VOL. XIV. No. 2. FEBRUARY 1929

MECCANO MAGAZINE

THE TWENTIETH CENTURY LIMITED (See page 98)

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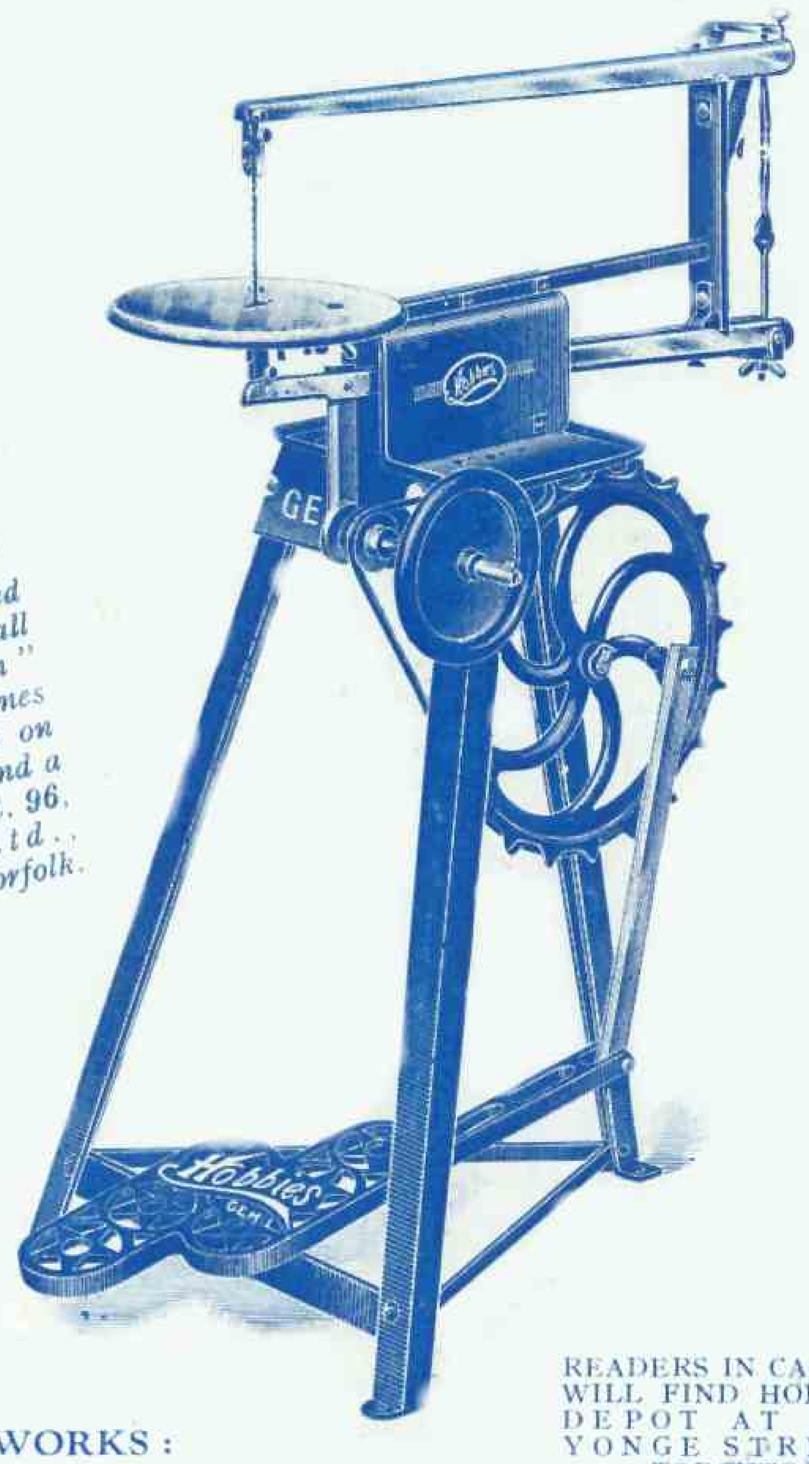

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With the Editor

London to Africa by Rail

In October last I remarked on the readiness with which man burrows underground, and pointed out that at least one great tunnel is almost always under construction somewhere in the world. The great railway tunnels under the Alps or the Rocky Mountains are well worth their cost and the difficulties met with in their construction, for they save a considerable amount of time and bring nations and peoples into closer contact with each other, thus promoting a more friendly spirit between them.

Valuable as these tunnels are, there is another which, if it could be completed, would be even more effective. This is the Channel Tunnel, the construction of which has been discussed for more than a century. The idea of boring a railway tunnel from Great Britain to the Continent has met with considerable opposition from those who do not wish to see this country lose its insular position, and the reasons for and against its construction have been vigorously debated.

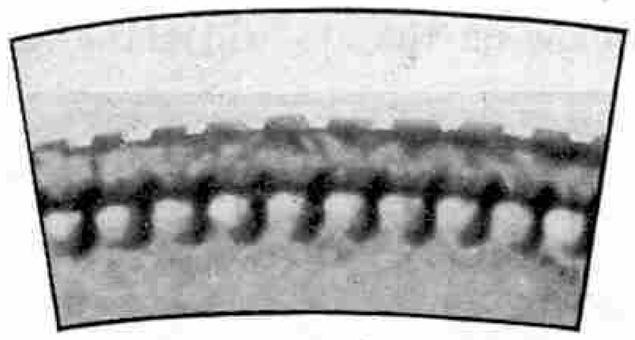
Possibly the Channel Tunnel may never become a reality, but the preliminary borings already made have shown the nature of the problems that will have to be faced if the necessary permission is further obtained. These are described in the article that appears on page 130 of the present number, and I am sure my readers will be greatly interested in this account of the proposed tunnel, which would be one of the world's greatest engineering wonders.

The most significant feature of the interest now being displayed in the construction of the Channel Tunnel is that it is being shown not only in England and France, but also in Spain! The reason for this is that a scheme is afoot to bore a tunnel under the Straits of Gibraltar. This would give direct railway access to Africa and also bring South America much nearer by reducing the necessary sea voyage from Europe by thousands of miles. In conjunction with the proposed railway tunnel an air route across the narrowest part of the South Atlantic would reduce the time required to travel from Paris to Rio from thirteen days to six!

A Tunnel from Asia to America

The Channel Tunnel also would bring Siberia and the Far East into direct communication with Great Britain, and a tunnel under the Bosphorus would extend the same facilities to Southern Asia, including India. America, too, could be linked up, as the Bering Straits are only 36 miles in width at their narrowest part. That Asia and America should be joined by a railway tunnel may sound fantastic, but in fact the suggestion that this should be done was made quite seriously at the time of the Klondyke gold rush many years ago. The difficulties that would be encountered in constructing a line through the frozen wastes of Eastern Siberia are so great, however, that it will undoubtedly be many years before a passenger for Patagonia or the Argentine Republic will be able to take his place in a train that travels from London or France across the Old World before it traverses the New.

WHAT EVER IS IT?



No. 3. The two previous photographs published on this page have aroused such interest that it is proposed to publish some more of these "Puzzle photographs" from time to time, as opportunity allows.

To the first reader to send an exact description—or to the reader who gives one most nearly correct—of the object depicted in the above photograph, I will send an autographed copy of my book "Engineering for Boys."

Solutions should be written on postcards only and addressed "Editor, Competition No. 3, Meccano Limited, Old Swan, Liverpool." Closing date 1st March next.

Mystery Photographs

Any doubt that anyone might have as to the perennial alertness of "*M.M.*" readers would be speedily dispelled by the response to the two competitions announced on this page in December and January. Great interest was aroused by the two photographs, and it was obvious both from the quality and quantity of the entries that many brains had been racked—and racked very thoroughly—in the endeavour to track down the apparent freak to its rightful home! The first correct entry I examined was from Fred Miller, 25, Eric Street, Oldham, who identified photograph No. 1, which was a view from the bottom of the spiral staircase in the lighthouse at the Point of Ayre, I.O.M. A copy of my book "*Engineering for Boys*" has been sent to the successful competitor, as promised.

Although many partially correct entries were received, there was a still greater number of incorrect identifications. Nearly 50 boys decided that the curious object was undoubtedly the tongue of a butterfly! Other tongues that wagged for the good of the cause were those of a chameleon, a frog, a moth, and a bee. It was inevitable that some competitors should "see things," and the photograph was successively stated to be the "eye" on a peacock's tail feather, the eye of a parrot, a butterfly, a turkey, a human being, a pigeon, a fly, an owl, a snail and a brontosaurus! The ornamental prows of ancient Viking galleys found favour in other quarters, and closely allied ideas suggested were the bows of a canoe, a gondola, and a Chinese junk. Dozens of entrants favoured shells, metal turnings, furniture and other wood carvings. Among the "curiosities" I must mention "a played out Catherine wheel," "an opening parachute," "a photomicrograph of a malignant disease," and "the tail of an Ichthyosaurus!" For sheer ingenuity, however, the palm must go to the boy, who taking his courage in both hands, as it were, plumped for a "spiral nebula whose light takes 1,000,000 years to reach the earth."

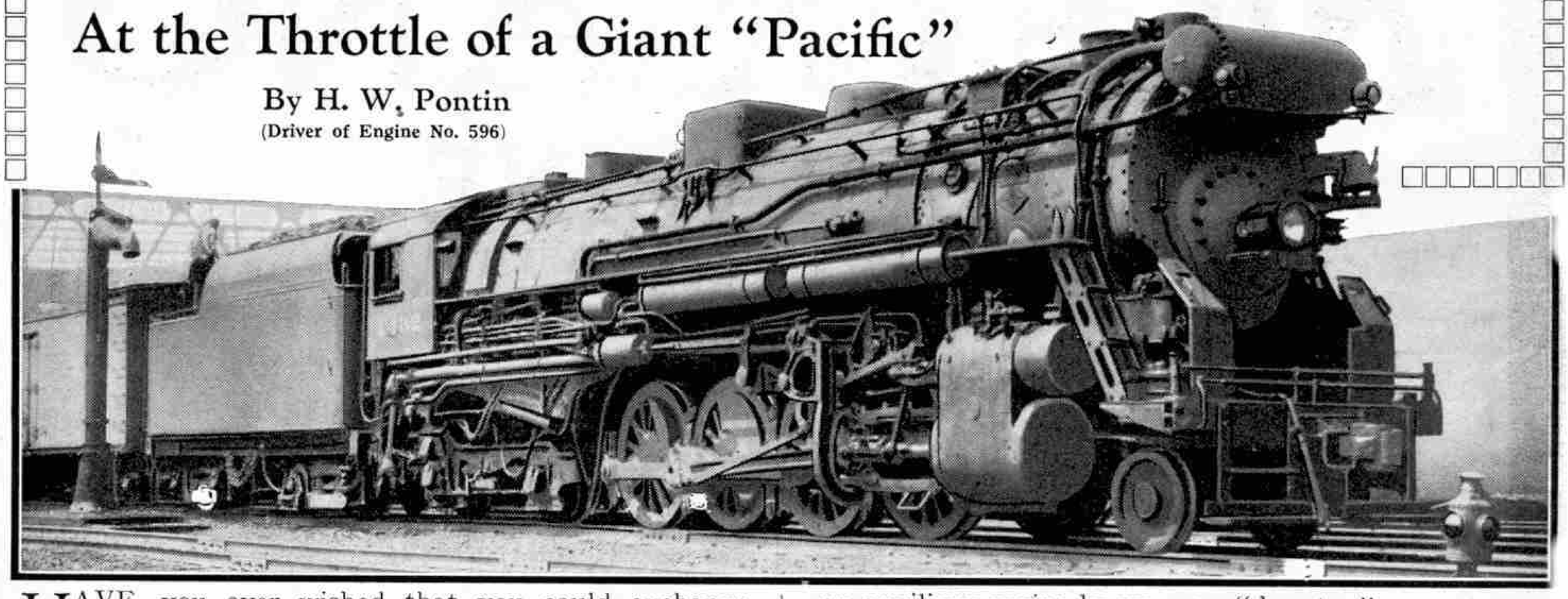
It is not often that the judging of a competition provides so much enjoyment as I have had on this occasion, and if my readers have had half as much fun, they will welcome with wide open eyes the third mystery photograph that is reproduced on this page.

As there was no Overseas section to the second contest announced last month, I am able to disclose also the solution to that. The photograph was part of the head of a Meccano bolt as seen through a microscope of low power. The first correct entry was received from E. Norris, 16, Havelock Road, Bexhill-on-Sea, Sussex, and I have sent to him a copy of my recent book "*Pioneers of Wireless.*" The entries again provided considerable interest, although it would seem that the majority of entrants found the puzzle rather easier. This we judge from the increase in the number of correct answers. Nevertheless, some amusing ideas were suggested. Among these there was a vacuum cleaner, an X-ray photograph of a splinter, the smoke box of a locomotive, the disappearing tail-end of a train, a railway-wagon buffer, part of a fly's foot, a slot in an automatic machine, a sky rocket, and an air view of a canal!

A Run on the "*Twentieth Century Limited*"

At the Throttle of a Giant "Pacific"

By H. W. Pontin
(Driver of Engine No. 596)

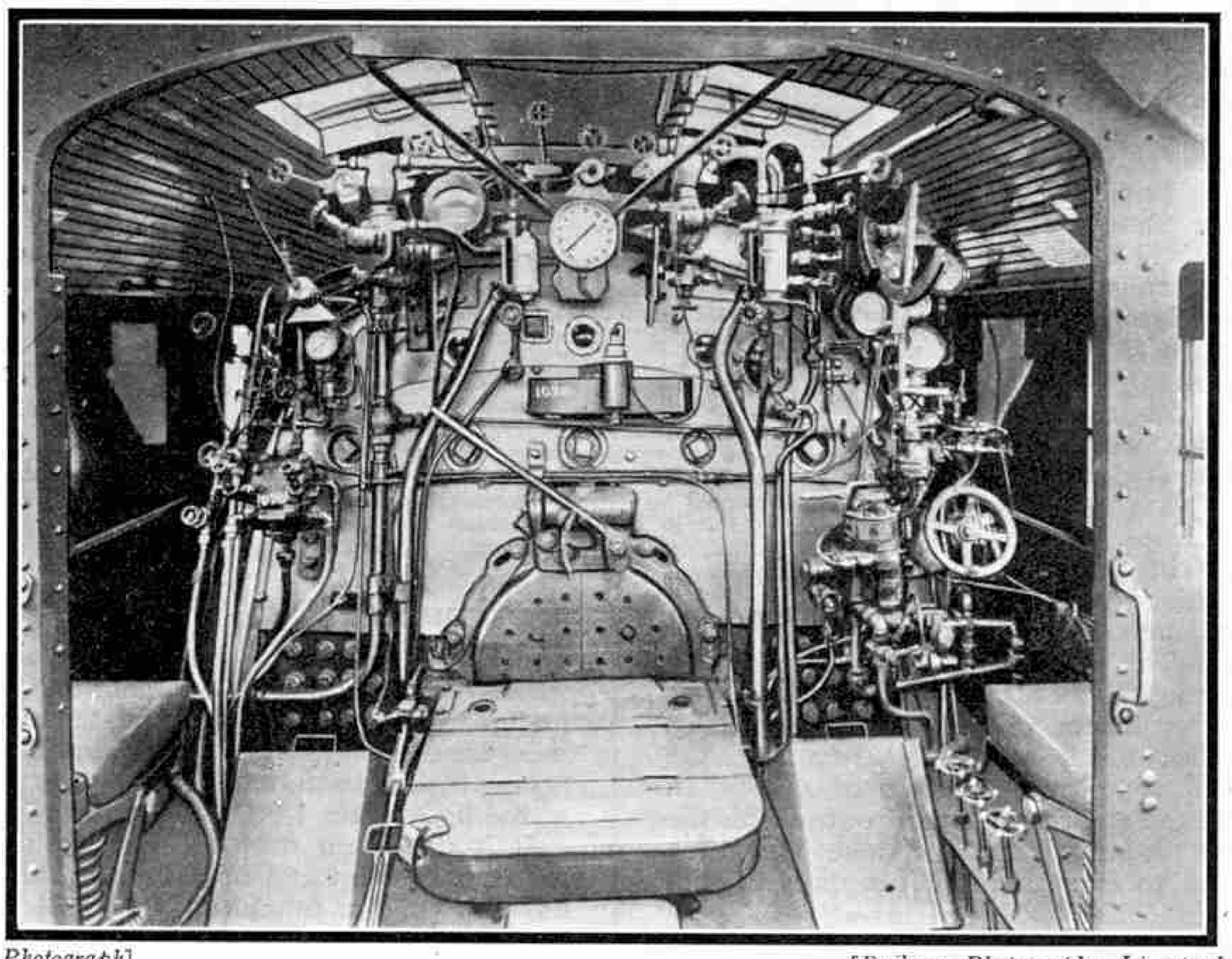


HAVE you ever wished that you could exchange places with one of the engine crew of a famous "Limited" express, in order to experience just for once the thrill of piloting one of these huge steel giants? Unfortunately it is given to few actually to stand at the throttle, but "second-hand is next best," and I want "*M.M.*" readers to come along with me in imagination. I want them to sit at my elbow on the footplate of No. 596, which is to pilot our portion of the "*Twentieth Century Limited*," America's most famous train, from Boston, traversing the 200-mile main line of the Boston and Albany Railroad to join the New York portion at Albany, New York.

Now that we are all quite ready, let us go along to the engine-house and prepare our locomotive for the road. First of all, however, we must examine the bulletin board. On this board are shown plainly any changes in signals, notices concerning reconstruction work in progress, and any other running changes that affect the tracks over which we are to go. All these, of course, we must note carefully.

A few yards farther on and here we are! No. 596, one of the newest productions of the American Locomotive Works, is standing, bright and shiny, awaiting us. She—this engine of ours is too nearly human to be coldly termed "it"—incorporates everything new for securing economical power. She is a "Pacific" of phenomenal size, and to the trailer axle she has geared an auxiliary engine known as a "booster."

Now we climb aboard and start up the turbo-generator, which sets every cab light gleaming and energises the automatic train control apparatus. Next we start the air compressor and observe closely the gauges that indicate the pressure. Now, while you are watching the fireman as he inspects and oils the mechanical stoker, I will oil the valve motion connections and one or two other vital points, and then away we go!



Photograph] [*Railway Photographs, Liverpool*

The cab of one of the giant Pacifics that haul the "*Twentieth Century Limited*." This photograph gives an excellent idea of the complexity of the controls, etc., as compared with those of a British locomotive

Backing slowly across the turntable, we stop to take water and coal and then move off to the Union Station, where on track four our train of nine 100-ton Pullmans is waiting. Coupling-up is the work of only a few minutes, and after charging the train air-brake pipes and cylinders we make a test, to ensure that everything is in perfect working order. If the weather conditions demand it, steam heat must be applied from the engine to the entire train. This steam is used also to heat water for the use of the barber and for various other purposes.

And now we have just a few minutes to spare in which to examine our "make up," so we will pass quickly along the platform and take a peep into the Pullmans. The first car is a combination baggage and buffet car. Here the chairs are arranged as in a club room, and every facility is provided for the business-man. A porter attends to the needs of the passengers and serves refreshments from a buffet located at one end of the car. The next three cars are of the regular Pullman drawing-room

type. Then comes the diner, followed by four more Pullmans, the last of which bears a large illuminated sign that reads "*The Twentieth Century Limited.*" Now we must hurry back to the engine as time is getting short.

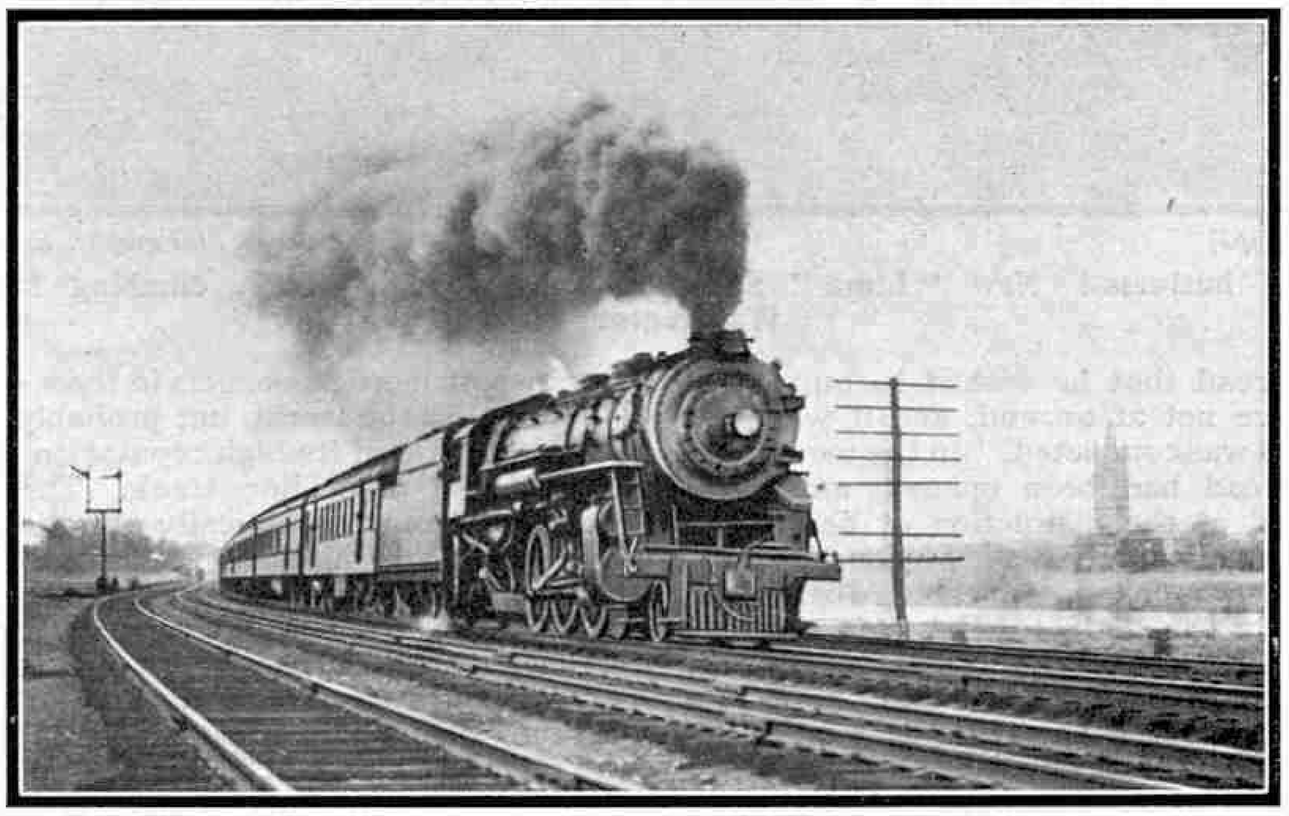
Just before we receive the starting signal let us take a look at the controls and gauges in the cab. Note how easily the engineer and the fireman can reach every lever and valve without leaving their cushioned seats. The gauges are all placed on one well-illuminated instrument panel, recalling the engine-room of an ocean liner. Where possible every steam pipe is placed outside the cab. Storm curtains to make the cab wind-tight and storm-proof in winter are coiled up ready for use.

Photograph] [*Railway Photographs, Liverpool*

The "*Twentieth Century Limited,*" hauled by locomotive No. 596

Now look into the firebox. All you can see is just a few live coals and some ashes, and you wonder what will happen when the engine starts to exhaust on that fire! Well, watch closely. You will see that when the fireman starts the stoker the fire gradually brightens until it becomes a snow-white sheet of flame all over. This, of course, would not be possible under the old system of hand firing.

Look, there is the starting light gleaming, and here comes the "Right Away." Open the throttle and we're off—12.30 p.m. on the dot! It is a smooth, easy start too, for we cut in the booster to provide us with the additional power that renders all jerks entirely unnecessary.



Photograph] [*Railway Photographs, Liverpool*

The east-bound "*Twentieth Century Limited*" at speed near Allston, Mass.; new Pacific locomotive, No. 596

Our engine soon settles down to business, and it is indeed surprising how easily these new engines handle in spite of their enormous size. The road ahead of us is very heavy and curves abound, so that here we shall have little time to watch the scenery. Our first stop is Worcester, 44 miles from Boston. Here we feel our bearings and prepare for the hard climb to Charlton Summit.

Now you will hear "596" bark! We are three minutes late, too, so that we must gather all the speed we can over the first couple of miles of level track in order to get a run at the hill. As the gradient gets steeper we feed the "notches" to our engine until the exhaust becomes a continuous roar. Peep into the firebox now; you see only the same snow-white flame and nothing more. The coal actually is consumed in mid-air as it falls from the elevators and all that remains on the grates is just ashes. No human fireman could keep pace with our engine now, but the mechanical stoker does all that is necessary quite easily.

Here is Charlton Summit, and we have picked up two minutes. From now on as far as Springfield the gradients are not so severe and the engine may be eased a little. With ordinary luck we shall make Springfield on time, which means 140 minutes for the 100 miles—quite lively enough when the heavy grades we have encountered are taken into consideration.

A few minutes later we swing into the New Station at Springfield exactly on schedule time. Water is running low so we must fill up our tank and, while the rod cups—which are lubricated by hard grease—are being filled, "596" is once more examined for warm bearings. We leave Springfield promptly to time and the next few miles take us along the banks of the Westfield River. From this point onward the scenery is wonderful. Here the famous Berkshire Hills start to rear their lofty heads and the booming exhaust of our engine echoes and re-echoes through the chasms. Climbing all the way to Chester, 26 miles from Springfield, we come to the foot of the famous Mount Washington. At this point we tackle our stiffest climb for the gradient rises 90 ft. to the mile—1 in 59. The steep rock cuttings through which we climb as they echo our roaring exhaust seem to be bellowing encouragement to the engine as she is

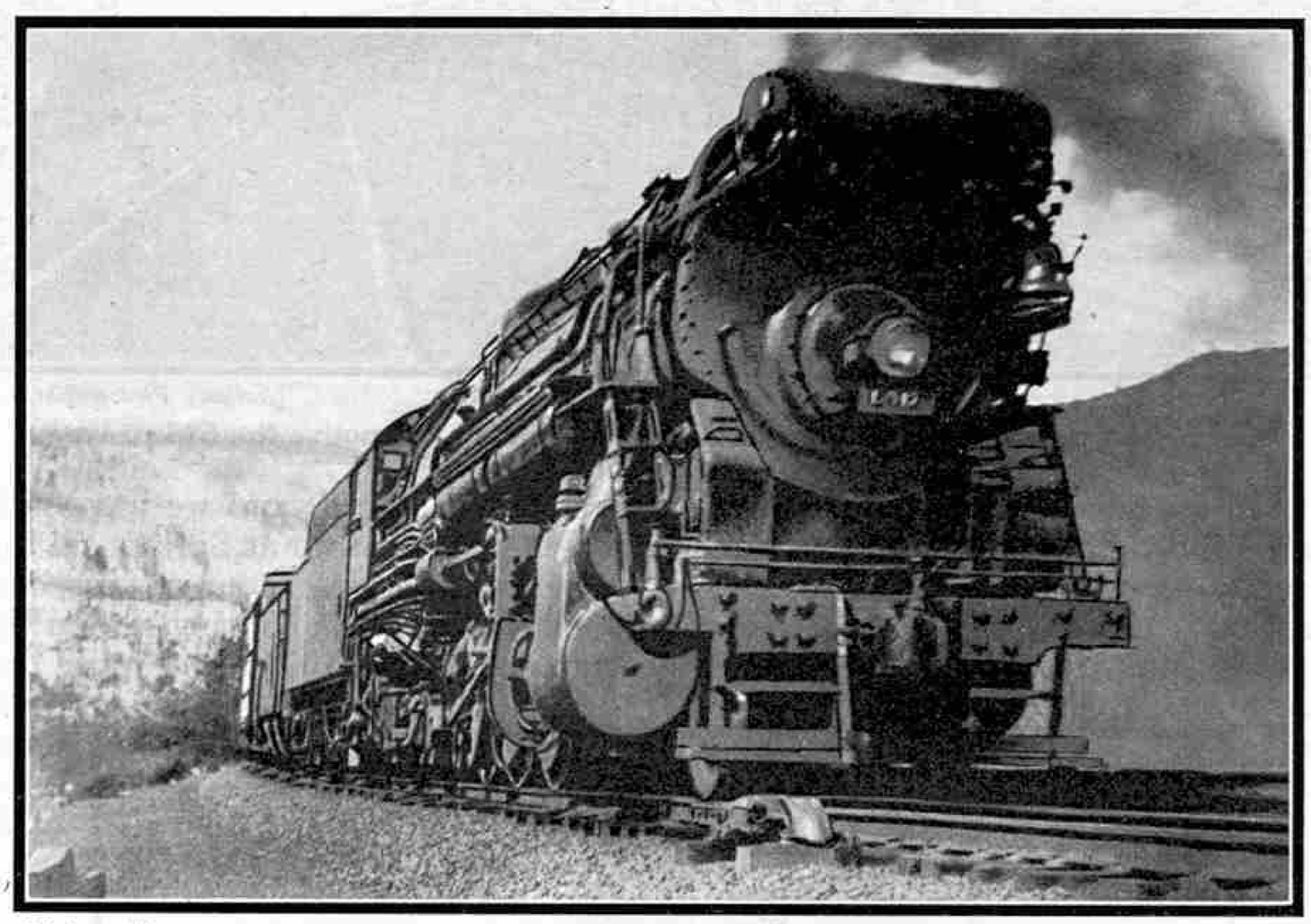
(*Continued on page* 133)

New York Central Railroad

On Which Runs America's Most Famous Express

THIS month our coloured cover depicts a daily scene in La Salle St. Station, the palatial terminus at Chicago of the main line of the New York Central Railroad. Each of the three magnificent locomotives is waiting for the signal that will despatch it with its long train of luxurious cars on the 978 miles run to New York. The trains are sections of the "*Twentieth Century Limited*," one of the world's most famous passenger expresses. It is not as old as our "*Flying Scotsman*," and has only recently celebrated the 25th year of its existence, but in that time it has earned for the New York Central line a high reputation for punctuality and comfort.

The story of the growth of the great system on which the "*Twentieth Century Limited*" runs is one of the most fascinating romances in the railway history of America. The origin of the line may be traced back to 1812, when Geo. W. Featherstonhaugh, a scientist and explorer who lived in a town about 150 miles from New York, suggested that a steam locomotive running on iron rails would be an improvement on any system of transport then in operation. Although he had a great reputation, and numbered among his friends the most distinguished men of his time, Featherstonhaugh had great difficulty in making converts to his views, but in 1826 he succeeded in obtaining the necessary charter for the construction of the railroad that he wished to build.



Photograph] [*Railway Photographs, Liverpool*

Doing business! New "Lima" Super-Power Engine No. 1417, climbing Mount Washington, Mass.

Even then his difficulties were not at an end, and it was not until five years later that the line was completed. In the meantime the Baltimore and Ohio Railroad had been opened, and thus Featherstonhaugh was deprived of the distinction of being the actual railway pioneer of the American continent. The Mohawk and Hudson Rail Road, as his line was called, connected Albany and Schenectady, two small towns in the centre of the state of New York, and was only 17 miles in length. From this small beginning the system grew until it connected New York and Boston, on the shores of the Atlantic, with Chicago and the important cities on the Mississippi River a thousand miles away.

This growth was not achieved without a struggle. In its early days the Company had to contend with the strenuous opposition of those interested in the Erie Canal. This famous waterway connects the Hudson River with the great lakes, and was then the chief means of transport between New York and the growing communities of the West. Large sums of money had been expended in its construction, and for many years its supporters hindered very considerably the growth of the line that was the nucleus of the future New York Central Railroad.

By 1873, the line had grown until it reached from New York to Buffalo, a well-known city a few miles south of Niagara Falls. In that year was made the greatest step forward in the history of the Company. The principal figure in its management was Commodore Cornelius Vanderbilt, the first of the famous "Railway Kings" of North America. It was he who had been mainly responsible for the growth of the railway until it covered almost the whole of the State of New York, and in 1873, he acquired control of a company owning a line from Chicago to Buffalo. From that time onward the two railroads were worked in close alliance, and in fact, had the same principal executive officers. Finally on 23rd December, 1914, the two were consolidated into the extensive and remarkable system now known as the New York Central Railroad Company.

In the meantime progress has been continuous. Branches have been built and existing lines purchased until to-day a system of tracks 12,095 miles in length is under the control of a giant organisation called the New York Central Lines. Its nucleus is the New York Central Railroad and it includes what were originally about 560 smaller companies.

The magnitude of this great enterprise may be judged from the fact that during 1926 the total goods traffic over its lines amounted to more than 40 thousand million ton-miles. This was greater than the similar traffic in the same year on the whole of the railways of Great Britain and France combined.

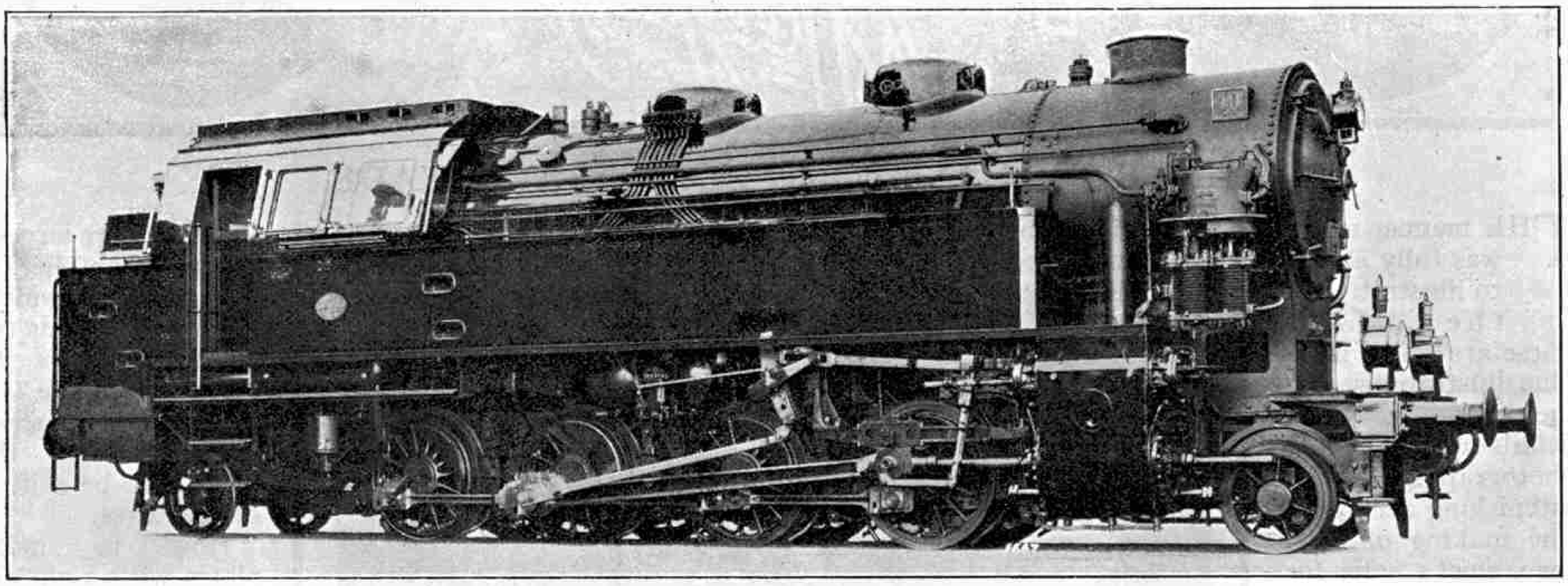
Although its goods traffic is of such amazing proportions, it is chiefly as a passenger line that the New York Central has earned its great reputation. Over its lines run an astonishing number of luxurious and splendidly-equipped trains, on many of which the whole of the cars are Pullmans. The New York Central Lines transport more passengers in these comfortable cars than any other railroad in the world, but probably an equally important factor in the creation of its high reputation as a passenger line has been its wonderful main line track. This runs across low lying open country, and is practically at water level over the entire distance between New York and Chicago. There are no sharp curves or steep inclines, and unusually heavy trains may be operated on it.

The most famous of the many wonderful expresses that run over the lines of the New York Central Railroad is undoubtedly the "*Twentieth Century Limited*." This train was first run on 15th June, 1902. It was planned to cover the distance between New York and Chicago in 20 hours at an average speed of almost 49 miles per hour. This startled many conservative people, and it was said that the experiment would soon be abandoned, as neither the track nor the rolling stock would be able to withstand the rough treatment they would undoubtedly receive. Prophecies of this kind not infrequently are made to appear ridiculous in later days, and this case was no exception. So far from being abandoned after pounding the track of the New York Central Railroad to pieces, the "*Twentieth Century Limited*" seized on public imagination and grew more and more popular. To-day its position as possibly the most remarkable long-distance express train in the world is unchallenged.

Even the railway officials who planned the running of this express can scarcely have foreseen the success that it would achieve. The train that left New York on that memorable day in 1902 carried only 27 passengers, and consisted of five cars. To-day an average of three trains, each consisting of ten cars, are required every day to maintain the service in each direction, and on rush days the express may be run in as many as seven sections!

New Tank Engines for Mountain Railway

Remarkable Hauling Power on Steep Gradients



THE interesting tank locomotive illustrated here has recently been built in Germany by the Hannoversche Maschinenbau A.G. for the Halberstadt-Blankenburg Railway. This railway owns a branch line from Blankenburg in the Hartz Mountains, climbing steadily to a height of some 3,740 ft., and having gradients up to as steep as 1 in 16½.

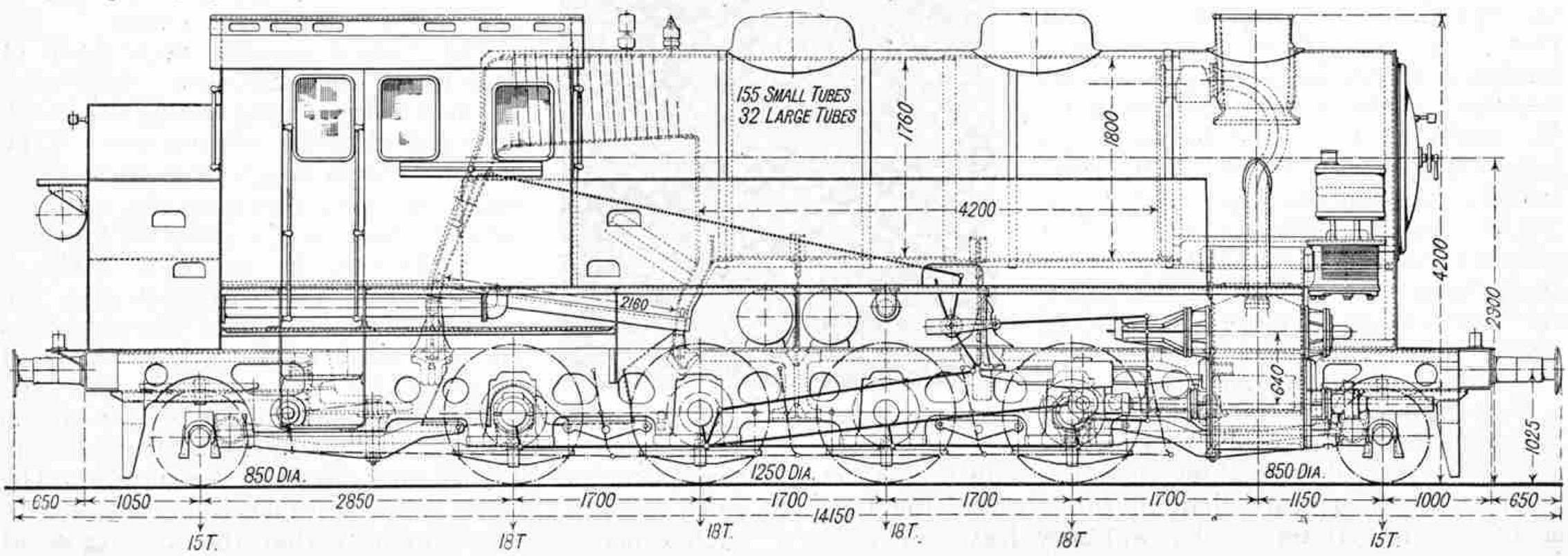
For a considerable time rack locomotives were used exclusively on this line but in 1921 the experiment was made of substituting ordinary adhesion locomotives. This obviously was a bold step to take, and it attracted considerable attention. The locomotives that were put into service were of the 2–10–2 goods type weighing 110 tons in running order. Their success was immediate. They tackled the steep mountain grades without difficulty while hauling quite considerable loads, and their only defect was that, owing to their small wheels, they were not equally suitable for passenger traffic on the more level sections of the system. In order to overcome this difficulty some lighter 2–8–2 locomotives were ordered last year and have recently been placed in service. These are constructed on the same principles as their heavier predecessors but are fitted with larger wheels.

As our photograph shows, the new engines are quite distinctive in appearance. The boiler has been specially designed with reference to the heavy gradients, the diameter being relatively large and the tubes short. The result is to provide a high space above the top of the firebox that obviates any difficulty on account of the variations in water level on the gradients. As a further precaution the firebox top has been given an inclination of 1 in 16. The steam pressure is 235 lb. per sq. in.

The frame of the engine is of bar construction and has a fixed wheelbase of only 5 ft. 7 in. The two centre axles only are in fixed bearings, the others being in bogies; so that the engine is able to negotiate without difficulty the mountain curves. The steam cylinders are of unusually large size—25.2 in. diameter, 23.6 in. stroke—the object of this being to allow high tractive effort to be developed at the same time working economically with an early cut-off. Pneumatic sanding gear is provided on both sides of all the coupled wheels.

In the course of trial trips the new locomotives have hauled up the 1-in-16½ gradient coupled loads ranging up to as much as 200 tons, which is a very remarkable performance taking into consideration the fact that the available adhesive weight is only 70½ tons.

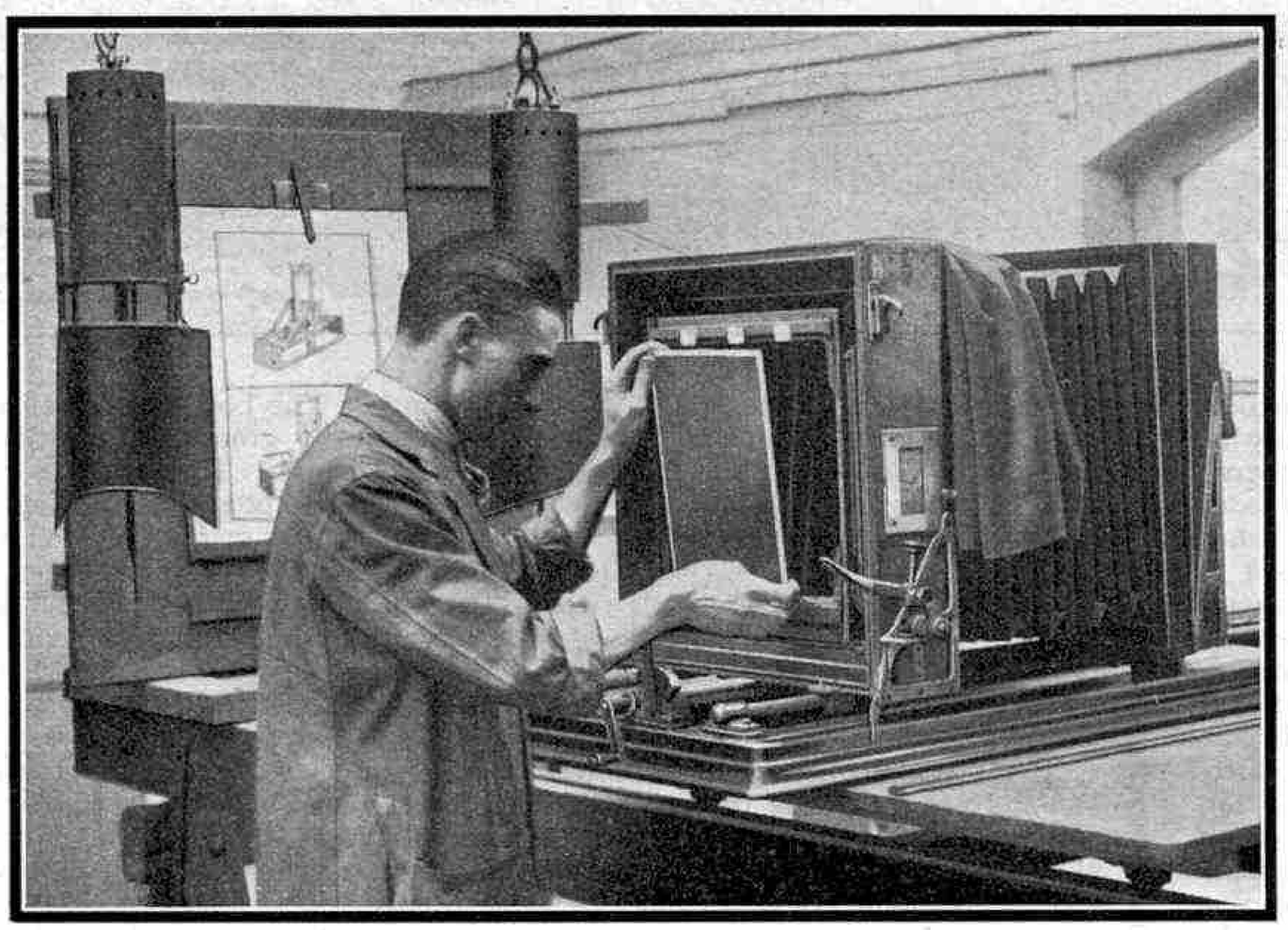
Above is shown a general view of one of the 2-8-2 tank locomotives for a line in the Hartz Mountains that formerly was worked by rack locomotives. This photograph and the elevation shown below (dimensions in m.m.) are reproduced by courtesy of "*The Railway Engineer.*"



VIII.—HOW HALF-TONE BLOCKS ARE MADE

THE manner in which zincos or line blocks are made was fully explained last month, and now we come to illustrations of the type used almost exclusively in the *"M.M."* These are called half-tone illustrations, and they reproduce the details of the original photographs with astonishing accuracy. The making of half-tone blocks calls for a very high degree of technical skill, and the block has to pass through many intricate processes before the finished product reaches the hands of the printer.

A close examination of any half-tone illustration will show that it is made up of a large number of dots of different sizes. Although these are seen most easily in the pictures that appear in daily newspapers, the smaller dots in the illustrations in the *"M.M."* may be detected by any reader with keen eyesight. The use of a small magnifying glass will at once reveal their shapes and sizes.

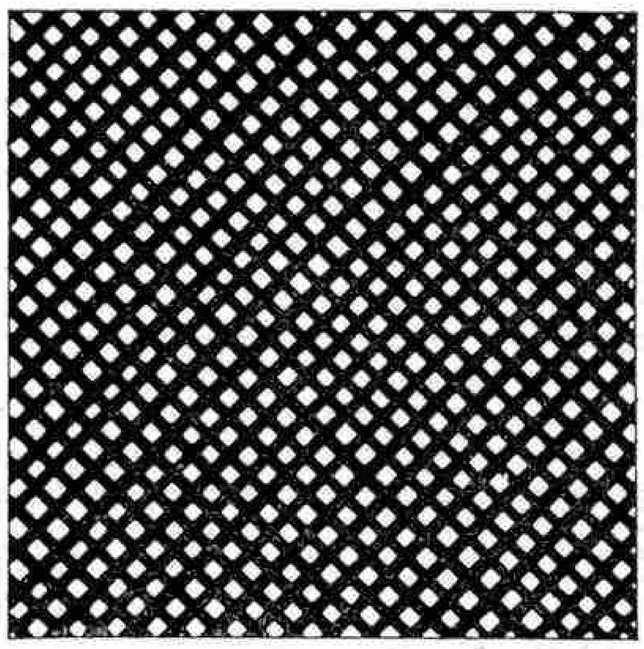


Half-tone screen being placed in position in a photo-engraver's process camera. The photographic plate fits immediately behind the screen

In order to understand why pictures are reproduced in dots, let us imagine that a photograph is printed on a sensitised metal surface, and that we wish to transfer it to a sheet of paper. We might try to do this by running a roller charged with ink across the plate and then pressing the paper firmly on it. We should find, however, that a blot only was formed, and that there would be no trace of a picture on the paper, the reason being that the ink would be distributed evenly over the whole of the surface of the metal.

Now suppose that we break up the flat surface of the picture into a rectangular pattern of dots, making these larger in the darker portions of the picture than in those where the tone is light. The printer's roller will now leave ink only on the dots. Most will be left where the dots are largest, and very little will be transferred from the roller to the portions of the plate where the dots are widely separated. Thus the varying tones of the picture will be reproduced on the sheet of paper, but the result will be a little more coarse.

How to make plates with a surface broken up into dots in this manner was a problem that occupied the attention of inventors in several countries. A solution was discovered at about the same time by several pioneers, the two chief being Meisenbach of Munich, and Max Levy, an American living in Philadelphia. These men broke up the flat surface of their "copy" by photographing it through screens containing a very large number of tiny holes arranged in a regular pattern. Light could only reach the sensitive plate through the holes, and thus the final print consisted of a large number of dots, each of which corresponded to one of the holes in the screen.



Enlarged view of half-tone screen

The earliest screens were made of wire mesh, and thus had actual holes in them; those used to-day are much finer and of better construction. They are made from sheets of flawless glass, with tiny transparent areas that serve the same purpose as the holes in the wire mesh screens. In order to make a single screen, two sheets of glass are needed. Diagonal lines are engraved on one surface of each with great accuracy by an automatic machine. A black opaque pigment is then rubbed into the rulings in order to give them the appearance of black lines drawn on the surface. The ruled faces of the two sheets are placed in contact with each other in such a manner that the lines cross at

right angles and enclose tiny squares of transparent glass, through which the " copy " may be photographed. They are then bound together by aluminium strips.

As the screens play a very important part in the production of half-tone blocks, the greatest care must be used in making them. They are very costly, especially when the transparent sections are very small. The photo-engraver grades his screens according to the number of lines ruled to the inch. This may vary from 50 to 200. The coarser screens are used in preparing blocks required for rapid printing on low grades of paper. Those used in newspaper work, for instance, usually have 65 lines to the inch, and the dots of the pictures produced with their aid are visible without magnification.

Finer screens are used when paper with a smoother surface is available. An excellent example is provided by the "*M.M.*" itself, the screens used in preparing the majority of the illustrations that appear in it having 120 lines per inch. This size is the most suitable for the paper and the speed of printing, and an examination of the illustrations in any copy of the Magazine shows that it gives excellent results.

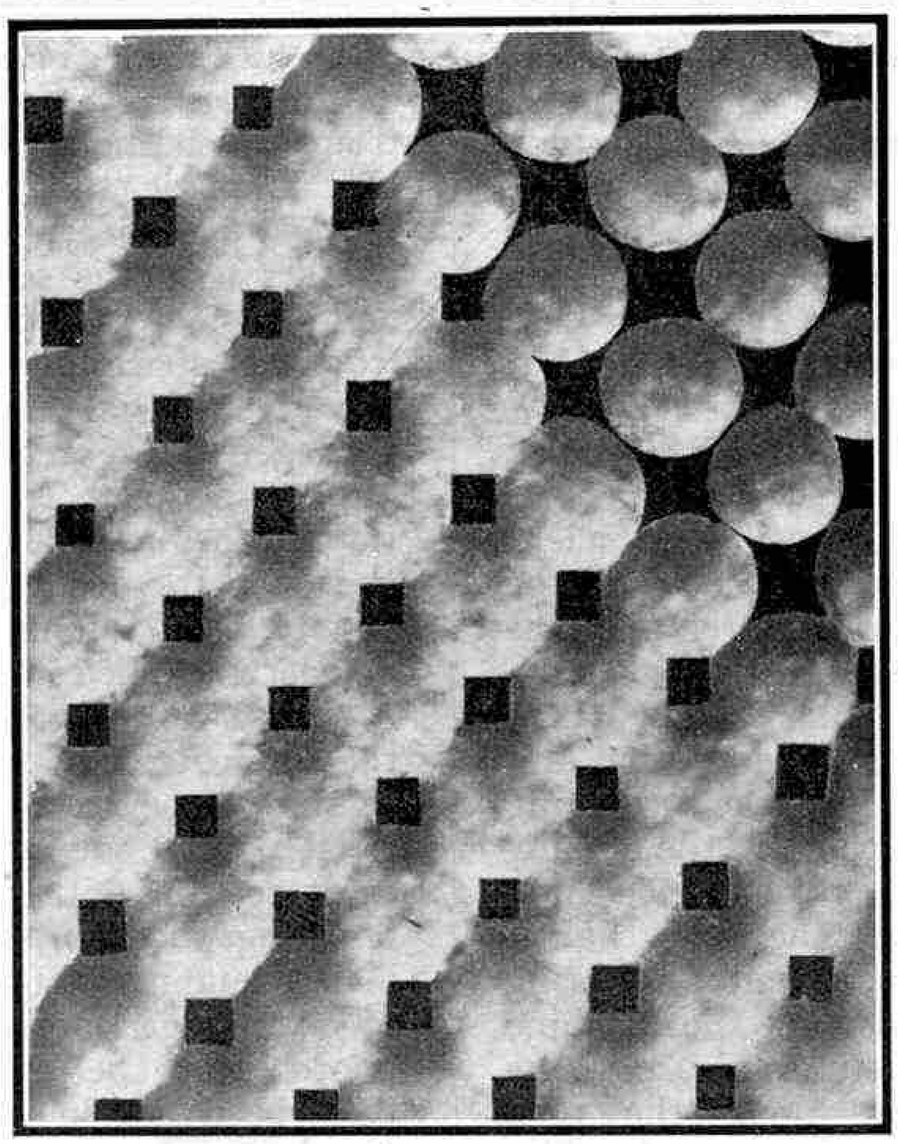
For high-class work, in which pictures must show absolutely to the best advantage, even finer screens may be used in conjunction with superfine paper. In the preparation of catalogues containing illustrations of complicated machinery, for instance, every detail must be shown clearly. In such work screens having from 150 to 200 lines per inch are used, and it is impossible to see the dot formation without the assistance of an excellent magnifying glass.

Now let us follow the making of a half-tone block in order to show exactly how the screen performs its work. Last month we saw that the first step in the preparation of a line block is to photograph the originals. This also must be done in half-tone work. Accordingly the picture to be reproduced is placed on the copy board alongside the camera, and the operator moves the latter about on its rails until the image focussed on the ground glass is of the required size. When all is ready the slide carrying the sensitised plate is inserted.

So far the process is similar to that employed in making line blocks. In the earlier stages, in fact, the only difference—but a very important one, of course—is that the camera contains a ruled screen. This is fitted into an aluminium frame just in front of the plate and the exposure is thus made through the little squares of glass between the diagonal rulings. The result is the same as if the diagonal lines of the screen were drawn on the copy and a photograph taken in the ordinary manner. The negative is made up of dots, and is not continuous, as an ordinary photographic print appears to be.

Pouring sensitised fish glue on a copper plate that is to be made into a printing block

The next step is to print from the negative on to the metal plate that eventually becomes the finished block. The metal used in half-tone work is not zinc, as in the case of line blocks, but copper. The first step is to coat a plate of the metal with a film that is sensitised to light. This is made by adding ammonium bichromate and white of egg to clarified fish glue. The printer, working in a dark room, pours a quantity of the mixture on to one side of the sheet of metal and allows it to flow over the whole of the surface. He then dries the film by inverting the plate and whirling it round at great speed over a gas flame, the rapid motion spreading the mixture and giving a film of even thickness. This process is very interesting to watch. The plate is attached to the whirler by a rubber suction cup, and gearing enables the operator to spin it very rapidly.



A greatly enlarged photograph of the surface of a half-tone block. Most of the dots are very small, but in the upper right hand corner are several that have been practically unattacked by acid

The negative and the sensitised plate are now placed in contact and laid in a vacuum printing frame of the kind described last month. As in the case of zincos, printing is done with the aid of a powerful arc lamp near which the frames are reared on end.

A remarkable chemical change takes place in those portions of the film to which the light penetrates through the negative. The film itself may easily be washed away by water, but when exposed to light it undergoes a change that makes it insoluble, and no amount of washing will remove it. When the sensitised copper plate has been exposed and washed, therefore, the picture is outlined on it by the hardened portions of the film. It cannot easily be seen, for the film is very delicate and almost invisible when wet. In order to bring out the details the plate is usually immersed in a bath

of a violet dye, which is absorbed by the film, but does not affect exposed copper.

The plate is now dried and heated over a gas stove until the film has been baked into a hard enamel that is acid-resisting. It will be quite clear that this remains on the plate in those places where the light has acted on the film during printing, and thus the picture to be reproduced is now marked out in enamel. This process is called "burning in," and the purpose of the enamel formed in this manner is to protect certain parts of the plate during the etching process that immediately follows.

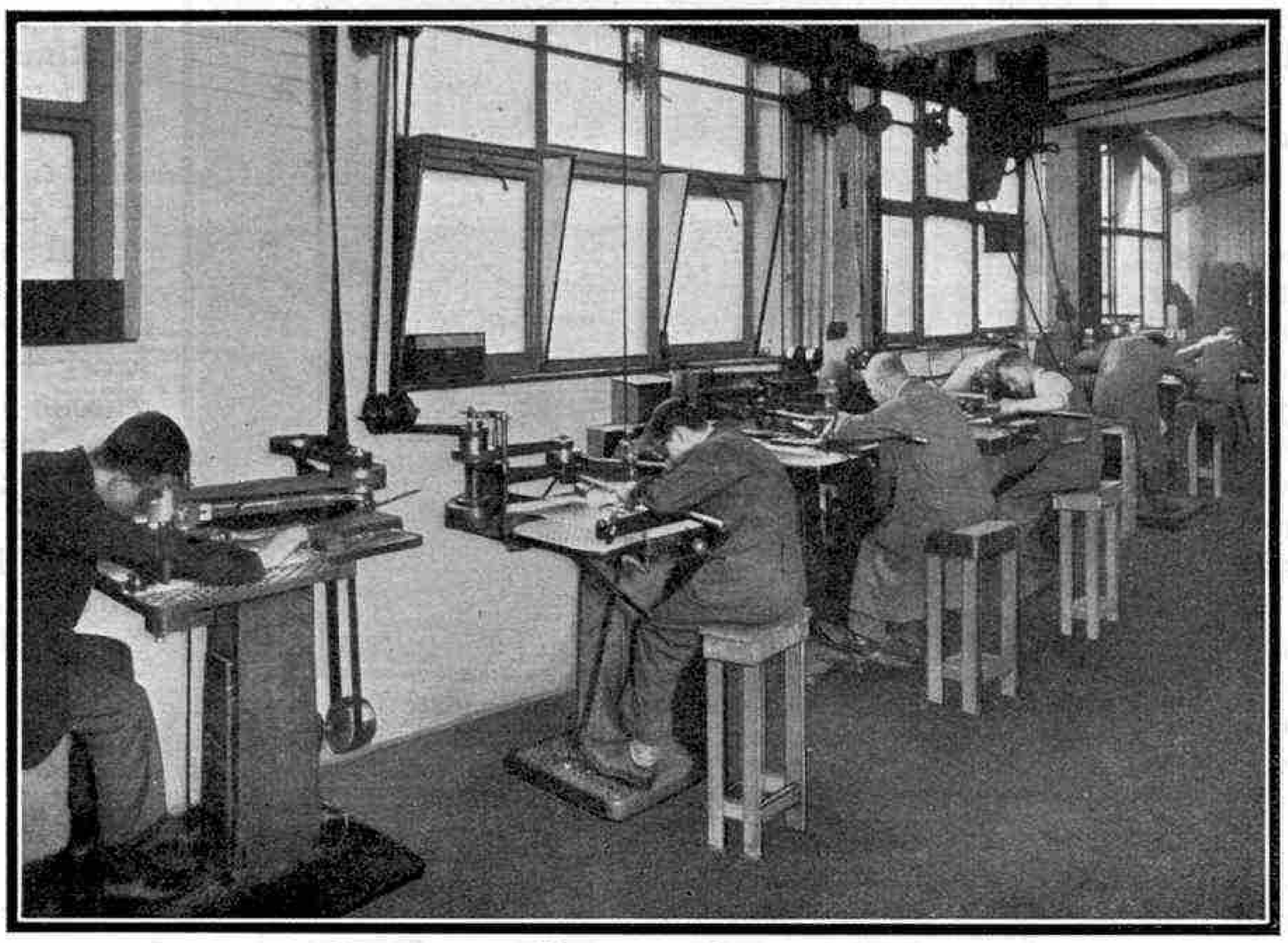
The object of etching is to make the dots stand out above the general surface of the metal. For this purpose the plate is placed in an etching machine similar to that used for making line blocks, but the nitric acid used for etching zincos is replaced by chloride of iron, a chemical that acts on copper more slowly and gently than would the nitric acid.

The spray of corrosive liquid thrown on the plate eats away copper from the unprotected surface, but leaves untouched the dots, which are protected by the enamel. As the etching continues, the corrosive liquid begins to eat into the sides of the dots in exactly the same manner as it does into the sides of the lines in making zincos. In the latter case Dragons' Blood is applied to prevent this action, but in the case of half-tone blocks this is not necessary. To a very large extent the final effect of the block depends on the size of the dots.

The action is allowed to continue until a sufficient depth of metal has been etched away between the dots in the darker portions of the picture, and the plate is then removed from the machine. It is in a comparatively rough state, and a skilled artist called the "fine etcher" now takes it in hand. His first task is to cover the darker tones with an acid-resisting pigment, after which the plate is returned to the etching machine. The further action that takes place only affects the intermediate tones and the high lights. When the plate has been etched sufficiently to bring out the former, it is again removed from the machine for retouching. This time the fine etcher also protects the intermediate tones, and leaves alone the dots representing the portions that are to appear white in the finished reproduction. A third etching reduces these almost to pin points. During the printing process they present very little surface to the inking rollers and make very tiny marks on paper.

Plates may now be etched by a very ingenious electrical machine, and the blocks that are used to illustrate the "*M.M.*" are usually prepared in this interesting manner. The new machine is an American invention, and has recently been installed by Gilchrist Bros. Ltd., Leeds, the makers of these blocks. It acts in the opposite manner to the usual etching machine. Instead of unwanted copper being eaten away by the attack of acids, it is driven off by making the copper plate the anode, that is to say, the positive electrode, in an electrolytic circuit.

The principle is exactly the same as that used in electro-plating. Metallic objects may be given a coating of copper by suspending them in a solution of a copper salt and passing an electric current through this. The article that is to be copper-plated is connected to the negative terminal of a battery, and a rod or plate of copper is suspended in the solution to act as the positive electrode. On passing the current through the solution copper is transferred from the anode to the negative electrode.



Row of Routing machines at work in the mounting room

In the case of block-making in the electrical machine the central feature is the copper plate from which metal is to be removed, and accordingly this is made the positive electrode. Those parts of the plate that are covered by enamel and are not in contact with the solution do not take any part in the action, the whole of the copper removed thus coming from the spaces between the protected dots.

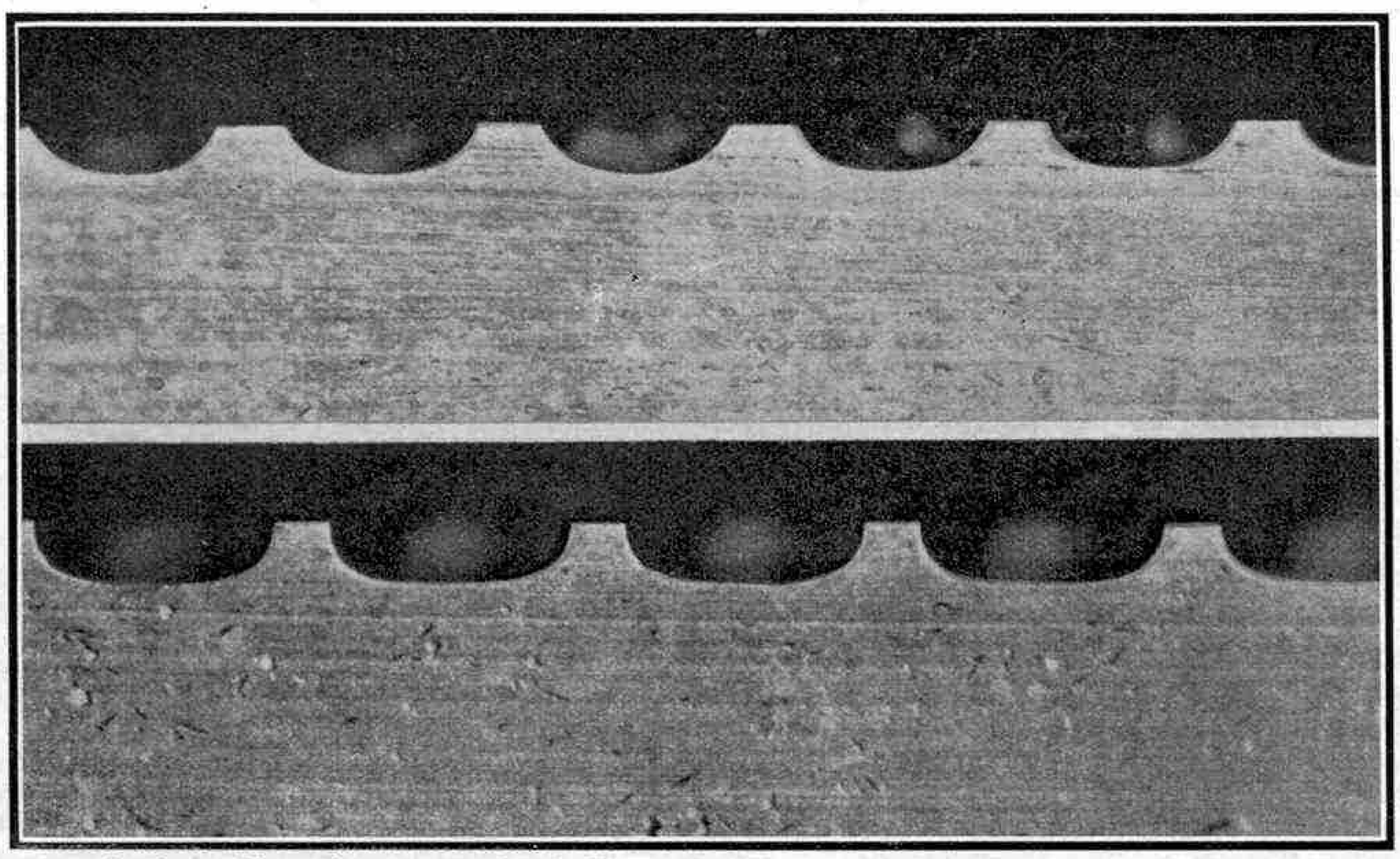
The electrical etching machine includes a dynamo that generates an electric current of low voltage but high amperage. In it plates are etched more quickly than in the old type of machine, and the hollows between the dots are deeper.

After each etching the plate is dried and a white powder is rubbed into it in order to show up the picture. A glance will reveal that metal has been removed from the unprotected portions of the surface. In order to show how the action has been carried out, however, it is best to cut across the plate and to examine the cross section with the aid of a microscope. The interesting photographs on page 105 have been obtained in this manner. They show the appearance of a plate at two stages of the etching process. In the lower photograph the spaces between the protected dots have been etched more deeply than in the upper one, which represents an intermediate stage.

It is extremely interesting also to examine the surface of the finished plate through a microscope. The raised surfaces of the dots stand out very sharply, as may be seen in the accompanying illustration. Most of the dots on the portion of the plate shown in the photograph are very small, and will retain only very little of the ink with which a printer's roller is charged.

In the upper right hand corner are several that have been etched very lightly. They represent a darker portion of the picture. Their larger surfaces will take up more ink, and thus make a blacker impression.

When the etching has been completed a proof is pulled and the impression carefully compared with the original. Possibly the high lights are still rather dark, in which case etching is carried a little further after the protecting pigment has been applied to the rest of the plate. Photo-engravers can alter and improve the contrasting tones to an astonishing extent by "stopping down" in this manner. They cannot make the dots larger and thus are unable to deepen the tone of any portion of an imprint; but they can tone down other portions of a plate in order to reproduce the exact tonal value of their copy. In particular, a block may be so etched that it gives a flatter or a brighter appearance to reproductions than is seen in the original picture.



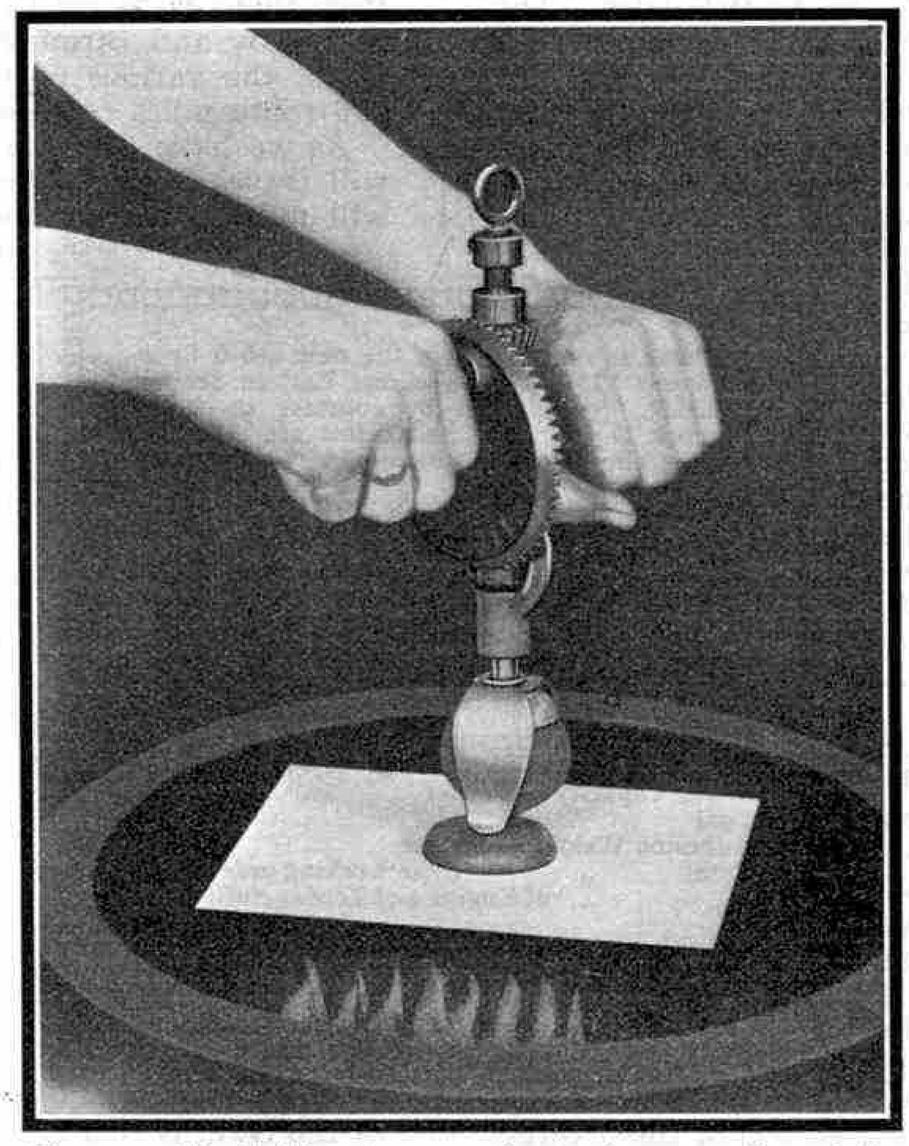
Stages in the etching of a copper plate. The upper illustration shows an enlarged cross-section of an unfinished plate, and below is a similar view of one that is ready for use

When the proof has been finally approved, the plate is passed on to the engraver, who uses a fine cutting tool to remove slight imperfections. Occasionally it is necessary to remove the background of a plate, and in this case he also cuts a groove round the desired outline.

The plate is then passed to the operator of the routing machine, on which the actual cutting out is performed with a tool that rotates at the tremendous speed of 20,000 revolutions per minute. It will be remembered that this machine is used for a similar purpose in making zincos. After routing the plate is returned to the engraver, who trims off the rough edges left by the machine. Finally all the plates that are square or rectangular in section are given a bevelled edge. This is done by a special machine, which cuts a bevel, $\frac{1}{4}$ in. in width, which extends about half-way through the thickness of the plate.

In order to bring the plate to type height it must then be mounted on a block of wood. Absolute accuracy is necessary in cutting the wood and also in mounting the plate. The blocks are usually made of birch wood that is carefully planed to the exact thickness required, and is soaked in linseed oil to prevent warping. Thin nails are driven through the bevel of the plate in order to fix it to the block, and the edges of the block are then trued up in a machine called the "bowler." It must be remembered that during printing the block will be set in the midst of type, and it is therefore essential to have the sides as true as the surface.

The block is now finished and ready for the printer. In order to make absolutely certain that it is in perfect condition a film of printer's ink is rolled on to its surface and a proof pulled on superfine paper. This is carefully examined and sent out with the block in order to show that it may be used to obtain good and faithful representations of the original picture.



The sensitised film is spread evenly over the plate and dried by whirling the latter very rapidly over a ring of gas flames

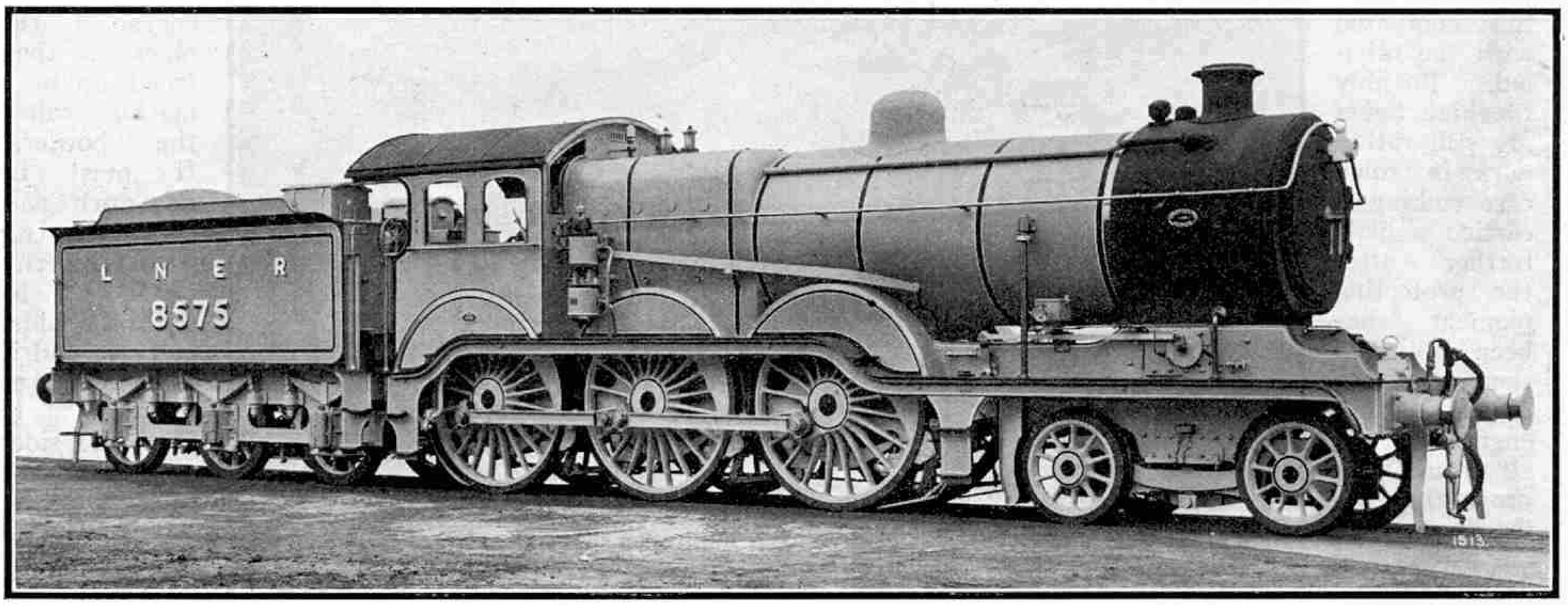
A comparison of illustrations printed from half-tone blocks with those reproduced from zincos will show the immense superiority of the former. They are more pleasing to the eye, and reproduce detail with astonishing accuracy, particularly when fine screens are used in their preparation. Another great advantage of half-tone blocks is that they may be made directly from photographs. If zincos are used, the artist must first prepare line drawings, but in the case of half-tone blocks the only preliminary work necessary is to make indistinct detail a little clearer by outlining it in Chinese White. The retouched photographs may then be pinned on the photo-engravers' copy-board.

The best half-tone illustrations only require to be coloured in order to be absolutely faithful reproductions of the scenes they represent, and photo-engravers have made good use of this fact. The splendid covers of the "*M.M.*" show that they have been completely successful, and next month we will give an account of this fascinating branch of block making.

FAMOUS TRAINS: XXV.

"*North Country Continental*," L.N.E.R.

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



IN more respects than one the train whose running we are going to follow in this article is among the most interesting in the country. First of all, its working now calls for one of the longest continuous locomotive journeys performed throughout the course of the year anywhere in the British Isles. The engine attached at Ipswich, on the northbound journey, at 8.2 in the morning, runs right through to Manchester (Central) 220 miles away and reached at 2.7 p.m., and then returns the next day to Ipswich again, the one crew being responsible throughout. On this trip the enginemen encounter a combination of grading and scenery which, for one unbroken journey, is probably unique. First from the engine-sheds by the side of the tidal estuary of the Orwell at Ipswich, then over the sharp ups-and-downs of pastoral districts through Bury to Ely, from there across the dead flatness of the Fen Country to Lincoln, then through coalmining and manufacturing areas to Sheffield, and lastly up the toilsome gradients that lead to the summit of the bleak uplands of the Pennines, at Woodhead, ere the swift descent is made into the city of Manchester.

Other parts of the same train travel in various directions. A substantial section is worked northward from Lincoln to Doncaster and York, and achieves the distinction of making a return journey over a distance exceeding 400 miles daily—from Harwich to York and back, 435 miles—without touching one single town with as many as 100,000 inhabitants. This is in itself a record in Great Britain for a set of corridor coaches attached for the greater part of their journey to an up-to-date restaurant car express. It is of interest to note, by the way, that before the war the York and Harwich section of this express provided the "backbone" of its formation, Liverpool and Manchester being served by a couple of through coaches only. What is more, this was probably the first train in Great Britain that allowed to the humble third-class passenger access to a restaurant car.

After the war the main train was diverted to Liverpool, and after various rearrangements of service, too complicated to enter into here, York was once again provided with a through section over the direct route through Gainsborough and Doncaster. To this portion there is now added a through coach right up into Scotland, continuing along the East Coast route to Edinburgh and Glasgow, making a through journey of 471 miles from Harwich. The only section of the train now remaining to be mentioned is that which is detached at March on the forward journey, running from there eastward to Peterborough, and on over L.M.S. metals to Rugby and Birmingham, 171 miles from Harwich. Between them, the various portions of this one train cover no less than 676 route miles of Great Britain daily.

As we have done on our previous journeys by boat trains we will travel towards the sea, rather than away from it, and this will mean following the various sections of the "*North Country Continental*" from the beginning of their journeys to Harwich. The first of these through vehicles involves us in an early start. By half-past eight in the morning we must present ourselves at the Queen Street Station of the L.N.E.R. in Glasgow, as our coach is attached to the 8.37 a.m. express for Edinburgh. If we happen to be late in arriving we may derive some consolation from finding our quarry to be the last coach on the back of the train, and the nearest therefore, to the platform barrier.

We are in mixed company. Next to us are a couple of corridor coaches with passengers for another port—Southampton. These are usually Great Western vehicles, and connect with the steamers from Southampton to Havre and the Channel Islands. Next beyond these are a couple of East Coast coaches for King's Cross, destined to be attached at Edinburgh to the "*Flying Scotsman.*" The remaining four or five cars are non-corridors, for local passengers between Glasgow and Edinburgh. At the front of the train is either one of the Great Central 4–4–0 "Directors," which have taken so important a part in the working of the L.N.E.R. express services in Scotland, or, quite likely, one of the new three-cylinder 4–4–0's of the "Shire" class.

Starting out of Queen Street terminus is no easy business. The line vanishes into the black recesses of a tunnel, so that its inclination is not visible from the platform. It is actually at 1 in 42 for 1¼ miles, and for many years outward-bound trains were pulled up to Cowlairs by a wire rope worked from a stationary engine at the summit of the bank. To-day each train is assisted in the rear up to Cowlairs by the engine that brought in the empty

Above is shown one of the new 4-6-0 Locomotives, "1500" class, Great Eastern Section, L.N.E.R. (photograph by courtesy of Beyer, Peacock & Co. Ltd.), and below are given the leading dimensions of this engine.

Cylinders, Diameter	...	...	20 in.
,, Stroke	...	...	28 in.
Driving Wheels, Diameter		...	6 ft. 6 in.
Heating Surface, Fire Tubes		...	970 sq. ft.
,, ,, Flue ,,		...	366 ,,
,, ,, Firebox	...	...	140 ,,
,, ,, Superheater		...	188 ,,
,, ,, Total	...	...	1,664 ,,
Firegrate Area	...	...	26.2 ,,
Working Steam Pressure	...		180 lb. per sq. in.
Tractive Effort at 85% Wkg. Pressure			22,000 lb.
Water Capacity of Tender		...	3,700 gals.
Coal ,, ,,		...	4 tons
Adhesion Weight of Engine		...	45.7 ,,
Total ,, ,, (in working order)			66 ,,
,, ,, of Engine and Tender (full)			105¼ tons
Length of Engine and Tender (over buffers)			57 ft. 9 in.

stock. Of this fact, travelling as we are in the rearmost coach, we shall have no uncertain reminder, as we listen to the vociferous exhaust of the "banker"—probably a 0–6–2 tank of the late North British—through the tunnels. We shall also find it very much in the interest of our comfort to keep the window of the compartment closed until we have cleared Cowlairs. A special slip-coupling, operated from the bank engine, keeps the latter attached to the train up to Cowlairs Station, passed in five or six minutes out of Queen Street, where the banker quietly drops off the rear.

Now, by way of contrast, we have before us the most singularly level stretch of line in the whole of Scotland—the more surprising, indeed, in that it cuts right across the centre of the country. Northward we have fine prospects, across the Forth Valley, first of the Campsie Fells and then of the hills round Stirling; later the estuary of the Forth comes into view. There is a "conditional" stop at Lenzie Junction, and then a regular stop at the important junction of Polmont, from which we are booked to make the run of 20¾ miles into Haymarket Station at Edinburgh in 26 minutes, and may quite possibly do it in 24 minutes or even less.

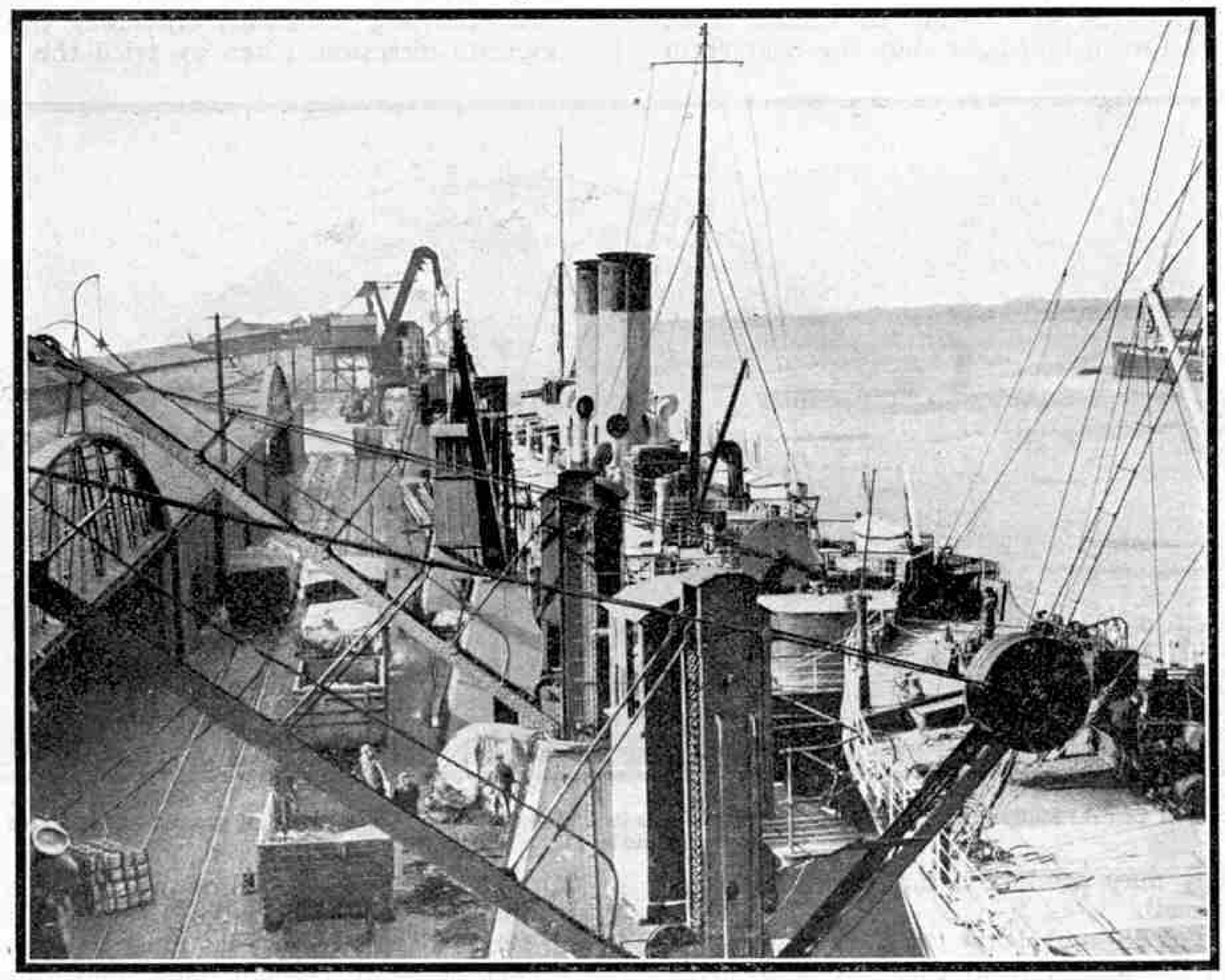
Very prominent after Linlithgow are the great tips of shale that have been left as refuse after the extraction of the valuable oil found in this neighbourhood. We are due at Haymarket at 9.42 a.m., and if we are a minute or two early, or the North train is late, quite probably we shall sweep up the four-track "straight" from Saughton alongside the Aberdeen section of the *"Flying Scotsman."*

At 9.46 a.m. we are due in the great Waverley Station at Edinburgh. Here some busy moments await the station staff, as much marshalling has to be done round about ten o'clock in the morning. We are pushed about hither and thither, the first consideration being to get the East Coast coaches in front of us attached to the rear of the *"Flying Scotsman,"* due to leave at 10 a.m. In the summer months the Southampton and Harwich coaches leave Glasgow later, at 8.55 a.m., with the *"Junior Scotsman,"* which forms the second part of the *"Flying Scotsman"* proper, starting from Edinburgh at 10.15 a.m., and they run on to Newcastle in the same distinguished company.

From the middle of October, however, one *"Scotsman"* only suffices for the London traffic, and a special train is therefore run behind the *"Scotsman,"* at 10.15 a.m., to bring these vehicles down to York. One cannot help thinking that the tremendous tractive power of the L.N.E.R. "Pacifics" ought to permit, at least as far as Newcastle, and except, possibly, at week-ends, of the attachment of these through coaches to the *"Scotsman"* itself, thus saving in locomotive mileage. Two or three L.N.E.R. corridor coaches are attached at Edinburgh to the three through vehicles, and a North Eastern "Atlantic" has the simplest of tasks in running this train of five or six cars over the 57½ miles to Berwick in 71 minutes, and thence along the 67 easily-graded miles to Newcastle in 80 minutes.

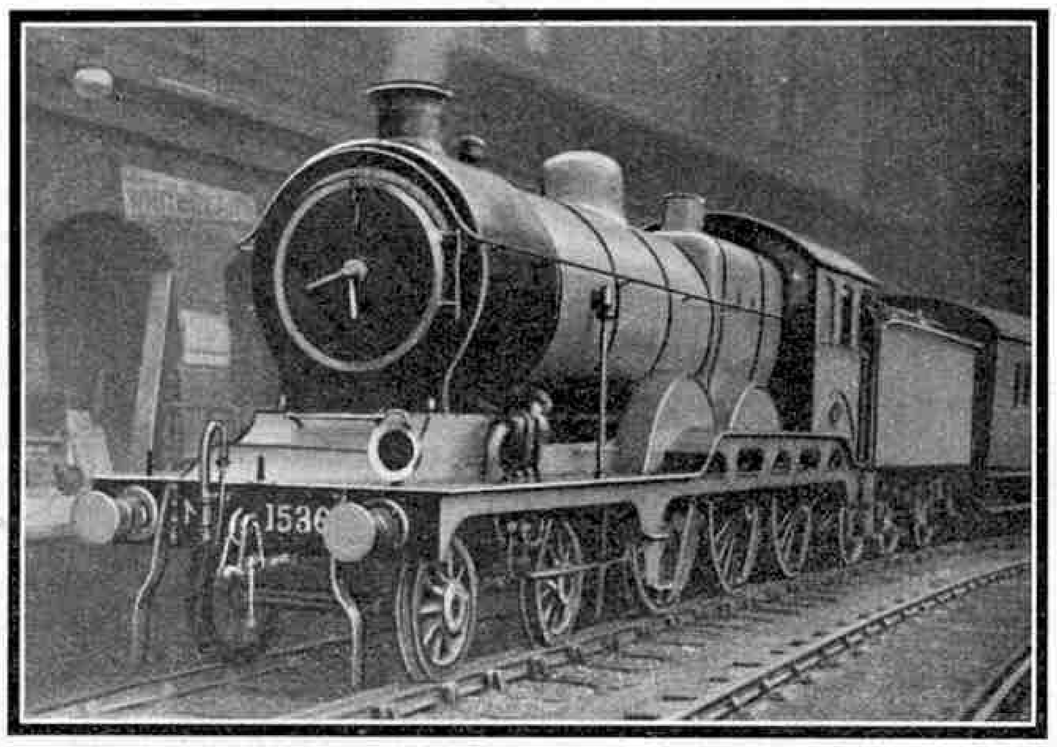
By now it is 12.48 a.m., and as there has been no restaurant car attached as yet to our train, we shall probably be feeling the pangs of hunger. But one is waiting for us at Newcastle, and we may well rub our eyes in astonishment to see it attired in the chocolate and cream livery of the Great Western Railway! With a couple more Great Western coaches, it is provided by that company to run through to Oxford with the Southampton portion of our train; we enjoy the use of it as far as York.

Our engine from Newcastle to York is probably a 4–4–0 three-cylinder "Shire." The only intermediate stop is at Darlington, whence we are booked to make the fastest run of our journey, covering the 44 miles to York in 48 minutes, at an average speed of 55 m.p.h. But the section concerned, as you doubtless know, is almost dead level and practically straight throughout.



A view of Parkeston Quay, Harwich. The quay is altogether 2,809 ft. in length. The passenger gangway leads direct from the Station Platform to the Quay, facilitating the boarding of passengers on the Hook of Holland steamers of the L.N.E.R.

At York, where we are detached from the Southampton train, there is a tedious wait of 47 minutes ere we are due to leave for Lincoln—time enough, indeed, to hurry round to the most interesting Museum of railway relics, early locomotives included, which the London and North Eastern Railway have established close to the station. Before 3.25 p.m. we must be back in our places, however, as at that hour we are due to start away again. In charge, probably, of a North Eastern "Atlantic," we make stops at Selby, Doncaster and Gainsborough—just before reaching which we cross the wide River Trent by a girder bridge of considerable size—and reach Lincoln at 5.15 p.m. Incidentally, we shall have had fine views *en route* of four cathedrals—Newcastle, Durham, York and Lincoln—and if it is still light we shall catch sight of a fifth, at Ely, before the journey's end.



L.N.E.R. (G.E. section) 4–6–0 locomotive No. 1536. This type of engine is used to work the "North Country Continental" of the L.N.E.R. throughout the journey from Ipswich to Manchester Central

But now we must put the clock back for three hours in order to cross the country to Liverpool, where we find the main restaurant car portion of the *"North Country Continental"* waiting for us at the Central Station of the Cheshire Lines Committee. This, the largest of all the British "joint" lines, was before the grouping a combination of the Great Northern, Great Central and Midland Railways; now, of course, the companies interested are the L.N.E. and L.M.S. Railways. The C.L.C. have their own coaches and wagons, but locomotive power throughout has been provided by the Great Central, and it is one of the smaller Great Central 4–4–0 engines, now superheated, that we shall doubtless find at the head of our train for the 34-mile run to Manchester. The load, for most of the year, consists of three corridor coaches, next the engine, for Grimsby and Cleethorpes; then the boat portion—a third-class brake, composite, combined first-class restaurant

and kitchen car, open third-class car and third-class brake—and on the rear a through L.M.S. coach for Sheffield, a tare load of about 275 tons.

The Cheshire Lines Committee have long maintained a reputation for the punctual running of the 45-minute expresses between Liverpool and Manchester. The journey includes a stop of a minute at Warrington, and as there are some fairly steep intermediate grades the engines have no time to spare. Most of the expresses leave at the even half-hour, but the boat train is an exception, being due away at 2.5 p.m. Out of Liverpool the line is in tunnel for over two miles, save for a brief breathing space past the large marshalling sidings at Brunswick, but at St. Michael's we come out into the open, the loudness of the engine exhaust indicating that hard work is being put in to keep time. There is a gradual rise to Hunt's Cross and Halewood, then a drop to Hough Green and a rise to Farnworth, whence the fall at 1 in 170 past Sankey may produce a maximum 70 miles an hour, if we are running well.

Courtesy] [*Cheshire Lines Committee*

Manchester Central Station, Cheshire Lines Railway. This imposing Station covers 10 acres of ground and contains nine platforms and no less than 13 roads

Warrington we reach at 2.28 and leave at 2.29 p.m. The only remaining obstacle is the ascent from Glazebrook to cross the Manchester Ship Canal at Irlam, where the line had to be raised, at the expense of the Ship Canal Company, on a gradient of 1 in 135 for two miles, sufficiently high to clear the masts of the liners passing underneath. The Partington Steel Company's works are a very prominent object here to the right of the train, on the banks of the canal. From the viaduct down to Flixton, where the original main line of the C.L.C. is clearly seen well below the left of the train, we probably exceed 60 miles an hour, and when finally we breast the sharp rise from Throstle Nest Junction, up over the great steel viaduct into Central Station it is to come to rest at precisely 2.50 p.m.

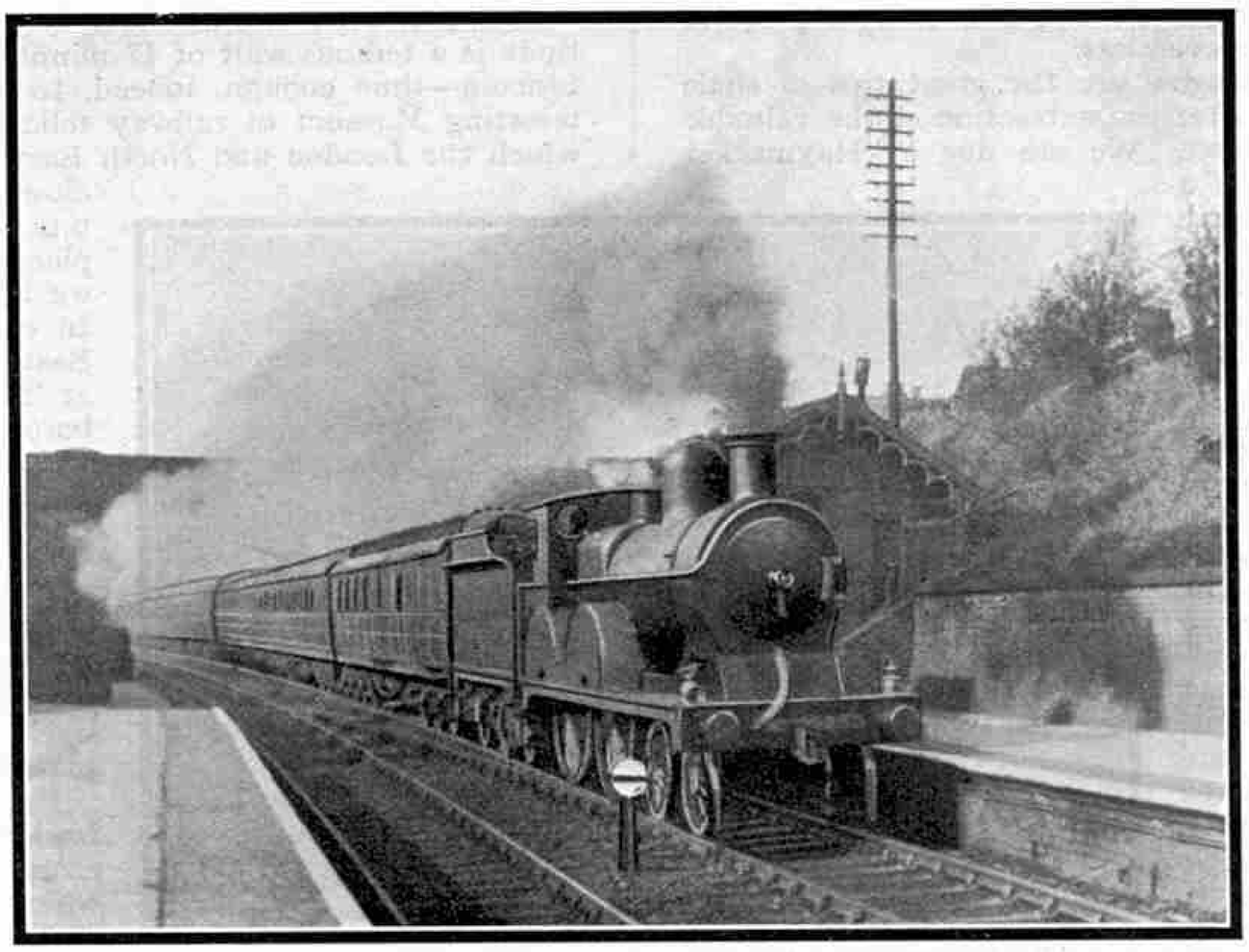
Here the first operation is to detach the L.M.S. coach from the rear, or what is now to become the front, of the train, ere we see backing on what is indeed a "stranger" so far to the west of the country as this. Very spick-and-span, and with tender piled high with coal in view of the length of run ahead, the Great Eastern 4–6–0 is coupled to our train in readiness for a journey right across Britain from one side to the other. We have already made the acquaintance of these engines when travelling on the "*Hook Continental*" from Liverpool Street to Parkeston Quay, when we noted the exceptional tractive power of a locomotive of but 44 tons adhesion and 64 tons total weight. Our steed to-day is of the same type, save that possibly one of the newest 10—numbered between 8571 and 8580—may be provided, distinguished from the others by the raised framing over the coupled wheels and the extended smokebox.

Punctually to time at 3.5 p.m. we are away. The run immediately ahead of us, despite the fact that our gross load, with passengers and luggage, does not exceed 260 tons, is one of the hardest of the journey. After a swift start down to Throstle Nest, where we must slacken for the Chorlton direction, and a further slack at Chorlton Junction where we leave the Cheshire Lines for L.N.E. metals, we have a steady ascent before us for 25 miles until we have breasted the Pennines at Dunford Bridge. You doubtless remember travelling over the same route in the opposite direction, when we tried the "3.20 down Manchester" out of Marylebone.

There are slight easings of the grade past Guide Bridge and across the viaducts at Mottram and Dinting, but after the latter, for 7½ miles up through the high hills, past the picturesque chain of reservoirs which fringe the left side of the line, the line is inclined at 1 in 117 to 1 in 100. Guide Bridge must be passed at 3.22 p.m., and then only 22 min. are allowed for the 14¼ miles up to Woodhead, where we enter the famous three-mile tunnel of that name, and five min. more to the summit at Dunford Bridge, 3¼ miles further, so that the speed up these formidable grades must average 39 m.p.h. continuously.

Then a swift descent past Penistone to Sheffield, with an allowance of 22 min. for the 19 miles in order to discourage excessive speed over the many sharp intermediate curves, brings us into Sheffield Victoria Station at 4.11 p.m. Here we get rid of the Cleethorpes coaches, which follow us to Retford on a subsequent train. A minute later we may see arriving on the opposite side of the station the Southampton train that convoyed our Glasgow coach as far as York. The coach in question was worked from York to Sheffield by this route for a time, joining the main train here, until the direct train from York to Lincoln was reinstated.

From Sheffield, left at 4.18 p.m. to Lincoln the 4–6–0 engine has but a light load; for a large part of the year it amounts to no more than five coaches. The timing is easy by comparison with that we have just tried to keep from Manchester, and in the event of a late arrival at Sheffield the lost minutes can easily be recouped before Lincoln. At Woodhouse, after passing through a deep cutting that has been opened out from what was previously a tunnel, we diverge to the left from the London main line and pass over a high embankment that was once a long brick viaduct across the valley, but has now been filled in. A brief stop is made at Worksop at 4.45 p.m. and then we hurry down a falling grade to Retford, where the East Coast main line is crossed on the level—a survival of early days of which but few examples still remain, though there are many such railway crossings in America.

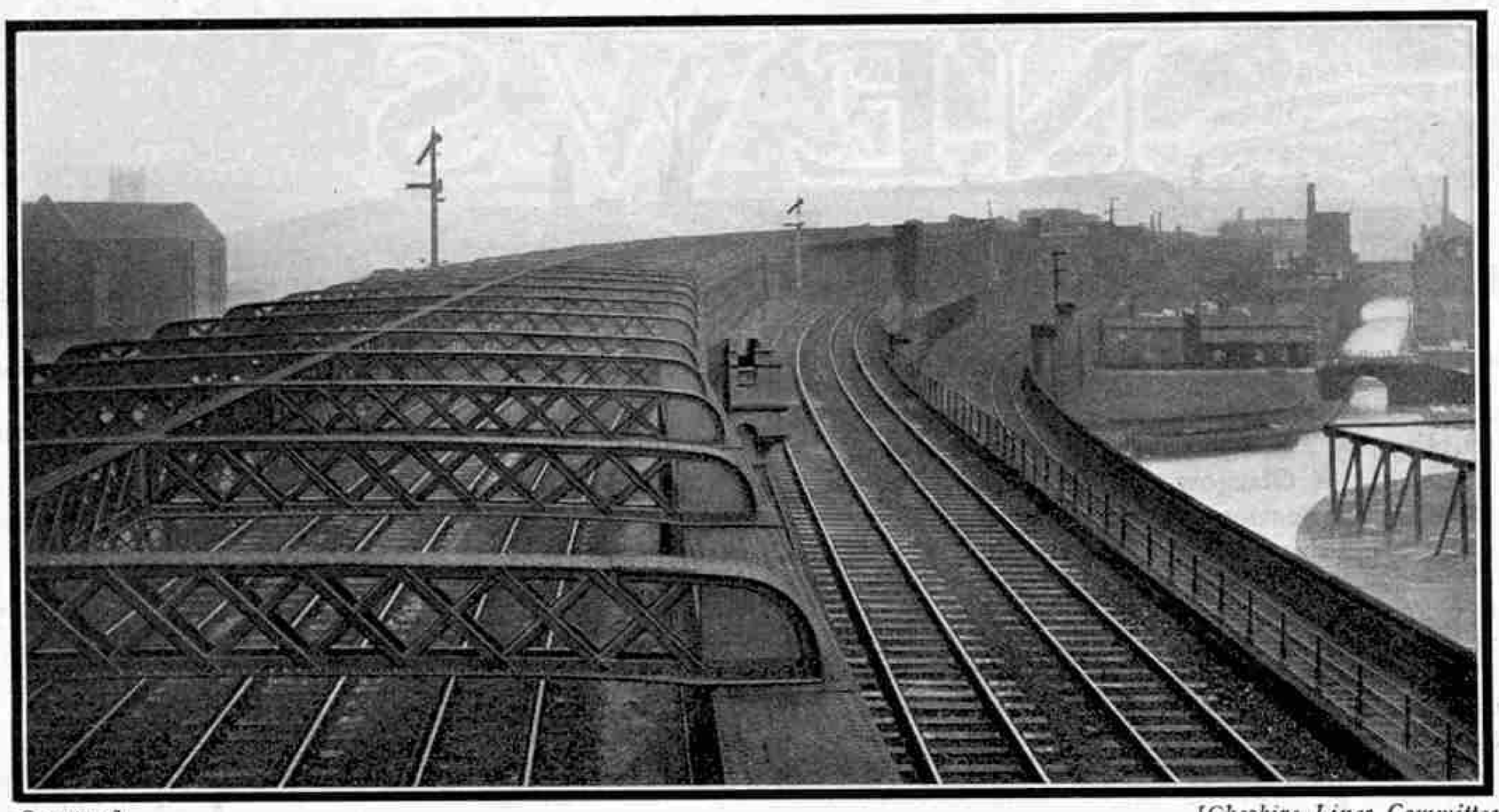


"At St. Michael's we come out into the open, the loudness of the engine exhaust indicating that hard work is being put in to keep time"

The only other engineering work of note is the bridge crossing

the River Trent at Torksey, and at 5.20 p.m. we run across a busy road level crossing—a serious hindrance to prompt traffic working at Lincoln, but, presumably, too costly a subject for replacement by a bridge—into High Street Station, 42½ miles from Sheffield.

At Lincoln we attach the North portion, which arrived five minutes earlier, and our load is thus brought up to a minimum of nine corridor coaches. We leave again at 5.32 p.m. and for many miles ahead there are no difficulties of any kind confronting the engine. The old "Great Eastern and Great Northern Joint Line," as it was before the days of grouping, cuts in a straight line across the flat Fen Country of Lincolnshire and Cambridgeshire, and once we have mounted a gentle rise from Lincoln to Potterhanworth, and attained 65 miles an hour or so on the subsequent descent to Branston, speed should keep just nicely round about the "sixty" level until the next stop at Spalding.



Courtesy] [*Cheshire Lines Committee*

The viaduct leading into Manchester Central Station. This carries the five main lines over part of the city of Manchester

The *"North Country Continental"* in the reverse direction makes a diversion from the main line to call also at Sleaford, adding thereby a couple of miles to its journey, but we take the straight line between the North and South Junctions at Sleaford and are allowed 46 minutes in which to cover the 38¼ miles from Lincoln to Spalding. A couple of minutes standing and we are away again, to make the brief run of 19 level miles from Spalding to March in 26 minutes. Just before running into March, which is reached at 6.46 p.m., we pass the extensive sidings at Whitemoor, to which considerable additions, laid out on the "gravity" principle and equipped with all the latest devices for speeding up the work of marshalling, are just being made. March requires a six-minute stop, and then follows another level run over the 15½ miles to the cathedral town of Ely, for which 22 min. are allowed. It is now 7.14 p.m.

Down "North Country Continental" passing St. Michael's Station, hauled by L.N.E.R. (Great Central Section) "Pollitt" 4-4-0 Locomotive No. 5880

At Ely the final addition is made to our load. Just before 4 o'clock in the afternoon (at 3.55 to be precise), our two Birmingham coaches left New Street Station in that city, attached to a train of the L.M.S. bound for Peterborough. Their initial run—to Coventry—has been the fastest made by any portion of the *"North Country Continental"* as with the best Birmingham-Euston expresses the 18.9 miles are allowed only 20 minutes, start to stop, entailing an average speed of 56.7 m.p.h. Then followed a 14-min. run over the 11.4 miles to Rugby. From Rugby across country to Peterborough, through Market Harborough and Seaton, the L.M.S. train is of "semi-fast" character—in fact you could leave Birmingham more than an hour later, travel to Euston, and still have a comfortable 50 minutes in which to get across to Liverpool Street and catch the *"Hook Continental,"* if you were not encumbered with luggage. Actually its journey of 50¾ miles from Rugby, left at 4.37 p.m., takes as much as 93 minutes. Thus it was 6.10 p.m. when the "Black Country" portion rolled under the great girder bridge carrying the Great Northern main line of the L.N.E.R. into Peterborough East Station. Here the coaches were taken charge of by a locomotive of the L.N.E.R. which ran them over the 14¾ miles to March in 20 minutes, and thence after a three-minute stop ahead of us to Ely where they arrived nine minutes earlier, at 7.5 p.m.

So we have now our full load. This is, at the least, 11 cars, weighing probably about 340 tons, but when last I saw this train, in the height of last summer, it had 14 coaches on, mostly of the latest East Coast type stock, weighing empty 437 tons and with passengers and luggage fully 460 tons. At Ely important connections are given to Norwich, Cambridge, and the Eastern Counties generally.

We are due out of Ely at 7.22 p.m., and then follows immediately what is—by comparison with, say, the tremendously busy lines between Liverpool and Sheffield over which we have passed—the strangest part of the journey. For from here to Chippenham Junction, near Newmarket, a distance of 12 miles, we have to run over a single track. The single-line tokens must be exchanged *en route*, and this necessitates severe slowings through Soham and Fordham, as well as at the junction last mentioned.

We do not pass through Newmarket, but skirt the margin of the famous "Heath" and join the Cambridge and Bury line at Snailwell Junction. On account of the slow running just mentioned it is necessary to schedule as much as 42 min. for the 28 miles from Ely to Bury St. Edmunds. Leaving the latter town at 8.6 p.m. we run eastward to Haughley, where another severe slowing is required as we join the main line from Norwich to Liverpool Street. From Haughley to Ipswich the line is downhill throughout, and with a final "burst" at 60 miles an hour, or slightly over, we thread East Suffolk Junction and run into Ipswich Station at 8.43 p.m. having covered the 26½ miles from Bury in 37 minutes. Here the locomotive that has done us such excellent service all the way from Manchester is uncoupled, and runs quietly away through the tunnel ahead of us to the engine-sheds on the banks of the Orwell.

For our last stage of just over 20 miles we have the services of one of the 4–6–0 engines stationed at Parkeston Quay, which has probably been up to London, down from there to Ipswich by an evening express, and is now waiting to get "home." This locomotive that has come down from Liverpool Street is attached to a train hailing from Liverpool!

At 8.48 p.m. we enter the tunnel, take water, very likely from the track-troughs at Halifax Junction—

(*Continued on page* 133

New Locomotives for the L.N.E.R.

A series of ten new 4–6–0 locomotives are now under construction by the North British Locomotive Co. Ltd., of Glasgow, for use on the Great Eastern Section of the L.N.E.R. With the exception of the ten Holden "1500" class locomotives that were built last year, these are the first express passenger engines that have been constructed for use on the G.E. section since the amalgamation in 1923.

The cylinders of the new locomotives are 17½ in. by 26 in. and are fed with superheated steam by a boiler pressed to 200 lbs. per square inch. The driving wheels are 6 ft. 8 in. in diameter, and the tractive effort at 85 per cent. of the boiler pressure is 25,379 lbs. The weight of the engines in working order is 76 tons 13 cwt. Short tenders of the G.E. pattern, weighing only 39 tons 8 cwts. each, are supplied with these engines. The first locomotive of this class is No. 2800 "*Sandringham*," and the other engines will be named after well-known country seats in the eastern counties.

* * *

Good L.N.E.R. Engine Performances

The success of the new "Shire" class D.49 4–4–0 locomotives recently built by the L.N.E.R. for work on their lighter express passenger services is emphasised by some remarkable record performances, of which we are able to publish details of four.

The first and second concern engine No. 245, "*Lincolnshire.*" The first train in question was the 1.2 p.m. Newcastle-York express. The weight handled by the engine, exclusive of the tender, was 491 tons from Newcastle to Darlington and 507 tons from there onward to York. In spite of the fact that the locomotive was handling a load of over eight times its own weight, it was successful in maintaining schedule time over the 80½ miles, a wonderful piece of work. The Newcastle-York section of the L.N.E.R. has always been a noteworthy stretch for fast train working and high-class locomotive performances, but we doubt whether a 4–4–0 locomotive of any description has ever been known to handle such a colossal load as "*Lincolnshire*" did on this occasion.

The same engine is reported to have handled a train, due in King's Cross at 9.25 p.m., over the 76.4 miles from Peterborough in 82 minutes, or three minutes under schedule. The performance is all the more creditable when it is remembered that the weight behind the tender was no less than 420 tons.

Locomotive No. 236, "*Lancashire,*" of the same class, put up a good performance on the 8.55 a.m. Leeds-Glasgow express, also between York and Newcastle. The train in question weighed 285 tons and left York seven minutes late, but on arrival in Newcastle it was only one minute behind time. Another "Shire" class engine, No. 251, "*Derbyshire,*" dealt successfully with the 1.2 p.m. Newcastle-York train weighing 442 tons and two minutes were gained on schedule time.

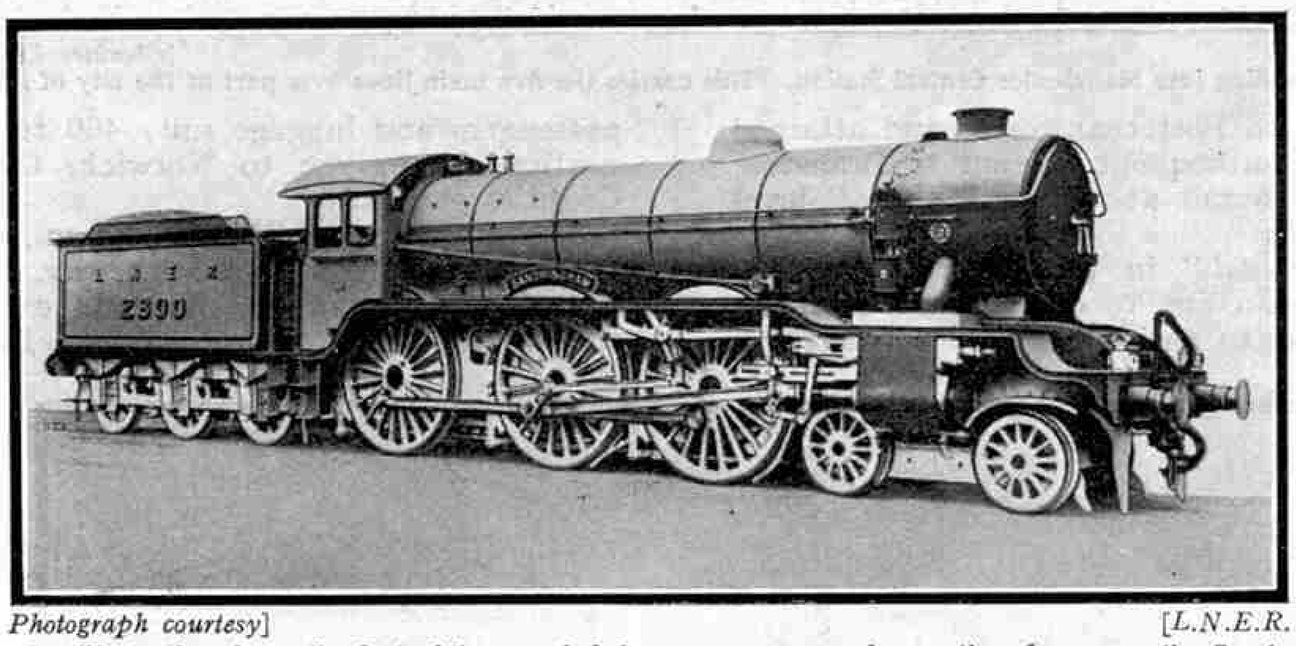
The 8.5 p.m. train, weighing 302 tons, left Newcastle for York 11 minutes behind schedule, double-headed by "Atlantic" locomotives No. 2203 and 2166. After an extremely good run it arrived in York only two minutes behind time. The average speed on this occasion was no less than 67.8 m.p.h. from start to stop.

Later, on the same train, "Raven" Pacific locomotive No. 2401, "*City of Kingston-upon-Hull,*" made a very creditable performance. The train weighed 310 tons and left Newcastle eight minutes late. On arrival at York three minutes of this loss had been recovered and the average speed from start to stop was 66.1 m.p.h.

"Gresley" Pacifics still continue to perform herculean tasks with apparent ease, as the following runs show. The 10.5 a.m. train from King's Cross to Edinburgh left London with a load of 512 tons. An extra vehicle was attached at Grantham, where the first stop was made. Another vehicle was attached at York and the load from York to Newcastle was 569 tons. In spite of this tremendous weight, the train actually arrived at Newcastle four minutes ahead of schedule time! The "Pacific" in charge of the train throughout from London to Newcastle was No. 2554, "*Woolwinder.*"

Another good "Pacific" run was made by locomotive No. 2573, "*Harvester.*" The train was the 10.15 a.m. Edinburgh-Newcastle express. Notwithstanding seven minutes' delay through signal checks and permanent way slacks, and that the load totalled 513 tons, the train arrived at Newcastle on the stroke of time!

On a train of 510 tons, another "Pacific," No. 2578, "*Bayardo,*" left Edinburgh



Photograph courtesy] [*L.N.E.R.*

Our illustration shows the first of the new 4–6–0 express passenger locomotives for use on the Great Eastern Section of the L.N.E.R. This engine, which has just been completed, has been named "Sandringham" by special permission of H.M. the King

Co-ordination of Rail and Road Transport

One of the first results of the new road powers recently conferred by Parliament upon the railway companies is an agreement that has been reached between the G.W.R. and the National Omnibus and Transport Company. Under this agreement a new company has been formed with an authorised capital of £1,000,000, and this company will take over all road services for passengers that at present are being run by the respective parties in an agreed area in the West of England. It is anticipated that the new company, which is to be known as the "Western National Omnibus Company Limited," will bring about co-ordination of road and rail transport facilities in this area to the advantage of the travelling public.

It is of interest to note that this new undertaking will include the first regular road motor omnibus service to be run in Great Britain, namely, that between Helston and the Lizard. This was inaugurated by the G.W.R. in August, 1903, some months before motor omnibuses appeared on the streets of London.

DIFFICULTIES EXPLAINED

6. The Yellow CC plate on private owners' wagons

The yellow plate bearing the Letters "CC," fitted to some private owners' wagons in this country, indicates that the owners are a party to the "Commuted Charge" arrangement. This means that the owners agree to an annual payment for shunting charges on their wagons, instead of being debited on each occasion.

five minutes late. The train was the 11.5 p.m. from Edinburgh to King's Cross, and although suffering a loss of three minutes by permanent way speed restrictions at East Linton, it succeeded in arriving at Newcastle two minutes ahead of booked time.

* * * *

Systematic Departure Times

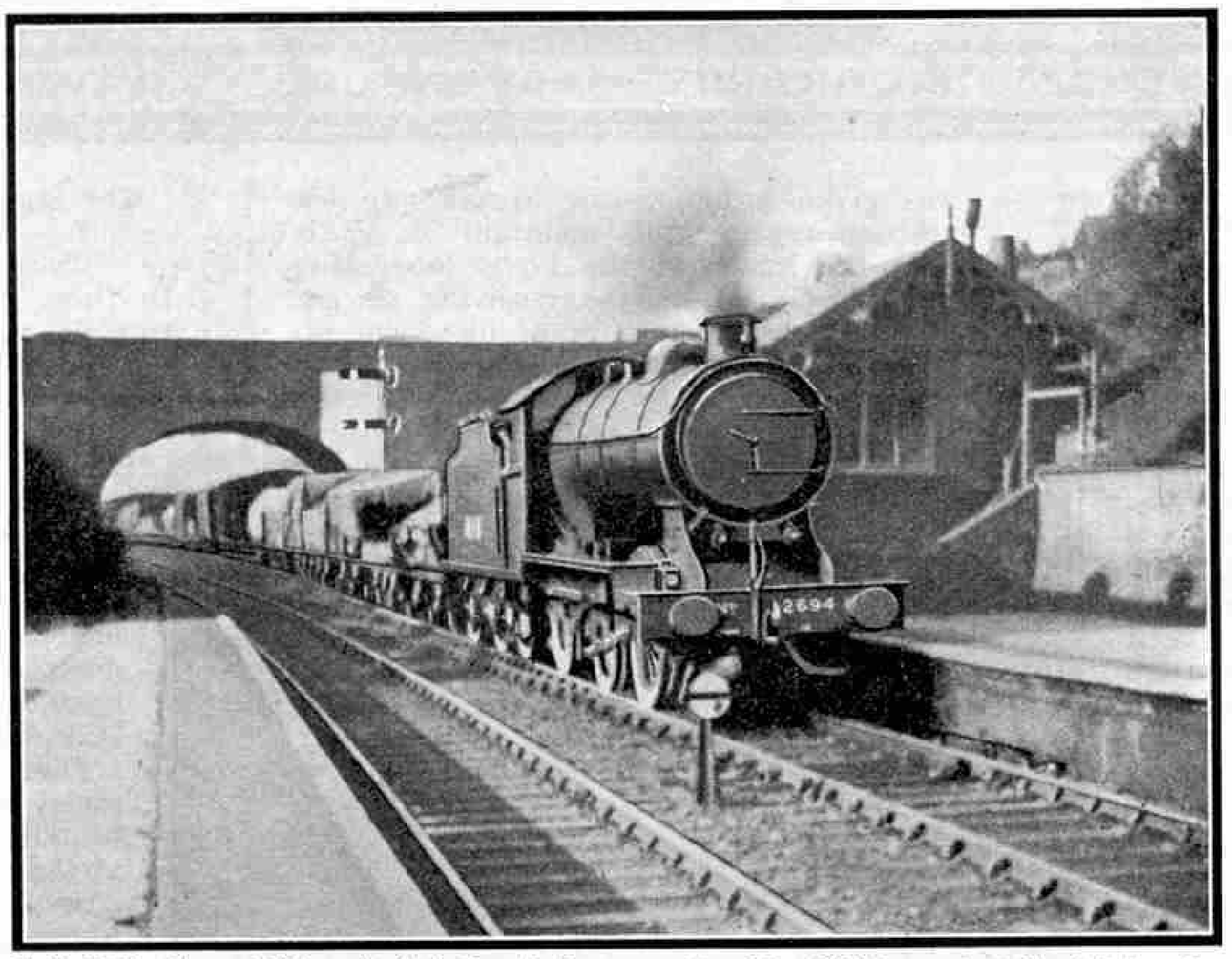
Mr. Cecil J. Allen's article in the December number of the "*M.M.*" on the Midland "Twenty-fives," in which are also mentioned the G.W.R. systematic timetables, calls to mind the remarkable systematic timetable that has been in force for many years over a certain section of the G.E.R. suburban service. Not only do the trains leave Liverpool Street at the same number of minutes past each hour, but each train for any one destination starts from the same platform.

The service in question is in operation between Liverpool Street and Walthamstow and Chingford, and Liverpool Street and Enfield and Palace Gates, and is run only during the rush hours in the morning and evening. At every 8, 18, 28, 38, 48, 58 minutes past the hour a train leaves platform 4 for Wood Street, Walthamstow. These are followed at every 10, 20, 30, 40, 50 and 60 minutes past each hour by trains from platform 3 to Enfield Town, and two minutes later (in each case), that is to say, at 2, 12, 22, 32, 42 and 52 minutes past the hour, trains depart for Chingford from platform 2.

To complete this crowded ten-minute cycle, a train sets out for Enfield at 4, 14, 24, 34, 44 and 54 minutes past each hour, and starts from platform 1. This timetable is slightly irregular, in that certain of the 4, 14, 24, 34, 44 and 54 minute trains go through to Palace Gates instead of Enfield, while certain others, for Enfield, join connections for Palace Gates. But such trains are few, and are therefore easily remembered by constant travellers on the line.

Each train remains in its allotted platform for six minutes (quite long enough for 900 and sometimes 1,000 people to get in), and therefore the next train is due to arrive only four minutes after the former train has vacated the platform. Since this service is steam-operated, the engine that brought the first train in has to leave the station and take up its position in its siding outside during this four-minute interval.

The crowning achievement of this remarkable service is the running of all these trains (and there are 48 in each direction between 4.58 p.m. and 6.58 p.m.) over the steep incline of one-and-a-quarter miles to Bethnal Green Junction, on the same set of up and down metals. From the end of Liverpool Street platforms the lines drop for a few hundred yards at 1 in 300, and after entering a tunnel begin to rise at the same rate until shortly after leaving it, when the incline steepens to 1 in 70, at which it continues up to the junction. When the difficulties of the route are considered, and also the weight of the trains, which often, when they are full, exceeds 230 tons, it will be admitted that some very energetic work is called for, even from the new 0–6–2 tanks which are now a familiar sight on all the L.N.E.R. lines. These fine engines have now almost entirely taken over the working of this route, although tiny 0–6–0 and 0–4–4 tanks used to do very well on these exacting jobs.



L.N.E.R. Class J.39. 0–6–0 Goods Locomotive No. 2694 passing St. Michael's Station on a C.L.C. goods train

I believe I am correct in saying that this is the most remarkable steam-operated suburban service in the world.—M.B.F.

* * * *

A Unique Excursion

Many "*M.M.*" readers were included in a mammoth excursion run by the G.W.R. from London to Swindon Locomotive Works early last month. Readers of our "*Famous Trains*" articles will be interested to hear that this excursion was arranged by our contributor, Mr. Cecil J. Allen, whose party consisted of 1,970 boys, both young and old. They were members of the "Crusaders' Union," in which he is leader of one of the classes.

This party was divided into three sections and dealt with on three separate days, and even then trains of 12 and 13 of the G.W. 70 ft. coaches were needed for each trip. "*King George V*" hauled the "*Crusader Limited*" on each day, and carried on the smokebox front an enormous replica of the badge of the "Crusaders' Union." The quickest times were made on the third day when, with a 465-ton train "*King George V*" ran the 77.3 miles from Paddington to Swindon in 75½ minutes and came back to London in 74½ minutes.

This outing proceeded without a hitch and provided another example of G.W.R. efficiency.

* * * *

Great Western Locomotive News

The North British Locomotive Co. Ltd. are constructing a series of 0–6–0 tank locomotives for the Great Western Railway. It is anticipated that the first 50 of these engines will be ready early this year. They will be numbered 5700-5749.

Manchester Electrification Scheme

The electrification of the eight miles of railway between Oxford Street station, Manchester, and Altrincham should soon be well in hand. The scheme will cost approximately £500,000 and the overhead wiring system will be adopted. Services are expected to be commenced in about December of this year.

Two new stations are to be constructed in connection with this scheme and these will be at Dane-road, Ashton-on-Mersey, and at Navigation-crossing, Altrincham. The present Old Trafford cricket and football ground station is to be made a permanent residential station.

* * *

Loud Speakers in Stations

A system of loud speakers is to be installed in the Southern Railway's London Bridge station. The loud speakers will inform passengers, as they enter the station, of the number of the platform at which they will find their train. We understand that successful experiments in this direction were made at the Eastern Section station some time ago.

* * *

L.N.E.R. Locomotive News

The L.N.E.R. announce that the 0–6–0 J.39 class engine is proving one of the best for all-round work. This class of locomotive is used on both heavy freight and passenger services, and is gradually finding its way on to all sections of the L.N.E.R. Four more of these engines have now been completed at Darlington, and are numbered from 2714 to 2717. Nos. 2691, 2692 and 2694 have been noted on C.L.C. goods work.

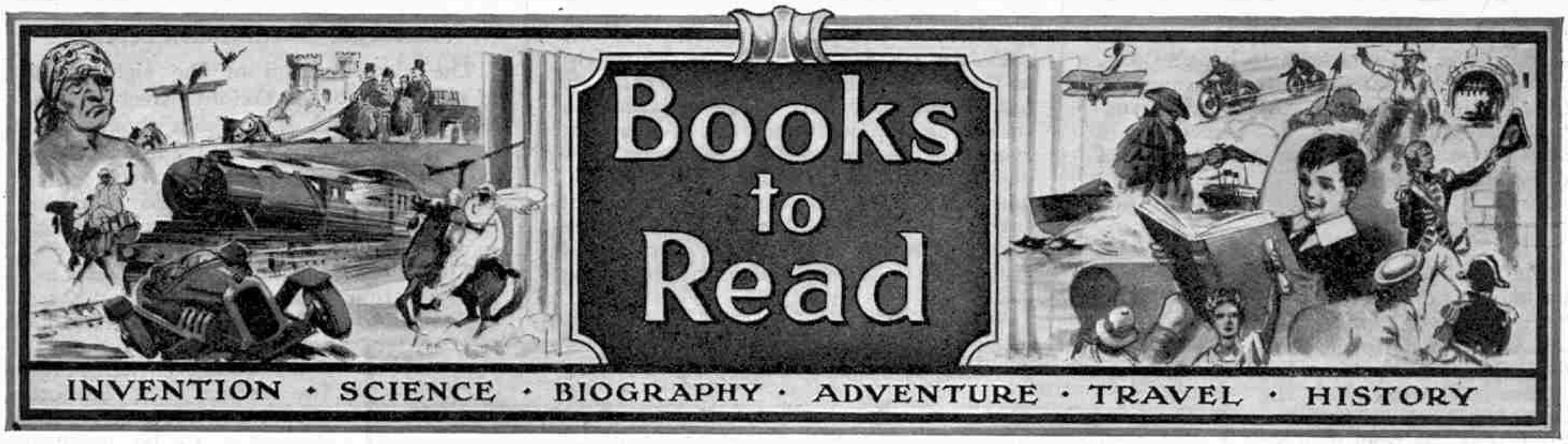
G.N. booster-fitted "Atlantic" No. 4419 was recently transferred from the Southern to the North-Eastern area, and is now stationed at Leeds Neville Hill Shed. The booster apparatus should be of great assistance to this locomotive when it is working heavy trains between Leeds and Harrogate via Arthington or Wetherby, where heavy gradients have to be negotiated.

* * * *

The *L.M.S. Magazine* announces that a new express freight train, fitted with the vacuum brake, is timed to leave London at 9.30 p.m., arriving at Chester and Birkenhead early the following morning.

* * * *

According to a report issued by the L.N.E.R. in December last, the 10.5 a.m. Pullman express from Glasgow to King's Cross left Leeds 13 minutes behind time. The train was delayed four minutes en route by signals, but arrived at King's Cross on time, the distance of 186 miles having been covered in 188 minutes at an average speed of 59.4 m.p.h. The journey from Grantham to King's Cross, a distance of 105 miles, was covered in 101 minutes, which represents an average speed of 62.2 m.p.h. Unfortunately we have no particulars as to the type of locomotive that made this excellent performance.



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." In regard to the supplying of these books we draw attention to the notice that appears at the oot of the second column on this page.—EDITOR.

"Television"

By A. Dinsdale
(Published by Television Press. 5/–)

Written so as to be understood by the average person, this book gives a complete review of the new science of Television. It explains the underlying principles and describes the lines of research that have been followed by the leading experimenters in all countries. The greater portion of the book is devoted to a very full account of the work of the British inventor, Mr. J. L. Baird, who was the first in this country to demonstrate Television. There is much technical information concerning his latest discoveries, and the large number of diagrams and illustrations greatly enhance the value of the work.

It is interesting to note that when Mr. Baird was some years ago compelled by ill-health to abandon an active business career, he devoted himself exclusively to studying the problem of Television, in which he had been previously interested as a hobby. Month after month he worked with apparatus of the crudest description until, in April 1925, he was able to give the first public demonstration of Television, transmitting outlines by wireless between two separate machines at Selfridges, the Oxford Street Stores.

He continued his experiments and one day, in October 1925, he had the satisfaction of seeing the face of a ventriloquist's doll (which he used for his experiments) on his receiving screen, not in outline but as a real image with shape and detail. Greatly excited Mr. Baird rushed out of the laboratory in search of a human subject to take the place of the doll. The first person he met was William Taynton, an office boy from the floor below. After some difficulty, Mr. Baird persuaded Taynton to come up to the laboratory and take his place before the televisor. Seating him in the correct position, Mr. Baird dashed through the laboratory to look at the receiving screen but to his great disappointment there was nothing to be seen! He made various adjustments without success and then went back to the transmitter to find that the failure of the experiment was due to the office boy. Being afraid of the terrific glare of the lights, he had moved back out of focus. "In the excitement of the moment," as Mr. Baird says, he was given a half-crown to take up his position again and maintain it. This time the image of the boy's face came through clearly on the receiving screen. It is certainly a matter of historical interest that the first human being ever to be televised had to be bribed to accept the distinction!

Mr. J. L. Baird who, in April 1925, gave the first public demonstration of television in this country. (From "Television," reviewed on this page)

Many advances have been made since that time, of course, and the reader who is interested in the subject cannot do better than add this book to his library. Successful television is within measurable distance, and nobody can afford to be ignorant of its principles.

Important Notice

As some of our readers—particularly those living overseas—tell us they have difficulty in obtaining new books, we have made arrangements to supply copies of any of the books reviewed on these pages.

Orders should be addressed to Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/– should be added to the published price of the book to cover the cost of postage. Any balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"The Story of Buckingham Palace"

By Bruce Graeme
(Published by Hutchinson. 24/–)

In these days, when the mind of the nation is turned even more closely to Buckingham Palace than in normal times, this book has a particular interest of its own. It tells us the fascinating story of Buckingham Palace in an unconventional style, and the volume is more full of human interest than most novels. Not only does it give an interesting study of the development of Buckingham Palace, but it deals with the many picturesque characters who have lived, loved, and died within its historic walls.

Buckingham Palace stands in the midst of London—a modest unpretentious and much-criticised building—at the centre of the fusion of ancient cities, towns and villages, which to-day forms the heart of an Empire. During the course of centuries, the Palace has seen many changes. How many people know that originally it was a silk-growing farm, built by James I to promote the silk industry in this country? It then became the London residence of the Earl of Arlington, a favourite of Charles II, next a popular night resort of gamblers, and eventually the home of the greatest rake in the history of England, George IV.

For many Londoners, and for the crowds of tourists who daily journey to the outskirts of the courtyards, its sole claim to fame lies in the picturesque ceremony of the Changing of the Guard. For all loyal Britons, however, its real interest must lie in the fact that within its substantial walls is the home of the ruler of the British Empire and his family—of all of the families who have ruled the British people, the most regal and democratic, the most respected and most beloved.

The book is enhanced by 32 photogravure illustrations and makes a fine volume full of interesting reading.

* * * *

"Surveying from Air Photographs"

By Lieut. L. Hotine, R.E.
(Published by H.M. Stationary Office. 3/6)

Means of surveying from air photographs, depending in the first instance on really skilled navigation by the pilot, have been known and practised since the days of the War. But, as is pointed out in the introduction to this publication, it has not hitherto been made clear what errors may result from these observations and how best to obviate them.

To do this, it was decided, in 1926, to

carry out a small survey near Arundel in Sussex. and this book is a description of the experiment, and the deductions to be drawn from it. It contains chapters on the preliminary plotting, field-work, final plotting organisation costs, etc. The book, which is the third publication in the Professional Papers of the Air Survey Committee, will, of course, be of interest only to surveyors or air-pilots. To such people, however, it will be of considerable practical value.

* * * *

"The Sun, the Stars, and the Universe"

By W. M. SMART
(Published by Longmans Green & Co. Ltd. 12/6)

The endeavour of the author is to present an account of modern astronomical discoveries in descriptive language. The first seven chapters are devoted mainly to the sun, planets, and comets, and we note with interest that in particular the recent interesting observations of Mars are described, and the question of canals discussed.

Some difficulties in the way of photographing the Martian canals are explained. We are told, for instance, that when Mars is close to the Earth its angular diameter is no larger than one-eightieth of that of the Moon, and the image of the planet on a photographic plate, even with a large telescope, is but a fraction of an inch in diameter. It is clear, therefore, that the delineation of fine detail in an image so small must largely depend upon the best of possible observing conditions. The astronomers at Flagstaff Observatory claim that the photographs show the canals of Mars in every detail.

Dr. Smart sums up the recent researches by saying that Mars has an atmosphere thinner than the earth's; that there is a limited amount of water on the planet; and that it is, at the best, a somewhat cold and chilly planet. There appears to be some form of vegetation there and there is now little doubt that the canals do actually exist—a matter that has long been hotly disputed by rival astronomers. "The Earth teems with life of every form," says Dr. Smart, "the Moon is cold and dead, and somewhere in between comes Mars, a decaying world, nearly run."

Other chapters in the book deal with the movements of stars; their distances and their light characteristics; the two star streams; double stars; variable stars; star clusters; and nebulæ. The origin of the planetary and stellar systems and the structure of the universe are also discussed.

To anyone interested in Astronomy, this book will be a mine of useful facts and valuable information.

* * * *

Our Wonderful Universe

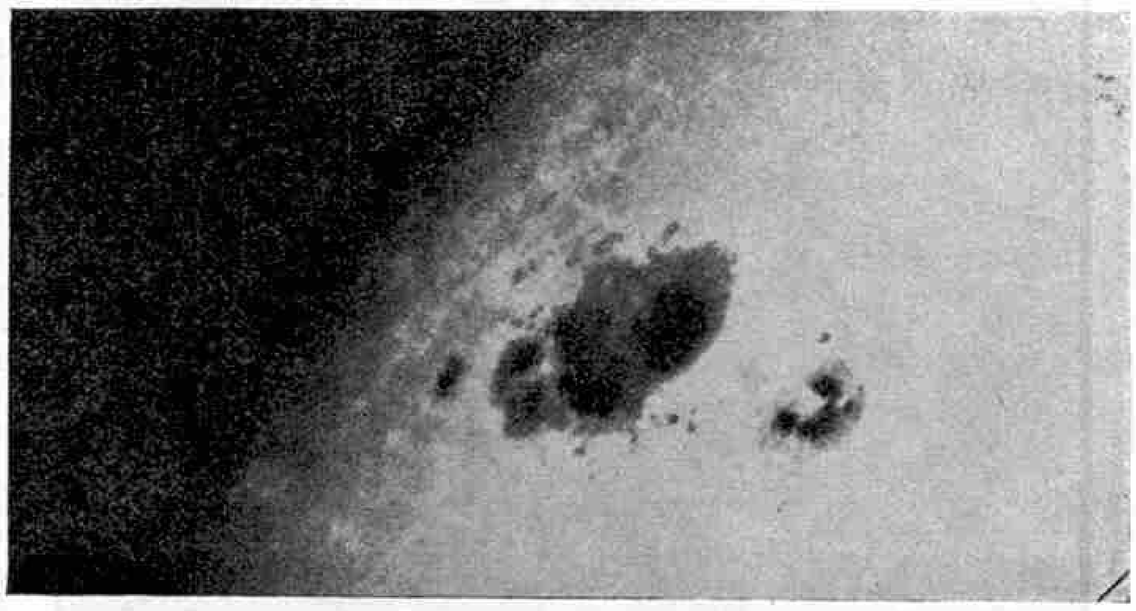
By C. J. CHANT. (Published by Harraps. 5/-)

This little book is written in the form of a talk and is illustrated by 139 illustrations, most of which are from photographs. The reader is taken out into the open air and attention is directed to the various phenomena to be seen in the sky, which are then explained in simple language. Each chapter is divided into sections, any one of which may be read by itself and all are full of interesting facts.

The general structure of the Universe, the Earth, Sun and Moon, the planets, the stars, and other heavenly bodies are all dealt with in turn. The distance of the nearest star alpha Centauri is graphically illustrated by the statement that a spider's web weighing 10 lbs. would be sufficient, as a single strand, to reach to the Moon but it would require 500,000 tons of web to reach alpha Centauri. Even if this gigantic distance were represented by 1 in., some of the spiral nebulæ would be 600 miles distant on the same scale.

To those who want a clear and vivid picture of our Universe this book will appeal, and it will not fail to excite the wonder and fire the imagination of those interested in things astronomical.

The Trifid Nebula in the constellation of Sagittarius (see below)



The Great Sun-spot, 20th January, 1926

This illustration, and the one above, are from "The Sun, the Stars, and the Universe" reviewed on this page

* * * *

"Gentlemen Prefer Aeroplanes!"

By E. F. SPANNER
(E. F. Spanner, 9, Billiter Square, E.C.3. 35/- net)

Mr. Spanner starts his preface with the words: "This is not a humorous book"—it certainly is not! The author has already made one attack upon airships in his book "*This Airship Business*," and in the present volume he sets out to drive home still further his arguments.

This book, even more than its predecessor, gives one the impression that the author regards the airship from a very prejudiced and one-sided viewpoint. Apparently he has made up his mind that this type of aircraft is unsound and impracticable, and as far as he is concerned that is the end of the matter. In his endeavour to prove that there is no future at all for airships for passenger-carrying purposes, he draws a gruesome picture of the pitching of an airship at all kinds of angles, and emphasises his point by a series of alarming diagrams of an Atlantic liner pitching at similar angles. His object is to convince us that, as compared with the passengers in a big ocean liner, the misguided people who choose to travel in an airship must suffer horrible discomfort.

His reasoning on this point appears to us to be quite unsound. It is extremely doubtful whether an airship's movements are ever likely to be more erratic than those of a ship rolling heavily in a cross sea. One recalls also the statement of Dr. Eckener, and other members of the crew of the "*Graf Zeppelin*," that nobody on the ship was air-sick throughout the Atlantic crossing, and that the movements of the ship were never such as could have made anyone unwell. In this, as in many other of his arguments, Mr. Spanner ruins his case by overstatement and exaggeration.

We have not space to consider Mr. Spanner's long and tedious technical arguments, which do not appear to us to be at all convincing. They are statements of opinion pure and simple, and the solid framework of proof is conspicuously absent. There is no doubt that we still have a great deal to learn in regard to large airships, and possibly Mr. Spanner may turn out to be right. On the other hand, experts strongly believe in the future of the airship, and these experts have at least equal qualifications and certainly more experience. For the present, therefore, we are not inclined to be unduly depressed by Mr. Spanner's gloomy prophecies, and we look forward with interest to the trials of "R.101."

Interesting New Books

"MYSTERIES OF THE SEA"
by J. G. LOCKHART.
(Philip Allan & Co. Ltd. 3/6)

"SEAMEN ALL"
by E. KEBLE CHATTERTON.
(Philip Allan & Co. Ltd. 3/6)

"PERIL OF THE SEA"
by J. G. LOCKHART.
(Philip Allan & Co. Ltd. 3/6)

"SEA WOLVES OF THE MEDITERRANEAN"
(Philip Allan & Co. Ltd. 3/6)

"THE PAGEANT OF CIVILISATION"
by F. B. WARREN. (Ernest Benn Ltd. 21/-)

"CHILDREN'S PLAY-HOUR"
by S. Southwold. (Longmans, Green. 6/-)

X.—THE EQUIPMENT OF A MODERN FIRE STATION

PROBABLY every Meccano boy has at some time or other halted outside the wide doors of a fire station and gazed in admiration at the imposing array of engines in their spotless vermilion coats and with their polished brasswork shining resplendently. There is indeed something remarkably fascinating about a fire station and its equipment, and this fascination is increased by a sense of mystery regarding what exists behind the scenes.

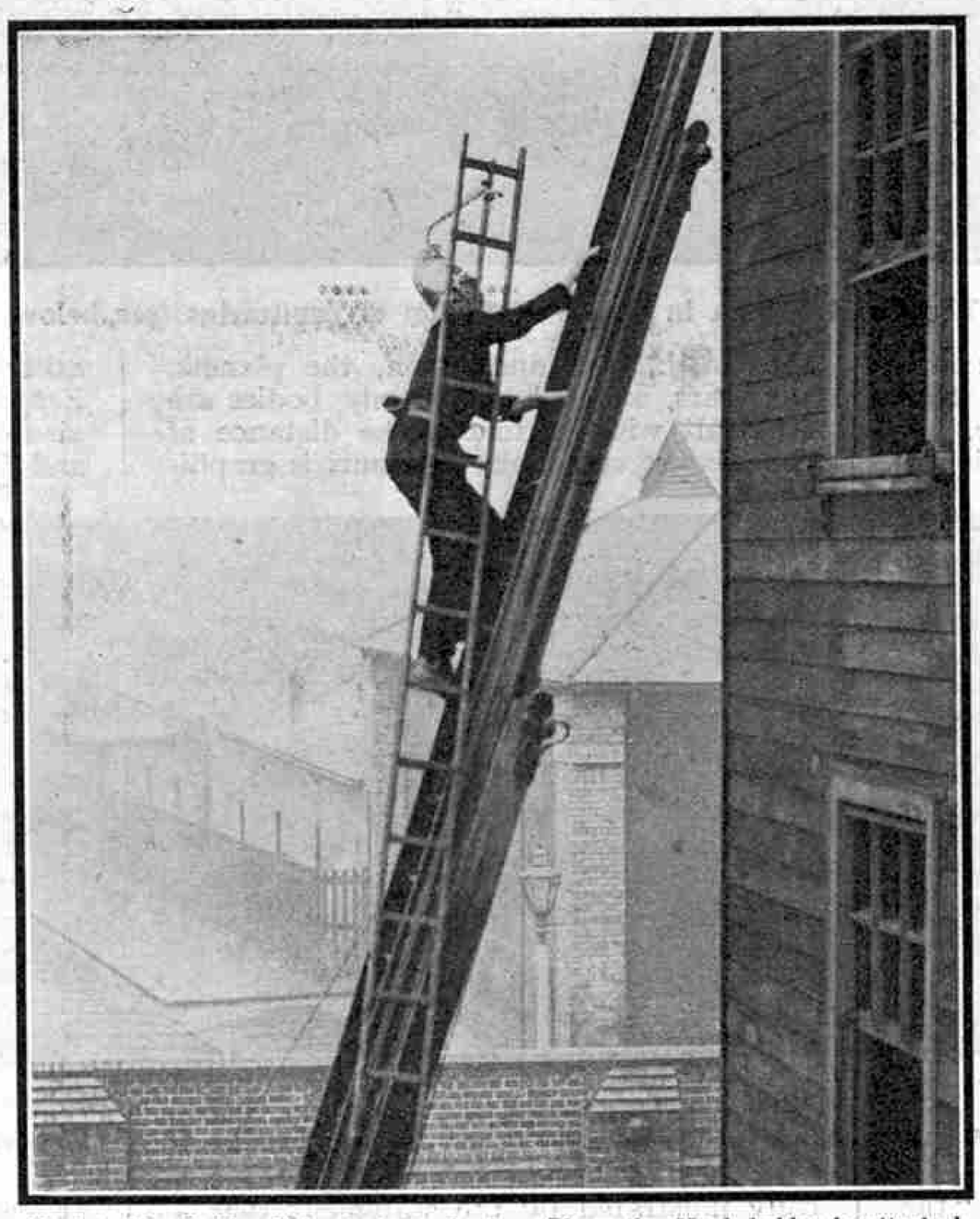
No two fire stations are exactly alike, but although they differ in point of detail the majority are built and equipped on the same principle. The number of firemen and machines varies according to the size of the station and the extent of the area that it serves. A village fire station rarely possesses more than one fire engine and often that is of antiquated design, but town fire stations are equipped with two or more powerful motor-driven fire pumps, fire escapes and tenders carrying accessories.

Large cities are divided into a number of areas and branch fire stations are established as centrally as possible in each area. By this means an outbreak of fire in any of the outlying districts can be attended to with the same promptitude as one occurring close to the chief fire station. The branch fire stations are known as "district" stations, and the chief station is referred to either as "Headquarters" or "Central."

The bulk of a city's fire extinguishing equipment is kept at the headquarters, but each district station is provided either with a motor-driven fire engine complete with an escape ladder capable of being extended 50 or 60 ft., or with a petrol-driven tender having an escape ladder attached to it.

At headquarters the large room in which the machines are lined up ready for use contains a fascinating assembly of equipment. There are powerful motor-driven fire pumps with wheeled escape ladders carried overhead, huge motor turntable ladders each capable of extension to a height of from 80 or 90 ft., motor tenders and a Special Appliance van.

We have already dealt with fire pumps and turntable ladders (see "*M.M.*" of December last) and therefore we need not say anything further about them. The motor tenders are built on similar lines to the pumping engines, but they do not carry pumps and in some cases they are without escape ladders. The whole of the interior of the box-like body of a tender is occupied by reels of delivery hose neatly stacked in a vertical position so that they may be quickly and easily withdrawn when required for use. Alongside each side of the tender is a long box in which are stored lengths of suction hose, and the lid of each of these boxes provides standing accommodation for six firemen. Other stores carried include spare nozzles, ordinary ladders and hand fire extinguishers of various types.



Hook-ladder Drill. This photograph shows how the Hook-ladder is attached to the Fireman without interfering with his movements

The "special appliance" van contains a number of interesting accessories. Among these are supplies of self-contained breathing apparatus, smoke helmets, oxy-acetylene cutters, and rubber gloves for use by the firemen when there is danger of electric shocks. All these articles are stored neatly in a series of small lockers ranged along each side of the vehicle.

The breathing apparatus is a very necessary item of fire brigade equipment. In construction and operation it is almost identical with the gas-masks of wartime. In use the mask of the apparatus is slipped over the fireman's head and is made airtight. A clip grips the nose of the wearer, compelling him to breathe entirely through his mouth. He breathes out into a tube that conveys the discharged air to a chamber in which it is chemically purified, ready to be passed back to the mouth and breathed over again.

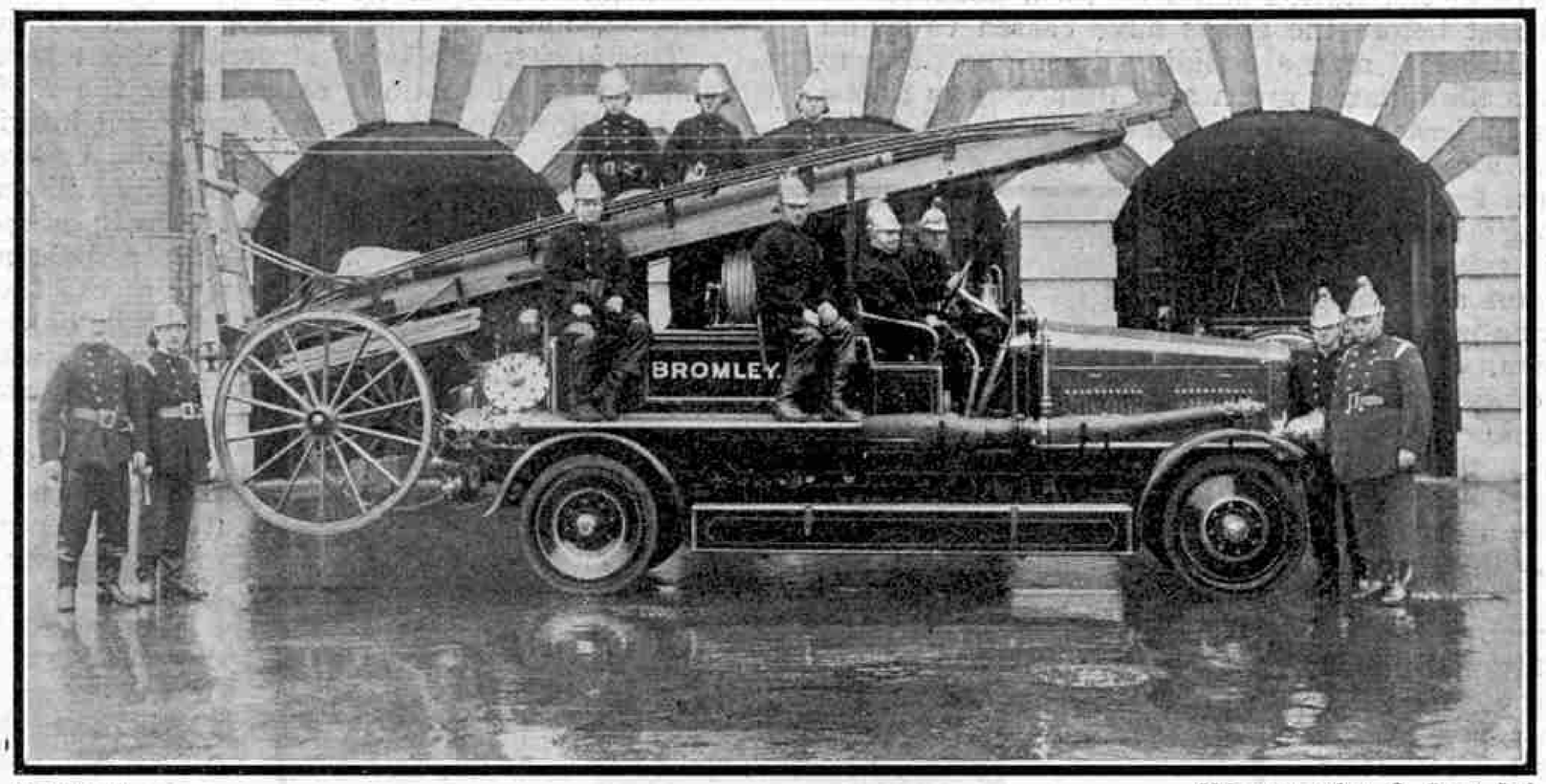
The smoke helmet is for the special purpose of enabling a fireman to breathe in an atmosphere thick with smoke. The helmet is of leather and is slipped over the head and tied in position. One end of a coil of flexible tube is then secured to a mouth-piece in the helmet and the other end of the tube is connected to an air pump to which a cylinder of oxygen has been linked up. As the fireman gropes his way through the smoke and fumes the flexible tube is paid out and oxygen is pumped through it continually. The necessity of using a tube in this manner limits the range of utility of the smoke helmet, and when it is necessary for a fireman to operate beyond a certain distance from the oxygen supply the helmet is replaced by the self-contained breathing apparatus.

Behind the scenes at a large central fire station there exists a veritable engineering works. Repairs to the engines and tenders are usually carried out on the premises and, in addition to the engine room that accommodates the machines, there is a garage in which a vehicle can be "docked" for overhaul, with a fitting shop, carpenter's shop, and smithy adjoining. The fitting shop usually contains one or more pits on which an engine that requires attention may be placed for inspection from below. Lathes, shaping machines and grinding machines, operated by belts driven from overhead shafting actuated by an electric motor, enable existing engine parts to be repaired and new ones to be turned and finished. There are the usual fitter's benches complete with vice and hand tools. In the carpenter's shop replacements to the damaged portions of the body-work of the engines are made and painted in readiness for fitting to the vehicles, and in this department are carried out also any necessary repairs to ladders.

In most large cities the fire station personnel includes men who have gravitated to the brigade from many different trades, and these men are able to carry out the various repair jobs that

become necessary. The fire brigade of Liverpool, for instance, includes fitters, carpenters, joiners, coach-builders, coach painters, house painters, plumbers, whitesmiths, coppersmiths and blacksmiths! The men carry out the repair jobs during their period of duty, provided they are not away at a fire. The repair shops of the London Fire Brigade, on the other hand, are manned by a special staff of fitters, etc., who do not undertake any fire-fighting duty.

In addition to the various repair shops there are large store-rooms in which are maintained substantial stocks of all spare parts—valves, nozzle pieces, engine parts, axes, hammers, hose, nuts and bolts. Bulky material is stored on shelves and the smaller items are accommodated in lockers arranged in rows along the sides of the rooms and numbered or titled according to their contents. The motto of a fire station is: "A place for everything and everything in its place," for it is of the utmost importance that any article that may be required should be found in its proper place at any moment. The store-rooms of a fire station are indeed an outstanding example of system and orderliness.



Courtesy [*Merryweather & Sons Ltd.*

A modern Motor Driven Fire Engine fully equipped for turning out to a fire. The ingenious and effective method of carrying the Escape is clearly shown

It is clearly necessary that, in whatever room of the station a man may be, he should be at all times within reach of some kind of signal to call him to duty in case of a fire alarm. At the Liverpool central fire station every room frequented by the men has on one wall a glass-fronted box about 1 ft. square. A vertical partition divides this box into two compartments, each of which can be illuminated electrically; and one compartment is fronted by a red glass and the other by a green one. When an alarm is sounded one or other of these compartments is illuminated, and by the colour of the light indicates the particular class of "duty" men who must respond to the summons. This signal will be referred to again later.

A fire station is staffed day and night. At some stations the men work in two shifts each of 12 hours' duration, while at others they are on "continuous" duty, those who are not occupied in repair or other jobs at the station being on "bell call" at their homes. The two-shift plan is known as the "Two Platoon" system, and during the time that the platoon men are on duty they have to remain on the station premises in readiness for any fire call that may be received. They wear their uniforms throughout their period of duty so that when an alarm is sounded they have only to don their helmets—or in the case of men on certain work their tunics also—and slip their axes into their belts. The "duty" men are seldom idle, for when not away at a fire those who have a trade are busy in the workshops, while others are employed in the stores on various jobs such as repairing hose.

A Fireman wearing Self-contained Breathing Apparatus rescuing an unconscious man from a smoke-filled cellar

During each shift certain firemen are assigned to duty in the station Watch Room, where are situated the telephone and automatic and street-alarm switchboards by which headquarters is kept in direct touch with all its branch stations and also with the various parts of the town. These switchboards are never left unattended for a moment. On one wall of the room is a large map of the town and its suburbs with the various district stations and their areas clearly marked out in red. Localities designated by the Chief Superintendent as "danger zones" are also indicated on the map, and these include mills, warehouses and depots stocked with inflammable materials, and also congested areas where narrow streets and courts would render it very difficult for the brigade to reach a fire. The private office of the "Chief" usually adjoins the Watch Room and he or his deputies are always near at hand.

When the firemen retained on duty have a leisure hour they are permitted to retire to the recreation room or to the rest room. The former is usually a large room containing one or more billiard tables, a piano, a well-stocked bookcase and sometimes a gramophone and records. In the rest room an orderly array of blanketed palliasses denotes the men's couches. These couches are arranged on the two-berth plan, an upper group being supported upon the floor level couches by a strong iron framework. The quarters include also a bathroom, a mess-room, and a well-equipped kitchen. Separate mess-rooms and other accommodation is provided for the officers of the brigade.

These various rooms form the upper storeys of the fire station and a wide staircase at one end of the building provides means of access from the ground floor. The negotiation of a staircase takes time, however, and when an alarm is sounded the men descend to the engine room by the far quicker method of sliding down thick steel brass-covered poles. There may be only a couple of these poles but they are so situated in relation to the men's quarters that wherever a man may be in the upper storeys of the building he is not far from one of the poles. At the upper floor each pole is encased in a huge circular wooden cabinet in which a door provides access to the pole. These casings eliminate the possibility of anyone falling through the wide aperture that is cut in the floor for the pole and its traffic.

When a fire call is given from a street alarm it is received at the nearest district station and also in the Watch Room at headquarters. The system adopted to indicate the number of the box from which the alarm has been given varies at different stations, one method being by the fall of a flap on a street-box switchboard. This signal is known at headquarters as an "assistance" call, and if it is deemed necessary to send a machine from headquarters to supplement the district turn-out the alarm is then sounded through the Central Station by means of huge gongs situated in various parts of the building. There is no mistaking their summons!

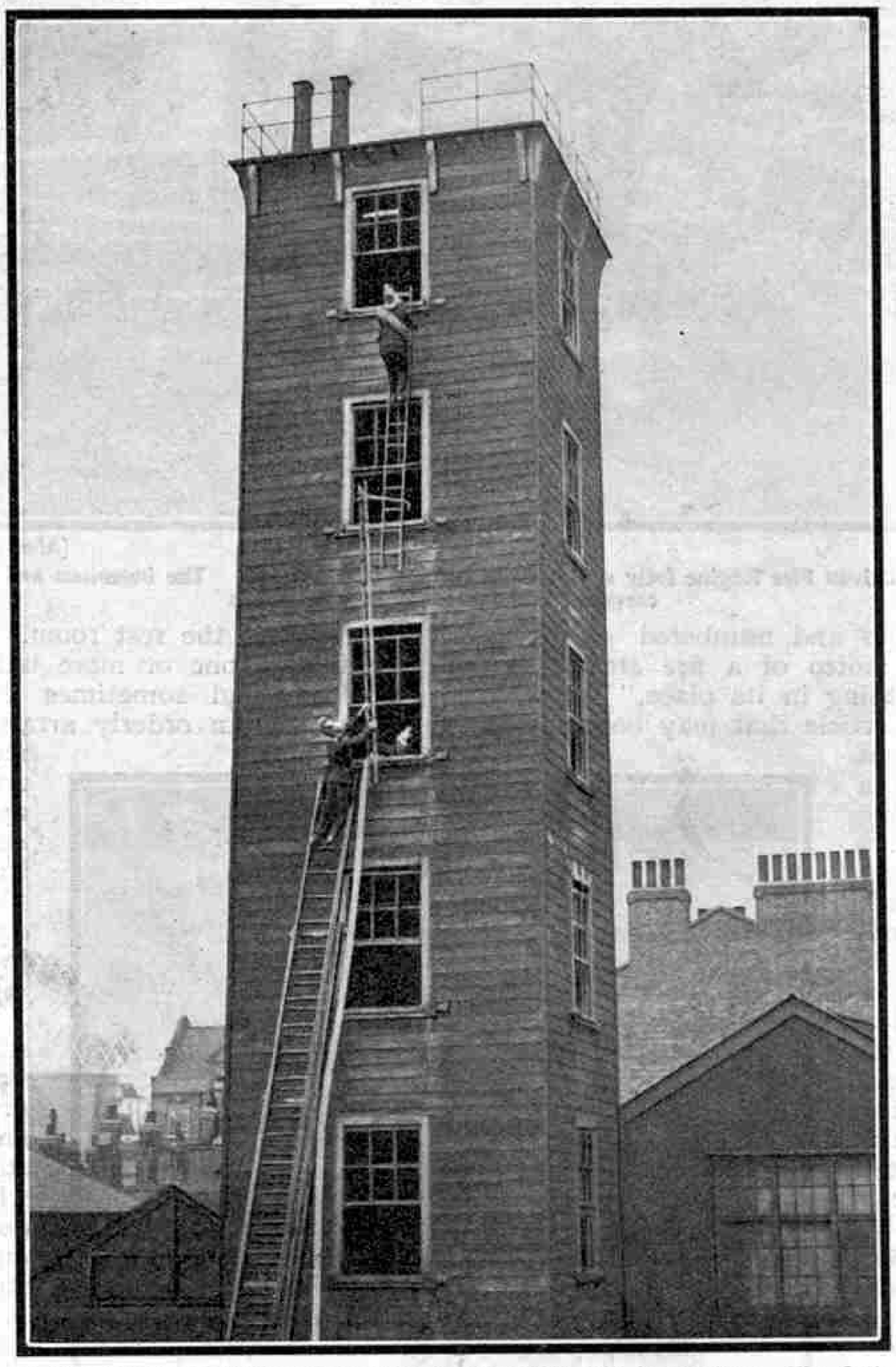
The details of organisation vary to some extent in different fire stations but the general principles are the same. In order to obtain a good idea of the inner workings of a thoroughly up-to-date fire station let us imagine ourselves at the Liverpool Central

Fire Station when an alarm is received. As the powerful gongs send out their summons one of the Watch Room firemen manipulates a switch that illuminates the green lights in the various rooms. This signal indicates that firemen who are on "assistance" duty during that shift must be first to answer the summons; the other men on duty at the station stand by for a possible call for further aid. Almost before the gongs have ceased to sound the alarm the "assistance" men are sliding down the poles to the engine room. An illuminated green sign immediately above one of the machines indicates the particular one that has to be taken out and so avoids any possibility of the men losing time by mounting wrong machines. In less time than it takes to tell the quick-opening doors are swung apart and the machine is speeding away on its mission.

If the outbreak of fire is in a danger zone or is otherwise of a menacing character, the headquarters brigade turns out in full force in addition to dispatching the district brigade in advance. On the other hand, a conflagration occurring in the area protected by the Central Station brigade may assume such proportions that the district stations have to be summoned to assist headquarters.

The signal for a full turn-out from headquarters is indicated to the men on duty by the switching on of both the red and the green lights. At the same time the men on "bell call" are summoned by the automatic ringing of a bell in their homes.

It is in these circumstances that the headquarters fire brigade is seen at its best. For a few moments the poles seem to be black with men descending swiftly to the engine room. Before the last man has reached the ground the engine destined to be the first away has been started up and the driver is at the wheel, and scarcely have the big doors been swung apart before there is a vacant space where the machine had stood. Overhead electric coloured signs indicate to the firemen the order in which the various machines have to be manned and dispatched, and each man goes to the machine to which he was assigned at the commencement of his period of duty. There is thus no hesitation or inquiry when the call comes.



A Fire Station Drill Tower showing Hook-ladder drill in progress. The first man has just hooked his ladder to the uppermost window and is ascending it

Closely following the first engine goes a tender with its complement of extra firemen and supplies of hose. This tender probably will be followed by one of the great turntable ladders and in the wake of this follow other motor pumps and tenders as the "bell call" men arrive and man them. Somewhere in the procession also is the "special appliance" van.

The departure of men and machines is carried out so swiftly and in such an orderly manner that if it were not for the strange silence and vast emptiness of the station when the last machine has gone, one might almost be inclined to believe that the whole affair had been imagined!

The return of the brigade from a fire is in marked contrast to their departure. The spick-and-span appearance of the vehicles has vanished, the brasswork of the pumps that gleamed resplendently is now dull and water-coursed, the lengths of hose that lay clean and dry along the sides of the machines now drip water and in places are coated with dirt from the ground with which they have been in contact. The smartness of the firemen's helmets has similarly disappeared and the men themselves present a begrimed and smoked appearance and resemble a troop of battle-scarred warriors returning from a conflict.

The returning engines are driven into the concrete yard at the rear of the fire station. Here the firemen dismount and remove all used hose and exposed detachable equipment from the machines. The hose is then connected up to a hydrant in the yard and the machines are thoroughly washed down. When thus cleansed they are driven into the engine room where they are later polished up and restored to their former smartness.

The lengths of hose are then connected up to the yard hydrant and thoroughly tested under pressure so that any leaks that have developed while the hose was in use at the fire may be revealed. Any defective places that are found are carefully marked, and the hose is then hauled to the "drying" tower.

This is a square brick structure about three storeys in height, and devoid of windows except near the roof. The tower is entirely hollow, and at a first glance up the interior seems to resemble a wide, covered chimney. By peering diligently up through the gloom, however, it will be seen that a balcony runs along each side of the tower near to the roof. On this balcony are winches by means of which the lengths of wet hose are hoisted up and suspended to dry. The necessity of such a lofty building for this purpose can be appreciated when it is known that some of the reels of hose when unravelled are no less than 100 ft. in length.

When the lengths of hose are dry they are lowered to the base of the tower and withdrawn by hand. Lengths that are faulty or are not required for immediate replacement on the machines are returned to the store-rooms. At some stations these are in the basement, and the hose is conveyed to the stores by way of a chute, the entrance to which is in the yard and close to the tower. The chute resembles a wide pipe sticking up out of the ground to a height of about 1½ ft. and is covered by an elevated cone-shaped lid. The lengths of hose as received underground are sorted, the sound lengths being rolled up and replaced in stock while those marked for repair are patched up or darned by the storeroom staff before being returned to the shelves.

At last the machines and lengths of hose are cleansed and put away and the firemen are free to return to their quarters to indulge in a much needed bath and "clean-up." Their uniforms are later taken down to a drying room in the basement, where they are hung over racks close to the ceiling. This room is heated by means of a series of steam pipes extending under the floor, which consists of iron grids, and drying is carried out very rapidly.

Let us turn now from the machines to the men. There are two qualities essential in a fireman—absolute physical fitness and complete lack of "nerves." So important is the latter qualification that before an applicant for an appointment in a fire brigade is allowed to undergo the necessary medical examination he is escorted to the station yard, one of the big turntable ladders is brought out and extended to its full height, and he is asked to scale it. His progress upward is watched closely by the brigade officers, and if his knees show any signs of wobbling, or if he otherwise betrays a sense of insecurity, he is rejected, and the medical officer is spared the task of examining him.

This seems rather hard lines on an unsuccessful applicant who is keen to become a fireman, and it might be thought that in the course of practice and drill he would entirely overcome his trepidation, but as a matter of fact the genuine fireman is born, not made. However much training in the art of climbing ladders a recruit might receive, there would always be the possibility that, under the stress of exceptional circumstances at a fire, his acquired "nerve" might desert him. Such a relapse while carrying out a rescue or executing some task at a great height might easily be fatal, not only to himself but to others. In consequence, only men who show inherent self-confidence and ability to climb quickly to lofty heights without any trace of dizziness are of interest to a fire brigade superintendent.

The applicant who successfully (*Continued on page* 171)

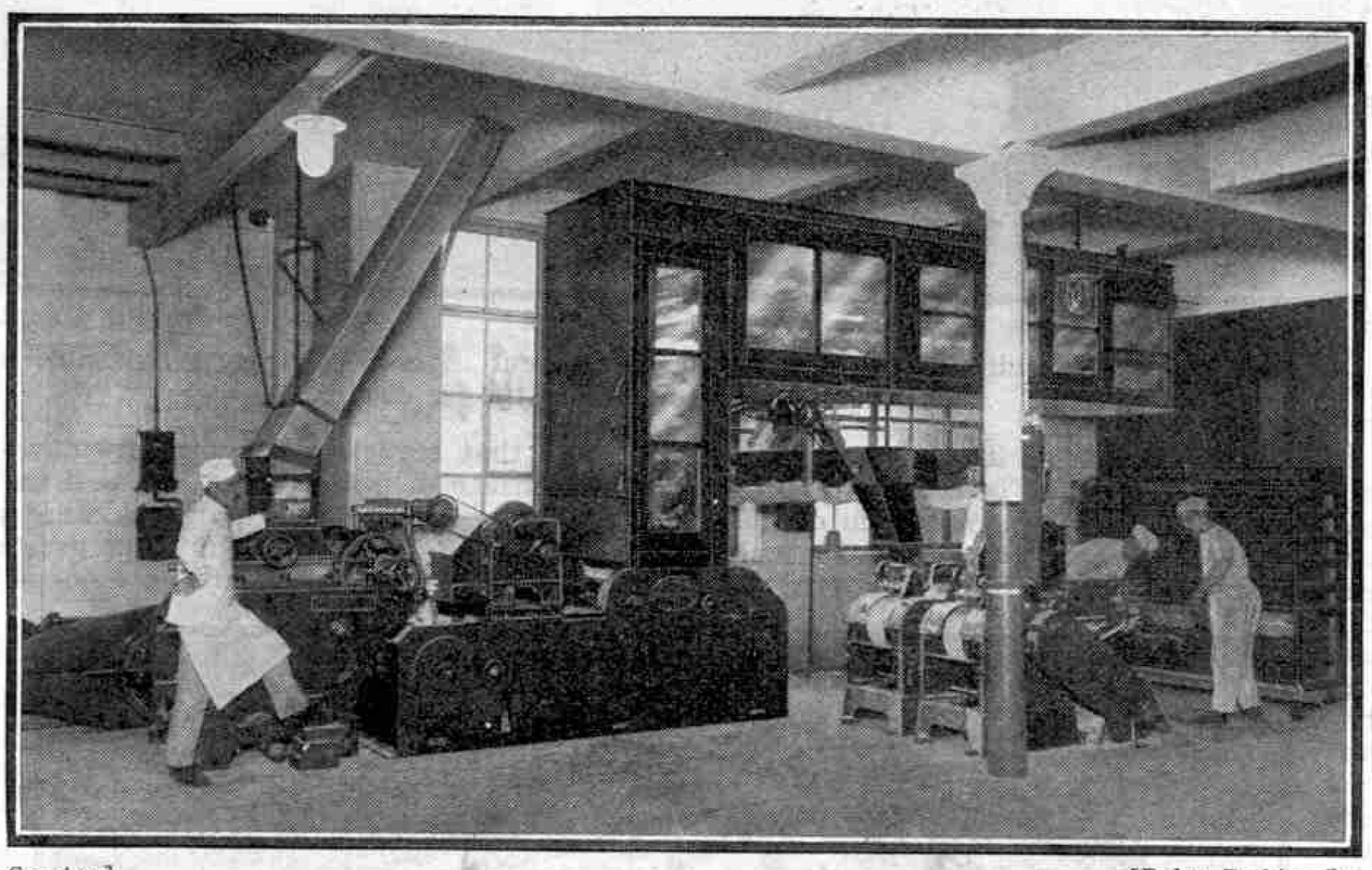
VIII.—THE ART OF BREAD BAKING

IN the previous articles in this series we have seen how wheat is harvested, transported across the seas and ground into flour, and now we must follow the progress of the flour in the hands of the baker, whose task it is to turn it into our actual daily bread.

The art of baking is of great antiquity. The nomad races of prehistoric and ancient times ground their corn in rough mortars and mixed it with water to make cakes that were roasted over a fire. These were heavy, and to us would seem very unappetising, and it was a very happy day for the digestive systems of the human race when the discovery of means to lighten bread was discovered. We do not know when this happened or how it occurred ; it certainly followed the discovery of alcoholic fermentation, for the bacteria that transform sugars into alcohol are also responsible for lightening bread. In this manner began a connection between bread making and the wine and spirit industry that has continued to this day.

Possibly the discovery of the fermenting action of certain bacteria was due to their accidental presence in a vessel containing a mixture of honey and water. If these bacteria were of the type we now call yeast plants, they would be thoroughly at home in the sweet liquid and would grow abundantly, forming alcohol and carbonic acid gas. It was in this manner that the mead drunk by our Saxon forefathers was made.

The bacteria that bring about the fermentation of honey are capable of acting in a similar manner on the sugars present in meal made from wheat or barley. This also was discovered in prehistoric times, either by accident, or as a result of an experiment performed by some curious individual. The action takes place best when the meal is mixed with water, and it is found that the carbonic acid gas penetrates through the dough and expands it into a light mass that bakes into very agreeable cakes. The equally valuable discovery was made that a piece of fermented dough could be used to commence the aerating, or "leavening" process, as it is called, in a fresh mixing.

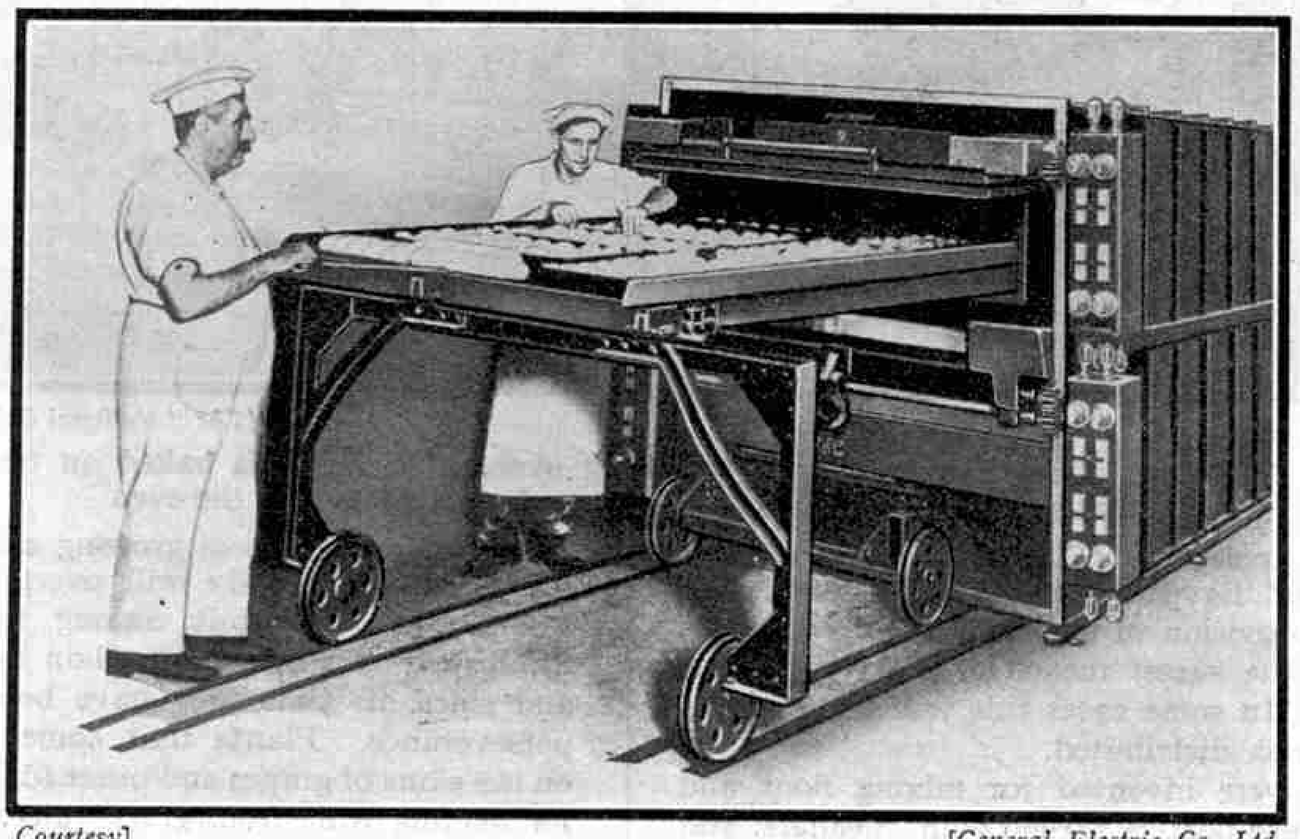


Courtesy] [*Baker Perkins Ltd.*

Bread making plant in which loaves automatically are cut off, passed through the prover, and moulded before being carried to the oven

It is curious to note the connection between bread making and the wine industry. Bacterial plants of the kind that we call yeasts are found in the "bloom" on the outer skin of freshly gathered grapes, and it is their action that turns grape juice into wine. These ferments have long been known under the name of "must of wine." They also may be used to leaven bread, and there is no doubt that "must of wine" was used in this manner by the Celtic races who lived in Spain and France long before the coming of the Romans.

The use of means to lighten bread is mentioned very often in the early books of the Bible. The Egyptians made use of leaven at a very early date and were probably the first to do so. They were a settled people when their neighbours were still pastoral nomads. The latter seldom stayed a sufficient length of time in one place to allow the leaven to work its slow way through a



Courtesy] [*General Electric Co. Ltd.*

The last word in cleanliness ! An electrically heated draw-plate oven, with the plate withdrawn to enable the baking chamber to be refilled

large mass of dough, but the Egyptians were able to elevate baking into an art. We learn from the 40th chapter of the book of Genesis that Pharaoh's chief baker was an important official, and it is interesting to note that he appeared to rank with the chief butler, whose task was largely concerned with wine making. This is an instance of the close connection that has always existed between baking and the making of alcoholic drinks.

The Israelites who followed Joseph into Egypt learned to make regular use of leaven, but in their forty years' travels in the Wilderness they were compelled to revert to the habits of their former life, and lived on unleavened bread. To this day, 5,000 years afterwards, the Jews annually make and eat unleavened bread in commemoration of the stirring events that accompanied their escape from bondage in Egypt.

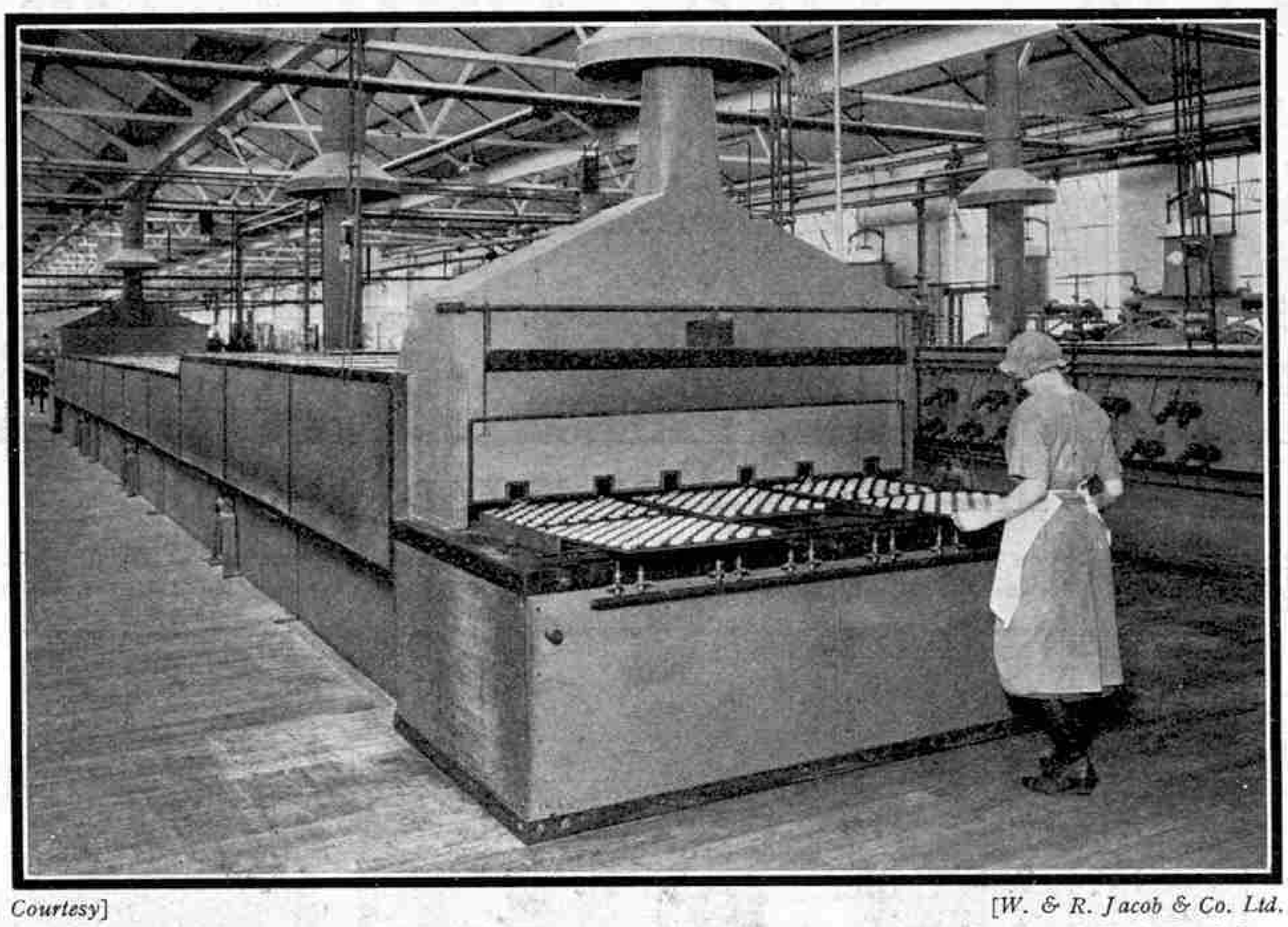
The unleavened bread or "Passover Cake" eaten to-day during the seven days of the Jewish Festival is by no means unpleasant, in spite of the absence of leaven, for means have been discovered of making it more appetising than it must have been in the troubled times of the exodus from Egypt. It is made from good white flour, and not from crudely ground wheat grains, and is similar to a crisp but tasteless biscuit.

The knowledge of leavens spread rapidly from Egypt to the settled nations round the shores of the Mediterranean Sea, some of whom probably made the discovery for themselves. The Greeks had a partiality for fine white bread, and the Romans also learned to make use of similar material. Knowledge of the process of aerating dough is supposed to have reached Rome from the East and it is certain that better bread was baked in the city after the earliest Asiatic wars. The yeast or ferment used was obtained from "must of wine."

Bread played a very interesting part in Roman history. A problem that was always before the officers of the republic, and also the Roman Emperors of later time, was how to feed the teeming population of the ancient city. Corn was brought at great expense from Sicily and Egypt for free distribution among the lower classes, and the provision of a plentiful supply of this necessary food was one of the surest means of currying favour with the electors of Rome. In some cases this was taken so far that not corn, but bread was distributed.

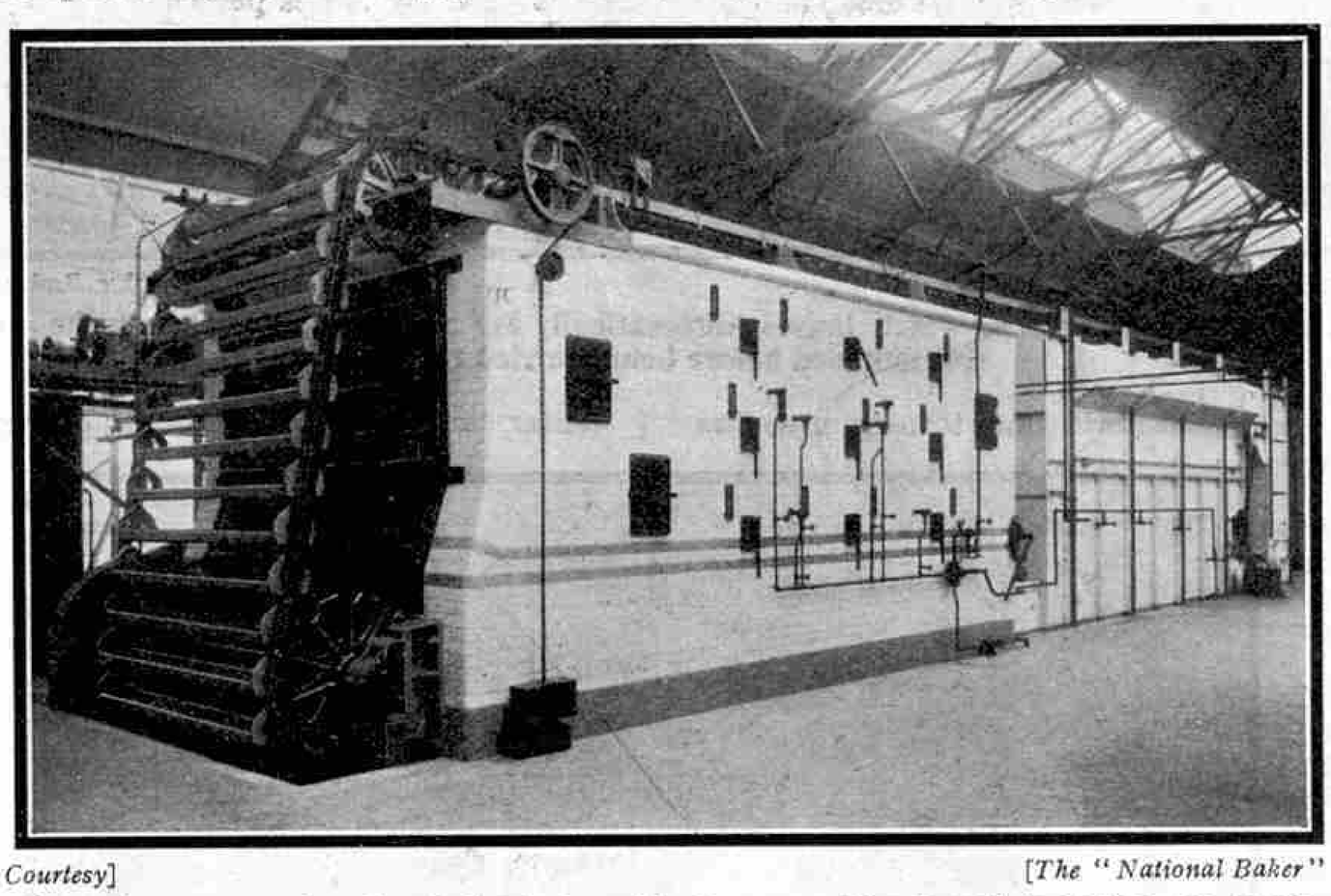
In later times machines were invented for mixing flour and water into dough. These were beaters rather than kneaders, and generally consisted of wooden arms that were plunged forcibly into the dough by means of long levers. Crude machines of this kind persisted until comparatively recently but never came into general use. It is in fact only within the last hundred years that satisfactory methods of making bread on a large scale have been introduced, and it is even less since the strange process involved in its production has been understood.

The most interesting ingredient necessary in making an appetising loaf is the aerating or leavening material. In former times the yeast was used almost accidentally. Bakers made "barms" by steeping malt in warm water. The liquid was drained off some hours later, and barm from a previous mixing was added, in order to make sure that the leaven was present. All that was known about the barm thus made was that bread could be aerated with its aid, and bakers had no suspicion that a tiny plant was hidden in it. The first hint of any such thing came about 250 years ago, when a Dutchman named Leuwenhoek chanced to examine some of it through a microscope and saw that it contained a number of round cells. These were so small that several millions of them would be required to cover the surface of a halfpenny. Less than 100 years ago it was discovered that the tiny particles were actually living cells! It is they who do the work, and the greater part of the barms used by bakers was merely bait and food for them.



Courtesy] [*W. & R. Jacob & Co. Ltd.*

Feeding trays of biscuits into a "travelling" gas oven. The biscuits are fully baked by the time that they emerge at the far end



Courtesy] [*The "National Baker"*

A modern example of a baker's travelling oven. The bread is baked on trays that are carried on chains three times along the length of the oven

The tiny plants feed on sugars and increase in number at an astonishing rate. Each cell multiplies by throwing off buds and a complete bud is formed in six hours. This in its turn continues the process, so that the original cell becomes one of a colony, or chain of cells, each of which is capable of forming new buds. How rapid this growth is may be judged from the fact that in seven days a single microscopic cell will grow to no less than 30 cwts. of yeast if properly fed!

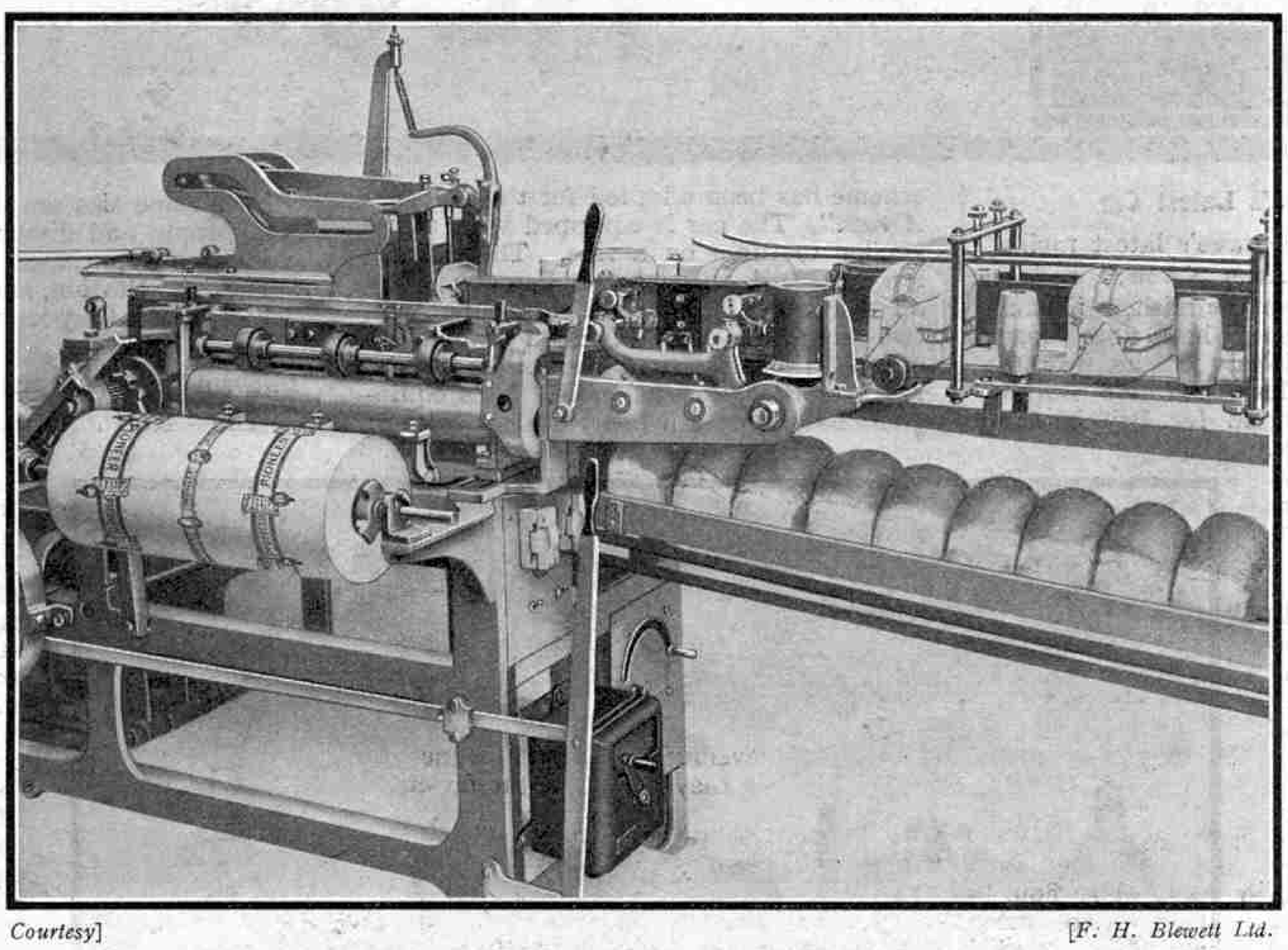
The inquisitive reader may satisfy himself of the rapid rate of growth of the cells by adding a little yeast to water containing dissolved sugar, and leaving the vessel containing them to stand in a warm place. Very soon a spongy mass of growing cells will cover the surface of the liquid and eventually will overflow the vessel.

Yeasts are certainly among the strangest of plants. Their life history was first made plain by the famous chemist, Pasteur, and since his time they have been studied with great care and perseverance. Plants that come under this heading are found on the skins of grapes and other fruits. Some are specially adapted for making wine from grape juice, and others for brewing; still others have been found most advantageous for bread-making. Chemists have studied their manner of living and discovered

their favourite foods, and to-day they cultivate races of yeast in exactly the same manner as nurserymen cultivate varieties of apples or new strains of flowers. One result of their labours is that bread may now be made with the aid of pure yeast, instead of a mixture containing feeding materials that do not help in the aeration of the dough.

Distilleries are the source of the yeast now used in the preparation of our daily bread. Immense quantities are produced during the formation of alcoholic liquors from malt. Formerly most of it was thrown away, but it has been discovered that the yeast cells retain life when they are removed from the vats in which they grow, and are not killed even when they are pressed in order to get rid of the liquid mixed with them. This discovery was made in Germany, and for a long time dried yeast prepared in this manner was called "German Yeast."

The yeast sent out from distilleries is in the form of a pale yellow mass that has the consistency of soft cheese. When newly grown it has a pleasant fruity smell, that later becomes sour. The cells are in a dormant condition; like squirrels and other hibernating animals, they only come to life again when conditions become warmer. If the temperature is raised before suitable food is provided these strange plants simply consume part of their own substance and quickly perish. But if they are given a supply of their favourite diet of sugar in a little warm water, and mixed with dough, they become willing and tireless workers that thrive and multiply exceedingly while performing their curious task.



Courtesy [*F. H. Blewett Ltd.*

A machine that automatically wraps and seals 2,000 loaves per hour

Bread making with the aid of yeast is not a complicated task, and by far the most comfortable place in which to study it is the kitchen of a farmhouse on a winter baking day. Then a bright fire burns in the grate in order to heat the oven to the necessary temperature, and also to keep the room sufficiently warm to enable the yeast cells to do their work at reasonable speed. On a low stool in front of the fire stands a large bowl containing flour that has been flavoured by the addition of a little salt. In the centre a large excavation is scooped out, and into it is poured the leavening liquid, which in the meantime has been standing in a warm place in order to coax the yeast cells to life ready for action. Next is poured in sufficient lukewarm water to convert the flour into dough. The sides of the excavation are then slowly stirred into the frothy liquid in the centre until the whole of the latter has been absorbed by the flour, with the formation of a heavy mass of dough.

The dough is thoroughly kneaded and left in front of the fire to rise, the bowl being turned round from time to time in order to ensure even and thorough warming. This encourages the yeast cells, and the carbonic acid gas produced during the fermentation penetrates throughout the dough and blows it up into a light elastic mass that eventually threatens to run over the sides of the bowl. It is then ready for baking. Sufficient to fill a loaf tin is cut off, kneaded into shape and dropped into the tin in which it is to be baked. This is repeated until the dough has been used up. The kneading breaks up the bubbles of gas and the tins therefore are left in front of the fire in order to allow the leavening to recommence. The loaves rise a little further, and finally are plunged into the oven, from which they emerge later baked through and beautifully browned.

The scientist tells us that the brown colour of the crust of a well-baked loaf is due to the partial charring of the sugar and starch in the flour. Whatever the chemical changes may have been, the result is very pleasant, for there are few things nicer than a well-browned crust from a newly baked loaf.

The changes that take place during baking are very interesting. When the dough is first placed inside the oven the yeast is still at work producing alcohol and carbonic acid gas. At first the yeast cells take very kindly to the increased temperature; they are stimulated to greater exertions, and the loaf rises rapidly owing to the greater production of gas. Very soon the temperature rises beyond the limit of comfort for the cells however, and they are burnt up. In addition the alcohol is vaporised and the carbonic acid gas diffuses into the air. Thus we get the remarkable result that the yeast and the products of its action do not remain in the finished loaf! In the most obliging manner they disappear when their work is finished and leave only the light and wholesome loaf into which they have transformed the heavy mass of dough.

Of late years the practice of home baking has shown signs of dying out. Many people have found that it is far more convenient to buy bread as it is wanted than to undergo the labour of kneading. In addition the introduction of machinery has made bread making into an exact science and has reduced costs, with the result that a good and uniform white loaf may now be bought without difficulty in practically any district.

There are still a very large number of bakehouses where no machinery is used. In these the process is carried out in almost the same manner as in home baking except that in some districts barms are still used. The mixing is done on a larger scale; a capacious trough therefore replaces the bowl, and the leaven is allowed to act for a longer period. As a rule breadmaking is carried on at night, and it is not until the early hours of the morning that the dough has risen sufficiently to be ready for weighing off and shaping into loaves. In the interval between the mixing and the baking the dough is kept warm and is covered up with flour sacks to exclude draughts.

During last century machinery came into use on an increasingly large scale in the baking trade. At first it met with considerable opposition, usually owing to the mistaken idea that no machine could knead a dough as light as one mixed by hand. As machines increased in number and efficiency, the opposition died away, and in modern bakeries excellent bread is made by machines in which the ingredients are not touched by hand at any stage while the loaf is automatically sealed in a paper wrapper.

The machines in which the mixing is carried out are a great improvement on the primitive types already referred to. The latter merely pounded the dough, but those now used actually mix it and turn it over. In one type the flour, water and other ingredients are placed in a cylindrical container that rotates slowly while curved arms move up and down inside it. The speed of the arms is not constant. They are slowest during the downward drive and quickest as they sweep upward, a movement that gives a close imitation of hand-kneading. Other machines are constructed on similar lines, and only differ in the arrangement of the arms or blades that are used for mixing and kneading.

The division of the dough also is performed mechanically. It is pushed along the trough by a worm conveyor and at the end sufficient to form a single loaf is cut off. The pieces of dough fall on a travelling band that carries them into the "prover." This is an enclosure in which

(*Continued on page* 170)

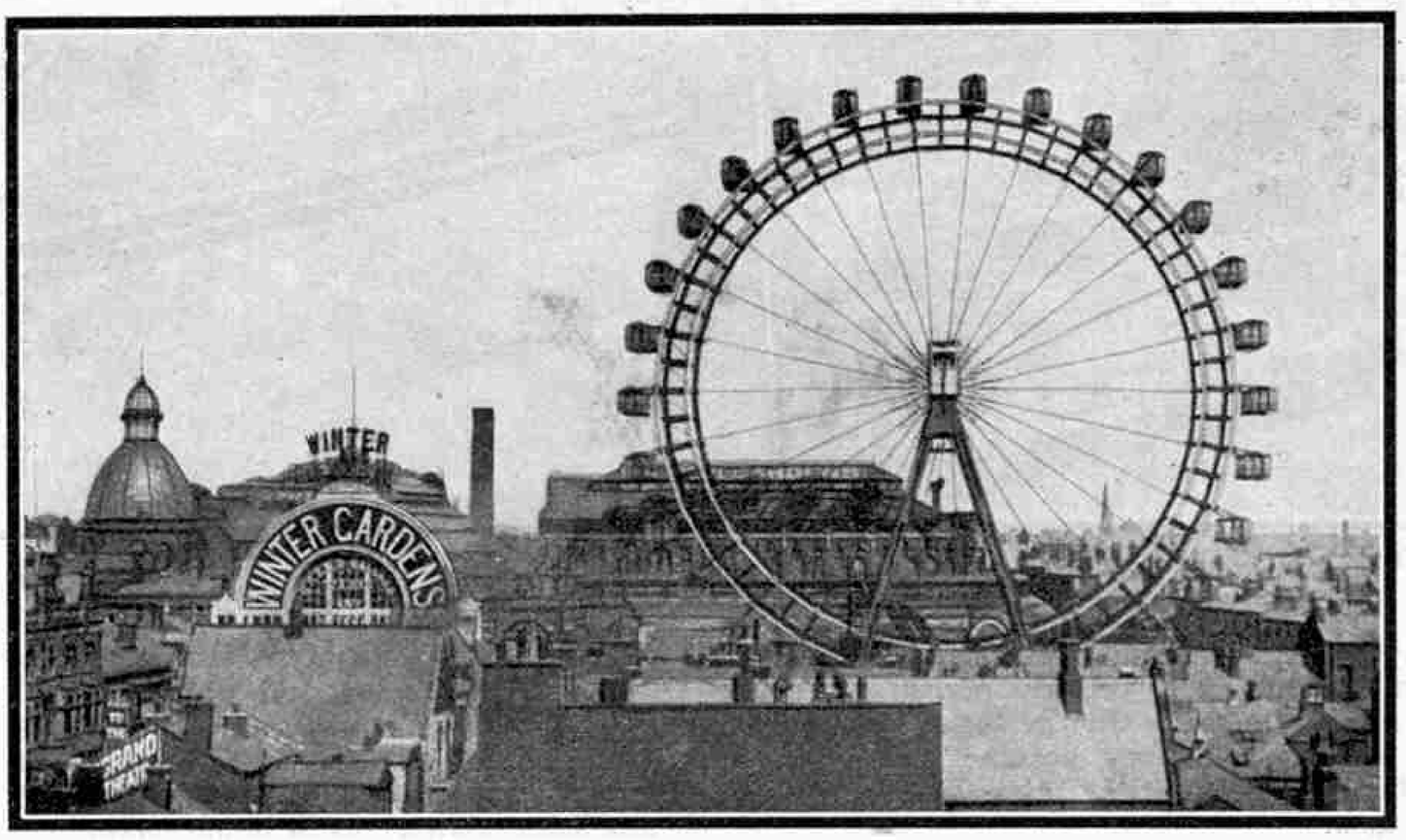
ENGINEERING NEWS

Major Segrave's Latest Car

Major H. O. D. Segrave's latest racing motor car, the "*Golden Arrow*," a description of which was published in our November 1928 issue, has now been completed and is already on its way to Daytona Beach, Florida, where Major Segrave hopes to regain for Britain the world's motor speed record, at present held by an American. The car has been constructed to develop a maximum speed of approximately 250 miles per hour, and if anything approaching this speed is actually reached the record will most certainly be ours, for it is at present held with a speed of only 207.55 miles per hour.

The "*Golden Arrow*" is fitted with two radiators in order to overcome the cooling problem always present in such high-powered cars, and they are placed one on each side of the machine, stretching from the front to the rear wheels. An entirely new method of still further cooling the water from the radiators has been incorporated in the system by the introduction of an ice-box behind the engine, through which the water is passed. Another interesting feature is the transmission system. The car has been built on similar lines to the body of the Supermarine Napier S5 Seaplane, and exactly fits Major Segrave, being actually made to measure! This makes his driving position an absolutely central one, and consequently the orthodox central transmission shaft cannot be used. The drive is therefore separately transmitted to the two rear wheels by means of two propeller shafts that are entirely independent of each other. It obviously would be impossible for a standard type differential to be fitted, and an adapted form of differential is arranged inside the specially modified gear-box. The clutch is power-operated in order to allow of greater delicacy of control than would be possible with a clutch operated only by foot-pressure.

At the high speeds possible to be attained by a car of this type, steering presents an extremely difficult problem, and an entirely new and ingenious steering scheme has been adopted for the "*Golden Arrow*." The car is equipped with sights similar to those on a rifle. These sights are observed through a telescope fitted on the car and brought into line with two huge bulls-eyes raised on scaffolding, one at the start and the other at the finish of the measured mile. This equipment has aroused a great deal of interest among racing motorists and the success or otherwise of its operation will be closely watched.



The Blackpool "Big Wheel" which, for many years, has been a familiar landmark to thousands of holiday-makers. After a long and useful career it has been condemned as unsafe and is now being dismantled

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Southampton Docks Extension Scheme

Good progress is being made with the Southern Railway's £13,000,000 Docks Extension Scheme at Southampton, a description of which was given in our October 1928 issue, and the reclamation of 18 acres of mudland near the Royal Pier was completed during the past year. A start has now been made on the reclamation of a further 170 acres of mudland, and the dredging of the remainder of the approach channel which will involve the removal of about 10,000,000 tons of spoil from the bed of the River Test.

The work to be carried out during 1929 will cost about £650,000 and includes the erection of a new Pier House, to give access to the Royal Pier on the one side, and to a new recreation ground, which the Corporation propose to lay out, on the other.

To cope with the various storm water drains that discharge along the existing foreshore, a new culvert 7 ft. in diameter is being constructed. Two more culverts of the same size are being constructed for the supply and discharge of sea water for condensing purposes at the Corporation Electricity Station, and for the supply of sea water to the Corporation swimming baths.

* * * *

Lifeboat Equipment on the New German Liners

The North German Lloyd liners "*Bremen*" and "*Europa*" which will be put into commission on the Bremen-New York service this year are equipped with the most modern life-saving apparatus available. Each of the ships will carry 22 motor lifeboats to accommodate 135 persons each, four smaller lifeboats each to accommodate 25 and two rowing boats with a capacity of 40 each. The liners will carry only 3,140 persons including passengers and crew so that the lifeboat accommodation for 3,150 appears to leave a margin of ten. In reality, however, each of the larger lifeboats could carry another ten passengers so that there is actually a safety margin of some 230 boat places.

* * * *

New 12,000-Ton Motor Vessel

A 12,000-ton twin-screw motor vessel is being constructed by Palmers' Shipbuilding & Iron Company Ltd., for the Blue Star Line, who intend it for their South American service. It will be 485 ft. in total length with a beam of 68 ft., and twin sets of 4,500 s.h.p. eight-cylinder Sulzer engines, developing maximum power at 115 r.p.m., will be installed.

It is stated that one of the main reasons for ordering the vessel is that the Blue Star Line wish to obtain full details as to the relative efficiency of different types of propelling machinery operating under identical conditions.

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First Electric River Dredger

The first electrically operated river dredger to be constructed has been put into commission by the Austrian State Danube Regulation Board on the River Danube. Three generators giving a total capacity of 126 k.w. are installed in the vessel and operated by Diesel engines. The chain of dredger buckets is operated by 14 motors.

The New Lambeth Bridge

A contract for the construction of the new bridge at Lambeth, the building of which has been discussed for about 20 years, has been placed with Dorman, Long & Co. Ltd., the engineers who were in charge of the Tyne Bridge. The general designs for the bridge have been prepared by the London County Council's chief engineer, but the entrances and obelisks have been planned by Sir Reginald Blomfield, R.A., and Mr. G. Topham Forrest, who is chief architect to the London County Council.

The construction of the bridge will provide a great number of men with employment for at least three years, during the whole of which period it will be necessary for a temporary foot-bridge to span the river at this point. It is also one of the terms of the contract that the demolition of the old three-span bridge and the construction of the new five-span bridge must be carried out in such a manner that no inconvenience shall be caused to river traffic.

The bridge will be 714 ft. in total length and 60 ft. in width, while the approach spans will each be approximately 125 ft. in length, the intermediate spans each 149 ft., and the central span 165 ft. The four supporting piers for the structure will rest on steel caissons that are to be sunk, by means of compressed air, to about 25 ft. below the river bed. Some 3,500 tons of steel are expected to be used in the work, and the estimated cost is £555,000.

* * * *

A Giant Electric Excavator

A huge excavator, operated by electricity, is now being constructed by Ruston and Hornsby Limited, for a brickworks near Bedford. When the excavator is completed it will be approximately 380 tons in total weight and will be capable of dealing with 200 tons of clay per hour. It is interesting to note that both the excavator and the brickworks are the largest things of their kind in the world, and that 200,000,000 bricks are made in the brickworks every year. We shall hope to give further details of this remarkable excavator in a future issue.

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The World's Telephones

According to the "*Telephone and Telegraph Journal*" there are 32,500,000 telephones in operation throughout the world, and the analysed statistics up to 31st December, 1927, show that the number of telephones per 100 inhabitants in the chief countries of the world is as follows:—U.S.A. 16, Canada 12.7, New Zealand 9.9, Denmark 9.2, Sweden 7.6, Australia 7.4, Norway 6.3, Switzerland 5.5, Germany 4.4, Great Britain 3.6, Netherlands 3.2, Finland 3.1, Austria 2.4, Belgium 2.4, France 2.1, Argentina 2.1.

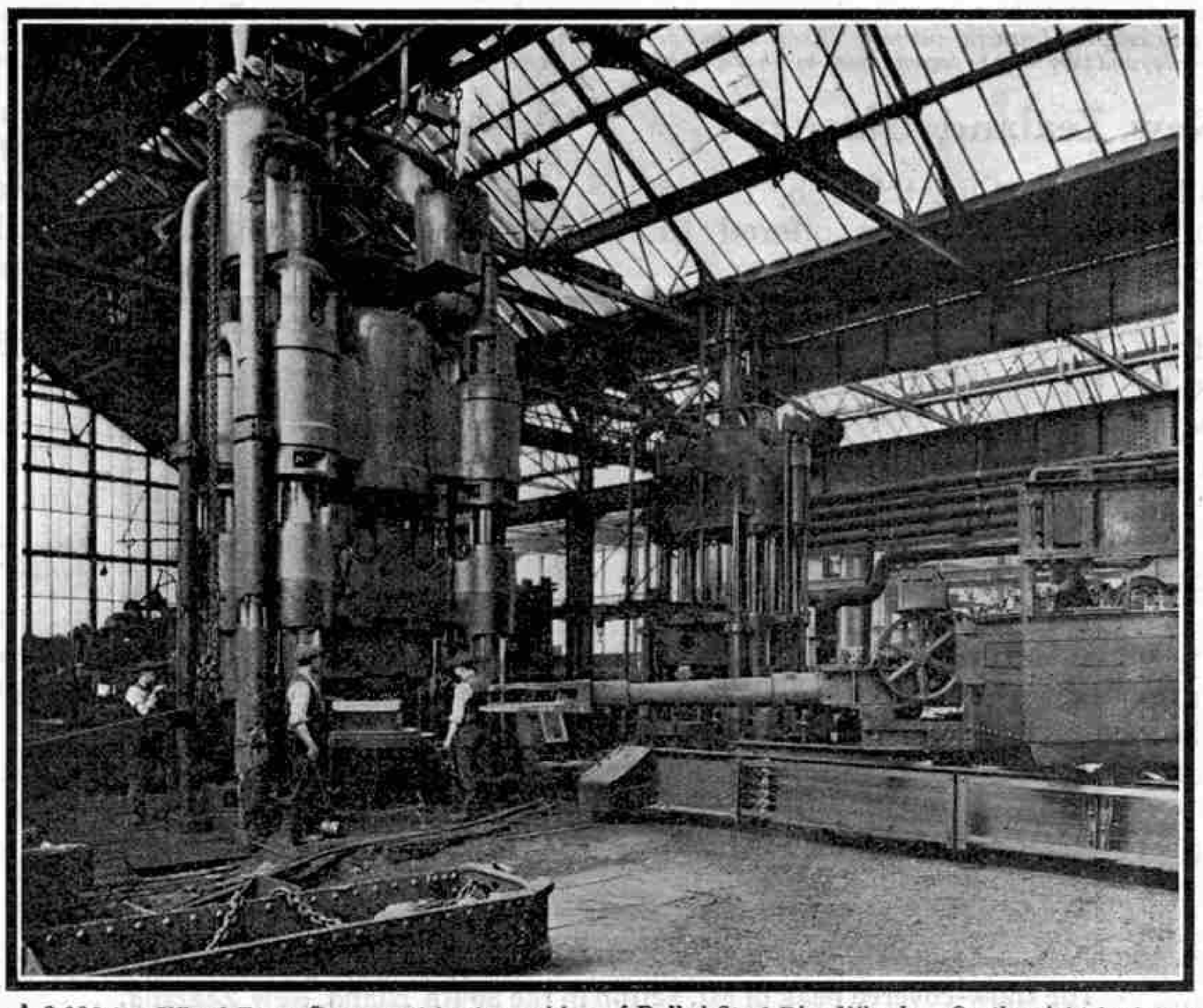
Passing of Blackpool Big Wheel

For many years Blackpool has enjoyed the distinction of two unique landmarks, the Tower and the Big Wheel. This year visitors will look in vain for the Big Wheel, however, for this great structure, having been condemned as unsafe, has had to be dismantled. It will be missed particularly by those who have enjoyed the experience of a slow and dignified circular journey in one of its carriages and have appreciated to the full the remarkable and ever-changing view that the trip afforded.

The building of the wheel was commenced early in 1896. In February of that year the first piece of ironwork was brought on to the ground, and construction proceeded so rapidly that in the following August the wheel was completed and thrown open to the public.

The total height of the wheel from the ground to the top of the uppermost girder was 220 ft., or about 260 ft. above sea level. Its weight, with cars attached, was nearly 1,000 tons. The superficial surface for painting purposes was 2,000 sq. yards, and it is an interesting and rather surprising fact that two coats of paint weighed about 2½ tons! The carriages, of which there were 30, each weighed 3 tons 3 cwts. Each one was capable of carrying 30 passengers, so that a total of 900 could be accommodated at one time. The wheel itself was built of steel girders bolted together, and the peripheries or rims were suspended from the axle by 120 wind ties and spokes of steel cable. The total length of the two cables used in hauling the wheel was 3,132 ft. or nearly threequarters of a mile. The axle weighed somewhere about 30 tons and its circumference was 6 ft. 10 in.

The work of dismantling the wheel has aroused a great deal of interest and large numbers of people have watched the proceedings. It is interesting to note that a medal has been specially struck as a souvenir of the old wheel, the metal for this being taken from parts of the structure.



A 2,000 ton Wheel Forge Press used in the making of Rolled Steel Disc Wheels. On the right is shown Mechanical Manipulator waiting to grasp the Forging after it has been Pressed and Transfer it to a Re-heating Furnace. (See article on "Rolled Steel Disc Railway Wheels" next month)

New Dock at Calcutta

The King George's Dock at the port of Calcutta, which is part of the large dock construction scheme that was commenced at the beginning of 1920, has been formally opened by the Viceroy of India. The project, which has cost over £7,000,000, provides an independent dock scheme slightly south of Calcutta itself, a basin situated at the northern end of the extensions, and two arms that are each approximately 4,500 ft. in total length, making a total water area of about 190 acres. The quay has a total length of approximately 25,000 ft., and provides berths for 35 vessels.

The entry lock through which access is obtained from the river to the basin measures 90 ft. in width and 700 ft. in length, while the depth of water maintained varies from a minimum of 22 ft. to a maximum of 56 ft. Ships may also pass from the river to the basin through two dry docks that are adjacent to the entrance lock.

Of the 35 berths available, 33 can be used either for the importation or exportation of cargo and are fully provided with up-to-date cargo-handling facilities and spacious warehouses. Vessels waiting for an empty berth, either to be unloaded or loaded, will be docked at one of the two remaining berths, until another one is available. In order to speed up the delivery of cargo, railway lines have been constructed alongside the docks, and merchandise can be transferred direct from the railway wagons into the steamers, or vice versa.

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The longest electric tramway system in the State of New York has been closed and is to be replaced by a service of motor omnibuses. The tramway system had over 120 miles of track, operated by over 100 cars and 500 men.

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Extensive Irrigation Scheme in Mexico

It is stated that an extensive scheme for the irrigation and development of the Tijuana Valley, which is situated in the Mexican district of Lower California, is soon to be commenced upon. The cost of the project is estimated at approximately £400,000 and according to contract terms the work must be completed before the winter of 1930.

The scheme includes the construction of a dam across the Rio de Tijuana in order to provide water for the irrigation of 2,500 hectares of land situated in the district of Zaragoza. Approximately 140,000,000 cubic metres of water will be impounded by the dam, which will supply drinking water for the Valley of Tijuana in addition to the water required for the irrigation purposes. As this district is troubled by earthquakes, the dam will be constructed of reinforced concrete, which is expected to stand very severe tremors.

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.

Two Days on New Zealand Glaciers

Along with my schoolfellows at Christchurch, I was greatly excited when an opportunity was offered to us of visiting Mt. Cook, the highest mountain in New Zealand. As the train steamed out of the station we rent the air with cheers. We travelled by train to Timaru, a distance of 112 miles, and completed the 244 mile journey by motor bus.

During the road journey we passed Lakes Tehapo and Puhahi, and until then I had no idea that water could be so blue! As we climbed to higher altitudes we felt the benefit of the cold invigorating air of the mountains, and by the time we reached the Hermitage, where we were to make our headquarters, we were ready to do justice to the excellent dinner awaiting us.

The snow-covered peak of Mt. Sefton in the South Island, New Zealand. The Hochstetter Ice Falls on the right of the photograph are two miles in width

The whole of the next two days were to be devoted to mountain climbing and to exploration of some of the many glaciers. At 9.30 next morning we set off to the Hooker Hut, a distance of 10 miles over very rough country. Having walked for about a mile we came to a suspension bridge that crossed a chasm 500 ft. in depth, at the bottom of which raged a mountain torrent. From here we obtained an excellent view of the terminal moraine of the Mueller glacier. The Hooker glacier was seen next. This glacier is so covered with stones and rocks that it is impossible to see much ice.

Having reached the hut we had lunch, consisting of tea, bread and butter and ox tongue. After lunch we explored the glacier and all the time we were on it we could hear water running underneath. To the north the three peaks of Mt. Cook, the highest of which is 12,349 ft. in height, could be seen glistening in the sun. About three o'clock we made our way back toward the Hermitage, where we dined that evening on roast duck.

It was raining next morning so we stayed at the Hermitage and passed the time by holding a ping-pong tournament. In the afternoon the weather cleared and we went for a short walk to the Baby Glacier. This walk was more interesting than the previous one as we passed numerous waterfalls surrounded by native shrubs. We also had the good fortune to see an avalanche.

That night we had great fun. What with hauling off the mattresses of other boys' beds, tying their pyjamas in knots, making them eat soap, and last of all making them sing, the evening was quickly passed. Next morning at 8 o'clock we started for home.

J. M. STEEDS
(Christchurch, N.Z.).

Ready for a tramp above the snow line of the Southern Alps in New Zealand. Capes are worn because it is always raining on the glaciers!

A Flight Over Niagara Falls

I was fortunate enough recently to find employment at the Niagara Falls airport. This is one of the links in Canada's growing airway system, and from it an aeroplane takes passengers on pleasure flights over the Falls themselves. I had worked there only two weeks when I was asked if I would like to make this trip. Naturally I jumped at the chance, and eagerly climbed aboard.

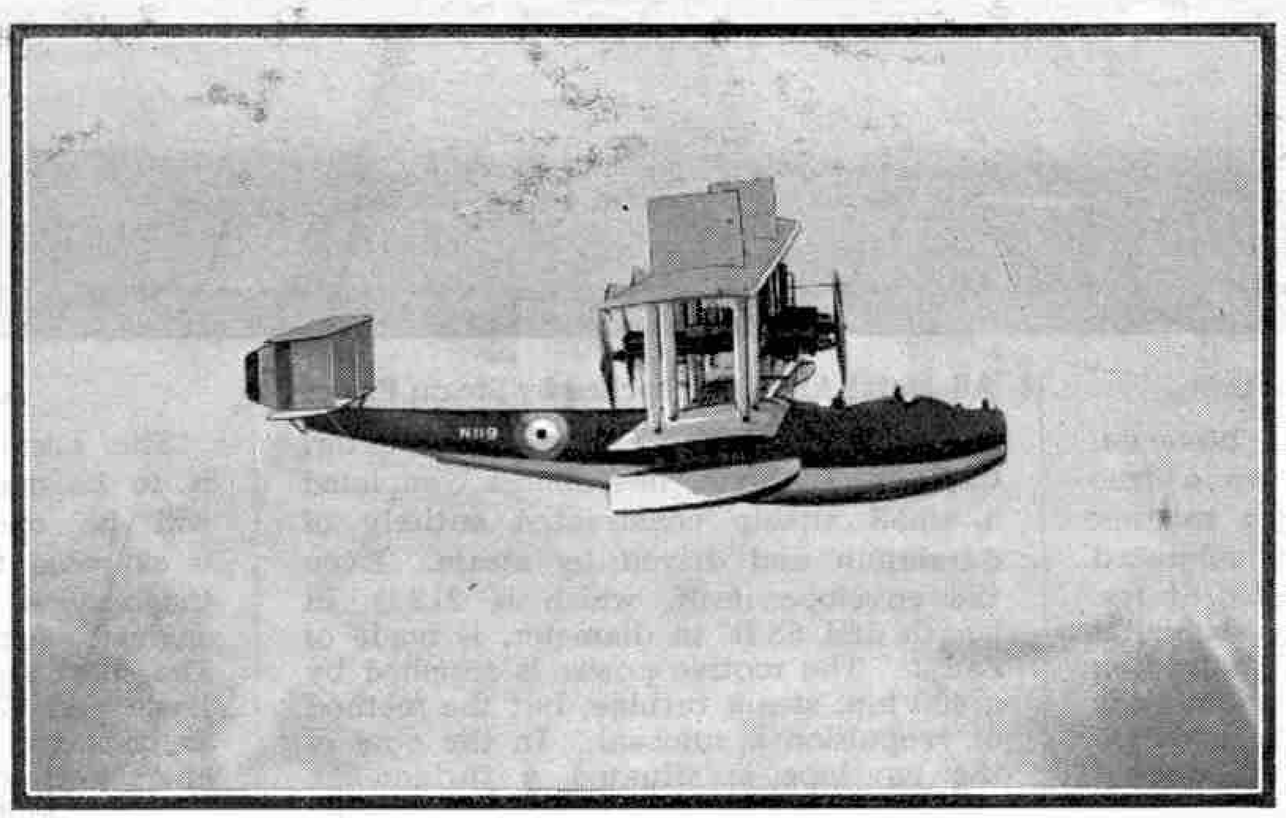
While waiting in one of the 14 comfortable seats for other passengers to appear, I began to have a sinking feeling and wondered if I should return to earth safely, or come to an unpleasant end in the river! My misgivings vanished, however, as the cabin filled with pleasure-seekers.

The aeroplane was a huge Ford-Stout monoplane that had three Wright "Whirlwind" engines, which started with remarkable ease. The throttle was opened quickly, there was a tremendous roar, and the clouds of dust blown from the ground shut out my view of the aerodrome. When the dust cleared I found that we were moving at a good pace. The throttle was opened further and the aeroplane left the ground.

This was my first flight and my sensations as I rose in the air were pleasantly thrilling; but I soon forgot

everything except the wonderful view below. We mounted rapidly above the Falls, but could not hear their thunder above the roar of the engines. It was a beautifully clear day, and every detail of both the Canadian and the American Falls was plainly visible. After crossing the Falls themselves the aeroplane was headed downstream and circled over the boiling waters of the famous Whirlpool. For the return journey we mounted to a height of 3,000 ft. and obtained a wonderful panoramic view of the Falls and the surrounding country.

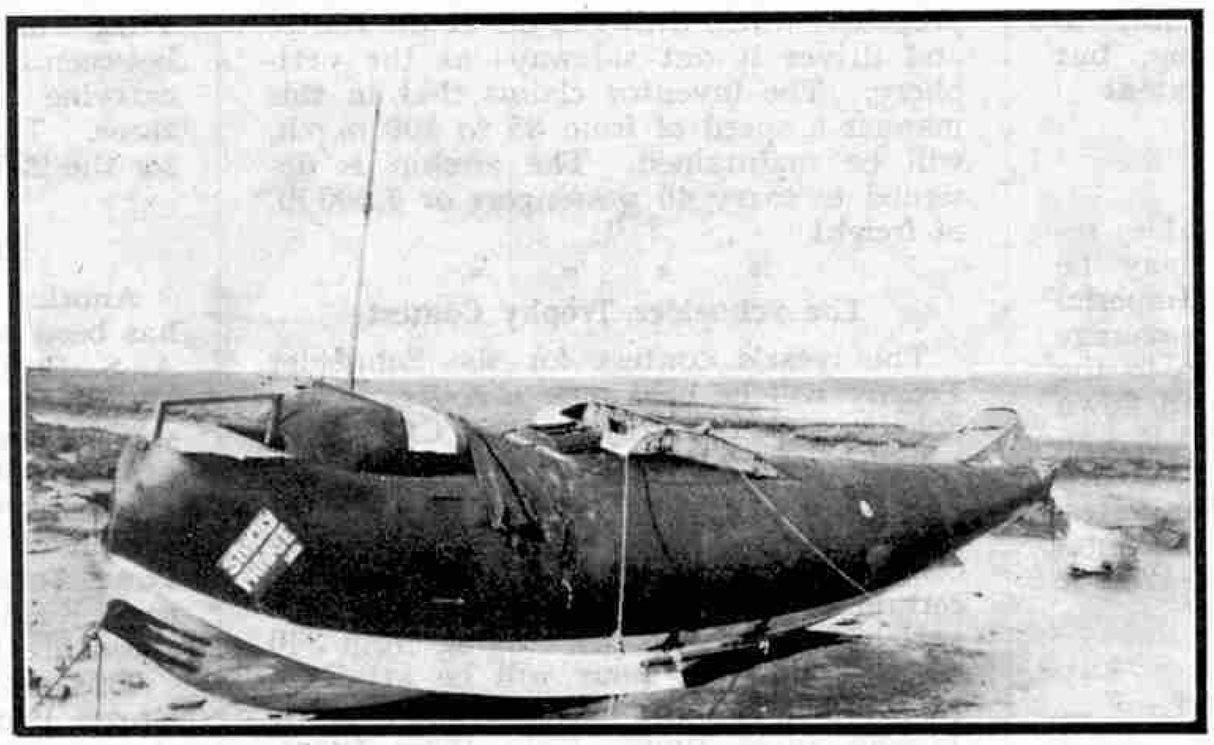
Nearing the airport we descended slowly and turned round to face the wind. The engines were throttled down to gliding pace and we lost way. The ground reached out for us; then we heard the rumble of the wheels and finally we came to a stop. The engines were then opened up once more and we taxied back to our starting point, thus ending a very interesting and enjoyable flight. J. B. NELSON (Niagara Falls).



At the height of its glory—the Fairey "*Atalanta*" Flying Boat in flight

The End of a Giant Flying Boat

I was interested in the article on the Rolls-Royce "Condor III" aero engine that appeared on page 798 of the "*M.M.*" for October last, and particularly in the Fairey "*Atalanta*" flying boat shown in one of the illustrations. This boat is no longer in active service, and possibly my fellow readers may be surprised to learn that for the past year its fuselage has been lying on the mud at Felixstowe Ferry! The accompanying photograph shows the present derelict condition of this famous machine, which only a short time ago had the proud distinction of being one of the two most powerful flying boats in the world.



How are the mighty fallen! The fuselage of the Fairey "*Atalanta*" now lying in the mud at Felixstowe. Our photograph was taken by a reader, Edgar Bell

The "*Atalanta*" is not the only relic to be seen in the neighbourhood. In a backwater of the river the visitor may see many seaplane fuselages that are now used as house-boats. These novel residences are devoid of wings, engines and floats. They are simply moored on the edge of the stream, and at low tide they rest on the mud.

The flying boats of which they once formed part were made at the seaplane works in Felixstowe, where aircraft of this type are now being built on a larger scale than ever. The neighbourhood is full of interest, since seaplanes of all kinds are to be seen every day, either cruising about on the water or making trial flights. A few miles from Felixstowe is Martlesham Heath aerodrome, and it is most interesting to drive through it and to see the various machines. These include several huge three-engined monoplanes that are too big for the existing accommodation. Larger buildings are in course of erection here, and aiso at Felixstowe, where longer slipways are being built to enable the seaplanes to be launched into the water for testing purposes.

FRANK GREEN (Bradford).

A Trip on a Light Railway

While I was staying in Barnstaple I decided to make a trip over a portion of the Barnstaple and Lynton Light Railway. This interesting line is 18 miles in length, has a gauge of 1 ft. 11 in. only, and is single throughout except at stations.

As I entered the station I noticed that the platform was only a few inches above the ground level. Presently the train backed in. First came three passenger coaches, each of which was divided into six compartments that were only just large enough to seat four aside. Then followed a goods van, and finally a 2–6–2 tank locomotive, the driving wheels of which were very little more than 1 ft. in diameter. Everything was on a miniature scale, and was in striking contrast to the scene at a London terminus when one of the famous expresses is about to start.

Punctually at 10.15 we set off. At first the track ran between the factories and houses of Barnstaple, and a notice on the side of the line restricted speed to eight miles per hour. On leaving the town the track seemed to pass through a kitchen garden, after which it followed the course of the River Yeo for some distance. I got out on reaching the second station and discovered that I had to wait more than an hour for a train to take me back. Progress on the return journey was painfully slow and at times it seemed quite possible to lean out of the window and pick flowers while the train was in motion! At last I arrived at Barnstaple once more, and left the station feeling well satisfied with my experience on this slow but interesting trip. E. F. HOPE-JONES (Eton College).

A Device to Assist Pilots

A wireless device that has been designed to enable pilots to keep a true course when flying during foggy weather or above the clouds has been subjected to a number of tests in the United States. The instrument has for its fundamental components two white-tipped vibrating reeds that are connected with a pair of electro-magnets, the whole arrangement being installed inside a shock-proof case. The magnets are substituted for the earphones on the standard wireless equipment of the aeroplane, and when radio signals come through, the reeds are caused to vibrate and in consequence to make pairs of vertical lines on a sheet of paper. So long as the pilot is proceeding on his true course the two lines remain identical in length. As soon as he is off his course, however, one line becomes longer than the other, and thus enables the pilot not only to ascertain that he is going wrong, but in which direction and to what extent.

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A Splendid Record

A good idea of the remarkable reliability of modern aeroplanes may be obtained from the records of three Imperial Airways Argosy liners. During an average period of service of two years, up to the end of 1928, the liner G-EBLO had flown 1,843 hours 37 minutes; G-EBLF had 1,585 hours 15 minutes to her credit, while G-EBOZ flew 1,433 hours 15 minutes. The total distances flown by these machines is 165,925 miles, 142,672 miles and 128,942 miles, respectively.

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Another Cheap Single-Seater

Among the more interesting recent aeroplane designs is one for an all-metal single-seater to cost from about £250 to £300, or possibly less if mass production methods can be employed. The machine, which is named the "Beetle," is fitted with a Bristol "Cherub III" engine developing 33-36 h.p. and it is stated that the remarkably low petrol consumption of 0.58 pint per b.h.p. hour has been achieved. The machine has a maximum speed of 96 m.p.h. and lands at 40 m.p.h. If it were fitted with automatic slots its landing speed would be considerably lower. Eight gallons of petrol can be carried in the tanks, giving a cruising range of over 300 miles.

All-Metal Airship Propelled by Steam Power

It is stated that a Californian inventor, Capt. T. B. Slate, has almost completed a small airship constructed entirely of duralumin and driven by steam. Even the envelope itself, which is 212 ft. in length and 58 ft. in diameter, is made of metal. The motive power is supplied by a 400 h.p. steam turbine, but the method of propulsion is unusual. In the nose of the envelope is situated a turbine-like propeller, which draws in air at the centre and drives it out sideways at the periphery. The inventor claims that in this manner a speed of from 85 to 100 m.p.h. will be maintained. The airship is designed to carry 40 passengers or 7,000 lb. of freight.

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The Schneider Trophy Contest

This year's contest for the Schneider Trophy will be held over a course in the Solent, and the Royal Aero Club have received entries from Italy, France and the United States, in addition to Great Britain, the holder of the Trophy. The contest between the four countries is certain to be exceedingly keen, and it is anticipated that speeds ranging from 340 to 360 miles per hour will be attained. In previous contests England has won the Trophy three times, Italy three times, the United States twice and France once.

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A company operating under the name of Airwork Limited has acquired a large area of land about eight miles from the centre of London, along the Great West Road, for use as an aerodrome. The aerodrome is intended primarily for the convenience of private owners, but the company will also be prepared to carry out any work in connection with aviation. The aerodrome will most probably be opened for service next month, and will be of great convenience for trial flights during the next Aero Show, which is to be held at Olympia in July.

THIS MONTH'S AIR STORY

Two pilots were exchanging yarns. At first they did not depart seriously from the truth, but as time went on the tales became gradually "taller," each pilot trying to outdo the other.

"Yes," said one. "I quite agree that you have had some interesting experiences, but do you know that after my last altitude record-breaking flight the propeller was found to be dripping with whipped cream!"

"Good gracious, man, what on earth do you mean?" exclaimed the other.

"Well, you see, it's like this. On the way down I passed through a part of the Milky Way!"

Air Service to India

The London-India air service, which is to be operated by Imperial Airways, will be opened shortly. The journey is expected to occupy only six days and the service will be operated by triple-engined Armstrong-Siddeley air liners. The short section of the journey between Basle and Genoa will be made by train as it is not considered desirable for the liners to fly over the Alps, and passengers and luggage will be transported over the Mediterranean between Genoa and Cairo in Short "Jupiter" flying boats. From Cairo a day's flight across the desert will be made to Basra, and the flight down the Persian Gulf to Karachi will take up the remaining two days.

* * * *

Paris to Croydon in 100 Minutes

A record was set up by one of the Imperial Airways "Silver Wing" air liners when it made the journey between Paris and Croydon in 100 minutes, carrying 17 passengers and a crew of three. This works out at an average speed for the 225 miles of 135 m.p.h.

* * * *

The Gipsy-Moth Again!

Another world's light aeroplane record has been set up on a Gipsy-Moth, by Mr. A. S. Butler, who is Chairman of the de Havilland Aircraft Company. The record was for two-seater light aeroplanes flying over a 100 km. closed circuit, and the pilot, carrying Mrs. Butler as passenger, completed the 62-mile course from Stag Lane Aerodrome, Edgware, to Twyford, near Reading, and back, at an average speed of 119.84 miles an hour.

This record makes the seventh held by Great Britain. Four of the remaining six were obtained by Captain Broad, who has broken three speed records on the de Havilland "Hound," and also the speed record for single-seater light aeroplanes over 100 km., in a de Havilland "Tiger-Moth." Captain de Havilland is the holder of the two-seater light aeroplane altitude record

* * * *

The unexplored stretch of country, known as Barren Lands, between Hudson Bay and the Mackenzie River Basin has been crossed for the first time. The crossing was made by three Canadian aviators during a flight of over 3,960 miles, which was accomplished in 40 hours' flying time. The distance across Barren Lands is 300 miles.

Big Scheme to Develop Civil Aviation

An important scheme, the object of which is to develop and popularise civil aviation, has been launched by a group of air experts headed by Squadron-Leader F. E. Guest, P.C., C.B.E., D.S.O., M.P., who was Secretary for Air in 1921-22, and who now commands No. 600 (City of London) (Bombing) Squadron. A new organisation under the name of National Flying Services Ltd. has been formed and has already acquired an estate of 230 acres at Feltham, near London, to serve as its headquarters. On this estate will be provided two aerodromes, one for private and the other for commercial flying.

The most important part of the scheme will be the establishment of 22 principal aerodromes and 100 landing grounds scattered up and down the country. The main aerodromes will be equipped with modern offices, hangars, stores, workshops and lock-up garages for private cars. The landing grounds, however, will only be provided with such necessities as supplies of petrol, and telephone and field facilities. The construction of these aerodromes and landing grounds will tend to reduce greatly the number of accidents due to forced landings caused by mechanical failure or exhaustion of fuel supplies.

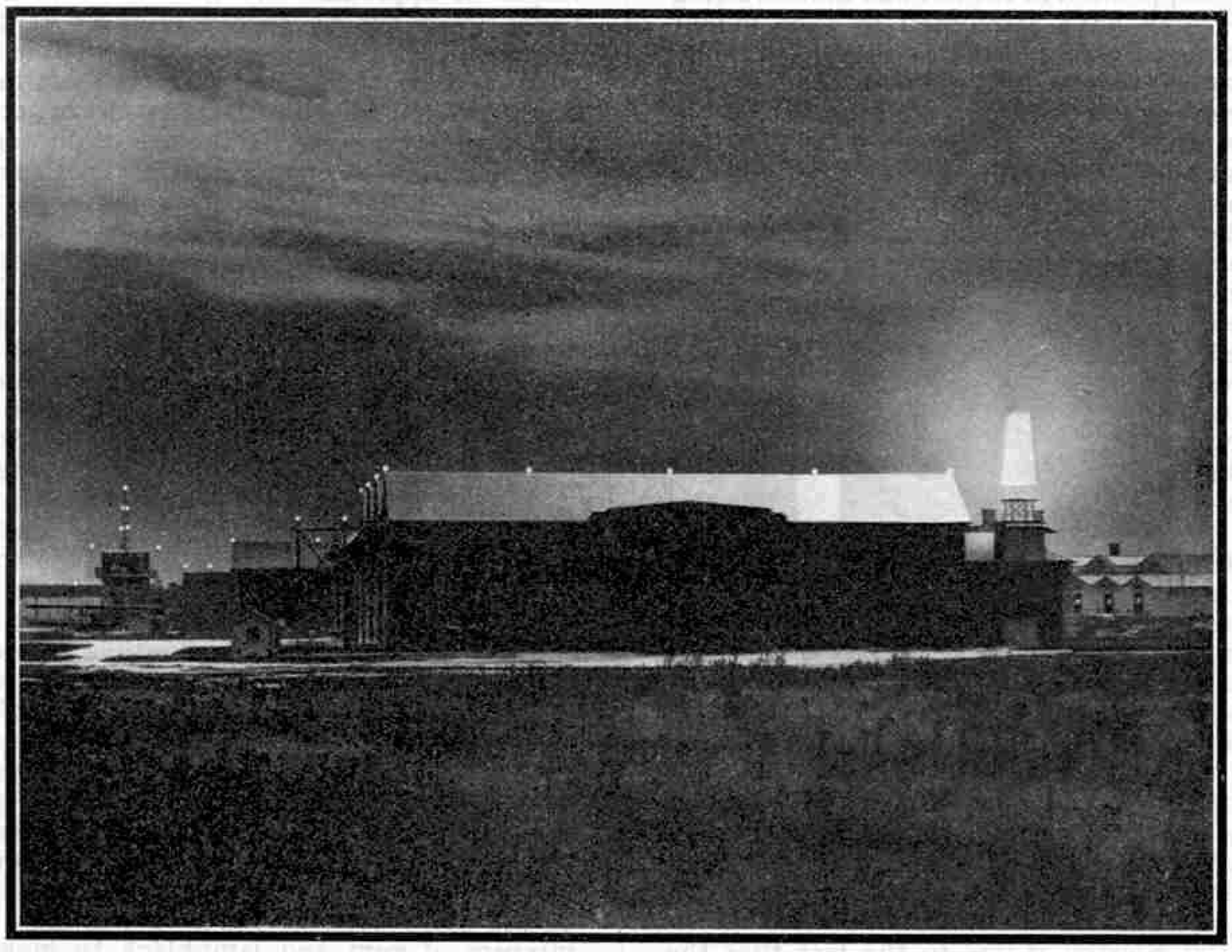
At each of the main aerodromes instructional work will be carried on and it is proposed to provide aeroplanes for private persons for business purposes or pleasure trips. Only ex-R.A.F. officers will be employed as pilots or instructors and, according to Squadron-Leader Guest: "National Flying Services will go a long way towards solving the problem of the short service officers, 150 of whom now leave the Royal Air Force every year with little prospect of obtaining employment."

The scheme has the approval and co-operation of the Air Ministry, of whom financial assistance has been asked during the early stages of the scheme, on the basis of payment by results.

* * * *

It is announced by the French Air Union that they intend to inaugurate a night service between London and Paris this year. As the route between these places is not lighted, it is very improbable that a similar service will be opened by Imperial Airways.

Croydon by Night



This remarkable photograph, showing the famous aerodrome at night, is published by courtesy of Imperial Airways Ltd. The beacon on the right is a neon gas beacon, which flashes intermittently, the light being of several seconds duration. This red glow can be seen for several miles and the rays are extremely penetrative in foggy and misty weather

New American Airships

Two large rigid-type airships, each employing 6,500,000 cu. ft. of non-inflammable helium gas, are being constructed by the Goodyear-Zeppelin Corporation, under contract for the United States Navy. These airships are considerably larger than the "*Graf Zeppelin*," and larger even than the British R100 and R101, which have a displacement of 5,000,000 cu. ft. An interesting feature of the new ships will be a hangar to house five aeroplanes inside the airships.

The total length of the new airships, which will be called Z.R.S.-4 and Z.R.S.-5 respectively, will be 785 ft., the maximum diameter 132.9 ft., and the overall height 146.5 ft. They will possess a gross lift of 403,000 lb. and be capable of carrying a useful load of 182,000 lb. Eight engines will be fitted, developing a total horse-power of 4,480, and a maximum speed of 72.8 knots. The ships will be able to cruise at 50 knots for a distance of 9,180 nautical miles before having to refuel. The first one is expected to be ready for service about June of next year.

* * * *

Aeroplane Reprisals

When Bedouin highway-robbers attacked a party of Government survey officials in Egypt, retribution, in the shape of Royal Air Force machines, was quick to arrive, and for a week the Bedouins were prevented from obtaining fresh supplies of food. In addition to this, the R.A.F. kept the Camel Corps men well informed of the robbers' movements, enabling them to intercept every attempt at escape.

An Interesting Single-Seater Monoplane

An interesting little single-seater monoplane is now being produced regularly by an American aircraft constructing firm of Niles, Michigan. The machine is known as the "Williams" monoplane, and in general appearance it does not present any outstanding departure from orthodox low-wing monoplane constructional practice, except that the tail skid is replaced by a small brake-fitted wheel which is attached to the bottom of the rudder.

During the preliminary trials of this monoplane a take-off in 50 ft. was recorded and the machine was found to climb at the rate of 1,000 ft. per minute, although only rated at 925 ft. per minute. It possesses a span of 26 ft. and an overall height of 6 ft. 6 in. The area of the wing is 108 sq. ft., and the tare weight 440 lb., while a useful load of 90 lb. may be carried. The landing speed of the machine is only 30 m.p.h., and its maximum speed is 85 m.p.h. Enough fuel may be carried to give a cruising range of 360 miles, and the maximum ceiling is 19,000 ft.

* * *

It is rumoured that a young German lady, while inspecting an Imperial Airways air liner at Croydon, asked her guide for the correct pronunciation of the name of the aeroplane, "G-EBMT"!

* * * *

Six Days in the Air!

A world's endurance record, both for aeroplanes and airships, has been set up at Los Angeles by an American Army monoplane, named "*Question Mark*," which remained in the air for a period of 150 hours 40 minutes, eventually being forced to land owing to engine trouble. While the monoplane was making its record-breaking flight it was fuelled at regular intervals from an Army light aeroplane by means of a long hose through which petrol was poured at a rate of 75 gallons per minute. Over 3,500 gallons were transferred in this manner. In addition to this quantity of fuel, food, newspapers, letters, and a new window were also delivered to the aviators!

Twice during the course of the flight it was thought that a landing would have to be made, once owing to fog, and once as bad weather prevented refuelling for a considerable time.

Photographing by Invisible Rays

How Plates and Films are Cured of Colour-Blindness

MOST "*M.M.*" readers who are interested in photography have had the experience of photographing a landscape the beauty of which consisted in its great variety of colour, and of being surprised and disappointed at the flat and uninteresting result. Some readers also may have attempted to take indoor photographs of brightly coloured objects such as vases, etc., only to obtain a similarly disappointing result. The reason for this is that light rays of different colours produce very different effects on the chemicals in the sensitive emulsion, and that the ordinary plate or film is more or less blind to certain of these rays while at the same time it is abnormally sensitive to others.

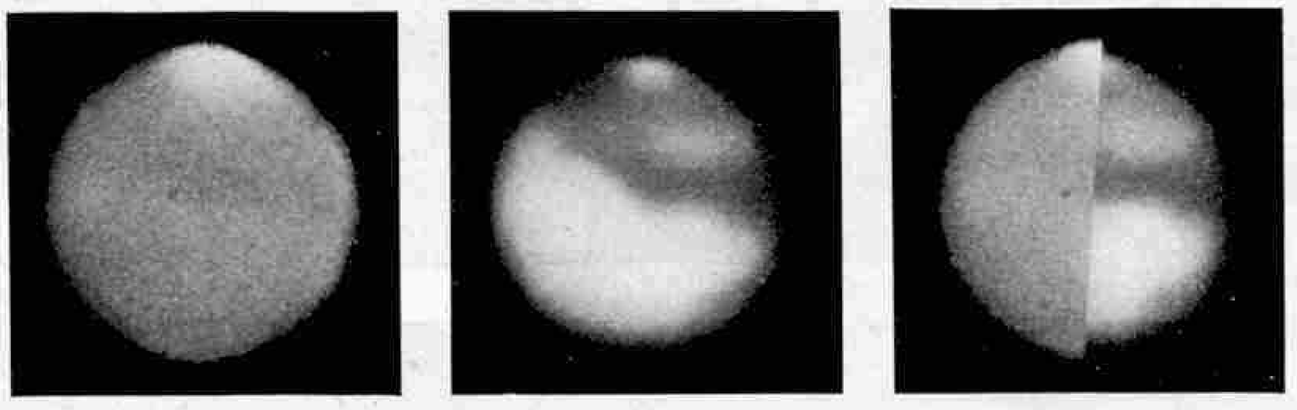
Photographs are usually taken in direct or indirect sunlight and a little consideration of the complex nature of the light emitted by the Sun will show the importance of taking the effect of colour into account in endeavouring to obtain faithful photographic renderings.

Most "*M.M.*" readers will know that white light is produced by the mixture of the colours of the rainbow. Newton first showed that this was the case. He passed a narrow beam of sunlight from a slit in a shutter through a prism-shaped piece of glass with one side parallel to the slit and found that the bending of the light as it passed through the prism was accompanied by a broadening into a colour band. Seven colours were easily recognised; these were red, orange, yellow, green, blue, indigo and violet.

The widening observed by Newton is due to the fact that the angle of bending of a ray of light is dependent on its colour. A ray of blue light is bent or refracted, more than a ray of green light, green light more than yellow and so on. The same colours are visible in the same order in the rainbow, where they are formed by a similar bending during the passage of light rays through minute drops of water. Newton, it may be noted, proved that this was the explanation of the band of colour by placing a second prism of the same size and shape in the path of the colour beam. This second prism when placed the opposite way to the first caused the rays to bend in the reverse direction, with the result that white light was produced once more by recomposition.

The band of colour into which a beam of light from a narrow slit is spread is called a spectrum. The order in which the colours occur in the spectrum is also the order of their wave lengths. Thus the waves in the ether constituting red light are longer than those of yellow light and as we proceed along the spectrum the wave length decreases, until the violet rays of very short wave length are reached.

Returning once more to the photographic problem, it has been found that the portion of the visible spectrum that has the greatest effect on a photographic plate is in the blue region. Light of longer wave length is progressively less effective until we reach a wave length of approximately 5,200 on the usual scale, in which the unit of length is one ten-millionth of a millimetre. This is in the green region of the spectrum and light of longer wave length has practically no action on photographic materials. Thus the eye appears to be a better instrument for seeing the yellow, orange and red portions of the spectrum than the camera. These rays are useless in ordinary photography.



Photographs courtesy] [*Professor Wright*

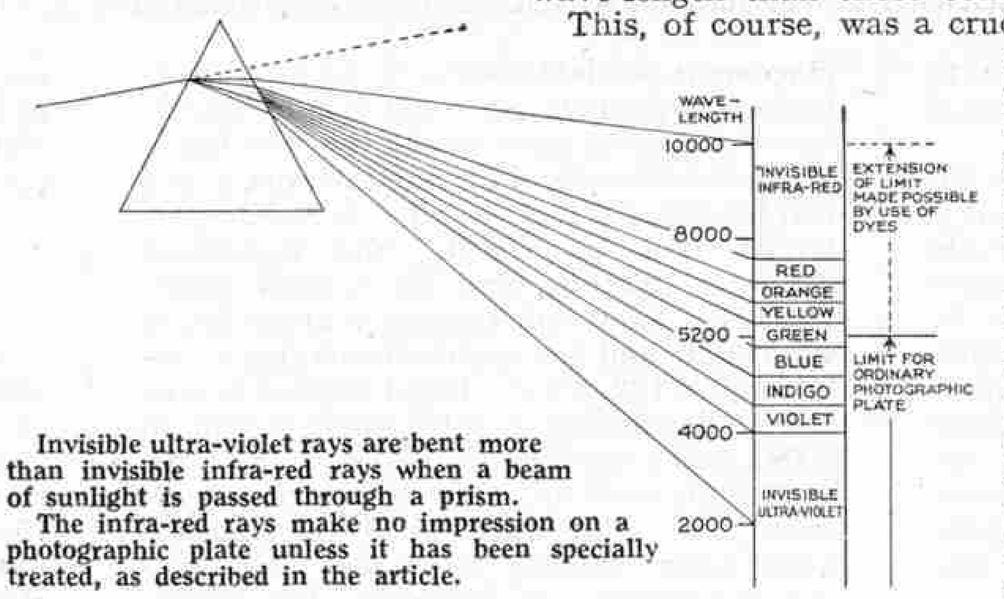
Comparative photographs of Mars taken with (left) an ordinary plate and (centre) extreme red sensitive plate with filter.

On the right is a composite of the two other photographs. By cutting each of these in half and pasting the two halves together, it will be seen that the photograph taken with an ordinary plate appears to be larger than the photograph taken with the red sensitive plate, which shows the actual diameter of the planet.

Proceeding towards the blue end of the spectrum, that is in the direction of decreasing wave lengths, it is found that the intensity of the action on a photographic plate increases, until a wave length of approximately 4,500 is reached. The most remarkable thing about the photographic effect at this end of the spectrum is that it continues beyond the visible limits. In other words when a beam of sunlight is spread out into a spectrum by means of a prism the rays that bend most are actually invisible to the eye, but may be detected by the use of photographic methods. These are, of course, the famous ultra-violet rays now so largely used by doctors. Reference has been made in the "*M.M.*" on several occasions to the beneficial action of these rays.

The discovery of the existence of invisible rays of longer wave length beyond the red was made by Sir William Herschel in 1800. He attempted to measure the heating power of the different colours by holding a delicate thermometer at various points in the paths of the rays, and found that the temperature indicated by the thermometer rose even outside the red end of the spectrum, thus suggesting the existence of rays that were not bent or refracted so much in passing through a prism. The method that finally proved their existence also made use of the fact that the infra-red rays, as they came to be called, are heat-producing rays, and was used by Sir John Herschel, the son of the discoverer, in 1840. He coated a sheet of paper with a mixture of gum and lampblack to make it absorb heat readily and wetted it with alcohol. He then focussed the rays of the spectrum on it, taking care that a portion of the wetted paper projected on either side of the visible portion. The paper dried most quickly in several patches outside the red of the visible spectrum, thus proving the existence of radiations of greater wave length than those constituting red light.

This, of course, was a crude method. Other ways of mapping out the infra-red spectrum were developed later, some of which were very accurate indeed, but none of them was so convenient as the photographic method used for the violet end of the spectrum.



Invisible ultra-violet rays are bent more than invisible infra-red rays when a beam of sunlight is passed through a prism.

The infra-red rays make no impression on a photographic plate unless it has been specially treated, as described in the article.

The trouble was in the emulsion used on plates. This contains small particles of a compound of silver with the unpleasant red liquid, bromine, suspended in gelatine. Light acts on the silver bromide in this emulsion, changing a proportion with the formation of metallic silver. This is produced in the form of small black particles and the proportion of silver liberated on any portion of the photographic plate depends upon the intensity of the light falling upon it. It also depends, however, as we have seen, on the colour of the light acting upon the plate.

Various attempts were made to produce silver bromide emulsions that would be sensitive to green and red light and to infra-red light also. The discovery that led to the methods now used for photography in the infra-red regions was made accidentally by a scientific photographer named H. M. Vogel in 1873. He added a small proportion of yellow dye to the emulsion on a batch of plates with the idea that halation would be diminished. Amateur photographers will be familiar with halation effects, which are produced when taking photographs of brilliantly lighted objects. They often appear, for instance, round the image of a well-lighted

window when a photograph is taken with the camera pointing directly towards it from the interior of a room. The effect is mainly due to reflection from the glass plate of light rays that have passed through the emulsion itself.

Using plates prepared in this way Vogel noticed that their sensitiveness to light was quite different from that of ordinary plates. This accidental discovery was followed up by using other dyes admixed with the emulsion and finally it was established that the addition of a dye made silver bromide more sensitive to the light absorbed by the particular dye used.

Astonishing results have followed on the use of various dyes. There is a dye named pinachrome, for instance, that absorbs green light and makes a silver bromide emulsion containing a small proportion of it sensitive to green light. For ordinary photographic purposes the results of work of this description may be seen today in the use of what are known as panchromatic plates. As the emulsion of ordinary plates is sensitive to blue light but practically unaltered by green or red light it is necessary to add sensitisers for the two latter in order to produce a plate that is equally sensitive throughout the whole colour range. This is effected by using a dye known as pinacyanol in conjunction with pinachrome. The former sensitises the emulsion for red and infra-red light, while the pinachrome sensitises it for green. A plate prepared in this way is said to be panchromatic and an examination of two photographs of the same coloured object, one taken with an ordinary plate and the other taken with a panchromatic plate, will immediately show the vast superiority of the latter in the rendering of colour tones.

The above photograph of three Hornby wagons was taken on an ordinary plate and clearly shows its colour-blindness. The bright red "Shell" tank wagon has photographed as though it were black and the blue of the side tipping wagon and the "Seccotine" wagon appears white

Although the panchromatic plate is so much more colour-sensitive than the ordinary plate, it will not by itself give a reproduction that corresponds exactly to the impression received by the eye. It is still too sensitive to certain rays, and in order to obtain full colour correction these rays must be toned down. This is done by fitting a light filter in the camera in such a position that the light passes through it before reaching the plate. The exact colour of this filter varies with different plates and perfect results can only be obtained by having plate and filter accurately adjusted.

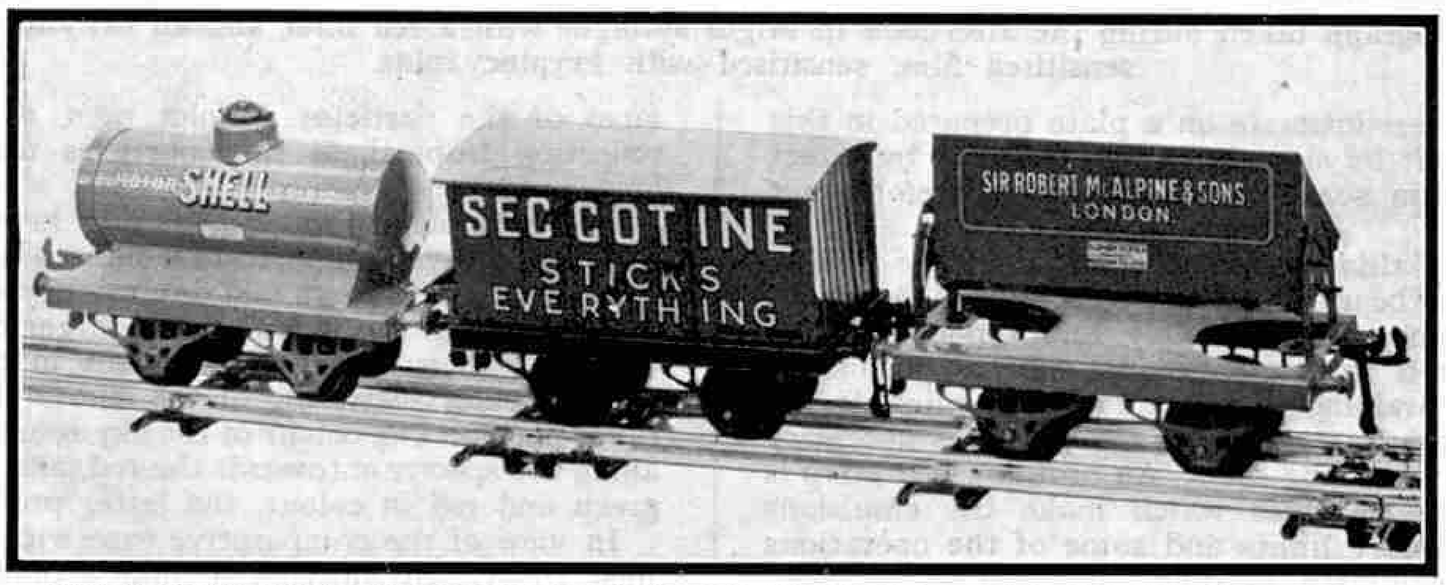
Although full colour correction is the ideal for most purposes, it is sometimes desired to deliberately distort colour proportions in order to accentuate a pattern or design. This is the case in the photography of furniture, brightly coloured carpets, oil paintings, etc. Special screens are prepared for this kind of work to produce the exact amount of over-correction that is found most suitable.

The different effects produced on the two kinds of plates are splendidly shown by the accompanying photographs of Hornby wagons. These were taken under identical conditions. The three wagons were undisturbed after the ordinary photograph was taken and the panchromatic photograph was taken immediately. The "Shell" petrol tank is brilliant red in colour, while the side tipping wagon is blue. On the ordinary photograph the blue of the latter has had a very great effect, with the result that it has photographed very light in tone. On the other hand the red "Shell" tank has an unpleasant black appearance, because the emulsion is practically unaffected by it. Turning now to the photograph taken on the panchromatic plate, it will be seen that the petrol wagon has a far brighter appearance and now has its proper tone value in comparison with the side tipping wagon.

The superiority of a panchromatic plate is also shown in many other ways, especially in the rendering of detail. The black lining of the word "Shell" on the tank, for instance, is indistinguishable from the red background in the ordinary photograph, but is clearly visible in the print from the panchromatic plate. Another interesting comparison may be made between the respective renderings of the lettering and border on the side tipping wagon. On the ordinary photograph the gilt lettering does not show up well against the bright blue background, because the light from the latter has had a much greater effect on the plate. The red border has not affected the plate at all, with the result that it appears to be quite black. On the panchromatic print both lettering and border are much brighter in appearance than the background, thus giving a far more faithful rendering of the actual appearance of the wagon.

The Seccotine wagon is a specially interesting example. To the eye the yellow roof of the wagon has a lighter appearance than the blue sides, and the black relief to the white letters is not unduly prominent. This appearance is faithfully reproduced when a panchromatic plate is used, but on the photograph taken with an ordinary plate the sides appear to be far lighter in tone than the roof, and indeed almost as light as the white letters themselves, while the lettering appears to have been carried out by merely drawing in the black outline that surrounds each character.

Readers who have some experience in photography will wonder how on earth panchromatic plates are handled in the dark room. As they are sensitive to light of all kinds it almost seems as if no light at all would be permissible while they were being developed. This point has not been overlooked, however, and a screen transmitting a safe green light has been introduced. This light is not entirely without effect on panchromatic plates, but is rather the light with minimum action. It must not be allowed to fall on the plate directly or for too long a period, in spite of the fact that it appears to be very feeble indeed compared with the orange light used with the plates and films of 20 years ago, or even with the red light used with modern orthochromatic plates and films.



This photograph of the same wagons shown above was taken on a panchromatic plate with a screen. The improvement in the rendering of the colour values is strikingly shown

Panchromatic plates may now be obtained that have a de-sensitizing compound in the backing. These are developed in total darkness, solutions of known strength being always used and development carried on for definite periods. When using these plates they must be well agitated in the developing bath and at the end of the period of development may be examined for a few seconds by the light of a candle placed at a distance of a few feet.

Since the introduction of the dyes that have made the panchromatic plate possible, even more remarkable colour sensitisers have been discovered. From the point of view of an ordinary observer with an ordinary human eye the panchromatic plate overdoes things a little, as pinacyanol extends the sensitivity of the emulsion with which it is mixed well beyond the limits of the visible red in the spectrum. In 1919 a new dye was discovered that went even further than pinacyanol in this respect. It is called kryptocyanine and admixture with it makes emulsions sensitive to invisible infra-red rays of wave length as great as 8,000 on the scale already mentioned.

Still more recently H. T. Clark, a chemist working in the

laboratories of the Eastman Kodak Company, discovered that during the preparation of kryptocyanine a small quantity of a second dye, less soluble in water, was produced at the same time. This dye, to which the name neocyanine was given, was found to be even more effective than kryptocyanine and with its aid it is possible to take photographs in invisible light of wave length 9,000, and with long exposures of over 10,000. Thus the photographic range has been extended over the whole visible spectrum and far beyond it into the infra-red region.

A remarkable feature of the use of kryptocyanine and other sensitising agents is the extremely small proportion that is necessary. Only one part in 500,000 of the former is necessary while the concentration of the other dyes usually required varies from one part in 10,000 to one part in a million.

The best results are obtained by mixing the dye with the emulsion when it is made. At times this is impossible owing to the circumstances in which the plate is required or because of the instability of the dye used, for some of these lose their sensitising power on standing. In that case the less satisfactory method of bathing the plate in a solution of the dye is adopted. The contact between the particles of the dye and the silver bromide grains of the emulsion is less intimate on a plate prepared in this way, as it is brought about by slow diffusion instead of by direct mixing, and the maximum sensitising action is, therefore, not so readily attained.

Photograph courtesy [*Eastman Kodak Co., Inc.*

Photograph taken during the afternoon in bright sunlight with a red filter and an extreme red-sensitised film, sensitised with kryptocyanine

To sensitise a plate by this method a solution of the dye in either water or alcohol may be used. Usually the plate is thoroughly wetted and then immersed completely and quickly in the solution, which is agitated from one to five minutes according to the dye used. After draining the plate is dried, quick drying usually giving the best results. Absolute cleanliness is necessary and in each case the light must be safe. An ordinary red lamp is useless for bathing plates in dyes which make the emulsions sensitive beyond the ordinary limits and some of the operations must be carried out in complete darkness.

The discovery of these methods of inducing red and infra-red rays to record themselves on a photographic plate is of great interest and importance in photography, as we have already seen, but the applications made of it in scientific photography are even more striking. For this purpose photographs of objects are secured in light of different colours in addition to photographs taken in ordinary light and comparisons are then made.

So far the most remarkable results have been obtained with the planet Mars. Dr. Wright, of the Lick Observatory, has taken photographs of the planet on plates sensitised with kryptocyanine, using a filter to cut off all light except that of the red and infra-red rays. In this way he obtained a photograph of the form of the planet when seen only in the red light reflected from its surface. At the same time he took photographs on ordinary plates without using colour filters. It will be clear on considering what has been said on the point, that the second photograph gives the form of Mars in the violet light reflected by it, for this light has by far the greatest effect on ordinary plates.

The photographs on page 126 show the two hemispheres of Mars taken in this way. The left hemisphere is the result obtained on using ordinary plates while that in the centre is a photograph taken in red light only. The difference in size is striking. As the two hemispheres were photographed with the same apparatus and at practically the same time they should apparently have been of the same size and an explanation must be found for the difference.

In order to give an explanation many photographs under various conditions on earth were taken. Two of these are here reproduced on page 129 and a study of them leads to an explanation of the strange photographs of Mars taken by Dr. Wright.

In each of the two photographs the view is that from the top of Mount Hamilton in California looking across a valley towards the mountains of the Yosemite region. Very little can be seen on the photograph on the right. This was taken on an ordinary plate and the rays of light from the mountains in the distance have been unable to penetrate the haze in sufficient strength to have any appreciable effect on the plate.

Red rays penetrate a hazy atmosphere with its millions of small particles of dust or water much better than do blue rays. This is because of their greater wave length. Sand will not pass through a riddle if the size of the openings in it is less than that of the grains of sand. Similarly light cannot pass directly through a thick layer of mist if its wave length is less than the diameter of the particles of dust or moisture in it, as much of it is lost by reflection in various directions from the surfaces of the particles. Violet rays, therefore, are scattered by reflection from these tiny particles more readily than are the longer red rays.

One example of this effect is seen in sunsets. When the Sun is setting the rays of light from it must pass through a greater length of atmosphere than at mid-day as they strike the earth obliquely. Thus they run the gauntlet of a larger number of the particles of dust and moisture always present in the atmosphere and as a result greater scattering of the shorter blue and violet light rays takes place. The colour of the sky round the setting Sun is moved along the spectrum towards the red, and the sky is often yellowish-green and red in colour, the latter predominating.

In view of the comparative ease with which red rays penetrate mist Dr. Wright decided to take a photograph in red light only. In order to do this he placed in front of the camera a filter to cut off all other light and used one of the new plates sensitive to the red and infra-red rays. The difference between the two photographs is extraordinary. In the second the mountains surrounding the Yosemite Valley are clearly seen and a great amount of detail can readily be distinguished in the valley lying between them and Mount Hamilton. The only part of the view that appears in the ordinary photograph is the foreground and this in the second photograph is brightened up incredibly and looks exactly as it would on a perfectly clear day.

Returning now to the photographs of Mars we may apply the lesson learned from the Mount Hamilton photographs. It seems fairly definite from the photographs that Mars has an atmosphere, contrary to all previous supposition. In the photograph taken in ordinary light we have impressed on the plate the rays of light reflected not only from the planet itself but also from the atmosphere surrounding it. The smaller disc must be a photograph of the actual planet itself taken in light of longer wave length that has penetrated the haze, as the light of short wave length reflected from the surface of the planet is scattered in its passage through this atmosphere and light of similar wave length reflected from the atmosphere is cut off by the use of screens.

The atmosphere is fairly substantial, for measurements of the sizes of the two hemispheres show that it is 120 miles in depth. The atmosphere of the earth is not usually supposed to be so deep as this, but if the gravitational attraction of our own planet were as small as that of Mars, the height to which it would reach above the surface would be just about 120 miles. The atmosphere on Mars is not dense and does not contain nearly so much water vapour as that of the earth. The exact nature of the particles that constitute it is not known. Water is undoubtedly present on the planet, as the spectroscopic observations show, but as the amount of water is small it is possible that the surface is largely desert. In that case the atmosphere may well contain large proportions of fine dust and sand. This would account for the colour of Mars. Its general colour is reddish in tone for exactly the same reason as the sky at sunset on the earth is reddish—because the blue and violet rays are scattered by reflection from the particles in the atmosphere, whatever their nature, to a greater degree than are the longer red rays.

The chief uses of a plate equally sensitive to light of all colours are, of course, in securing photographs of coloured objects in correct colour tones, but there is no doubt that the photographic methods described in this article will find other uses in addition to those already suggested. One example is in aerial surveying. The use of aeroplanes for surveying and mapping a new or changing country is now well-known and experience has made it very accurate. In addition it can be carried out far more expeditiously and at less expense than can an ordinary ground survey.

The method used depends entirely on photography. One of the greatest difficulties met with in carrying out the necessary operations is that ground fog very often obscures portions of the area being surveyed and much delay and inconvenience are caused. This difficulty can be completely overcome by using screens and plates sensitised with one or other of the dyes referred to so that the necessary photographs are taken in red light in the same manner as the clear photograph of the pair shown on this page.

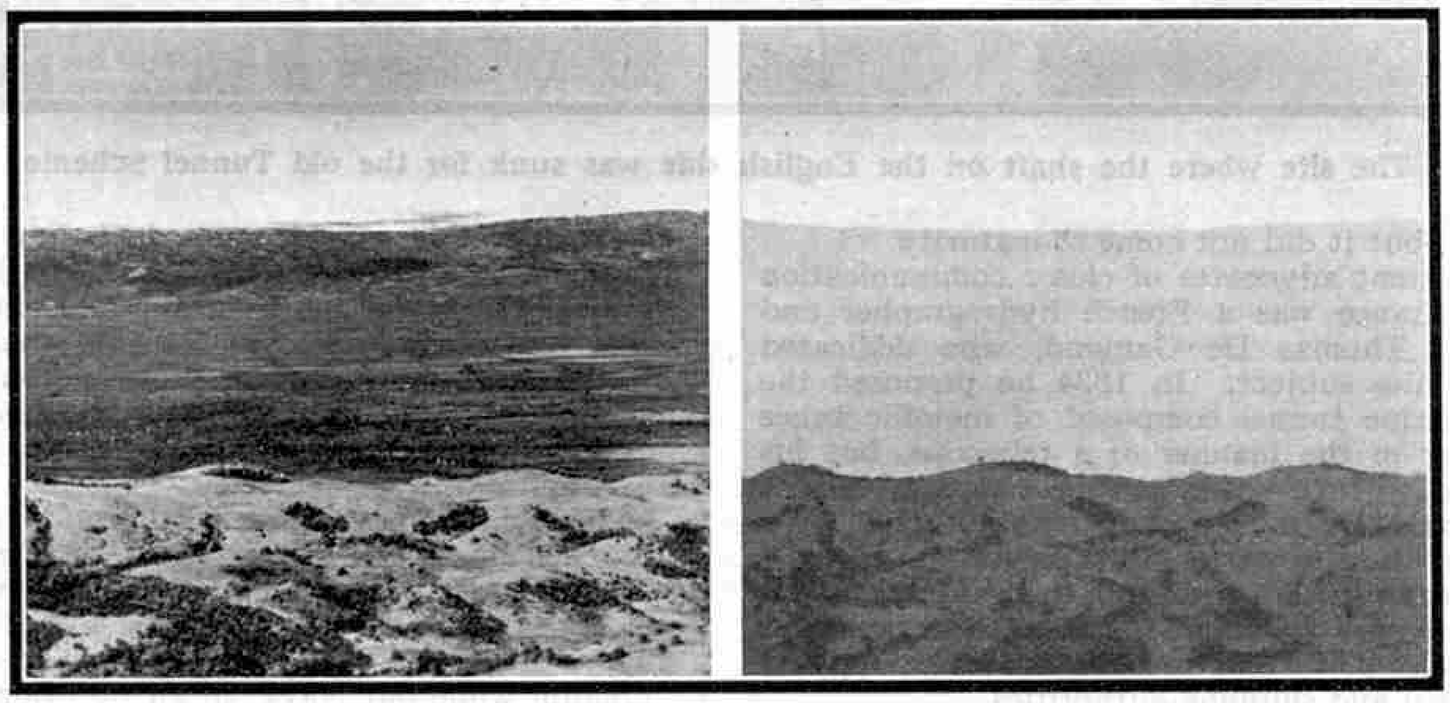
In the air survey of the land on the Congo Border of Rhodesia by the staff of the Aircraft Operating Company under Major Patrick, great use was made of the new method, with a surprising saving of time and expense. In this case it was found necessary to use bathing methods of hypersensitising films for use when ground-fog was prevalent, as plates with the dyes incorporated with the emulsion did not retain their sensitiveness in the hot climate in which the work was carried out. The plates were used immediately after drying, and no difficulty was experienced in continuing to photograph the ground from the aeroplanes of the expedition, except under very exceptional circumstances. Practically all air-survey expeditions now make use of plates sensitised in this manner, and are thus able to complete their work without interruption.

As yet we are only at the beginning of the developments that will follow the discovery of the effect of adding dyes to the emulsion of photographic plates, and many interesting and unexpected uses will no doubt be found for photography by invisible rays. One of them is suggested by an examination of the upper illustration on this page. This is a reproduction of a photograph taken at noon in brilliant sunshine, and the Sun was actually visible at the moment of exposure. Even the novice is aware that he will be disappointed if he uses an ordinary plate in an attempt to photograph light clouds in a sunny sky; instead of clouds he will find blank white areas on his print! In order to secure the photograph shown, the film was sensitised with kryptocyanine, and shielded from the blinding glare of the Sun by a screen that allowed only red and infra-red rays to pass through it. The wonderful cloud effects thus obtained suggest an approaching storm!

Photo courtesy] [*Eastman Kodak Co., Inc.*

Our illustration shows a beautiful cloud effect, the original photograph being taken with a red filter and an extreme red-sensitive film sensitised with kryptocyanine

The ease with which ordinary sunlight may be toned down, or even cut off entirely, led to efforts to secure certain photographs of the Sun that can only be obtained by ordinary means during an eclipse. The feeble light of the corona, for instance, is only visible to us when the far more powerful light radiated from the Sun's disc is cut off by the body of the Moon. Even then exposures of a few seconds only may be given, and no really satisfactory photographs of the corona have ever been taken. Very promising attempts have now been made in ordinary daylight with the aid of screens. The plates used were sensitised with a new dye called "procyanol," that is even superior to the neocyanine discovered by H. T. Clark, and very soon astronomers may be in a position to learn more in one day about the corona than they could hope to gather during the eclipses of several centuries.



Photograph courtesy] [*Prof. W. H. Wright*

These remarkable photographs were taken from the Lick Observatory and show a surprising result. The photograph on the right is taken with an ordinary plate whilst the photograph on the left, taken at the same time and of the same view, is taken with an extreme red-sensitised plate with a red filter.

It is almost impossible to believe that there could be such a marked difference, for whereas the town and the valley beyond the crest are quite invisible on the ordinary plate, the specially-sensitised plate shows them up in every detail.

It is interesting to remember that infra-red rays have been used by Mr. J. L. Baird, the well-known inventor of television, for "seeing" by night or in a dense fog. A beam of invisible light is projected by a searchlight on the objects to be seen, and the reflected rays are allowed to act on the photo-electric cell in a television transmitting set. These are transformed in the receiver into visible light, and thus objects approaching through thick fog may be seen while they are still completely invisible by any other means. The use of these remarkable rays in this manner will add very greatly to the safety of aircraft and shipping.

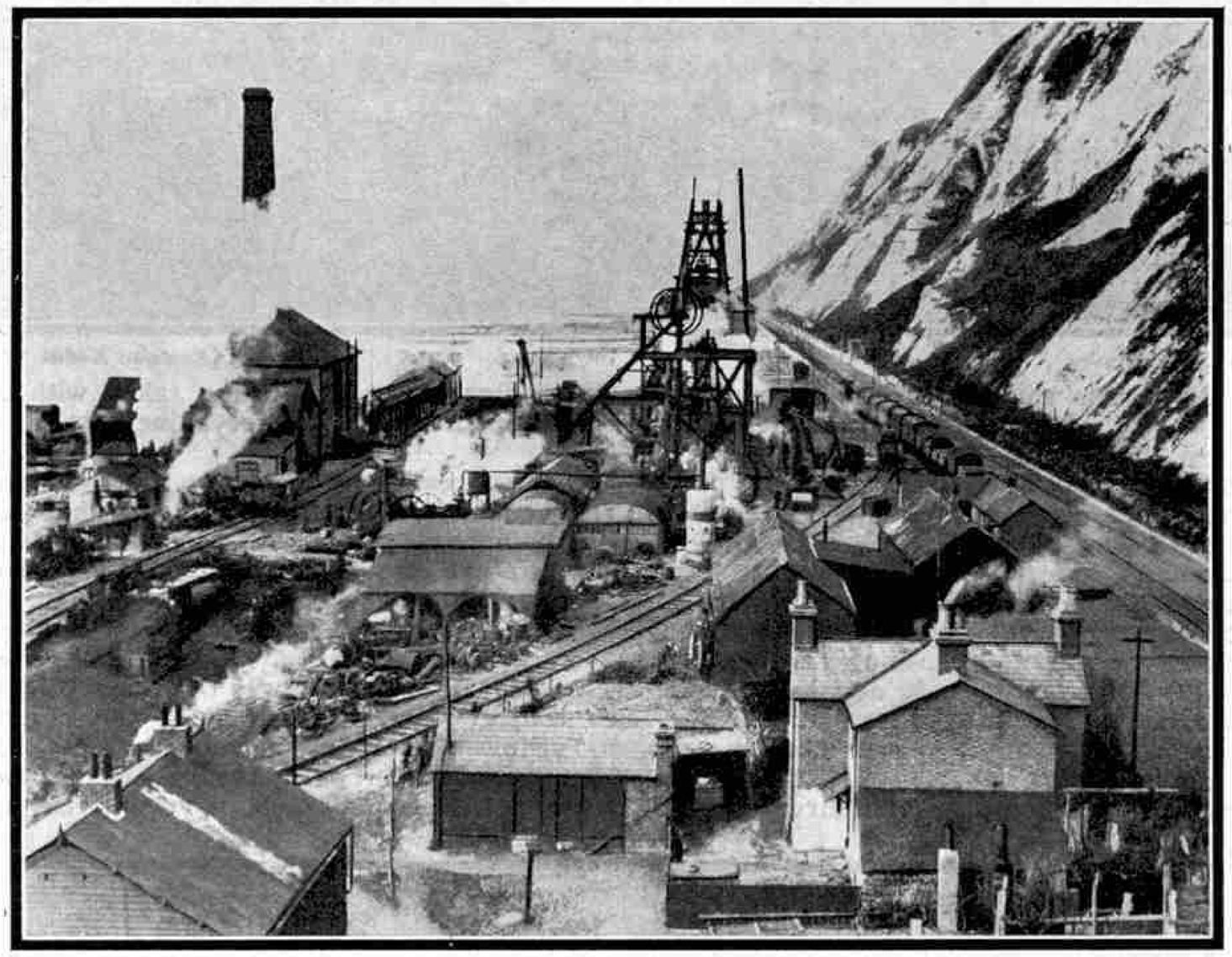
The New Channel Tunnel Scheme

Proposed High-Speed Broad Gauge Railway

FEW projected engineering schemes have been the subject of such protracted debate as the Channel Tunnel scheme. It is almost 130 years since the idea was first put forward of linking up England and France by means of a submarine tunnel, and the matter has not yet passed beyond the discussion stage.

In 1802 a French mining engineer named M. Mathieu presented to the Emperor Napoleon a scheme for connecting England and France by means of a tunnel under the Strait of Dover. Mathieu proposed to build the tunnel in two sections each about 10 miles in length, one from the English coast and one from the French shore. Each section was to terminate on the Varnes Bank, which is situated about midway in the Strait. This submerged bank is only about 50 ft. below sea level and by means of strong embankments it was to be built up into a large island. The engineer suggested that an international town should be erected on the island, which was to be provided with a harbour of refuge for shipping. The two sections of the tunnel were to be lighted by oil lamps and ventilated by vertical shafts extending from the tunnel to the open air.

To us to-day this scheme appears crude, but it is undoubtedly ingenious. It had many strong supporters, including the famous British statesman Charles James Fox, but it did not come to maturity.



The site where the shaft on the English side was sunk for the old Tunnel Scheme

One of the most persistent advocates of closer communication between England and France was a French hydrographer and mining engineer named Thomas De Gamond, who dedicated his life and fortune to the subject. In 1834 he proposed the construction of a submarine tunnel composed of metallic tubes fitted one into the other in the manner of a telescope, but his plan was coldly received. Three years later he suggested that a train ferry service should be inaugurated, but although this idea attracted interest at the time it was soon forgotten.

In 1857 De Gamond drew up a scheme for spanning the Strait by means of a bridge that was to extend from a point near Dover to Calais. This scheme also met with no success for it was opposed very strongly by the naval and shipping authorities.

During the latter half of last century many schemes for establishing closer communication between the two countries were brought forward. Between 1862 and 1870 the idea of a train ferry service was revived and persistently advocated by the British engineer Sir John Fowler. Strong opposition from the Admiralty and from the Harbour Authorities effectually prevented any progress being made with the scheme, with the result that it had to be abandoned.

De Gamond's idea of a submarine tunnel was revived about this time and the British government proved to be more favourably inclined toward the subject than previously. Diplomatic communications were established with France on the matter and ultimately a joint Commission was appointed to consider the important and difficult details of a scheme for a tunnel between the two countries, and to decide upon the best means by which such a project could be carried out.

After investigation the Commission drew up a report embodying certain conditions that were to be the basis of a treaty between the two nations. When the problem of raising the necessary funds for the construction of a channel tunnel came to be considered, however, the interest of the British government waned, and eventually it was decided that existing financial conditions were unfavourable for giving support to the scheme. As a result of this decision the treaty was never signed.

In spite of this lack of government assistance a Channel Tunnel Company was formed in 1867 under the auspices of Lord Richard Grosvenor and Sir Edward Watkin, and investigations and surveys were carried out during the ensuing years. Nothing more was done until 1881, however, when preliminary plant was erected and the sinking of shafts commenced near Dover, in Kent, and at Sangatte, in France.

This definite move spurred opponents of the scheme to renewed and still more vigorous protests. The military authorities who, up to that time, had not displayed any particular hostility toward the idea, now suddenly woke up and opposed it tooth and nail. In addition, several prominent statesmen including the Duke of Cambridge, Lord Wolseley, and Lord Randolph Churchill, denounced the project on the ground that it would entirely destroy the security that Great Britain enjoyed from its situation as an island. "Fortifications," declared Lord Wolseley, on one occasion, "afford no adequate security of national safety and Dover in the possession of an enemy holding the tunnel, means England is at its mercy."

Admiral Sir Cooper Key, First Sea Lord of the Admiralty, addressed a letter to Lord Northbrook, First Lord of the Admiralty, couched in equally strong terms. He expressed the opinion that "Four hours' possession of the tunnel would enable 100,000 men to assemble and they would be joined in as many hours by as many more. What is to prevent an army from marching on London while our Navy, in all its pride and strength and power, looks on, a helpless spectator?"

This cumulative opposition resulted in work on the Channel Tunnel being stopped in March 1883. The operations carried out up to that time included the sinking of the two shafts and the boring from each of a heading, or small tunnel. The two headings were to meet in mid-channel, so that the complete heading would form a passage by which the strata of the channel bed could be investigated.

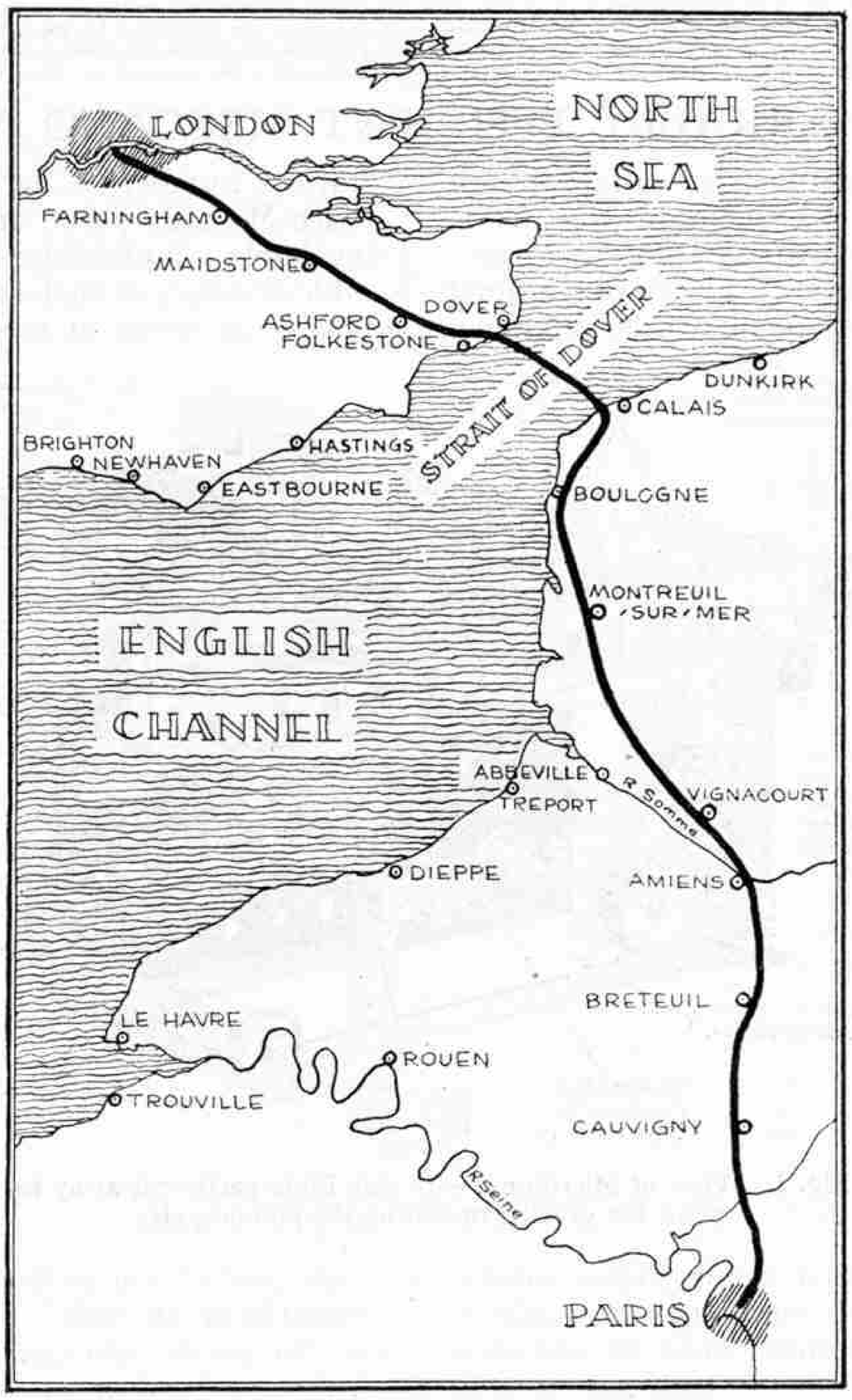
On the English side a shaft had been sunk to the west of Shakespeare's Cliff, between Dover and Folkestone, and at the time that work was stopped the heading extended seaward from the base of the shaft for a distance of about 2,000 yds. The heading was 7 ft. in dia. and had been excavated on a descending gradient of 1 in 80. It was driven through a thick stratum of grey chalk

and proved to be almost dry. Only 1½ gall. of water per min. penetrated into the tunnel, and this quantity gradually diminished. A 4 in. piston pump operating during one half-day per fortnight proved sufficient to drain the heading, which was not provided with any brick or iron lining to prevent percolation.

The heading from the base of the French shaft was driven seaward for about the same distance as the English heading. At the time when operations were stopped good progress was being made, and as much as 115 yds. of tunnel were bored out in six days. Like the Dover heading, the French one was unlined, and at one time water was leaking into the tunnel at the rate of about 400 gall. per min. Both headings were excavated by means of "Beaumont" boring machines, having two arms with steel teeth and driven by compressed air.

The tunnel scheme was revived once more in 1906, when British and French engineers inspected the old workings and drew up a joint report in which they recommended that communication between England and France should be established by means of two single track tunnels, 36 ft. apart from centre to centre, instead of by one double-track tunnel as contemplated in 1881. They advocated that the tunnels should be driven chiefly on a descending grade, but with a slight rise near mid-channel. The tunnels were to be driven by means of shields and were to be lined throughout with cast-iron segments, cement-grouted on the outside to prevent corrosion and to stop any leakage of water into the tunnels. When the segments were in position they were to be lined with concrete and limewashed, so as to provide a smooth interior surface.

The engineers recommended that each of the tunnels should have an internal diameter of 18 ft., which would be large enough to accommodate the rolling stock of the British and French principal railways. Under this arrangement electric locomotives operating solely on the channel tunnel lines would take charge of trains at each terminus of the system. These locomotives were to be of sufficient power to cope with the heaviest trains running on the British and French main lines. It was further recommended that the two tunnels should be connected by cross passages equipped with air-tight doors.



Map showing the route of the proposed tunnel and the London-Paris Railway

This report attracted a great deal of attention and for some time was extensively discussed by engineers and others interested. Then once again the opposing influences prevailed and in spite of all efforts the scheme passed into oblivion.

During the War period and up till quite recently circumstances have made any fresh proposals impracticable, but now the subject is again attracting public attention in the form of a scheme put forward by a London engineer, Mr. William Collard.

Mr. Collard's scheme provides for a railway of 7 ft. gauge linking up London and Paris by way of a single tunnel under the Strait of Dover. The trains on this railway would be hauled by powerful electric locomotives operating on the third-rail system, and would travel at an average speed of 92 m.p.h., at which speed they would cover the 253 miles of line between the English and French termini in the short time of 2¾ hours.

The Channel tunnel would have an overall length of 44 miles and would consist of an 11-mile approach tunnel on the English side, a 24-mile length of tunnel under the Strait of Dover, and an exit tunnel on the French side nine miles in length. As trains would not be allowed to pass through the tunnel at a speed in excess of 60 m.p.h. the period of travel through the underground portion of the line would be about 45 minutes.

The tunnel would be large enough to accommodate a double track, while from the two termini to the respective approach tunnels four tracks would be laid. These would be supplemented by two additional tracks in the terminal suburban area—from London to Farningham, and from Paris to Beaumont-Persan. Both the London and the Paris terminals of the railway would be situated within easy reach of the principal thoroughfares of those cities, the London station being at Westminster and the Paris terminus in the Rue St. Lazare, between Gare St. Lazare and the Eglise de la Trinité. As a result of its location it would be proposed to give the Paris station the name of Paris-Trinité.

The accompanying map shows clearly the route of the proposed railway. The average gradient both ways over the entire route has been worked out at 1 in 746. The gradient of the "overland" section on the English side, that is from London to Monk's Horton station, would average 1 in 1,215. At Monk's Horton station the railway would enter the approach tunnel on a falling grade of 1 in 165, and the tunnel section would have an average gradient of 1 in 242. On the French side the average gradient of the overland section of the line would be 1 in 1,351.

The sharpest curve on the system would have a radius of one mile and would be at the entrance to the Paris terminus, while a curve having a radius of five miles would occur at St. Denis, near Paris. Other curves on the line have been planned for a minimum radius of seven miles.

On account of the broad gauge of the railway it would be impossible to link up with any of the existing railway systems in this country or in France in such a manner as to run through trains. This would appear to be a drawback but on the other hand it is pointed out that even if such linking up were possible, no advantage would be derived by passengers, because the compulsory customs examination in London and in Paris would necessitate their leaving the train at those places. Similarly, the necessary unloading of goods traffic for customs inspection would counteract any advantage of through conveyance and would entail elaborate precautions to keep track of loaded trucks passing through other countries on their way to or from remote places in Europe. A further advantage claimed for the broad gauge is that it would result in greater stability and would allow of increased freight accommodation on the trains.

The type of electric locomotives that would operate the system has not yet been definitely settled but probably they would be equipped with motors capable of at least 120 m.p.h. for short periods while hauling heavy loads. This high speed would be attained over certain portions of the journey through open country, the longest period of travel at the maximum speed being not more than 80 minutes. Two types of locomotive have been suggested. One is a recently designed gear-less locomotive equipped with six 1,000 h.p. motors and built by the General Electric Company, U.S.A. The other is the Brown-Boveri type, having four 1,500 h.p. motors set rigidly in the frames from the driving axles and transmitting their power to the driving wheels through two gear wheels. The locomotive would take direct current at 2,000 volts from a centre third rail.

The absence of curves of short radius would make practicable the use of unusually long coaches. It is anticipated that these would be 75 ft. in length, with a width of 13 ft. and a height of 14 ft. They would have 6-wheeled bogies of the Gresley articulated type with a wheelbase of 16 ft.

The first-class and third-class corridor coaches and the luggage vans each would weigh 50 tons, while (*Continued on page* 133)

Scientific Apparatus in Meccano

Microscope Accessories made by Dr. Ernest Bade

This article is the third of a series in which we describe various uses that have been found for Meccano in the field of science. In the first two articles we described an instrument designed for electrocuting small equatic animals for microscopical study, an apparatus for photographing objects through the microscope, and a device for projecting microscope slides on to the screen. Below we deal with a Meccano microtome, a wonderful precision instrument for use in connection with the microscope. All the apparatus so far dealt with is the work of Dr. Ernest Bade.

III.—A REMARKABLY EFFICIENT MECCANO MICROTOME

IN describing a photo-micrographic device last month (see January issue, page 40) mention was made regarding an instrument known as a "microtome" used for cutting very thin slices of plant and animal tissue. The use of such an instrument will be unknown to many of our readers, although any who are particularly interested in microscopical study will know that without a microtome their field of experiment would be considerably limited. The reason for this is that although the student may obtain considerable information of a substance by examining its external appearance under the microscope, he must study its internal construction and the formation of the cells of which it is composed if he wishes to obtain a complete knowledge of the specimen.

This cannot, however, be carried out directly as in practically every case the substance that is to be examined will be of an opaque or semi-opaque nature. If on the other hand we had some means available whereby an extremely thin section could be obtained of the substance, it would become transparent and minute details of its structure would consequently be discernable. The photo-micrograph of a section of bulrush illustrated in the January issue obtained with the aid of this instrument demonstrates its extreme usefulness, and the way in which the tiny cells comprising the major portion of the bulrush have been severed, and so exposed to view, will be noted.

Naturally, very great precision is essential in the manufacture of an instrument of this type, and it is not therefore surprising that its cost varies between £5 and £20. It is therefore all the more remarkable, that an instrument capable of dividing a portion of matter into a number of very thin slices can be constructed with Meccano parts, and in addition to testifying to the system's adaptability, it also demonstrates the remarkable accuracy of each component part. We may mention also that while in most of the manufactured products the experimenter is required to manipulate the blade himself (an operation that requires a certain amount of skill), the action of the knife in the Meccano model is entirely automatic, the operator only having to push a framework up and down. By an ingenious arrangement of gearing, the knife, which consists of a razor blade, is given a lateral sliding action, in addition to its forward cutting motion, and consequently a very smooth cut is obtained.

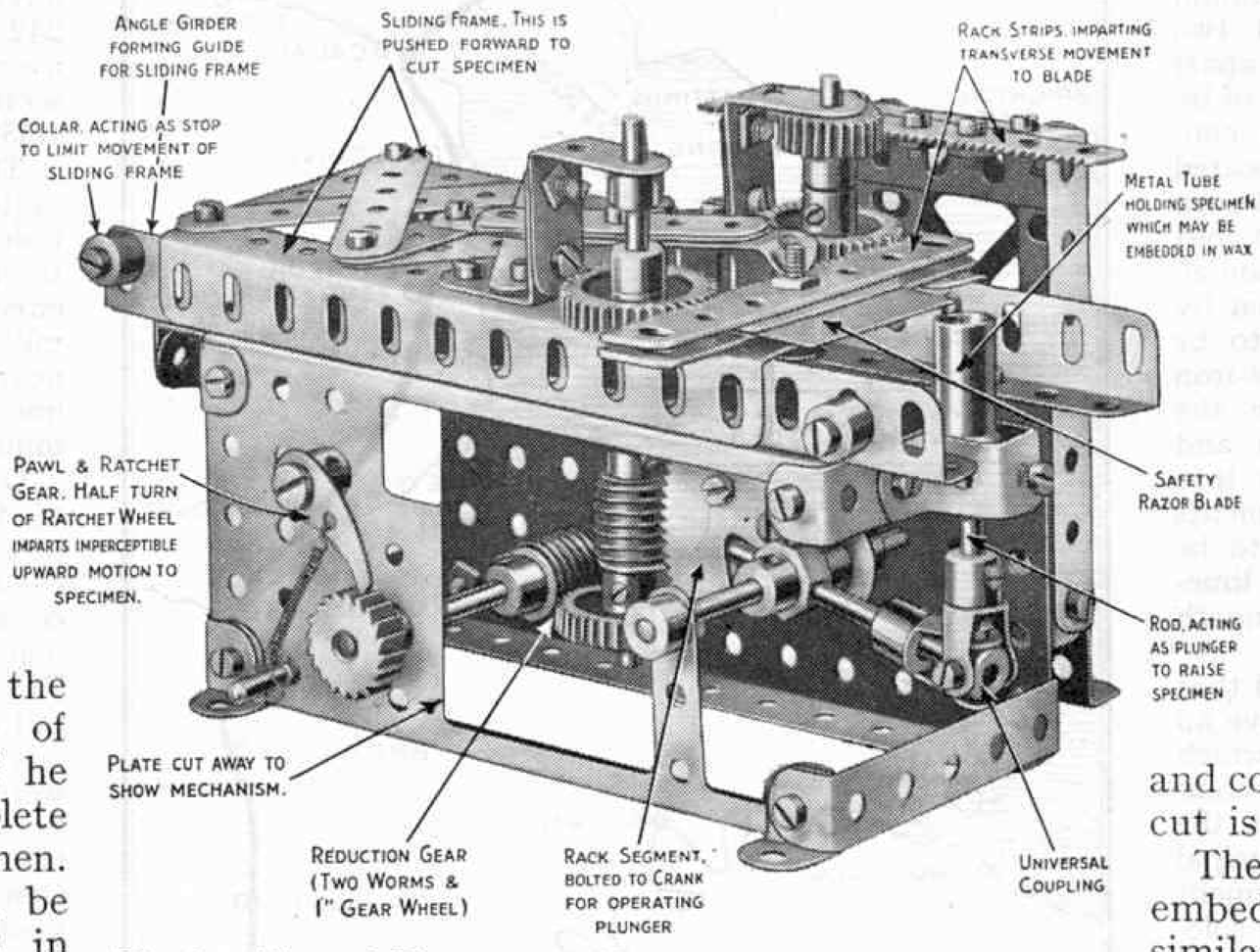


Fig. 1. View of Microtome with side Plate partly cut away to show the gearing operating the plunger, etc.

The object to be cut is embedded in paraffin wax or similar substance, and an ordinary safety blade, which moves forward with a sideways motion, cuts perfectly a section as amazingly thin as two thousandths of an inch! The only non-Meccano parts used in the model are the razor blade and the small metal tube for holding the specimen to be cut. (A Sleeve Piece would serve quite well in place of this tube).

The construction of the model is quite simple. The sides of the frame consist of $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates spaced apart by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, and a $7\frac{1}{2}''$ Angle Girder is bolted to the top flange of each of the Plates, as shown in the illustrations.

A Ratchet Wheel is secured to one end of a Rod that is journalled in the Flanged Plates and that also carries a Worm. The latter meshes with a 1" Gear on a vertical Rod to which is secured a second Worm meshing with a Rack Segment. The Rack Segment is bolted rigidly to a Crank which, in turn, is secured to a transverse shaft

Parts Required

The following is a complete list of parts required to build the Meccano Microtome :—

5 of No. 4	2 of No. 12B	40 of No. 37	1 of No. 97
4 „ „ 5	1 „ „ 16A	1 „ „ 45	3 „ „ 103G
2 „ „ 8B	2 „ „ 16B	4 „ „ 48A	3 „ „ 110
2 „ „ 9	2 „ „ 17	2 „ „ 52	2 „ „ 111C
2 „ „ 9B	2 „ „ 18A	2 „ „ 58	1 „ „ 115
4 „ „ 9E	1 „ „ 25	6 „ „ 59	1 „ „ 119
3 „ „ 12	3 „ „ 31	1 „ „ 62	1 „ „ 140
4 „ „ 12A	2 „ „ 32	1 „ „ 63	1 „ „ 147

1 Safety Razor Blade

1 Small Metal Tube

comprising two short Rods joined together by an Octagonal Coupling. A Rod is held in the transverse bore of the Coupling and carries at its outer extremity a Universal Coupling, in the other portion of which is held a short Rod that passes upward through the centre of the tube 7 (Fig. 2). The top of this Rod is fitted with a Collar or similar part to fit the diameter of the tube. If the latter consists of a Sleeve Piece, the top end of the Rod may be equipped with a $\frac{1}{2}$" fast Pulley, which will be found to be a sliding fit in the bore of the Sleeve Piece. The specimen to be cut is retained in place on the top of the plunger by means of a small quantity of paraffin wax and lard, etc.

The method by which the slicing motion is given to the razor blade is very ingenious. A sliding frame comprising two $5\frac{1}{2}$" Angle Girders braced by $2\frac{1}{2}$" and 3" Strips, slides on the up-turned flanges of the $7\frac{1}{2}$" Girders that are bolted to the $5\frac{1}{2}" \times 2\frac{1}{2}$" Flanged Plates, and two 1" Gears are mounted on the front end of the sliding frame as shown in the illustrations. On the Rod of the far 1" Gear in Fig. 1; a $\frac{3}{4}$" Pinion is secured, and meshes with a portion of a Rack Strip 6 (Fig. 2) attached to a fixed portion of the frame of the model. In engagement with the 1" Gears are two Rack Strips 5 bolted face to face with the razor blade 4 clamped between them. They are held in mesh with the Gears by means of the Strips 8 pressing down on the upper one and a Spring attached to the lower one and to the sliding frame.

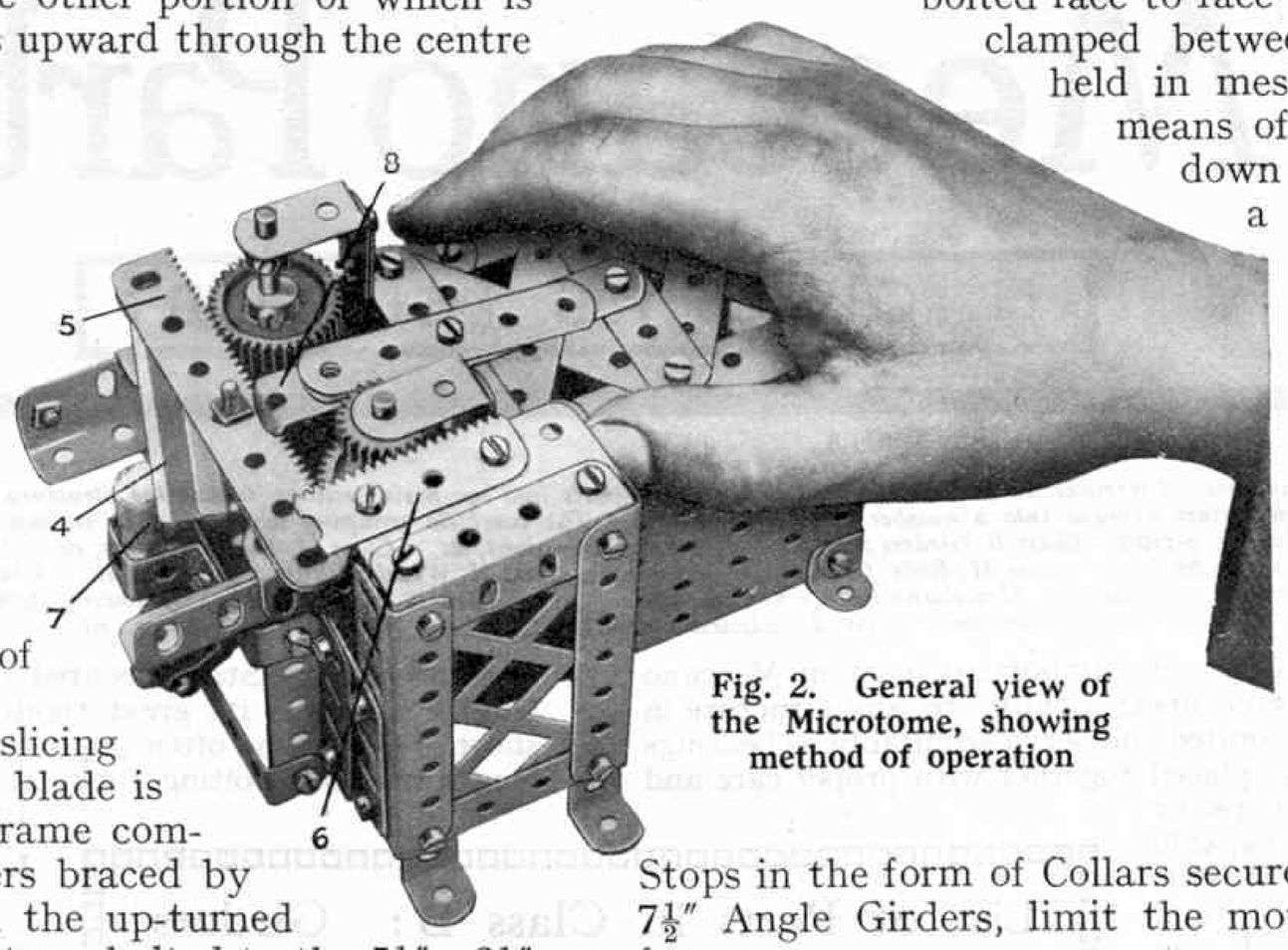


Fig. 2. General view of the Microtome, showing method of operation

When the frame is moved forward, the blade moves across the frame laterally at the same time, owing to motion imparted to the $\frac{3}{4}$" Pinion by the Rack Strip 6. Thus a perfectly clean cut is given to the specimen. Stops in the form of Collars secured to either end of the $7\frac{1}{2}$" Angle Girders, limit the movement of the sliding frame.

It will be seen that, by turning the Ratchet Wheel one or more teeth at a time, the thickness of the cut may be regulated to within very fine limits.

A Run on the "*Twentieth Century Limited*"

(*Continued from page* 99)

"thrashed" to her utmost limit.

Upward we go until at last, after 62 miles' continuous climbing, we reach the summit of Mount Washington. From here after a sharp drop to Pittsfield, where we may touch 70 to 80 m.p.h. the scenery is just one beautiful panorama after another.

Through sleepy towns and villages we tear, the speedometer hanging steadily on at the 72 mark, until, as we start to cross the historic Hudson River we commence to decelerate in readiness for our entry into the great Union Station at Albany, N.Y. Here, two minutes to the good, we detach our train, leaving it to be taken forward to Chicago by one of the new "Hudson Speed" type of engines of the New York Central. Recrossing the Hudson River we reach our resting place where "596" will be thoroughly inspected and washed in preparation for the return on the morrow.

No doubt you feel ready now for a wash and a sleep but that does not prevent tongues from chattering. How, asks somebody, would that great "Hudson Speed" or even our gallant "596" look at the head of the "*Cornish Riviera*" express! That reminds me of an amusing little incident that occurred to me quite recently. That day I was driving "598" on the "*South Western Limited.*" We rolled into the terminal station of Boston and a few minutes later as I was looking over the engine a young fellow addressed me. It did my heart good to hear him speak. I am from England myself, you know, and he was from good old Lancashire! He was greatly interested in the engine and after a few moments' conversation he mentioned that he was an ex-Lancashire and Yorkshire Railwayman. I asked him how the engine would look running into Exchange Station, Liverpool. "By gum!" he replied, "I don't believe the beggar could get in!"

Famous Trains—

(*continued from page* 109)

the first trough we have seen all the way from Liverpool!—and mount the $2\frac{1}{2}$ miles at 1 in 125 to Belstead Signalbox. A quick run down to the Stour Valley, with a last "60" maximum, precedes a severe slowing over the North curve at Manningtree, which takes us on to the Harwich branch. Sharp ups-and-downs along the right bank of the Stour estuary have to be negotiated with our heavy load, and then, as we run down the final incline from Wrabness, the lights of our arrival being timed at 9.18 p.m. Parkeston Quay bear into view dead ahead,

We are not allowed to stand at the long platform any longer than is necessary to unload passengers and luggage, as the "*Esbjerg Continental*" is due from Liverpool Street at 9.31 p.m., the "*Hook Continental*" 11 min. after that, and the "*Antwerp Continental*" 10 min. later still. This is one of the reasons why our timings have been on the leisurely side, as punctuality of arrival at Parkeston is of vital importance, and there is ample margin for recovery of lost time should one of our many connections put in a late appearance *en route*. After leaving Parkeston Quay we have but another two miles to run, calling on the way at Dovercourt Bay, ere we "make the port of Harwich" at 9.31 p.m. We have had, as I am sure you will agree, a most interesting day.

The New Channel Tunnel—

(*Continued from page* 131)

each dining car would be 55 tons in weight. A train unloaded would weigh 505 tons, and would consist of three first-class corridor coaches, each accommodating 100 passengers; two third-class corridor coaches seating 132 passengers each; one dining car; one luggage van and one locomotive. The passengers and luggage represent an additional 45 tons, so that a loaded train would weigh 550 tons.

The estimated total cost of the project is £189,177,094. Of this enormous sum the English "overland" section is estimated to cost £58,529,345, the Channel Tunnel £30,811,200, and the French "overland" section £99,836,549. It is calculated that the fare for the entire journey would be approximately £2; that for the journey to Boulogne £1, and the shorter journey from Ashford to Boulogne 10/–. Based on these figures, the gross receipts are estimated at £35,166,664 per annum, of which £23,209,998 would be required to meet working expenses, leaving a net profit of £11,956,666.

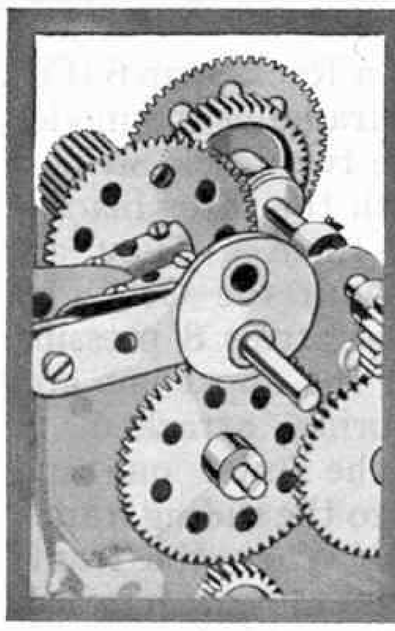
The interesting details of the proposed high-speed railway given in our article were published exclusively by "*Modern Transport.*" We have been able to reproduce them through the courtesy of the Editor of that paper.

How to Use Meccano Parts

(*Continued from page* 135)

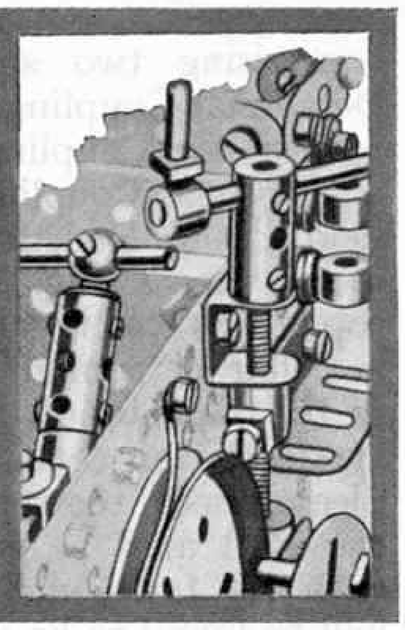
Another important function of the Circular Girders is illustrated in the Steam Shovel (Model No. 7.7, Special Instruction Leaflet No. 19,) where it is used as the upper guide rail of a built-up roller bearing unit (see also Standard Mechanism No. 106). The part is invaluable in building models of large cement-mixing machines, wagon tipplers, and similar models where circular structures are necessary.

Channel Segments (part No. 119), which resemble curved channel girders, are dealt with in Class N (Wheels, Pulleys, etc.), as also are Ring Frames (No. 167B), which resemble the Circular Girder. Girder Brackets and Channel Bearings, which might be compared with very small girders, are included under Class C (Brackets, Trunnions, etc.).



HOW TO USE Meccano Parts

II. GIRDERS (CLASS B)



For the purposes of this series of articles we have grouped all the Meccano parts into two main sections, termed the Structura and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping was published in last month's "M.M." as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools, and Literature. Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical parts. In addition to these classes, the following should be added to the Mechanical Section: Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

MECCANO Girders play a very important part in Meccano engineering. They give great rigidity to any structure in which they are incorporated and serve admirably as bearings for shafting. A few Girders placed together with proper care and braced by one or two Strips or Rods will form a structure capable of supporting a man's weight, without the slightest disruption.

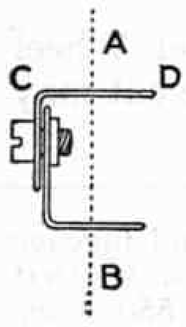


Fig. 1

The secret of the strength of the Meccano Angle Girders is found in the right-angle formation of their flanges, which enables them to withstand bending stresses in any direction. This will become more clear from the following:—

If a wooden beam is mounted so that both ends only are supported, as in Fig. 4, and a heavy load is placed upon it, it will naturally bend. When this happens it is obvious that the upper part of the beam will be in compression and the lower part in tension. These compressive and tensional forces exert a maximum effect along the outer edges (AB, CD in the sketch) of the beam, and decrease toward the centre, in proportion with their distance from the centre, so that there is a zone between the upper and lower portions where the material of the beam is neither in compression nor in tension. It will be obvious that the more material there is above and below the neutral axis, as this zone is termed, the stronger will be the beam. Hence it will be clear that the strength of a beam is determined by its depth rather than by its width.

If a Meccano Strip is laid flat across the two supports shown in Fig. 4 and a small load placed upon it, it will bend considerably, since the areas in compression and tension will be very small, but if the Strip is placed on edge it will withstand a very much greater load. Now a single Angle Girder combines the property of two ordinary Strips secured rigidly at right angles along their lengths; hence its great rigidity. When a Meccano boy runs short of Girders he often improvises by placing two Strips together lengthwise and bolting them at right angles by means of Angle Brackets.

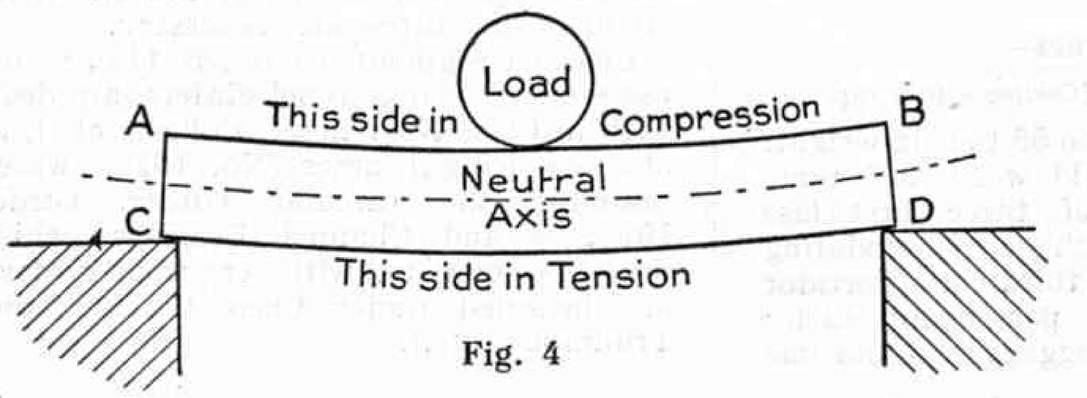


Fig. 4

List of Parts in Class B: Girders

Angle Girders (L-Section, $\frac{1}{2}'' \times \frac{5}{8}''$)

No.				s.	d.	No.				s.	d.
7.	24½″	long	... each	0	8	9a.	4½″	long	... ½ doz.	0	10
7a.	18½″	„	... „	0	6	9b.	3½″	„	... „	0	8
8.	12½″	„	... ½ doz.	1	9	9c.	3″	„	... „	0	8
8a.	9½″	„	... „	1	3	9d.	2½″	„	... „	0	7
8b.	7½″	„	... „	1	2	9e.	2″	„	... „	0	6
9.	5½″	„	... „	1	0	9f.	1½″	„	... „	0	6

Braced Girders (2″ deep)

No.				s.	d.	No.				s.	d.
97.	3½″	long	... ½ doz.	0	9	99a.	9½″	long	... ½ doz.	2	0
97a.	3″	„	... „	0	8	99b.	7½″	„	... „	2	0
98.	2½″	„	... „	0	8	100.	5½″	„	... „	1	0
99.	12½″	„	... „	2	6	100a.	4½″	„	... „	0	10

Flat Girders ($\frac{1}{16}''$ wide)

No.				s.	d.	No.				s.	d.
103.	5½″	long	... ½ doz.	0	10	103e.	3″	long	... ½ doz.	0	6
103a.	9½″	„	... „	1	2	103f.	2½″	„	... „	0	5
103b.	12½″	„	... „	1	3	103g.	2″	„	... „	0	4
103c.	4½″	„	... „	0	9	103h.	1½″	„	... „	0	4
103d.	3½″	„	... „	0	7	103k.	7½″	„	... „	1	0

No. 113. Girder Frames, 5½″ long ... . each 0 3

No. 143. Circular Girders, L-section, 5½″ diam. ... „ 1 0

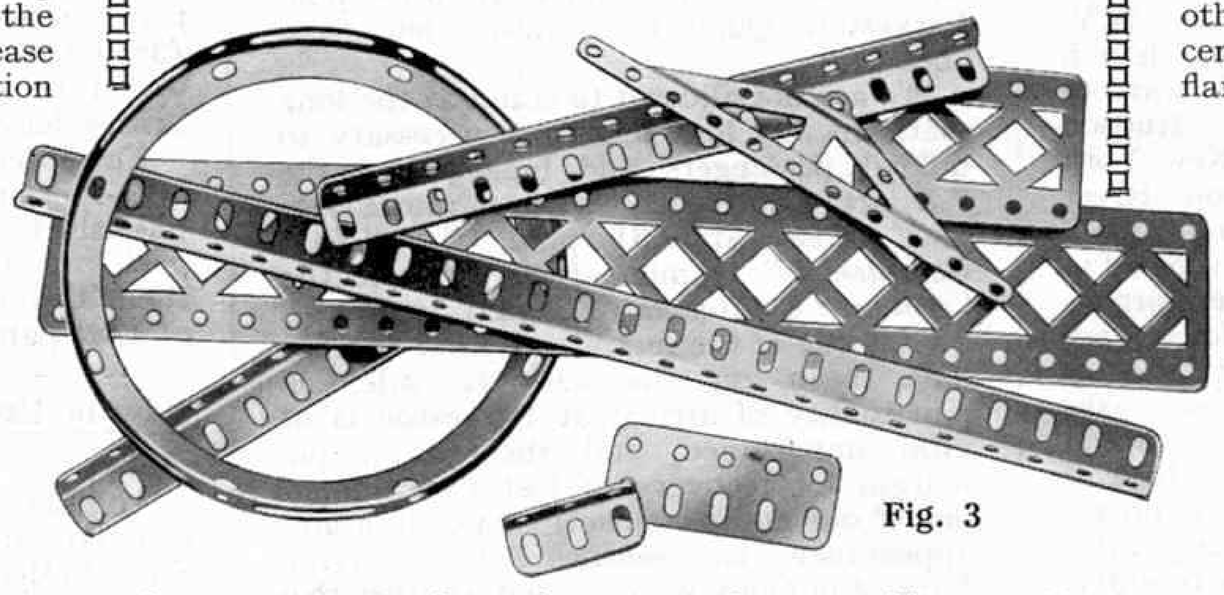


Fig. 3

L-section Angle Girders (Nos. 7 to 9f)

The Meccano Angle Girders, parts Nos. 7-9f, differ only in their lengths. Each is perforated with round holes in one flange and elongated holes in the other. The object of the elongated holes is to provide the "play" that often is necessary when bolting a Girder to other parts. The value of this play is illustrated in Figs. 1 and 2, which represent sections of two Angle Girders that are bolted together to form channel-section girders. Fig. 1 shows the right method of securing the Girders and Fig. 2 the wrong method. In the former the narrow flange of one Girder is bolted to the broad flange of the other, with the result that the centres of the holes in the remaining flanges are exactly opposite, whereas the centres of the corresponding holes in Fig. 2 are not in line.

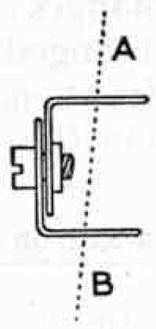


Fig. 2

The importance of thus bolting the Girders correctly together will become at once apparent when it is desired to journal a Rod through the flanges of a channel girder of this type. Of course to journal the Rod in a girder of the form shown in Fig. 1, it will be necessary to bolt a short Strip to the flange CD, so that one of its round holes may be used instead of the elongated hole of the Girder to receive the Rod.

How Girders are Designed

All Meccano boys will know that girders are of various shapes, but it may not be altogether clear to some why this should be so. It might be thought that if a girder is to be placed across two supports as in Fig. 4 and used to support a heavy compressive force, it should be of a rectangular shape. But a rectangular shape is not always the strongest form, weight for weight. It has already been pointed out that the compressive and tensional forces to which the

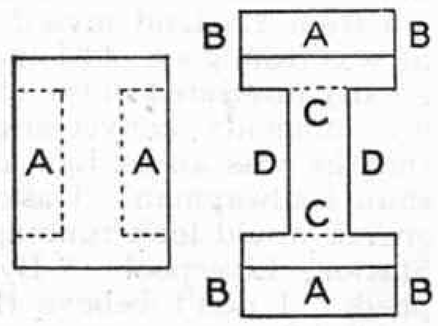


Fig. 5

girder is subjected diminish towards the centre, or neutral axis. Hence if a rectangular girder is used to withstand a bending stress a good deal of material would be subjected to comparatively little strain. Fig. 5 shows rectangular and I-shaped girders having the same sectional area. The I–girder would be stronger than the other, for it is deeper and has a large proportion of its mass concentrated at the points A, where the stresses are greatest. In the rectangular girder the material corresponding with the portions A occupies the positions indicated, where it is subjected to comparatively little compressive or tensional force.

The parts BB of the I–girder are known as the " flanges " and the vertical part CC is called the " web." In practice the shape of the I–girder shown would be modified still further in order to make the best possible use of the material of which it is composed.

As a rule, I–girders designed for ordinary purposes, such as railway lines, etc., are rolled from the solid, but if they are required to be of exceptional size or to withstand exceptional loads, as may be the case in bridge-building, they are sometimes built up from a number of steel plates or smaller girders. Similarly, in Meccano engineering, it is possible to build up girders of this shape and of almost any size. A typical Meccano I–girder is shown in Fig. 7. It consists of four Angle Girders bolted to a Flat Girder, which forms the web.

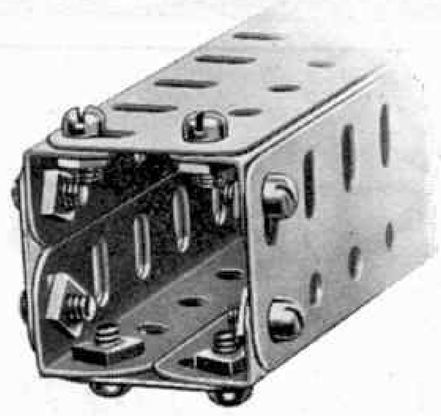


Fig. 6

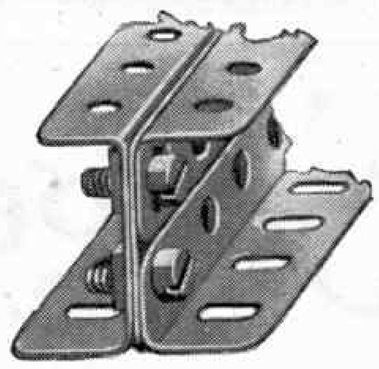


Fig. 7

It will be seen that the I–girder resembles two channel girders bolted together. A simple built-up channel girder, consisting of two Angle Girders connected together by Flat Girders or by Flat Brackets, is illustrated in Fig. 11. It will be found extremely useful in building up large structures.

Figs. 10 and 12 illustrate different types of built-up girders that are capable of withstanding tremendous bending stresses. The jib of the Meccano Stiff Leg Derrick (model No. 7.9, Special Instruction Leaflet No. 6) which has to withstand both bending and compressive forces, consists of Angle Girders bolted together in the formation shown in Fig. 10. Fig. 6 shows a built-up rectangular girder, consisting of four Angle Girders connected together by Flat Girders, which form the four sides. A girder of this type is best suited for use as a supporting column or pillar, for it will withstand very great compressive force.

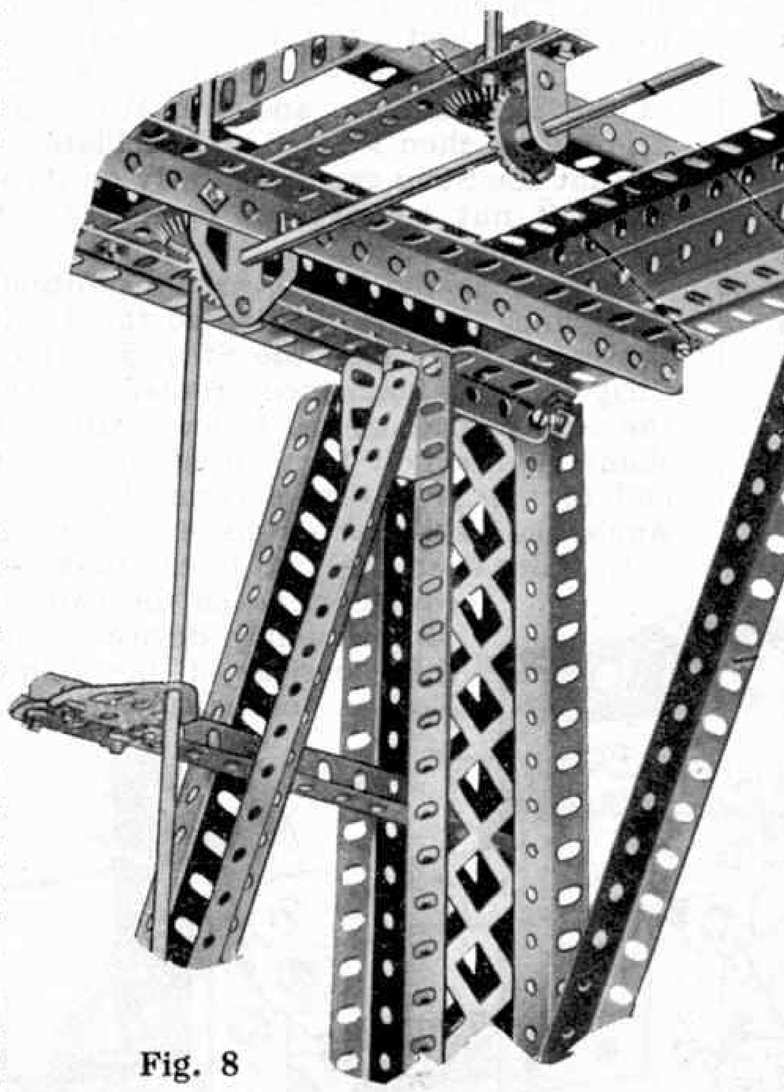


Fig. 8

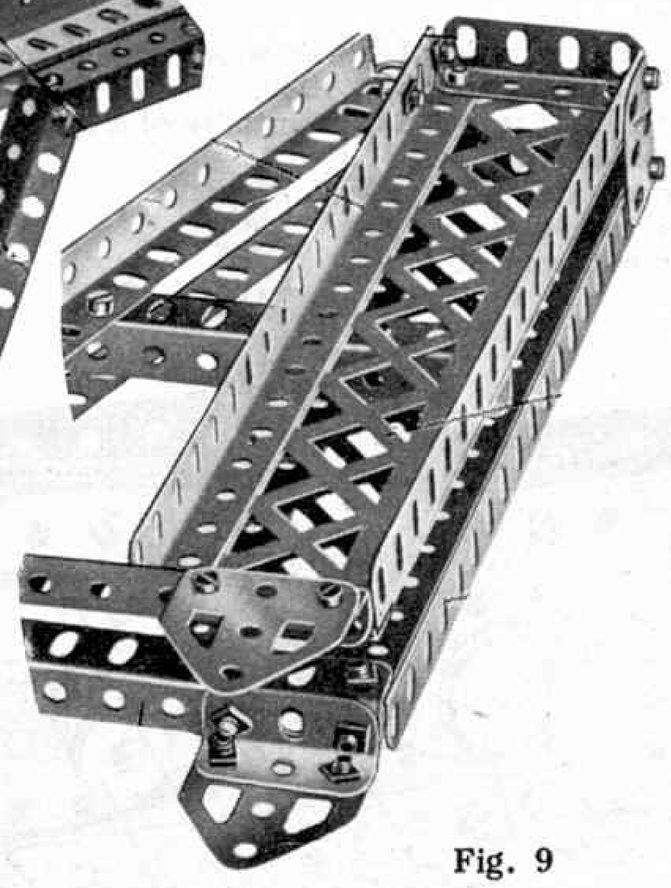


Fig. 9

Two excellent examples of Meccano construction are illustrated in Figs. 8 and 9, the subjects being sections of the Giant Block-setting Crane (Special Instruction Leaflet No. 4). Fig. 8 shows a portion of the travelling gantry, viewed from underneath, while Fig. 9 is a detail view of one of the four columns that support the gantry. It will be noticed that the upper horizontal girders, which have to withstand considerable bending stresses, are of the " I " type, similar to that shown in Fig. 7 but larger. The supporting columns are in reality large rectangular girders; note the use of Braced Girders, which form two sides of the rectangle and serve to strengthen the corner Angle Girders.

Braced and Flat Girders

The Meccano Braced Girders (parts Nos. 97–100A) are not only very useful in building large structures, but are also very ornamental. They consist, in effect, of two parallel strips placed so that the opposite holes are 1½" between centres, and connected together by a series of diagonal ties and struts. They are beautifully made, the perforations being cleanly cut and rounded off so that there is no roughness or sharp edges. Until quite recently the parallel strips were left unconnected at the ends, but all Braced Girders now being made are finished off at the ends by a strip of metal at right angles to the sides, as will be seen in Fig. 3. This of course is a great improvement, as each Braced Girder now forms a complete unit in itself.

When connecting two Braced Girders together by overlapping, they should, wherever possible, be overlapped an odd number of holes, so that the diagonals coincide. If they overlap an even number of holes the diagonals of one Girder appear between those of the other, and the result is not so neat or realistic. The uses of Braced Girders will be obvious and a detailed description of them is not necessary therefore.

Flat Girders (parts Nos. 103–103K) are used principally in connection with Angle Girders in building up large girders. Several of their uses in this connection have already been mentioned (see Figs. 6, 7 and 11). In appearance they resemble an Angle Girder flattened out, and like the latter, they are perforated with one row of round holes and one row of elongated holes.

Good use of Flat Girders is made in various parts of the Meccano Dragline (Special Instruction Leaflet No. 27). For example, each of the four-wheeled bogies upon which this model runs, consists primarily of two 3½" Flat Girders connected together by Double Brackets in such a way that their round holes can be used as bearings for the wheel axles and gearing, etc.

An interesting demonstration of the value of the elongated holes in the Meccano Girders will also be found in this model. The compensating beam, which is pivoted at a central point to the travelling base and is mounted across the rear pair of bogies, consists of an I–shaped girder similar to that shown in Fig. 7. Since the strain on this girder is at a maximum at its centre and diminishes towards the ends, in practice it is made deeper at the centre than at the ends, and this shape has been reproduced very closely in the Meccano model, owing to the fact that the play allowed by the elongated holes enables the lower flanges of the I–girder to be placed on a slant.

Girder Frames and Circular Girders

Part No. 113, Girder Frame, may be likened to a large Trunnion. It consists of a strip perforated with eleven holes, at the centre of which, and at right-angles to it, is a piece 1¼" long supported by two diagonals. The part is clearly shown in Fig. 3. It is particularly useful for bolting to the sides of Meccano wagons, etc., to form bearings for the axles, and it can be used to form journal bearings in many other types of model. It also has a certain ornamental value, as is shown by the Meccano model Flyboats (Special Instruction Leaflet No. 33). In both the Single and Double Flyboats, Girder Frames are used as finishing pieces for the vertical A-frames which support the large revolving wheels.

Circular Girders (No. 143) prove useful wherever it is required to build a rigid circular structure. For example, two or more of these parts may be used as the " ribs " of a Meccano built-up boiler, a series of Strips being bolted round their circumference. (Incidentally, Hub Discs, part No. 118, could be employed equally well for this purpose, but these parts are included under Class N : Wheels, Pulleys, etc.)

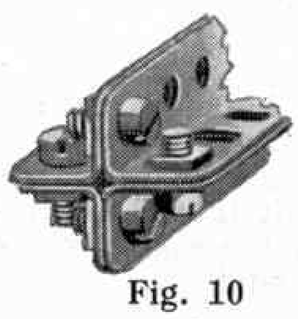


Fig. 10

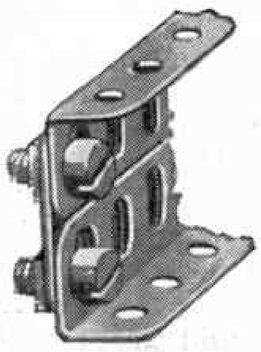
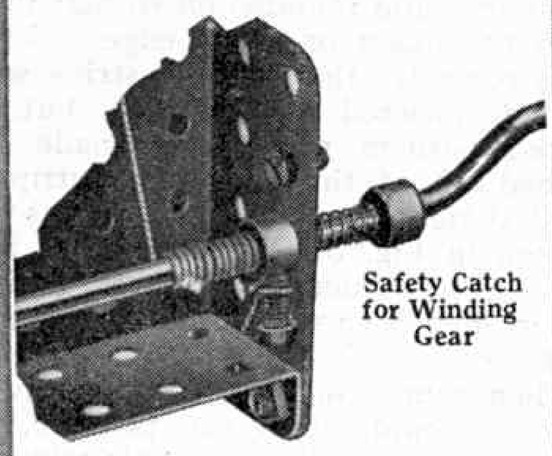


Fig. 11

Fig. 12

(*Continued on page* 133)



Safety Catch for Winding Gear

Suggestions Section

Edited by "Spanner"

(146)—Demonstration Model of "Servo" Motor Car Brake

(T. M. Cartledge, Harrow)

IN the case of the modern high power motor car some more efficient and reliable type of brake than that which depends upon the muscular efforts of the driver is almost indispensable, if not from the motorist's point of view, then certainly from that of the poor harassed pedestrian! Several efficient types of brake that are operated partly by the driver and partly by the engine, are now fitted to the higher priced cars, and are known by the general name of "servo" brakes. Perhaps one of the most interesting is the Dewandre power-braking mechanism, a system in use on Daimler cars.

A detailed description of this type of brake was given in the "Story of the Motor Car" (see September, 1928, "*M.M.*"), from which it will be remembered that it consists essentially of a system of levers working in conjunction with a cylinder and piston. Immediately the brake pedal is moved, a valve is opened placing the cylinder in communication with the induction pipe of the engine, with the result that a vacuum is created in the cylinder on one side of the piston only. Hence the piston is sucked into the cylinder, and its movement actuates the brake pull rods. The latter are interconnected with the brake pedal by means of a compensating lever, so that whatever pressure is applied to the pedal, considerably greater pressure is applied by the vacuum cylinder. Aided by a brake of this kind, the driver can bring the fastest and most powerful car to a standstill in a remarkably short distance.

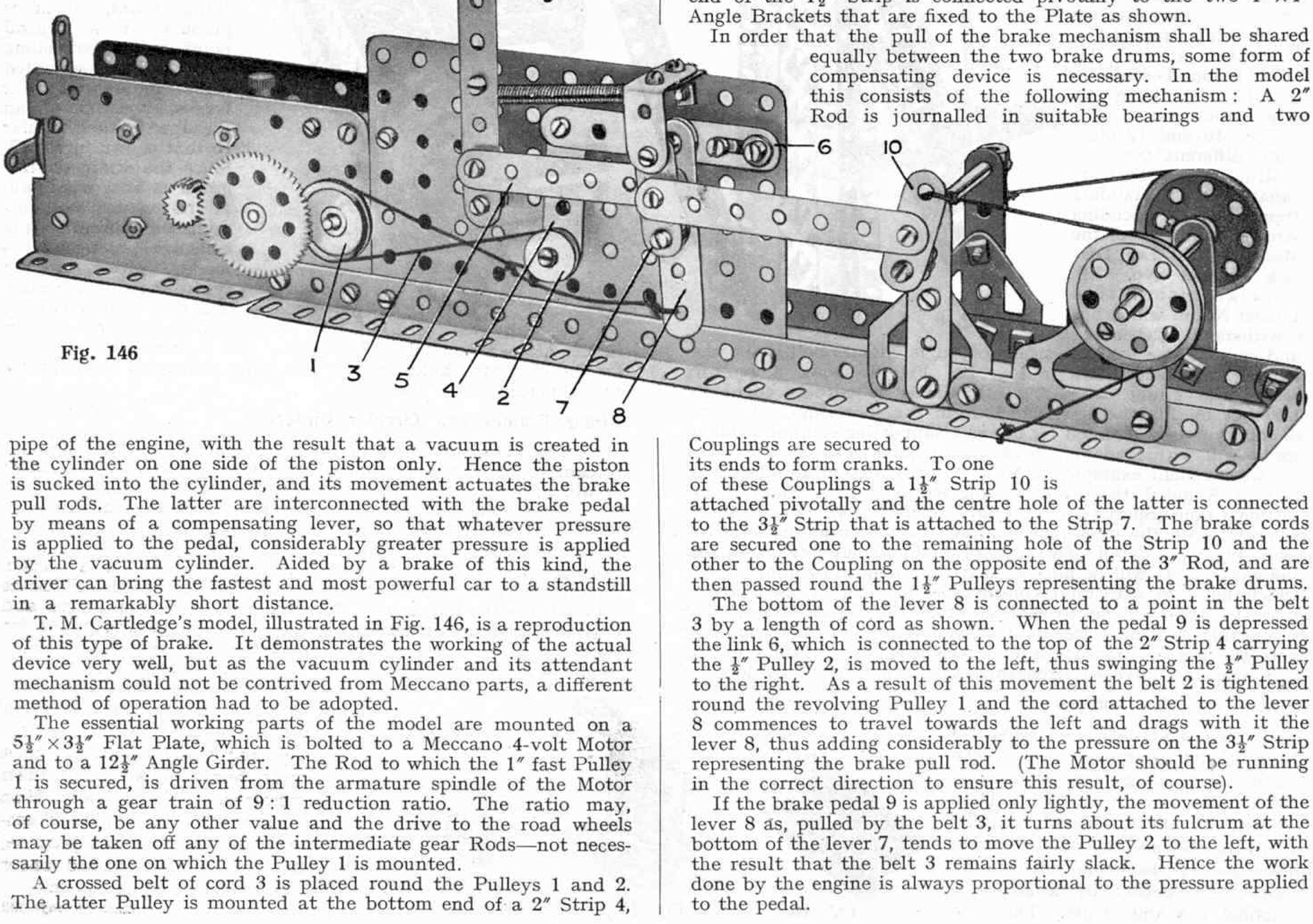


Fig. 146

T. M. Cartledge's model, illustrated in Fig. 146, is a reproduction of this type of brake. It demonstrates the working of the actual device very well, but as the vacuum cylinder and its attendant mechanism could not be contrived from Meccano parts, a different method of operation had to be adopted.

The essential working parts of the model are mounted on a $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate, which is bolted to a Meccano 4-volt Motor and to a $12\frac{1}{2}''$ Angle Girder. The Rod to which the 1" fast Pulley 1 is secured, is driven from the armature spindle of the Motor through a gear train of 9 : 1 reduction ratio. The ratio may, of course, be any other value and the drive to the road wheels may be taken off any of the intermediate gear Rods—not necessarily the one on which the Pulley 1 is mounted.

A crossed belt of cord 3 is placed round the Pulleys 1 and 2. The latter Pulley is mounted at the bottom end of a 2" Strip 4, which is mounted pivotally on a $\frac{3}{8}''$ Bolt passed through its third hole from the bottom and secured to the Flat Plate; a Washer is placed on the bolt behind the Strip for spacing purposes. To the upper end of the Strip is attached pivotally by means of a lock-nutted bolt a link 6 composed of a 2" Strip and a 2" Slotted Strip bolted rigidly together. A $\frac{3}{8}''$ Bolt is inserted in the slot of the Slotted Strip and two Washers are placed on its shank. The bolt is then secured to the Plate by double nuts and spaced so that the Strip can slide freely on its shank. A stop, consisting of a bolt, nut, and Washer, is secured in the slot to limit the movement of the link.

Pivoted to the link 6 in the position indicated is a $2\frac{1}{2}''$ Strip 8 to which, in turn, is pivoted the 3" Strip 5 that forms the connecting link between the Strip 8 and the brake pedal 9. A $1\frac{1}{2}''$ Strip 7 also is connected pivotally to the Strip 8 by a $\frac{1}{2}''$ Bolt in the bottom hole of the former Strip, a Collar and Washer on the shank of the bolt being used for spacing purposes. The upper end of the $1\frac{1}{2}''$ Strip is connected pivotally to the two $1'' \times 1''$ Angle Brackets that are fixed to the Plate as shown.

In order that the pull of the brake mechanism shall be shared equally between the two brake drums, some form of compensating device is necessary. In the model this consists of the following mechanism: A 2" Rod is journalled in suitable bearings and two Couplings are secured to its ends to form cranks. To one of these Couplings a $1\frac{1}{2}''$ Strip 10 is attached pivotally and the centre hole of the latter is connected to the $3\frac{1}{2}''$ Strip that is attached to the Strip 7. The brake cords are secured one to the remaining hole of the Strip 10 and the other to the Coupling on the opposite end of the 3" Rod, and are then passed round the $1\frac{1}{2}''$ Pulleys representing the brake drums.

The bottom of the lever 8 is connected to a point in the belt 3 by a length of cord as shown. When the pedal 9 is depressed the link 6, which is connected to the top of the 2" Strip 4 carrying the $\frac{1}{2}''$ Pulley 2, is moved to the left, thus swinging the $\frac{1}{2}''$ Pulley to the right. As a result of this movement the belt 2 is tightened round the revolving Pulley 1 and the cord attached to the lever 8 commences to travel towards the left and drags with it the lever 8, thus adding considerably to the pressure on the $3\frac{1}{2}''$ Strip representing the brake pull rod. (The Motor should be running in the correct direction to ensure this result, of course).

If the brake pedal 9 is applied only lightly, the movement of the lever 8 as, pulled by the belt 3, it turns about its fulcrum at the bottom of the lever 7, tends to move the Pulley 2 to the left, with the result that the belt 3 remains fairly slack. Hence the work done by the engine is always proportional to the pressure applied to the pedal.

(147)—Useful Aerial-Earth Switch

(H. Rose, Sheffield)

The novel switch shown in Fig. 147 makes an excellent aerial-earthing switch for wireless sets. When the 'phones are placed on the hooked end of the switch arm, the aerial is automatically connected direct to the earth and static charges in the aerial can pass to earth without causing damage to the set.

Essentially the switch consists of a pivoted arm 1 composed of a 2½″ Strip and a 2½″ small radius Curved Strip, mounted pivotally on a 3″ Rod 2. This Rod is mounted in the flanges of the 5½″ × 2½″ Flanged Plate forming the base, the switch arm being passed through the slot in the Plate. One of the contacts consists of a Double Bent Strip 4 which is carefully insulated from the Plate by means of Insulating Bushes and Washers on the 6 B.A. retaining Bolts 6, and is connected by a short length of insulated wire to one of the three terminals, the shank of which must be insulated from the Plate. This terminal should be connected to the earth lead (near the earth end) by a suitable length of wire. The various connections of the switch are clearly shown in Fig. 147a, which is a rear view of the device.

The second contact 3 consists of a ½″ × ½″ Angle Bracket carrying a bolt that is arranged to make contact with the switch arm 1 when the latter is pulled upward by the tension of a length of Spring Cord. This contact is secured to the Plate by an insulated 6 B.A. Bolt 5 (Fig. 147a), which is connected to one of the terminals. This terminal is insulated and is connected to the aerial terminal of the set, whilst the third terminal, which is not insulated, is attached to the aerial lead-in.

As soon as the 'phones are lifted off the hook, the switch arm is pulled upward by the Spring Cord into contact with the bolt on the Bracket 3, thus connecting the set with the aerial system.

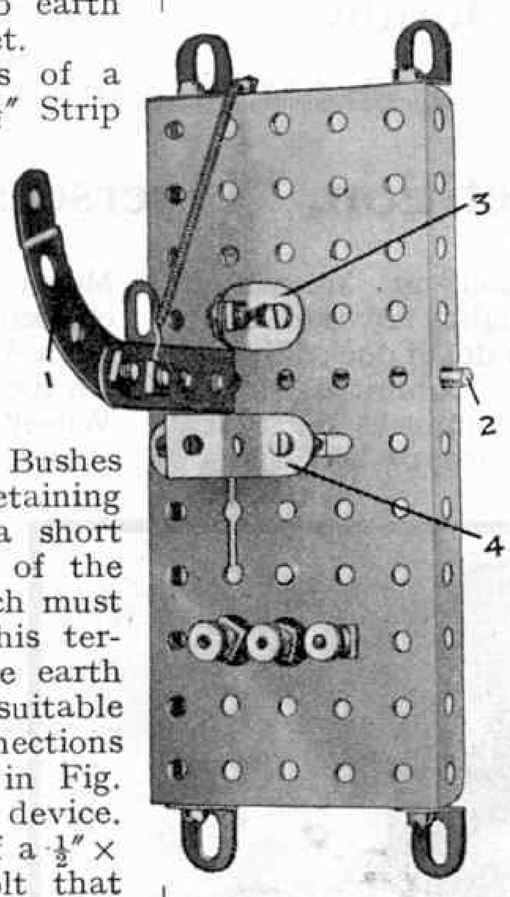


Fig. 147

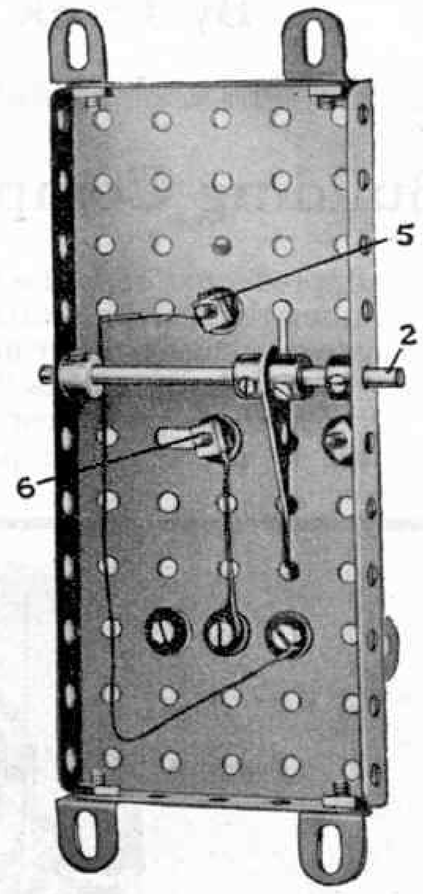


Fig. 147a

(148)—Novel Electric Game

(Donald Currie, Withington, Manchester)

The ingenious little model shown in Fig. 148 will be welcomed, we hope, by a large number of readers of all ages. It is designed on the lines of a sideshow attraction that may be seen at many country fairs, and in which the visitor is cajoled into throwing a coin on to a table covered with electrical contacts. If he is lucky (the odds are, of course, against him!) the coin comes to rest across certain contacts, a bell rings and a lamp bearing a number is illuminated. He then receives a prize, the value of which varies according to the number shown.

Fig. 148 shows the finished model whilst Fig. 148a is a diagram of the electrical connections. The panel on which the contact studs—ordinary Meccano bolts—are mounted is composed of a piece of cardboard.

The studs are connected together by lengths of copper wire in such a manner that they form two distinct electrical circuits 1, 2 (Fig. 148a). One end of the circuit 1 is brought to the bolt that secures the 2″ Strip carrying the Lamp Holder 5, and one end of the circuit 2 is taken to the insulated terminal 4. The Lamp Holder is attached to the 2″ Strip by a 6 B.A. Bolt, the shank of which is insulated from the Strip by an Insulating Bush. The base of the Lamp Holder must be in electrical contact with the 2″ Strip and hence the Bush must be on the reverse side of the Strip. The projecting end of the 6 B.A. Bolt is provided with a terminal 3 by means of which connection may be effected with the Meccano 4-volt Accumulator; the other terminal of the latter is connected to terminal 4.

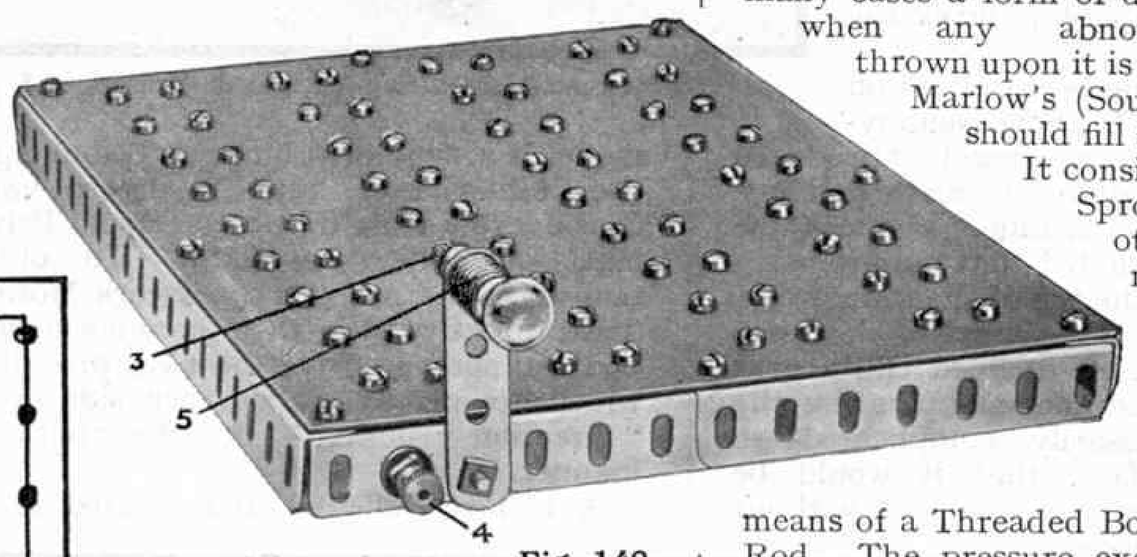


Fig. 148

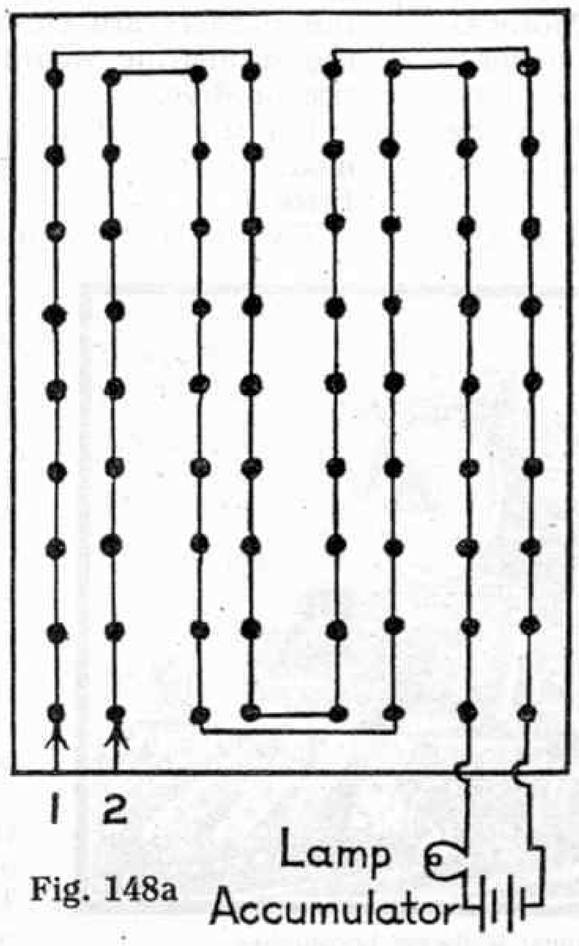


Fig. 148a

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.33). Escapement Mechanism.—An escapement wheel proposed by M. Couchman (Bognor) consists of a number of Flat Brackets bolted to a Face Plate, and projecting beyond its periphery at an angle. The pallet mechanism comprises a Crank with a 2½″ Strip bolted at right angles to its end hole and two ½″ × ½″ Angle Brackets attached to the ends of the Strip. Such an arrangement should prove quite effective, but we do not think it holds any advantages over the Meccano escapement described under Standard Mechanism No. 88.

(M.34). New Clutch.—A clutch suggested by R. Ogden (Manchester) consists of a ¾″ Contrate Wheel and a Pinion of similar size, the teeth of the latter interlocking when desired with those of the Contrate. This forms an effective clutch when other parts are not available but the Meccano Dog Clutch is of course more compact and reliable.

(M.35). Realistic Model-building.—Keen Meccano boys will be interested in J. B. Scoucroft's (Torquay) account of the way in which he builds most of his models. He points out that it is much more fun and more realistic to hoist the girders, etc., into place with the aid of a derrick or crane. To quote his own words: "I not only get the fun of building the models themselves, but also the satisfaction of having constructed them exactly as their prototypes would have been constructed. Many other appliances may be used besides cranes, such as jacks and conveyors, and trains to convey material to the site. Naturally the bigger the Outfit the more lifting tackle, etc., can be made without running short of parts with which to build the model."

(M.36). Slip Clutch Chain Wheel.—In many cases a form of drive that will slip when any abnormal strain is thrown upon it is very useful and P. Marlow's (Southampton) device should fill a much felt want. It consists essentially of a Sprocket Wheel or other similar part running freely on a Screwed Rod, and an Eye Piece, which may be forced against the face of the Sprocket by means of a Threaded Boss on the Screwed Rod. The pressure exerted by the Eye Piece may be modified to suit various conditions of working by altering the position of the Threaded Boss on the Rod. The Wheel is restrained from longitudinal movement by a Collar on the Rod on the side remote from the Eye Piece.

(M.37). Winding Clockwork Motors.—J. E. Garrett, of Coulsdon, finds that in some cases the Clockwork Motor may be wound more easily if the key is left in place on the winding spindle of the Motor and Meccano Rods of any length are connected to it by means of a Strip Coupling and led to a more convenient operating position on the model, where they terminate in a suitable handle. This is quite a good plan but it would probably be necessary to file flats on the Rods wherever Couplings, etc., are secured.

Results of Meccano Model-Building Contests

By Frank Hornby

"June" Model-Building Competition, "Overseas" Section

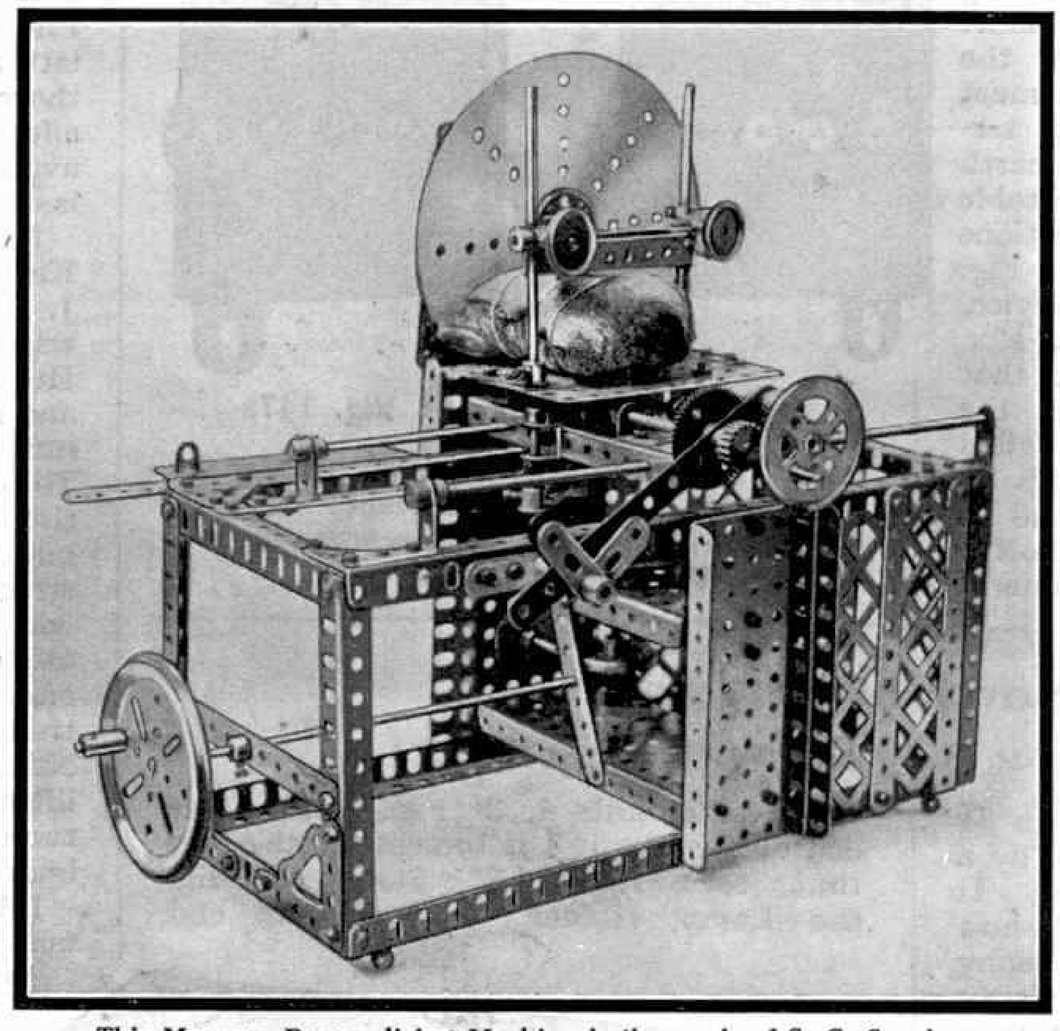
THE fact that Meccano model-builders are never "hard up" for ideas for their models is shown by the variety of subjects chosen by entrants in this section of the "June" Contest. The prizes have been awarded as follows:—

FIRST PRIZE (cheque to value £3-3s.): awarded jointly to A. J. Scherpenhuyzen, Jr., and H. D. Segaar, The Hague, Holland. SECOND PRIZE (cheque to value £2-2s.): Vincenzo Gatti, Cairo, Egypt. THIRD PRIZE (Tie; each competitor will receive cheque to value £1-1s.): Roger Frey, Barcelona, Spain; Ernest Smith, Montreal, Canada.

SIX PRIZES, each consisting of Meccano products to the value of 10/6: J. L. Aguilar, Barcelona, Spain; A. Hobart, Minneapolis, Minn., U.S.A.; Denis S. Lake, Bendigo, Victoria, Australia; J. Butler, Wynberg Cape, S. Africa; S. G. Couch, Napier, New Zealand; C. Clinton, Palmerston North, New Zealand.

TWELVE PRIZES, each consisting of Meccano products to the value of 4/6: C. Poirer, Montreal, Quebec, Canada; B. W. Monk, Adelaide, S. Australia; O. Barabino, Geneva, Switzerland; J. M. Willats, Sydney, Australia; O. M. Baron, Madrid, Spain; C. A. Quadri, Villamil, Buenos Aires, Argentine; Ian Macdonald, Sale, Victoria, Australia; Mario Cesari, Savona, Italy; Hugh Robertson, Wellington, New Zealand; Ian Johnstone, Hastings, New Zealand; Boey Pak Yeng, Kedah, F.M.S.; R. Tamblyn, London Canada.

SPECIALLY COMMENDED (Certificate of Merit and Standard Mechanisms Manual): W. L. Holcroft, East London, S. Africa; F. Blundy, Burwood E.13, Victoria, Australia; A. Pilgrim, Leederville, Australia; S. Foreman, Ontario, Canada; Frank Van Bulck, Paris, France.



This Meccano Bacon-slicing Machine is the work of S. G. Couch

The First Prize has been carried off by two Dutch boys, A. J. Scherpenhuyzen and H. D. Segaar, who together produced an excellent model of an automatic delivery "coin-in-the-slot" machine. The machine has been so constructed that upon placing a coin in a slot at the top of the framework, a box of matches or a packet of chocolate is delivered down an inclined chute near the base. The mechanism operating the machine is necessarily complicated—so complicated, in fact, that it would be useless to attempt describing it without sectional illustrations, but as a really efficient slot machine would form both an interesting and at the same time really useful model, I am taking steps to have such a model prepared. Doubtless it will follow very closely the design submitted by these two Dutch Meccano inventors.

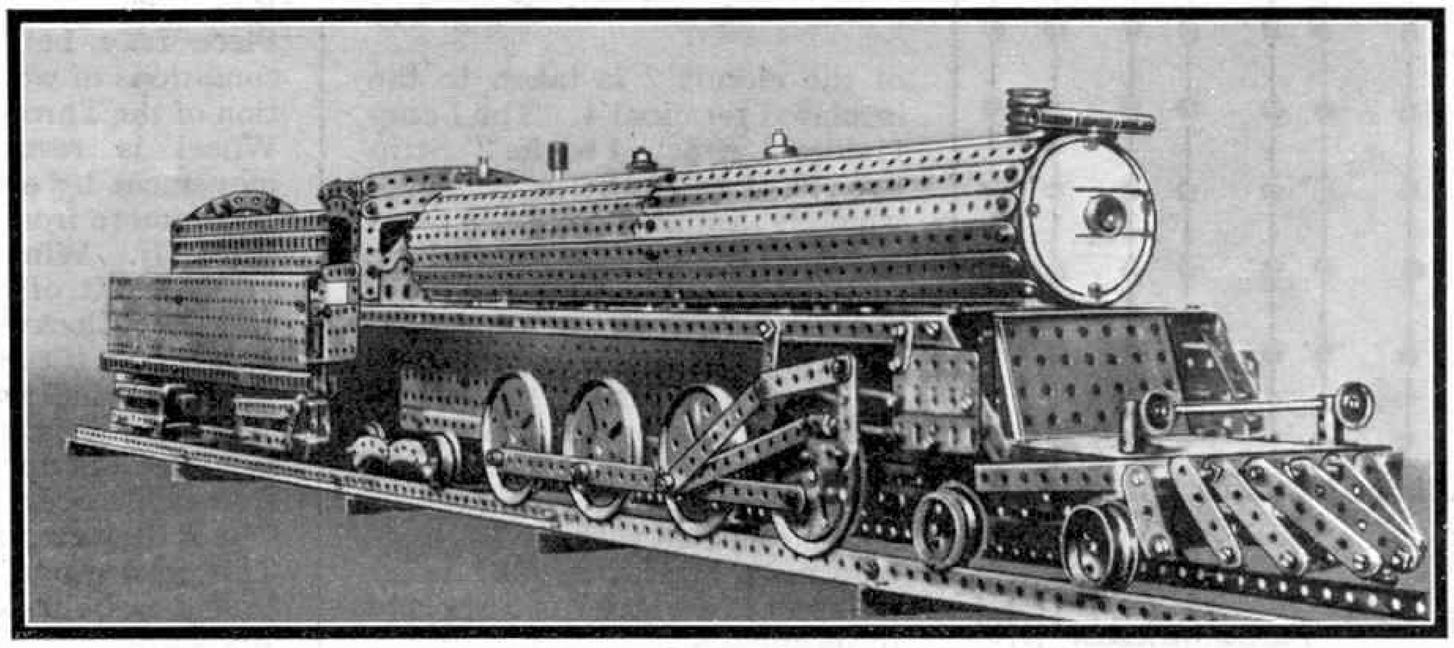
It is generally admitted that there are a few (a very few!) mechanisms in the engineering world that are not particularly adapted to reproduction in Meccano. Submarines, I had thought, fall into this category, but a clever model of one of these "mechanised fishes" submitted by Vincenzo Gatti almost convinces me that this is not so. The prototype of Gatti's model is a type of submarine belonging to the Italian navy, and its design varies considerably from that of the usual British type of underwater craft. To obtain realism in the model a Clockwork Motor is fitted directly below the "conning-tower" and arranged to drive the twin propellers, which are placed one on each side of the "direction rudder," in the following manner.

A 1″ fast Pulley is first secured to the Motor shaft and is coupled, by means of a crossed belt, to a second 1″ Pulley mounted in an Axle Rod journalled in the framework. On the lower end of this Rod a 1½″ Contrate Wheel is secured and meshes with a ½″ Pinion attached to a shaft running lengthwise in the hull and carrying one propeller devised from two Double Arm Cranks. A similar Rod carrying a second propeller is journalled in a corresponding position on the other side of the vessel and is rotated by means of cord that passes over Flanged Wheels mounted upon both Rods.

The direction rudder of this interesting model is controlled from the conning tower, the control wheel consisting of a 1″ Sprocket, behind which is placed a 1″ fast Pulley. Cord placed over this Pulley passes around two ½″ loose Pulleys that act as guides, enabling the cord to be carried down the hull and then round the groove of a second 1″ fast Pulley secured to the rudder post. The blade of the rudder consists of a 3½″ Flat Girder. The depth rudders (which have been ingeniously devised from Windmill Sails) are also controlled from the conning tower, the control lever consisting of a 3½″ Strip pivoted at its lower end and connected to a 57-teeth Gear Wheel by a link attached to one of the radial holes of the Gear. The rudders themselves are bolted to Cranks that, in turn, are secured to a Rod carrying a ½″ Pinion meshing with the 57-teeth Gear. Hence, on moving the lever located in the control tower backwards or forwards, the rudders are elevated or lowered and the submarine would consequently either rise or dive.

For the excellence of the design of this model, Gatti has been awarded the Second Prize.

Two extremely novel models tied for Third Prize. One is a funicular railway, submitted by Roger Frey. The main portion of the model comprises the power house containing the winch that draws the cars up the inclined ropeway. The platform from which the passengers step into the cars is raised one storey, and in order not to inconvenience patrons by making them walk up a flight of stairs, a lift is fitted. The motor driving the winch can also be used



An impressive photograph of J. Butler's model Canadian National Railways Locomotive

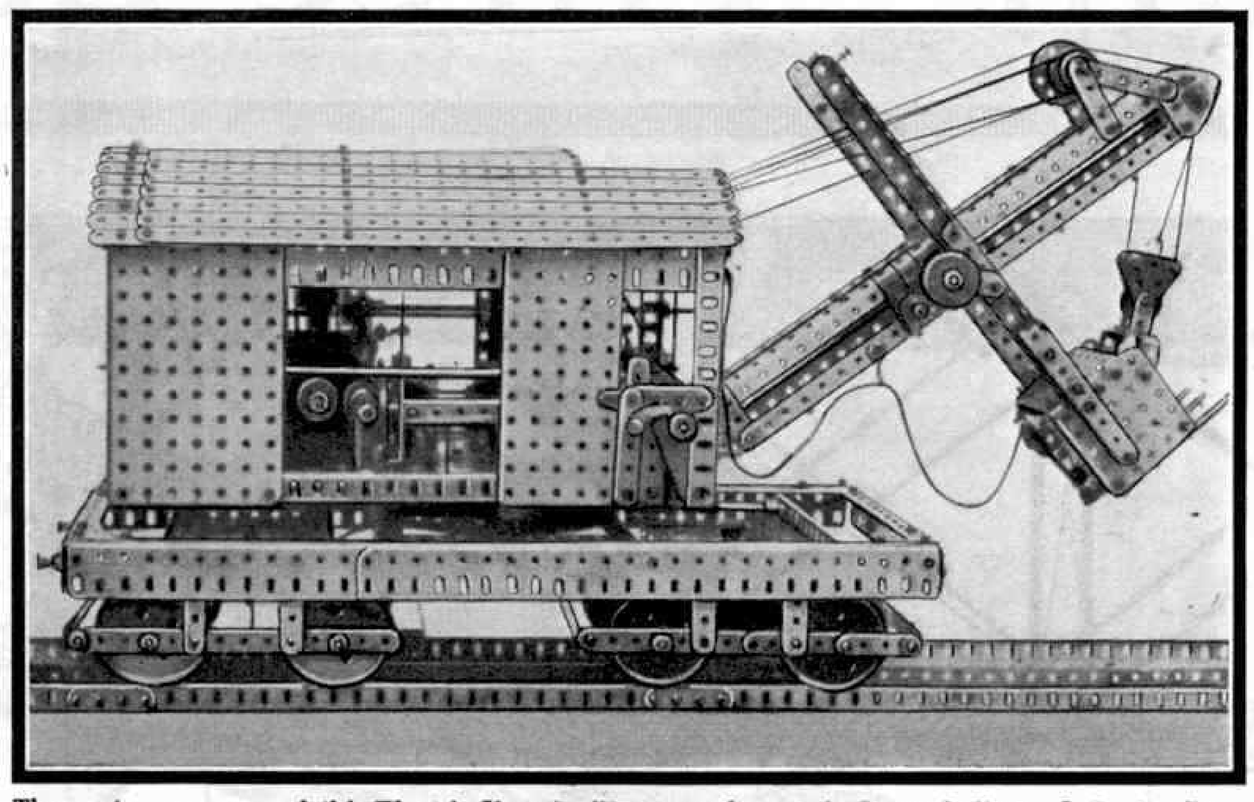
for hauling the lift up and down. The model is adequately lit by two large electric lamps situated in the roof of the power house.

None the less interesting is the model of the "*Mayflower*" constructed (with the exception of the sails) entirely from Meccano parts, by Ernest Smith. Models of old-fashioned ships have, as readers will no doubt know, recently become very popular for indoor decoration purposes, but while numerous publications have issued instructions for building these models from similar materials from which the actual vessels themselves were constructed (wood, iron and cloth), few have hit upon the idea of using Meccano sets for the purpose! Nevertheless it would be difficult to conceive a more graceful piece of work than the model submitted by Ernest Smith.

Peeping from "gun ports" in the sides of the hull formidable weapons can be seen, each consisting of a number of Double Angle Strips slipped on to Axle Rods and tipped with ½" fast Pulleys, which indicate the characteristic "flare" of the muzzles of the old carronades with which a ship such as the "*Mayflower*" was fitted. An addition that is not altogether in keeping with the other refinements of the model is a miniature Canadian Ensign proudly flying from the tip of the mainmast! However, the significance of the voyage of the "*Mayflower*" with the colonisation of Canada is such that there is ample excuse for the use of the more modern flag. One point in the model that attracted me particularly was the steering wheel that works the crude and clumsy rudder of this historic craft. It consists of a "spider" removed from a Universal Coupling, and fitted with four Threaded Pins. The wheel is mounted in the "pilot house" built on the mizzen deck and is coupled to the rudder post by Sprocket Gearing.

Turning now to a more modern (and speedier!) form of propulsion, a glance should be taken at D. S. Lake's reproduction of the Supermarine S5 Seaplane, winner in 1927 of that much-prized trophy, the Schneider Cup. It is unnecessary for me to go into a description of the machine as it is already well known to "*M.M.*" readers and they will be able to form their own opinions of the merits of Lake's model. I feel sure their verdict will be a favourable one!

The model of "Mountain" class Canadian National Railways engine, constructed by J. Butler, is illustrated on the preceding page. The model has an impressive appearance, but I think it would have been improved if some form of flanged wheel had been used instead of the 3" Pulleys for the driving wheels, for the grooves of the Pulleys tend to bind on the rails. Personally, I would have built the model to a slightly smaller scale and used flanged wheels built up from Face Plates and Wheel Flanges bolted together, as in the two model locomotives shown in the 4-7 Instruction Manual (models Nos. 716 and 732). The placing of the steam chest and valve gear might also have been improved slightly. If these alterations were carried out the final effect would be really excellent.



The neat appearance of this Electric Shovel will at once be noted. It was built by J. L. Aguilar

Another particularly fine model was the electric navvy built by J. L. Aguilar and illustrated on this page. Meccano boys will note the extremely neat appearance of this model and the almost entire absence of gears, etc., on the outside of the cab and boom. To construct a model that includes all the necessary functions of its prototype and at the same time has a realistic and tidy appearance, is no simple task and much credit is due therefore to Aguilar.

One of the many charms of Meccano model-building is that the work is not restricted to any particular scale. The constructor may build, say, a bridge 60" or 6" long, just as his fancy pleases. It is not easy to incorporate a large amount of detail in a 6" model, however, without coming up against certain difficulties. Nevertheless, Andrew Hobart achieved considerable success in building a tiny steam shovel, little over 6" overall!

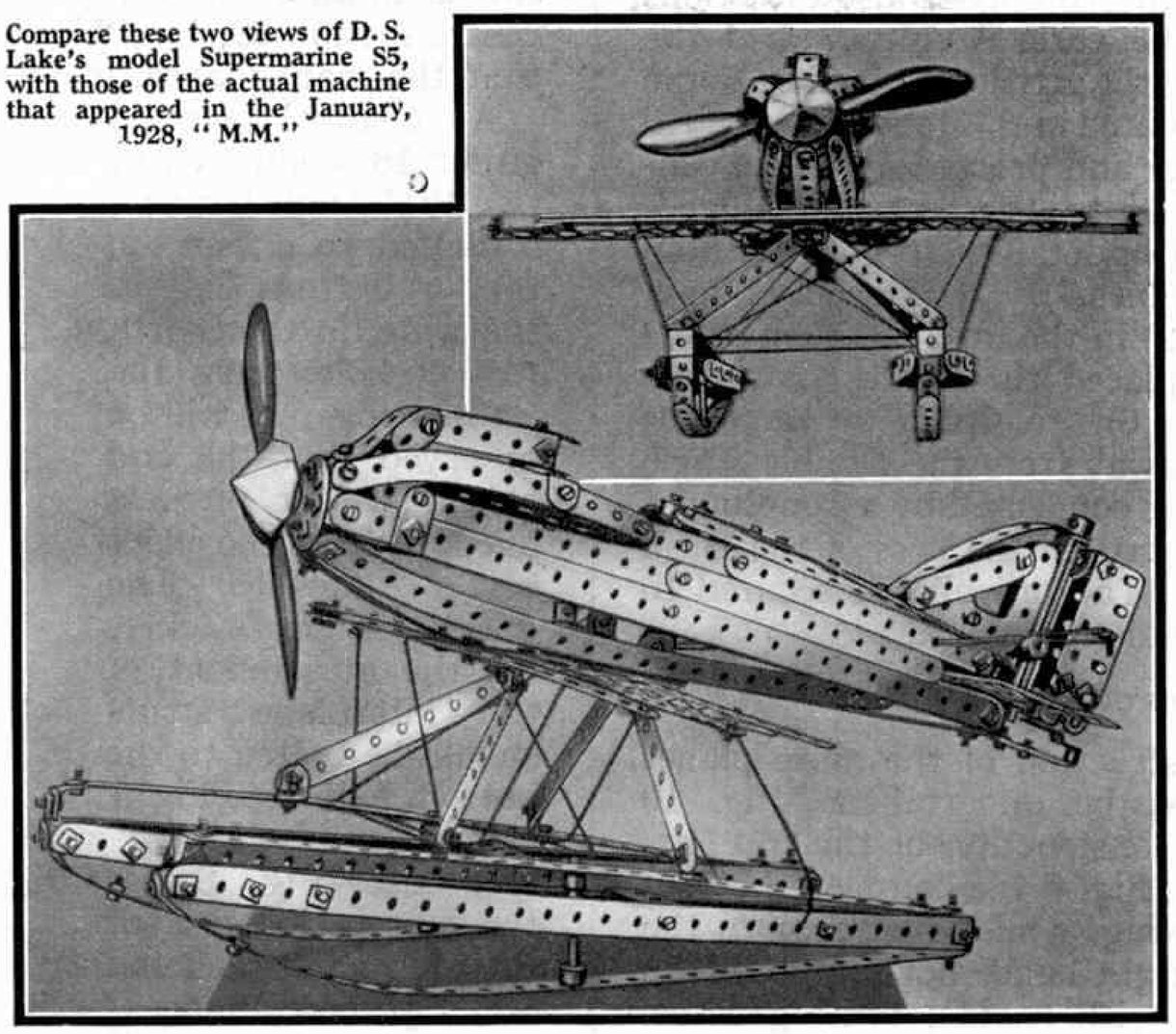
The model includes such features as controls for the boom and shovel arm, a tiny representation of the steam cylinder and connecting gear (it actually revolves when the crank handle is turned) and caterpillar track that constitutes the travelling movement of the complete model. For the digging bucket, 1½" Double Angle Strips bolted to 1½" Strips are used, whilst the cab that "houses all gearing, etc." (a ¾" Pinion and a 50-teeth Gear Wheel) consists of three 2½" × 2½" Flat Plates.

The "engine" is perhaps the **most** ingenious detail of all. It consists of a Coupling pivotally attached to one side of the cab, and in its bore slides a 2" Axle Rod carrying at one end a Collar that in turn, is secured pivotally to a second Coupling that forms the crank. The caterpillar traversing mechanism consists of four ¾" Sprockets, over which are placed two lengths of Sprocket Chain. A Worm Wheel does service for a chimney in this ingenious model, and is secured to the top 2½" × 2½" Plate forming the cab roof.

A visit to the family grocer's is generally an irksome undertaking but even this can be interesting to the Meccano boy if the store is equipped with a bacon slicing machine. It is fascinating to watch the carriage of the machine carrying the bacon quickly backwards and forwards, while the circular knife cuts off slice after slice with remarkable precision! S. G. Couch did not stop at looking on, however, but built one of these machines in Meccano, and an illustration of it appears on opposite page.

The mechanism whereby the carriage is given an oscillating motion consists of a Face Plate rotated by means of the hand wheel, and having a Strip bolted to it, the other end of the Strip being attached pivotally to a second Strip bolted to the bacon carriage.

Compare these two views of D. S. Lake's model Supermarine S5, with those of the actual machine that appeared in the January, 1928, "M.M."



Correction

Readers will no doubt remember the excellent model of the "Bluebird" Racing Car entered in the "May" Contest, Overseas Section (the results of which appeared in the January issue). The racing car model was the joint work of three Dutch Meccano boys, namely K. Voure, J. H. v. Gilse and R. Verkade, but unfortunately only Verkade's name was mentioned in connection with the model and we offer our apologies to the boys whose names were not mentioned. The prize was awarded jointly to all three boys, of course.

A Striking New Meccano Model:

Giant Three-Engine

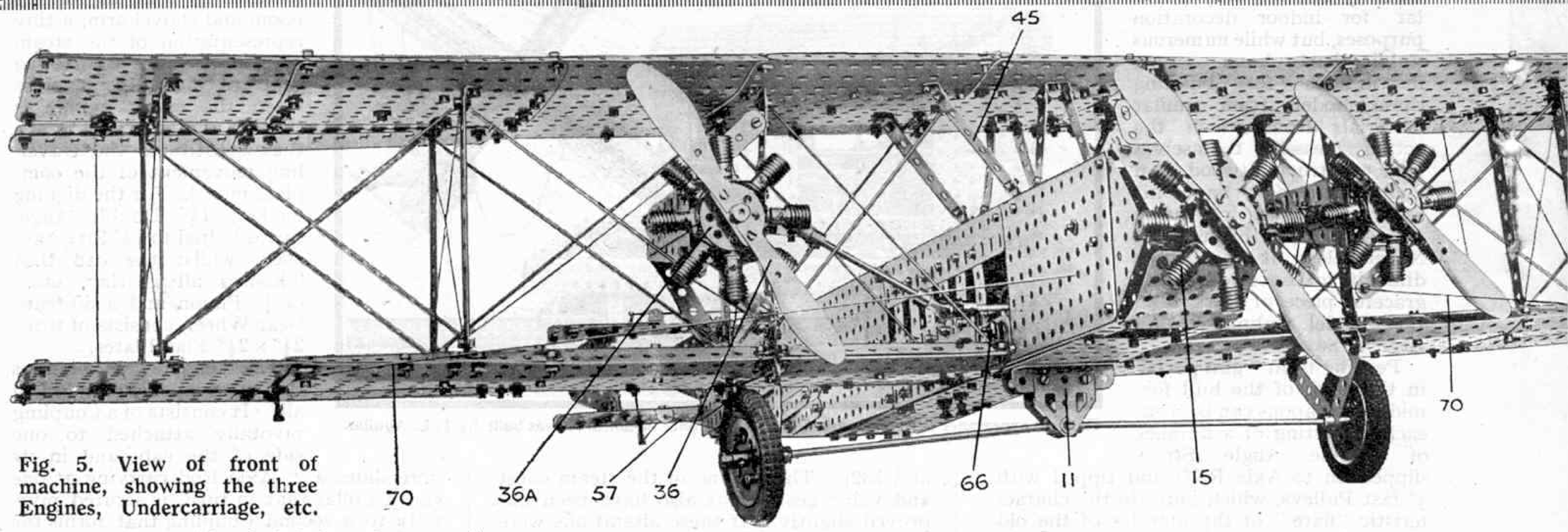


Fig. 5. View of front of machine, showing the three Engines, Undercarriage, etc.

(Concluded from last month)

IN this article we conclude the detailed instructions for building the Meccano model Three-engine Biplane.

In last month's "*M.M.*" we described the erection of the fuselage and tail unit and explained the principles of operation of the rudder control mechanism and joystick. The present article includes instructions for building the main planes, engines, etc., and comprises also directions for the final assembly of the various units and of the aileron controls. In reading the article it should be borne in mind that Figs. 1 to 4 appeared in the January "*M.M.*"

Before leaving the fuselage and proceeding to the construction of the remaining units, the centre "engine" should be mounted in place (for details of its construction, see under "The Wing Engines"). It is secured to a Double Angle Strip 8 (Fig. 2) in the nose of the machine by means of two $\frac{1}{2}$" Bolts placed through the holes 29a in the Bush Wheel 35 (Fig. 6). A Collar on each bolt serves to space the engine away from the Double Angle Strip. The Rod 14 (Fig. 2) is connected by a Coupling to a $3\frac{1}{2}$" Rod that is free to rotate in the boss of the Bush Wheel 35. The propeller is secured to the outer end of this Rod.

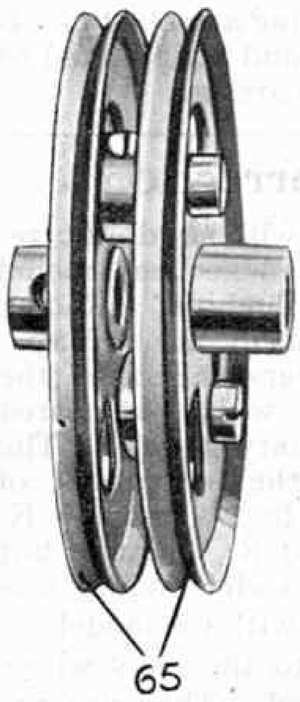


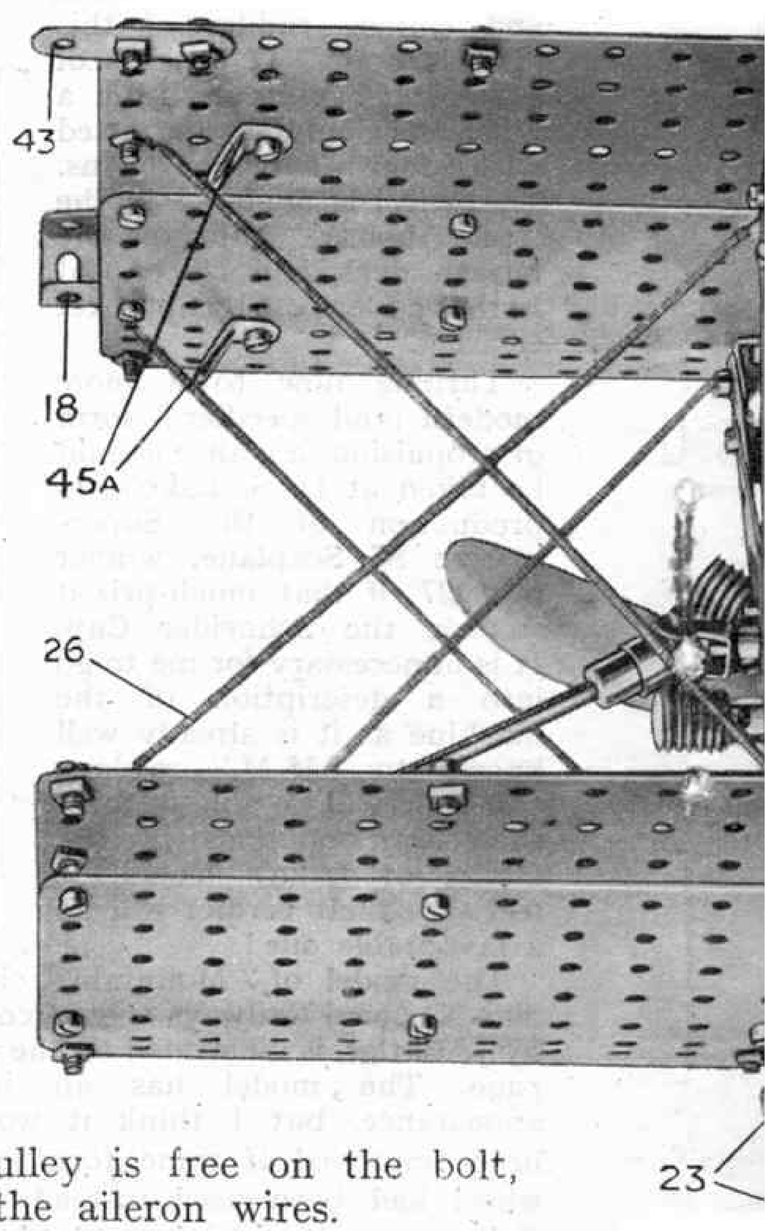
Fig. 7. One of the Landing Wheels, with tyre removed

Construction of the Main Planes

The construction of the main planes should next be undertaken. Fig. 10 shows the construction of the top left-hand wing, Fig. 9 the complete bottom left-hand wing, whilst Fig. 8 gives the complete right-hand bottom and top wing unit, with engine, bracing wires, and interplane struts.

To describe first the construction of the portions of the dissembled top wing shown in Fig. 10. As will be seen from the illustration it is double surfaced—a feature common to all the wings—each half consisting of six $5\frac{1}{2}$" $\times 3\frac{1}{2}$" Flat Plates and two $5\frac{1}{2}$" $\times 2\frac{1}{2}$" Flat Plates. The Plates 16 are overlapped two holes in the direction of their length and by the same amount in regard to their width. The Plates 17, however, are overlapped one hole in length and three in width. The edges of the $3\frac{1}{2}$" $\times 5\frac{1}{2}$" Flat Plates forming the leading edges of the top and bottom halves are curved slightly, so that when they are bolted together the complete wing has a streamline section as in an actual aeroplane wing. (The profile of the centre section 39, Fig. 2, gives a good idea of the shape that the main planes, in section, should present).

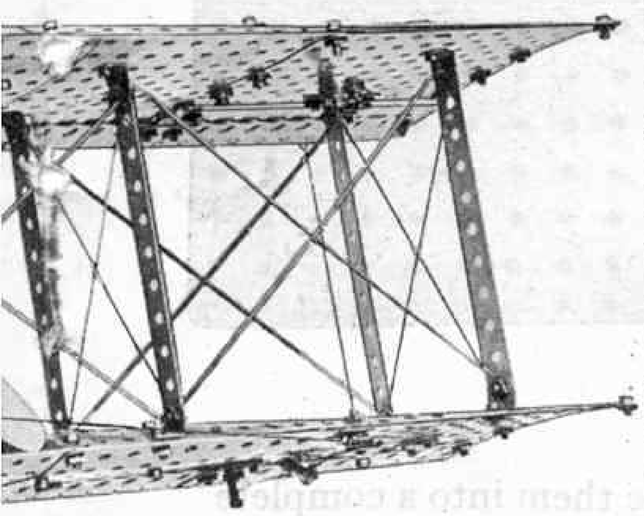
A channel section girder 18, composed of two $12\frac{1}{2}$" Angle Girders, is bolted to either the top or bottom half of the wing, in the fourth row of holes from the leading edge. It will be observed that the end of the Girder projects one hole from the edges of the Plates 16. The various Angle Brackets for the attachment of the interplane struts should be bolted to the bottom half (see Fig. 1 in last month's "*M.M.*," and also Fig. 8 for the correct location of these Angle Brackets), and a $\frac{1}{2}$" loose Pulley is attached to the top half by means of a $\frac{1}{2}$" Bolt that is held in place by nuts on each side of the Plate (see Fig. 1, January "*M.M.*"). The Pulley is free on the bolt, and serves as a guide for the aileron wires.



The two halves of the wing may now be bolted together,

Armstrong-Whitworth "Argosy" Type

Passenger Aeroplane



$\frac{3}{8}$" Bolts being used to draw the leading edges of the Plates together whilst ordinary bolts are used for the trailing edges of the Plates 16. The aileron 19, consisting of four $5\frac{1}{2}$" Flat Girders, is hung from the trailing edges of the $2\frac{1}{2}" \times 5\frac{1}{2}"$ Flat Plates 17 by means of Hinges 20. It will be found that when the two halves of the wing are fitted together there is a space between the trailing edges of the Plates 17. Therefore it is necessary to place four Washers—two on each side of the Hinge—on the $\frac{3}{8}$" Bolt 20a (see also Fig. 10). The Hinge nearest the tip is merely bolted direct to the top of the wing surface.

It should be apparent from the various illustrations that from the end of the $12\frac{1}{2}$" Angle Girders 18 the upper and lower wing surfaces taper towards the wing tips. In view of this, therefore, the curve on the Plates should gradually diminish toward the wing tips and such bolts that project inside the wings near the wing tips require their shanks to be shortened by placing Washers under their heads. The right-hand top wing is made in a precisely similar manner, of course.

As regards the construction of the lower wings the main features are the same as in the case of the top wings, but each one is only 5" wide as compared with the 6" of the top ones: they are also $\frac{1}{2}$" longer. The upper and lower surface of each bottom wing consists of four $5\frac{1}{2}" \times 3\frac{1}{2}"$ Flat Plates (Fig. 9) all overlapped one hole, thus giving the extra $\frac{1}{2}$" in length compared with the top wing. Two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plates are bolted to the trailing edges of the $5\frac{1}{2}" \times 3\frac{1}{2}"$ Plates at one end, overlapping the latter Plates by two holes in width.

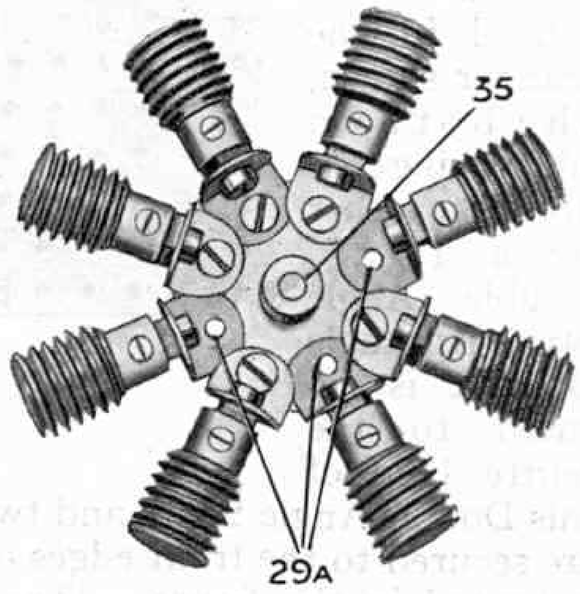


Fig. 6. One of the three Engines

The support 23 for the landing wheel axle consists of a 3" Strip and a $2\frac{1}{2}$" Strip, and is attached by $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets to the bottom surface of the wing. The Angle Brackets must be bolted to the wings before the latter are closed up, of course, a fact that should be borne in mind also with regard to the Angle Brackets to which the interplane struts are attached. The loose Pulley 22 is attached by means of a $\frac{1}{2}$" Bolt in the front row of the holes as shown in Figs. 5, 8 and 9.

The landing wheels each consist of two 2" Pulleys 65 (Fig. 7) that are held rigidly together by $\frac{1}{2}$" Bolts and nuts, a Collar on each bolt spacing the Pulleys the required distance apart. The wheels are shod with two 2" Dunlop Tyres, which are sprung in the groove formed between the two Pulleys in order to make them more secure.

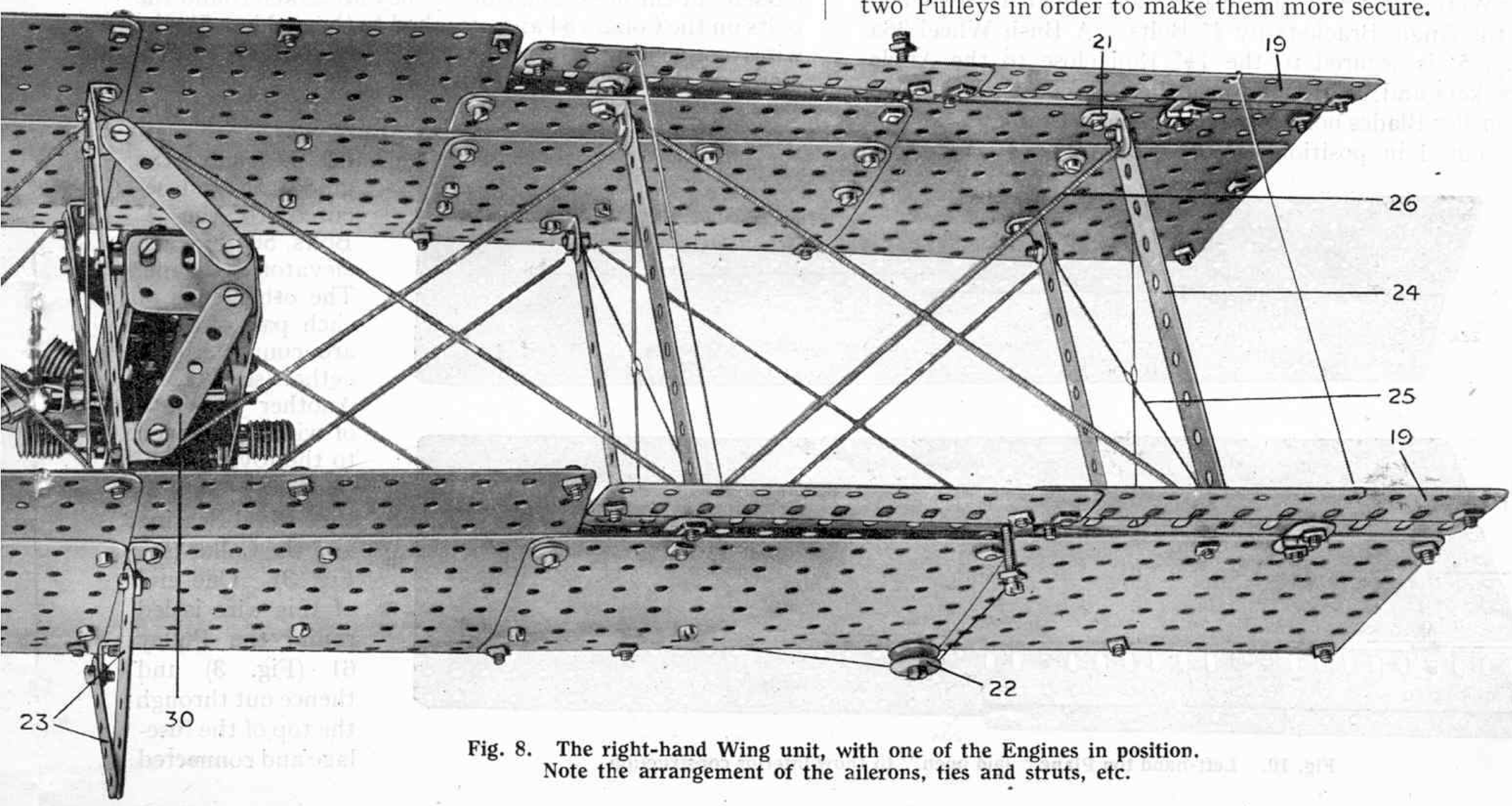


Fig. 8. The right-hand Wing unit, with one of the Engines in position. Note the arrangement of the ailerons, ties and struts, etc.

The Wing Engines

Each wing engine is housed in a nacelle or casing (Fig. 11) which is constructed as follows. The top of the nacelle consists of a $3\frac{1}{2}$" Flat Girder 27, to the edges of which two $3\frac{1}{2}$" Angle Girders are bolted. Each side consists of $3\frac{1}{2}$" Flat Girders arranged in the manner shown, the bottom edges being connected together by a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. An Angle Bracket is secured to the centre hole of this Double Angle Strip, and two further Angle Brackets are secured to the front edges of the side Flat Girders as indicated in the figure. Three $\frac{3}{8}$" Bolts 29 are bolted to these Angle Brackets.

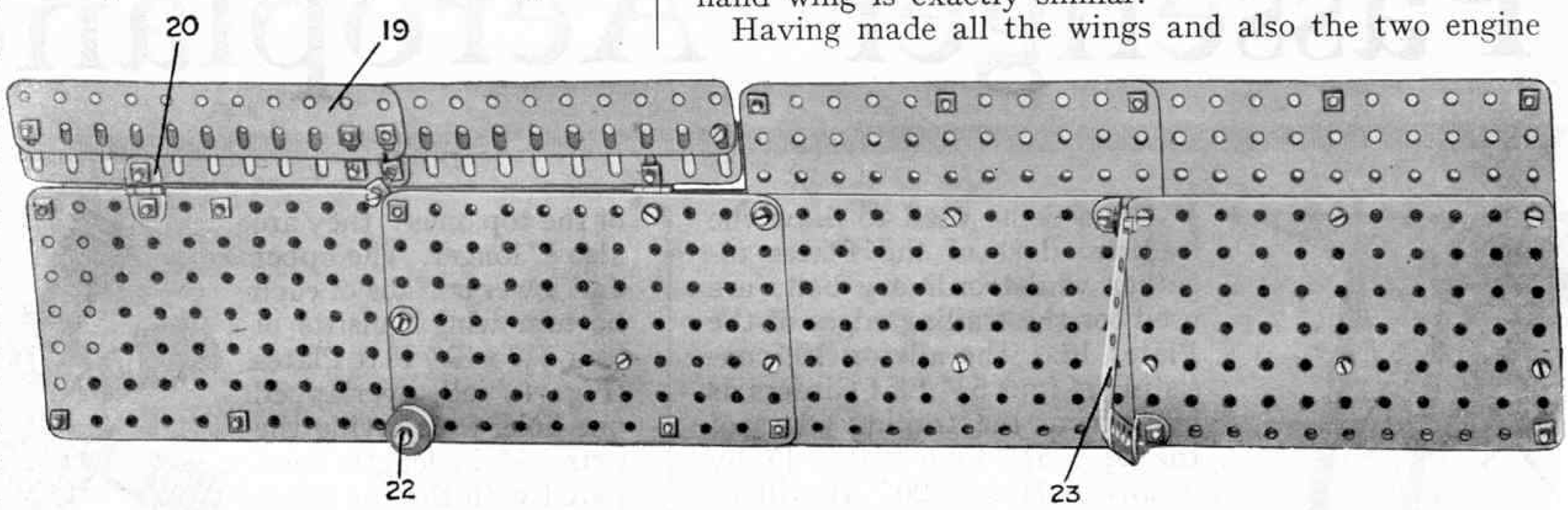


Fig. 9. Underside view of the left-hand bottom Plane

The back of the nacelle is formed by a $1\frac{1}{2}$" Flat Girder attached by Angle Brackets to the top of the nacelle (see Fig. 8). Two $2\frac{1}{2}$" Strips 30 are attached to the $1\frac{1}{2}$" Flat Girder, and two 2" Strips 32 are secured also by Angle Brackets to the front end. The nacelle is attached by the $\frac{3}{8}$" Bolts 31 to the $5\frac{1}{2}$" Strips 24 that form two of the interplane struts, two Washers being placed on each bolt for spacing purposes.

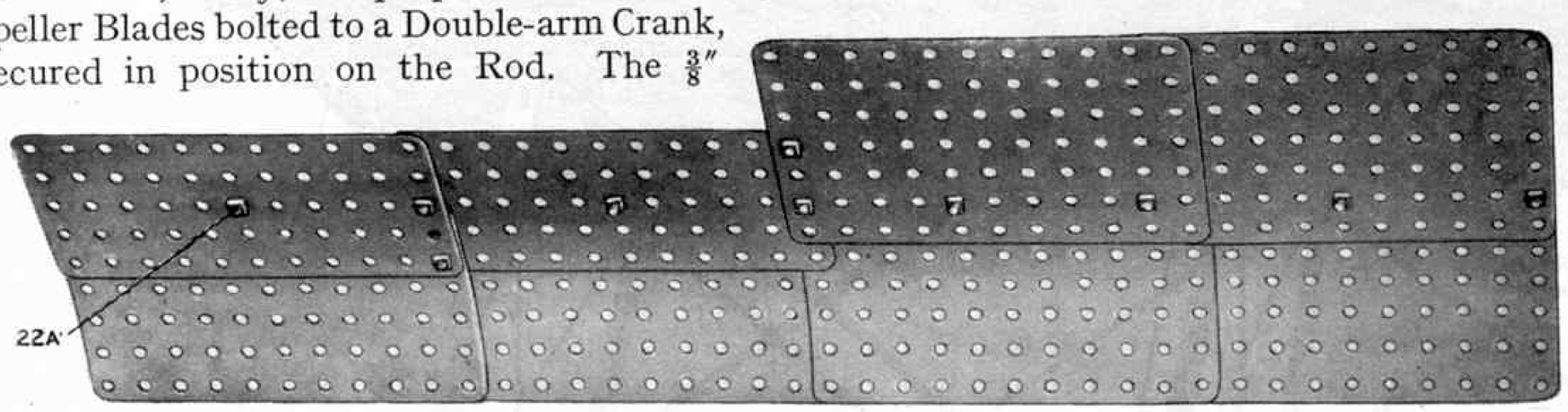
The 2" Rod 33 is journalled in the Flat Girders composing the sides of the nacelle, and carries a $\frac{7}{8}$" Bevel 34, which is intended to mesh with a second Bevel that is secured to a $1\frac{1}{2}$" Rod journalled in the centre hole of the Bush Wheel 35 (Fig. 6). Eight Angle Brackets are arranged round the periphery of the Bush Wheel and carry the Worms representing the cylinders, which are attached to the Angle Brackets by $\frac{3}{8}$" Bolts. A Bush Wheel 36a (Fig. 5) is secured to the $1\frac{1}{2}$" Rod close to the Angle Brackets and, lastly, the propeller 36, consisting of two Propeller Blades bolted to a Double-arm Crank, is secured in position on the Rod. The $\frac{3}{8}$" Bolts 29 bolted to the Angle Brackets on the nacelle are passed through the holes 29a in the Bush Wheel 35, nuts holding the latter in place. The left-hand wing engine nacelle is shown in Fig. 11; the other for the right-hand wing is exactly similar.

Having made all the wings and also the two engine nacelles it remains only to assemble them into a complete unit as shown in Fig. 8. The interplane struts 24 are attached to the Angle Brackets 21 by nuts and bolts, the latter serving also to secure the various "bracing wires." The Loom Healds 25 prevent fore and aft movement of the struts, whilst the Spring Cord 26 is intended to brace the planes in a vertical direction. The complete unit should now appear as in Fig. 8.

Erecting the Model

Having completed the various portions of the model it remains now to erect them in their respective positions. The first step is to attach the tail unit to the fuselage. It is bolted firmly to the Angle Brackets on the ends of the Strips 9 and to the Angle Brackets 10 at the end of the fuselage (Fig. 2) and should appear as in Fig. 1. Two wires 55 are now fixed to the rudder bar (one at each end), led along inside the fuselage for some distance, and then passed out through each side. They are taken round the bolts on the Collars 54 and attached to the rudders 51, the wires connecting all three together so that the movement of the rudders synchronise.

Short lengths of wire 57 are passed through the guides 58 and secured to the $\frac{3}{4}$" Bolts 56 on each elevator plane. The other ends of each pair of wires are connected together (see Fig. 1). Another length of wire is clamped to the joystick between the boss of the Swivel Bearing and the Collar (see Fig. 3). One end of this wire is led round the Pulley 61 (Fig. 3) and thence out through the top of the fuselage and connected



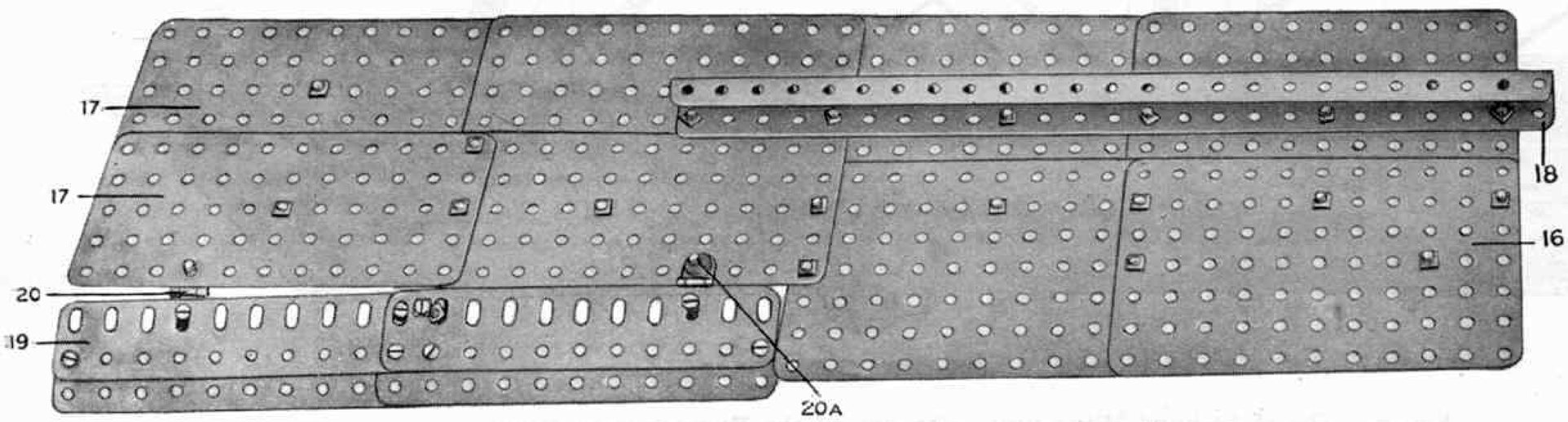


Fig. 10. Left-hand top Plane "laid open" to show interior construction

to the wire yoke 57 of the upper elevator (see Fig. 1), while the other end is taken directly to the yoke of the lower elevator. If the length of the wire 57 is adjusted correctly by means of " strainers " the elevators will rise and fall in accordance with the movements of the joystick. The elevators cause the actual machine to rise or dip whilst the rudders direct its course to left or right.

Attaching the Wing Units to the Fuselage

Each bottom wing has two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets bolted to its upper surface at the end nearest the side of the fuselage. These Brackets are slipped on to the $\frac{3}{8}''$ Bolts 66 bolted to the side of the fuselage (see Figs. 2 and 5). The projecting end of the Girder 18 (Fig. 8) should now be pushed into the centre section so that the Girder 18 is in line with the Girder 40 (Fig. 2), and the holes in the Girder 18 in line with those in the Plates 39 in order that a 1" Threaded Rod 18a (Fig. 1) may be passed through the holes. The Threaded Rod is retained in place by nuts on its ends. The trailing edge of each wing is connected to the Flat Girder 41 of the centre section by the Strip 43 (Fig. 8), and the ends of the Strips 45 bolted to the Angle Brackets 45a (Figs. 2, 5 and 8).

The ends of the landing wheel axles 11a are supported in the Strips 23: the landing wheels are placed on the ends of the axles and retained in place by Collars.

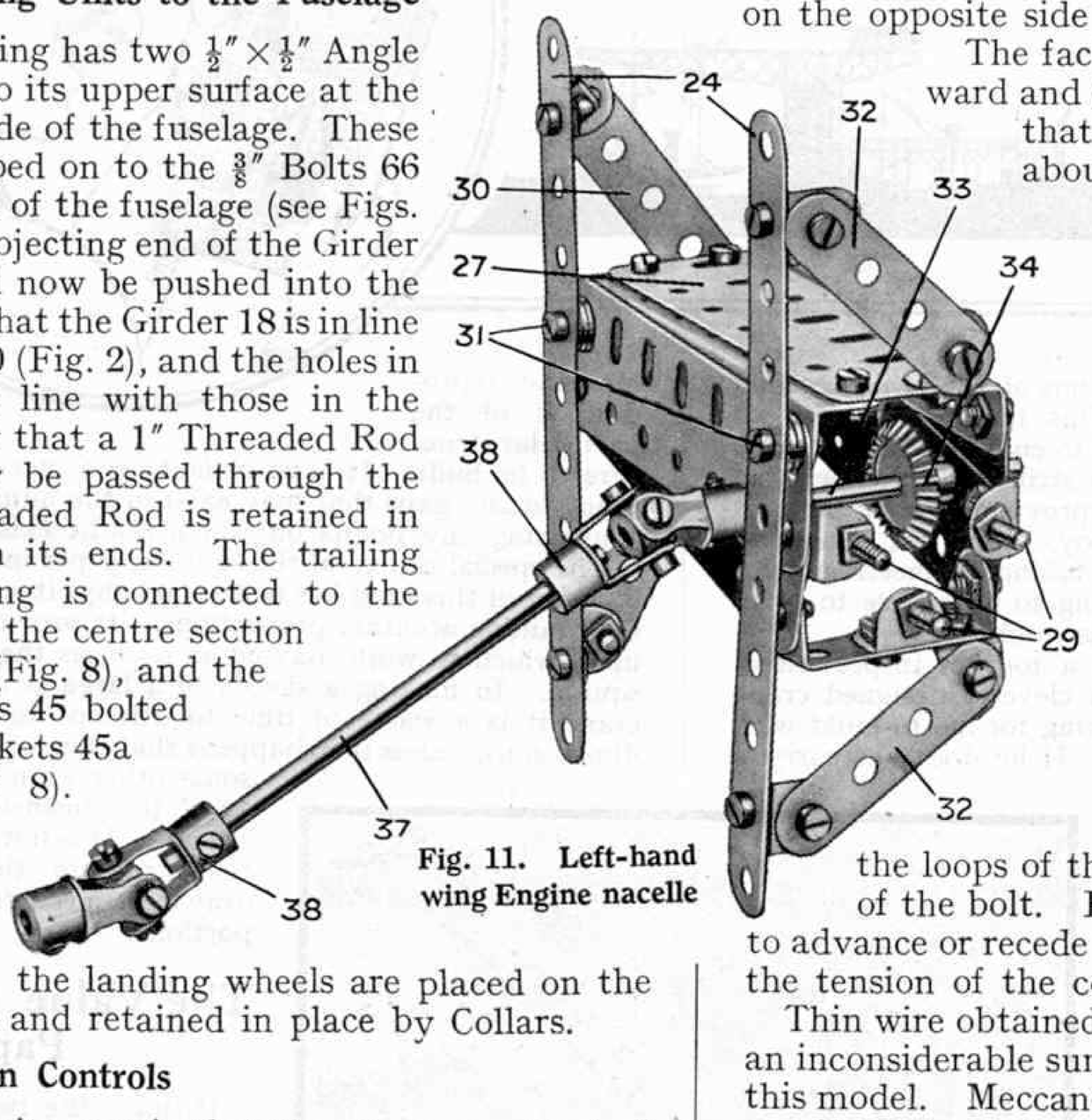


Fig. 11. Left-hand wing Engine nacelle

Fixing the Aileron Controls

Having made quite certain that the wings are attached securely to the fuselage, the next step is to connect up the ailerons with the joystick.

The top wing ailerons are connected together by a length of wire 70 (Fig. 1) that is attached to $\frac{3}{4}''$ Bolts secured to the trailing edges of the ailerons and passed round the $\frac{1}{2}''$ Pulleys on the top surface of the wings. The length of the wire is so adjusted by means of a " strainer " that it is taut when both ailerons are perfectly level in relation to the main plane surface and therefore parallel to each other.

The upper ailerons are connected by short lengths of wire 70 to the lower ailerons, to transmit the motion of the former to the latter. The length of these wires must be such that the upper and lower ailerons are parallel with one another.

A further length of wire 70 is attached to the bolt held in the end of the Coupling 62 (Fig. 3) and its ends are passed through the holes in the side Plates of the fuselage. Thence they are led round the Pulleys 22 on the bottom wing (Fig. 8) and fastened to the $\frac{3}{4}''$ Bolts that are bolted to the under surfaces of the lower ailerons. The length of the wires must be so adjusted by means of the strainers incorporated in each of them, that when the joystick is in a vertical position, the ailerons are level with the main plane surfaces. Therefore any side-to-side movement of the joystick should result in an up and down movement of the ailerons—those on one side of the machine moving downward whilst those on the opposite side move upward simultaneously.

The fact that one aileron is inclined downward and the other upward produces a couple that tends to roll the actual machine about its longitudinal axis. This is known as " banking," a manœuvre that is necessary when turning the machine in either direction. It is also necessary to operate the ailerons frequently while the machine is in flight, in order to maintain equilibrium and counteract sudden gusts of wind, etc.

Mention has been made of " strainers " incorporated in the various control wires to adjust their length, and hence their tension, very minutely. To make a suitable strainer, the control wire requiring such an addition is cut and a loop made on each of the cut ends. A $\frac{1}{2}''$ Bolt is passed through the loops of the wire and a nut placed on the end of the bolt. By turning the bolt the nut is made to advance or recede up the shank of the bolt, so altering the tension of the control wire.

Thin wire obtained from any ironmongers or stores for an inconsiderable sum is used for all the control wires on this model. Meccano Cord is not suitable, as it stretches considerably and would prevent satisfactory working of the model. Meccano No. 27 S.W.G. Bare Iron Wire (part No. 312) could be used very easily, however.

Driving the Wing Engines

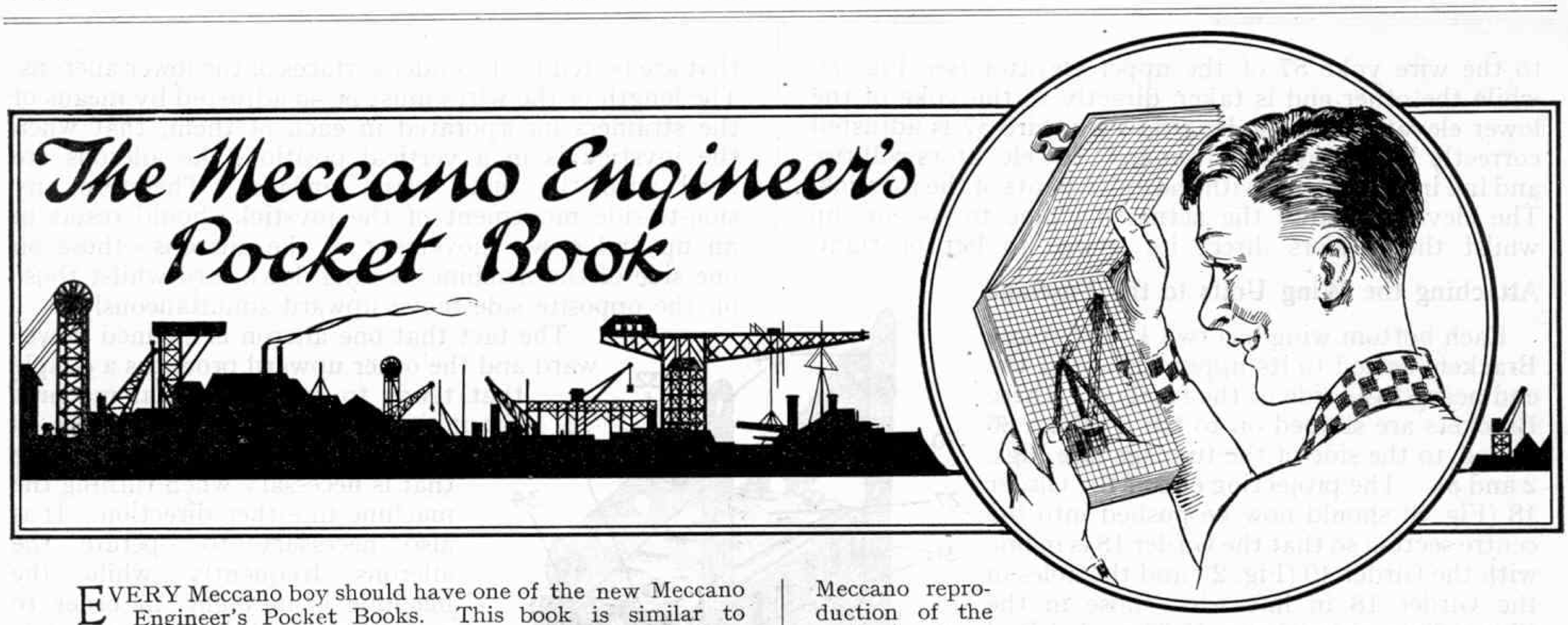
To connect up the drive from the Electric Motor to the wing engines, the Universal Couplings 38 (Fig. 11) are secured to each end of the Rod 13 (Figs. 2, 5). All three propellers are driven at the speed of the armature of the Motor, as the ratio existing between the various gears is unity. The Couplings 38 should be adjusted carefully so that the propellers turn quite freely.

Two terminals 67 are provided on the bottom of the fuselage (see Fig. 2) to form a convenient means of attaching the leads from a 4-volt Meccano Accumulator. The shanks of the terminals are 6 B.A. Bolts (part No. 304) secured to and insulated from the fuselage by 6 B.A. Nuts (part No. 305) with Insulating Bushes and Washers (parts Nos. 302 and 303). The terminals are connected to those on the Motor by short lengths of wire.

Parts required to build the Three-Engine Biplane :

6	of No.	1	12	of No.	8	2	of No.	15A	6	of No.	30	2	of No.	48A	2	of No.	82	7	of No. 103K
2	„ „	1A	4	„ „	9B	3	„ „	16	2	„ „	31	46	„ „	52A	12	„ „	101	9	„ „ 111
14	„ „	2	4	„ „	9D	2	„ „	16A	24	„ „	32	15ft.	„ „	58	18	„ „	103	3	„ „ 111A
2	„ „	3	2	„ „	9F	1	„ „	16B	489	„ „	37	8	„ „	59	2	„ „	103A	56	„ „ 111C
6	„ „	4	12	„ „	10	2	„ „	17	74	„ „	37A	5	„ „	62B	4	„ „	103B	20	„ „ 114
20	„ „	5	6	„ „	11	3	„ „	18A	2	„ „	37B	3	„ „	63	11	„ „	103D	2	„ „ 126A
18	„ „	6	86	„ „	12	4	„ „	20A	42	„ „	38	22	„ „	70	4	„ „	103F	4	„ „ 140
10	„ „	6A	2	„ „	13A	5	„ „	23	6	„ „	41	5	„ „	72	5	„ „	103G	1	„ „ 165
4	„ „	7A	1	„ „	14	6	„ „	24	3	„ „	48	3	„ „	76	3	„ „	103H	2	„ „ 302

2	of No.	303
2	„ „	304
2	„ „	305
2	„ „	306
8	„ „	312
1	Electric Motor	



EVERY Meccano boy should have one of the new Meccano Engineer's Pocket Books. This book is similar to that used by actual engineers to enable them to take a note or any engineering feature that strikes them as being of interest—possibly with a view to improving on it, or perhaps reproducing it. The Meccano boy, being an engineer himself, should adopt this habit of taking engineering notes and sketches of interest, for by doing so he is able to get a great deal more pleasure out of his hobby.

Supposing a Meccano boy is on a tour of inspection of some interesting docks, and that a cleverly designed crane catches his eye. "Just the very thing for me to build with my Meccano," he says to himself. If he does not carry a note book he tries to memorise the most important features of this crane, with a view to constructing a model of it upon his return home. In the majority of cases the memorising of engineering features in this manner leads to failure when the time comes for building them in Meccano. It is fairly easy to build a model that will perform similar functions to its prototype, but it is a very difficult matter indeed to reproduce from memory individual mechanical details.

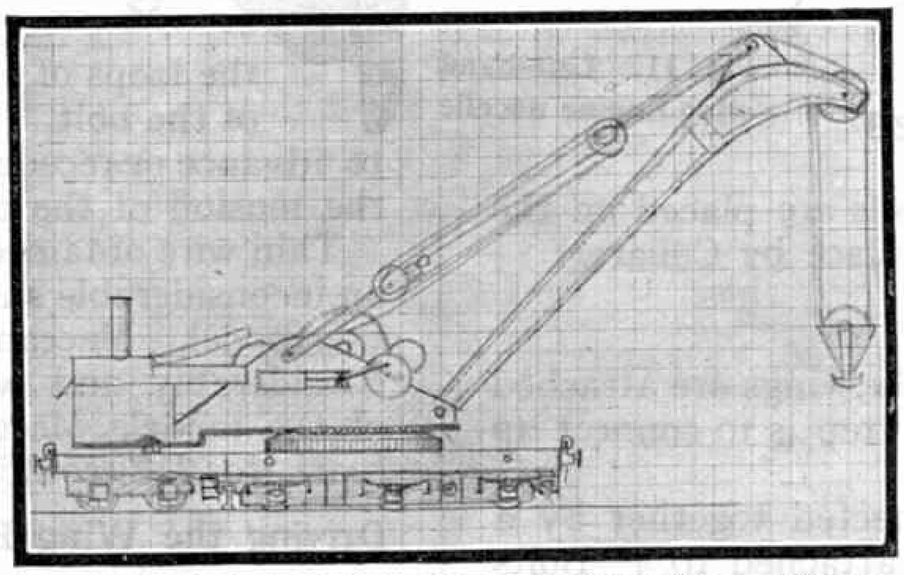
When faced with a problem of this kind, a real engineer would immediately take out his pocket book and set to work to sketch in it all the details that he would require in order to prepare later a practical working drawing. Meccano boys are in a position to do likewise if they always make a point of carrying a copy of the "Engineer's Pocket Book" about with them.

How to Use It

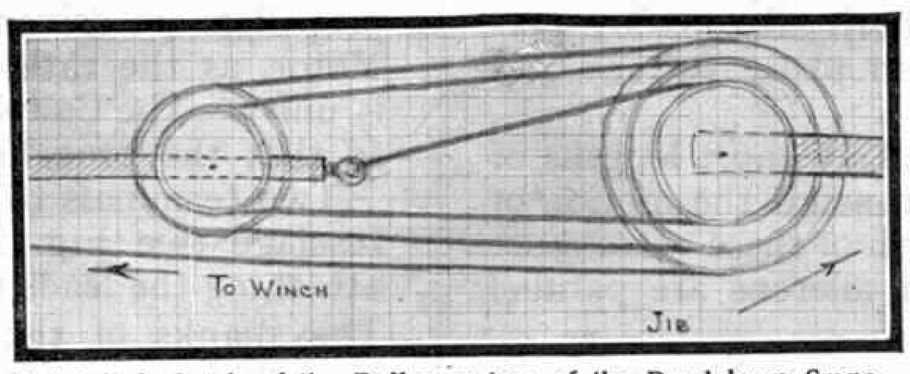
When a Meccano boy comes across an engineering subject that strikes him as being particularly interesting, he should make a sketch in his pocket book showing as clearly as possible its general outline. He should then give close consideration to any mechanical details that are at all complicated, and, having satisfied himself as to how they work, should make small sketches of all parts that appear to him difficult to remember. In addition, a few notes as to the general layout of the structure and its working details will subsequently be found of great value.

Many boys appear to be afraid of tackling a sketch of this kind because they feel that they have very little drawing ability. This is a mistake. It is quite obvious that the average boy who has had no training in draughtsmanship will not be able to turn out a work of art, but that does not matter in the least. A drawing of the type we are now describing is made for the sole purpose of enabling an accurate Meccano reproduction of the particular structure to be built. It acts, in fact, as a mechanical memory, filling in any gaps that may exist in the human memory and confirming any points on which doubt exists.

The special utility of the squared paper in making a rough drawing of this kind lies in the fact that it simplifies the task of obtaining accurate proportions. It provides a foundation upon which to work, having as its basis the unit of a single square. In making a sketch of a large structure such as a crane it is a waste of time to attempt to gauge its exact dimensions, unless it so happens that it can be compared with some other structure close by of which the dimensions happen to be known. It is not the exact size of the structure that matters for drawing purposes, but its proportions.



An example of a first sketch of a Railway Breakdown Crane. Although quite rough, it shows up all the most important details with sufficient clearness to enable a Meccano Model to be produced



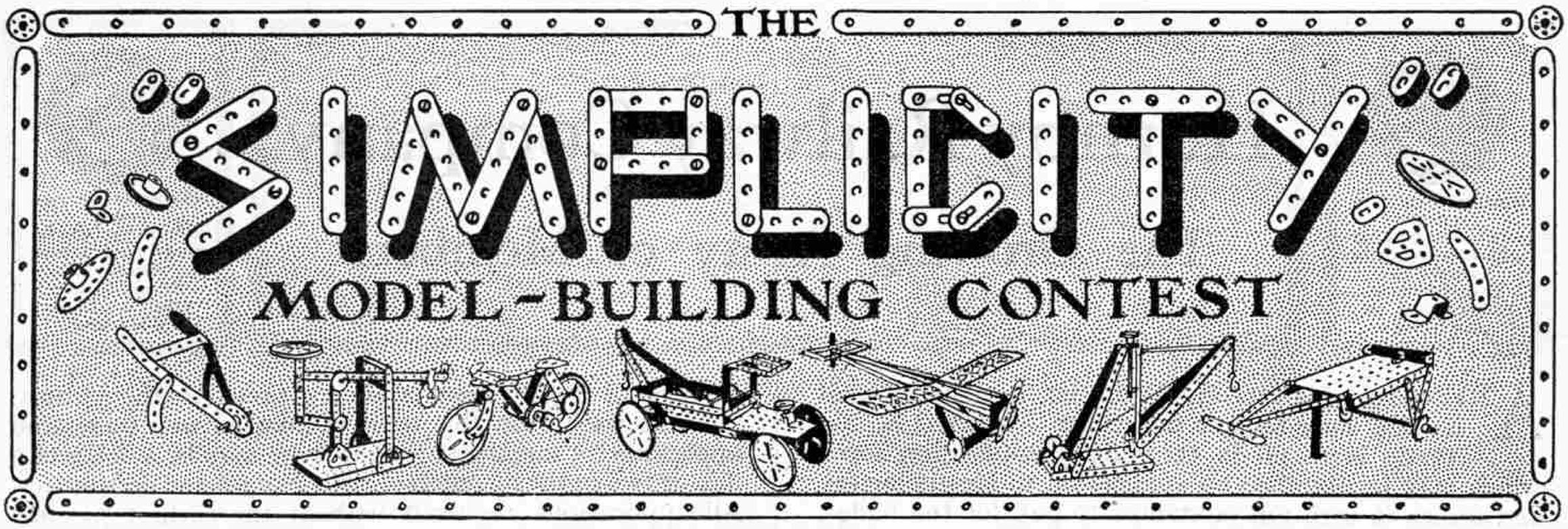
A detailed sketch of the Pulley system of the Breakdown Crane. This sketch was made to simplify the subsequent building of the model

The Value of Squared Paper

Perhaps the best way of commencing work is to fix upon some moderately small but prominent feature of the structure. A certain number of squares should then be decided upon as representing the size of this feature, and from this basis the remainder of the structure may be drawn with a very fair approximation to correct relative proportions. The old plan of making relative measurements by holding a piece of pencil in front of the eyes is quite useful in establishing the proportionate size of two parts of a structure, or how much smaller or larger they are than the feature taken as the standard for measurement. This may sound rather complicated, but after a few trials it is surprising how simple it becomes to transfer to squared paper the main outlines of any engineering structure that is not too elaborate, allocating three sections to one portion, six to another, and so on.

Meccano boys will find it a good plan to make their drawings to such a scale that the squares correspond to the Meccano standard equidistant holes. For example, it so happens that the length of the main frame members of the breakdown crane that we illustrate is equal to the width of approximately 25 squares. Hence, if it is decided to use $12\frac{1}{2}$ in. Angle Girders (25 holes) to form these members, it will be a very simple matter to choose the parts to represent the various other sections of the crane.

The Meccano Engineer's Pocket Book costs 1/3, post free, and will be sent on receipt of this amount in stamps. Write to Dept. 70, Meccano Ltd., Binns Road, Old Swan, Liverpool.



BIG PRIZES FOR SMALL MODELS

THE Model-building Contest this month has been organised on new and original lines and will form an interesting test for every Meccano boy who enters it, no matter what his age may be or how big the Outfit he possesses. The title of the Contest—"Simplicity"—has special bearing on the type of model that is to be entered.

In previous contests we have found that while many of the larger models submitted have been designed on efficient and practical lines, their construction was unnecessarily complicated. It is quite a common occurrence for even the best model-builders to err on the side of using too many parts, where fewer and simpler parts would fulfil the required functions efficiently, and to prove that the average Meccano boy can make good use of his inventive ability we are organising this contest.

The Importance of Resourcefulness

The engineer's true merit is best shown when he is endeavouring to construct a mechanism with a minimum of material or with parts that are not most suited to the purpose. Similarly the inventive genius of the Meccano boy will be more readily brought out when he is "up against it," that is, when he has not every desired article and implement at hand with which to construct his model.

Do not imagine, however, that, in entering this Contest you are restricted to any specified number of parts. You may use any number or variety of parts that you wish, but the prizes will be awarded to those boys who succeed in constructing the most ingenious models with the *smallest number of parts*. Neither should you think that this Contest is for the owner of a small Outfit only, as it is possible to employ in the construction of simple models and mechanisms many Meccano accessories such as Cranks, Gear Wheels, Couplings, etc., that are not to be found in the smaller Outfits. The competitor who submits the smallest model will not necessarily obtain the First Prize.

It is possible, of course, to bolt together two or three Strips and a few Pulleys, and call the finished model a motor car (or even an aeroplane!) but such a machine would have little chance of obtaining a prize! You should first choose a prototype and then build your model with the smallest number of Meccano parts consistent with a realistic effect.

There is another factor that gives every model-builder, no matter what his age, an excellent chance of carrying off a prize, and that is originality. Every Meccano boy has a certain originality, which he naturally expresses when he is designing and building his model. Hence, a long-experienced Meccano boy may submit an excellently designed and neatly constructed model, but the latest recruit to the Meccano family might quite easily hit upon a really novel idea for a model and carry off the prize! There is therefore quite an element of excitement in the contest, and we predict plenty of fun and friendly competition amongst model-builders.

Rules Governing Entry

When you have completed your model, the question arises as to what particulars and illustrations should be submitted. Whilst a good photograph is preferable to a drawing, it is far better to forward a clear drawing if the photos turn out indistinct or are too small to enable the essential features of the model to be discerned. It is usually advisable to submit a short description of the model, although in the case of a very simple model a description might be superfluous. Photos or drawings need not be your own work, but the model itself must be entirely the result of your own unaided efforts.

No entry forms are needed, but you must take special care to see that your name, address and age appear on the back of each sheet of paper or photograph that you submit, and also the Section in which your model is to be entered. Address the envelope containing your entry "Simplicity" Contest, Meccano Ltd., Old Swan, Liverpool.

Your photograph or drawings, if unsuccessful, will be returned provided that a stamped addressed envelope of the necessary size is enclosed. It should be noted, however, that photographs of prize-winning models become the property of Meccano Ltd.

More than one model may be entered in the Competition, but all entries from any single competitor must be sent under the same cover. No single competitor can win more than one prize; if he sends two or more models they will be considered jointly.

Entries will be divided into three Sections: Section A, for competitors over 14 years residing in Great Britain; Section B, for those under 14 years residing in Great Britain; Section C, for readers of all ages residing Overseas.

Home and Overseas Closing Dates

Although in previous contests we have been compelled to reject numerous entries because they were received a day or so after the closing date, there can be no excuse for the tardy model-builder this time, for the closing dates for the "Simplicity" contest have been specially extended.

30th April, 1929, is the last day on which entries may be received from competitors entering in the Home Sections (A and B). Overseas readers entering in Section C must forward their entries so that they reach Liverpool not later than 31st July, 1929. The ample time allowed for construction, coupled with the original and interesting nature of the contest itself, should produce a record number of outstanding entries and we trust that Meccano boys will once more live up to their reputation!

THE PRIZES

The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Meccano products to value three guineas.

Second Prize: Meccano products to value two guineas.

Third Prize: Meccano products to value one guinea.

Six prizes, each consisting of Meccano Double Headphones, or Meccano Crystal Receiving Set.

Twelve prizes, each consisting of Meccano products to the value of 5/–.

The Prizes in Section B are as follows:—

First Prize, Meccano products to value two guineas.

Second Prize: Meccano products to value one guinea.

Third Prize: Meccano Double Headphones, or Crystal Receiver.

Six Prizes, each consisting of Meccano products to the value of 5/–.

Twelve Prizes, each consisting of a Complete Instructions Manual.

A limited number of Certificates of Merit and complimentary copies of "Meccano Standard Mechanisms" Manuals will be awarded in each Section.

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

Hornby Railway Company

The Growing Army of Members

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

ANY owner of a Hornby Train Set, no matter what its size, may become a member. All that he has to do is to fill in the official application form, which may be obtained on application to Headquarters, and return it with 6d. in stamps to pay for the badge. A few days later he will receive a certificate, and the badge that shows him to be a member of this wonderful organisation.

Members of the H.R.C. also are entitled to join the Correspondence Club, by means of which they are enabled to exchange railway news and photographs with fellow-members in various parts of the world.

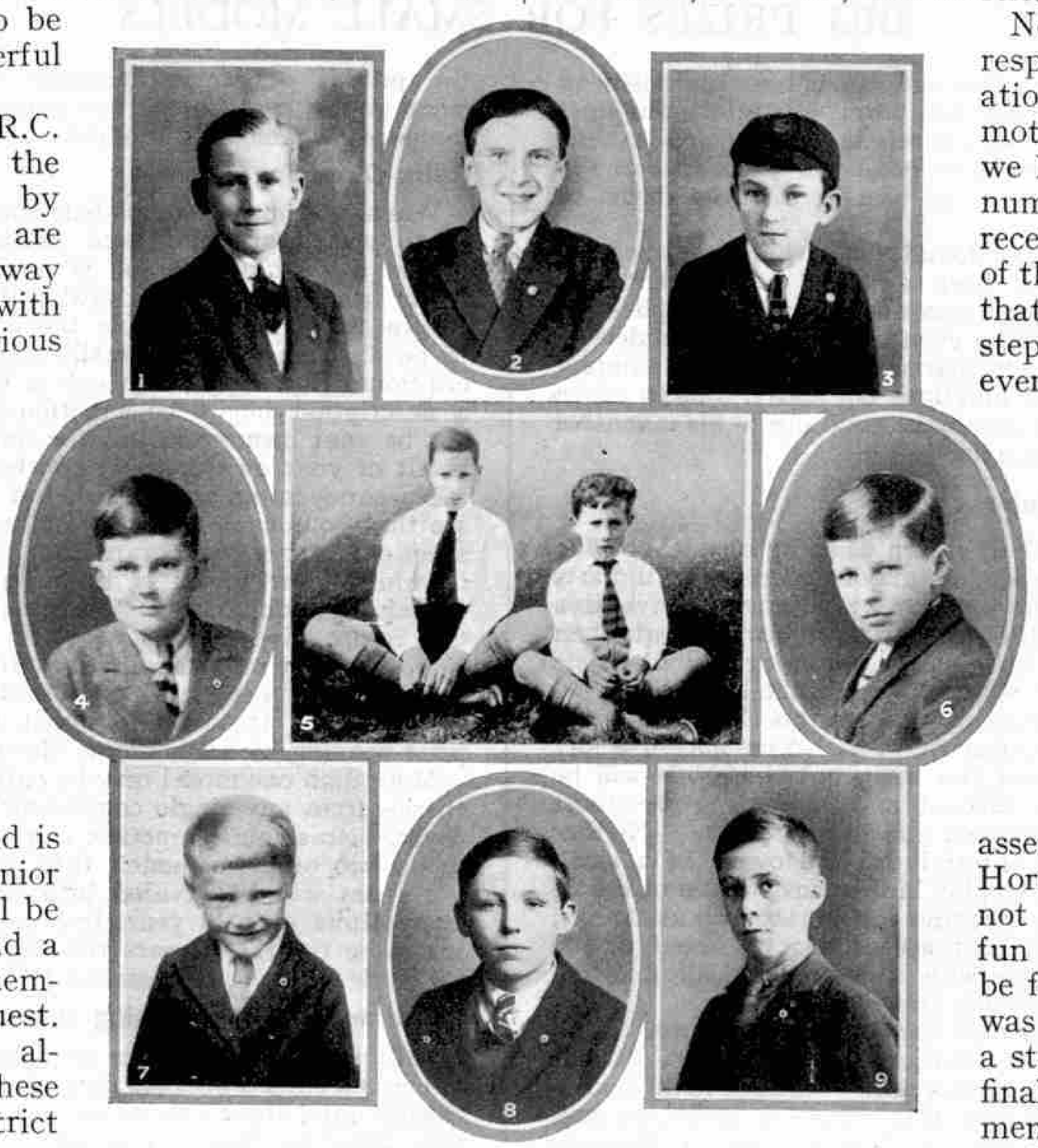
A booklet that has been specially prepared in connection with the H.R.C. is sent free to all members, or will be sent for 2d. post free to non-members. It explains how to plan and operate model railways on realistic lines. In addition another booklet has been prepared for younger members, and is known as the "H.R.C. Junior Section" booklet. It will be ready in a few days, and a copy will be sent to any member post free on request. Many applications have already been received, and these will be dealt with in strict rotation.

It is now five months since the formation of the Hornby Railway Company was announced, and the period that has elapsed is sufficiently long to enable the merits of the Company to be judged impartially.

The fact that the scheme has really supplied a want has been shown in two ways—first, by the great number of applications for membership, and second, by the nature of the correspondence that has been received, both from members and non-members.

As regards applications, these began to arrive in small numbers on the day after the scheme was announced. Since then the number has increased steadily, and during the past few weeks the figure has ranged from 150 to 250 per day. The record for any single day so far is 445! It is a very big task to deal with such a stream of applications, and it will be readily understood that the energies of a good-sized staff are taxed to the utmost.

While we are on this topic it may be well to remind applicants for membership that there may be a delay of a day or two in the dispatch of their badges and certificates. All applications are dealt with at the earliest possible moment, however, and in strict rotation.



Some Cheery Members of the H.R.C.

1. Walter H. Bennett (55), Bishopton, Renfrewshire; 2. S. G. Burley (53), Reading; 3. Sydney Holloway (79), Stoke, Devonport; 4. P. J. H. Green (23), Southsea; 5. J. Waite (14), Ben Rhydding, Nr. Ilkley; 6. J. A. S. Green (24), Southsea; 7. James Stanton (95), Birmingham; 8. Eric Williamson (89), Edinburgh; 9. Chris Bruton (72), Dublin.

Next, with regard to the correspondence that the inauguration of the scheme has set in motion. In previous issues we have referred to the large numbers of letters we have received expressing approval of the scheme and satisfaction that we have taken such a step. In addition we receive every day a great number of letters of a different nature. These letters are of especial interest because they reveal the fact that, prior to the formation of the "H.R.C.," the writers had never realised the possibilities of their model railways.

If any proof were needed of the truth of our assertion that the majority of Hornby Railway owners were not obtaining the maximum fun from their sets, it is to be found in these letters. It was the conviction that such a state of affairs existed that finally decided us to commence the "H.R.C.," and to-day we are fully satisfied that our action was justified from every possible point of view.

In the "*M.M.*" for October last, when the "H.R.C." was first announced, we stated that one of the objects of the organisation would be to assist members with their railway problems. This announcement has brought us widespread appeals from members, who describe their existing layouts and ask for revised schemes of a more railway-like nature, together with advice as to the best method of operating them. Many experienced and expert model railway enthusiasts also ask for advice on some particular point in connection with their layout, or for help in the preparation of a practicable working timetable.

Greatly as these letters vary in their style and nature, they all have one feature in common—they reveal a great revival in model railway enthusiasm.

News from the H.R.C. Branches

Interesting Lines of Development

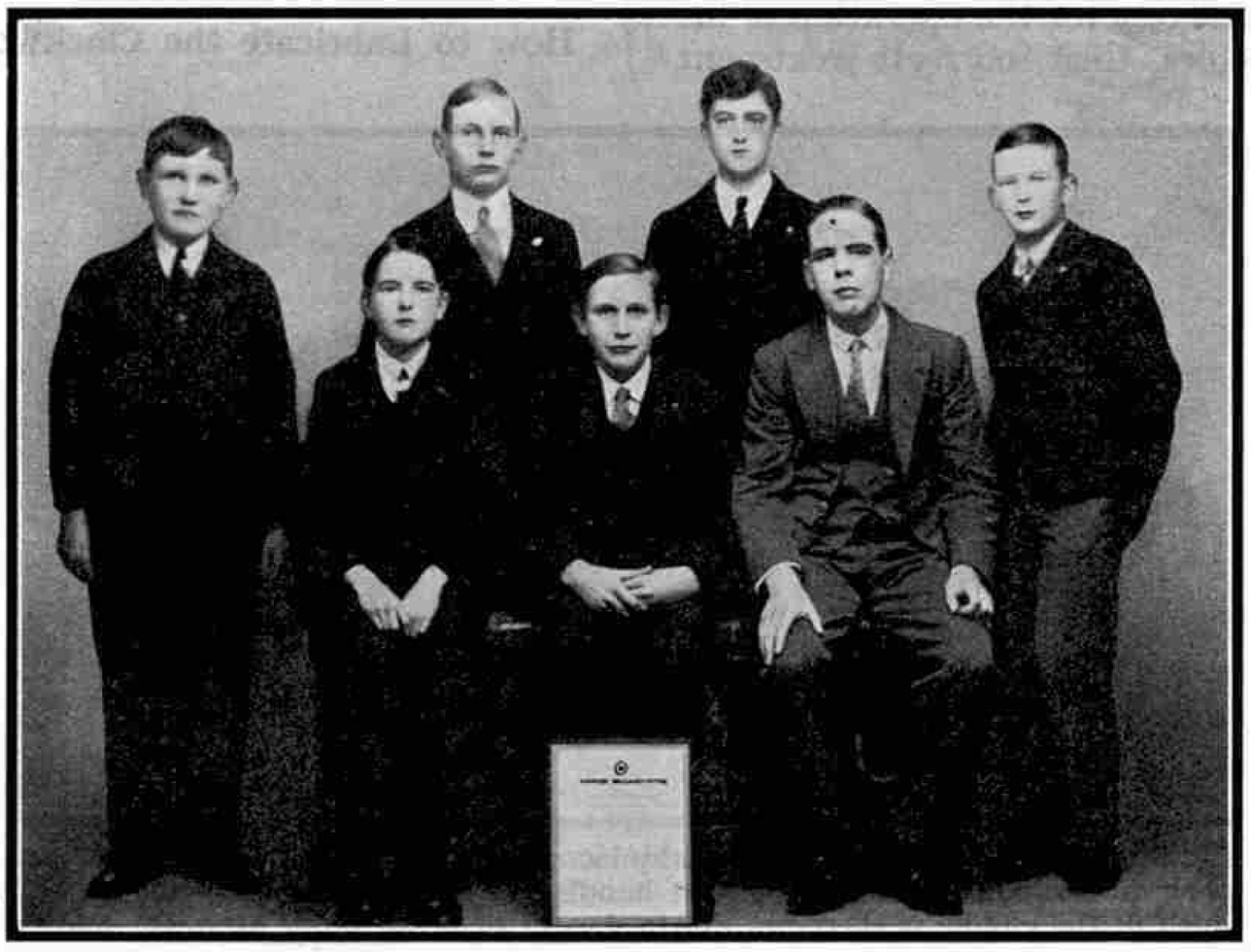
THE formation of local Branches of the Hornby Railway Company continues steadily. The Branches that have already become incorporated with the parent Company are all flourishing, and in numbers of towns and villages local enthusiasts have undertaken to form Branches, and the preliminary negotiations are well in hand. There is every prospect that within the next few months the "H.R.C." will have behind it a strong force of incorporated Branches, well organised and with every member keen to do his utmost.

It is interesting to note how quickly the incorporated Branches have developed an individuality of their own. While all are, of course, united in a common enthusiasm for model railways, each one approaches the matter from its own point of view and has some particular branch of railway operation in which it specialises.

As regards general organisation the branches are, quite naturally, very similar, but they vary greatly in their domestic details. In most cases the tendency seems to be towards a policy of caution as regards the purchase out of Branch funds of railway material. For the time being members are bringing their own material, or certain sections of it, to meetings, with the result that splendid layouts are possible without any expenditure to the Branch. One Branch, for instance, reports a meeting at which there was a double track, with two terminal stations and one through station. The layout included twelve sets of points and two turntables, and was operated by seven engines and 31 coaches and trucks. A layout of this nature is full of splendid possibilities. What a contrast to the dull monotony of one boy playing alone with a mere circle or oval of rails!

On another occasion the same Branch spent a keenly enjoyable evening in testing the various locomotives in order to find out what sort of work they were best suited for; that is, whether they should be assigned to express passenger trains, or fast or slow goods trains. The test was very thorough, the engines being put through their paces for speed, hauling power, ability to tackle gradients, and distance of run on one winding.

The difficulty of obtaining a suitable meeting room has proved a very serious one to some of the Branches and has been temporarily overcome by holding meetings at different members' homes in turn. By degrees this difficulty is being overcome, and rooms are being obtained in which a permanent layout is possible. Some Branches have found it necessary to adopt a compromise in the shape of semi-permanent layouts laid down in sections on stout boards. This arrangement enables the layout to be dissected, as it were, at the end of the meeting, and stowed away in quite small space, leaving the room unobstructed. Schemes of this nature have given full scope to members possessing carpentering ability, and the fitting up of the various tracks has been a source of great enjoyment. We intend to deal with the details of the various Branch layouts in future issues.



Our illustration shows the members of the Ellesmere Branch of the Hornby Railway Company. This Branch was the first to be incorporated, and therefore has the honour of being numbered 'One' in the register at Headquarters

Most of the incorporated Branches have already turned their attention to visits to places of railway interest. One Branch paid an extremely interesting visit to the King's Cross Locomotive Sheds, and a kindly driver took them all for a short ride on a 4–6–2 express engine. As may be imagined, this visit was a huge success! The members are now contemplating a descent upon Nine Elms Goods Depot, S.R. permitting, of course!

There appears to be a tendency among certain Branches to wind up the evening with a short talk or "lecturette," followed by an informal general discussion. This makes a very pleasant change from the more strenuous work of model railway operation. We hear also that some Branches are approaching local gentlemen who are connected with railway operation, and endeavouring to persuade them to visit the club and speak on some topic in which they specialise.

Branch secretaries are reminded that some exceptionally interesting lectures are loaned free of charge by the various railways. Application for these should be made to the following officials:—

G.W.R.—Mr. R. H. Nicholls, Paddington Station, London, W.2.

L.M.S.—Mr. G. Hawkins, Advertising Dept., Victoria Station, Manchester.

London Underground Railway—The Press Agent, 66, Victoria Street, Westminster, London, S.W.1.

L.N.E. — District Passenger Manager, L.N.E.R., London Road Station, Manchester.

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

Hornby Railway Company

JUNIOR SECTION

II.—Care of the Locomotives and Rolling Stock

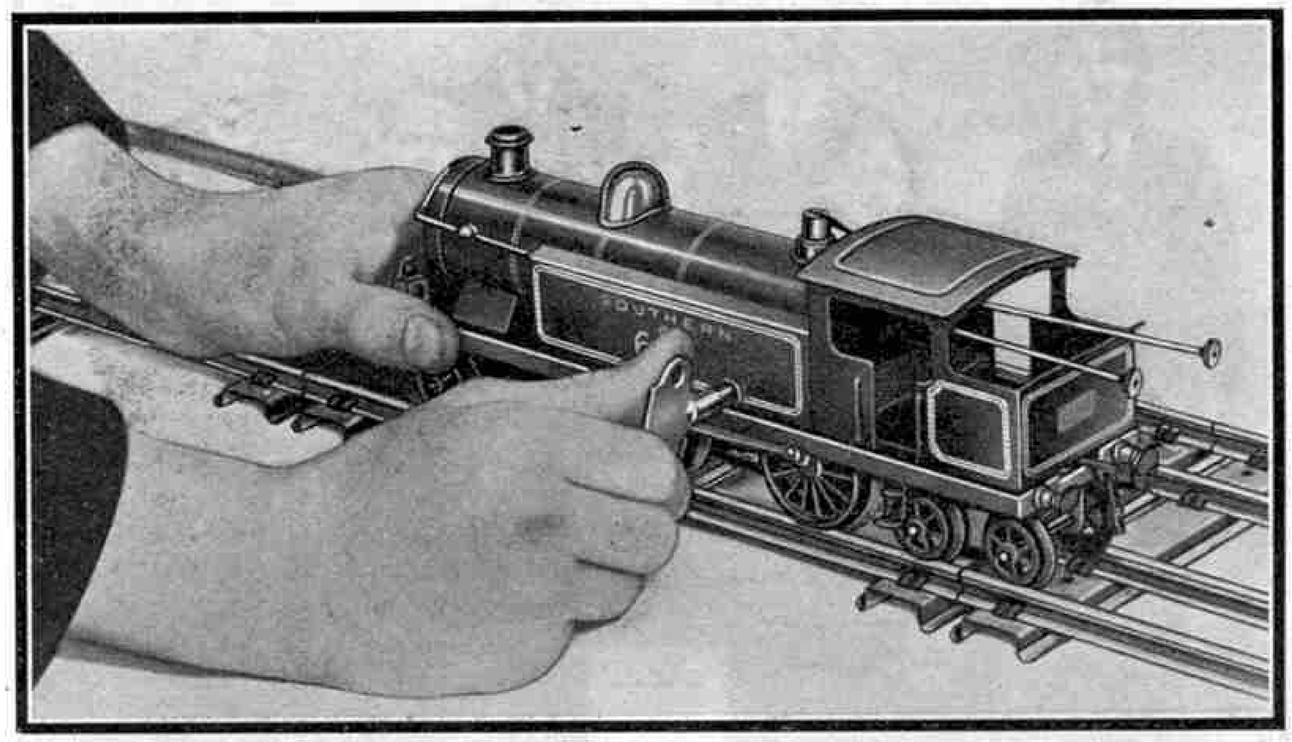
MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

LAST month we explained the first steps to be taken by any Hornby Railway enthusiast when commencing to plan his first model railway layout. We showed how the maximum amount of fun could be obtained from even the simplest of layouts, and described how Hornby track should be laid in order to get the best possible results. This month our attention will be concentrated on the most important points relating to the care of the locomotives and rolling stock.

In every case it is upon his locomotives that the model railway engineer must rely for the operation of his train services, and therefore their correct treatment is a question of primary importance.

Winding up the Motor

One of the most frequent questions asked by purchasers of Hornby Trains is: "How many turns of the key may I give safely in winding up the clockwork motor of my locomotive?" Anxiety on this point is usually the result of sad experience with cheap engines, the clockwork mechanism of which is liable to collapse from the very slightest overstrain. The motors fitted to all Hornby locomotives are very stoutly built, however, and the danger of damaging them by over-winding is very remote. It is a perfectly safe plan to turn the key as far as it will go *without forcing*, and a little practice enables one to tell when to stop by the "feel" of the spring as it is wound up.



The best method of winding a Hornby locomotive on the track. The enamel work on the boiler and tanks is not handled in any way, and the fine glossy finish of the engine is therefore not in danger of being spoilt by finger-marks

It is of the utmost importance to remember that the winding key of any clockwork engine should never be turned backward. Carelessness in this respect is very liable to result in the breaking of the spring, or at any rate, in the spring becoming detached from the winding spindle. Another point to be remembered is that the key must be pressed well home as far as it will go on the winding spindle, otherwise the extra strain of the winding key on a small section of this shaft is liable to wear round both the spindle and the hole in the key.

Another very important point to remember is that the locomotive should never be pushed along the track by hand, when the spring is run down. Pushing a run-down engine along the track forces the spring and has precisely the same effect as winding the engine backward.

Winding up a locomotive when it is in service is another point that does not receive sufficient care or attention. We illustrate the correct method of performing this operation, so as to make the matter quite clear to beginners. The best method is undoubtedly to hold the edges of the front buffer beam of the engine with the thumb and forefinger of one hand, and turn the key with the free hand. If this method is adopted the engine will wind easily and smoothly, and in addition, the beautiful gloss of the enamel work will not be spoilt by finger marks.

How to Lubricate the Clockwork Mechanism

Before any engine is set to work it should have all its gears and spindles well oiled with the Meccano oil specially prepared for this purpose. This oil may be purchased from any Meccano dealer. It is of the utmost importance that too thick an oil should not be used. If, as the result of the use of unsuitable oil, a locomotive has become clogged with oily dust so that it runs sluggishly, the only thing to do is to wash the mechanism clean with petrol and subsequently lubricate it thoroughly with the Meccano oil.

Generally speaking, the practice of allowing the driving wheels of any clockwork locomotive to spin round in the air at full speed is a bad one, and wherever possible should be avoided. The reason for this is that if a motor is allowed to "race" (as this spinning is called), undue pressure is put on the governor. There are occasions, however, when it is necessary to allow the mechanism to run down quickly and one of these is while it is being lubricated. It is always best to apply lubricating oil to gears, spindles, and bearings while they are in motion, and the coupling and connecting rods also should not be forgotten.

The reversing gear should be operated while it is being lubricated, but while this is being done the motor should not be running. As a general rule it is a bad practice to operate the reversing gear of any clockwork engine without first applying the brakes, as this is liable to put undue strain upon the reversing movement, and it has the effect of loosening the bearings and wearing the teeth. Of course, this rule cannot be observed when the engine is being reversed automatically from the track, but it should

be adhered to whenever it is at all possible.

A new engine often appears to be running stiffly. It should not be imagined that this is due to imperfect workmanship, for the same thing occurs in the case of every new mechanism until it has become what is known as "run-in." Silence and smoothness of running, together with maximum power come only with time and careful treatment.

Another important point that is frequently forgotten is that an engine should never be put away until the mechanism has been allowed to run down. If an engine is put away with the motor half wound, the spring is liable to lose a good deal of its tension and as a result a great deal of power.

Care of the Rolling Stock

Once the locomotives are in good running order, the next thing to attend to carefully is the moving parts of the Rolling Stock.

In many cases brand new coaches or wagons will not run very smoothly. This is due very largely to the wheels and axles not being "run-in," just as in the case of the locomotives. Frequently, however, extreme stiffness of the wheels is caused by the trunnions being pressed against them in course of packing. The wheels should be inspected carefully, and in cases where they are too tight, they should be loosened by bending the trunnions slightly outward.

Hornby Railway enthusiasts will all agree that W. A. Jack of Paisley (No. 292 of the H.R.C.) appears to be getting a great deal of pleasure by running his Hornby trains. Jack is in the very fortunate position of having a little outhouse allotted to him in which to lay out his miniature system

All axles and bearings should be lubricated with the same fine oil that is used for the engines. Care is necessary even in the lubrication, for if too much oil is put on the axles, it is liable to run off the wheels on to the track. A greasy track is a terrible bugbear to a model railway enthusiast and has disastrous results on the running of his models. Locomotive driving-wheel slip is frequently due almost entirely to greasy track.

After each wheel, axle and bearing has received individual attention, the couplings should be loosened and oiled if they are stiff. If it is intended to open and close the doors of the vehicles, each of the hinges, and also the handles, will need a small drop of oil. Hornby Train owners are advised to use the doors as little as possible, however. Although these doors are strongly built, they will naturally not stand the same amount of wear and tear as the rest of the metal work of the rolling stock and, unless they are treated carefully, will in time work loose and perhaps be a considerable nuisance when trains are travelling.

When all locomotives, coaches and wagons have received individual attention, they will be ready for "running-in." For this purpose it is a very good idea to lay down one of the simplest of layouts, such as a long oval. No points or crossings should be used, as the whole object of the oval should be to give as long and at the same time as straightforward a run as possible.

Scarcely a day passes without our receiving queries from readers regarding the capabilities of some particular locomotive in the Hornby series. It is scarcely surprising that such queries should arise when one takes into consideration that there are now ten different types of locomotives in the series. As a matter of fact there should be little difficulty in understanding clearly the nature and capabilities of each of these locomotives because the whole of them fall into three classes. These are first, locomotives fitted with a non-reversible motor; second, a larger type fitted with reversing gear; and third, locomotives that are fitted with the Special Hornby Control mechanism.

The first class is composed of the 'M', and No. '0', series of locomotives. The M.1 and the M.2 are the smallest in the series and are fitted, in common with all Hornby locomotives, with a brake which can be operated automatically from the track by means of the special brake rail provided with the smaller train sets. The M.3 is a similar model, but is fitted with outside cylinders, connecting rods and coupling rods. The No. '0' which, like all the above-mentioned engines, is of the 0–4–0 wheel arrangement, is finished with rather more detail than the M.3. It has, in addition, a more powerful spring, which makes a longer run possible.

The second class begins with the No. 1 engines, which are also of the 0–4–0 type. These are more powerful than the previous locomotives and, like all the remaining engines of the Hornby series, are fitted with a very valuable feature, namely, a reversing gear in addition to the brake. The No. 1 Tank engine is very similar to the No. 1 Tender engine, both in construction and operation, being fitted with the same type of mechanism. The remaining locomotives of this class are the large No. 2 express 4–4–0 tender locomotives and the 4-4-4 No. 2 tank type. These are beautifully finished and are very powerful.

The third class of locomotives are of the 4–4–2 Atlantic type and they are by far the most powerful locomotives in the whole of the Hornby system. They are all fitted with Hornby Control mechanism, and by means of a special control rail they may be stopped, started or reversed from the track. Although these engines have been specially designed to work with the Hornby Control System they can be used without it. It should be borne in mind, however, that while engines fitted for control can be reversed by means of the trip piece of the ordinary brake and reverse rail, they cannot be braked in this manner.

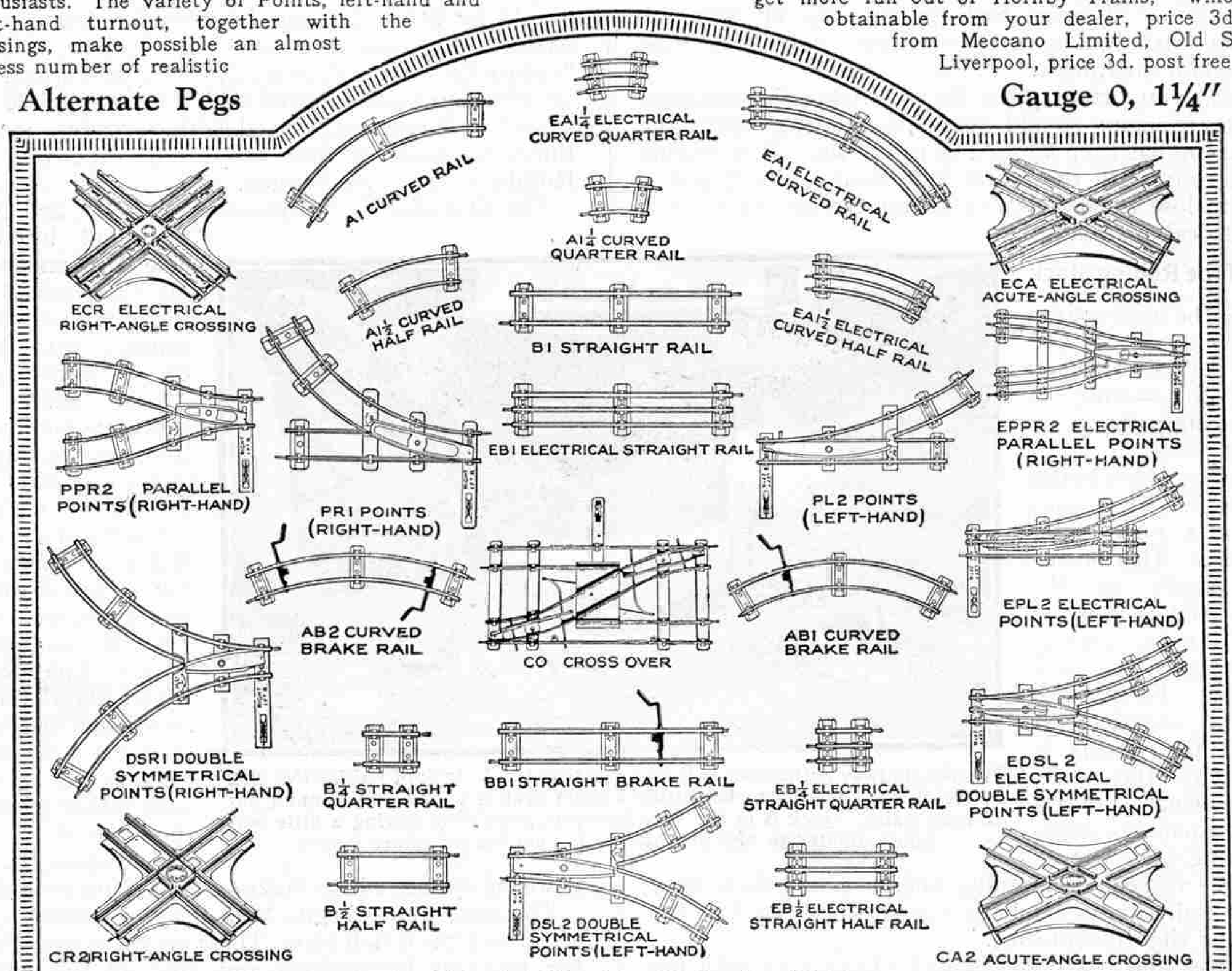
It should be noted also that the No. 1 and No. 2 engines may be obtained fitted for control if required.

There only remains to be mentioned the Metropolitan clockwork locomotive. The mechanism of this model is exactly the same as that fitted to the No. 2 control-fitted locomotives and both its speed and hauling capabilities are therefore practically identical.

Hornby Series -:- Rails, Points and Crossings -:- Hornby Series

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. The variety of Points, left-hand and right-hand turnout, together with the Crossings, make possible an almost endless number of realistic and railway-like layouts. The adaptability of the Rails, Points and Crossings is well shown in a special booklet "How to get more fun out of Hornby Trains," which is obtainable from your dealer, price 3d., or from Meccano Limited, Old Swan, Liverpool, price 3d. post free.

Alternate Pegs **Gauge 0, 1¼"**



The addition of straight and curved brake rails supplied for Clockwork Trains makes possible a great deal more fun. By the use of the straight brake rail, trains may be brought to a standstill at the station platform in a very realistic manner.

Rails for Clockwork and Steam Trains

CURVED RAILS

1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/–
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/–
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	5/–

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right	per pair	5/–
DSL1	Double symmetrical points, left		

For 2-ft. radius curves

DSR2	Double symmetrical points, right	per pair	5/–
DSL2	Double symmetrical points, left		

PARALLEL POINTS

For 2-ft. radius curves

PPR2	Parallel points, right	... per pair	5/–
PPL2	Parallel points, left		

CROSSINGS AND CROSSOVERS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	1/6
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/6
CR1	Right-angle crossings (for 1-ft. radius tracks)... ...	„	1/6
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/6
COR2	Crossovers, right hand ...	per pair	12/–
COL2	Crossovers, left hand ...		

POINTS

For 1-ft. radius curves

PR1	Right-hand points	... per pair	4/–
PL1	Left-hand points		

For 2-ft. radius curves

PR2	Right-hand points	... per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, right ...	per pair	7/6
PSL2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, left ...		

STRAIGHT RAILS

B1	Straight rails	per doz.	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track ...	½ doz.	4/6
RCP	Rail connecting plates	„	4d.

Rails for Electric Trains

STRAIGHT RAILS

EB1	Straight rails	per doz.	7/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	8/–
EA1½	Curved half rails	„	5/–
EA1¼	Curved quarter rails	„	4/6

2-ft. radius

EA2	Curved rails	per doz.	8/–
EA2½	Curved half rails	„	5/–
EA2¼	Curved quarter rails	„	4/6

CROSSINGS

ECA	Acute-angle crossings	each	4/–
ECR	Right-angle crossings	„	4/–

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	... per pair	10/–
EPL2	Left-hand points		

For 2-ft. radius curves

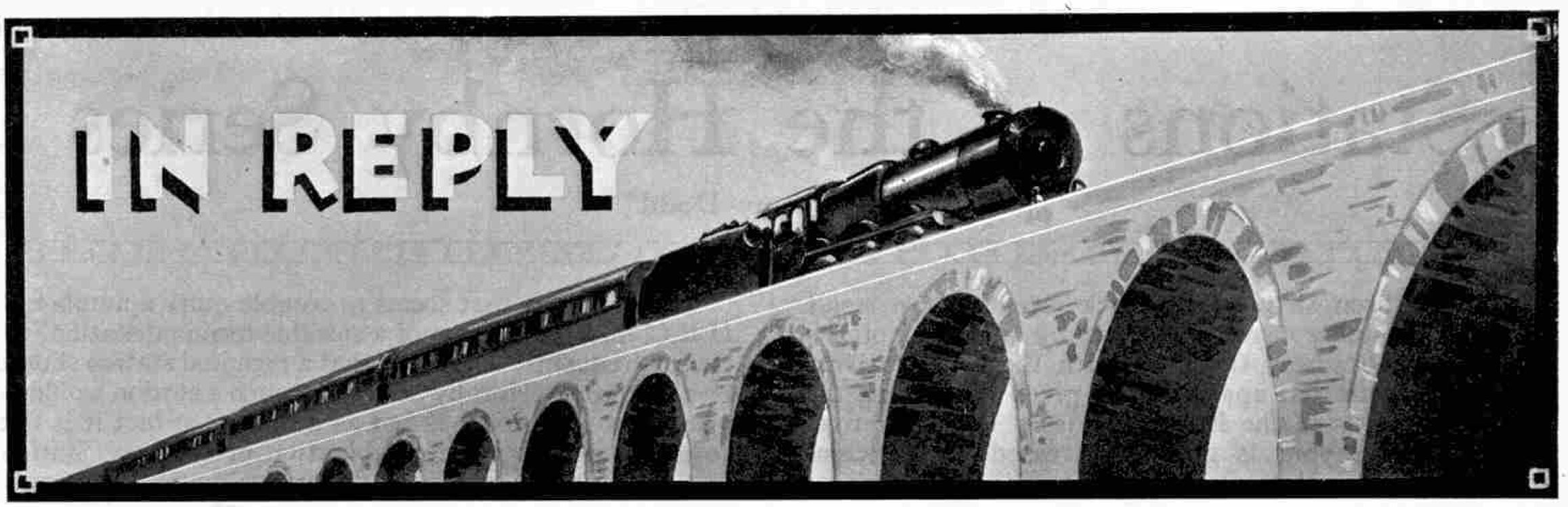
EDSR2	Double symmetrical points, right	per pair	12/–
EDSL2	Double symmetrical points, left		

For 2-ft. radius curves

EPPR2	Parallel points, right	per pair	12/–
EPPL2	Parallel points, left		
TCPL	Terminal connecting plates (low voltage)	each	1/6
TCPH	Terminal connecting plates (high voltage)	„	1/6

Electrical Points for 1-ft. radius curves are not supplied

Manufactured by MECCANO LIMITED, OLD SWAN, LIVERPOOL



Suggested Hornby Train Improvements

VACUUM BRAKE PIPES.—Details such as vacuum brake pipes tend to increase the price of rolling stock. It is possible, however, that when we undertake the manufacture of more detailed models we shall make the introduction you suggest. (*Reply to J. Jones, Stonehouse, Gloucester*).

"M" COMPOSITE COACHES.—Your suggested "M" composite Pullman coaches would certainly fill a deficiency that exists at present in the "M" Pullman sets. We will consider your idea later. (*Reply to A. Butler, Swindon*).

OUTSIDE CYLINDERS.—Although we agree that the appearance of the No. 2 Hornby locomotive would be improved by the addition of outside cylinders and motion, it should be remembered that the engine would be no more efficient as regards running performance. The objection to your idea is that the cost of producing the model would be greatly increased. (*Reply to R. Ramsay, Auckland, N.Z.*).

MAGNETIC SHUNTER'S POLE.—We have experimented with a magnetised shunter's pole, and we find that the coupling and uncoupling of the wagons is only facilitated to a very slight degree. (*Reply to P. Nicholls, Christchurch*).

No. 2 TANK PULLMAN SET.—At present we supply a tender locomotive with the No. 2 Pullman Set. You could purchase two Pullman cars and a tank locomotive separately if you require a No. 2 Tank engine in the Set. (*Reply to C. S. J. Roy, Offley, Herts.*).

SCALE MODEL No. 1 TANK LOCOMOTIVE.—We are surprised to note that you are not satisfied with the appearance of your No. 1 tank engine. This is a very popular little model. Although it is not intended to represent any particular type used in actual practice, we claim that it is very handsome and a typical little goods engine. (*Reply to J. Johnson, Norwich*).

SLIP-COACH APPARATUS.—As we have stated on previous occasions we have been experimenting for some time with a view to the production of a really practical device of this kind. As soon as we have reached a definite result we shall make an announcement in these pages. (*Reply to P. Wallace, Birmingham*).

CAST WHEELS.—We have already introduced scale Mansell wheels. These wheels may be fitted to any type of Hornby rolling stock and their use is strongly recommended. (*Reply to H. Wilson, Oxford; J. Fidler, Fleetwood; and others*).

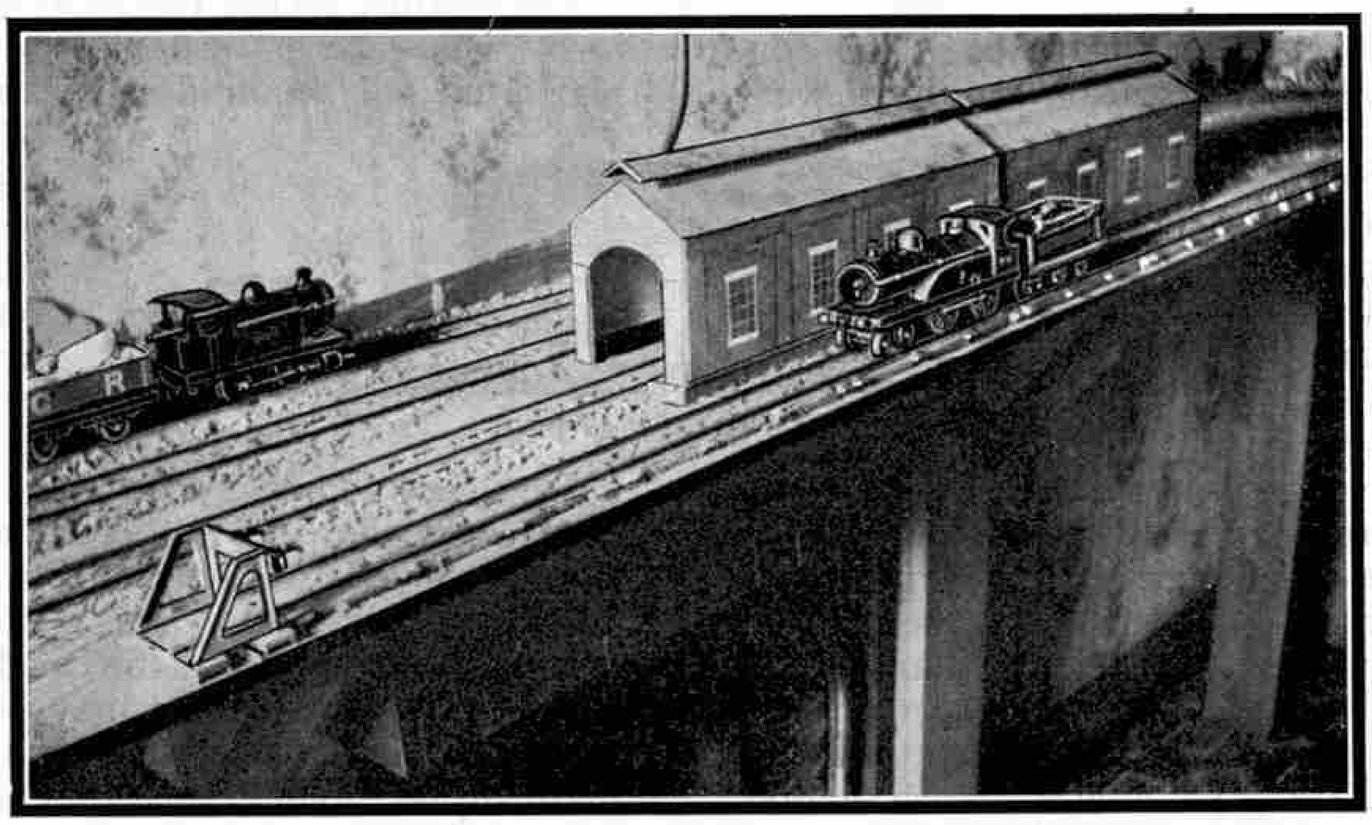
EIGHT-WHEELED GUARDS' VAN.—The question of introducing an eight-wheeled guards' van has been considered, and we have decided that, as such vans are comparatively unknown in actual railway practice, they would not be popular if produced. (*Reply to E. Nicholson, Bath*).

GAUGE "00" RAILWAY.—At present we cannot consider the introduction of "00" models. (*Reply to C. Robinson, Birmingham*).

REVERSE LEVERS ON LOCOMOTIVES.—We quite appreciate your point. The reverse levers on Hornby locomotives are rather long and later on we hope to arrange to have these made shorter. (*Reply to J. Evans, Hanley*).

ELECTRIC POINTS FITTED FOR CONTROL.—As stated last month, we are now in a position to supply electric points fitted for control. (*Reply to P. Bradbury, Warrington, and J. Smith, Chester*).

AMBULANCE COACH.—This type of coach is very rarely seen running on the actual railways and for this reason we consider that a model of it would not be in great demand. (*Reply to G. Bryant, Manchester*).



An excellent example of art in the use of cardboard. This model engine shed was entirely constructed by C. McLean of Ayr, N.B., and is used for storing both the Hornby locomotives seen in the illustration, when they are not in use

FISH VAN.—A model of one of these vans would certainly prove very useful on a miniature railway. We will file this idea and go further into the matter as soon as the opportunity presents itself. (*Reply to E. Judd, Newcastle-on-Tyne*).

FIRE BUCKETS AND RACK.—The introduction of a rack and miniature fire buckets has been suggested previously. We have recorded it as being an idea suitable for early consideration. (*Reply to H. Jacobs, London, S.E.5*).

LARGER RADIUS CURVES.—You will probably be interested in our new double-track curves, which include rails of 2 ft. and 2 ft. 3¾ in. radius The use of this double-track will enable you to build up a perfectly symmetrical parallel track (*Reply to David B. Smith, Hipswell, Yorks.*).

RACK RAILWAY.—We have had practically no demand for railways operating on the rack system and we do not think that such an introduction would be popular. (*Reply to M. Trim, Dewsbury*).

ELECTRICAL CROSSOVERS.—It is possible that crossovers for use in electrical layouts will be obtainable before long, though at present we have taken no steps in this direction. (*Reply to M. J. French, Epsom*).

BREAKDOWN VAN.—Fortunately, on most mode railway layouts, the breakdown van and crane is not called upon often enough to warrant special clockwork mechanism being incorporated. (*Reply to H. Berry, Finsbury Park, London*).

STEAM OUTLINE ELECTRIC LOCOMOTIVES.—We are surprised to hear that you object to seeing model steam outline locomotives running on electric track. As a matter of fact trains are often seen running over electrified portions of track in actual railway practice. Typical examples of steam and electric working are those of the Southern Railway in the London district and the L.M.S. (L. & Y. section). (*Reply to R. Read, Hemel Hempstead*).

ROYAL TRAIN SET.—We do not consider that there is sufficient demand for a model of the Royal Train to warrant our manufacturing one. As regards your query as to the type of locomotive used to haul Royal trains in actual practice, this duty is always performed by standard express passenger locomotives. (*Reply to C. Watson, Bombay*).

CONTAINERS.—We propose to give this suggestion our careful consideration when the opportunity presents itself. We believe that the idea will become popular. (*Reply to G. Jarrett, Clevedon*).

L.M.S. STANDARD COMPOUNDS.—Your suggestion for the introduction of models of these engines is interesting. As previously stated in these pages we propose to give this matter further consideration. (*Reply to G. W. Barnes, Hampstead, London, N.W.3*).

ADVERTISEMENT HOARDINGS.—It is very probable that we shall introduce miniature accessories of this nature at a later date. In the meantime quite good specimens can be made at home with very little trouble and there is a great deal of fun to be obtained from the making of small items of this nature to one's own design. (*Reply to E. Urben, Wimbledon, S.W.20*).

REDUCTION IN SIZE OF COUPLINGS.—You will notice that on our new rolling stock the size of the couplings has been considerably diminished, a fact that no doubt will please every Hornby Train enthusiast. (*Reply to G. Edmondson, Bradford; E. Bawtree, Sutton, Surrey; R. Townsin, Peterborough; R. Mackie, Maidstone; and N. J. Ramsay, Canterbury*).

METROPOLITAN LOCOMOTIVES.—As pointed out in these pages previously, the advantages to be gained by converting the wheel arrangement of our Metropolitan locomotive motor do not warrant our undertaking such a costly alteration. (*Reply to R. K. Smith, Birmingham*).

ELECTRIC LIGHTING IN MODEL COACHES.—Your suggested scheme for fitting electric light in the Hornby No. 2 Pullman coaches is certainly interesting and ingenious. The objection to the idea is that it would be too costly to put into practice. (*Reply to P. Johnson, Wolverhampton, and J. Walker, York*)

Stations of the Hornby Series

By 'Tommy Dodd'

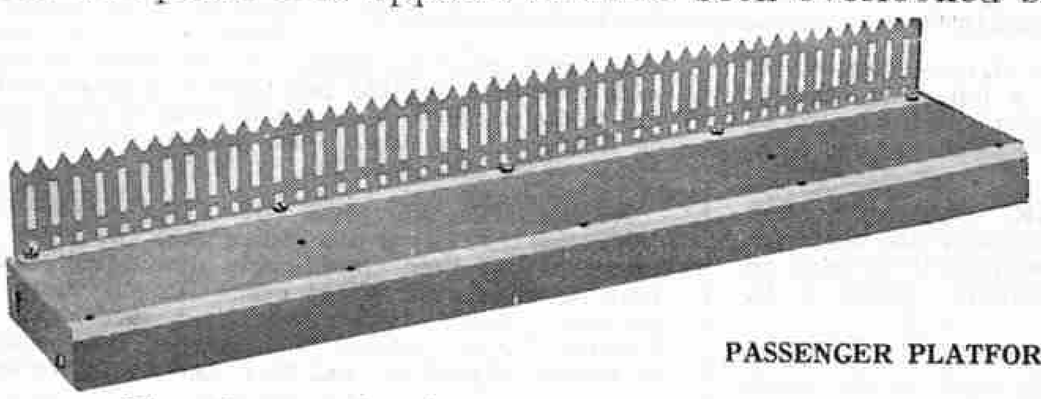
I HAVE been very much struck recently as a result of examining layouts sent in by members of the Hornby Railway Company with the comparatively small attention that appears to be given to utilising the various stations in the Hornby Series. The attractiveness of any layout is greatly increased by judicious arrangement of stations, whether terminal stations or

RAILWAY STATION No. 1

mere passing stations for stopping trains. The range of model stations in the Hornby Series is such as to provide very great possibilities, and I am taking this opportunity of drawing attention to the special features of the different types.

Take Railway Station No. 1, for instance. This consists of quite a simple block of station buildings, very attractively coloured. If really used in its correct place, this station should stand as a suburban station. The length of the platform itself is $16\frac{3}{4}$ in.

At this point I am reminded of various letters I have received from time to time asking why there was not included in the Hornby Series a station long enough to accommodate a three-coach train with locomotive and tender. I had to explain to the writers of these letters that it is unpractical for various reasons to manufacture stations made to correct scale length. In order to overcome this difficulty, however, Hornby stations are specially designed so that it is possible to attach sections of plain platform to the section of the platform supporting the station building. The result is that the total length of the station may be increased as required, and this is a point that appears to have been overlooked by

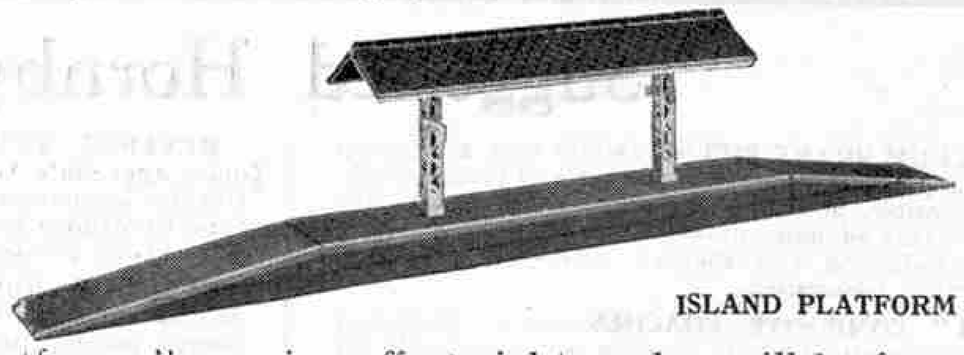


PASSENGER PLATFORM

many Hornby enthusiasts. The sections of platform that may be used for lengthening a station are known as "Passenger Platforms." These also are $16\frac{3}{4}$ in. in length, this being the standard length of all Hornby Platforms.

The No. 2 Station is similar to the No. 1, but is complete with two ramps and has additional details such as chimneys on the roofs. The palings that are included at the rear of the station add greatly to its general appearance.

Another point that seems to trouble quite a number of H.R.C. members is that of a suitable terminal station. It is very frequently suggested that a terminal station should be added to the Hornby Series, but such a station would be very costly to produce, and as a matter of fact it is not really necessary. The combination of Railway Station No. 2, without ramps, and two or four "Passenger



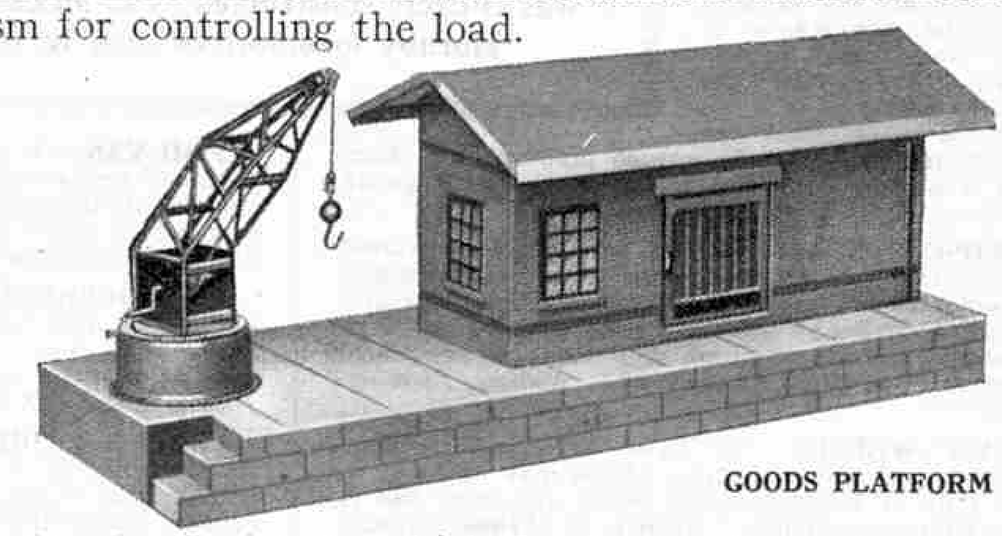
ISLAND PLATFORM

Platforms" running off at right-angles, will be found to form a very attractive bay for a terminal station. When two lines are run into this bay, and are finished off by means of a couple of buffer stops, the appearance is very definitely realistic.

The Hornby Island Platform serves a useful purpose in cases where large terminal stations are laid out and platforms are required with two faces. These island platforms may be used also in suitable positions on important through stations. It is useful to remember that detachable ramps, similar to those supplied with Railway Station No. 2, but without palings, are supplied with the Island Platform.

RAILWAY STATION No. 2

A recent addition, and one that I am pleased to say is being received with the enthusiasm it deserves, is the new Goods Platform. This is most attractive in appearance and includes a realistic Goods Shed fitted with sliding doors. The Goods Shed may be used for storing goods that may be discharged from trains by means of the automatically revolving crane that is also fitted to this platform. The crane is in itself quite an interesting piece of mechanism and is fitted with a crank and ratchet mechanism for controlling the load.



GOODS PLATFORM

Another point to which I wish to draw attention is that white paled fencing as supplied with the Passenger Platform may also be purchased separately, price sixpence per length. This fencing is extremely useful for many purposes, and is remarkably effective in giving a finished and attractive appearance to a station of any kind.

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

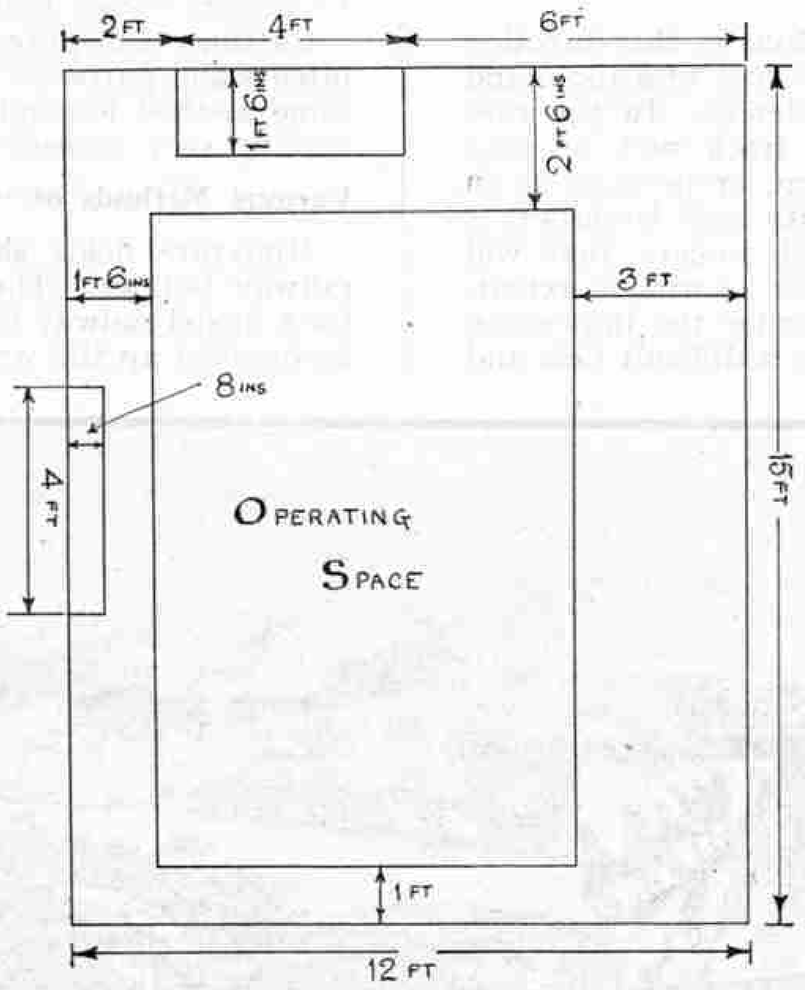
AN INTERESTING LAYOUT PROBLEM

This month we give every H.R.C. member an opportunity of showing his capabilities in the planning of a model railway on sound lines, with the greatest economy of material.

In the centre of this page appears a plan of a room to be used for a model railway layout. Competitors are to imagine that, by a stroke of good fortune, they have been given permission by the household authorities to use this room solely for their model railway operations.

The first step to take in laying out a track permanently on trestles is obviously to make a survey of the room to be used. We will suppose that this has been done and that the room has been found to be 15 ft. in length by 12 ft. in width. This information is noted in on the plan, together with any other items of importance, such as the fact that at one side of the room there is a cupboard 4 ft. in width by 1 ft. 6 in. in depth, and on the adjacent side of the room there is a fireplace 4 ft. in width, and jutting out 8 ins.

Wood was ordered and the baseboards and trestles were constructed. The baseboards were then laid all round so that on one side there was a long table, or shelf, 3 ft. in width. Along another side the shelf was only 1 ft. in width, and by the fireplace the distance between the outer edge of the baseboard and the wall was arranged to be 1 ft. 6 in. In order to give comfortable room for the lines to pass the cupboard, the shelf along that side of the room was exactly 2 ft. 6 in., measuring from the edge of the shelf to the wall. The door of the room is situated opposite the fireplace and it can be assumed that arrangements have been made to enable the operators to enter by lifting up a section of the baseboard.



Now for the terms of the competition. The problem is to design a really interesting and railwaylike track layout with such Hornby rails, points, crossings, etc., as can be purchased for £4. It should be noted that the contest is concerned with track only, locomotives, rolling stock and accessories such as tunnels, signals, etc., being ignored. Competitors should send in a neat sketch of their proposed layout, together with a complete list of parts and their total cost.

Prizes of Hornby railway material to the value of £1/1/–, 15/–, 10/6 and 5/– respectively will be offered to the senders of the four best entries in order of railway merit, in each of the two sections, Home and Overseas.

Every entry must bear the H.R.C. membership number of the competitor at the right-hand top corner of his plan. Entries that do not bear this number will be disqualified. Envelopes should be marked "H.R.C. Layout Competition" in the top left-hand corner, and should be plainly addressed.

Closing date, 28th February, 1929. Overseas, 31st May, 1929.

THE MOST INTERESTING MODEL RAILWAY PHOTOGRAPH

Recently we have received quite a large number of really good photographs of model railways from H.R.C. members and, judging from the generally high standard of their work, we are convinced that there is considerable photographic talent in the H.R.C. ranks.

Photographs of anything connected with model railways are always of interest, and in order to encourage members to make more use of their cameras for this purpose we are offering prizes this month for "*The Most Interesting Model Railway Photograph.*"

In judging this competition the main point to be considered will be that suggested by the two words "most interesting." In other words, a photographically perfect reproduction of something entirely lacking in real railway interest will stand much less chance than a poor photograph of an attractive feature. At the same time it should be understood that, in the event of two entries being of equal railway merit, preference will be given to the one that is the better from a photographic point of view. It is not necessary, in order to win a prize, for a member to have a large and elaborate layout, for a good photograph of a simple layout may be of equal interest and consequently will stand an equally good chance of success.

As this is the first H.R.C. Photographic Competition, a few words of advice may be useful to beginners. First of all, the temptation to include the whole of a layout should be resisted as, unless the layout is exceedingly small, the result is a photograph in which the individual details appear too small to be of interest. Such photographs also are quite hopeless for reproduction purposes. Far better results may be obtained by selecting a section of a layout and securing a sharply focussed photograph of it in which the details appear of reasonable size.

Another important point is the preparation of a suitable background. Frequently we receive model railway photographs that are utterly ruined on account of the details appearing hopelessly mixed up with various objects in the background that have no connection at all with the layout. Unless all unwanted objects can be cleared out of the way for the time being, the best plan is to place behind the section that is to be photographed a large sheet of brown paper or some other patternless material. A photograph with a plain background is not only more satisfactory to look at, but is far better when reproduced.

A little attention should be given also to avoiding reflections as far as possible. For instance, the Sun should not be shining directly on to the polished coats of the locomotives. Frequently it will be found that a reflection on some object can be got rid of by moving the object so that its angle towards the source of light is changed.

Four prizes are offered of Hornby Railway material (or Meccano if preferred) to the value of 15/–, 10/6, 5/– and 2/6 respectively, for the four most interesting photographs in order of merit, in each of the two sections, Home and Overseas.

The H.R.C. number of the competitor must appear on the back of each photograph submitted, together with the competitor's full name and address. Each envelope should bear the words "H.R.C. Photographs" in the top left-hand corner.

Closing date, 28th February. Overseas, 31st May.

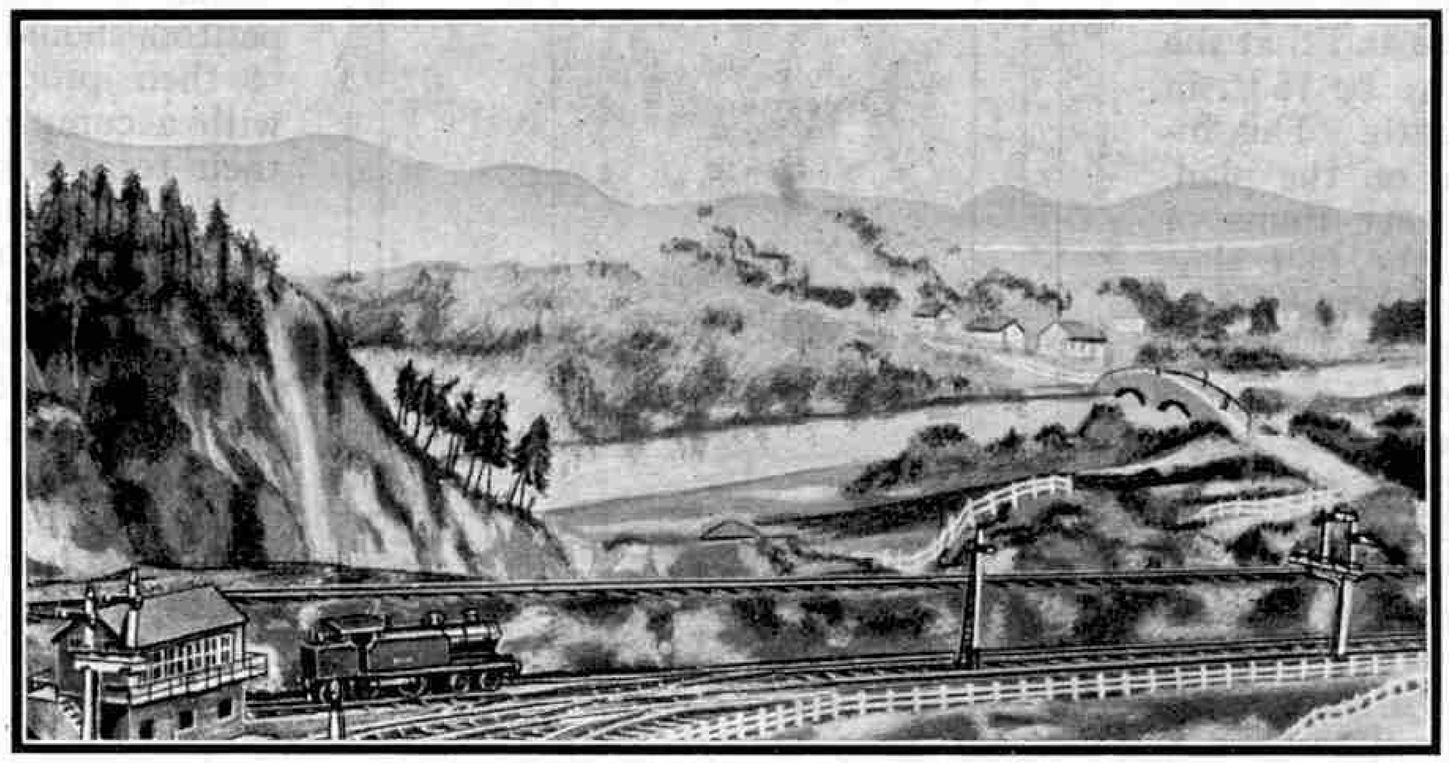
How to Get More Fun from your Hornby Railway

IV.—MAKING MINIATURE SCENERY

THE aim of the really keen model railway enthusiast is to make his railway as far as possible a miniature reproduction of the real thing. The first and most important point is to develop a layout that can be operated on actual railway principles. Even when this has been done, however, and when the line is working realistically to timetable there still remain great possibilities in the way of providing the layout with realistic surroundings.

It is unfortunately true that little can be done in this direction with a track that has to be laid down on the floor of a room and subsequently must be taken up again completely. In the case of a permanent or even a semi-permanent track such as may be laid down in an attic or other spare room, or perhaps in an outhouse, the position is quite different. With such layouts it is quite possible to provide a background and scenery that will improve the attractiveness of the layout to an enormous extent. Many model railway owners appear to be under the impression that the making of suitable railway scenery is a difficult task and only practicable for those with artistic ability. This is a great mistake, however, and the object of this article is to show by what simple means quite realistic effects may be obtained.

First of all from an onlooker's point of view a perfectly flat model railway never looks as realistic as one that is laid in hilly surroundings. It is quite true that inclines of any steepness are not practicable with clockwork locomotives but little difficulty should be experienced with slight inclines. Even if no inclines at all were possible the difficulty is not insurmountable. As a matter of fact a miniature railway that is level or almost level may be made to appear distinctly undulating. This effect is produced by careful distribution of embankments and cuttings and a general arrangement of scenery so as to produce the effect of hilly country.



Our illustration shows a very attractive piece of scenery arranged round a model railway layout. Readers will be interested to learn that all the landscape effects were painted directly on to the wall of the room occupied by the railway

How to Make Embankments

It is quite a simple matter to make a really effective embankment. A framework should first of all be arranged to support the lines, which should be nailed to a piece of board or a plank to ensure their steadiness. This board should be fixed on top of the embankment framework. The next step is to cover the sides of the framework with pieces of old felting, brushed up the wrong way with a stiff brush so as to make it rough. The embankment will then be ready to be painted over, either with a thin layer of green paint to represent grass, or with brown paint, to give the effect of soil. An occasional patch of a lighter brown, or perhaps a delicate touch of red here and there, will make the finished work look as though it consists of soil containing clay.

Another very effective method of finishing off an embankment side is by soaking brown paper in a thin solution of glue and warm water. The paper should be taken out, and after the superfluous liquid has been drained off, it should be attached to the framework and worked up into any desired shape, which it will retain when dry. The embankment is then ready to be sprinkled over with gravel or with bits of rock and stone.

The most popular method of covering over tunnels is very similar to that employed in making embankments, and some very realistic results have been obtained in this direction by numbers of Hornby Train owners. We reproduce here an illustration showing a tunnel and also a piece of realistic scenery, to give beginners some idea of what to aim at when they are about to commence work on a scenic layout. The tunnel in question was made by first of all designing the entrances on cardboard and then cutting them out. The round roofs were then manufactured out of blackened cardboard and stuck in position inside. When this had been done a heap of old boxes and crumpled cardboard was placed on top and brown paper soaked in paste was spread over the whole. Finally an excellent effect was obtained by painting the paper to imitate rough rock.

Cuttings are quite a simple matter to make, and are, to all intents and purposes, embankments "inside out." As long as the same method is employed, no difficulty should be experienced in making very realistic cuttings.

Various Methods of "Growing" Miniature Fields

Miniature fields should present no difficulties to the model railway builder. The recognised method of "growing" a field for a model railway is to obtain a piece of cheap felt which should be brushed up the wrong way by means of a stiff brush and then given a coat of green paint. In order to obtain the best effect, the paint should not be laid on too thickly and uniform but should be rather patchy to give the effect of the grass being thicker in some places than in others.

Another very popular plan for making a field is to obtain some ordinary surgical lint. This is cut into the required shape for the field and is immersed in a green dye. After the lint is dried and brushed up, the effect is quite astonishing.

Still another way of creating a model meadow is by obtaining some fine sawdust. This is put into a basin, and green water paint, or dye, is poured in. The whole is stirred thoroughly, the water is drained off, and the sawdust is then laid out on a sheet of paper and put in the oven to dry. The area to be converted into a field is then glued or Seccotined over and the dried green sawdust is sprinkled lavishly on top. A light brush, or duster, will remove all superfluous "grass" and the field will be quite ready for fattening up model cattle!

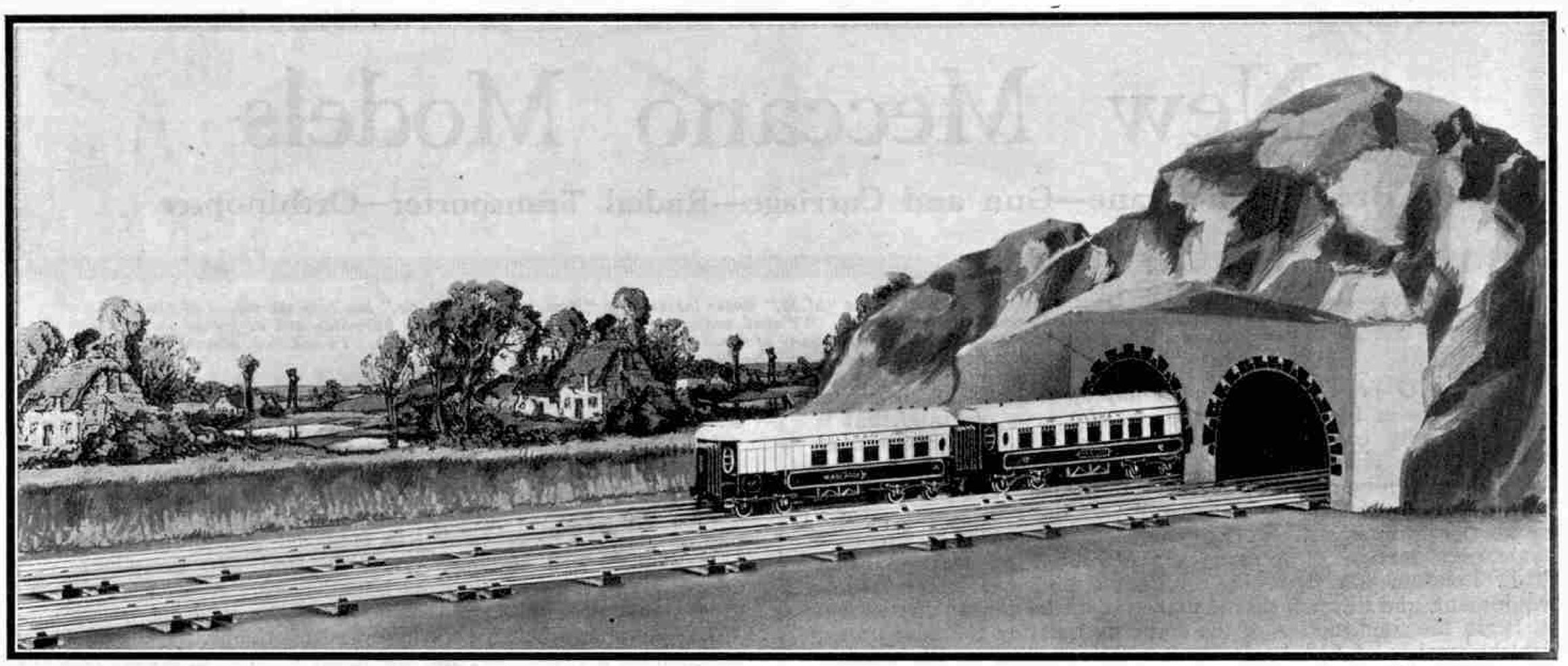
Very often a field of this kind may be relieved by a miniature pond, and the best way of making one of these is undoubtedly to cut out a hole in the field and to place an old piece of mirror underneath. This will look remarkably like a pond and if the banks look rather sharp and unrealistic, these can be smoothened off by the use of Plasticine.

Trees, Shrubs, and the Manufacture of Forests

The tasteful distribution of trees will enhance the appearance of any model line-side to a great degree, and if the engineer has sufficient patience to undertake the manufacture of a forest, he will be well repaid for his trouble. Trees may be made from suitable twigs. Small bits of green moss, obtainable from any florist, are then glued on to the "branches" to represent the leaves. Another method of making foliage for trees is to obtain some green felt or other green woolly material, and to grate this to fluff by means of an old nutmeg grater. The fluff should be stuck to the twigs to represent leaves, and the result obtained will be found to be quite effective.

Fences for Lineside and Background Scenery

Very often the addition of a small fence running up and down hills in the background will improve the general appearance of the scenery around a model layout immensely. There are



The use of wallpaper frieze as scenery on a model railway is illustrated here. In order to obtain the realistic sky effect the wall of the room was first of all distempered in light sky blue. The sky that already existed on the frieze was then cut away and the remainder of the frieze pasted in position. The embankment, consisting of felt treated as explained in this article, was then laid down to the line-side

various methods employed for making fences but the following two are probably the most practicable.

For the construction of a fence that is close to the railway lines, match-sticks may be used, securely planted in small holes that may be made in the baseboard by means of a gimlet. The matches should be connected together by cotton, and the small fence should then receive a light coating of some dark coloured paint. For fences in the more distant background, old gramophone needles placed at regular intervals and bound together with cotton are very useful. These should also be coloured over with a thin layer of paint, and the result is really most attractive.

The Equipment of a Large Station

In addition to making use of the standard Hornby Railway Stations many model railway owners like to make for themselves a terminal station on as big a scale as circumstances will permit. Such a station, even if made accurately and neatly to scale looks very dead and unrealistic until certain finishing touches are provided.

The first matter for consideration is the platform surface. In actual railway practice a platform surface, apart from the paved portions, is covered with asphalt or tar. The best method of obtaining the "asphalt" effect is to varnish over the model platform with some cheap black enamel, and when it is beginning to dry to sprinkle fine emery or pumice powder over it. In order to finish-off a platform the edges should be coloured with a slaty-gray paint to represent the flagstones that are usually found as an edging to the platforms in an actual station.

Then there are the buildings to be considered. Station buildings are usually manufactured from wood, but in many cases are left unpainted and consequently do not look anything like as effective as they might do. All buildings should be finished off by painting bricks on the walls. In order to get a really good brick wall effect, first paint the wall over with brick-red flat paint. Then obtain some Indian ink and rule on the bricks. When finished, the wall will be all that can be desired.

Cottages and houses around the station or along the line-side may be pebble-dashed quite successfully. Glue the surface of the walls and sprinkle coarse sand all over them. When this has been done, coat them over with a thin layer of flat paint, either white, grey or brown, to suit the taste of the "householder."

The use of home-made Papier-mache

Papier-mache comes in extremely useful for scenery work on a model railway. Embankments and cuttings may be made from it, and tunnels may be covered over with it. The simplest way to make papier-mache at home is to obtain some old newspapers, tear them into small pieces and boil them in water in an old pan. The paper eventually will become very soft and pulpy. At this stage the water should be strained off and water paint should then be added, the colour being selected to suit the purpose in mind. A little glue or size should be added to enable the papier-mache to set hard when it is being laid out in position.

The mixture is then ready for use and may be shaped as and where required on the railway. Papier-mache must be left approximately three weeks to dry, but when dry it will be extremely hard and will stand any amount of knocking about. Plaster is very often used instead of papier-mache, but the objection to plaster is that it has a nasty habit of cracking when holes are drilled in it.

Asbestos Sheets for Rock Cuttings

Asbestos sheets often come in very handy in model railway construction. The track may be laid on asbestos sheets if required, but there are one or two points that must be carefully noted before setting to work with this material.

The objection to asbestos sheets is that they are very brittle and snap easily unless handled carefully. Nails should on no account be driven into an asbestos sheet without holes having first been drilled for them. Another point that should be remembered is that it is not advisable to saw too near the edge of a sheet. Platforms may be made from asbestos sheeting and deep cuttings may be represented in a very true-to-life manner by placing a piece of sheeting on each side of the track and colouring it over with flat grey paint. The appearance is exactly the same as a deep cutting in rock.

Ballasting a Model Track Realistically

Ballasting is a subject that is dealt with in almost any article on model railways and no doubt many Hornby enthusiasts are well experienced in the art of ballasting a model track realistically. The ingredients to use are granite chips, or "chicken grit." The chips may be laid down round the sleepers of the track loosely if desired, but some enthusiasts prefer to mix them with glue so as to avoid the rail bed spreading. It is a good plan to lay felt under the sleepers of the rails and then to spread the ballast round up to the level of the top of the sleepers. The smoothness of the running of trains on tracks so treated will be noticeable immediately.

As practically all model railway scenic effects have to be painted, a few words of advice as regards the kind of paint to use will not be out of place here.

For rough jobs such as the colouring of baseboards and similar large surfaces, any cheap brand of stain can be used. On the other hand, for jobs such as the painting of trees, fields and the like, a finer brand of flat oil paint comes in very useful. If possible, however, the best type of colour to use on this kind of work is Reeves' Showcard Paint. This is not a transparent colour similar to those that are supplied in artists' water-colour boxes, but is opaque and, in addition, has the advantage of drying quickly. For fine work, such as the painting of details on model buildings, etc., nothing but first-class enamel should be used.

During painting a great deal of patience must be exercised. More than one good piece of work has been spoilt through being touched before it has dried properly. If two coats of paint are required, the first should be allowed to dry thoroughly before the second is applied.

New Meccano Models

Breakdown Crane—Gun and Carriage—Radial Transporter—Orthinopter

Since the beginning of 1928 the series of articles published in the "M.M." under the heading "New Meccano Models," has been the means of placing before our readers no less than eighty-four new and original models. We shall endeavour to continue the series month by month and as far as possible we shall deal in each issue with several new and quite simple models, many of which will be suitable for the smaller Outfits. In addition, special articles from time to time will deal with the Meccano "super" models.

MECCANO boys will find many unique features in the model shown in Fig. 1. It is a model of a type of crane that is specially constructed for mounting on a motor truck or lorry so that it may be quickly and easily transported. The vehicle so equipped fulfils similar functions, with respect to motoring and road transport generally, as the railway breakdown crane does to rail transport. The Meccano model is almost a scale reproduction of a crane manufactured by Harvey Frost Ltd., London, who specialise in garage and automobile repair equipment, and this fact should make the model doubly interesting.

Begin the construction of the crane by building the base frame, which consists of 5½" Angle Girders 22 attached in the manner shown. A 4½" Girder is bolted across the side members in order to carry the two 1½" Girders 4, and to the front of the base frame two 5½" Girders are bolted in an upright position and are kept rigid by 5½" Strips. To complete the "fixed" portion of the crane the guides 8, consisting of 5½" large radius Curved Strips, should be bolted to the side girders of the frame.

It is advisable to assemble the jib in one piece, pivoting it to the base frame when completed. As will be seen, it consists essentially of two 12½" Angle Girders 10 and two 5½" Angle Girders 13, the Girders 13 being held together at the topmost end by a Double Bracket, whilst a 3½" Angle Girder 20 secures the extremities of the Girders 10. These Girders are prevented from warping when a heavy load is placed on the pulley block by struts and tie members constructed as follows. A rectangular frame, consisting of three 2½" Angle Girders and a 2½" Strip, is first bolted to the centre of the Angle Girders 10, and to the top of the frame four 5½" Strips 19 are bolted, the lower pair of Strips being secured to 1½" Strips that, in turn, are fastened to the Angle Girders 10. The upper pair of Strips are fastened to 1½" Angle Girders bolted to the Angle Girder 10 by Angle Brackets. To ensure rigidity a 2" Screwed Rod 18 is fastened between the 1½" Angle Girders by four nuts.

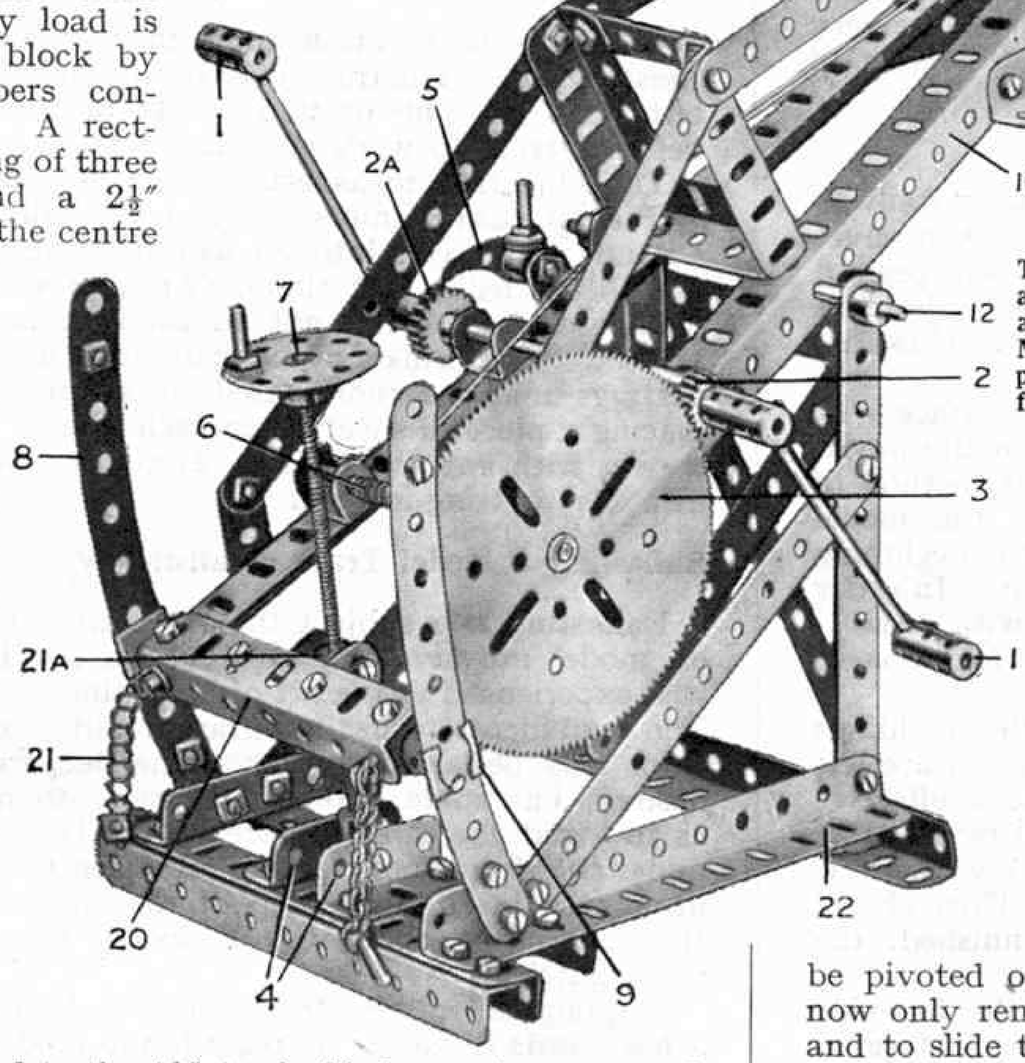


Fig. 1
This model should form a popular addition to the already big family of Meccano Cranes. Its prototype is used specially for breakdown and repair work on the road

The jib head should next receive attention. The Angle Girders 13 are supported by two 4½" Strips that are bolted to the 1½" Angle Girders and are secured to the Girders 10 by 2" Screwed Rods 14a secured in place by four nuts. The arrangement of the jib head Pulley is novel and should be noted particularly. The Pulley is capable of turning round on a swivel, thus enabling the hoisting block to be hauled in at any angle to the jib.

The supports for the 1" loose Pulley over which passes the hoisting cord, consist of two Corner Brackets 15 spaced apart by a Large Fork Piece, additional width being obtained between the Brackets 15 by slipping Washers on to the bolts. The Brackets 15 also form supports for a 1" Rod that carries a ½" loose Pulley held in place by a Collar on either side.

The Rod 14, to which the Large Fork Piece is attached, is journalled at the top in a Double Bracket 17, whilst its lower end passes through a Cranked Bent Strip secured to a 2" Strip that is bolted across the 5½" Angle Girders 13. This Cranked Bent Strip cannot be seen in the illustration, since it is obscured by the upper end of the Angle Girder 10.

We may now turn to the construction of the winding mechanism. Four Double Brackets should first be secured to the Angle Girders 10 as shown. In the lower pair of Brackets a 4½" Rod 6 is journalled, this Rod carrying a 3½" Gear Wheel 3. In the second pair of Double Brackets a 5" Rod is placed, and upon it are slipped a ½" Pinion 2, a Ratchet Wheel 2a and two Couplings, each Coupling carrying in one of its lateral holes a 3" Rod terminating in a second Coupling, and so forming the winding handles.

To complete the ratchet mechanism the Pawl 5 should be fastened on a Pivot Bolt and the latter secured to a Flat Bracket, which, in turn, is secured to one of the Girders 10. In order to provide a "release" lever whereby the ratchet mechanism may be put out of gear, a Threaded Pin is screwed into the grub-screw hole in the boss of the Pawl, and in order to prevent the screwed part of the Pin "fouling" the Pivot Bolt, two Washers are placed under the shoulder of the Pin. By moving the Threaded Pin in an anti-clockwise direction the Pawl is disengaged from the Ratchet, when the load coupled to the crane block will fall freely. If it is found, on completing the model, that there is a tendency for the Pawl to slip off the Ratchet a small spring, consisting of a short length of Spring Cord fastened to the Pawl and to the Girder 10, will put matters right.

The Threaded Boss 21a forms part of the jib adjustment gear and should be pivoted on bolts that pass through an Angle Bracket on either side, each Bracket being secured to the 3½" Girder 20 by means of further Angle Brackets. The 4½" Screwed Rod 7 can now be screwed into the Threaded Boss 21a. This Rod carries on its lower end a Collar, fixed to the Rod by its setscrew, a second Collar, the setscrew from which has been removed, and two nuts. The latter are lock-nutted in such a position as to allow of the free rotation of the centre Collar, which can now be pivoted on two bolts journalled in the Angle Girder 4. It now only remains to attach the Eye Pieces 9 to the Girders 10 and to slide them on to the guides 8.

The method of arranging the hoisting cord will be clear from the illustration. Many forms of pulley blocks could be built up for this model, but the Meccano Single Sheave Pulley Block would look particularly effective. The block shown in the illustration was devised from two Single Bent Strips held together by a Threaded Pin 16, the shank of which forms a bearing for a ½" loose Pulley. The complete jib is pivoted to the base frame on a 4½" Axle Rod 12.

The parts required to build the Motor Breakdown Crane are as follows: 8 of No. 2; 2 of No. 2a; 1 of No. 3; 1 of No. 5; 1 of No. 6; 2 of No. 6a; 2 of No. 8; 9 of No. 9; 1 of No. 9a; 1 of No. 9b; 2 of No. 9d; 1 of No. 9e; 4 of No. 9f; 6 of No. 11; 7 of No. 12; 1 of No. 15; 2 of No. 15a; 3 of No. 16; 1 of No. 18b; 1 of No. 22a; 3 of No. 23; 1 of No. 24; 1 of No. 26; 1 of No. 27b; 60 of No. 37; 11 of No. 37a; 5 of No. 38; 1 of No. 40; 1 of No. 44; 2 of No. 50a; 1 of No. 57b; 13 of No. 59; 4 of No. 63;

1 of No. 64 ; 1 of No. 80b ; 2 of No. 81 ; 2 of No. 89 ; 4″ of No. 94 ; 2 of No. 102 ; 1 of No. 111 ; 2 of No. 111a ; 2 of No. 111c ; 4 of No. 115 ; 1 of No. 116 ; 2 of No. 133 ; 1 of No. 147a ; 1 of No. 147b ; 1 of No. 148.

(All the above parts are included in the No. 6 Outfit, with the exception of 1 of No. 9e).

An Interesting Radial Transporter

Readers will possibly notice the similarity between the model illustrated in Fig. 3 and the radial coal transporter that was fully described on pages 718 and 719 of the "*M.M.*" for last September.

First build the fixed base, which consists of a 5½″ × 2½″ Flanged Plate 22 to which are bolted two 2½″ Angle Girders. To these Girders, 4½″ Girders 21 are attached in a vertical position and secured at their upper ends by means of further 2½″ Angle Girders 26. A Ball Bearing 16 (part No. 168) is bolted to the top of the tower so formed, and two 2½″ Angle Girders, to each of which two 4½″ Girders 17 are bolted, are secured to the Geared Ball Race.

The outer tower or vertical support is built up from 9½″ Angle Girders 2 connected together at the base by a framework of Strips 1 and 1a, and at the top by Angle Girders. The two towers are connected together by means of four pairs of 12½″ Angle Girders 4 and 5 as shown, but if 18½″ Girders are available they should, of course, be used here, four only being required. Two 12½″ Angle Girders 8 next are bolted together to form a channel girder and secured to the upper Girders of the gantry by means of 2½″ Strips. These Girders form the runway for the crane trolley, which is built up from 2½″ and 1½″ Strips, the ½″ loose Pulleys 10 forming the travelling wheels.

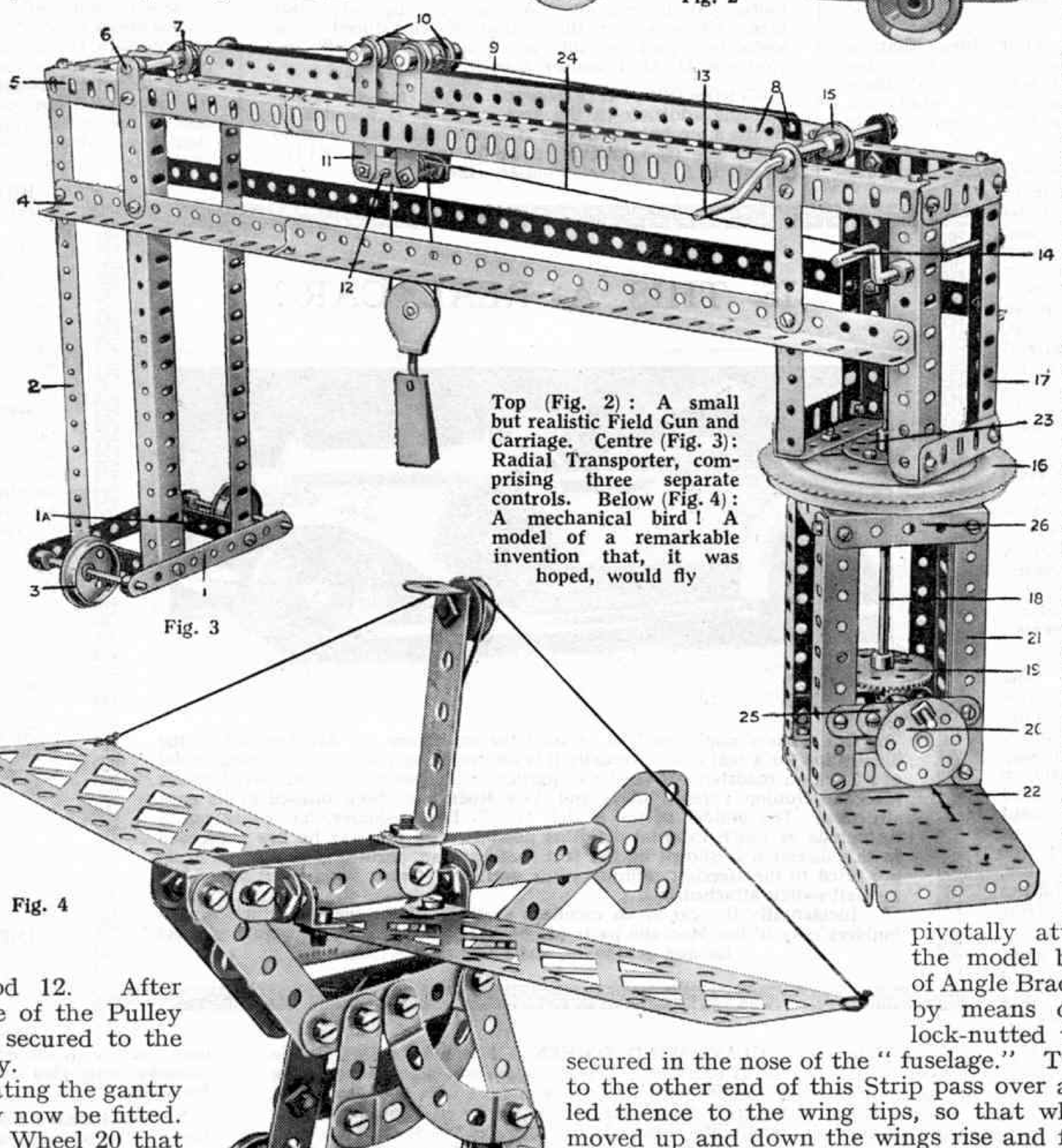


Fig. 3

Top (Fig. 2) : A small but realistic Field Gun and Carriage. Centre (Fig. 3): Radial Transporter, comprising three separate controls. Below (Fig. 4) : A mechanical bird ! A model of a remarkable invention that, it was hoped, would fly

The movements of the trolley are controlled by means of the Crank Handle 13 carrying a ½″ fast Pulley 15. A length of cord 9 is secured to the trolley and passed round the Pulley 15, then round the Pulley 7 on the Axle Rod 6, and finally is secured to the trolley. The hoisting gear is operated by means of the Crank Handle 14, cord 24 being firmly secured to this and then passed over a ½″ Pulley on the Rod 12. After passing round the sheave of the Pulley Block the cord is firmly secured to the framework of the trolley.

The mechanism for rotating the gantry about the fixed base may now be fitted. It is operated by a Bush Wheel 20 that is secured to a 1½″ Axle Rod journalled between a 2½″ Strip and the Double Bent Strip 25. This Rod also carries a ½″ Bevel Gear which meshes with a 1½″ Bevel 19 on the vertical Rod 18, the upper end of which is passed through the Ball Bearing and secured in the boss of the Bush Wheel 23, which is bolted to the Geared Race of the Ball Bearing. Hence, on rotating the hand wheel 20 the gantry can be made to travel radially to the right or left according to the direction of rotation of the wheel.

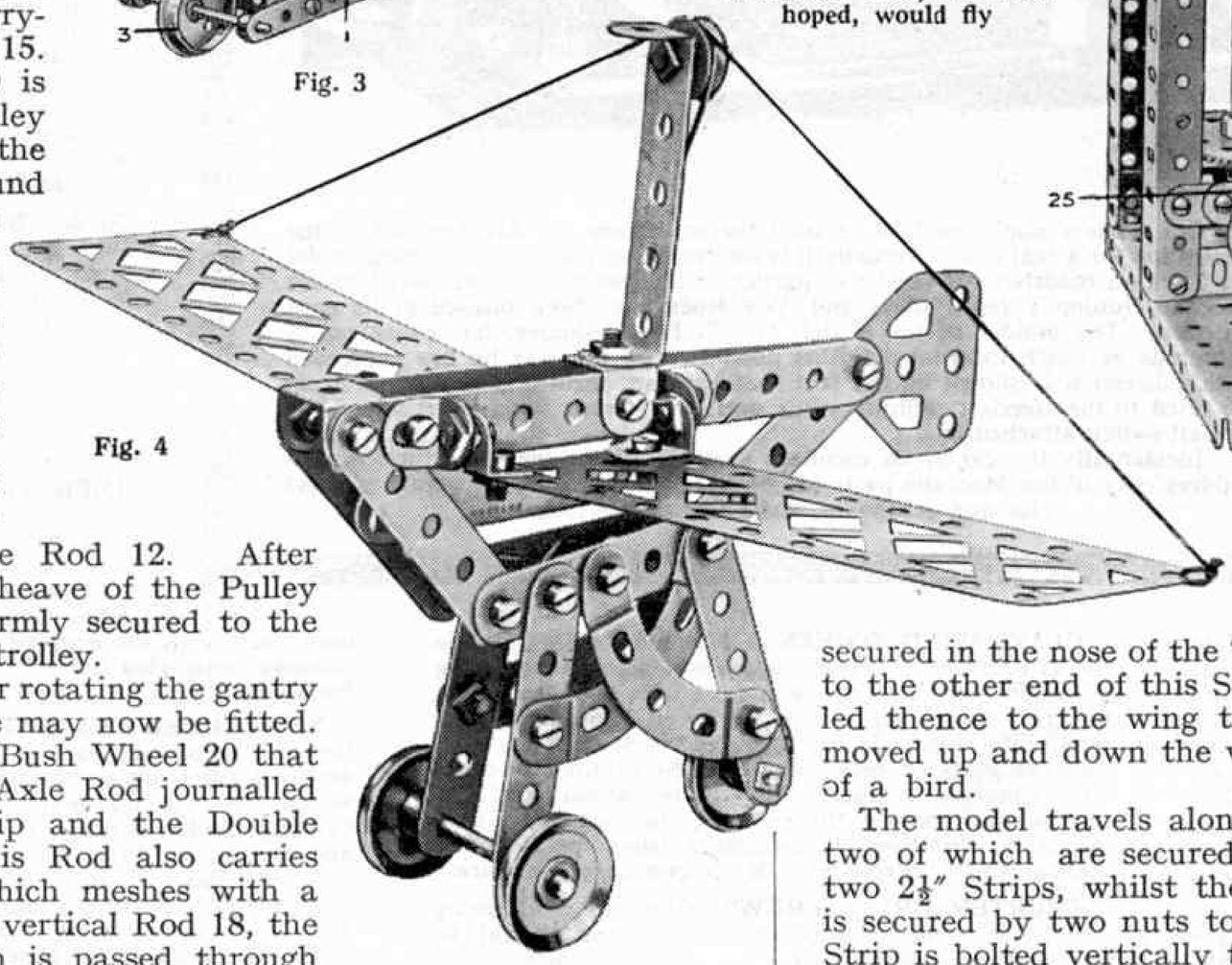


Fig. 4

The parts necessary to build the Radial Transporter are as follows : 2 of No. 2a ; 4 of No. 4 ; 9 of No. 5 ; 4 of No. 6a ; 10 of No. 8 ; 8 of No. 9a ; 10 of No. 9d.; 1 of No. 14 ; 3 of No. 16b ; 1 of No. 17 ; 3 of No. 18a ; 2 of No. 19s ; 2 of No. 20 ; 1 of No. 22a ; 4 of No. 23 ; 2 of No. 23a ; 2 of No. 24 ; 1 of No. 30a ; 1 of No. 30c ; 64 of No. 37 ; 8 of No. 37a ; 1 of No. 40 ; 1 of No. 45 ; 1 of No. 52 ; 20 of No. 59 ; 1 of No. 66 ; 2 of No. 82 ; 1 of No. 115 ; 1 of No. 151 ; 1 of No. 168.

Field Gun and Carriage

This model (Fig. 2) is just the thing for the boy who owns a set of toy soldiers. Although small and built from very few parts, it is quite realistic, and as soon as it is completed Meccano boys who are right up-to-date in their ideas will no doubt start building a tiny model tractor with which to pull it along !

The barrel of the gun consists of three 2½″ Strips secured together by means of Double Brackets, while further 2½″ Strips are bolted to these as shown, with a Double Bracket secured across their other ends. The 1″ fast Pulleys forming the travelling wheels are secured to a 1½″ Axle Rod that is journalled in two Flat Brackets.

The axle of the gun carriage is passed through the centre holes of two 2½″ Strips and through a Cranked Bent Strip. The carriage is attached to the gun merely by the shank of a bolt passed through a hole in a ½″ Reversed Angle Bracket, which is secured to the rear end of the gun.

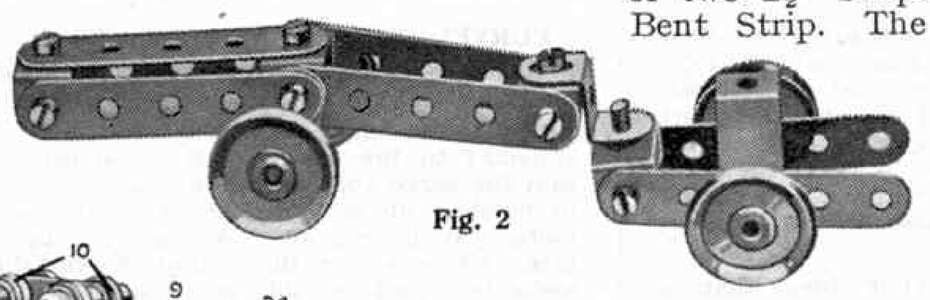


Fig. 2

This model comprises the following parts: 7 of No. 5 ; 2 of No. 10 ; 4 of No. 11 ; 2 of No. 18a ; 4 of No. 22 ; 11 of No. 37 ; 1 of No. 37a ; 1 of No. 44 ; 1 of No. 111c ; 1 of No. 125.

Orthinopter Flying Machine

One of man's many attempts to conquer the air by imitating the action of birds and insects whilst in flight, is to be found in the model illustrated in Fig. 4. The actual machine, the invention of an American, has been christened an "Orthinopter" because it is propelled by the operator rapidly raising and lowering a pair of hinged wings, just as a bird or winged insect (Orthoptera) does when flying. In spite of its somewhat terrifying name the model is quite simple to construct !

The "wings" in the Meccano model consist of 5½″ Braced Girders pivotally attached to the body of the model by means of four pairs of Angle Brackets. They are actuated by means of a 2½″ Strip that is lock-nutted to one of the 2½″ Strips secured in the nose of the "fuselage." Two pieces of cord secured to the other end of this Strip pass over a ½″ loose Pulley and are led thence to the wing tips, so that when the pivoted Strip is moved up and down the wings rise and fall, or "flap" like those of a bird.

The model travels along the ground on three 1″ fast Pulleys, two of which are secured to a 2″ Axle Rod journalled between two 2½″ Strips, whilst the other is journalled on a ¾″ Bolt that is secured by two nuts to a 2½″ Strip. A 2½″ × ½″ Double Angle Strip is bolted vertically to the fuselage, and the ½″ loose Pulley, over which passes the cords supporting the wings, is attached loosely to this by means of a ⅜″ Bolt and lock-nuts.

Should the parts be available, the model could be built to a larger scale and used for demonstration purposes.

The following parts are required to build the Orthinopter Flying Machine : 2 of No. 2 ; 9 of No. 5 ; 2 of No. 11 ; 8 of No. 12 ; 1 of No. 17 ; 3 of No. 22 ; 1 of No. 23 ; 31 of No. 37 ; 5 of No. 37a ; 1 of No. 40 ; 1 of No. 48a ; 3 of No. 90a ; 2 of No. 100 ; 2 of No. 111c ; 1 of No. 126a.

In this and the following page we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these 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 a separate sheet 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, Old Swan, Liverpool.

IMPROVED FAN.—We note your suggestion that the Boss at present fitted to the Fan (Part No. 157), should be extended, and the new portion grooved, in a similar manner to the boss of the Flywheel (Part No. 132). This is an interesting idea, and as the Fan is often required to be driven by Cord, the addition would be very useful. We are giving very careful attention to the suggestion. (*Reply to V. D. Carse, London*).

NEW TYPE SPROCKET.—Your idea that a range of Sprockets without bosses should be introduced is quite interesting, but we fear that there would be little use for these parts and it would not therefore be advisable to introduce them. (*Reply to R. Keay, Richmond*).

OVAL BUFFER.—We were very interested in your idea that the head of the plunger of the Spring Buffer (Part No. 120a) should be manufactured oval, and not round as at present. You mention that, besides facilitating shunting operations with Meccano wagons, etc. the plunger could then be used in an internal expanding brake mechanism, and we consider this a very novel and ingenious idea. We will give careful attention to your suggestion, and will probably comment on it further in these pages in the near future. (*Reply to V. Smith, Dublin*).

BINDERS FOR INSTRUCTION LEAFLETS.—To supply binders of such a size that the Instruction Leaflets could be clipped in would be a good idea, as there is certainly a likelihood of the leaflets becoming torn and soiled if left unprotected. Your suggestion will receive attention. (*Reply to V. K. Rangaswami, Madras*).

NEW COLLAR.—An extra long collar, fitted with a groove at one end, so that a small rubber ring could be fitted to it, would no doubt prove a useful addition. Your idea in suggesting this article is apparently so that Pinion Wheels could be pressed against the rubber ring in a Constant Mesh Gear Box, similar to the one described in Suggestion No. 141 (see "Suggestions Section," November, 1928). The idea has possibilities and we are making a note of it. (*Reply to E. Waugh, Rochdale*).

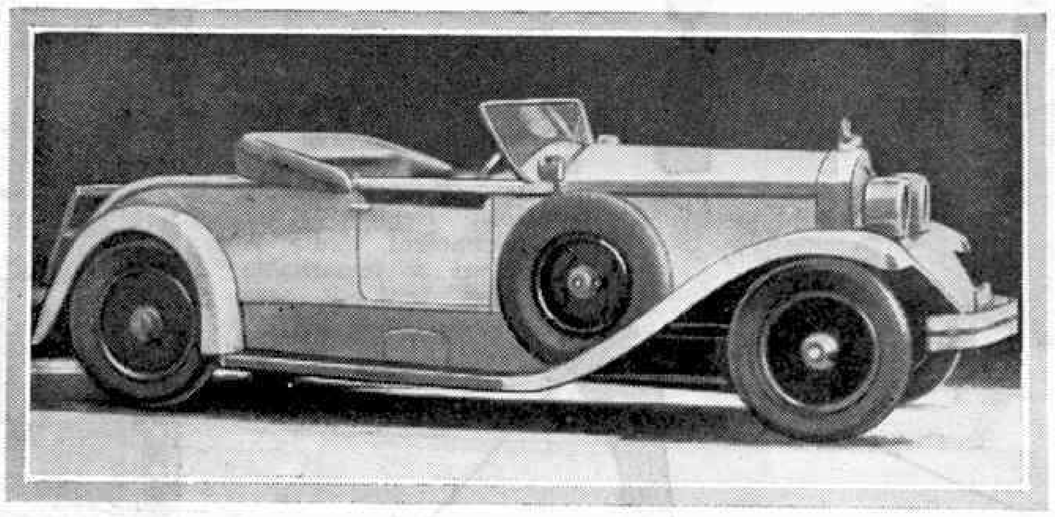
IMPROVED 6" CIRCULAR PLATE.—We note that you have endeavoured to utilise the 6" Circular Plate as a turntable in your Meccano gramophone, but that you have so far been unable to devise a suitable method whereby the plate can be rotated without adding any protrusion to its face. In using a Bush Wheel bolted to the centre of the Plate the bolt heads, of course, destroy the flat surface that is required for a turntable. While we consider that an alteration in the manufacture of this part would enable it to be used as a turntable, we do not think that it would be good policy to alter the design of the Plate for this purpose alone. At the same time we are not losing sight of your idea. (*Reply to E. J. Farner, Bath*).

FITTINGS FOR SIGNALS.—Although we have introduced recently Signal Arms (Parts Nos. 158a and 158b), as these could not be reproduced efficiently with standard parts, we think that it would be "going to extremes" if "finials" and lamps were added! It is by no means a difficult task for the constructor to devise these parts for himself from existing accessories. For example, an excellent signal finial can be improvised from a Hand Rail Support (part No. 136), and three Angle Brackets bolted together to form a "cube" will satisfy the builders desire for a suitable lamp. Many boys, however, will prefer to use a Meccano Lamp Holder and Lamp in this position. (*Reply to A. R. Bastin, Peckham, S.E.*15).

CURVED STRIP.—Your suggested strip, curved so that the ends are at right angles to each other is interesting. This strip would, of course, be very similar to the simple Bell Crank (Part No. 127) already standard to the system, but apparently you think that the curve your strip would have would be useful in building up structural work in Meccano such as motor car bodies, etc. We are looking into your idea, although we think that if introduced your suggested part would be somewhat superfluous. (*Reply to M. M. Plummer, Guernsey, C.I.*).

GYROSCOPE.—A gyroscope would make an unsuitable addition to the system, as it is possible to devise a mechanism of this kind from standard Meccano parts (see 00-3 Manual, page 55, model No. 1.131). (*Reply to E. J. Myers, Pontiac, Illinois*).

IS THIS A REAL CAR?



Our readers might well be excused for mistaking the car depicted in the illustration for a real one. Actually it is an exceedingly well proportioned model of a Packard roadster. It will be of particular interest to Meccano boys because Meccano Dunlop Tyres, Pulleys and Axle Rods have been utilised in its construction. The builder of the model, Mr. E. Barrow-Sicree, has endeavoured to include as much external detail as possible, and how far he has succeeded in this direction is shown by the fact that ignition, throttle and light controls are fitted to the steering column, while even the electric windscreen wiper has a small switch attached to it!

Incidentally the car is an excellent example of the way in which model-builders may utilise Meccano parts in conjunction with such materials as sheet tin and cardboard, and a few simple tools.

GLASS WIND SCREEN.—It would be inadvisable for us to introduce special glass windscreens for fitting to model cars, as they would be of a too specialised nature. Your suggestion, however, opens up the possibility of introducing sheets of transparent material such as glass or celluloid, punched round the edges with equidistant holes. Such plates would no doubt find several uses in the system; in particular, they might be employed as insulating bases for electrical mechanisms. (*Reply to L. M. Noguera, Buenos Aires*).

SHORTER GRUB SCREWS.—We are considering your idea that extra short grub screws should be included in addition to the standard size. This would enable a Coupling, for instance, to be used as a belt pulley or a winding drum for a crane, as the heads of the grub screws would not protrude above the surface of the Coupling. (*Reply to O. Spinney, Grafton*).

LONGER AXLE RODS.—Axle Rods longer than 12½ in. have purposely not been introduced as extra long rods are liable to bend, and are, moreover difficult and clumsy to handle. Where an extra long length of rodding is needed, the Meccano boy can easily construct this for himself by using a number of shorter Rods joined together by standard Couplings. (*Reply to D. Cameron, Carr's Creek, New South Wales*).

METAL OUTFIT CONTAINERS.—To supply all outfits in thin metal containers would constitute, we consider, a distinct improvement as it is impossible for the cardboard cartons not to become damaged with continual use. We note you also suggest that a number of equidistant holes should be punched in the lid of the suggested metal boxes, so that the container itself could be used as a base for models. This is also a good idea, although we are afraid it would be necessary to line the boxes with cardboard or stiff paper in order to exclude the dust that would be liable to enter through the holes. While considering the suggestion an excellent one, we fear that the cost of the metal would prohibit the universal adoption of your idea, but we are giving it further attention. (*Reply to G. Allaby, Ashton-under-Lyne*).

BRASS STRIP.—Your idea for overcoming the trouble that occurs when the Strips are bent is an ingenious one. To supply coils of brass strip punched with equidistant holes, so that any length could be cut off and used at will would entirely prevent the standard Steel Strips from being damaged when bent, and we will give further attention to your idea. (*Reply to J. Rue, Lithgow*).

METAL SCREEN BOXES.—As a radio enthusiast we note you have been conducting experiments in using the standard Meccano Plates for building up metal "screening-boxes" for coils in radio circuits using the "screened-grid valves," but that you have obtained poor results. This is due of course, to the fact that the Plates are of steel, but we fear that it is impossible for us to introduce aluminium or brass Plates in standard sizes, as they would be expensive to produce and their functions would be very limited. (*Reply to R. Galloway, London*).

NEW BUCKET.—No advantage would ensue from introducing a special "drag-bucket," similar to the one built up from Meccano parts in the Dragline Super Model. The Dragline model itself is on a sufficiently large scale to enable considerable accuracy to be obtained in the built-up bucket. (*Reply to K. Smith, Burnley*).

IMPROVED FACE PLATES.—We think that to stamp eight additional radial holes around the edge of the 2½ in. Face Plate as you suggest, is a good and practical idea. This would enable Strips, etc. to be attached more readily to the edge of the Plate, and we will consider your idea carefully. (*Reply to G. N. Reed, Portsmouth*).

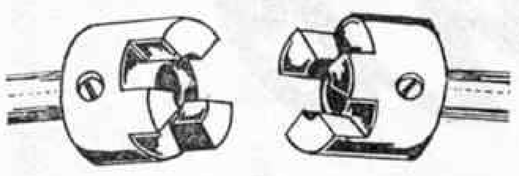
NEW GIRDER BRACKET.—Girder Brackets manufactured in several sizes in addition to part No. 113 would perhaps prove of use in certain constructional works. We would point out, however, that the existing Girder Bracket is quite an adaptable part, and can be used in models of varying sizes in conjunction with the Flat and Angle Girders (as for example in the Block Setting Crane; Super Model, No. 4). We doubt therefore whether it would be worth our while to increase the range of this part. (*Reply to P. Dodd, Didsbury, Manchester*).

SHORTER CRANK.—We have gone into the question of introducing a shorter crank having only one hole, but we do not consider that there would be any advantage in doing this, as where a reciprocating motion is required the Eccentrics (Parts Nos. 130 and 170) will be found to fulfil requirements. (*Reply to H. Hancock, Welwyn, Herts.*).

NEW DOUBLE ANGLE STRIPS.—Such a strip would be entirely superfluous if introduced, as its functions are already covered by existing parts. (*Reply to T. G. Cockroft, Bingley, Yorks.*).

Suggested Meccano Improvements—(*Continued*)

NEW TYPE DOG CLUTCH.—The suggestion that you put forward regarding an improvement to the Dog Clutch is interesting and shows considerable ingenuity. For the benefit of other readers we have included a sketch of the idea and it will be noticed that both portions of the clutch are identical, each having three radial slots cut in its boss. Slightly smoother engagement and disengagement would be obtained by the use of this type of Clutch, but we regret to inform you that we cannot consider the adoption of your idea as the cost of manufacture would be considerable. This can best be summed up by stating, that whereas it is a comparatively simple matter to cut a slot or lateral ridge in a brass boss, considerable complications would be introduced if it were necessary to cut three radial slots in the boss. (*Reply to A. L. Wright, Edinburgh*).



RESISTANCE WIRE.—We note your suggestion that high resistance wire should be introduced for the construction of motor controllers. We would point out, however, that as the resistance of the circuit when the Low Voltage Motor is used is comparatively low, a variable resistance of low ohmic value, such as can be made with the existing Meccano Bare Iron Wire, will control the speed of the Motor quite effectively. (For best results the resistance of the Motor and Accumulator should equal approximately the resistance of the controller). High resistance wire could of course be employed in devising controllers for the High Voltage Motor, but the construction of such articles is, we fear, out of the scope of the Meccano model-builder. A controller for the 4-volt Motor will be found in the Electrical Manual. (*Reply to A. Beck, Kensington, W.8*).

IMPROVEMENT TO CLOCKWORK MOTORS.—We are giving careful attention to your suggestion that the reversing lever of the Clockwork Motor should be brought out on the side of the Motor a little distance above the brake lever. Doubtless this could be done by using an extra coupling strip, but the idea would have to be put to practical tests before we can give a definite opinion on it. We are giving careful attention to the matter. (*Reply to E. Jeromes, Coleshill, Birmingham*).

6 B.A. WASHERS.—As previously stated in these columns we are unable at present to give consideration to the manufacture of washers of this size. We agree that there are many uses for small washers that can be used in conjunction with 6 B.A. Bolts, and we would point out that if you specially require them they can be obtained from an electrical store for quite a small sum. (*Reply to R. Loveland, Haywards Heath, Sussex*).

DOUBLE COTTON COVERED WIRE.—Your remarks regarding the insulated wire at present standard to the system are noted. We do not consider, however, that there is any necessity for the single cotton covered wire to be replaced by the double cotton covered variety, as the existing wire provides efficient insulation for general requirements. As some model-builders, however, will now be experimenting with radio receivers, where D.C.C. wire is of special use, we will give attention to your idea. (*Reply to R. Jenkins, West Hartlepool*).

IMPROVED BOLT.—We note that you suggest that in order to overcome the difficulty of the Screwdriver slipping out of the slot of the bolt, the slot should be closed at both ends. This would certainly overcome the trouble, but it is open to several objections. In the first place your suggested type of bolt head could only be rotated by a Screwdriver of special width. In addition the cost of manufacture of bolts fashioned in this way would be considerable. (*Reply to John Couran, Dublin*).

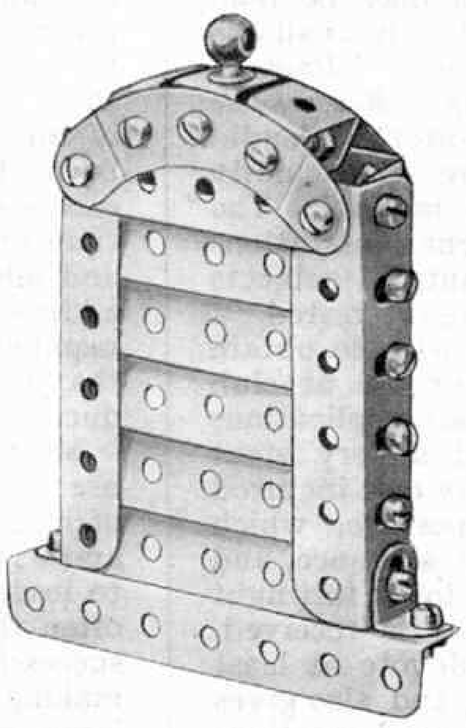
DOUBLE THROW ECCENTRIC.—We are afraid that there would be little use for a double throw eccentric, if it were introduced, as the Triple and Single Throw Eccentrics fulfil most needs. (*Reply to H. Thornton, Peterborough*).

HEXAGON NUT.—Your suggestion that the four corners of the standard nut should be removed, thus forming a hexagon nut, is interesting. We agree that this alteration would considerably increase the ease with which nuts could be fastened to bolts, and moreover, there would be less likelihood of nuts "fouling" each other in confined spaces. We will look into this suggestion with care. (*Reply to B. Simpson, Queenstown, Co. Cork*).

MINIATURE GRINDSTONE.—We consider that your suggestion regarding a miniature grindstone is particularly interesting. This article would of course add a touch of realism to a model workshop constructed from standard parts and you may be sure we will go into the question of supplying small grindstones in the near future. (*Reply to A. Tattersill, Clapham Common, S.W.11*).

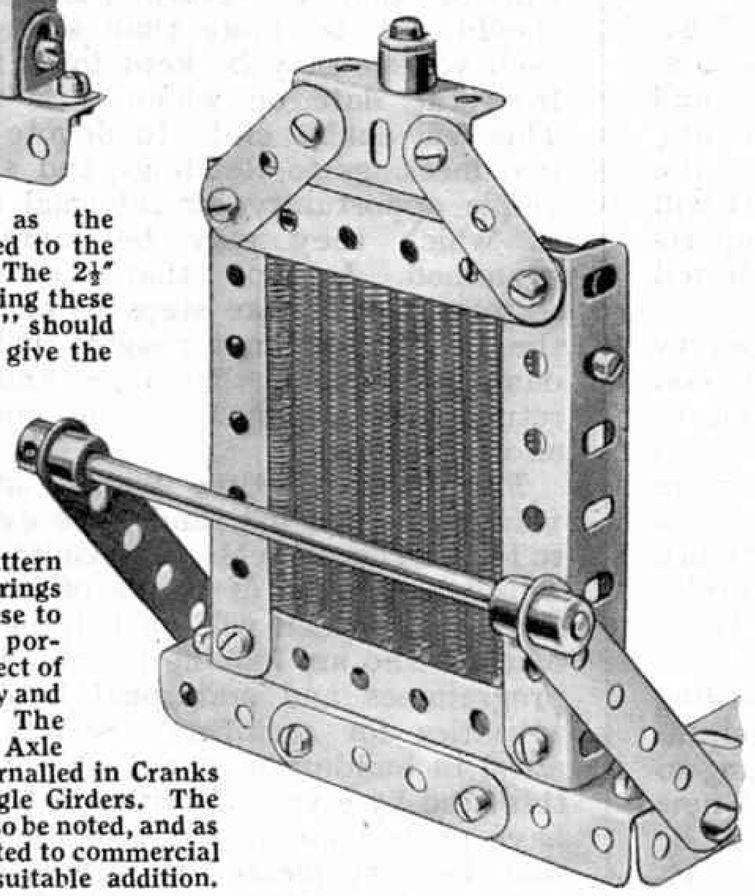
TIP BUCKET.—The system already contains a comprehensive range of excavating tools, i.e., the Digger Bucket, Dredger Bucket, Crane Grab, and there would therefore be little use for a bucket of the type you suggest. (*Reply to R. Wardale, Liverpool*).

REALISTIC MOTOR RADIATORS



Amongst suggestions received in the past for new Meccano parts, the idea that a special automobile radiator should be manufactured has held a prominent position. Many Meccano boys must therefore be of the opinion that an article of this type is essential to the completion of "perfect" model motors. The illustrations reproduced herewith, however, prove that this is not the case, and that with a little ingenuity a most realistic radiator either of the "private car" or "commercial lorry" type can quite easily be constructed from standard parts to meet requirements. Meccano boys should remember the old adage "Necessity is . . ."!

The upper illustration shows the "private car" type and it will be seen that it is fitted with "louvers" in place of Springs as in the lower model. This gives the radiator a most distinctive appearance as the "louvers" are only fitted to the more expensive cars. The 2½" Double Angle Strips forming these "louvers" or "shutters," should be bolted on the slant to give the required effect. A Handrail Support (Part No. 136) forms the "filler cap" and gives a finished appearance to the complete radiator. In the lower illustration a heavier pattern of radiator will be seen. Springs have been used in this case to form the "honeycomb" portion and they have the effect of giving the radiator a sturdy and workmanlike appearance. The Springs are held on two 3" Axle Rods whose ends are journalled in Cranks bolted to the upright Angle Girders. The "bumper bar" should also be noted, and as this article is generally fitted to commercial lorries it forms a most suitable addition.



MECCANO POCKET BOOK.—In response to numerous queries we are pleased to say that we have decided to publish a pocket book for Meccano boys and that the book is now available. (Price 1/3, post free.) (*Reply to N. Regent, Bradford; L. R. Jackson, London, S.E.3; and many others*).

FLEXIBLE SCREWDRIVER.—We were interested in your idea that a screwdriver should be manufactured having a shaft similar in many respects to the well-known Bowden cable. We note that you think such a tool would prove very adaptable in intricate mechanisms as the shaft could be bent in almost any direction so that bolts that could not be touched with the standard screwdriver, could be screwed up. We doubt, however, whether it would be possible to make such a tool. You will find it quite impossible, for example, to transmit a torsional stress through Bowden wire. (*Reply to A. W. Walker, Norwich*).

EXTRA LONG BOLT.—In place of the longer bolts, that you suggest should be introduced, you can use 1" or 2" lengths of Threaded Rod. (*Reply to K. Black, Hull*).

IMPROVEMENT TO WINDING KEY.—To cut a square hole in one of the wings of the winding key would certainly allow it to be used as a spanner. This is an ingenious little improvement and we will give it our careful attention. (*Reply to F. Ledson, Sheffield*).

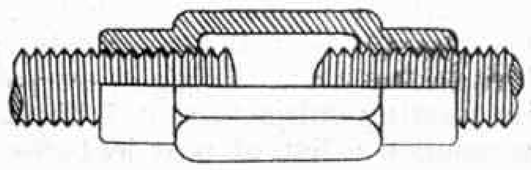
PIVOT PIN.—Your suggested part resembling a Meccano bolt minus the thread would no doubt have a few uses if incorporated in the system. We are of the opinion, however, that where a pivot pin is required the existing Threaded Pin or Pivot Bolt meet all requirements most efficiently. We do not therefore think there is any need for the introduction of your suggested article. (*Reply to E. Vaugh, Rochdale and E. Slater, Hampstead, N.W.3*).

GRADUATED DIAL.—We agree that with the inclusion of a number of measuring instruments constructed in Meccano (see "Suggestions Section" etc.) graduated dials would be of considerable use. The main objection to the inclusion of these articles however, is the fact that one dial could not be made to serve all purposes and this would mean that several different types would have to be introduced. Perhaps you can help us by giving your opinion as to which would be the most suitable size and exactly how it should be graduated? (We should of course remind readers that the Theodolite Scale or Protractor, part No. 135, will be found extremely useful where a dial is required). (*Reply to J. S. Stevens, Birmingham*).

COMBINED WINDING KEY AND SCREWDRIVER.—Your suggestion that one wing of the winding key of the Clockwork Motor should be fashioned in the shape of a screwdriver is interesting. Curiously enough a reply on this page to another reader concerns a somewhat similar idea. It might be possible to so shape the wing that it will form both a spanner and a screwdriver. We are keeping your idea before us. (*Reply to G. H. Wells, Beckenham*).

PAPER PINION.—Compressed paper gear wheels are often fitted to many forms of machinery, and examples of this type of wheel will be found in turbine reduction gearing, crane gear boxes, gramophone motors, etc., the chief advantage being that they are more silent when running than the metal wheels. The idea of adapting this type of wheel to the Meccano system has not up to the present been brought to our notice, but it certainly appears quite sound, and many models would benefit from the introduction of such a pinion as the noise created in the gearing of a model would be considerably reduced. (A particular case is the Electric Flashing Sign fully described in the "Electricity Applied to Meccano" article in the July 1928 Magazine, as excessive noise when the Sign is in operation, detracts from the complete effect). We will look into the possibilities of introducing this part. (*Reply to F. Barrett, Adelaide, S. Australia*).

ADJUSTABLE JOINT.—This is an interesting mechanism, but we regret to say that we do not think it suitable for inclusion in the Meccano system. The main principle of the joint will be seen from the accompanying sketch. A metal sleeve having a right and left-hand thread cut in its ends constitutes the joint itself, and the outside is finished in the shape of a nut so that it can be rotated by means of a spanner, and both rods brought together or moved apart simultaneously. The main objection to the introduction of this part is of course the fact that it would be necessary to introduce left-hand threaded rods. This we are not prepared to do as they would unnecessarily complicate matters and very few uses could be found for them if added. We would point out to you that while it is of course impossible to duplicate this mechanism exactly with standard Meccano parts, a very close reproduction can be obtained by using Threaded Cranks or Threaded Bosses in conjunction with the standard right-hand Threaded Rod. (*Reply to D. C. Morton, Harsarden*).



With the Secretary

Prompt Reports Necessary

I wish to raise a point of importance in connection with reports from the secretaries of affiliated clubs. Of late I have noticed a growing tendency to send these at the end of each session instead of monthly. When they do arrive they are always excellent, and I must admit that a report of the activities of a complete session is usually an imposing record and makes splendid reading. Unfortunately the chief purposes of the "Club Notes" page are to some extent defeated by the adoption of this practice.

In the first place the notes are to a large extent out of date when finally they appear in the pages of the *"M.M."* I should like to remind secretaries that the Magazine necessarily must go to press considerably in advance of publication, and that reports intended to appear in any issue must be received not later than the first day of the preceding month. It will be seen that delay in forwarding reports may mean that some of the events referred to are four months old!

I prefer to have a short report every month, rather than a long one at the end of each session, in order to enable me to give a continuous record of a club's activities. I feel sure that this is the more satisfactory method and a little reflection by Leaders and secretaries will convince them that their members would prefer to have their clubs mentioned in these pages as often as possible.

The second reason for forwarding reports more often is that they are helpful to other clubs. It is always interesting to read what other clubs are doing, and new ideas are most readily passed round the family circle of Meccano clubs through the medium of the "Club Notes" page. Prompt monthly reports will greatly help in their circulation, and I hope that the officials of every club will use every endeavour to report progress regularly.

Meccano Lectures

The Meccano Lectures that are available on loan from Headquarters have provided clubs with many interesting evenings during the winter sessions. The subjects they deal with are of the greatest interest to Meccano boys, and they have proved so popular that I have had some difficulty in keeping pace with the demand for them. Secretaries will be pleased to learn that I am taking steps to add other interesting subjects and I hope shortly to announce a list of new lectures.

In addition I have made arrangements to loan to clubs a number of books from which chapters or extracts may be read aloud. Volumes that are already available include *"Engineering for Boys," "Pioneers of Wireless"* and the *"Book of Remarkable Machinery,"* three of the Editor's splendid books for boys, that are particularly suitable for use in this manner. The volumes are full of excellent illustrations and give fascinating accounts of subjects in which modern boys are interested.

Secretaries of clubs who wish to obtain the loan of these books for use at club meetings should send in their applications without delay, as I expect a very great demand for them. The only cost incurred will be that of return postage, which should not be more than sixpence, and each volume may be kept for a fortnight from the date on which it is received. This will enable clubs to devote at least two meetings to Readings, and also gives ample opportunity for informal meetings at which they may be more closely examined. I hope that Leaders and secretaries will take steps to ensure that the volumes are not roughly handled or damaged while in their care, and also to return them promptly at the end of the allotted period.

From time to time I shall add other volumes to the list, and hope eventually to form a complete Meccano Guild Library. This will consist of books of interest to boys, and which will be helpful to club officials who are looking for new ideas for programmes and additional hobbies and activities for members. Secretaries can assist in building up a valuable library of this kind by giving the titles of books that have proved useful in this manner, and I shall be very pleased to receive any suggestions that will help to make the scheme successful.

Help from Dealers

On page 163 appears the third instalment of the complete list of affiliated Meccano clubs throughout the world. This completes the number of clubs in Great Britain, and gives details of a number of overseas organisations. I have been thinking about the circumstances and activities of the clubs in these lists, and it has occurred to me that the majority of them do not take sufficient advantage of the good offices of local Meccano dealers.

Clubs that are in touch with a dealer invariably find him willing to advertise the club, and thus to enable them to secure new members. A dealer's window is always the centre of attraction to the Meccano boys of the neighbourhood, and practically every dealer willingly agrees to bring the existence of a club before these boys by exhibiting in it a notice of the meetings of the club. This should be neatly typed or printed on a sheet of cardboard, and should show plainly the time of meeting, in addition to the name and address of the club. The secretary's address also should be given and intending members asked to apply to him in order that he may give them a personal introduction to the club.

Most dealers are willing to allow the use of their windows for the exhibition of prize winning models in club competitions, and as a rule they are pleased to respond to invitations to judge the models. Very often they help to make exhibitions more successful by showing special models or making a Hornby Train display on a large scale. My advice to all Leaders and secretaries is that they should immediately make friends with the local dealer, and if possible invite him to become President or Vice-president of the club. I feel sure that an excellent response will be obtained in practically all cases and the association will be of great benefit to both sides.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:—

AUSTRALIA—T. Butler, 114, Stanhope Street, Malvern, S.E. 4, Australia.

AUSTRALIA—G. Robertson, 1029, Wellington Street, West Perth, West. Australia.

CLIFTON—H. Baines, 15, Richmond Terrace, Clifton, Bristol.

EASTBOURNE—T. Woodthorpe, St. Georges School, Eastbourne, Sussex.

FELTHAM—W. Hooper, 78, Southern Avenue, Feltham, Middlesex.

HERNE BAY—P. G. Shears, Edington House, Herne Bay, Kent.

KINGTON—T. Williams, Holmes Marsh, Lyonshall, Kington.

LONDON—J. Halliday, 14, Queensbury Road, Church Lane, Kingsbury, N.W.9.

LONDON—J. H. Paterson, Eltham College, London, S.E.9.

LUTON—R. Whitmore, 53, Selbourne Road, Luton, Beds.

PUDSEY—F. North, 203, Swinnow Road, Lowtown, Pudsey, Leeds.

The Origin of Guilds

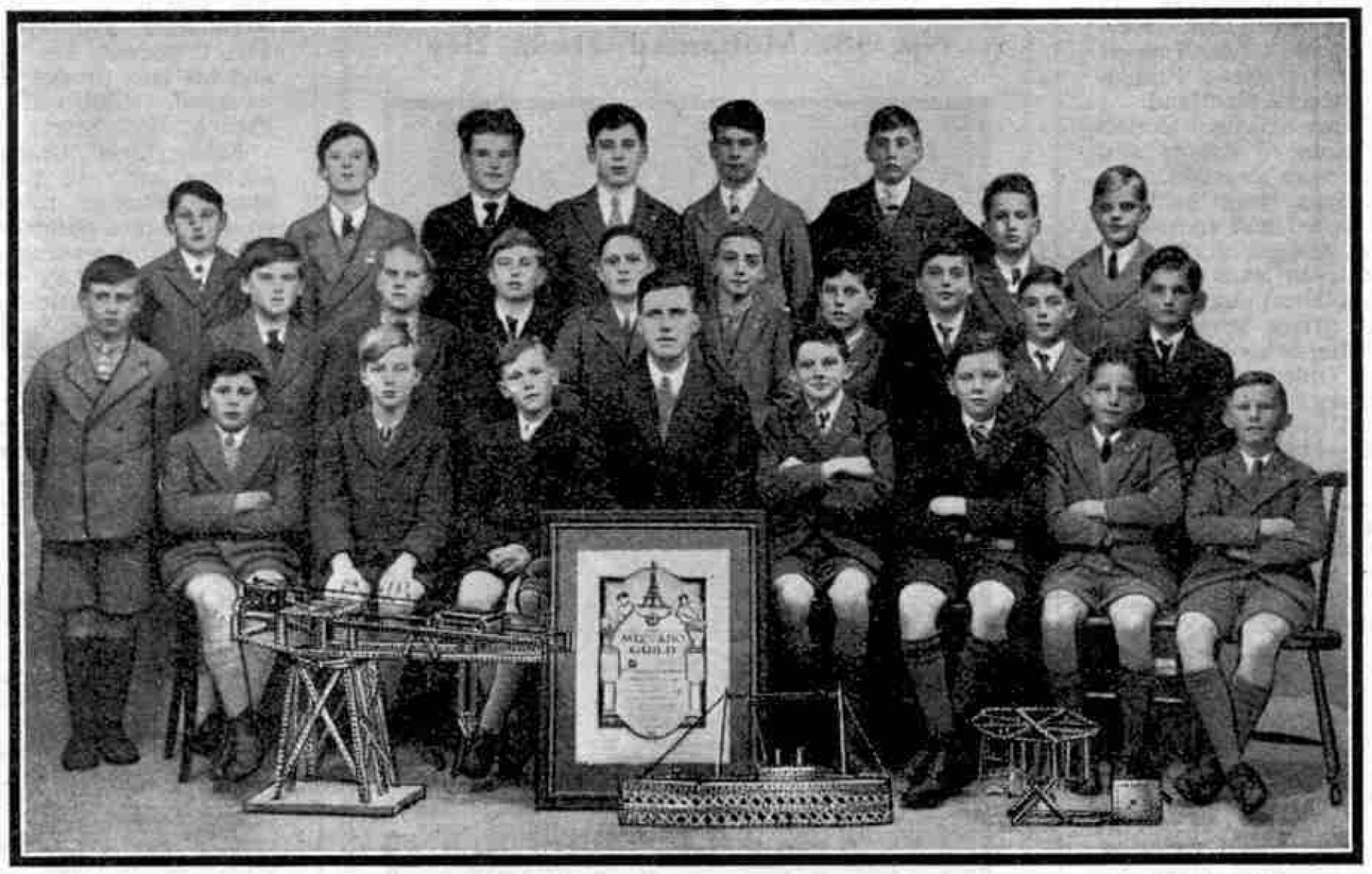
The Splendid Ideals and Traditions of the Ancient Companies

WE have been asked repeatedly why we chose the name "Guild" for the great Meccano organisation. The answer is that we wished our movement to be based upon the splendid ideals and traditions of the old Guilds—good fellowship and comradeship and unselfish working for mutual benefit. The old Guilds are dead, but the spirit that animated them is as much alive to-day as ever, and we believe that spirit animates the members of the Meccano Guild. As long as its members remain true to these ideals, the Meccano Guild will live and prosper and become an ever-widening influence in the world of modern boyhood.

Craftsmen from Flanders

A Guild may be described briefly as a union of men formed for mutual benefit, responsibility and protection. It cannot be claimed that Guilds originated in England, but it was in England that they reached their highest development.

After the conquest of England by William I, traders and skilled artisans began to come from Flanders and northern France to settle in what was then a comparatively thinly populated country. These men were masters of their respective crafts and were also very industrious, and consequently in time they became very prosperous. Those were lawless times. Merchants found it necessary to band themselves together for mutual protection of their lives and property, and so a number of Guilds came into being.



A cheery group of members of the Weymouth Central School Meccano Club. This club was affiliated in June, 1928, and has made rapid progress under the skilful Leadership of Mr. R. J. Dewey, who is seated in the centre of the front row of our photograph. Surprise Model-building Nights form a notable feature of the club's syllabus. On these occasions each member is called upon to build a model the name of which is drawn from a hat

Formation of Merchant Guilds

As time went on and the state of the country became more peaceful, the need for combining against robbers gradually disappeared. By this time, however, the merchants had realised that there were many other advantages in such combinations, and so the Guilds already in existence were kept going, and from time to time others were formed. In the twelfth century Merchant Guilds received Royal authorisation, and thus were placed upon a sound basis.

The Merchant Guilds were formed primarily for trading purposes, and the members passed many stringent rules regulating trade in various towns and villages. For instance, only members of the Guild were allowed to sell goods to the inhabitants of a town. A stranger might bring in goods, but he could only sell them to members of the Guild, and anyone found breaking this rule was very severely punished. It might be thought that the merchants, protected by Royal authority and strongly organised in this manner, would make exorbitant charges, as there was no competition and no restraint. This was not the case, however, for wise rules were drawn up by all the merchants assembled together, and any member disregarding these for his own profit had his privilege of membership taken away and was thus deprived of the means of livelihood.

Gradually the scope of the Merchant Guilds widened, and when the liberties of the townsmen were threatened there were large assemblages at the Guild Hall to consider ways and means of defending their rights. Thus the Guild's affairs became more and more the town's affairs, and later on we find that the Guild Halls became Town Halls and the Merchant Guilds became Town Councils.

Unfortunately the Merchant Guilds showed a tendency to become tyrannical as their power and wealth increased. They excluded the landless men of the handicrafts with the result that these united among themselves to form Craft Guilds.

Craft Guilds and Apprentices

As the Merchant Guilds gradually changed in character, the Craft Guilds soon entirely replaced them as far as trading interests were concerned. The Craft Guilds, as was the case with the Merchant Guilds, were governed by very strict rules. Each member held himself directly responsible for the actions of his fellow members and this naturally led each one to consider his conduct very carefully.

The rules and regulations were drawn up on the vote of the majority, and were framed for the welfare of the community as a whole, and for the religious and moral good of the individual. They demanded that each member should lead an upright, honest life, and do his utmost to live up to the high ideals of the Craft. Should a member find his business failing through the markets going against him, it was the duty of his fellow members to help him and save him from going to moneylenders, who charged exorbitant interest for their assistance.

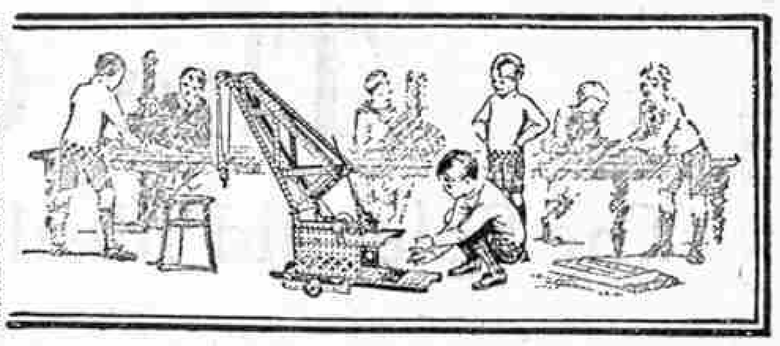
A determined effort to break down class distinctions was made through the introduction of the apprenticeship system. No matter how rich and influential a man was, he could not buy the right of entry to the Guild for his son, who must serve his apprenticeship, live, sleep, have his meals and his games with his fellow apprentices. Promotion to the various offices in the Guild was given on merit alone, and it was possible for the son of the poorest parent to gain the highest honours the Guild had to bestow.

As in the case of the Merchant Guilds, the interests of the Craft Guilds widened, and in addition to the ordinary commercial and social obligations they took a deep interest in religious and educational matters. Not only did they strive to make the Church services beautiful, but they spent endless time, energy, and wealth in beautifying the buildings in which the services were held, and many churches and chapels bear evidences of their efforts to this day. In educational affairs they spent huge sums in founding and endowing many famous schools and colleges.

The Dissolution

The Guilds, in the oldest and best sense, received their deathblow in the reign of Henry VIII. A Bill was introduced in Parliament authorising the King to acquire all the property and lands belonging to the Guilds. They managed to retain a great many of their rights and privileges from a commercial and social point of view, but their colleges, churches and chapels were seized and confiscated. The Guilds never recovered from this blow, and it is doubtful if they can ever exist again in the same form as that of hundreds of years ago.

CLUB NOTES



Falmouth Wesleyan M.C.—Has had a most successful session. The programme includes Lantern Lectures, Model-building Competitions and Social Evenings. Prizes given for models showing originality encourage the members to use their inventive powers. A very interesting Lecture on "*Norwegian Fiords*" has been given, and a Concert and Model Display is being arranged. Club roll: 37. Leader: Mr. T. H. Jordan, Langton Terrace, Falmouth.

Morison Memorial M.C.—Joint meetings with the Victoria M.C. have been very successful and are being continued. At one of them a Lantern Lecture on "*A Tour from Venice to Cannes*" was given. The slides shown were from photographs taken by the Lecturer, whose account of his travels was very interesting. At ordinary meetings special models made by members have been displayed and explained, and at a demonstration of Fretwork a number of excellent Calendar Holders were cut. These are being completed and sold. The President, Rev. W. Gerard, gave an interesting talk on "*The Humour of Mark Twain.*" Club roll: 54. *Secretary*: Francis Bannister, 7, Wallace Street, Clydebank, Scotland.

Whitgift Middle School M.C.—Many excellent models were shown at a special Exhibition of Cranes and Road Vehicles, and several prizes were awarded. On Hornby Train Nights Competitions were held on specially designed tracks for the speed and endurance of members' locomotives. The Annual Exhibition was a great success. The models on view included the Ship Coaler, on loan from Headquarters, and an interesting feature was that prizes were offered for models shown by members of the School who have not joined the Club. The session ended with a Social Evening. Club roll: 35. *Secretary*: F. T. Brockes, 14, Addiscombe Court Road, East Croydon.

Woolwich and Plumstead M.C.—Members are keen on Boxing and Physical Development, in which they are trained by Mr. J. Gorrod, M.S.F. who has acted as second to several well known Boxing Champions. The Lending Library continues to be successful and interesting Lantern Lectures have been given. The club now has a splendid football ground. Club roll: 60. *Secretary*: S. E. Weller, 22, Woodhurst Road, Plumstead.

Harehills (Leeds) M.C.—Members now meet in a more convenient club room, with the result that the attendance has improved. Several debates have been held on such questions as "*The Gramophone v. Wireless*" and "*Aircraft v. Navy as a means of Defence*," while the lecture on "*The Story of the Motor Car*" was loaned from Headquarters. Draughts Championship Night caused great excitement. The Exhibition was very successful, valuable help being given by Mr. W. J. S. Carpenter, a local Meccano dealer who has kindly consented to become President of the club. The session ended with a Cinematograph Show and a Conjuring Entertainment. Club roll: 20. *Secretary*: R. K. Fourness, 12, Berkeley Street, Harehills, Leeds.

Bridport Grammar School M.C.—Members show great interest in Model-building and many ingenious ideas have been worked out. The local Meccano dealer very kindly judged the models entered in the Competition held last session, and gave a prize for originality. Lectures and debates add variety to a good programme. Club roll: 31. *Secretary*: E. Lawrence, 161, St. Andrews Road, Bridport, Dorset.

Galashiels M.C.—Members were glad to welcome their Leader, Mr. H. Chalmers, when he returned on recovering from his illness. The club now possesses a Lantern and interesting slides are shown regularly. A Lantern Lecture entitled "*A Visit to Bournville*" was most enjoyable and was specially reported in "*The Border Telegraph.*" Debates are frequently arranged. Club roll: 28. *Secretary*: D. Richmond, 58, St. John Street, Galashiels.

Braintree County School M.C.—Fifteen Locomotives were run on a large Hornby Train Layout constructed at one meeting. A second Model-building Contest attracted many entries, Motor Cars, Aeroplanes, and Cranes being the most popular subjects for models. Two lectures on "*Timber*" and "*The Magneto*" interested members very greatly. A Stamp Section and also a Football team have been organised, and a well-attended Exhibition was held during the Christmas Holidays. Club roll: 23. *Secretary*: P. Allen, St. Edmunds, Bocking, Braintree, Essex.

Harpenden M.C.—Has now secured affiliation, and the members are greatly indebted to Mr. W. A. Jones, who has accepted the post of Leader. Splendid lectures on "*Printing*" and "*The Evolution of the Steam Engine*" were given by Messrs. Archer and Boulton. Other interesting items in an excellent programme were a visit to the Printing Works of "*The Luton News*" and a successful Exhibition and Concert. Club roll: 22. *Secretary*: A. J. Buck, Station Road, Harpenden, Herts.

Albion (Portsmouth) M.C.—The meetings of this club are very interesting, the Leader explaining the construction and use of every part of a model in a very clear manner. The club model of a Gantry Crane working on the radial system was completed, the task of erection being carried out with the aid of properly designed hoisting tackle. Tenders for dismantling the Crane were then called for. The successful group contracted to take it down in 15 minutes, and their actual working time was only three minutes greater. Members then built a model of an American Mallet Triplex Locomotive. This was entered in a competition held by local Meccano dealers. Club roll: 9. *Secretary*: J. V. L. Kemp, Albion House, Mile End, Portsmouth.

Meccano Club Leaders

No. 38. Mohamed Hafiz Bey

Mohamed Hafiz Bey is the Leader of the Sphinx M.C., Cairo, which was affiliated with the Guild in October 1928. He takes a very active part in the work of the club and is keen on the promotion of Model-building and other Competitions. His signature appears on our portrait, and readers will have an interesting time trying to decipher it!

Liverpool M.C.—Most meetings are devoted to Model-building and there is always a good attendance on Meccano Nights. The models constructed have been of a very high standard and have included Aeroplanes, Cranes, and a Dragline worked by a Motor. Hornby Train Nights are also popular, and games of various kinds are usually organised at the end of the meeting. Club roll: 15. *Secretary*: J. Ibbotson, 30, Redvers Drive, Orrell Park, Liverpool.

Lund Park (Keighley) M.C.—A splendid display of models was seen at the Exhibition. These included a Motor Chassis, Omnibus, a Tipping Chute, Excavator and a Traction Engine, all built by members, and also the High Speed Ship Coaler loaned from Headquarters. The last named model was a great attraction to a large number of visitors. The sum of £2/19/- was raised. Club roll: 18. *Secretary*: H. S. Holmes, 56, Mannville Road, Keighley.

Victoria (Glasgow) M.C.—Joint meetings with the Morison Memorial M.C. have been highly successful, and at one of them the President, Rev. C. M. Macleroy, presented the prizes won at the inter-club sports. Mr. H. G. Cooper gave a Lantern Lecture on "*Northern Italy and the Riviera*," and showed more than 130 slides made by himself. The Secretary gave a talk on "*Bridges*" and this was followed by a very successful Contractors' Night. Club roll: 50. *Secretary*: H. C. Thompson, 4, Montgomerie Gardens, Scotstoun, Glasgow.

Cecil Road (Gravesend) M.C.—The Leader and secretary show great ingenuity in drawing up programmes. At one meeting a Hornby Train Layout was constructed, and was made very realistic by the addition of Meccano Bridges, Cranes and Stations. On Aeroplane Nights the machines constructed were suspended in mid air and "spotted" with a Meccano Searchlight. A fierce bombing attack then ended in the destruction of most of the raiders! "*Cecil Road M.C. Fairground*" was a great success, members constructing many splendid models of Roundabouts, Swings, and Figure-Eight Railways. Club roll: 20. *Secretary*: G. N. Cottle, 53, Cecil Road, Gravesend, Kent.

Great Baddow M.C.—Visitor's Night was a great success, a splendid entertainment being provided by the efforts of the members themselves. Prizes and Medals won during the year were presented by Mrs. Douglas, and a collection amounting to £3 16s. 1d. was taken. A Competition for the best models of Aeroplanes attracted a large number of entries. The President, Dr. Spencer Philips, acted as judge, and his task proved so difficult that extra prizes were awarded. Club roll: 34. *Secretary*: Miss D. K. French, High Street, Great Baddow.

Ashby Boys' Grammar School M.C.—A Firework Display early in the session concluded with Community Singing round a fire, while the members enjoyed baked potatoes and roasted chestnuts. Lantern Lectures and readings from the "*M.M.*" were greatly enjoyed, while at ordinary meetings models were built in preparation for the Exhibition. This was held in the School Gymnasium and was highly successful. A Hornby Train track completely surrounded the models on view and several Locomotives were kept running almost continually. The Motor Chassis on loan from Headquarters was a great attraction, and demonstrations of gear changing, etc., were frequently given. The President, T. A. Woodcock, Esq., M.A., who is Head of the School, stated that he learnt more from the demonstrations in ten minutes than during a two hours' conversation with a local Motor Salesman. Excellent music by the School Dance Band helped to make the evening enjoyable. Club roll: 50. *Secretary*: R. W. T. Moore, "Summerfield," Wilmot Road, Swadlincote, Burton-on-Trent.

Atherstone Grammar School M.C.—Model-building Evenings continue to be the most popular with members, and an Air Gun Shooting Contest has provided variety. An interesting Lantern Lecture entitled "*Transport and its Uses in Industry*" was kindly loaned by Cadbury Bros. Ltd. A Lightning Model-building Competition, and a close study of a Motor Chassis model lent from Headquarters were other attractive features. An amusing Mock Trial was held at the end of the session. Models built by members were on view at an Exhibition held in December, at which a Meccanograph loaned from Headquarters was also demonstrated. Club roll: 20. *Secretary*: W. C. Stokes, 11, Stafford Street, Atherstone.

Blyth M.C.—The weekly meetings are well attended and members are very keen. A Silver Medal has been offered for competition by Mr. Stimpson, the North East Divisional Secretary of the Y.M.C.A., and will be awarded to the member having the highest number of marks at the end of the session for Model-building, Attendance, and Conduct. A Christmas Party was arranged to take place in the Y.M.C.A. hall, and one of the leading members of that Association gave a display of Conjuring during the evening. Several new members have been enrolled but more are still required. Boys who wish to join should communicate with the Secretary. Club roll: 12. *Secretary*: R. N. Carr, 135, Hambledon Street, Blyth.

Selwood House (Falmouth) M.C.—This new club has held several interesting meetings which were chiefly devoted to the construction of large working models. These included a Trip Hammer and a Telpher Span. On Hornby Train Nights the desks in the Schoolroom in which the club meets were joined by Meccano Bridges and a very lengthy track laid down. A visit to Pendennis Castle and a Concert given shortly before Christmas were also greatly enjoyed. Club roll: 9. *Secretary*: F. G. A. Ashby, Selwood House School, Falmouth.

St. Mary's, Wavertree M.C.—Members of this new club are very enthusiastic, and have already made several splendid models, including a Destroyer on which was mounted an Anti-aircraft Gun, a Tower Wagon and a fighting Aeroplane complete with Machine Gun. The Football Team has played several keen but enjoyable games, and successful Cycle Runs have been held. Recruiting is good, but more members are required, and the Secretary will be pleased to hear from boys wishing to join. Club roll: 14. *Secretary*: F. Joyce, 45, Northdale Road, Wavertree Liverpool.

Wallisdown M.C.—A new Leader has been secured and a varied programme of Model-building, Games, and Debates has been arranged. New members are required and the Secretary will be glad to hear from any boy who wishes to join. *Secretary*: E. G. Hoddinott, "Bryant's Cross," Wallisdown, Bournemouth.

Ilfracombe M.C.—The Exhibition attracted a record number of visitors and the proceeds exceeded £5. The chief feature was an extensive Hornby Train Layout. It represented a railway running along a rocky coast, the "rocks" being ingeniously constructed from brown paper and glue and coloured with paint. A splendid display was made of working Meccano Models and the Side-shows also attracted attention. Visitors were guided to the hall by a large signal above the entrance. This was worked by a length of wire and was visible from a considerable distance. Club roll: 22. *Secretary*: R. Trawin, 33, Victoria Road, Ilfracombe.

Middlesbrough M.C.—Visitors' Evening was a great success, about 50 people being present. The club's Jazz Band contributed musical items, and a splendid address on "*The Use of Leisure*" was given by Mr. W. Holmes, the well-known former full-back of the Middlesbrough A.F.C. The third Annual Christmas Party was highly successful. An excellent tea was provided by the parents of members and a large Birthday Cake was cut by the Leader. During the evening a book was presented to the Secretary in recognition of his services. The Annual Ghost Story Evening was productive of many weird tales. A visit was paid to the Stockton M.C. on the occasion of their Exhibition. Club roll: 60. *Secretary*: A. Bradley, 95, Deepdale Avenue, Marton Grove, Middlesbrough.

Hessle M.C.—Is making good headway. At the end of last session stock was taken of club property and its affairs placed on a business footing. A club Library has been opened and plans drawn up for the formation of a branch of the H.R.C. Club roll: 11. *Secretary*: J. A. Fillingham, "Red Lea," Marlbro' Avenue, Hessle.

Sittingbourne Pioneer M.C.—A Weight Pulling Competition was held on Challenge Night. The challenger's clockwork motor, fixed in a simple framework, pulled a weight of 14 lb. over a distance of 9 ft. with one winding, and won the contest. Hornby Train Evenings are especially popular with members, and it is probable that a branch of the H.R.C. will be formed. Club roll: 10. *Secretary*: R. Hampshire, 2, Charlotte Street, Milton Regis.

Winchmore Hill Collegiate School M.C.—One member gave a lecture on "*Lighthouses*" and another showed an excellent model of a Motor Car. A similar model was shown at a later meeting and comparison between the two was very interesting. Hornby Train Evenings are held regularly and are always highly successful. Club roll: 37. *Secretary*: R. Truscott, 10, Old Park Road, Palmers Green, London, N.13.

Australia

Hampton M.C.—A recruiting campaign has been commenced and membership is increasing in a satisfactory manner. New members remain on probation for one month before being enrolled. Games Evenings and Hornby Train Nights are prominent features of the programme. A visit to the Melbourne Fire Brigade Headquarters was very enjoyable. A Magazine has been started and members take a great interest in printing it, a task that is performed on club night. Club roll: 20. *Secretary*: L. E. Jones, 34, The Avenue, Hampton, Victoria, Australia.

Glebe M.C.—"Foreign Correspondence Evening" is a new and popular feature. Members display photographs and stamps, and discuss information contained in letters from overseas correspondents. The club's Birthday Evening was greatly enjoyed. The former Leader paid a surprise visit, and delighted members with his stories of trips among the mountains around Cressy. *Secretary*: Miss M. M. Sculthorpe, "Cash Martin," 5, Short Street, Glebe, Hobart, Tasmania.

Hobart M.C.—This year the "Bolts" secured the Shield offered in Competition between the two sections. They have worked very hard and deserve their success. Mr. F. Ward, Director of Agriculture in Tasmania, gave an excellent Lantern Lecture on New Zealand scenery. Parties of members visited the local Flour Mill and also the Works of Messrs. Cadbury, Fry and Pascall. Miniature rifle range shooting is to be introduced, and the syllabus includes Debates, Mock Trials, Lectures, Games and Meccano Magazine Nights in addition to Model-building Contests. Club roll: 21. *Secretary*: F. Downie, 50, Letitia Street, North Hobart, Tasmania.

New Zealand

Dunedin M.C.—A splendid programme of Drawing and Model-building Competitions has been followed. Games Evenings and a "Sharp Eyes" Contest also have been greatly enjoyed. The story "*A Night at the Pool*" has been obtained from Headquarters, and is being read aloud in instalments. The visit to the Dunedin Observatory was very successful, the night being clear, and good views were obtained of several interesting stars and planets. Club roll: 15. *Secretary*: A. MacLachlan, 6, Art Studio, 66, Albany Street, Dunedin.

Napier M.C.—Held a very successful Exhibition, models on view that deserve special mention including a realistic Buick Chassis and a reproduction of a Racing Car Game. The Leader exhibited a splendid model of a Loom. It was capable of weaving cloth 22in. in width and attracted much attention. The club has now been divided into Senior and Junior Sections. Leader: Mr. Frank Drew, c/o "Daily Telegraph," Box 72, Napier, New Zealand.

Wanganui M.C.—Recent meetings have included a Model-building Contest, an Impromptu Speech Evening, Lantern Lectures and Indoor Games Tournaments. A Visitors' Night proved very successful, the Superintendent of the Fire Brigade judging the models. A debate on "*Motor Transport v. Railroad*" ended in a win for the advocates of the former by three points. Club roll: 20. *Secretary*: S. Smith, 16, Selwyn St., Wanganui, N.Z.

Egypt

Sphinx (Cairo) M.C.—A photographic section has been formed and the members have visited many of the famous photographic studios in Cairo. Model-building Competitions are held frequently and excursions have been made to various places of interest. Club roll: 15. *Secretary*: A. H. A. A. Monem, 2, Haret El Ismaily, Nasria, Cairo, Egypt.

Affiliated Meccano Clubs:—Third List

Town	Name of Club	Secretary
PENARTH	TREWINARD	Mr. S. Hooking, 27, Planey Street.
PERSHORE	PERSHORE	T. Pettifer, High Street.
PITSEA	PITSEA AND DISTRICT	Mr. E. Knight, Vange, Nr. Pitsea.
PLYMOUTH	PLYMOUTH	K. Wills, 8, Beechwood Avenue.
PONTYPOOL	PONTYPOOL ROAD	Mr. W. B. Sale, "Springfield."
PORTSMOUTH	ALBION	J. Kemp, Albion House, Mile End.
PRESTON	EMBEE	J. R. Drysdale, 20, Meath Road.
READING	READING	F. M. Wheeler, 72, Pell Street.
REDRUTH	REDRUTH	L. Trenberth, Tunnel Stores.
REIGATE	HOOLEY SCHOOLS	Miss Elsie Jordan, 7, South Road.
RICHMOND	RICHMOND	A. R. White, 15, Albert Road.
ROBERTSBRIDGE	ROBERTSBRIDGE	Mr. J Bennett, The Villas, Station Road.
ROTHERHAM	ST. JAMES	E. Brown, 52, Beech Road, Wath-on-Dearne
,,	GOLDTHORPE	E. Turner, 73, High Street, Goldthorpe.
,,	ROTHERHAM	A. E. Wood, 26, Norfolk Street.
ROTHESAY	ROTHESAY	J. Alston, Avondale, Ardbeg.
RUDDINGTON	RUDDINGTON	T. Dickens, The Red House, Manor Park
RUTHIN	RUTHIN SCHOOL	J. Butcher, Ruthin School.
SANDWICH	SANDWICH	W. Barlow, 9, Paradise Row.
SELKIRK	SELKIRK	W. Blake, 29, South Port.
SHEFFIELD	SHEFFIELD	K. Stacey, 157, Rustlings Road.
SITTINGBOURNE	PIONEER	E. L. G. Thorn, Anchorage, Addington Road
,,	SITTINGBOURNE AND MILTON	Mr. F. C. E. Cleaver, 53-59, West Street.
SOUTHALL	SOUTHALL	Mr. E. C. Carpenter, 56, Hammond Rd., East
SOUTHPORT	SOUTHPORT	E. Williamson, 10, Delamere Rd., Ainsdale.
ST. ALBANS	ST. ALBANS	H. M. Upward, "South Mead," Warley Road.
ST. HELENS	ST. HELENS	F. Ripley, 214, Greenfield Road.
ST. LEONARDS	QUEBEC	E. P. Frankan, Langley Place.
STANSTED	STANSTED	G. Haselden, Bank Cottages.
STOCKPORT	DAVENPORT	A. D. Stoker, 124, Bramhall Lane.
STOKE-ON-TRENT	STOKE AND NEWCASTLE	P. L. Taylor, 6, Poolfield Avenue.
STOTFOLD	PIONEER	E. Ray, Stotfold House.
STRATFORD-ON-AVON	EDWARD VI SCHOOL	J. Roper, 11, Church Street.
SWINDON	GORSE HILL BAPTIST	A. G. Chappell, 146, Ferndale Road.
TAUNTON	HUISH'S G.S.	S. A. Mair, Huish's Grammar School.
TEIGNMOUTH	ST. MICHAELS	F. Russell, 19, Bank Street.
,,	TEIGNMOUTH	D. Ford, 16, Higher Brook Street.
TENTERDEN	TENTERDEN	A. Nicholls, The Creamery.
TONBRIDGE	ST. SAVIOURS	C. Copper, 91, Shipbourne Road.
UTTOXETER	UTTOXETER	Mr. E. H. Davies, 4, Heathfield Road.
WALLASEY	WALLASEYAN	G. N. Gaynor, 20, Valkyrie Road.
WATFORD	WATFORD P.M.	S. Page, 211, Leavesden Road.
WESTON-S.-MARE	WESTON	R. B. Nichols, Little Combe, The Shrubbery.
WEYMOUTH	CENTRAL SCHOOL	R. Mogg, 26, Chelmsford Street.
WHITBY	WHITBY P.M.	T. A. Smeatham, Clifton, Whitby Heath.

Overseas Affiliated Meccano Clubs

Country	Name of Club	Secretary
ARGENTINE REPUBLIC	LA PLATA M.C.	Mr. A. J. Solari, s/c 45 num, 879, La Plata.
AUSTRALIA	ADELAIDE M.C.	Mr. J. A. Saddler, "Narbethong," 56, Myall Av.
	BRIGHTON M.C.	D. Rosevear, Colton Avenue, Brighton.
	GLEBE M.C.	Miss M. Sculthorpe, "Cash Martin," 5, Short Street, Glebe.
	GLENELG M.C.	K. Peek, 5, Bevington Road, Glenunga.
	HAMPTON M.C.	F. G. Wallis, 25, Avondale Street, Hampton.
	HOBART M.C.	F. Downie, 50, Letitia Street, Hobart.
	KATOOMBA M.C.	C. Boots, "Illawarra," Loftus Street, N.S.W.
	SWASTIKA M.C.	R. Wood, c/o Mrs. E. H. Green, P.O. Box 20, Port Pirie.
	TRINITY M.C.	H. Hauptmann, 3, Henson Street, Sydney.
	YERONGA M.C.	J. Hooker, Grosvenor Street, Yerongpilly.
CANADA	KITSILANS M.C.	R. A. Clarke, 2236, Yew Street, Vancouver.
	MANITOBA M.C.	Mr. E. G. Bricknell, 197, Stradebrooke Ave. Fort Rouge.
DENMARK	ODIN M.C.	A. Oswald, Langelinie 46, Odense.
EGYPT	CLEOPATRA M.C.	A. E. H. A. A. Monem, 1, Haret el Wazzan, Darb-el-Gamariz, Cairo.
	STUDENTS M.C.	M. Younis, 7, El Arbein Street, Saida Zenab, Cairo.
INDIA	CALCUTTA M.C.	Mr. A. N. Roy Chowdry, 35, Beadon St.
	DELHI M.C.	Mr. R. Raman, Children's Meccano Club, Charkhe Walan.
	EXCELSIOR M.C.	S. A. S. Royan, Senji House, Komaleswarenpett, Mount Rd. P.O.
	TIMAPUR, DELHI M.C.	Mr. M. Mushir Ali Khan, Headmaster, N.A.A.V.M. School.
ITALY	SIENA M.C.	Valentino Bruchi, 39, Via Ricasoli, Siena.
NEW ZEALAND	DUNEDIN M.C.	T. MacLachlan, Art Studio, 66, Albany St. Dunedin.
	NAPIER M.C.	L. Pickering, Shakespeare Road, Napier.
	TAKAPUNA M.C.	G. P. Henwood, 56, Lake Road, Takapuna.
	WANGANUI M.C.	J. P. S. Orr, c/o Public Works Office, Wanganui.
	WISEMAN'S M.C.	W. Shearer, 170-172, Queen St., Auckland.
SOUTH AFRICA	CLIFTON M.C.	H. Jacobsen, 169, Loveday St., Clifton.
	DURBAN M.C.	A. Altmann, P.O. Box 1941, Durban.
	MALVERN WESLEYAN M.C.	J. Warrie, Box 54, Cleveland.
	OBSERVATORY M.C.	Mr. J. Wilson, 6, Irwell St., Observatory.
	SEA POINT M.C.	Mr. G. E. Barrett, P.O. Box 1247, Cape Town.
	SIMONSTOWN M.C.	R. G. Randall, Municipal Office, Simonstown.
	VILLIERIA M.C.	Jack Wood, Villieria, Pretoria.
STRAITS SETTLEMENTS	SINGAPORE CHINESE M.C.	Mr. B. Tan, 15, Killiney Road, Singapore.

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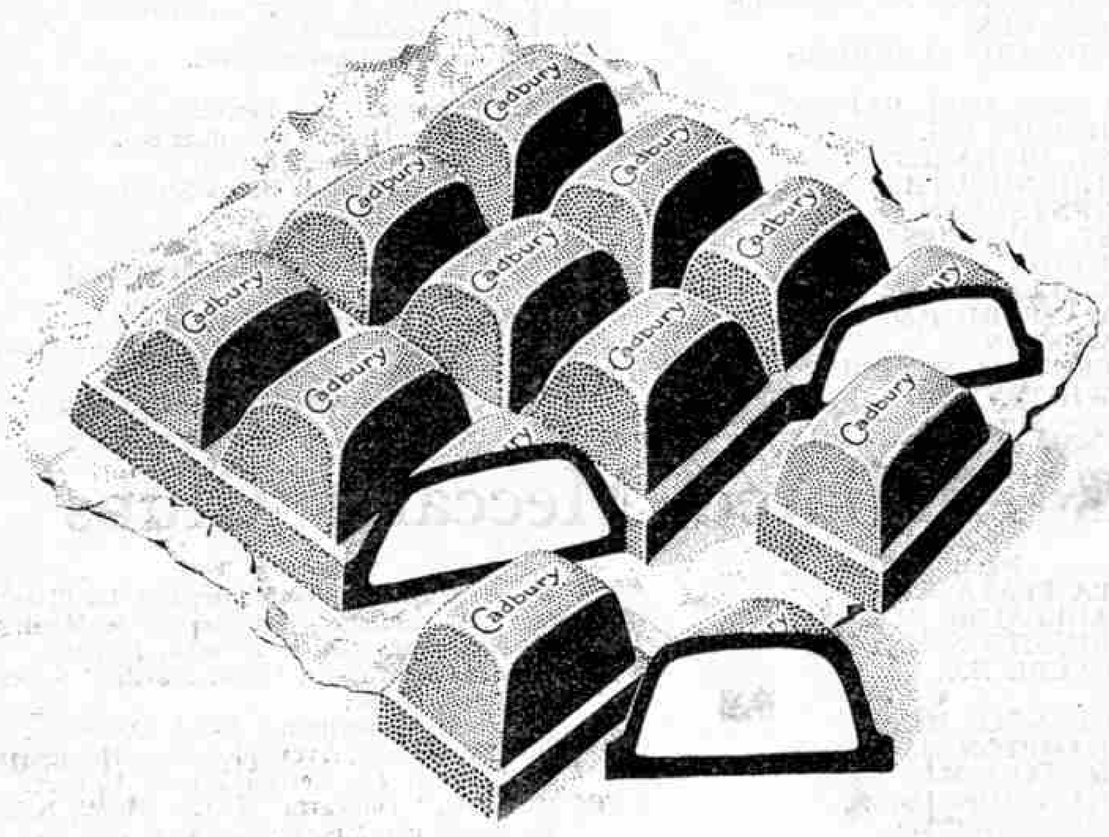

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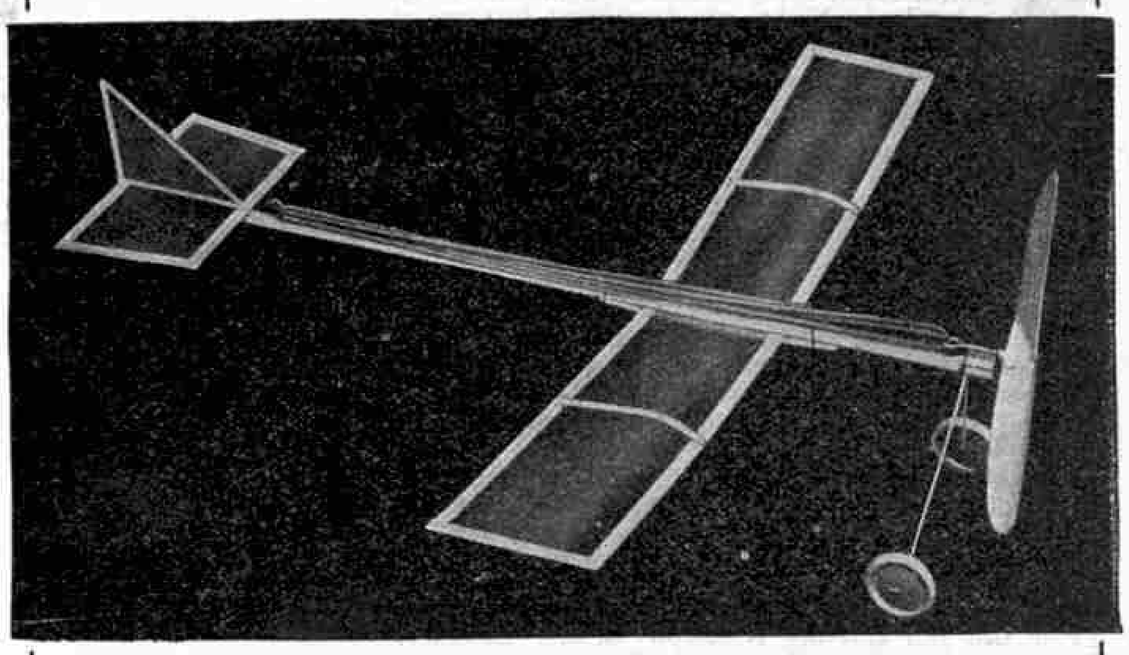
A Wonderful New Model for 1929



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Competition Page

A NEW CROSSWORD PUZZLE

CLUES ACROSS

1. Currency, 5. Driving Power, 9. Indefinite article, 10. Low, 13. Cherished, 15. Negative, 17. Quicker, 21. Piece used in playing a game, 23. Less Difficult, 24. Dandy, 26. Paddled Boat, 28. Sour, 29. Fast, 32. Keen, 33. Latin preposition, 34. Show Place, 36. Level, 39. Low person, 42. Oak Bark, 44. Follow, 47. Washing Place, 48. A Grouped Railway, 49. Conjunction, 50. A hawk-like bird, 51. To go in, 53. A Game, 54. A Watcher, 56. Copper Coins, 57. Rest, 60. An Habitual Drinker, 63. Printer's Measure, 65. An American Silver Coin, 66. Wild, 67. Personal Pronoun, 68. Fate, 69. Musical Compositions, 70. To rob with violence, 71, Evil, 73. General Staff Officer, 74. Three cardinal points, 76. Make believe, 80. To use extravagant language, 81. Descendants of a common ancestor, 84. Matches, 85. An Indian Princess, 86. Short for work, 87. Wrong side of Ledger, 88. A dress material, 90. Beam, 91, To make up 88 across, 93. For propulsion, 94. Skill, 96. Urge, 97. Anger, 98. A coniferous tree, 99. In the direction of, 100. Branch of Army.

CLUES DOWN

1. Footwiper, 2. Above, 3. Printer's Measure, 4. Affirmative, 5. Spoil, 6. Otherwise, 7. Same as 2, 8. Measure of land, 11. From Whence Man Sprang, 12. Fuel, 13. Controlled Feeding, 14. Before, 16. Narrow Road, 18. Biblical character, 19. Matter in wrong place, 20. Manage, 21. Masculine, 22. Negative, 24. Distant, 25. Liquid Measure, 26. Malignant Growth, 27. And the rest, 29. Proceeded at Fast Pace, 30. More Gloomy, 31. Arched recess, 35. Joy, 37. Headpiece of door, 38. Busy Insect, 40. Shaker, 41. Hinders, 42. One who samples, 43. Ambitious, 45. Own (Scot), 46. Had a teasing desire, 52. Colour, 53. Large stacks, 55. A battle scarred city, 56. Fondle, 58. Piece of turf, 59. Stop a gap, 61. To prepare a way, 62. Initials of Famous Railway, 64. Negative, 67. Mother, 72. Minister, 75. Happy, 77. Desires, 78. Indefinite Article, 79. Same as 67 across, 81. Egyptian God, 82. Same as 78 down, 83. An evergreen tree, 89. A climbing annual plant, 90. Tomfoolery, 92. Summons, 93. Hideous Giant, 95. To run slowly, 96. British Dominion nearest to London.

In recent months there has been a marked revival in the popularity of the crossword puzzle, which, after becoming a craze some five or six years ago, seems to have settled down as an evergreen source of amusement. It is nearly two years since last a puzzle was set in these pages, and we are sure that readers will welcome the new contest we set this month, particularly because of the novelty of the design that has been employed. It is a distinct change from the formal square.

We do not think it necessary to enter into detailed explanations of the rules governing the solution of crossword puzzles, for every reader by now is familiar with them. One point we wish to emphasise, and that is there are no unfair traps, and every word used in the puzzle will be found in Chambers' 20th Century Dictionary.

Prizes of Meccano Parts or Hornby Train Accessories, to be chosen by the winners, to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions in the order in which they are opened on the morning following the closing date. In addition, there will be a number of consolation prizes.

Entries must be addressed to "Crossword Puzzle, Meccano Magazine, Old Swan, Liverpool," and should reach this office not later than 28th February. Overseas closing date, 31st May.

No competitor may submit more than one entry.

27th Drawing Contest

Fire engines are familiar objects to all readers, and special attention has been drawn to them by recent articles in the "Famous Inventions" series. In setting "A Fire Engine" as the subject of our drawing competition this month, therefore, we have no doubt it will prove popular with everyone. The illustration on page 115 will be found very useful by those of our readers who have not had many opportunities of seeing modern fire engines.

Prizes of Meccano or Hornby Train Goods, to be chosen by the winners, to the value of 10/6 and 5/– respectively, will be awarded to the senders of the best and second best drawings in each of the usual two sections, "A" for those aged 16 and over, "B" for those under 16. Every competitor must see that his name, age and address appear on the back of his entry, which must be addressed to "27th Drawing Competition, Meccano Magazine, Old Swan, Liverpool," and should reach this office not later than 28th February. Overseas closing date, 31st May.

HOME RESULTS

Christmas Jokes Competition.—Lack of space precludes a detailed comment upon the entries for this competition, but selected entries will be published, as opportunity serves, in the "Fireside Fun" pages. The following is a list of the successful competitors:—1. G. Briggs (Northwich); 2. R. Briggs (London, N.19); 3. E. Calvert (Lincoln); 4. T. Murphy (Cheltenham, Glos.). Consolation Prizes: D. H. Pattullo (Dundee); J. Collins (Salisbury); J. McLaren (Plymouth); W. Murtagh (Belfast); R. Peiri (Glasgow); R. J. Mason (Newcastle).

OVERSEAS

Railway Planning Contest.—Many very interesting suggestions were put forward by competitors in this section of the Railway Planning Contest, and each of these will be examined very carefully with a view to ascertaining the full possibilities.

The awards are as follows:—

First Prizes: Section A, J. S. Williams (Melbourne); Section B, R. Tomlinson (Vancouver). Second Prizes: Section A, S. R. Baker (Sydney); Section B, J. Whitehead (Waikoto, N.Z.).

35th Photographic Contest.—First Prizes: Section A, E. Bonnici (Malta); Section B, C. R. Jenkins (Toronto). Second Prizes: Section A, E. Worthington (Vancouver, B.C.); Section B, N. Johns (Sydney, N.S.W.).

Silhouettes No. 3.—The correct solution to this competition is as follows:—1. Fairy Dyes or Soaps, 2. H.M.V. Gramophones, 3. Hall's Distemper, 4. Wrigley's Spearmint, 5. Bird's Custard, 6. Podmore's Duplicator, 7. Quaker Oats, 8. Ethyl Pratt's Motor Spirit, 9. Monkey Brand, 10. Gibb's Dentifrice, 11 Mobiloil, 12. Fry's Cartets, 13. Myatt's Daymark Blades, 14. Camel Cigarettes, 15. Black Cat Cigarettes, 16. White Horse Whisky, 17. Gold Flake Cigarettes, 18. Karswood Poultry Spice.

No Overseas reader succeeded in giving a completely accurate solution and the prizes were awarded as follows:—1. C. Galdes (Malta); 2. N. F. Keith (Victoria, Australia); 3. I. D. Fox (Vancouver Island, B.C.); 4. M. Heckman (Gibraltar). Consolation Prizes: M. M. Simmonds (S. Rhodesia); E. Bonnici (Malta).

36th Photographic Contest.—First Prizes: Section A, J. A. N. Beyers (Pietermaritzburg, S.A.); Section B, V. Bolitho (Via Benoni, S.A.). Second Prizes: Section A, D. Glenny (Wanganui, N.Z.); Section B, J. Bonnici (Malta). Consolation Prize: C. Galdes (Malta).

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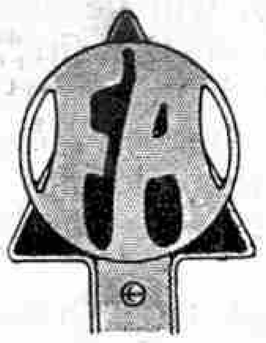

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No. 3, De Luxe Model, with ball bearing wheels, 1" ribbed tyres, plated rims, etc.	59/6	No. 7, as Model 6, but with 16" × 1$\frac{3}{8}$" pneumatic tyres	75/-

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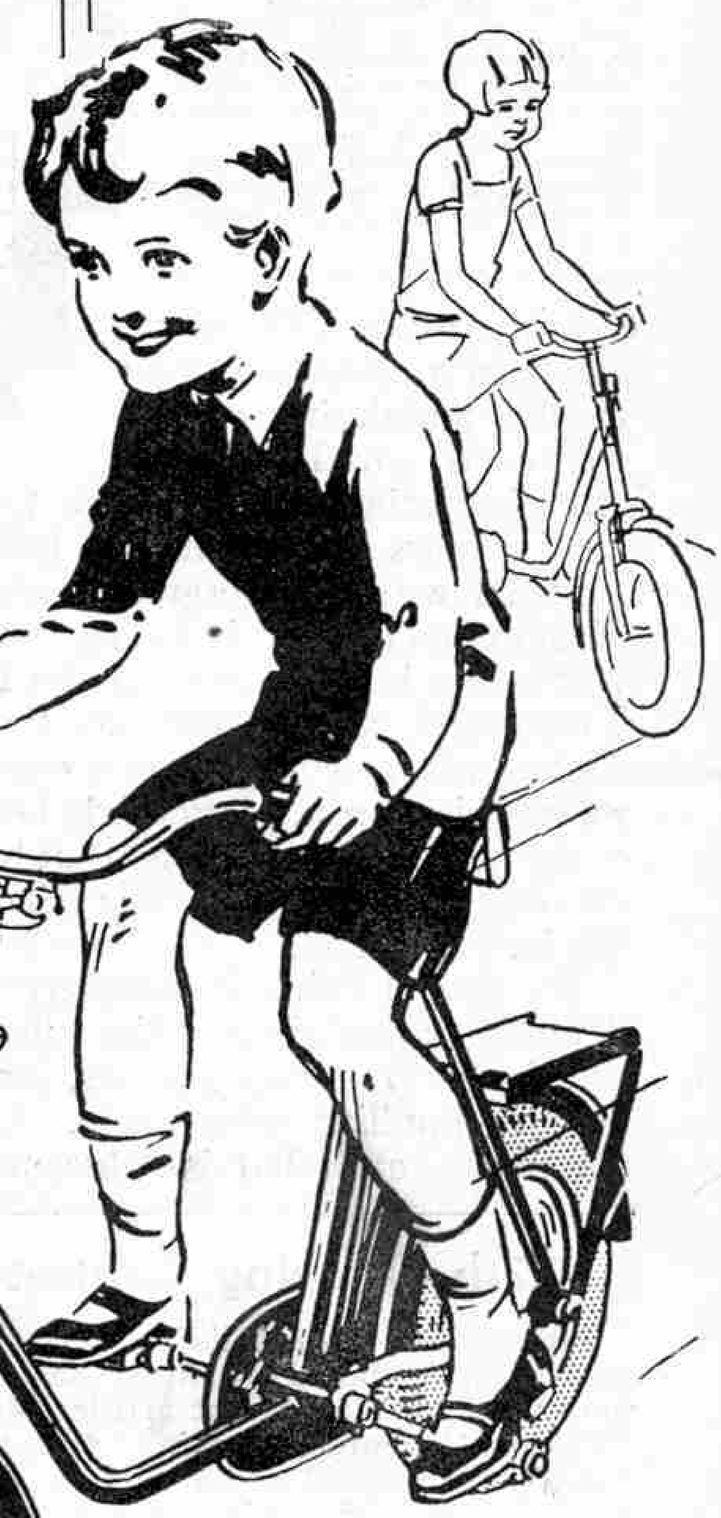

SPECIFICATION

The illustration above is of the No. 8 model. It has real Dunlop Balloon Pneumatic Tyres, with 2$\frac{1}{4}$" buttressed treads, special tubular forks, large domed mudguards, chain guard, stand and carrier. Ball bearings throughout, plated rims and rim brake. Finished Black, Orange or Blue.

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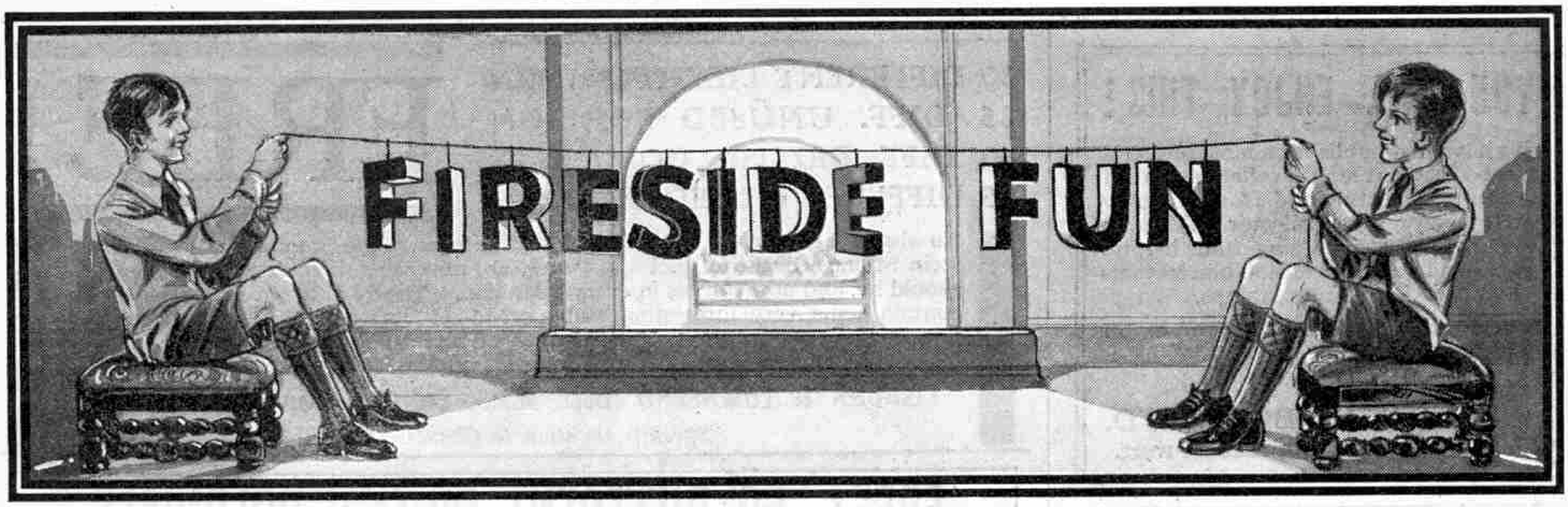


THE RECIPE

A wife asked her husband—an absent-minded professor—to copy off a radio recipe she wanted. He did his best—poor man—but got two stations at once, one of which was broadcasting the morning getting-up exercises and the other the recipe. This is what he took down.

"Hands on hips, place one cup of flour on shoulders, raise knees and depress toes and mix thoroughly in one-half cup of milk. Repeat six times. Inhale quickly one-half teaspoon of baking powder, lower the legs and mash two boiled eggs in a sieve. Exhale, breathe naturally and sift into a bowl. Attention! Lie flat on the floor and roll the white of an egg backward and forward until it comes to a boil. In ten minutes remove from the fire and rub smartly with a rough towel. Breathe naturally, dress in warm flannels and serve with fish soup."

"Dalhousie Gazette."

* * *

Lady Visitor (watching pugilist shadow-boxing): "And is he really trying to hit his own shadow?"

Trainer: "That's right, miss."

"Good heavens! Poor man! How long has he been like that?"

* * *

Employer (to office boy going an errand): "On the way there you will pass a football ground."

Office Boy (hopefully): "Yes, sir!"

Employer: "Well—pass it!"

* * *

Professor: "You have now been, I understand, twenty-five years in my service, Henry?"

Faithful Domestic (expectantly): "Yes, sir."

Professor (impressively): "Well, as a reward for your faithful service I have decided to name after you my newest species of beetle."

* * *

MANNERS MAKETH MAN

The students had been asked to write essays on "Manners," but one of them, who had a reputation for a wag, asked if he might write on bad manners.

"Oh, yes," replied the professor, "write about what you know best."

* * * *

When an Irish soldier, home on leave from the war, was asked what had struck him most in France, he replied it was the number of bullets that had missed him.

* * * *

Mike: "Did you ever speak before a large audience, Pat?"

Pat: "Fairly large. I did, Mike."

Mike: "And what did you say?"

Pat: "Not guilty, your Honour!"

* * * *

Father (to his bright offspring): "When I was your age I was glad to get dry bread to eat."

Bright Offspring: "You're much better off now that you're living with us, aren't you, Daddy?"

* * * *

Schoolmaster: "Boys, it is the man who works hard who succeeds, but whatever you want to do, you must always be content to start at the bottom of the ladder."

Jim Smith: "Please, sir what about swimming?"

Sergeant: "Sir, the enemy are as thick as peas."

Officer: "Then shell them, idiot!"

* * * *

"What was the hair wash you sold me? My hair has become quite green."

"I told you it would have astonishing results."

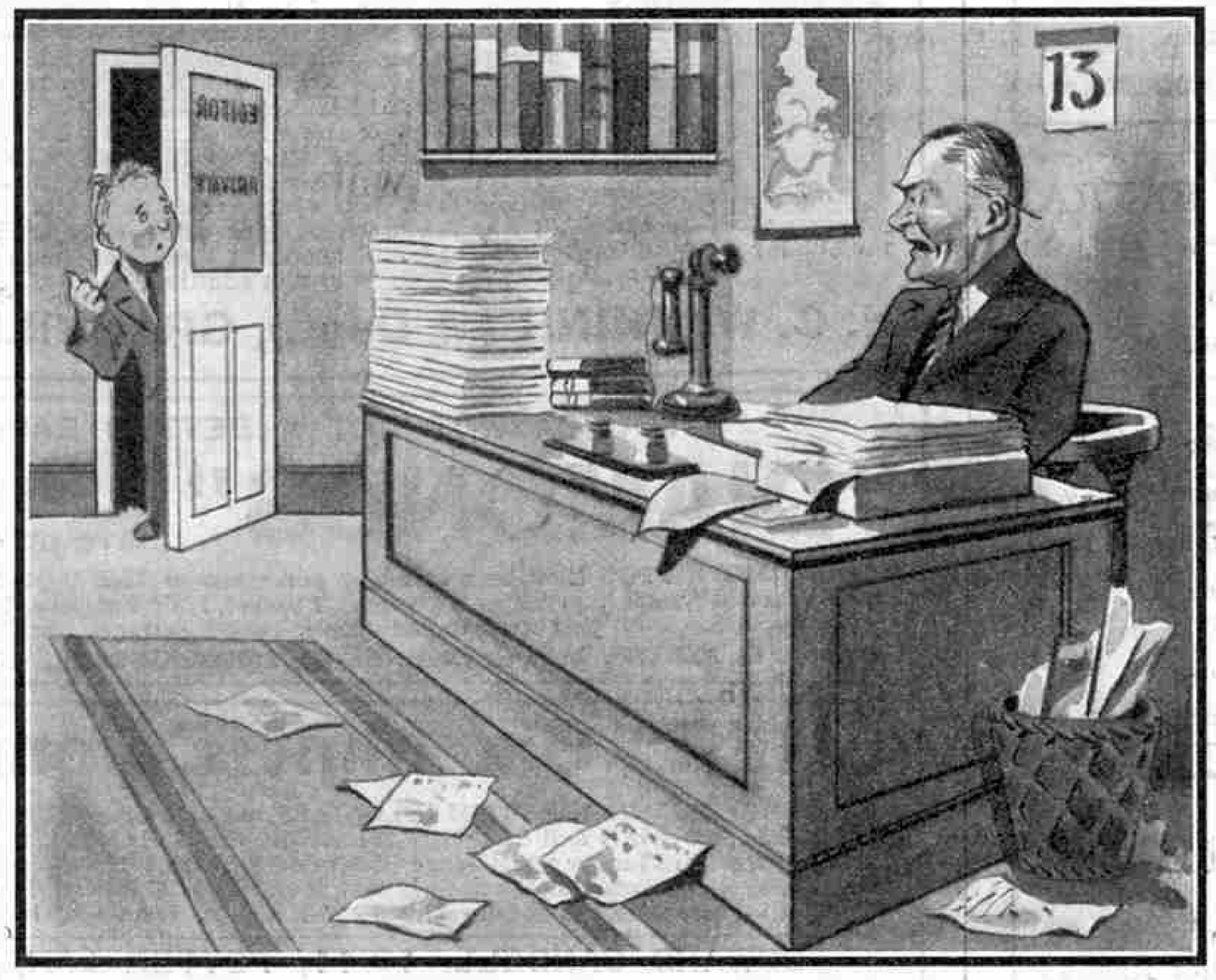
* * * *

"Late for breakfast again," said father in a stern voice. "What is your excuse to-day?"

"Well, father," replied Johnny, "you see, when you called me I was in the middle of a very funny dream, and I just slept to finish it."

* * * *

HOW HE KNEW



Editor: "Didn't I tell you I would not see anyone else this morning?'

Office Boy: "Yes, sir. But this is a gentleman."

Editor: "How do you know he's a gentleman?"

Office Boy: "Well, sir, he's got spats on!"

* * * *

A Dutch army officer appeared in public with his breast covered with medals.

"Where did you get all those medals, Colonel?" a friend asked him. "Did you win some big battle?"

The officer pointed to the biggest, brightest medal of all.

"Dot's de first one," he said. "I got dot by mistake. On I got all de oder ones because I had dot one."

* * * *

"I want a lad who is active—one who isn't afraid to move about."

"I think I'll do, sir, I've had nine jobs n two months."

* * * *

"When did you first become acquainted with your husband?"

"The first time I asked him for money after we were married."

AS USUAL

Little Norman had gone to the station to see his father off. The train pulled out, and the youngster gazed after it until it had disappeared. Presently a locomotive came in sight with a train of the same length as the one that had taken his father away, and as it entered the station he clapped his hands excitedly.

"Mamma! Mamma!" he shouted, "here comes the train back again! Daddy's forgotten something."

* * * *

The bright youth who was about to move a small handbag from the only vacant seat in the railway carriage was pounced upon by a grumpy man in the opposite corner.

"The seat is taken! My friend will be back in a moment."

"Sorry," said the bright youth, as he jumped back on the platform.

He waited till the guard blew his whistle and then, as nobody appeared to claim the empty seat, he sprang in, and flung the handbag out on to the platform.

"It wouldn't do for your friend to lose his bag as well as his train," he remarked sweetly to the grumpy man, as the train glided out of the station.

* * *

Slim: "When do you do your hardest work?"

Fat: "Before breakfast."

Slim: "What do you do?"

Fat: "Try to get out of bed."

* * *

Barber: "Is there any particular way you'd like your hair cut?"

Customer: "Yeah, off!"

* * *

She: "I took the recipe for this cake out of the cookery book."

He (after sampling): "You did perfectly right, dear; it should never have been put there."

* * *

A THRILLING ESCAPE

The little man had listened patiently to his friend's tall yarns of thrilling escapes; then he thought it time he had a word.

"Yesterday I fell off a twenty-foot ladder," he said.

"Really?" queried the spinner of yarns. "And yet you are quite fit to-day?"

"Yes, you see," replied the little man as he moved off, "I only fell from the bottom rung."

* * * *

"Watt are you doing here?"

"Eating currents," replied the apprentice. "Anode you'd catch me at it?"

"Never mind, but wire you insulate this morning?" asked the Boss.

"Leyden bed."

"Can't your relay shunts get you up?"

"Amperently not, sir."

"Fuse going to do that every day, you can go ohm," said the Boss, and the circuit was broken right there.

* * * *

Fond Auntie: "Now, Harold, if your mother gave you a large apple and a small one, and told you to divide with your brother, which would you give him?"

Harold: "Do you mean my big brother or my little one?"

* * * *

Boy (in French class): "Please, sir, what is 'to die'?"

Master (from London): "Wednesday."

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ENGINEERING STAMPS (III): WARSHIPS

CONTINUING our series of engineering stamp articles, we turn our attention this month to battleships. A stamp collection containing specimens of every stamp featuring a ship in its design would present to the student of naval history a fascinating pictorial record of the evolution of the war vessel, and it is unfortunate that we cannot display this development in pictorial form in a page article. We must content ourselves with brief references, and illustrations of one or two old-time vessels, supplemented by the very small number of stamps illustrating the modern "Man-o'-War."

Our first illustration takes us back to the early days of maritime history. The stamp is the 5c. value from the set issued by Egypt in 1926 to commemorate the International Navigation Congress held at Cairo. It shows an ancient Egyptian slave galley as depicted on a piece of statuary preserved in the Temple of Deir-el-Bahari.

Galleys have been used as war vessels from comparatively modern times down to the far-off days of the siege of Troy. Naturally individual tastes governed the design of individual ships, but usually they were low, flat vessels, having bows and sterns raised considerably above the level of their decks. The galleys were propelled through the water by great oars manned by slaves, but in addition there was usually available a single mast fitted with a square sail for use in favouring winds. The oars would vary from 14 to 59 ft. in length, according to the size of the vessel, and while some could be driven by 50 oarsmen, it is on record that the great galley of Caligua required 1,600 slaves to handle it!

Although the traditions of the British Navy go back many hundreds of years, it is difficult to find a good illustration of any vessel of pre-Nelson days. A British battleship of the early 19th century appears on the 4 drachma Greek commemorative issued in 1927, to mark the centenary of the Battle of Navarino Bay, which definitely established Greek independence of Turkish dominion. The stamp illustrated here shows Admiral Sir Edward Codrington's fleet actually in conflict with the Turkish fleet in the Bay.

The circumstances of the fight were rather curious, for the trouble really dated back to 1821, when a revolution in the Near East forced a temporary evacuation of the Turkish Army of Occupation. Immediately Greece made a bid to recover her independence, and in the course of the ensuing warfare appalling massacres were perpetrated by both sides. Eventually the three Great European Powers, France, Great Britain and Russia, decided to intervene on the side of Greece, and the British and French Mediterranean Fleets were despatched post-haste to Navarino Bay. On arrival they were reinforced by a Russian squadron, and the whole Allied Fleet entered the harbour together, with all guns loaded and decks cleared for action ready to assume a closer control over affairs.

It was not the intention of the Allied Fleet to precipitate war, but when the Commander of one of the British frigates, the "*Dartmouth*," discovered that his vessel was lying to the windward of a Turkish fireship, he sent a boat to move the fireship further on, thus to lessen the danger to his own vessel. The Turks interpreted this action as a declaration of hostilities; fire was opened

(*Continued on page 171*)

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The Story of Bread—(*continued from page* 119)

the temperature is suitable for the rising process that the housewife carries on in front of a fire. While the loaves pass slowly through it fermentation re-commences, and the dough becomes thoroughly aerated.

From the "prover" a second conveyor carries the loaves to a moulding machine in which they are given their final shape. The design of the moulder depends on the type of loaf that is required, but whatever their shape the loaves are left on setting boards to recover before being placed in the oven.

Bakers' ovens are of several different types, and it is not a little curious to find that all the chief kinds that have been invented are still in use in some form. In the earliest ovens the fire was actually made in one corner of the baking chamber. The temporary stone structures rudely thrown together by nomads were heated in this manner, and the same principle was used in the better-built ovens constructed by settled races. Interesting examples have been unearthed at Pompeii. These are built of stone and in the interior there is a flat surface on which the bread rests while being baked. Wood was the fuel used, and when the oven had reached a satisfactory temperature the ashes of the fire were withdrawn and the bread left to bake.

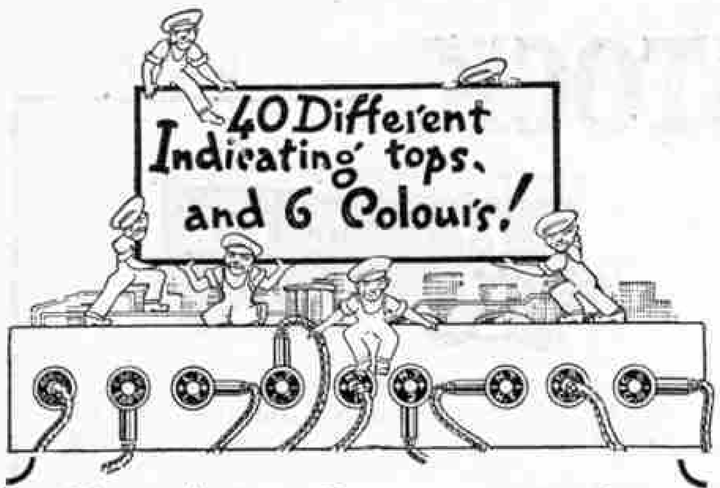
Ovens heated in this manner are still used, but coke has replaced wood as fuel. Objections have been raised to them on the score of want of cleanliness, however, and ovens in which the heating is indirect are becoming more common. A very popular kind is the hot-air oven, in which the fumes produced in the furnace do not pass into the baking chamber, but circulate round it through flues built in the walls.

In the most efficient of commercial ovens used to-day the baking chamber is heated by sealed steam pipes, the lower ends of which project into the furnace. The steam thus becomes superheated and the temperature of the oven is raised sufficiently to "fire" the bread.

The bread also is handled by greatly improved methods. In the older type of oven the loaves were introduced and removed by means of a wooden shovel called a "peel." The task of filling or emptying large ovens in this manner is very laborious, however, and in order to save time "draw-plate" ovens have been introduced. In these a large plate or tray in the bottom of the oven may be withdrawn bodily, and thus the whole of the contents may be removed in one operation.

This principle is carried still further in the so-called "travelling ovens" used in the delicate operations carried on in a biscuit factory. In them the biscuits travel slowly through a long oven, and the baking may be regulated by adjusting the speed of travel and the temperature of the oven. We hope shortly to publish an article on this highly-specialised industry, and in it these remarkable ovens will be described more fully.

An interesting development is the modern electrical oven in which the chief heating elements are placed immediately below the floor of the baking chamber. Others are fixed in the oven itself, and thus help to maintain a uniform temperature. An electrically-heated draw-plate oven is perhaps the nearest approach yet achieved to the ideal appliance, for it combines cleanliness with convenience in working, and ovens of this type will undoubtedly come into more general use.



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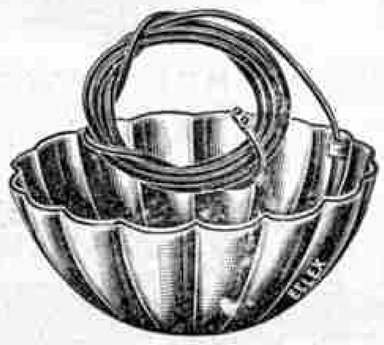

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Stamp Collecting—(*continued from page* 169)

quickly and before long every ship in the harbour was engaged. The fight was fierce but short, and before night fell the Turkish Fleet had been wiped out, and the independence of Greece assured.

The Battle of Navarino, although of particular importance in Greek history, has also two unique claims to fame in British records. More decorations were awarded in connection with this fight than for any previous sea fight in British history, and it was the last battle of any magnitude in which wooden battleships took part.

The most up-to-date vessel available for our naval collection is the Greek cruiser "*Giorgios Averoff,*" which forms the subject of one of the most striking designs of the current Greek issue, the 3 drachma stamp that is illustrated on page 169. This cruiser was built in 1911 from funds principally provided by a Greek millionaire philanthropist whose name the ship bears. It is 462 ft. in length, has a beam of 69 ft. and draws 21¾ ft. of water. Its engines develop 19,000 s.h.p., sufficient for a speed of 24 knots. The "*Giorgios Averoff*" carries a crew of 560 and is armed with four 9.2 in. guns, eight 7.5 in., 16 3 in. guns and three under-water torpedo tubes. During the Balkan Wars it served as the flagship of the Greek Navy.

The biggest modern battleships in our collection are the Japanese battleships "*Katori*" and "*Kashuma*" that provided the design for the Japanese issue of September, 1921, commemorating the return of the Crown Prince from his European tour. These battleships were his escort while the Prince was afloat. The two ships are sisters and were both completed in 1906. The "*Kashuma*" has a slightly greater displacement than the "*Katori,*" the respective figures being 16,400 tons and 15,975 tons. The official complement of each ship is 864 and both have a recognised speed of 19 knots. The armament in both cases consists of four 12 in. guns, four 10 in. guns, 12 6 in., 19 smaller light and machine guns, and five submarine torpedo tubes.

The Uruguayan light cruiser "*Monte Video,*" with its two attendant gunboats, make an interesting illustration, for this small fleet comprises the total strength of the Uruguayan Navy. The stamp itself is the 1c. value taken from the commemorative issue of August, 1908, that celebrated the declaration of the independence of Uruguay. Another South American state is represented in our battleship stamp fleet, for the 5 centavo 1903 Colombian stamp shows the 1,200-ton light cruiser "*Cartagena*" which was acquired from Morocco to serve as the flagship of the tiny Colombian fleet, the remainder of which consists of four gunboats.

The Turkish 2 piastre stamp from the 1913 issue shows the cruiser "*Hamidieh,*" built in 1904. At this time the ship, which has a displacement of 3,800 tons, was the fastest vessel in the Turkish Fleet, its designed speed being 22 knots. It carried a crew of 300 and was armed with two 6 in. and eight 4.7 in. guns.

(*Continued at foot of next column*)

Famous Inventions—(*continued from page* 116)

passes the turntable ladder test and emerges creditably from his medical examination is accepted into the brigade for a trial period of one year. During that time he is given a thorough training in the duties of a fireman, and there is plenty for him to learn. The training is not confined to the fire station, for an early opportunity is taken to send him out with the brigade in order that he may begin to learn from actual practice many things that mere station training cannot teach him.

One of the most interesting items in a fireman's training is hook-ladder drill. The hook ladders are each about 12 ft. in length and have a metal hook some 3 ft. in length attached at one end. This hook has a coarse saw-edge to insure its exercising a firm grip on a window sill or ledge. Four or five firemen are engaged at a time in the drill. Each man wears a broad belt in the front of which is a large hook attached to a metal loop.

The drill is carried out under the supervision of a brigade officer and when he gives the command "Go!", the first man picks up his ladder and, running to the drill tower, hooks the ladder on to the first floor window ledge. He then climbs the ladder and attaches himself to the top rung by means of the hook at the front of his belt, at the same time letting go of the ladder. The second man then follows and passes his ladder to the first man who unhooks himself from his own ladder and hooks the second to the second storey window. The first man then mounts the second ladder, his place at the top of the first one being taken by the second man. This manœuvre is repeated until all the men and their ladders are engaged and at the conclusion the first man is at the head of the topmost ladder and the last man is in the position originally occupied by the first man. The officer then blows a whistle and the men lean back on their hooks and extend their arms to show that they are not clinging to the ladder with their hands. This is an excellent test of nerve and the drill is carried out periodically.

A new recruit to a fire brigade is given very careful instructions in life-saving drill. He is taught how to lower a body from an upper storey window by means of a rope sling; how to shoulder an unconscious person and convey him safely down an escape ladder, and how to render first aid in an efficient manner. Personal attendance at fires teaches him the value of being clear-headed and methodical. A suitable recruit becomes an excellent all-round fireman at the end of his year of probation, or even before, and it is a proud moment for him when he learns that he has passed his test and is now officially "one of the brigade."

(*Continued from previous column*)

An interesting supplement to a collection of warship stamps would be the addition of stamps showing naval harbours. We have not the space to illustrate here specimens that would be suitable for inclusion, but two come to mind, Port Royal, shown on Jamaica's 6d. issue of December, 1922, and the harbour at Malta, appearing in the current Maltese series. This stamp, it will be recalled, was illustrated in our issue of December last.

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.

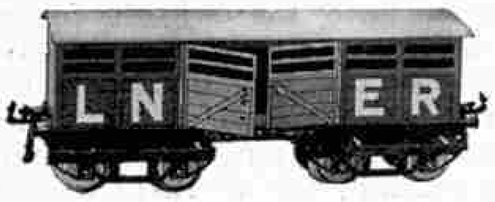
HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines and are beautifully enamelled, mostly in the correct colours of the L.N.E., L.M.S., G.W. or Southern Railways.

Ask your dealer to show you the full range of Hornby Rolling Stock.



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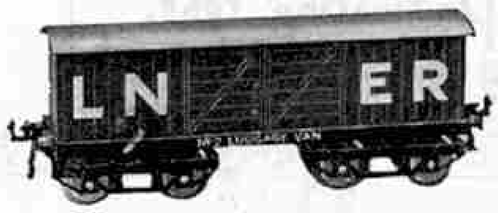
Splendid model fitted with double doors. Suitable for 2 ft. radius rails only. Price **5/9**



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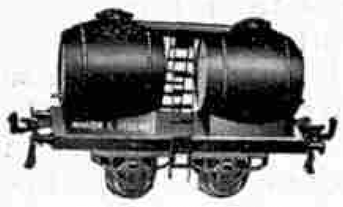

WINE WAGON
An attractive model, artistically enamelled in red and black. Price **3/9**

SECCOTINE VAN
Beautifully finished in blue, with opening doors. Price **3/6**

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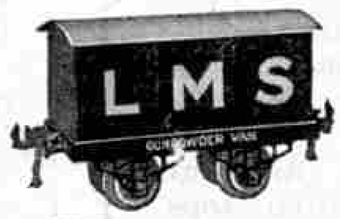
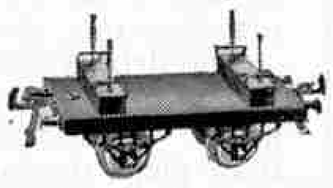


***GUNPOWDER VAN**
Finished in red, with opening doors. Price **3/9**

PETROL TANK WAGON "REDLINE"
Finished in blue and red. Price **2/6**

***SNOW PLOUGH**
With revolving plough driven from front axle. Price **5/6**



***LUMBER WAGON No. 1**
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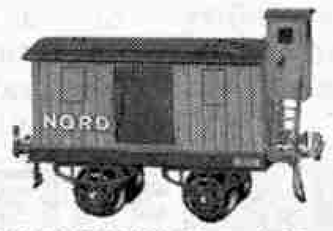
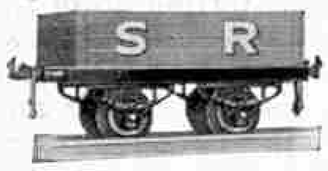
Beautifully enamelled in green and red. Price **1/9**



BRAKE VAN (French Type)
Lettered Nord. Beautifully finished in colours. Opening doors. Price **4/–**



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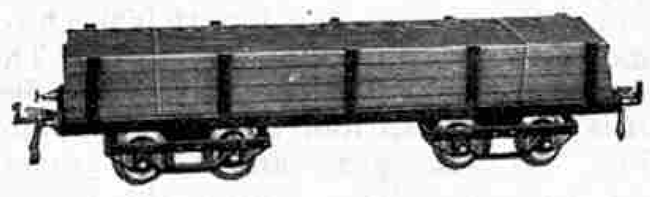
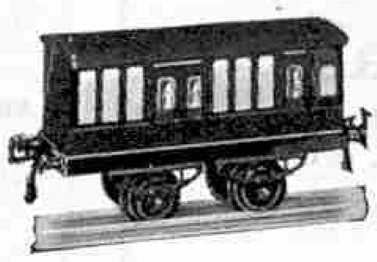
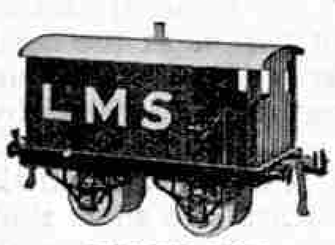


***TIMBER WAGON No. 2**
Beautifully enamelled in green and red. Suitable for 2 ft. radius rails only. Price **3/6**

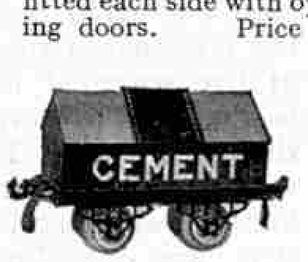


***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **2/6**

***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price **2/6**



BRAKE VAN
Finished in grey, with opening doors. Obtainable with L.M.S. or G.W. lettering. Price **3/6**



***CEMENT WAGON**
Finished in red. Price **3/–**

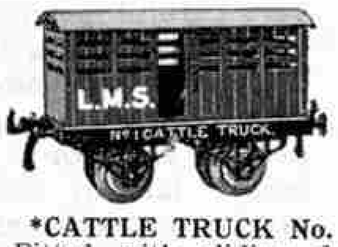
CRAWFORD'S BISCUIT VAN
Finished in red, with opening doors. Price **3/6**

***LUGGAGE VAN No. 1**
With opening doors. Price **3/6**

***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **4/–**

BRAKE VAN
Finished in brown, with opening doors. Obtainable in N.E. or S.R. lettering. Price **3/6**

SIDE TIPPING WAGON
Excellent design and finish. Price **2/6**



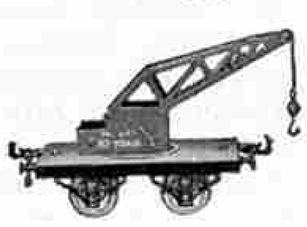
***CATTLE TRUCK No. 1**
Fitted with sliding door. Very realistic design. Price **3/6**

***LUMBER WAGON No. 2**
Fitted with bolsters and stanchions for log transport. Suitable for 2 ft. radius rails only. Price **4/–**

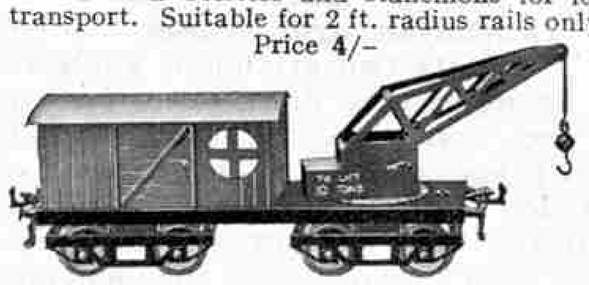
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with sliding doors. Price **3/9**

ROTARY TIPPING WAGON
Finished in orange. Price **3/–**

***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans. Price **3/6**

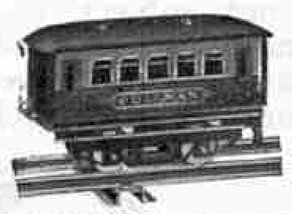


***CRANE TRUCK**
Finished in brown and blue. Price **3/6**

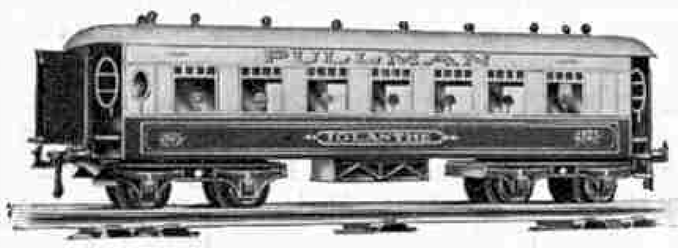


***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2 ft. radius rails only. Price **6/3**

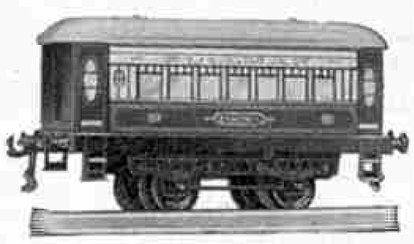
WAGON (French Type)
Lettered Nord. Highly finished in colours. Price **3/3**



"M" PULLMAN COACH
Strong and well finished, in colours. Price **1/–**

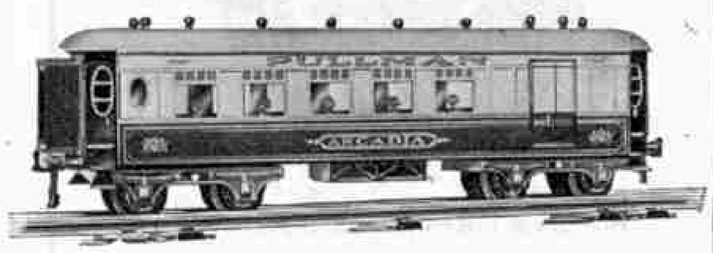


HORNBY PULLMAN COACH No. 2-3
As supplied with Nos. 2 and 3 Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2 ft. radius rails only. Price **11/6**



No. 1 PULLMAN COACH
Distinctive in design and beautifully finished in colours. Price **3/–**

No. 1 PULLMAN COACH COMPOSITE
Special type. One part designed for passenger accommodation and the other for conveyance of luggage. Price **3/–**



HORNBY PULLMAN COACH COMPOSITE No. 2-3
As supplied with Nos. 2 and 3 Train Sets. One part is designed for passenger accommodation and the other for conveyance of luggage. Suitable for 2 ft. radius rails only. Price **11/6**

**Lettered L.M.S., N.E., G.W. or S.R.*

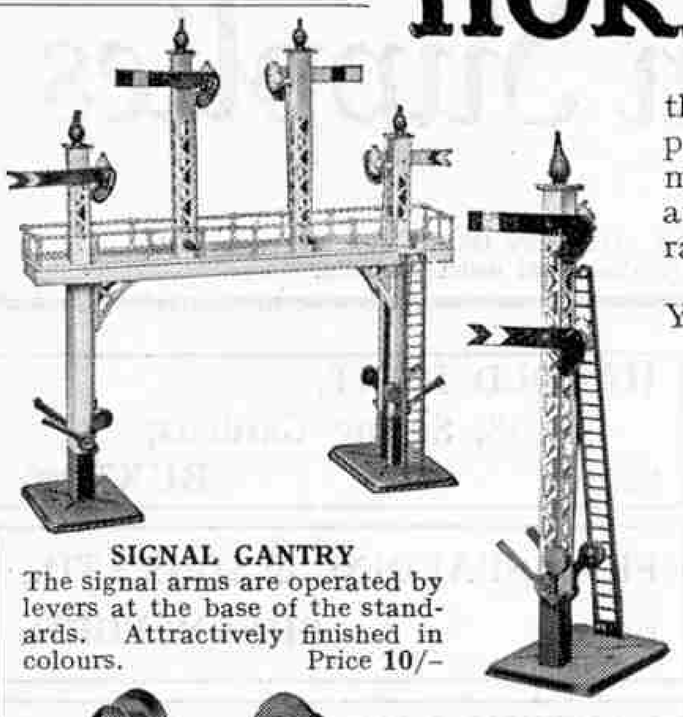
HORNBY SERIES

HORNBY ACCESSORIES

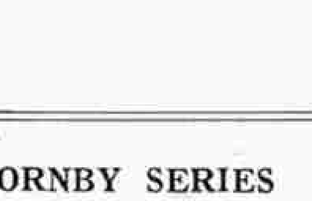
GAUGE 0

There is a splendid range of Hornby Accessories in the Hornby Series, all built in exact proportion and all perfectly designed. With these realistic Accessories the most elaborate railway system may be constructed and operated in exactly the same manner as a real railway in actual practice.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



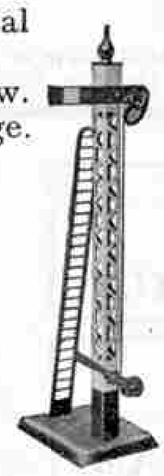
SIGNAL GANTRY
The signal arms are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**



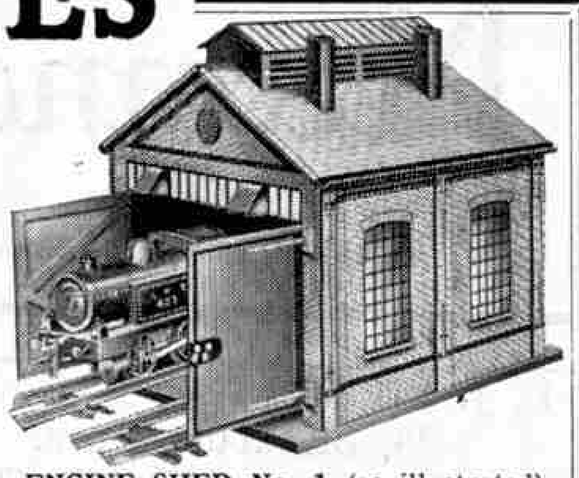
MANSELL WHEELS
These wheels are die cast.
Price per pair **4d.**

DOUBLE ARM SIGNAL No. 1
Price **3/9**
per pair
DOUBLE ARM SIGNAL No. 2
(as illustrated)
Price **3/-** each

RAILWAY STATION No. 1 (as illustrated). A well-made model, richly finished in bright colours. Dimensions: Length 16¾ in., width 6 in., height 6 in. Price **5/-**
RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Dimensions: Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/-**



SIGNAL No. 1
Price **3/-** per pair
One "Home" and One "Distant."
SIGNAL No. 2
(as illustrated)
Price **2/6** each
"Home" or "Distant"

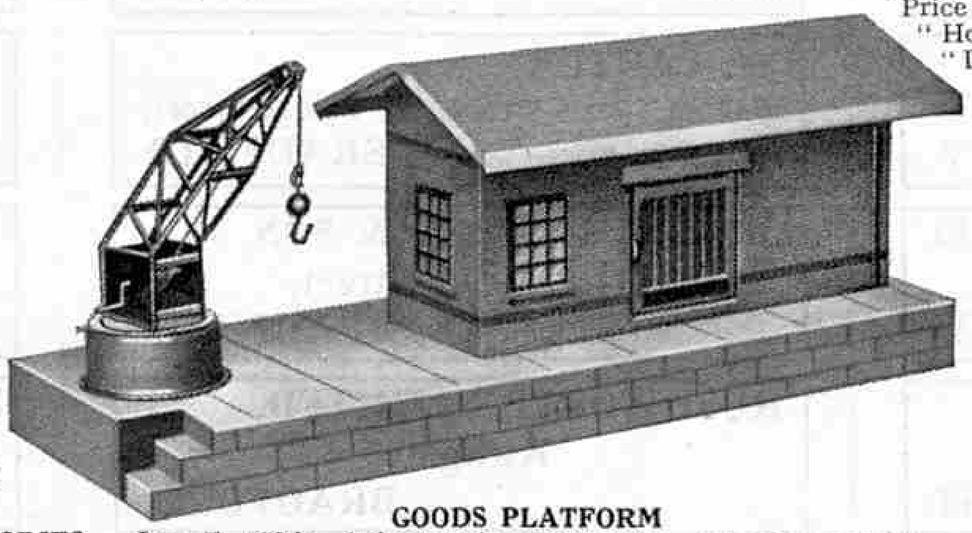


ENGINE SHED No. 1 (as illustrated) This Shed will accommodate Locomotives and Tenders of the M Series, No. 0 and No. 1 types. Price **11/-**
ENGINE SHED No. 2
This Shed will accommodate two of any type of Hornby Locomotive and Tender. Price **17/6**

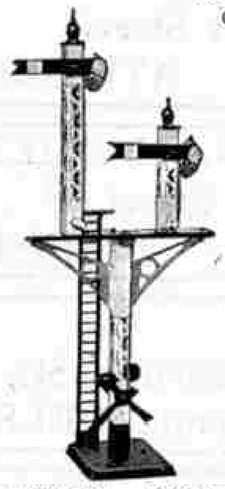
TUNNEL
Realistic and finished in colours. Price **7/6**

LOADING GAUGE
Price **1/9**

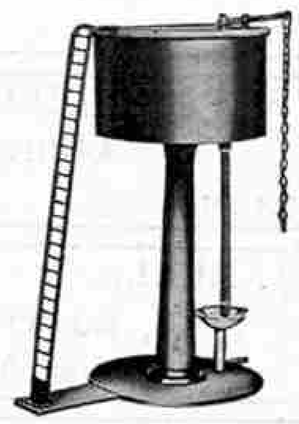
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker. Price **1/6**



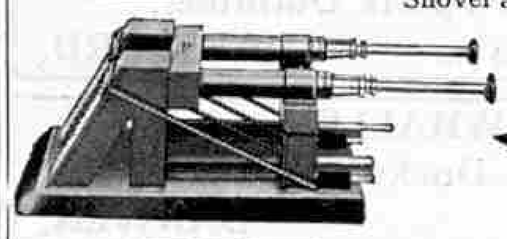
GOODS PLATFORM
Length 16¾ in., height 6½ in., width 6 in. The crane at the end of the platform revolves on its base Price **10/6**



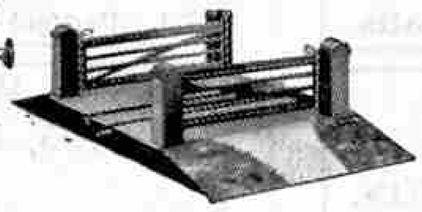
JUNCTION SIGNAL
"Home" or "Distant" Signal arms operated by levers at base. Price **5/6**



WATER TANK
Fitted with flexible tube and valve lever. Price **6/6**

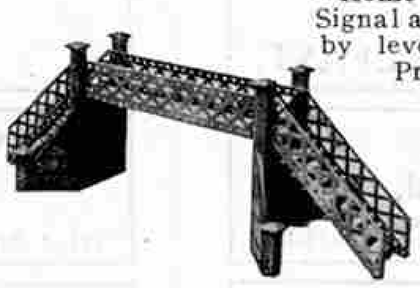


BUFFER STOPS No. 2 (HYDRAULIC)
Price **5/-**

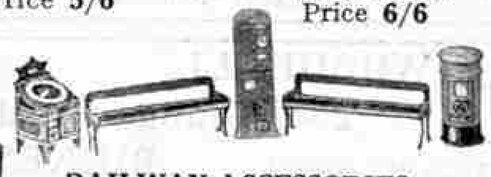


LEVEL CROSSING No. 1
(as illustrated)
This model is suitable for a single track only and has gauge 0 rails in position. Price **3/6**
LEVEL CROSSING No. 2
Measures 11½ × 7½ in. with two tracks of gauge 0 rails in position. Price **5/-**

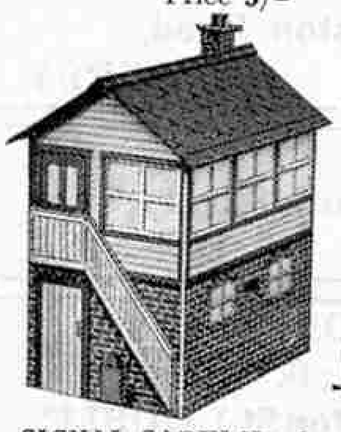
TARPAULIN SHEETS
Strongly made. Lettered L.M.S., N.E., G.W. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price **6d.**



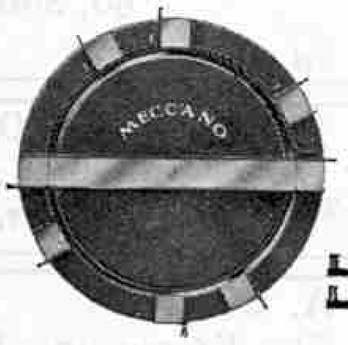
LATTICE GIRDER BRIDGE
Constructional type. Strong and well proportioned. Price **9/6**



RAILWAY ACCESSORIES
No. 1 Miniature Luggage and Truck. Price **1/6**
No. 2 Milk Cans & Truck. Price **1/6**
No. 3 (as illustrated) Platform Machines, etc. Price **1/6**
No. 4 Composite of Nos. 1, 2 &3 Price **3/9**



SIGNAL CABIN No. 1
(as illustrated)
Finished in colours.
Price **2/9**
SIGNAL CABIN No. 2
Roof and back open to allow signal levers to be fitted inside cabin, if desired. Price **6/6**

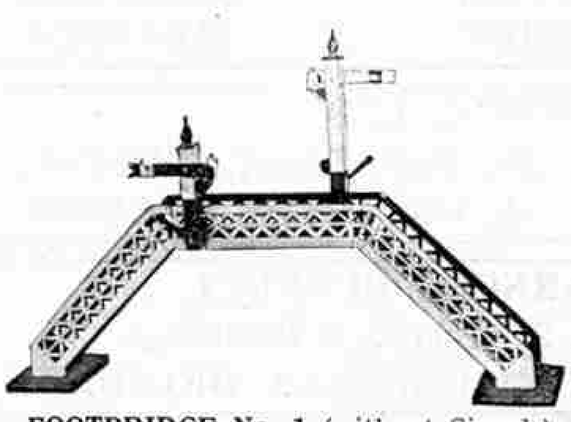


TURNTABLE No. 2
(as illustrated)
Price **4/-**
TURNTABLE No. 1
Price **2/6**

TELEGRAPH POLES
Price per pair **3/6**

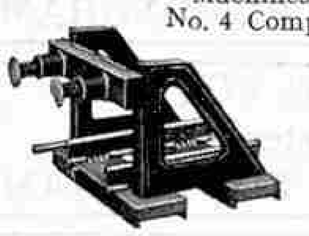
VIADUCT No. 1. Price **7/-** **Centre Section only,** Price **4/6**
ELECTRICAL VIADUCT, Price **8/-**
Centre Section for Electrical Viaduct.
Price **5/-**

SHUNTER'S POLE. Price **4d.**

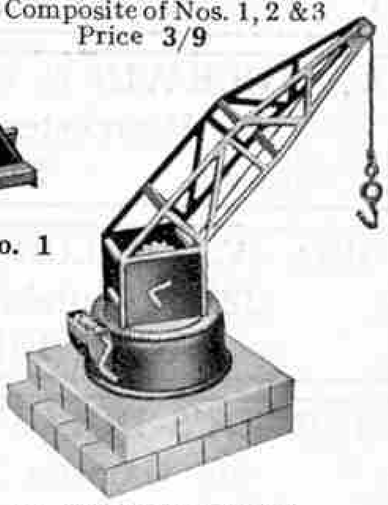


FOOTBRIDGE No. 1 (without Signals) Price **3/6**
FOOTBRIDGE No. 2 (as illustrated), complete with detachable Signals. Price **6/-**
Signals only, per pair **2/9**

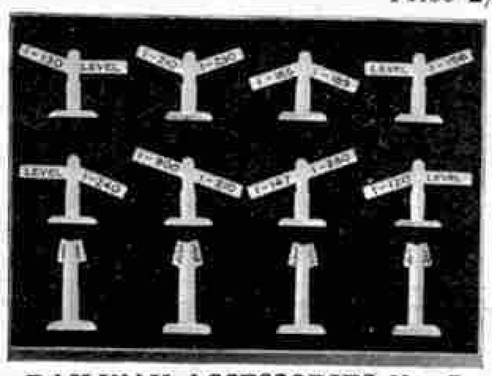
LAMP STANDARD No. 2 (DOUBLE)
(as illustrated)
Four-volt bulbs may be fitted into the globes. Price **4/-**
LAMP STANDARD No. 1 (SINGLE)
A 4-volt bulb may be fitted into the globe. Price **3/-**



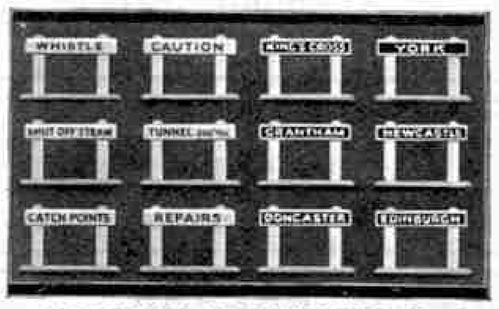
BUFFER STOPS No. 1 (SPRING)
Price **1/-**



PLATFORM CRANE
The Crane revolves on its base and is fitted with a crank and ratchet mechanism for controlling the load. Price **4/-**



RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price **2/-**



RAILWAY ACCESSORIES No. 6
Notice Boards, and Station Name Boards
Price **4/-**

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.

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PHINS LIMITED,
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CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, the Railway Coys., etc.

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Tel. : Douglas 2701 GLASGOW.

LYON LTD.,
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222, Argyle Street
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Grand Building, RAWTENSTALL.

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The Hove Hornby Train Store,
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C. BOOTH & SON,
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Complete Sports Outfitters,
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"Baby's Kingdom,"
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FREDERICK BECK,
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W. F. CHAPMAN, Streatham 1736-0759
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Tel. : Bish. 2284 LONDON, E.C.2.

DAVIES & CO.,
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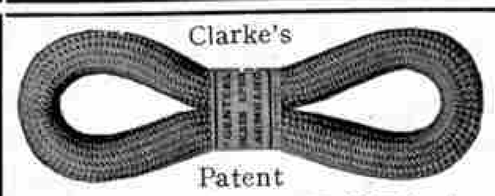

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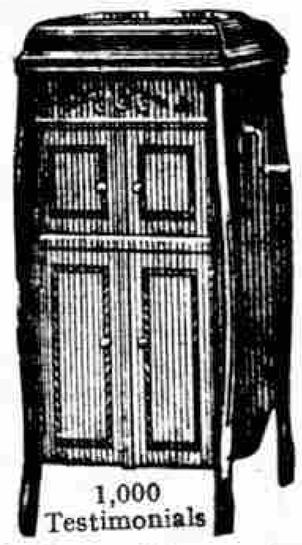

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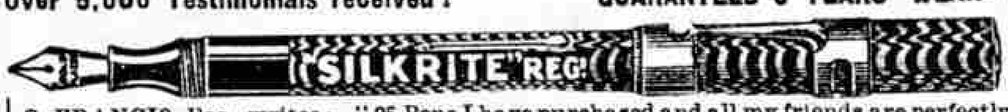

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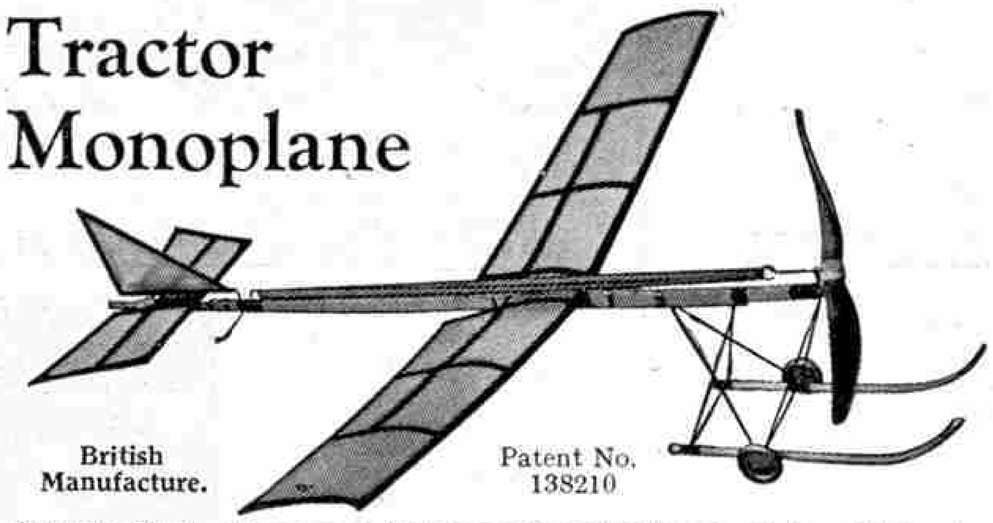

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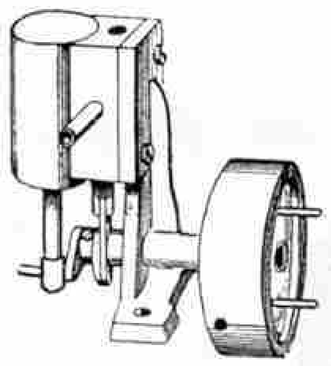

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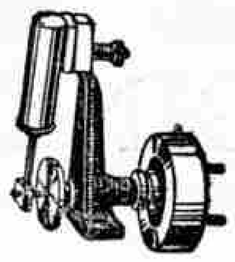

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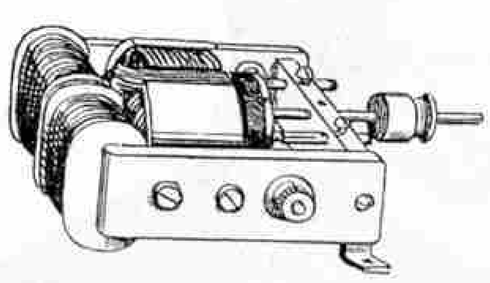

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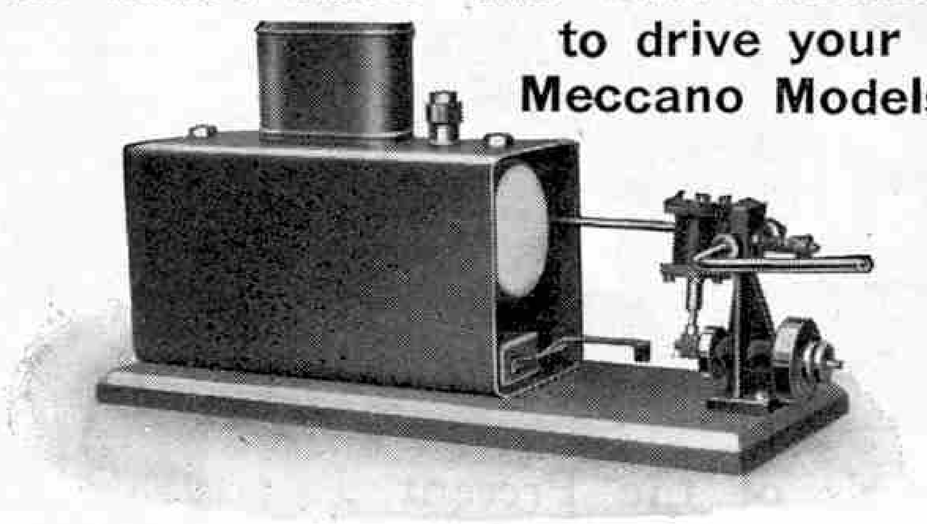

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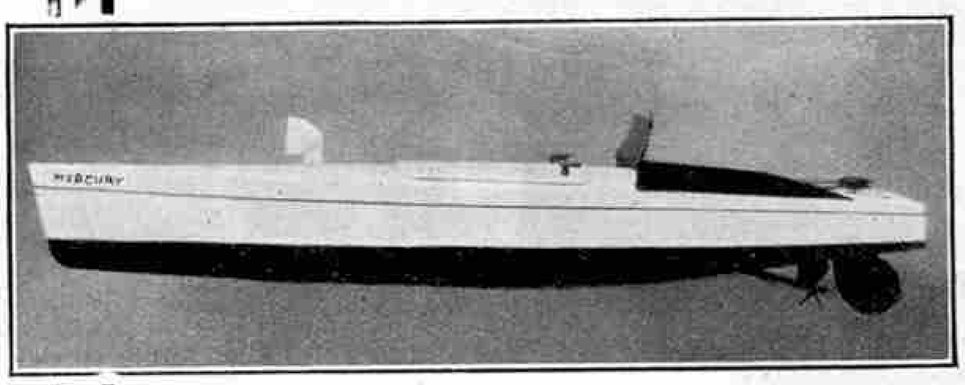

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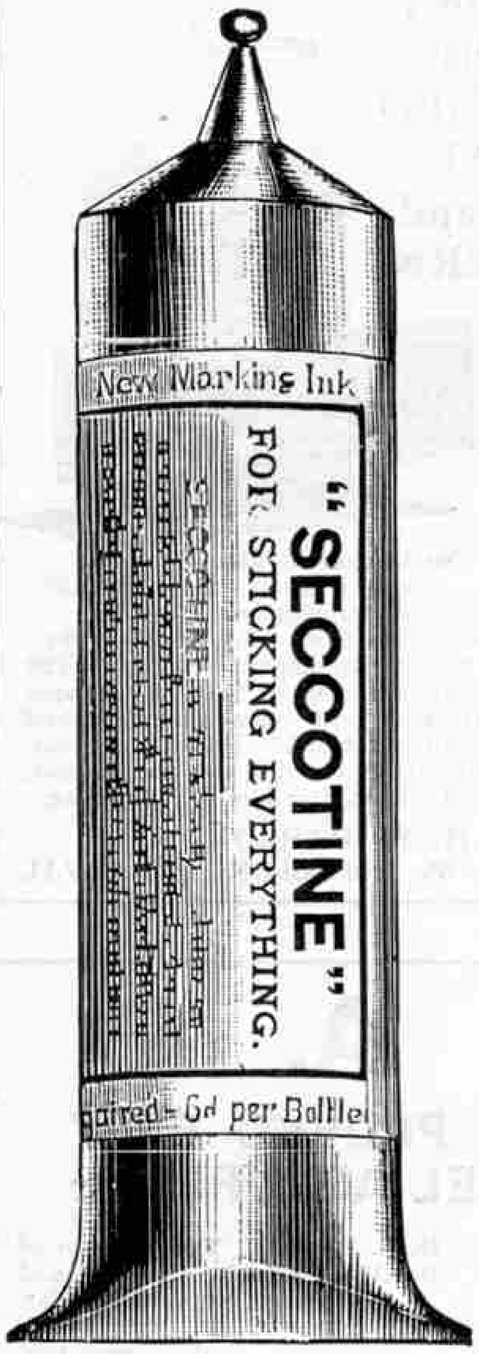

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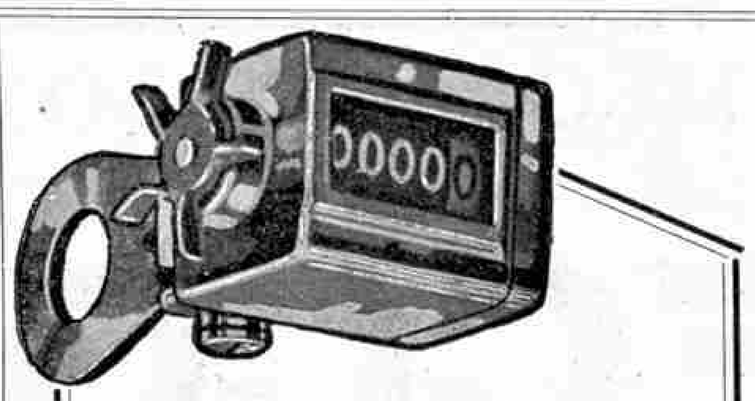

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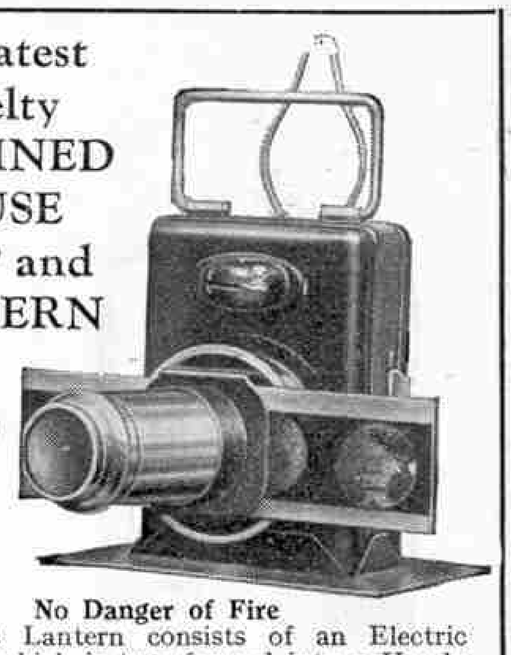

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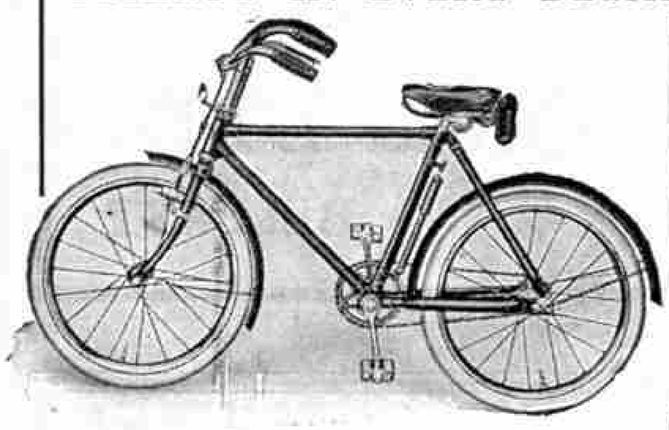

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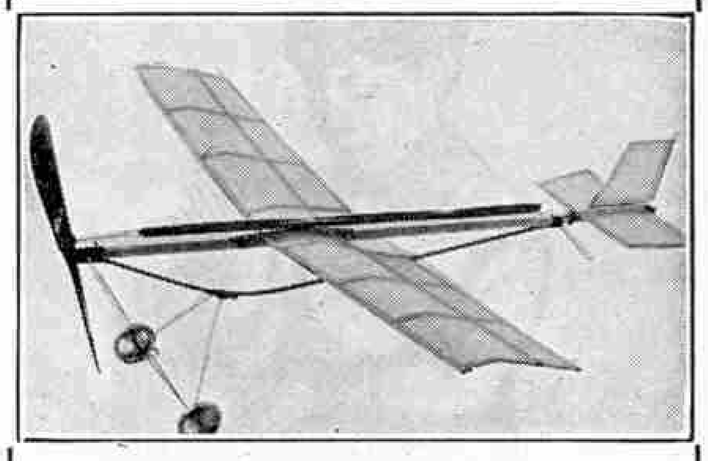

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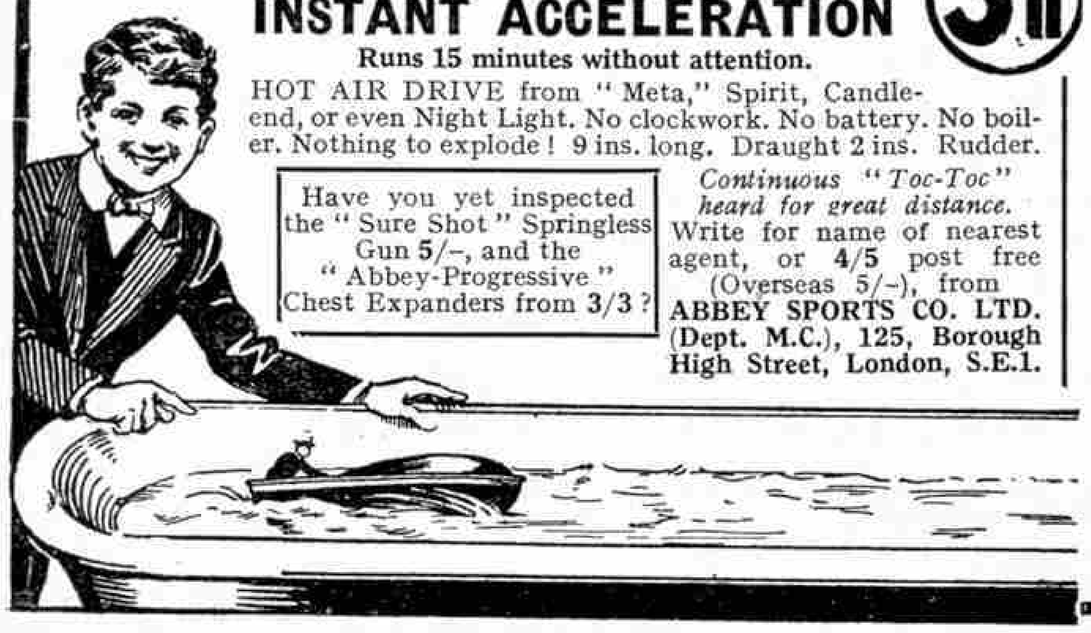

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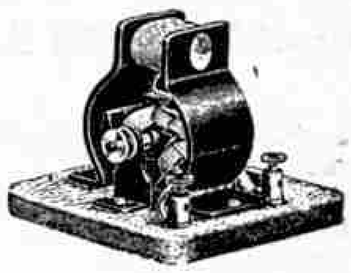

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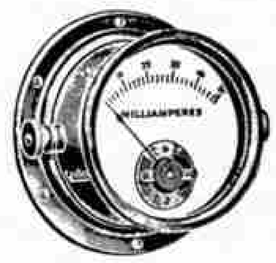

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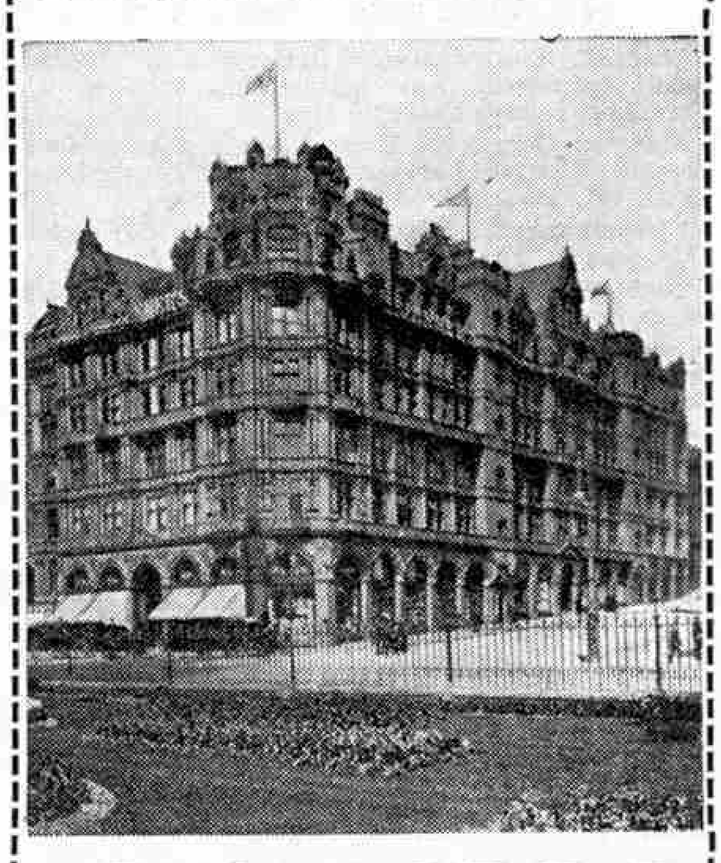

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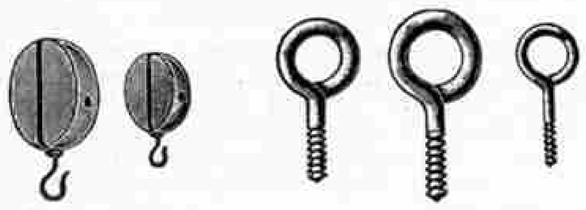

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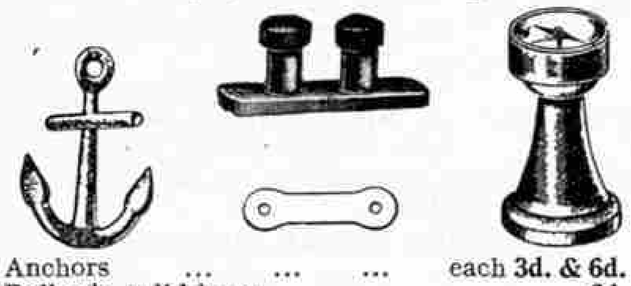

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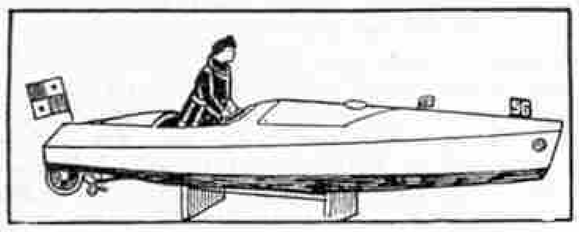

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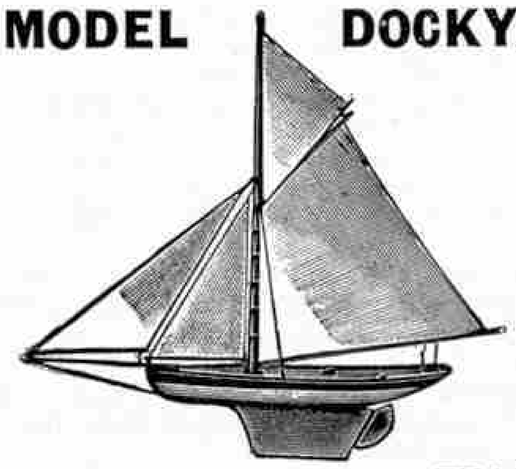

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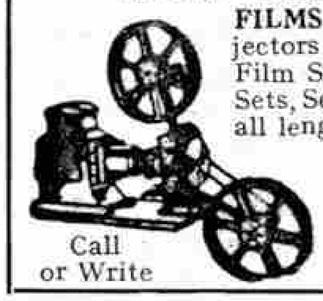

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Particularly interesting chapters are devoted to advice on starting fretwork and on the choice of suitable wood, while others contain useful information on such topics as the construction of cabinets for wireless sets and loud speakers of the cone type; the cutting of calendars, picture frames, and jig-saw puzzles; and simple box and table making. As usual there is a section containing designs for an amazing variety of articles ranging from stationery cases and photo frames to bookstands and artistic clock cases. These include working models of the Tower Bridge, a water mill and several cranes.

The catalogue contains interesting details of many other products of Hobbies Limited. These include a new and extensive range of steam launches and model sailing boats, and also useful stationary steam engines, one of which is sold in parts ready for assembly by the purchaser. The catalogue may be obtained for 9d. from any Hobbies dealer or direct from Hobbies Limited, Dereham for 1/– post free.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:
BINNS ROAD, LIVERPOOL.
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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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the case of Australia, where the price is 1/– per copy (postage extra), and the subscription rates 7/– for six months and 14/– for 12 months (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street.
Bombay: Bombay Sports Depot, Dhobi Talao.
Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

Cases have been reported recently, in which readers in various parts of the world have been charged more than the published price for their copy of the magazine—that is to say, more than 1/– in Australia and more than 6d. in other parts of the world.

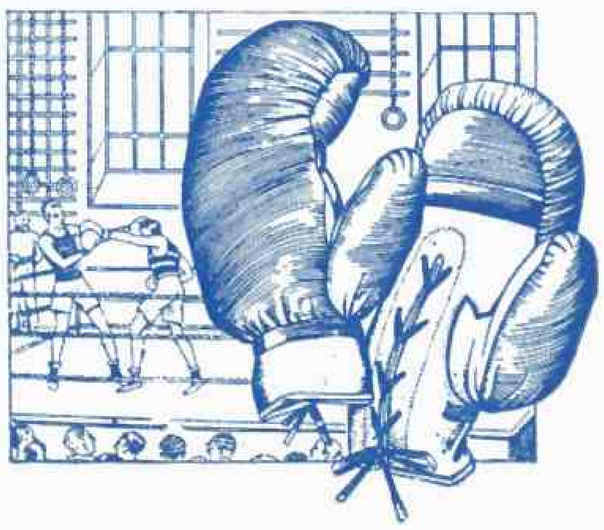
The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the correct figure. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor. The name of the nearest Meccano dealer who is willing to supply at the correct figure will then be given.

"MECCANO MAGAZINE" BINDERS

Your Magazines may be kept clean and tidy by enclosing them in one of the special binders we supply. Two sizes, price 3/– and 4/6 post free, from Meccano Ltd., Old Swan, Liverpool.

ANOTHER PAGE OF GOOD THINGS FROM

GAMAGES



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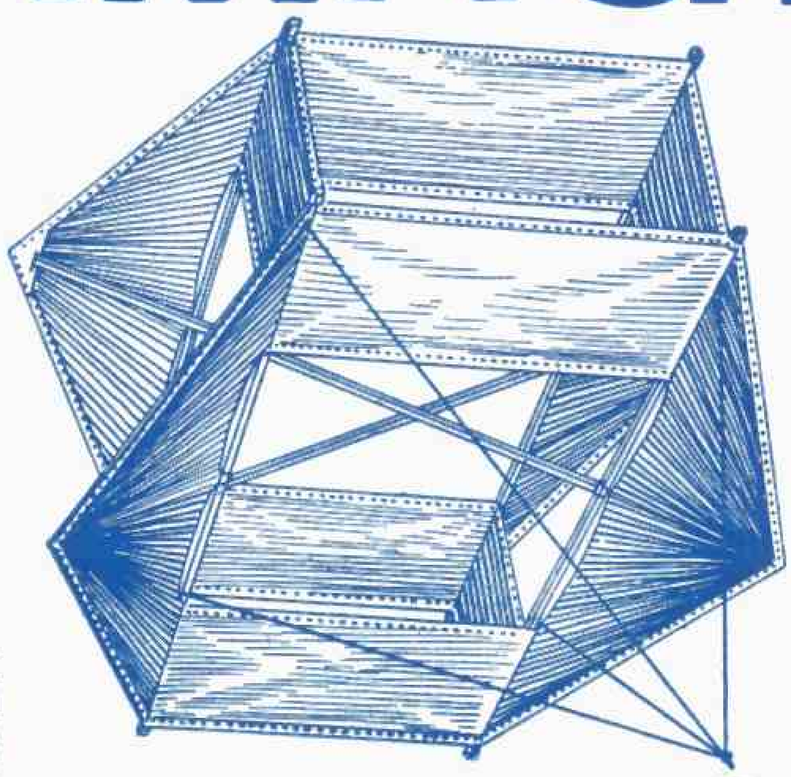
A "few rounds" with the gloves every day will keep you fit and strong. These Boxing Gloves are most suitable for the hard wear you will give them. They have laced palms, correctly placed bar grip, and are stuffed evenly with pure horse-hair.

Youths' **14/6** the set. Boys' **13/6** the set.



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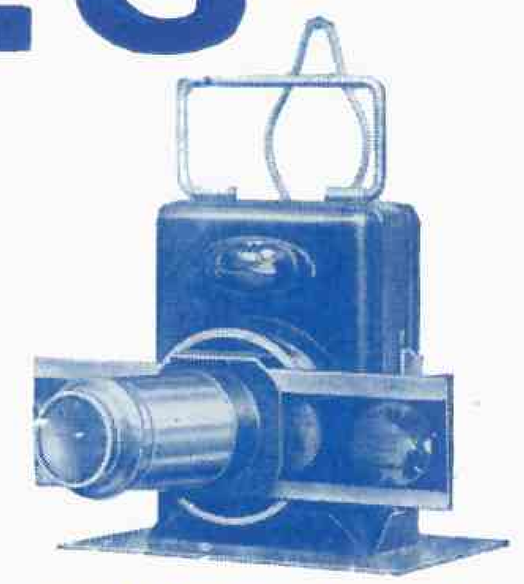
In the Altitude Display given by the Council of the Kite and Model Aeroplane Association, one of our Quadroplane Kites, attained the highest altitude, carrying out 2¼ miles of 22-gauge wire. Winner of the First Prize, Kite Flying Association Meeting, Wimbledon Common. Awarded highest marks for stability, Kite and Aeroplane Association Competition for Baden Powell Shield.

No.	1	2	3	4
Height	29	32	35	38 inches
Price	**3/6**	**4/6**	**5/11**	**7/6**

Postage and Packing 6d. extra



COMBINED ELECTRIC
MAGIC LANTERN
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Complete with battery and slides (6) Extra battery, 6d. Extra slides, 1/– doz. Post free **5/6**

THE WARNEFORD
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Strongly made of stout lacquered metal. Post 6d. **1/11**

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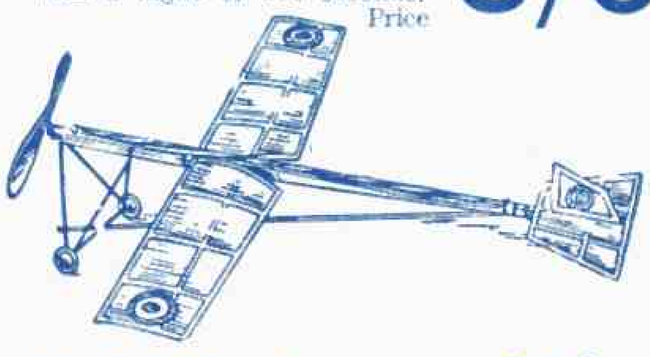
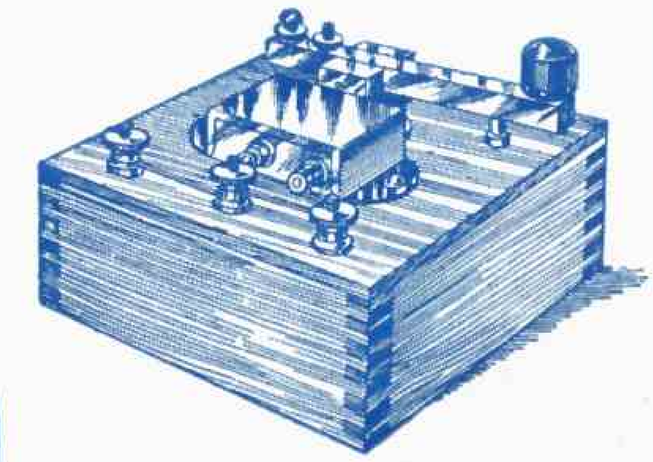
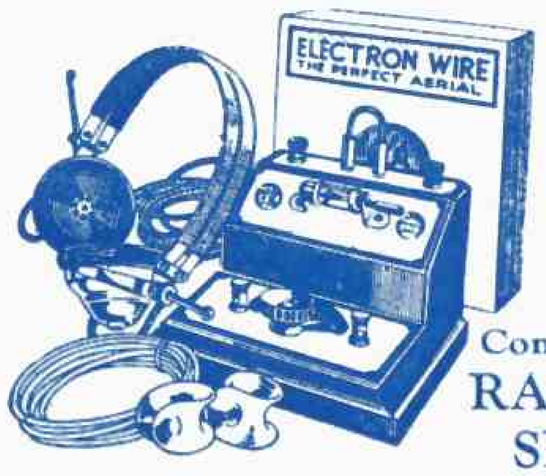


THE WARNEFORD MODEL AEROPLANE

Is a guaranteed flying machine very easy to fly—no complicated adjustments. The Elevator or Controller can be bent down towards the main plane in order to make the machine rise quickly—or flattened out for long distance flying—and can be bent to the right or left in order to obtain a circular flight in either direction. The length of flight depends on weather conditions, and under suitable conditions, it is quite possible to get a flight of 300 to 500 yards.

Model No. 0	5/6
Model No. 1	7/6
Model No. 3	21/-





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(as illustration).

This practice set is fitted with reliable buzzer and well made morse key. Battery can be fitted into the base of the set. All brass parts lacquered and beautifully finished. Size: Height over all, 2½ ins.; length, over all, 3¾ ins.; width, over all, 3½ ins. Battery **6d.** extra. Post 6d. Price **6/6**

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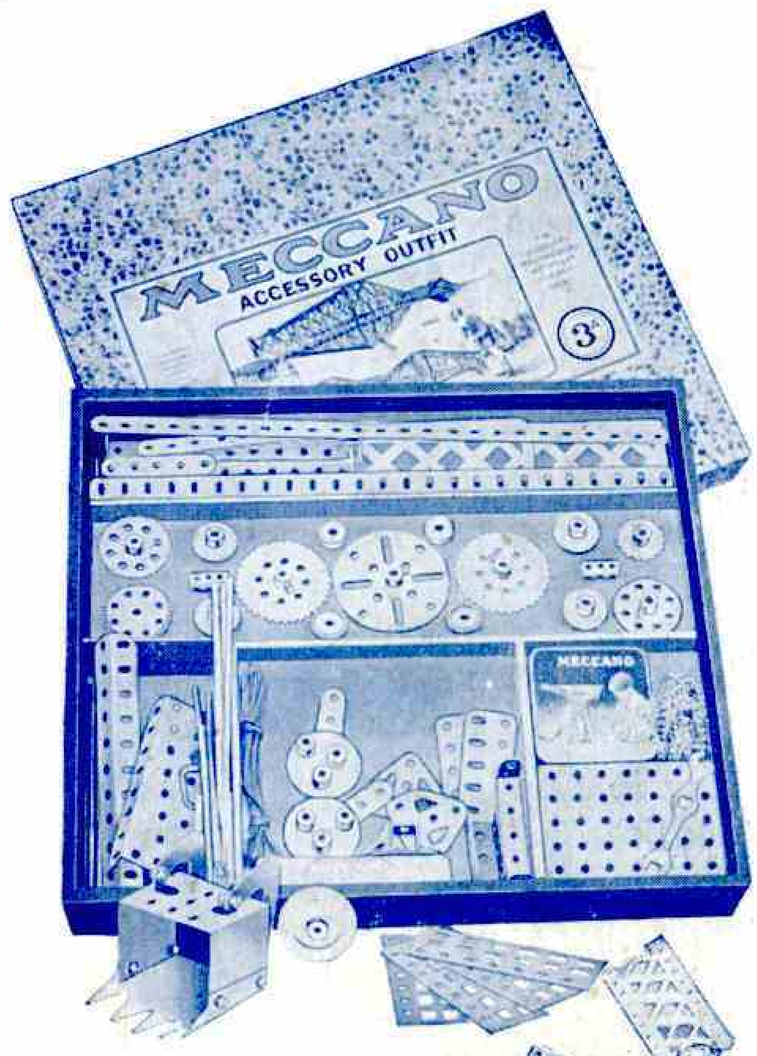


Meccano Accessory Outfits connect the main Outfits from No. 00 to No. 7 and may be aptly described as the stepping stones to bigger and better models. A No. 2 Outfit may be converted into a No. 3 by adding to it a No. 2A Accessory Outfit and a No. 3A would then convert it into a No. 4. In this way, no matter with which Outfit you commence, you may build it up by degrees until you possess all the parts contained in the largest Meccano Outfit.

The Special Inventor's Outfit, illustrated below, is also an Accessory Outfit, but it does not connect any two regular Outfits in the same manner as the ordinary Accessory Outfits. It is intended principally for those boys who already possess a Meccano Outfit, since it enables them to develop their inventive ability to the fullest possible extent. A good selection of valuable parts that have recently been added to the Meccano system is contained in the Special Inventor's Outfit.

Prices of Meccano Accessory Outfits

		Price
No. 00A	(converts a No. 00 Outfit into a No. 0)	1/6
„ 0A	(„ „ 0 „ „ „ 1)	5/6
„ 1A	(„ „ 1 „ „ „ 2)	7/-
„ 2A	(„ „ 2 „ „ „ 3)	12/6
„ 3A	(„ „ 3 „ „ „ 4)	23/6

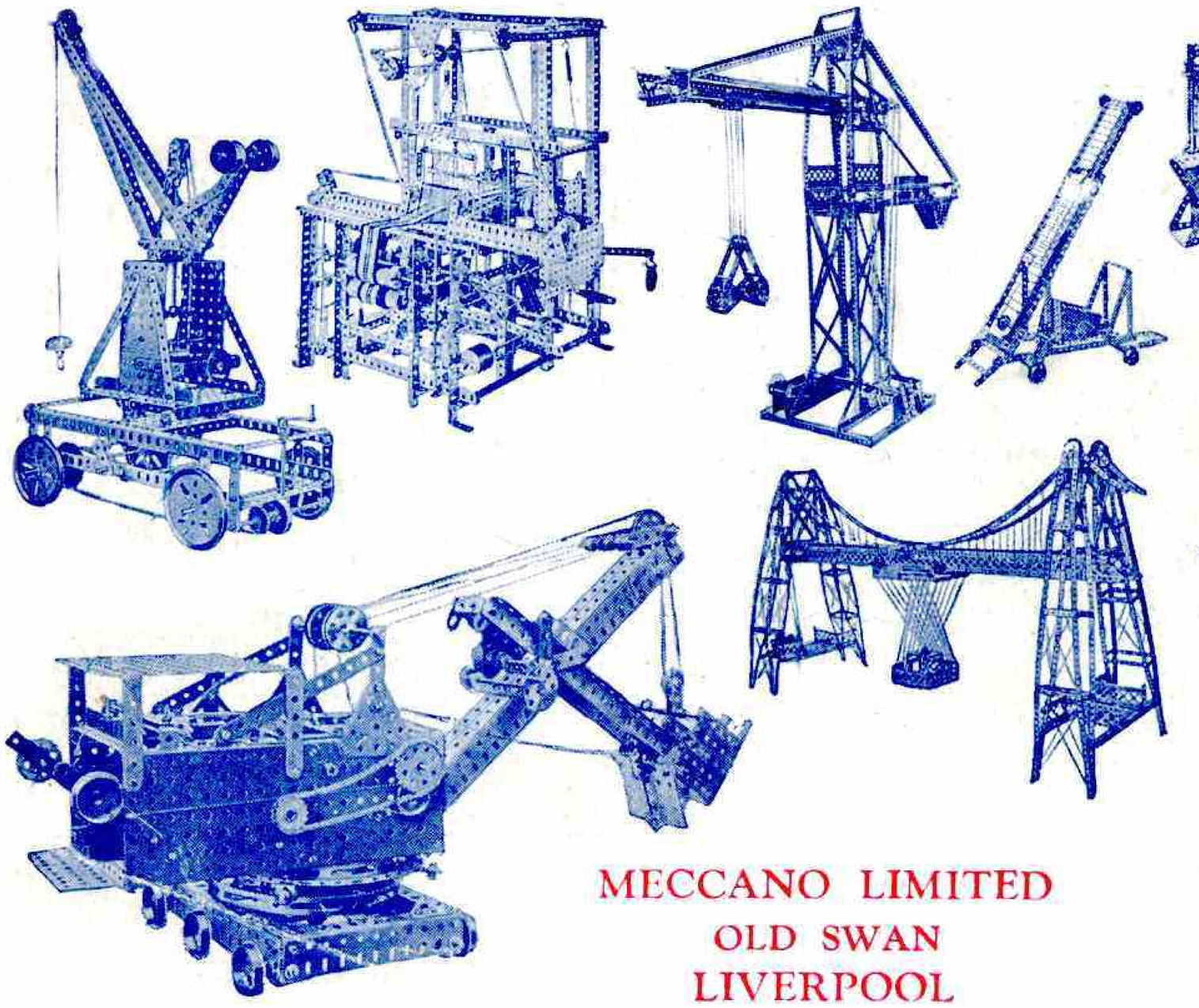
*Carton.

		Price
No. 4A	(converts a No. 4 Outfit into a No. 5)*	15/-
„ 5A*	(„ „ 5* „ „ „ 6)*	50/-
„ 5A†	(„ „ 5† „ „ „ 6)†	80/-
„ 6A†	(„ „ 6† „ „ „ 7)†	215/-
Special Inventor's Outfit	... ...	17/6

†Wood.

Your Meccano dealer carries stocks of Meccano Accessory Outfits and the Special Inventor's Outfit. He will be happy to give you any further information you may require.

MECCANO



Special Inventor's Outfit

MECCANO LIMITED
OLD SWAN
LIVERPOOL

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