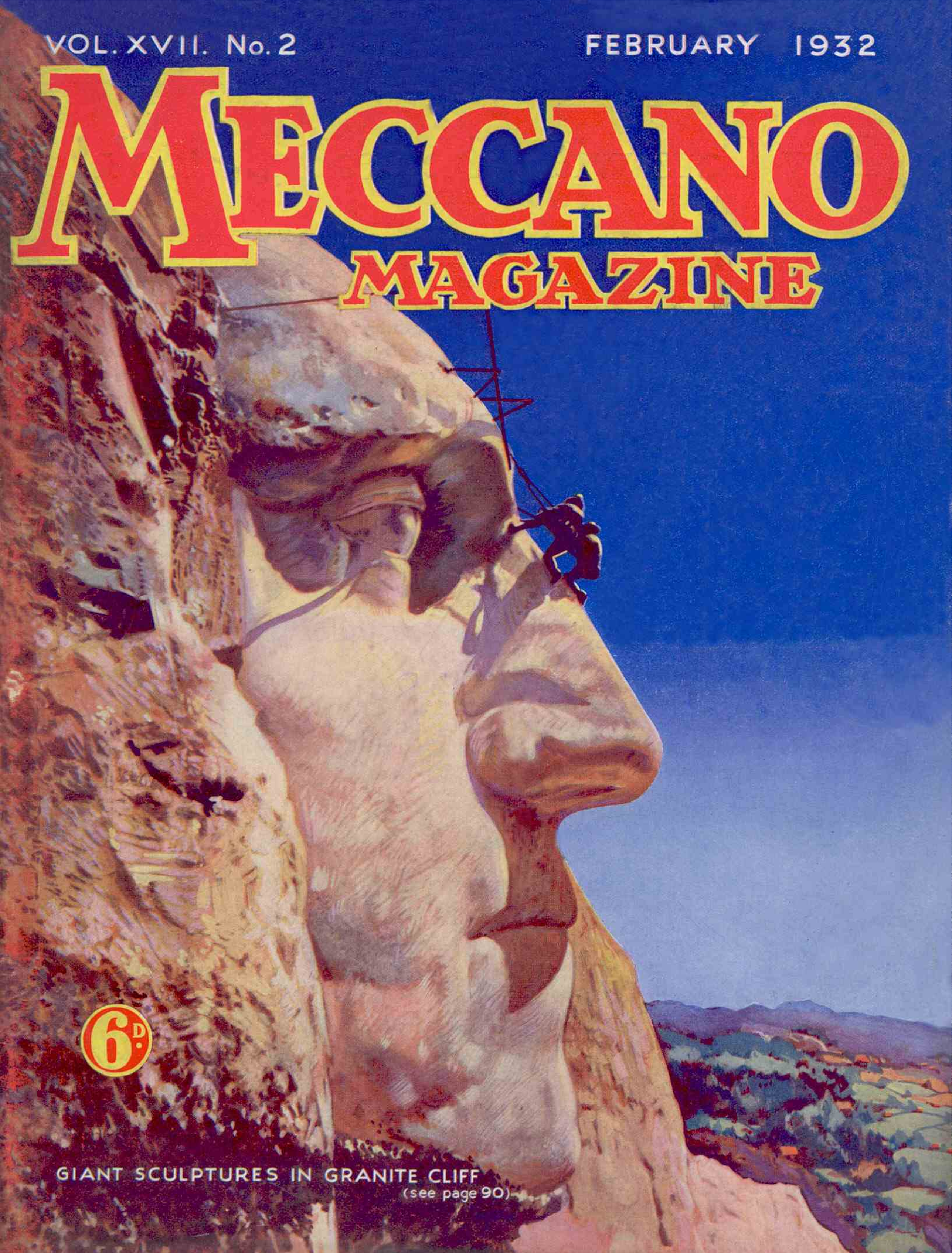
VOL. XVII. No. 2 FEBRUARY 1932

MECCANO MAGAZINE

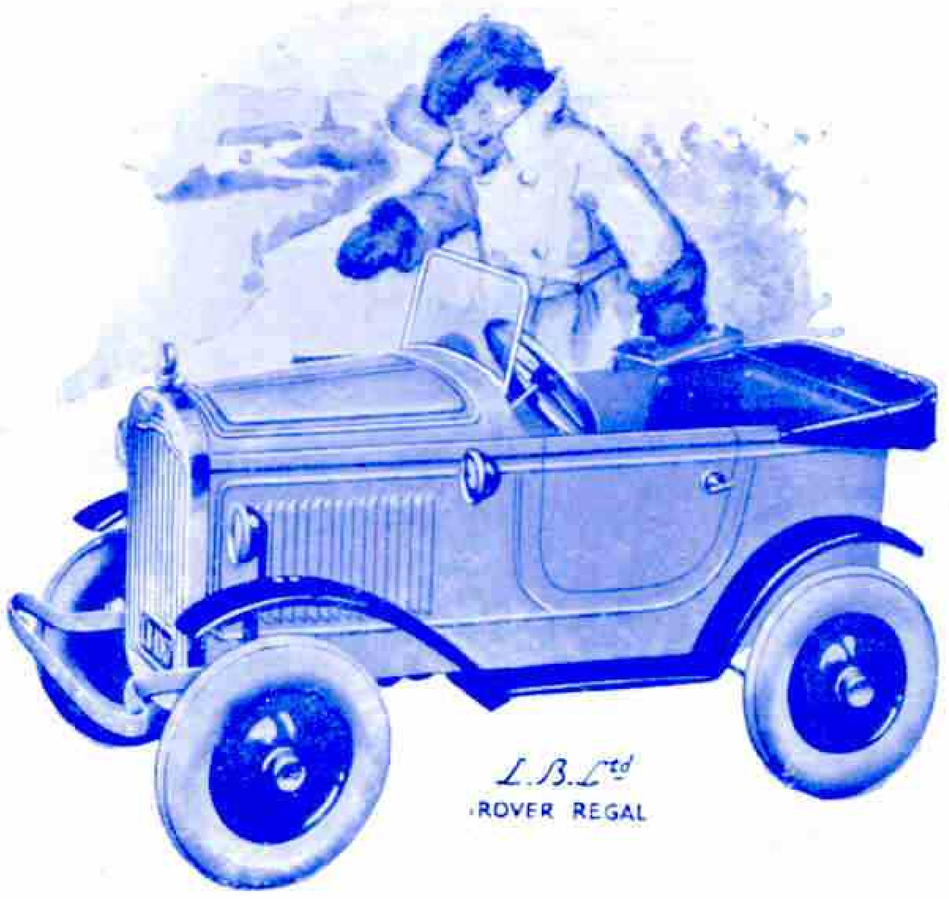


6D.

GIANT SCULPTURES IN GRANITE CLIFF

(see page 90)

Toy Cars with the real car look!



If you want the most realistic toy motor, built on sound engineering principles and fitted with really correct radiator, insist on a TRI-ANG (Regd. Trade Mark) car. The new models shown here are all wonderfully life-like productions, having pressed steel bodies with opening side doors, facsimile nickel-plated radiators, and adjustable tubular framed windscreens. They are easily propelled by improved double crank drive with rubber pedals, and will stand up to really hard usage. The glossy enamel gives a finishing touch to TRI-ANG (Regd. Trade Mark) cars which puts them in a class by themselves. See the famous Tri-ang trade mark before you buy!

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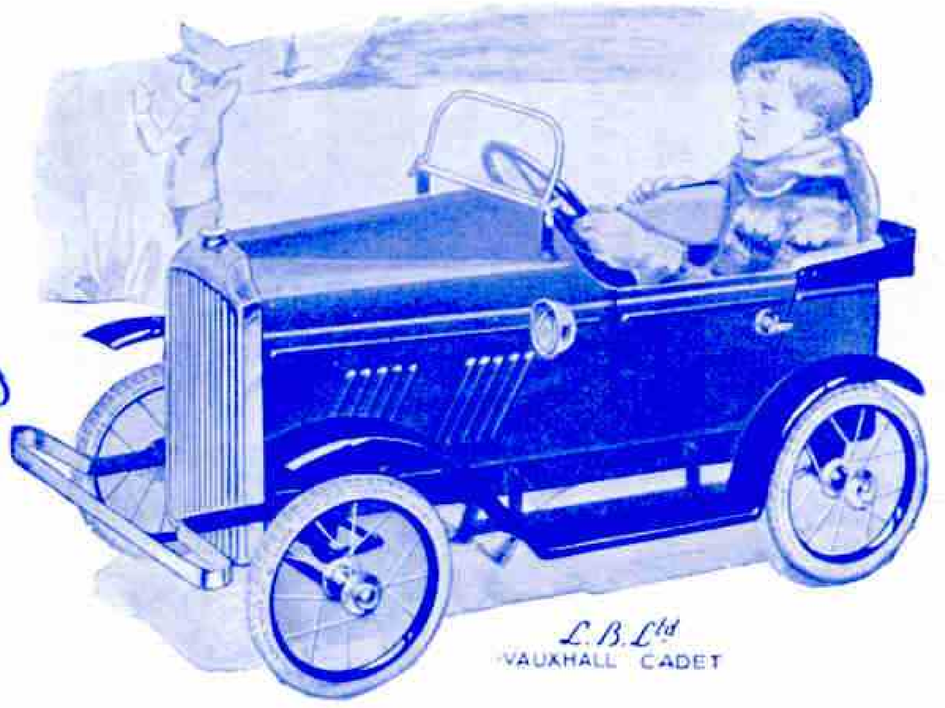
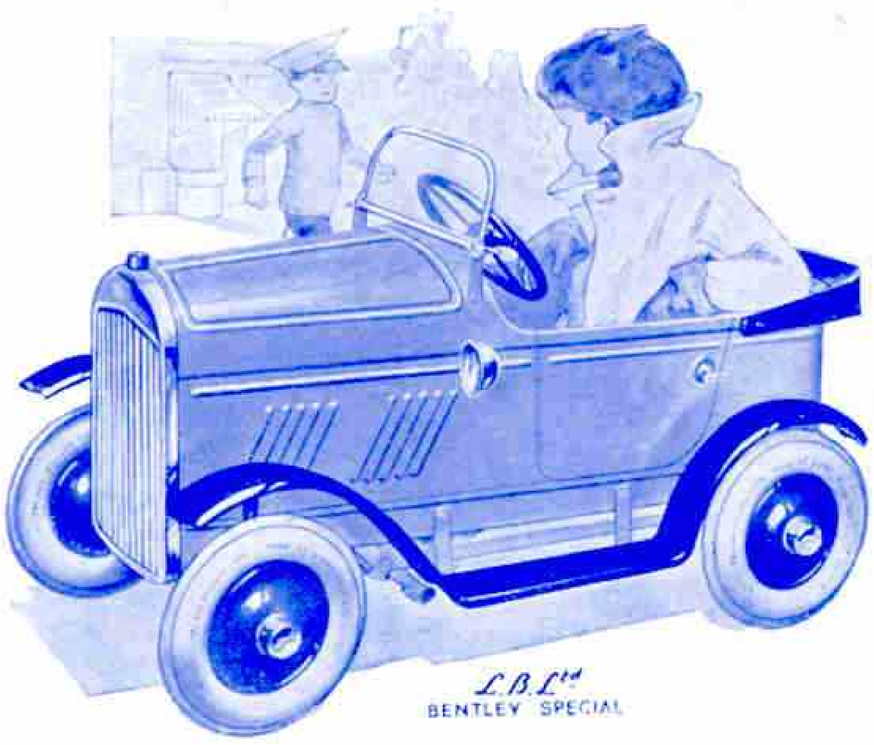
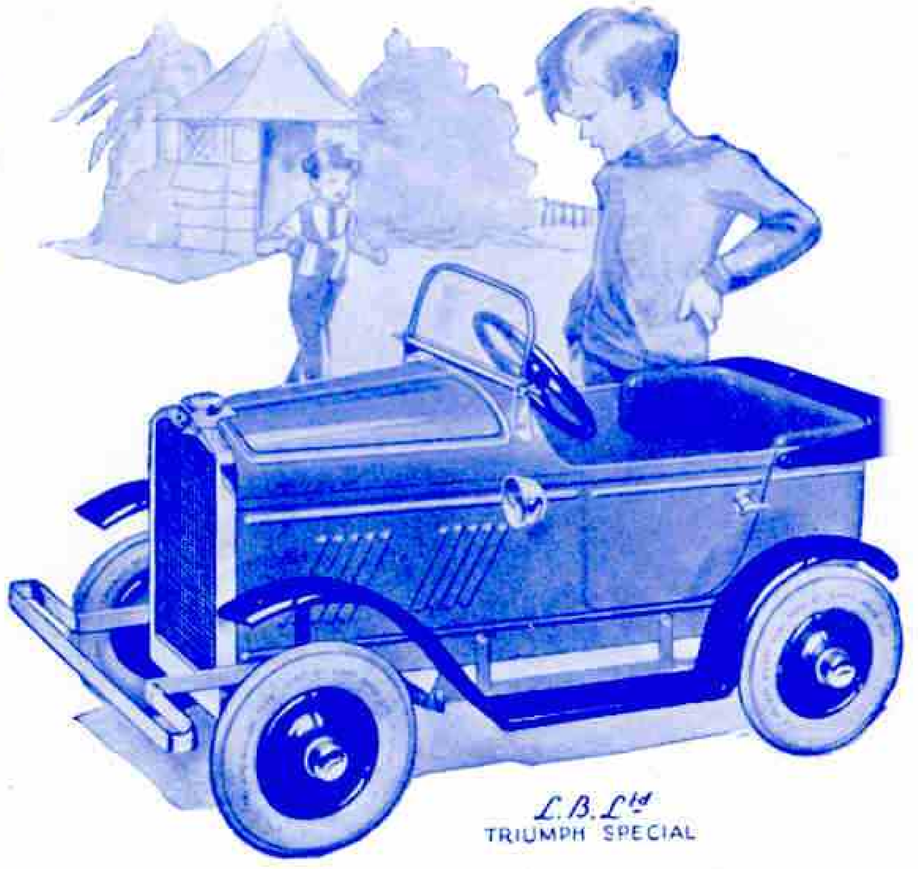




VAUXHALL CADET.—*For ages 2½-5 years. Pressed steel body, beautifully finished royal blue. Facsimile Vauxhall radiator, adjustable screen, nickel-plated bumper, side door, dummy hood.* **35/-**

BENTLEY SPECIAL.—*Plated Bentley radiator, adjustable windscreen, side door, 8" balloon wheels. Upholstered back, dummy hood. Mudguards and steps. Finished blue. For kiddies 2½-5 years.* **25/6**



TRIUMPH SPECIAL.—*Correct model of Triumph radiator with badge and cap. Adjustable tubular framed screen. Pressed steel body, opening side door. 8" balloon wheels, ½" rubber tyres. Upholstered back, dummy hood. Painted beige, red lines. Ages 2½-5 years.* **29/6**

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With the Editor

The Disarmament Conference

During this month there is to take place a conference unique in the world's history—the Disarmament Conference at Geneva. This may not seem a very interesting topic for an "*M.M.*" editorial, but I want all my readers to think seriously about it for a little while, because upon the result of this conference may depend the future of civilisation.

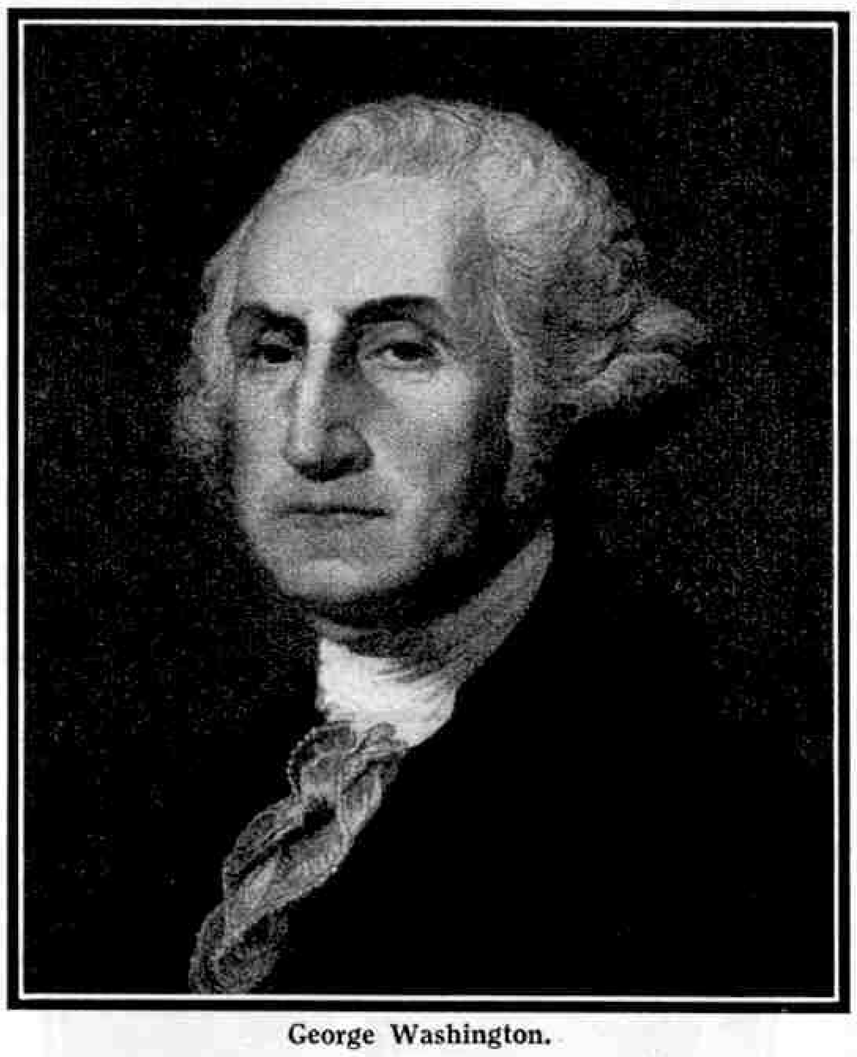
It is now more than 13 years since the Great War came to an end, and none of my younger readers will have any personal recollection of the events that occurred during its four terrible years. We are reminded of it annually on Armistice Day, when millions of people stand silent for two minutes as a tribute to the fallen; but there is a danger that the generation now approaching manhood may not realise how disastrously the War has affected, not only the nations that took part in it, but the whole world.

Throughout the War 11,000,000 men lost their lives. It is difficult to grasp this enormous figure, and perhaps the best way of doing so is to remember that it is nearly equivalent to the slaughter of every man, woman and child in Scotland, Ireland and Wales. As if that terrible slaughter were not enough, over 19,000,000 men were wounded, many of them so seriously that they are disabled to this day, and will remain so to the end of their lives. These terrible figures alone are sufficient to make every Meccano boy, whatever his nationality, resolve to do all in his power to make war impossible in the future. The tragic story does not end here, however. During the War millions upon millions of pounds were spent on guns, shells, high explosives, and military and naval equipment of all kinds. To provide for this expenditure governments raised huge loans from their own people, and borrowed enormous sums from richer nations.

After the Armistice came the problem of settling up. Nothing could be done to compensate for the loss of life, but there remained the inter-allied debts to be repaid, and reparation to be made by Germany to France for the devastation of her country. The burden of these payments has resulted in the dislocation of the financial foundations of the whole world, and has been largely responsible for bringing about the trade depression that hangs like a dark cloud over every civilised nation. Millions are unemployed, and millions more are suffering loss and hardship. The World War has indeed brought about world misery.

What is to prevent this awful tragedy from happening again? Nothing—so long as nations continue to watch each other with suspicious eyes and to spend vast sums on their armies, navies and air forces. From the beginning of the world's history preparation for war has always resulted in war, and it will do so again. The only safeguard for world peace is world disarmament. No one nation dare disarm while its neighbours remain armed; universal disarmament is the only solution.

This month's Disarmament Conference, which will be attended by representatives of practically every great nation, will seek to find a basis for international disarmament by friendly agreement. If it fails, the outlook is dark; but if it succeeds there will open up a long vista of peace, during which the world may return to prosperity and happiness. I am sure that all my readers will join with me in a heartfelt wish for its success.



George Washington.

George Washington

On the 22nd of this month occurs the 200th anniversary of the birth of George Washington, the great American who is usually spoken of as the "Father of his Country." Washington earned this title in a double sense. He was commander-in-chief of the armies that wrested independence from the British Government, and afterwards he became the first President of the new republic, guiding its footsteps during the first eight years of its existence.

Washington was a true American, for he was born in Virginia, then an English colonial possession, in which his immediate ancestors had lived for some 100 years. It was intended that he should enter the British Navy, and he actually obtained a commission as midshipman; but his mother decided to keep him at home. He took up the profession of land surveying, in which he found congenial occupation for some years. In the course of his duties he acquired a knowledge of woodcraft that was of great value to him in the part he played in the struggle between the English and the French for the possession of North America. He was one of the few who emerged with credit from the disastrous attack on Fort Duquesne made by General Braddock who, in spite of many warnings, allowed his army to be ambushed and overwhelmed by Indians. Later Washington led the force that finally took possession of the Fort.

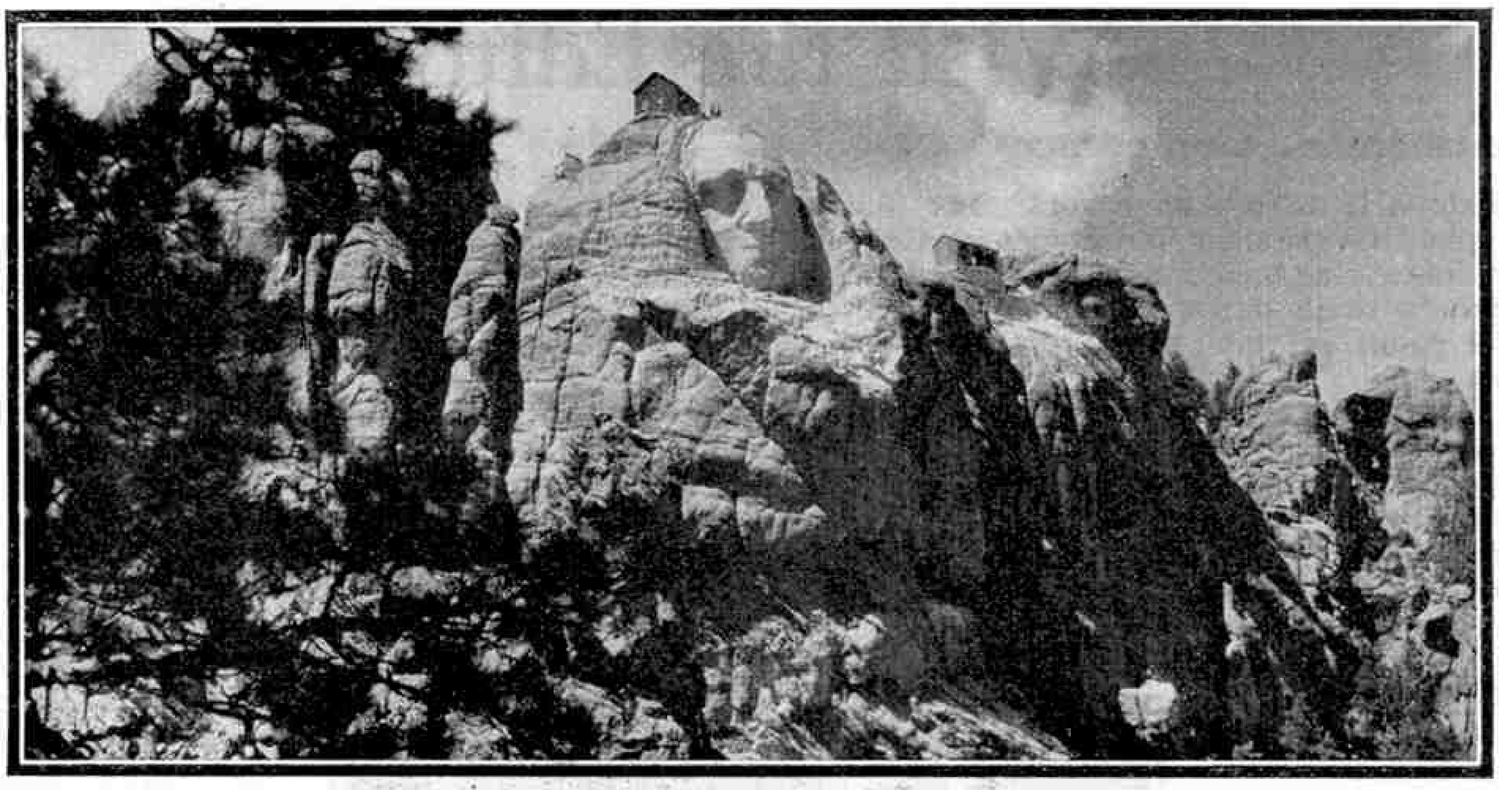
After the French had been driven out of North America, quarrels broke out between the colonists and the British Government. These went too far for reconciliation, and the Revolutionary War followed. Washington took his stand with his fellow countrymen, and gained their confidence to such an extent that he was elected commander-in-chief. He was not a military genius, but his strength and steadfastness of character, and his unwavering faith in the ultimate triumph of the cause he had adopted, were worth far more to the Americans than the mere winning of battles. When finally independence was won, he undoubtedly ranked first in the affections of the American people. He had devoted several years of his life to the task of leading them in war, and although his chief desire was to return to a quiet life as a country gentleman in his native State, he sacrificed his personal wishes to their urgent call for his services.

As first President of the United States, Washington appreciated the need of peace in order to enable the young republic to become firmly established, and he guided his country through the troublous times of the French Revolution with statesmanlike sagacity. America has produced many great men, but none who ranks higher than Washington in farsightedness, courage and honesty of purpose.

Nation's History Carved in Granite Cliff

United States Mountain Memorial

ON the sheer 300 ft. cliff on Mount Rushmore in the heart of the Black Hills of South Dakota, U.S.A., the sculptor Gutzon Borglum is carving for posterity a historic memorial depicting on a colossal scale the founding, expansion, preservation and unification of the United States. The figures of four presidents, Washington, Jefferson, Lincoln and Roosevelt, who played leading parts in these four phases of the nation's development, will be flanked by an entablature on which will be engraved a 500-word history of the country to be written by Calvin Coolidge. This sculpture will exceed in size anything before attempted. The proportions will be several times those of the Egyptian sphinx. The heads of the figures will each measure 60 ft. from the top of the head to the chin, and the figures will be shown to the waist line, where they will fade into the cliff. The history will be cut into the rock in letters 3 ft. high, and it is expected that these will be legible at a distance of three miles. Work on the memorial has been under way at intervals since 1927, and it will require three or four more years to complete it.



The partly completed head of Washington. The great size of the figure can be appreciated by comparing it with the cabin on the top of the rock. For the illustrations to this article we are indebted to the Editor of "The Compressed Air Magazine."

At first thought it might appear that a more appropriate subject could have been chosen for the site—one more in keeping with the traditions of the region. In fact some of the people of South Dakota hold the opinion that a memorial to the American Indian, or to the pioneers who won the West from the wilderness would typify better the history of the Black Hills. Further consideration, however, shows that there is nothing incongruous in the plan. The work is a national memorial designed to portray a story of more than local importance. Not only is the State selected close to the centre of the country from east to west, but its history is linked inseparably with one of the outstanding episodes that will be included in the message the stone will carry to future generations.

It was on the site of Fort Pierre across the Missouri River from the city of Pierre, capital of South Dakota, that agents of the French king, Louis XV, secretly buried in 1743 a leaden plate on which it was set forth that France claimed for her own the vast territory known as Louisiana. It was the hope of the French ruler to thwart his country's ancient enemy, Great Britain, and to prevent the dominance of the Anglo-Saxon race in the west portion of America. The far-sightedness of Jefferson in purchasing this domain in 1803 altered the history of the nation, and was of inestimable aid in promoting the colonisation of the West.

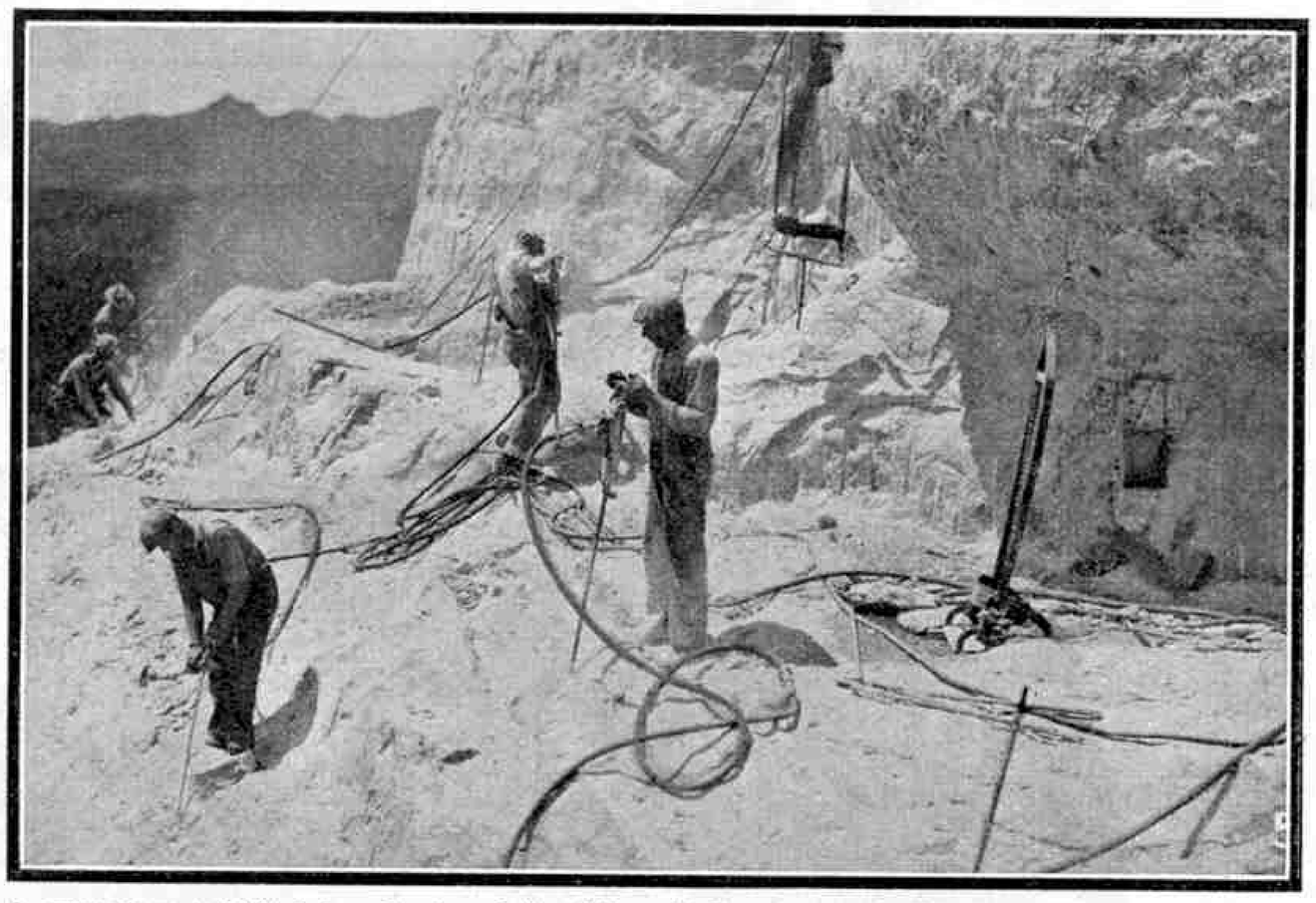
Mount Rushmore was chosen by Mr. Borglum as the site of the memorial because it best fulfilled three main requirements. These were first, that the stone to be carved should be situated so as to receive full sunlight during as much of the day as possible; second, that the granite should be sound; and third, that the stone should be present in masses sufficiently large and free from fracture as to admit of group sculpture.

The "Steel Monkey"—a man who travels about the cliff in harness—delivering necessaries to the men at work.

In the arrangement of the figures Jefferson will come first on the left, by virtue of his authorship of the Declaration of Independence. Washington is given next place as the framer of the Constitution, and for his numerous other services to the nation; and then will come Lincoln as the preserver of the country's uniformity when internal warfare came. On the extreme right will be Roosevelt in recognition of his completion of the Panama Canal, and fulfilment of the dream of Columbus for a direct route between the eastern and western oceans. Each of these figures will be on the scale of men 465 ft. in height, if completed from head to foot. Approximately 150 ft. to the right of the group on a

perpendicular face of rock measuring 80 ft. by 120 ft. will be carved the history.

The site of the memorial is in the highest area between the Rocky Mountains and the Atlantic coast. It is about 30 miles from Rapid City and within three miles of the mining camp of Keystone, from which a temporary road was built for construction purposes. The cliff that is being carved rises abruptly from a canyon. The lower slopes are wooded with pine trees, and above them the rock extends upward almost perpendicularly. The top of the group of figures will be some 500 ft. higher than the rustic building that houses the sculptor's models, and which will serve as a museum and observation point when the memorial is completed. The actual work of carving the memorial is being done with tools operated by compressed air.



A crew at work 60 ft. below the top of the cliff. At the upper right is seen Washington's chin as roughed out.

The first step in sculpturing the figures was the preparation of the models in plaster of Paris. The models are made on a scale of 1 to 12; that is to say, 1 in. on the model represents 1 ft. on the cliff. This simplifies calculations in transferring measurements. In order to effect this transfer and thus guide the workmen, two methods are used. For roughing out the head of Washington, the first to be undertaken, a protractor was mounted horizontally on top of the model of the head. Directly behind the centre of the arc opposite the 90 degrees mark was placed a pivot to which was attached one end of a metal rod that extended outward across the arc of the measurement scale and over the head.

As soon as it was determined where the top of the head was to be, and at what angle the face would look out from the cliff, a large metal protractor was set in the rock in a position corresponding to that on the model. An upright pipe was erected at the pivot point, and a diagonal run from it to support the boom extending out over the cliff and corresponding to the rod installed on the model. By attaching a string with a plumb-bob at its end to the metal rod on the model it was an easy matter, by moving the rod round the arc, to measure the horizontal distance in inches from any point on the string to the nearest point on the model. By using the larger apparatus on the cliff, and substituting feet for inches, the amount of stone that had to be cut away at any point was quickly determined.

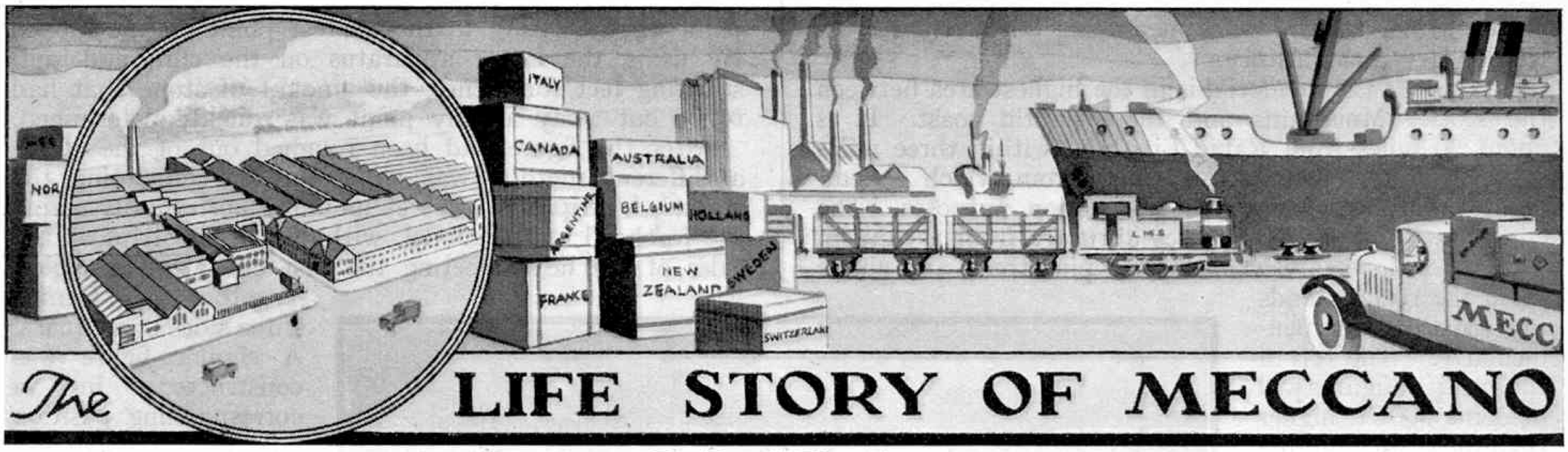
Gutzon Borglum, the sculptor, inspecting the work on Washington's forehead. Borglum is the centre figure.

After the figure had been roughed out of the stone, a different method was employed for completing the work. A strip of wood was mounted horizontally across the forehead of the model, with two other strips at the sides of the head meeting the first one at right-angles. Together they formed three sides of a square. A similar figure was constructed in a corresponding position on the partly-completed head on the cliff, using angle irons for material. By suspending strings from the front strip and from the nearest side strip of the model, it was possible to measure the distance from both the side and the front to any point on the figure. When such a point was determined it was marked by means of a tack stuck into the plaster. By repeating the process on the cliff and marking the amount to be cut, the work proceeded with complete assurance that the dimensions of the figure in rock would be closely proportional to those of the model. This point system is said to have been used by sculptors throughout the ages.

For roughing out the figures and for semi-finishing work "jackhamer" drills are used. Down holes are mainly required for the roughing-out work, and the maximum depth of the holes is 40 in. Ordinarily a row of holes is placed so as to permit shooting off 30 in. slabs up to 4 ft. in thickness. The greatest horizontal cut called for so far was about 30 ft., this being under the chin of Washington's head. Blasting is done with gelatine dynamite in cartridges fired electrically. After a figure has been roughed out greater care in drilling is called for, and no more blasting is done, the final 6 in. of material being removed entirely by tools. The Mount Rushmore granite is a grey fine-grained stone that is quite uniform in texture, and this and the fact that it is practically free from fractures promotes ease and speed in working it, considering that it is a hard rock.

(*Continued on page 113*)

Workman breaking out rock between shallow drill holes being put in by the man at his right.



The LIFE STORY OF MECCANO

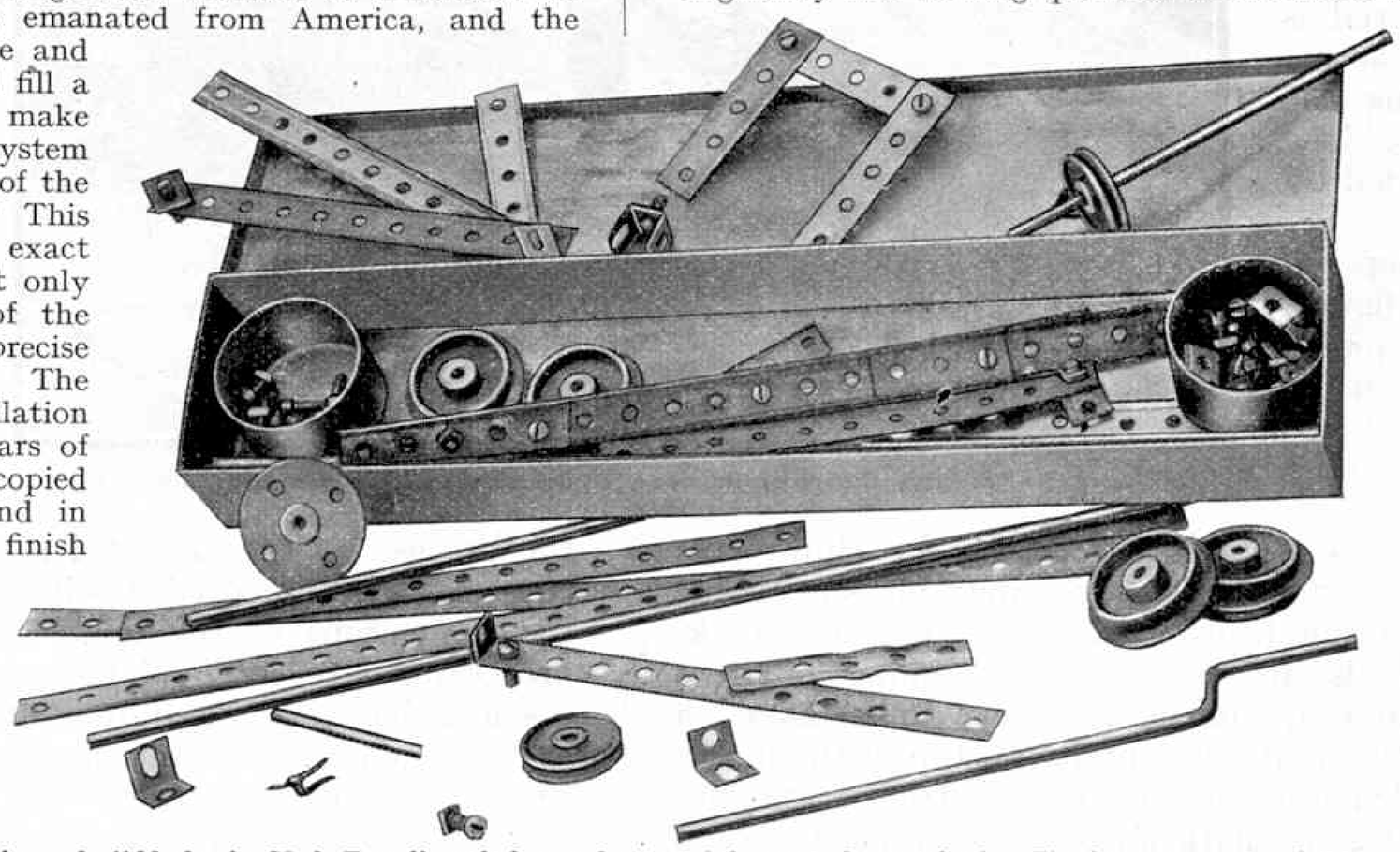
By Frank Hornby

LAST month I described the earliest stages of development of the Meccano System, and referred to the fact that few articles ever made have had to fight against so much imitation.

I think that probably the greatest number of imitations of the Meccano System have emanated from America, and the complete history of the rise and downfall of them all would fill a large volume. The first to make its appearance was a system introduced under the name of the "American Model Builder." This system was almost an exact duplication of Meccano, not only in regard to the design of the parts, but even to the precise contents of each outfit. The Meccano Manual, the compilation of which had taken me years of thought and study, was copied almost in its entirety; and in fact, except for the inferior finish of the parts and the generally less attractive arrangement, one of these imitation outfits might easily have been taken for a genuine Meccano Outfit.

You may imagine the deep concern I felt when I discovered that all for which I had worked and striven for so many years had been misappropriated by a newcomer, whose sole intention was to rob me of the business I had built up. I immediately sailed to New York and had a consultation with a well-known firm of attorneys in regard to the steps to be taken to put an end to this grossly unfair form of trading. It seemed to me that such a flagrant breach of the laws of copyrights and patents could very quickly be ended, and I felt sure that I should soon be able to compel the manufacturers of the imitation system to withdraw their outfits from the market. I was destined to have a bitter experience of the slowness of the law, however. The case lasted for no less than nine years and cost my company many thousands of pounds; but it ended in the final and complete establishment of our copyrights, patents, and other privileges.

Since the conclusion of the case against the "American Model Builder," which was tried before the United States Circuit Court of Appeal, I have had the briefs, the transcripts of record of the evidence, and all documents connected with the proceedings collected together and bound. They are too bulky to be included in one book, and therefore they are made up into four large volumes, looking like so many big family Bibles! The case was considered of the utmost importance in America, and was closely followed by the legal profession. The final judgment was both sweeping and emphatic, and in my opinion it stands as the finest possible tribute to the originality and sterling qualities of the Meccano System.

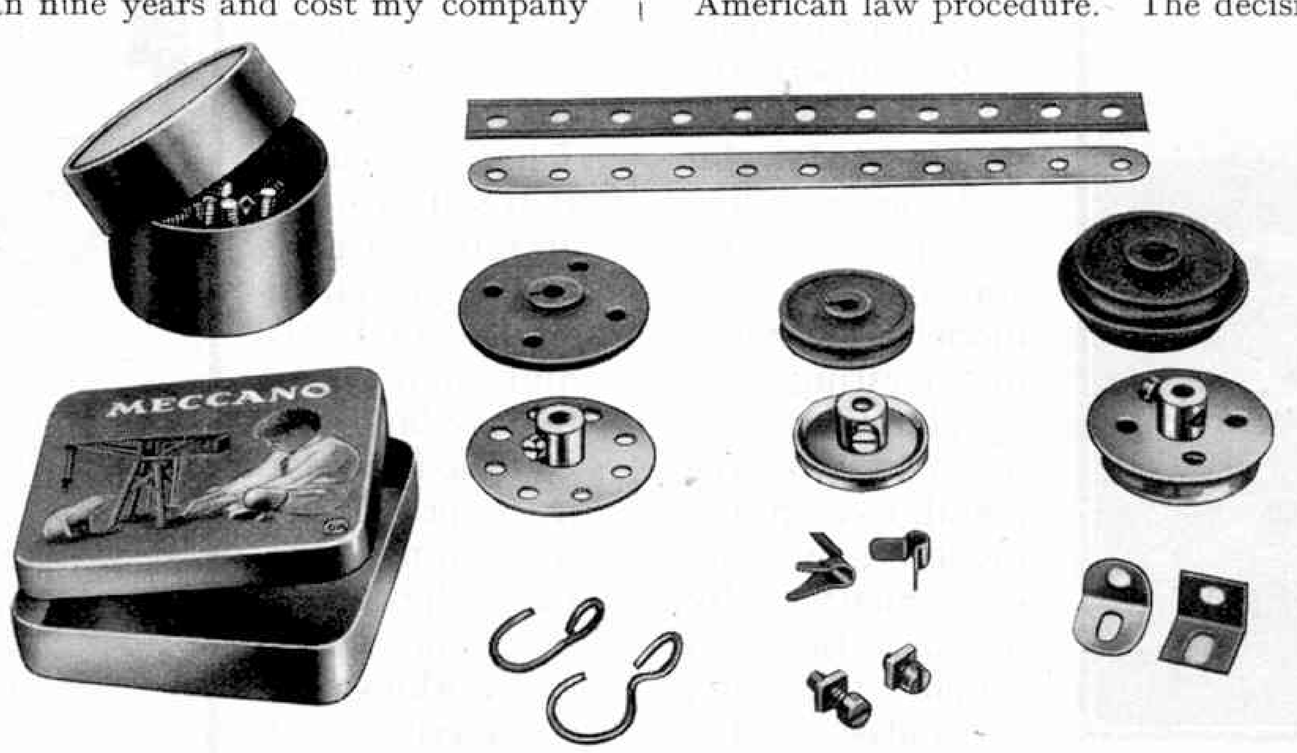


An early "Mechanics Made Easy" outfit box and some of the parts it contained. The box was made of thin sheet metal, and the lid carried the printed label that is shown at the top of the opposite page.

The late Hon. H. C. Hollister, United States District Judge, in delivering his opinion, spoke of Meccano as a "toy of great utility and educational value, stimulating the imagination, appealing to a boy's creative faculties, that not only gives enjoyment, but is highly instructive." He went on to say that the "American Model Builder" was in his opinion not only a fraud on the public, but also a fraud on Meccano Limited. He further said that the "Meccano Manual is not unlike a key by which the really wonderful treasures contained in the various parts of the outfits may be unlocked." I do not think that a more equitable judgment was ever delivered.

Throughout the whole proceedings, although these were often wearisome and tedious, the most painstaking efforts were made by the judges to arrive at the truth in what proved to be an extremely complicated case. Although I was a stranger and a foreigner in the country, and the proceedings were against a firm of American nationality, a spirit of the utmost fairness characterised the entire proceedings, and left me with a high opinion of many sides of American law procedure. The decision in this case naturally had its effect upon the many other imitators that had sprung up, and one by one they dropped out and disappeared from the market.

Imitators sprang up also in Europe. One of the earliest of these systems consisted essentially of bars of wood perforated at regular intervals with holes, and capable of being fastened together in various positions by metal pins passed through these holes. By means of this system it was possible to build a variety of houses and other fixed structures, but it was impossible to construct engineering models or mechanisms that worked. No matter how the parts



Ancient and modern! Some of the earliest Meccano parts photographed side by side with corresponding present-day types.

were joined to one another, the result in every case was a fixed position—there was no means of producing movement. The opening words of the patent specification of this system read :—"The subject of the invention is a toy building set, by means of which structures can be put up closely resembling real structures erected by carpenters . . . ." This phrase places it beyond all possible doubt that the object of this system was to produce fixed structures based on the principles of carpentering. Meccano, on the other hand, is designed to produce working structures built on the principles of engineering.

My claim was, and is, that Meccano is the original application of the basic principles of engineering to a metal constructional or mechanical toy. It was on this basis—that is, as a metal mechanical system—that I obtained the first English patent for my invention on 9th January, 1901—more than two years before the above mentioned patent was granted for the wooden unmechanical system.

In the course of the next few years the German manufacturers, who at that time largely dominated the toy business in this country, became alarmed at the success of Meccano, and an avalanche of imitations followed. They all went badly astray, however, for they left the path of engineering and introduced makeshift fastenings, couplings, and odd contrivances of all kinds, that they evidently thought were good enough for a toy that was to be played with by boys. Many of these German imitations had some vogue on the Continent before Meccano became well known there. The best that can be said of them is that they had attractive labels on the box lids. One or two of them tried to get a footing in this country, but neither the public nor the dealers would pay any attention to them, so that little was heard of them.

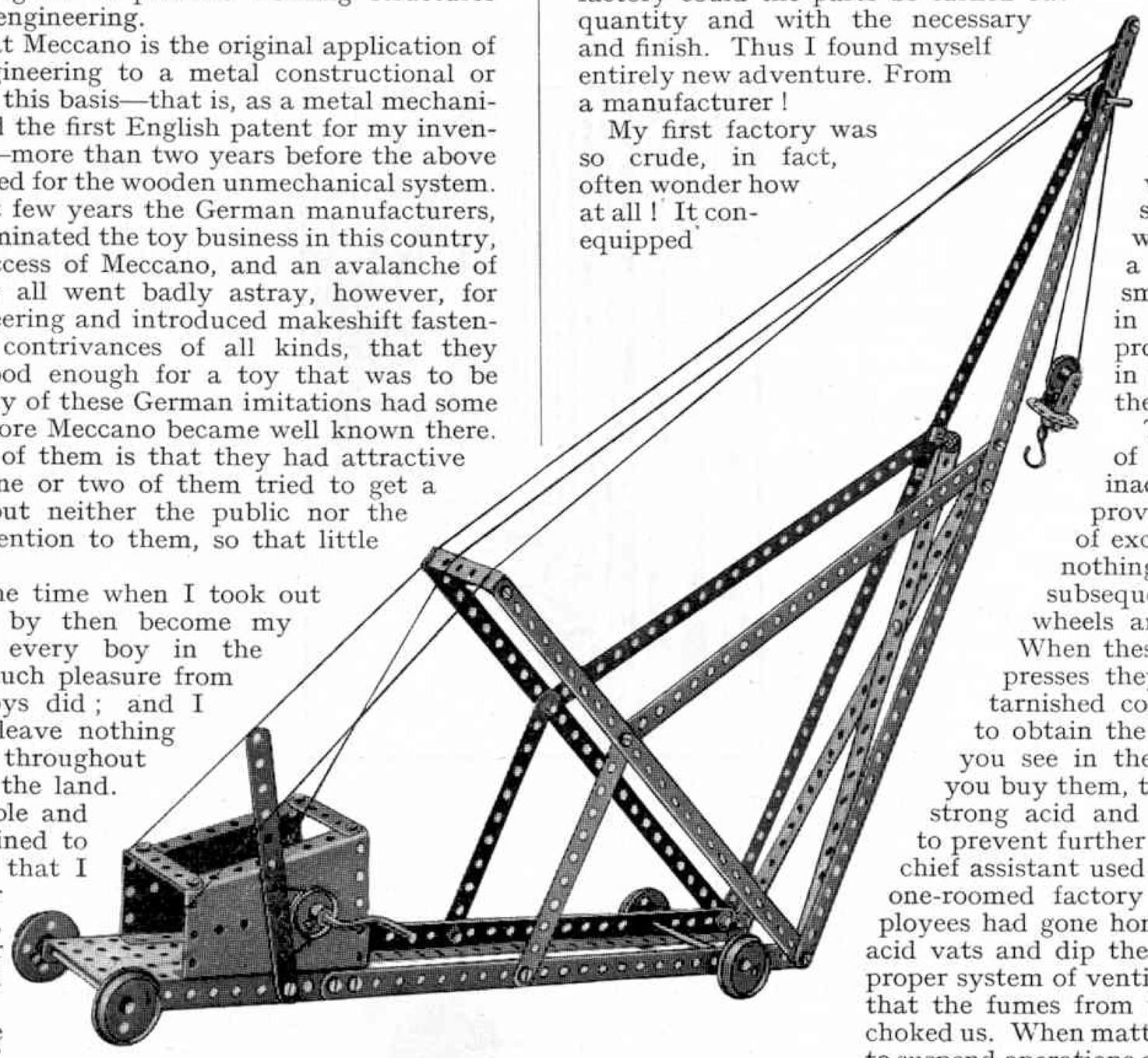
I must return now to the time when I took out my first patent. It had by then become my unshakable opinion that every boy in the country would derive as much pleasure from my system as my own boys did ; and I determined that I would leave nothing undone to make it known throughout the length and breadth of the land. If I had foreseen the trouble and difficulties that I was destined to encounter, I do not think that I should have been so eager and so confident. Indeed, I sometimes wonder whether I should ever have tackled the job at all !

I gave the name "Mechanics Made Easy" to my invention, and I was firmly convinced that I had only to show it to manufacturers and dealers for them to be tumbling over one another to be the first to make and sell it. I was quickly undeceived. The dealers considered it to be crude and unattractive in appearance, and were very emphatic that it was not in the least likely to meet with a favourable reception from the public ; and the manufacturers would not even look at it. Although these rebuffs were very disappointing, they did not shake my confidence in the ultimate success of my invention. By degrees I succeeded in persuading a few dealers to take it up, in many cases against what they called their "better judgment" ! I was convinced that as soon as boys saw the invention and realised its possibilities they would be keen to possess an outfit ; and to my unbounded joy—and to the astonishment of the majority of dealers—this proved to be the case. For a time progress was very slow, but it increased steadily, and I was now faced with an entirely new problem—that of producing the parts in sufficient quantity.

At first I had the various parts made for me by different manufacturers. This arrangement worked fairly well for a while, but presently, as the system became known and the demand for parts increased, all kinds of troubles developed. I could never rely on all the parts being ready at the same time ; and frequently outfits for which dealers were becoming impatient were held up because one firm had failed to supply a particular part by the time specified. A further and even more serious trouble arose from the fact that there was no uniformity of finish among the parts. Not only was there a wide difference in the quality and appearance of parts made by different firms, but also I could never be sure that two batches of parts made by one firm would be alike. It began to be obvious that only by centralised production in one factory could the parts be turned out in the necessary quantity and with the necessary consistent accuracy and finish. Thus I found myself embarked upon an entirely new adventure. From an inventor I became a manufacturer !

My first factory was a very crude affair—so crude, in fact, that looking back I often wonder how we produced anything at all ! It consisted of a single room equipped with a few hand presses, a lathe or two, and a small gas engine which, in spite of its many protests, we succeeded in persuading to provide the necessary power !

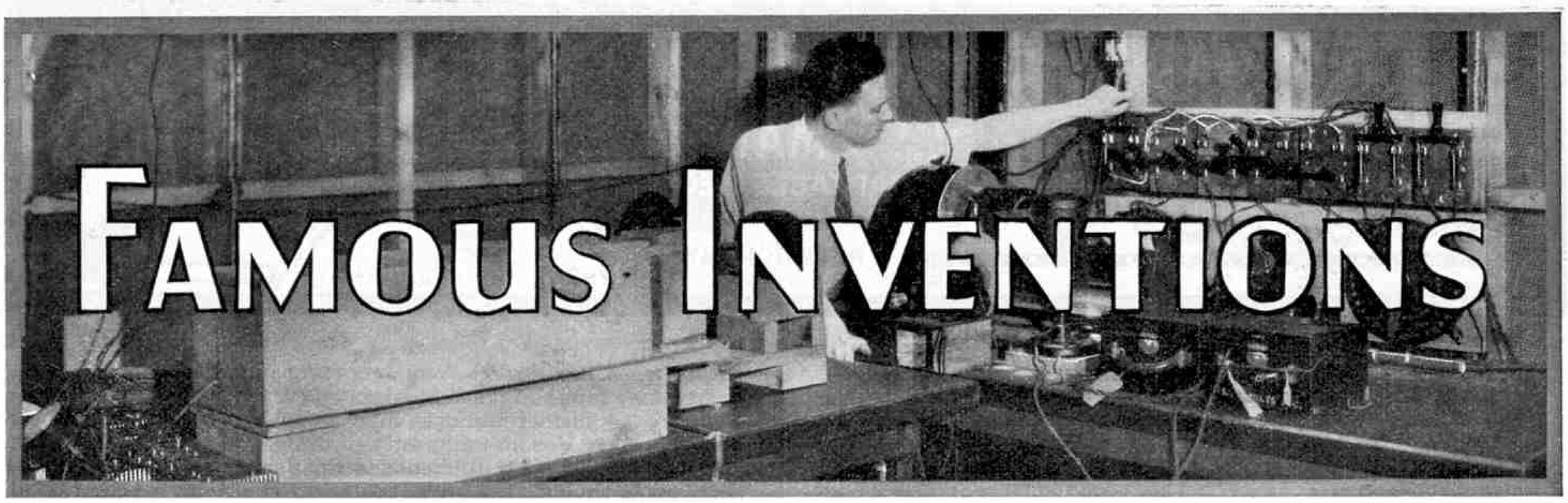
The actual production of the parts with our inadequate machinery provided us with plenty of excitement, but this was nothing to the thrills of subsequently cleaning the wheels and other brass parts. When these first come from the presses they are in a dirty and tarnished condition, and in order to obtain the brilliant surface that you see in the finished parts when you buy them, they are first dipped in strong acid and afterwards lacquered to prevent further tarnishing. I and my chief assistant used to stay behind in our one-roomed factory after the other employees had gone home, and bring out the acid vats and dip the wheels. We had no proper system of ventilation, with the result that the fumes from the acid often nearly choked us. When matters got too bad we had to suspend operations abruptly, and dash out into the open air to recover, and at the same time give the air in the room a chance to clear again ! Gas masks had not been thought of in those days, but they certainly would have been very useful to us ! Every now and then I take a walk to the splendidly equipped and perfectly ventilated room in which this process is carried on in the present Meccano factory ; and as I watch the work proceeding smoothly and swiftly I recall the difficult days through which we passed in my first factory.



Meccano models have always been designed on real engineering lines. The crane seen on the early box label shown at top of page, for instance, was so soundly constructed that its design has scarcely been altered at all. This is shown by the lower illustration of this model in its present-day form.

With such a primitive system of production it was inevitable that things frequently should go wrong. As fast as we overcame one difficulty, another cropped up at some unexpected point. To use a familiar phrase, we were always "up against it" ! In spite of all obstacles, however, we always managed to "deliver the goods."

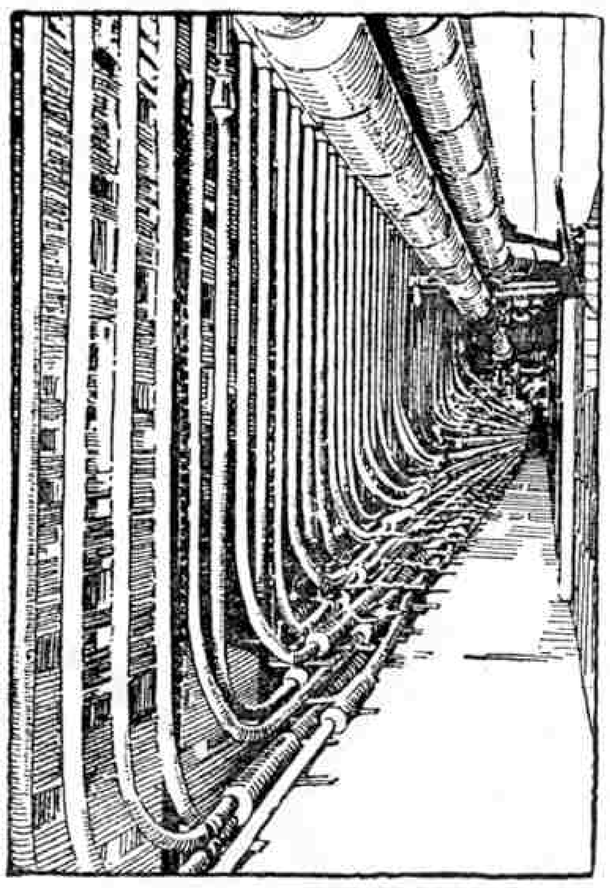
It was during the time that I was in this factory that I decided to change the name of my outfits from "Mechanics Made Easy" to "Meccano." The latter was a handier and shorter name, and I thought it would enable boys to identify my goods more easily. Also I could register this name, so that no one else could come along at any future time with imitation goods and palm them off on the public as being the real thing. I registered "Meccano" in England on 14th September, 1907, and in Germany in July, 1912. As a result no one else can ever use the word "Meccano," and of course without this name no parts are genuine. *(To be continued)*



XXX.—THE DEVELOPMENT OF THE TELEPHONE EXCHANGE

IN the previous article in this series we described the development of the telephone in America from a crude apparatus, faintly conveying the sound of the human voice into a practical instrument enabling two people to talk to one another from a distance when they had the necessary instruments connected together by wires. The next problem was that of devising some means of enabling all the owners of instruments in a certain area to be placed in communication with one another as required, and it was solved by the introduction of the telephone exchange. In the exchange system the wires from all the telephones in a certain area are extended to a central building, where they terminate at a switchboard in charge of an operator, usually a girl, whose duty it is to put any subscriber of that area in touch with any other subscriber he desires to speak to, by connecting the wires from his telephone to those leading to the telephone of the called subscriber.

The first telephone exchange was established in Boston, America, in 1877, and was a small and crude affair. It had no facilities for placing telephone users in direct communication with each other, and one subscriber wishing to get into touch with another had to call up the operator, who received the message and repeated it to the desired person. As the number of subscribers increased it became impossible for the operator to keep pace with the calls, and it was obvious that some means must be devised of enabling the operator to put telephone users in direct communication with each other easily and quickly.



In the cable vault of a telephone exchange. The many wires in the lead-covered cables lead from the subscribers' instruments to the exchange switchboard.

The invention of the "Williams" switchboard made this possible. This switchboard consisted of two vertical panels carrying the indicating mechanism, and immediately in front of these were two operator's tables each provided with a transmitter and receiver, and connecting, earthing and battery keys. Numerous horizontal brass strips grouped in pairs and containing holes for the reception of circular pegs extended across the upper portion of each panel. The lower portion contained three rows of indicators or "drops," the front portion of each drop consisting of a small metal door hinged at the bottom. Immediately beneath each drop was a "slipper," which consisted of a small flat brass spring that made contact with a brass plate connected to earth through the indicator. In addition there was a set of flexible cords each terminating at one end in a circular brass peg and at the other end in a plug called a "flat jack," a small brass plate secured to a piece of insulating material.

When a subscriber wished to get into touch with the exchange he pressed a "calling button" on his instrument, and this action caused a battery current to be transmitted over his line to the slipper associated with his telephone number on the exchange switchboard, where the opening of the door of the indicator notified the exchange of his call. F. G. C. Baldwin in his book "*The History of the Telephone in the United Kingdom*" relates that "the connecting operator then inserted the flat jack at the end of one of the loose cords into the slipper associated with the indicator of the calling subscriber, which had the effect of connecting the cord to the subscriber's line, and disconnecting the subscriber's indicator and earth connection. The circular peg at the other end of the connecting cord was then inserted into one of the holes in a brass strip which was not in use and the indicator shutter restored."

This operation connected the subscriber's line to keys controlled by the second or "answering" operator who, by depressing appropriate keys, established connection with the particular horizontal strip to which the calling subscriber was connected, and asked for the telephone number required. "The connecting operator," says Baldwin, "was then instructed to connect the wanted subscriber's line to the horizontal bar which formed a pair with the first one, a second connecting cord being used for the purpose. The required subscriber was then called by means of a key associated with the answering operator's instrument and, when his attention had been secured, he was informed of the pending conversation and the two subscribers left connected through the two connecting cords."

A switchboard of this type was imported from America and installed in the first telephone exchange in England. This exchange was established in 1879 at 36, Coleman Street, E.C., and started with only seven or eight subscribers. A steady increase in subscribers soon resulted in two more telephone exchanges being started in London, one at Leadenhall House, in Leadenhall Street, and the other at 3, Palace Chambers, Westminster. The switchboard at Leadenhall House was made in this country and though similar to the others in being of the "slipper jack" type it had some novel features, one being that it had numerous brass contacts instead of the horizontal strips of the Williams switchboard. Another innovation was that when a subscriber replaced his receiver at the close of a conversation the descending switch hook of his telephone caused a "clearance signal" to be automatically transmitted to a galvanometer at the exchange.

A modern telephone instrument equipped with dial for automatic operation.

These early exchanges, and others installed in various provincial cities, placed subscribers in touch with one another, but the method by which this was done entailed much manipulating by the operator and consequent delay to the caller.

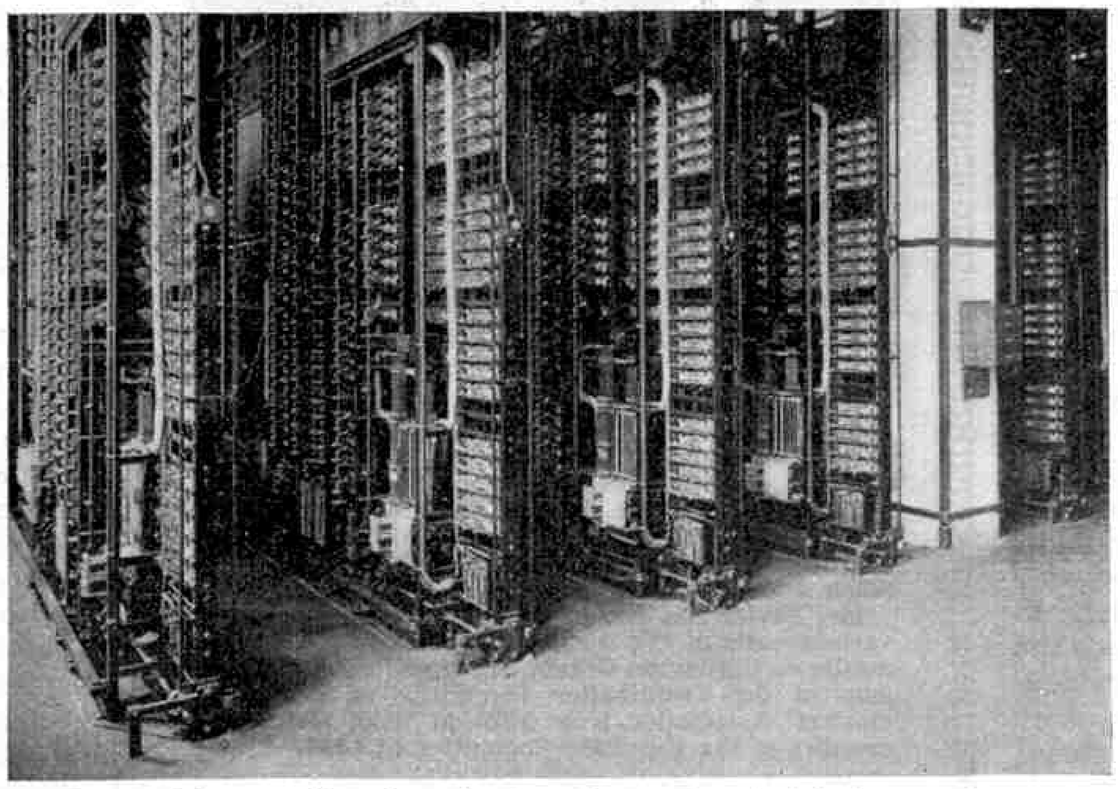
For many years telephone users called up the operator at an exchange by turning a handle situated at the side of their instrument. The handle worked a small dynamo and the current produced caused the door of the drop on the exchange switchboard to fall open, revealing the caller's telephone number. Immediately the operator switched on her telephone to the caller this door automatically resumed its closed position. The operator then ascertained the telephone number required and called up the subscriber concerned. Some of these handle-operated telephones are still in use, but they are being replaced gradually by instruments that do not entail the turning of a handle or the opening and closing of drops at the exchange.

The user of the improved telephone needs only to lift the receiver from its rest and immediately a small electric bulb near his indicator and jack on the exchange switchboard lights up.

At the exchange numerous flexible cords terminating in plugs, and grouped and electrically connected in pairs, rest on a long shelf in front of the operator. The cords pass through the shelf and hang below it, being kept taut by lead weights on pulleys. When a plug is lifted the cord comes up through the shelf, and when the operator later releases it from the switchboard it is drawn back into its hole by the weight on the cord. A small lamp is fixed close to each cord, and as mentioned earlier each jack also has a lamp of its own. Normally the two lamps near each pair of cords are lighted, but when a subscriber lifts his receiver to call the exchange, the lamp associated with the first cord goes out, and the lamp near his jack immediately glows. This lamp goes out when the operator inserts one plug of a pair into the jack indicated by the light. She switches on her telephone to the caller and says "Number, please," and on receiving this information she inserts the other plug of the pair into the jack associated with the required number. This causes the lamp of the second cord to glow. The operator then presses a button that causes the bell of the wanted subscriber's telephone to ring. Immediately that subscriber lifts his receiver to answer the summons the lamp of the second cord goes out, thus silently informing the operator that he has responded and that the two subscribers are in communication with each other. At the close of their conversation the speakers replace their instruments and immediately the two lamps concerned at the exchange light up, and the operator knows that she can disconnect the plugs.

Interior of a large manual operated telephone exchange, showing the extensive switchboard.

As the telephone became more and more popular and the number of subscribers increased, additional switchboards had to be installed in all important exchanges. Each switchboard was in charge of one operator and the telephone numbers ran consecutively, the first switchboard dealing perhaps with 200 lines, numbered 1 to 199; the second switchboard with lines numbered 200 to 399, and so on. By this means a very large number of subscribers could be dealt with by a single exchange, but a serious defect of the system was that a subscriber belonging to the first section could not easily be connected to a subscriber in the other sections owing to the distance the first operator had to stretch across to the other operators. It was of the utmost importance that each operator should be able to quickly connect any one of her subscribers to any other subscriber in the exchange, and the problem of accomplishing this was solved by the adoption of the "multiple" switchboard.



Some of the complicated mechanism at an automatic telephone exchange.

The first switchboard of this kind was fitted in the Central Trunk Exchange in Oxford Court, Cannon Street, London, in 1883, and since that time thousands of multiple switchboards have been installed in exchanges throughout this country and abroad.

A modern multiple switchboard is divided into sections each provided with as many jacks as there are lines in the exchange. Suppose the exchange has 1,800 lines, and that these are divided into groups of 200 lines. Above the 200 indicators in front of each operator there are 600 jacks which, together with 600 on her left and 600 on her right, cover the whole of the lines of the exchange, so that each operator can reach any number unassisted. It will be seen that all the sections are multiples of each other, and the duplicate jacks are known as "multiple jacks." These jacks are connected in parallel with one another. The lamps are not multiplied, for only one operator is required to answer any particular line at once, although all must be able to call it.

The multiple system made necessary a further addition to the switchboard circuit, for if a certain subscriber is engaging in a conversation put through by the operator covering his number, he must not be interrupted by being called by another operator further down the switchboard who cannot see that he is engaged by the operator of his section. In order to enable operators to ascertain quickly whether the line is free or not, an electrical test is incorporated in the system. When two lines are connected, all the multiple jacks belonging to each line become charged with electricity, and any operator who touches one of these jacks with the tip of a plug hears a clicking sound in her receiver, by which she knows that the line is engaged elsewhere.

It is essential that the operator should have both her hands free to manipulate the plugs, and for this reason her telephone receiver is fixed over one ear by means of a clamp over her head, and a peculiarly shaped transmitter is suspended from her shoulder so that it is always close to her mouth.

Trunk calls, when a subscriber from one exchange wishes to speak to a subscriber belonging to another, are put through in different ways at different exchanges, according to the method of working. The common system is for each operator to have before her a number of jacks that are connected to the neighbouring exchanges in the same way as the other jacks on her switchboard are connected to subscribers. The called exchange answers and is informed of the number required, and the call is put through in the usual way.

The manual system just described is employed at the present time in thousands of exchanges throughout the world. Although it entails the employment of a fairly large staff of operators, it represents an enormous advance on the system used in the early days of telephony, particularly in the employment of various automatic devices to assist and speed up the service.

Rapidly as the telephone system advanced, telephone engineers were not satisfied, for they had visions of automatic systems in which the exchanges would require no operators, subscribers making their own connections by means of simple switching arrangements in their own homes.

Three American inventors patented an automatic switching device as long ago as 1879, and instruments incorporating their invention were shown at the Paris Exhibition held two years later. The defects of the system were so numerous, however, that it did not come into general use. In 1883 a British engineer named Sinclair took out a patent for a semi-automatic switching device for use at branch telephone exchanges. This instrument incorporated a system of remote control by which telephone calls were controlled from the distant control exchange, where operators were in attendance, thus dispensing with the need of an operator at the branch exchange. An instrument of this kind was installed at Coatbridge, near Glasgow, in 1886, six years before automatic exchanges came into use in America.

Sinclair's line selector, as the invention was known, was far from perfect, but a more efficient system was not invented until 1889. In that year A. B. Strowger, a Kansas (*Continued on page 150*)

XXVIII.—A TEACHER

IN spite of the prominence now given to educational affairs in this country, it may be said that the teaching profession is as yet in its infancy. The principles of teaching have been very thoroughly and carefully studied for a considerable time, but it is only since 1870, when the provision of free elementary education was made compulsory, that any real effort has been made to put these principles into practice on a large scale. To-day it is being recognised more and more that a nation can only retain a leading place in the civilised world if its citizens are alert, thoughtful and well-informed. Ability in commercial and professional affairs, and even skill in industrial operations, depend very largely upon mental capacity, and this can only be developed by means of a carefully designed system of education. As previous articles in this series have shown, this fact is recognised by the bodies that control the affairs of the important professions. These emphasize the need for a high standard of education among candidates for membership, and from time to time they revise their regulations in the endeavour to improve the qualifications of their recruits. The growth of technical education points in the same direction.

As the result of successive Acts of Parliament passed since 1870, the administration of publicly-controlled education is the work of municipal and county authorities. General regulations are laid down by the Board of Education, an important government department that gives large grants from national funds to supplement local rates. These regulations deal with the training of teachers and the conditions under which they are employed, and one important result of the work of the Board of Education has been the establishment of national salary scales. This desirable state of affairs was only reached in 1920, when what are known as the Burnham scales came into operation. Prior to that time the pay of teachers had been chiefly a matter for local consideration.

The Burnham scales derive their name from the fact that Lord Burnham was chairman of the committee responsible for them. In 1925 they were made compulsory throughout the kingdom, but in the interests of national economy cuts have been made from time to time, including one of 10 per cent. last year. The position to-day is far better than it was 20 years ago, however, and there is no doubt that on the whole the status of the teaching profession is improving.

At present a fully trained and certificated teacher commences his career at the minimum age of 20 with a definite salary, which increases at the rate of £12 per annum up to a reasonable maximum, provided, of course, that satisfactory work is being carried out. In addition, there is always the prospect of promotion to better paid posts, and a proportion of members of the profession may ultimately hope to become headmasters, whose greater responsibilities are recognised by higher salaries.

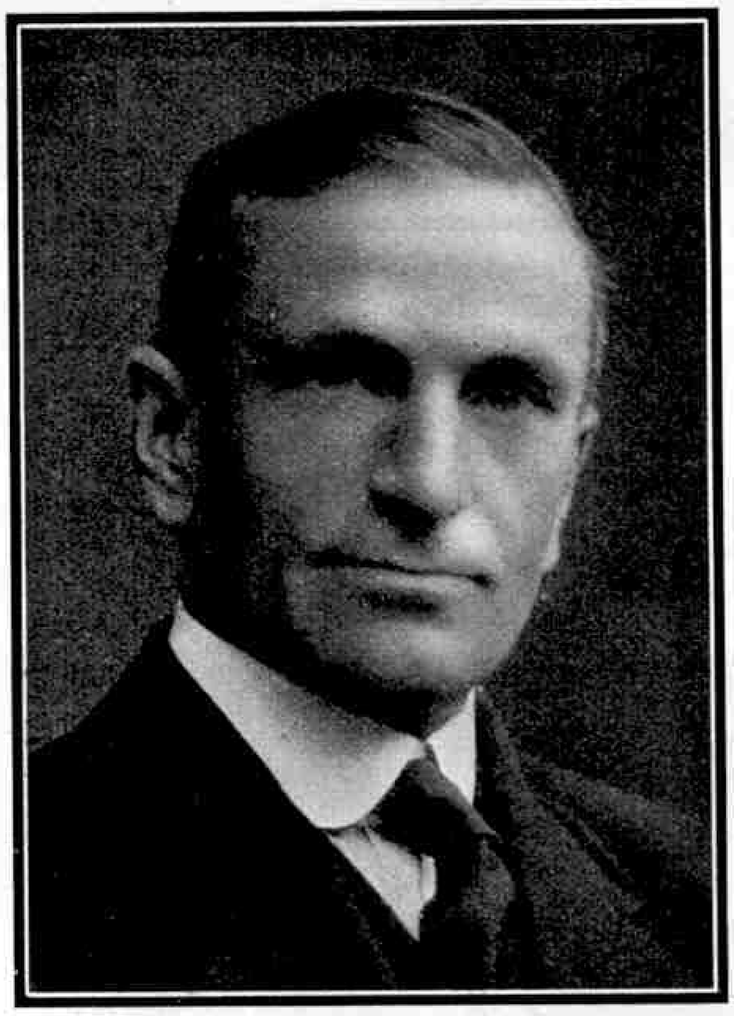
At the moment the teaching profession appears to a certain extent unattractive, the recent 10 per cent. cut in salaries being a serious reduction of the earnings of those engaged in it. It can scarcely be said that the prospects are bright, therefore, but the check that the progress of the profession has received is probably temporary, and there can be little doubt that the return to normal conditions will bring with it an increased appreciation of the value of the work of teachers and of the need for extending the scope of the educational facilities of this country. The profession is one that in the long run will rise to greater heights, in spite of recent disappointments.

The life of a teacher has many good features, for although the strain of daily class life is very great, the hours are not too long and generous holidays are allowed. A member of the profession has a secure position, and is able to count upon receiving a salary that is increased regularly every year, while on reaching the retiring age he becomes entitled to an adequate pension, towards which he has himself contributed under the superannuation schemes now in operation.

Schools may conveniently be divided into those of the elementary type on the one hand, and those usually referred to as secondary or public schools on the other; while in addition there are many specialist institutions. The demands made on teachers in schools of different kinds vary considerably. The standard of work in an elementary school is much lower than in a secondary school, and as a rule teachers deal with classes rather than with subjects. More specialisation is customary in secondary schools, the teachers having special qualifications in certain subjects and taking various classes in them. An important result of these differences is that the kind of training required varies in the two cases. The secondary school teacher almost necessarily must be a University graduate, and usually is one who has special qualifications in particular subjects; while the elementary school teacher receives his training at special colleges instituted for the purpose, in which work of an all-round character associated with the profession is carried on.

Whatever the branch of education an intending teacher wishes to enter, it is absolutely necessary that he should begin with a sound education of the secondary school type. The minimum qualification for admission to training colleges is the possession of a satisfactory School Certificate, but preference is given to

An Eminent Teacher



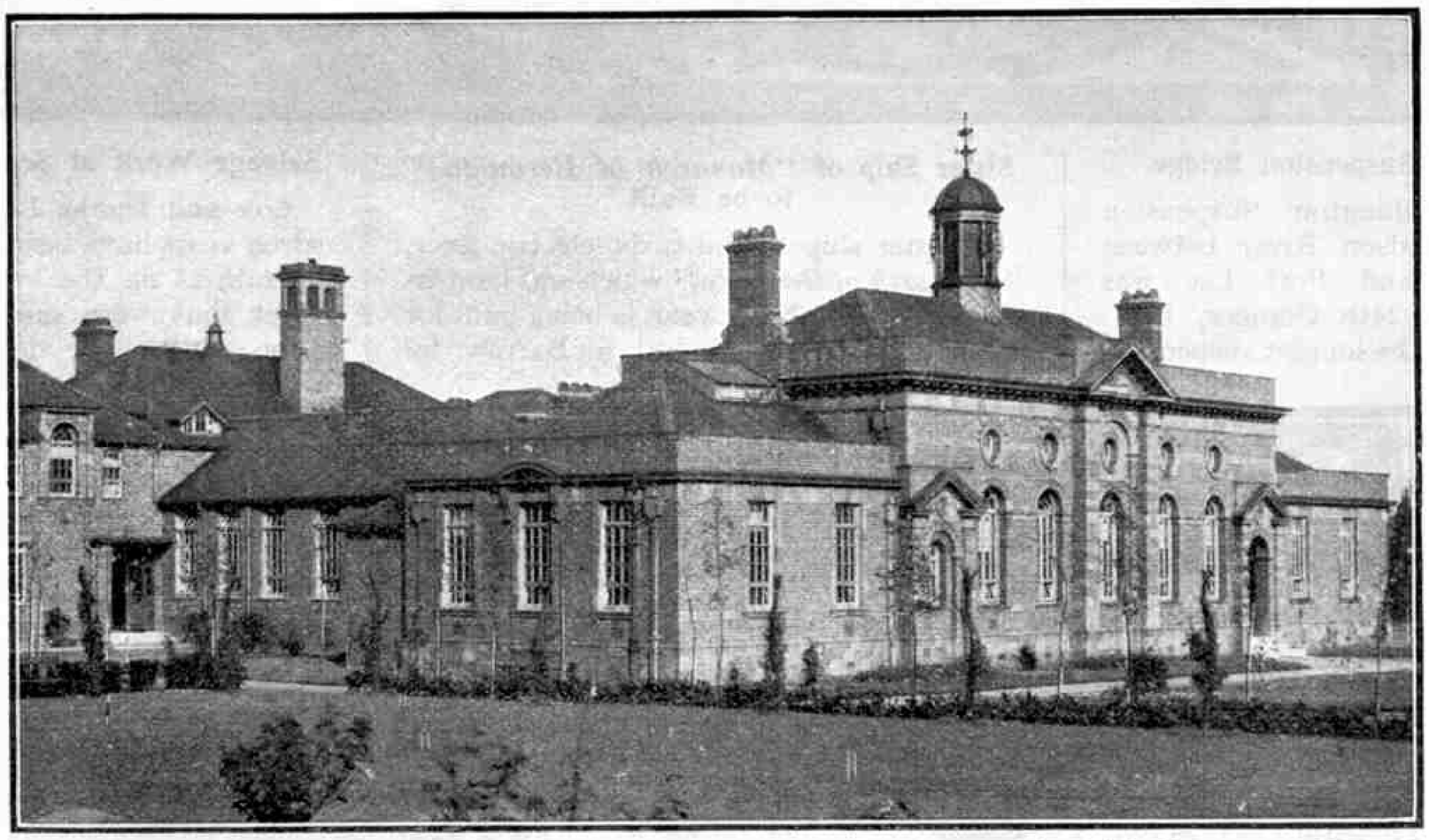
Mr. C. W. Taylor, M.A., is President of the Incorporated Association of Headmasters. He was educated at Warwick and at New College, Oxford, securing the B.A. in 1901 with Second Class Honours in Modern History. He became an M.A. in 1904. At both school and college Mr. Taylor was a good sportsman and a keen Rugby and Association footballer and Cricket player.

Mr. Taylor has taught at a number of schools in various parts of the country, and is at present headmaster of Darlington Grammar School. He was Chairman of the Examination Committee of the Headmasters' Association from 1924 to 1930, and was a member of the Burnham Committee in 1928.

candidates who have passed the matriculation examination. It is advisable to carry secondary school education up to the Higher Certificate standard before actually making application, and as the minimum age for entry into a training college is 18, there should be sufficient opportunity before leaving school to take this examination.

When the necessary conditions are satisfied, it is usual to make application for admission to several colleges. The maximum number to which approach may be made is five, and on every application form the names of the colleges chosen must be given in the candidate's order of preference. Application must be made as soon as possible after 1st October in each year, and decisions in regard to admission are announced in the following February, the intervening time having been devoted to review of candidates' qualifications, a process in which interviews with the heads of the colleges plays a great part.

The training colleges are maintained chiefly by education authorities in various parts of the country, for these are concerned with the provision of teachers for staffing the schools in their care. This concern is shared by the Ministry of Education, and Government grants are allotted in order to encourage the establishment of colleges run on sound and adequate lines. These circumstances have an important bearing on fees, for if no grants were available the cost to intending teachers would be considerably higher than it is at present. In view of the assistance thus rendered indirectly by the Board of Education, every candidate admitted to a training college is required to sign a declaration that he intends to complete the course of training and afterwards to follow the profession of teacher in an approved school.



Some of the buildings of the Cheshire County Training College at Crewe. This photograph is published by courtesy of F. H. C. Brock, Esq., M.A., Principal of the College.

The normal course of a training college extends over two years. The fees payable vary from £25 a year upward, but the average is about £40 a year, which includes the cost of board and residence during term time, in addition to the fees for tuition. Necessary incidental expenses include the purchase of text books, and subscriptions for sport clubs and bodies organised in connection with the social life of the college. The most important of the courses of study arranged deal with the theory and practice of teaching, but every subject of importance in connection with elementary education also is studied to a fairly high standard. Special attention is paid to music, physical training and similar subjects that to-day play such an important part in all-round school work. Modern ideas of what is meant by education are more liberal than those held 25 years ago, and facilities for giving expression to them are constantly undergoing extension. This aspect of the teaching profession is not overlooked in training colleges, on the staff of which rests the responsibility of directing the first efforts of the teachers of the future.

At the end of their second year of training, candidates for entry into the profession sit for a final examination, which must be passed in order to secure recognition by the Board of Education as certificated teachers. The possession of this distinction qualifies them for posts in elementary schools under local education authorities, and gives them a recognised professional standing. They are distinct from uncertificated teachers, a class that is disappearing because of the importance now attached to a higher standard of professional knowledge on the part of teachers. Certificated teachers naturally have higher salaries and better established positions, and no candidate for the teaching profession should dream of adopting any other course than securing the recognised qualification.

The course to be followed by those who wish to teach in secondary and public schools differs considerably from that adopted by elementary school teachers. The divergence takes place at the end of the period spent in a secondary school, for instead of proceeding to a training college the future teacher enters a university. There he completes the recognised course for a degree in the subjects in which he is specially interested, for, as already pointed out, specialisation is one of the distinguishing features of the work of the secondary school teacher. This is not carried out to excess, of course, many secondary school teachers dealing with one or two subjects in addition to the one with which they are chiefly concerned. No degree, whether in arts or science, can be obtained by the study of one subject alone.

The possession of a degree enables a teacher to obtain a good post in a school of the type chosen, but it is advisable to study the theory and practice of education before actually taking up work. There are various means of doing this. Departments of education have been organised in most universities, many of which grant special degrees or diplomas in this subject and provide the necessary facilities for theoretical instruction and also for the actual practice in teaching that forms an essential part of educational training. An alternative method is to take a special course at one of the training colleges to which reference has already been made, for practically all of these provide one-year courses specially intended for graduates of universities and teachers already possessing a certificate who wish to take up advanced work.

In certain respects posts in public schools are on a different footing from those in secondary schools. The requirements are not quite the same, for in many cases traditions have been established in the institutions classed as public schools, and it is regarded as important that these traditions should be carried on. The possession of a good degree is essential to those who wish to take up masterships of this kind, and there is no doubt that the standing of the great Universities of Oxford and Cambridge gives their graduates an important advantage, particularly if attendance at one of these institutions has been preceded by a public school education. A point of importance is that sports and games are regarded highly in most schools of this type. All masters are not called upon to take part in this side of school life, of course, but athletic skill, and ability to make use of it, count heavily in making work in such a school effective.

It may be pointed out that private schools also offer opportunities, both for graduates and non-graduates. A degree is not absolutely essential and social and athletic qualifications are extremely useful, although they cannot be regarded as substitutes for a sound education and an ability to control and teach pupils.

Another branch of education that offers good openings, particularly for teachers qualified in science, engineering and commercial subjects, is that provided in modern technical schools. These are chiefly devoted to the training of students engaged during the day in ordinary occupations, but in many instances day classes are also arranged. The work is largely specialist in character, and those who intend to take it up should be thoroughly acquainted with the industrial or commercial applications of their subjects.

We have already pointed out that one of the advantages of the teaching profession is the existence of a definite scale of salaries, with fixed annual increments. Educational areas of the country are divided into four grades, and salaries for all classes of teachers in elementary, secondary and technical schools in each of these areas have been definitely laid down. There are slight differences between the various grades, higher salaries being paid in London and other important centres than in rural areas. Teachers may move from one district to another, and on securing a post under an educational authority of higher grade they are entitled to a special promotion increment that brings them under the scale applying in their new district. It is impossible (*Continued on page 150*)

World's Longest Suspension Bridge

The George Washington Suspension Bridge over the Hudson River between Upper Manhattan and Fort Lee was formally opened on 24th October, 1931. This bridge is by far the longest suspension bridge in the world, for its main span has a length of 3,500 ft., while that of the Ambassador Bridge, Detroit, its nearest rival, is only 1,850 ft. in length.

The supporting towers of the new Hudson River Bridge are 635 ft. in height, and about 40,000 tons of steel were used in their construction. The four main suspension cables are 36 in. in diameter and each is made up of 26,474 parallel steel wires. There are over 28,370 tons of cable wire in the bridge. The roadway of the bridge is 250 ft. above the level of the river and is sufficiently high to allow the largest ocean-going vessels to pass beneath. When completed the bridge will have two decks. At present only the upper one is in service, and this has a capacity of 30,000,000 vehicles per year.

The bridge so far has cost £12,000,000, and it is estimated that the addition of the lower floor will cost another £3,000,000. Its construction has been a task of great engineering interest, and we hope to give an account of the work in an early issue.

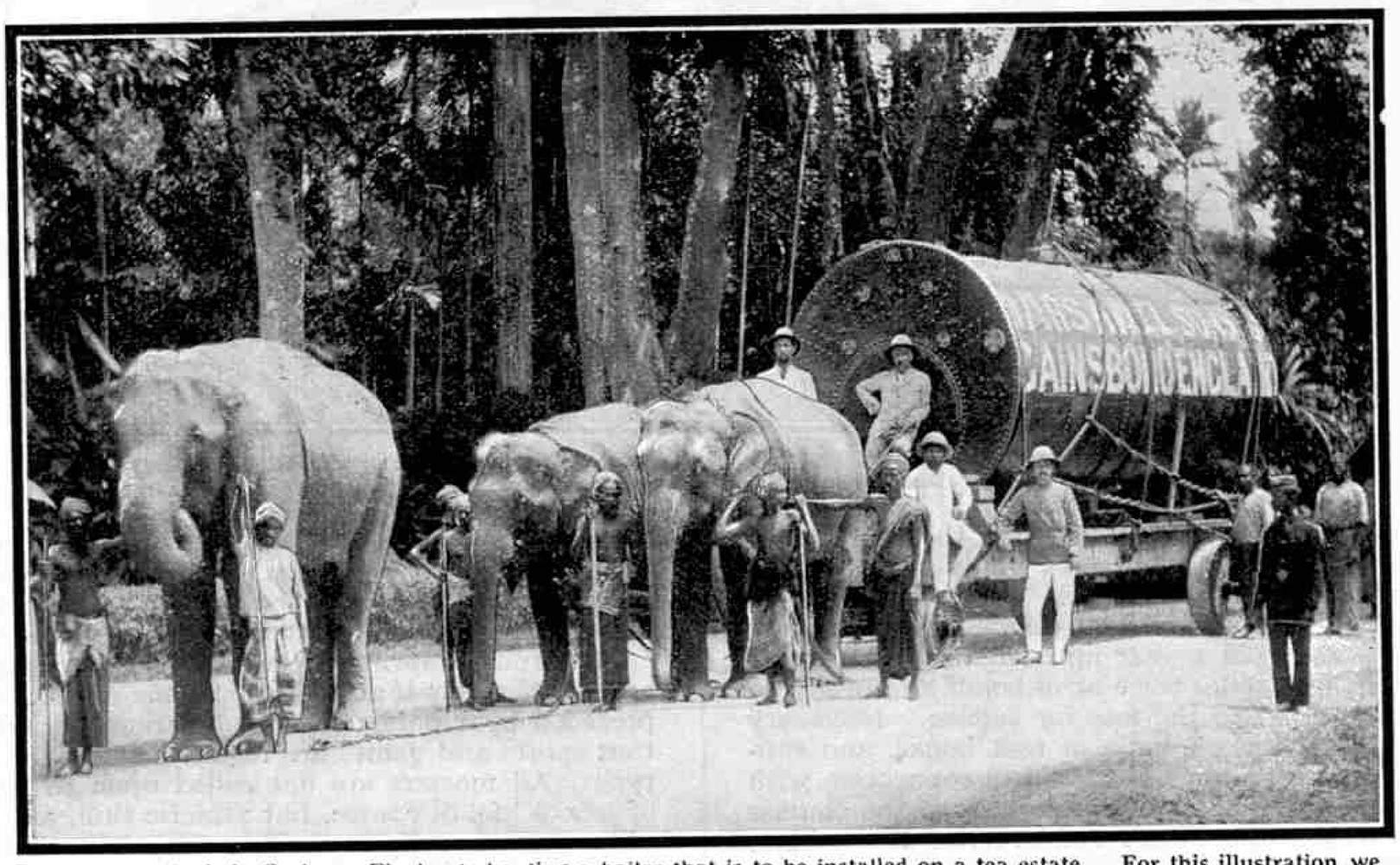
Reconstruction of Famous Bridge in Paris

The reconstruction of the Pont de la Concorde, Paris, has been completed after nearly three years work. The old bridge was built towards the close of the 18th century, and as it was less than 40 ft. in width it was unsuitable for modern conditions. The new structure has a width of 114 ft., the roadway itself being 74 ft. in width. The total cost of rebuilding has been about £150,000.

Sister Ship of "*Monarch of Bermuda*" to be Built

A sister ship to the turbo-electric liner, "*Monarch of Bermuda*," which was launched on 17th March last year, is being built for Furness, Withy & Co. Ltd. at Barrow, by Vickers-Armstrongs Ltd. This company also built the "*Monarch of Bermuda*," but that vessel was constructed at their yards on the Tyne. She is 576 ft. in length, and has a gross tonnage of 20,500. On her trials she attained a speed of 20 knots. She has accommodation for 830 first-class passengers and 30 second-class passengers, and was designed chiefly for the service between New York and Bermuda. The vessel is fitted with four electric motors. Each of these is rated at 4,650 h.p. and they drive their respective propeller shafts at 150 r.p.m.

The construction of the new vessel will provide employment at Barrow for about 2,000 men for 15 months, and as the drawings and patterns of the "*Monarch of Bermuda*" were available when the order was received, it was possible to make an immediate start with the work. The main propelling machinery for the vessel is to be constructed at Witton by the General Electric Company.



Transport methods in Ceylon. Elephants hauling a boiler that is to be installed on a tea estate. For this illustration we are indebted to Marshall, Sons & Company Ltd., Gainsborough.

Salvage Work at Scapa Flow Abandoned

Cox and Danks Ltd., who for the last seven years have been carrying out salvage operations on the vessels of the German Fleet that were sunk at Scapa Flow in June, 1919, have decided to discontinue the work, as it is now unprofitable. Only the heavier vessels remain submerged, and as they lie in 20 fathoms of water, the cost of salvaging them would be greater than their cost as scrap metal.

The last vessel to be raised was the battleship "*Prinz Regent Luitpold*," which was preceded by the 20,000-ton battle cruiser "*Von der Tann*." The salvage of the battle cruiser "*Hindenburg*" was the most difficult feat carried out during the operations, in spite of the fact that this 28,000-ton vessel was resting upright on the bottom with her masts and funnels showing above water. About 800 patches were put on her side before she was brought to the surface, and it was then necessary to sink her again as she immediately threatened to capsize. This happened several times, and when eventually she was refloated in July, 1930, it was found that the work had been carried out at a loss of about £30,000.

When they commenced work on the scuttled German ships at Scapa Flow, Cox and Danks Ltd. had no previous experience of salvage operations to guide them. They have raised 32 vessels, however, six of which were of more than 20,000 tons displacement, and their average weekly wage bill has been £500.

* * * *

A bridge recently constructed over the Danube at Belgrade is 1,379 yds. in length and is the longest in the Balkans. It contains 20,000 tons of steel and there are 100,000 c.m. of concrete in the pylons.

Motor Omnibus with Front Wheel Drive

The first motor omnibus with a front wheel drive has been built by the Gilford Motor Co. Ltd., London. It is called the "Wycombe" omnibus, and has two decks. An omnibus with a single deck employing the same type of drive also has been designed and constructed by this firm.

The use of a front wheel drive for heavy motor vehicles has the advantage that a body with a very low platform and a practically unobstructed floor may be constructed. The centre of gravity of such a vehicle also is low, giving great stability, and the compactness of the mechanism is a factor in keeping down maintenance costs.

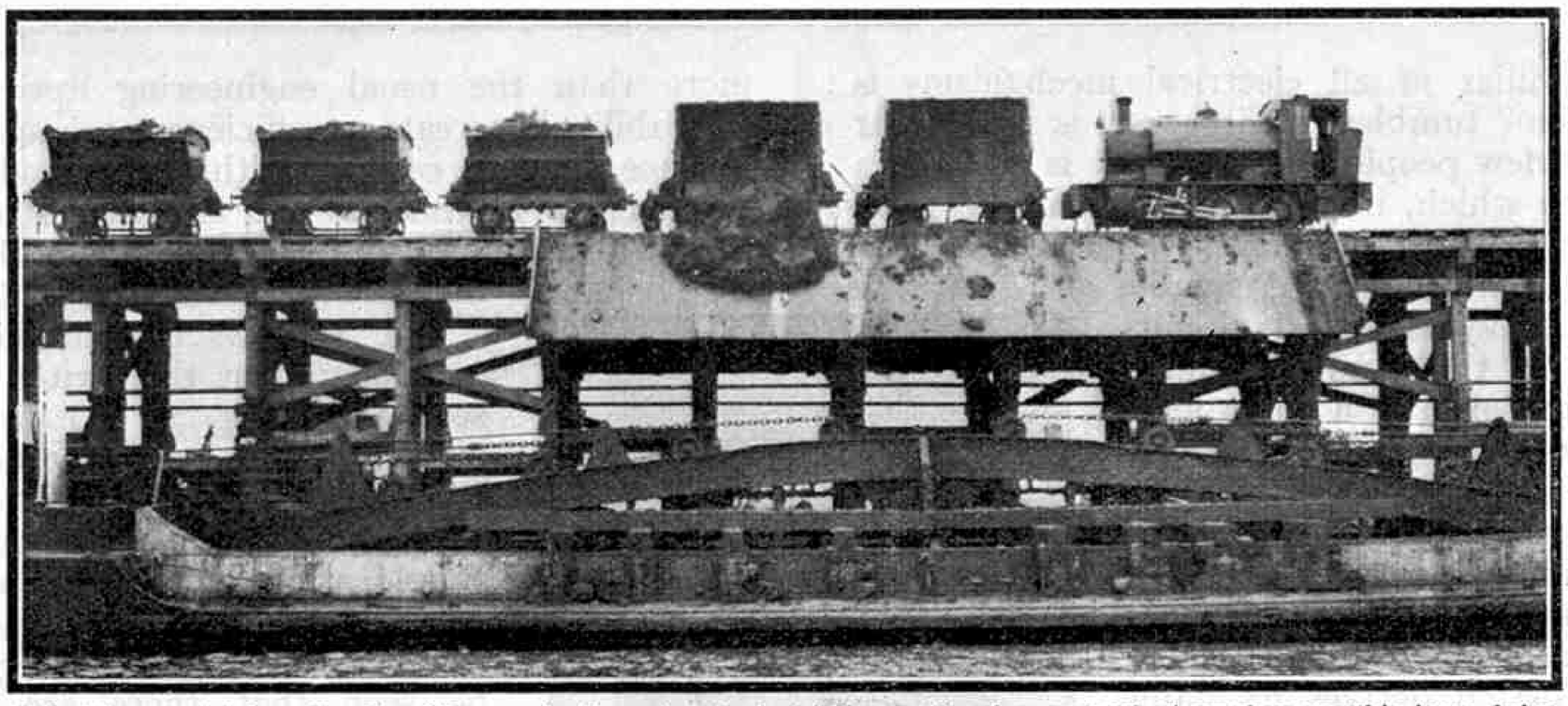
The most unusual feature of the "Wycombe" omnibus is the absence of a chassis of the normal type. The power unit of the vehicle and its accessories are carried in a braced steel structure that forms the front wheel arches and the body bulkhead, and behind this is a box girder, built up of light but rigid steel members, on which the coachwork fittings are carried.

A Junkers two-stroke Diesel oil engine of the type described on page 461 of our issue for June, 1931, is fitted to the omnibus. This engine develops 120 b.h.p. at 2,000 r.p.m., and the drive is taken through a four-speed gear box of the constant mesh type. Each wheel is independently sprung and steering is effected by the cam and roller method. It is interesting to know that the use of a front wheel drive in the "Wycombe" omnibus involves only a slight increase in weight in comparison with vehicles of the ordinary type.

Floating Dock Towed 13,500 Miles

The floating dock built on Tyneside by Swan, Hunter & Wigham Richardson Ltd. for use at Wellington, New Zealand, has now reached its destination after being towed by two steam tugs over a distance of about 13,500 miles. The average rate of progress maintained throughout the voyage was nearly 100 nautical miles per day, and the arrival of the dock in New Zealand waters brings to an end the longest tow of this description ever made. The insurance premium for the journey was £30,000.

The dock, which was described on page 617 of our issue for August, 1931, has a lifting power of 17,000 tons. Its overall length is 584 ft. and it has a total lift of 117 ft. 6 in. The draught of water over the keel blocks is 26 ft. and the dock requires a depth of at least 46 ft. for its operation. It was built at a cost of £196,125.

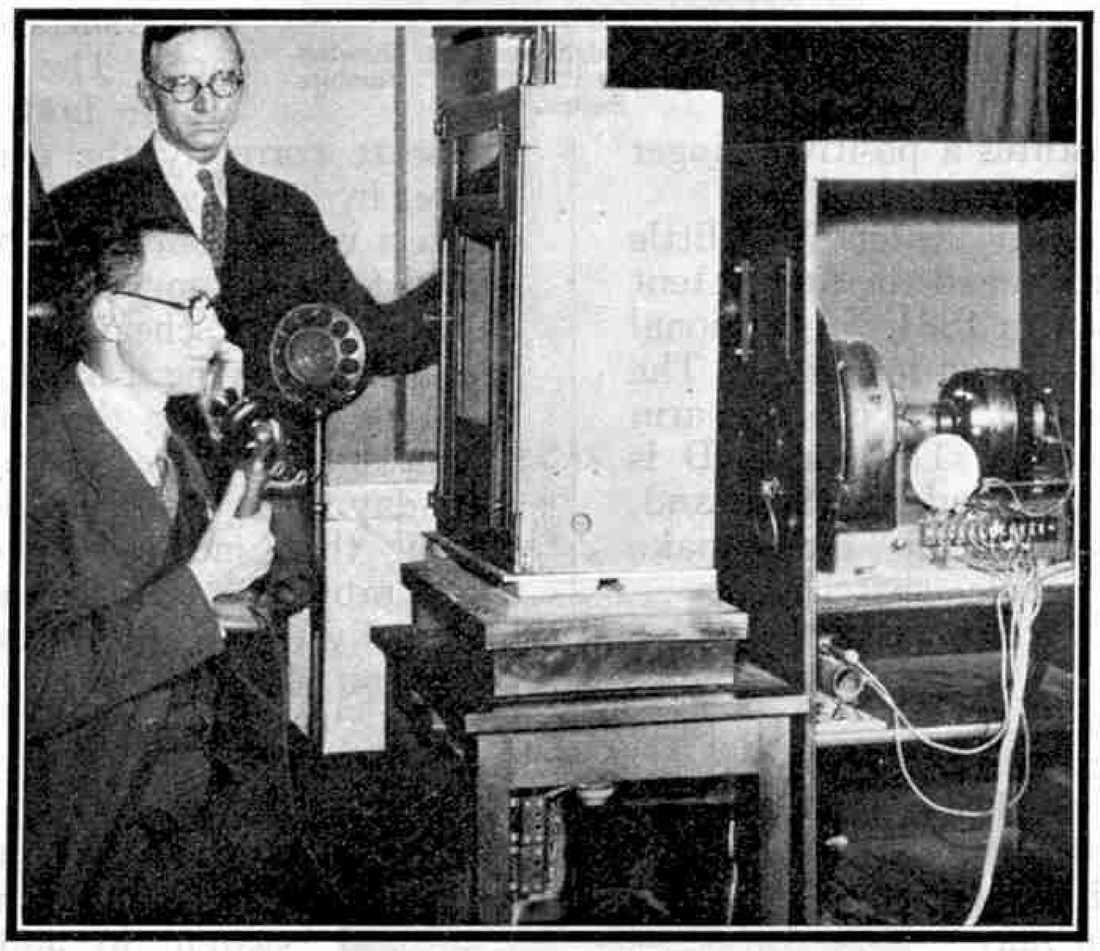


Material excavated from the site of the new Southampton graving dock, mentioned on page 15 of our last month's issue, being deposited into a hopper barge. Our photograph is reproduced by courtesy of the Southern Railway Magazine.

"Baby" Motor Car does 114.77 m.p.h.

Four new "Baby" motor car records have been set up in an M.G. Midget on the Montlhery track, near Paris, by Mr. G. E. T. Eyston, the well-known British racing motorist. These are over distances of five kilometres, 10 kilometres, and five and seven miles respectively, the speeds ranging from 114.46 m.p.h. for the seven miles record to 114.77 m.p.h., reached in making the record over a distance of five kilometres. Mr. Eyston's speeds over the remaining distances of 10 kilometres and five miles were 114.72 m.p.h. and 114.74 m.p.h. respectively.

Mr. Eyston was the first man in the world to drive a "Baby" car at a speed of 100 m.p.h. He created a world's record by driving an M.G. Midget at a speed of 103.13 m.p.h. in February of last year and later made a gallant attempt to capture the records he has now gained. This effort ended disastrously, for his machine caught fire and his leg was broken when he jumped from it while travelling at high speed. In the accident he sustained severe burns. The car was repaired and the new records were actually set up in the same machine.



A television demonstration in 1927 in the studio of the American Telephone and Telegraph Company, New York. The photograph shows the transmitting end of the apparatus, with the motor-driven scanning disc in front of the speaker.

Concrete Granary to be Built in Leith

A large concrete granary is to be constructed at the Imperial Docks, Leith, to replace a grain warehouse that was burned down in January, 1930. It will cost about £40,000 and will have a capacity of about 25,000 tons of grain.

The building will be fitted with two intake bulk conveyors, each of which will be capable of dealing with 300 tons of grain an hour. Five elevators inside the building itself will carry the grain to the top floor, where it will be automatically weighed before delivery to other conveyors leading to storage bins or to railway wagons waiting to be loaded. Five discharge conveyors, each having a capacity of 150 tons per hour, will be fitted below each storage bin, and portable automatic weighing machines will be provided to enable grain in sacks to be weighed before leaving either by railway or road.

The machinery of the granary will be electrically operated. Special precautions are being taken against fire, and automatic apparatus is being installed to give a record of the temperature of the grain at various depths in each storage bin.

New P. & O. Liner's Maiden Voyage

The new Peninsular & Oriental liner "*Carthage*," which carried out official trials at the end of last year, is now on her maiden voyage between this country and Japan. The vessel has a gross tonnage of 14,500, and is of the twin-screw type. She has been specially designed for the eastern service of the Company, in which the "*Corfu*," her sister ship, also is employed; and she has accommodation for 380 first and second class passengers, in addition to facilities for the transport of mail and cargo.

The propelling machinery of the new liner consists of single-reduction geared turbines of the latest Parsons type, which operate at a stop-valve pressure of 375 lb. per sq. in., and these are supplied with steam by four Yarrow water tube boilers. The boilers work on the forced draught system and are oil-fired. The vessel is designed to have a speed of 19½ knots, but this was exceeded during her trials.

* * * *

Only two of the wooden railway viaducts constructed on the line of the G.W.R. by I. K. Brunel, the famous engineer, now remain. These are at College Wood and Ringwell, on the Falmouth branch. They are to be replaced this year.

The Making of a Tumbler Switch

An Achievement in British Mass Production

THE most familiar of all electrical mechanisms is probably the "tumbler" switch. It is so familiar indeed that few people realise that it is actually a machine, and one which, in spite of its small size, has many interesting features. Actually the vital mechanism of a modern tumbler switch, capable of interrupting heavy electrical circuits many hundreds of thousands of times, occupies only one-eighth of a cubic inch. A further remarkable point is that, unlike the majority of mechanisms with which we are familiar, the tumbler switch has to operate unfailingly for years without cleaning, without oiling, and in fact without attention of any kind.

The tumbler switch derives its name from its "tumbling handle" or "dolly." Its original was a purely British characteristic, for Continental engineers used the turn-handle switch, and American engineers the turn or push-button switch. Since the Great War, however, the whole world has copied British designs in electric switches and changed over to the British tumbler type. The difference between the British-made and the foreign switch is essentially one of quality. The foreign-made product is built for use on voltages of half the pressures usual in this country, and for this reason its use on the higher British domestic pressures constitutes a positive danger to the user.

Fig. 1. Part of a high-speed film showing the quick action of a "Crabtree" Tumbler Switch.

The early history of the tumbler switch is a little obscure, but so far as can be ascertained the first patent was taken out by Mr. H. Faraday in 1884. A sectional drawing of the Faraday switch is shown in Fig. 4. The tumbler handle A is pivoted at B, the contact arm engaging into spring contacts at C. The spring D is attached between the contact arm and the base and, working over a dead centre, gives a semi-"quick make and break" operation. The whole switch is contained in a rectangular wood box having a screw-down cover F.

This mechanism is believed to mark the beginning of tumbler switch history—a history which, covering nearly 50 years of gradual development, has given us the high-efficiency switch of to-day. The evolution in design may be appreciated by comparing Faraday's switch with the section of a "Crabtree" switch reproduced in Fig. 2. It will be seen that, while there is no relation in shape and size, there are definite points of likeness in both the handles or "dollies" and the cable terminals. Further, the movement of the contact arm in Faraday's switch may be said to contain the rudiments of the "underslung" movement in the modern "Crabtree" switch.

Fig. 2. Sectional view indicating how the switch arm swings backward and forward.

The design of a tumbler switch demands something more than the usual engineering aptitude of mind. The ability to create an efficient mechanism in so small a space must be coupled with a profound knowledge of the peculiar mechanical and electrical stresses to which the switch will be subjected in use, so that these may be correctly estimated and provided for.

Fig. 3 shows the number of separate components in the switch illustrated in section in Fig. 2. At first glance the number might appear to be unnecessary. It does not seem possible that all these items should be essential for so apparently simple a product as a one-way switch. Actually, however, every small part has its own specific purpose. It will be seen that there are tiny washers made with special indentions for the location and rigid fixing of the dolly hinge pin; small cams to regulate positively the motion of the switch arm; five components to achieve the insulation and fixing of the switch blade; and wax to seal up the back fixing nuts. In addition there are copper locking rings to ensure that the nut fixing the terminal holds tightly—without risk of fracturing the porcelain—the copper bedding down to the surface irregularities of the porcelain face. The two peculiar-shaped plates at the bottom of Fig. 3 are introduced to locate correctly the contacts upon the china base. These, by the way, are called "spider plates" by the workers who assemble the switch. It is quite true that some of these components could be dispensed with in the interests of cheapness, but the final result would be a switch having a much shorter life and less efficiency than one possessing these refinements of detail.

The manufacture of high-grade tumbler switches is to-day a highly specialised branch of industry. In visiting the Lincoln Works, Walsall, where thousands of "Crabtree" switches are produced daily, we see practically every known scientific aid enlisted to ensure perfection in each small part.

Some idea of the scientific research necessary to plan the production of a tumbler switch may be gathered from the fact that the 42 separate parts shown call for no less than 240 processes. Each switch, in addition, has to pass through eleven inspections during assembly. As the output of the various types of "Crabtree" switches is many thousands per week, the number of weekly operations involved runs into millions. It will be appreciated, therefore, that without scientific planning the task of rapidly producing and assembling the parts would be impossible. The problems arising out of this task are in fact very similar to those associated with the production of motor cars, and it is interesting to note that they are solved by similar expedients.

Lincoln Works is actually planned so that "single line" assembly methods can be practised to their fullest extent, all operations being so co-ordinated that the "single line" is practically unbroken.

Raw materials enter the Works on the west side where, after passing laboratory tests, they are stored in close proximity to the landing platforms. The second step in the "single line" is composed of the various shops in which the earliest processes take place and where the raw material is broken up into component parts. The shops therefore radiate from the raw material stores and, wherever possible, follow each other in the sequence of operations. Components as they are completed are sent to the parts stores, where they are checked, many millions of parts being counted every week by automatic machinery. Immediately following, and fed by the parts stores, are the assembly departments, from which the thousands of separate components emerge as finished switches, carefully examined and tested.

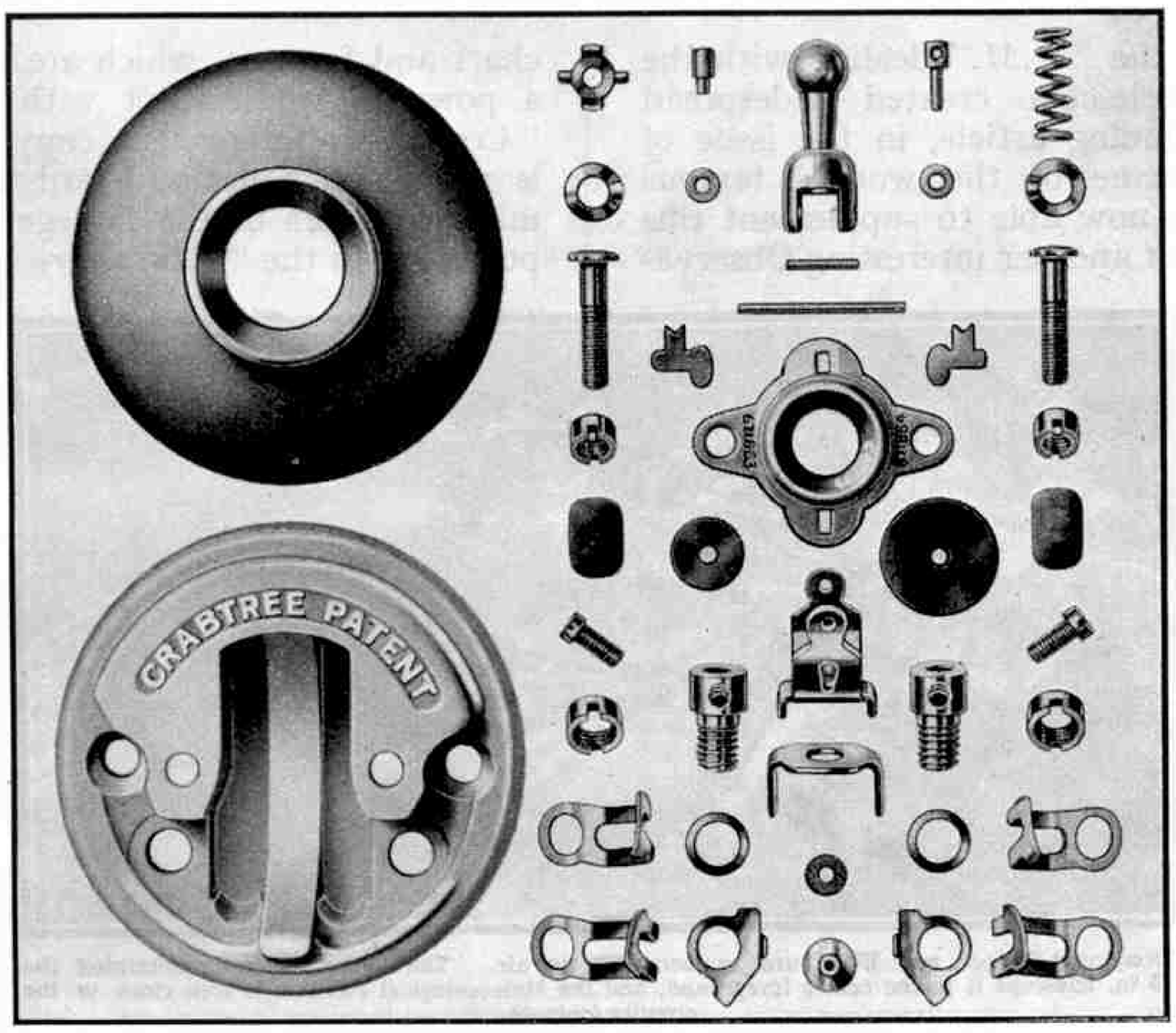


Fig. 3. The 42 components that make up a "Crabtree" one-way "Underslung" Switch.

By this time we have reached the wrapping department, where each switch is wrapped in its own little box and packed and transferred to the warehouse. Following on the usual sequence, the wrapping, warehouse and shipping departments are on the east side of the factory, and the finished switches travel from department to department by belt and roller conveyor in the order stated. One of these switches may be starting on its journey to finish on your own wall at home; or it may be commencing its journey to the African Veldt, to a station in the Himalayas, or to a ranch in distant New Zealand.

The modern tumbler switch requires the use of many different materials, each of which is selected by specification. It is then subjected to tests that will show on the one hand if it is suitable for the necessary works operation, and on the other hand, what will be the effect during service.

To the uninitiated it may seem a waste of time for "Crabtree" analysts to subject such a common material as brass to the most stringent tests, and to carry out research upon practically every component part made from this material. It should be remembered, however, that brass is liable to an "age weakness," or "season cracking" unless rigid precautions are taken in the specification of the original material. Brass, in fact, is liable to perish just as plants die and wood rots.

The metallurgical section of the "Crabtree" laboratories is equipped with much interesting apparatus for the micro-examination of metals. One instrument is provided with attachments that enable it to be used for examination under either reflected or transmitted light. Its range of magnification is from 18 to 3,750 diameters; which is equivalent to magnifying the size of a boy standing 5 ft. in height to six times the height of Snowdon!

"Ageing" experiments upon materials and finished switches are made day and night for periods of over six months under exaggerated conditions of temperature and humidity. The prevailing line of development in this direction appears to be the acceleration of adverse factors that are experienced during the normal life of a switch, and the basing of "pass" figures on the accelerated test. For example, the average number of operations of a "Crabtree" tumbler switch allows for a theoretical life of over 200 years! Quite as stringent as the chemical and physical tests are those imposed to ensure electrical efficiency. Exacting routine tests are carried out while the switch is in process of assembly. For some of the smaller switches one test is of five minutes' duration at 2,000 volts. These tests are inaugurated and developed under the supervision of the electrical laboratory which, in order to ensure that "Crabtree" standards are maintained, takes batches of switches from stock and tests them at many times their rated capacity.

Research work in the electrical laboratory demands an infinitude of care. The model of a new switch, for instance, may have taken months of patient work for its development. It will then be submitted to the laboratory, which will have to carry out exacting tests with the utmost care, supplying new data and yet not damaging the material in obtaining the necessary information. Anyone who has witnessed the destructive effects of electrical overloads will appreciate the trying nature of this work. It is work that must be carried out, however, for all "Crabtree" designs are based upon a knowledge of how they will react to conditions rightly, and often wrongly, imposed upon them. All tests are made as far as possible under actual service conditions.

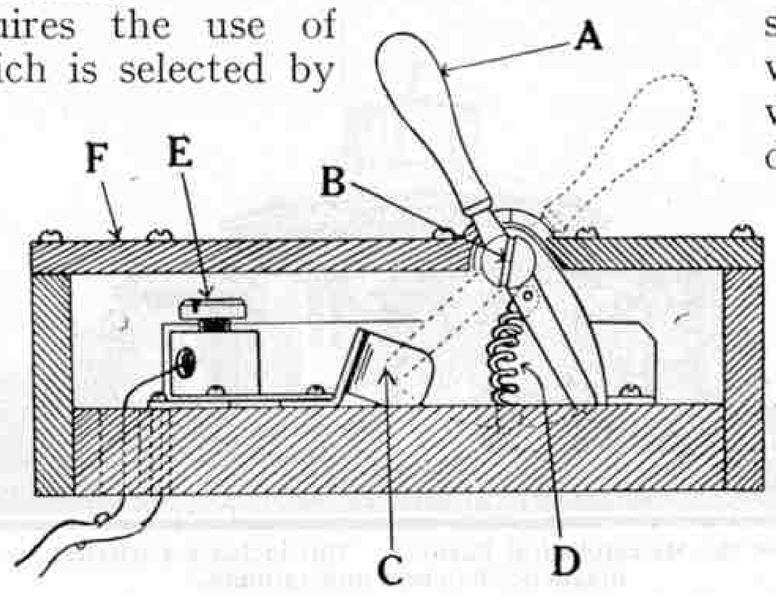


Fig. 4. Sectional drawing of the first tumbler switch, invented by Mr. H. Faraday in 1884.

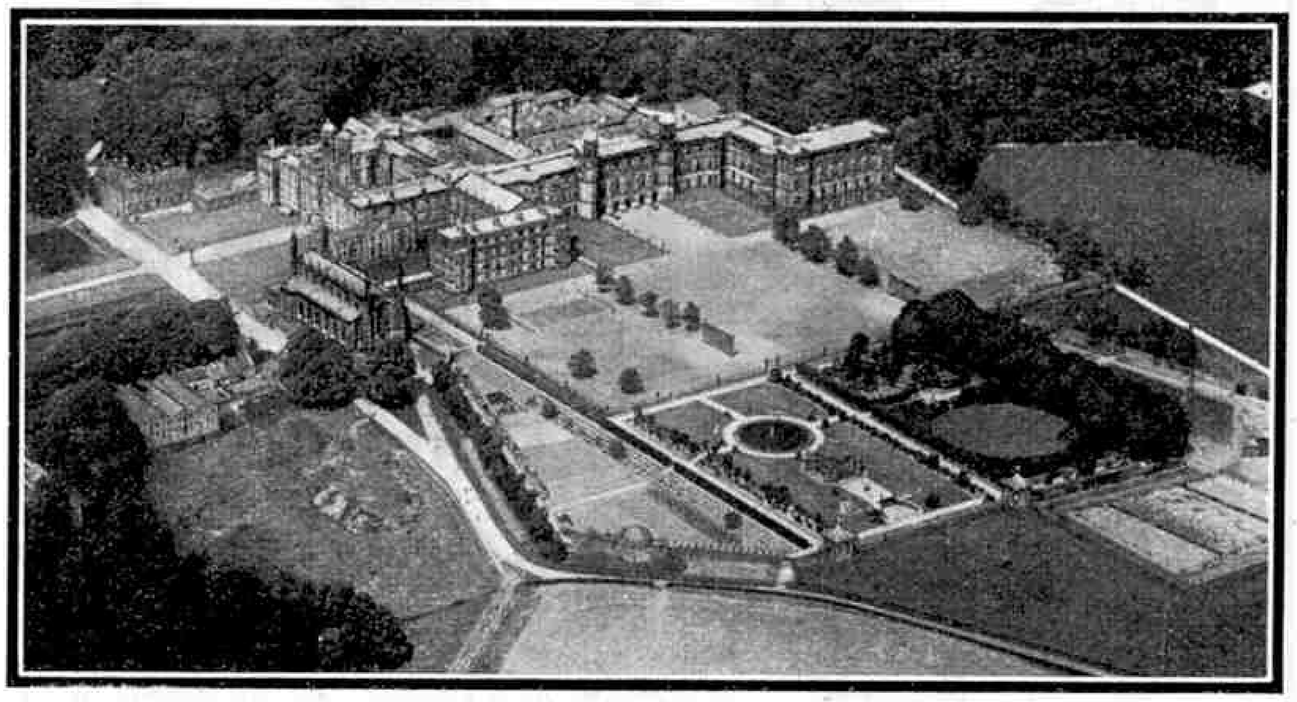
We leave Lincoln Works with no illusions as to why "Crabtree" products are ahead of modern requirements. Years of thought have been given to ensure perfection in what seems to be merely an unobtrusive little switch that one flicks "on" or "off" when electrical service is or is not required. As we watch the *(Continued on page 150)*

The Story of a Famous Observatory

Astronomers of Stonyhurst College

THE recent articles in the "*M.M.*" dealing with the invention of the telescope created widespread interest. The concluding article, in the issue of August last, described some of the world's famous Observatories, and we are now able to supplement this article with some details of another interesting Observatory, that of Stonyhurst College, near Blackburn. This Observatory has become famous by reason of the achievements of the astronomers who have been its directors.

The Stonyhurst College Observatory was founded in 1838 as a meteorological station, but though meteorology has been carried on there continuously since that time, the work of the Observatory now covers a much wider field. Progress may be said to date from 1858, when the Observatory was enriched by the addition of a set of instruments for obtaining absolute measurements of the elements of terrestrial magnetism. Other additions to its equipment have been made from time to time, and each has enlarged the scope of its work.



Stonyhurst College, near Blackburn, as seen from the air. The domed building containing the 15 in. telescope is in the centre foreground, and the Meteorological Pavilion is seen close to the circular footpath.

The principal buildings of the Observatory are the meteorological pavilion and the domed chamber containing the 15 in. telescope. The pavilion was built in 1838, and has magnetic chambers underground. It contains a large central room used as a computing room, and built outward from it are four chambers facing respectively north, south, east and west. The north chamber contains the seismograph; the south chamber is used as a dark room in connection with the stellar photography carried out at the Observatory; the west chamber is devoted to work with the grating spectrum, and the east chamber is the transit room. On the first floor, above the computing room, is the wireless room and a portion of the library.

A closer view of the Meteorological Pavilion. This includes a wireless room and has magnetic chambers underground.

The Observatory consists of four departments devoted respectively to meteorology, terrestrial magnetism, seismology and astronomy. The meteorological department is responsible for the daily production of a weather chart and forecast, which are prepared with the help of a powerful wireless set with which is incorporated a "Creed" undulator. A copy of the chart and forecast is posted on a notice board that hangs in one of the main corridors of the College, and the forecast is also published in the "*Lancashire Daily Post*." In addition to the ordinary meteorological instruments the department contains a rain gauge that automatically records the amount and duration of the rainfall in the locality; a "Robinson Cup" anemometer and a "Dines" pressure tube anemometer. These instruments are for measuring the pressure or the velocity of the wind and recording its direction. In the "Dines" instrument the wind acts on a recorder floating in water, and a rotating drum receives the trace.

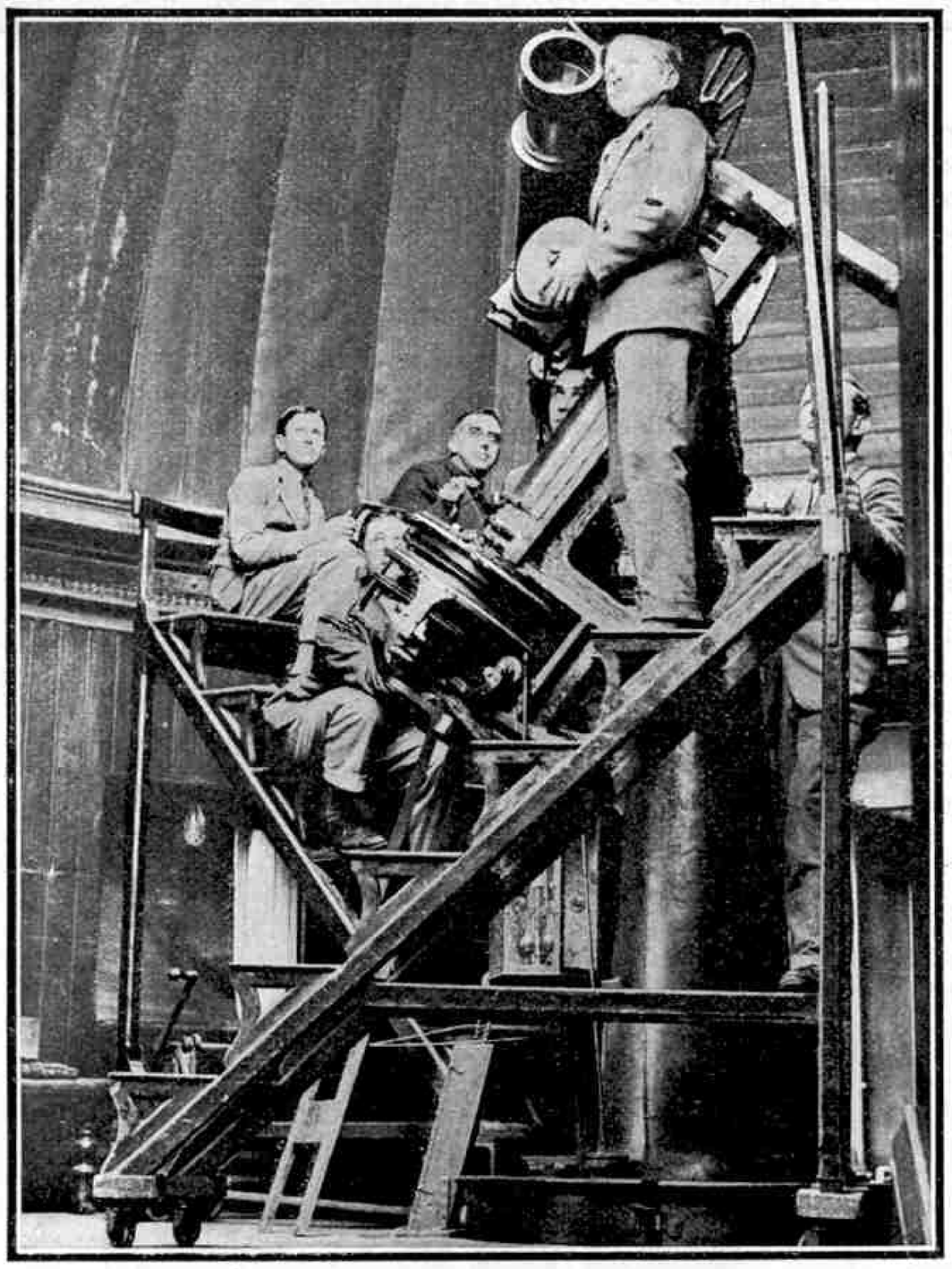
The terrestrial magnetism department has carried out observations of the absolute values of the elements of terrestrial magnetism continuously since 1858, and photographic records of the various elements have been taken since 1867. An important branch of the work of this department is the study of the inter-relation of solar phenomena and terrestrial magnetism.

The seismological department is devoted to the study of earthquakes. This work is done by means of a Milne-Shaw seismograph, a delicate instrument that automatically records the vibrations of the earth due to earthquakes. In this a weight is supported in such a manner that it tends to remain at rest, even when everything about it is moving, and by means of a system of light levers it gives a magnified record of any movement of the ground relative to itself. The record is made by a spot of light focussed on a sheet of photographic paper that is being moved at a uniform rate by clockwork. Normally the trace is a straight line, but when the earth trembles, a wavy line is obtained. The work of this department is in the charge of the Rev. J. P. Rowland, who is a member of the Seismological Committee of the British Association.

The apparatus used by the astronomical department includes a 15 in. refracting telescope to which can easily be attached two solar spectroscopes, instruments by which light is separated into vibrations of different frequencies so that its properties can be studied. By replacing the eyepiece of the spectroscope with a camera the instrument becomes a stellar spectrograph, and a large grating spectrograph attached to a 6 in. refracting telescope is used for the study of the spectrum of the Sun, sunspots, etc. In addition the Observatory contains a 4 in. refracting telescope equipped with an objective prism for stellar spectrographs.

A drawing of the Sun is made on every available day by the astronomical department. This drawing shows all sunspots and markings. The prominences on the Sun's limb are examined and measured, and their positions noted, and charts are then constructed showing the life history of the Sun for each rotation.

Astronomy does not form a special subject of the curriculum of the College, but arrangements are made for the various instruments to be shown and explained to the boys, and facilities are also given for the boys to view various interesting celestial objects through the telescope. The College societies include an astronomical club, and there are always many boys who take considerable interest in the subject. Lectures on astronomical and allied subjects are also given from time to time by the Director and his staff.



The 15 in. " Perry Memorial " Refracting Telescope, the largest of three refracting instruments at the Observatory.

The history of the Observatory is closely linked with the names of three well-known astronomers, Fathers Perry, Sidgreaves and Cortie. The earliest of these was Father Perry, who first became a director of the Observatory in 1860, but left three years later to continue his religious studies, returning to the Observatory in 1868 to begin his real life work. Father Perry was passionately fond of astronomy, and during the years in which he was associated with the Observatory he had charge of many important scientific expeditions. One of his earliest tasks of this nature was the making of a magnetic survey of France, which he carried out during the summers of 1868 and 1869. Two years later he made a similar survey in Belgium. The results were printed in the Philosophical Transactions and the Proceedings of the Royal Society, and in recognition of his work the Society elected him a Fellow.

In 1870 Father Perry was chosen to lead a British Expedition to Cadiz to observe an eclipse of the Sun, and four years later, and again in 1882, accompanied by Father Sidgreaves, he was in charge of Government expeditions to view the transit of Venus. In the interval of conducting these and other expeditions he devoted much time to lecturing, addressing not only the College students, but scientific bodies and the general public. He was a lecturer of the first rank, and at times as many as 3,000 people attended his lectures.

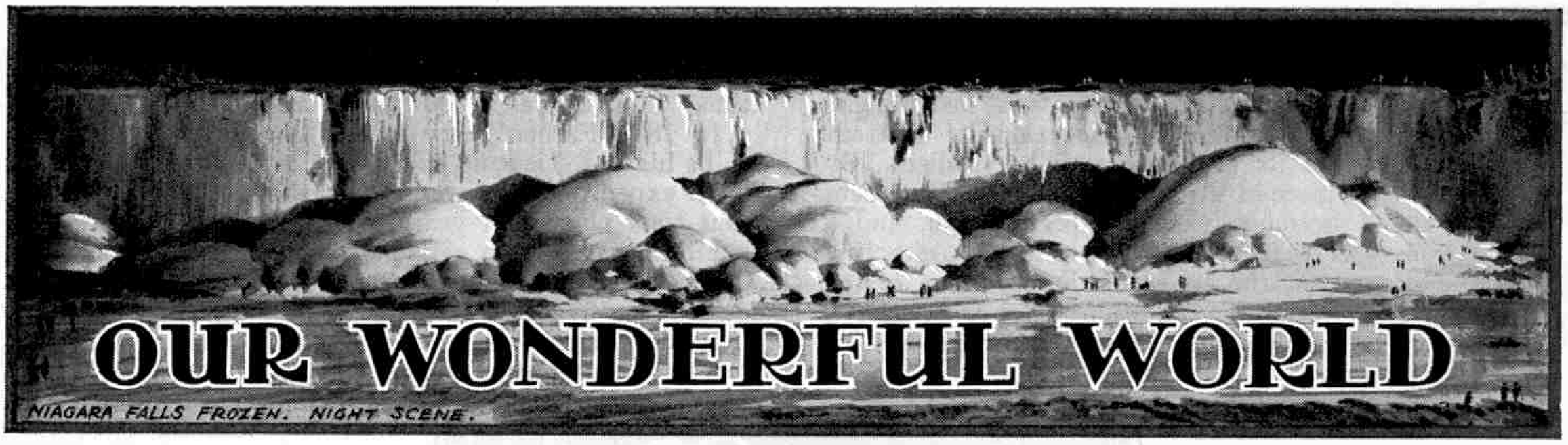
In 1889 Father Perry took charge of what proved to be his last scientific expedition. This was a Government expedition to Cayenne to observe the solar eclipse that took place that year. While there he became ill, but he insisted upon carrying on his work, and he was carried from his bed to take his last observations. He died at sea five days later.

Father Perry was succeeded as director of the Observatory by Father Sidgreaves, who had previously held this office from 1863 to 1868; and the Observatory owes a great deal to his work. In 1863 he began the systematic work on terrestrial magnetism that has been continued there without a break down to the present day, and in 1865 he issued the first magnetic report, which was presented to the Royal Society. A grant of about £225 by this Society enabled him in 1867 to instal the self-recording magnetographs which have been in operation ever since. Father Sidgreaves' greatest work, however, was in connection with stellar spectroscopy, and his beautiful photographs of star spectra earned him a gold medal at the St. Louis Exposition of 1904, and a Grand Prix at the Franco-British Exhibition of 1908. His astronomical friends used to enjoy looking at the apparatus with which he secured his splendid results, for this had been put together by himself, the framework consisting of cast-off chalk boxes and old snuff tins!

The care with which Father Sidgreaves made all his observations and the accuracy of the results he obtained were generally recognised, and during the transit of Venus expeditions led by Father Perry his observations were used as the standard to which the others were referred. In 1893, during his second period as Director of the Observatory, he installed the 15 in. refracting telescope that had been subscribed for by the friends of Father Perry. This instrument is known as the " Perry Memorial " telescope.

Father Sidgreaves was succeeded at the Observatory by Father Cortie, who had been in charge of a Stonyhurst Expedition in Spain during 1905. Like his two predecessors, Father Cortie was entrusted with important Government work, and in 1911 he led an official expedition that was sent to observe a solar eclipse visible in the Tonga Islands in the South Pacific. In 1914 he visited the north of Sweden for a similar purpose, and on this occasion he was accompanied by Father O'Connor, who succeeded him a few years ago as Director of the Observatory, and to whom we are indebted for the information contained in this article.

A grant of £100 from the Royal Society (*Continued on page 150*)



Industrial Use For Radium

X-rays have long been used to discover interior flaws in constructional materials, and a full account of the manner in which they are employed for this purpose appeared in the issues of the *"M.M."* for March and April, 1927. The rays are directed through the material to be tested on to a photographic plate. They pass more easily through crevices than through solid wood or metal, and the shadow photographs thus obtained reveal the presence of cracks and flaws of all kinds.

One of the disadvantages of using X-rays is that very elaborate apparatus working at high voltages may be required, particularly if heavy metals are to be examined. For this reason other sources of highly penetrating radiation have been tried, and it has been discovered that radioactive substances may be usefully employed in a remarkably simple manner.

Radioactive substances emit three kinds of rays, known respectively as alpha rays, beta rays and gamma rays. Alpha rays are really atoms of helium, while the beta rays consist of streams of electrons shot out at almost incredible speeds. The gamma rays are very penetrating X-rays of short wavelength, and it is these rays that are now being used for testing purposes.

The most convenient source of gamma rays is radon, a radioactive gas that is one of the products of the changes that take place within the radium atom. This is collected in tiny glass capsules that are roughly about the size of a pea. A capsule only remains active for a few days, but new supplies of radon are continuously being produced from radium, for the activity of this remarkable metal only falls to half its original value in 1,560 years.

Capsules containing radon are stored in lead casings that are handled by means of tongs, for the penetrating radiations are harmful to those who remain in contact with them for long periods. For use, a capsule is removed from its lead box and placed on one side of the material to be tested. A photographic plate specially sensitised to gamma rays is placed on the opposite side of the test piece, and is exposed to the radiation for a sufficient length of time to obtain a good shadowgraph. Long exposures are often necessary, but the means employed are so simple that the new method may readily be used in testing large castings that cannot conveniently be examined when ordinary X-ray apparatus only is available. Additional advantages are that the capsule and the film holder may be taken to the material to be tested, thus avoiding troublesome removals, and that several objects may be tested simultaneously by arranging them around the capsule. Satisfactory shadow photographs have been taken through thicknesses of steel up to $10\frac{1}{2}$ in.

World's Oldest Piece of Wood

What is regarded as the oldest piece of wood in the world has been discovered near Ellensbury, Washington, U.S.A. It was found in a deep excavation made during the construction of a canal and its position shows that its age must be between 19,000,000 and 23,000,000 years.

The most remarkable feature of the discovery is that the fragment is definitely not petrified, but is really a piece of preserved wood. It is blackened by age, of course, but still shows its original grain and pieces of it readily burn if ignited.

A deposit of a compound of iron and sulphur was found in contact with the wood, into the grain of which some of the mineral had penetrated. There is evidence that the stratum in which it was found was at one time subjected to a high temperature.

Martin and his wife out for a ride ! Our photograph of the two bears illustrates the readiness with which certain animals can be trained to behave with apparent intelligence.

The Lightest Wood in the World

The lightest wood known is balsa, the wood of a tropical tree that grows most freely in Ecuador, the country on the west coast of South America through which the Equator passes. The trees have smooth barks and large broad leaves. They grow to a height of from 70 ft. to 80 ft., and their trunks measure up to 3 ft. in diameter.

The density of balsa wood is only half that of cork, and a beam of balsa wood 20 ft. in length and 10 in. square weighs only about 75 lb., or less than a quarter of the weight of a beam of pine of the same size. The reason for its lightness becomes apparent when it is examined under the microscope, for it is then seen to have a honeycomb structure. As the trees grow older, the wood becomes heavier, the walls of the cells of which it is composed increasing in thickness. For this reason only young wood has a commercial value.

Balsa wood is so buoyant that in water it can support a weight almost ten times that of its own, and at first it was chiefly used in making lifebuoys and other life-saving apparatus. Other uses were quickly found, however, and it is now very largely employed in the building of aeroplanes and airships, for although light it is strong and easily worked. The demand for it has increased to such an extent that it is grown in plantations. The trees are cut down when they are five years old and the wood is heated in a dry kiln in order to destroy the tiny tropical organisms that otherwise would destroy it.

It is about 300 years since balsa wood was first seen by Europeans. Early in the sixteenth century a Spanish pilot called Bartholomew Ruiz sailed southward from Panama along the shores of South America, in a preliminary exploration on behalf of Pizzaro, the famous conqueror of Peru. On that voyage Ruiz met a large Indian raft made of tree trunks lashed together with vines, and learned from the natives that they called their craft a balsa, a name that has since been given to the wood of which it is made.

Balsa was rediscovered as recently as 1911, when an American seaman visiting Central America on a trading voyage was astonished to see a chief carrying an entire tree on his back! When the visitor discovered how light the wood was, he realised its value and took a quantity of it to the United States. There he formed a company to manufacture articles from the wood, and the demand for this unique material increased very largely during the Great War.

Drifting Meadows of the Sea

The tiny single-celled plants called "diatoms" are in many respects the most remarkable living things in the sea. Although covered with a thin protecting covering of silica, they are real plants, for they contain chlorophyll, the mysterious green organic chemical that gives them the power of making use of the energy of the Sun to build up their tissues from the mineral foods on which they live.

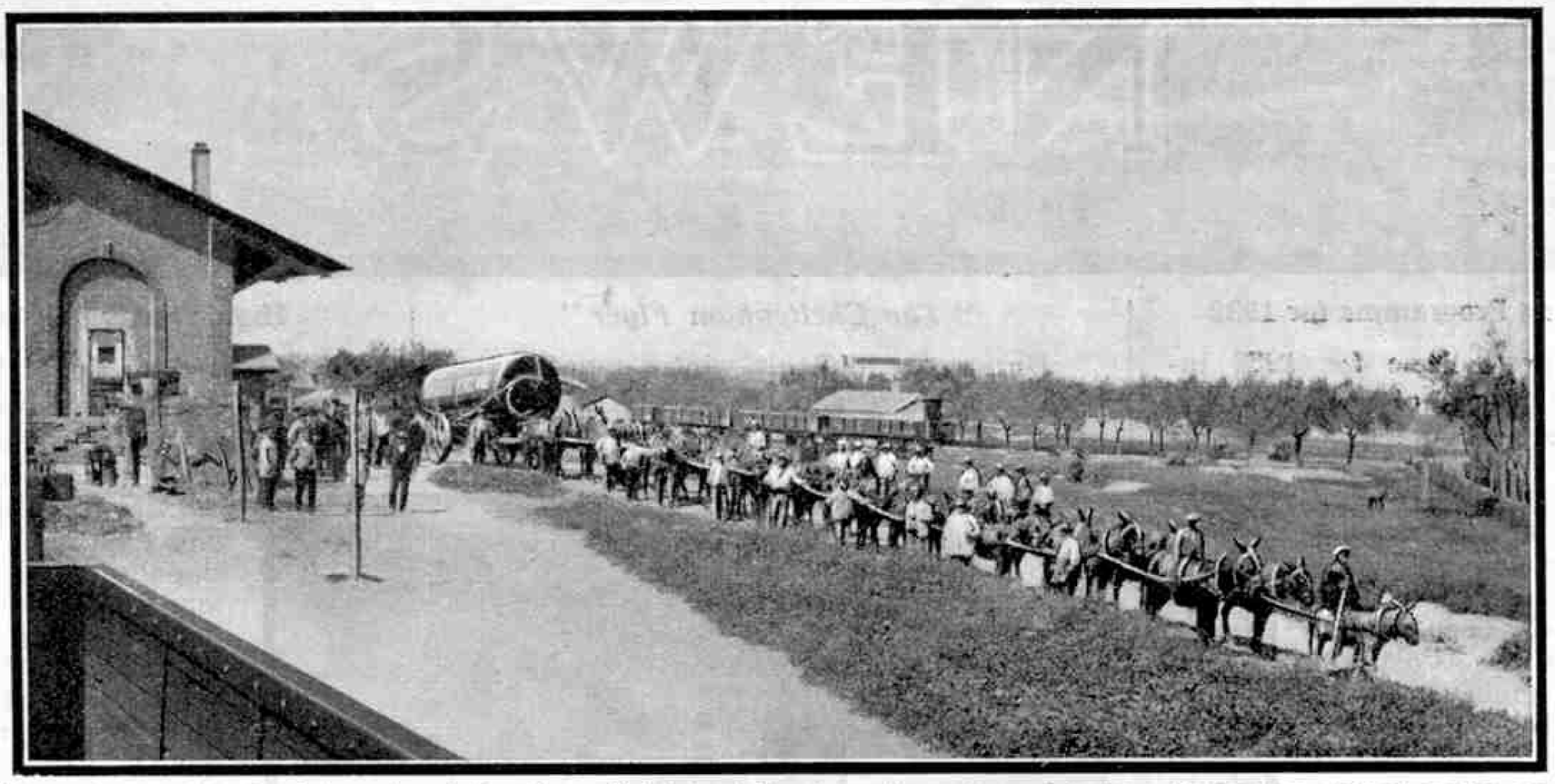
Diatoms drift about the ocean in great colonies, and under favourable conditions develop very rapidly. Each cell divides into two every few hours, and it has been calculated that from a single individual a billion new diatoms may be produced within a month. The plants are extremely small, and it has been found that a thimbleful of water from the Baltic Sea contains many thousand individuals. It is believed that 5½ tons are produced every year beneath an acre of water in the English Channel, and in Polar seas, where they grow best, bands of diatoms 15 ft. in thickness and hundreds of miles in length are frequently seen.

It is fortunate that diatoms are so plentiful and grow so rapidly, for they form the beginning of an interesting food sequence. These "drifting meadows of the sea," as they have been called, are the chief food of myriads of tiny creatures, some of them almost microscopic in size, that live in enormous numbers in the ocean. These are devoured by jelly-fish, sea worms, shrimps and many crab-like animals that are themselves the prey of fish of various sizes. Practically all the inhabitants of the sea thus depend directly or indirectly upon diatoms, and a decrease in their number is inevitably followed by a reduction in the population of the sea.

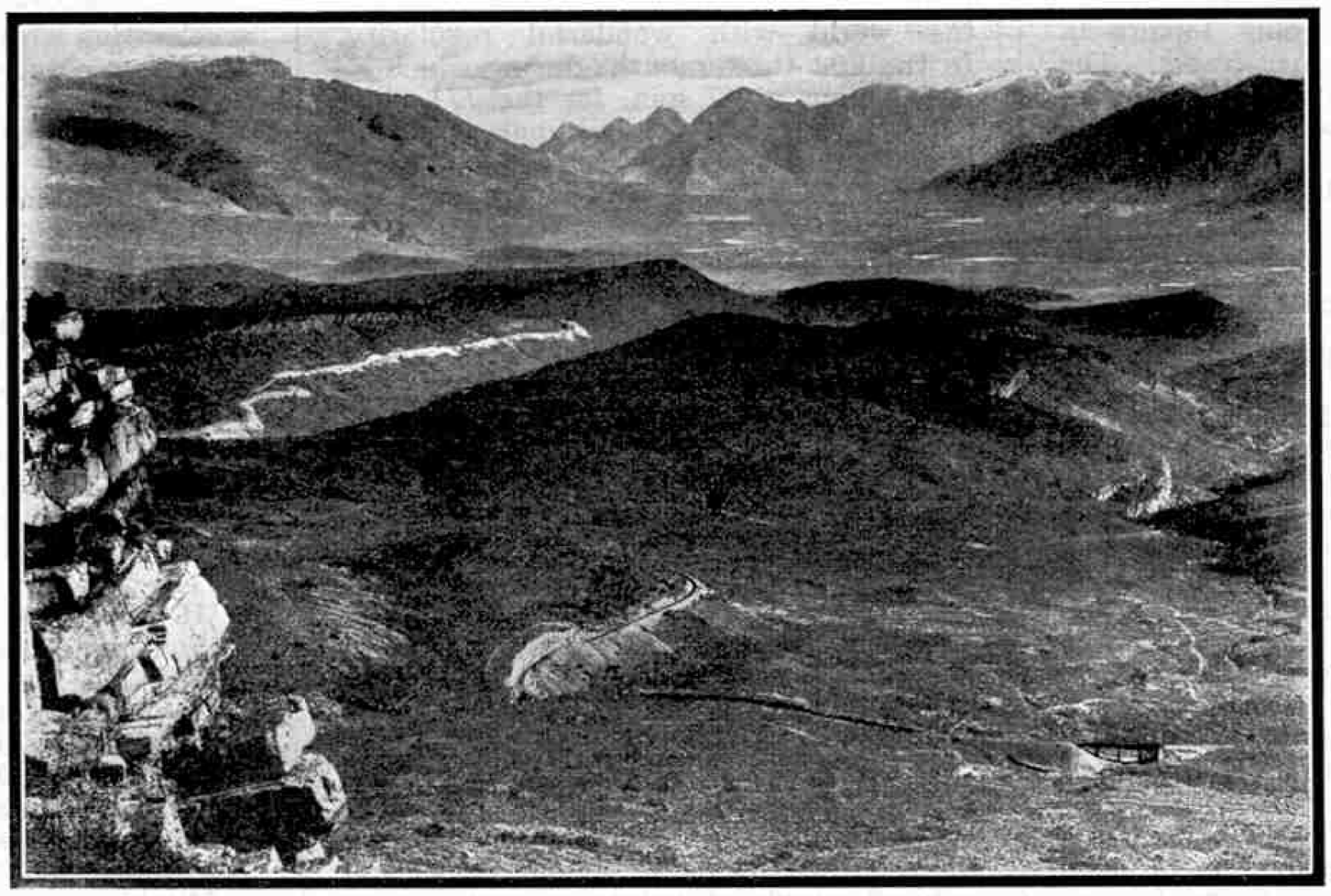
The usefulness of the diatom does not end when it dies, for then its shell, built of silica extracted from salts dissolved in sea water, settles to the bottom of the ocean, to give rise in the course of millions of years to the earths known as diatomite, kieselguhr, and tripolite. How slowly the deposits have been built up is shown by the fact that there may be as many as 50,000,000 diatom skeletons in a cubic inch of one of these earths.

Diatomite and similar materials find many uses in industry. Kieselguhr is employed in transforming the dangerous explosive nitro-glycerine into the comparatively harmless dynamite. Nitro-glycerine is a liquid and is readily absorbed by kieselguhr, the resulting solid mass being safe to handle and exploding only when given a violent shock by means of a detonator.

Cane sugar solution is filtered through diatomite during the process of refining. Bricks made of this earth are used in constructing linings for furnaces, as its fusion point is very high, and finely-ground diatomite enters into the composition of gramophone records, paints and varnishes, linoleum and many rubber products. It is used also as an absorbent in the manufacture of various chemicals, and is the base of many metal polishes. Earths formed from the skeletons of small diatoms that lived in fresh water are said to be the best for polishing purposes.



Heavy transport on Spanish roads. A Cornish multi-tubular boiler drawn by mules and donkeys, leaving the railway station on the way to the mines where it is to be installed. We are indebted to Marshall Sons & Co. Ltd., Gainsborough, for this illustration.



The sinuous course of the railway line from Capetown to the north among the Hex River Mountains. The steepest gradient in this section is 1 in 40, and the highest point reached is 3,147 ft. above sea level. Photograph reproduced by courtesy of the South African Railways.

New Uses for X-Rays in Museums

Before purchasing mummies it is advisable to have them X-rayed, for like other articles of commerce, these relics may be made the subjects of frauds, and in certain instances high prices have been paid for mere bundles of rags. An even greater advantage of the use of X-rays is that a mummy examined with their aid retains its full value. The only alternative to their employment is the removal of the wrappings, and these cannot afterwards be restored.

By means of X-rays a permanent record of a mummy may be received on a photographic plate, often with surprising results. For instance, the shadow photograph of a mummy of an Egyptian boy showed clearly that he had met his death by violence, for it could be seen that the skull was fractured, the jawbone broken, and a tooth knocked out.

X-rays also find increasing application in dealing with pictures. The old masters used mineral pigments containing salts of heavy metals that were practically opaque to the rays, and radiographs or shadow-photographs taken by means of the rays show every detail of their work. The pigments now used are largely of vegetable or coal tar origin, and are readily penetrated by X-rays, with the result that radiographs of paintings in which they have been used show practically nothing. The rays therefore may be used to detect modern copies of old pictures. Copies of the paintings of old masters by artists of their own times cannot be distinguished from the original in this manner, but study of the brushmarks revealed in X-ray photographs is effective for this purpose, for these are as characteristic of an artist as his finger-prints would be.

X-rays are also useful in studying embedded fossils and for examining the structures of rare specimens of fish, birds, reptiles, small animals and even insects, while when turned upon ancient caskets, cabinets and writing desks they reveal unsuspected secrets. New uses for them are continually being found and they promise to become increasingly valuable.

G.W.R. Building Programme for 1932

The G.W.R. programme for 1932 includes the construction of 90 new locomotives. Of these, 30 are 4–6–0 express engines of the "Castle" and "Hall" classes, and the remaining 60 are 0–6–0 tank engines intended chiefly for suburban services.

Work has already been started at Swindon on ten new "Castles." Although in the main they will correspond with the earlier "Castles," some improvements in details are being made.

Ten of the new 2–6–0 engines of the "9300" class have been completed at Swindon and are numbered 9300–9. The first five of a new series of 0–6–0 tank engines are just being put into traffic. They are numbered 6400–4. These engines are in all respects similar to those of the recent "5400" class, except that the wheels are 4 ft. 7½ in. in diameter instead of 5 ft. 2½ in.

A large number of engines are now at Swindon undergoing repairs in preparation for the summer traffic. The equipment for dealing with these includes four 100-ton lifting cranes, four 50-ton lifting cranes, and four traversing tables. Provision is made for 130 engines to be over pits for working purposes at the same time.

Through Train from Manchester to Budapest

A noteworthy transport feat has recently been carried out by the despatch from Trafford Park, Manchester, to Budapest, Hungary, of a number of special L.N.E.R. and German ferry-service wagons loaded with heavy electrical equipment for use in connection with the electrification of a section of the Hungarian State Railways. The wagons were conveyed across the North Sea by the Harwich-Zeebrugge train ferry. They then began their 1,000-mile journey across the Continent, passing through Belgium, Germany and Austria, en route to Hungary. They are the first British wagons to travel so far into Central Europe, but goods traffic is conveyed regularly in through wagon loads between Great Britain and Italy, France and other countries overseas.

Compound Locomotives for Irish Railway

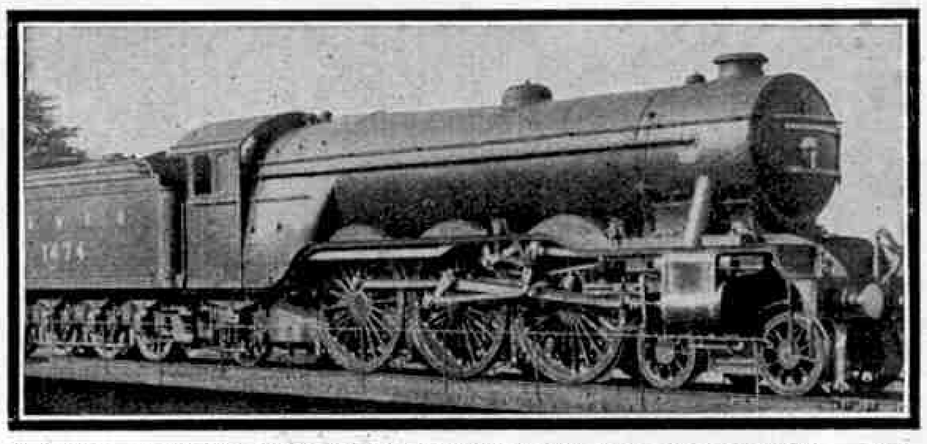
Five three-cylinder compound express locomotives of the 4–4–0 wheel arrangement are being built for the Great Northern Railway of Ireland by Messrs. Beyer, Peacock & Co. Ltd. They will have a working pressure of 250 lb. per sq. in.

"The Cheltenham Flyer"

During the difficult winter months the G.W.R. *"Cheltenham Flyer"* is maintaining its exacting schedule—the fastest in the world—with wonderful regularity. In the first three months during which its new timing of 67 min. for the 77¼ miles between Swindon to Paddington was in operation, this record-breaking express covered 6,008 miles in 5,233½ minutes. This was only 7½ minutes more than the total booked time allowed for the 78 daily runs then made and the figures give a remarkable proof of the consistent running, for time lost owing to signal checks and reduced speeds at points en route owing to repairs and alterations to the line was not taken into account.

As showing how time is kept and even improved upon, in spite of checks, a run made on Thursday, 7th January, may be cited. The engine was No. 5001 with Driver J. W. Street at the regulator. Swindon was left on time but a long slack at Didcot cost almost five minutes, yet Paddington was reached two minutes early.

The down "Cornish Riviera Express" passing Kensal Green hauled by 4-cylinder 4-6-0 No. 4044, "Prince George." These earlier 4-cylinder engines had almost exclusive charge of this train for many years until the more powerful "Castles" and "Kings" were introduced. (Photograph, Railway Photographs, Liverpool).



L.N.E.R. "Pacific" No. 4474, "Victor Wild," on the turntable. Reproduced by courtesy of the "Southern Railway Magazine."

High Speeds on the L.N.E.R.

Stimulated no doubt by the exploits of the G.W.R. *"Cheltenham Flyer,"* the L.N.E.R. has lately been exploring the possibilities of higher speeds on the part of its own engines and expresses, and some exceptionally fast runs have been made.

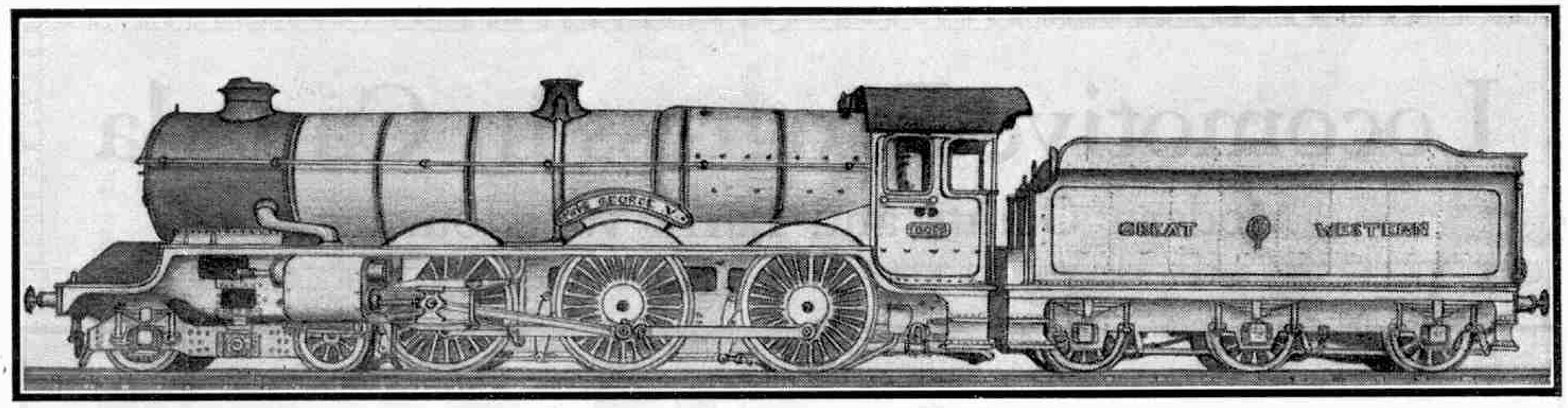
On the first of the trial runs, an "Atlantic" engine—No. 3295—in charge of Driver W. Sparshatt, ran from Peterborough to King's Cross, 76.4 miles, in 71 minutes.

On the second run, a "Pacific" engine—No. 2547 *"Doncaster"*—was employed, with Sparshatt again as driver, and much faster running was made. The load behind the tender was about 230 tons and the 76.4 miles were covered in 66 minutes, at an average speed of 69.2 m.p.h. A speed of 90 m.p.h. was attained just before Hatfield, and at New Barnet a maximum of 92 m.p.h. was reached. The engine was still accelerating when steam had to be shut off and speed reduced to 10 m.p.h. on account of the new road bridge under construction at New Southgate. But for this long slack, the run could doubtless have been made in three minutes less time. The uphill running was notably smart and Potters Bar summit was passed at 75 m.p.h.

The third test was made on the 9.44 a.m. train from Grantham which runs non-stop to King's Cross. The engine on this occasion was "Pacific" No. 2743, *"Felstead,"* with Driver Watson, of Doncaster, in control. The weight of the train was 310 tons. The 105½ miles from Grantham to King's Cross were run off in 92 min. 42 sec. The average speed being 68.4 m.p.h. If allowance be made for the New Southgate slack, the net time was only 89½ min. Between Little Bytham and Essendine a speed of 92 m.p.h. was achieved. At New Barnet the speed was 90 m.p.h., and over three stretches, totalling 60 miles in length, an average speed of 80 m.p.h. was maintained. The 27 miles from Huntingdon to Hitchin, *mostly on a rising gradient*, were covered in the astonishing time of 20 min. 42 sec., or all but 80 m.p.h.!

L.M.S.R. Watford Services

The L.M.S.R. electric train service between Euston and Watford is to be made more intensive, and about 31 compartment coaches are under construction for the revised service. Three-aspect colour-light signalling also is provided for in the arrangements now being made.



L.M.S.R. Locomotive News

The last of the new batch of 25 "Class 2" 4–4–0 locomotives has been finished at Crewe and sent into service. It is numbered 660. Additional 0–8–0 freight engines numbered 9627–8 also have been built at Crewe.

Camden engine shed and motive power depot is at present undergoing reconstruction. At this shed are located the engines that haul most of the trains leaving Euston for the north. Eighteen "Royal Scots" are included among them.

A London correspondent who was at Willesden Junction on a recent afternoon reports that he saw three rebuilt large-boilered "Claughtons" pass through in the down direction in fairly close succession. One of the three was No. 5999 "*Vindictive*," working a goods train, and the others were the Caprotti "Claughtons," No. 5927, "*Sir Francis Dent*," and No. 5947. It was noticeable that in starting, "*Sir Francis Dent*" gave eight puffs of the exhaust to one revolution of the driving wheels, and this engine therefore must have a special setting of the cranks.

Another famous engine that has been condemned to the scrap-heap is "*Dunalastair*," No. 721 of the former Caledonian Railway. Built in 1896, this engine was notable in having a boiler of a larger diameter than was possessed by any other British locomotive at that time. In common with the other engines of its class, it did exceptionally fine work in regular service and performed many brilliant runs.

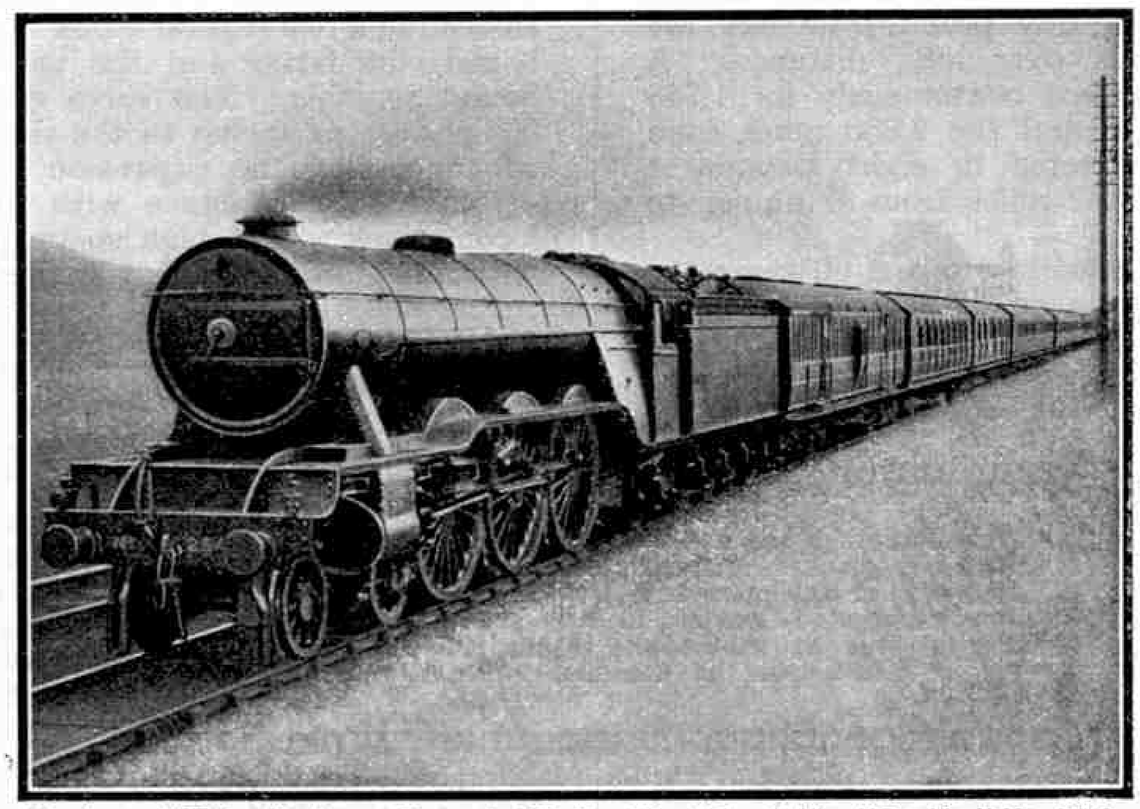
Other L.M.S. withdrawals include several 4–4–0 engines of the former L.N.W.R. These are:—No. 5112, "*Centurion*," and No. 5156, "*Diamond Jubilee*," of the "Renown" class; and No. 5194, "*Vandal*," No. 5210, "*Victor*," No. 5228, "*Penguin*," and No. 5265, "*Phalaris*," of the "Precursor" class. The "Renowns" of course are former 4-cylinder Webb compounds, rebuilt as 2-cylinder simple engines. This step was first taken by Mr. G. Whale in 1908, and in their rebuilt form these engines resemble the "Precursors" designed by him.

Canadian Freight Car's Wanderings

A freight car made by the Canadian National Railways 28 months ago, has just returned to its starting point after having travelled 38,500 miles. During its journeyings it has travelled in every Province in Canada except Nova Scotia, every State in the American Union, and as far south as Santa Rosalla in the State of Chihuahua, Mexico.

Experimental L.N.E.R. Suburban Train

The L.N.E.R. have put into service between King's Cross and New Barnet an experimental suburban train with some interesting features. It consists of eight coaches with seats for 616 passengers and weighs about 200 tons. The principal improvement in the new train is the tasteful upholstery, which is carried out in various shades of moquette in the second and third class compartments and rep in the first class. The first class is provided with arm-rests and four seats on each side instead of the usual five. The lighting also has been improved and smooth running is ensured by the use of the articulated construction introduced by Mr. H. N. Gresley, the chief mechanical engineer. This was first applied on the late G.N.R. for suburban vehicles. As a result of its success, its use has been extended to main line coaches, including dining and sleeping cars.



The down "Flying Scotsman" passing Hadley Wood, headed by "Pacific" No. 2543, "Melton" (Railway Photographs, Liverpool). Above is a drawing of the G.W.R. locomotive "King George V," by our reader, L. A. J. White, Chard.

New L.M.S.R. Mechanical Engineer

Mr. W. A. Stanier, M.I.Mech.E., has been appointed Chief Mechanical Engineer of the L.M.S.R. in succession to Mr. E. J. H. Lemon, now a Vice-President of the Company.

Mr. Stanier has hitherto been associated entirely with the G.W.R. As a Swindon boy, in 1892 he became an apprentice in the G.W.R. works and passed through all the shops. His abilities gained for him steady promotion until in 1924 he attained the post of principal assistant to Mr. C. B. Collett, O.B.E., Chief Mechanical Engineer. It will be interesting to observe to what extent the stamp of Swindon will be impressed upon the future locomotives of the L.M.S.R.

Successful Booster Trials on L.N.E.R.

From Doncaster works further 2–6–2 tank engines of the new "VI" class have been turned out and 25 are now in service. The latest to be completed is numbered 2924.

A novel method of smoke deflection is being tried on the "Pacific" locomotive No. 2747, "*Coronach*." The upper part of the smokebox has been partitioned off and opened out in front and at the rear in order to create at speed a strong upward rush of air immediately behind the chimney. This lifts the exhaust clear of the cab.

The reconstructed booster-fitted "Atlantic" No. 727 has been subjected to some interesting tests from which it has emerged with distinct success. When tried with a 300-ton train on a gradient of 1 in 70, a speed of 18 m.p.h. was attained in eight minutes without the booster in action. When, however, the booster was brought into operation, a speed of 25 m.p.h. was attained in 5¾ minutes. When tested on a level road, No. 727 was able to start a load of almost 500 tons without the aid of the booster, the draw bar pull registering nine tons. With the aid of the booster, a load of almost 750 tons was started and a draw bar pull of 12¼ tons was registered. It may be added that the new boiler fitted to this engine is larger than that originally fitted and the firebox has a grate area of 30 sq. ft.

Improved Turntable on L.N.E.R.

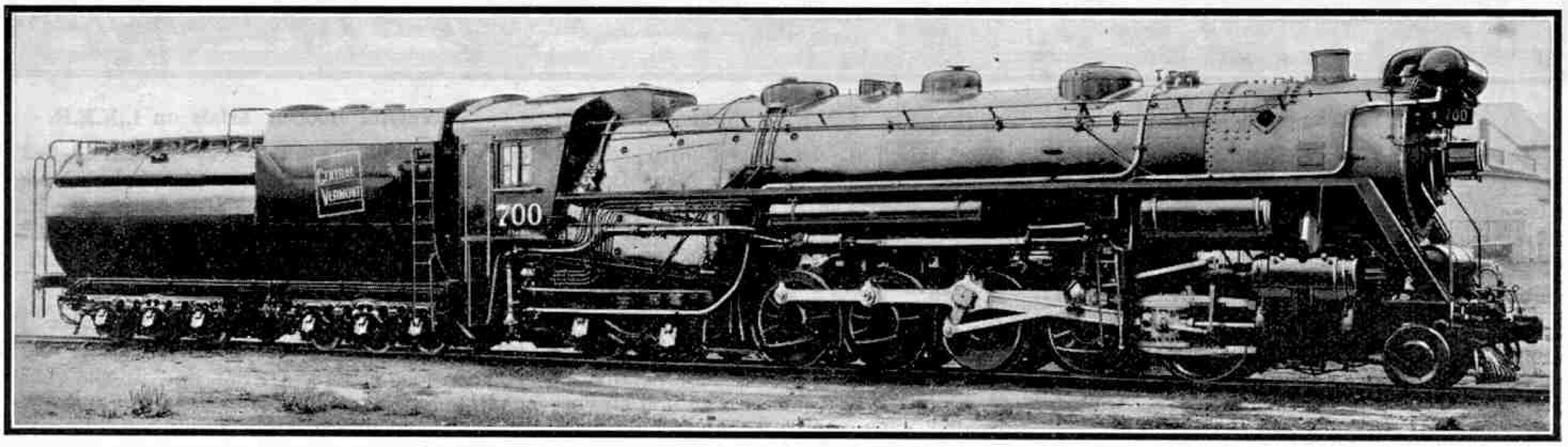
A new type of locomotive engine turntable in which support is provided by the end track wheels as well as the centre is under construction for the new L.N.E.R. Locomotive Depot at York.

With the increase in the length and weight of the modern express passenger locomotives the difficulty of turning engines at the ends of their journeys has increased. The turntables previously used in this country have been of the centre-balance type capable of carrying up to 159 tons. They consist of deep section steel girders and a large turntable pit must be made when erecting them, while costly and difficult drainage arrangements are necessary.

The new turntable, which is designed to turn the longest and heaviest locomotives, can be placed on a very shallow foundation. It may be turned easily, irrespective of the weight of coal and water in the engine tender, and it is not necessary to secure an accurate balance before moving an engine, an operation that sometimes takes a considerable time to carry out.

Locomotive Progress in Canada

Modern Giants and Early Woodburners



MODERN locomotives are remarkable for their great size and power, and nowhere are these characteristics more marked than on the North American continent. There train loads are heavy, and running conditions difficult, so that powerful cylinders and boilers of large steaming capacity are necessary, while to utilise the available power, adequate adhesion is essential. In addition sufficient fuel and water must be carried for the needs of the boiler, and the tender therefore is often a huge vehicle carried on twelve wheels, as present-day practice favours the continuous operation of locomotives over long distances. A Canadian Pacific locomotive has worked continuously for 1,250 miles from Fort William to Calgary, and the 2,886 miles from Montreal to Vancouver are now covered in eight locomotive stages, of which the longest is the 832 miles from Winnipeg to Calgary.

The difference in the conditions met with now and 60 years ago is illustrated in a striking manner by a comparison between the various locomotives shown on these pages. The venerable "*North Star*" and "*Trevithick*" are in striking contrast to No. 700 and No. 6100. They represent a type that was characteristic of railway practice in the United States for so long that it became known as the "American" type. This signified a 4–4–0 locomotive, almost invariably with outside cylinders, although several examples existed in which the British practice of inside cylinders was followed.

The "700" class are the largest freight locomotives in New England, and recently the heaviest single-headed train that ever left Vermont yards was hauled by the engine illustrated. They are 95 ft. long, and weigh over 340 tons; while the boiler pressure is 250 lb. per sq. in. They develop a tractive effort of 86,000 lb., and the huge tender accommodates 20 tons of coal and 13,500 gallons of water.

The other giant locomotive illustrated bears the name "*Confederation*," and it was the first of the "6100" class, which are the largest passenger locomotives in the British Empire. The 4–8–4 wheel arrangement is employed, and this has been named the "Northern" type. These locomotives are used on such famous expresses as "*The International Limited*," and one of them works the train throughout the part of its journey from Montreal to Sarnia, a distance of 535 miles. Their total tractive effort of 69,700 lb. is not surprising when it is remembered that loads of 16 heavy steel coaches, or about 900 tons, have to be handled. To supply the necessary steam the huge boiler has a total heating surface of 4,256 sq. ft., and works at a pressure of 250 lb. per sq. in. With its total height of 15 ft. 3 in. and its length of 93 ft. $10\frac{3}{4}$ in. No. 6100 completely dwarfs the old locomotive "*Trevithick*" standing alongside.

In addition to their size these modern giants are noticeable for their economy in working. The most prominent feature at the front end is the feed-water heater slung across the smoke-box. Many valuable heat units are saved by this apparatus, for the feed is delivered to the boiler hot instead of cold, thus reducing the demand upon the boiler, and therefore helping to reduce maintenance costs. The cylinders have the valves on top, and instead of the old-fashioned slide valve housed in a rectangular chest, and moved by a spidery-looking valve rod as on "*North Star*," we have the modern circular piston valve, the form of which has produced a change in the contour of the cylinder casting. Instead of a rectangular "box" being placed on top of the cylinder barrel, the latter and the valve chest look like two cylinders bound together. The valve gear is outside, and although neat is very strong owing to the simple nature of the Baker motion, which employs no expansion link. This gear can be notched up close in accordance with the modern practice of operating locomotives with a high steam pressure and a long valve travel, with full throttle and a limited cut-off.

The massive nature of the connecting and coupling rods gives a fair indication of the power to be transmitted, particularly in the case of No. 700; and these splendid forgings with their solid ends and bushes are very different from the frail-looking cottered rods with adjustable brasses of "*North Star*." To provide the requisite balance, massive crescent weights are employed in the driving wheels, whereas on "*North Star*" weights bolted on between the spokes as necessary were considered sufficient. On the other hand, the old Grand Trunk engine "*Trevithick*" appears more up to date as regards coupling rods and balance weights, for the rods have round ends with circular bushes, and the balance weights are of the more modern crescent shape.

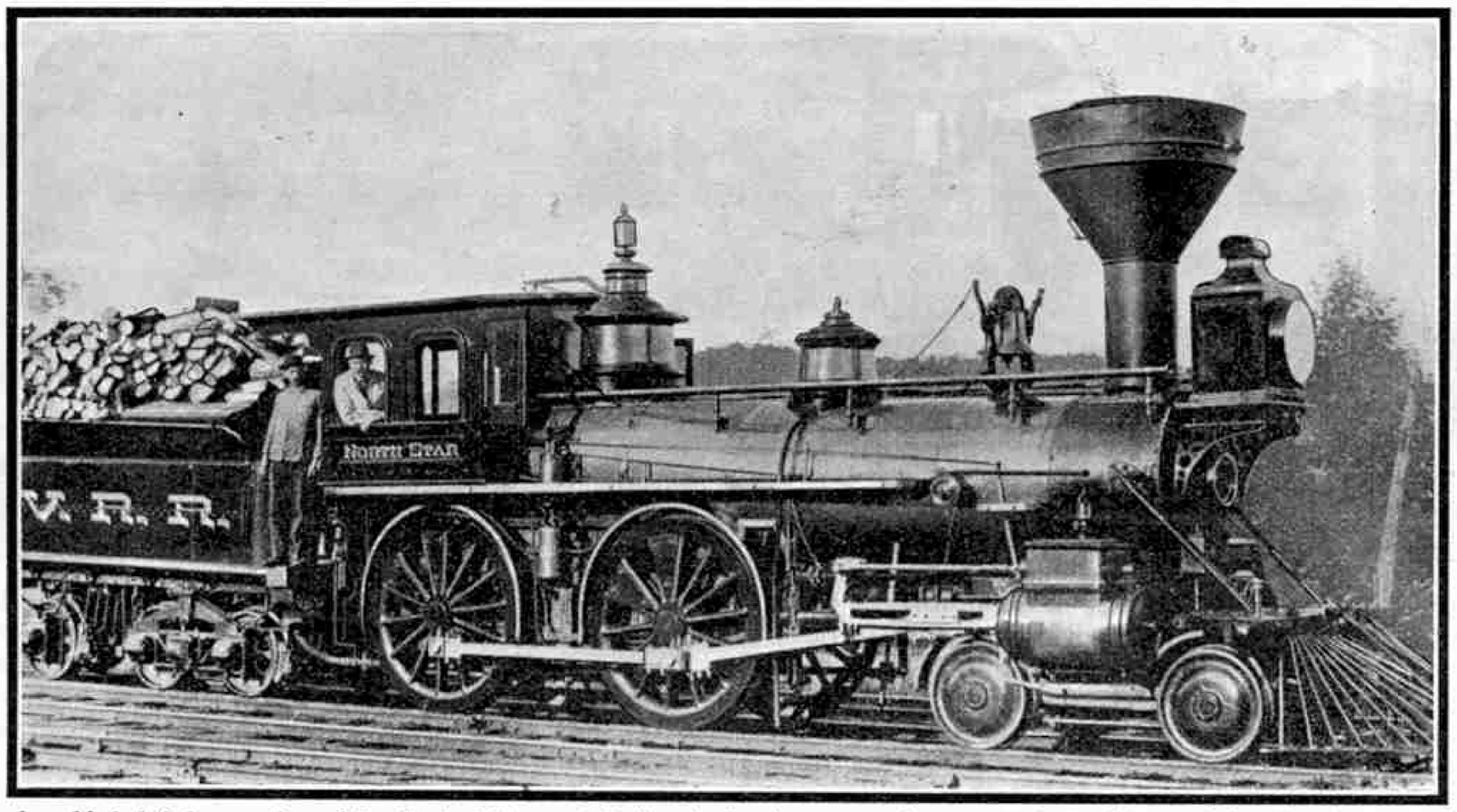
The photograph above shows the pioneer of the "700" class 2-10-4 locomotives intended for heavy freight traffic. Some indication of their power is given by the fact that loads of 3,000 tons are regularly assigned to them and are hauled with ease. For this and the photographs on the following page we are indebted to the Canadian National Railways.

The monster modern boilers and wide fire-boxes completely dwarf the diminutive wagon-top generators of the old locomotives, and an interesting point of difference between No. 700 and "*North Star*" that can be plainly seen in the illustrations is the location of the check valves on the respective boilers. On "*North Star*" a motion-driven pump forces the feed through the check valve at the side of the boiler immediately in front of the running board. On No. 700 top-feed principles are followed, and the check valves may be seen on top of the boiler barrel behind the smoke-box. The feed pipe-line can be clearly traced to the back of the engine, where the injectors are situated. Top-feed is adopted on a large scale in these days, and is being found of considerable advantage. The feed water, entering the boiler in a fine spray, may be freed to some extent from temporary hardness, or that removable by boiling, by arranging suitable trays upon which it falls. Scale is thus deposited on the trays instead of in the boiler itself. In order to increase still further the tractive power afforded, booster cylinders are incorporated in the trailing trucks of No. 700 and No. 6100. This is a valuable feature in starting heavy loads and in ascending steep inclines, the booster being cut out when its assistance is no longer necessary.

Typical features that were common on Canadian and American locomotives of last century may be gathered from the two old 4–4–0's. Perhaps the most striking, especially in the case of "*North Star*," is the enormous chimney, or smoke-stack as it is usually termed. The reason for its gigantic proportions is to be found in the log fuel that is piled high in the tender. In the early days wood was commonly used, and in order to prevent excessive fire-throwing, chimneys of wonderful appearance were provided on many engines. That shown on the engine "*Trevithick*" is another example, and there is perhaps little to choose between the two for their sheer clumsiness. In keeping with the monstrous erection on "*North Star*" is the large lamp placed in front of it. This is supported by an ornamental bracket, for the designers of those early days were keen on decorative details, even if the locomotive as a whole was scarcely handsome. The bell also claims our attention, and both this and its mounting are quite handsome, the bell itself probably receiving a great deal of polishing by the enginemen. The ringing of this bell when passing stations, or traversing the streets of a town, was, and still is, a common custom in America. An interesting comment on the American locomotive bell is found in the diaries of David Joy, who wrote of "that big thing hung at the middle of the boiler and rung on passing every station or town, and on trains meeting, and this was worse. Approaching, the clangour rises rapidly in pitch till it shrieks as the trains pass, and the two mingle their clangs in an inharmonious roar, and then parting die away into a moaning melancholy dirge."

The sand-boxes on each of these engines are placed on top of the boiler barrel. This gives the sand a good fall and, together with the fact that the warm position helps to keep it dry, makes the possibility of failure through blocked pipes remote. The external appearance of the casing and that of the dome cover on the fire-box of "*North Star*" makes them resemble biscuit barrels, except that the dome has a whistle mounted upon it. The lamp on "*Trevithick*" is smaller than that on "*North Star*," and the sand-boxes and dome covers appear more workmanlike. They resemble British practice to some extent, for the sand-box cover looks like an ordinary round-topped dome, and the dome cover is like that on many old British locomotives having a spring-balance safety valve on top. The whistle on "*North Star*" is considerably larger than the usual British "bell" whistle, and in comparison with the shrill note of the latter it emits a mournful hoot not unlike the siren of a steamer. Readers who have heard the early American locomotives that have featured in several "sound" films will have no difficulty in recalling the note. An interesting feature on the two modern locomotives illustrated is that the whistle is placed as far away from the cab as possible, in order to prevent the crew from being inconvenienced by its shriek when the train is travelling at high speed. The whistle is situated at the left-hand side of the chimney, and is seen in the illustration of No. 6100.

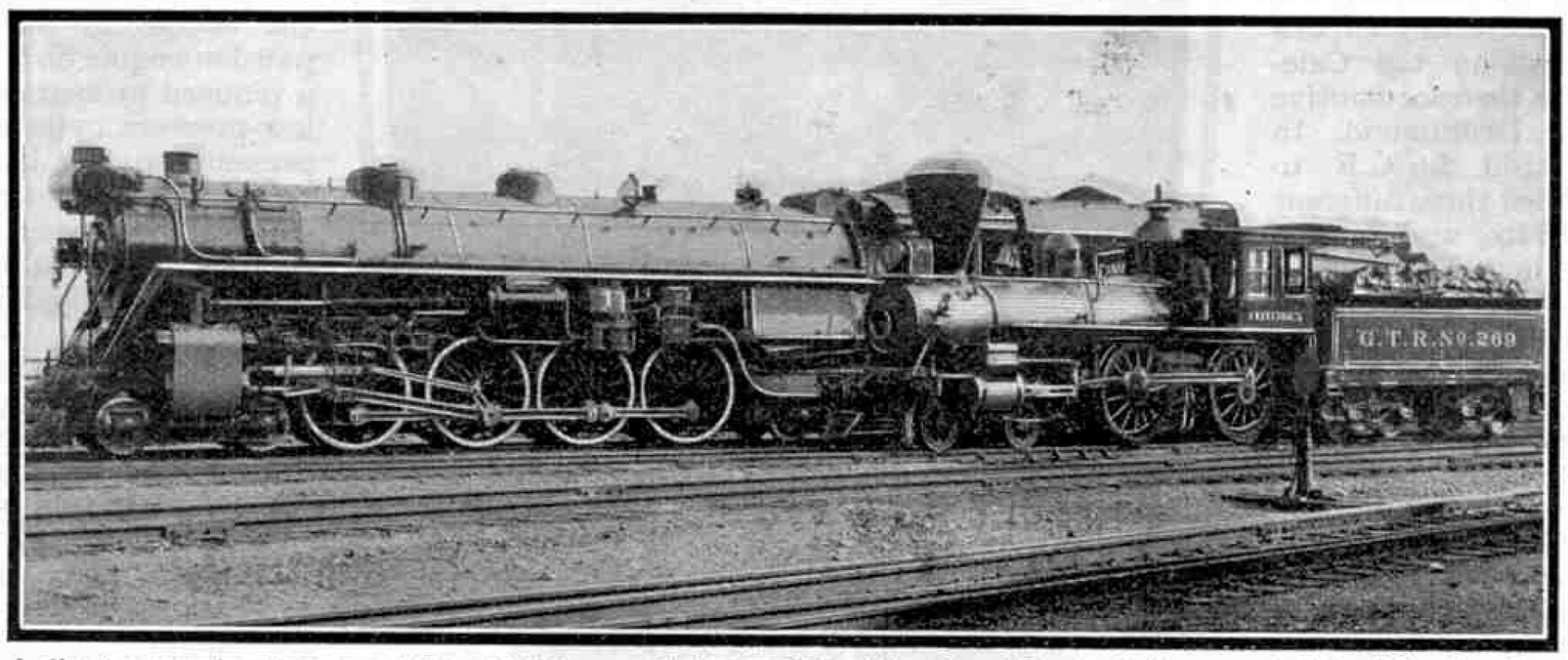
The cab of each 4–4–0 is a quaint structure in comparison with the steel "house" that protects the crew on modern locomotives, but it has the valuable feature that doors are provided for the convenience of the crew if they should require to pass along the running board above the wheels. This was frequently necessary in the early days, for cylinder lubrication was commonly carried out by pouring hot tallow into the steam chest through a suitable valve. To do this the fireman had to walk along the running board to the cylinders, and as a result of his lubricating activities he was known as the "tallow pot." The pilot or "cow-catcher" of these engines is of the light construction common in those days, and very different from the stout built-up or cast framework that is now employed. Typical also of the period are the guards placed over the wheels of "*North Star*."



An old 4–4–0 locomotive of the Central Vermont Railroad, showing many features typical of its period. Wood was used as fuel and the enormous chimney was intended to prevent the throwing of sparks.

The provision of slide valves in rectangular chests on top of outside cylinders and actuated from inside motion by means of rockers was for a long time a standard American feature, and it is clearly shown in "*North Star*." In more recent years the common use of outside motions such as the Walschaerts, Baker and Southern valve gears has, of course, done away with the need for rockers. It is interesting that the Great Western Railway have followed to a great extent the practice of having outside cylinders and valves with inside motion.

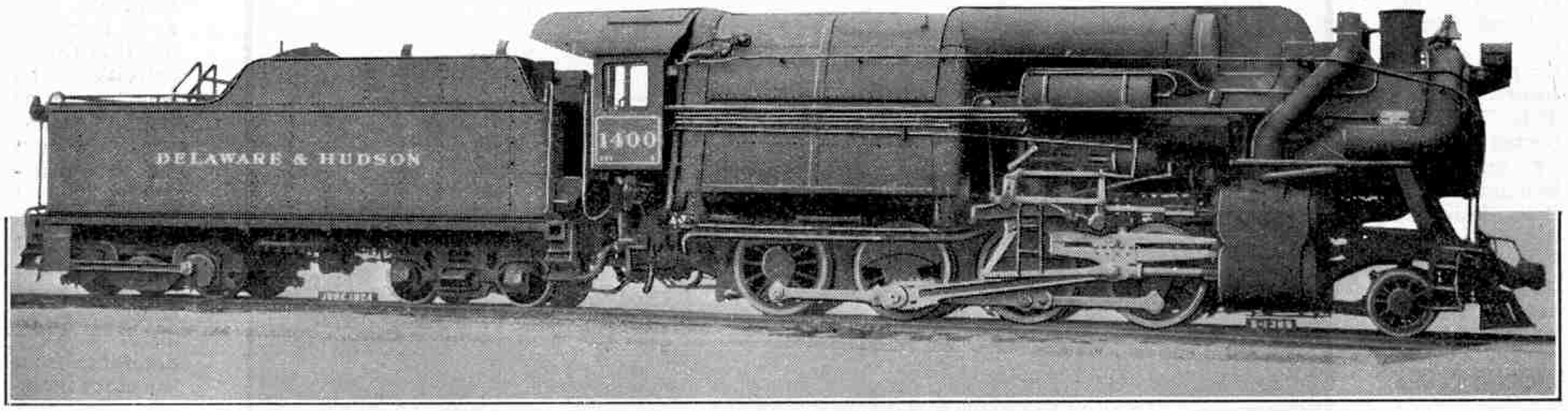
Although the tender of "*North Star*" is carried on bogies it appears to be inadequate to accommodate sufficient fuel to satisfy the demands of the engine, for the wood logs are piled as high as the cab roof. Possibly the result of the fireman's efforts with this fuel account for another nickname applied to him in early days, that of the "smokeboy." The bogie trucks of these two old locomotives appear very flimsy in comparison with the cast steel trucks now commonly used, and as shown under the tender of No. 700. The size of modern tenders and of course their weight make it essential that the running gear should be of substantial construction. Tenders have been improved in no less a degree than locomotives since the days of "*North Star*"; the massive steel tender of No. 700 with its circular tank is very different from the simple timber-framed vehicle behind the earlier locomotive. Steel underframes are now the invariable rule for tenders, while a recent development has been the making of the frame or bed and the tank bottom a single casting. Also in order to dispense with riveting in construction, tenders are frequently welded throughout. The use of welding in railway work generally has made rapid strides during recent years, and some 2–10–2 or "Santa Fe" locomotives recently delivered to the C.N.R. have their cabs built up by welding.



A direct comparison between "Trevithick," an early locomotive of the Grand Trunk Railway, and "Confederation," a modern engine of the Canadian National "6100" Class "Northern" type.

High-Pressure Steam for Locomotives

A Chapter of Railway Progress



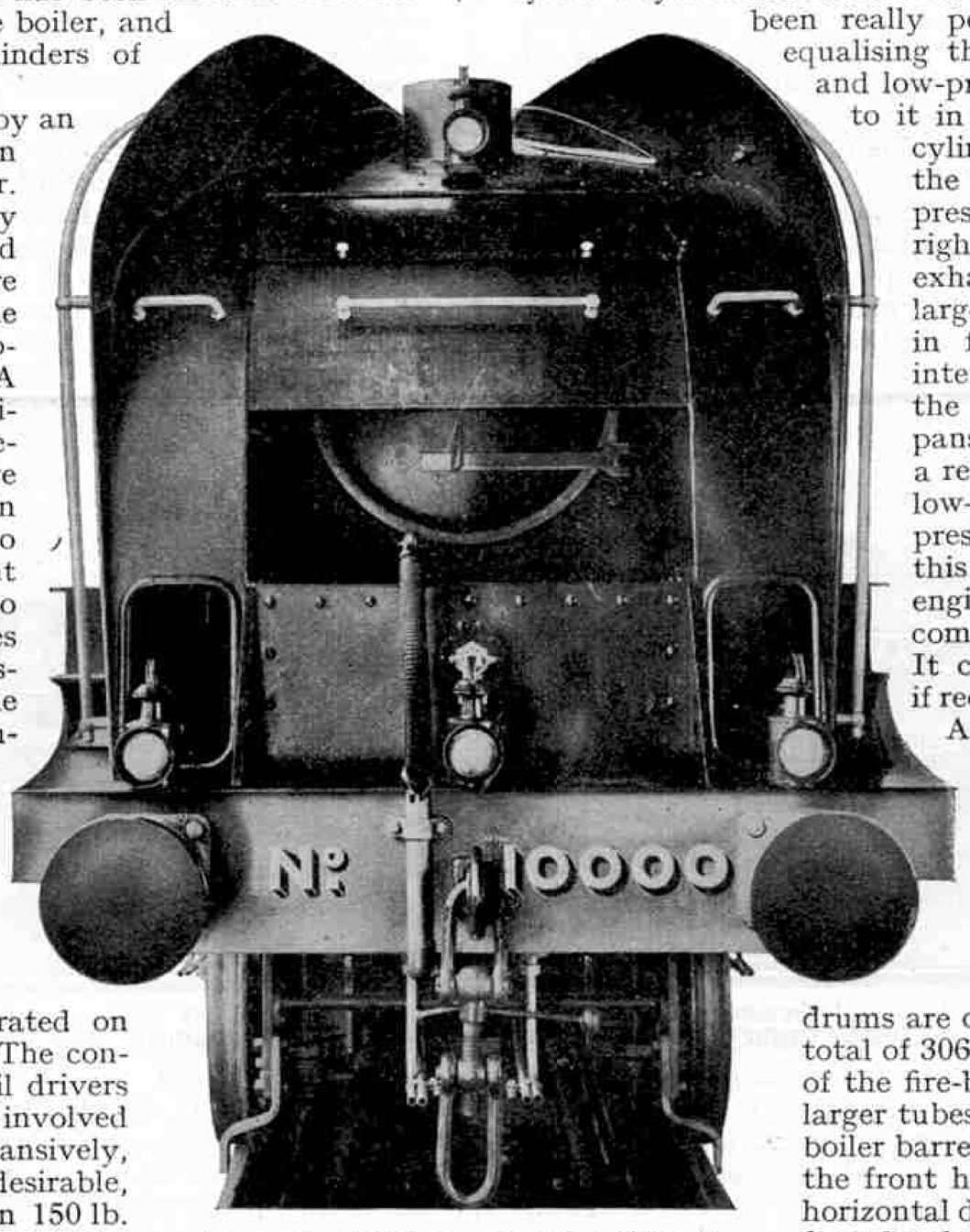
THE constant increase in power demanded of locomotives has resulted in a great deal of experimental work being carried out with the object of improving engine efficiency. The most obvious step is to increase the capacity of the cylinders, but this is of little practical value unless the steam generating power of the boiler is equal to the new demands. Nevertheless this was the course followed by many locomotive engineers during the latter part of last century, until in 1896 the Caledonian Railway, and in 1902 the Great Northern Railway, showed that boilers of large steaming power were not only necessary but practicable. The size of the boiler that can be accommodated above the wheels of an express locomotive of the ordinary type is strictly limited by the loading gauge, and recently attention has been directed towards the use of higher steam pressure in the boiler, and more expansive working in the cylinders of the steam thus produced.

The economy in fuel brought about by an increase in steam pressure has been shown on many occasions. In 1885 Mr. S. W. Johnson of the Midland Railway commenced to use steel for boilers, and thus was enabled to raise the pressure from 140 lb. to 160 lb. per sq. in. The result was a saving in the coal consumption to the extent of 11 per cent. A few years later some interesting experiments were conducted on the Caledonian Railway by the then locomotive superintendent, Mr. D. Drummond. In four engines, the first on the C.R. to have steel boilers, he tried three different pressures, 150 lb., 175 lb., and in two cases 200 lb. per sq. in. The engines were identical except as regards pressure, and they were employed on the same work. Economy in steam consumption was shown in favour of the high pressures, and similarly the consumption of coal in one of the engines with 200 lb. pressure was from 9 lb. to 12 lb. less per mile than was the case with the 150 lb. engine. It is notable also that the highest pressure engines were generally operated on shorter cut-offs than the other two. The conclusion then arrived at was that, until drivers were more familiar with the principles involved in using high-pressure steam more expansively, pressures exceeding 170 lb. were not desirable, but that they should not be less than 150 lb.

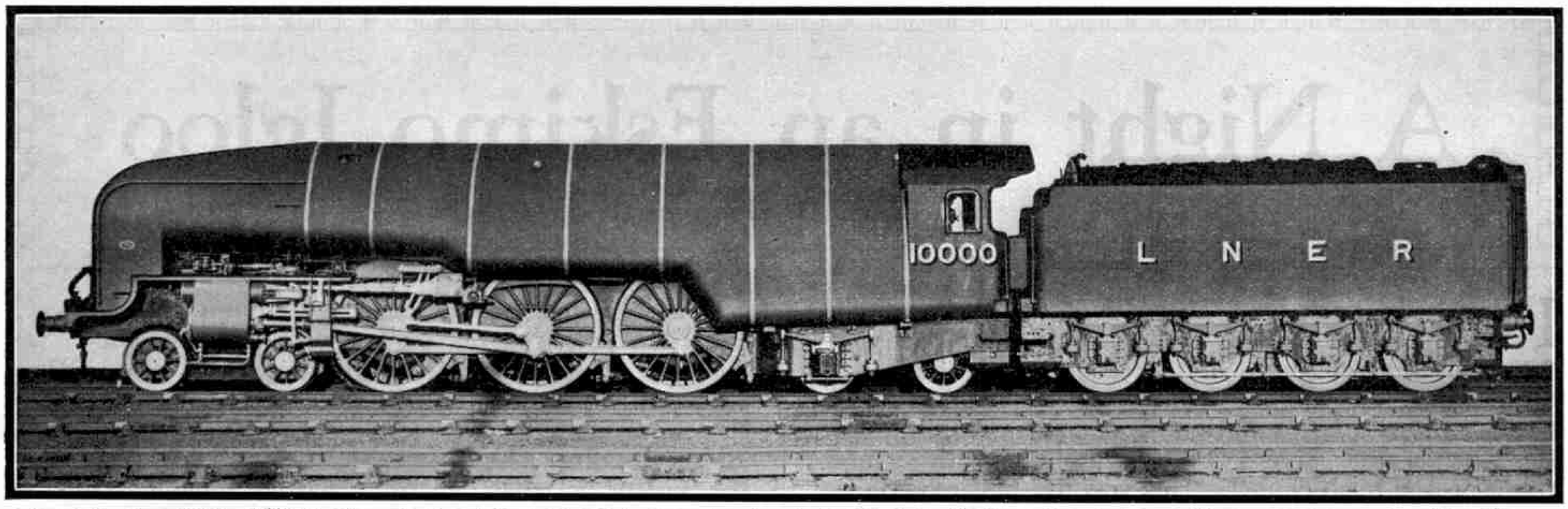
Notable advances have been made recently, and the L.M.S.R. "Royal Scots," the G.W.R. "Kings," and engines on the Canadian and American railways have boiler pressures of 250 lb. per sq. in. The difficulty of using pressures much higher than 250 lb. when the boiler is of the conventional type has resulted in the adoption of various types of water-tube boilers, and in order to obtain the utmost expansion from the steam, compound working has been given a good deal of attention. The Delaware and Hudson Railroad of America have been prominent in this direction, and the locomotive "*Horatio Allen*," No. 1400, aroused widespread comment among locomotive engineers on its appearance in 1924.

The "*Horatio Allen*" is specially interesting in that it was the forerunner of other high-pressure locomotives in America, and in England and on the Continent, and it is also worthy of note that two-cylinder compound working is a feature. Although the two-cylinder system had been used before to some extent, it had never been really popular owing to the difficulty of equalising the work between the high-pressure and low-pressure cylinders, so that the return to it in this engine was remarkable. The cylinders are of large dimensions from the British point of view. The high-pressure cylinder is placed on the right-hand side of the engine, and the exhaust steam from this passes into the large pipe passing over the smoke-box in front of the chimney. A special intercepting and starting valve allows the engine to work as a simple expansion engine on starting, live steam at a reduced pressure passing direct to the low-pressure cylinder. As soon as the pressure in the large pipe builds up, this supply of steam is cut off, and the engine commences to operate as a compound or double expansion engine. It can be worked simple at any time if required.

A water-tube fire-box is used, and consists of two upper horizontal drums and two bottom drums, joining the vertical headers made of plate and stayed. These take the place of the usual throat-plate and back-plate, and are approximately of the usual fire-box shape. The upper and lower drums are connected by vertical water tubes, a total of 306 of these being situated on each side of the fire-box; and there are in addition eight larger tubes between the two upper drums. The boiler barrel is formed in two rings connected to the front header, and above the barrel are two horizontal drums forming extensions beyond the front header of the upper fire-box drums. These extensions are connected to the barrel by flanged plate headers, stayed where necessary. In all cases the drums pass through the headers, but that portion of them between the header



The upper photograph shows the "Horatio Allen," the pioneer high-pressure locomotive of the Delaware and Hudson Railroad. The lower illustration is of the front end of L.N.E.R. "No. 10000," showing how the chimney is sunk within casing plates.

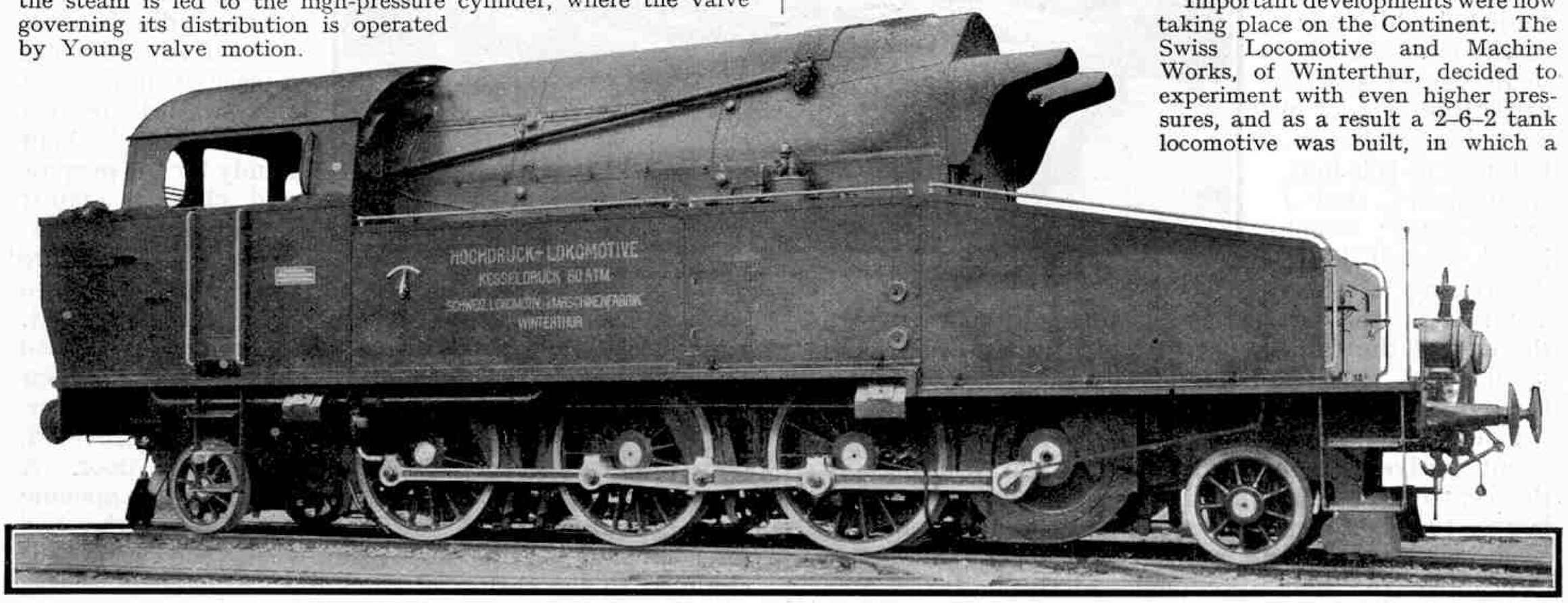


A broadside view of "No. 10000." The extension of the lagging plates to enclose the whole of the boiler, fire-box and smoke-box, and the apparent suppression of the chimney, give the locomotive a remarkable appearance. The engine has taken its turn in working famous L.N.E.R. expresses.

plates is liberally provided with holes. The ends of the drums are formed of dished plates with flanged openings, each closed by a manhole cover and cross-bar.

Steam is taken from both extension drums to a Y-shaped collector casting situated between them. The injectors and the steam turret in the cab are supplied from this collector. The main steam pipe runs forward from it to a duplex Chambers throttle, placed on top of the barrel near the end of the drums. The two throttle valves are controlled by the same lever in the cab. The first admits steam at 300 lb. pressure to the cylinder; the second, which comes into operation later, allows steam at the full 350 lb. pressure to pass to the superheater header situated over an opening in the top of the smoke-box behind the chimney. A very high degree of superheat is not used, as it was not considered advisable until more experience of such a high working pressure as 350 lb. had been gained.

The superheater consists of 42 elements, each of spiral form from the front end to near the fire-box tube plate. Here they double back and become straight, returning to the smoke-box through the centre of the spiral. This method increases the heating surface of each element, and in addition to other advantages reduces the stresses due to expansion. After passing through the superheater the steam is led to the high-pressure cylinder, where the valve governing its distribution is operated by Young valve motion.



The 2-6-2 high-pressure design of the Swiss Locomotive and Machine Works of Winterthur. The strange outline makes it look more like an electric than a steam locomotive.

The pipe through which the steam passes from the superheater is clearly shown in the illustration. The tender, it will be noticed, is provided with booster gear on the rear truck. This is a feature of special value for a locomotive working under the difficult conditions of American freight service.

The "*Horatio Allen*" gave satisfactory results, and showed a high overall efficiency. The evaporating power of the boiler and the relatively low consumption of fuel were marked features, and in addition a good distribution of work in the high-pressure and low-pressure cylinders was realised. The performance of the locomotive led the Delaware and Hudson Railroad to design a similar engine, incorporating certain modifications chiefly with the idea of reducing weight and improving the accessibility of the fire-box tubes. This took shape in 1927 as the "*John B. Jervis*," No. 1481, and like its predecessor it was built by the American Locomotive Company to the designs of Mr. J. E. Muhlfield.

In this locomotive the same cylinder and wheel arrangement are employed, but a higher boiler pressure of 400 lb. is used, as no particular trouble had been experienced with 350 lb. in the earlier engine. The cylinders throughout are somewhat smaller, so that the power developed should not be excessive for the available adhesion weight. The grate area is increased and the water-tube system is rearranged; while the superheater is increased in size in order to give a higher degree of superheat. Walschaerts valve motion replaces the Young type, and the appearance of the locomotive as a whole is a great improvement on that of the earlier one, as the boiler clothing covers practically all the projecting parts that are so noticeable in the "*Horatio Allen*." The reduction in weight amounts to rather more than five tons. The smoke-box arrangements are modified, and the tender, booster fitted as before, has six-wheeled trucks.

In the meantime the Baldwin Locomotive Works produced a high-pressure 4–10–2 locomotive in 1926. This has three cylinders arranged for compound working, and the boiler pressure is 350 lb. per sq. in. A water-tube fire-box is used as in the case of the Delaware and Hudson engines, in order to eliminate any possibility of trouble with stays in a fire-box of normal design.

Important developments were now taking place on the Continent. The Swiss Locomotive and Machine Works, of Winterthur, decided to experiment with even higher pressures, and as a result a 2–6–2 tank locomotive was built, in which a maximum working pressure of 850 lb. was aimed at, with an average pressure of about 700 lb. A high-speed three-cylinder uniflow engine was incorporated, driving the six-coupled wheels through reduction gearing and a jack-shaft and side rods. An advantage of the geared arrangement is that a standard engine may be fitted with different gearing suitable for goods or passenger services as required. In addition, irregularity of drive is much reduced as compared with the ordinary type of locomotive.

The admission of steam in this locomotive is controlled by cam-operated single-seat valves, six different cams being available for forward and reverse running. The exhaust is governed by the pistons themselves moving on the exhaust ports arranged in the central portion of the cylinder liner. A water-tube boiler composed of a top drum and two bottom drums connected by water-space walls is used, and placed directly on the (*Continued on page 113*)

A Night in an Eskimo Igloo

By R. H. G. Bonnycastle

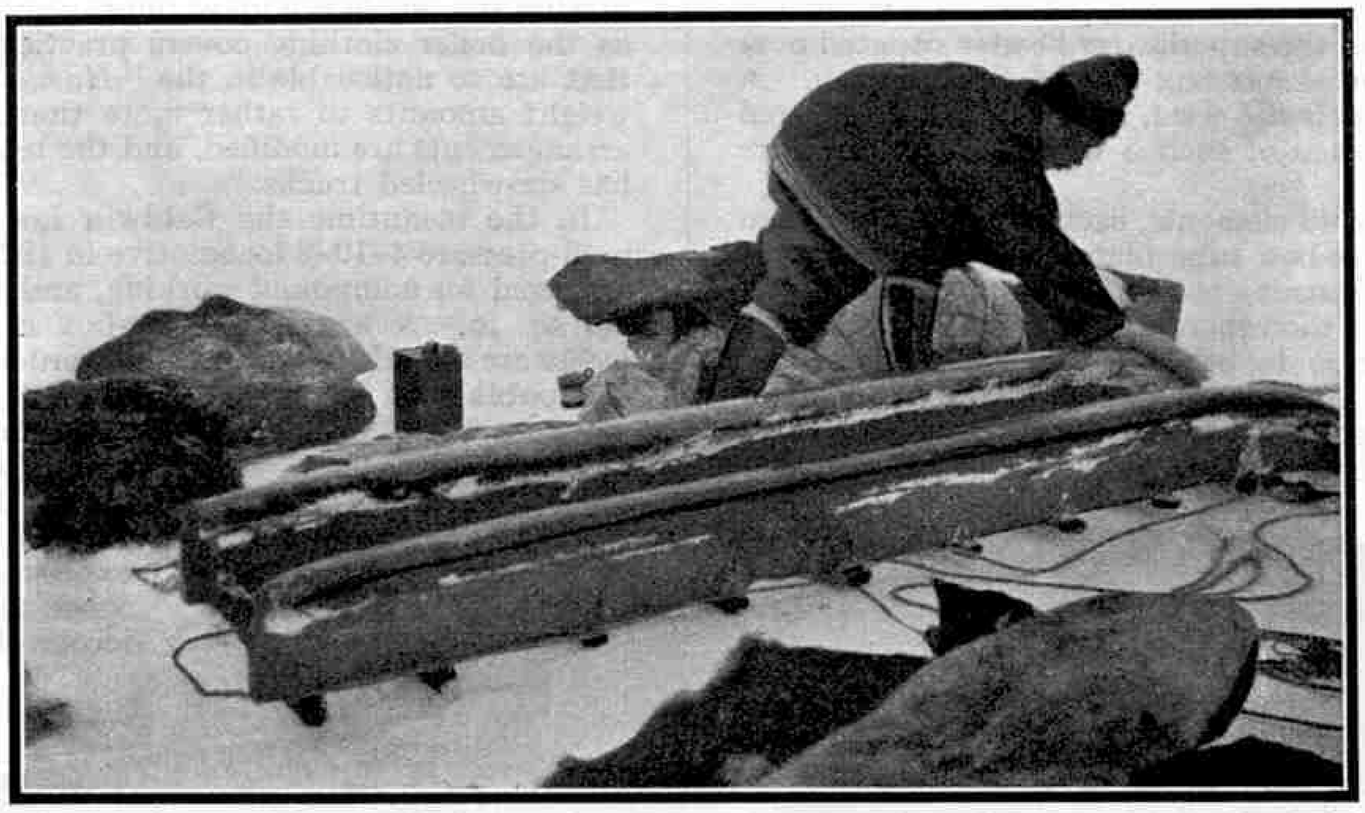
IT was after dark on a March night when three dog trains, accompanied by their Eskimo drivers, wives and children, and myself, approached their destination, an Eskimo winter encampment on the frozen waters of Coronation Gulf near the mouth of the Coppermine river. Fairly familiar with winter travel in the bush country, this was my first experience of the barren Arctic Coast in winter. From what I had read and heard, I anticipated that a few indistinct mounds in the snow would indicate our arrival at the snow village, and was amazed, as we rounded the rocky bluff of an island, to see a cluster of bright lights in the darkness, apparently suspended in mid-air. At sight of these, the dogs broke into a gallop, each team heading for one particular light, and at the same time small, dark objects came running towards the sleds. The lights came from seal oil lamps shining through the ice windows of snow houses, and the dark objects were children running out to meet the sleds returning home from the trading post.

My own particular guide halted his team at the entrance to a small tunnel several yards from a knot of lighted snow houses. Pointing to this hole, he indicated that I should enter; which I did, on all fours. Progressing a short distance in this undignified manner brought me to the end of the tunnel, out of which issued three very small holes. I entered the left-hand one, and wriggled through.

I now found myself in a most commodious igloo, about twelve feet in diameter and eight feet high in the centre. It was well illuminated by two seal oil lamps, the light being reflected and intensified by the clean, white walls and roof. A platform, about two feet above the floor, occupied exactly half the area and was covered with deerskins. Blankets and bedding were rolled back on it, against the wall. Other furniture consisted of a board resting on snow blocks acting as a table, two half-moon shaped stone lamps, each on a snow platform and with a sort of scaffolding erected over them made of bits of willow. Pots were suspended from this willow frame and odd garments spread on top to dry. A sort of reservoir, built of snow, against the wall, acted as a receptacle for scraps, and everything seemed clean.

I seated myself on the edge of the sleeping bench, for such was the platform, and removed my outer deerskin garments, which the woman of the house carefully brushed free of snow, folded and stowed away. She then prepared tea over a primus lamp, which we all took, together with hard-tack and jam. Other people—men, women and children—visited us, crowding the snow house and gratefully accepting a cup of tea and a biscuit. They came and went, freely discussing the visitor in their guttural native tongue. On the occasion of a second visitation, the good housewife produced a fine, raw, frozen salmon, which she cut in pieces, one for each person. This everyone ate in their fingers, first tearing off the skin with their teeth. It is a favourite article of diet for these people, and contrary to my expectations, tasted not unpleasant.

By and by, with so many people in the igloo, which, of course, is constructed entirely of snow (not ice, as many think), the temperature began to rise, the weather being comparatively mild in any case. The result was that the snow roof started to drip in places, and I soon felt a trickle of cold water run down the back of my neck. I was much interested in my host's remedy for this discomfiture when I saw him cut a piece of snow about the size of his fist from a block kept handy for the purpose and clap it against the moist spot overhead. The moisture caused the block to stick and further drops, if any, were absorbed by it.



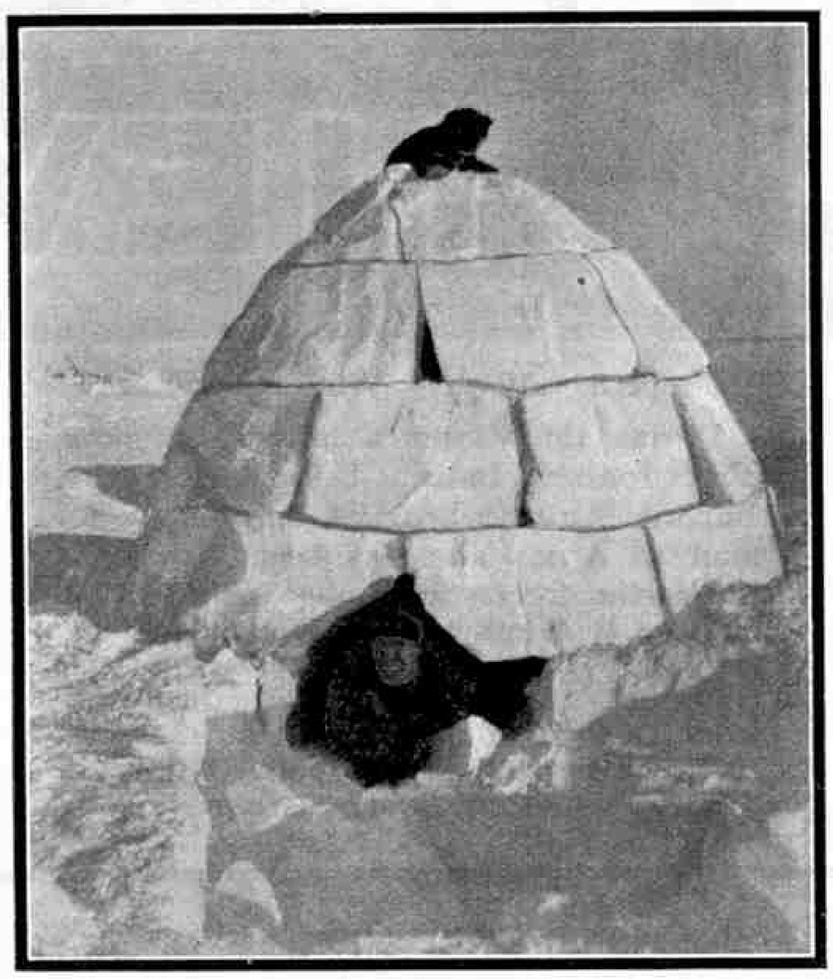
An Eskimo Icing-Over the Mud Runners of his Sled.

About 11.30 p.m., I wanted to sleep and indicated this by signs. Immediately all guests took their departure, first prostrating themselves on the floor, not from any sense of deference to myself, I discovered, but simply to get on even terms with the door. A nicely fitting snow block was then placed in this opening to keep out the cold, also inquisitive dogs, who had already paid several scavenging visits and were thus confined to the shelter of the entrance porch or tunnel leading from the igloo itself to the outside. Bedding was spread out on the sleeping platform. The seal oil lamps were extinguished, and soon the family and I were settled in our respective sleeping bags, warm and comfortable. Before dropping off to sleep, I pondered the amazing character and resourcefulness of the people who live this life.

These Eskimos had spent the previous few years back from the Arctic Coast, in the Barren Lands, where they hunted deer, living in tents of skin or canvas in the summer and in snow houses in the winter. Each year in March or April, they were accustomed to pay a brief visit to the Hudson's Bay Company trading

post at Kugaryuak or Fort Hearne to secure their limited requirements of ammunition, tea, tobacco and other odds and ends, returning immediately afterwards to the interior. This year the deer hunt had failed, and they sought the coast in January in order to seal on the ice, which was their occupation when I visited them. They are not great hunters of foxes and bother themselves very little with trapping or white man's goods, provided they can get plenty of their native foods—deer, fish and seal. They live happily together, having developed the community idea to a high degree.

Chief amongst the many things which amaze a newcomer is the extraordinary efficiency of their snow houses, mud sleds and seal oil lamps. Scarcely anything civilization produces can compete with these three phenomena in their own field. The snow houses cost nothing to build, the only tool necessary is a snow knife, while the only material (snow) is available in large quantities all winter. No portable dwelling could be so comfortable or so well adapted to requirements. The sled, or *kometik*, which is made of two long planks on edge with cross-pieces lashed on top, is equipped by its ingenious owner with mud runners, extraordinary as this may sound. The sled is turned upside down, and nice pliable mud, like Plasticine, previously thawed over a Primus lamp, is stuck along the entire length of the runners. This freezes solid, when, with the aid of a plane or rasp, it is made level and smooth. Next, a piece of bearskin is moistened with water and brushed along the surface of the mud, leaving a film which immediately becomes ice. This is repeated until there may be a quarter of an inch of ice covering the mud, giving an ivory-smooth finish with a minimum of friction on snow. The sled is then uprighted and ready for loading up. Enormous loads can be hauled with little effort on account of this lack of friction. The ice wears off and is renewed daily, or sometimes oftener, but the mud sticks on wonderfully provided bare rock and gravel are avoided. If a piece comes off, it is carefully preserved, thawed out and replaced.



An Amateur Effort at Building an Igloo !

Much could be written about the seal oil lamps. The lamp itself is fashioned of soap-stone. The oil used is secured from the seal, which also provides food and clothing. The wick is moss gathered in swampy places. Everything is home grown, so to speak, and the result provides light and heat for the igloo. Pondering these things in my mind, I soon dropped off to enjoy my first night's rest in an igloo.

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High Pressure Steam—(*Continued from page 111*)

frames. The combustion chamber is boxed in by the tube elements. The gases pass a water-space wall and reach the superheater and feed-water preheater, which are situated in the boiler flue in front of the fire-box. They are then exhausted in the usual manner by the blast. Air for combustion is taken in by two cowls in the front of the smoke-box, is preheated and led to the grate from below. Exhaust steam is used for the feed-water preheater, the rest passing to the atmosphere. A pump forces water into the feed-heater, whence it passes to the main heater, and so to the top boiler drum.

In 1928 comparative tests between this locomotive and an ordinary superheated locomotive showed an economy of approximately 40 per cent. in coal and 50 per cent. in water, in respect to the indicated horse-power per hour, in favour of the high-pressure design.

In England in 1924 Mr. H. N. Gresley, Chief Mechanical Engineer of the L.N.E.R., approached Mr. Yarrow of the well-known firm of water-tube boiler makers regarding the design of a type of water-tube boiler suitable for locomotives. In 1927 a joint patent was taken out, and in the following year a boiler was ordered from Yarrow & Co. Ltd. This was applied to the four-cylinder compound 4-6-4 locomotive "No. 10000," the engine portion of which was built at the Darlington Works of the L.N.E.R. This locomotive is remarkable not only because of its working pressure of 450 lb., and numerous special features, but also on account of its unusual appearance. When viewed broadside-on, there is apparently no chimney! The chimney actually is situated between the smoke deflecting plates at the front end, and as these conform to the general contour of the boiler lagging, and no fittings project on top of the boiler, the general effect is rather forbidding. The contour of the lagging was settled from experiments with a model, the idea being to prevent the exhaust from the chimney from obstructing the driver's view.

A separate cut-off in the high-pressure and low-pressure cylinders is afforded by means of a special arrangement patented by Mr. Gresley. Two sets of Walschaerts valve gear are placed outside the frames and operate the low-pressure valves direct, the motion to the inside ones being transmitted by rocking shafts. Various minor alterations have been made as a result of experience. The high-pressure cylinders have been reduced in diameter, and the superheater has been modified, as the degree of superheat was found to be excessive. The rear end of the locomotive is carried on a booster-driven pair of trailing wheels running in Cartazzi axle-boxes in outside frames, and an additional pair of wheels mounted in a Bissel truck.

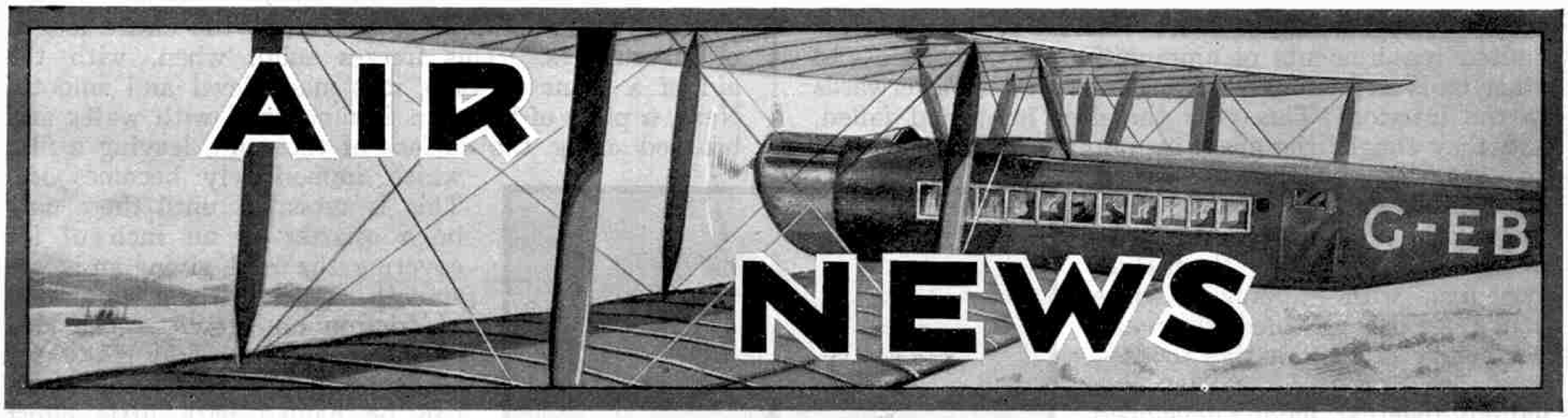
An interesting point is that the chassis of the engine as a whole, except for special features necessary in the design, is little different from that of the ordinary Gresley "Pacifics." Therefore, if the water-tube boiler justifies itself, the conversion of the ordinary engines to this system would not be unduly costly. This is an important point, for any new design, no matter how great its merits, would be at a serious disadvantage if its application involved the wholesale condemnation of existing types, or if its introduction could only be made as these became withdrawn. "No. 10000" has been employed on a variety of important duties on the L.N.E.R.

Still higher pressures are employed in a three-cylinder compound locomotive built by the Berliner Maschinenbau A.G. for the German State Railways. This is a "Pacific" working on the Schwartzkopff-Löffler system. The principle of this consists essentially in evaporating water to steam in a non-fired boiler and steam drum by a stream of superheated steam. The system is very suitable for locomotive work, as it is economical at high pressures, and overcomes the difficulty of boiler scale.

Nation's History—(*Continued from page 91*)

The granite weathers to a pleasing brown colour, free from stains, and it is estimated that the memorial will endure for 500,000 years before it is effaced by erosion.

The work on the cliff calls for real steeplejack methods, practically all the operations being carried on by men suspended in harness devised by Mr. Borglum. Each harness is suspended on a wire cable from a winch in a shed on the top of the cliff, and bears a number. When a workman wishes to be moved up or down he calls out his number and gives his directions, and the winch controlling his cable is manœuvred accordingly. The men get to and from their labours by means of a footpath and a wooden stairway that lead up a ravine and from there up the rear of the cliff. An electrically-operated tramway, 1,300 ft. in length, transports drill steel and other supplies to the work from the valley below.



Hinkler's Atlantic Flight

The first eastward flight across the South Atlantic Ocean was made recently by Sq. Ldr. Bert Hinkler, the famous British airman who was the first to fly to Australia in a light aeroplane. His flight from South America to Africa was made in a de Havilland "Puss Moth," which usually is regarded as a light aeroplane. No official claim for a record in this class can be made, however, for the machine slightly exceeds the limits imposed by the Federation Aeronautique Internationale, the body that examines all claims for records in aviation.

The Atlantic flight was one of a series of remarkable solo flights made by Sq. Ldr. Hinkler. The first of these was made in October, 1931, when he flew non-stop from New York to Jamaica, a distance of 1,600 miles. He then flew on to Brazil, and on 25th November left Natal on a flight to the African coast, a distance of about 2,000 miles. After a crossing occupying about 22 hours he landed at Bathurst, Gambia, and later flew to England in stages, arriving at Hanworth on 5th December, 1931.

Sq. Ldr. Hinkler did not fit floats to his machine for the flight across the Atlantic. He encountered heavy clouds and lightning storms while crossing the ocean, but his skill in navigation brought him safely to the west coast of Africa at a point within 10 miles of his destination. He has been awarded the Gold Medal of the Royal Aero Club.

Hinkler's next big flight probably will be one round the world.

Mapping the Nile Valley from the Air

An area of 11,000 sq. miles in the valley of the upper Nile has been mapped from the air, the work being carried out by means of two Fairey machines equipped with air survey cameras. If carried out by older methods the survey would have taken several years to complete, and would have cost £60,000 more to effect.

Imperial Airways Winter Services

During the winter a faster and more direct route to India is being operated by Imperial Airways Ltd. A mid-weekly air mail to Africa also has been organised.

A further interesting change is a reduction in fares that has made travel cheaper by air than by the fastest rival surface transport. For example, the fare by air from England to Kenya is only £92, while to travel by surface transport would cost £100. In addition, there is a saving of time of 21 days. Similarly the fare by Imperial Airways from Croydon to Egypt is £38, which is £14 less than that by boat, while the journey occupies two days less. An even more remarkable instance is the air journey from England to Khartum, which costs £23 less than the expense of travel by boat and train.

Front view of the two-seater cabin type of the Cierva "Autogiro" constructed by the de Havilland Aircraft Co. Ltd., and described on page 27 of last month's issue. For permission to reproduce this illustration and the lower one on the opposite page we are indebted to the courtesy of the Cierva Autogiro Co. Ltd.

England's First Air Beacon

A beacon recently installed on the roof of a store in Manchester is the first to be erected in this country. It is carried on a steel tower, the top of which is 165 ft. above the level of the pavement and 315 ft. above sea level. The beacon has a central section consisting of 25 neon tubes each 12 ft. in length, and below this there are 36 smaller tubes arranged in circular formation. The beacon has an intensity of 20,000 candle-power, and in normal conditions is visible for 60 miles. It is automatically switched on at sunset and similarly extinguished at sunrise.

A powerful searchlight eventually will be fitted to the beacon. This will point in the direction of the Manchester Airport.

Aeroplane Becomes Flying Menagerie

When a goods-carrying machine alighted at Croydon airport recently it was discovered that its freight compartment had been temporarily transformed into a flying menagerie and contained parrots, monkeys and a bear, together with a number of tropical fish in tanks. On another occasion the occupants of an aeroplane were several live alligators, travelling in special crates; while officials were once called upon to install in a freight machine a den in which a fully-grown lion, accompanied by its trainer, could be brought from the Continent to London in order to take part in a circus performance. Even horses may be carried by air, a valuable animal having recently been brought to this country from abroad in a cargo machine.

More common travellers than the animals and birds already mentioned are day-old chicks. Consignments of these are often placed in machines leaving Croydon early in the morning, this time being chosen to enable them to reach Continental destinations in a day's flight. Recently 2,000 chicks were flown in a single consignment from this country to Roumania. Other travellers by air have included dogs, cats, mice, turkeys and bees.

A special department has been established by Imperial Airways to deal with this growing form of aerial traffic. Arrangements are made to ensure that animals make their journeys in a minimum of time, and they receive individual care and attention while in transit.

The Junkers G.38 Mark II

The next machine of the G.38 type constructed by the Junkers-Flugzeugwerke A.G., is to accommodate 30 passengers and employ four 800 h.p. Junkers L.88 engines. It will carry a load of about one ton more than the early type, and the cruising speed will be raised from 110 m.p.h. to 115 m.p.h.

New D.H. Machine for Royal Air Force

Some years ago the de Havilland Aircraft Company constructed a small low wing racing monoplane on which a world's speed record for light aeroplanes was established. This aeroplane was called the "Tiger Moth," but it was never put into production. The name has now been applied to a new machine designed for use in the Royal Air Force, and thus its use is in accordance with the scheme of the Air Ministry, in which the names of all training machines begin with "T."

The new machine is fitted with an inverted "Gipsy III" engine. It is very similar in general appearance to the ordinary "Moth," but a different system of wing bracing is used and access to the front cockpit has been improved. The "Tiger Moth" also differs from other D.H. light machines in that its wings do not fold. This would be a serious disadvantage for a private owner, but is of no great importance in a Royal Air Force machine.

The span of the "Tiger Moth" is 29 ft. 4 in. and the machine is 23 ft. 11 in. in length. The maximum gross weight allowed for normal work is 1,825 lb., but may not exceed 1,650 lb. if a certificate for aerobatics is desired. The machine has been so designed that it can be employed for a variety of purposes, including training, reconnaissance work and long range light bombing. When loaded to a gross weight of 1,643 lb. the maximum speed at sea level is 109.5 m.p.h., while at 15,000 ft. this drops to 85.5 m.p.h. The stalling speed is 46.5 m.p.h. and the machine climbs at sea level at a speed of 700 ft. per minute; while the climb to 15,000 ft. is completed in 54 min.

The New Grid Searchlight

A remarkable new form of searchlight for use in detecting air raiders at night has been invented by Major Savage, the originator of skywriting. The preliminary search for an enemy bomber is carried out by means of a single beam of light that cannot be seen by the pilot of the bomber until his machine is lit up by it. When that happens other beams are switched on. These give a rectangular grid pattern when they are projected on to a cloud, and the rays form a huge network from which an enemy cannot escape without being seen. The height and speed of a machine crossing the network can be calculated from the time taken to travel between the bars of light.

The apparatus devised by Major Savage can be carried on a lorry. An electric light of 3,000,000 candle-power is employed, and the beams are sufficiently powerful to illuminate machines at an altitude of 15,000 ft. It is interesting to note that the device may be used also to project words and short sentences into the sky, and thus is admirably suited for advertising purposes at night, when ordinary skywriting is invisible.

Another view of the cabin type of Cierva "Autogiro" shown opposite. This machine is fitted with a D.H. "Gipsy" Mark III inverted engine and has a cruising speed of 100 m.p.h. The upper illustration shows pilots of the U.S. Army Air Corps equipped for work at an altitude of five miles. The men breathe by the aid of oxygen apparatus and communication is maintained by wireless. Official photograph, U.S. Army Air Corps.

Automatic Fire Extinguisher for Aircraft

It is claimed that the danger of fire in aeroplanes may be avoided by the use of an extinguisher produced by J. Blakeborough & Sons Ltd., of Brighouse, Yorkshire. This automatically sprays a fire-extinguishing chemical over various parts of an aeroplane immediately there is a slight increase in temperature inside the machine, and also comes into operation in the event of a crash.

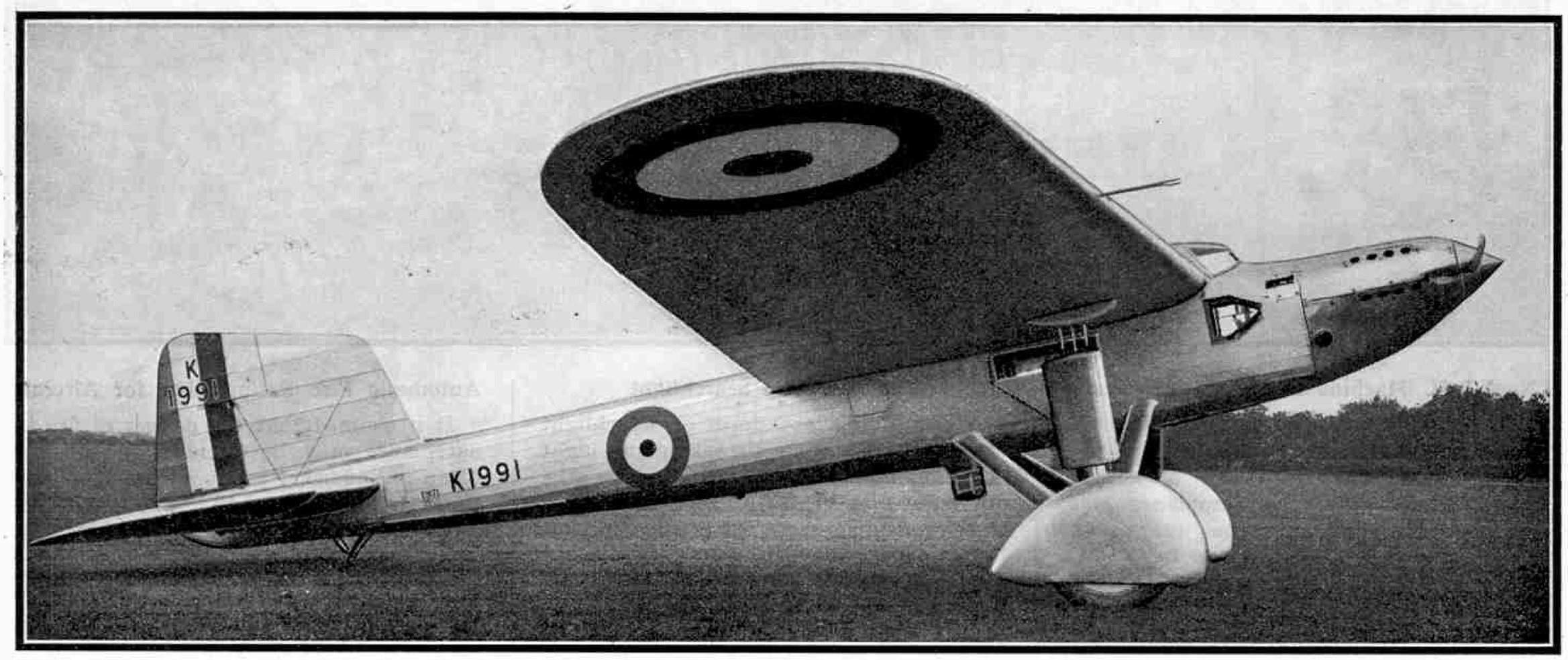
The chemical employed in the extinguisher is methyl bromide, a liquid that is readily vaporised. It is stored in a lead box carried inside a metal cylinder that also contains a supply of compressed air. Automatic switches, consisting of metallic strips that make contact when expanded by heat, are fitted throughout the machine. If fire breaks out in any part, therefore, at least one switch is closed, and this causes an electric current to operate a relay that plunges a needle into the box containing the methyl bromide, which is ejected by the compressed air and pours out of nozzles situated in various parts of the machine.

In the switch that acts in the event of a crash, the contact points are held apart by a balanced mechanism that is disturbed when the machine hits the ground.

When the apparatus was being tested by the Air Ministry a special metal tray was loaded with cotton wool over which 60 fluid ounces of petrol was poured. This was allowed to burn for ten seconds and then the extinguisher was brought into action. This put out the blaze in 21 seconds, and less than one quarter of the methyl bromide in the container was required.

The Fairey Long Range Monoplane

British Machine to Attempt Record Flight



THE two world's aeroplane records that are valued above all others are those for speed and endurance. They can only be secured with the aid of machines of outstanding excellence, and efforts to establish them are of the greatest value in showing how the general design of aircraft may be improved. The speed record is already held by Great Britain, Flt. Lt. G. A. Stainforth reaching the amazing speed of 407.5 m.p.h. in a Vickers-Supermarine Rolls-Royce S.6B seaplane in September of last year, and a determined effort now is to be made to secure the endurance record for this country.

A splendid long distance flight was made by two French airmen, MM. Costes and Bellonte, who in September, 1929, flew a distance of 4,912.4 miles in a straight line. The machine they used was a Breguet "Superbidon" fitted with a 600 h.p. Hispano Suiza engine, and they flew from Le Bourget to Moulart, China. This record has been surpassed by two Americans, Russel Boardman and John Polando, who in July, 1931, flew from New York to Constantinople, a distance of 4,999 miles, and this effort is now recognised as the official record.

The British attempt on the world's endurance record is to be made in a machine built for the Air Ministry by the Fairey Aviation Company Ltd. The aeroplane will be piloted and navigated by two officers of the Royal Air Force. They are Sq. Ldr. O. R. Gayford, D.F.C., and Flt. Lt. D. L. G. Bett, who will try to reach Capetown, about 6,000 miles from Cranwell, their starting point in Great Britain. These officers already have made a preliminary non-stop flight to Egypt in the machine. They left Cranwell at 7.0 a.m. on Tuesday, 27th October, and flew across France and the Mediterranean Sea to Tunis. Turning eastward, the flight then was continued to Abu Sueir Aerodrome in Egypt, where a landing was made at 2.15 p.m. on Wednesday. The distance covered during this flight was 2,857 miles, and the route followed was selected in order to give the pilots an opportunity of navigating their machine with the aid of the stars that will be used on their flight to South Africa.

The Fairey machine in which the attempt on the record is to be made is a development of the long range monoplane built by the same firm in 1928. This was briefly described on page 386 of the "*M.M.*" for May, 1929. Piloted by Sq. Ldr. A. G. Jones-Williams, M.C., and Flt. Lt. H. Jenkins, O.B.E., D.F.C., the original Fairey monoplane made in April, 1929, the first non-stop flight between this country and India. In the following December an effort was made to fly non-stop to Capetown in an attack on the existing long distance record. Unfortunately the machine was wrecked in Tunis during a storm and the two pilots were killed.

In external appearance the new machine differs little from the old one, the chief alteration being the fitting of streamlined nacelles over the wheels. The practice of fitting "spats," as these are called, is becoming popular in aeroplane design, and by following it the speed of the Fairey monoplane has been increased by two miles per hour.

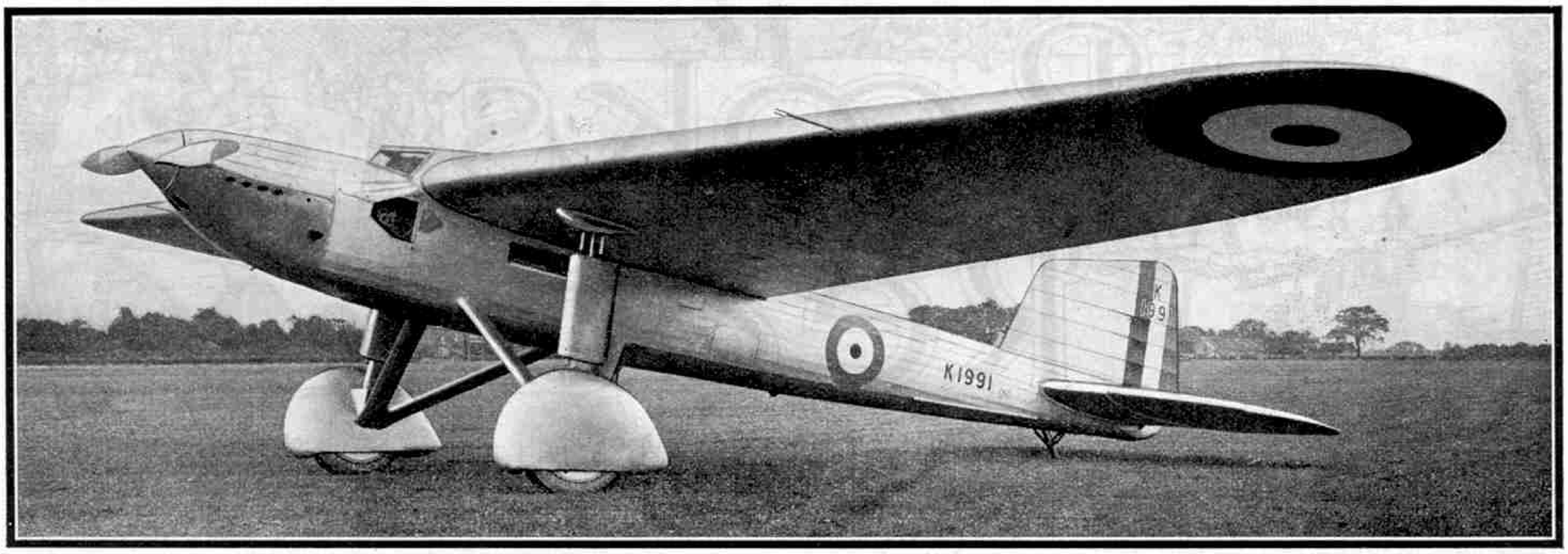
The machine resembles its predecessor in being a pure cantilever monoplane. It is 48 ft. 6 in. in length and 12 ft. in height. The wing has a span of 82 ft., and is tapering, both the thickness and width, or chord, decreasing towards the tips. It is covered with fabric and special internal bracings are employed to strengthen it in order to avoid trouble due to twisting that has been experienced with other machines of this type that had no solid wing covering. Tests have shown that the wing possesses a high lift coefficient.

The illustration above shows the Fairey Long Range Monoplane, the machine in which a non-stop flight to Egypt was made on 27th October of last year. This was a preparatory flight carried out during preparations for a longer one to Capetown, when it is hoped to establish a world's record for distance flown in a straight line. The machine is described in this article. We are indebted to the courtesy of the Fairey Aviation Company Ltd. for permission to reproduce the illustrations.

The tail of the machine is also of the cantilever type and the only external bracing wires about the machine are those supporting the fin. The undercarriage has been made wide in order to give stability on the ground and the wheels and tyres are specially strengthened. As the take-off with a heavy load of petrol requires a long run, the wheels are specially mounted on roller bearings.

A totally enclosed cabin has been fitted and provision is made for cleaning the windows from inside. Triplex glass is employed and the windows may be opened for ventilation purposes. Special attention has been paid to the view from the cabin and to other navigational requirements. A drift sight can be fitted in the floor of the cabin and a hole in the roof makes it possible to take sextant readings when necessary to check the course.

In view of the lengthy flights to be made in the machine, special attention has been paid to the comfort of the occupants of the cabin. The pilot's seat is adjustable and the rudder bar is fitted with footplates lined with sorbo rubber instead of the customary small pedals. The pilot off duty is provided with a deck lounge



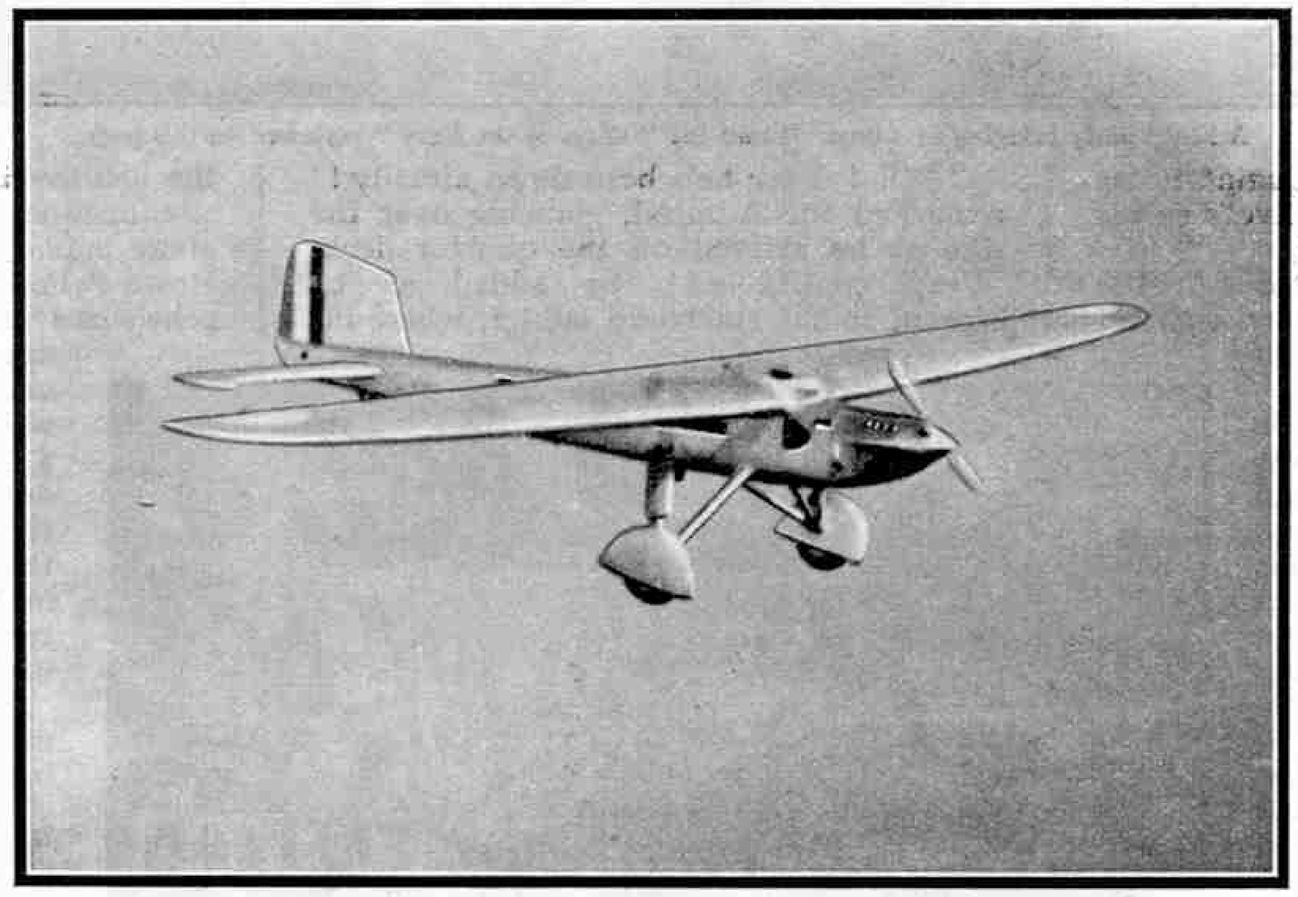
Another view of the Fairey Long Range Monoplane. The fitting of " spats " to this machine has slightly increased the weight but has increased the speed by two miles per hour. A 530 h.p. Napier engine is fitted.

chair that is equipped with padded neck and knee rests. In this he may sleep or sit while working at navigation or other duties. A folding table also is fitted and hot and cold drinks are carried in the cabin in addition to an ample supply of food. During night flying, special flashlamps fitted to the spar behind the pilot's seat are employed to illuminate the instrument board.

The machine is fitted with a 530 h.p. Napier " Lion " engine. This is practically of the normal service type but the carburetter has been specially tuned in order to keep down fuel consumption and pistons giving a slightly higher compression ratio have been fitted.

More than 1,000 gallons of fuel may be carried in the machine. The tanks are placed in the wing and have been specially designed in order to reduce loss of fuel through evaporation and surging. Petrol is fed by gravity to a collector tank in the cabin and from this is pumped to the engine. If the engine pump should fail, gravity feed may be brought into operation, and if necessary this may be supplemented by the use of a hand pump.

Wireless apparatus is essential in a machine designed for long distance flights, and a short wave transmitter is fitted on the Fairey monoplane in order that the pilots may keep official wireless stations in touch with their progress. Routine reports giving the position of the machine are transmitted at intervals of two hours during a flight and when the attempt on the record is made wireless stations in the United Kingdom, Malta, Ismaila and other places near the route to be followed will keep special watch for signals from the pilots. The call sign is GEZAA and transmissions are on a wavelength of 33.71 m. The Air Ministry has announced that it will be glad to have forwarded to it authentic reports picked up by private wireless stations. The aeroplane is not equipped for the receipt of wireless messages during flight. To avoid confusion and jamming, owners of private wireless stations are to be asked to refrain from transmitting on this wavelength when the attempt on the record is made.



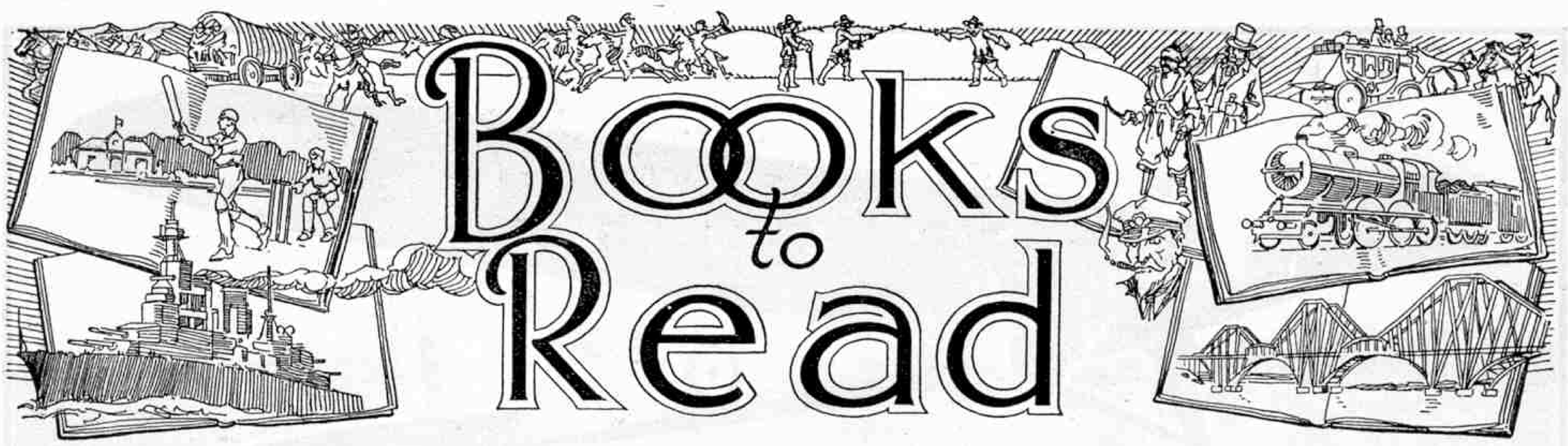
The Fairey Long Range Monoplane in flight.

A machine that is to make a non-stop flight of more than 5,000 miles must be thoroughly tested before the journey is attempted. The Fairey monoplane was subjected to unusual tests in order to ensure its suitability for the heavy strain that will be imposed upon it. These tests were carried out partly on models in wind tunnels at the National Physical Laboratory, and partly on the machine itself when completed. For instance, the wheels were subjected to loads greatly exceeding that which would be placed on them when making a forced landing, or in other circumstances that might arise during a flight, but no sign of failure was apparent. Equally stringent tests were carried out with the engine, for the success of the flight depends very largely upon its ability to run at high speed without interruption for almost incredibly long periods. It was found during the trials that a Napier " Lion " engine, similar to the one to be used during the actual flight, could be run on the bench under load for a period of 70 hours without showing undue signs of wear.

The preparations for the flight also included trials of the instruments to be employed and of the automatic control that is fitted in order to relieve the pilots and so reduce the strain of a long flight. The control employed has been developed in the Royal Aircraft Establishment. The system has been under test for several years and may be said to have reached the stage when an aeroplane in flight can be controlled automatically far more precisely than is possible with the most skilled human pilot. Flights lasting several hours, and made in all kinds of weather conditions, have shown the value of the device, for it not only relieves the pilot completely of the fatigue of flying large aircraft for long periods, but it also greatly improves the accuracy of navigation. For instance, it is difficult to maintain straight flight in cloud or fog, as the pilots normally depend upon the visible horizon. The automatic pilot maintains very accurate straight flight in these difficult conditions, however, and when it is in use the human pilots may even leave their seats.

The automatic pilot—usually known in the R.A.F. as " George "—depends for its sense of direction on a gyroscope driven by compressed air. The axis of this maintains a fixed direction, and any movement of the machine relative to it operates certain pistons, that in turn move the rudder and elevator of the aircraft in the correct manner when necessary. The mechanism is so sensitive that the deviation of the aircraft from the set course by a fraction of a degree is detected and instantly corrected.

It is interesting to note that the pilots of the Fairey long range monoplane do not simply fly their machine at any height and speed they think necessary. Instead a log is prepared giving their course, the heights at which they will fly and the engine speeds to be employed. For instance, the log prepared for the recent flight to Egypt instructed the pilots to climb steadily but slowly from the take-off in order to reach a height of about 6,000 ft. just before reaching the mountains of Northern Africa. This is done partly to guide the pilots, but also to ensure economy in the use of fuel.



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the 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. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"The Ways of the Navy"

By Rear-Admiral D. ARNOLD-FORSTER, C.M.G. (Ward Lock. 7/6)

Everyone will be interested in this vivid description of "the ways they have in the Navy," and more especially so, perhaps, because the author is a frequent contributor to the "*M.M.*" Probably no one but the gallant Rear-Admiral could have put together such a collection of yarns, customs, and quaint items of sea-lore, and his pen is as lively as his memory.

Of the many "good stories" the following, from the chapter entitled "Tales of Resource," is one of the best.

"One of the quickest actions in emergency I ever saw was that of a gunner during an Admiral's inspection. General quarters, fire, and collision drills had been exercised; the sheet anchor had been let go and weighed by hand; and other seaman-like feats carried out in incredibly short times. The Admiral, looking on from the bridge, was pleased with the ship and said so, but decided to spring one more surprise on them.

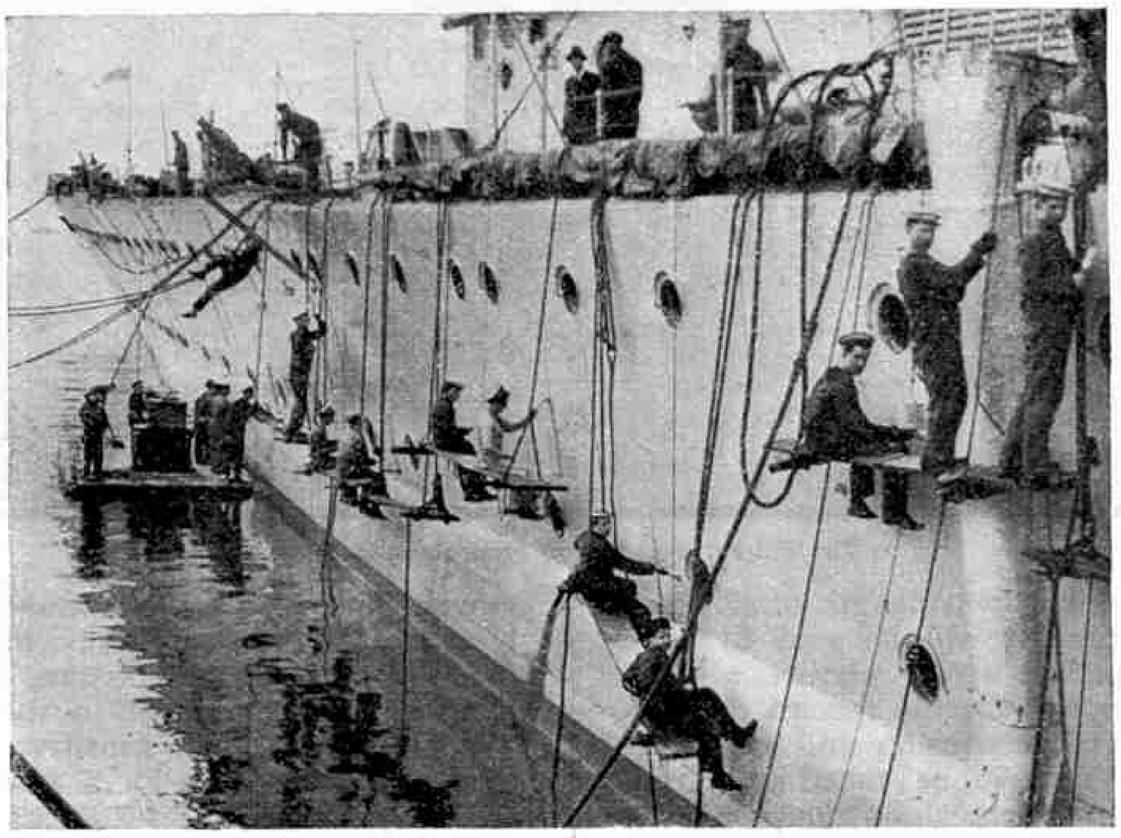
"'Send a diver down from the port accommodation ladder,' he said as he collected his staff and began to move aft to leave the ship.

"Almost as soon as the order 'Out diving gear' rang out, the gear was being rushed aft to the quarter deck, and long before the Admiral arrived there a diver, ready dressed, was standing at the bottom of the port ladder. Four men were heaving round the diving pump, another was holding the front glass of the great copper helmet, and waiting to hear the hiss of air before screwing it on. But something was wrong with the pump and no air came. The gunner, who is responsible for all diving gear, was horrified. Suddenly he made a dash for the bucket, and calling out 'Wet the diver!' threw it to the men at the bottom of the ladder, who quickly dipped it into the sea and soused the diver.

"'Oh! I see he's been down already!' remarked the Admiral, glancing over the side as he arrived on the quarter deck. 'Very creditable!' he added as he crossed to the starboard ladder, where his steam barge was waiting to take him away."

The book succeeds in showing that the great and apparently soulless machine, to which we owe the safety of the Empire, is intensely human. It is enhanced by a number of good photographs.

A beach party bringing in a boat. From the "Ways of the Navy" reviewed on this page.



Painting ship. Every seaman, stoker and mariner is a bit of a painter, and to keep a ship decent requires at least four coats a year outside, all of which is done by the crew from stages rigged over the side. (See above).

"Flights of Naval Genius"

By B. TUNSTALL. (Philip Allan. 12/6)

The author deals with five famous men who all possessed one quality in common—the capacity for assuming responsibility on a large scale and in a striking manner. In the case of four of them, this capacity was occasionally possible with such brilliant results that it amounted to genius of the highest order.

"To-day it is assumed without question," says Mr. Tunstall, "that complete physical fitness should be a primary test for command." Some of his examples show us, however, that this attribute is not always necessary for genius to manifest itself, and that it is not always the physically well-equipped, the stalwart, or the healthy individual who conquers over circumstances. On the occasion of the great naval mutiny at Spithead, Earl Howe (who quelled it) was a decrepit old gentleman racked with gout, of venerable appearance and sentimental urbanity. Although Lord Rodney was also afflicted with gout (but a tyrant with a shocking temper and a worse digestion) he broke the French line at the Battle of the Saints by an act of genius in naval leadership that recaptured the mastery of the seas for Britain.

Of the others, Sir Sidney Smith was an eccentric genius and has been described as "half a crusader and half an emir." He quarrelled with Nelson, beat Napoleon at Acre, and signed a Convention on his own responsibility! His organisation of the advance at Acre was no mere piece of bluff or luck, and it is difficult to deny that his whole conduct in the Levant was marked by genius of an extraordinary kind. Although his cousin Lord Camelford was not in any sense a genius, his was a career of exceptional interest showing how easy it is for certain elements of genius to take the wrong path and turn to mania. Camelford was marooned by Vancouver, shot a brother officer dead, left the Navy in a huff, and terrorised the streets of London, to be finally killed in a duel.

Sir Charles Napier repeated Sir Sidney

Smith's career under somewhat similar conditions. Although it was his misfortune to reach his prime in the peaceful years that followed the Napoleonic Wars, he possessed a genius for leadership that in the days of slow communication was displayed with a profound disregard for the man who was not on the spot.

The years covered by the activities of these five men saw the last and greatest period of the sailing ship, and Mr. Tunstall has chosen them purposely to show the diversity and many-sidedness of British genius at sea. As he points out in his Preface: "To-day, steam, wireless and aircraft have severely limited the initiative of the man on the spot, while we are given to understand that there are fewer incompetents . . . . the genius of to-day has more varied means at his disposal but his opportunities for using them are more limited."

A book to interest all whose inclinations are to the history of the sea and its ships.

A player jumping high to head the ball. (See below).

"The Boys' Book of Association Football"

By JOHN GRAVES. (G. Bell & Son Ltd. 5/- net)

This is a companion volume to the publishers' "*Boys' Book of Cricket*," reviewed in our issue for May, 1930, and is planned on the same practical lines. Its author is a well-known Casual who has made a complete study of the art of playing Association football, and now places his knowledge at the disposal of his youthful readers. The book is packed with valuable advice, and is a useful guide both to novices and to more experienced players who wish to improve their game.

The first chapter is devoted entirely to the rudiments of the game. These include kicking, tackling, trapping and heading, and Mr. Graves rightly devotes considerable space to them, for he is a firm believer in the importance of correct method. He emphasizes the fact that the natural kick is of no use when playing Association football, and with the aid of splendid action photographs shows how to develop effective kicks in various positions. Other ways of dealing with a football are explained in the same careful manner, and the photographs and descriptions may be studied with advantage by older players as well as by those for whom the book is intended.

From the elements of the game Mr. Graves goes on to the special needs of each position on the field. He deals first with the best means of taking up position in order to begin and press home attacks, and gives sound advice on intelligent shooting. From there he passes on to deal with the work of the defenders, the half-backs, the full-backs and the goalkeeper. Although for convenience he makes a distinction between attack and defence, he does not overlook the influence that the backs may exert in starting and supporting attack, nor does he lose sight of the defensive efforts that a forward may be able to make. This point is more fully brought out in the next chapter, which deals with team work. Here Mr. Graves speaks of the importance of backing up and of the need for adapting tactics to the weather, the state of the ground, and other circumstances. The concluding chapter deals with the throw-in, corner kicks and the rules of the game, and also contains hints on equipment that should be given serious attention.

One of the most valuable features of the book is the large number of excellent action photographs it contains. These are devoted chiefly to showing the correct method to adopt in practically every phase of the game, but in certain instances they demonstrate how things should not be done, and the keen player will derive great benefit from a study of both types.

A short pass off the inside of the foot. From "The Boys' Book of Association Football" reviewed on this page.

The goalkeeper has claimed an unusual share of the photographer's attention. This is deliberate policy on the part of the author, however, for so much depends on this member of the team that it was felt undesirable to leave anything to chance. The photographs of the custodian at work therefore emphasize the necessity for making use of a double guard and of adopting methods that are safe rather than spectacular. Many interesting and useful diagrams, dealing chiefly with field positions and team play, are also included.

Sending across a surprise centre at right-angles. (See below).

"The Land of the Arab"

By ROBERT HARDING (R.T.S. 2/- net)

The characters with which Mr. Robert Harding has peopled his "Land of the Arab" are just the sort of material for a boy's book, and they move in a glorious setting of grim gorges and beetling crags. Of the heroes, the most picturesque is undoubtedly Roger Larkfield, a Herculean member of the Secret Service, who can play skittles with any foes who happen to cross his path. The resource of this man is amazing, but it is surely only just enough to save him and his companions from the clutches of Kurda Ali, the robber chief, and of Gomalin, a particularly nasty dwarf.

The situations in which the party of white men find themselves during their visit to the robber lair are bewildering, but Larkfield is well able to deal with each difficulty as it presents itself. Thanks to him everybody comes safely through a most trying ordeal—everybody, that is, except the robbers!

"British Aircraft Illustrated"

By C. A. SIMS. (A. & C. Black Ltd. 3/6 net)

The development of British aircraft is proceeding so rapidly that it is extremely difficult for the amateur enthusiast to keep pace with it. Most of us live in districts in which aeroplanes are still comparatively rare visitors, and the machines we see are seldom of the latest type. For this reason it is important for all who are interested in the development of aviation to have at hand a good collection of photographs of aircraft of all types, for there is little doubt that it is only by careful study and comparison of photographs of this kind that enthusiasts can learn to distinguish between the types of machine seen flying overhead and to appreciate outstanding features of their design.

"*British Aircraft Illustrated*" meets this requirement excellently. It contains 43 first-class photographs of different types of machines, each one accompanied by a page of useful descriptive matter. It forms in fact a splendid pictorial record of the products of British aircraft designers, and it should find a place on the bookshelf of every boy who is keen on aviation. In a foreword, Mr. C. G. Grey, Editor of "*The Aeroplane*," says: "This book has been produced so that English people without any particular technical knowledge of aircraft may get a fair idea of the excellent work which is being done by the British Aircraft Industry. At the time of writing we happen to hold the world's speed record, but in this country we have never made much of a habit of going for records, we have rather preferred to depend on the excellent record which our manufactured products have always held for material and workmanship."

FROM OUR READERS

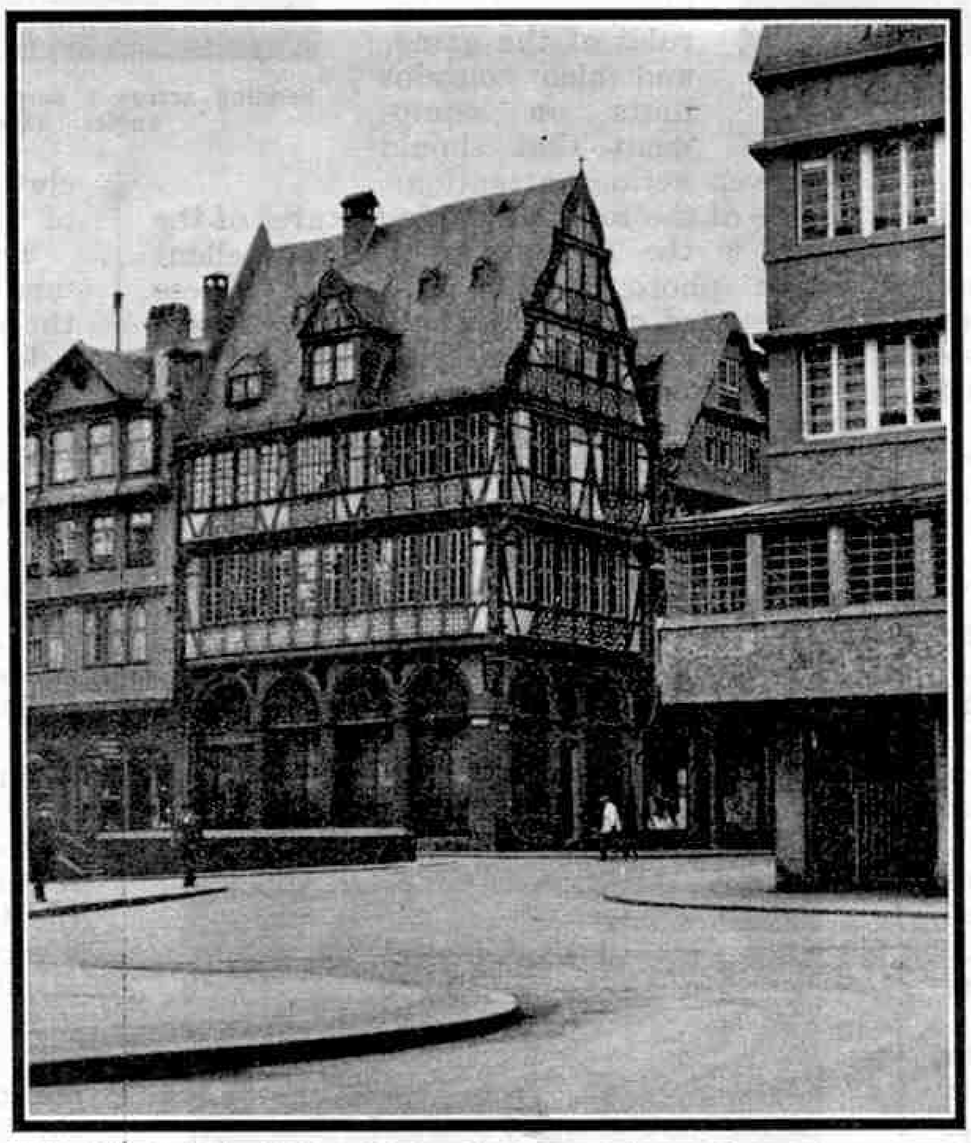
These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles 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.

A Week in the Valley of the Rhine

Recently I enjoyed a week's tour of the Rhine Valley in a luxurious motor coach. Our starting point was Cologne, and our road ran southward through valleys covered with vines.

Coblenz was the first city we visited, and there I was greatly interested in the Bridge of Boats across the Rhine, of which I had a splendid view from my bedroom window. This bridge is opened at intervals by the removal of a few pontoons in order to allow barges and other vessels to pass through on their way up or down the river. At the opposite end of the bridge is Ehrenbreitstein, behind which is a magnificent fortress built upon a precipitous rock 400 ft. above the Rhine. The first castle was erected on the site more than 1,000 years ago, but the present work is a restoration of the fortress blown up by the French in 1801.

From Coblenz we went to Frankfurt, the famous German city on the Main, the Rhine's chief tributary. Many old buildings may yet be seen in certain parts of the city. The most important of these is the Römer, a range of mediæval buildings that now serves as a Town Hall, and in which the German emperors of the Middle Ages were elected.



The oldest building in Frankfurt. It was erected more than 600 years ago, and forms a striking contrast to the block of modern flats on the right.

Our road now crossed the Odenwald Mountains and eventually brought us to Heidelberg, where we visited the castle. The English Wing of this historic structure interested us greatly, for it received this name because it was built early in the 17th century by the Elector Palatine in honour of his wife Elizabeth, a daughter of our own King James I. The castle is now in ruins, never having been rebuilt since its destruction by the armies of the French King Louis XIV, towards the end of the same century. From the ruins I saw one of a series of dams built in connection with a scheme for connecting the Rhine with the Danube.

On the return journey we visited Mainz, where we saw the house in which Gutenberg, the inventor of printing, was born. At Rudesheim, lower down the Rhine, we boarded a steamer in which we passed through part of the wonderful gorge cut by the river from Bingen northward. The scenery was magnificent and the many heavily-laden barges we passed added to the interest of the trip. E. OAKLEY (Southampton).

Britain's Most Northerly Lighthouse

When visiting the Shetland Isles I was fortunate in being able to visit Muckle Flugga lighthouse, for there are few days when it is possible for visitors to land on the small group of rocks on which the lighthouse is built. These rocks are half a mile from the northern cliffs of the island of Unst, and another half mile further north is the Out Stack, the rock that forms the most northerly point of the British Isles.

On the day of my visit I and my friends left the village of Baltasound in a motor boat. We made our way north past magnificent cliffs that in places are more than 500 ft. in height, and on rounding the north-east point of Unst saw ahead of us the rocks of Flugga. The intervening distance of about four miles was quickly covered, and we then rowed to the landing stage in the dinghy, leaving our boat in charge of members of the party who had already visited the lighthouse.

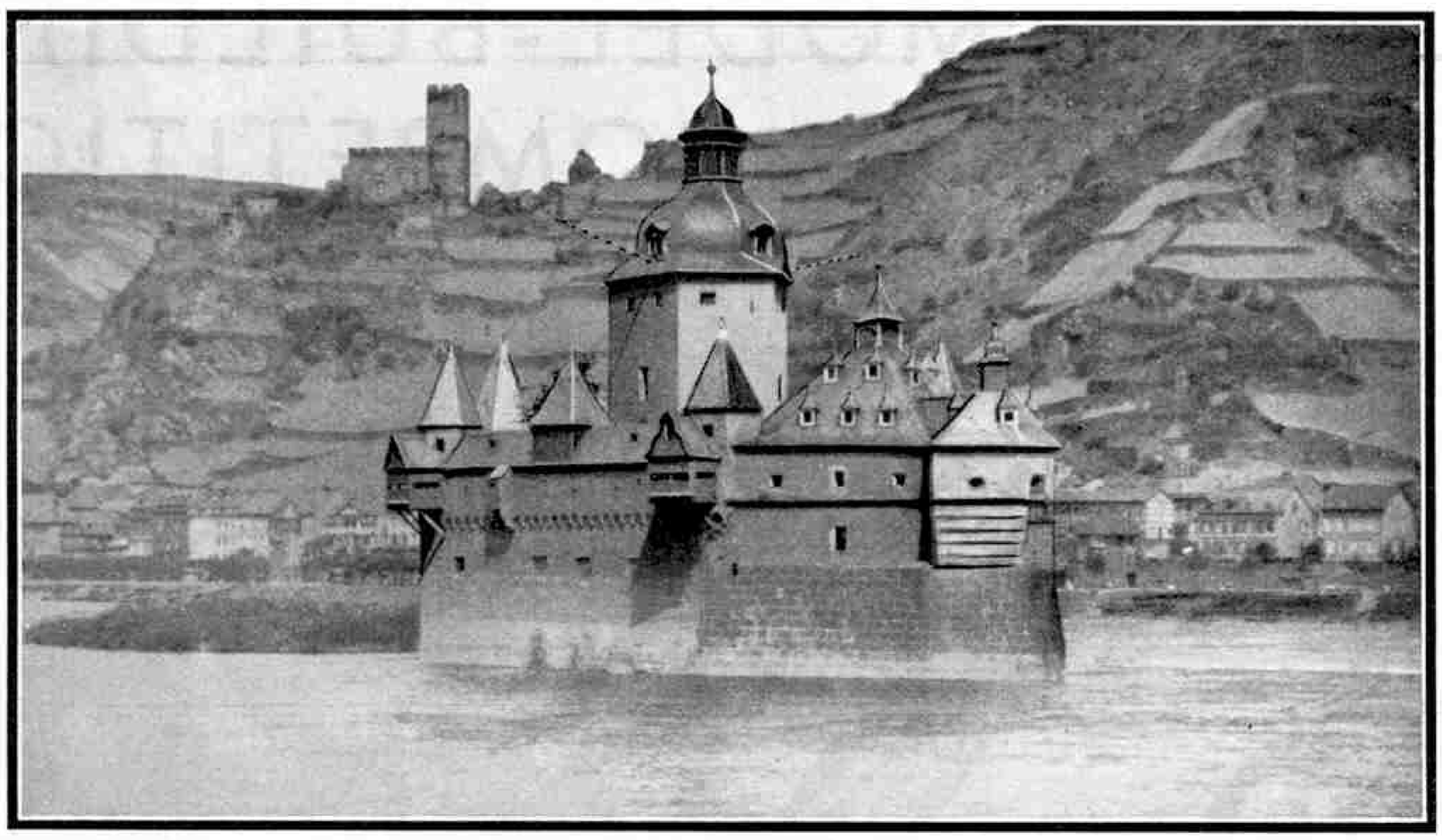
It was necessary to climb 250 steps in order to reach the top of the rock. On arrival there we were shown over the lighthouse itself, which is a four-storey structure. Store rooms occupy most of the ground floor space. Above these is the living room, which is equipped with a wireless outfit, and on the next floor are bunks for the three men in charge. More stairs lead to the room in which is installed the necessary mechanism and other equipment, and at the very top of the lighthouse is the lamp itself. This burns oil, and is surrounded by a large screen pierced by two wide slits. The screen is slowly revolved by means of machinery driven by a falling weight, and thus the light from the lamp is projected in two revolving beams that from passing ships are seen as flashes.

From the balcony of the lighthouse there is a wonderful view. The cliffs, the hills and islets of the Shetlands may be seen on looking southward, and to the north is the Out Stack, beyond which the sea stretches to the Arctic. In other directions nothing is visible but the ocean.

The day was calm and peaceful, but in winter the rocks must present a different aspect, for we were told that in one storm the wall round the top of the cliff, 180 ft. above sea level, was washed away. A. SANDISON (Croydon).

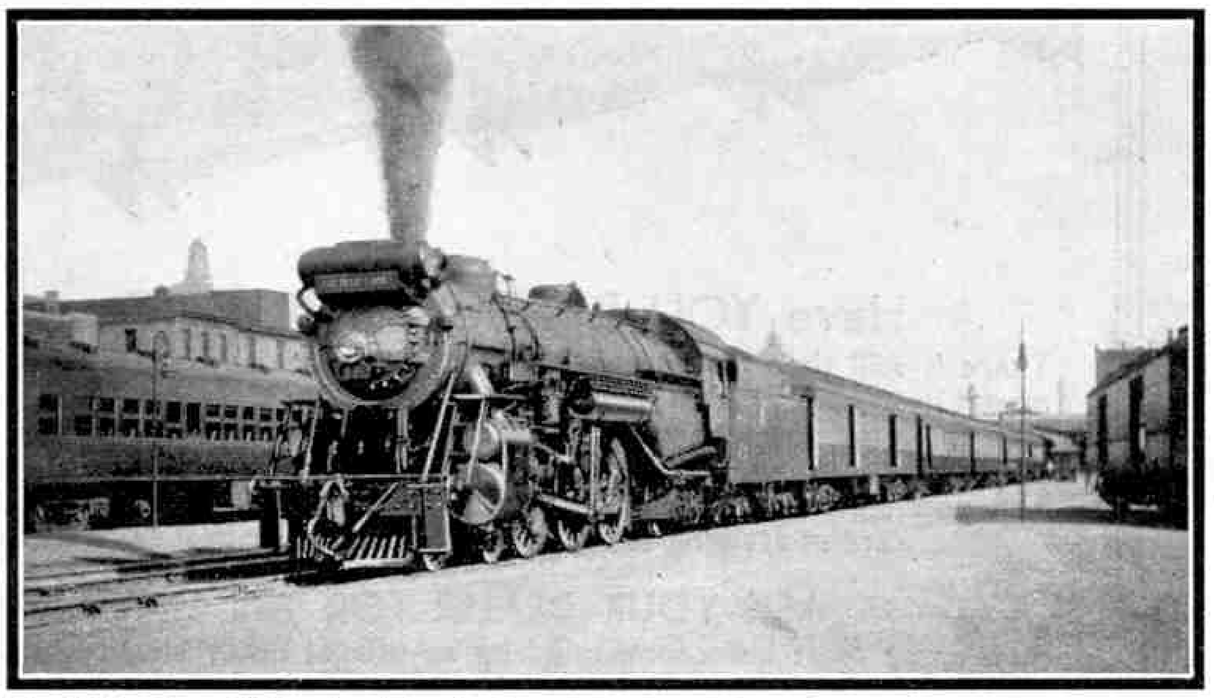
A Famous American Express

The "*Blue Comet*" of the New Jersey Central Railroad leaves Jersey City, on the west bank of the Hudson River opposite New York, twice daily to speed down to Atlantic City, the well-known playground on the Atlantic Coast, while two journeys are made daily in the reverse direction. It is a handsome train, composed of steel cars painted dark blue to match the locomotives that haul them, and a distinctive appearance is given to it by a broad cream-coloured stripe, extending its full length, that reaches from below the windows to the board on which the name of the train is painted. Each coach bears on its side the name of a star, comet or constellation, and even the luggage vans are distinguished in this manner.



The Pfalz Castle built in 1347 at Caub on the Rhine. It can be reached only by boat. This interesting photograph was taken by our reader, E. Oakley, Southampton.

I succeeded in photographing the "*Blue Comet*" as it left Atlantic City on the run to Jersey City. Traffic was light on this occasion and only five coaches were in use, including a dining car and a composite luggage and smoking car. No standing is allowed on this train, every passenger being provided with a reserved seat, for which no extra charge is made, and a high standard of comfort is maintained.



The "Blue Comet" leaving Atlantic City, with "Pacific" No. 831 of the New Jersey Central Railroad at its head. This famous train runs twice daily between the well-known coast resort and Jersey City. Photograph by our reader, F. R. Elliott, Philadelphia, U.S.A.

The locomotive shown at the head of the train in my photograph is a giant "Pacific," No. 831. It is fitted with a feed-water heater placed in front of the chimney in accordance with the usual American practice, and below this is the nameplate of the train. A large steel cabinet immediately behind the buffer beam contains relays and amplifying valves required for the automatic train control system in use on the New Jersey Central Railroad. A mechanical stoker is fitted, and a generator on the engine supplies current for the control system, as well as for the headlight and the electric bell, two features characteristic of American railways. The locomotive differs in general appearance from those in use on British lines, but is thoroughly representative of American practice.

F. R. Elliott (Philadelphia, U.S.A.).

My Visit to a Scottish Quarry

A short time ago the owner of Cunmont Quarry invited me to visit it under his guidance. This quarry is about 13 miles from Forfar, and is one of the largest and best equipped in Scotland. The machinery installed is electrically driven, current being supplied by the Grampian Company at 11,000 volts, and transformed down to suit requirements. The electrical equipment is housed in a shed, near which is the compressor that provides the air under high pressure required for the pneumatic drills. It was quite clear from the noise I heard on arrival that these were in operation. I was informed that holes 20 ft. in depth were being drilled in the face of the rock, and that blasting operations would take place later in the week.

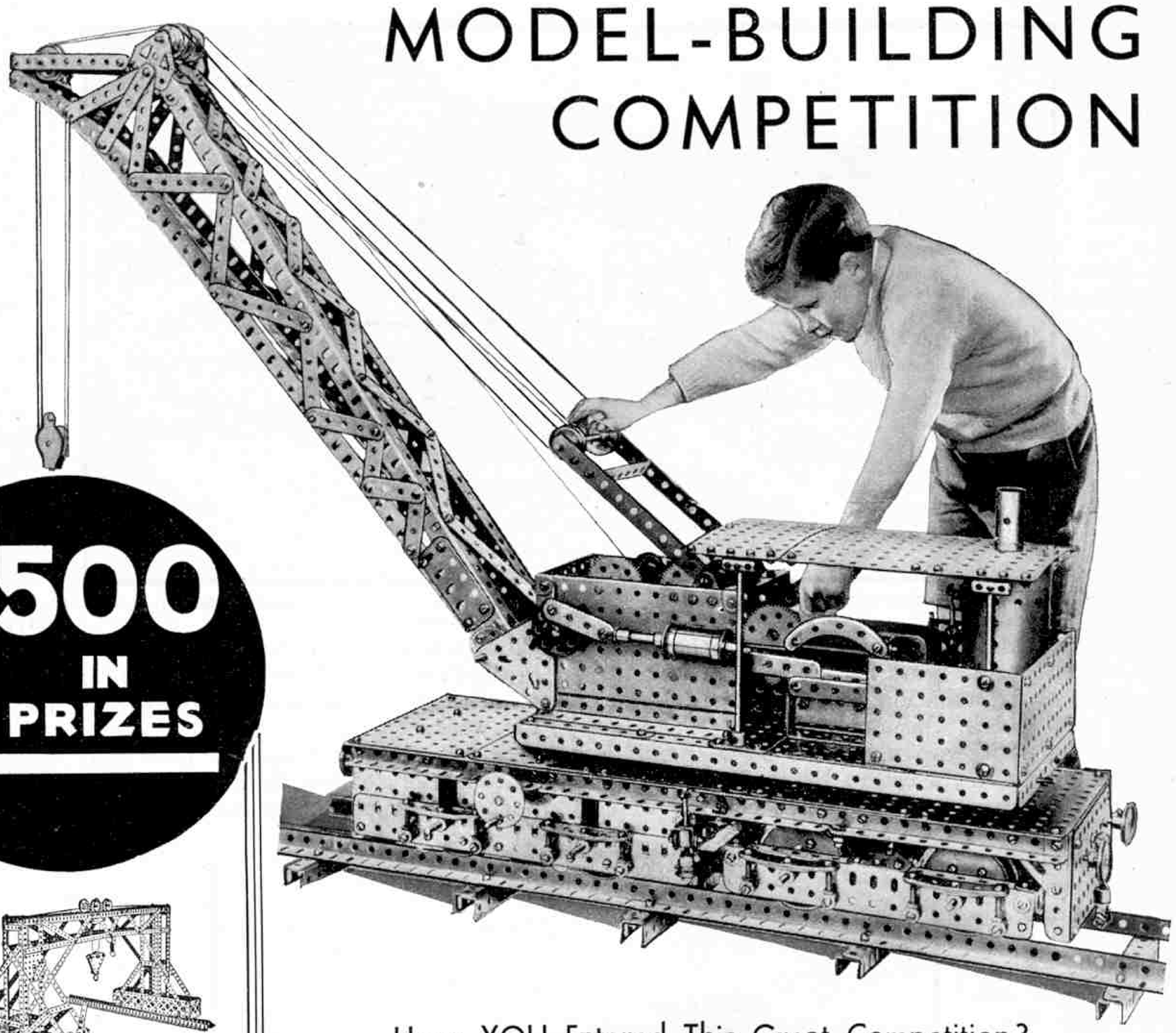
Stone from the Cunmont Quarry is broken up into material for roadmaking. The plant installed for this purpose is of enormous power. Large rocks fed into a crusher are rapidly converted into smaller pieces, and these travel on a moving belt over magnetised pulleys that remove stray pieces of iron. The lumps of rock then drop from the belt into a second crushing machine, and thence to a revolving perforated cylinder that separates the pieces of different sizes and delivers each grade to conveyors leading to the storage bins.

The crushed stone is now tarred at the quarry and the surface of a road made with it only needs rolling in order to prepare it for traffic. The tarring is carried out in giant mixers, the stones being thoroughly covered with hot tar by means of two revolving wheels with enormous spikes. When the mixing is complete, the tarred stone is allowed to drop into the lorries waiting to carry it to the road on which it is to be used. The plant in which the stone is tarred is a triumph of modern engineering. It is capable of an output of 800 tons a day, and while I was in the Quarry what seemed to be an endless succession of motor lorries arrived empty and were driven away with full loads.

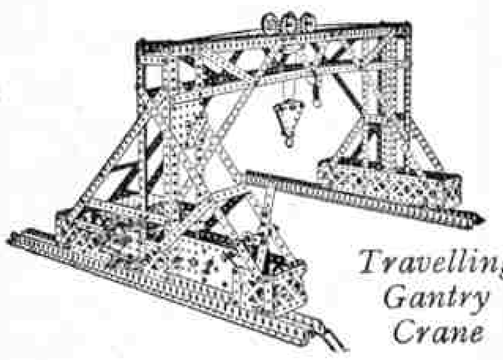
J. McKenzie (Forfar).

MECCANO

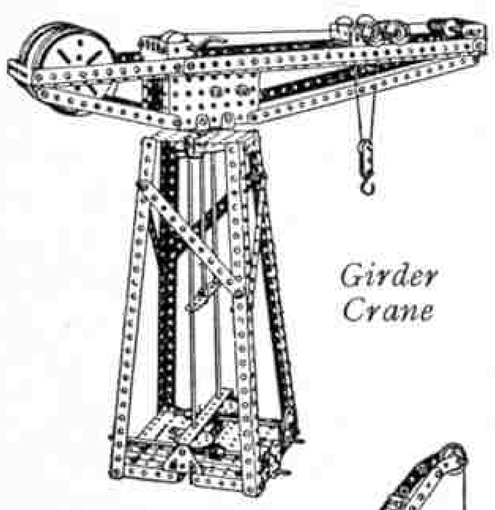
MODEL-BUILDING COMPETITION



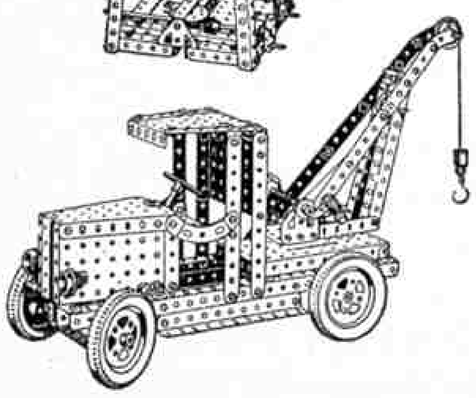
£500 IN PRIZES



Travelling Gantry Crane



Girder Crane



Motor Breakdown Crane

Have YOU Entered This Great Competition?

There is still time for every Meccano Model-builder to win a big prize by entering a model in the grand £500 Meccano Model-building Contest. All a competitor has to do is to think out a new model and set to work to build it in Meccano. This model should be revised and improved until the competitor feels satisfied that he has produced the best possible result. Then all that remains to be done is to send a photograph or a careful drawing of the model to us. Actual models must not be sent.

ASK YOUR DEALER FOR AN ENTRY FORM

Each entry must be accompanied by an official Entry Form, obtainable free from any Meccano dealer. Overseas competitors can obtain their forms from the Meccano agent for their particular country. Any competitor who has difficulty in obtaining an Entry Form should write for one direct to Meccano Ltd., enclosing a 1½d. stamp to cover return postage. Full details of the Contest, together with a complete list of the prizes that are to be awarded, appear on the Entry Form.

DO NOT MISS THIS GREAT OPPORTUNITY—COMMENCE YOUR MODEL TO-DAY!

The closing date is now rapidly approaching. Every owner of a Meccano Outfit who has not yet sent in an entry should set to work at once and build a model. Time is passing quickly and it will soon be 31st March, after which date no further entries will be accepted.

CLOSING DATE, 31st MARCH, 1932

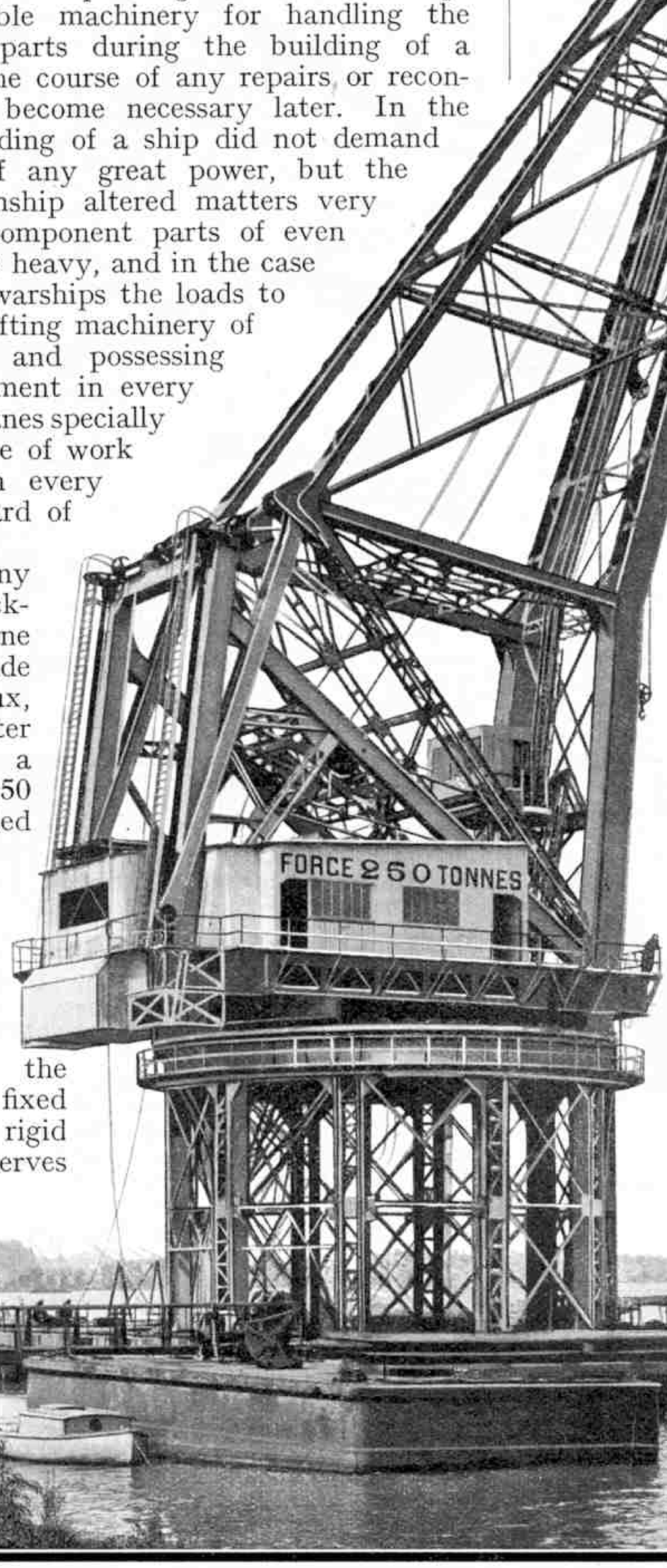
MECCANO LTD. OLD SWAN LIVERPOOL

Giant Crane at a French Dockyard

Twelve Electric Motors to Lift 250 Tons

THE enormous growth in the size of ships has necessitated a corresponding continual development of suitable machinery for handling the various component parts during the building of a vessel, and also in the course of any repairs or reconstruction that may become necessary later. In the days of sail the building of a ship did not demand lifting mechanism of any great power, but the coming of the steamship altered matters very considerably. The component parts of even a small steamship are heavy, and in the case of modern liners or warships the loads to be handled require lifting machinery of enormous capacity, and possessing wide range of movement in every direction. To-day cranes specially designed for this type of work are to be found in every dockyard and shipyard of any importance.

Among the many interesting large dockyard cranes is the one in use at the Gironde Dockyard at Bordeaux, France. This monster crane, which has a lifting capacity of 250 tons, was constructed at Jeumont (Nord) by the Forges et Ateliers de Constructions Electriques de Jeumont, to whom we are indebted for our illustration. The framework of the crane consists of a fixed steel base and of a rigid superstructure that serves as a base for the movable working parts, and contains the counterbalance. From this is carried the jib, which has been specially designed to enable it to be inclined at various angles according to the nature of the loads to be lifted. The whole structure is built upon a platform supported by four caissons.



The reach of the crane under maximum load, 250 tons, is 52½ ft., calculated from the outside edge of the pontoon; but this reach can be increased as the load is reduced. Under a load of 125 tons the reach is 101¾ ft., and under 30 tons it is 108¼ ft.

The load is gripped by means of hooks. For 250-ton loads two hooks are employed, but the controlling mechanism is arranged in such a manner that only one hook is necessary for lifting 125 tons and smaller loads. An auxiliary hook hung from a small trolley running under the jib serves for small loads up to 5 tons. The jib can make a complete turn with a maximum radius of 108¼ ft., and in this position the total height from the end of the jib to the water level is 134½ ft. With an effective radius of 52½ ft. the total height is 147¾ ft.

The mechanical movements, the swivelling of the crane, the raising and lowering of the jib and the lifting movement, are operated by means of twelve 75 h.p. electric motors running on direct current at 220 volts and making 720 revolutions per minute. The braking arrangements for controlling the heavy loads dealt with have been designed to give every guarantee of safety. Braking is carried out in four different ways. First by worm, not reversible, which prevents the descent of a load when the speed of the motors is being changed. Second, by electro-magnetic braking; as soon as the current is sent to the motor this brake is disengaged, and on the other hand the load is instantly blocked if the current is switched off. Third, by rheostatic brake, which automatically limits the speed of the descent of the load and prevents all crowding; and fourth, by hand braking. The bringing into action of any of these four methods of braking ensures the complete stoppage of a load at any point.

New Meccano Models

Autogiro—Grabbing Crane—Big Wheel—Mobile Crane

ALL Meccano boys will have heard about the "Autogiro" aeroplane. This machine, which was invented several years ago by a Spanish aeronautical engineer, Juan de la Cierva, makes use of a special cantilever rotor system that is mounted above the fuselage of the machine. The rotor, or windmill blade system, is set in motion by a mechanical starter, and the machine is then able to take off after a run of only about 30 yards. The rotor system eliminates the possibility of the aeroplane stalling when in the air due to engine failure, etc., and the long glide and run on returning to earth that is required by the standard type of aeroplane is rendered unnecessary.

The machine has been called the "back garden" aeroplane owing to its ability to take off and land in such small spaces, and it is interesting to note that two models of the machine have now been placed on the market. One of these, the C24, is a two-seater cabin machine, while the other, the C19 Mark IV, is a two-seater open cockpit machine. The Meccano model shown in Fig. 1 follows the design of the C19 type machine, but it is fitted with a four-bladed rotor, whereas the latest model of the "Autogiro" incorporates a three-bladed rotor.

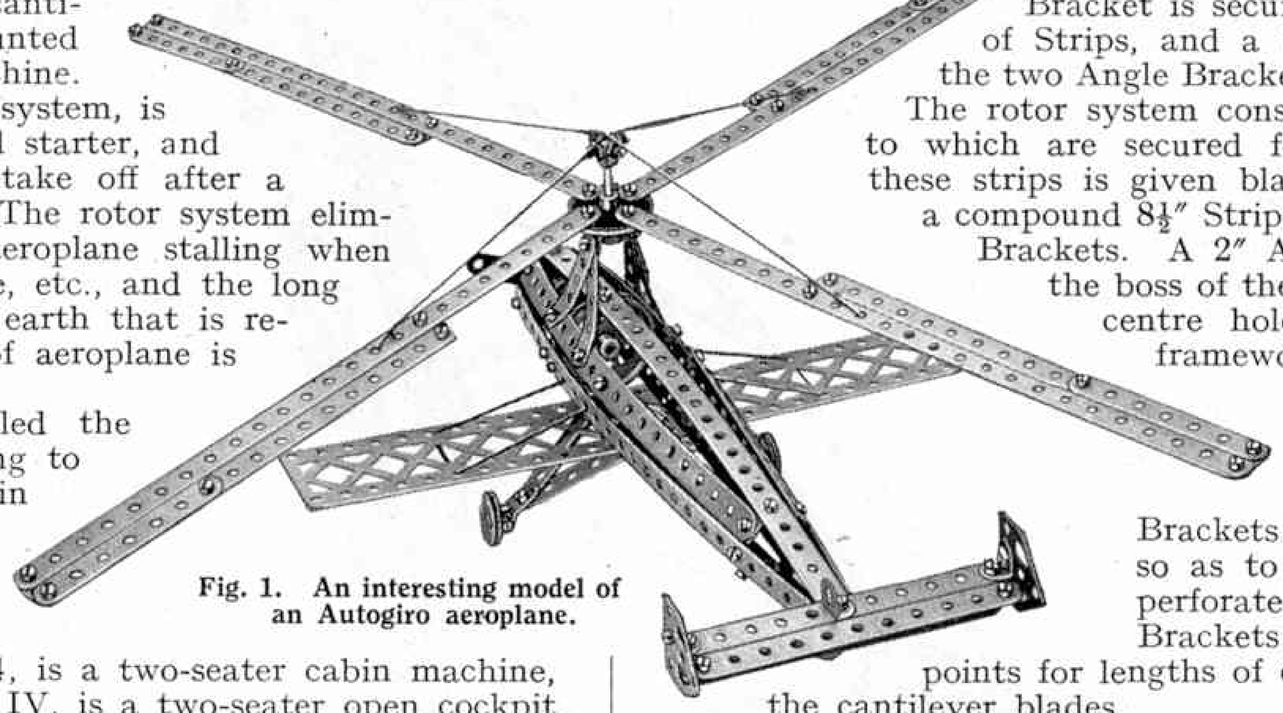


Fig. 1. An interesting model of an Autogiro aeroplane.

The fuselage of the Meccano model is built up from 12½" Strips and compound strips consisting of 5½" Strips overlapped and bolted together. These Strips are secured by means of Angle Brackets to a Bush Wheel which forms the nose of the machine. A 2" Pulley Wheel is held in position by means of Angle Brackets mid-way between the ends of the fuselage to form a circular "bulkhead" round which the covering Strips of the fuselage may be placed. A 1½" Strip and two Flat Brackets are used to hold the Strips together at the rear of the fuselage.

The main wing of the machine consists of a 12½" Braced Girder bolted to the underside of the fuselage and braced to it by means of lengths of cord. The undercarriage, which is of the divided or "split axle" type, consists of two pairs of 2½" Strips, each pair having a Flat Bracket secured to it. A ⅜" Bolt is passed through the round hole of each Flat Bracket and a 1" Pulley is placed on the shank of each Bolt, the set-screw in the boss of the pulley being tightened on to the shank of the Bolt so as to lock the Pulley to the Bolt. The Pulleys are thus free to rotate. The framework supporting the pivot for the rotor blades consists of two pairs of 2½" Strips secured to the upper sides of the fuselage. An Angle Bracket is secured to the top of each pair of Strips, and a 1½" Strip is joined between the two Angle Brackets.

The rotor system consists of a 1½" Pulley Wheel to which are secured four 12½" Strips. Each of these strips is given blade formation by attaching a compound 8½" Strip to it by means of two Flat Brackets. A 2" Axle Rod is passed through the boss of the 1½" Pulley and through the centre hole of the 1½" Strip of the framework. The Rod is held in place by means of a Collar, and a Collar is also secured close to the top of the 2" Rod. Two Double Brackets are placed on the Rod so as to rest on the Collar. The perforated lugs of the Double Brackets serve to provide anchoring points for lengths of cord that are used to brace the cantilever blades.

The tail unit consists of two 5½" Strips, and the steering fins are represented by Flat Trunnions held to the Strips by means of Angle Brackets.

The propeller of the machine consists of a 3½" Strip, and it is mounted on a 2" Axle Rod passed through the Bush Wheel forming the nose of the fuselage. The Rod is held in place by means of a ¾" Flanged Wheel placed on the inside of the fuselage, and a Collar on the outside.

In order to build the model Autogiro the following parts will be required: 8 of No. 1; 15 of No. 2; 5 of No. 3; 8 of No. 5; 2 of No. 6a; 8 of No. 10; 4 of No. 11; 12 of No. 12; 1 of No. 12a; 2 of No. 17; 1 of No. 20a; 1 of No. 20b; 1 of No. 21; 2 of No. 22; 1 of No. 24; 89 of No. 37; 6 of No. 38; 1 of No. 45; 5 of No. 59; 1 of No. 99; 2 of No. 111c; 2 of No. 125; 2 of No. 126a.

Grabbing Crane with interesting features

The model Grabbing Crane shown in Fig. 2 incorporates several interesting constructional features. The model is powered by means of a Meccano No. 2 Clockwork Motor, and this is connected to the drums controlling the jib and the grab so that luffing, hoisting and grabbing actions can be carried out.

The Clockwork Motor forms the framework of the swivelling superstructure. A 3½" × 2½" Flanged Plate is secured to one of the Motor side plates, and two Sector Plates are bolted to the Motor side plates and the Flanged Plate to form the sides of the gearbox.

The jib of the crane is composed of 12½" and 5½" Strips, and a 2½" × ½" Double Angle Strip is bolted between these Strips at the bottom end, while two 1½" Strips held in place by Angle Brackets brace the jib at the centre.

Two 5½" Strips are pivotally secured close to the top of the jib by means of bolts and lock-nuts. A Threaded Pin is secured to the lower end of each Strip, and a Small Fork Piece is mounted on each Pin. These Fork Pieces support a ½" Bolt on which is placed a ½" Loose Pulley 9.

The arrangement of the luffing and hoisting drives may be followed from Figures 3 and 5. A Worm is secured on the Motor spindle, and a ½" Pinion on each of the Rods 1 and 2 may be brought into engagement by the operation of the 3½" Strip

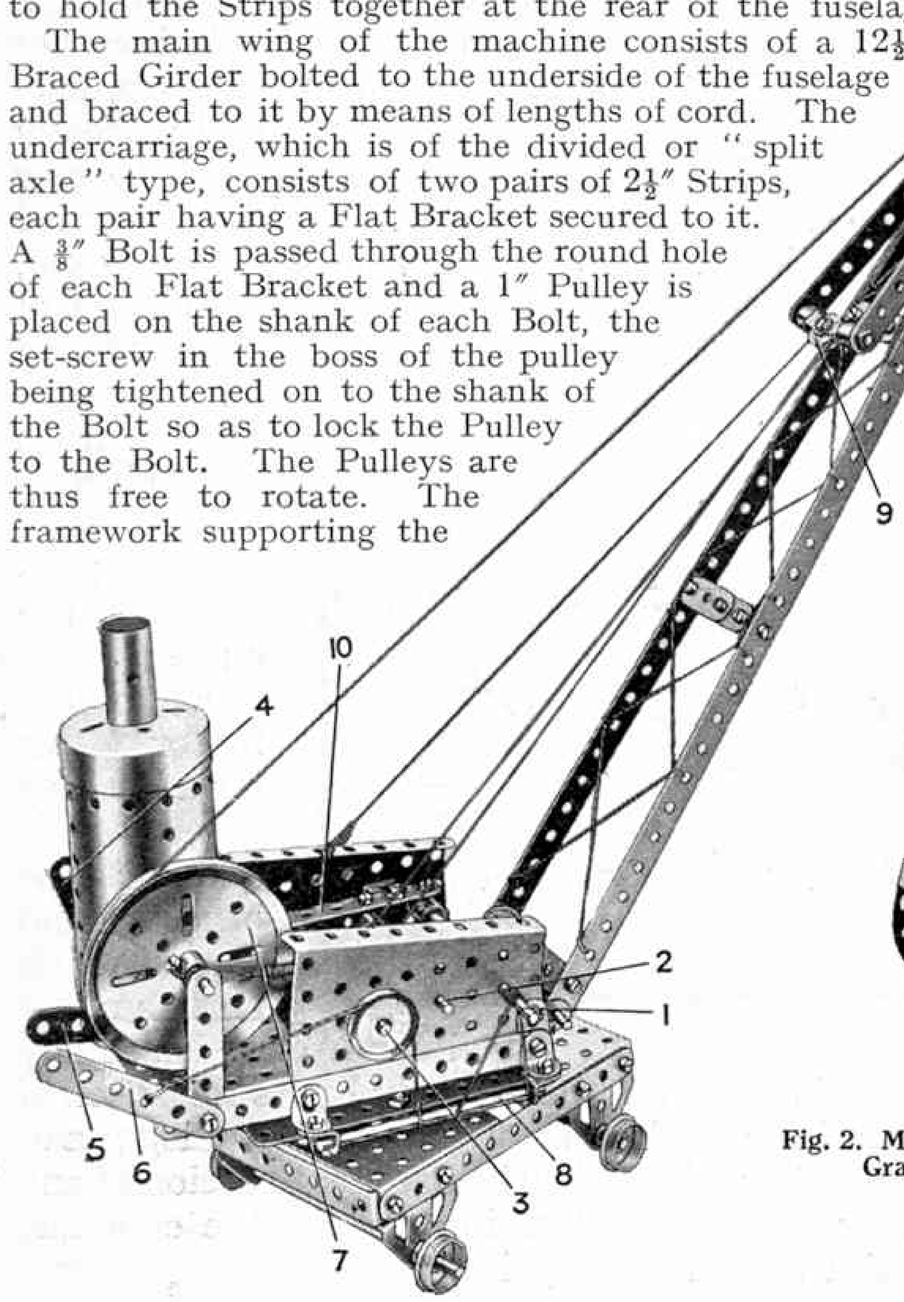


Fig. 2. Model Travelling Grab Crane.

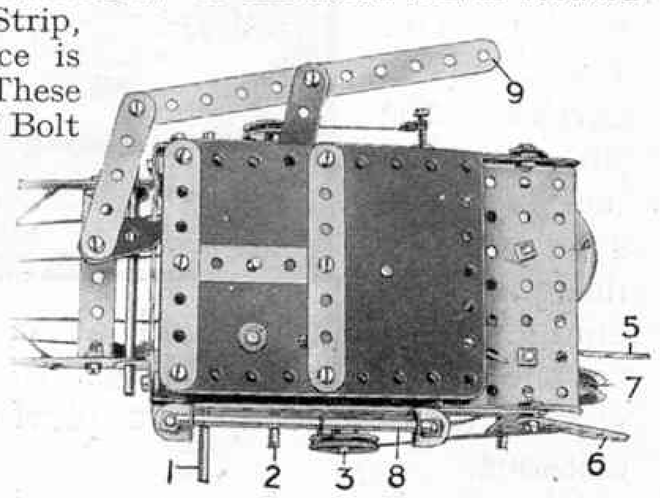


Fig. 3. Underside of swivelling Super-structure of Grab Crane.

10. This Strip is mounted pivotally on a 1″×1″ Angle Bracket that is secured to the side of the gearbox, and carries bolts, the shanks of each engaging between Collars on the Rods 1 and 2. A further Rod 3 carries a 57-teeth Gear, and matters are so arranged that when the ½″ Pinion on the Rod 2 is fully in mesh with the Worm, it is also engaging with the 57-teeth Gear. When the Rod is moved slightly in its bearings, however, the ½″ Pinion disengages the 57-teeth Gear, but still remains in mesh with the Worm.

The Rods 2 and 3 comprise the hoisting and luffing barrels. When the former pays out its cord the latter winds in and thus an approximation to level luffing is obtained. Strap and lever brakes 4 and 6 are fitted to each movement.

As will be seen from the illustrations, an automatic coiling drum is provided for the grab holding rope. The action of this is governed by the Spring 7a in the following manner. A length of cord, secured to the set-screw of the Pulley 7, is wrapped four times round its Rod and is then attached to the Spring 7a. The other end of this Spring is secured to the side of the gearbox, under tension, by means of a Hook. When the Grab Holding Cord is attached to the rim of the Pulley 7 (see Figs. 2 and 5) the action of the crane is as follows. As the grab ascends, the spring 7a turns the Pulley 7, and in doing so winds in the holding rope. When the grab is lowered, however, and is near the bottom of its descent, the brake 5 is applied, thus opening the grab.

The luffing cord is secured to the Rod 3, passed over the ½″ Pulley 9 and then secured to one side of the gearbox.

The travelling base of the crane is built up from two 3½″×2½″ Flanged Plates held together by means of 5½″ Strips. A 3½″×½″ Double Angle Strip is attached to each end of the base frame. Trunnions are bolted to the base frame, and these carry Axles upon which ¾″ Flanged Wheels are secured. One 2½″ and two 3½″ Strips are secured together in "H" formation. A Pivot Bolt is placed through the centre hole of the 2½″ Strip, and the complete assembly is secured to the lower side Plates of the Clockwork Motor (see Fig. 3). In bolting the "H" pieces in place, Washers should be used so as to allow the head of the Pivot Bolt to rotate freely.

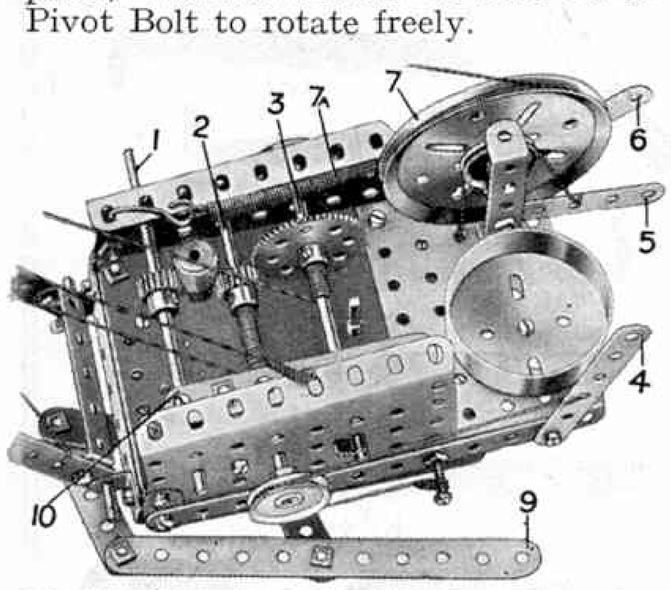


Fig. 5. Gearbox of Grabbing Crane showing gears and Motor control.

In the construction of this model the following parts are used: 2 of No. 1; 9 of No. 2; 6 of No. 3; 2 of No. 4; 12 of No. 5; 2 of No. 6a; 3 of No. 10; 13 of No. 12; 3 of No. 12a; 2 of No. 15; 3 of No. 15a; 4 of No. 16; 2 of No. 17; 1 of No. 18a; 2 of No. 19b; 4 of No. 20b; 4 of No. 22; 2 of No. 22a; 1 of No. 123; 2 of No. 26; 1 of No. 27a; 1 of No. 32; 12 of No. 35; 90 of No. 37; 8 of No. 38; 2 of No. 40; 1 of No. 43; 7 of No. 48a; 2 of No. 48b; 3 of No. 53; 2 of No. 54; 1 of No. 57; 4 of No. 59; 1 of No. 63; 4 of No. 90a; 1 of No. 111; 3 of No. 111c; 2 of No. 115; 1 of No. 116a; 2 of No. 125; 2 of No. 126; 2 of No. 126a; 1 of No. 147b; 1 of No. 162; 1 of No. 163; 1 of No. 164; 1 of No. 166; No. 2 Clockwork Motor.

Petrol-electric Mobile Crane

The model shown in Fig. 4 represents a petrol-electric mobile crane designed for the handling of goods in railway sidings, factories, etc. Many model-builders will see at once that this model is a simplified version of the Meccano Super-model Mobile Crane (see Instruction Leaflet No. 20). Although the model is small, it is nevertheless very effective, and the No. 1 Clockwork Motor with which it is powered enables the jib to be lifted and the load to be hoisted. A simple gear change system is incorporated, so that either motion may be brought into action by means of a lever.

The frame of the model is built up from two 3½″×2½″ Flanged Plates, and Strips are secured to the flanges of these. The No. 1 Clockwork Motor is mounted on the Flanged Plates, and 5½″×2½″ Flanged Plates are secured to the sides of the framework to form the gearbox. A 3½″ Strip is attached at each end of the gearbox

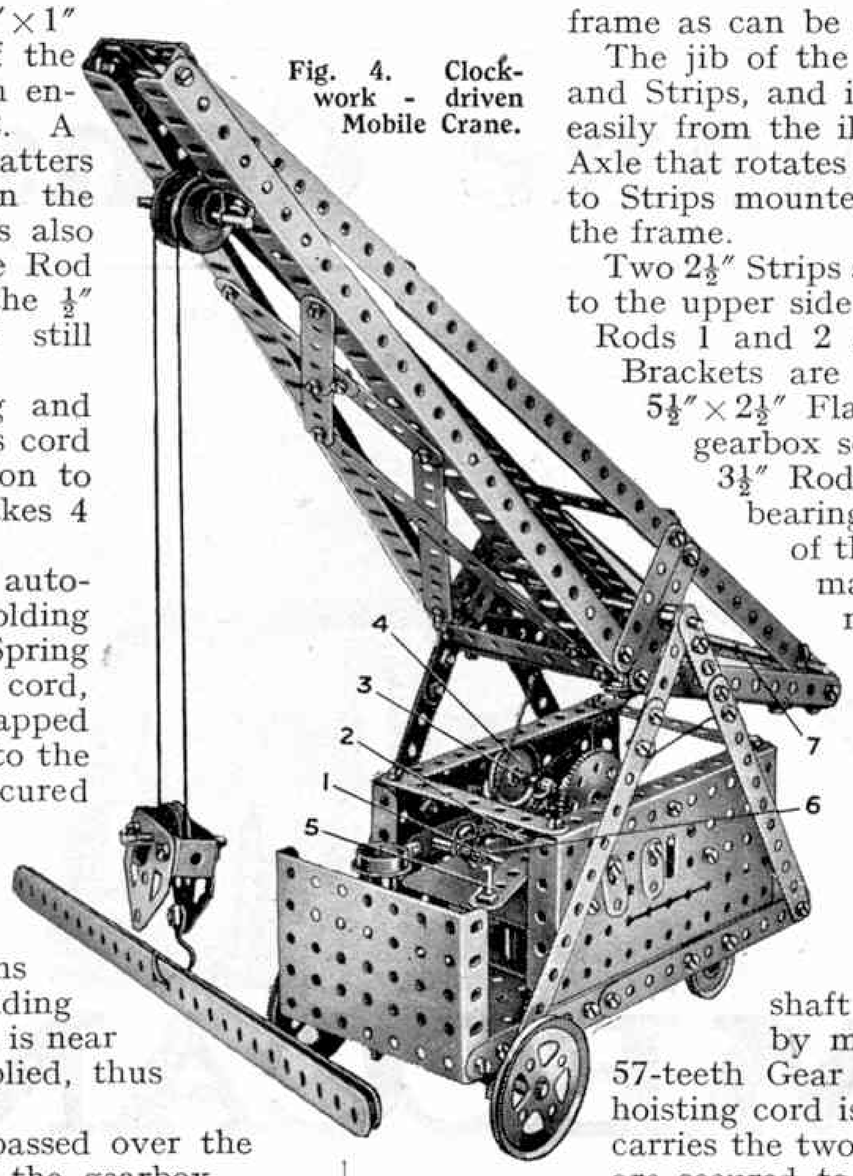


Fig. 4. Clockwork-driven Mobile Crane.

frame as can be seen in Fig. 4.

The jib of the crane is built up from Angle Girders and Strips, and its construction may be followed quite easily from the illustration. The jib is pivoted on an Axle that rotates in the bosses of Cranks that are bolted to Strips mounted in "V" formation at each side of the frame.

Two 2½″ Strips are secured by means of Angle Brackets to the upper side plate of the Motor, and two 2½″ Axle Rods 1 and 2 are journalled in these Strips. Flat Brackets are bolted to the outside faces of the 5½″×2½″ Flanged Plates forming the sides of the gearbox so as to close the holes and prevent the 3½″ Rods 1 and 2 from slipping out of their bearings. A ½″ Pinion is mounted on each of the shafts 1 and 2, and either of these may be brought into gear with a Worm mounted on the Motor driving shaft by means of the pivoted lever 5. This lever is lock-nutted to a ½″×½″ Angle Bracket bolted to the 1½″×½″ Double Angle Strip 6. The Axle Rod 3 is mounted between the sides of the gearbox in Reversed Angle Brackets, and carries a 57-teeth Gear Wheel and a 1″ fast Pulley 4. The Gear Wheel should be arranged so that when the ½″ Pinion on the shaft 2 is brought into mesh with the Worm by means of the lever 5, the teeth of the 57-teeth Gear also engage with the Pinion. The hoisting cord is fitted to the Rod 1, while the Rod 3 carries the two luffing cords. These two latter cords are secured to the Rod 3 by a Spring Clip and are attached to the jib of the crane by means of the 5″ Rod 7. A strap and lever brake is fitted to the shaft 3 and also to the luffing barrel.

The two front road wheels are secured to the frame of the crane by means of Flat Brackets. The rear wheels are carried on a swivelling bogie or "castor" composed of two 1″×1″ Angle Brackets. These Brackets are locked together by means of a Bolt and Nut, and the projecting end of the Bolt is passed through the underside of the frame of the crane and held in place by two further lock-nuts. Cords are attached to the ends of the Angle Brackets and to a Bush Wheel mounted on the lower end of a Rod forming the steering column. The upper end of this Rod carries a ¾″ Flanged Wheel that forms the steering wheel.

The parts employed in the construction of this model are as follows:—2 of No. 1; 17 of No. 2; 6 of No. 3; 1 of No. 4; 12 of No. 5; 1 of No. 6; 6 of No. 8; 4 of No. 10; 3 of No. 11; 7 of No. 12; 2 of No. 12a; 3 of No. 15a; 4 of No. 16; 1 of No. 17; 1 of No. 18a; 2 of No. 20a; 1 of No. 20b; 4 of No. 22; 2 of No. 22a; 2 of No. 26; 1 of No. 27a; 1 of No. 32; 14 of No. 35; 92 of No. 37; 6 of No. 37a; 14 of No. 38; 1 of No. 40; 1 of No. 45; 1 of No. 46; 1 of No. 48; 1 of No. 48b; 2 of No. 52; 3 of No. 53; 1 of No. 57; 2 of No. 59; 2 of No. 62; 1 of No. 63; 2 of No. 90; 1 of No. 111; 6 of No. 111c; 1 of No. 115; 2 of No. 125; 2 of No. 126a; No. 1 Clockwork Motor.

Big Wheel

The assembly of the Big Wheel will be clear from Fig. 6.

Parts for the model are:—8 of No. 1; 16 of No. 2; 4 of No. 4; 8 of No. 5; 2 of No. 6a; 6 of No. 8; 4 of No. 11; 8 of No. 12; 2 of No. 12a; 1 of No. 15; 2 of No. 16; 1 of No. 19; 4 of No. 19b; 2 of No. 22; 6 of No. 35; 94 of No. 37; 4 of No. 37a; 12 of No. 38; 2 of No. 48; 4 of No. 48a; 2 of No. 52; 2 of No. 59; 4 of No. 90a; 2 of No. 111c; 4 of No. 125; 2 of No. 126a.

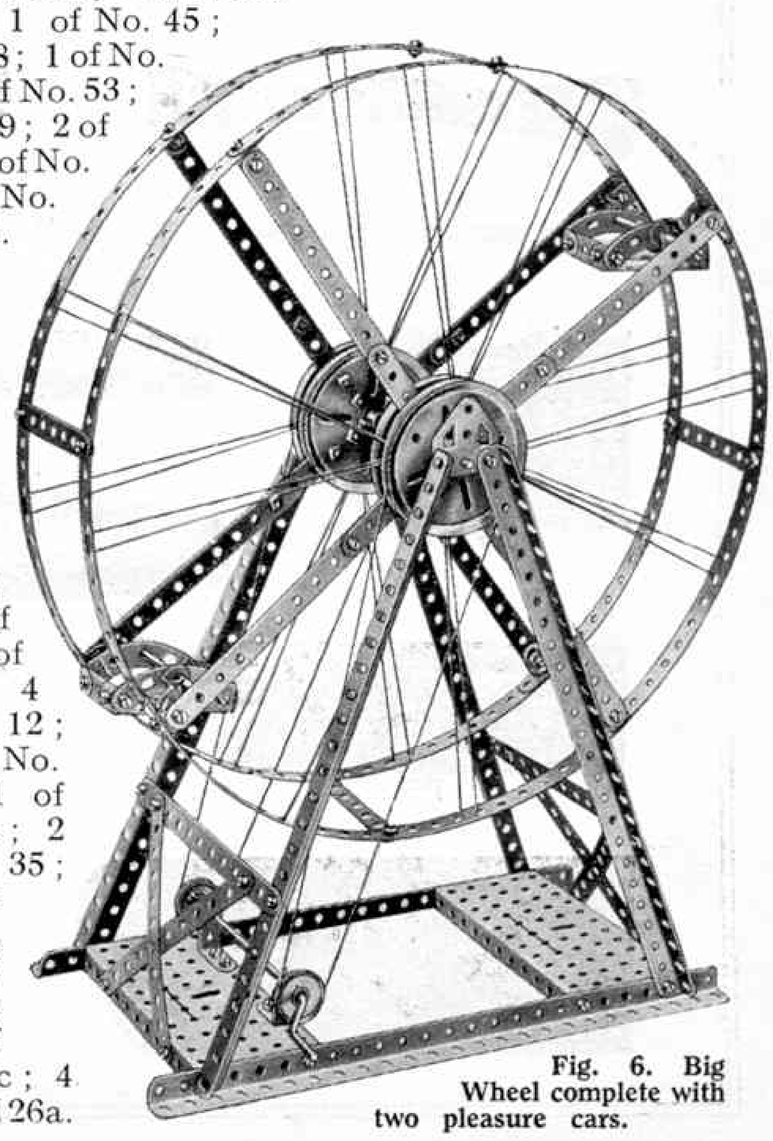
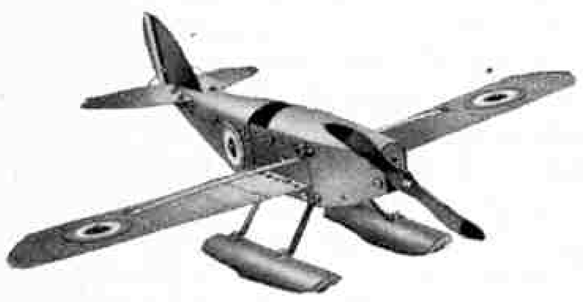
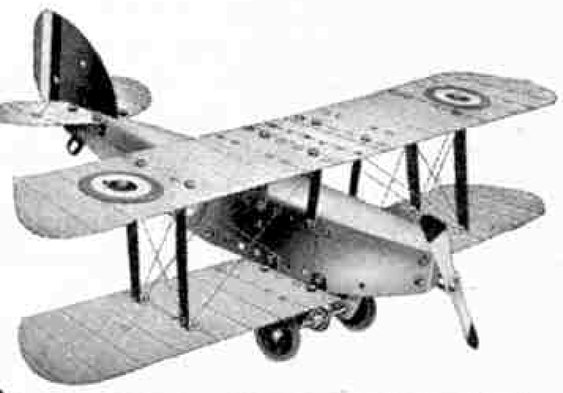
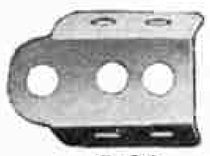


Fig. 6. Big Wheel complete with two pleasure cars.

Aeroplane Constructor







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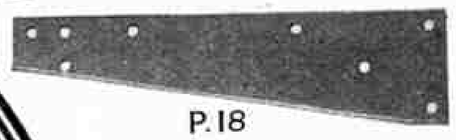

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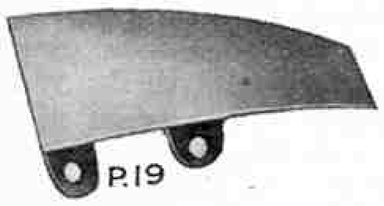

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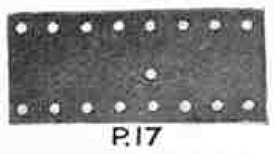

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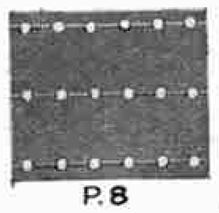

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MECCANO

Boys, it's great fun building model aeroplanes with the new Meccano Aeroplane Constructor Parts. They are the most wonderful and the most realistic models you ever saw! If you already have a Meccano Aeroplane Constructor Outfit you should purchase extra parts so that you may build a bigger range of models. All the parts are illustrated on this page. You may derive a great deal more fun and pleasure, too, by driving your models with one of the Aero Clockwork Motors that are specially designed to build into the fuselage.

If you have a No. 1 Aeroplane Outfit there is a No. 1A Accessory Outfit that will convert it into a No. 2 Outfit. This will enable you to build a much wider range of models, including triple-engined monoplanes and biplanes, and a racing seaplane of the type used in the Schneider Trophy Contests.

Ask your dealer for the complete illustrated price list of Aeroplane Constructor Outfits, Parts and Motors.

PRICES OF MECCANO AEROPLANE OUTFITS

No. 1 Outfit	9/-
No. 1A Accessory Outfit	8/6
No. 2 Outfit	16/6

PRICES OF AERO CLOCKWORK MOTORS

No. 1 Motor	2/-
No. 2 Motor	4/6

MECCANO LIMITED
Old Swan, Liverpool

23A

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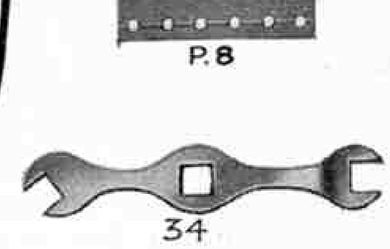

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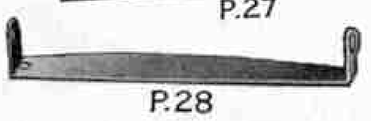

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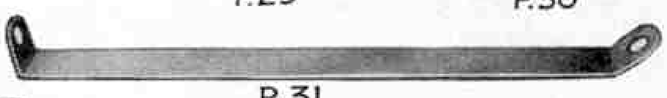

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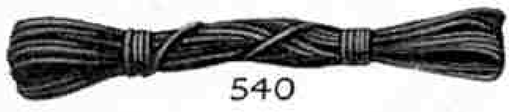

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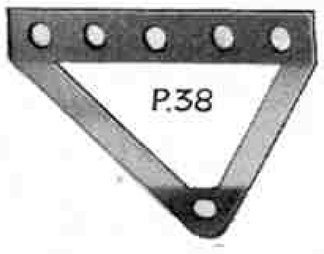

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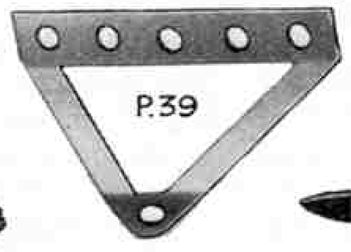

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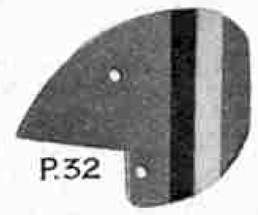

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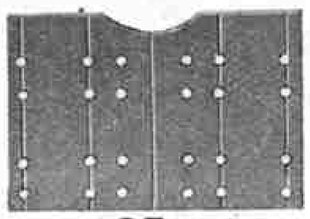

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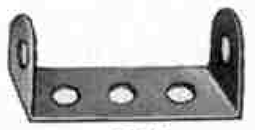

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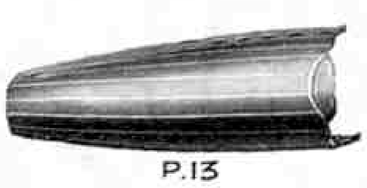

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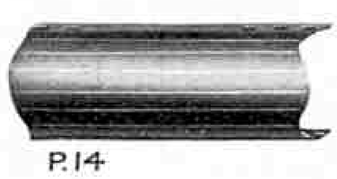

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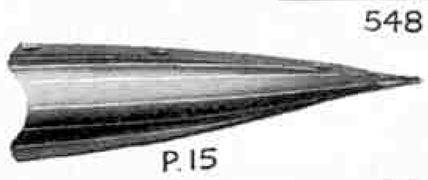

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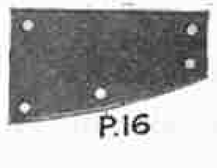

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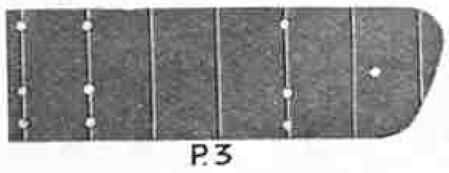

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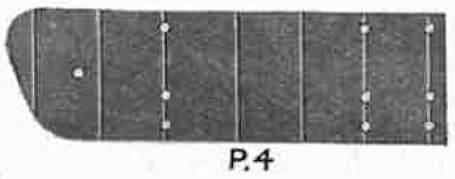

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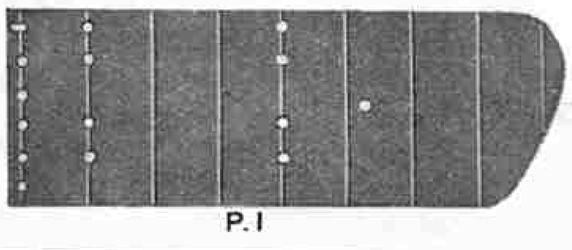

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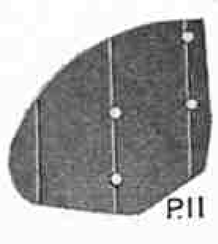

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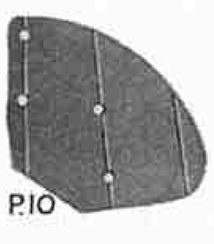

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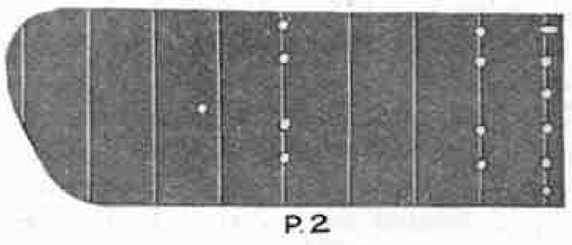

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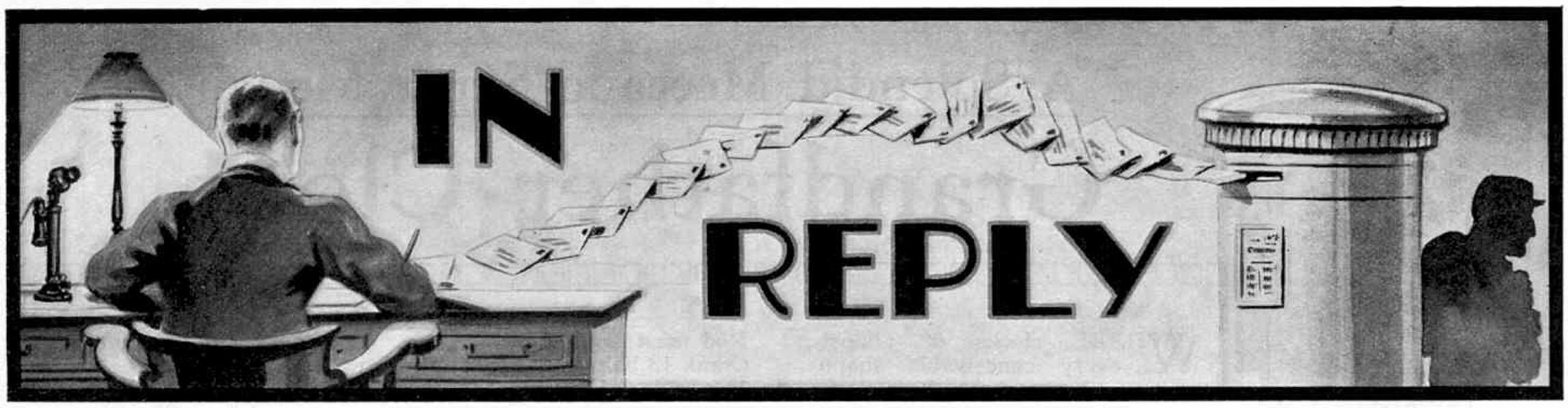


BUILDING ELECTRIC LOCOMOTIVES

Many Meccano boys wish to build model electric locomotives with their outfits, using a Meccano Electric Motor for the driving power, and to run the built-up engine on Hornby rails. This is an excellent plan and an engine that is both realistic and powerful can be made quite easily. A number of constructors, however, appear to be uncertain whether to use the "third rail" or "overhead wire" system of supplying current to the Electric Motor in the chassis of the locomotive.

Both systems possess certain advantages and a few notes on the operation of the two systems will no doubt be of assistance.

The "third rail" system is undoubtedly the simpler method of conveying current from the accumulator or transformer placed at the side of the track to the motor mounted in the frame of the engine. If this system is adopted, the Meccano Collector Shoe (part No. 149) should be fitted to the underside of the chassis. The Shoe is mounted on a strip of fibre so that it is insulated from the frame of the engine. A length of wire should be attached to the Shoe and the free end of the wire joined to one terminal of the Electric Motor. The other terminal of the Motor should be joined to the frame of the engine. Hornby Electric Track having the special insulated centre rail must be used with this system, and constructors should note that separate parts for converting standard Hornby Track to Electric Track are now available. The Collector Shoe makes contact with the centre rail of the track and in this way the current is conveyed to the windings of the Motor. The terminals of the Accumulator or Transformer are connected to the outside rails and the insulated centre rail respectively, and in returning, the current passes through the frame of the locomotive to the wheels and thus to the outside rails of the Track.

With the "overhead" system of current collection, a "pantagraph" is made use of, and this may be constructed quite easily from Meccano parts. The pantagraph is mounted on the roof of the model engine. It is connected to one terminal of the Motor, the other terminal of this being connected to the frame of the engine, from which the pantagraph is insulated. A number of gantries must be built and arranged along the track to support the overhead cable, which may consist of Meccano 22 gauge Bare Copper Wire. One terminal of the Accumulator or Transformer is connected to the rails while the other is connected to the overhead wire. The current then passes from the overhead wire to the Motor windings via the pantagraph, and is returned through the frame and wheels of the Locomotive.

The "overhead" system possesses the advantage that the standard "non-electric" type of Hornby Track may be used. It has the disadvantage that it is more complicated than the "third rail" method, but it is an interesting system to build up and details of a locomotive designed for this type of working will be found in the April 1928 issue of the *"M.M."*

LARGE RADIAL ENGINES

Model aeroplane enthusiasts will note that there are two sizes of Radial Aeroplane Engines in the range of Meccano Aeroplane Constructor parts. Part No. P43 is a die-cast representation of a 9-cylinder air-cooled radial engine, and three of these Engines are included in the No. 2 Aeroplane Constructor Outfit (three Engines will also be found in the No. 1a Accessory set).

The Radial Engines, part P43, are suitable for fitting to models of two and three-engine machines, and in the No. 2 Instruction Manual several models of multi-engine aircraft are shown fitted with these Engines. Part No. P46 is a larger version of the Radial Engine No. P43, and although it is not included in the No. 2 Outfit, Meccano aircraft engineers will find the Engine very useful in building up various special types of machines. For instance, there are many actual machines fitted with a single radial air-cooled engine of large horse power. Such machines as the Bristol "Bulldog," the Armstrong-Whitworth "Siskin," and the Westland "Wapiti" are all fitted with one large radial engine, and the Meccano Radial Engine No. P46 can be used conveniently when models of these machines are being built. Constructors will doubtless be able to find many other uses for the large Radial Engines in the construction of model aircraft. Part No. P46 may be obtained from any Meccano dealer who stocks Meccano Aeroplane Constructor Parts.

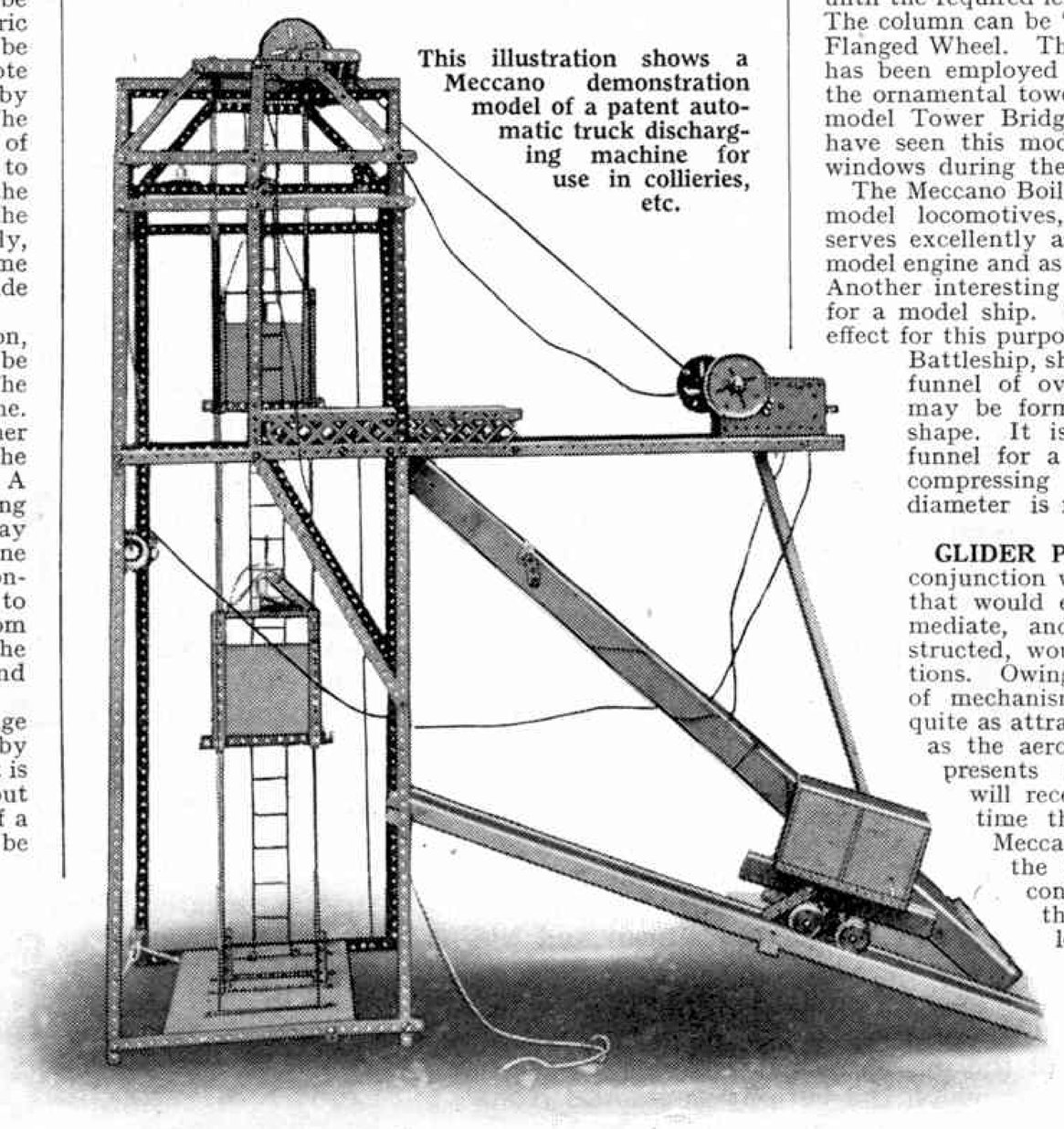
MECCANO CAMS

Although a cam is not included in the Meccano range as a standard unit, it is possible to build up a number of types of cams from existing parts.

A particularly neat and useful cam may be formed from two Collars (part No. 59). One Collar is mounted on the cam-shaft, and held in place by its Grub Screw. A 7/32" Grub Screw (part No. 69b) is then screwed into the tapped bore of the Collar. A second Collar (with Grub Screw removed) is secured to the first one by screwing the projecting shank of the 7/32" Grub Screw into the tapped hole of the second Collar. In this way the second Collar may be locked tightly to the Collar mounted on the cam-shaft. This type of cam is quite efficient, the sides of the Collars providing a good bearing surface for the Strip or other part that acts as a tappet, while the rounded surfaces of the Collars themselves enable the cam-action to be carried out smoothly and evenly.

Another form of cam that will be found useful in larger models may be constructed from two Bush Wheels and a number of Collars. The Collars are secured between the Bush Wheels by means of ¾" Bolts that are passed through the holes in the faces of the Wheels. The number of Collars used in the construction of this type of cam may be varied to suit the type of cam-action required. It is also possible to use Meccano 2" and 3" Pulley Wheels in place of the Bush Wheels, so that a larger reciprocating action is obtained. Where a sharp lifting action is needed, Meccano Double Brackets may be substituted for the Collars. Cams built up in this way are employed in the "picking" motion of the Meccano Loom. In this model, the cams actuate cranks and levers that control the picking sticks, which in turn drive the Shuttle from side to side in the slay.

Most of the Meccano Wheels may be used as cams by mounting them "off-centre." A Bush Wheel may be mounted in this way by first securing a Coupling to it by means of a ¾" Bolt or a 1" length of Screwed Rod, passed through the boss of the Bush Wheel and through the end transverse plain bore of the Coupling. The "cam-shaft" may then be passed through the other end transverse bore of the Coupling and through one of the eight holes in the face of the Bush Wheel.



This illustration shows a Meccano demonstration model of a patent automatic truck discharging machine for use in collieries, etc.

TUBULAR ELEMENTS IN MECCANO

From time to time model-builders ask us how tubes and circular columns may be constructed from standard parts. There are at present two tubular elements in the Meccano system, the Sleeve Piece and the Boiler, and with these it is possible to build up a number of tubular structures. An excellent cylinder for a locomotive, etc., can be formed by pushing a ¾" Flanged Wheel on to each end of a Sleeve Piece.

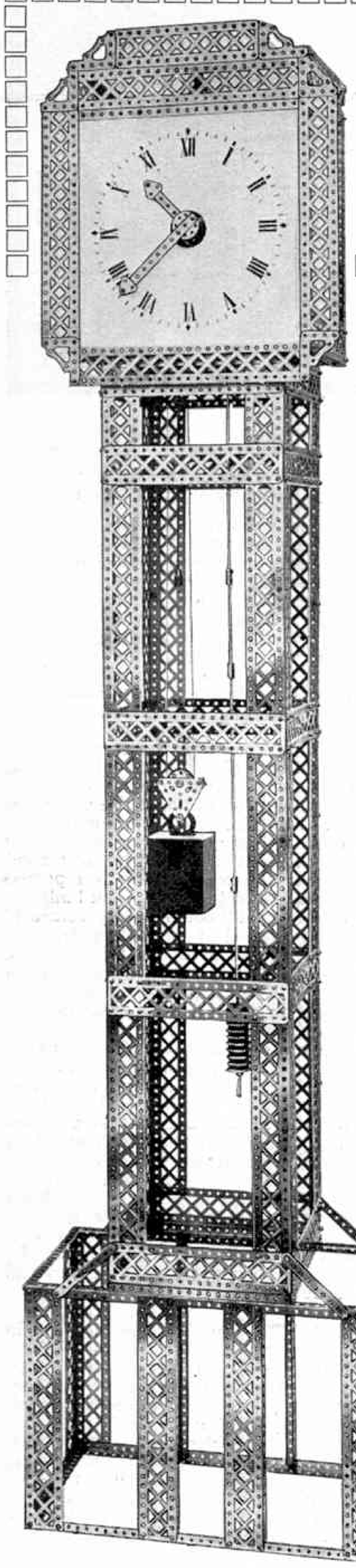
A pillar or column for use in a model church or public building can be built up from a number of Sleeve Pieces in the following manner. A Meccano Axle Rod is used as the central support for the column, and a ¾" Flanged Wheel is secured close to one end of the Axle. A Sleeve Piece is placed on to the Axle and pushed over the flange of the Flanged Wheel. A Chimney Adaptor is slipped on to the Rod and pushed half-way into the Sleeve Piece, and a second Sleeve Piece is placed over the projecting portion of the Chimney Adaptor. This is followed by a second Chimney Adaptor, and the construction is repeated until the required length of column has been built up. The column can be "capped" conveniently with a ¾" Flanged Wheel. This method of column construction has been employed with excellent effect in building the ornamental towers of the Meccano demonstration model Tower Bridge. Doubtless many readers will have seen this model in operation in their dealers' windows during the Christmas season.

The Meccano Boiler is primarily intended for use in model locomotives, donkey engines, etc. It also serves excellently as a petrol or oil tank in a large model engine and as a storage tank in model buildings. Another interesting use for the boiler is as a funnel for a model ship. The Boiler is used with excellent effect for this purpose in the model "Revenge" class Battleship, shown in the 5-7 Manual. Where a funnel of oval section is needed, the Boiler may be formed quite easily to the required shape. It is also possible to make a thin funnel for a model tramp steamer, etc., by compressing the boiler so that its overall diameter is reduced.

GLIDER PARTS.—Special parts for use in conjunction with the existing Aeroplane Parts that would enable models of primary, intermediate, and secondary gliders to be constructed, would prove quite interesting additions. Owing to the almost complete absence of mechanism, the glider does not provide quite as attractive a subject for model-building as the aeroplane, but nevertheless the idea presents interesting possibilities and it will receive consideration. At the same time the possibility of using standard Meccano parts in conjunction with the special Aeroplane Parts for the construction of special models of this type should not be overlooked. *(Reply to C. Perry, Cambridge).*

AIRCRAFT ARMAMENT.—Ideas for the extension and improvement of the range of Meccano Aeroplane Parts are always welcome and we were interested in your suggestions. Miniature machine guns and Lewis guns would look very effective if fitted to models of military aircraft, and it may be possible to introduce accessories of this type in the future. In the meantime, we suggest that you represent these parts with standard Meccano parts (Axle Rods, Couplings, etc.), as some quite realistic results can be obtained in this way. *(Reply to R. Stewart, Glasgow).*

RUBBER TRACK.—Your suggestion regarding special rubber track for use in model tanks, farm tractors, etc., is quite ingenious. The track would consist of an endless rubber band on one side of which would be formed a number of projections or spikes. The band would be passed round Pulleys driven by a Motor and the spiked track would then draw the model along the ground. We have noted your idea for further attention. *(Reply to W. Cox, Yeovil).*



A Splendid Meccano Super Model

Grandfather Clock

WHEEL clocks of almost every conceivable shape and size have been constructed, but it is doubtful whether there has ever been a more popular type than the weight-driven "Grandfather" pattern. For over 400 years the Grandfather clock maintained its place as the standard time-piece for the home, and it was only with the introduction of mass-produced clocks of relatively small size, during the middle of the last century, that the "Grandfather" was ousted from its proud position. These ingenious clocks were the products of skilled craftsmen, and the excellence of their construction may be gauged by the fact that many that were built more than 100 years ago are still keeping perfect time.

The "Grandfather" type of clock undoubtedly provides one of the clearest examples of the principle of operation of a clock mechanism. The Meccano model that is described in this article therefore fulfils two distinct functions, for besides being a perfect working mechanism that may be put to practical use in the home, it also enables the constructor to gain a thorough knowledge of the principles underlying clock construction.

The Meccano model stands 6 ft. high and runs for 18 hours without rewinding. With the exception of a lead weight and a cardboard dial, which may easily be made at home, the model is composed entirely of standard Meccano parts. When carefully adjusted the model will keep perfect time over long periods, the effective length of the pendulum being capable of adjustment or "compensation" for varying conditions.

Fig. 1. General view of the Meccano Grandfather Clock.

The model consists of two main units, the Mechanism and the Clockcase. It is best to construct the clock mechanism first, so that this may be adjusted to operate correctly after which the case may be built up, and the top of the clockcase, and dial, etc., secured in place around the mechanism.

The frame or "skeleton" in which the various Gears and Rods forming the mechanism are accommodated, is shown in Fig. 2. The frame is composed of four $12\frac{1}{2}$" Angle Girders 1 bolted at their lower ends to $9\frac{1}{2}$" Girders 4 and at the top to $5\frac{1}{2}$" Girders 3. Other $5\frac{1}{2}$" Girders 2 and a number of $5\frac{1}{2}$" Strips are secured between the vertical members. Two $5\frac{1}{2}$" Angle Girders are also secured between the Girders 3 to provide supports for the $7\frac{1}{2}$" Strips 7 and 9, the lower ends of these Strips being bolted to $5\frac{1}{2}" \times \frac{1}{2}$" Double Angle Strips 5 and 8, secured between two pairs of horizontal $5\frac{1}{2}$" Strips. A $9\frac{1}{2}$" Strip 10 is secured to the back of the frame as shown, and a $5\frac{1}{2}" \times 3\frac{1}{2}$" Flat Plate is bolted to the two $12\frac{1}{2}$" Girders forming the front of the frame. A Flat Trunnion 6 is attached to the Double Angle Strips 5, and Double Bent Strips 11 and 12 are secured to the frame in the positions shown to provide bearings for the clutch gear operating shaft and winding-crank spindle respectively.

To complete the frame unit, supports for holding an 8" Axle Rod must be secured in place. The front support consists of a Crank 13 bolted to a Flat Trunnion which, in turn, is secured to a $1\frac{1}{2}$" Angle Girder bolted to the top of the frame. The rear support incorporates also a Crank, which is secured to a 2" Strip and a Trunnion bolted to the top of the frame. The pallet pivot Rod 56 (see Figs. 4 and 6) is journalled in the centre holes of the Trunnions and also in the slotted holes in the Cranks 13.

In fitting the various gears in position, it will materially assist the constructor in understanding the operations of the model if he assembles the gears in the order in which they transmit the motion from the prime mover.

The primary gears are the $3\frac{1}{2}$" Gear Wheels 43 (see Figs. 6 and 7), one of which meshes with a $\frac{1}{2}$" Pinion 14 on the 3" Axle Rod 24 (see Fig. 3). This Axle should therefore be pushed into place, and the $\frac{3}{4}$" Pinion 26 and the 50-teeth Gear 15 secured in the positions shown in Figs. 3 and 6; the Rod 24 is held in place at its outer end by means of a Collar.

From the $\frac{3}{4}$" Pinion 26, the drive is taken to the 50-teeth Gear Wheel 25. This last-mentioned Gear is mounted on a 3" Axle Rod that is slideable in the holes in the Double Angle Strips 5 and 8 in which it is journalled. It carries in addition to the 50-teeth Gear a $\frac{1}{2}$" Pinion 65, a Crank 60, and a Compression Spring 27. Three Washers are placed on the Rod between the Pinion 65 and the Double Angle Strips 5 (Fig. 2).

The aim of providing a sliding action for this Rod is to enable the gear train from the clock hands to the winding drum to be "broken" when it is required to adjust the hands of the clock, the action of "declutching" being achieved by the aid of the mechanism now to be described.

The boss of the Crank 60 is slipped on to a 3" Axle Rod 79 (Fig. 6), journalled in the Double Angle Strips 5 and 8; and the boss is then locked to the shaft by means of its set-screw. A Double Bracket 80 (Fig. 3) is slipped on to the Rod 79 and held in place by means of Collars secured on each side. The Bracket is pivotally connected, by means of the lock-nut device, S.M. 262, to a Bell Crank 81, the boss of which is secured to a 2" Rod journalled in the Double Bent Strip 11 that is secured to the frame of the mechanism (Fig. 2).

To the free arm of the Bell Crank 81, a length of cord is attached, and by pulling on this the Crank 60 will draw the 50-teeth Gear Wheel 25 (Fig. 3) out of engagement with the $\frac{3}{4}$" Pinion 26, thus "breaking" the main gear train, and enabling

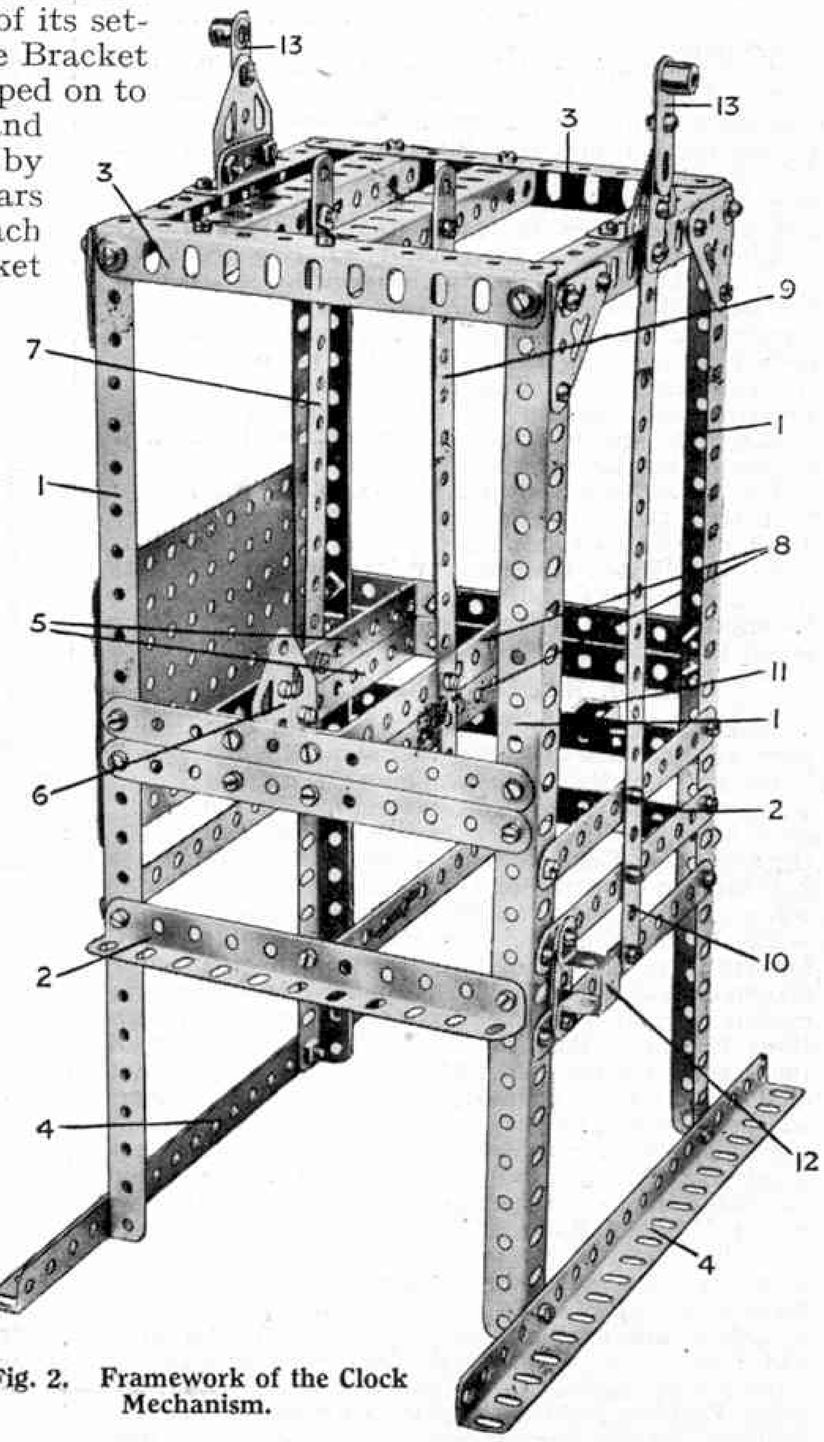


Fig. 2. Framework of the Clock Mechanism.

either of the clock hands to be turned freely.

The next step in the construction of the main gear train is to place the Rod 36 (Fig. 3) in position and mount on it the 57-teeth Gear Wheel 28 and the ¾″ Pinion 30, these Gears being secured one on each side of the Double Angle Strips 5.

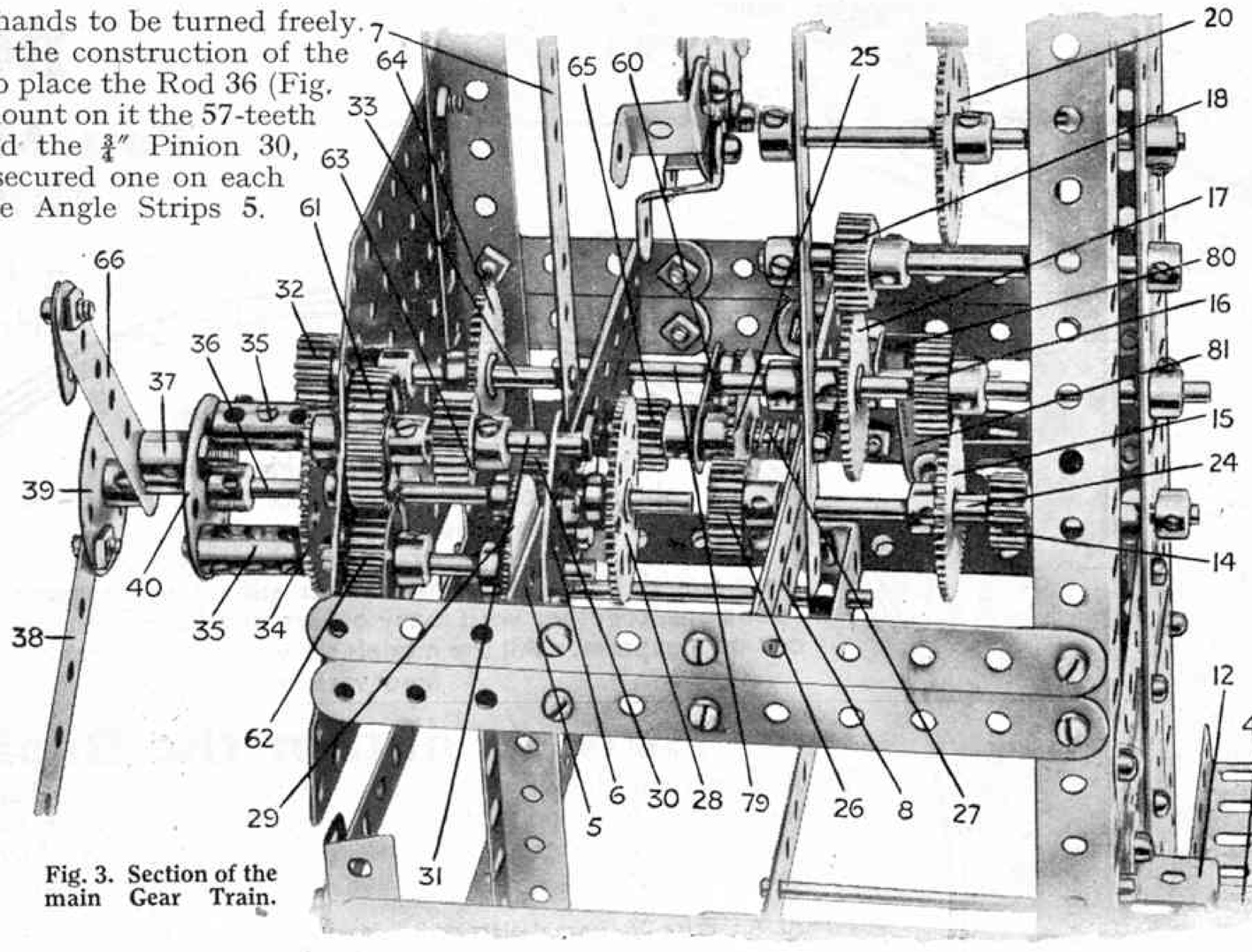


Fig. 3. Section of the main Gear Train.

The Rod 36 carries at its outer end the minute hand, but as we are dealing only with the internal gears at this stage, the minute hand unit should not yet be fitted.

A 2″ Rod is journalled in one of the Double Angle Strips 5 and the Flat Plate forming the front of the frame, and carries a 50-teeth Gear Wheel 29 that meshes with the ¾″ Pinion on the minute hand shaft 36, and a 1″ Gear 62. Two Washers should be placed between the Gear 62 and the Flat Plate in order to allow the Gear to rotate freely.

The Gear 62 engages with a further 1″ Gear 61 mounted on a 2″ Rod 31, which carries also a ¾″ Pinion 63.

To complete the drive to the hour hand, a Rod 33 is journalled in the Strip 7 (Fig. 2) and the 5½″ × 3½″ Plate, and carries a 50-teeth Gear Wheel 64 (Fig. 3), which meshes with the Pinion 63. The Rod 33 carries also a ½″ Pinion 32 mounted on the Rod against the outside face of the Flat Plate.

The hour arm unit may now be built up and secured in position on the Rod 36. The unit consists of a 57-teeth Gear Wheel 34, to the face of which are secured two Couplings 35 by means of bolts. A Bush Wheel 40, with its boss turned inward, rests on the Couplings and is held to them by further bolts, the shanks of the bolts being nipped by the set-screws in the Couplings. A 3½″ Strip 66, fitted with a 1″ Triangular Plate forms the hour hand, and is held to the Bush Wheel 40 by means of a ¾″ Bolt passed through the Strip and a Threaded Boss 37. The hour hand unit is quite free to rotate on the Rod 36, but is spaced away from the face of the Flat Plate by the Wheel boss and Washers. The minute hand unit consists of a 5½″ Strip 38 fitted with a 1″ Triangular Plate, the Strip being bolted to a Bush Wheel 39, which is secured rigidly to the Rod 36.

After the main gear train has been placed in position, it is interesting to follow the manner in which the drive has been reduced before being taken to the minute hand shaft; and the method employed to provide an auxiliary reduction ratio of 12 : 1 for the hour hand shaft.

The drive is first taken from one of the Gear Wheels 43 (Fig. 7) to the Pinion 14 (Fig. 3), thus providing a step-up of 7 : 1. It then passes to the Gear 25 via the Pinion 26, the resulting 2 : 1 ratio providing a total reduction of 14 : 1. From the shaft carrying the Gear 25, the drive passes to the minute hand shaft, a reduction of 3 : 1 being employed here in the form of the ½″ Pinion 65 and the Gear Wheel 28. The total reduction is thus 42 : 1, and the minute hand will consequently rotate at 1/42 of the speed of the winding drum.

The hour hand drive is composed of a 2 : 1 ratio between Pinion 30 and the Gear 29; a 1 : 1 ratio from Gear 62 to Gear 61, and a 2 : 1 ratio from the Pinion 63 to the Gear 64 on the shaft of which is mounted the Pinion 32 meshing with the 57-teeth Gear 34; the latter Gears giving a final drive of 3 : 1. The product of this compound gear train is exactly 12 : 1, so that the hour hand rotates at 1/12 of the speed of the minute hand, and at 1/504 the speed of the winding drum.

After the main gear train has been assembled, the gearing connecting the escapement with it may be secured in place.

The drive from the shaft 24 (Fig. 3) is taken to a ¾″ Pinion 16 mounted on a 3″ Axle, by means of the 50-teeth Gear 15 (Fig. 3). The Rod of Pinion 16 also carries a 50-teeth Gear Wheel 17, which meshes with a ¾″ Pinion 18 on a further 3″ Axle, that is journalled as shown. A 57-teeth Gear Wheel 22 is also mounted on this Axle (see Fig. 6), and this gears with a ½″ Pinion 19. The drive is finally transmitted to the pallet wheel shaft 23 (Fig. 6), by means of a further 57-teeth Wheel 20 (Fig. 3), meshing with a ½″ Pinion secured to the shaft 23.

The pallet and pallet wheel are illustrated in Figs. 4 and 6, the latter view showing the details of the construction of these parts very clearly.

The pallet wheel consists of a Face Plate 76 (Fig. 4) mounted on the Axle 23 (Fig. 6). The Plate carries eight Reversed Angle Brackets 77 secured to the Plate by Bolts placed in their slotted holes. Washers should be placed under the heads of these Bolts to ensure a firm grip.

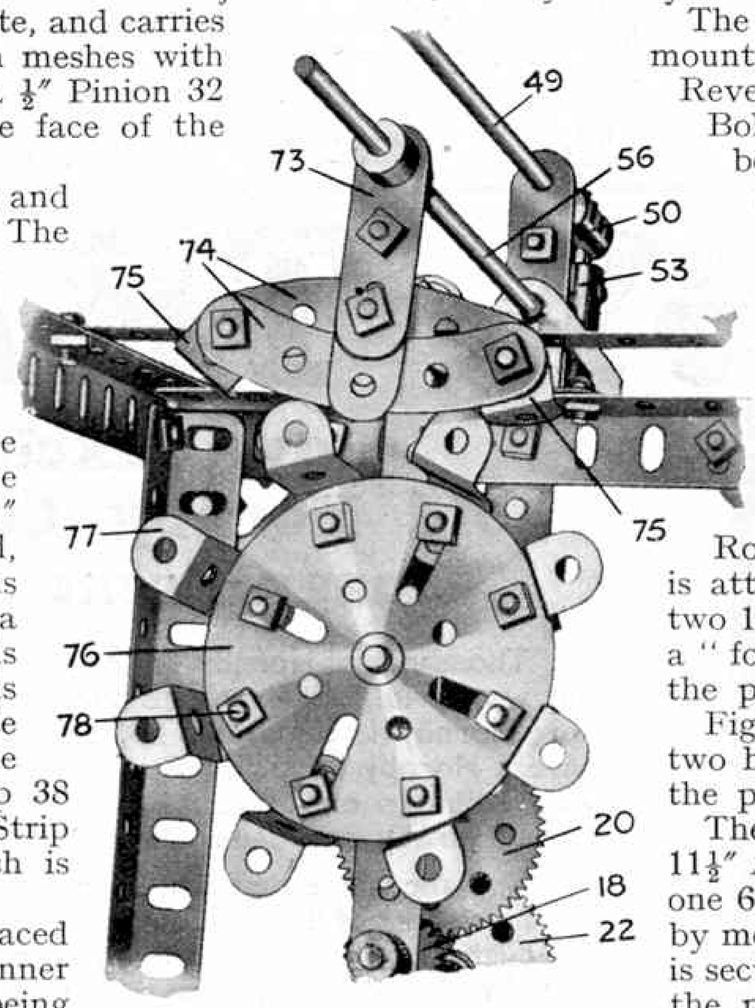


Fig. 4. The Escapement Mechanism.

The pallet itself is built up from two Cranks 73 secured back to back. A 1½″ Strip is secured to these, and also two Curved Strips 74. Angle Brackets 75 are also attached to the ends of the Strips 74. The complete pallet is mounted on a 6½″ Axle Rod 56 (Fig. 6), journalled in the supports 13; and is held in place at the front end by a Collar and at the rear by means of a Coupling. This Coupling carries a 6½″ Axle Rod 55, to the lower end of which a further Coupling 58 is attached, as shown. This Coupling in turn carries two 1″ Rods 59 placed in its lateral bores, thus forming a "fork" that enables connection to be made between the pallet and pendulum.

Fig. 5, shows the lower portion of the pendulum in two halves, and the weight, while the upper part, and the pivot and pivot support, may be seen in Fig. 6.

The complete pendulum rod is built up from three 11½″ Axle Rods (Fig. 5), one each for 78a, 78c, 78d and one 6½″ Rod 78b. These Rods are connected together by means of Couplings, and a Strip Coupling 54 (Fig. 6) is secured to the end of the Rod 78a. The lower end of the pendulum carries a weight composed of ten 1⅛″ Flanged Wheels, the position of the latter being adjusted when setting the clock in operation, to provide the correct movement of the crutch.

The pendulum swings about a Pendulum Connection 51 (Fig. 6) which is secured tightly in the slots of the Strip Coupling 54 and 53 by means of bolts. A 1″ Rod is secured in the vertical bore of the Strip Coupling 53. This Rod is also gripped in the end lateral bore of the Coupling 50 that is mounted on the 6½″ Rod 49, the Rod being held rigidly in the bosses of the Cranks 13.

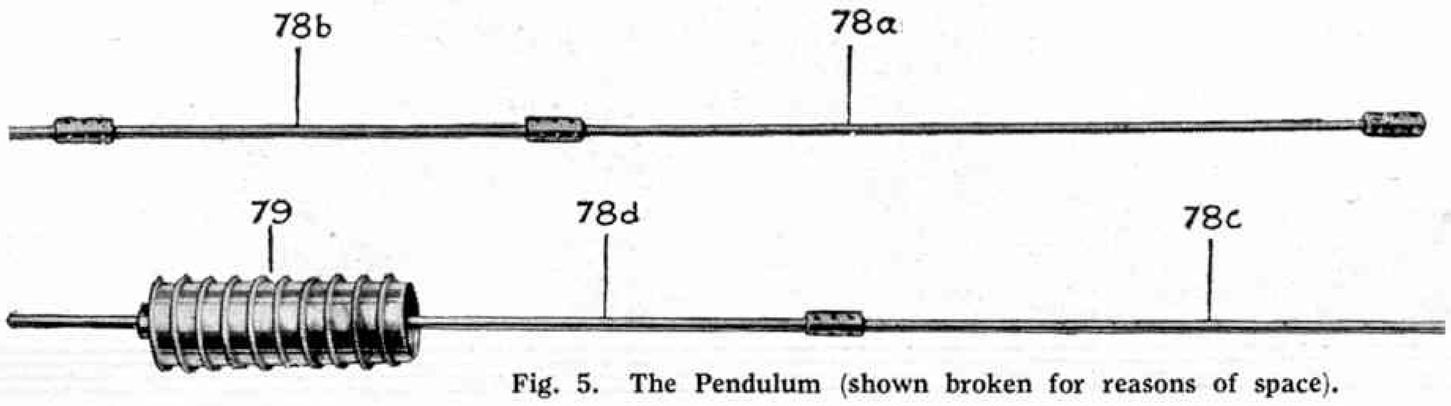
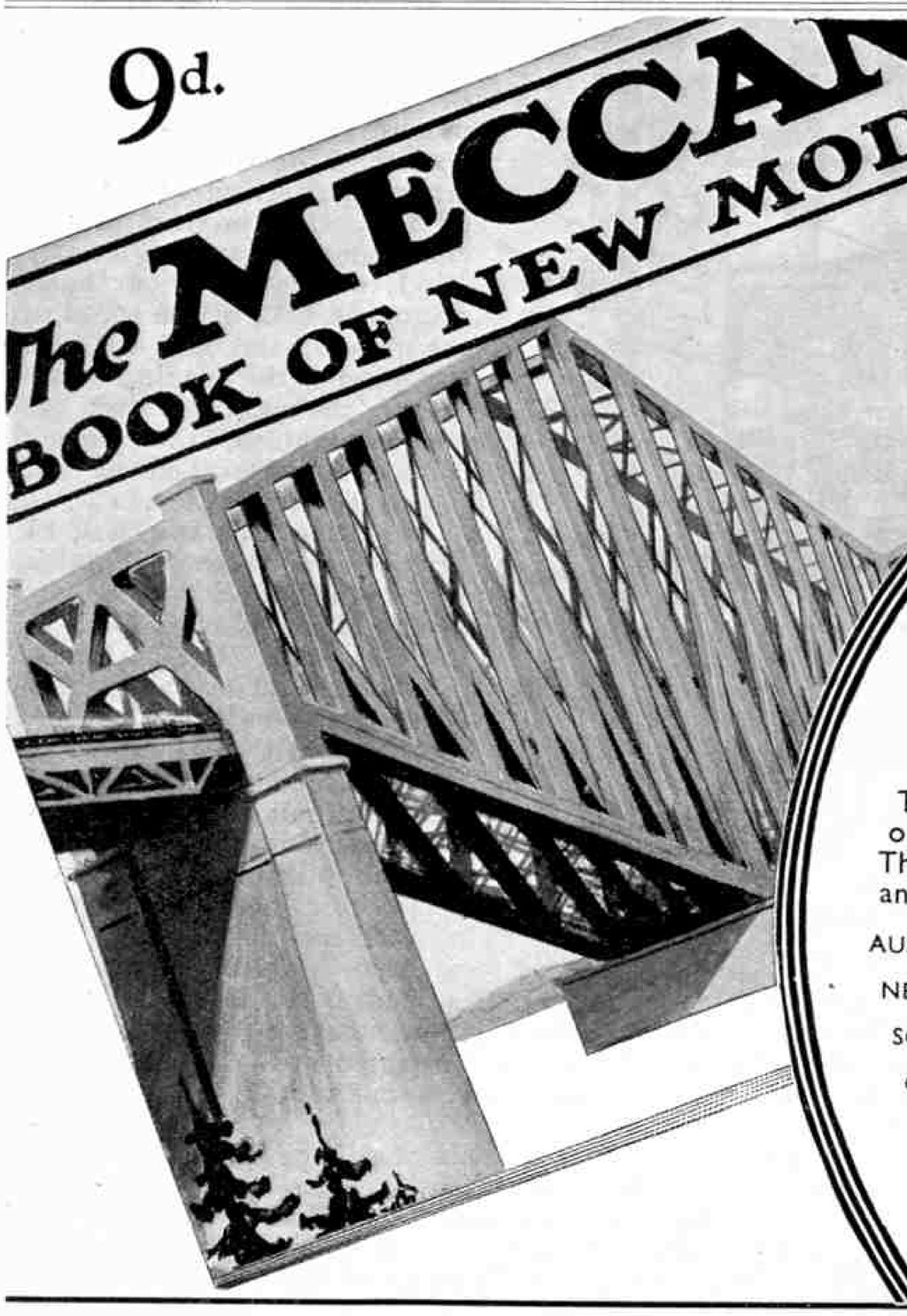


Fig. 5. The Pendulum (shown broken for reasons of space).

The ratchet winding gear and winding drum are seen incorporated in the mechanism frame in Fig. 6, while Fig. 7 shows the unit disassembled.

The drum, ratchet and gears are mounted upon a 6½″ Axle Rod 41. The drum consists of four Face Plates 68,

9d.



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bolted together in pairs and securely locked to the shaft 41 by two set screws placed in each boss. Eight 3″ Axle Rods 69 are then passed through the holes in the Plates and held in position by Collars. The loop in the end of the Wire Line 70 is passed over one of the Axles 69, and held in place against one of the Face Plates by means of an additional Collar.

The Ratchet Wheel 42 should next be secured rigidly to the Axle by means of two set-screws, and a 3½″ Gear Wheel 43 slipped on to the Rod. As the Gear Wheel must rotate freely on the shaft 41 in one direction, its set-screw should be removed. This Wheel 43 carries two Pawls 46 secured to its face by Pivot Bolts. The Pawls are held in engagement with the teeth of the Ratchet 42 by means of short lengths of Spring Cord 67, one end of each length being secured under the head of an ordinary bolt fixed in one of the holes in the face of the Gear Wheel, and the other end passed through the hole in the Pawl and twisted back to form a strong loop. The length and tension of the springs should be adjusted so as to keep the Pawls in firm contact with the Ratchet, and thus prevent any possibility of slipping. The Gear 43, complete with Pawls and springs, is held in position against the boss of the Ratchet Wheel 42 by means of a Collar.

The complete winding drum axle is journalled in two 5½″ Strips forming part of the frame (Fig. 6), and is prevented from moving lengthwise by means of two Collars 71 and 72, secured on each end. The position of the 3½″ Gear Wheel carrying the Pawls of the ratchet mechanism must be adjusted so that it engages with the Pinion 14 (See Fig. 3). The second 3½″ Gear 43 meshes with a ½″ Pinion 44 (Fig. 6), mounted on a 4½″ Rod journalled in the Double Bent Strip 12 (Fig. 2) and a 5½″ × ½″ Double Angle Strip secured between the mechanism frame. This Rod carries also a Crank 45 (Fig. 6), fitted with a Threaded Pin, thus forming a convenient winding handle by which the Wire Line (part No. 141) may be wound round the winding barrel to raise the clock weight. The reduction gearing of 7 : 1 fitted between the winding handle and the drum shaft makes quite easy the operation of lifting the heavy Weight.

The Wire Line, after being secured to the winding drum, is passed round the groove of a 1½″ Pulley mounted on a 1″ Rod journalled in two Triangular Plates that form the weight pulley block. The Triangular Plates are held apart from each other by means of Double Brackets, and the weight itself is secured to the block by passing a 1″ Axle through the holes in the Plate and also through a ring on the weight. Any form of weight may be used here, provided it is not less than 18 lb. and of such dimensions as not to foul the sides of the clockcase. A suitable shaped weight is shown in the general view.

The other end of the Wire Line, after passing round the 1½″ Pulley, is secured to a Hook attached to the lower 5½″ × 1½″ Double Angle Strip in the lower portion of the mechanism frame. (See Figs. 2 and 3).

It now remains to build the clock case, as shown in the General View (Fig. 1) of the completed model.

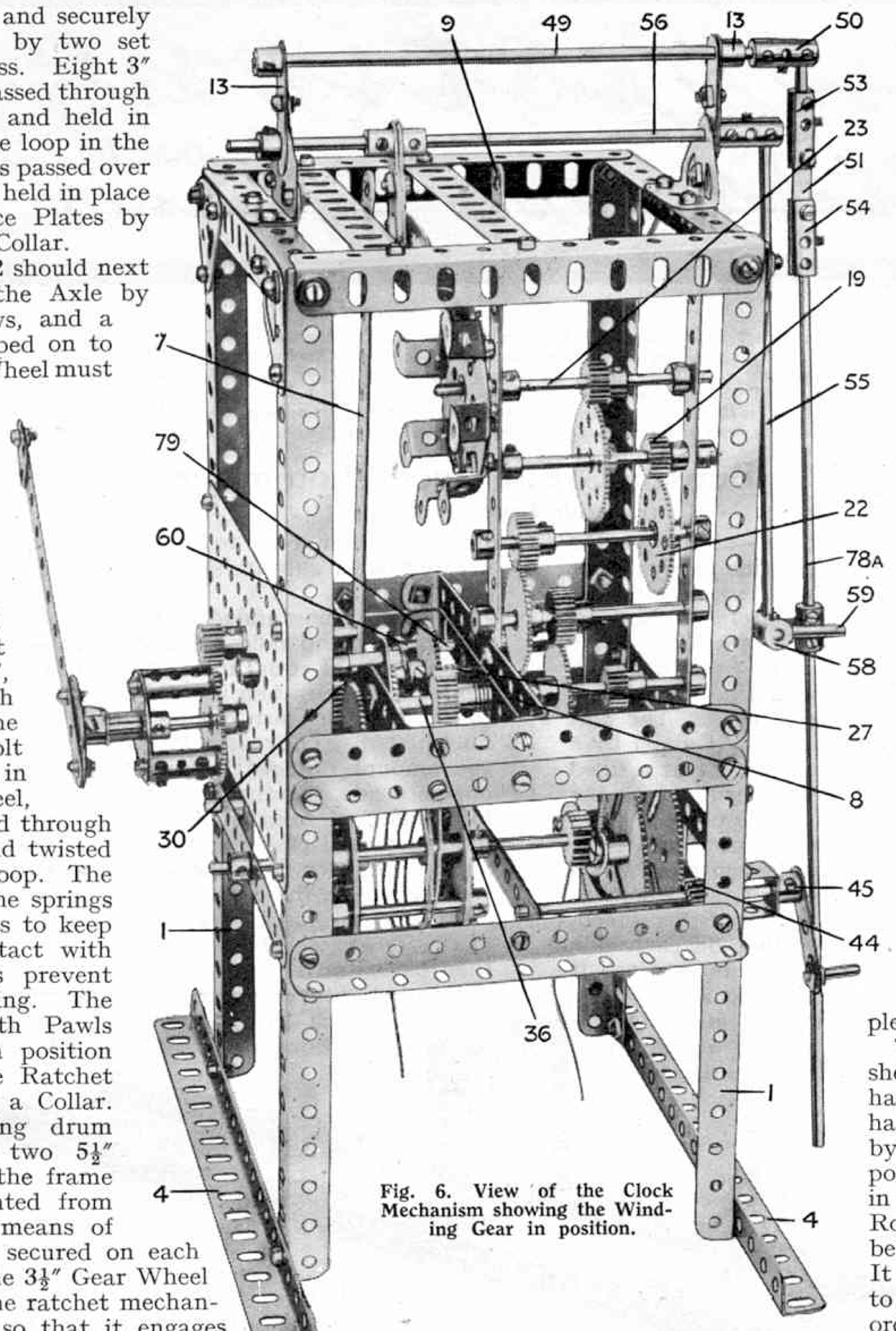


Fig. 6. View of the Clock Mechanism showing the Winding Gear in position.

The base of the case consists of two rectangular frames composed of 12½″ and 9½″ Angle Girders spaced apart by means of vertical 12½″ Angle Girders; 12½″ Braced Girders and extra Angle Girders also being secured as shown to give added strength and to improve the appearance of this portion of the case.

The main body of the case consists of four vertical compound 46″ Angle Girders, each built up from two 24½″ Angle Girders overlapped three holes and bolted together. The vertical members are secured together at top and bottom by 9½″ and 12½″ Angle Girders, and Braced Girders are affixed as shown to provide an artistic finish. The framework is securely bolted to the base of the case, and four 4½″ Strips bolted in the positions indicated ensure rigidity.

The complete mechanism may next be secured rigidly in place by passing bolts through the end holes in the Angle Girders 4 (Fig. 2), and the 12½″ Girders forming the upper portion of the case. The mechanism frame is enclosed in a casing that carries the dial. This casing consists of 12½″ and 9½″ Girders, and four vertical members each consisting of a 12½″ and a 3″ Girder, the latter being overlapped two holes. The frame surrounding the dial is composed of 12½″ Braced Girders and Architraves bolted together in rectangular formation as shown in the view of the completed Clock.

The dial or clock-face consists of a sheet of white smooth-surface cardboard having a centre hole to admit the hand units. It is fastened in place by boring holes in the card to correspond with those in the Braced Girders in which the securing bolts are placed. Roman numerals or Arabic figures should be drawn on the card in Indian ink. It should be noted that it is not essential to employ all the Braced Girders in order to maintain the required degree of rigidity, as several of these parts are included simply to enhance the appearance of the model.

After the final assembly of the Clock parts, the mechanism may be wound up and the Clock set in motion.

Before setting the clock to work apply a little oil to all gears and shafts and bearings of the mechanism. For best results use Meccano Oil, which is specially prepared for use with Meccano models.

It will perhaps be found necessary to make several little adjustments before smooth operation of the different parts is secured. Special attention should be paid to the pendulum and probably experiments will have to be made in order to ascertain the exact position required for the weight 79, for any slight alteration to the position of this weight will make a great difference in the timing of the clock and until the right position is found the clock will either gain or lose time.

The Meccano parts required to build the Grandfather Clock are as follows :—

9 of No. 1a ; 2 of No. 1b ; 11 of No. 2 ; 4 of No. 2a ; 2 of No. 3 ; 1 of No. 4 ; 1 of No. 5 ; 2 of No. 6a ; 8 of No. 7 ; 4 of No. 7a ; 25 of No. 8 ; 12 of No. 8a ; 6 of No. 9 ; 1 of No. 9f ; 3 of No. 11 ; 6 of No. 12 ; 4 of No. 13 ; 4 of No. 14 ; 1 of No. 15 ; 1 of No. 15a ; 5 of No. 16 ; 1 of No. 16a ; 3 of No. 16b ; 10 of No. 17 ; 3 of No. 18a ; 2 of No. 18b ; 10 of No. 20 ; 1 of No. 21 ; 2 of No. 24 ; 5 of No. 25 ; 5 of No. 26 ; 5 of No. 27 ; 4 of No. 27a ; 2 of No. 27b ; 2 of No. 31 ; 422 of No. 37 ; 42 of No. 38 ; 2 of No. 45 ; 5 of No. 48d ; 2 of No. 52a ; 1 of No. 57 ; 39 of No. 59 ; 6 of No. 62 ; 11 of No. 63 ; 2 of No. 63b ; 1 of No. 64 ; 2 of No. 76 ; 2 of No. 77 ; 2 of No. 90 ; 38 of No. 99 ; 24 of No. 99a ; 1 of No. 99b ; 8 of No. 100 ; 1 of No. 103a ; 6 of No. 108 ; 3 of No. 109 ; 1 of No. 111a ; 3 of No. 111c ; 1 of No. 113 ; 1 of No. 120b ; 2 of No. 125 ; 1 of No. 126 ; 2 of No. 126a ; 1 of No. 128 ; 6 of No. 133 ; 1 of No. 141 ; 2 of No. 147 ; 1 of No. 148 ; 1 of No. 172 ; 1.18 lb. weight.

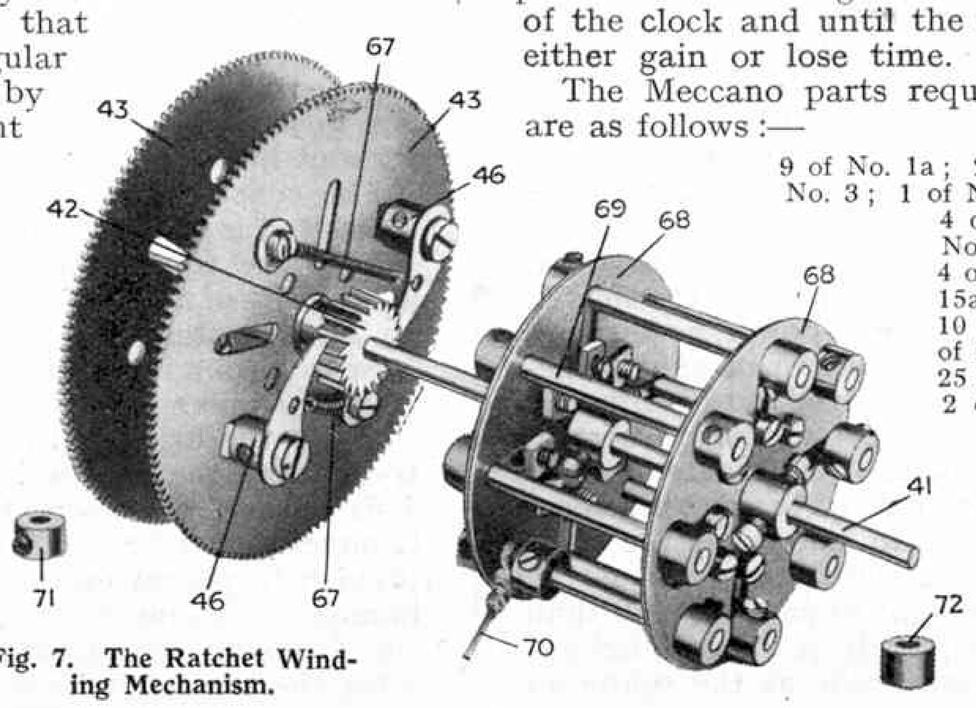
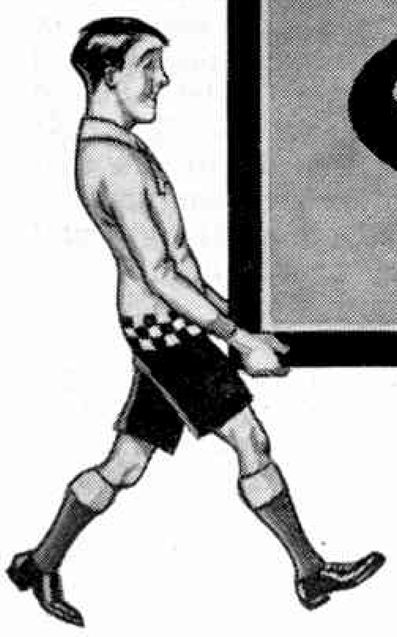


Fig. 7. The Ratchet Winding Mechanism.



Suggestions Section "Edited by Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(258) Bunsen Grease Spot Photometer

(J. Sinclair, London, N.19)

The adaptability of Meccano parts makes them suitable for the construction of apparatus for carrying out scientific experiments, and the model illustrated in Fig. 258 shows that these experiments are not limited to those of purely engineering interest. Readers interested in the study of light will recognise it as a form of the Bunsen Grease Spot Photometer. The name "photometer" means measurer of light and instruments of this kind are used in comparing the intensities of different sources of light. The unit employed is the candle-power, or the amount of light given by a spermaceti wax candle of a certain size when burning at a fixed rate, and a lamp that gives a light 10 times as brilliant as the flame of a standard candle is said to be of 10 candle-power.

The Bunsen photometer is a simple type of instrument. It consists of a sheet of white unglazed paper, in the centre of which is a spot of grease that makes part of it translucent. The sources of light to be compared are placed on opposite sides of this screen, and are moved about until all parts of the paper on each side are evenly illuminated. By comparing their distances from it when this position has been found it is possible to ascertain how much more intense one light is than the other, and if one of them is a standard candle, or a source of light of known intensity, the candle-power of the second may be measured directly.

For the frame of the model two $24\frac{1}{2}''$ Angle Girders are secured, with their flanges outward, to two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates. To each of these Girders a second $24\frac{1}{2}''$ Girder is bolted, but spaced by a Washer on each securing bolt to allow the flanges of two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates to slide freely between them.

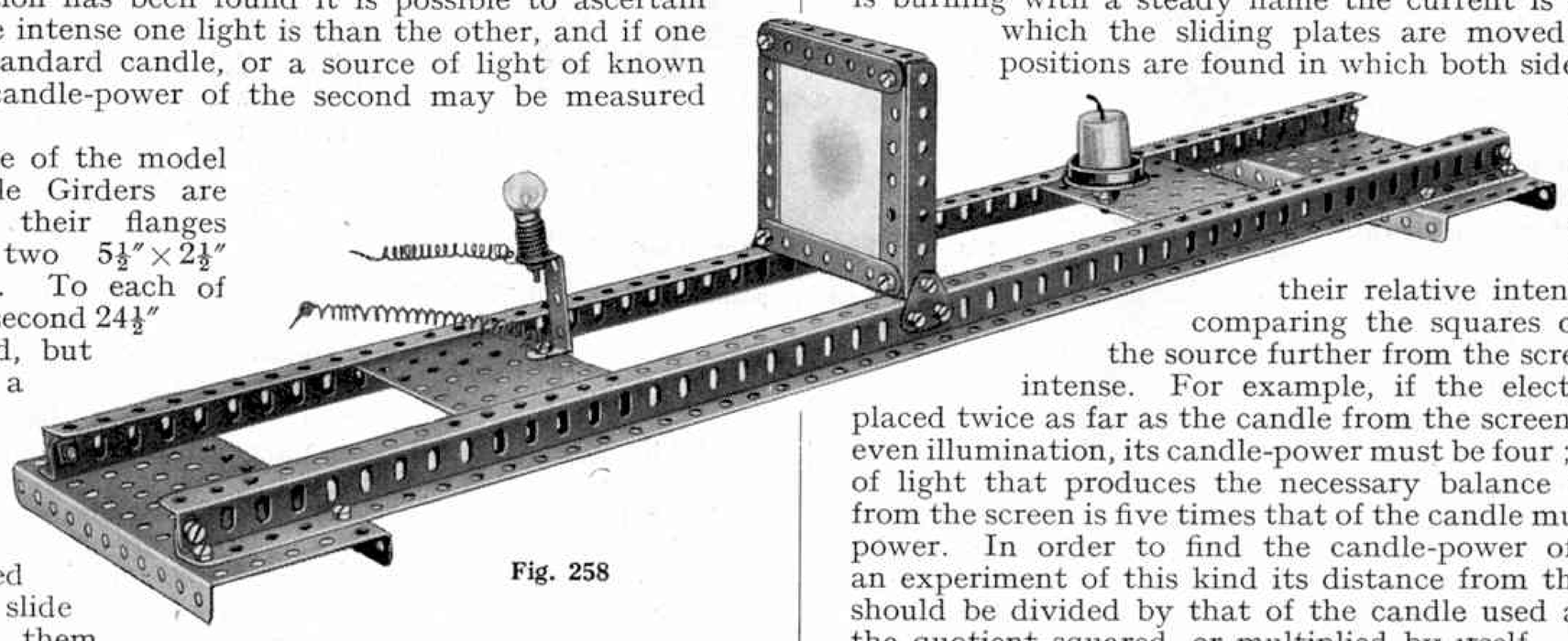


Fig. 258

At the centre of the Girders and between the two sliding Plates the frame supporting the screen is fixed. This consists of four $3\frac{1}{2}''$ Angle Girders secured together in the form of a square and attached to the base Girders by 1" Triangular Plates. The sheet of paper is held in position by $3\frac{1}{2}''$ Strips. A Threaded Pin fitted to one of the $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates carries a $1\frac{1}{8}''$ Flanged Wheel in which a short length of candle is placed, and the other sliding Plate carries a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip at the upper end of which is fixed a Bulb Holder. The 6 B.A. Bolt securing the holder in position is insulated from the Double Angle Strip by an Insulating Bush, and connecting wires are attached to the Bolt and Strip.

The light emitted from an ordinary wax candle cannot be taken to represent accurately one standard "candle-power," as the light varies with the thickness of the candle and wick, and the constituents of the wax. For the purpose of the model, however, it can safely be regarded as one candle-power, as absolute accuracy is not essential. Having an illumination of one candle-power, it is now possible to estimate the light given out by different electric bulbs fitted into the holder at the other side of the screen. In order to understand the principle of the photometer, let us assume that a light is placed on only one side of the paper screen, and that this is viewed from the opposite side. All the light reaching this side is transmitted through the screen, and as the grease spot is translucent it allows more light to pass through than the remainder of the screen, and consequently it appears lighter. When the screen is viewed from the same side as the source of light, however, only reflected light reaches the eye, and the ungreased paper appears brighter than the grease spot, which reflects less light.

If a light is now added at the other side of the screen, light will be transmitted and reflected from both sides of it. If both sources of light are of equal intensity and are placed at equal distances from the screen, then it will be difficult to detect the grease spot, for it and the surrounding paper on each side will be evenly illuminated. The reason for this is that on each side of the screen, the amount of light coming through the grease spot from the opposite side, together with that reflected from it, is equal to the light reflected from the ungreased portion of the paper. If one light is placed closer to the screen the white paper on that side will be brighter than the grease spot, but on the other side the reverse will be the case.

In order to find the candle-power of an electric bulb by means of this model, the bulb is screwed into its holder. The candle is then placed on the second sliding plate and lighted, and when it is burning with a steady flame the current is switched on, after which the sliding plates are moved to and fro until positions are found in which both sides of the paper are evenlyilluminated. The distances of the two sources of light from the screen are then measured, and their relative intensities obtained by comparing the squares of these distances, the source further from the screen being the more intense. For example, if the electric bulb must be placed twice as far as the candle from the screen in order to secure even illumination, its candle-power must be four; similarly a source of light that produces the necessary balance when its distance from the screen is five times that of the candle must be of 25 candle-power. In order to find the candle-power of a lamp used in an experiment of this kind its distance from the screen therefore should be divided by that of the candle used as a standard and the quotient squared, or multiplied by itself.

(261) Fog Signal for Hornby Track

(T. Robson, Scarborough)

Keen Hornby Railway enthusiasts will find this ingenious device an interesting addition to their model railway. If the system is operated at night the absence of lights behind the signals makes conditions very similar to those existing in actual practice in fog. The periodic detonations indicate the position of the train, and it is a good plan to fit brake rails so that the loco can be stopped without handling when the line is not clear.

The construction of the fog signal device is quite simple. A short Rod is free to swing horizontally about a pivot placed at the side of the track, and should protrude beyond the running rail at a height of about $\frac{1}{2}''$. The other end of the Rod overlaps a lever on a horizontal pivot and carrying at its other end a Threaded Boss to form a hammer. Directly beneath this a second Threaded Boss or similar part should be secured to the base.

When the fog signal is set, the leading wheels of the oncoming train strike the protruding Rod and swing it clear of the track. This releases the lever, to which a Spring is fitted, causing the hammer to strike the boss fixed on the base. A small "cap" previously placed on this part explodes on being struck by the hammer. A length of Spring Cord should be arranged to keep the swinging Rod clear of any projecting portions of the train after the lever is released.

(259) Electric Motor

(J. S. Maloney, Dublin)

In large and complicated models it is occasionally advisable to employ a separate Electric Motor for each of several movements. This was the case with our contributor, who constructed a printing machine, in which a suction fan was to be employed for lifting the sheets of paper and feeding them into the rollers. As the fan was to be mounted on the end of a swinging arm, several difficulties were encountered in arranging gearing from the Motor used for driving the other parts of the model, and eventually a separate electric motor was mounted for the purpose directly above the fan. This motor was constructed from Meccano parts, and forms a useful power unit for light work in other Meccano models.

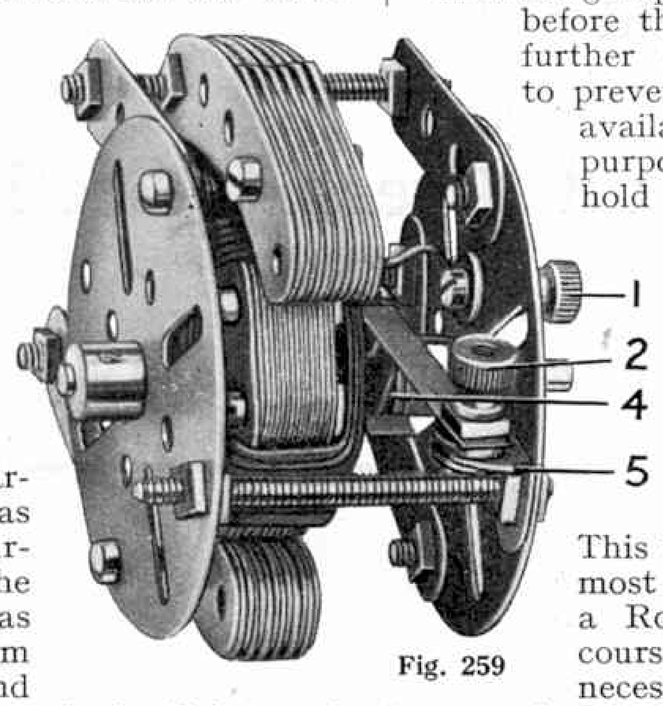
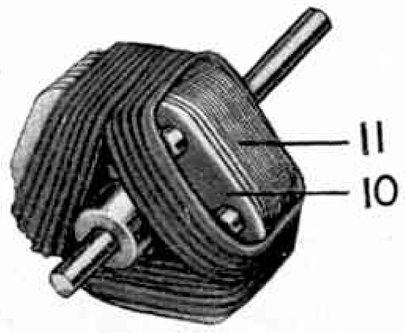


Fig. 259

The motor is shown in Fig. 259. It is of neat construction and the compact arrangement of the components makes it very suitable for use in confined spaces. Fig. 259a shows the motor partially dismantled to reveal its construction.

The core for the field windings 12 consists of six 2″ Strips between which 2½″ large radius Curved Strips are secured as shown. Six 1½″ Strips are held between the Curved Strips at their outer ends. Insulating tape is wound round the core before the wire is wound on, and a further layer covers the windings to prevent damage. If tape is not available, brown paper serves the purpose quite well. Screwed Rods hold the field to the motor side plates, which consist of Face Plates carrying 2″ Strips.

The armature is built up on a 2½″ Axle Rod, and each of the three cores consist of fourteen Flat Brackets 11 between two Triangular Plates 10. This length of Rod will be found most suitable for general use, but a Rod of any length may, of course, be substituted if found necessary. The three coils are wound in a similar manner and the inner wire of each coil is connected to the outer wire of the next to form the three leads that are to be taken to the commutator. Fine wire or cotton is used to hold the three coils together, thus preventing them from slipping off the ends of the cores. A Collar is placed on the Rod at each side of the armature and one of these is covered with insulating material. The insulation is removed from the ends of the three leads from the coils, and the bare copper wires are spaced equal distances apart and secured to the insulated Collar by a length of cotton. The wires should be curved round the Collar for a little over ¼″ to form the three commutator "segments" 4. The ends of the wires should be bent inwards and passed under the cotton. Wear on the brushes will be minimised if the wires are arranged slightly obliquely. The position of the commutator segments in relation to the armature is important; they should be placed so that the space between each segment is in line with the centre of each magnet core.



The brushes 7 and 8 consist of Pendulum Connections secured by 6 B.A. Bolts to Angle Brackets, but insulated by fibre Bushes and Washers. The Screwed Rod 6 holds the Bracket for the Brush 7 at the end of which is the Terminal 2. The Brush 8 is attached to the Bracket 9 and one of the wires from the field is connected to it. The remaining wire from the field windings is attached to the Terminal 1 (see Fig. 259) which is bolted to the Face Plate but insulated therefrom. The Terminals 1 and 2 should be connected to the Accumulator or Transformer. The motor will operate satisfactorily from 4 or 6-volts, if wound as shown with 26 gauge wire. For 6-volt working it is advisable to increase the number of turns on the field.

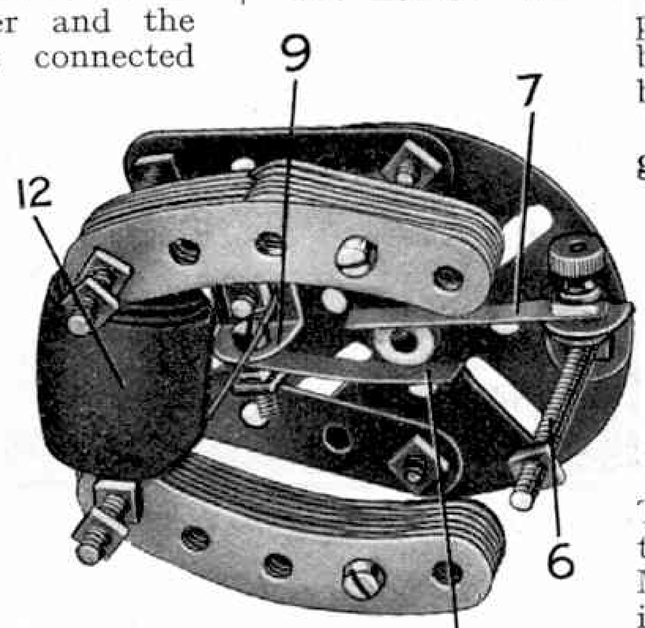


Fig. 259a

(260) A Compact Switch

(F. Waterford, Bath)

This switch is particularly suitable for use in models where space is limited, as the outstanding feature of the device is its compactness. It was originally designed for use in a Hornby Signal Cabin. A 1″ × ½″ Angle Bracket carries a 6 B.A. Bolt 1 which is insulated by means of Insulating Bushes and Washers. The shank of the Bolt is passed through the centre of a Collar, which is held to the Bracket by the Set-screw 2 carrying a nut. A Set-screw is used for this purpose because its shank will not touch the Bolt 1 and the Bolt and Collar should be very carefully placed in order to ensure that they are not in contact with each other. The Bolt 4 is fixed to a Flat Bracket and screwed into the remaining bore of the Collar. It should be so adjusted that with the Flat Bracket in the position shown, the Bolt touches the 6 B.A. Bolt 1, but when the Flat Bracket is moved over to the opposite position the Bolt 4 withdraws a short distance and contact is broken. The switch is secured in position by the ⅜″ Bolt 3, the shank of which carries four Washers.

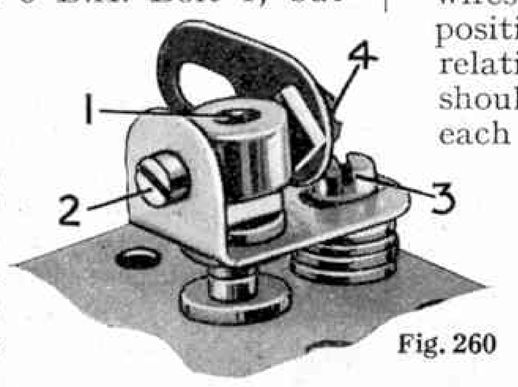


Fig. 260

In connecting up the switch, one wire should be taken from the frame of the model, and the other from a 6 B.A. Bolt insulated from the frame and placed directly under the Bolt 1 so that the heads are in contact with each other. As an alternative method, the wire can be connected direct to the Bolt 1, but in this case it cannot easily be detached without interfering with the adjustment of the switch. It may be found more convenient to wire up in this way in order to fit the switch in position.

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.142). Improved Method of Winding Bobbins.—The single-strand copper wire employed in winding Meccano Bobbins has a tendency to break near the small holes in the cheeks through which it is passed, and if this happens to the inner wire it becomes necessary to re-wind the coil. It is advisable to take preventive measures to avoid this inconvenience, therefore, and F. E. Williamson (Harrogate) suggests the following method for the purpose. Short lengths of multi-strand flexible wire are joined to the ends of the copper wire used on the Bobbin, and this flex is passed through the holes in the cheek in order to take the strain of the bending necessary in making connections. The joins should be made just on the inside of the cheek and the core of the bobbin must be covered with paper or other insulating material to prevent any possibility of "shorting." The flexible wire will withstand a surprising amount of bending without breaking.

(M.143). Meccanograph Improvement.—D. Martin (Peterborough) has thought out an ingenious device for increasing the number of designs produced with the Meccanograph. The possibilities of this Meccano Super Model are endless and it appears that there is no limit to the number of different designs that can be produced. Martin's model is a replica of the standard Meccanograph, with the exception that the Triangular Plates holding the pen are made to pivot about the end of the writing arm so that the pen swings from side to side. A Strip rigidly secured to the Triangular Plates extends horizontally at right-angles to the arm, and to the outer end of the Strip a long connecting rod is pivoted. This member is built up from Strips and is pivotally connected to a Bush Wheel driven from the crown head. As this wheel rotates the pen is rocked from side to side, but its movement may be varied by altering the length of the connecting rod, or changing the position of its pivot on the Strip attached to the Triangular Plates. By this means a large range of designs are obtainable without altering the other movements of the model, which may be converted for normal working by removing the connecting rod from its Bush Wheel and attaching it to the writing arm. This fixes the pen rigidly in one position.

When operating the model it will be found necessary to counterbalance the weight of the Strip attached to the pen-holder and also the connecting rod. This may be done by fitting a second Strip on the other side of the pen-holder and adding a suitable weight.

The range of designs can be increased still further by the use of a gear box between the crown head and the Bush Wheel operating the connecting rod.

Results of
Meccano Model-Building Contests

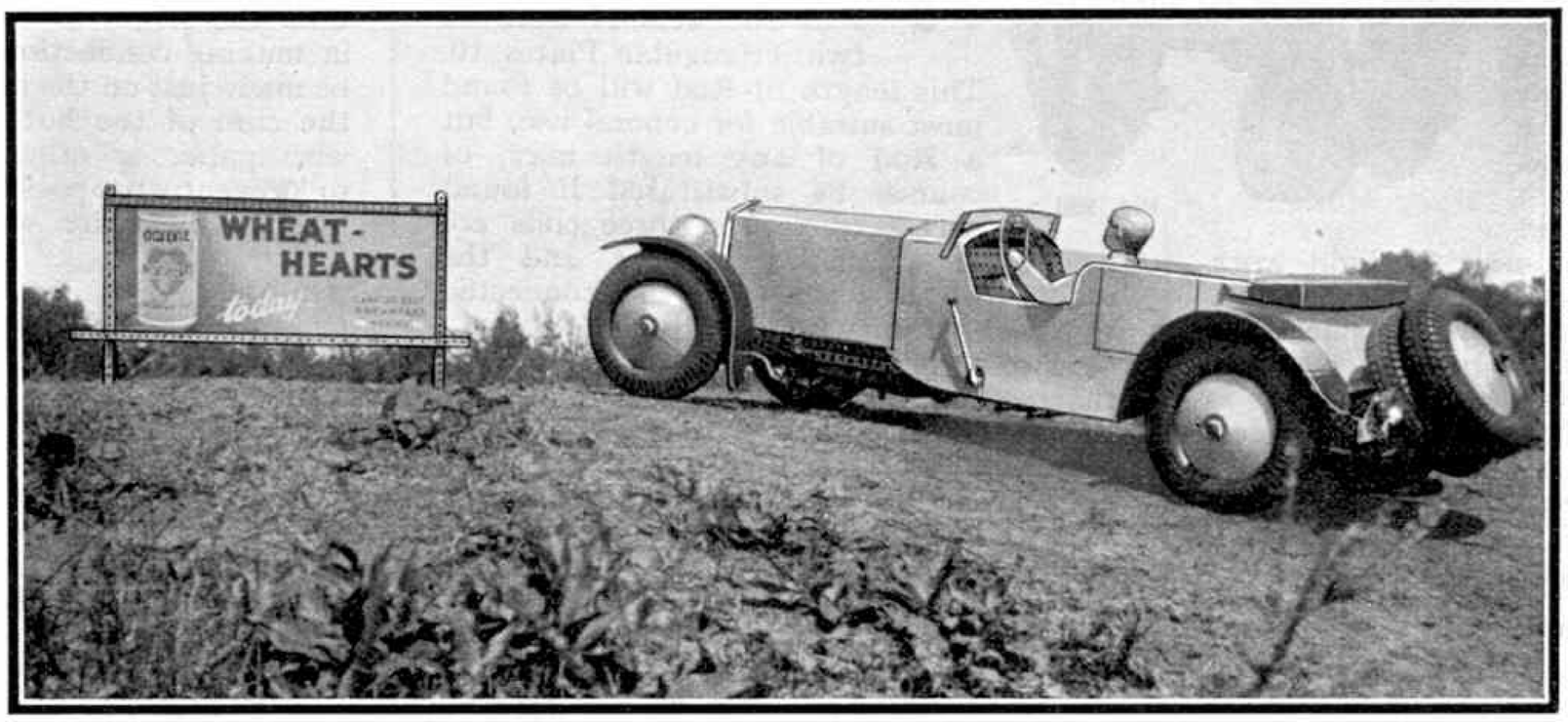
By Frank Hornby

"Realism" Contest (Home and Overseas Sections)

THE "Realism" Contest provided a good opportunity for model-builders to exercise their artistic abilities as well as their knowledge of engineering and Meccano model-building, and that it was taken advantage of to the full is evident from the fine collection of models received. Many of the entries display remarkable dexterity in the handling of the various mediums used to produce realistic settings, and some particularly clever work was done in "fake" photography, examples of which are shown in the accompanying illustrations.

On studying the list of prize-winners I was most interested to see that one of the highest honours in the Overseas Section had been won by Lillian Cowie, a keen girl Meccano enthusiast from Nanaimo, B.C., Canada, who won Second Prize with the fine model illustrated here. I think this is the first occasion on which one of the principal prizes has gone to a girl, and I wish to take this opportunity to congratulate her and to express the hope that she will long continue to derive pleasure from Meccano model-building, and eventually will head the prize list in a Meccano competition.

The full lists of awards in the Home and Overseas Sections of the Contest are as follows:—



An example of a Meccano model motor car placed in a realistic setting by Norman B. Scott, Winnipeg, Canada. The "hill" the car is climbing is actually only the camber of the road!

Home Section.

FIRST and SECOND PRIZES combined and divided between four competitors, each receiving a Cheque for £1/6/3: Roydon J. Packer, Bristol; Kenneth Gibbes, Weedon, Northants; David H. Caulkin, Solihull, Warwicks.; John Matthews, Fillongley, Nr. Coventry. THIRD PRIZE, Cheque for £1/1/–: Paul Marriott, Leigh-on-Sea, Essex.

SIX PRIZES of Leather Pocket Wallets: D. Elias, Weaste, Manchester; R. Storrar, Letham Ladybank, Fifeshire; D. Oliver, Purley, Surrey; B. Richardson, Chadwell Heath, Essex; W. Raybould, Bloxwich, Staffs.; L. Willington, Aston, Birmingham.

SIX PRIZES of Complete Instruction Manuals: G. Townend, Great Leigh, Nr. Chelmsford; G. Hodgkins, Moseley, Birmingham; D. Robinson, Ponders End, Enfield, N.; B. Rivron, Ipswich; A. Hemmings, Bengeo, Herts.; J. Byard, Stoke-on-Trent.

TWELVE PRIZES of "How to use Meccano Parts" Manual: T. Choate, Worthing, Sussex; J. Cory, High Wycombe, Bucks.; C. Boston, Birkenhead; F. Roberts, Plympton, Devon; D. Ainsworth, Prestwich, Nr. Manchester; W. Burke, Cork, Ireland; P. Dykwel, Croydon, Surrey; I. Jones, Llanfyllin, Mont.; R. Lamming, Edgware, Middx.; F. Woodhouse, York; S. O'Farrel, Dublin, Ireland; S. Vertue, Sanderstead, Surrey.

FOUR PRIZES of Meccano Engineer's Pocket Books: F. Stringer, Sidcup, Kent; E. Chamberlain, Solihull, Warwicks.; D. Lewis, Lowestoft, Suffolk; M. Scott, Hexham, Northumberland.

Overseas Section

FIRST PRIZE, Cheque for £3/3/–: Norman B. Scott, Winnipeg, Manitoba, Canada. SECOND PRIZE, Cheque for £2/2/–: Lillian Cowie, Nanaimo, B.C., Canada. THIRD PRIZE, Cheque for £1/1/–: James Credie, Cape Town, S. Africa.

SIX PRIZES of Solid Leather Pocket Wallets: Jens Per Jensen, Skien, Norway; T. H. Brierley, Johannesburg, S. Africa; M. C. Sonyondjoglon, Kiphissia, Greece; E. C. Stonyer, South Canterbury, New Zealand; R. Mayes, Kyogle, N.S.W., Australia; J. Hedley, Johannesburg, S. Africa.

SIX PRIZES of Instruction Manuals: N. F. Pincho, Gibraltar; P. Farnworth, Wellington, New Zealand; O. Boston, Calcutta, India; R. Townsend, Bombay, India; J. Williams, Cape Town, S. Africa; B. Thomas, Brisbane, Australia.

TWELVE PRIZES of "How to Use Meccano Parts" Manuals: S. Hunter, Toronto, Canada; M. Overton, Cape Town, S. Africa; P. Rose, Pinetown, Natal, S. Africa; R. Newman, Toronto, Canada; K. J. Mistry, Lahore, India; J. McClymont, Toronto, Canada; D. Mutlow, Port Elizabeth, S. Africa; C. Hochapfel, Britstown, South Africa; B. Silva, Kotahena, Ceylon; C. A. Boogaerdt, Vlandingen, Holland; C. E. Bodger, Christchurch, New Zealand H. Way, Warrimoo, N.S.W., Australia.

It will be seen from the foregoing list that four competitors in the Home Section tied for First Prize. The merits of each of the four entries were so equally balanced that the judges were unable to give preference to any one of them, and it was decided to combine the First and Second Prizes and then divide the total amount equally between the four competitors concerned.

One of these is R. J. Packer, and his entry consisted of models of an Army tank and a "fighter" aeroplane, arranged in a striking setting depicting actual warfare. The tank is seen crashing its way across a shell-ridden "battle-field," while the aeroplane swoops low and drops its bombs, an attack which is repelled by rapid fire from the guns of the tank.

Another excellent illustration of "fake" photography by N. B. Scott. Careful examination is necessary to reveal the fact that the car is only a Meccano model.

So far as the actual construction of the models is concerned there is little of interest to note, for both are built in the orthodox manner, using Plates and Strips as their principal components. The tank's guns, of which there are several, are represented by short Rods. Unfortunately, neither this photograph nor any of the others of the principal prize-winners in the Home Section are suitable for reproduction.

Another of the tying entries represents a scene on a railway during the process of excavating a cutting. This is the work of David H. Caulkin. The model is a well-built steam digger, driven by a Meccano Steam Engine, and it is shown actually at work tipping excavated material into the waiting wagons of a Hornby Train. The setting is made up from gravel, grass and twigs, all neatly arranged to give the appearance of a full-size railway cutting.

A very novel idea in models is that of Kenneth Gibbes, who submitted a photograph of himself at work in his garden using a Meccano spade! The spade is strongly built and is capable of

doing actual digging in light soil. The blade is made up of Flat Plates, across which Angle Girders are bolted to give rigidity. The shaft makes use of Angle Girders bolted together in the form of a square-section girder, and the handle is made up of Strips.

A model railway station, in which the famous "*Royal Scot*" train is just drawing up to the platform, forms the entry from John Matthews. The realism of this entry is remarkable in itself, but the model of the "*Royal Scot*" gives added merit owing to its excellent construction. It weighs over 28 lb., contains 1,050 nuts and bolts, and incorporates working valve gear and most of the features of the actual "*Royal Scot*."

A very different type of entry came from Paul Marriott, the winner of Third Prize for Home Competitors. His entry shows a powerful Meccano logging tractor hauling huge tree trunks, which are carried on trucks fitted with caterpillars. Judging from the photograph the scene is in India, and comprises a roadway that winds its way through the most beautiful tropical scenery. Ferns and palms line the roadside, and in the foreground are to be seen several stumps of felled trees, which give a most realistic touch to the scene.

Barrie Rivron built an aerodrome complete with hangars and pilot lights. A Meccano "Auto-giro" aeroplane is shown hovering over the aerodrome, and a few judiciously placed hedges and small trees give the scene a quite life-like appearance. The appearance would be more accurate, however, if the trees were absent, in view of the fact that aerodromes usually are situated in wide-open spaces where there are as few as possible obstructions, such as trees, chimneys and telegraph poles.

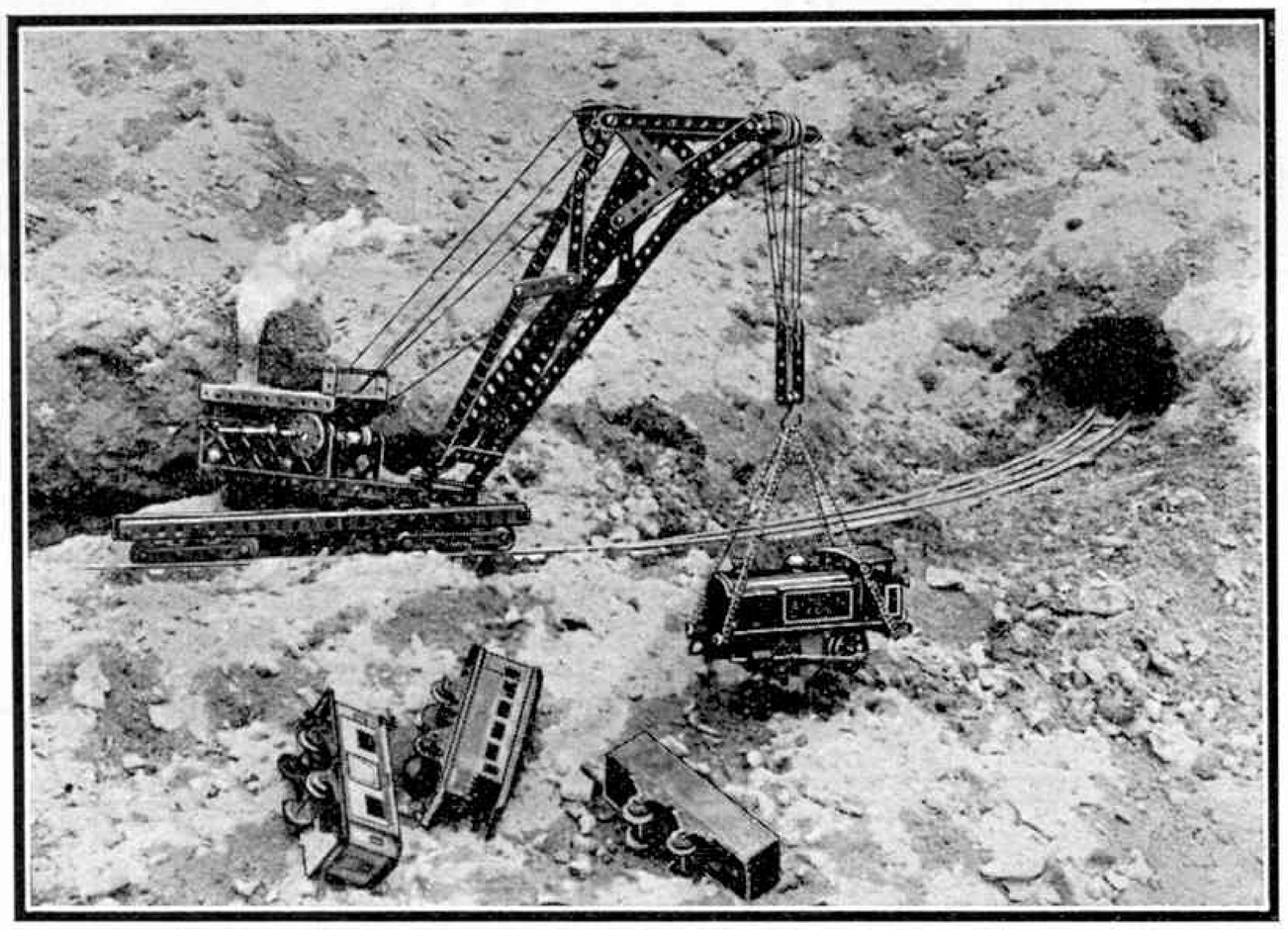
Another good entry in this Section is a dock scene by A. J. Hemmings, Bengeo, Hertford. With the aid of a few wooden boxes, which he has painted to look like warehouses, and an artificial dock with real water, he has produced a very fine effect. The Meccano model is a large jib crane, which is shown at work unloading cargo from a ship. A few miniature models of ships and a Hornby Train track laid along the dock wall complete the picture.

I come now to the Overseas entries and in my opinion it is here that the most praiseworthy efforts are to be found. In support of this opinion I refer readers to the several illustrations that appear on this and the opposite pages.

First and foremost is the work of Norman B. Scott, whose knowledge of model-making, art and photography has produced results that are remarkably good. Take for example his work on the saloon motor car, which is shown ploughing its way along a snow-covered country road. Could anything be more realistic? So truly life-like is the effect that I think most readers will find it hard to believe that the scene depicted is not that of an actual road, and a full-size motor car! Close examination, however, will reveal that the car is only a model and that the roadway, although real, has been reduced in scale to correspond with the proportions of the car. This is a very clever piece of "fake" photography, and I hope to include in an early issue of the "*M.M.*" an article describing how Scott succeeded in producing such excellent results. Cardboard body-work hides almost all of the chassis in both of Scott's models, but the chassis are constructed entirely from Meccano. It is interesting to note that the bodywork in the case of the sports car is lacquered cream and the mudguards are coloured carmine. The bucket-type seats are leather covered, and the driving seat is adjustable for leg room. The driver is a clay bust with cardboard arms!

The chassis of the sports car contains an Electric Motor, a single-plate type clutch, and a four speeds forward and reverse gear box, of the sliding selective type. Four-wheel brakes, built-up rear axle and differential are other chassis features. One of the photographs of the sports car was taken at an angle from a ditch at the side of the road, and the "hill" the car appears to be climbing is really only the camber of the road!

Lillian Cowie's work is straightforward and does not need a great amount of description. It will be seen from the illustration that the breakdown crane is constructed on sound lines, and the setting of the track, showing the line running through the tunnel, is well arranged. The arrangement of the derailed carriages, however, is a little too symmetrical to be thoroughly realistic.



This scene of tragedy was arranged by a girl Meccano enthusiast, Miss Lillian Cowie, of Nanaimo, B.C., Canada.

A quite ordinary scene of a girder-built arch bridge laid across a turbulent river, afforded James Credie, Cape Town, S. Africa, considerable scope for the display of ingenious scenic effects. The roadway of the bridge carries a railway track.

The realism of C. E. Bodger's racing scene, in which a splendid model of the "*Golden Arrow*" is the centre piece, is so good that one can almost hear the terrific roar of the engine as the car speeds over the ground! A large number of Meccano models of this famous racing car, in which the late Sir Henry Segrave broke so many records, have been made by Meccano model-builders, and I think Bodger's model is one of the best I have seen. Its lines and proportions compare very favourably with the design of the actual car and it is complete in almost every detail. It is 3 ft. in length and the chassis is $4\frac{1}{2}$ in. in width, the body being large enough to conceal an Electric Motor and the mechanism. Ackermann steering is fitted and the chassis has a ground clearance of half-an-inch.

Bodger submitted a photograph showing the car travelling at a terrific speed apparently, although actually it was standing at the time the photograph was taken. The effect of speed was obtained by swivelling the camera while the exposure was made, the result being that the car appears as a slightly blurred mass, while the background, which by the way is a plain white cloth, gives a cloud effect as though the car is racing against the skyline.

A real car or only a Meccano miniature? To decide this question needs a thorough study of every detail of the model, which was built and arranged in this picturesque setting by N. B. Scott, Canada.

From far-off Australia came an entry that depicts a scene common enough in Bendigo, where quartz mining is carried on. The competitor concerned is Harold Way, and his entry consists of a mining scene showing the pit-head gear and what are known as "Povett legs" in position over the mine shaft. Povett legs are a kind of huge tripod, and they support the mechanism for drawing the cage and its load to the ground surface.

Preparations for Exhibitions

The second of the two winter sessions is a very important period in the yearly routine of a Meccano club, for the seasonal excitements of Christmas and the New Year have subsided and members have settled down to the ordinary programme, usually with enlarged outfits and a desire to make the most of their increased resources. It is a wise plan to give them something definite to aim at, and one of the best means of doing this is to arrange an Exhibition or Concert. The end of the second winter session is a suitable time for a display of this kind, for it marks the close of the indoor season, and provides a suitable opportunity for distributing prizes. Special Merit Medallions earned by members also may be presented at the same time and advantage may be taken of the introduction of these awards to explain briefly to visitors the aims of the Guild and the work of Meccano clubs.

If this plan is adopted, then from now to the end of the session members will be kept busy with preparations, and will have little time to waste if these are to be completed satisfactorily and in good time. Care should be taken not to overdo this work, however. The need for variety in the programme should never be overlooked, and in particular, Games Nights, and the short periods devoted at every meeting of certain clubs to recreation, should not be restricted in any way. Leaders should use their own judgment in regard to special preparations, but their aim should be rather to encourage members to extra voluntary efforts than to demand that they should turn their attention in one direction only. These naturally take pride in their efforts to create a good impression on an occasion when their parents and others interested in their work are invited to be present, and almost invariably may be relied upon to do their utmost to ensure the success of the Exhibition or Concert arranged.

Models from Headquarters

A valuable feature of practically all Exhibitions organised by Meccano clubs is the inclusion in the display of models on loan from Headquarters. In this connection I find it necessary to emphasize the need for adequate notice of the desire of any club to obtain a model. The Meccano Model department is always fully occupied with development and other work, and in certain cases I have been unable to supply models because of lack of time in which to build them. Notice of at least five weeks is necessary, and it will help to prevent delay if the voltage and other details of the current supply available are given when ordering. A list of models for club use may be obtained on application to Headquarters.

Special Merit Medallions

This month I give the names of the members of Meccano clubs to whom special Merit Medallions were awarded during 1931. The large number of recipients of this, the highest award open to Meccano boys, is evidence of the enthusiasm of those taking part in the Guild and the club movement.

In every club two Merit Medallions are available for presentation each session. They are awarded on the recommendation of Leaders, who are asked to nominate the members who have done the best work on behalf of their clubs. No stipulations are made in regard to the nature of this work, and the medallions may be awarded for energy and foresight in securing recruits, for outstanding excellence in Model-building, or for any other activity that helps to increase the reputation of the Guild and the club movement.

I hope that Leaders will forward their recommendations for the present session to Headquarters as soon as possible, particularly if they wish to adopt the plan already suggested of presenting them at an Exhibition organised as a climax to the indoor season. The award of a Merit Medallion always gives intense pleasure to those members whose good work on behalf of their clubs is thus recognised, and their pleasure is greatly enhanced when the presentation is made in the manner suggested.

Merit Medallions Awarded in 1931

BARTON-ON-HUMBER—F. Burton. BURY ST. EDMUNDS (St. Edmundsbury)—G. Ely, J. W. Legget, K. Townsend, R. Ely. CHILWELL (Attenborough Choir)—A. E. Dodd, E. K. Draper. CLYDEBANK (Morison Memorial)—C. Brodie, D. Sinclair. CORK (Mallow)—K. Bronin, W. J. Roche. CROYDON (South Croydon and Purley)—A. Bawden, G. Green. EDINBURGH (St. George's)—W. S. Howgate, G. Hunter. EXETER (St. Peter and St. John's)—J. Brown, P. A. Sparkes. GLASGOW (Victoria)—R. Hannah, D. Murray. GRANTHAM (Earlsfield)—R. Newcombe, L. Parker, T. Parker, R. Peel. GREAT BADDOW—A. Crockford, H. Pennack, D. Radford, F. Smee. HARROW (Wealdstone Wesleyan)—E. Glass, R. Parham, E. Peyton, M. Tomlin, R. Winckless. HARWICH—E. Grey, J. Higgons, H. Thorpe. HERNE BAY—R. Bennett, W. Chapman, W. Harris. HEYWOOD (Heywood Regent Street School)—W. Franks. HULL (Newcomen)—G. Acklam, T. Shirtliff. KINGS LYNN—P. N. Hayes, J. P. Smith. KNUTSFORD—C. Pemberton. LEEDS (Horsforth)—H. Giles, P. Travers. LONDON (Chiswick Crusaders)—H. P. B. Betlem. (Hampstead and Cricklewood)—N. D. Nabarro. (Holy Trinity, Barnsbury)—R. Cooper, F. Hines, J. Hines, A. Hurden, W. Moore, J. Reed, D. Sharp. (Ken)—R. Boeckstens, G. Hierons, J. Jackson, R. Jackson. (Manor House)—J. F. W. Burrow. (Roe Green)—J. S. Knightley, L. N. Newton, D. W. Wallis, S. C. Wilkes. MIDDLESBROUGH—H. French, J. Rowlatt, S. Tapster. NEWCASTLE—S. Ormond, A. Sheel. SIDMOUTH (Sid Vale)—L. R. I. Gliddon, E. C. Palk, A. Passmore. SLIGO—L. Costello, J. Cox, L. Dixon, S. Hunt, Mr. J. Johnson, J. Paterson, R. Pettit. SUNDERLAND (St. Columba's)—T. Davison, D. Ferguson, R. Hayton, R. Robson, R. Tutin. SWANSEA (Sketty)—G. Isaacs, T. Malin. SWINDON (Gorse Hill Baptist)—S. Cavey. WALLASEY (Marlowe)—E. Nuttall, T. Smith, A. Trapnell, K. Turner. WELLINGTON—M. R. Blackmore.

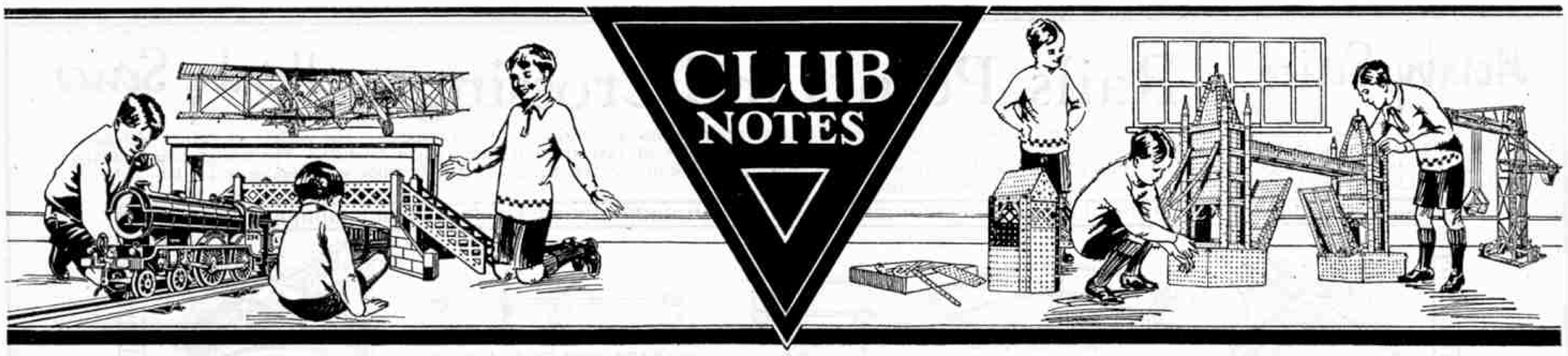
OVERSEAS CLUB MEMBERS

AUSTRALIA (Melbourne)—L. Saunders. FRANCE—A. Alt, R. Muller, J. Pierrot. GREECE (Athens College)—C. Canaris, C. Laskaris, M. Souyoudjoglou. HOLLAND (Alphen)—D. ten Cate Brouwer, C. Koolhaas, J. Zonneveld. NEW ZEALAND (Ashburton)—F. Coates. SOUTH AFRICA (Malvern Methodist)—E. Paynter, Miss J. Russell, Miss E. Savage, C. O. Trent.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested in becoming members should communicate with the promoters, whose names and addresses are given below :—

AKELEY—R. A. Tibbetts, "Verandale," Akeley.
BRECHIN—John McKenzie, 3, Nursery Lane, Montrose Street.
BRISTOL—Frank E. Starr, 19, Windsor Terrace, Totterdown.
BULUWAYO (S. RHODESIA)—Frank R. Taylor, 137, Grey Street.
HOLLAND—K. A. v.d. Niewenhuizen, Noorwolde, Prov. Groningen.
INGATESTONE—Edward Hawkins, Gate House School.
MANCHESTER—H. C. Thompson, 53, Henshaw Street, Stretford.
PONTNEWYNYDD—D. K. Nicholas, "Corbet," Hanbury Road.
READING—J. Hewett, "Abbeville," Pitts Lane, Woodley.
REIGATE—Wilfred Woods, 2, North Road, South Park.
SHOREHAM-BY-SEA—J. D. Mills, "Netherley," Windlesham Gardens.
SOUTH HARROW—T. Bartlett, 379, Eastcote Lane.
WALLINGTON—R. Blackstones, 64, Montagu Gardens.
WITHAM—John M. Pinkham, Chignall House, Collingwood Road.
WORCESTER—R. G. Price, Springdale House, 36, Sansome Walk.



Wimbledon M.C.—On a recent Contractors' Night two gangs were organised, each electing a foreman. Tenders for the construction of a bridge across a river were then prepared, and the members of each section were told to build the structure they had designed. One bridge was of the cantilever type and the other was a suspension bridge, and a short discussion on their merits followed. At other meetings a lecture was given by Mr. R. T. Hill on "*Track-Laying and Tunnelling*," and a short sketch was given by members of the club. Club roll: 16. *Secretary:* G. W. Rose, 117, Dora Road, Wimbledon Park, S.W.19.

Greenock Academy M.C.—The plan of forming Senior and Junior sections has proved successful, the Juniors particularly showing remarkable skill and enthusiasm in Model-building. A party of 40 members visited the Clock Lighthouse and this was followed by visits to the local Fire Station and the Scottish Motor Show at Glasgow. The Annual Exhibition of models was held last month, the display also including an excellent Hornby Train Layout. Club roll: 77. *Secretary:* I. D. Leitch, 26, Dempster Street, Greenock.

St. Thomas' (Oswaldtwistle) M.C.—Model-building is the chief activity, and members showed models at a County Fair, at which £30 was raised for the benefit of church funds. The club is organised in accordance with a timetable, and by strictly following this smooth working is ensured. Games are played at the end of each meeting, and particular attention is being devoted to the hobby of Stamp Collecting. Club roll: 15. *Secretary:* W. Clarke, 17, Percy Street, W.E., Oswaldtwistle.

Harrogate and District M.C.—This club has been revived and is making excellent progress. In a Model-building Competition, equal numbers of parts from a large Meccano Outfit kindly loaned by Mr. Beal were given to groups of members, each group being required to build a Motor Car. Prizes presented by Miss Hirst, President of the Club, and Mr. Crausaz, Leader, were awarded for the best models constructed. At a special meeting members provided games material, and an interesting evening was spent. Hornby Train Nights also have been arranged regularly. Club roll: 50. *Secretary:* F. Brown, 31, St. Nicholas Road, Harrogate.

Wembley M.C.—Two groups have been formed, the leaders having undergone a test in their knowledge of Meccano parts and their uses. An interesting Debate entitled "*Road v. Rail*" was keenly contested, members becoming so interested that speech-making continued until it was too late to take a vote! Meetings usually close with a "camp fire chat," when matters of club interest are discussed. New members are required and the secretary will be pleased to hear from any boy wishing to join. Club roll: 23. *Secretary:* C. L. Crawford, "Alma," 16, Wyld Way, Wembley.

Newcomen (Hull) M.C.—Mr. T. Shirtliff has resigned his position as Assistant Leader, to the regret of the Leader and members. Model-building Evenings continue to be favourites, enthusiasm for work of this kind being greater than ever. Efforts are being made to secure a new club room. More members are required and those wishing to join are asked to write to the secretary. Club roll: 13. *Secretary:* H. Acklam, 103, Newcomen Street, Hull.

Clacton and District M.C.—An interesting Lecture on "*The Railway Centenary of 1925*," was followed by a visit to the local L.N.E.R. engine sheds. The Traction Engine on loan from Headquarters was keenly studied by members at one meeting and others have been devoted to "Simplicity" Model-building Contests and to Hornby Train operations. Mr. McVie, Leader of the Club, has resigned owing to removal. Members greatly regret his departure, for his enthusiastic leadership has been very successful. Club roll: 17. *Secretary:* M. H. Carter, 12, Wellesley Road, Clacton-on-Sea.

Old Charlton M.C.—Affiliation to the Meccano Guild has been secured and an attractive programme has been arranged. This includes Model-building, Lectures and short talks by members, questions being encouraged at all meetings. Subjects for Model-building have included public vehicles of the future and aeroplanes. Many of the omnibuses of the future were highly original in design, and most of the models built on the Aeroplane Evening were representations of "*Hannibal*," the Handley Page air liner of Imperial Airways. Club roll: 10. *Secretary:* B. Stevens, 53, Mount Street, Charlton, S.E.7.

Hornsea M.C.—The club continues to make good progress, the programme including attractive Lantern Lectures and Cinema Displays given by Mr. R. W. Shooter. The subject of one lecture was "*A Visit to Norway*," the slides being from photographs taken by the Leader. A special section has been formed for new members, who are called Junior Apprentices. Close inspection was made of a locomotive during a visit to the local engine shed. Club roll: 84. *Secretary:* P. Thom, 5, Alex Road, Hornsea.

Attenborough Church Choir Boys' M.C.—The chief feature of the programme is Model-building. Splendid models of Aeroplanes, Seaplanes and Gliders were shown at one meeting, eight of these receiving full marks. Equally meritorious model Cranes were submitted on another occasion. A lecture on "*Bees and Honey*" was given by Mr. W. Musson, a well-known gardener. Club roll: 24. *Secretary:* A. E. Dodd, "Wyville," Devonshire Avenue, Long Eaton, Notts.

Bell Hill and District M.C.—The club is making steady progress, a varied winter programme having been arranged. A lecture on "*The Story of the Motor Car*," on loan from Headquarters, was read and discussed at two meetings, and others have been devoted to Games and Model-building Contests. New members will be welcomed by the secretary, who will give full details of the club on application. Club roll: 12. *Secretary:* R. A. Hart, Kingswood Hall, Vange, Pitsea, Essex.

Eynsford Baptist Church M.C.—Steady progress is reported. Interesting models have been constructed for the club's Exhibition, for which a Hornby Train Layout has been planned. A Lecture given by Mr. R. E. G. Brown, President of the Club, on "*Motor Engines*" was an attractive feature of the programme during recent weeks. Mr. Brown held the attention of the members throughout his talk. Club roll: 12. *Secretary:* S. A. Forward, 5, Oliver Crescent, Farningham, Nr. Dartford, Kent.

INDIA

Ranjit (Lahore) M.C.—Special Meccano models were built for a successful Exhibition held in the rooms of the local Y.M.C.A. A series of lectures on engineering subjects has been given by the Leader, Mr. R. S. Khati, Leader of the club, and an interesting programme of excursions and picnics has been followed. A novel feature is that the secretary is required to sing a song at each meeting. Any club wishing to follow this example should first make sure of the quality of the secretary's voice! Club roll: 8. *Secretary:* Asa Singh, Bhagwan Bazaar, Gowal Mandi, Lahore.

NORWAY

Sandefjord M.C.—A new club room has been secured and many interesting meetings have been held. Model-building Contests are arranged regularly, members being so keen that the competitions in which there are no prizes are as popular as those in which awards are made. Papers were read one evening by Mr. H. R. Sorensen, Leader of the club, and T. Jacobsen, the secretary, on the Forth Bridge and the new Hudson River Bridge respectively. Meccano models were used to illustrate the talks. Stamp Collecting is a popular hobby with members and the secretary gave a short lecture on the production of stamps. Club roll: 6. *Secretary:* T. Jacobsen, Jernbanealleen, 5, Sandefjord Norge.

A cheery group of members of Whitgift School M.C. This club was affiliated in March, 1929, and its programme has included a series of well-organised Exhibitions. Much of its success is due to the inspiring Leadership of Mr. F. Broadbent, who is seated in the centre of the above group.

Clubs Not Yet Affiliated

Harlesden M.C.—Membership is steadily increasing and excellent meetings are being held. The programme includes Model-building, Hornby Train operation, Debates and Lantern Lectures. An interesting evening recently was spent in building model Motor Cars, and at another meeting a talk was given by Mr. Weightman on "*How To Use Meccano Parts*." The club has been divided into two groups called "Nuts" and "Bolts," membership of each section being obtained by means of a brief test. Club roll: 24. *Secretary:* L. Rallison, 6, Harley Villas, Harley Road, Harlesden, N.W.

Copenhagen (Denmark) M.C.—A club room has been secured and meetings are held weekly for Model-building and the exchange of stamps. A display of models constructed by members attracted many visitors and added to the club funds. A magazine is published, recent issues containing the story of the "*Life of Edison*," the famous inventor. New members will be made very welcome. *Secretary:* Frode Severin, Rud. Berghsgade 17, Copenhagen.

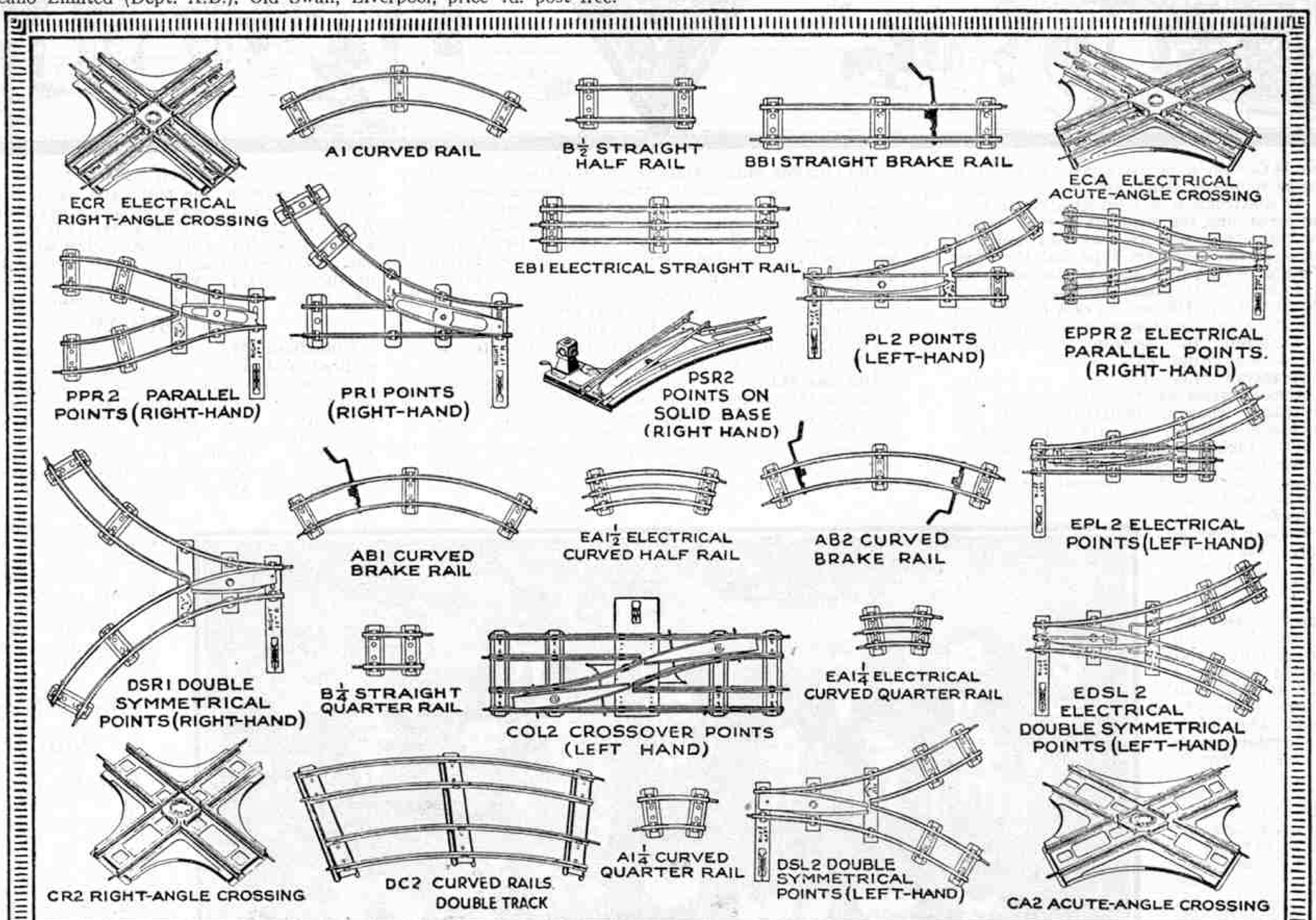
Unley (South Australia) M.C.—A club room has been secured and Mr. C. Hickox, who kindly placed this at the disposal of the club, has accepted the leadership. Regular Model-building meetings are now being held, and it is hoped to secure affiliation shortly. Boys who wish to join should write to the secretary for full details. *Secretary:* J. Edge, 62, Frederick Street, Unley, South Australia.

Lewisham (Sydney, Australia) M.C.—Has now an excellent room and a large supply of Meccano parts is available for Model-building. Visits to various places of interest are arranged regularly, and it is hoped shortly to print a magazine with the aid of a duplicator presented to the club. A loud speaker fitted in the club room is operated from the set of the owner, who kindly allows members to listen to programmes during the meetings. Recruits are wanted, and further particulars may be obtained from the *Secretary:* W. S. T. Watson, 595, Parramatta Road, Leichhardt, N.S.W.

Christchurch (New Zealand) M.C.—Continues to make good progress, Model-building Contests, Hornby Train Nights and Games being popular items in the programme. Mr. F. Armstrong gave a display of films taken during his tour of California, Alaska and Honolulu. Members have visited Linwood Engine Sheds and the Christchurch "Star" Printing Works. Club roll: 36. *Secretary:* E. A. Gay, c/o 625, Colombo Street, Christchurch.

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 Plan your Hornby Railway," which is obtainable from your dealer, price 3d., or from Meccano Limited (Dept. A.B.), Old Swan, Liverpool, price 4d. post free.



Alternate Pegs

	CURVED RAILS		
	9-in. radius (For MO Trains)		
M9	Curved rails	doz.	3/–
MB9	Curved brake rails	each	3½d.
	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.	7/6
	STRAIGHT RAILS		
BM	Straight rails (for MO Trains)	per doz.	2/9
B1	Straight rails	„	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.

Rails for Clockwork and Steam Trains

Gauge 0, 1¼"

BBR1	Straight brake and reverse rails	each	1/6
DS1	Straight rails, double track ...	½ doz.	6/6
	DOUBLE SYMMETRICAL POINTS		
	For 1-ft. radius curves		
DSR1	Double symmetrical points, right-hand	per pair	5/–
DSL1	Double symmetrical points, left-hand		
	For 2-ft. radius curves		
DSR2	Double symmetrical points, right-hand	per pair	5/–
DSL2	Double symmetrical points, left-hand		
	PARALLEL POINTS		
PPR2	Parallel points, right-hand	per pair	5/–
PPL2	Parallel points, left-hand		
	CROSSINGS		
CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/–
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	each	2/–
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9
	CROSSOVER POINTS		
COR2	Crossover points, right-hand	per pair	12/–
COL2	Crossover points, left-hand		
	POINTS		
	9-in. radius (For MO Trains)		
MR9	Right-hand points	per pair	3/–
ML9	Left-hand points		
	1-ft. radius		
PR1	Right-hand points	per pair	4/–
PL1	Left-hand points		
	2-ft. radius		
PR2	Right-hand points	per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		
RCP	Rail connecting plates ...	½ doz.	2d.

Rails for Electric Trains

	CURVED RAILS		
	1-ft. radius		
EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails	„	4/–
	2-ft. radius		
EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/–
EDC2	Curved rails, double track ...	½ doz.	9/–
	STRAIGHT RAILS		
EB1	Straight rails	per doz.	6/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–
EDS1	Straight rails, double track ...	½ doz.	8/6
	CROSSINGS		
ECA	Acute-angle crossings	each	4/–
ECR	Right-angle crossings	„	4/–
	POINTS		
	For 2-ft. radius curves		
EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		
	DOUBLE SYMMETRICAL POINTS		
	For 2-ft. radius curves		
EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		
	PARALLEL POINTS		
	For 2-ft. radius curves		
EPPR2	Parallel points, right-hand...	per pair	8/6
EPPL2	Parallel points, left-hand ...		
	CROSSOVER POINTS		
ECOR2	Crossover points, right-hand	per pair	24/–
ECOL2	Crossover points, left-hand		
TCPL	Terminal connecting plates (low voltage)	each	1/6

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

Centre Rails for Converting Ordinary Track to Electrical

	CURVED CENTRE RAILS		
	1-ft. radius		
AC1	Curved centre rails ...	per doz.	1/–
AC1½	Curved centre half rails ...	„	9d.
AC1¼	Curved centre quarter rails ...	„	6d.
	2-ft. radius		
AC2	Curved centre rails ...	per doz.	1/–
AC2½	Curved centre half rails ...	„	9d.
AC2¼	Curved centre quarter rails ...	„	6d.
	STRAIGHT CENTRE RAILS		
BC1	Straight centre rails ...	per doz.	1/–
BC½	Straight centre half rails ...	per doz.	9d.
BC¼	Straight centre quarter rails ...	„	6d.
ICR	Insulators for insulating centre rails	per doz.	3d.
CCR	Clips for fixing centre rails ...	„	6d.

Manufactured by MECCANO LIMITED, OLD SWAN, LIVERPOOL

Branch Notes

WIMBORNE GRAMMAR SCHOOL.—A recent meeting was devoted to explaining to newly-joined members the methods of forming trains, signalling and timetable working. The stations have now been named "*Binns Road*," "*Hornby North*," "*Hornby South*," "*Meccanoville*" and "*Old Swan*" respectively. A tunnel is being reconstructed and a cutting erected outside "*Old Swan*" station, and the "hump" of "*Binns Road*" goods yard has been removed and the whole yard put on a slope. A set of rules has been drawn up to facilitate the running of the Branch, and fines are imposed when any of the rules are broken. Secretary: J. K. Bennett, 120, Newington Causeway, London, S.E.1.

KILMAURS.—An interesting visit was paid to the Barleith Railway Depot and the members were allowed to make a close inspection of the engines. In the evening a lantern lecture entitled "*Britain's Largest Railway*," loaned by the L.M.S.R., was given. Secretary: Hugh T. Stewart, "Beaufield," Kilmaurs, Kilmarnock.

FIRST CHERTSEY.—This Branch has amalgamated with the local Meccano Club, and a successful exhibition was given by the two clubs. A model railway was operated by the Branch members, while the Meccano enthusiasts demonstrated how the various models worked. Secretary: V. Longman, 2, Chantry Road, Chertsey, Surrey.

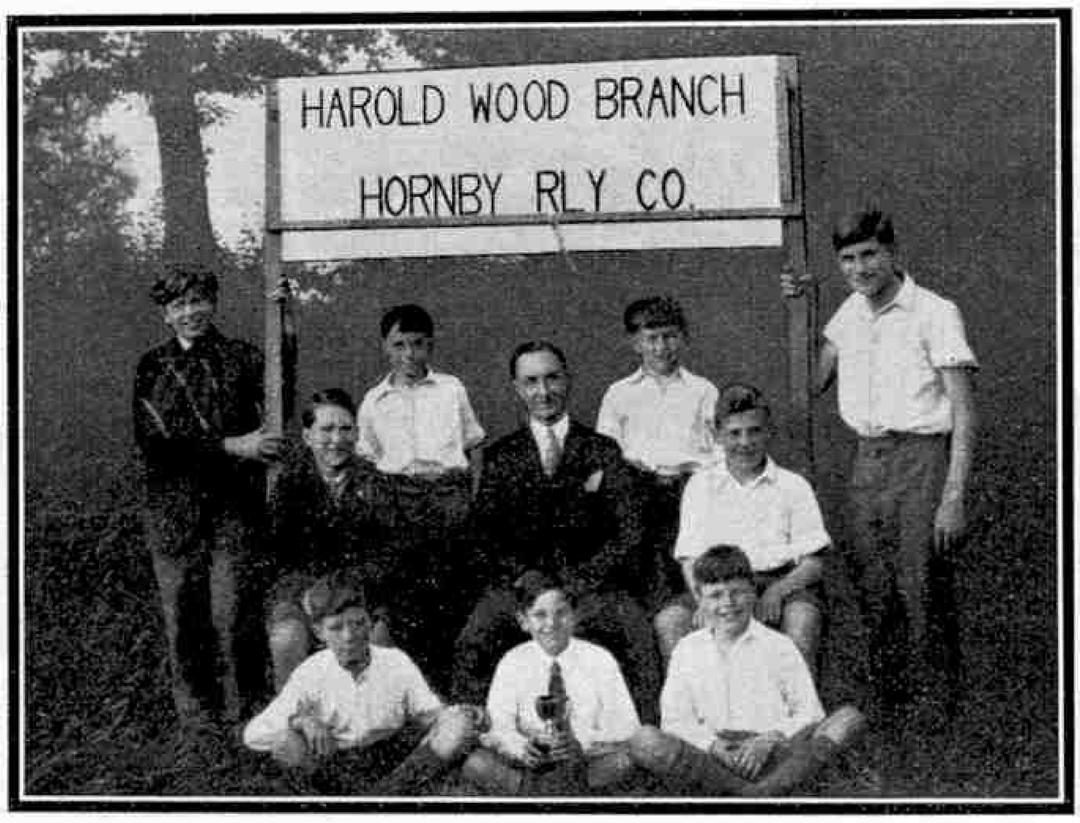
FIRST BOURNEMOUTH.—Many track designs were tried at the first meetings of this Branch to decide which one should be adopted permanently. The layout that was finally adopted can be operated to a 15-minute timetable. Arrangements are being made to visit local railway centres, and it is hoped to arrange for several talks by local railway officials. Secretary: R. P. Common, 13, Uplands Road, Bournemouth.

ST. ALBANS.—The newly-formed Branch held its first meeting in the Toc H headquarters. Various plans for the Branch layout were suggested, the one finally adopted including a triangular junction, so that locomotives and trains could be turned by the triangle method instead of a turntable. Haulage tests have taken place with trains of goods vehicles to test the capacities of the Branch locomotives. Secretary: A. W. West, 6, Oswald Road, St. Albans.

CHURCHILL (OXFORD).—Members visited the Swindon Works of the G.W.R. Keen interest was taken in the furnace for heating copper sheets preparatory to forming them into fire-box plates, and in the large drop hammers, presses and bending rolls. The "Swindon" superheater for locomotives was explained by the guide, and also the action of the driver's regulator. The cutting, planing and fitting of rails for points and crossings was another interesting sight. The locomotive 6006, "*King George I*" was thoroughly examined, as were also some 0–6–0 tank engines. Secretary: Mr. C. E. Blake, School House, Churchill, Oxford.

WHITGIFT SCHOOL.—Papers have been read during the month on "*The Caterham Branch of the S.R.*," "*Remarkable Ships*" and "*The Vesuvius Railway*." An interesting meeting was held at which the members were asked to put forward suggestions and criticisms. Arrangements were being made for an aeroplane flight, but it has been decided to postpone it until later in the year. Secretary: J. D. Mellor, 71, Birdhurst Rise, S. Croydon.

EAGLEHURST (PALMERS GREEN).—The Branch members have been busy this month re-laying the double track in numbered sections. The track is now screwed down to lengths of board that can be quickly assembled on trestle tables round the hall. This work has revealed a considerable amount of carpentering talent. Secretary: Mr. P. D. Garton, 24, Elmdale Rd., Palmers Green, London, N.13.



Our photograph this month is of the Harold Wood Branch No. 109. Chairman, Mr. F. Mares. Secretary, E. N. Tyler. The Cup held by one of the members was presented to the Branch as second prize for their decorated lorry that was entered in the Romford Carnival.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BELFAST.—R. McGurk, 13, Pandora Street, Belfast.

BRIDGWATER.—Mr. E. W. J. Giles, 28, St. Mary Street, Bridgwater.

BRISTOL.—Frank E. Starr, 19, Windsor Terrace, Totterdown, Bristol.

CAMBRIDGE.—A. J. Neal, 26, Rathmore Road, Cambridge.

CORSHAM.—A. D. Dyke, "Wisteria," Pickwick Road, Corsham.

LONDON, W.13.—J. R. D. Chegwyn, 34, Bellevue Road, West Ealing, London, W.13.

MANCHESTER.—Mr. J. Radcliffe, 19, Roseberry Street, Gorton, Manchester.

MIDDLESBROUGH.—W. Hall, 21, Hambledon Road, Linthorp, Middlesbrough.

NEW BARNET.—A. Comfort, "Havengore," Tudor Road, New Barnet.

TROON.—W. Donald, 25, Harling Drive, Troon, Ayrshire.

WITTON PARK.—L. L. D. Cama, Carwood House, Witton Park, via Darlington.

OXFORD.—Raymond Witheridge, 110, Walton Street, Oxford.

WEST HARTLEPOOL.—Robert B. Carney, 48, Carlton Street, West Hartlepool.

WELWYN GARDEN CITY.—E. Lowe, 31, Attimore Road, Welwyn Garden City.

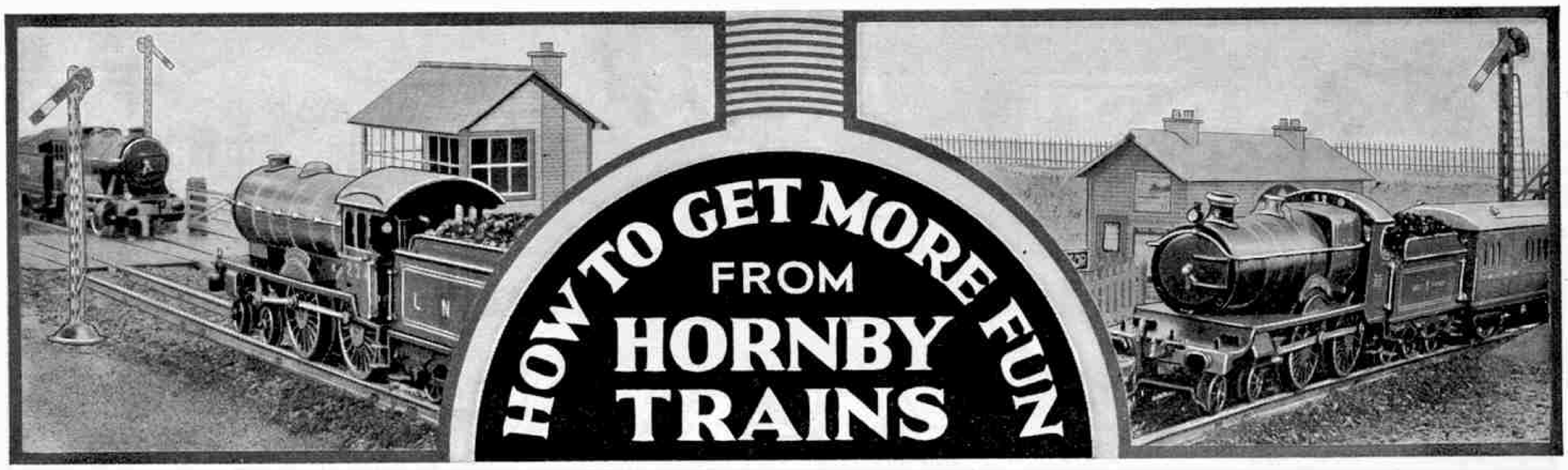
RUNCORN.—J. Blake, 27, Lord Street, Runcorn.

OVERSEAS

AUSTRALIA.—M. Clarke, "Werlong," 13, Queen Street, Colac, Victoria.

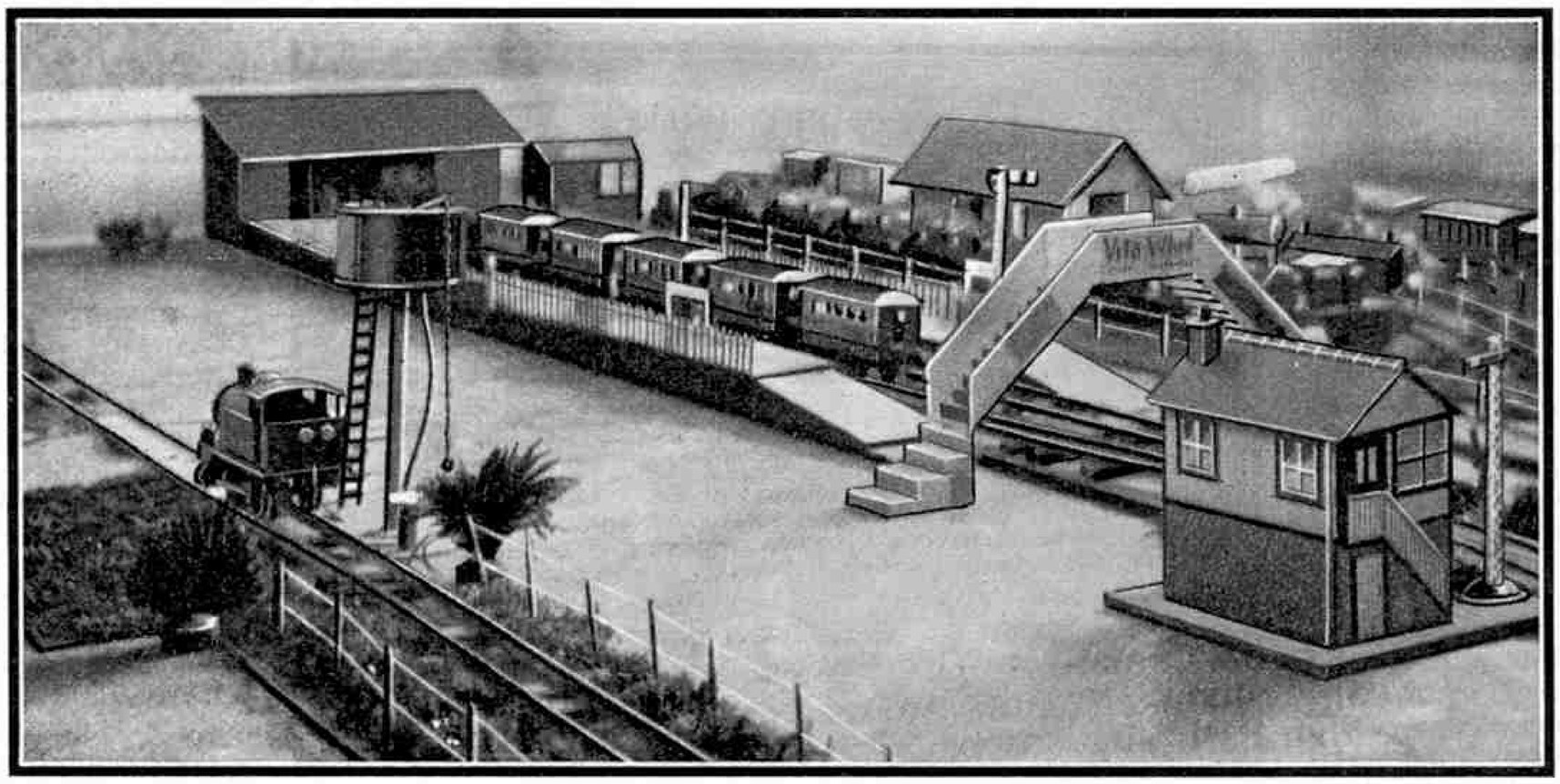
Branches Recently Incorporated

207. BOWDON—P. Brotherton, "Aberfoyle," Chesham Place, Bowdon.
208. LOUGHBOROUGH GRAMMAR SCHOOL—F. Smith, School House, Loughborough.
209. BOWDON MODEL RAILWAY CLUB.—N. M. Makin, "Arden," Cavendish Road, Bowdon.



XL.—RUNNING WINTER SPECIALS

PROBABLY few Hornby railways have not had some additions made to them during the recent holidays, either in the form of further supplies of track or perhaps new locomotives and rolling stock. As a result, further traffic can be dealt with, and more interesting operations carried out. We are sure that keen railway owners have not neglected the opportunity presented by the winter holiday season to observe the characteristic features of real railway traffic at this period. The reproduction in miniature of such features gives a topical air to the proceedings, and shows any interested visitor that the model railway owner is keenly alive to what goes on.



Part of the layout of J. Thomas of Swanage (H.R.C. No. 17547). A " turnover " locomotive standing at the water tank is waiting to proceed to the terminus and take out the coaches of the train that has just arrived.

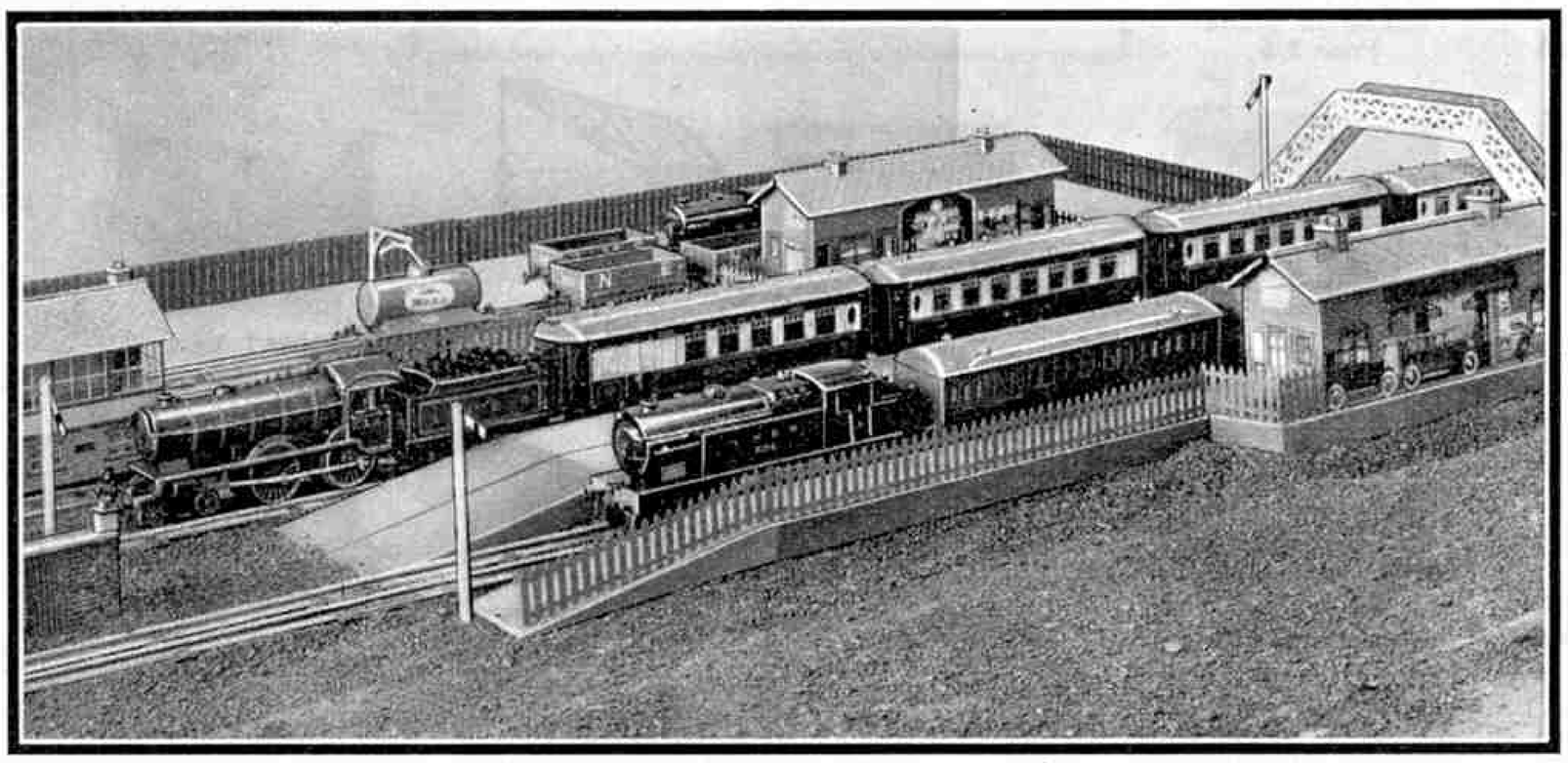
Numerous additional trains are run, and these of course have in their operation all the characteristics of special traffic, such as we have dealt with previously in considering the summer programme of Hornby railways. Of the many specials that are run at this time of the year not the least interesting are football specials. They are run for the benefit of those desiring to follow the fortunes of their favourite club, and particularly in the various Cup-ties. It may be necessary to run a train in several portions, and on a Hornby layout the sight of these ready for departure from adjacent platforms of a terminus is quite impressive. One of the accompanying photographs shows two such specials, the engines bearing the special train numbers prominently displayed at the front end. One interesting custom is that the engine of such a train may bear a special decorative board or poster at the front, or else display the colours of the club concerned. This scheme will no doubt be eagerly adopted by keen model railwaymen, as attention to minor details of this kind renders the various railway operations surprisingly true to life. Some of these trains travel long distances, but locals, too, may contribute to the busy period on a Hornby layout. Small posters advertising such facilities are another suggestion, and may easily be prepared by Hornby railway owners for display on their stations.

Many H.R.C. members who are at boarding schools will have travelled either on the joyful journey homeward or on the more sober return upon a " school special." Where large numbers of boys are travelling in this way, a special train is often operated for their benefit, and the running of such a train on their Hornby railways would be a novel proceeding. Now that Clips are available for fitting to Hornby coaches, a special board bearing the title " School Special " will enable such a train to be indicated in an appropriate manner. Possibly part of the journey is made over a branch line, and the working of the various trains at the particular junction will always furnish suggestions for miniature practice.

Branch lines themselves have received some previous attention in these pages, but there is no harm in stressing the additional interest that results from the incorporation of even a small branch line in a layout. The connection of the branch with the main line trains and the transfer of parcels and luggage between the two will involve quite an amount of interesting bustle at the junction. There is also the re-marshalling of goods trains, and the transfer of wagons from main line trains to serve the branch.

One of our photographs shows an attractive junction station layout. The centre platform of the station is of island form, and is made specially wide to accommodate the passengers requiring to change trains, with their

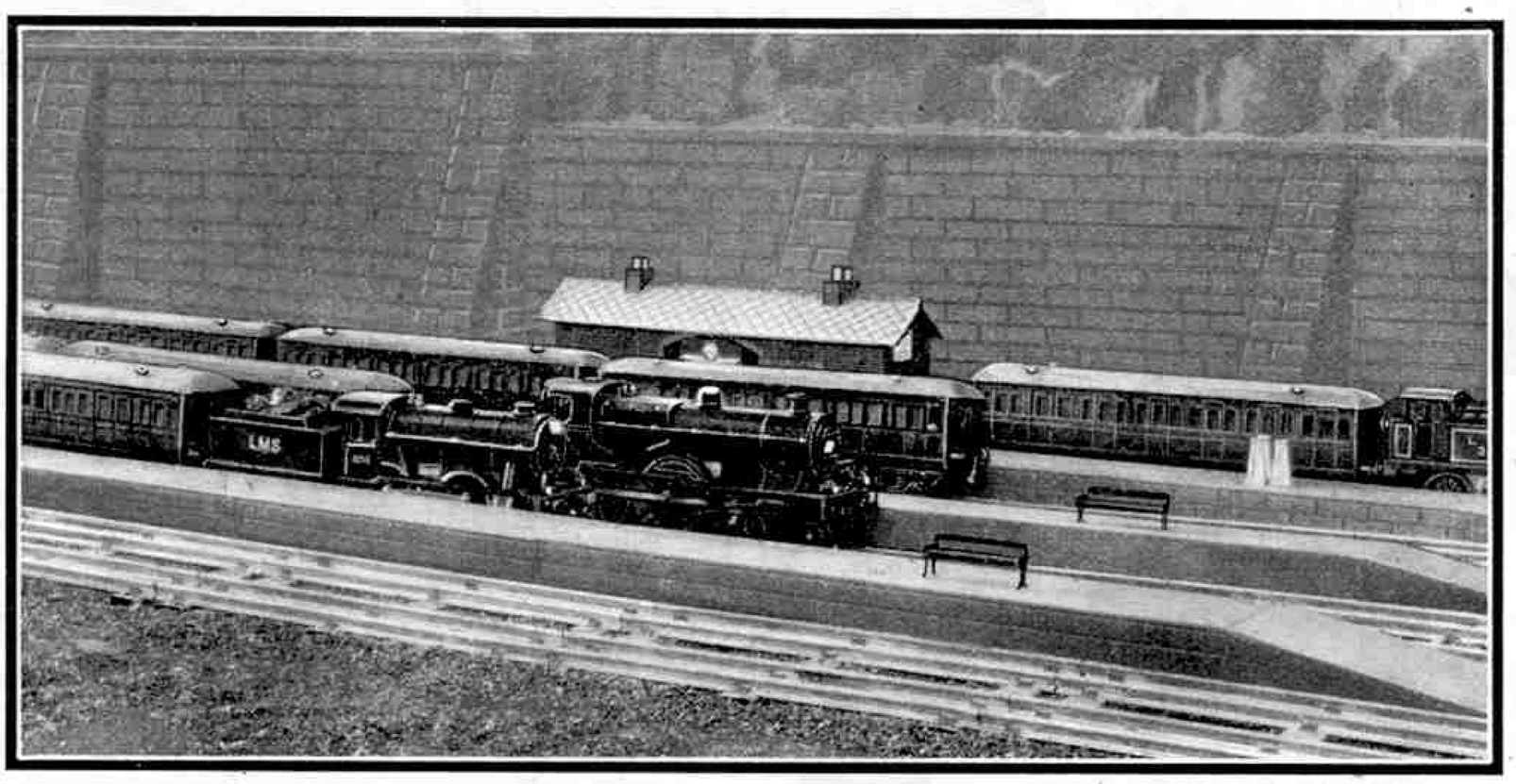
luggage. The branch line ends in a single road " bay," the inner platform on the near side being intended particularly for local passengers. This is not a common arrangement, but is one that is permissible in miniature practice, as it may be a convenient way of arranging matters. Local goods traffic and any re-marshalling of trains that may be necessary are carried out in the yard at the other side of the station. For the effective use of the new Station Hoardings and Miniature Figures, in addition to the various other accessories that are available, the large centre platform has much to commend it.



An attractive junction station layout. The local train connects with the Pullman express, and a wide island platform is provided for the transfer of passengers and their luggage.

Most boys will have made one or two journeys on their local lines during their holidays, and the methods of dealing with local trains that are booked to depart from a terminus within a short period of their arrival are points to attract notice. In many stations that have been modified and have had their layouts changed somewhat during comparatively recent years, special crossovers and tracks are usually provided to enable an arriving engine to run forward from its train, reverse over a crossover, and proceed to the other end of the train, perhaps replenishing the water supply from a tank or column at the platform end, while waiting for the " right away." This practice may be operated in miniature where space allows, but often it is impossible to provide Crossover Points in the limited confines of a model terminus. The Crossover itself is equal in length to two Straight Rails, and there has to be sufficient length for the engine to run on to before reversing, quite apart from the track occupied by the train itself. In addition there are the various connections at the other end of the station. This means that the terminus station will threaten to over-run the whole of the railway in many cases!

Fortunately an alternative arrangement is possible and is often employed in real practice, while its use on miniature systems is frequently the only method that can be adopted in the conditions. This is to provide what is known as a " turnover " locomotive. The arriving engine runs into the station and is perhaps unable to be released until the departure of the train on its return journey. Another locomotive that may have been waiting in a siding, or perhaps has itself been released by the departure of another train, comes on to the train, couples up and draws it away on its journey. As soon as the way is clear, the engine that brought the train in can then leave the platform and undertake its next turn, perhaps acting as a " turnover " locomotive to another train that has arrived in the meantime. The difficulty is thus solved in a satisfactory manner without a large outlay in the matter of track. It means that an additional engine or engines will be required, but as a general rule the proportion of locomotive power to rolling stock is high in miniature practice. One of our photographs shows part of the layout of J. Thomas of Swanage, and a " turnover " locomotive waiting to proceed to the station to take up its duties is seen by the water column. A useful function frequently performed by the first engine as the train departs with the turnover locomotive at its head is to provide rear-end assistance in banking the train out of the station. This is a feature of the working at certain stations and may be observed at Euston and St. Pancras. Where heavy trains are involved the work of the train engine in getting them on the move is lessened and station operations are speeded up, as the time taken by the train in getting away is lessened. This help is particularly valuable in the winter as fog or snow may cause the rails to be very slippery. Such assistance may be given in miniature where circumstances make it possible to do so. A straight length of track is essential or buffer locking will be almost certain to occur, as the banking engine will not be coupled to the train, being retarded by a Brake Rail at the platform end.



Two portions of a special train ready for departure. Such trains are frequently run for football enthusiasts as suggested in this article. The locomotives of course carry the special train numbers in a prominent position at the front end.

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, strongly built and beautifully enamelled.

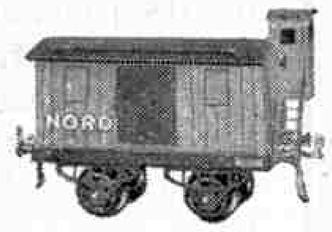
Ask your dealer to show you the full range of Hornby Rolling Stock.

OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/6**

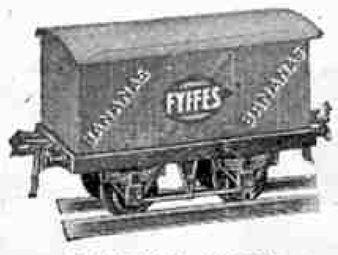
PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/6**

PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**

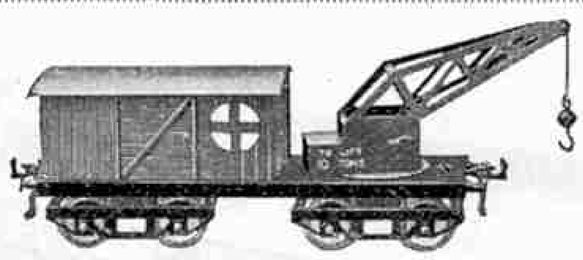
OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/6**



BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**



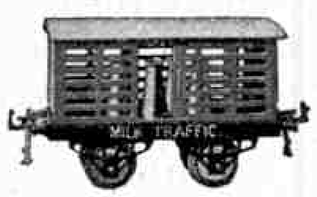
BANANA VAN
An attractive model, finished in yellow and green. Price **3/-**



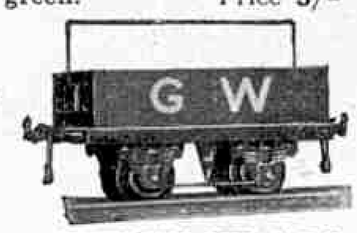
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

MEAT VAN
This is a very realistic model. Available lettered L.M.S. only. Price **2/6**

FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/9**

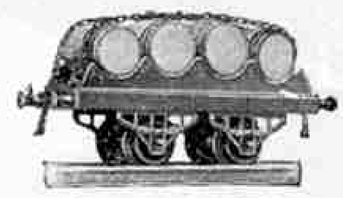


MILK TRAFFIC VAN No. 1
Fitted with sliding doors. Complete with milk cans. Price **3/-**



***OPEN WAGON "B"**
Similar to Hornby Wagon No. 1 but fitted with centre tarpaulin supporting rail. Price **2/3**

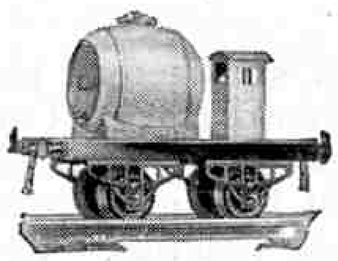
MITROPA COACH No. 3
Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **15/6**



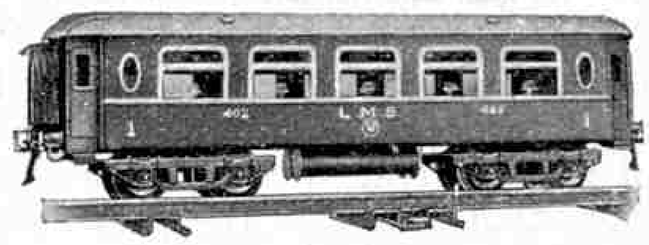
BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/9**

GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**

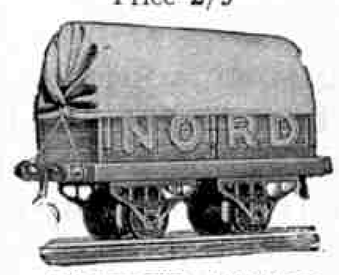
SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/-**.

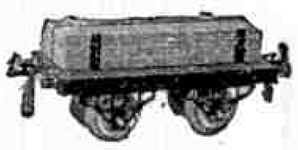


No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**

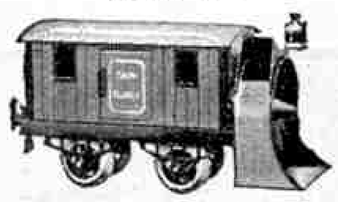


COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/-**

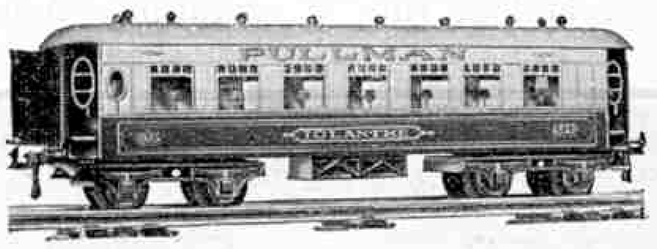
ROTARY TIPPING WAGON
Finished in orange. Price **3/-**



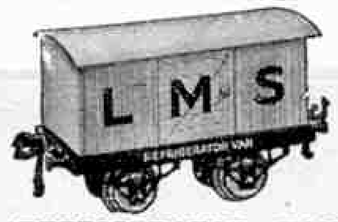
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



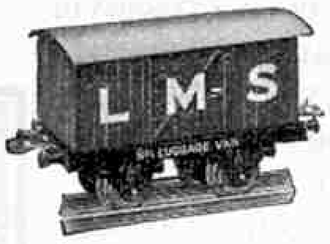
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



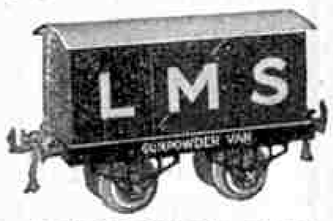
HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/-**



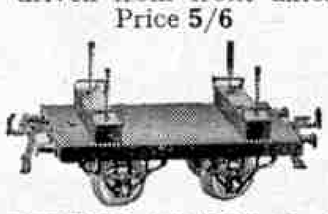
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/-**



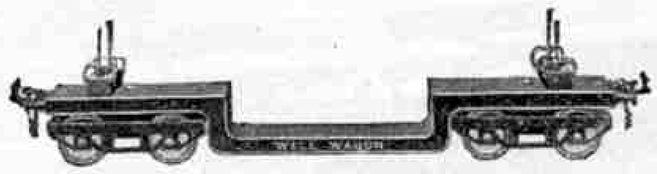
***LUGGAGE VAN No. 1**
With opening doors. Price **3/-**



***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/-**

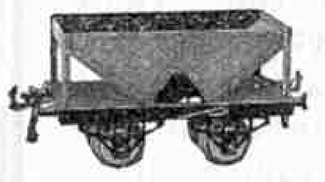


LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/-**

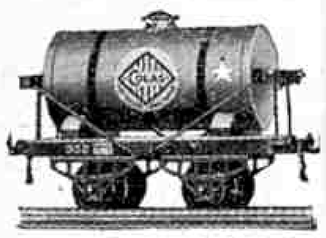


TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

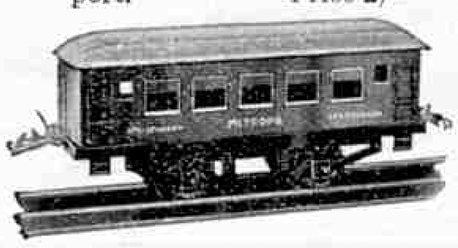
CRANE TRUCK
Finished in brown and blue. Price **3/6**



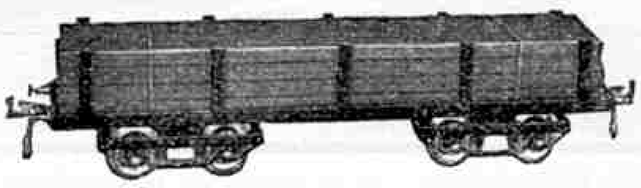
***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**



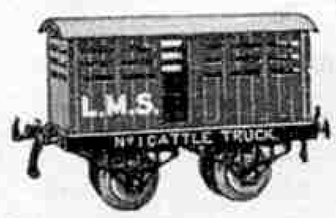
BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**



MITROPA COACH No. 0
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**

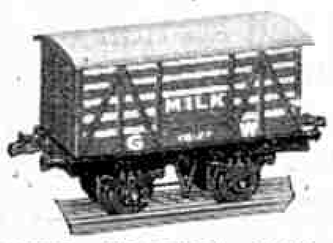


TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**

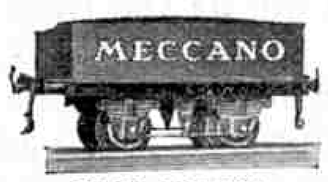


***CATTLE TRUCK No. 1**
Fitted with sliding doors. Very realistic design. Price **3/-**

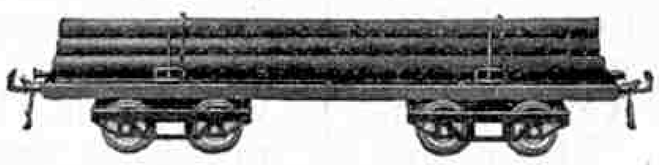
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**



MILK TRAFFIC VAN No. 0
An attractive model. Available lettered G.W. only. Price **2/6**



COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**



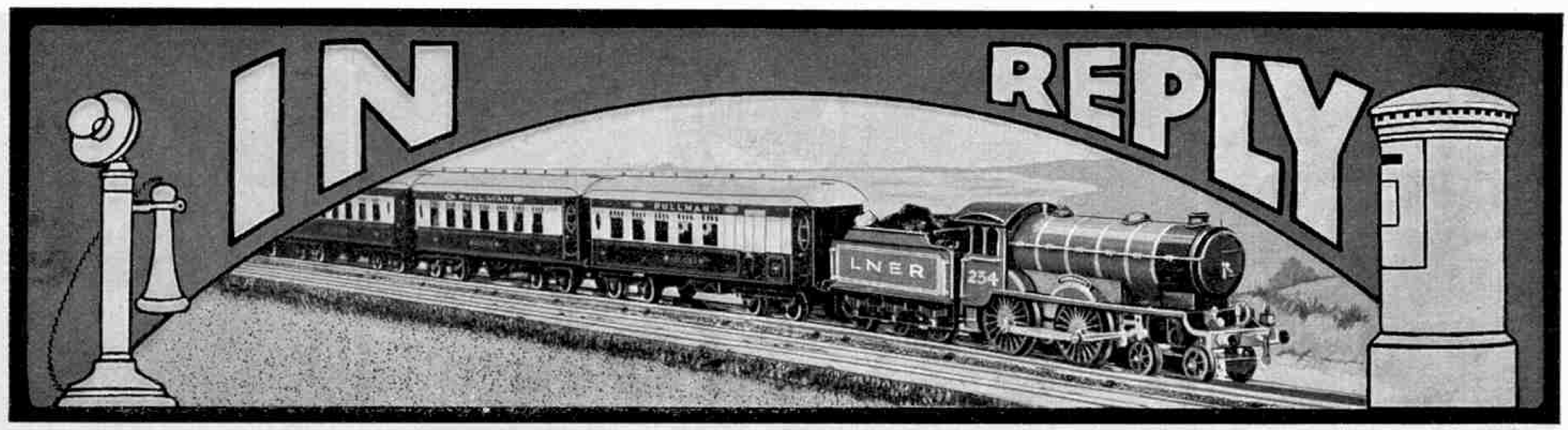
LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/-**

**In L.M.S., L.N.E.R., G.W. or S.R. lettering.*

FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **2/6**

SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/-**

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL



Suggested Hornby Train Improvements

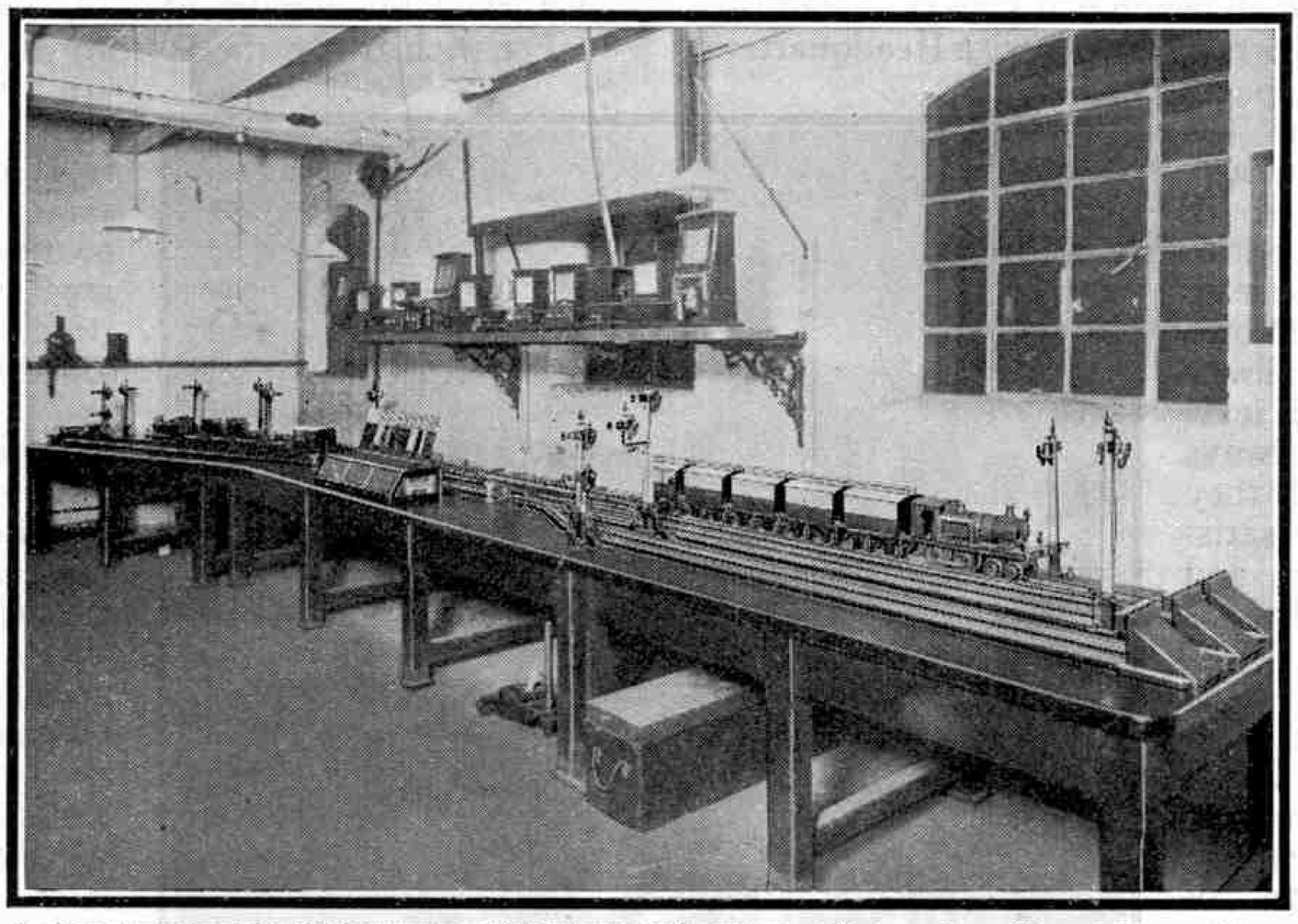
ELECTRIC LIGHTING FOR PULLMAN COACHES

Since the introduction of the Hornby Electrical Lamp Standards, the imitation of night-time conditions has become a popular feature with miniature railway owners. The illumination of the trains is an obvious idea, and numerous readers have fitted up satisfactory installations worked from flashlamp batteries carried on the trains themselves.

Where No. 2 Special Pullmans are to be lighted, the roof of the vehicle should be removed, and the cross members connecting the sides of the coach made use of to support the lamps. A Meccano Bulb Holder should be soldered in a horizontal position to one of these, so that the bulb, when screwed in, will be approximately in the centre of the coach. If soldering is objected to, the Holder may be kept in place by wrapping the connecting flex several turns round it and the cross member. A 6BA Bolt is passed through the insulating washer at the end of the Holder, and a Nut is used to secure the insulated flex by means of which connection is made to one terminal of a flashlamp battery. The circuit is completed by connecting the cross member of the coach to the other battery terminal, a small switch being included if desired. The battery and switch could be housed in the Composite Coach at the tail of the train, the switch being placed just inside the luggage doors, so that it is readily accessible. Where several Coaches are fitted with bulbs, the leads should be carried through the corridor connections.

The position of the bulb high up near the roof gives a good effect, and to diffuse the light satisfactorily, strips of tissue paper should be slipped inside the celluloid window strips fitted to these Coaches.

In a complete train the number of bulbs in use may make an additional battery necessary. This may be connected to the first in parallel, that is, with the positive terminal of one connected to the positive terminal of the other, and the negative terminals connected similarly.



A signalling school for the instruction of signalmen and railway staff generally. The miniature railway system is laid out as in actual practice, and the train movements are carried out according to real regulations, various block instruments being used.

CORRECT LUBRICATION

One of the most important conditions to observe in the operation of a miniature railway is that the moving parts of the locomotives and rolling stock should be adequately lubricated. The necessity for this cannot be overstated, particularly when judging the performance of a new train set. The various parts of any mechanism are inclined to stiffness when new, and oil is therefore specially necessary under these conditions. It enables the spindles and bearings to become nicely worked in to one another, with the result that after a short time the locomotive, or whatever item is being dealt with, runs far more easily and smoothly. The use of a thick oil is to be avoided, for its heavy nature is more likely to retard than assist, and it does not penetrate into minute bearings as well as a lighter oil. Thick oils, too, often become "gummy" after a period, and attract a great deal of dust, which has a clogging effect and has to be removed with petrol.

For Hornby Locomotives and rolling stock Meccano Oil is particularly suitable. It should be applied to each spindle, axle and bearing of a new train set, and its regular use subsequently has a good effect upon the performance and long life of the various components. Owing to its special nature and lubricating properties, only a small drop on each point to be treated is required. Over-oiling causes almost as much trouble as using no oil at all. The surplus oil collects dust and finds its way to places where it is definitely not wanted, such as the wheel treads and so on to the track. The power and length of run of the engine is impaired by a slippery track, and when dust settles on rails in this condition it forms a kind of mud that cakes round all the wheel treads, adding to the resistance. This necessitates the frequent use of a petrol rag, and it is a laborious process to have to wipe clean the wheels of a large number of engines and wagons. "Little and often" in regard to lubrication is thus an excellent maxim that will ensure the best service being obtained from locomotives and rolling stock alike.

Where the Hornby Control System is in use the various components should be lightly oiled to aid their operation. Bell crank pivots and the bearings on the Lever Frame should receive attention, and to make the various signal and point wires run freely, a little oil where they pass through the Guide Brackets is a great help. Points themselves should not be oiled, as there is a danger of their becoming slack and causing derailments owing to the switch rails moving under the passage of a train.

For applying oil there are two Meccano Oil Cans available, the No. 1, which is of the ordinary pattern, and in its latest form has a circular reservoir, and the No. 2, which is a perfect reproduction in miniature of the well-known "K" type can used by engineers. Its fine spout enables it to reach perfectly into locomotive mechanisms, and the spring-button control of the oil enables the smallest possible quantity to be fed to the point required.

BALLAST ON MINIATURE RAILWAYS

An essential feature in actual railway practice is a good firm bed of ballast for the track. It must keep the sleepers in position, and yet be of such a nature that rain readily drains away. How necessary it is may be judged by the speed reductions that are in force when relaying is in progress, and trains have to pass over a length of track the sleepers of which rest only on the road bed, and are not ballasted up. Although ballast is not so necessary on a Hornby railway, its use adds a great deal to the appearance of the line as a whole. It also has the effect of reducing the noise made by the trains. This in any case is an advantage, and what is particularly attractive is that the actual wheel beats of a train in motion can easily be distinguished, and the impression of realism thus gained is very pleasing.

Fine granite chippings may be used, and may generally be obtained from a local builder. The material should be well riddled and then washed to remove dust before it is used. If granite is not available, a good substitute is chicken grit, which can be purchased from a corn chandler. Cinders and other dusty material should not be employed.

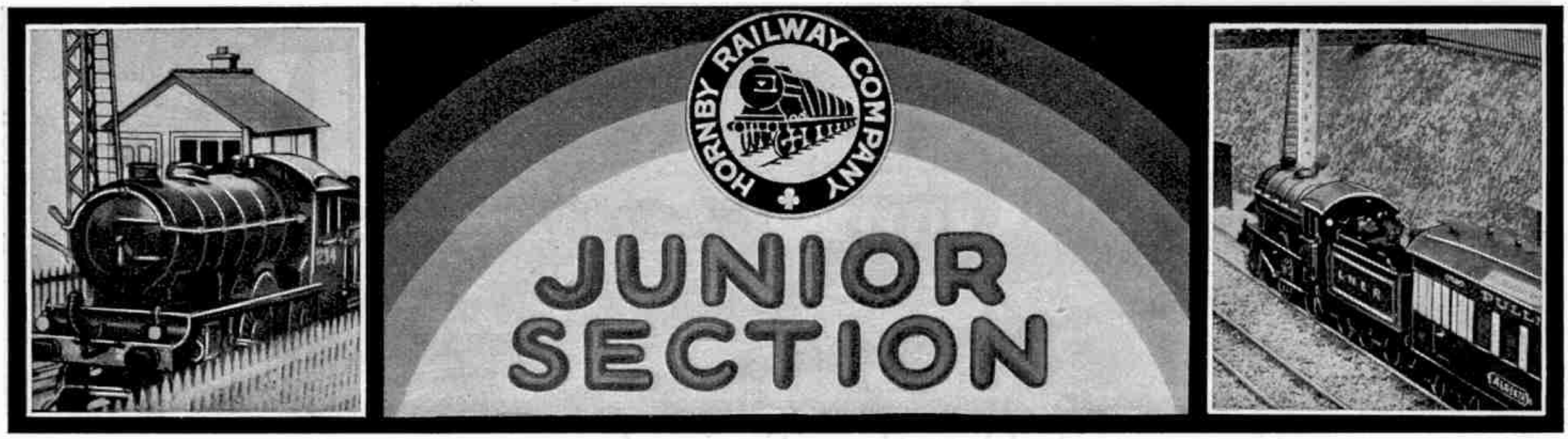
Ballast of course can hardly be used on a portable layout, though where the line is mounted in sections upon boards the ballast may be permanently attached to the boards. Where this is possible, and of course for permanent layouts, ballast may be prepared in the following manner. The washed ballast should be placed in a bucket, and about half-a-pint of thin hot glue poured over it and the whole well stirred. The track should then be ballasted with this mixture, the ballast being nicely levelled off and with the edges conforming with the contour of the track. It should be left for perhaps two days, and by then should be very firm and solid. Where this method is employed the nuisance of the ballast shifting is avoided, and the whole may be easily dusted with a soft brush when necessary.

MINIATURE GROUND DISCS FOR HORNBY POINTS.—We agree that the realism of our Points and Crossovers would be increased by the addition of ground discs, or "Tommy Dodds" as they are often called. As the introduction would probably prove popular we propose to give the matter attention in due course. Point lamps are of course already provided on our Points with Solid Base, PSR2 and PSL2. (*Reply to J. Morley, Leicester*).

TRUE-TO-TYPE TANK ENGINES.—Your suggestion is interesting, but for the time being it is not likely that we shall introduce engines of this description. The selection of suitable prototypes is a thorny problem, and this fact, together with the price question, makes the present policy of manufacturing standard designs in various companies' colours the best method of suiting the desires of the majority of model railway owners. (*Reply to R. Band, Warwick*).

FOUR-WHEELED MACHINERY TRUCK.—Such wagons are frequently seen carrying heavy machines of all kinds, and a miniature vehicle, loaded perhaps with a model tractor, would look very fine. Although the present range of goods stock is extensive, the addition of one of these wagons would probably be welcome. (*Reply to P. Archer, Sheffield*).

CLOSE-COUPLED SUBURBAN SET TRAIN.—These trains are not used to the extent that they once were, owing to the increased employment of electricity on suburban routes. A "set" or "block" train of this kind is a neat unit, and of course a certain amount of space is saved when the vehicles are close-coupled. We think, however, that owing to the varying requirements of the traffic on different miniature railways, most "general managers" prefer to make up their trains from individual coaches. (*Reply to C. Keanor, Walthamstow*).



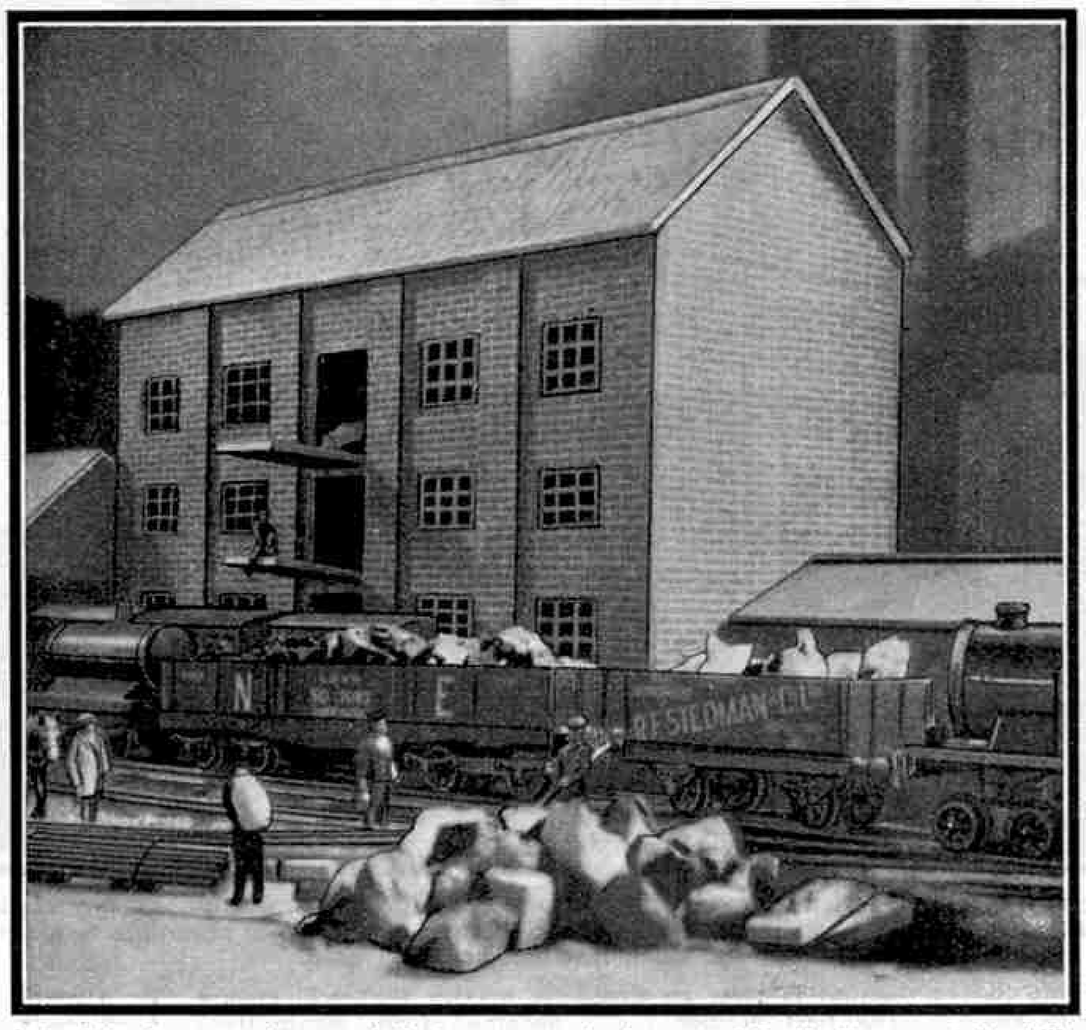
XXXVIII.—FREIGHT TRAFFIC ON HORNBY RAILWAYS

ONE of the most notable results of the three years' progress of the Hornby Railway Company has been the increasing degree of realism that is found even on the most simple layouts. Miniature railway owners who were formerly content to operate their trains in a more or less happy-go-lucky fashion are now keen to conduct their systems in a similar manner to real railways, and this is shown in many ways. Membership of the H.R.C., the correspondence with Headquarters, a study of the H.R.C. pages in the "*M.M.*" and the meeting of fellow enthusiasts through the formation of Branches, has combined to make almost every phase of the hobby better known among miniature railway owners. The general level of realism in their railways has been raised, and they themselves are more satisfied with their efforts, and get more entertainment as a result.

A marked feature is the more general interest in goods trains, or freight trains to use the modern term, for the Hornby Series contains a tremendous variety of wagons, and the making up of a representative train is thus not difficult. Various points as to the marshalling and general make-up of goods trains, and also the layout of yards for their accommodation, have been recently dealt with in the "*M.M.*" The question of loads in order to supply a reason for the operation of the trains therefore remains. Attention has been directed towards this in the "*M.M.*" previously, but in order to complete the freight question, and for the benefit of new readers or those commencing the model railway hobby, it will be of advantage to deal with the question again.

The extraordinary variety of loads that are found in actual practice cannot of course be reproduced in miniature, but some of the more familiar traffic may be carried on a small scale. The best-known items are probably coal, coke and mineral traffic generally, and these substances look quite well if broken to suitable size and loaded into Hornby Open Wagons. Material of this kind should be washed to free it from dust, and instead of filling up the wagons with whatever load is required, a scheme already suggested several times for wagons and tenders should be employed. Briefly, it consists of making up a false structure to fit inside the wagon, on top of which a layer of the "load" is glued. This scheme ensures cleanliness, for the load cannot be disturbed by derailment and spill all over the place.

For such traffic the Hornby No. 0 and No. 1 Wagons are very suitable. The "Meccano" Coal Wagon represents the numerous wagons belonging to private owners that are found in great numbers in every coal train, and it is already provided with an imitation load. In busy times the Open Wagon B may be pressed into service for such traffic. Granite chippings also may be carried for any road-making that may be going on in the district served by the line, or a train of wagons so loaded may be operated as a work train going to ballast the track at some spot where the Permanent Way Department are engaged.

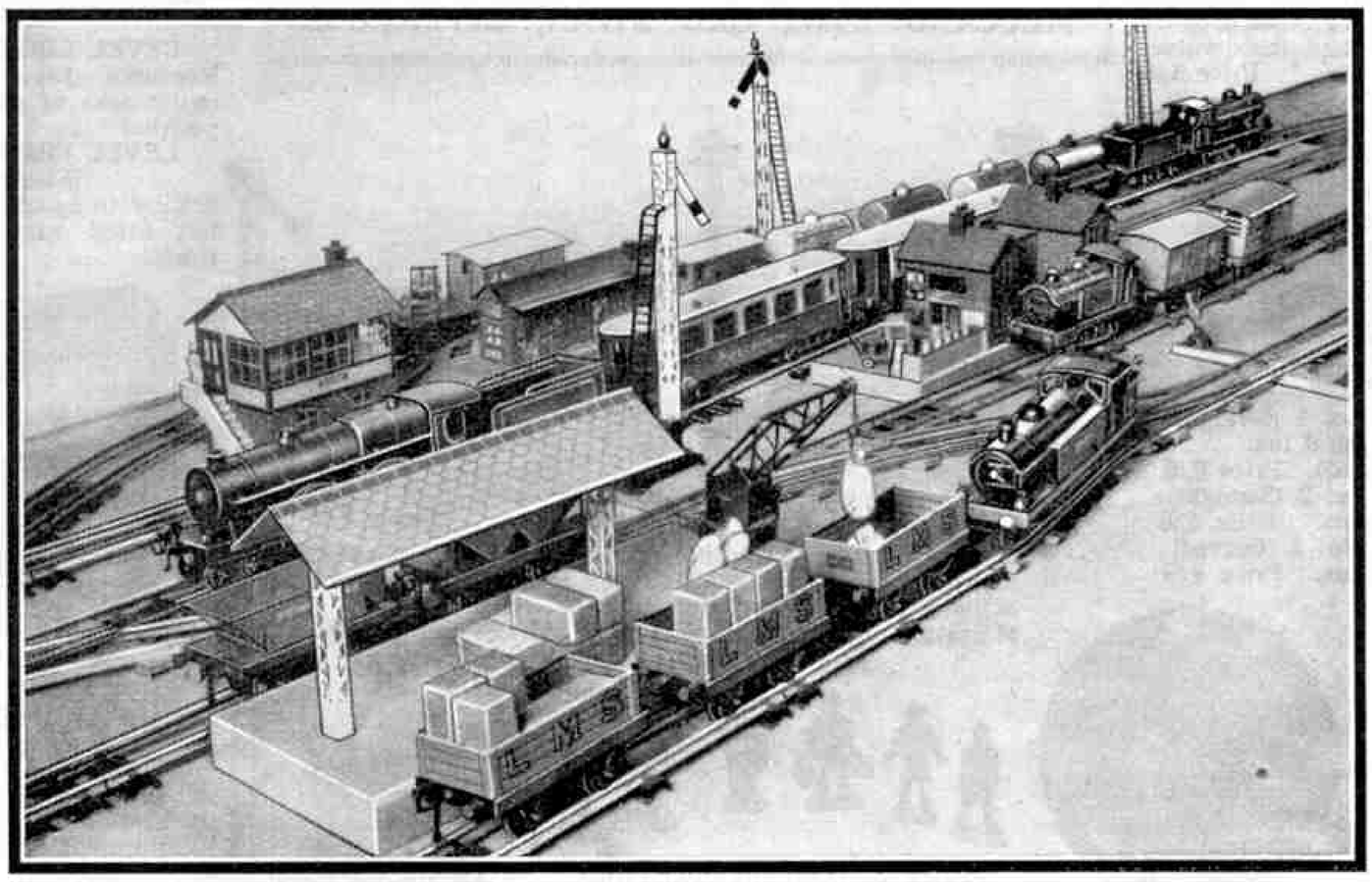


Actual loads are a characteristic feature on the layout of P. B. Denny of Bexhill-on-Sea (H.R.C. No. 1587). The photograph shows wagons carrying coal and Meccano Loaded Sacks as suggested in this article. The warehouse provided shows the extent of the goods traffic dealt with.

For those who prefer to load the actual freight, other types of loads are more suitable, and of course home-made items in great variety will suggest themselves to the keen operator. The making of the roads previously mentioned involves the laying of water mains and drains, and large pipes for this purpose are often to be seen carried in railway wagons. Lengths of such pipe are easily made from sections of postal tubes of suitable diameter, or of circular gas mantle boxes. They should be cut to length and a narrow strip of cardboard stuck round one end to form the raised socket portion of the pipe. Painted dark grey or black, and marked with some well-known makers' name, such as "Stanton," these pipes look very effective when carried by a miniature goods train, as will be seen from one of the accompanying photographs.

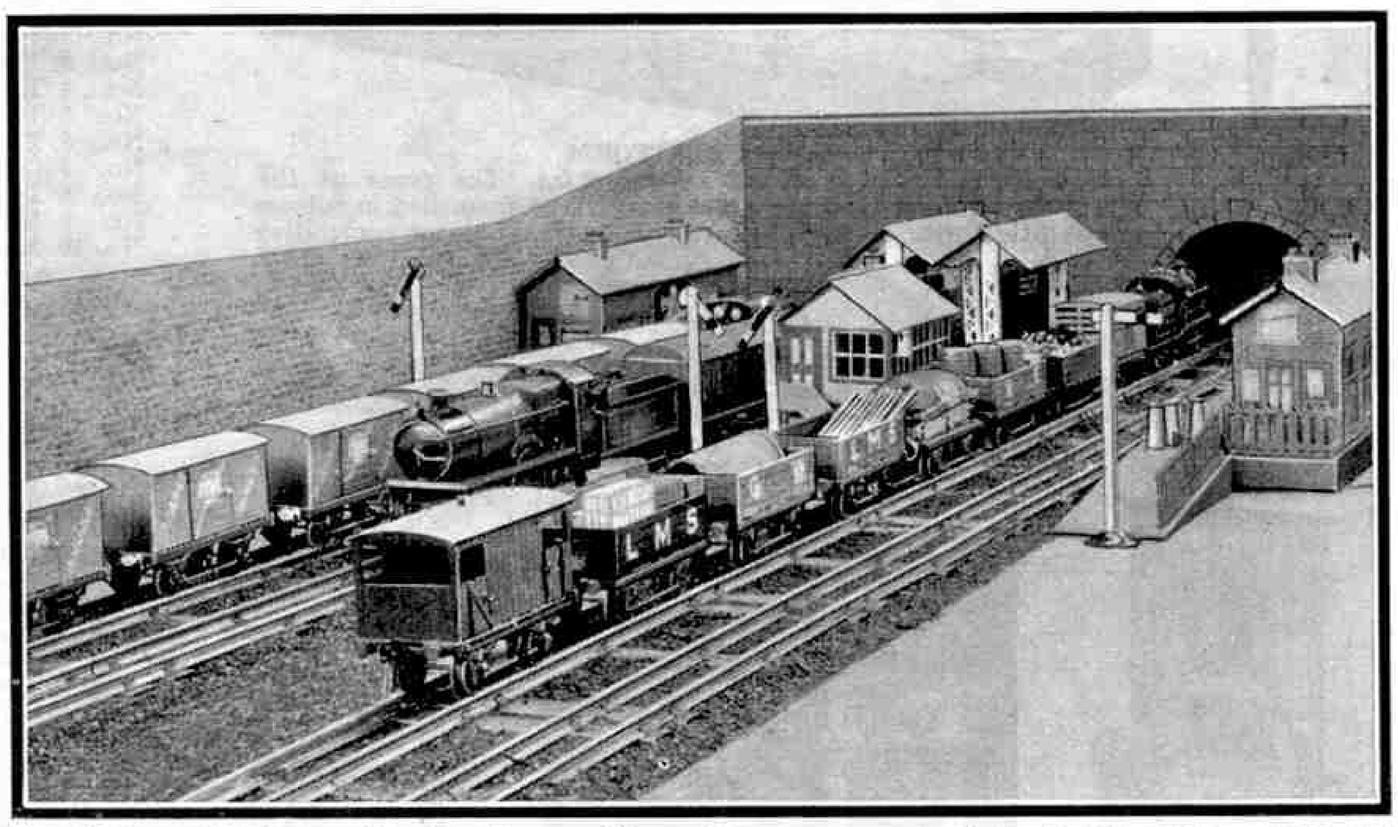
Then again there may be cable drums to be carried, and perhaps the poles for the telephone and telegraph wires. The former can readily be made up by glueing

discs of cardboard at each end of a cotton reel; and when they have set, attaching another strip of card, connecting the discs, all round their circumference. The function of the reel is to provide a firm foundation, so that the drum when complete will not easily collapse. There are numerous makes of cable, so that readers may mark their drums with whichever name they consider most appropriate. For the poles, of course, the Hornby No. 2 Lumber Wagon is ready loaded. The use of the "Colas" Tank Wagon in this connection immediately suggests itself, although it is not actually loaded. Paving stones also are another familiar feature, and to imitate these thick sheets of card should be cut to suitable sizes and loaded on their edges into wagons. If desired, the individual "stones" may be glued together for convenience, and touched up with paint.



An attractive layout showing a passenger station with its Goods Platform near by. Miniature Luggage and Milk Cans are plainly visible on the passenger station, and at the Goods Platform sacks and stone blocks are being loaded.

Bricks and tiles are perhaps too small to reproduce satisfactorily as loads, but larger blocks of prepared stone may be carried. As one of our photographs shows, such blocks form a notable part of the traffic being loaded at the Goods Platform. They are of course heavy, but their natural appearance makes them preferable to any made-up substitutes. This photograph is also interesting in that it shows Meccano Loaded Sacks being used as freight, one of them being actually slung up by the Platform Crane. These Sacks are very useful, and may be supposed to be carrying a great variety of different articles. Loaded perhaps into an Open Wagon B and duly sheeted over with a Tarpaulin, they are extremely effective. This brings us to another suggestion. The Fibre Wagon that has recently been introduced is complete with its load, and the protection of this by a Tarpaulin is an interesting and realistic step.



A realistic goods train on a Hornby railway. The various wagons are loaded with different items, including Barrels and Meccano Rods. One wagon contains a section of home-made drain pipe, and the last wagon is filled with miniature crates and cases.

Perishable traffic, such as that necessitating the use of the Hornby Refrigerator, Meat and Banana Vans, cannot be very well represented in the form of loads. However, boxes for fish traffic may be made up if desired, and the same applies where Biscuit Vans are in use. Milk traffic dealt with in churns immediately suggests the Milk Cans contained in Railway Accessories Set No. 2, and the Milk Traffic Van No. 1 is already provided with a number of Cans. The barrels on the Barrel Wagon are another interesting item, and although it is perhaps better to leave them on the wagon, they can be removed and loaded into other trucks as desired. They remind us of the great traffic that originates at Burton-on-Trent, and necessitates the daily running of a special train for its carriage to London.

Crates, bales, cases and other items of general merchandise may be made up at home as required, but more use might be made for goods traffic of the items of luggage in Railway Accessories Set No. 1. The hamper in particular is a very effective piece, and a stack of these upon a busy station platform waiting for the "parcels train" looks most realistic, as such hampers are used in large numbers for the conveyance of a great variety of goods.

Meccano parts of course have their uses, and Rods of different sizes may represent steel bars, pipes and tubes according to the traffic supposed to be carried. Heavy engineering items that perhaps need special handling may be reproduced in Meccano, and if made with due regard to proportion they look quite well loaded upon, say, Hornby Trolley Wagons.

Meccano Motors and Transformers too may be carried, the latter items being commonly seen now in actual practice owing to the extensive alternating current electric schemes that are being proceeded with generally. Owing to the large size of modern transformers, giant trolley wagons of special construction have been put into service for their conveyance. It will be an interesting scheme to reproduce the main features of one of these vehicles using Meccano parts built up on Hornby bogies. We shall be glad to hear what results are obtained by H.R.C. members who experiment on these lines.

Cattle trains of course may be loaded by using miniature animals of suitable size, such as may now be obtained almost anywhere.

HORNBY SERIES

HORNBY ACCESSORIES

GAUGE 0

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.

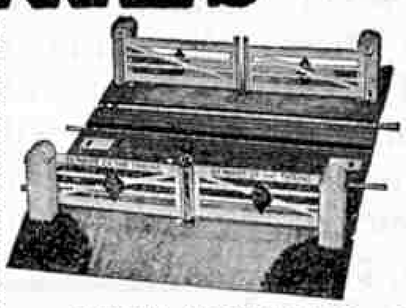
MECCANO LTD., OLD SWAN, LIVERPOOL

DOUBLE ARM SIGNALS No. 1
Price 4/3 per pair.
DOUBLE ARM SIGNAL No. 2
(As illustrated).
Price 3/- each.

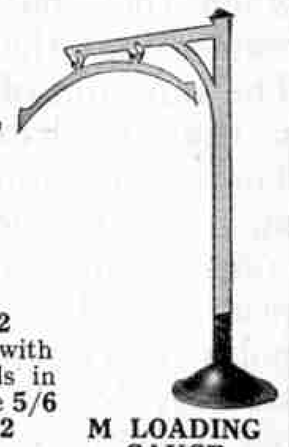
OIL CAN No. 2 (" K " Type)
This miniature Oil Can operates perfectly. The oil is ejected drop by drop by depressing the valve. Polished Copper. Price **3/6**

TUNNEL No. 1 (Straight)
Length 8 ins.
(as illustrated). Price **2/6**
TUNNEL No. 2 (Straight)
Length 15¾ ins. Price **4/6**
TUNNEL No. 3 (Curved)
Length 13 ins. Price **4/9**

M STATION SET, 7 pieces
Price complete **3/-**
The components of the M Station Set may be purchased separately as follows:—M Wayside Station. Price, each, **10d.**
M Signal Box ... Price, each, **4d.** M Signals ... Price, each, **4d.**
M Station ... Price, each, **1/-** M Telegraph Pole No. 1 Price, each, **3d.**
M TELEGRAPH POLE No. 2. Price **6d.** each.

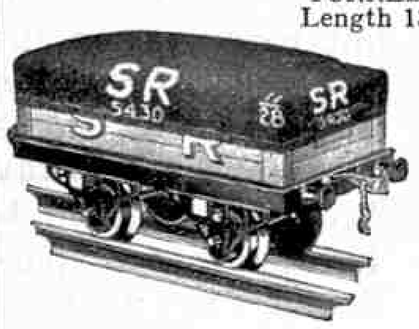


LEVEL CROSSING No. 2
Measures 13½ × 10½ ins., with two tracks of gauge 0 rails in position ... ... Price **5/6**
LEVEL CROSSING No. 2 (Electrical)
Similar to Level Crossing No. 2, but fitted with two electrical tracks ... ... Price **8/-**



M LOADING GAUGE
(Illustrated)
Price **1/-**
LOADING GAUGE
Price **2/3**

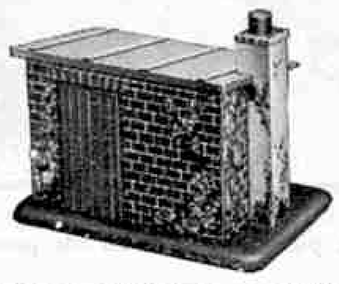
TUNNEL (Metal)
Realistic and finished in colours ... Price **5/9**



TARPAULIN SHEET
Strongly made. Lettered L.M.S., G.W., N.E. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price **3d.**

TURNTABLE No. 2
Price **4/6**
TURNTABLE No. 2 (Electrical)
Similar to Turntable No. 2, but fitted with electrical rails ... Price **8/6**

MODELLED MINIATURES No.1 STATION STAFF
These splendid models, which are beautifully enamelled in colours, add the final touch of realism to Hornby Station Platforms. Price **2/-** per set.



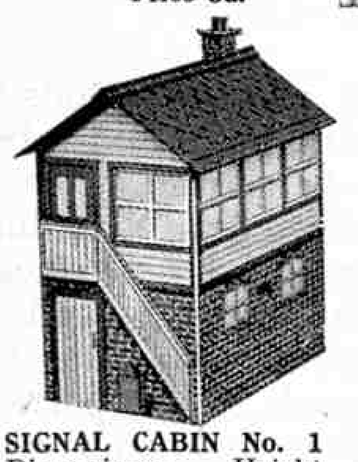
PLATELAYER'S HUT
Price ... **2/6**

STATION HOARDING
This is a realistic accessory, suitable for the station platform. Brightly coloured. Price **8d.**

Station Hoarding

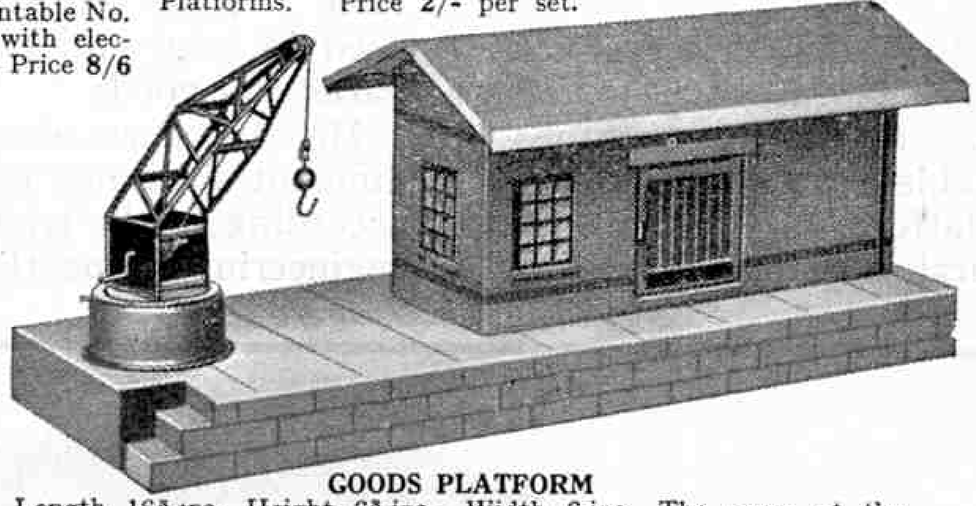
POSTER BOARDS to carry Hornby Miniature Posters. Provided with lugs for attachment to paled fencing, etc. Packet of 6 (3 large, 3 small). Price **6d.**

POSTERS IN MINIATURE are reproductions of familiar national advertisements. They are intended to be pasted on the Station Hoardings or the Poster Boards described above, and are beautifully printed in full colours. Packet of 51 ... Price **6d.**

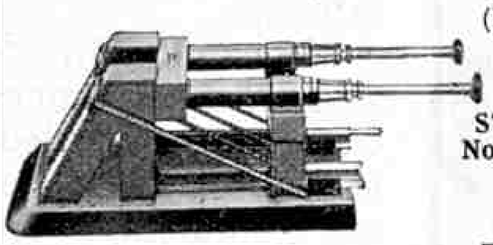


SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price **2/9**

LAMP STANDARD No. 1 (Single) Electrical
(Illustrated above)
Price **3/6**
LAMP STANDARD No. 2 (Double) Electrical
Price **4/3**



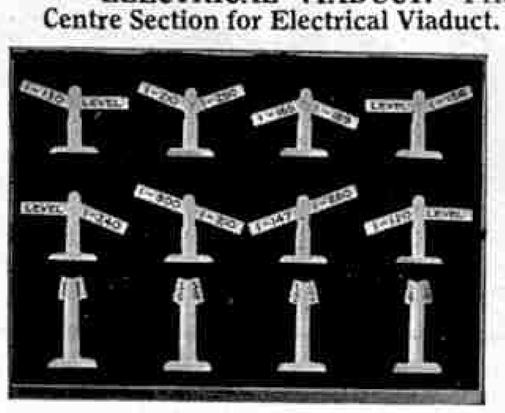
GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **12/6**



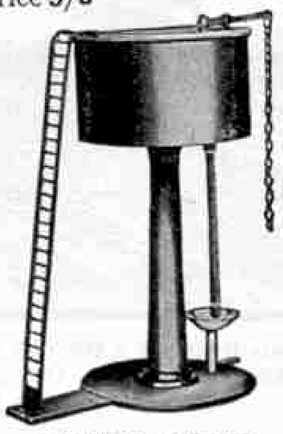
BUFFER STOPS No. 2
(Hydraulic) Price **5/6**

VIADUCT. Price **7/-**. **Centre Section only.** Price **4/9**
ELECTRICAL VIADUCT. Price **8/-**
Centre Section for Electrical Viaduct. Price **5/3**

RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price **1/6**



RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price **2/-**



WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever. Price **8/6**

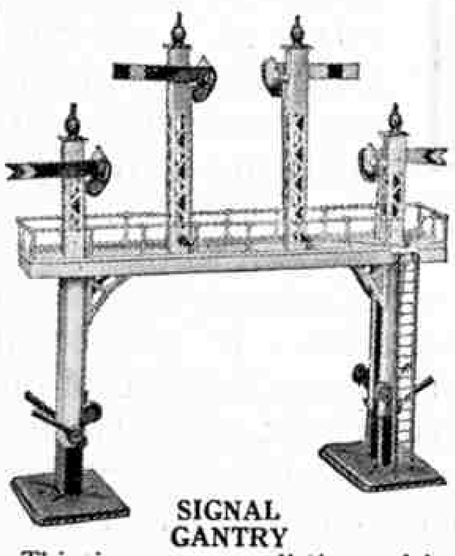
TRAIN NAME BOARDS
These name boards are for No. 2 Pullman Coaches and add greatly to the realistic appearance of the coaches. Details are as follows:—

No. 1 The Flying Scotsman.
No. 2 The Scarborough Flier.
No. 3 The Royal Scot.
No. 4 The Merseyside Express.
No. 5 The Golden Arrow.
No. 6 The Bournemouth Belle.
No. 7 Cornish Riviera Express.
No. 8 Torbay Limited Express.
No. 9 King's Cross, York and Edinburgh.
No. 10 King's Cross, Edinburgh and Aberdeen.
No. 11 London (Euston) and Liverpool (Lime Street).
No. 12 London (Euston) and Glasgow (Central).
No. 13 Victoria and Dover.
No. 14 Waterloo, Salisbury and Exeter.
No. 15 Paddington, Exeter and Plymouth.
No. 16 Paddington and Bristol.

Price per packet of four of a kind, **4d.**

CLIPS FOR TRAIN NAME BOARDS
These clips are for use with coaches that are not fitted with brackets to take the Name Boards. There are two types: No. 2 S, for No. 2 Special Pullman and No. 2 Special Pullman Composite Coaches; and No. 2, for No. 2 Pullman and No. 2 Saloon Coaches. Price per packet of twelve, **1/-** (either kind).

TUNNEL No. 4 (Curved)
Length 20 ins. For 2 ft. radius tracks only. Price **5/6**



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable. Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price **12/6**

ENGINE SHED No. 1
This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, and Locomotives of No. 0 and No. 1 types ... ... Price **15/-**

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.

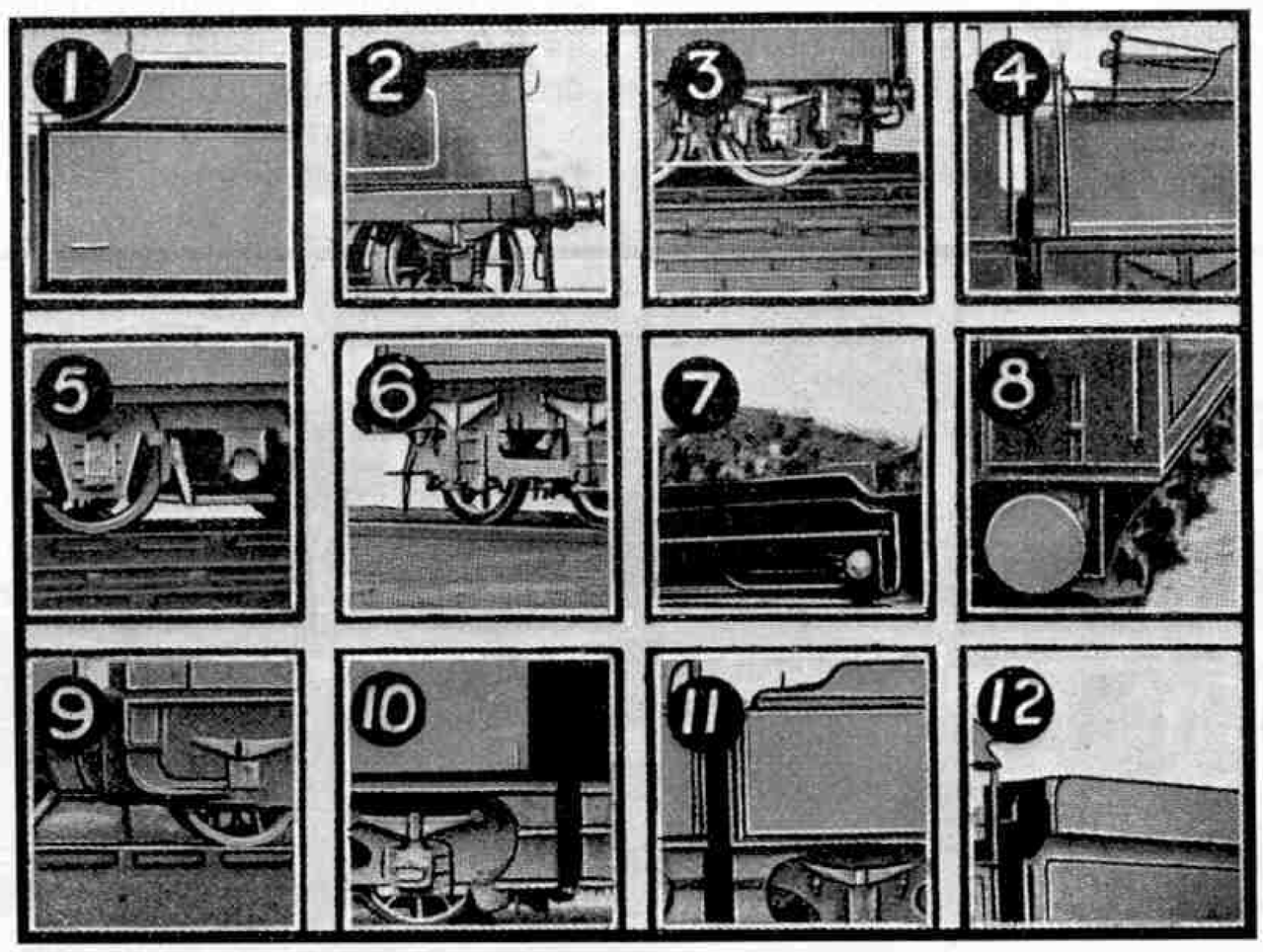
TENDERS CONTEST

Tenders play a very important part in present-day railway working. Although their functions are simple and straightforward, it is necessary for them to have as high a standard of efficiency as that of the locomotives they feed; and they have developed to a striking extent since the early days of railways, when they were little more than water barrels on four wheels.

The weight of a modern tender is considerable, owing to the large amount of coal and water that has to be carried in these days of long-distance locomotive workings and non-stop runs. The special corridor tenders that are provided for the locomotives working the famous "*Flying Scotsman*" on its non-stop run of 392.7 miles between King's Cross to Edinburgh carry nine tons of coal and 7,000 gallons of water, and weigh in working order some 62 tons.

Individual designs of tenders are almost as numerous as those of locomotives, although frequently a standard design of tender is provided for several classes of engines. This is particularly the case on the L.M.S.R., where the "Midland" pattern of tender is standard for all new group constructions. The L.N.E.R. corridor and non-corridor eight-wheeled tenders, on the other hand, are only used with "Pacific" locomotives and the high-pressure giant "*No. 10000.*"

The characteristic features of many tenders enable them to be distinguished even when they are separated from the locomotives that they usually run behind. H.R.C. members, we are sure, would like to test their knowledge on this point, and our competition this month gives them the opportunity to do so. Illustrated on this page will be found portions of twelve different patterns of tenders, and competitors are required to state to which class or classes of locomotives they belong and the railway group owning them. If they are attached to any particular section, the name of that section should be stated.



To the senders of the four most correct entries will be awarded Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. There will also be a number of consolation prizes given to the senders of the next best attempts. H.R.C. membership numbers should be quoted on all entries, which should be marked H.R.C. "*Tenders Contest*" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 29th February. The closing date for the Overseas competitors is 31st May.

Questions Contest No. 3

This month we announce a "Questions Contest" on the lines of those that were announced on this page in the "*M.M.*" for July and January of last year. These two contests were exceedingly popular and we are sure that another will be equally attractive.

Competitors are required to answer as many as possible of the following questions. The answers should be brief, and as a matter of fact so long as they are clear the shorter they are the better.

(1) Who was the designer of the L.M.S.R. "Claughton" class? (2) Which train at present holds the world's rail speed record? (3) Which company employs "somersault" signals? (4) Which is the largest English terminal station? (5) What happens when the communication cord is pulled in a railway carriage? (6) What is a "Calling on Arm"? (7) What is the difference between the ejector and the injector? (8) What is the highest locomotive boiler pressure employed in this country? (9) What is meant by the term "Dual Fitted"? (10) Which English railway company first operated a dining car? (11) What are "Catch Points"? (12) Which company introduced the "Baltic" tank type?

To the senders of the four best sets of answers received in each section—Home and Overseas—will be awarded Hornby Railway Material (or Meccano products if preferred) to the value of 15/–, 10/6, 5/– and 2/6 respectively. In addition there will be a number of consolation prizes. Each sheet of paper used must contain the competitor's full name, address and H.R.C. membership number. Envelopes must be marked H.R.C. "*Questions Contest No. 3*" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 29th February. The Overseas closing date is 31st May. Entries received after these dates will be disqualified.

COMPETITION RESULTS

HOME

November "Marshalling Yard" Contest.—First: F. J. Christall (25242), Coulsdon, Surrey. Second: E. H. Smith (3668), Maidenhead, Berks. Third: K. G. Cross (13081), Leigh-on-Sea, Essex. Fourth: B. C. Clay (21511), Harrogate. Consolation Prizes: J. Archer (19788), Poulton-le-Fylde, Lancs.; G. R. Webb (24865), Leatherhead, Surrey; J. Elliott (25391), March, Cambs.; V. Walker (1823), North Walsham; W. J. Matheson (24597), Inverness; H. C. Kelynack (17548), London, W.4; W. N. Phillips (14727), Birmingham; C. S. Tricker (899), Ely, Cambs.; A. Bailey (1613), Sheffield; W. H. Hart (23989), London, S.W.16; D. Buttress (25332), Cambridge; E. Cock (20396), London, N.8.

November "Voting Contest."—First: T. Crotty (25003), Newtown Manor, Kilkenny. Second: S. Winnard (7843), Ince, Wigan. Third: D. Sexton (22014), Bromley, Kent. Fourth: E. H. Frewin (25098), Oldbury, Nr. Birmingham. Consolation Prizes: N. S. T. Ebbom (18874), Surbiton, Surrey; J. D. Hamilton (12216), Cheltenham Spa; A. S. Lucking (3556), Witham, Essex; R. G. Jennings (17345), King's Norton, Birmingham; D. P. Elias (10067), Weaste, Manchester; J. Cables (21250), London, S.E.13; C. E. Wrayford (6039), Moretonhampstead; T. K. Alcock (19928), Waterloo, Nr. Liverpool; A. Jenkins (22166), Keswick, Cumberland; J. Stannett (25290), Windsor, Bucks.; J. P. Cunliffe (4534), Long Eaton, Derbyshire; R. Redman (1381), Tonbridge, Kent.

OVERSEAS

August "Photo Voting Contest."—First: J. Perry, Southland, New Zealand. Second: T. Watson (18065), Sydney, Australia. Third: F. van Bulck (1875), Forest-Brussels, Belgium. Fourth: E. C. Stonyer (10306), S. Canterbury, New Zealand. Consolation Prizes: J. A. Rodriguez (3647), Montreal, P.Q., Canada; R. A. Wragg (7913), Bandikui, India; J. A. Coates (23863), Verdun, Que, Canada; D. A. Crombie (22002), Natal, S. Africa; B. Chiles (9191), Port Elizabeth, South Africa; B. C. Khumbatta (8026), Broach, India; A. Wallace (24241), Vancouver, B.C., Canada; D. Robson (22747), Wellington, New Zealand; A. Johnstone (16298), N.S.W., Australia.

Covered Wagons in the Hornby Series (1)

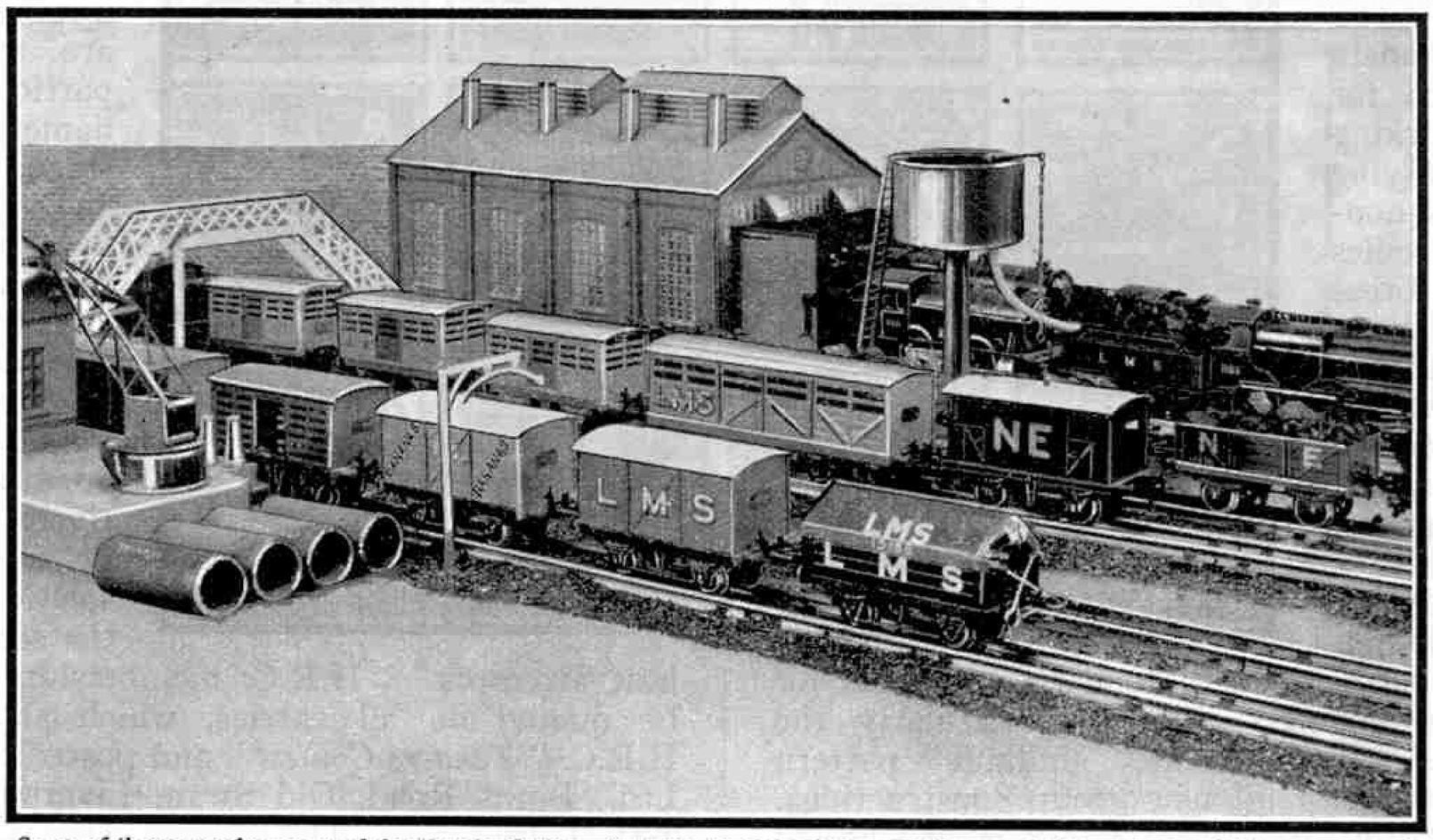
By "Tommy Dodd"

THIS month we return to our consideration of the rolling stock of the Hornby Series, and after the interesting vehicles we have dealt with recently the mention of covered wagons may not seem a very promising subject. This is not the case, however, as we shall see, for the variety of covered wagons in the Series is such that it will be necessary to extend their consideration over two articles.

Before dealing with covered wagons as usually understood we must mention the method by which the ordinary open goods wagon may become, for the time being, to all intents and purposes a covered vehicle. This is effected by using a large tarpaulin sheet that is placed over the load and upper portion of the wagon and secured by ropes. Particular mention was made of tarpaulins in this series in February last year, as no doubt readers will remember. In order to provide some support for the tarpaulin, many wagons are fitted with a stout bar running lengthways, turned down at the ends and pivoted at a convenient point at the end of the wagon. The position of the pivot and the length of the vertical portions of the bar are such that, when not required, the bar may be swung aside and allowed to rest out of the way on the top of either side of the wagon. When in its raised position the bar supports the wagon sheet along its centre, and the inclination of the sheet at each side ensures that rain or snow will readily be thrown off. For further protection of the load some wagons have their ends raised in semi-circular form, so that the bar is slightly above them. When the tarpaulin sheet is laid over the bar, a wagon of this kind offers complete protection from the elements, while of course it can be used as an ordinary open vehicle at short notice.

An interesting addition to the Hornby Series this season is a wagon fitted with a tarpaulin bar. This can be swung out of the way when not required exactly as in real practice, and in its vertical position a Hornby Wagon Tarpaulin can readily be laid over the bar and secured in the usual manner. The extremely realistic appearance of the vehicle thus fitted is shown in one of the accompanying photographs, and readers no doubt will agree that this novel wagon is likely to become popular. The Great Western and Southern Railways use such a wagon in large numbers, and the former company follow their usual practice and provide a code name for these vehicles. The "Opens A" have the ordinary wagon hand brakes, but those with the vacuum brake for fast goods working are distinguished as "Opens B." Similarly the Hornby example is known as "Open Wagon B," so as not to confuse it with the ordinary Hornby No. 1, No. 0, and "M" Open Wagons.

The appearance of a wagon of this kind with its tarpaulin sheet immediately suggests the shape of the next wagon to be considered, namely, that used for the conveyance of lime, cement and salt. This is similar to an ordinary open wagon, but the ends rise up to a point, and a sloping roof like that of a house is provided. Doors in the sides as in ordinary wagons are used, and there are in addition openings placed above these in the roof. To ensure the wagons being watertight a protective covering of tarpaulin or other heavy material is frequently fastened over the roof. This of course is an important precaution with the loads that are carried in such wagons. These vehicles are represented in the Hornby Series by a distinctive miniature wagon having the characteristic outline of the prototype. A hinged opening is provided in the roof, and the general construction and finish are typical of the Hornby Series vehicles. The purpose of the wagon is indicated by the word "Cement," transferred in large letters upon the side.



Some of the covered wagons of the Hornby Series. The No. 1 Luggage Van and the new "Open Wagon B" are prominent in the siding, while a train of Cattle Trucks is passing on the main line.

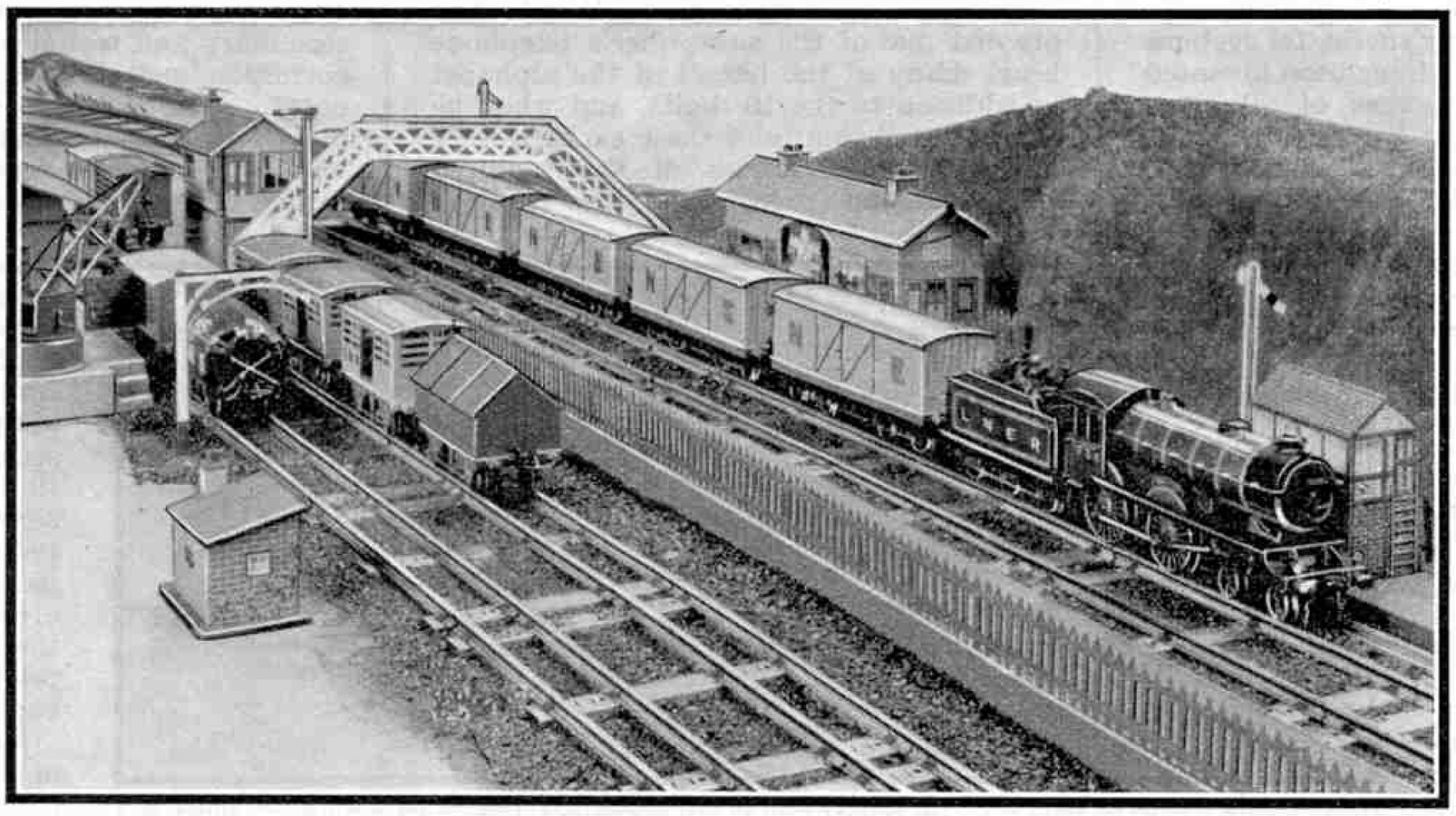
We come now to the first of the covered wagons proper, the ordinary box or luggage van that exists in so many varieties in real practice. In former days the corner pillars and strengthening members were of timber, and frequently the actual boarding of the sides and ends of the wagon was placed inside these timbers. Many wagons of this type are still in service, but the usual method of construction now is to use metal strengthening members of various angle sections. A great many varieties of doors are fitted to covered wagons. Some are made in two halves opening outward; others have their upper portions like this, but the lower part is hinged to the floor of the wagon and opens

downward, forming a useful flap when the wagon is being dealt with at the loading bank. The method largely followed in the latest wagons is to use single sliding doors on each side. These doors have small wheels attached at top and bottom, running on stout guide rails so that the door is easily and quickly opened. An interesting feature of certain L.M.S.R. vans is that although they are of wooden construction as regards the sides and roofs, the ends are formed of steel pressings, corrugated for strength. Their introduction was due to the damage frequently done to wagons owing to loads striking their ends during shunting. Some all-metal vans are also in use, and many of these are special gunpowder vans.

In the Hornby Series all the covered vans have developed from the No. 1 Luggage Van. This is a stoutly constructed vehicle, and is available in the style of all four groups. Vertical planking is embossed on the sides and ends, and the corner angles are raised and provided with dummy bolt heads. The doors on each side open, and a diagonal strengthening strap is embossed on them. A metal roof with rain trip is provided, and the whole is mounted on the familiar standard base introduced a short time ago.

The same structural features are found in the Hornby Gunpowder Van, the bright red colour of which indicates the dangerous nature of its contents. It is lettered for each of the four groups, and its title appears neatly transferred on the door. The Great Western example has only the letters "G.P.V.," in accordance with the practice of that company. The restrictions on the use of such vehicles in actual practice have been mentioned before in the "*M.M.*," but may be repeated with advantage. These wagons can be dealt with only at certain places, and must be marshalled in a train as far as possible from the locomotive. The goods guard must not have a fire in the stove in his van on any account when a gunpowder van is included in his train. Fly-shunting also is forbidden, owing to the possible disturbance of the cargo during shunting. Similar precautions, as far as they apply in miniature, should be observed on a Hornby layout.

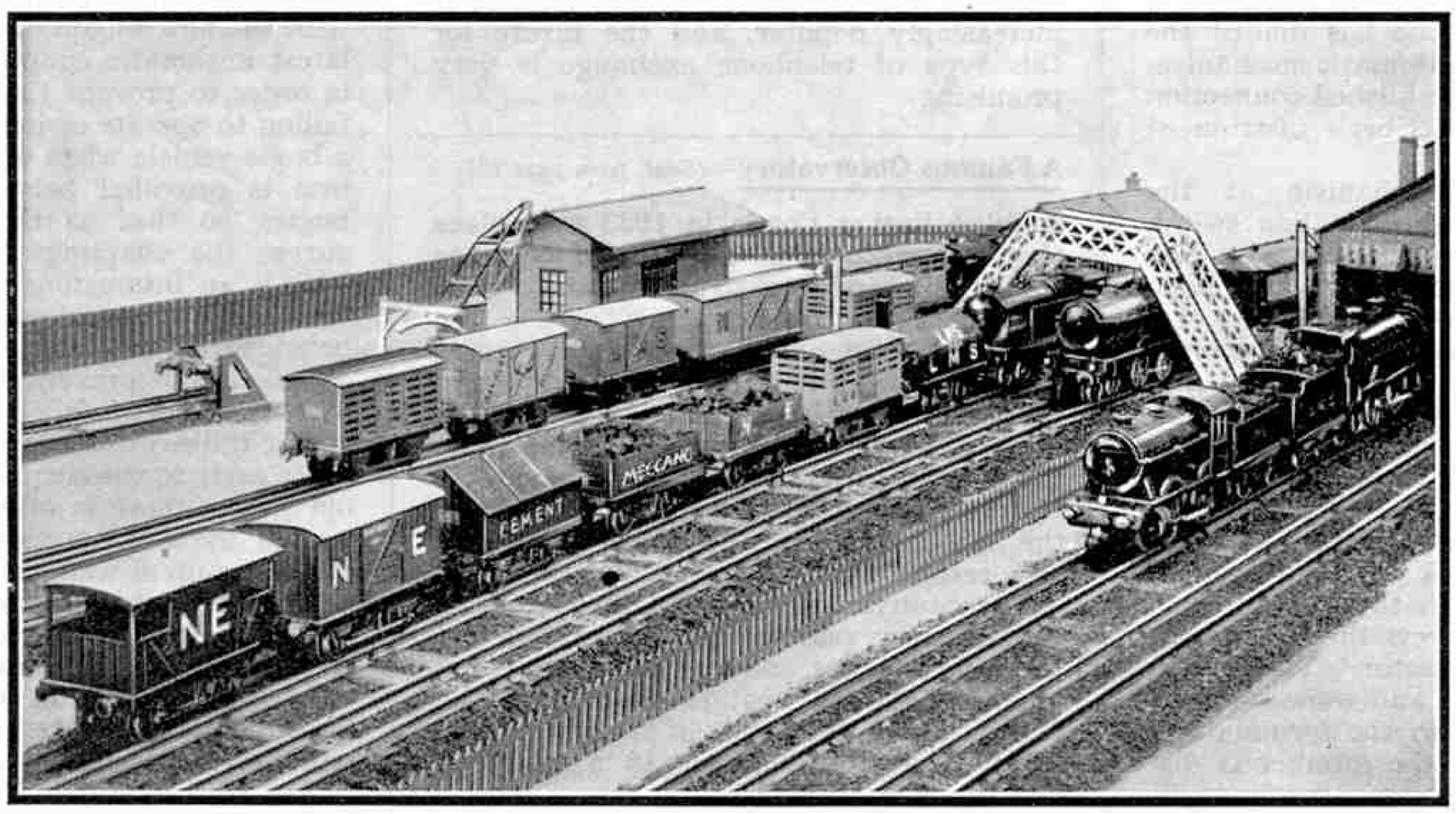
An interesting development of the No. 1 Luggage Van is its eight-wheeled counterpart, the No. 2. This represents a type of van that is more common in this country than is generally imagined. Large numbers of such vehicles are in use in the North Eastern area of the L.N.E.R. which, as the former N.E.R., was early prominent in the introduction of high capacity wagons into this country. Many other types of bogie vans, some having more of the character of coaching stock than of wagons, are in use for various purposes. The S.R. have their well-known "general utility" vans and baggage vans, and the G.W.R. have their milk and general traffic vehicles known in their code system as "Siphons" and "Monsters" respectively. Milk and parcel vans of similar character are also found on the L.M.S.R.



A fast goods train composed of No. 2 Luggage Vans passing through a station. The train has an important appearance as it is hauled by an express passenger locomotive.

The Hornby No. 2 Luggage Van is a very useful vehicle for different classes of traffic, and may be used equally well on goods or passenger trains, as such vans in actual practice are invariably fitted with continuous brakes. This feature is denoted in the L.N.E.R. code name for the vehicles previously referred to, which are known as "Covfits." A photograph of a complete train of Hornby No. 2 Vans representing a "fast fitted goods" appears on this page, and the important appearance of the train is very striking. These vans have a length of $9\frac{1}{8}$ in. over buffers, and are carried on bogies of the same general pattern used for so many Hornby No. 2 Wagons. These bogies have recently been modified

(*Continued on page 150*)



The Cement Wagon and the Gunpowder Van are plainly shown in this photograph. The latter van, in view of its dangerous load, is marshalled at the end of the train.

Famous Inventions—(*Continued from page 95*)

City undertaker, entered in the United States Patent Office a patent for an automatic exchange, and the vision then became a reality. It is true that this first system required five connecting wires between each subscriber and the exchange, but eventually these were reduced to two, and so far as the subscribers' wire plant was concerned it became as economical as the manual system.

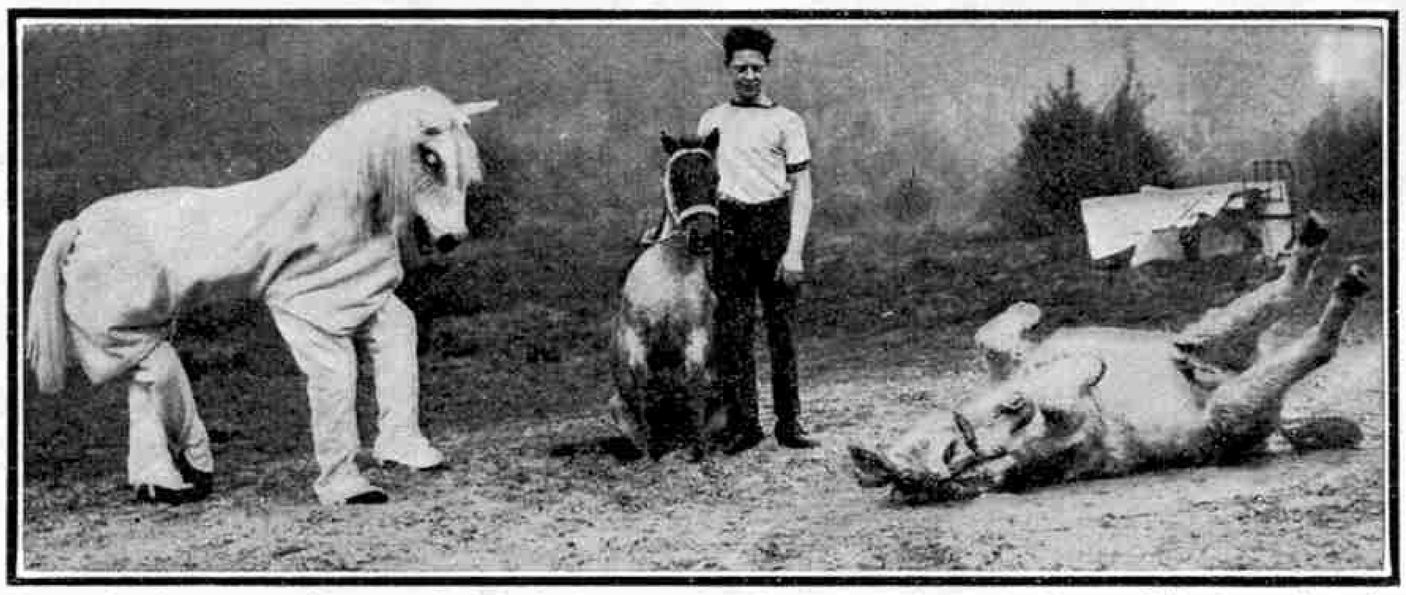
Since that time many successful systems of automatic telephony have been invented and installed in exchanges of all sizes. Each of these systems has its own particular advantages and disadvantages, but the Strowger system is one of the most popular. It is in extensive use in America and is being increasingly employed in large exchanges in this country. As the circuit connections of this system are very complicated we do not intend to describe them here, but only to give a general idea of what takes place when a call is made through a Strowger exchange.

The subscriber himself transmits the required number to the exchange electrically by means of a pivoted dial on his telephone. This has a series of holes round its circumference bearing the numbers 1 to 9 and 0. To call a number, say 5246, the subscriber lifts his receiver from its hook, inserts his finger in the hole marked 5 and rotates the dial in a clockwise direction as far as it will go. He then removes his finger, the dial swings round to its normal position, and he proceeds to repeat the operation, dialling in turn from the holes marked 2, 4 and 6. By the time he has dialled the complete number the automatic mechanism at the exchange has established connection with the wanted subscriber's instrument and rung the bell.

The complicated mechanism at the exchange includes a separate line switch for each subscriber on the system. The line wires from a subscriber's telephone are connected to the rotating portion of a switch and immediately he lifts his receiver current flows through the line circuit and actuates this switch, which automatically connects the subscriber's line to a "first selector" switch. The selector responds to the first digit dialled, that is the "thousands" digit, and then connects the subscriber's telephone to a "second group" selector that deals with the "hundreds" digit and in turn connects the instrument to a "third group" selector. This switch deals with both "tens and units" digits, and links the call up to the terminals of the number 5246. If the number is disengaged the exchange apparatus immediately connects an automatic ringer to his line and this continues to ring intermittently until either the called subscriber lifts his receiver to answer, or the originator of the call replaces his receiver, having failed to obtain an answer. If the called subscriber is engaged the caller hears a distinctive buzz in his receiver.

The automatic exchange may be subdivided and its parts distributed throughout several buildings in different sections of the area it serves, provided that the subscribers' calling numbers are so arranged that successive numbers are situated in the same area. A distinctive number or code letter is employed to mark the districts where automatic exchanges are situated. For instance, in the London area, where there are 38 exchanges within five miles of Oxford Circus, the exchanges are distinguished by means of letters. Thus the Avenue exchange is known as "A"; the Maida Vale exchange as "MV"; and the Willesden exchange as "WL." The pivoted dial of the subscriber's telephone bears many of the letters of the alphabet in addition to the 10 digits, and when he makes a call to any of these exchanges he dials the code letters of the required exchange and then dials the required number. To call a London area exchange that is outside the code system he dials the first three letters of the name of that exchange. An automatic device called the Strowger Director receives the letters and translates them into signals that effect the necessary connections.

The absolute accuracy and privacy obtained, and the high speed at which the automatic telephone exchange makes connections and disconnections are making it increasingly popular, and the future for this type of telephone exchange is very promising.



Have animals a sense of humour? The donkey seen in this photograph watched for a while the antics of a "horse" operated by two men, and then rolled on the ground apparently in paroxysms of laughter!

A Famous Observatory—(*Cont. from page 103*)

enabled Father Cortie in 1923 to replace the seismograph that had been in use since 1909 with a modern instrument, which gives very excellent results.

Since the present Director took office at least one event of outstanding interest to the Observatory has occurred. This was the total eclipse of the Sun on 29th June, 1927, the first to be visible at the Observatory. Unfortunately the presence of clouds over the Sun at the critical moment prevented any results from being obtained.

The Stonyhurst College Observatory is visited every year by various learned and scientific societies, and every facility is given to them and to visitors staying at the College to see the results of the work done, and to observe through the 15 in. telescope and other instruments.

The Tumbler Switch—(*Continued from page 101*)

never-ending stream of finished switches on their way to the shipping room we are astounded at what their numbers signify. They move by in their hundreds, their thousands, their millions.

For the information contained in this article, and also for the illustrations, we are indebted to J. A. Crabtree & Co. Ltd., Lincoln Works, Walsall.

What Shall I Be?—(*Continued from page 97*)

to give the scales of salaries in full. The initial salaries of certificated men assistant teachers vary from £168 per annum in a scale I area to £192 per annum under an educational authority to which scale IV applies, the corresponding maximum salaries ranging from £312 per annum to £408 per annum. Uncertificated assistants also come under the scale, but their pay is on a considerably lower basis; while that of secondary and technical school teachers is correspondingly higher, if they are graduates. The pay for non-graduates employed in secondary and technical school work is a little in excess of that for certificated elementary school teachers in areas to which the higher scale applies.

The Board of Education salaries do not apply to public and private schools. Appointments in these are secured through scholastic agencies or through advertisements in the press, and the salaries paid are a matter for arrangement between the governors or proprietors and the members of their staffs.

Whatever the type of school in which he is engaged, a teacher should be prepared to take an interest in a wide range of activities. While at a training college or university, therefore, he should seize every opportunity of taking part in games and in the work of the societies of varied types associated with such institutions.

Covered Wagons—(*Continued from page 149*)

so that the standard buffer height of 1 in. introduced in the four-wheeled vehicles with the new wagon base is observed. The latest automatic couplings are fitted, and in order to prevent the possibility of their failing to operate owing to the overhang of a bogie vehicle when on a curve, a connection is provided between them and the bogies, so that as the latter follow the curves the couplings keep in alignment. This is an interesting refinement common to all No. 2 vehicles. Double doors are provided on each side, and secure locking arrangements prevent them from opening at the wrong time.

Our railways had to turn their attention quite early to the carriage of livestock. In old prints there is often depicted a train hauled by a locomotive of the period, in the make-up of which is included a number of curious vehicles, rather like cages of different sizes, conveying many distinctly restive animals. The modern cattle wagon is a far more solid and commodious vehicle, and many of the latest examples are built with steel underframes and concrete floors.

The Hornby Cattle Truck is available in two varieties, the No. 1 four-wheeled and the No. 2 eight-wheeled; and in this respect they resemble the Luggage Vans from which they have been evolved. The upper portion of the sides of each is pierced to provide light and air for the animals. The No. 1 Truck has sliding doors, while the No. 2 has double hinged doors on each side. Either of them imparts an interesting appearance to a goods train, and at least one should be found on every layout.

Fireside Fun

A SURPRISE FOR BOTH

Nervous passenger: "P-please t-t-tell me when you're g-going to loop-the-loop again."

Newly-qualified pilot: "I'm sorry but I don't always know myself."

* * * *

Mary: "The other day Daddy said there was not another woman in the world like you, Aunty."

Aunty: "That was very nice of him."

Mary: "And he said it was a good thing too."

* * * *

Both the farmer and his horse were unwell, and his wife was paying a visit to the chemist for some medicine.

"Now, young man," she said to the assistant, "be sure and write plain on them bottles which is for the horse and which is for my husband. I don't want anything to happen to that horse before the ploughing."

* * * *

The self-made man was telling the story of his life to a friend.

"Ever since I was nine months old, when both my parents were killed, I have had to fight for myself," he declared.

His friend was frankly incredulous.

"My dear fellow," he said. "Surely that's rather an overstatement. What could you do for yourself when you were only nine months old? Why you couldn't even walk, then."

The self-made man puffed out his chest triumphantly.

"I crawled to a baby show that was being held near by, and won the first prize."

* * * *

Modern child (seeing rainbow for first time): "What's it supposed to advertise, mother?"

* * * *

Driving instructor: "What would you do if your brakes were to fail when you were going down a very steep hill?"

Novice: "Er—jump out and put a stone under the wheel."

* * * *

Teacher (to boy caught drawing sketches of him): "So you think you are quite an artist in black and white, do you?"

Boy: "Yes, sir."

Teacher (picking up cane): "I also am an artist; but I specialise in black and blue."

* * * *

YOU TAK' THE HIGH ROAD . . !

"Look! A lion's track!"

"You go and see where he went, and I'll see where he came from!"

* * * *

Teacher (looking suspiciously at map drawn as "homework"): "Brown, was any assistance given in the drawing of this map?"

Brown: "No, sir. Father did it all himself."

EASILY SEEN

Orator: "From the time that I was twelve years old I earned my own living. Gentlemen, I made myself!"

Voice from back of hall: "Well, you made a mistake"

* * * *

Mr. Brown, who was always trying to get something for nothing, buttonholed his friend, the doctor, in the street.

"What do you take for a bad cold?"

The Doctor was equal to the occasion.

"A fee," he said, as he hurried on.

* * * *

MAKING BOTH ENDS MEET

Yokel: "What are you cutting the plank for?"

Pat: "I want a bit to put on the other end to make it longer."

* * * *

The explorer had been telling some of his experiences to a group of his friends.

"I remember once when I was in Africa," he said, "I was in the middle of the jungle when a tribe of fierce savages came rushing at me."

His audience was spellbound.

"What on earth did you do?" demanded one.

"I just stared at them until I was black in the face and they mistook me for one of their own tribe," explained the explorer.

* * * *

The two "country cousins" were admiring the big London buildings.

"It's surprising," said one, "how mortar binds all those hundreds of bricks together."

The other was much amused. "You're quite wrong," he said, "the bricks aren't kept together by mortar. That's what keeps them apart."

* * * *

Undergraduate: "Father, when I graduate I intend to follow my literary bent and write for money."

Father: "You certainly ought to be successful at that, it's all you've ever done since you first went to college."

* * * *

Constable (to young lady driver): "That was a tidy speed to come along at, missy. Didn't you see the notice 'Dangerous Corner'?"

Young Lady Driver: "Of course I did, Constable, and as it was a dangerous corner I naturally wanted to pass it as quickly as possible."

* * * *

The labourer was puzzled, so he appealed to his better-educated neighbour.

"Say, Bill," he said, "What is a cosmopolitan?"

"Well," said Bill, after thinking for a short time, "If there was a Russian Jew who lived in Scotland with an Italian wife, and who always smoked Egyptian cigarettes in a room with a Persian carpet, and looked out from a French window beneath which a German band was playing 'The Dear Little Shamrock,' after a supper of Canadian cheese made into a Welsh rarebit, you would be quite safe in saying that that chap was a cosmopolitan."

* * * *

One day the following advertisement appeared in a country newspaper: "The man who picked up my wallet in High Street yesterday was recognised. He is requested to return it to W. L. Davies."

The next day a reply appeared.

"The recognised man who picked up your wallet the day before yesterday requests the loser to call at any time and collect it."

NOT SO GREEN!

It was the city urchins' first visit to the country, and they were admiring the green grass.

"Just like grass, ain't it?" said one.

"It *is* grass," replied the other.

"No, it ain't," persisted the first one. "It can't be, 'cos yer don't 'ave to keep orf it."

* * * *

The newly-rich man was mapping out his first tour in Europe and was scanning a map of Russia.

"Where's Moscow?" he demanded. "I can't find it anywhere."

"Of course you can't," replied his daughter, just down from school. "It was burnt down in 1812 when Napoleon went there."

* * * *

The class had just heard from their teacher the story of Ali Baba and the Forty Thieves.

"Now," he said, "we'll just have a few questions on the story. Tell me, Wilkins, what was it that Al Baba said when he wished to open the entrance to the cave?"

Wilkins was a regular frequenter of the local cinema.

"I know," he said. "Open, sez me!"

* * * *

Visitor (to retainer in old country mansion): "They tell me this place is haunted. Do you believe in ghosts?"

Retainer: "No, sir! But I'm afraid of them."

* * * *

An American locomotive was travelling slowly along the line when somehow it left the rails. A negro porter who had been standing by a window was flung through the glass, and flew some dozen feet through the air before he was brought up by crashing his head against a concrete post. He lay dazed for a few minutes, and then sat up, rubbing his head.

Then the conductor arrived on the scene. "Good heavens!" he ejaculated, "ain't you killed?"

"No," replied the porter. "Ah reckon that concrete post must 'a' broken ma fall."

* * * *

Bill: "What's the best way to keep a fire hot, Jim?"

Jim: "I should say to keep it frequently 'coaled'!"

* * * *

Teacher: "Brown, give me a sentence with the words 'attack' and 'heroes' in it."

Brown: "A man sat on a tack and he rose quickly."

* * * *

Father (to son who has returned from his first fishing expedition): "Did you catch anything?"

Son: "No, not a thing. My silly worm wouldn't bite anything."

* * * *

The counsel for the defence and the prosecuting counsel had engaged in a wordy battle in Court. The defending counsel thought to crush his opponent.

"If you do not know how to conduct yourself as a gentleman, I am sure I cannot teach you," he said.

"That is so," smilingly retorted his opponent.

* * * *

JUST WHAT WAS NEEDED

Waitress: "Oh, I've soaked you with water, sir. I'm awfully sorry."

Diner: "Don't worry, that's all right. My suit was too large, anyway."

* * * *

"What did you give your little baby for his first birthday?"

"We opened his money box and bought him such a lovely electric iron."

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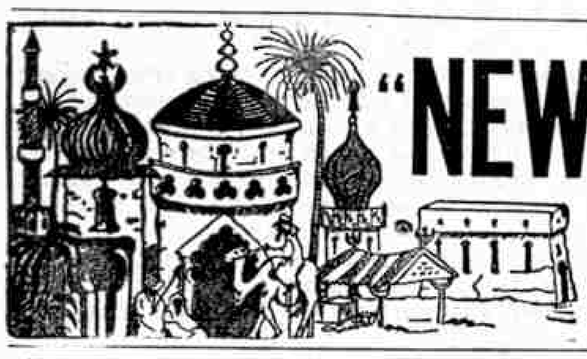

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Australia : new 6d. Air Mail	8d.	**Newfoundland :** 1932 new issue, 6c. showing first stamp portrait of Princess Elizabeth ...	5d.
Italy : Naval Academy commems. (3)	1/–	do., 1 to 6c., set of 6, including above ...	1/9
Latakia : The new State. Air Mails. ½p. ...	1d.	**Sarawak :** 1932 new issue, 1 to 6c. (6)	9d.
do., set of 5 to 5 pias	1/–	**United States :** 2c. Yorktown Commem. ...	3d.
Postage series, 7 values to 2p.	6d.	1932 Washington Bi-Centennial Commems., ½c. to 5c., set of 7	1/6
Belgium : 1932, 10c. provls. (2)	2d.	do., to 10c., complete set of 12	4/3
New Zealand : 1931, Child Health (2)	7d.	**Holland :** 1931 Charity, set of 4 (used 9d.) mint	1/3
New Air Mails, set of 3	1/6	**Switzerland :** 1931 Charity, set of 4	1/4
Papua : 5d. on 1/– new provisional	9d.		
5d. pictorial, replacing above	7d.		

Postage Extra. **WESTMINSTER STAMP CO., 43, BUCKINGHAM GATE, LONDON, S.W.1.**

THE CHRISTMAS CHARITY ISSUES

CHARITY issues were as usual a prominent feature of the stamp collector's Christmas, all of the countries accustomed to appeal to the philatelist's goodwill contributing to the flood of printing.

The outstanding item of interest among the new issues is Switzerland's fall from grace. The "*Pro Juventute*" issues have come to be regarded as leaders in this field, not only because they were the pioneers of Christmas charity issues, but also for the interest and beauty of their designs. This year, however, if sentiment and the necessity for preserving a continuous record were to be set aside, the 1931 set would find it difficult to justify its place in a stamp album, unless it were as an awful example of how not to issue pictorial stamps. By far the poorest effort, the 20c. value the design of which is alleged to be a view of the Lake of Geneva, near Vevey, with the Dents du Midi in the background, shows a stamp that has all the appearance of a very crude attempt at stage backcloth painting. It may be that the beautiful 1929 issue set too high a standard, but certainly the new issue is not to be compared with that.

The set contains three other values, a 5c., showing a view of the Lakes of St. Moritz from the Punt Muraigl; 10c., the Wetterhorn as seen from Grindelwald, with the Grindelwald Glacier to the right of the design, and a 30c., in which a portrait of Alexandre Vinet is superimposed upon a view of the Lake of Geneva, with the island of Salagnon in the background. Alexandre Vinet was a literary critic and leading theologian of the early 19th century, and is specially famous as the founder of the Swiss Free Church.

The German issue is a vastly more successful effort from the standpoint of design. It also consists of four values, each stamp depicting some spot of popular historic interest. The 8 pf. value shows the Zwinger at Dresden. The Zwinger is a remarkable building, for it was intended to be the entrance hall for a mighty palace to be built for Alexander the Strong. The palace was never built, but the "entrance hall" has become famous for its magnificent art collection, which includes Raphael's "*Sistine Madonna*," one of the world's greatest paintings.

The 15 pf. shows the ancient Town Hall at Breslau, where for very many years the Diets of Silesia were held. Next is the 25 pf. stamp, illustrating the famous old castle at Heidelberg, one of Germany's historic medieval fortresses. The remaining stamp, a 50 pf. value, illustrates the Holstentor Gate at Lubeck.

The Luxemburg issue, a 75c. stamp, bears the portrait of the Princess Alix, the youngest daughter of the Grand Duchess. In successive years the portraits of the six children of the royal house have been reproduced and the complete series makes a most interesting collection of royal portraits, worthy of inclusion in any philatelic art gallery.

Belgium also adopted a royal portrait, and the design, illustrated here, a portrait of Queen Elizabeth, was used for each of the seven stamps in its series. The values ranged from 10c. to 5 fr., sold at premiums ranging from 5c. on the 10c. to 5 fr. on the 5 fr.

The best of all the Christmas issues, in our view, is that of Holland, and we are indebted to our publishers' agents, Messrs. Hausemann & Hötte, of Amsterdam, for an early view of the beautiful stamps that comprise this series. The set consists of four values, 1½c.+1½c., 5c.+3c., 6c.+4c. and 12½c.+3½c., the premiums being devoted to child welfare work. Each of the designs, as our illustrations of the 1½c. and 6c. values show, depict actual incidents in child welfare work, or a type of child assisted. The 1½c. stamp shows a deaf and dumb child being taught to speak; the 5c. a helpless backward child; the 6c. a blind girl learning to read from Braille type; and the 12½c. an invalid girl being assisted to walk.

Our half-tone reproductions convey little idea of the beauty of the stamps, which constitute one of the finest pieces of stamp production we have ever encountered.

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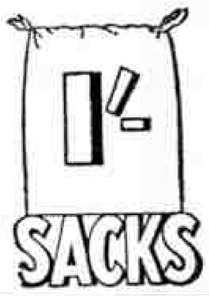

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Stamp Gossip

and Notes on New Issues

Sports Stamps

In an article on sports stamps in the "*M.M.*" for May, 1928, we criticised rather severely the set of stamps issued by Holland to celebrate the *IXe* Olympiade at Amsterdam. We could see little inspiration in the series, but evidence is to hand that at least one person likes them, so much so, in fact, that he has copied them as nearly as convention will permit. In September last there were some Olympic Games for the Balkan States at Sofia, and Bulgaria took the opportunity to make a commemorative issue of stamps with designs inspired by the earlier Dutch issue.

There is little that is good in the series; it is poorly produced and, from a sporting viewpoint, hopeless. The 1 leva value actually shows an athlete doing a handspring over the bar in a high jump competition! Stamp designers are entitled to a little latitude, but, as *Gibbons' Stamp Monthly* rightly comments, this is simply "not done," and would cause a riot at an arena such as Stamford Bridge!

There are seven stamps in the series, the designs being as follows:—1L., High Jump; 2L., Association Football; 4L., Horse Leaping; 6L., Fencing; 10L., Cycling; 12L., Diving; 50L., Victory.

Cook Islands Issues Combined

Very shortly the separate stamp issues for Rarotonga, Aitutaki and Penrhyn, in the Cook Islands Group, are to be withdrawn, and one general Cook Islands issue introduced for use in the three islands. Designs have already been chosen as follows:—½d., The Landing of Captain Cook; 1d., Portrait of Captain Cook; 2d., Double Maori Canoe; 2½d., Natives working cargo from a schooner; 4d., Port of Avarua; 6d., Moonlight view of R.M.S. *Monowai*, the steamer that connects Rarotonga with the outside world; 1/–, portrait of H.M. King George. Temporarily, the higher values are to be provided by overprinting New Zealand issues.

Niue, another of the Cook Islands Group, is to retain its separate issue, but new designs similar to the Cook Islands series will be introduced. The explanation of this distinctive treatment is that Niue is independently administrated and has no direct communication with Rarotonga.

A Philatelic Scoop

Stamp circles have been extremely puzzled recently to account for the sudden appearance of modest quantities of a wide range of obsolete Abyssinian issues, at prices far below those formerly ruling. Many guesses were made at the solution of the mystery, but all of them were fairly wide of the mark. Ultimately the Ethiopian Minister of Posts and Telegraphs was asked to confirm that a big deal in "remainders" had been made with a French syndicate, but an unvarnished denial settled that yarn.

The true story was told in a recent issue of "*Stamp Collecting*," and as it is an interesting illustration of the enterprise and ingenuity displayed by leading stamp firms in their efforts to serve their customers, it is worth re-telling here.

Only a few weeks before the coronation of the new Emperor, and the reorganisation of the system of Government, it came to the ears of a certain English stamp dealer, through a reliable informant, that stocks of the older issues of Abyssinian postage stamps still existed at the various post offices in that country. As soon as supplies of the new Imperial series, on order from Paris, came to hand, however, the postal authorities intended to call them in with a view to their destruction.

The dealer decided to make a "corner" in these obsolescent varieties before they were lost to philately for ever. Time being the essence of the contract, he cabled instructions to his agent to proceed at once to Abyssinia and buy up all the stamps he could possibly lay hands on before the arrival of the new stamps and the withdrawal of the old issues.

Arriving at Addis Abeba at the time of the coronation festivities, the agent spent several weeks going from post office to post office and by perseverance and "palm oil" persuading the clerks to disgorge their almost forgotten stocks, in some cases dating back as far as the original issue of 1894. The expenses of the undertaking were enormous, amounting, it is said, to something like £25,000, of which "baksheesh" was no small item; but at length the agent managed to complete the "corner." Even then his troubles were not over, for more than one difficulty with the Customs officials had to be smoothed over before he got his purchases out of the country and down to the Red Sea port of Djibouti.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations of our stamp pages have been made.

Striking Dutch Issues

In addition to the Child Welfare stamps referred to in our "Christmas Stamp" article on the preceding page, Holland has issued a Charity Appeal stamp to raise funds for the restoration of the old church at Gouda, near Rotterdam.

Originally named Groote Kerk, or St. Janskerk, the church is of Protestant denomination, and is widely famed for its beautiful stained glass windows. These are 44 in number, 13 being by Dirk and Wouter Crobeth, who are considered by many to be the cleverest artists in stained glass that the world has ever known. Full details of the subjects of the windows are not available, but Messrs. Hausemann & Hotte tell us that the first window to be installed after the re-building in 1555 was a composite showing the Bishop of Utrecht, George Van Egmond, Philip II, Margaretha van Parma, Prince Willem I, and an allegory representing the Dutch States. The great wooden arches in the interior, and an organ of amazingly beautiful tone, are other features of the church, the earliest portions of which date back to the 14th century.

We illustrate the extremely striking design of the 1½c. stamp, which was issued at a face value of 3c., the premium of 1½c. being devoted toward the cost of restoring the stained glass. The illustration, it will be seen, represents one of the magnificent windows and, inset, the hands of an artist at work on the restoration. The second stamp in the series, a 6c.+4c., bore a design of similar type.

The very striking effects secured in these designs and those of the Child Welfare stamps are repeated in a new 60c. air mail stamp, which bears, in addition to two flights of aeroplanes, a portrait of Queen Wilhelmina in photogravure. The results of Dutch experiments in stamp design have not always been happy, but the issues described this month are outstandingly good and, indeed, might justifiably be described as the most striking stamps of 1931.

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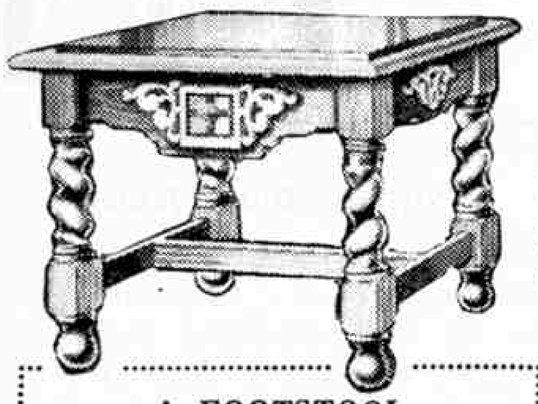

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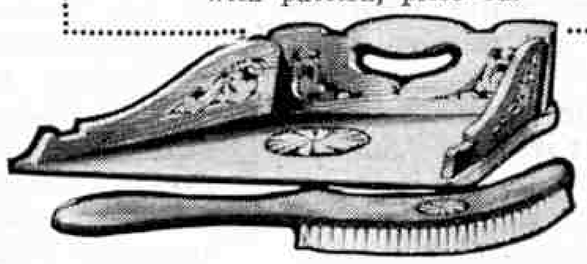

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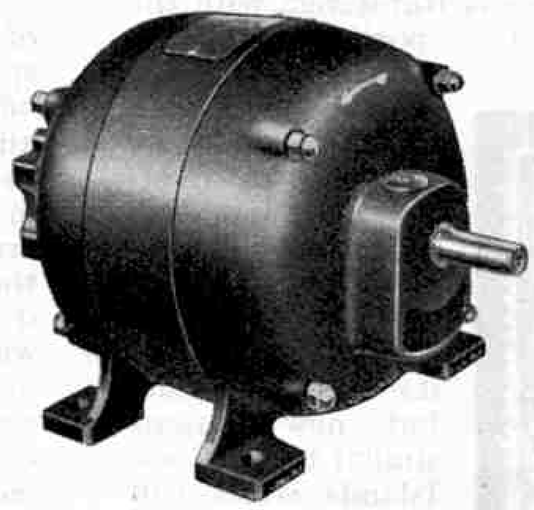

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NOTES ON NEEDLES—METALLIC TYPES

SEVERAL readers have written to ask what I consider the best gramophone needle. This is a question that cannot be answered directly, as so many points have to be taken into consideration. Since the gramophone came into being, an enormous variety of types and shapes of playing needles have been evolved, and the process still continues. By far the most popular needle to-day is the ordinary steel needle, designed to play one side of a record. At one time the manufacture of steel needles was carried out in a rather haphazard fashion, with the result that there was a considerable proportion of defective needles to be found in almost every box. Nowadays the standard of manufacture is uniformly high, and one rarely comes across a really defective needle among the products of any of the well-known firms.

Practically all manufacturers of steel needles make two or three grades, producing results of different loudness. The loud needles are usually short and fat, while the soft ones are longer and thinner. It is a good plan to have at least two grades of needles at hand, to be used according to the loudness or otherwise of the record, and the size of the room in which it is being played. One sometimes hears people say that the advice to play only one side of a record with one needle emanated from the manufacturers, who wished to sell as many as possible. This is a great mistake. The point of a steel needle is worn to such an extent after playing one side of a record that it is seldom capable of playing a second side without doing serious damage to the record. It cannot be emphasised too strongly that a steel needle should be used once only. A final word of advice is to decide upon a good make of needle and stick to it. The habit of experimenting with first one make and then another is very likely to have a bad effect on the records.

While I am dealing with this topic I may give one word of warning. Most gramophones are provided with cups for used and unused needles. These are very useful, provided that the used needles are invariably placed in their proper receptacle. A few used needles placed carelessly in the "unused" receptacle, or a supply of new needles poured into a cup that already contains used ones, may do serious damage to highly-prized records. If it is found that used and unused needles have become mixed in this manner, the only safe way is to scrap the whole lot and start with a new supply.

There are several semi-permanent metal needles on the market. Such needles have a point of some particularly hard metal, which resists wear sufficiently to enable the needle to be used for a number of records without damage. Prominent among such needles are the Columbia "Duragold"

Two favourite singers recording exclusively for Columbia, Aroldo Lindi, tenor, and Dora Labette, soprano. For our photographs we are indebted to the Columbia Graphophone Co. Ltd.

and the H.M.V. "Tungstyle," which are very satisfactory. Whatever type of semi-permanent needle is used, it is always wise to discard the needle before it has played the number of records claimed for it.

Next month I will deal with fibre needles, which probably have been the cause of more and fiercer argument than any other item of gramophone equipment.

Records Worth Buying

Probably there is no more popular overture in existence than "*Poet and Peasant*" by Suppé. It may not be great music, but it has an exhilarating swing that carries one along, and somehow even after repeated hearings it pops up again as fresh as ever. A really first-class cheap recording of this overture is now available on Broadcast 3123 (10 in., 1/6), and it is certainly remarkable value for the money. Sir Dan Godfrey, conducting the well-known Bournemouth Municipal Orchestra, gives us two attractive pieces on Columbia DB 689 (10 in., 2/6). The first, "*Raindrops*," is a delightful representation of the light pattering of rain; and the second, "*Fairy Ballet*," has charming little solos for cello and trumpet respectively.

It is curious how often one particular work by a composer becomes so popular that it overshadows all his other works, and indeed makes it difficult for these to get a hearing. A striking example of this is the world-famous "Prelude" in C Sharp Minor by Rachmaninoff. This "caught on" to such an extent that for a time it completely swamped all the composer's other pianoforte compositions, and I imagine there must have been many occasions when Rachmaninoff wished to goodness he had never written it! The great Finnish composer Sibelius provides another instance. Until quite recently he was popularly known only by two works, "*Valse Triste*" and "*Finlandia*"; and as far as the general public were concerned he might never have composed anything else. It is true that much of Sibelius' music is not easy to understand, but some of it is just as attractive as the two works I have mentioned. This is the case with his "*Karelia*" Suite, two movements from which, "*Intermezzo*" and "*Alla Marcia*" are recorded on Columbia DX 307 (12 in., 4/–). The music is light-hearted and full of gorgeous melody, and the recording is splendid. To readers who do not already possess a record of "*Valse Triste*" I recommend Columbia DX 314 (12 in., 4/–), on which it is magnificently played by William Murdoch, with Grieg's popular "*Norwegian Bridal Procession*" on the other side.

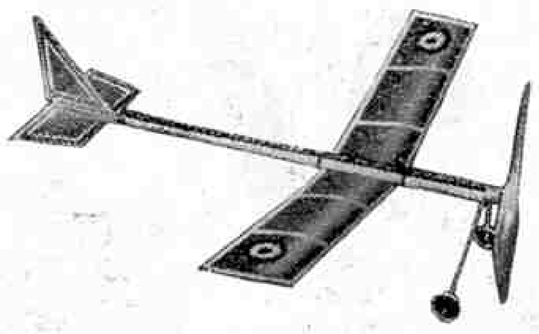
There is small choice in good recent military band records, but the best of them is certainly one of the finest records of this type that I have ever heard. This is a Columbia record (DX 308, 12 in., 4/6) of the "Zampa" overture, played by the Grenadier Guards Band. The tone of the different instruments is reproduced with wonderful fidelity and, in contrast to many otherwise good band records, the volume of sound never exceeds comfortable limits. Two favourite marches, "*Bravest of the Brave*" and "*Namur*" are excellently played by the Black Diamond's Band (Zono. 6008), and the Kneller Hall Band give an attractive rendering of Weber's "*Invitation to the Dance*" (Sterno 8025, 12 in., 2/6). The label of this record gives the word "Waltz" instead of "Dance," and this mistake occurs with such persistent regularity that there seems little hope of any change.

A Filmophone Novelty

Filmophone Flexible Records Ltd., have taken an interesting step in arranging with Mr. R. H. Naylor, the well-known astrologer, to record exclusively for them. The first record (No. 930, 10 in., 1/6), "*What the Stars Foretell for 1932*," is now ready, and is certain to arouse widespread interest among the public who have been astonished by the accuracy of Mr. Naylor's predictions. Not content with this, however, the company are arranging to present all Filmophone record users with their own horoscope, free of charge. Incidentally there has been a remarkable improvement recently in the quality of Filmophone products. The recording is generally of much higher quality, and the subjects chosen are of wider interest.

* * * *

The new Crystalate 12-in. records at the price of 2/– are remarkable value. The recording is good, apart from some unnecessary surface noise, and I look for interesting developments in these discs. Of the records issued so far I can recommend specially Z107, a selection from "*Cavalleria Rusticana*," played by the Berlin Philharmonic Orchestra; and Z104 and Z105, consisting of vocal selections from "*The Bohemian Girl*" and "*The Mikado*" respectively, rendered by the Palace Opera Company.

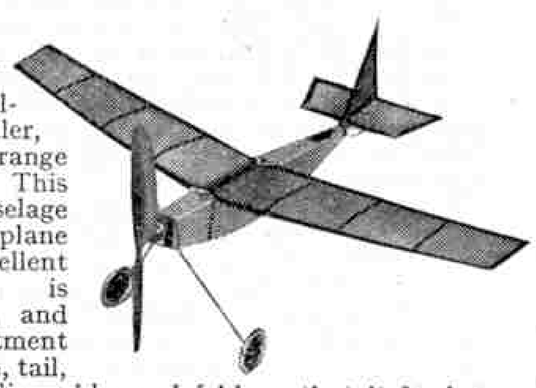


The "DEMON" Tractor. **Price 7/6**

Length 25½ in., span 23 in. Fitted 10 in. hand-carved and balanced propeller, patent double-bearing and shock-proof chassis, covered yellow proofed silk with identification discs. Weight and wind resistance are reduced to a minimum in this model, giving the utmost duration of flight.

Weight, 3¼ ounces. Distance, 850 feet.
Speed, 16 m.p.h. Ceiling, 80 feet.
Rises from the ground.
Patent No. 296946.

The Warneford "Whippet" Fuselage Model. Price 17/6



Length 20⅜ in., span 30 in., fitted 11 in. hand-carved and balanced propeller, and covered orange proofed silk. This beautiful Fuselage Model Aeroplane has an excellent performance, is very strong, and has full adjustment of main-plane, tail, and fin. It dissembles and folds so that it fits into a very small box for storage and transport. The finish is in keeping with the usual Warneford high standard.

Weight, 4⅜ ounces. Distance, 550 feet.
Speed, 17 m.p.h. Ceiling, 50 feet.
Rises from the ground.

Performance counts— not size

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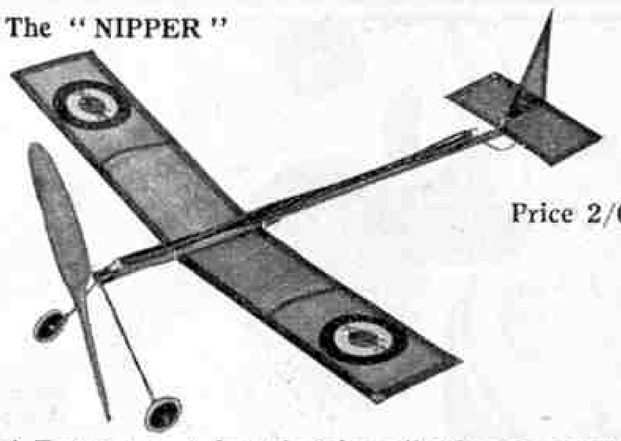
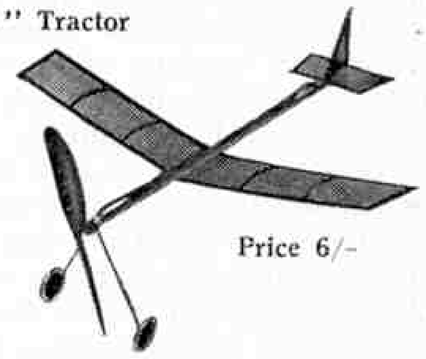
The "NIPPER" **Price 2/6**



Special Features: A long bearing allowing no movement or wobble on the propeller—therefore a steady flyer. High-tension steel wire tail and rudder—therefore model can be adjusted for stunting. All aluminium wheels, fitted brass bearings, and the model has an amazing performance as the whole aeroplane weighs less than one ounce. The finest machine ever produced at such a price.

Weight, 1 ounce. Distance, 400 feet.
Speed, 12½ m.p.h. Ceiling, 40 feet.
Rises from the ground.
Patent No. 296946.

The Warneford "IMP" Tractor



Length 23 in., span 20⅜ in., fitted 9 in. hand-carved and balanced propeller. This new model is of all-round increased performance, due to a general reduction in weight. It is fitted with the usual Warneford shock-proof chassis and a 9 in. hand-carved balanced propeller, and also a four-ribbed main-plane. This model having a steel wire tail-plane, is capable of being set for stunting.

Price 6/-

Weight, 2⅛ ounces. Distance, 750 feet.
Speed, 12½ m.p.h. Ceiling, 60 feet.
Rises from the ground.
Patent No. 296946.

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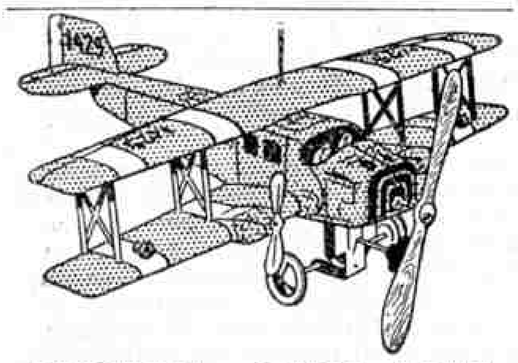

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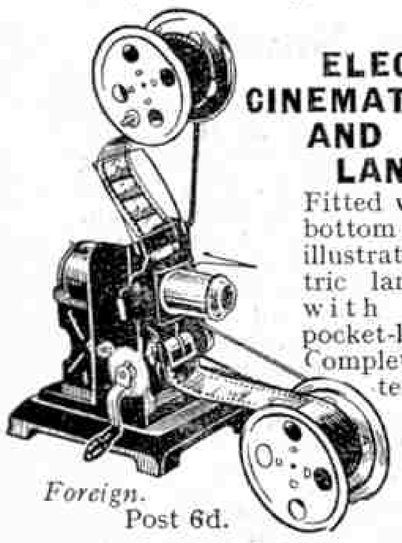

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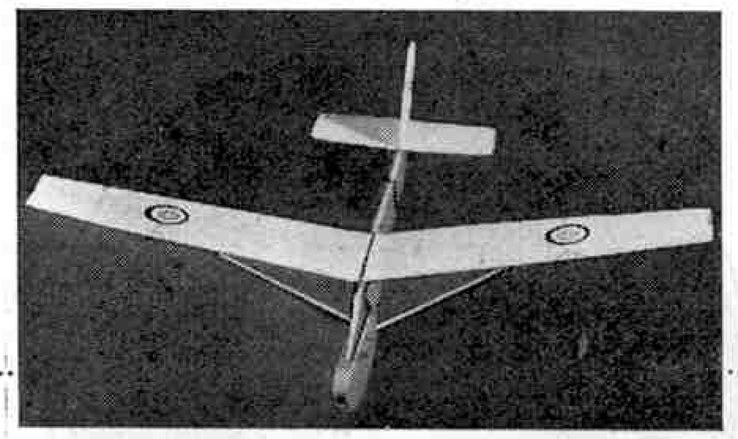
We stock all Hornby Trains and Meccano Parts and can give prompt delivery to all parts of Britain.



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Reduced by 6/-!

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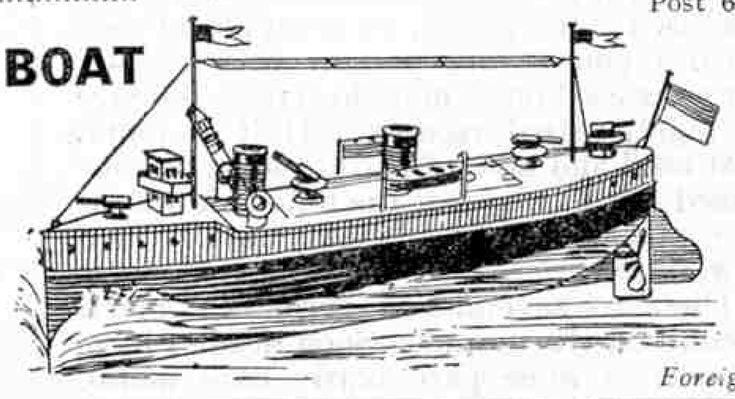
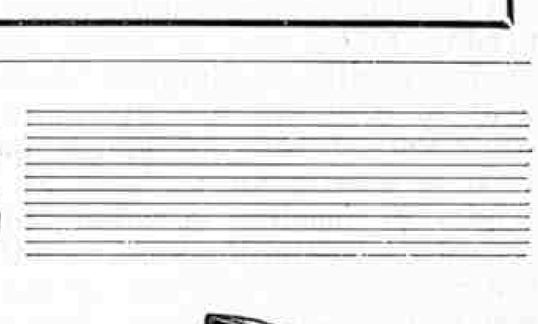


Foreign.



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Competition Page

IMPROBABILITIES

"Pawl," our office boy, who made his literary debut in the December "*M.M.*," has broken out again! Recently we discovered that he was studying a general knowledge course. This fact seemed to have distinct possibilities, and we asked "Pawl" to put on paper a few of the items of information that had interested him most in the course of his studies. In fairness to him we must say that he is a hard-working youngster—though generally at the wrong thing—and most of his study appears to have been done late at night after heavy and very mixed suppers!

The results of "Pawl's" cramming form such remarkable examples of jumbled facts as to suggest immediately that they would form the basis for a good competition; and with that object in view we reproduce the gems of the collection in the upper panel on this page.

Readers are asked to go through carefully the statements "Pawl" has made, and to make a list of the errors and improbabilities contained in them. Each statement must be considered not only in itself, but also in the light of the general context of the paragraph; otherwise it may be found impossible even to reconcile one sentence with another. Two members of the staff on whom we tried this contest expressed themselves so strongly that we believe "Pawl" is considering the advisability of making a bolt for it while the going is good!

Prizes of Meccano or Hornby Train goods (to be selected by the winners from the current catalogues) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four longest lists of genuine inaccuracies in each of our usual two groups, Home and Overseas. In addition there will be a number of consolation prizes.

Competitors should address their entries to "Improbabilities, Meccano Magazine, Binns Road, Old Swan, Liverpool," in time to reach this office not later than 29th February for Home competitors, and 31st May for those Overseas.

Captain Cook's route to the North Pole lay through Siberia, Spain, the South Orkneys and St. Helena, and after a hazardous voyage he finally detached the White Ensign from the Pole at daybreak on 31st September, 1703. To do so he had first of all to remove the Stars and Stripes planted there by Amundsen in 1832 to commemorate the first Independence Day of the United States of America.

* * * * *

H.M.S. Rodney is the largest cruiser in the Royal Navy at the present time. She was built in 1928 and took part in the famous battle of Jutland. Her armoury consists of 14-25" guns, numerous howitzers, field guns and six torpedo tubes, of which two are on the upper deck and one in the fighting top. The Captain resides at 10, Kensington Oval, London, N.W., and is in continual communication with the vessel by means of television and Marconigrams.

* * * * *

In the National Portrait Gallery, London, there is a photograph of Nebuchadnezzar sitting on his throne at York. The photograph was rescued from the Great Fire of London in 1748, and is the work of an Irishman named Pear, who was born in India of Scottish parents. The painter had spent many years in travelling round the world, during which he visited Troy, Pompeii and Babylon, before finally settling in London. There he invented soap, and amassed a huge fortune by selling electric lamps to the Imperial Gas Company. He died in the year of Waterloo, leaving most of his fortune for the erection of the Crystal Palace.

* * * * *

After the death of Lord Nelson the Emperor Charlemagne of France made up his mind to invade London. He was assisted by the Spanish Armada under Sir Walter Drake, but he was unable to sail through the dock gates at Folkestone and therefore failed to reach London. After riding out a gale in Lerwick Harbour, Drake returned to Spain after a stormy voyage, in the course of which his flagship damaged her propeller by striking it against the end of Dover Pier. Shortly afterwards Drake narrowly missed the rock of Gibraltar, which suddenly loomed up before him in the west on his starboard bow.

February Drawing Contest

For many years past the use of our main roads as arteries for heavy transport purposes has been growing. In making the subject of this month's drawing contest "*A Heavy Road Transport Vehicle*," we are certain, therefore, that the subject is one with which most of our readers are thoroughly familiar. For the benefit of readers who do not often see really big vehicles, however, we will consider any mechanically-propelled road transport vehicle as an eligible subject.

The entries will be divided into the usual two sections, A for readers aged 16 and over, B for those under 16, and prizes of artists' materials, or Meccano or Hornby Trains (to be chosen by the winners), to the value of 21/– and 10/6 respectively, will be awarded to the best and second-best entry in each section. In addition there will be a number of consolation prizes.

Entries should be addressed "February Drawing Contest, Meccano Magazine, Old Swan, Liverpool," and must reach this office not later than 29th February.

A duplicate set of prizes is offered for competition among Overseas readers, in precisely similar age groupings. Overseas closing date, 31st May.

Competition Closing Dates

HOME		
Improbabilities	...	**29th February.**
February Drawing Contest	...	**29th February.**
OVERSEAS		
Missing Words No. 2	...	**29th February.**
Crane Drawing Contest	...	**29th February.**
Christmas Decorations	...	**31st March.**
Christmas Letter	...	**31st March.**
Cover Voting	...	**30th April.**
New Year Resolutions	...	**30th April.**
Improbabilities	...	**31st May.**
February Drawing Contest	...	**31st May.**

Watch the Closing Dates:

Competitors, both Home and Overseas, are particularly requested to make a careful note of the closing dates of the competitions. Hardly a month passes without one or more entries of excellent quality arriving too late.

In sending entries to competitions that are divided into age groups, competitors should take particular care to mark their ages clearly on the back of the entry. It is not sufficient merely to indicate the age group, as age allowances are given to ensure equality of opportunity for the younger competitors.

Entries, other than prize-winning efforts, for photographic, drawing and similar competitions, will be returned to the competitors concerned if a stamped addressed wrapper is sent with the entry, and its return requested. Prize-winning entries are retained by the Editor.

COMPETITION RESULTS

HOME

September Photographic Contest.—First Prizes: Section A, JAMES ROBERTSON (Dalmuir); Section B, J. M. GIBSON (Lancaster). Second Prizes: Section A, P. MASON (Brighton); Section B, J. MACNAUGHTON (Kirkcaldy). Consolation Prizes: W. COWLISHAW (Swindon); D. DANGERFIELD (Bedford); J. B. GIBSON (Egham); W. JAMES (Rhondda); A. H. KARAMELLI (Golders Green, N.W.11); G. M. LANE (Wakefield); J. PHILLIPS (Woking); V. W. SOWEN (Bingley); R. WEBB (Brighton).

Missing Words No. 2.—C. CROCKER (Letchworth); 2. H. G. KERR (Eltham, S.E.9); 3. C. E. WILD (Redhill); 4. H. F. SAYCH (Thaxted). Consolation Prizes: R. COLE (Burnham-on-Crouch); W. J. DAWE (Portsmouth); J. PLEASANCE (Hampstead, N.W.3); W. F. RIDDELL (Berwick-on-Tweed); T. SHUTTLEWORTH (Preston).

Christmas Decorations.—First Prizes: Section A, W. K. JEWITT (Wakefield); Section B, L. TUCKER (Dorking). Second Prizes: Section A, L. A. SMITH (Chigwell); Section B, J. WALTON (Eye). Consolation Prizes: F. GRENEN (Bournemouth); H. C. LEWIS (Tottenham, N.15); A. M. JOHNSTON (Dunstable); J. MACKEN (Bromley); F. PARSONS (Brighton); C. SHACKLEFORD (Cheltenham).

OVERSEAS

Cricket XI Vote.—1. F. JOHNSON (Southland, N.Z.); 2. E. L. MEEK (Wellington, N.Z.); 3rd and 4th prizes combined and divided between T. DRIEBERG (Ceylon); D. G. TEES and L. R. TEES (Durban).

September Photo Contest.—First Prizes: Section A, F. M. BROWN (Christchurch, N.Z.); Section B, E. HUNT (Cape Town). Second Prizes: Section A, K. T. HOOSENBHOY (Karachi); Section B, G. CABAUD (Canton de Vaud).

Third Stomachion.—1. K. BUTTON (Auckland); 2. B. BAXTER (South Canterbury); 3. J. A. RODRIGUEZ (Montreal); 4. MACL. MORGAN (Cremorne, N.S.W.).

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HOURS of interest and instruction are yours when you make this beautiful model of the Gipsy Moth. You build it from detailed plans of the machine, and every part is true to scale. In constructing it you will gain invaluable knowledge of the actual principles and problems of aeroplane construction.

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are absolutely unique constructional sets, complete with everything needed for building perfect models—there are no extras to buy. All the parts are correctly coloured and the finished model has a most realistic appearance—so real that only an expert can tell a photograph of the model from one of the real machine. The elaborately detailed plans—scale copies of the originals—make the actual construction a fascinating job, yet a simple one.

Model Series No. 1, the world-famous Gipsy Moth, is now ready. No. 2, the well-known Comper-Swift, which recently broke the England-Australia record, is now in preparation, and model sets of other celebrated aircraft will follow at intervals.

PRICE **3/-** Complete

If unable to obtain from your local dealer, write direct enclosing Postal Order for 3/6, to AEROMODELS, Hooton Road, Willaston, Wirrall, Cheshire.

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A STEADY SOUND BASE

is a real necessity to all Mechanical Models. In Plasticine you will find a material that will stop slipping, wobbling, or any kind of movement on a slippery surface.

Let us send you a list of over 150 uses to which Plasticine has been put, you will then see how well it combines with Meccano Construction.

The New Octagon Box with Tool, etc., and 8 colours, **1/6**, by post **2/-**. The Corona Box—a full pound in 10 Colours, **1/6**, post **2/-**. Other Outfits from **6d.** to **£1/1/-**.

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Are You Interested in Chemistry?

Then ask any good toy dealer or store to show you Lott's Chemistry, and you will not fail to be impressed by the value and appearance of the sets. You will see that they are more than toys, for they have been designed throughout on correct scientific lines by a Doctor of Science.

In addition to many interesting reactions and chemical exchanges, such fascinating things as the following can be performed :—Growing chemical trees and big crystals. Changing the colours of liquids. Making coloured flares. Writing with, and developing invisible ink, etc. Here are some extracts from an experiment in Box 3.

A Time Experiment

In this experiment a colourless solution should give a beautiful deep blue colour very suddenly, like a flash. . . Get a watch with a seconds' hand, and when it is at 0 quickly add the contents of tube 2, and swirl them round. Now your blue colour may appear after a few seconds, or perhaps only after some minutes. . . When you have got a reasonable time (say 20 to 60 seconds), you will be able to repeat the experiment in front of your friends, and surprise them by forecasting the exact time of appearance of the blue colour.

Send a postcard to the address below for descriptive leaflet, and specimen pages from the Instruction Book.

BOX 1. Contains 18 chemicals, test-tubes, tin dishes, filter papers, litmus paper, magnesium ribbon, glass tubing, test tube cleaning brush, and Book of 42 Experiments.
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BOX 2. Contains 22 chemicals, Bunsen Burner, with rubber connecting tube, large and small test-tubes, tin dishes, filter papers, litmus paper, magnesium ribbon, glass tubing test-tube cleaning brush and Book of 80 Experiments.
PRICE 6/-

BOX 3. Contains 30 chemicals, Bunsen Burner, with rubber connecting tube, large and small test-tubes, tin dishes, crucible, flask, glass funnel, filter papers, litmus paper, magnesium ribbon, glass tubing, delivery tube, test-tube cleaning brush and Book of 131 Experiments.
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Seccotine grips like riveted steel. Almost as strong as welding. Nothing can shake its vice-like hold. Easy to apply. A tube lasts ages. **SECCOTINE IS BRITISH.**

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You balance your bicycle with a pedal precariously on the curbstone, or lean it against a wall or post—and what happens? More often than not it falls and is damaged. Scratches and entanglement, twisted handlebars, broken spokes, damaged lamps, scraped handle-grips—these all result from falls.

The "Avecta" Cycle Stand

will enable you to stand your machine anywhere without the slightest risk of falling.

It is a permanent fitment and lies along the front down tube when the machine is being ridden.

Ask your cycle dealer to show it to you.

PRICE **2/9** EACH.

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TRADE MARK

A real 'man size' liquid pistol for 1/9

LOOKS just like a real automatic and shoots a strong jet of water about 25 feet. It is strongly made from metal with blued steel finish and there are no rubber parts to perish or wear out. It's a pistol that will last a lifetime.

That's the pistol you should have—one that will really **do** something. Get one from your nearest dealer—only **1/9**—but be sure it's a DAISY as illustrated above.

A catalogue showing all DAISY Air Guns will be sent free on application.

DAISY AIR RIFLES

(Made in U.S.A.)

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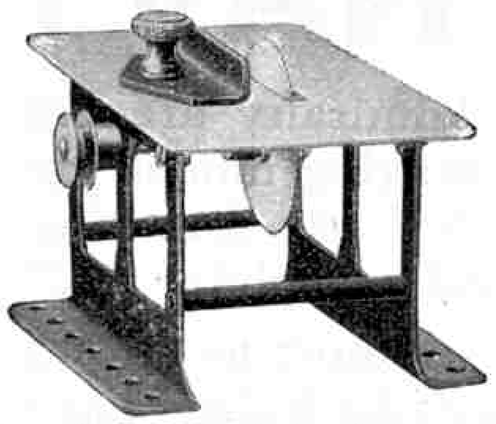
MECCANO SAW BENCH

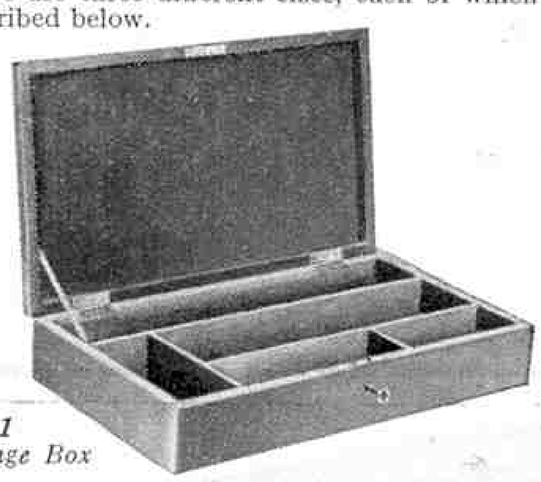


This model Saw Bench is suitable for use with an Electric or Clockwork Motor or Steam Engine. By means of the equidistant holes in the base it may be built into a Meccano Model Workshop. Beautifully finished in black enamel and nickel. Price 4/–.

Meccano Ltd., Binns Road, Old Swan, Liverpool.

STORAGE BOXES FOR MECCANO PARTS

Almost every Meccano boy purchases additional Meccano parts from time to time, but there is sometimes difficulty in finding suitable accommodation for them. The storage boxes that we supply are strongly made and have been specially designed for the purpose of keeping Meccano parts orderly and neatly. There are three different sizes, each of which is described below.



No. 1 Storage Box

No. 1 STORAGE BOX. Beautifully enamelled in red and fitted with partitions as shown in the illustration. The lid is hinged and is secured by means of lock and key. Dimensions: Length 15½ ins. Width 8¾ ins. Depth 2¾ ins. Price 10/6.

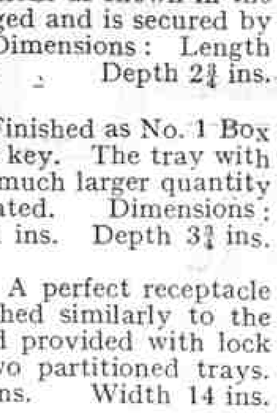
No. 2 STORAGE BOX. Finished as No. 1 Box and provided with lock and key. The tray with which it is fitted enables a much larger quantity of parts to be accommodated. Dimensions: Length 14½ ins. Width 11 ins. Depth 3¾ ins. Price 21/–.

No. 3 STORAGE BOX. A perfect receptacle for Meccano parts. Finished similarly to the No. 1 and No. 2 boxes and provided with lock and key. Fitted with two partitioned trays. Dimensions: Length 20 ins. Width 14 ins. Depth 5½ ins. Price 30/–.

Meccano Ltd., Binns Road, Old Swan, Liverpool.

Hornby Railway Company Forms

Perfect miniature reproductions of the forms used in actual Railway practice are available to members of the Hornby Railway Company.



Pads of the following, each containing 50 forms, may be obtained from Headquarters, price 5d. each, post free. Each type of pad is supplied in a distinctive tint.

G.W.1. General Working Timetables.
S.D.4. Stationmaster's Arrivals and Departures.
E.J.5. Engineman's Job Cards.
S.B.6. Signal Box Instructions.
S.R.7. Stationmaster's Report Forms.

The price of the complete set of five pads is 1/9 post free.

IMPORTANT.

Please quote membership number when ordering supplies.

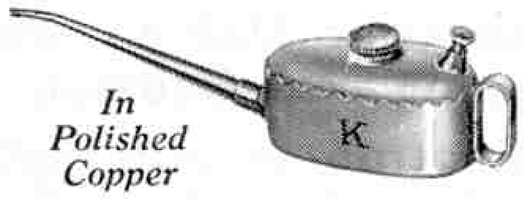
Headquarters: Hornby Railway Company, Old Swan, Liverpool.

MECCANO LUBRICATING OIL

Before commencing to operate a Meccano model, or to run a Hornby Train, all gears and bearings should be oiled thoroughly with Meccano Lubricating Oil. This oil is specially prepared and is of the right consistency for the purpose. Price per bottle 6d.

Meccano Ltd., Binns Road, Old Swan, Liverpool.

OIL CAN No. 2 ("K" Type)



In Polished Copper

Every Meccano and Hornby Train enthusiast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect.

One of the oil cans was sent to H.R.H. the Prince of Wales, and a gracious letter of acknowledgment was received expressing H.R.H.'s admiration of the beautiful lines and perfect finish of this model. Price 3/6

Meccano Ltd., Binns Road, Old Swan, Liverpool.

COMPLETE YOUR FILES

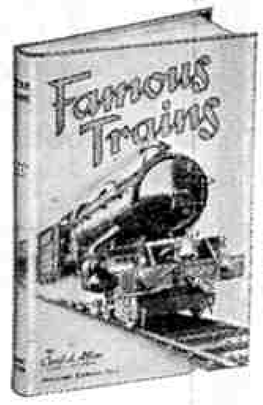
All "Meccano Magazines" prior to December 1923 with the exception of November 1917, February and March 1918, and May and June 1919 are out of stock. Each of the 1924 issues with the exception of January, February and September is in stock. Only the July, October and November 1925 issues are available. All the 1926 to 1931 issues are in stock with the exception of January, February and April 1926, March, July, August and November 1927, January and February 1928, January 1930, February and March 1931.

Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues of 1925 and 1926, and all the issues from 1927 to date are 8d. each.

Quotations for complete bound volumes may be obtained from the publishers—

"Meccano Magazine," Binns Road, Old Swan, Liverpool.

FAMOUS TRAINS



Thirteen chapters of Mr. C. J. Allen at his best!

All Railway enthusiasts should have this book. It contains much reliable and valuable Railway information, including the leading dimensions of many of the most famous express passenger locomotives in this country.

Price now 1/9 post free from

MECCANO LIMITED, Old Swan, Liverpool.

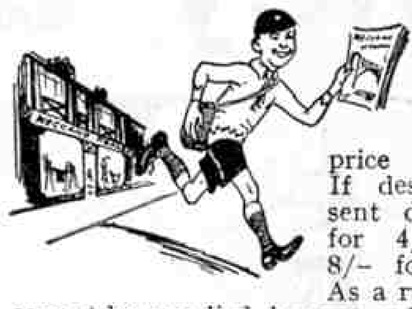
MECCANO ENAMEL

Meccano enamel has been introduced to enable model-builders to convert nickel parts to colour or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red, grey or green, each colour being identical in shade with the enamels used in the Meccano Factory for spraying Meccano parts.

Price per tin 8d.

Meccano Ltd., Binns Road, Old Swan, Liverpool.

How to obtain the "M.M."



The "*M.M.*" may be ordered from all Meccano dealers, or from any newsagent or bookstall, price 6d. per copy. If desired it will be sent direct, post free, for 4/– for six, or 8/– for twelve issues. As a rule back numbers cannot be supplied, because only sufficient copies are printed to fill standing orders. To prevent disappointment, therefore, place a regular order with your dealer, newsagent, or the publishers—

"Meccano Magazine," Binns Road, Old Swan, Liverpool.

H.R.C. WRITING PADS

Every member of the Hornby Railway Company should make a point of using the special H.R.C. writing paper for correspondence with his friends and with Headquarters. It is available in two sizes and is supplied in pads, each consisting of 50 sheets of superfine buff paper, and cover.

Prices, Large Size 1/– each (post free). Small Size 6d. each (post free).

ENVELOPES

Special envelopes, attractively printed and matching the writing paper in colour, are also available. These are suitable for both the large and the small sheets of writing paper.

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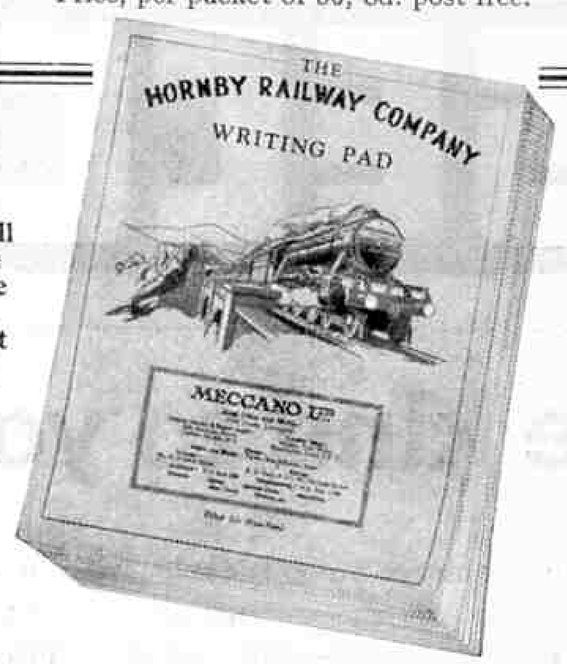

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These Writing Pads are very popular with Meccano boys as is shown by the large number of letters we receive each day written on the familiar tinted paper.

The Pads are supplied in two sizes, each consisting of 50 sheets and cover.

Prices—Large Size 1/– each (post free). Small Size 6d. each (post free).

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Special envelopes, appropriately printed and matching the writing paper in colour, are also available. These are suitable for both the large and the small sheets of writing paper.

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LONDON : 112, High Holborn, W.C.1.

MANCHESTER : 28, Corporation Street.

EDINBURGH : At Anderson's, The Arcade, 105, Princes Street.

Riley "Home" Billiards is a wonderful, never failing incentive for your boys to find their pleasure at home during the evenings. And not only the boys, but all the family will revel in the boundless enjoyment to be derived from this healthy, indoor game. There is nothing to prevent you having one of these magnificent tables. 13/3 down will bring the 6 ft. size to your door: the balance you pay as you play. Cash price £11 15s. 0d. Below are the prices for various sizes—all of them fit comfortably on an ordinary dining table.

4 ft. 4 ins. × 2 ft. 4 ins.	...	£7 0 0	or in	8/–
5 ft. 4 ins. × 2 ft. 10 ins.	...	£9 0 0	20	10/3
6 ft. 4 ins. × 3 ft. 4 ins.	...	£11 15 0	monthly	13/3
7 ft. 4 ins. × 3 ft. 10 ins.	...	£15 0 0	payments	17/–
8 ft. 4 ins. × 4 ft. 4 ins.	...	£21 10 0	of	24/6

13/3

Down brings the 6 ft. size Riley "Home" Billiard Table to you on 7 days' free trial. Riley's pay carriage and take all transit risks.

WRITE FOR ART LIST.

Riley's "Combine" Billiard and Dining Table.

Embodying in one piece of furniture both a beautiful dining table and a perfect billiard table. Available in many attractive designs, oak or mahogany, for cash or easy terms. Here are the sizes and prices for the round leg mahogany pattern.

5 ft. 4 ins. × 2 ft. 10 ins. ...	£22 10 0	or in 13
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This is the Riley "Cabriole" design, 6 ft. size, £34 10s. 0d., or in 13 or 20 monthly payments.

Riley's are the largest makers of Full Size Billiard Tables in Great Britain.

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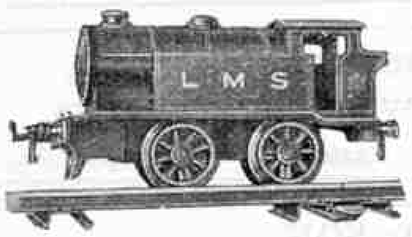
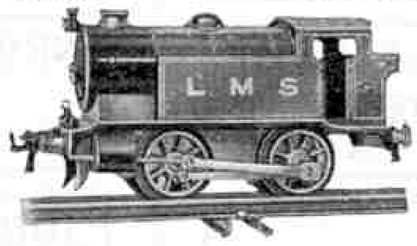
and Dept. U, 147, Aldersgate St., London, E.C.1.

HORNBY TANK LOCOMOTIVES



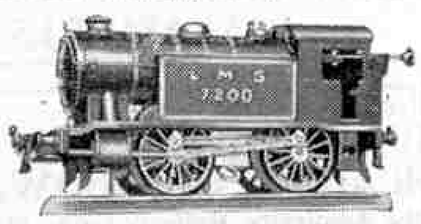
M3 Tank Locomotive

M3 TANK LOCOMOTIVE. This is the powerful Locomotive (reversing) supplied with the new Hornby M3 Tank Goods Set. It is a handsome and extremely reliable model that will give long and excellent service. Available in either red or green. **Price, 7/6**



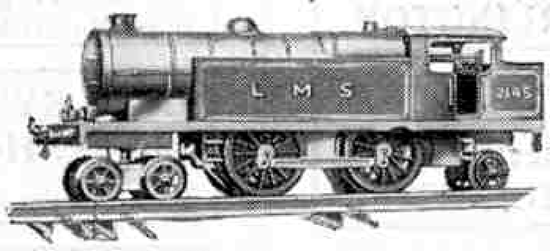
No. 1 Tank Locomotive

No. 1 TANK LOCOMOTIVE. This strong and durable Locomotive is capable of any amount of hard work. It is fitted with brake mechanism and reversing gear, and is supplied in colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Locomotives. **Price, 13/6**



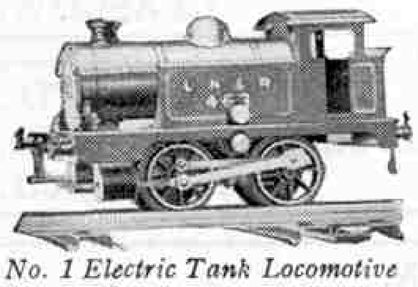
No. 1 Special Tank Locomotive

No. 1 SPECIAL TANK LOCOMOTIVE. This splendid Locomotive which is fitted with brake mechanism and reversing gear, has remarkable power and gives a very long run. It is available in the colours of the L.M.S., L.N.E., G.W. and Southern Railways. **Price, 18/**



No. 2 Special Tank Locomotive

No. 2 SPECIAL TANK LOCOMOTIVE. This Locomotive has great length of run and exceptional pulling power. It is fitted with brake mechanism and reversing gear. In every respect it is a perfect model, beautifully finished in the colours of the L.M.S., L.N.E., G.W. and Southern Railways. **Price, 25/–**



No. 1 Electric Tank Locomotive

No. 1 ELECTRIC TANK LOCOMOTIVE. This Locomotive is of the permanent magnet type, and may be run from a 6-volt accumulator. It can be stopped, re-started, reversed and the speed varied by the operation of levers at the side of the track. It is supplied with a terminal connecting plate, speed and reverse control switch and 3 feet of flex, and it is available in the colours of the L.M.S., L.N.E., G.W., and Southern Railway Locomotives. **Price, 32/6**

This Locomotive cannot be run from the mains supply.

MECCANO LTD. - OLD SWAN - LIVERPOOL

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Electrical Sets

OUTFITS WHICH GRIP THE IMAGINATION OF THE MODERN BOY

Here is a range of wonderful outfits, arranged by experts, that every boy just **must** have. Think of the thrills and excitement of performing scientific experiments yourself. The marvels of the modern universe—dynamos, electric motors, telephones, telegraphs, electric bells, etc., etc., unfolded in a clear and simple manner. Every boy can be a young electrician with a deep and practical knowledge of the science. Make your own batteries, lighting set, ammeters, voltmeters, etc., and build your own working models. NO PREVIOUS KNOWLEDGE REQUIRED.

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Obtainable at all stores and high-class shops. In case of any difficulty write direct to BRITISH GAMES LTD., 19, 20, 21, Clerkenwell Close, London, E.C.1.

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this and the opposite page carry full stocks of Meccano Outfits, Accessory Outfits, and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

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118, Union Street,
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G. A. HAYWARD,
15 & 16, Skinnergate,
'Phone 2277 DARLINGTON.

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Tel. 82 DUMBARTON.

DIXON'S,
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Tel. 5810 DUNDEE.

H. F. MARTIN,
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DUNDEE.

W. T. MARTIN, Tel. 4578
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87, High Street, Lochee, DUNDEE.

PHINS LIMITED,
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DUNDEE.

SMITH BROTHERS,
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A. & B. BLACKMAN & SONS,
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Tel. : Mount View 4310 LONDON, N.W.5.

Bon Marché Ltd.,
Brixton,
Tel. : Brixton 6201 LONDON, S.W.9.

DEMPSEY & CO.,
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W. HUMPHRYS & SON,
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Estab. in 1840 PECKHAM, S.E.15.

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42 & 44, Walworth Road,
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'Phone Livingstone 2482 Upper Norwood, S.E.19

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Meccano and Hornby Train Stockists continued on next page

Continued from previous page

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CURRYS LTD.,
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TYRRELL & GREEN LTD.,
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HENRY W. GINN,
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Tel. 2346 **SWANSEA.**

L. MYERSCOUGH, 57, South Rd.,
WATERLOO.
Branches : Crosby & Litherland.

W. L. LEWIS & SONS,
51, Church Street,
'Phone No. 210 **WEYBRIDGE, Surrey.**

F. CHAMBERLAIN,
57/59, Albert Road,
WIDNES.

PICKERINGS,
28, High Ousegate,
Tel. 3678 **YORK.**

"S.G. Minor" Stamp Album

Messrs. Stanley Gibbons Limited send us a copy of their newest publication—the "S.G. Minor" Loose-Leaf Stamp Album.

The size is the interesting feature of this Album, the pages being $5\frac{1}{2} \times 6\frac{3}{4}$ ins. There are 75 of them, quadrille ruled, and, bound together in a strong spring-back binder, they form a handy, pocket-sized book which will be most useful for the collections of the young enthusiast in Philately.

The price is 2/6, postage 4d. extra.

OUR MAIL BAG

In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

E. W. Amos (Romford).—"Once more I must convey to you my gratitude for having introduced me to one who is now my best friend, though we have never met." Your friendship with your Paris correspondent is another instance of the splendid opportunities provided by the Meccano Guild Correspondence Club.

F. J. Catton (Wimbledon, S.W.20).—Your suggestion for further articles on locomotives that have made history is interesting. We have in preparation several splendid articles dealing with the development of famous types of locomotives.

F. S. Kydd (Arbroath).—"My father has retired from his job in the office so that he can have more time to read the '*M.M.*'"! We wish your father every happiness in his retirement, but we suspect that the "*M.M.*" is not the sole cause of his decision!

H. McLinden (Glasgow).—"Every month, on the first day, I run to Mother and ask for sixpence for the '*M.M.*'. She gives it to me, and I run as fast as my legs will let me go!" That is the right spirit, Hugo. We quite understand how you will have missed your twin sister and we hope that she is well again.

L. Temple (Colchester).—Your suggestion for articles on model power boats is interesting, but we are afraid that the subject is too specialised to appeal to the majority of our readers. An excellent paper dealing with this topic is "*The Model Yachtsman.*"

Miss P. Kirtland (Sidcup).—We are glad to hear of your continued enthusiasm for model-building. Your railway code is interesting, and should be particularly useful on an outdoor model railway. Let us know how your railway engineering schemes progress.

P. Willis (Manchester).—In spite of the evidence you quote, it is wrong to write "Walschaert's gear," because the name of the originator of this gear is "Walschaerts," ending in "s." Therefore, if an apostrophe is to be used at all, it must be after the "s."

P. Hampson (Lincoln).—"The wireless weather forecasts give me the creeps! Thank goodness there are no deep depressions in Meccanoland"! We do not think Meccanoland will ever be troubled with depressions. We are always able to report "a ridge of high pressure," because every day there is something new and interesting to be done.

G. Watson (Leek).—We are glad that you forgave your small brother for "collaring" your Meccano outfit while you were in hospital. Evidently he knows a good thing when he sees it! The "*M.M.*" seems to be becoming an important item in hospital treatment.

Mr. N. H. Bamforth (Ripley, Derby).—Your "Leyland" lorry must be a fine model and we should like to see a photograph of it. We are glad to know that this model has assisted you in attaining your present position. Engineers are realising more and more the practical nature of the Meccano system.

J. G. Howard (Dunedin, N.Z.).—"This letter will come to you like a voice from the dead!" You really scared us with this opening sentence, and we were relieved to find that all was well and that Meccano enthusiasm is indestructible. Your laboratory work must be interesting; tell us more about it.

J. Busey (Alaska, U.S.A.).—"I am one of the only two white boys here. I cannot get the other white boy away from aviation. I sold him an old Meccano set of mine and the only things he's built with it have been aeroplanes!" It is interesting to hear that Meccano has reached the wilds of Alaska. We should like to hear more of your life out there and of the hunting and fishing.

Mr. K. Aboul-Zahab (Beirut, Syria).—Successful competitors in "*M.M.*" contests are entitled to select any of the products of this firm, including the "*M.M.*" itself, to the amount of their prizes. We have not forgotten stamp competitions and we may reintroduce these before long.

A. Seddon (Darlington).—We are glad that the information we sent you regarding aviation helped you to win the debate and that you were complimented on your success. We are always pleased to help when possible.

H. Smithson (Haywards Heath).—We certainly receive vast numbers of letters, but they do not quite run into millions! Anyhow, your letter is welcome. You say you have just got a No. 4 Outfit and a bad cold; get rid of the cold but keep the outfit!

Charles Letts's Diaries

The issue of the extensive range of Letts's famous diaries for 1932 marks the 117th year of their publication. Among the samples we have received, a prominent place must be given to the Schoolboy's Diary, price 1/6. In addition to space for diary entries and personal notes, this contains valuable reference pages devoted to athletic records, and a variety of handy information for school use.

The Boy Scout's Diary, price 9d. (1/– with pencil), is on similar lines to previous issues and is invaluable to all interested in the Scout movement. The Wireless Diary, price 1/–, contains notes and information of real practical value, and the Motor Cycling Diary, 1/–, includes articles on licenses and taxation, the maintenance of machines, and other topics of interest. The diaries are well printed and produced in an attractive and durable form.

Hobbies New Annual

(George Newnes Ltd. 3/6 net)

This annual, which now makes its first appearance, has been written for boys who are interested in making things, and the articles in its 128 pages cover an astonishing range. The book is devoted to practical instruction on making working models of all kinds, with valuable hints on soldering, woodwork, wireless, easy printing with a simple but useful press, and many other attractive hobbies. The models dealt with include submarines, cameras, aeroplanes, electric motors, a miniature theatre, a boomerang, and others of equal interest; and instructions are given for making fascinating puzzles and animated toys of a very amusing character.

The book is entirely practical, every model described having been made and tested. The directions given are clear, and large numbers of working drawings are included. It is therefore unlikely that any boy will find difficulty in obtaining satisfactory results, but if necessary the advice of an expert on any knotty point may be obtained by simply writing to the publishers of the book. Another valuable feature of the annual is that none of the articles dealt with requires either elaborate equipment or costly materials.

After-Treatment in Photography

Although the really enthusiastic photographer refuses to admit that there is such a thing as a "close season" for photography, the fact remains that the majority of amateurs pack their photographic equipment away in September and forget about it until Easter of the following year.

There is much fun to be secured from photography during the winter months, however, without troubling to load one's camera. It is the best time of all to examine the previous season's crop of negatives. Probably there are many that proved disappointing, but which will so far respond to a little "doctoring" as to present prints worth preserving. A browse among the prints from last summer's snaps also will reveal many that might be improved by toning or staining. Seascapes or woodland scenes in sepia, or green or blue stainings, often are a great improvement on the simple black and white rendering given by a gaslight print. In a similar manner, brown tones are specially suitable for many architectural subjects. Red staining usually adds considerably to the effectiveness of camp fire, fireside or forge scenes.

Messrs. Burroughs Wellcome & Company, Snow Hill Buildings, London, E.C.1, have prepared an illustrated booklet entitled "*After-Treatment in Photography*," in which simple methods of improving poor negatives, and of colouring prints, are dealt with in detail. Readers who are interested may obtain this book free by applying to Messrs. Burroughs Wellcome & Company, at the same time mentioning the "*M.M.*"

A Glider for Home Construction

Gliding is rapidly increasing in popularity, and there are large numbers of young men all over the country who are keen on taking up the sport. Unfortunately, however, there are not yet enough clubs in existence to enable everyone to do so. In order to overcome this difficulty, B.A.C. Ltd., have designed a sailplane specially for home construction. This machine, which is known as the BAC IX, is simple to assemble, and when completed is a thoroughly practical and efficient glider. It affords a splendid opportunity for a youth, or a group of youths sharing the cost, to enter upon this fascinating sport. Those who are interested should write to B.A.C. Ltd., Lower Stone Street, Maidstone, Kent, enclosing 6d. in stamps for a brochure giving a full description of the sailplane and of the methods of payment.

It is interesting to note that the managing director of this firm, Mr. C. H. Lowe-Wyld, is the holder of the first British Glider Pilot's license. He recently made the first motorless flight across the Firth of Forth in a two-seater sailplane manufactured by B.A.C. Ltd., while on a similar type Mr. C. J. Longmore, one of the firm's pilots, looped the loop from a height of 600 ft. on 29th November, 1931. This is the first occasion on which this feat has been performed by a British glider pilot, and also the first on which it has been accomplished from an altitude of less than 1,000 ft.

What About Your Future?

ARE you content with the position you occupy now—with the money you are earning—or do you wish for something better and something more?

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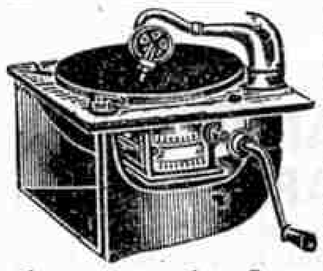

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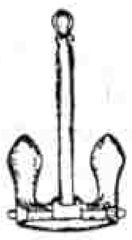

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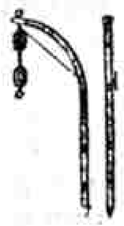

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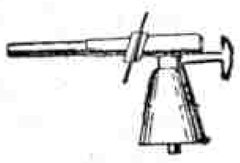

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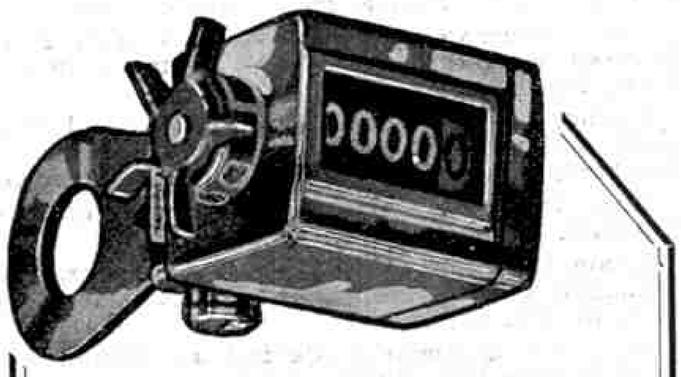

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Sale. Powerful Marklin 4–4–2 Loco. Excellent condition. Cost 39/6, sell 14/–. Apply—Young, 41, Nithsdale Road, Strathbunge, Glasgow.

Sale. "Meccano Magazines," 1925, except June and August, some coverless; 1926-1931 complete; "This England," April-October, 1930; "Kodak Magazines," June, 1930–December, 1931; all good condition. What offers?—K. Toon, 101, Howards Lane, Putney, S.W.15.

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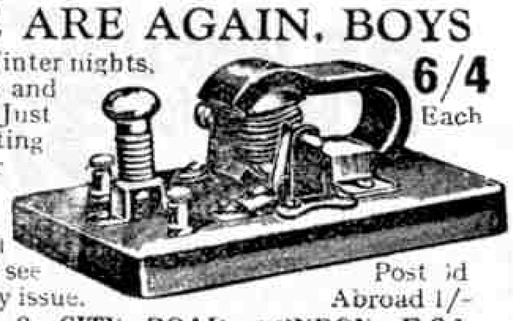

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Meccano Ltd., Old Swan, Liverpool

The Meccano Book of New Models

A copy of the "Meccano Book of New Models," described on page 130 of this issue, will keep any bright Meccano boy busy for months! The first section of the book is devoted to the best of the latest Meccano models, among which are a power press, flying boat, traffic control signal, tank locomotive, paddle steamer and steam shovel. Then follow pages of "New Meccano Mechanisms," representing the pick of the suggestions and ideas published recently in the "*M.M.*," described simply and clearly.

Another important section of the book shows some of the latest prize-winning models. These include a splendid model of the "*Flying Scotsman*" locomotive, a realistic triple-expansion marine engine, several ships, an old-type motor car, and the new Tyne Bridge. Finally there is a page of very valuable hints regarding the use of the new Meccano Parts.

No Meccano boy's library is complete without a copy of this book.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—

OLD SWAN, LIVERPOOL, ENGLAND.

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.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

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 cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (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., 34, St. Patrick St., Toronto.
UNITED STATES: Meccano Co. of America Inc., New Haven, Conn. Meccano Co. of America Inc., 200, Fifth Av., New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., P.O. Box 129, Auckland (Kingston Street).
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.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

Cinematograph Films. Lists Free. Sample 400 ft. length 2/–.—Eclipse Film Co., Edenthorpe, Doncaster.

Standard Cinema Films. Electric Cinemas Cheap. Bumper lists free.—Wayland, 109, Kenlor, Tooting.

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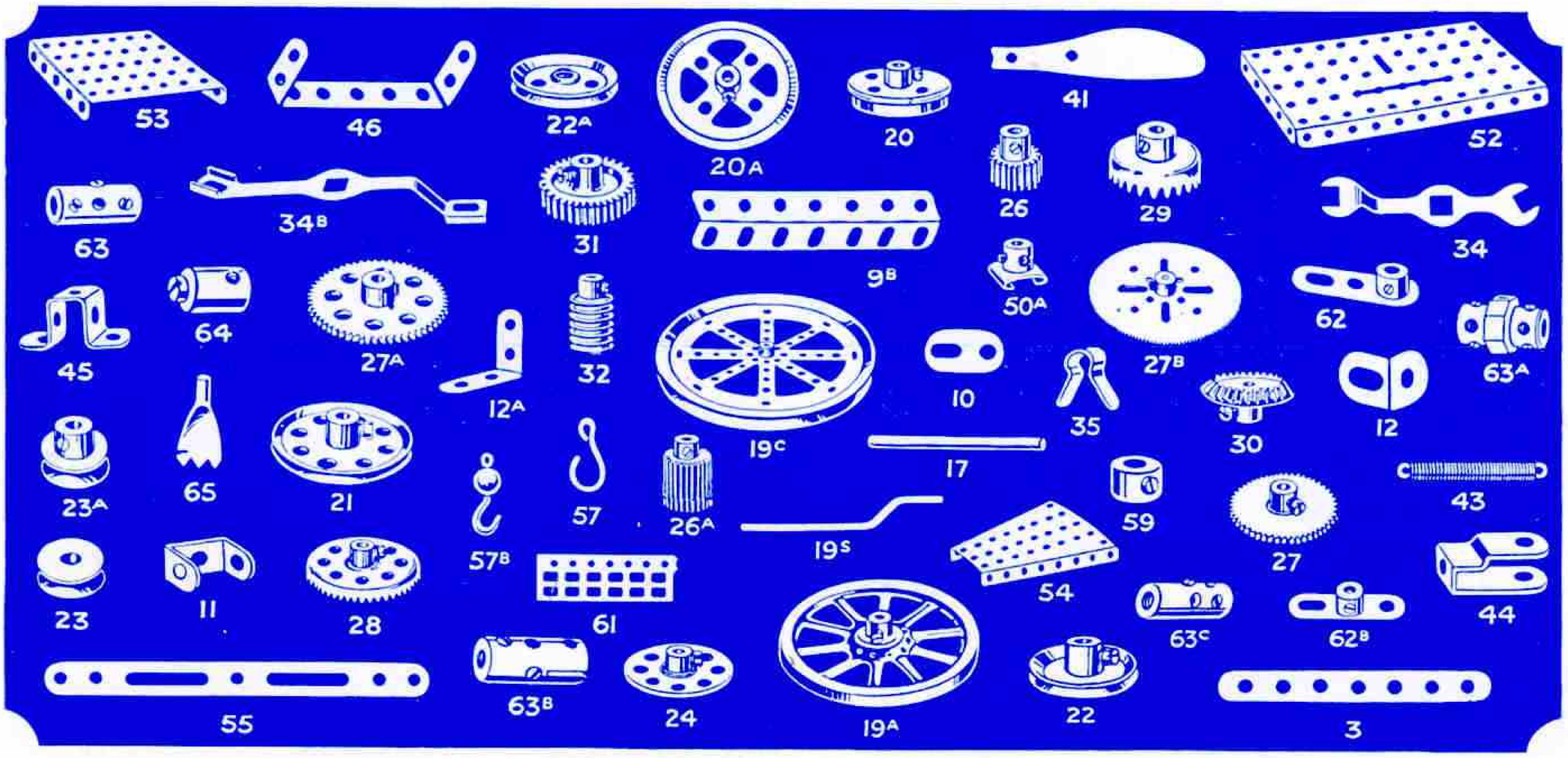
PARTS & ACCESSORIES



No.		s.	d.
1.	Perforated Strips, 12½" long ... ... ½ doz.	1	0
1a.	" " 9½" " ... ... "	0	9
1b.	" " 7½" " ... ... "	0	8
2.	" " 5½" " ... ... "	0	6
2a.	" " 4½" " ... ... "	0	5
3.	" " 3½" " ... ... "	0	4
4.	" " 3" " ... ... "	0	3
5.	" " 2½" " ... ... "	0	3
6.	" " 2" " ... ... "	0	3
6a.	" " 1½" " ... ... "	0	3
7.	Angle Girders, 24½" long ... ... each	0	8
7a.	" " 12½" " ... ... "	0	6
8.	" " 12½" " ... ... ½ doz.	1	9
8a.	" " 9½" " ... ... "	1	3
8b.	" " 7½" " ... ... "	1	2
9.	" " 5½" " ... ... "	1	0
9a.	" " 4½" " ... ... "	0	10
9b.	" " 3½" " ... ... "	0	8
9c.	" " 3" " ... ... "	0	8
9d.	" " 2½" " ... ... "	0	7
9e.	" " 2" " ... ... "	0	6
9f.	" " 1½" " ... ... "	0	6
10.	Flat Brackets ... ... "	0	2
11.	Double Brackets ... ... each	0	1
12.	Angle Brackets, ½"×½" ... ... doz.	0	3
12a.	" " 1"×1" ... ... ½ doz.	0	4
12b.	" " 1"×½" ... ... "	0	3
13.	Axle Rods, 11½" long ... ... each	0	2
13a.	" " 8" " ... ... "	0	2
14.	" " 6½" " ... ... "	0	1
15.	" " 5" " ... ... "	0	1
15a.	" " 4½" " ... ... 2 for	0	1
16.	" " 3½" " ... ... "	0	1
16a.	" " 2½" " ... ... "	0	1
16b.	" " 3" " ... ... "	0	1
17.	" " 2" " ... ... 3 for	0	1
18a.	" " 1½" " ... ... "	0	1
18b.	" " 1" " ... ... "	0	1
19.	Crank Handles, Large ... ... each	0	2
19s.	" " Small ... ... "	0	2
19a.	Wheels, 3" diam., with set screws "	0	6
20.	Flanged Wheels, 1¼" diam. ... ... "	0	5
20b.	" " 1" " ... ... "	0	4

No.		s.	d.
	Pulley Wheels		
19b.	3" dia. with centre boss and set screw each	0	7
19c.	6" " " " " " "	2	0
20a.	2" " " " " " "	0	5
21.	1½" " " " " " "	0	4
22.	1" " " " " " "	0	3
23a.	½" " " " " " "	0	3
22a.	1" " without " " " "	0	2
23.	½" " " " " " "	0	2
24.	Bush Wheels ... ... "	0	4
25.	Pinion Wheels, ¾" diam., ½" wide "	0	6
25a.	" " ¾" " ⅝" " "	0	8
25b.	" " ¾" " ½" " "	0	10
26.	" " ½" " ½" " "	0	4
26a.	" " ½" " ⅝" " "	0	6
26b.	" " ½" " ¾" " "	0	8
	Gear Wheels		
27.	50 teeth to gear with ¾" pinion ... "	0	6
27a.	57 " " " ½" " ... "	0	6
27b.	133 " " " ½" " (3½" diam.) "	1	3
27c.	95 " 2½" diam. ... ... "	1	0
28.	Contrate Wheels, 1½" diam. ... ... "	0	9
29.	" " ¾" " ... ... "	0	6
30.	Bevel Gears, ½", 26 teeth ... ... "	0	9
30a.	" " ½", 16 " } *can only be* "	0	6
30c.	" " 1½", 48 " } *used together* "	1	6
31.	Gear Wheels, 1", 38 teeth ... ... "	1	0
32.	Worms ... ... "	0	5
34.	Spanners ... ... "	0	2
34b.	Box Spanners ... ... "	0	4
35.	Spring Clips ... ... per box (doz.)	0	3
35f.	" " ... ... " (50)	0	9
36.	Screw Drivers ... ... each	0	3
36a.	" " Extra Long ... ... "	0	6
36b.	" " Special ... ... "	1	0
37.	Nuts and Bolts, 7/32" ... per box (doz.)	0	3
37a.	" ... ... " "	0	2
37af.	" ... ... " (50)	0	7
37b.	Bolts, 7/32" ... ... " (doz.)	0	2
37bf.	" " ... ... " (50)	0	7
37f.	Nuts and Bolts, 7/32" ... " (50)	1	0
37g.	" " " ... " (144)	2	9
38.	Washers ... ... (doz.)	0	1
38f.	" ... ... per box (50)	0	3

No.		s.	d.
40.	Hanks of Cord ... ... 2 for	0	3
41.	Propeller Blades ... ...per pair	0	4
43.	Springs ... ... each	0	2
44.	Cranked Bent Strips ... ... "	0	1
45.	Double " " ... ... "	0	1
46.	Double Angle Strips, 2½"×1" ... ½ doz.	0	6
47.	" " " 2½"×1½" ... "	0	9
47a.	" " " 3" ×1½" ... "	0	10
48.	" " " 1½" ×½" ... "	0	4
48a.	" " " 2½" ×½" ... "	0	5
48b.	" " " 3½" ×½" ... "	0	6
48c.	" " " 4½" ×½" ... "	0	9
48d.	" " " 5½" ×½" ... "	0	9
50a.	Eye Pieces, with boss ... ... each	0	4
52.	Perforated Flanged Plates, 5½"×2½" "	0	5
52a.	Flat Plates, 5½"×3½" ... ... "	0	5
53.	Perforated Flanged Plates, 3½"×2½" "	0	3
53a.	Flat Plates, 4½"×2½" ... ... "	0	3
54.	Perforated Flanged Sector Plates "	0	3
55.	" Strips, slotted, 5½" long "	0	2
55a	" " 2" " "	0	1
56h	Instruction Manuals, No. 00–4 ... "	1	9
*56j	" " No. 5–7 ... "	1	6
56c.	Meccano Standard Mechanisms Manuals..	1	0
56d.	" Book of New Models ... "	0	9
56f.	" Bound Manuals ... ... "	6	6
57.	Hooks ... ... 2 for	0	1
57a.	" Scientific ... ... each	0	1
57b.	" Loaded ... ... "	0	3
58.	Spring Cord ... ... per length	0	9
58a.	Coupling Screws for Spring Cord ... doz.	0	6
58b.	Coupling Hooks for Spring Cord ... each	0	1
59.	Collars with Set Screws ... ... 2 for	0	3
61.	Windmill Sails ... ... 4 for	0	6
62.	Cranks ... ... each	0	3
62a.	Threaded Cranks ... ... "	0	4
62b.	Double Arm Cranks ... ... "	0	3
63.	Couplings ... ... "	0	6
63a.	Octagonal Couplings ... ... "	0	8
63b.	Strip Couplings ... ... "	0	8
63c.	Threaded Couplings ... ... "	0	6
64.	" Bosses ... ... "	0	2
65.	Centre Forks ... ... "	0	1

*Details and prices of the complete range of Meccano Manuals may be obtained from any Meccano dealer.

The Meccano system is composed of some 250 real engineering parts, mostly made of steel or brass, each one of which has a definite mechanical purpose. These parts combine to form a complete miniature engineering system that enables practically any movement known in mechanics to be duplicated. A group of the parts from No. 1 to No. 65 is listed above.

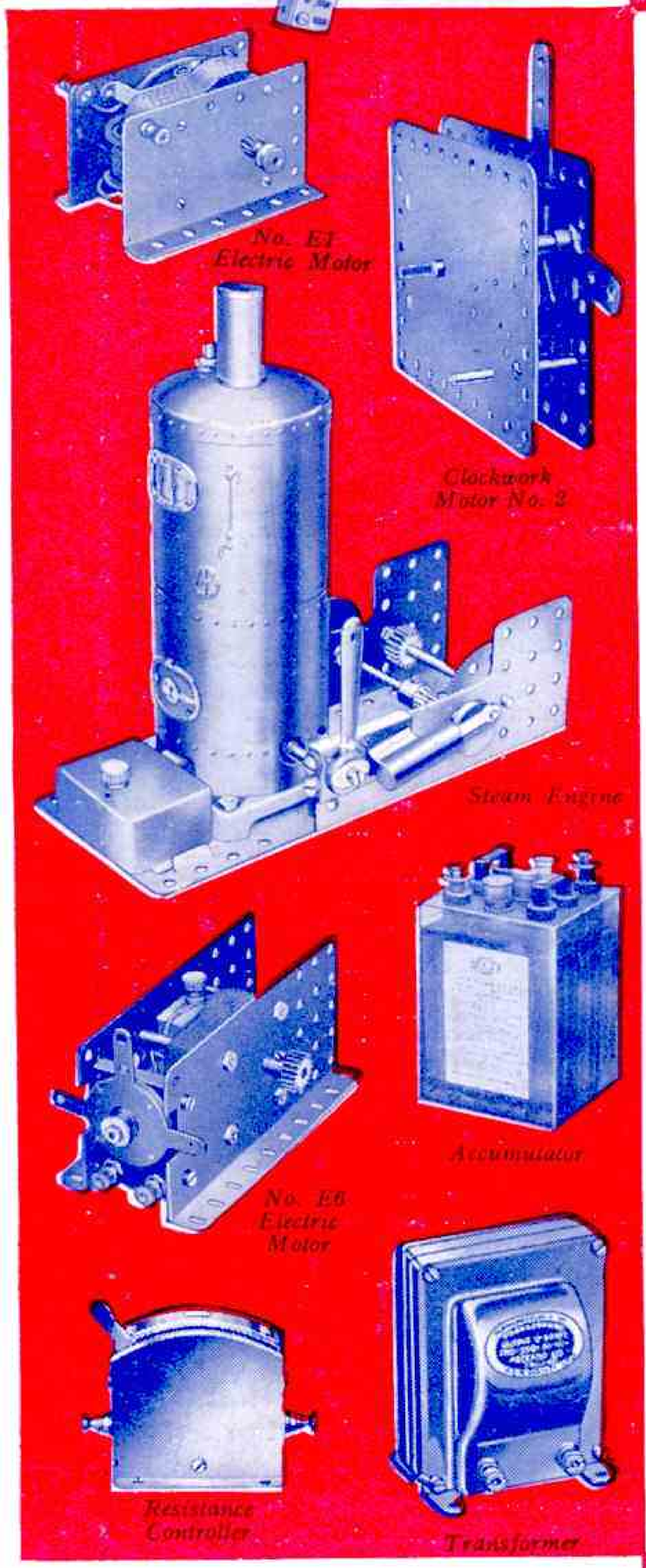
New parts are always being invented in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual practice.

A complete list of all the parts in the system may be obtained from any Meccano dealer on application.

MECCANO LTD. — Binns Road — Old Swan — LIVERPOOL

Run your Model with a Meccano Power Unit

This is a splendid Meccano model of the Bennie "Railplane," the invention of Mr. George Bennie of Glasgow. The Railplane system of transport makes use of cars suspended from an overhead structure and propelled at high speed by means of aircrews.



Building a Meccano model is the greatest fun in the world. Excitement increases steadily as the model grows, part by part, under your hands. Finally there comes the greatest thrill of all. You connect your completed Crane, Motor Chassis or Traction Engine to a Meccano Motor or Steam Engine, and see it work in exactly the same manner as the real thing!

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. The side plates and bases are pierced with the standard Meccano equidistant holes, which enables a motor or engine to be built into any Meccano model in the exact position required.

Particulars and prices of the Steam Engine, Motors and various Accessories are given below.

MECCANO ELECTRIC MOTOR E1 (6-volt)

This is a highly efficient electric motor (non-reversing) that will give excellent service. A 6-volt Accumulator will operate it, but it may also be driven from the mains (alternating current only) through the 6-volt transformer described below. Price **7/6**

MECCANO ELECTRIC MOTOR No. E6 (6-volt)

This powerful and reliable 6-volt Motor may be run from a 6-volt accumulator or, by employing the 6-volt transformer described below, from the main. It is fitted with a control mechanism that enables the motor to be started, stopped or reversed as desired. Price **15/6**

NOTE—The above Electric Motors will not run satisfactorily from dry cells.

MECCANO ACCUMULATOR (6-volt, 20 Amps.)

The Meccano Accumulator is of substantial construction and is specially recommended for running the Meccano 6-volt Electric Motors. Price **28/6**

TRANSFORMER

By means of this transformer the Meccano 6-volt Electric Motors may be driven from the main supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Price **22/6**

MECCANO RESISTANCE CONTROLLER

By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. Price **4/6**

MECCANO CLOCKWORK MOTOR No. 1 (Non-reversing

A long-running and highly efficient clockwork motor (non-reversing), fitted with brake lever. Price **5/-**

MECCANO CLOCKWORK MOTOR No. 2 (Reversing

This strongly-built reversing clockwork motor is a compact self-contained power unit. An efficient governor controls the powerful spring that is fitted on the motor, and ensures a long steady run at each winding. Price **10/-**

MECCANO STEAM ENGINE

On actual test this powerful steam unit has lifted over 56 lbs. A single cylinder of the oscillating type is employed, steam being admitted to it through a special reversing block. Operation of the reversing lever enables the crankshaft to run in either direction. The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risk of the spirit becoming heated. Price **25/-**

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