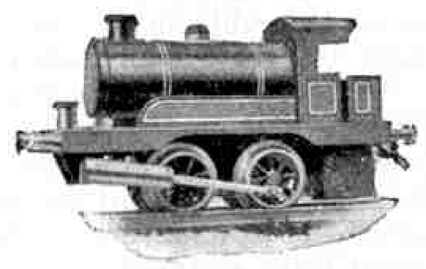
E 101 32/6
A very massive and powerful model. Weighs 7 lb.

Bowman Steam Engines

specially made with drilled bases for building into Meccano models. The most powerful engines in the world at the price. Solid brass and steel throughout. All these models are guaranteed to give satisfaction. Send us your orders at once.

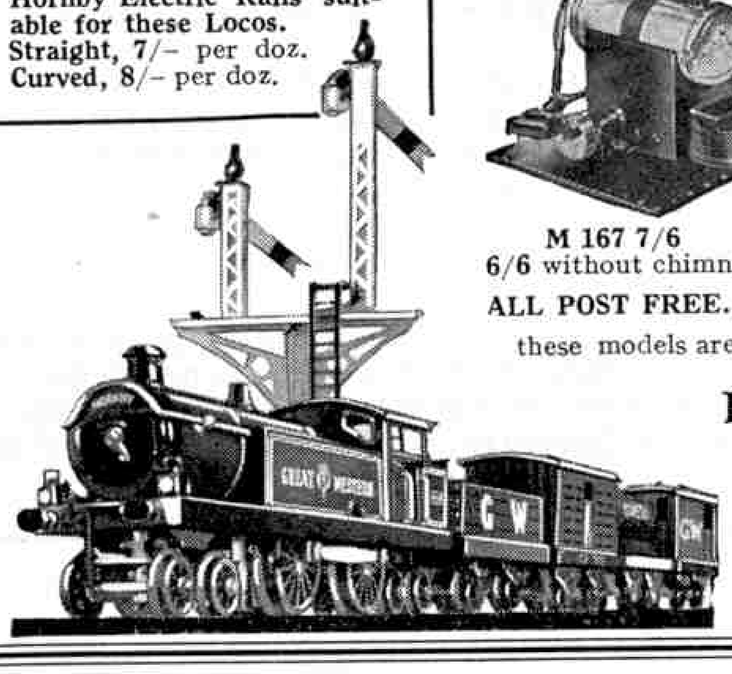
ALL POST FREE.

British Locomotives



25 S. O Gauge Steam Loco. Brass boiler, brass oscillating cylinders, anti-friction pistons, automatic oiler, wind guards. Will steam about 15 minutes with one filling. L.M.S. or L.N.E.R. Colours.
Price **12/6.** Post Free.

30 S. Strong Heavy Steam Loco. O Gauge, brass boiler, brass oscillating cylinders, anti-friction pistons, automatic oiler, wind guards. Will run for half-mile with one filling.
Price **21/–.** Post Free.
Hornby Rails suitable for these Locos.
Straight rails, 4/– per doz.
Curved rails, 4/6 per doz.

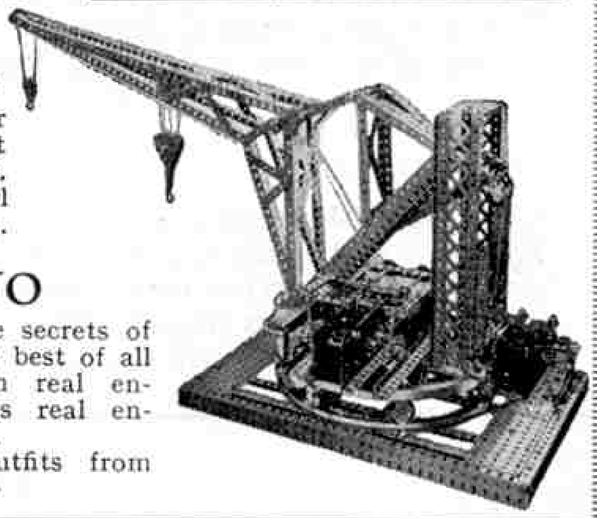


HORNBY TRAINS

Only when you've got a real train like the Hornby can you enjoy the fun of running your own railway system. It's the finest fun in the whole world. Prices of Hornby Trains from **7/6** to **110/–**

MECCANO

Meccano boys learn the secrets of great engineering in the best of all ways—they build with real engineering parts just as real engineers build.
Prices of Meccano Outfits from **3/6** to **380/–**



Send for our 64 page Illustrated Catalogue

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NORTH WESTERN ARCADE, BIRMINGHAM

Prompt Execution of Post Orders.

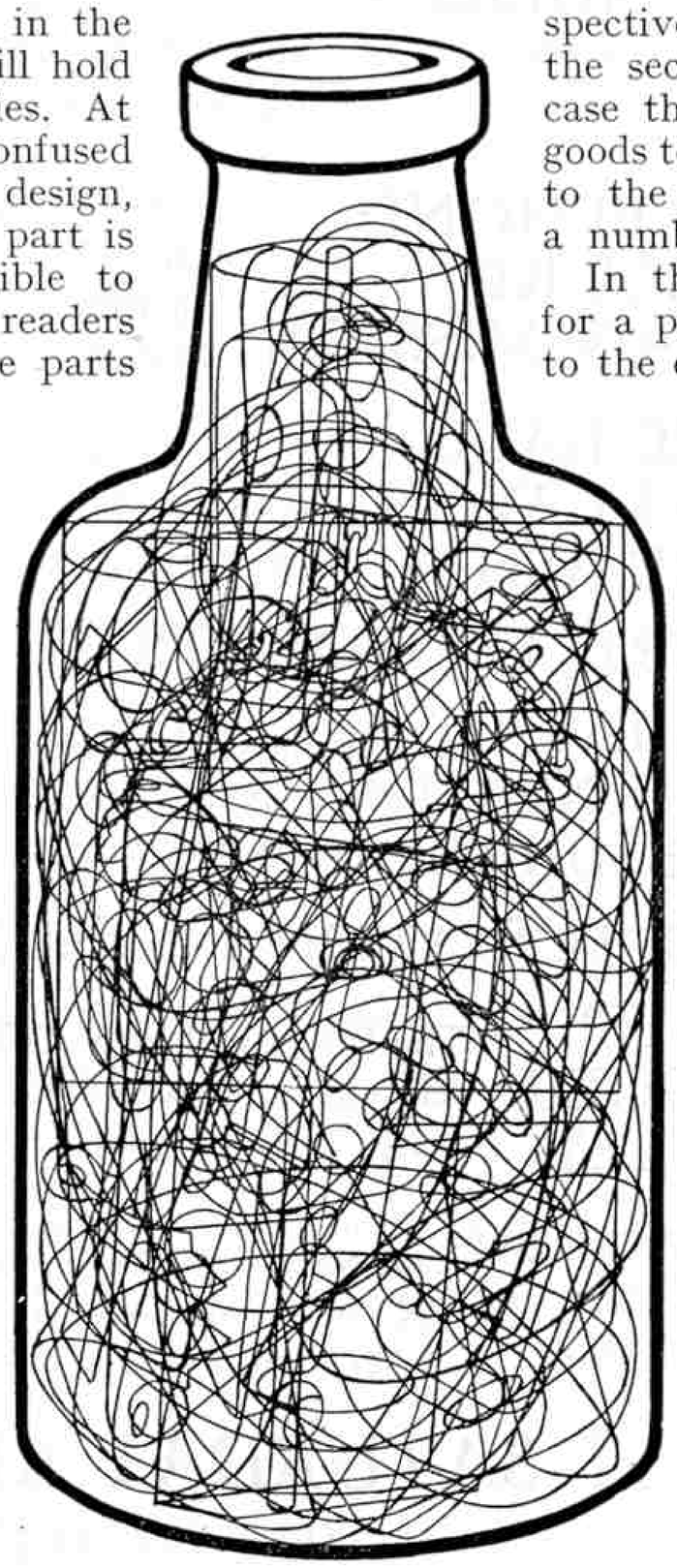
Post Free to "Meccano Magazine" Readers

Competition Page

Bottled Parts—No. 2

A Stiff Test for Sharp-Eyed Readers

The bottle illustrated here is unique in the fact that it is crammed as full as it will hold with standard Meccano parts and accessories. At first sight the whole thing appears to be a confused tangle of lines without any object or design, but as a matter of fact each Meccano part is accurately drawn and as far as possible to scale. The problem that we set our readers this month is to make a list of all the parts that they can find in the bottle.



In order to make the puzzle still more interesting we do not give any indication of the number of parts contained in the bottle, and therefore each competitor must scrutinise the drawing with the most minute care and identify the parts one by one until he can find no more. It will be found that a certain number of parts are quite obvious, but when these have been disposed of the task of identifying the remainder becomes more difficult with each one; in fact we believe that the task of recognising the last half-dozen or so will prove a real teaser! So far as we know there is no quick road to success in a contest of this nature and it is necessary to keep pegging away until all the drawing's secrets are revealed.

To the reader who succeeds in giving the most accurate list of the parts we will present Meccano Parts or Hornby Railway goods to the value of £1-1s. Similar prizes to the value of 15/- and 10/6 respectively will be awarded to the senders of the second-best and third-best lists. In each case the winner will be allowed to select the goods to be sent to him as his prize. In addition to the above-mentioned prizes, there will be a number of consolation prizes.

In the event of two or more entries tying for a prize it is our custom to give the award to the entry that is the neatest and most carefully prepared, or in which some specially ingenious or novel presentation is displayed.

A surprising number of competitors sent in complete lists in the first competition. Our artist believes that this time his effort will baffle even the most keen-sighted Meccano enthusiasts.

We take this opportunity of again reminding competitors that entries must be written on one side of the paper only, and that the competitor's name and address and age must appear on the back of every sheet of paper used. We have emphasised this fact on many previous occasions, but scarcely a month passes without a number of entries—some of them in the prize-winning class—having to be disqualified because they do not contain the slightest indication of the name or address of the sender.

Entries for this competition should be addressed "Bottled Parts No. 2, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office by 31st December. Overseas closing date 31st March.

Christmas Card Design Competition

Every year we receive large numbers of Christmas cards from readers all over the world conveying to us their sincere good wishes. A large proportion of these cards are the production of the sender and many of them show a considerable amount of artistic ability frequently combined with a good deal of ingenuity. There are few things more fascinating than preparing one's own Christmas cards, and to encourage more of our readers to do this we announce a competition for "THE BEST DESIGN FOR A CHRISTMAS CARD."

We make no restrictions of any kind in regard to the shape, style or size of the card, and competitors therefore have full scope for their inventiveness.

The design may be painted or done in crayon or alternatively may be black and white drawings. Competitors may send in more than one entry if they desire but each must bear clearly marked the name and address and age of the entrant. One further point to be emphasised is that no entries can be returned unless they are accompanied by a stamped addressed envelope of suitable size.

The contest will be divided into two classes—A for those of 16 and over and B for those under 16. Drawing or Painting materials or Meccano Products if preferred, to be selected by the winners to the value of £1/1/- and 10/6 respectively, will be awarded to the entries placed first and second in each class.

Closing date 31st December—Overseas, 30th April, 1929.

A Jokes and Riddles Contest

At Christmas every one indulges to some extent in an abnormal outbreak of jokes and riddles, and we feel sure that many original ones will be trotted out round the Christmas dinner tables of our readers throughout the world. It is always a pity for good things to be wasted and for this reason we announce a competition for "THE BEST JOKE AND THE BEST THREE RIDDLES." A selection from the winning entries will be published in the "*M.M.*" for the benefit of all readers.

Competitors should note that each entry must consist only of one joke and three riddles. Those competitors who find it difficult to make a selection from their store may submit a second or even a third entry if they desire. Once more we ask competitors to be careful to attach their name and address.

In this contest there will be one class only, irrespective of age. Prizes of £1/1/-, 15/-, 10/6 and 7/6 respectively will be awarded for the four best entries and in addition there will be a number of consolation prizes.

Entries should be marked "Jokes Contest" and should reach this office by 31st December. The Overseas closing date is 30th April, 1929.

Would you like to see:—?

WONDERS OF THE AIR The World's fastest fighting machines fully equipped, Control Car of an Airship and other secrets will be revealed for the first time.

TELEPHONE PICTURE TRANSMISSION On the DAILY MAIL stand will be seen wireless Photo Transmission Apparatus. The fastest Morse machine, a linotype and other machines.

THE BALL THAT WON THE ASHES Famous sports trophies including Bats used by W. H. Ponsford and other heroes of the Cricket Field.

WIRELESS ROBOTS THAT SPEAK

RAILWAY ENGINES *of the* EMPIRE Displayed by the Empire Marketing Board these engines will be shown with a background of attractive Empire products.

MODEL STATION AND ELECTRIC TRAIN

BOYS' BIGGER BISLEY The Bisley will be a really live affair. Specially selected guns, well lighted targets and valuable prizes. No boy must miss it.

TAKE BUS TUBE OR TRAM

The new hall is easy to reach, by Bus alight at Army and Navy Stores, Victoria Street.

By Underground alight at Victoria or St. James Park.

By Tram alight at Westminster Bridge.

✲ *OPENS FIRST SATURDAY AFTER XMAS* ✲

(ELEVEN TO TEN DAILY)

The New Schoolboys' Own Exhibition

For Youth of Empire

Saturday, Dec. 29th 1928, to Saturday, Jan. 5th 1929

AT THE

NEW HORTICULTURAL HALL, Vincent Square, Westminster.

Binding the "M.M."

In response to many requests, we have arranged for binding cases for back numbers of the Magazine to be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases supplied in two sizes (1) for six copies, price 3/6 and (2) for twelve copies, price 5/3 post free in each case. The binding cases are supplied in what is known as " Quarter Basil, full cloth "—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown below. The case is tastefully embossed in gold with the name " Meccano Magazine," and on the back is the name and volume number.



Binding Six or Twelve Copies

These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool, carriage paid.

Back Numbers of *"Meccano Magazine"*

All " Meccano Magazines " prior to December, 1923, are out of print. Each of the 1924 issues, with the exception of January, February and September, are in stock. Only the May, June, July, October and November, 1925, issues are available. All the 1926, 1927 and 1928 issues are in stock, with the exception of January, February and September, 1926, and January and March, 1927.

Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues, 1925 and 1926, and all the issues of 1927 and 1928, 8d.

We can supply a limited number of bound volumes of the "*M.M.*" at the following prices (carriage paid). January-December 1924, in one volume, 10/–. July-December 1926, price 8/3. January-June 1927, 9/6. July-December 1927, 9/6.

The Engine Room Ghost

A big ship was undergoing repairs. Her vital parts, engines and boilers were all adrift while the shore engineers attended to the various sections.

Even the dynamo was dismantled, leaving the ship without electric lights. Lamps and candles lighted the workmen at their tasks. In the semi-darkness of the engine-room moved a strange figure. It was clad in overalls and hood, and carried an electric torch in one hand, in the other a hammer. The form looked ghostly and behaved strangely. There was a pause in the clang of hammers.

A hush fell upon the workmen as the figure moved here and there, flashing the torch and striking with the hammer the metal illuminated. Into the stokehold went the ghost, tapping resounding blows as it passed. There it actually climbed into one of the fireless furnaces. Out again it came and visited the tunnel through which passage ran the propeller shaft. At the end where is situated the most vital part of a ship the ghost lingered awhile to examine the stern-tube " gland," packed with many turns of packing between tube and shaft to ensure keeping out the sea.

Then the hooded ghost made for the engineers' quarters and disappeared into one of the rooms. Presently there emerged a spruce, smart-looking man carrying a small attache case. He was the ghost.

The Board of Trade official had made a survey and had passed the engines and boilers A.1, at Lloyd's.—"*Liverpool Echo.*"

Meccano to the Rescue!

There is a deeper side to hobbies than mere amusement. Not long ago a young schoolboy's reason was saved by a doctor telling the boy's mother to go quickly and buy him the most expensive Meccano set she could afford. When it arrived it so occupied and delighted the boy that he soon forgot his imaginary sufferings and recovered his health.—"*Daily Express.*"

Roundabout Competition Results

Readers will remember that the " Roundabout " Contest, which was announced first in the August 1927 "*M.M.*," was so called because competitors were requested to complete a model roundabout built by one of our Dutch readers. A photograph of the half-finished model was reproduced, and it was left to the competitors to exercise their ingenuity in devising rotating cars, leaping horses, or other paraphernalia of the kind that is to be found on any typical roundabout.

Many novel suggestions were put forward by readers as to how the model should be completed, and after careful consideration it was decided to award a prize of Meccano products to the value of half-a-guinea to W. H. Ufton, of Sewell's Walk, Lincoln. In addition each of the following competitors will receive a special Certificate of Merit and a copy of the Standard Mechanisms Manual: J. Singleton, Linthwaite, near Huddersfield; J. Laidlow, Glasgow; R. S. Weaver, Prestwich, Manchester; A. F. Williams, Newport; S. Hart, Wolverhampton; K. Randall, Holloway, London, N.; R. G. Branstone, Portsmouth.

OUR MAIL BAG



In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

C. Gilmore (Edinburgh).—You and your chum evidently are having some splendid times with your Hornby railway. We quite agree that although nuts and bolts make very fine loads for the trucks they are a little troublesome if a truck gets upset! Your speed tests were interesting and we suggest that you try similar tests for haulage power and let us know the results.

L. B. Cross (Pretoria, S.A.).—We are pleased to hear that you have done well in your examinations—this is splendid news! Although the weather here has been quite good for the last month or two it was bad earlier in the year. We are becoming quite resigned to bad weather now, and are somewhat in the position of the old lady who said she had " enjoyed bad health for years."

J. G. Low (Caithness).—We are glad that our Editorial note enabled you and your friend to settle your argument about those " curious critters "—sea serpents.

W. P. Hills (Penzance).—Thanks for your appreciation. We have received a surprising number of letters expressing appreciation of these articles [" Hunting Red Deer with a Camera " and " King of the Twilight World,"] and shall endeavour to publish further Nature articles from time to time.

G. Milne (Brisbane, Queensland).—We were exceedingly interested to hear that on several occasions when arguments have cropped up among the employees at your office you have been able to settle the point at issue by reference to the "*M.M.*" We make the greatest efforts to ensure that every statement that appears in the "*M.M.*" is accurate and it is very encouraging to hear of our articles proving useful in this manner.

R. Turner (Northam).—" This boy broke the spring of his loco several months ago and took the loco to one of the jewellers of this town. The latter commended its stability and said that the loco was one of the finest pieces of workmanship in toys he had seen." The jeweller, Ronald, was quick to realise the secret of the success of Hornby engines—the best quality of material combined with the most skilful workmanship.

Mr. E. Worthington (Vancouver, B.C.).—Your account of the national playground of Vancouver is extremely interesting. Stanley Park must indeed be a wonderful place and we certainly think you are fortunate in being able to visit it so easily. As soon as space in the "*M.M.*" allows we hope to make use of your letter for the benefit of other readers.

S. Turner (Dublin).—Your congratulations on " The Story of the Motor car " articles are very welcome and we are particularly glad to hear that they have been helpful to you in your work. Many prominent people in the motor car world have written to congratulate us upon the simplicity of the descriptions of mechanisms.

P. Woodman (Teneriffe, Canary Islands).—" My "*M.M.*" was two days late and I was getting angry, but my temper stopped there when it came. It is a wonderful mag. If people say anything to me about the "*M.M.*" I just reply, 'Read it.' They read it—and another reader is formed!" This, Philip, sounds to us like real enthusiasm and cheers us wonderfully.

H. Perry (Wednesbury).—The collecting of names and numbers of railway locomotives is quite a good hobby and anybody who suggests that it is childlike does not understand the matter. We congratulate you on your success in the Trinity College of Music Examination.

C. Abbey (Swansea).—Your uncle is certainly a little bit unscrupulous in annexing your "*M.M.*," but after all it shows that he knows a good thing when he sees it! By all means enter for some of the competitions. Even if you do not win a prize for a while you will have a lot of fun in preparing your entries.

R. Abrahams (Balham, London).—We think that the Hornby Railway Company pages now running in the Magazine will meet your requirements as regards model railway matters. Send along any suggestions that may occur to you and if possible a photograph and description of your own railway.

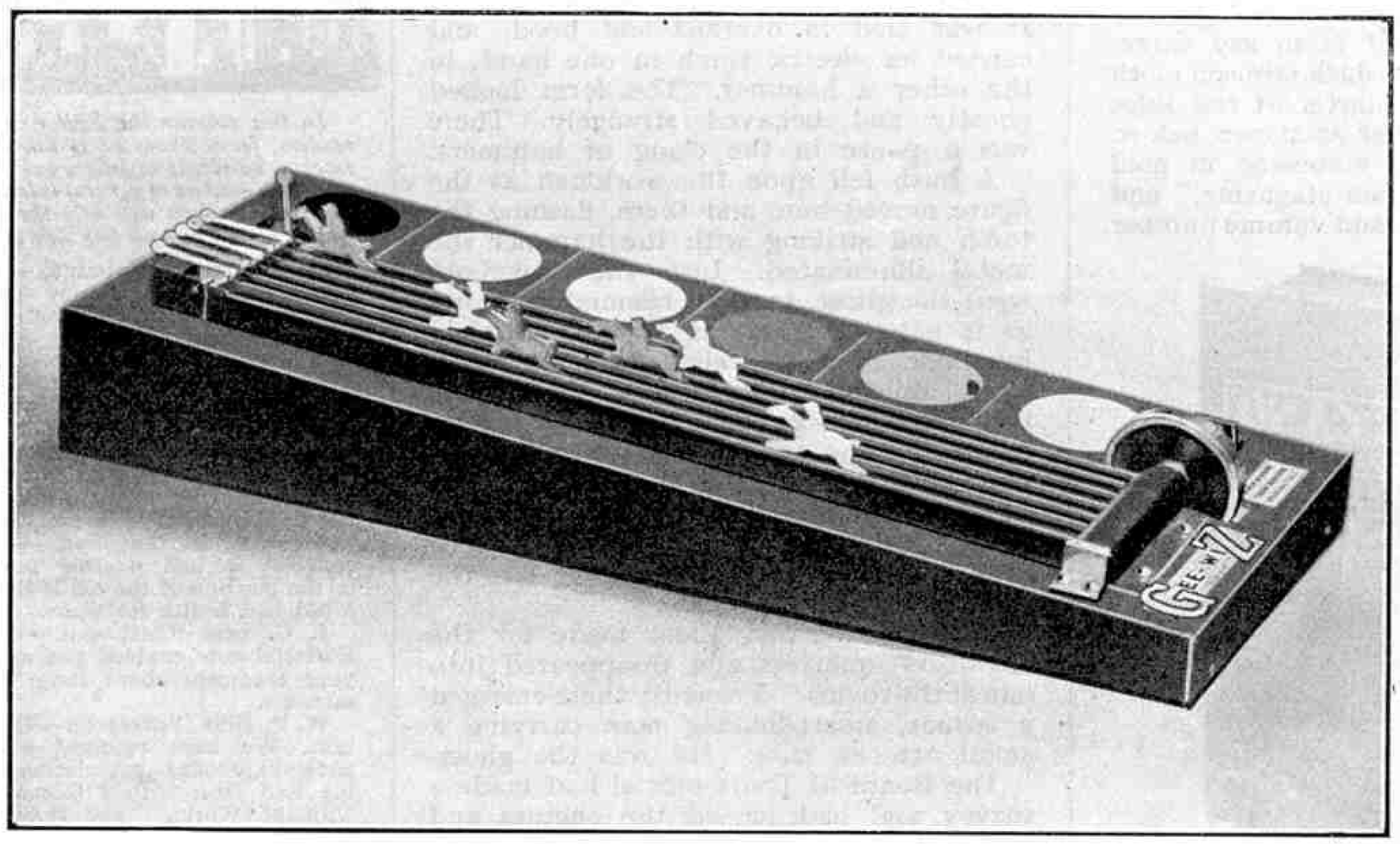
P. B. Drenning (London, S.W.7).—Apparently your suggestion is for a page of the "*M.M.*" to be devoted to a sort of monthly debate among readers. We are afraid, however, that with our 100,000 readers a debate on any one topic would go on for ever!

THE GAME FOR FURIOUS FUN

GEE-WIZ

TRADE MARK

CREATING ALL THE BREATHLESS EXCITEMENT OF A REAL HORSE RACE



Price 7'6 Each

Size 15" × 5½"

HORSES OR GREY-HOUNDS

STOCKED BY ALL LEADING STORES AND TOY SHOPS

If difficulty is experienced in obtaining, send 7/6 to the Manufacturers, Paton, Calvert & Co. Ltd., Binns Road, Old Swan, Liverpool, who will have a model despatched to you from the nearest dealer.

Boys! It's great Sport to throw a Boomerang!

AND DON'T MISS IT

VERY few white men have ever mastered the Australian aborigines' native weapon—the wonderful Boomerang, which circles round and kills its prey, or else returns to the feet of the thrower.

But here is the same thing in miniature—the "SPRINGO"—and every boy can master it in a few minutes. A little practice brings amazing skill. Challenge your friends to "21 up"—each giving away a point if the boomerang fails to return.

Three Boomerangs, with Projector and full instructions, in "vest-pocket" box, size 3¼" × 2¾" × ½".

From Newsagents and Stationers.

6d. per set. Or write direct.

6d. per set—postage 2d. extra.

2 sets—**1**/- post free.

3 sets—**1**/**4** post free.

Write for yours to-day. Get two friends to join you and order three sets.



SPRINGO BOOMERANG

MECHANICALLY PROPELLED

TRADE MARK

Performs the same as the actual full size boomerang as used by the Australian blacks

GREGORY & McBEATH, 19–20, Rupert St., London, E.1

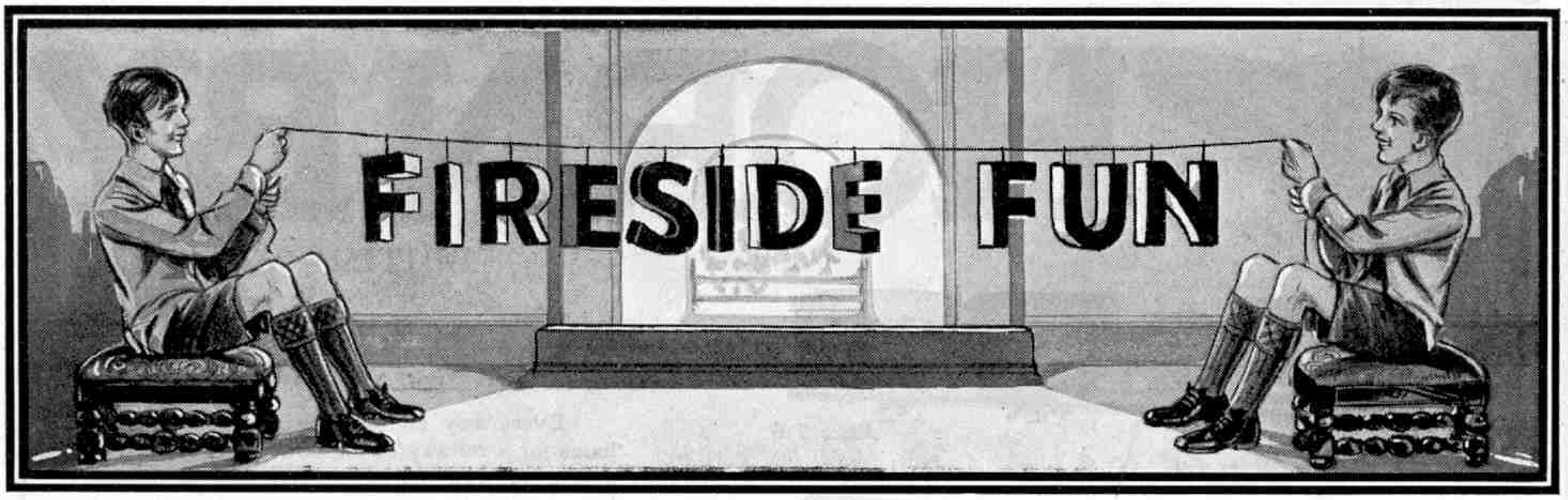


All Meccano Outfits and Hornby Trains are stocked by Kendal Milne of Manchester

Order by post if you cannot call. We pay carriage and guarantee satisfaction

Kendal Milne & Co.

DEANSGATE MANCHESTER



LATE AGAIN

Professor (to boy entering class late for the fourth morning in succession):
"When were you born?"
Boy: "On the second of April."
Professor: "Late again."

* * * *

Mother: "John! forgive your brother before you go to sleep. You might die in the night."
John (reluctantly): "I'll forgive him to-night, then, but if I don't die he'd better look out in the morning."

* * * *

The explorer was speaking. "Yes, it was a narrow escape," he said.
"Oh, do tell us," said his audience.
"Once," he related, "I was cornered by a Polar bear and I hadn't a bullet to protect myself with. Tears came to my eyes as I thought of home."
"What then?"
"Why the tears froze hard as rocks, and ramming them in my gun, I fired and—"
"And then?"
"The flame melted the tears into a squirt of water which again froze into an icy dagger as it went through the cold air—"
"Yes, yes?"
"It entered the bear's head, melted, and the bear died from water on the brain!"

* * * *

Tom: "Papa, what makes you so bald?"
Papa: "Oh, that's because my mother used to pat me on the head so much for being a good boy."

* * * *

"Willie," said the father irritably, "your mouth's open."
"I know," replied Willie. "I opened it myself."

* * * *

Boy (on seaside holiday): "Where is the bathroom, mother?"
Mother: "There isn't one here."
Boy: "Oh, so it's going to be a real holiday!"

* * * *

Patron: "Here's a piece of rubber tyre in my stew."
Waiter: "There's no doubt about it, sir—the motor's displacing the horse everywhere."

* * * *

HOW CARELESS!



Circus Proprietor (to lion tamer): "What do you mean by goin' off to dinner and leavin' the cage unfastened? Why, anybody might 'ave nipped in and taken the lion!"

* * * *

"Young man," said an inquisitive old lady to a tram conductor, "If I put my foot on that rail shall I receive an electric shock?"
"No, Mum!" he replied, "unless you place your other foot on the overhead wire."

OBVIOUSLY

"Mabel dear," said mother sadly, "every time you are a bad girl you give me another grey hair."
"Gracious!" exclaimed the little girl, "Look at poor Grandpa. You must have given him a time when you were my age."

* * * *

Teacher (during history lesson): "What races have dominated England since the invasion of the Romans?"
Small Boy: "Please Miss, The Derby and the Grand National."

* * * *

MOTOR TERMS ILLUSTRATED



AN OPEN THROTTLE
Courtesy of "The Ford Times"

* * * *

Mabel was on a visit to her aunt and grandmother.
"Grannie," she said, after her aunt had left, "how old is Aunt Dora?"
"I couldn't tell you, dear, without looking up the family Bible."
"Goodness," gasped the child, "is she old enough to be mentioned there?"

* * * *

"Now, look here, Dorothy," said her father sternly, "your mother tells me you've been naughty all day long. The next time you throw mud at your sister's clean dress you'll go to bed without your supper."
"The next time I throw mud at Doris," said the child, "I'll wait till after supper."

* * * *

Young Cyril had been asked out to tea. He remarked that he was afraid it would be his last visit, because he thought they were going to move.
"But what makes you so sure your mother is going to move?" asked his hostess. "She hasn't mentioned the matter to me."
"Ah," returned Cyril, "but, you see, I scratched the banister several times yesterday and mother never said anything."

JUST FOR VARIETY

Tram Conductor (to lady who has just tendered two farthings and a halfpenny stamp for a penny fare): "Next time you come, ma'am, just fetch a few jam jars!"

* * * *

Among the advertisements in a local paper there recently appeared the following:—
"As the gentleman who found a purse with money in the High Street was recognised, he is requested to forward it to the address of the loser."
A few days afterwards the reply was inserted:—
"The 'recognised' gentleman who picked up a purse in the High Street requests the loser to call at his house."

* * * *

Boarder: "What's for breakfast? I hope it is not ham and eggs again."
Maid: "No Sir, not ham and eggs this morning."
Boarder: "Thank goodness! What is it?"
Maid: "Only ham."

* * * *

A Scottish dentist had to summon several of his customers for non-payment of their bills. He appeared in court and gave evidence against them. One of the culprits admitted in examination that the teeth supplied him were a fine fit, and excellent in every respect.
"Yes," shouted out the dentist across the court, "and when I wrote asking you to pay your bill you came up to my surgery and gnashed at me with my own teeth!"

* * * *

The teacher had been giving the class a little talk on "Honesty."
"Now," he said to one of the boys, "If you found a shilling in the playground, would you keep it?"
"No, Sir," was the answer.
"Excellent," replied the teacher. "What would you do with it?"
"I'd spend it," said the boy, hastily retiring behind the lid of his desk.

* * * *

Scene: A children's Hospital Ward.
1st Little Boy: "Are you Medical or Surgical?"
2nd Little Boy (puzzled): "I don't know."
1st Little Boy: "Well, were you ill when you came in, or did they make you ill after?"

* * * *

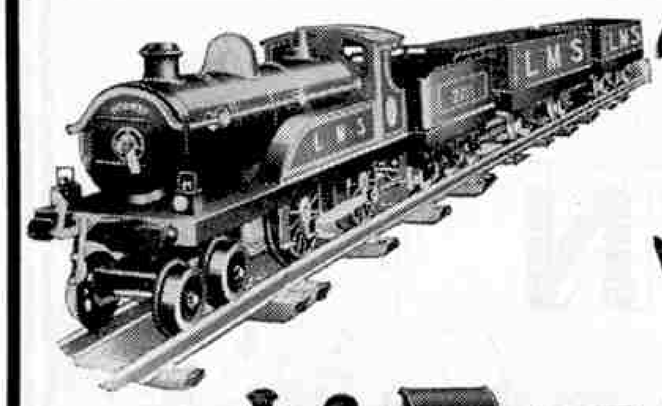
QUITE SO!



Tourist (to Irishman in porch of church): "Why is the bell ringing, my man?"
Irishman: "'Cause I'm pullin' the rope."

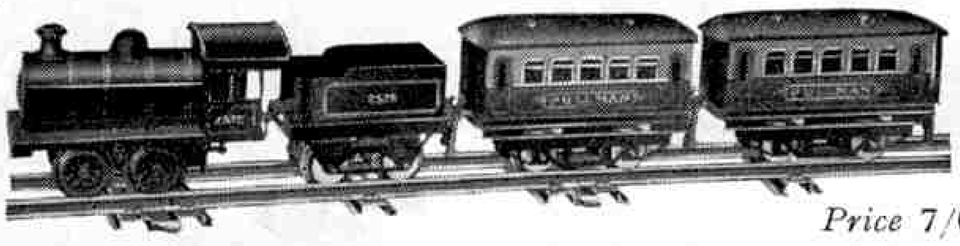
* * * *

American: "Do you know my big brother Bill was so strong he used to go into the woods every morning and pull up a tree by the roots."
Scotsman: "That's nothing! My big brother Jock used to go down to the river, jump into his rowing boat, and pull up the river."



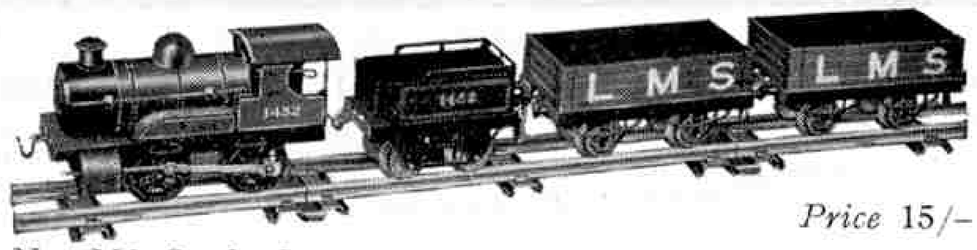
HORNBY

BRITISH MADE



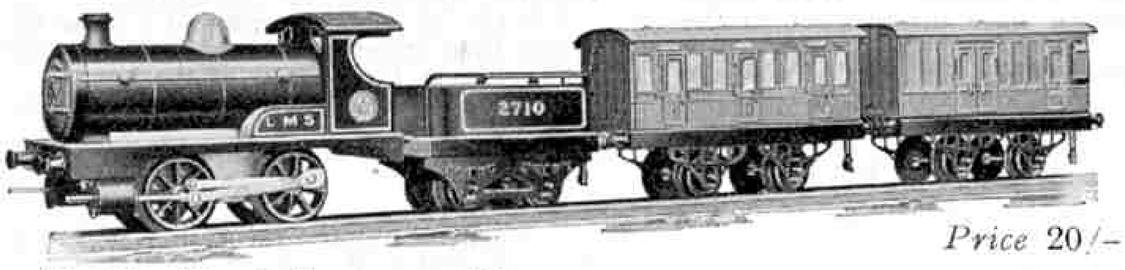
Price 7/6

No. M1 Passenger Set.



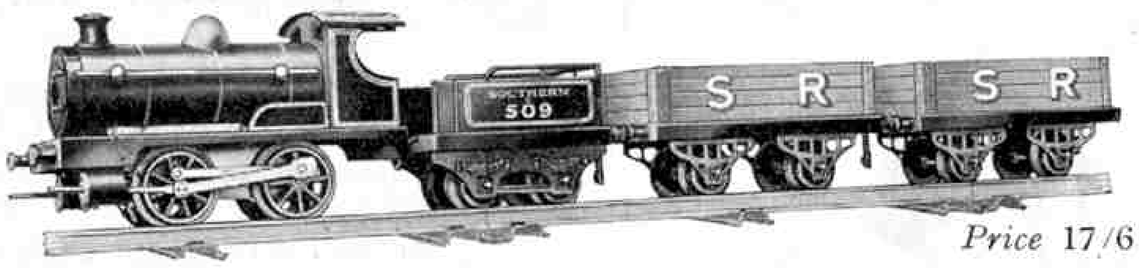
Price 15/-

No. M3 Goods Set.



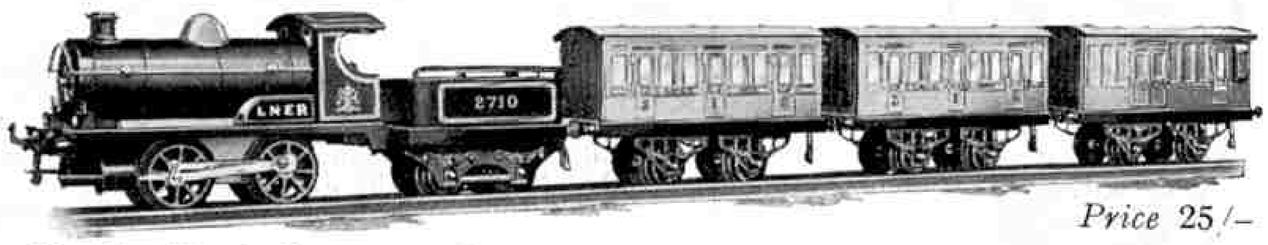
Price 20/-

Hornby No. 0 Passenger Set.



Price 17/6

Hornby No. 0 Goods Set.



Price 25/-

Hornby No. 1 Passenger Set.

Run your own Railway!

Every boy is fascinated by railways and longs for a railway of his own. But it must be a real railway, correctly laid out with main line, branch lines and sidings, stations, tunnels and bridges, and fully equipped with points, signals, etc. A railway of this kind is easily built from the component parts of the Hornby Train System and is exact in every detail. Almost every operation employed in modern railway practice can be duplicated. Passenger and freight trains may be run to timetables and shunting operations realistically carried out in miniature.

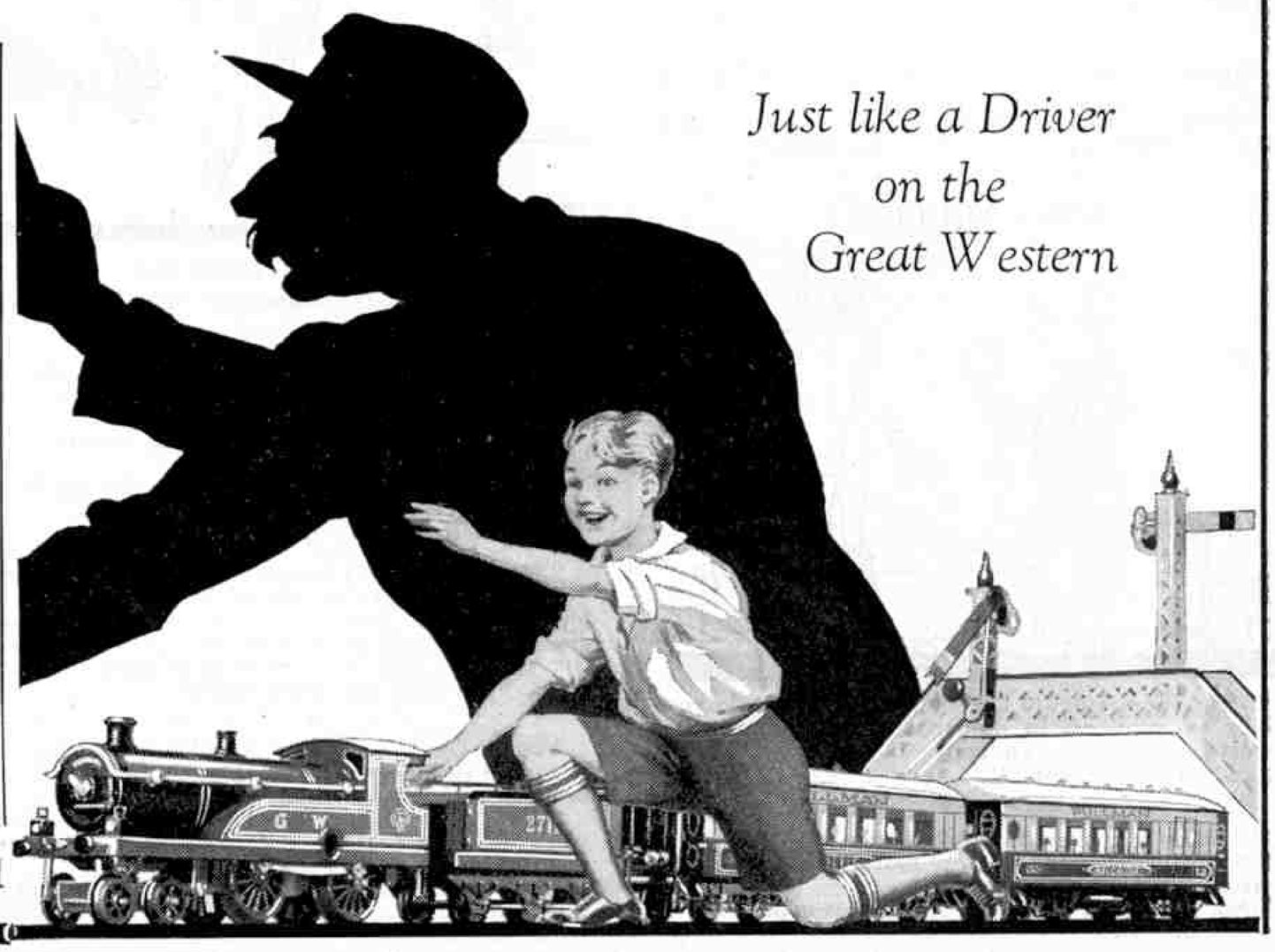
The splendid fun of running a Hornby railway is real and lasting because of the exceptional strength and reliable mechanism of the Hornby Locomotives, the realistic Hornby Rolling Stock, and the wide range of Hornby Accessories—all built in perfect proportion and all beautifully finished.

Important alterations have been made in the contents of several Hornby Train Sets this year. In some cases new rolling stock has been added, while in others replacements of rolling stock have been effected in order to give a more realistic appearance to the sets. These additions do not increase the prices of the train sets concerned. In fact, No. 0 Passenger Set is now reduced from 22/6 to 20/-.

HORNBY TRAIN PRICES

Clockwork Train Sets

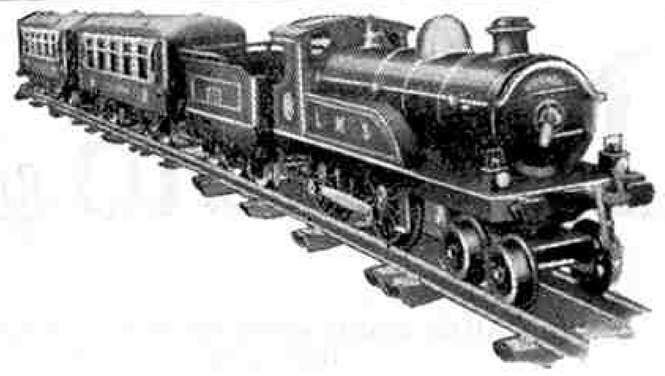
No.	M 1 Passenger Set	7/6
„	M 2 „ „	9/-
„	M 3 Goods Set	15/-
Hornby No.	0 Goods Set	17/6
„ „	0 Passenger Set	20/-
„ „	1 Goods Set	20/-
„ „	1 „ „ fitted for Hornby Control	23/6
„ „	1 Passenger Set	25/-
„ „	1 „ „ fitted for Hornby Control	28/6
„ „	2 Goods Set	32/6
„ „	2 „ „ fitted for Hornby Control	37/6
„ „	2 Pullman Set	50/-
„ „	2 „ „ fitted for Hornby Control	55/-
„ „	1 Tank Goods Set	22/6
„ „	1 „ „ fitted for Hornby Control	26/-
„ „	2 Tank Goods Set	37/6
„ „	2 „ „ fitted for Hornby Control	42/6
„ „	2 Tank Passenger Set	40/-
„ „	2 „ „ „ fitted for Hornby Control	45/-



Meccano Ltd. Old Swan Liverpool

TRAINS

FULLY GUARANTEED



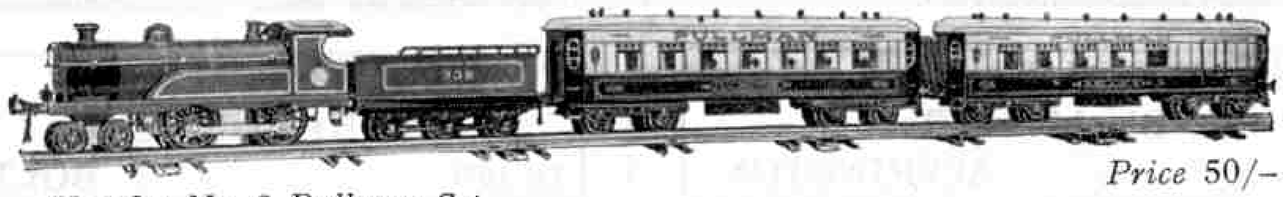
Completeness of Hornby System

From the day of their introduction Hornby Trains have always represented the latest model railway practice. Designs are continually being improved and new items added so that the system is complete in every detail. Hornby Locomotives—clockwork and electric—are splendidly built with strong and reliable mechanism. They are beautifully enamelled in the correct colours of the L.N.E., L.M.S., G.W. and Southern Railways. Hornby Rolling Stock includes every type in use on the big railways—Wagons, Trucks, Vans, Passenger Coaches and Pullman Cars. There is also a complete range of Accessories to add further realism to your railway—Stations, Engine-sheds, Signals, Bridges, Tunnels, Level-crossings, Viaducts, Telegraph Poles—and many others.

Finally, there is the new Hornby Control System that enables every model railway enthusiast to control his trains, signals, and points by operating levers in the Signal Cabin, just as a signalman does on a real railway.

Every hour spent in playing with a Hornby Railway is brimful of thrills and enjoyment. You will be proud of your Hornby Railway when you have tested it and discovered its splendid qualities.

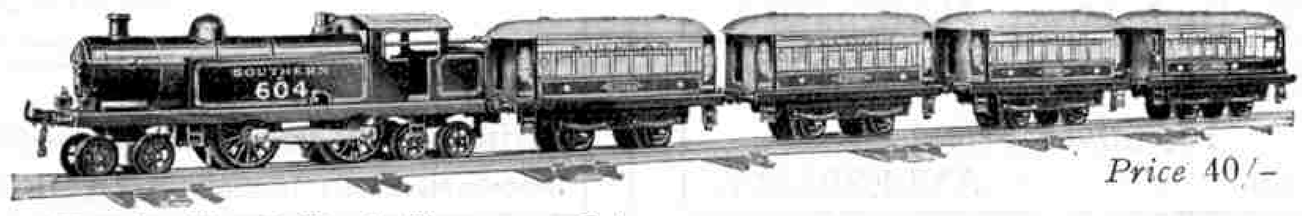
Take Dad to your dealer's store and show him the Hornby Trains. When he sees them he will be just as keen about them as you are.



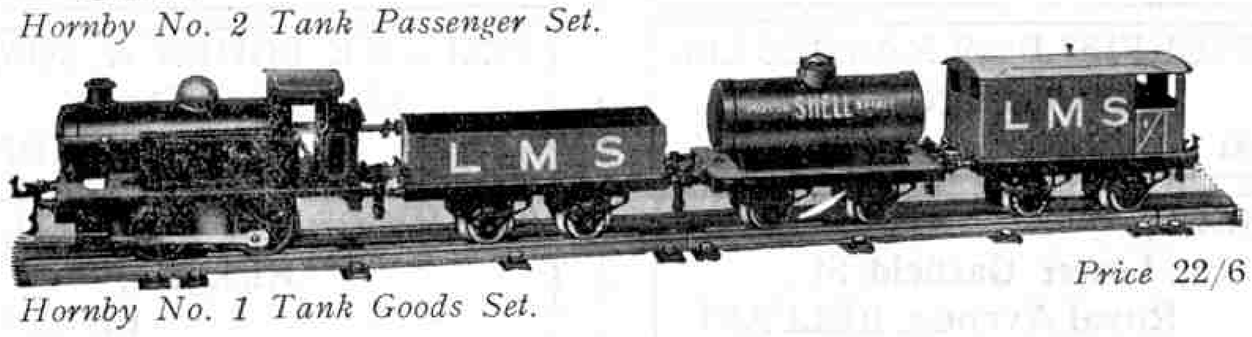
Hornby No. 2 Pullman Set *Price* 50/–



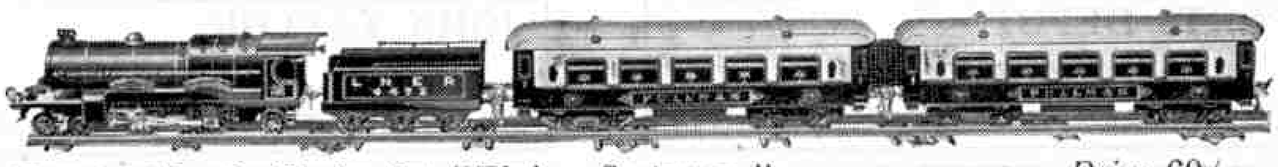
Hornby No. 2 Goods Set. *Price* 32/6



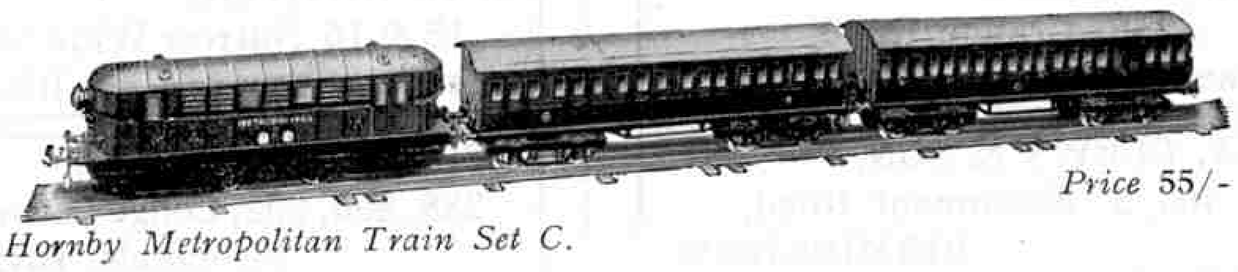
Hornby No. 2 Tank Passenger Set. *Price* 40/–



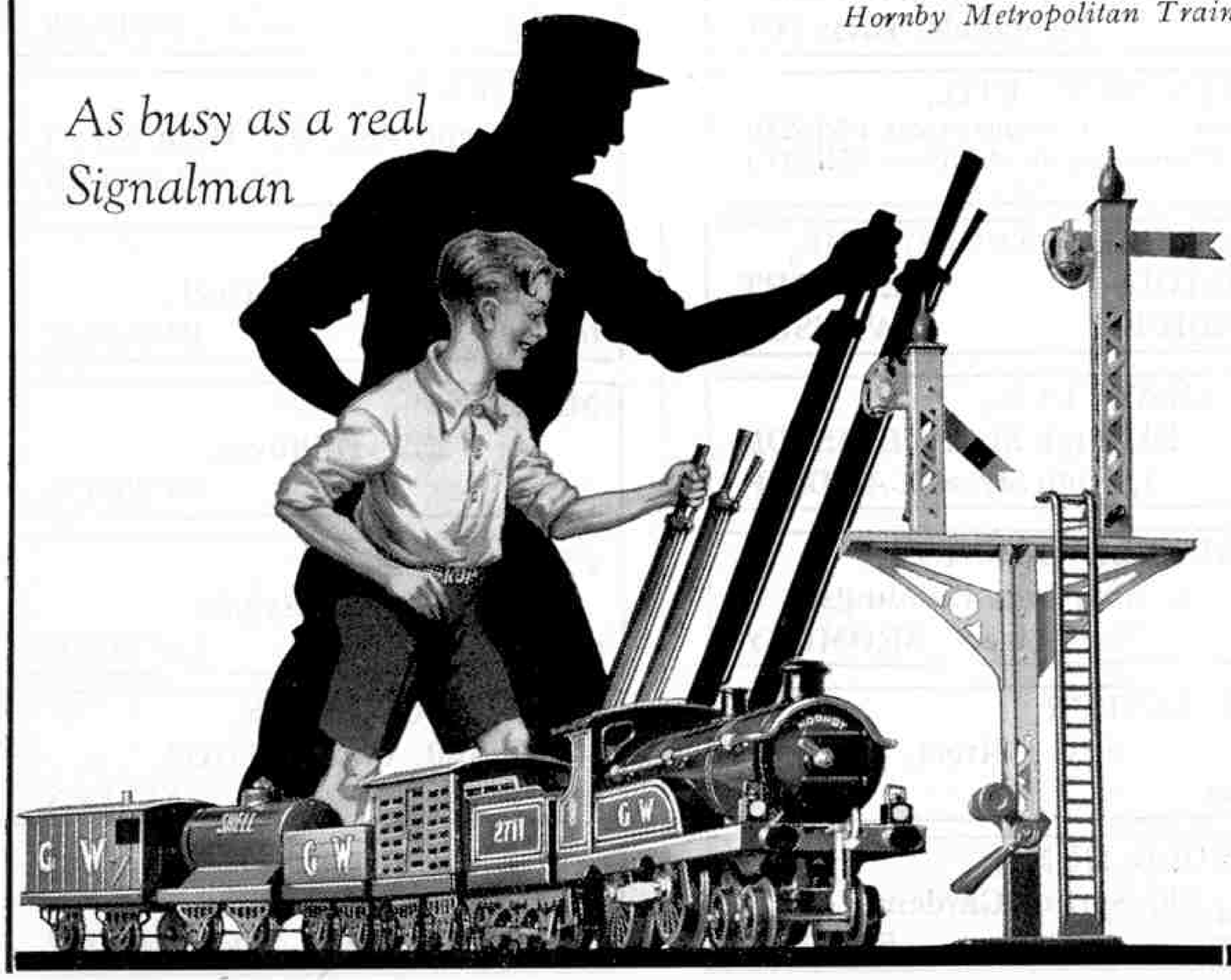
Hornby No. 1 Tank Goods Set. *Price* 22/6



Hornby No. 3c Train Set "Flying Scotsman." *Price* 60/–



Hornby Metropolitan Train Set C. *Price* 55/–



HORNBY TRAIN PRICES

(continued)

Hornby No.	3c G.W.R. "Cornish Riviera" ...	60/–
„ „	3c L.N.E.R. "Flying Scotsman"	60/–
„ „	3c L.M.S.R. "Royal Scot" ...	60/–
„ „	3c S.R. "Continental Express"	60/–
„ „	3c Riviera "Blue" Train	62/6
„	Metropolitan Train Set C	55/–

Electric Train Sets

Hornby No.	3E G.W.R. "Cornish Riviera" (4 volt)	75/–
„ „	3E L.N.E.R. "Flying Scotsman" (4 volt)	75/–
„ „	3E L.M.S.R. "Royal Scot" (4 volt)	75/–
„ „	3E S.R. "Continental Express" (4 volt)	75/–
„ „	3E Riviera "Blue" Train (4 volt)	77/6
„	Metropolitan L.V. (4 volt)	95/–
„	„ H.V. (100-250 volt) ...	110/–

Ask your dealer for a complete illustrated price list.

Meccano Ltd. Old Swan Liverpool

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on the following four pages carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

E. J. RILEY LTD.,
28, Blackburn Road,
ACCRINGTON.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

A. E. WILKINSON & SON,
Bank Street, ASHFORD, KENT.
57, High Street, MAIDSTONE.

BENNETT WATTS,
10, Silver Street,
Tel. 229 AYLESBURY.

BUTTERFIELDS & MASSIES Ltd.
Church Street,
Tel. 141 BARNSLEY.

J. BELL,
10, Lower Garfield St.,
Royal Avenue, BELFAST.

SPORTS DEPOT,
57, Victoria Street,
Tel. 4554 (Nr. Albert Memorial) BELFAST.

J. WOODHALL,
256, Grange Road,
Tel.: B'head 621 BIRKENHEAD.

H. A. CLEWS & SON,
404/5, Monument Road,
BIRMINGHAM.

A. STOCKWIN & CO.,
16, Worcester Street,
Tel.: Mid. 869 BIRMINGHAM.

GEO. W. TAYLOR,
221, Lichfield Road,
Aston, BIRMINGHAM.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
BLACKPOOL.

SELLEN'S BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

BURGESS' BAZAAR,
Opposite The Pier,
BOGNOR.

J. MORRIS, F.C.O.,
70, Knowsley Street,
Tel. 1074 BOLTON.

KEIGHTLEY'S,
High Street,
BOSTON.

BROWN, MUFF & CO. LTD.,
BRADFORD.

W. CARTER,
British Sports Depot, 15, Bridge Street,
Opposite Mechanics' Institute BRADFORD.

MAURICE COHEN & SON,
11, Darley Street,
BRADFORD.

RUSHWORTHS LIMITED,
Kirkgate,
BRADFORD.

JOHN TAYLOR,
28, Preston Street,
Tel.: Brighton 957 BRIGHTON.

S. H. ARTHUR,
15 & 16, Narrow Wine Street,
Tel. 511 BRISTOL.

ECONOMIC LIMITED,
288, 290, 292, Lodge Causeway,
Fishponds, BRISTOL.

GYLES BROS. LTD.,
Tel. 2888 24, Bridge Street, BRISTOL.
188, Whiteladies Road, Clifton, BRISTOL.
Tel. 143

JOHN HALL (TOOLS) LTD.,
BRISTOL. NEWPORT.
CARDIFF. SWANSEA.

SALANSON LTD.,
20, High Street, BRISTOL.
4, High Street, CARDIFF.

T. ARNOLD BENNETT,
2, Aberdeen Buildings,
High Street, BROMLEY.

SAM TAYLOR,
Silver Street,
Tel. 320 BURY.

HAROLD HUNT,
38, Spring Gardens,
Tel. 202 BUXTON.

FRED SPALDING & SONS LTD.,
Tel. 25 CHELMSFORD.

PANTOYS LTD., Tel. 3561
The Promenade, CHELTENHAM SPA.
37, Westgate Street, GLOUCESTER.

EYRE & SONS LTD.,
Ironmongery Dept., Arcade,
Tel. 2181 CHESTERFIELD.

R. H. JEPSON,
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COVENTRY.

E. A. ANELAY,
7, Parkgate,
Tel. 2925 DARLINGTON.

PURSEY & MOCKRIDGE,
The Sports Outfitters,
Tel.: Dartford 173 DARTFORD.

HENRY WHALLEY,
195, Duckworth Street,
DARWEN.

RATCLIFFES TOYERIES,
19, Osmaston Road,
DERBY.

JAMES L. DIXON,
14, Suffolk Street,
Tel.: Dublin 1528 (off Grafton St.), DUBLIN.

A. CURRIE,
The Emporium, 92, High Street,
DUMBARTON.

DIXON'S
41, High Street,
Tel. 5810 DUNDEE.

MARTINS',
232, Hilltown,
DUNDEE.

PHINS LIMITED,
45, Murraygate,
Tel. 3897 DUNDEE.

ALFRED GOODWIN,
140, Church Street,
Tel. 344 ECCLES.

ALDERTON'S,
8, Bank Parade,
Tel. 0303 EDGWARE.

BASSETT-LOWKE LTD.,
5, Frederick Street,
EDINBURGH.

HOWARDS,
72/74, Chase Side, ENFIELD.
& 246, Lordship Lane, N.22.

Devon & Somerset Stores Ltd.,
Toy & Sports Dealers,
Tel. 2638
Telegrams : Stores, Exeter
EXETER.

ROBERT BALLANTINE,
103½, St. Vincent Street,
GLASGOW.

CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, the Railway Coys., etc.

COPLAND & LYE LTD.,
Caledonian House,
Tel. 780 Douglas
GLASGOW.

LUMLEY'S
Lumley House, Sauchiehall Street,
Tel.: Douglas 2701
GLASGOW.

LYON LTD.,
389, Sauchiehall Street,
GLASGOW.

The MARVEL MART (Wm. Ross & Co.)
110, West Nile Street,
GLASGOW.

Pettigrew & Stephens Ltd.,
Sauchiehall Street,
GLASGOW.

POLLOCK & CO., 36, Bridge Street,
222, Argyle Street
(Under Railway Bridge),
GLASGOW.

ROWANS LIMITED,
70, Buchanan Street,
GLASGOW.

W. & A. SMITH (GLASGOW) Ltd.,
236, Argyle Street,
GLASGOW, C.2.

R. WYLIE HILL & CO. LTD.,
20, Buchanan St. & Argyll Arcade,
GLASGOW, C. 1.

FLETCHER'S TOYLAND,
77, Deardengate, HASLINGDEN.
Grand Building, RAWTENSTALL.

H. POULTON, Toyland,
75 & 77, High Street,
HOUNSLOW, Middlesex.

GAMLEYS,
The Hove Hornby Train Store,
78, Church Road, HOVE.

C. BOOTH & SON,
13, Cross Church Street,
Tel. 457
HUDDERSFIELD.

RUSHWORTHS LIMITED,
Westgate,
HUDDERSFIELD.

HAMMOND'S LTD.,
Paragon Square,
HULL.

PRIESTLEY'S,
62, Prince's Avenue,
Tel. 6040 Cent.
HULL.

YE OLDE TOY SHOPPE,
Chariot Street,
Tel. : Central 1031
HULL.

CRANBROOK SPORTS DEPOT,
Complete Sports Outfitters,
Tel. 0932
91, Cranbrook Rd., ILFORD.

WALKER'S EMPORIUM,
25-9, Inglis St., and 11-13, New Market,
INVERNESS.

W. J. S. CARPENTER,
13 & 15, Queen Victoria Street,
LEEDS.

RONALD B. MOSES,
Newsagent, 254, Tong Road,
WORTLEY, LEEDS.

PEARSON & DENHAM (PHOTO) LTD., 6, Bond Street,
LEEDS.

THORNTON'S,
Sports House, Briggate,
LEEDS.

A. WRIGHT, The Garage,
200/2, Dewsbury Road,
Tel. 22719
LEEDS.

ROBOTHAM'S LIMITED,
"Baby's Kingdom,"
Tel. 4809
Belvoir St., LEICESTER.

J. T. WEIGHTMAN,
198, Charnwood Street,
Tel. 58804
LEICESTER.

BYCROFTS EMPORIUM,
366, High Street,
LINCOLN.

T. ARMSTRONG & BRO. LTD.,
33, Dale Street,
Tel.: Central 3301
LIVERPOOL.

BUNNEY'S LTD.,
Church Street, LIVERPOOL.
Mostyn Street, LLANDUDNO.

C. LUCAS, Hobbies Depot,
35, Manchester Street,
LIVERPOOL.

Reliance Cycle & Motor Co.,
29/31, Manchester St., Liverpool.
Argyle & Conway Sts., Birkenhead.

ACACIA STORES,
168, 229 & 231, Upper Tooting Rd.,
Tel.: Streatham 2441
S.W.17.

The ARUNDEL CYCLE & SPORTS STORE, 52, Church Road,
Upper Norwood, LONDON, S.E.19.

R. E. BARNES,
88, Park Road,
Tel. Sydenham 2404
W. DULWICH, S.E.21.

FREDERICK BECK,
22, 24 & 26, Camden Passage,
Tel.: Clerkenwell 8403
LONDON, N.1.

F. C. CABELDU,
371, High Street, Lewisham,
Tel.: Lee Green 1342
LONDON, S.E.13.

W. F. CHAPMAN, Streatham 1736-0759
225, High Road, Balham, S.W.17
1410, London Rd., Norbury, S.W.16

THE CITY RUBBER & MOTOR Co.
(next Liverpool St. Station)
141, Bishopsgate,
Tel.: Bish. 2284
LONDON, E.C.2.

DAVIES & CO.,
157, Leytonstone Road,
Stratford, LONDON, E.

DEMPSEY & CO.,
69, South Side, CLAPHAM,
Tel.: Brixton 3022
LONDON, S.W.4.

W. HUMPHRYS & SON,
269/271/273 & 275, Rye Lane,
Estab. in 1840
PECKHAM, S.E.15.

JUCHAU,
32, East Road, City Road,
LONDON, N.1.

LAFFEATY,
308, King's Road, Chelsea,
Tel.: Kensington 2705
LONDON, S.W.3.

WILLIAM W. LANK,
Near Boleyn, East Ham,
LONDON.

LEDWITH BROS.,
42 & 44, Walworth Road,
Nr. ELEPHANT AND CASTLE
LONDON, S.E.17.

H. V. PALIN,
120, Station Road,
Tel. : Chingford 104
CHINGFORD, E.4.

Meccano & Hornby Train Supplies

All the dealers whose names appear on this page, on the preceding two pages, and in the twenty-three announcements on the opposite page, carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

PIGGOTT BROS. & CO. LTD.,
220/226, Bishopsgate,
Tel.: Bis. 4351 LONDON, E.C.2.

PERCIVAL & CO.,
140, High Street,
Tel. Wstw. 0120 WALTHAMSTOW, E.17.

F. J. WAIN & SON,
478, Kingsland Road,
Tel.: Clissold 9269 LONDON, E.8.

F. R. POTTER & SON,
43, Market Place,
LOUGHBOROUGH.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

The BERKSHIRE RUBBER Co.,
51, Queen Street,
MAIDENHEAD.

BARRS, Children's Paradise,
49, Deansgate,
Tel. 165 City MANCHESTER.

A. FRANKS LTD.,
95 & 97, Deansgate, MANCHESTER
90, Bradshawgate, BOLTON.

HENRY'S Toy & Game Stores,
22, King Street,
Tel. 3004 Central MANCHESTER.

A. INMAN, MANCHESTER.
105, Lapwing Lane, Didsbury. Tel. 1518.
179, Dickenson Rd., Rusholme. Tel. 2241.

EDWARD LLOYD & SON,
268, Upper Chorlton Road,
Tel. 613 Chorlton MANCHESTER, S.W.

JOHN NESBITT LTD.,
42, Market Street,
City 2284 MANCHESTER.

H. J. ROFE,
93, Piccadilly,
Tel.: Central 2945 MANCHESTER.

ALEC. WATSON LIMITED,
39, Piccadilly & 35, Oxford Street,
MANCHESTER.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

THE MANSFIELD & SUTTON CO-OP. SOC. LTD., Stockwell Gate,
Tel. 583 MANSFIELD.

JACKSON'S CYCLE STORES,
158, Parliament Road,
MIDDLESBROUGH.

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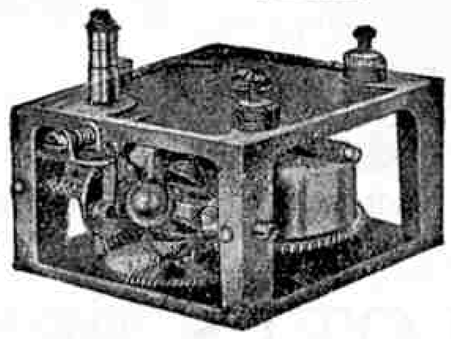
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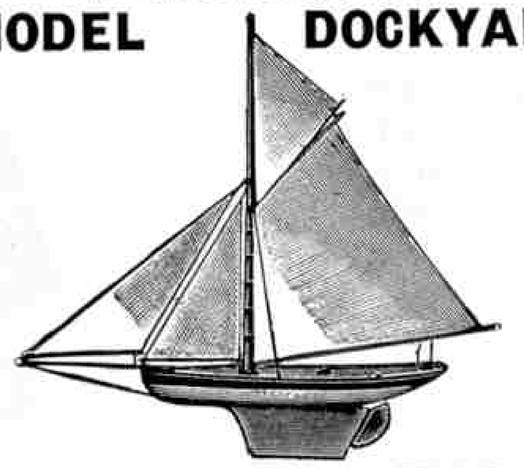


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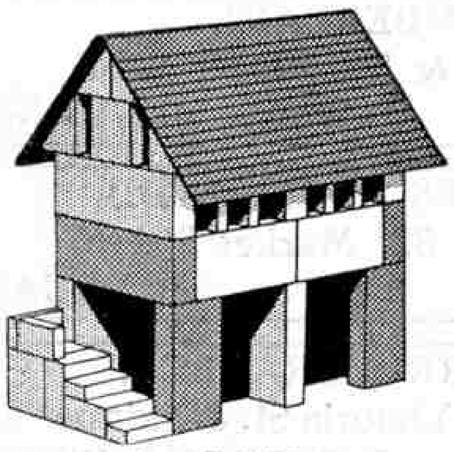
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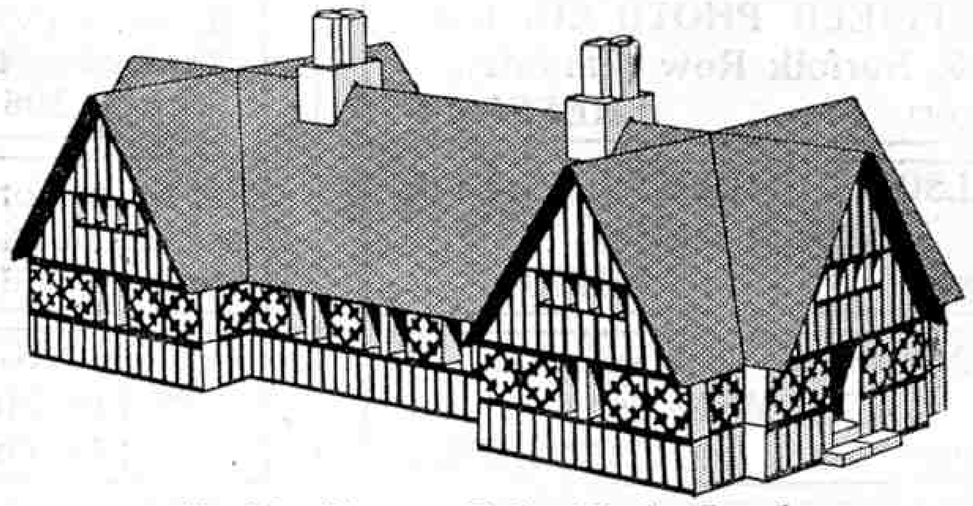
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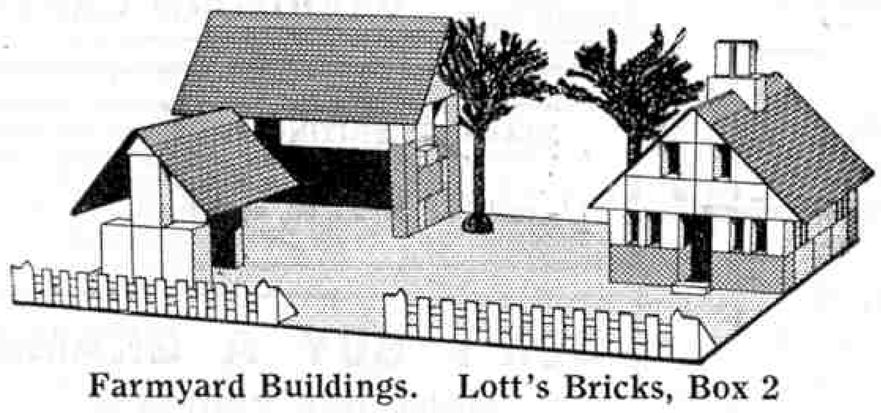
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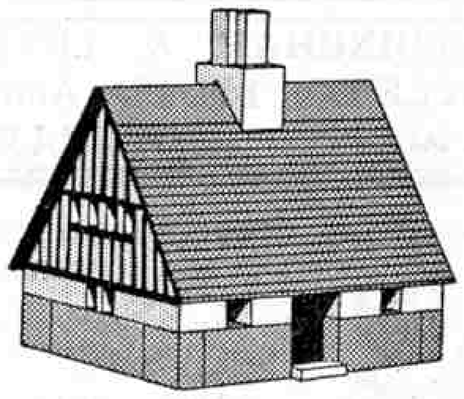
Cheshire House. Tudor Blocks, Box 4



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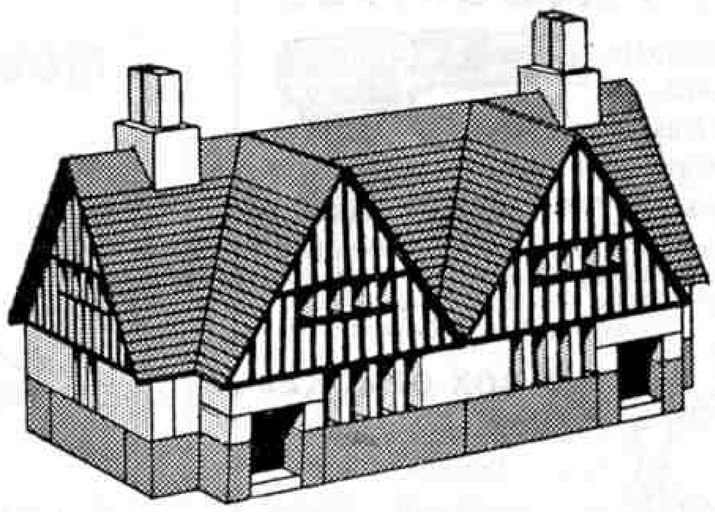
Cottage.
Tudor Blocks, Box 1

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,,	1	30	,,	5/–	,,	1a	12 ,,	5/6
,,	2	48	,,	10/–	,,	2a	18 ,,	10/6
,,	3	72	,,	17/6	,,	3a	6 ,,	7/6
,	4	84	,,	30/–	,,	4a	6 ,,	7/6

Box 5 100 Models 42/–



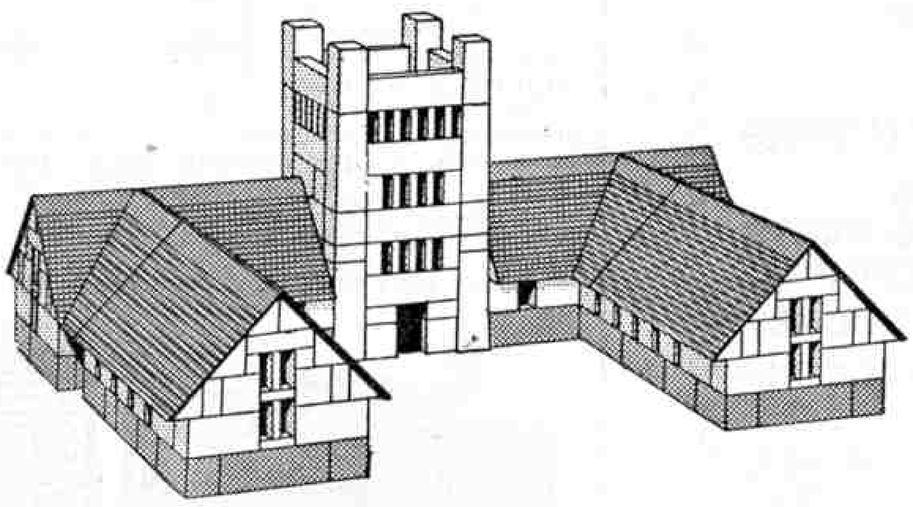
Pair of Houses. Tudor Blocks, Box 3

TUDOR BLOCKS

Box	1	12	Models	3/6	Box	1a	Supplement	4/6
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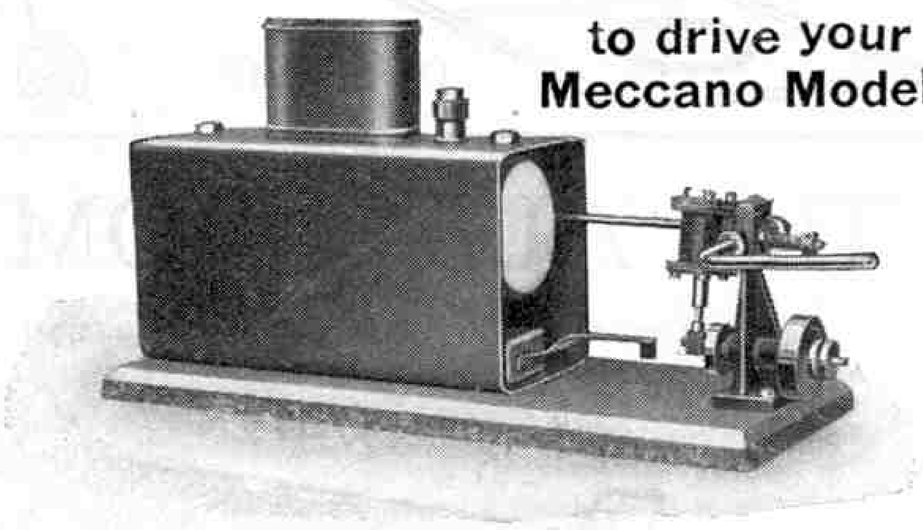
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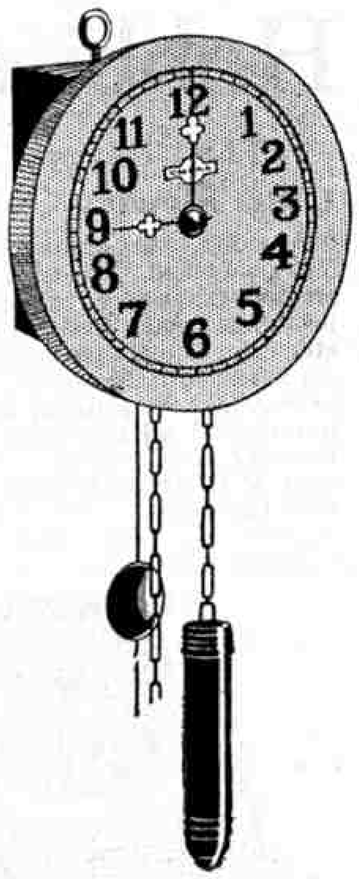
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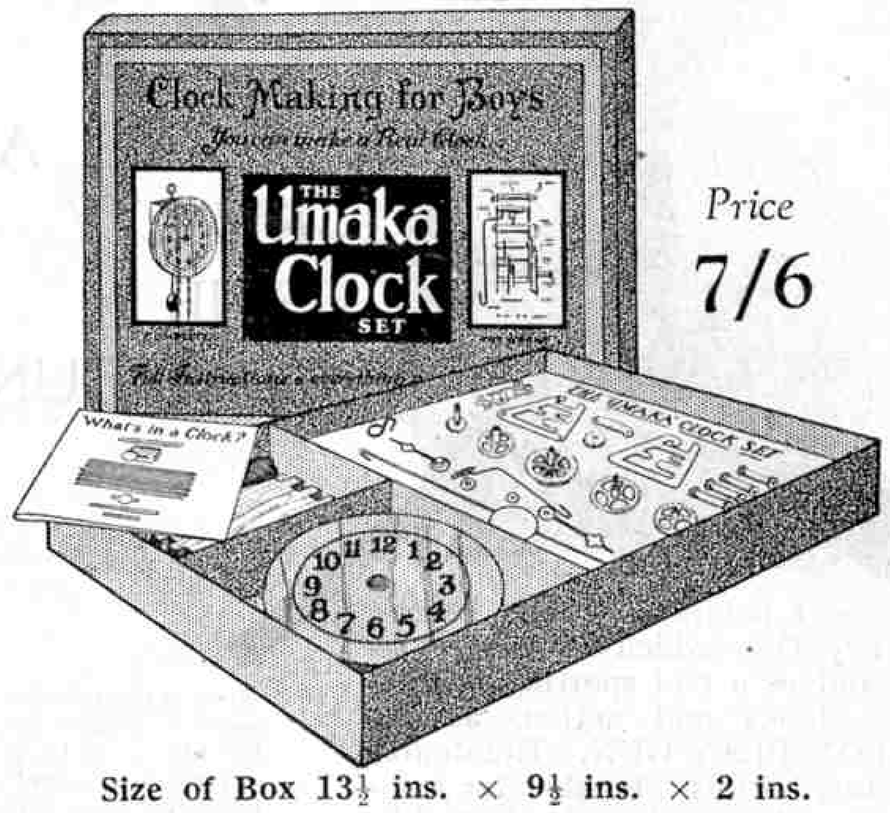


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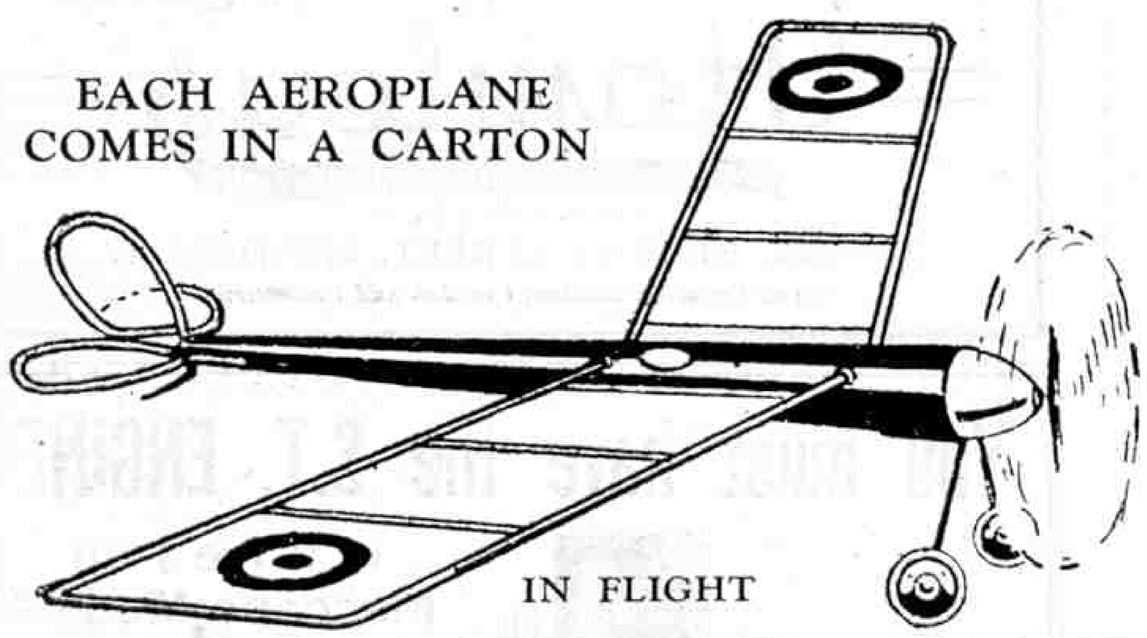


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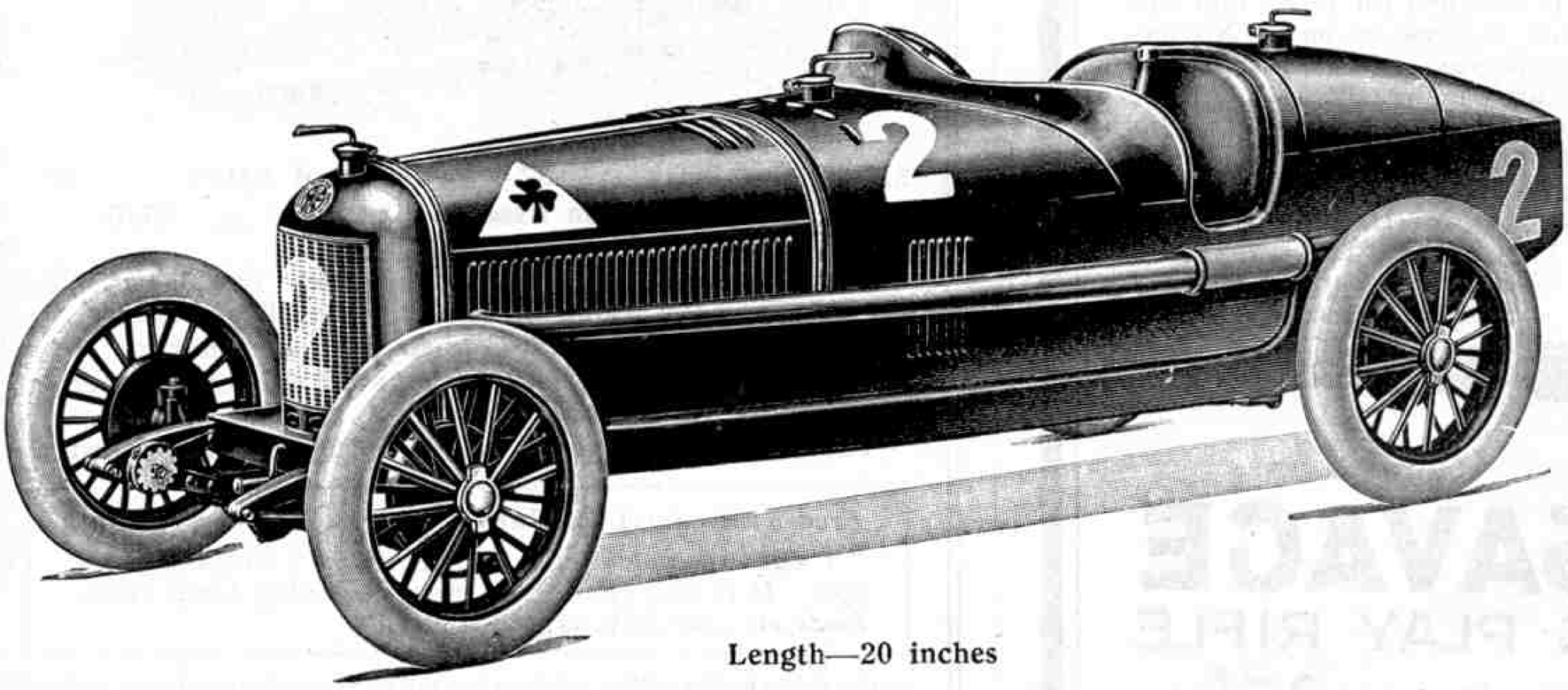
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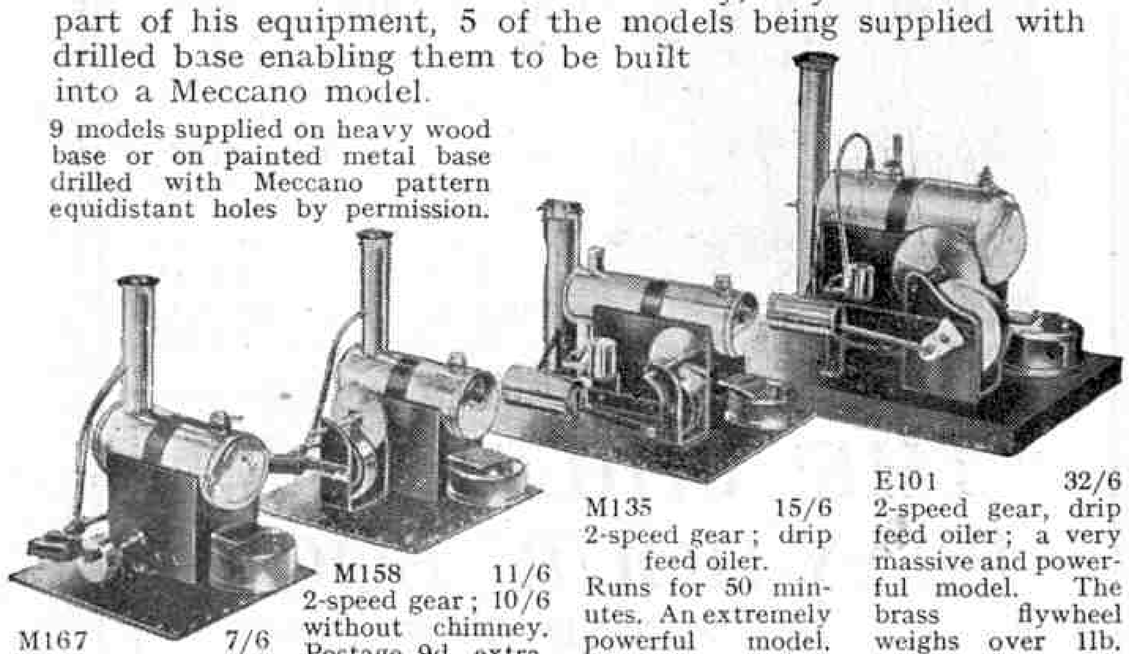
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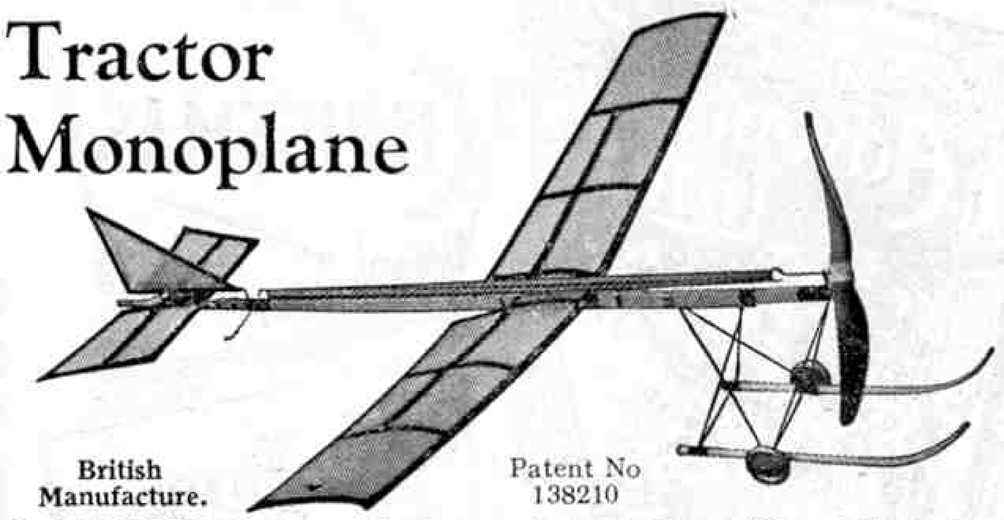
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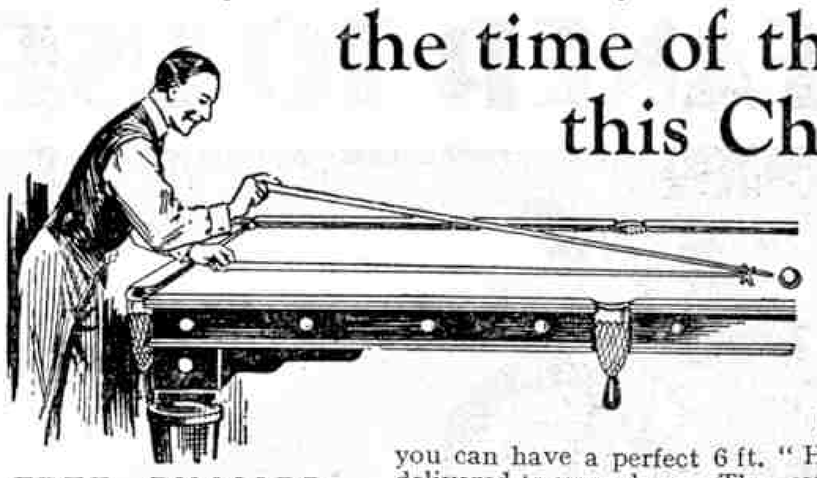
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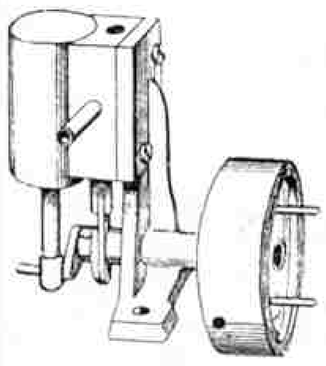
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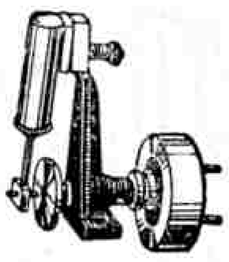
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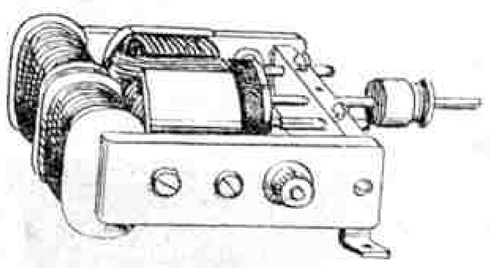


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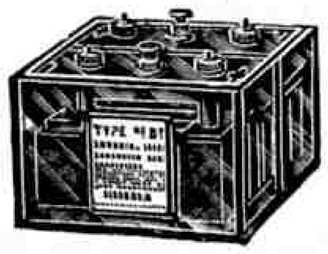
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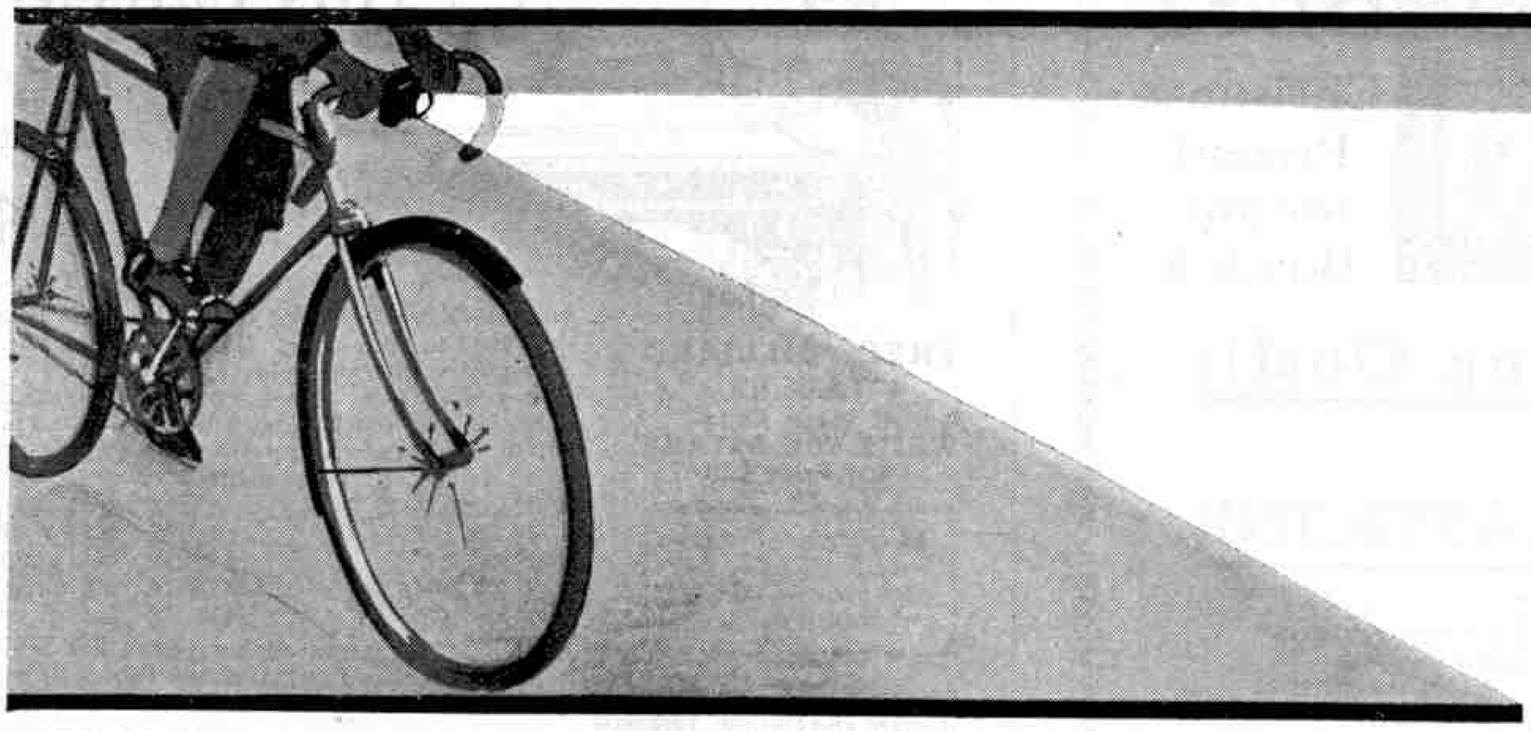
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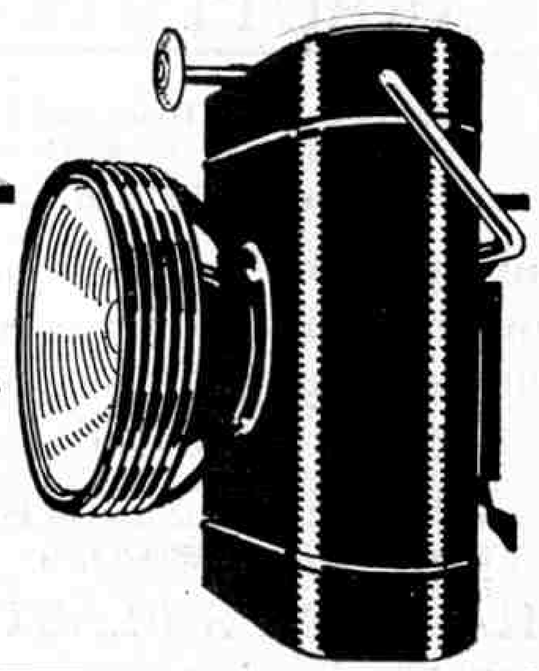


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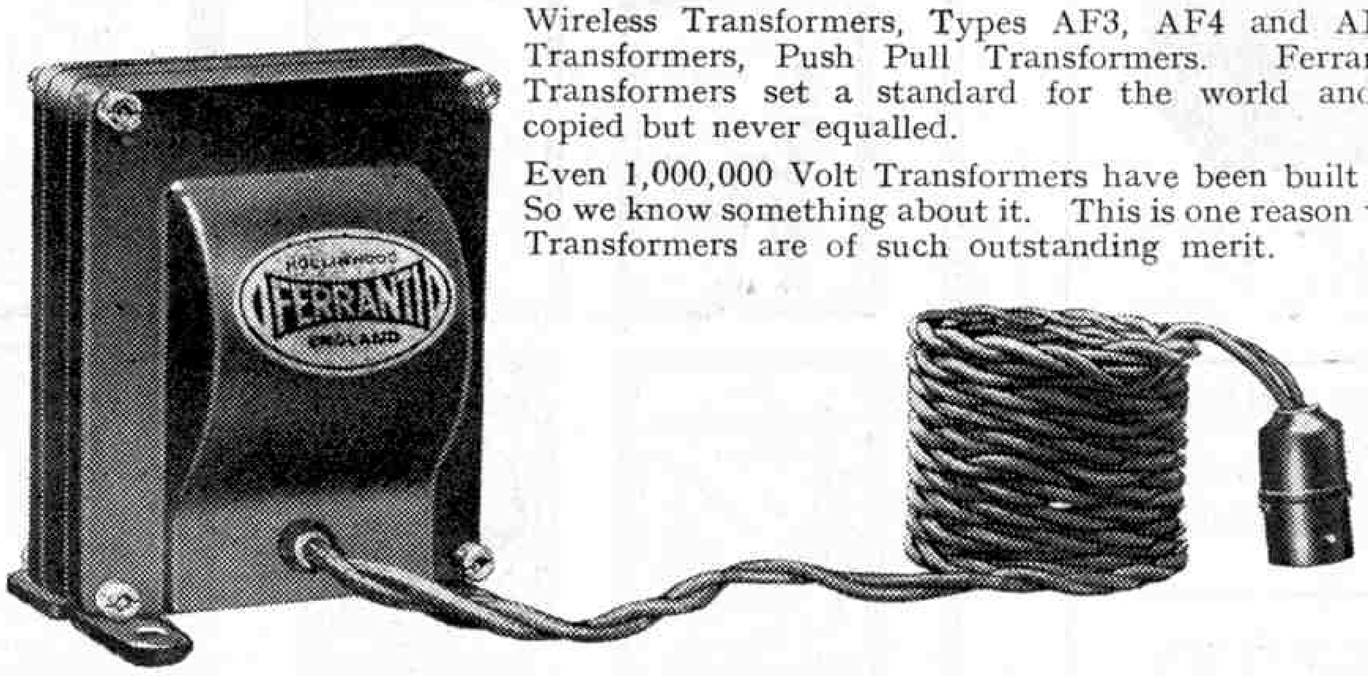
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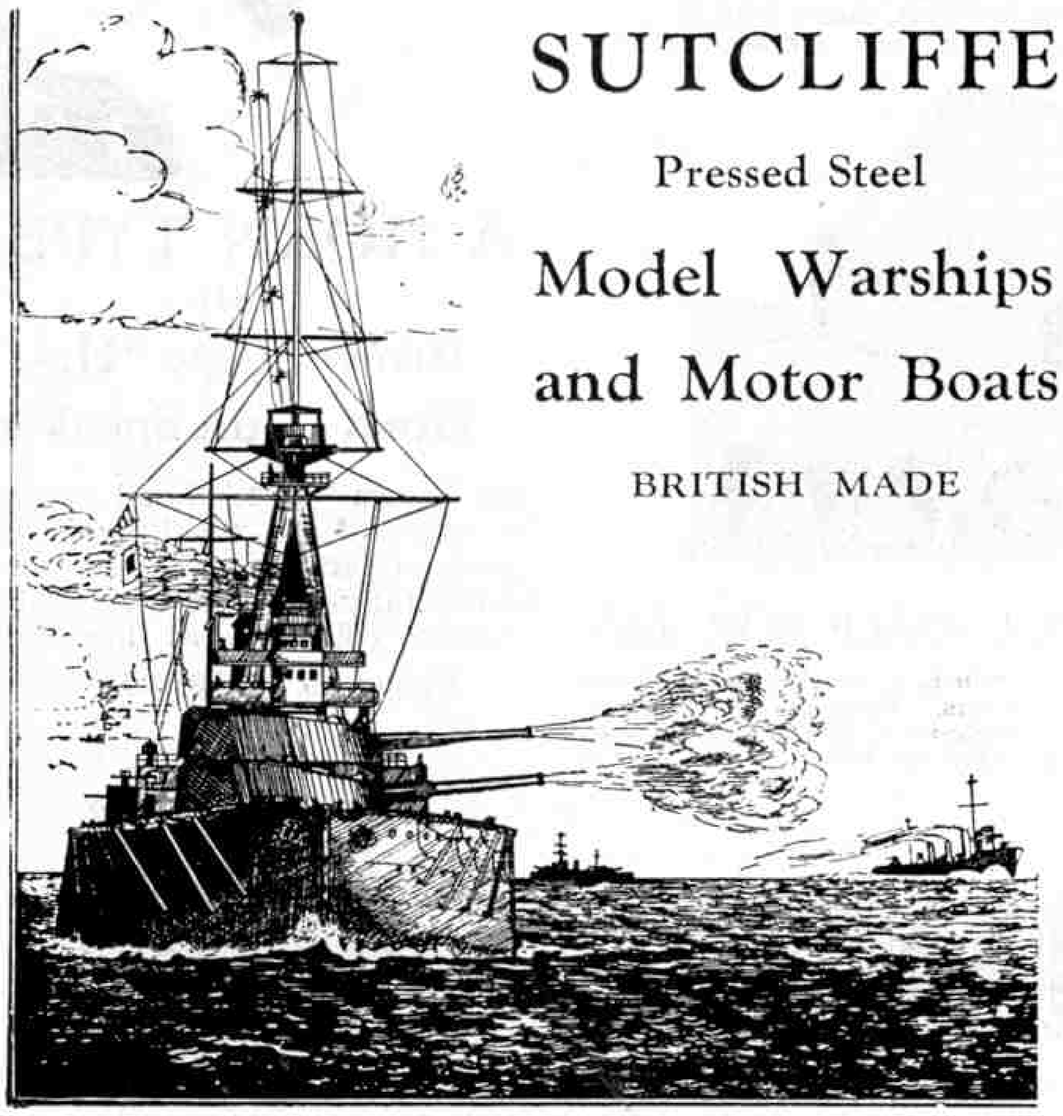
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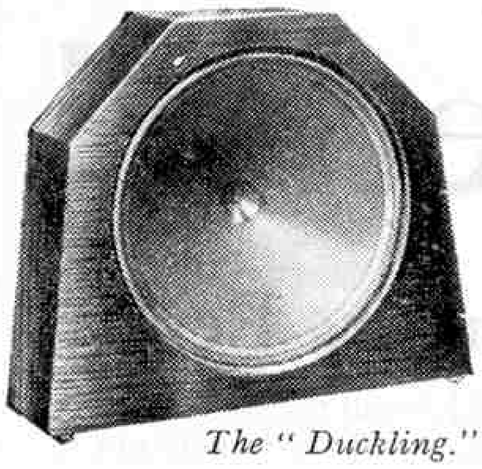
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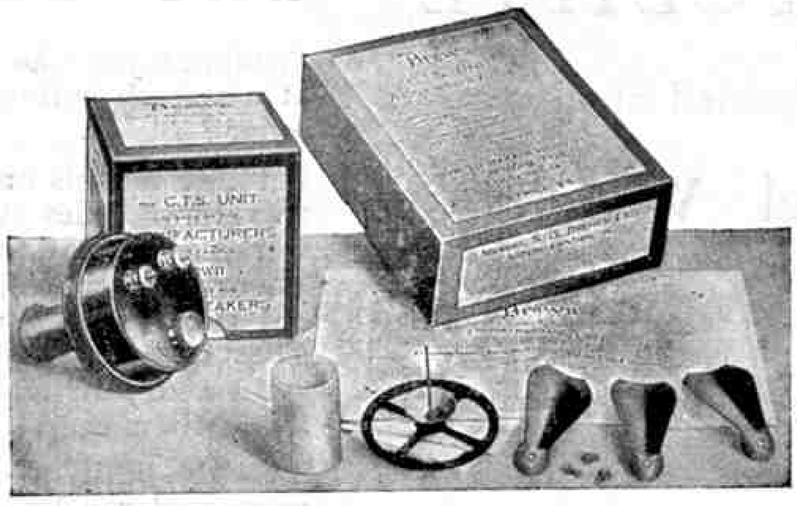
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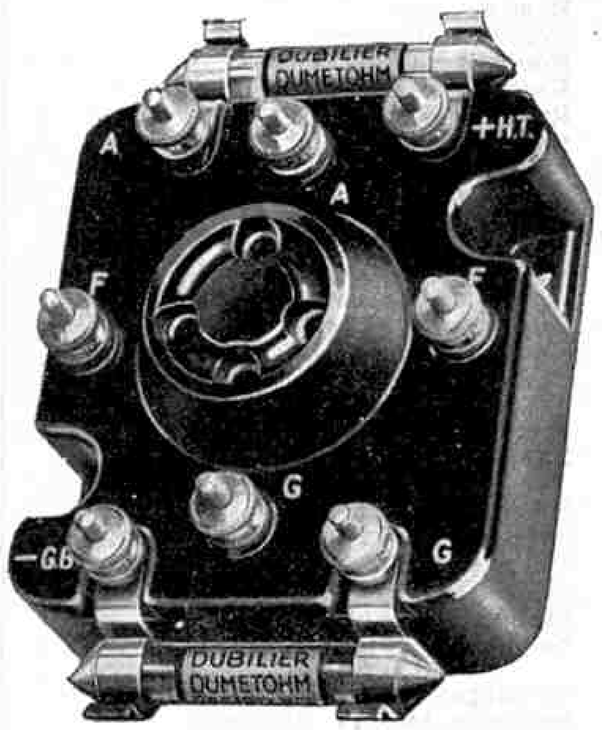
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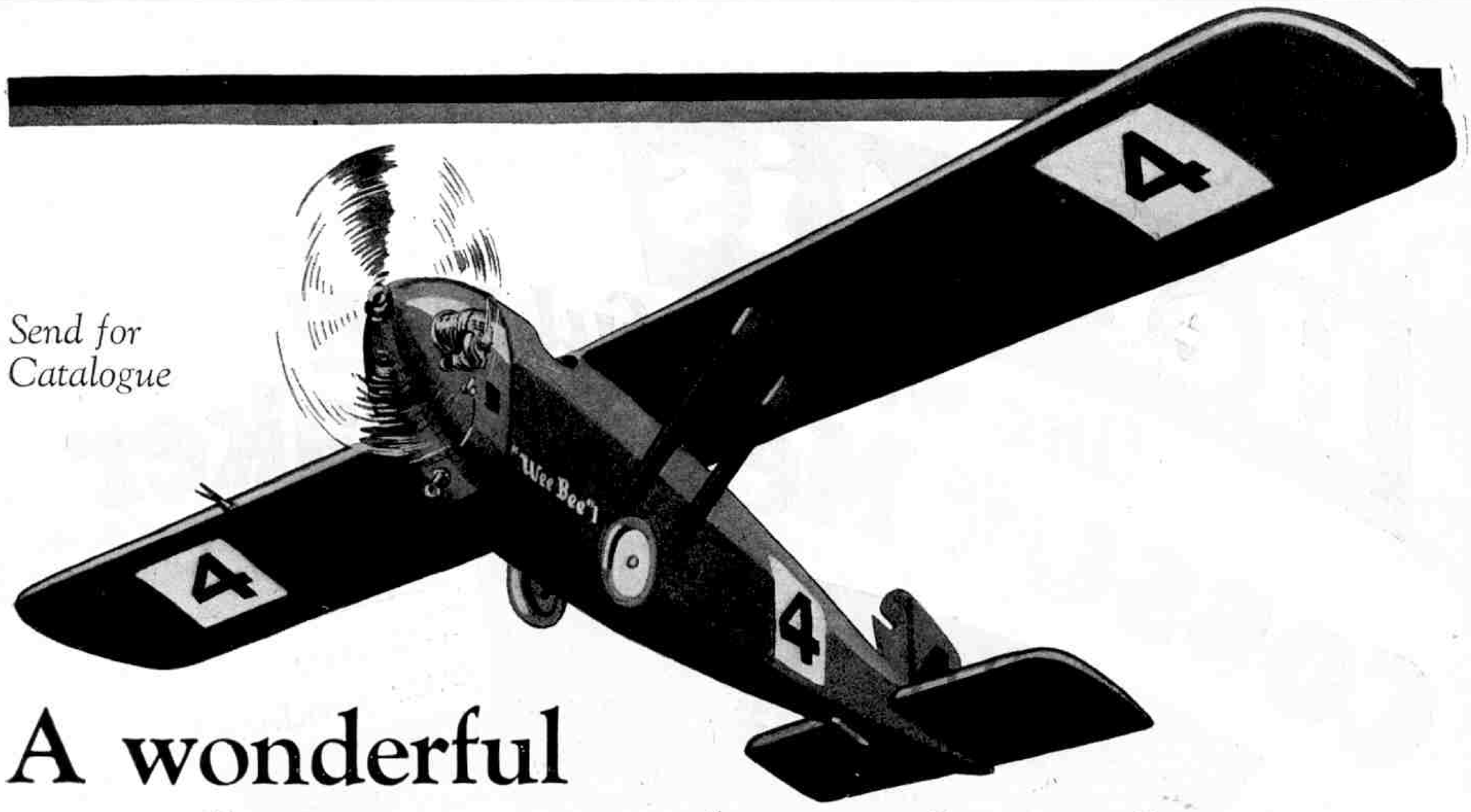
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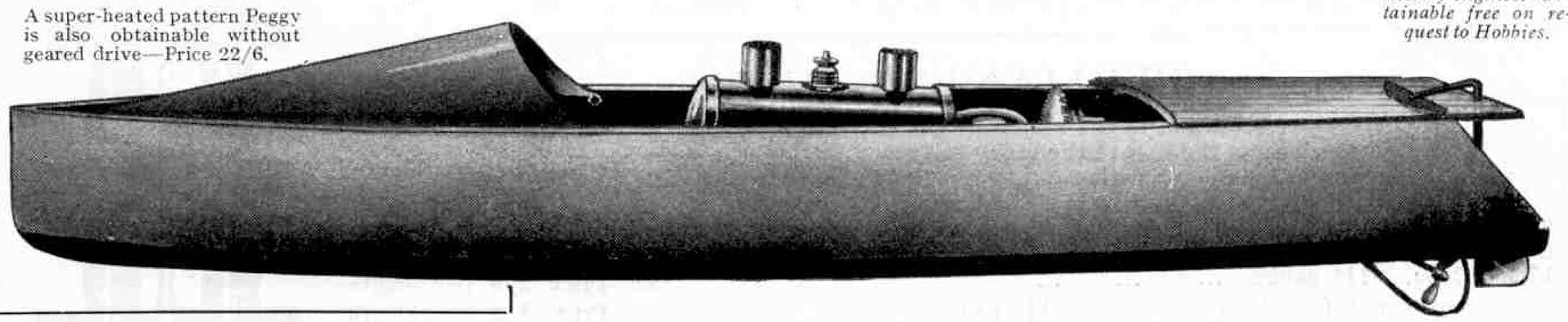
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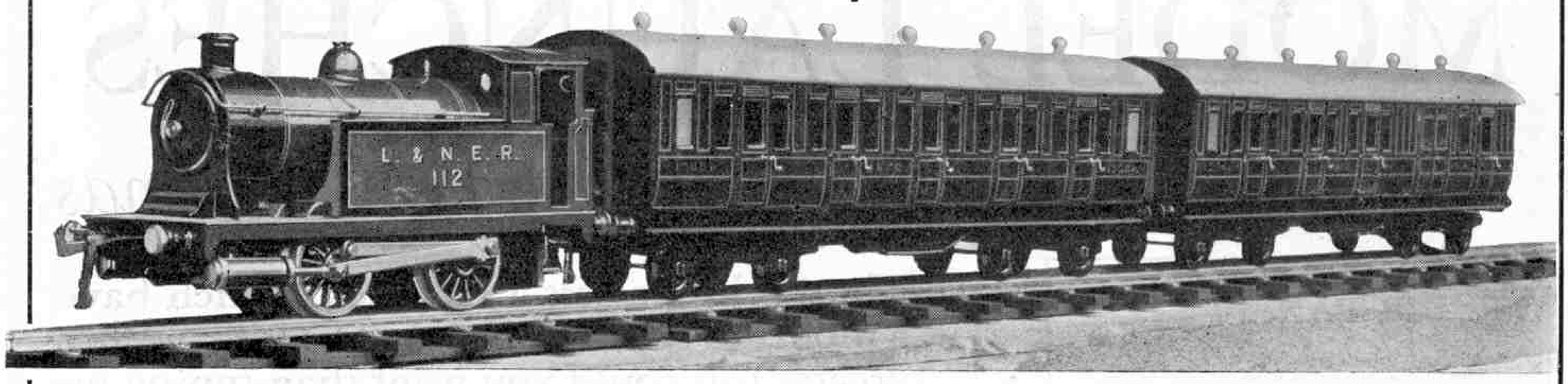
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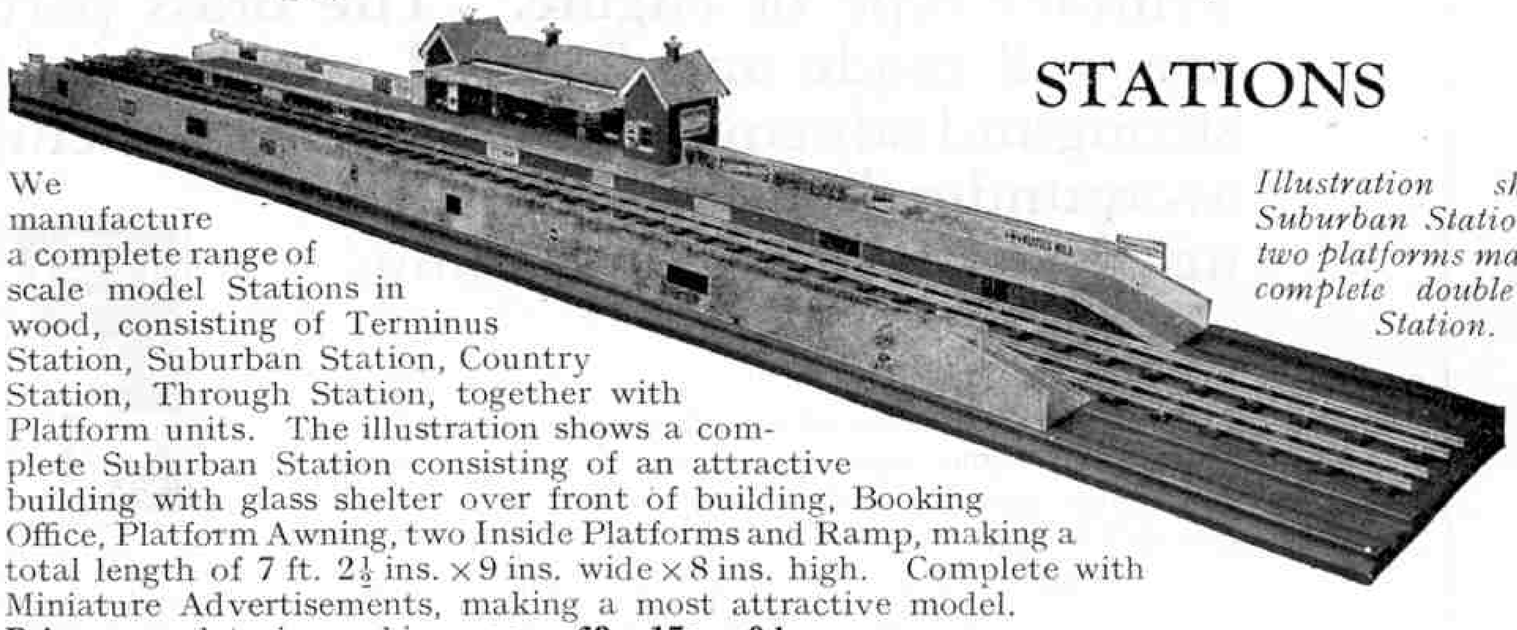
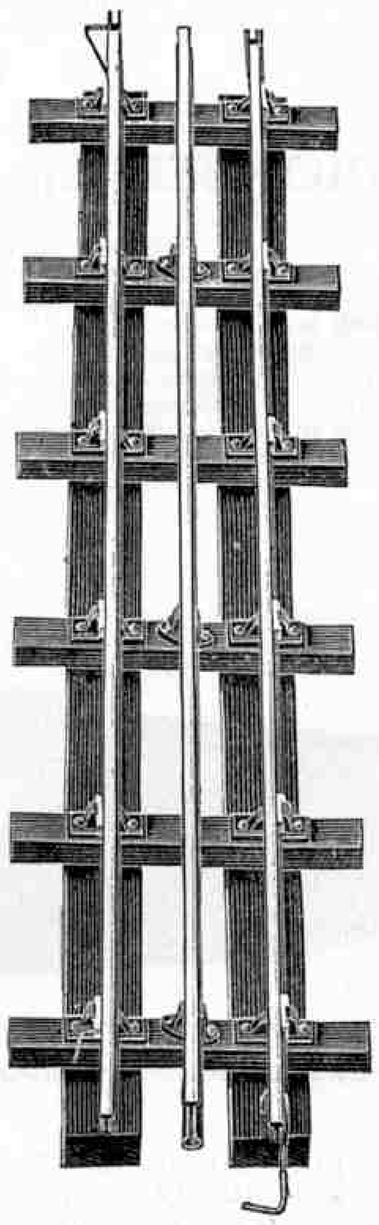


Illustration showing Suburban Station with two platforms making a complete double road Station.

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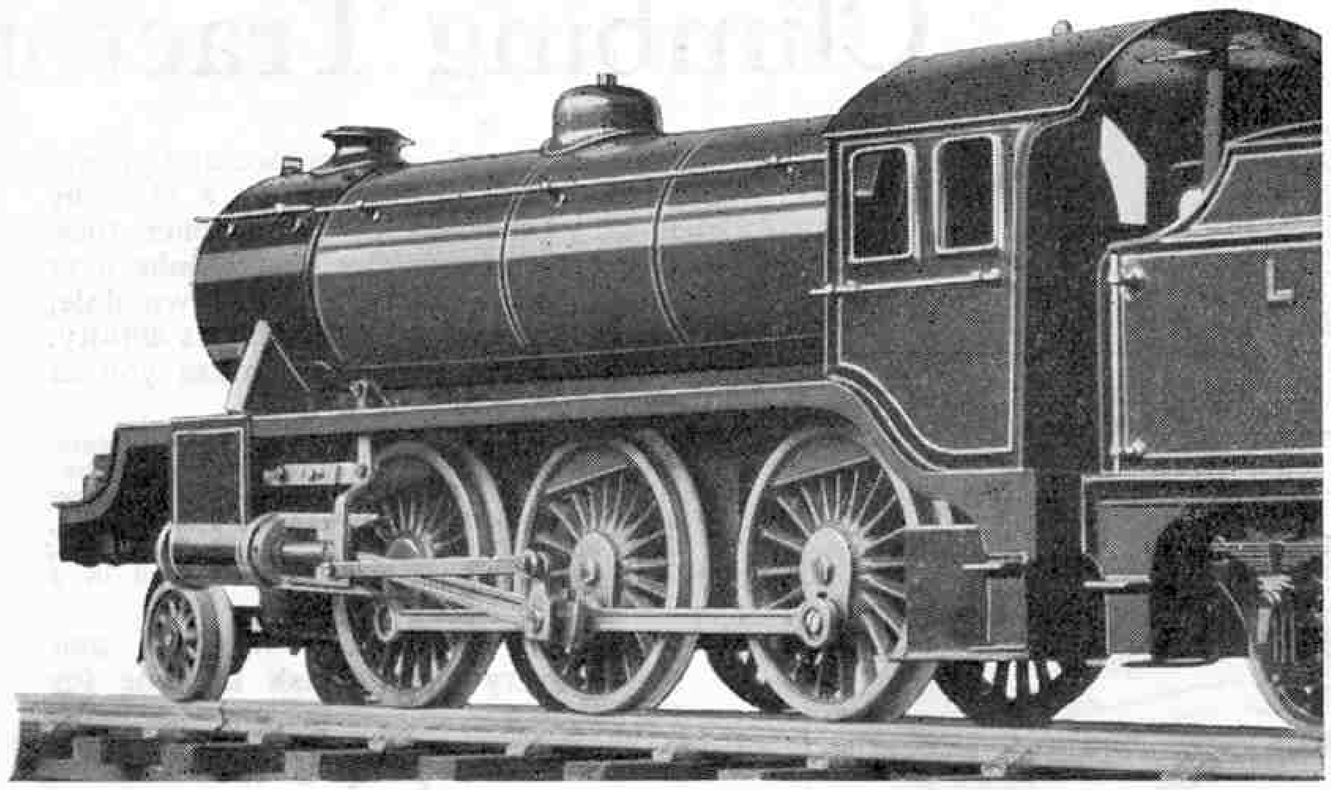
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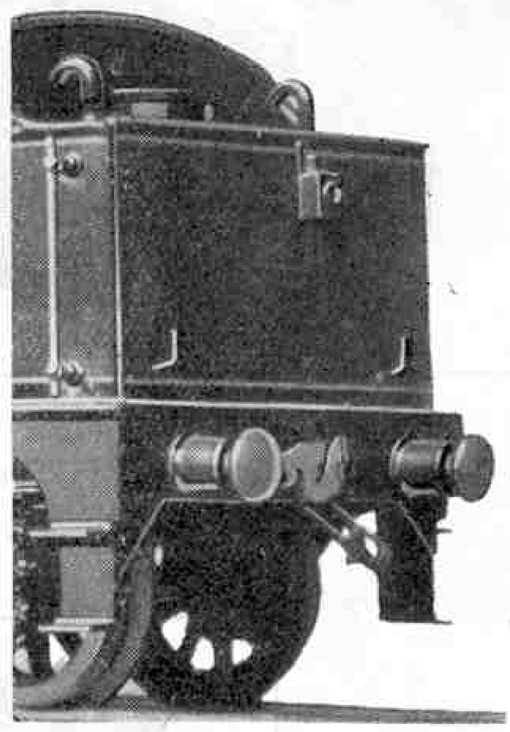
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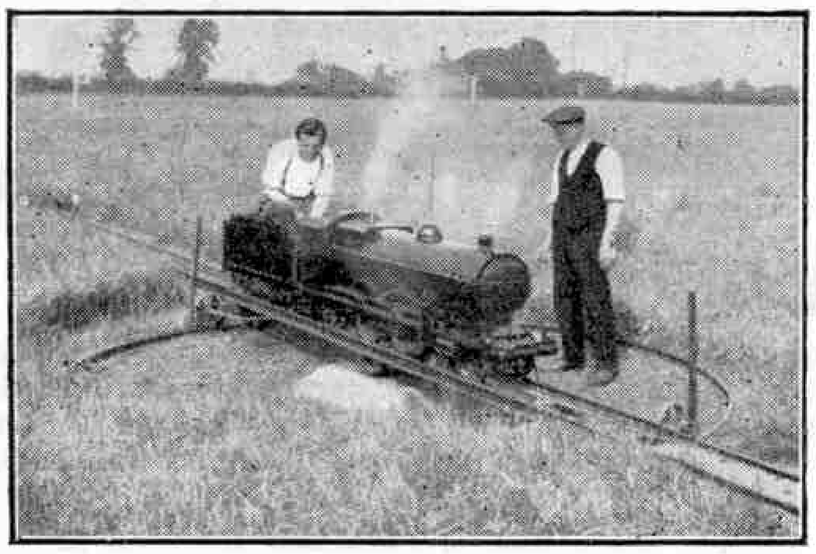
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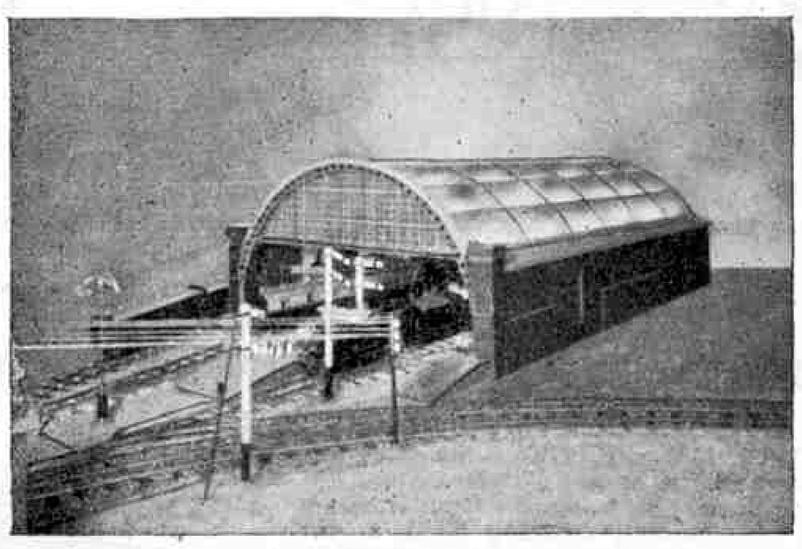
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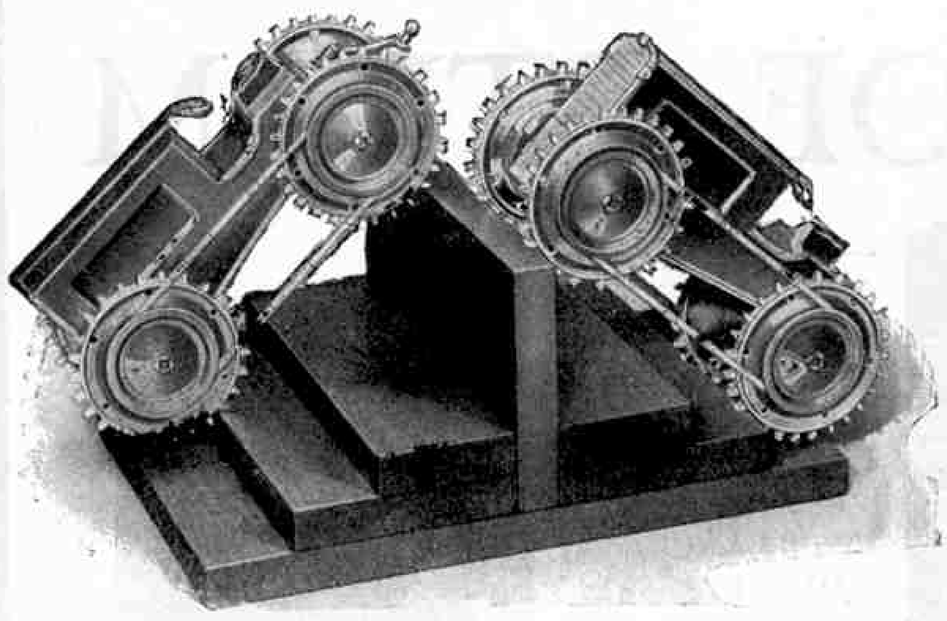


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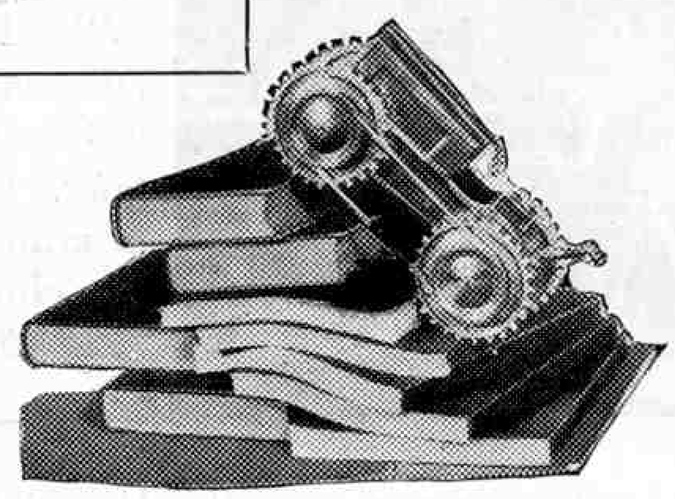
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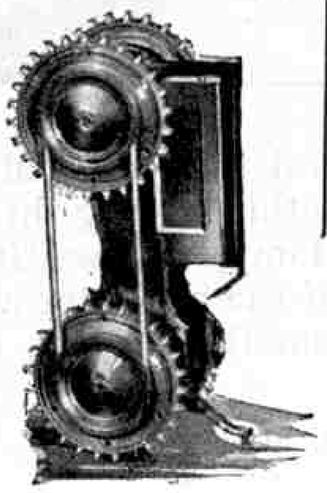
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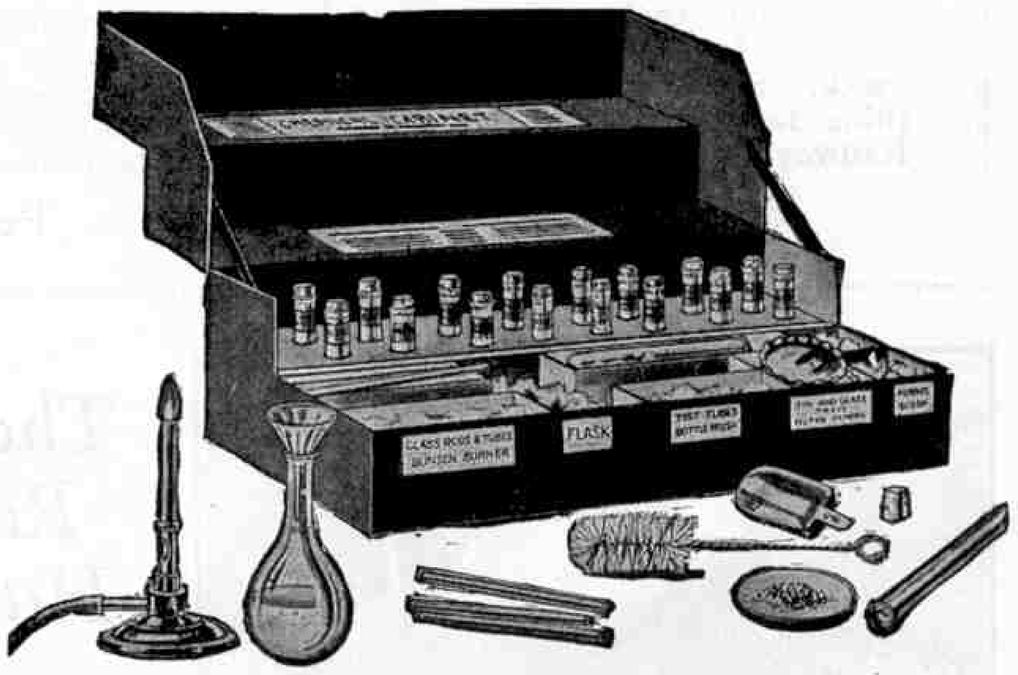
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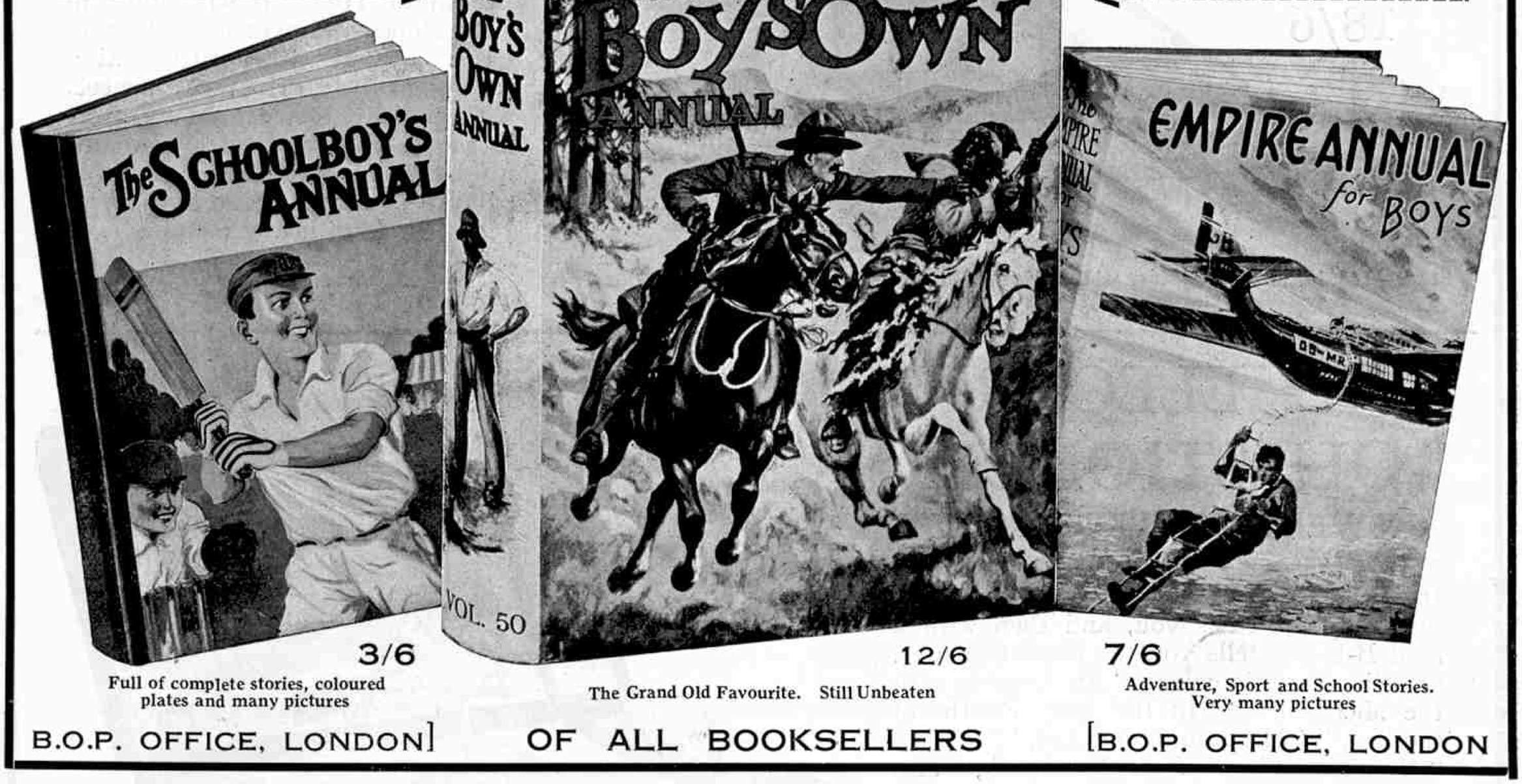
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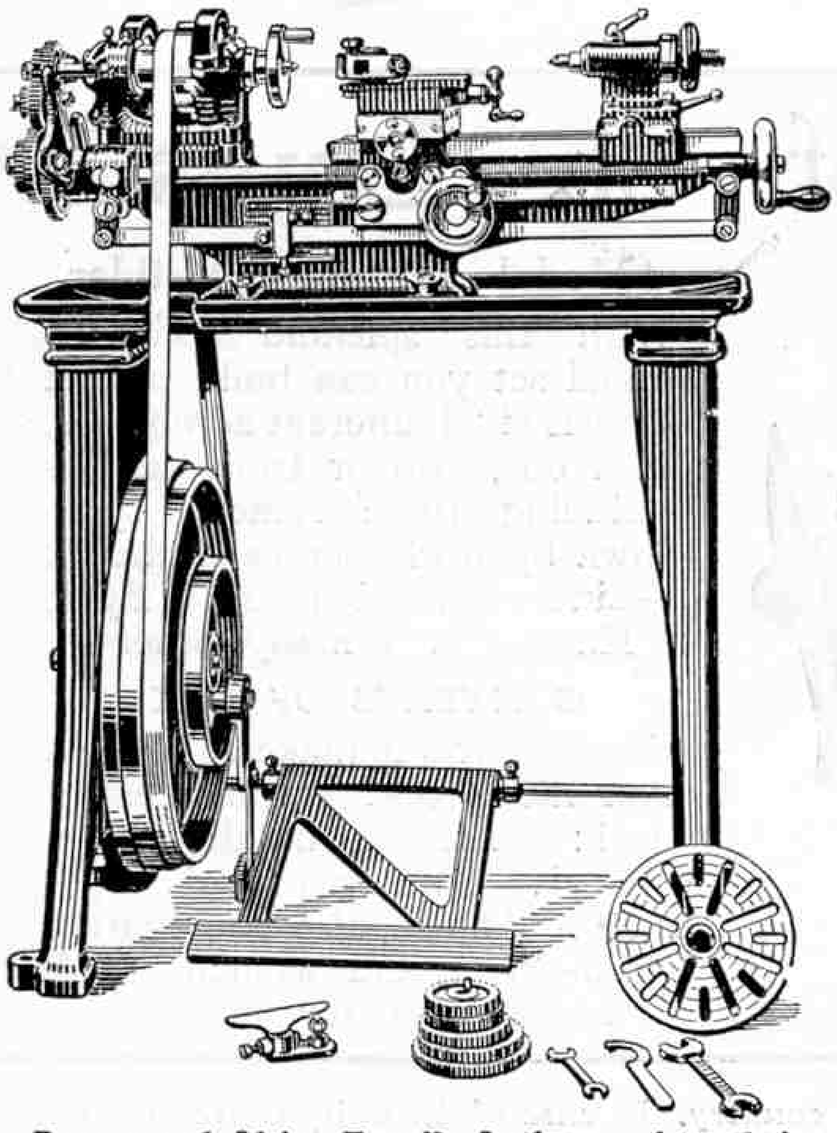
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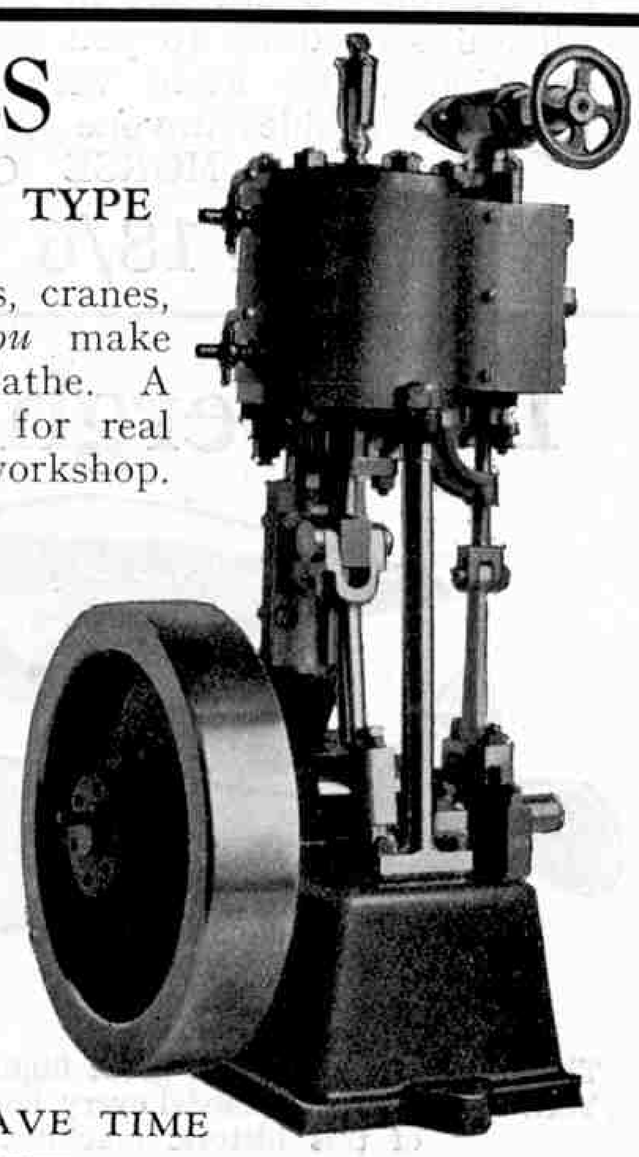


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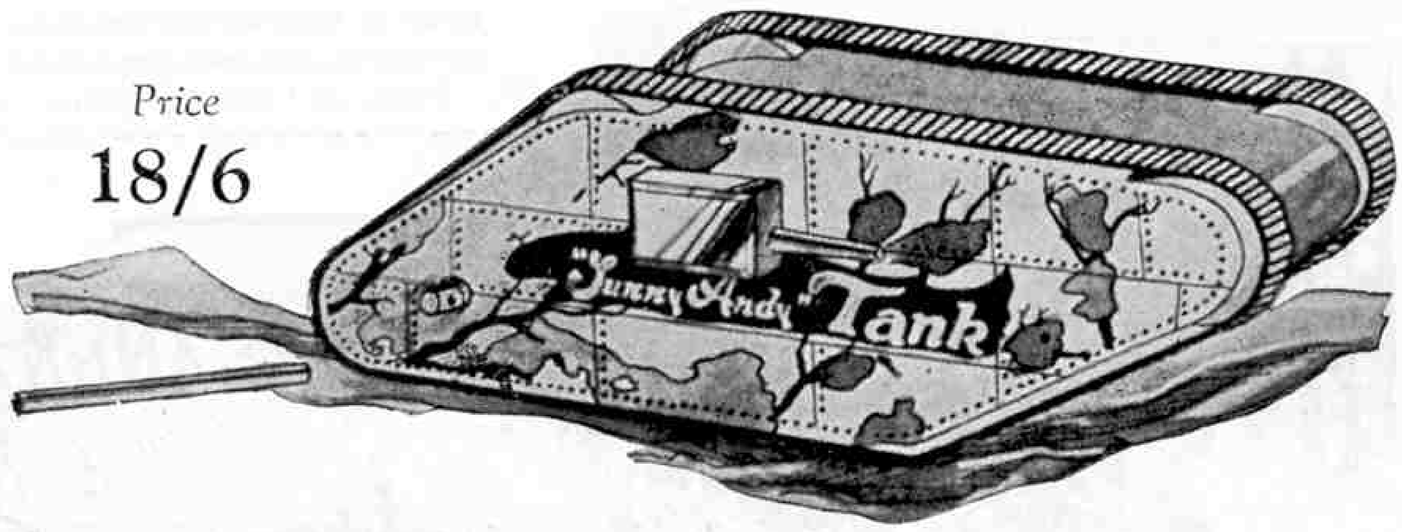
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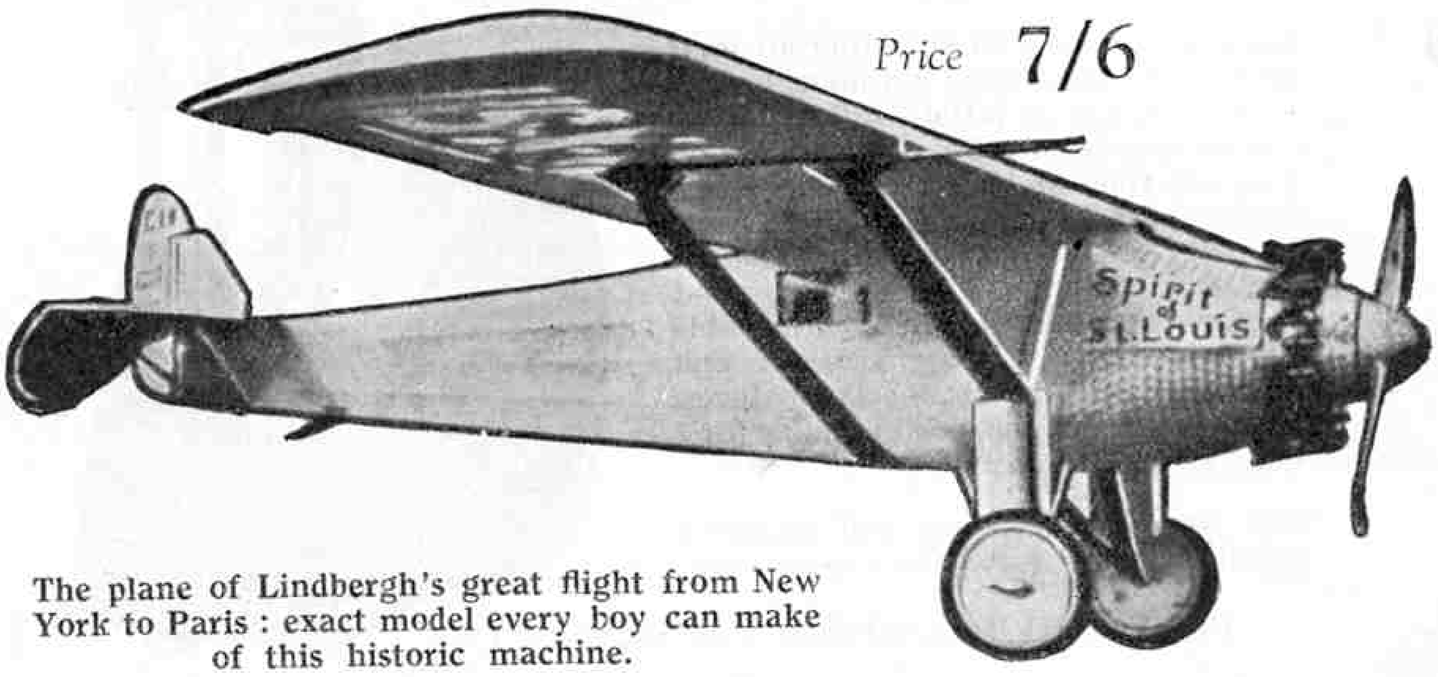
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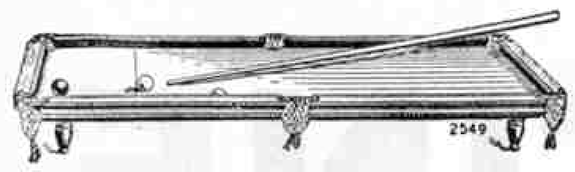
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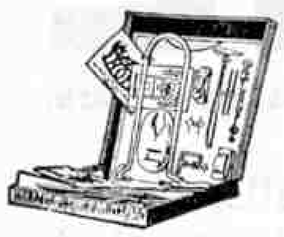
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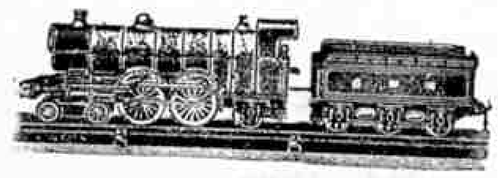


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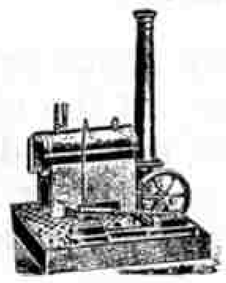


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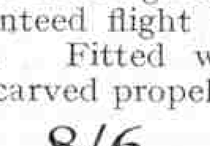




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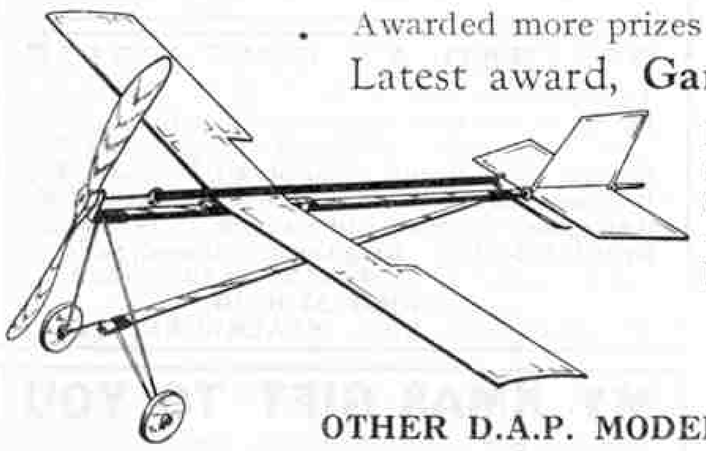
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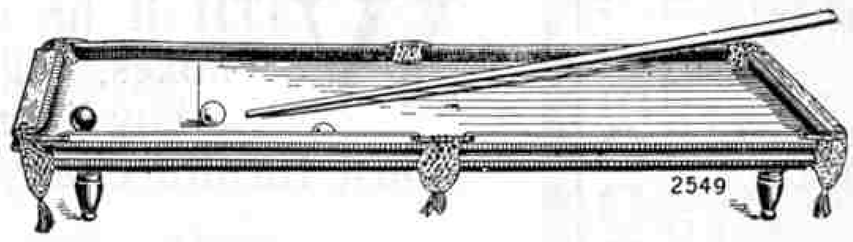
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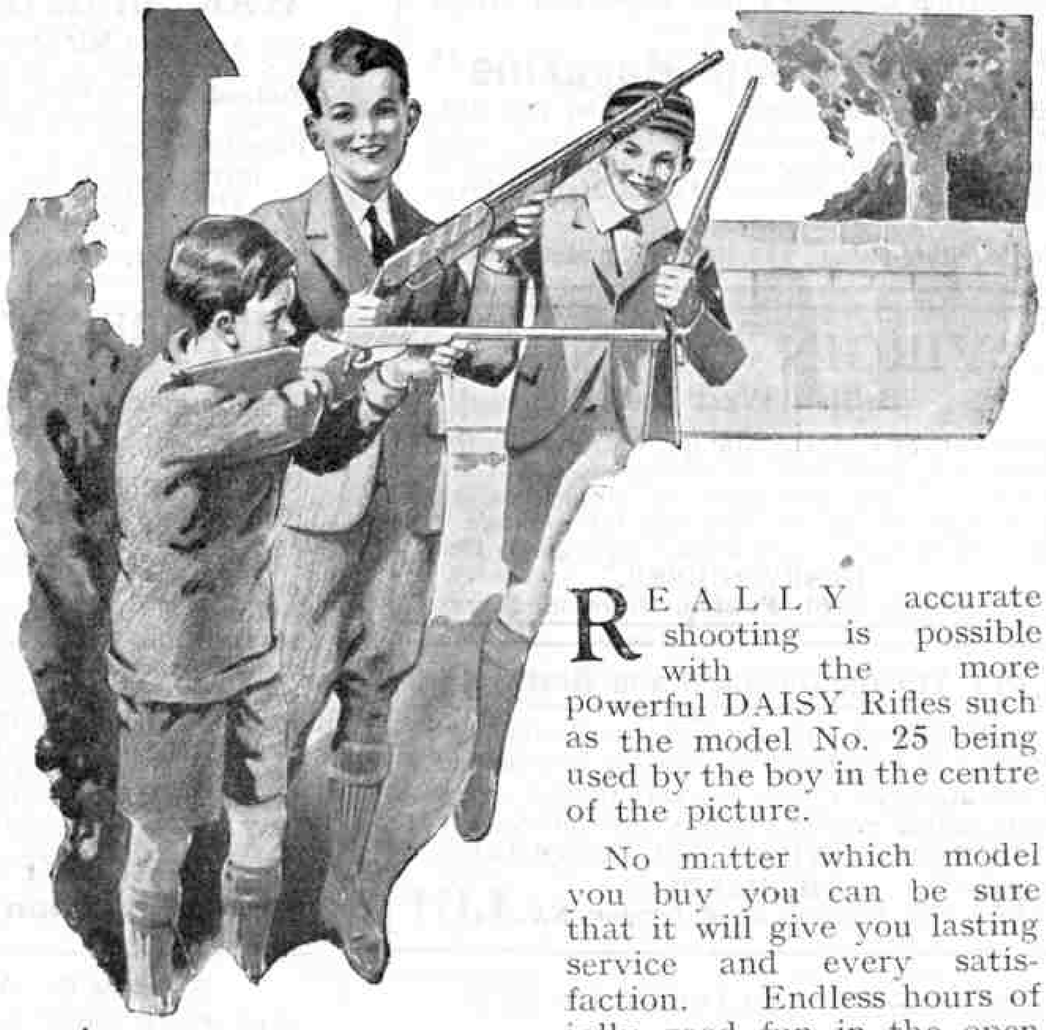
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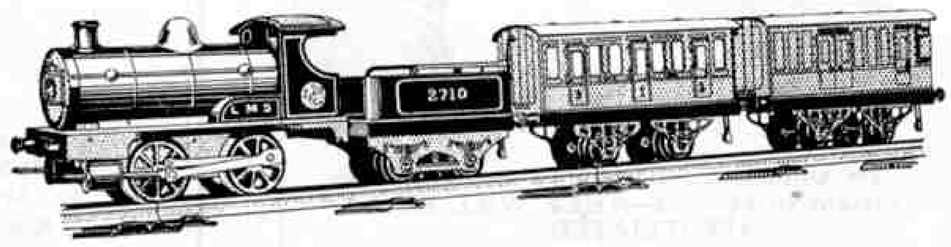
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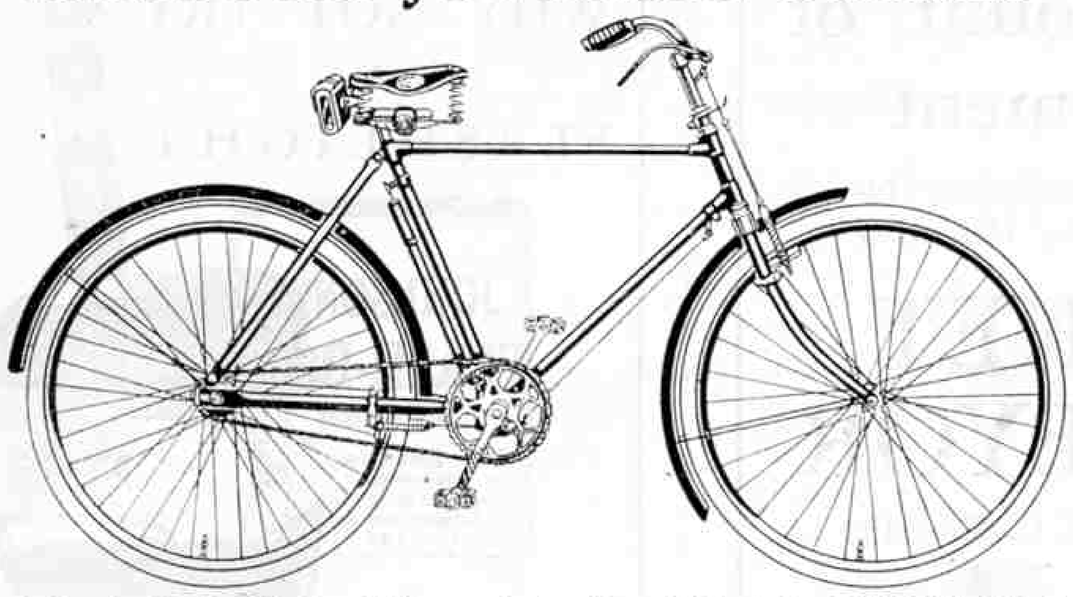
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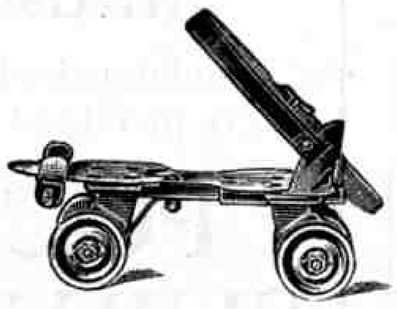
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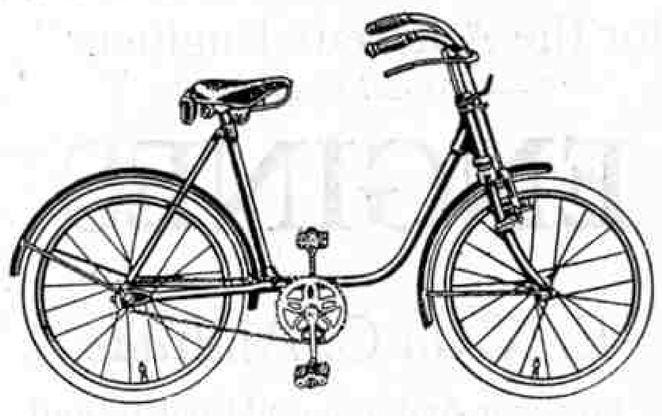
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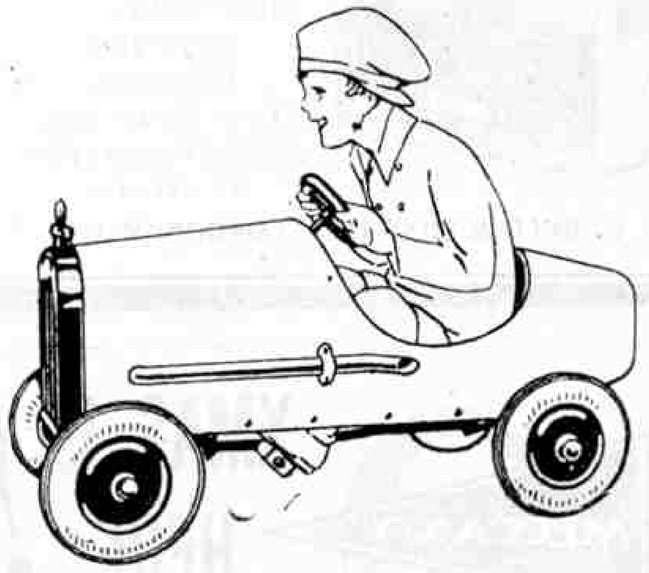
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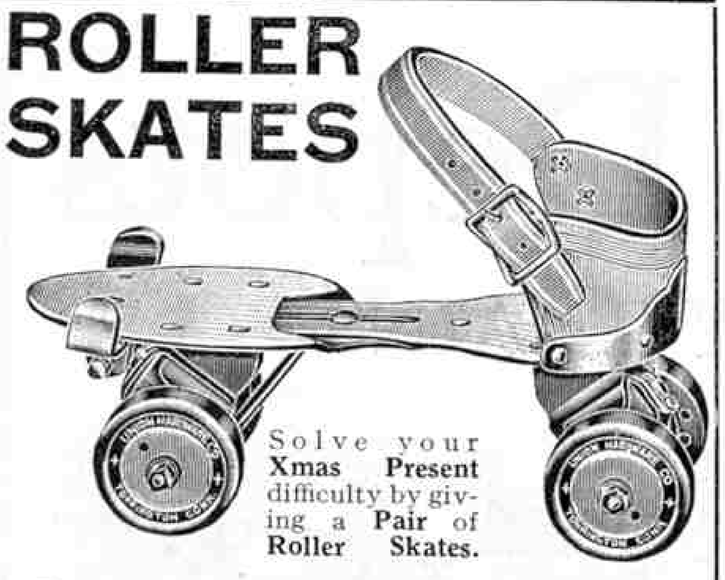
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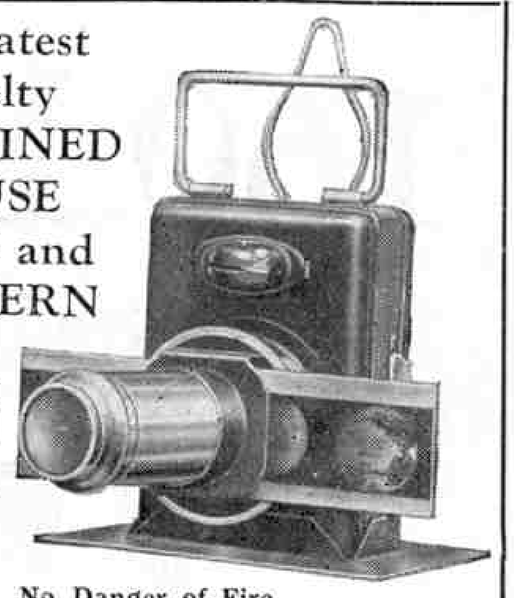
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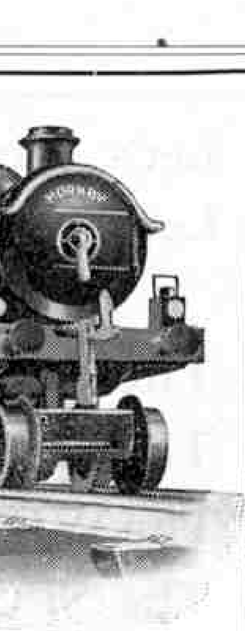


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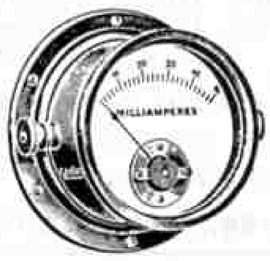


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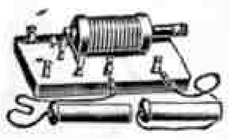
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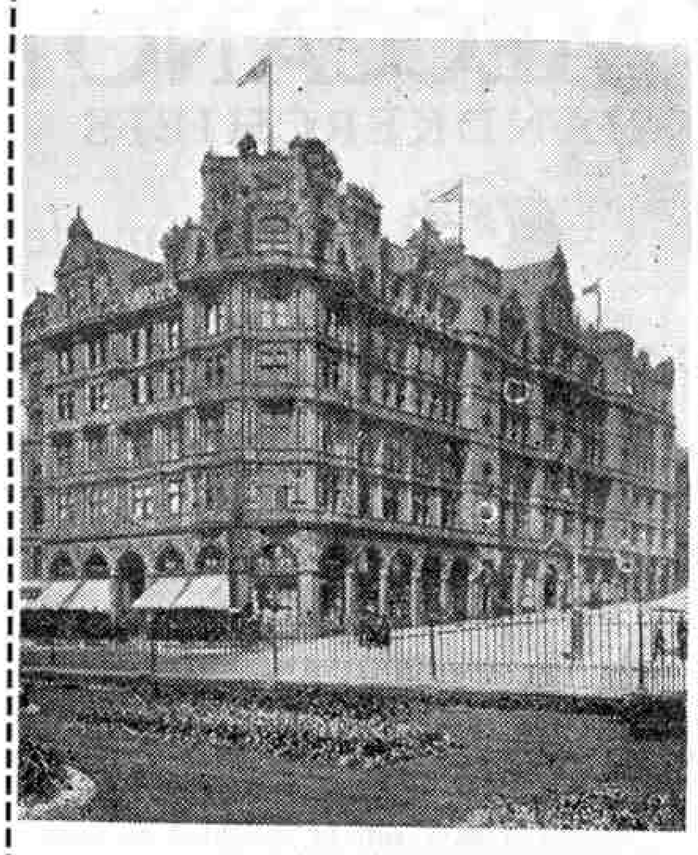
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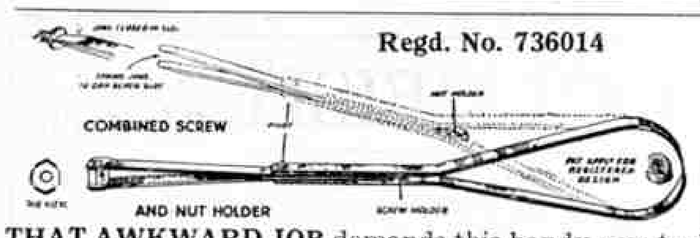


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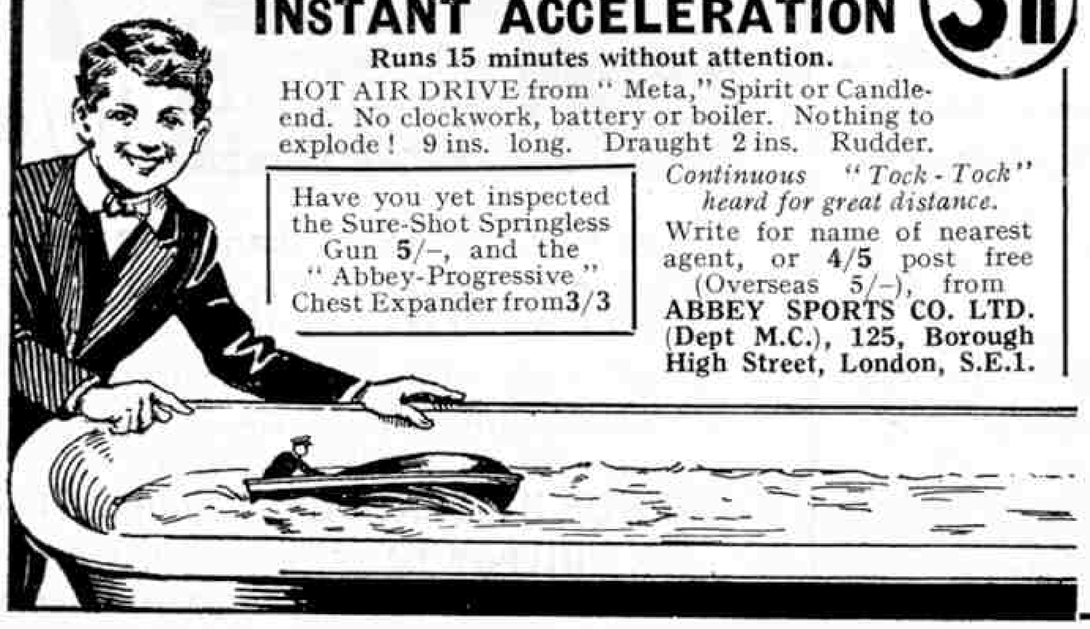
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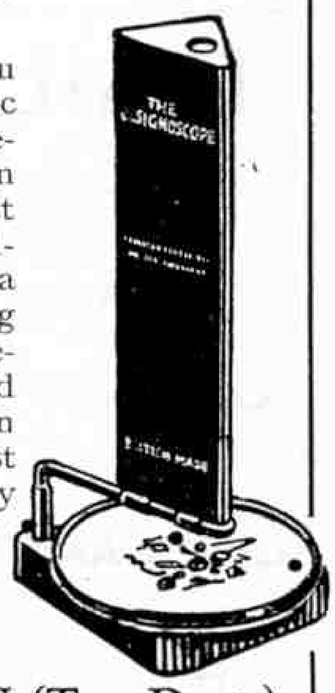
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This Month's Special Articles

	Page
Air News	992
Books to Read	1000
Christmas Books	986
Competition Page	1045
Conjuring Tricks for Christmas	974
Dials of Some Famous Clocks	970
Early Railroad Days in Canada	1002
Electricity Applied to Meccano	1014
Engineering News	990
Famous Aero Engines—Napier "Lion"	984
Famous Trains—The L.M.S. "Twenty-Fives"	978
Fireside Fun	1049
From Our Readers	1006
Great British Navigator, A	1008
Guild Pages	1040–41
Hornby Railway Company Pages	1024–27
In Reply—Hornby Section	1029
In Reply—Meccano Section	1039
Inside A Modern Flour Mill	998
Meccano Gun	1018
Model-building Contest	1013
Model-building Contest Results	1023
Modern Fire Engines	988
Motorcar, Story of the	996
New Meccano Models	1020
Of General Interest	1004
Our Busy Inventors	994
Producing the "*M.M.*"	972
Quebec Bridge	977
Railway News	982
Stamp Collecting	1035
Suggestions Section	1016

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Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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INDEX

Vol. XIII

Jan.—Dec., 1928

Aero Engines:—Armstrong Siddeley 700 h.p. "Leopard," 662; Beardmore "Cyclone" and "Typhoon," 888; Napier 530 h.p. "Lion," 984; Rolls-Royce "Condor III," 798; Wright "Whirlwind," 552
Aeroplanes:—Blackburn "Lincock," 721; D.H. 61, 301; Handley-Page Automatic Slot, 671; Westland "Westbury," 300; Brakes for, 671
Air, Conquest of the:—Early Balloon Ascents, 20, 109, 205, 307; Development of the Dirigible, 398, 484, 546; Development of the Aeroplane, 744
Aircraft Carrier "Courageous," British, 747
Aircraft of the Future, The, 118
Air News, 18, 122, 220, 300, 386, 472, 556, 670, 720, 818, 890, 992
Airships:—British R100 and R101, 19, 123, 220; Zeppelin's Trans-Atlantic Flights, 670, 993
Alligator Farming in Los Angeles, 142
America's Largest Freight Carrier, 405
Arctic, Exploring the:—Franklin Record Discovered, 14; Route to the Pole Discovered, 198; First Crossing of Greenland, 284; Nansen's Great Record, 375; The Pole at Last, 462
Arkwright, Sir Richard, 287

Baltimore Railway Centenary, 112
Books to Read, 30, 146, 234, 322, 420, 502, 586, 658, 740, 816, 902, 986, 1,000, 1,011
Bridges:—Building Quebec, 977: Lifting 900 tons through 5 ft., 152; Sydney Harbour, 291; World's Greatest Suspension, 370; New Thames, 32, 591

Cable Laying by Machinery, 786
Call of the Mountains, The, 458
Canals, Famous:—Panama, 2, 193; Welland, 804
Captain James Cook, Life Story of, 1,008
Civil Aviation as a Career, 124
Coal Handling Machinery, Modern, 718
Coaling Ships by Machinery, 874
Competition Pages, 69, 171, 261, 349, 439, 527, 607, 689, 767, 847, 941, 1045
Conjuring Tricks for Christmas, 974
Cricket Bat, The Making of a, 609

Dalziel of Wooler, The late Lord, 465
Docks:—Singapore Floating, 378, 466; Southampton Extensions, 805
Driving an Electric Locomotive, 571

Editor, With the, 1, 97, 193, 281, 369, 457, 545, 625, 705, 785, 873, 969
Egypt Without the Nile, 749
Electricity Applied to Meccano, 56, 156, 244, 339, 429, 515, 596, 674, 754, 836, 932, 1014
Electrification of the Metropolitan Railway, The, 652, 728
Engineering News, 32, 148, 236, 290, 378, 466, 590, 630, 726, 804, 894, 990

Feathered Home Makers, 498
Fire Engine, Story of the, 896, 988
Fireside Fun, 80, 180, 268, 352, 447, 532, 612, 773, 855, 949, 1049
Flagship of the U.S. Lines Fleet, The, 628
Flettner Rudder, The, 402, 506
Flights, Aerial:—Cobham's New African, 19, 670; Hinkler's Australian, 301, 387; India to England, 891; "My Flight to India," 136, 222, 302; Trans-Atlantic, 473, 670, 993; Trans-Pacific, 720
Flying, The Value of "Stunt," 410
From Our Readers, 28, 132, 218, 316, 504, 588, 660, 738, 820, 900, 1006
Furnace, Wonderful New, 67

G.W.Railway:—High Capacity Coal Wagons, 311; "King George V" Visits U.S.A., 112; Names of "St. Martin" Engines, 647; Re-Named Engines, 24; Revised Crest, 392; "Torbay Limited," 558, "Whitewash Special," 646

Harbour Construction, Modern, 706
Harnessing the River Shannon, 468
Hornby Frank:—My Tour Round the World, 6, 139, 228, 319, 383
Hornby Railway Company Notes, 920-1, 1024-25
Hornby Railway Layouts and Working:—Goods Yard, 922; Passenger Station, 1026
Hornby Series, Additions to the, 1031
How a Patent is Obtained, 460
How the "Electric Hare" Works, 494
How to Photograph Your Meccano Model, 757
How Wire Nails Are Made, 415
Hunting Red Deer with a Camera, 500

In Reply:—Hornby Train Section, 63, 163, 249, 335, 427, 513, 595, 679, 753, 833, 924-5, 1019; Meccano Section, 62, 162, 248, 334, 426, 512, 594, 678, 752, 832, 930-1, 1039
Inventions, Famous:—Fire Engine, 896, 988; Spinning Jenny, 208; Spinning Mule, 372; Submarine, 575, 648, 806; Typewriter, 10
Inventors, Famous:—Sir Richard Arkwright, 287
Inventors, Our Busy, 116, 486, 909, 994

Life at an O.T.C. Camp, 742
Lifting 900 Tons Through 5 ft., 152
Locomotive, Driving an Electric, 571
Locomotive Tender, Evolution of the, 584
Locomotives:—Electric, S.A.R., 24; Exhibition of Giant, 885; Giant "Garratts" S.A.R., 717; High Pressure Pacifics, L.N.E.R., 24; "King Arthur" S.R., 392; "King George V" G.W.R., 112; Modern American, 282; New Hudson, N.Y.C., 226; "River" Tanks, S.R., 393; "Royal Scots" L.M.S., 25, 227, 310, 392; Testing the Booster, L.N.E.R., 310
L.M.S. Railway:—Dock Improvements, 726; "Irish Mail" Express, 712; Manchester "Club" Trains, 296; Named Trains, 24; New Bogie Brake Van, 563; New Engine Livery, 393; New Standard Colour Scheme, 477; "Royal Scot's" Performance, 25; Signal Changes, 227; The "Twenty Fives" Expresses, 978
L.N.E. Railway:—"Aberdonian" Express, 126; Inside a Signal Box, 380; March Goods Yard, 647; Named "Shire" Engines, 25; "Queen of Scots" Express, 474; Restaurant Car Luxury, 709; Smart Engineering Feats, 131; Steam Rail Coaches, 226, 392, 562, 795

Mail Bag, 382, 694, 908
Mapping Alaska from the Air, 232
Meccano Club Notes, 74, 174, 263, 351, 441, 525, 605, 687, 765, 853, 943, 1041
Meccano Competition Models:—Aeroplanes, 680; Automatic Water-Level Indicator, 599; Bascule Bridge, 759; Belt Conveyors, 255, 917; Bucket Loading Machine, 343; Cranes, 248, 343, 598, 1023; Dam, 759; High-speed Mixing Machine, 681; Italian Monument, 832; Lathe, 840; Locomotives, 62, 64, 342, 518-9, 523, 599, 841, 917, 919; Mail Belt Conveyor, 681; Motor Caravan Trailer, 680; Motor Cars and Lorries, 162, 254, 342, 509, 758, 840, 918, 919; Motor Chassis, 65; Motor Cycle and Sidecar, 259; Motor Tractor and Trailer, 254; Palais de Danse, 918; Pneumatic Grain Elevator, 433; Railway Wagon, 335; Sailing Vessel, 930; Seaplane "S.5," 758; Seaside Pier, 519; Sewing Machine, 433; Ships, 512, 519, 758; Snow Motor, 841; Steam Navvy, 65; Theatre, 432; Traction Engine, 255
Meccano, Electricity Applied to, 56, 156, 244, 339, 429, 515, 596, 674, 754, 836, 932, 1014
Meccano Guild, Secretary's Notes, 73, 173, 262, 350, 440, 524, 604, 686, 764, 852, 942, 1040
Meccano in Parliament, 123
Meccano Magazine, Producing the, 550, 636, 710, 788, 876, 972
Meccano Model-building Contest Results, 64-6, 164, 254, 342-3, 432, 518, 598-9, 680, 758, 840, 917-9
Meccano Models, New:—Acrobat on See-Saw, 345; Aerial Railway, 257; Aeroplanes, 225, 256, 934; Alternating Swings, 834; Angler, 682; Baby's High Chair, 935; Bacon Slicer, 1021; Bagatelle Table, 1021; Battleships, 169, 683; Beam Engine, 345; Blacksmiths, 55, 520; Box Ball Alley, 1020; Bullock Cart, 1021; Captive Flying Machines, 435, 760; Carrier Tricycle, 682; Catapult, 683; Coal Cutter, 761; Coaster, 600; Coaster with Driver and Passenger, 935; Coco-Nut Shy, 761; Cranes, 55, 345, 521, 683, 934, 1020; Double Trip Hammer, 434; Drilling Machines, 169, 600; Dump Cart, 55; Electric Truck, 434; Elliptic Wood-Turning Lathe, 520; Executioner, 683; Fire Escape, 682; Football, 594; Foundry Ladle, 935; Goose, 834; Horizontal Engines, 54, 601; Jumping Horse with Jockey, 834; Ladder on Wheels, 257; Lathes, 55, 168, 935; Letter Balance, 760; Man and Dog, 1020; Mechanical Hack Saw, 168; Miniature Meccanograph, 934; Motor Chassis, 752; Motor Tractor, 761; Mounted Cowboy, 345; Naval 4.7 Gun, 1018; Old Siege Gun, 169; Ore Crusher, 257; Pecking Hen, 682; Prancing Horse, 54; Punching Machine, 168; Racing Car "Bluebird," 334; Railway Footbridge with Signals, 344; Rat Trap, 344; Revolving Chair, 169; Rock Drill, 256; Rope Making Machine, 600; Roundabout, 1021; Schoolmaster and Pupil, 521; Searchlight, 760; Spinning Top, 520; Steam Shovels, 601, 835; Strong Man, 683; Tilt Hammer, 257; Three-Wheeled Runabout, 935; Tip Wagon, 54; Tricyclist, 835; Well Drilling Apparatus, 256; Windmill, 601
Meccano Models, Super:—Motor Chassis, 51, 102; Roundabout, 664; Ship-Coaler, 250, 336; Traction Engine, 842, 936
Meccano Parts, New:—Ball Bearing, 684; Boiler, 63; Curved Strips, 426; Digger Bucket, 684; Enamel, 931; Geared Roller Bearing, 684; Girder Bracket, 931; Oil Can, 931; Perforated Flanged Plate, 426; Perforated Flanged Sector Plate, 426; Single Throw Eccentric, 931; Special Screw Driver, 931
Meccano, Scientific Apparatus in, 939
Meccano, Stonyhurst College in, 66
Monoplane, World's Largest All-Metal, 886
Motor Car, Story of the, 98, 211, 292, 488, 578, 654, 734, 809, 910, 996
Motor Passenger Liners, Two Great, 914
Moving the Nation' Merchandise, 154
My Flight to India 136, 222, 302

Niagara Falls:—Committing Suicide, 904; End of, 37
North with the Flying Scotsman, 314

Of General Interest, 150, 242, 422, 672, 1004
Oil Engine, Interesting High Speed, 732
Oil, Story of, 106, 202, 304, 394, 480
Our Daily Bread, Story of, 564, 639, 722, 801, 879, 998
Over 214 Miles per Hour, 412, 466

Permanent Way, Railway Notes on the, 324
Pioneer in Pullman Train Development, A, 465
Plough with Huge Rotary Cutter, 312
Post Office Tube Railway, London's, 32, 812
Puzzle Pages, 79, 471, 585

Railroad Days in Canada, Early, 1092
Rails, Mystery of Creeping, 38
Railway Centenary, Baltimore, 112
Railway Construction and Working, 496
Railway News, 24, 130, 226, 310, 392, 478, 562, 646, 716, 794, 884, 982
Railway Photographs, Collecting, 796
Railway Speeds in France, High, 882
Railways:—Decrepit Soviet, 153; Electrification of Metropolitan, 652, 728; Pennsylvania Railroad, U.S.A., 405; Veteran Coach, 478; What they Carry for One Penny, 130
Railways Fight Snow, How, 194
Railways, Miniature:—How to Make Accessories, 26; Timetable Working, 41
Restaurant Car Luxury, Last Word in, 709
Rocket to the Moon, By, 34

Saving the Buffalo, 327
"Scenery" Out of Sound, Making, 71
Schneider Trophy, The, 44
Scientific Apparatus in Meccano, 939
Seaplanes:—Gloster "Goring," 826; Short "Calcutta" Boat, 492
Ships:—"Clan Macdonald," 727; Exceeding the "Majestic," 590, 630; "Leviathan," 628
Signal Box:—Britain's Largest, 311; Moving 50-ton, 379; What's Inside a, 380
Southern Railway:—Electrification, 393; Electric Signals, 695; "Southern Belle" and "Folkestone Flyer," 47
Speeding Up the Mails, 197
Spinning Jenny, Invention of the, 208
Spinning Tops that Steer Ships, 144, 239
Stamp Pages, Special Articles;—Big Game Hunting, 355; British South African Stamps, 529; Charity Stamps, 691; Columbus and Discovery of America, 265; Engineering Stamps, 1035; Gossip, 179, 267, 357, 445, 531, 611; Great Musicians, 769; How to Commence the Hobby, 77, 849, 945; Sports Stamps, 443; War Vessels of Ancient Days, 177
Stories, Complete:—"In the Cab of the Congressional Limited," 632; "King of the Twilight World," 568; "Paldi Pays," 42
Submarine:—Aircraft Carrying, 221; Invention of the, 575, 648, 806
Suggestions Section, Meccano:—Automatic Coin-in-the-Slot Mechanism, 928; Automatic Reversing Device, 161; Boat Steering Gear, 593; Brown Steam Tiller, 830; Centrifugal Governor for Electric Motor, 750; Chronometric Governor, 424; Combination Safe Lock, 676; Combined Match-Box Holder and Ash-Tray, 247; Corliss' Valve Gear, 592; Desk Agenda, 511; Dual Control for Aeroplane, 677; Electric Target, 161; Folding Camera Tripod, 246; Friction Clutch, 333; Garage Elevator, 1017; Hand Punch, 247; Helicopter, 751; Infinitely-Variable Speed Gear, 160; Intermittent Motion, 1016; Intermittent Switch, 425; Lubricator, 1017; Manual Stand, 61; Map Measuring Instrument, 831; Miscellaneous, 246-7, 333, 511, 677, 751, 831, 929; Pen Rack, 247; Portable Lamp, 831; Puzzle Model, 751; Recording Calipers, 593; Screw Jack, 929; Spherometer, 425; Spring Letter Balance, 751; Square Hole Drill, 677; Two-Speed Constant-Mesh Gear Box, 929; Two-Way Panel Switch, 333; Walking Tractor, 60; Walschaerts Valve Gear, 332; "Wobble" Shaft Variable Speed Gear, 510; Worssman's Silent Feed, 511
Sunken Relics of a Roman Emperor, 418

Telegraph Line that Carries Nineteen Messages, 567
Testing Flatness to Two Ten-Millionths of an Inch, 668
Thornycroft, The Late Sir John I., 892
Tour Round the World, My, 6, 139, 228, 319, 383
Trains, Famous:—"Aberdonian" L.N.E.R., 126; "Folkestone Flyer" S.R., 47; "Irish Mail" L.M.S., 712; "Limited Mails" of Ireland, 790; Manchester "Club" Trains L.M.S., 296; "Queen of Scots" L.N.E.R., 474; "Southern Belle" S.R., 47; "St. Gotthard Pullman Express," 214; "Torbay Limited" G.W.R., 558; "Trans-Canada Limited" C.P.R., 388; "Twenty Fives" L.M.S., 978; "Union Express" S.A.R., 642
Trevithick's Home to be Preserved, 582
Tunnels, Empire's Longest, 134
Typewriter, Invention of the, 10

Waterwheel Alternator, Mammoth, 626
World, Our Wonderful, 36, 408, 748, 822
World's Largest All-Metal Monoplanes, 886

Zoo Notes, 638

A Page of GIFTS for MECCANO BOYS from GAMAGES

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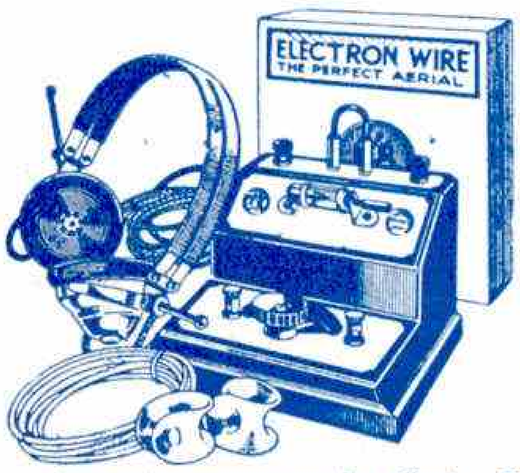
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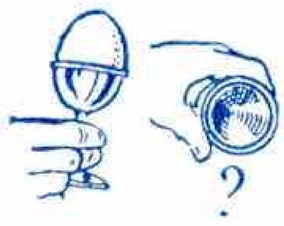
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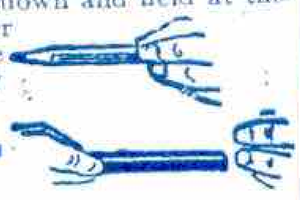
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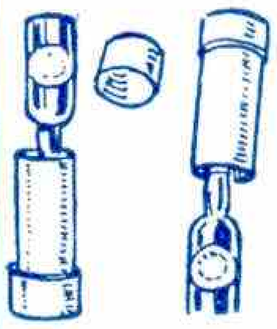
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1/6

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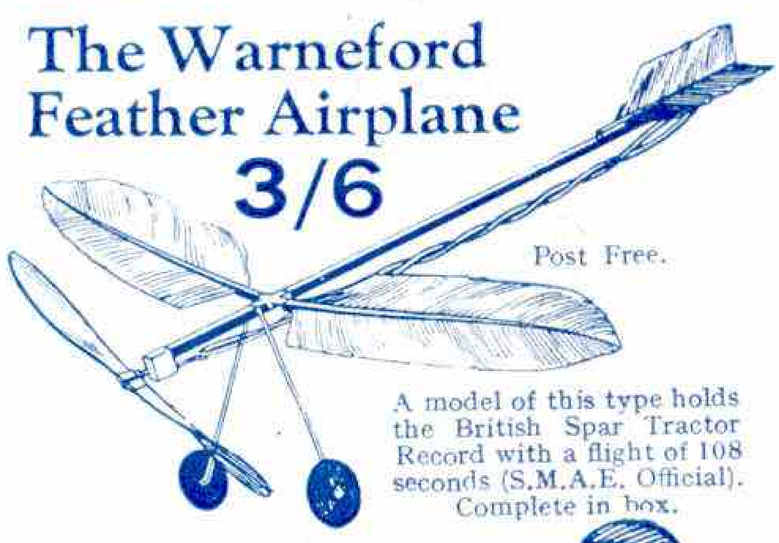
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3/6

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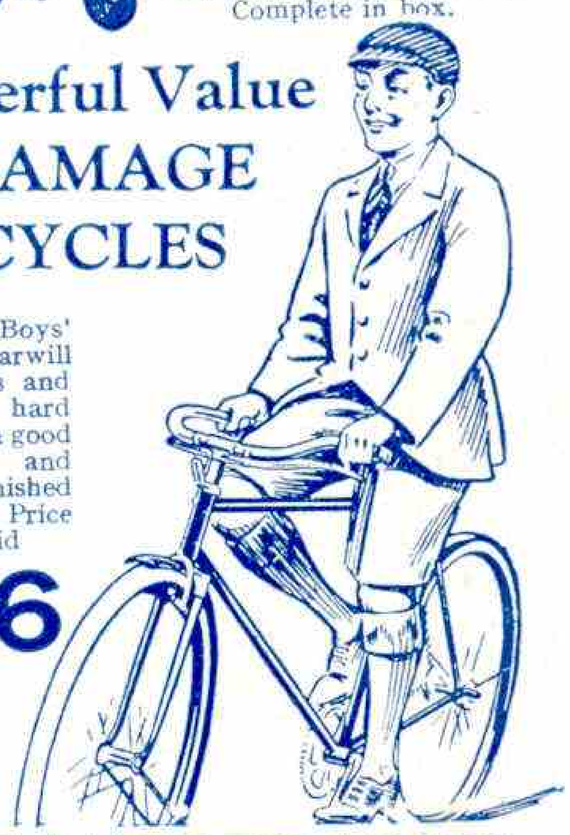


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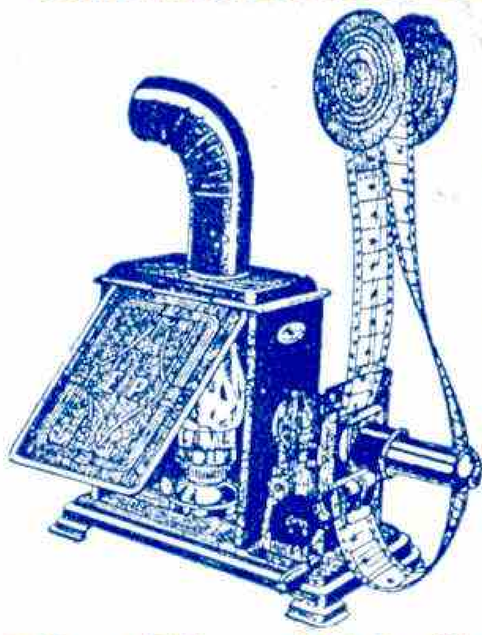
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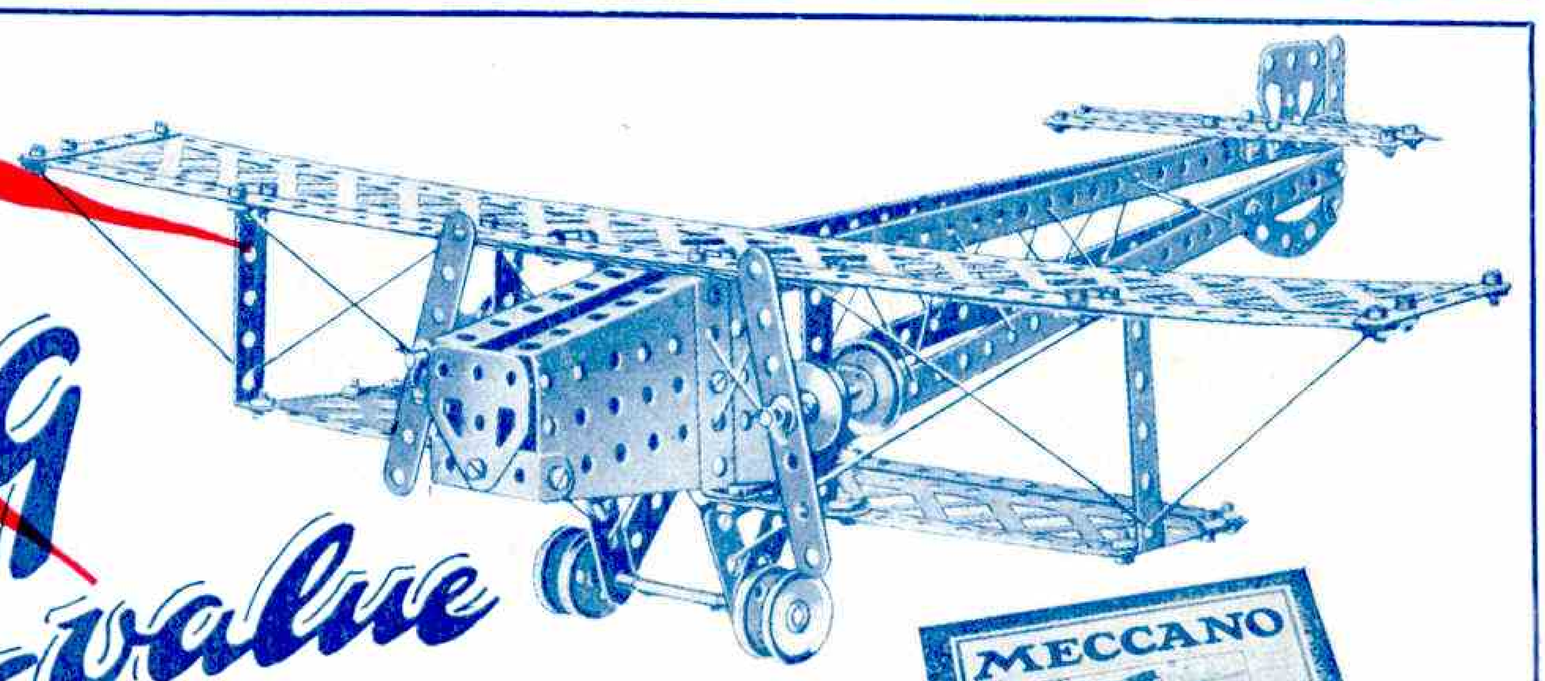


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This splendid Outfit builds bigger and better models than ever before. Full instructions for building 396 models are included

MECCANO

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„ 0	67	184	5/-
„ 1	102	348	10/-
„ 2	158	396	16/-
„ 3	202	447	27/6
„ 4	255	504	50/-

OUTFIT		NUMBER OF MODELS Old Style	New Style	PRICE
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„ 6	Carton	345	594	115/-
„ 6	Wood	345	594	150/-
„ 7	„	381	626	380/-

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