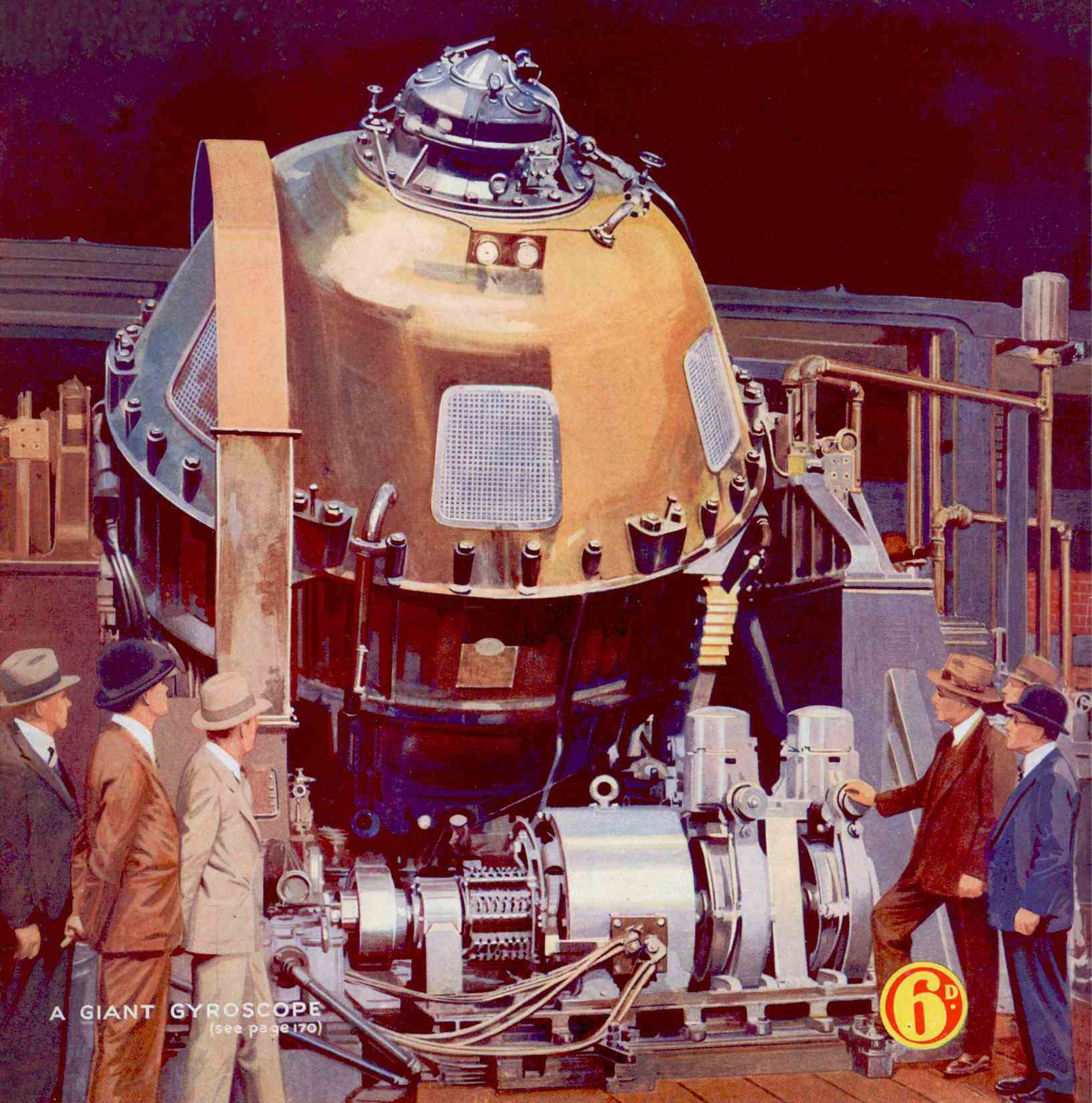
VOL. XVII. No.3 MARCH 1932

MECCANO MAGAZINE



A GIANT GYROSCOPE
(see page 170)

6D.



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MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool
England

Vol. XVII. No. 3
March, 1932

With the Editor

The British Industries Fair

The British Industries Fair has always been remarkably successful as a demonstration of the widespread activities of British industry, but this year it has surpassed all previous efforts. The number of exhibitors and the range of their products both show remarkable advances. This year's Fair comes at a time when British industry is passing through more serious difficulties than it has ever before encountered. Happily there are now signs of an upward tendency in trade, and the Fair should play an important part in speeding-up this movement. The "Buy British" campaign inaugurated towards the close of last year has had the effect of drawing our attention to the enormous range of British-made goods, and the Fair has completed the process. With this new knowledge of our industrial strength we shall be able to face world competition in a spirit of complete confidence.

Readers who have visited the Birmingham section of the Fair will not have failed to inspect the magnificent Meccano model of the huge lorry and trailer that recently transported a 99¼-ton girder through the streets of London. This model, which has aroused widespread admiration among the engineers who have examined it, is illustrated on page 185 of this issue.

Sir Alfred Yarrow

The passing of Sir Alfred Yarrow at the age of 90 brings to an end a long and active career as an inventor and shipbuilder. Sir Alfred was born on 13th January, 1842, and like many other famous inventors of the past century he became interested in engineering at a very early age. His first invention was a steam plough produced at the age of 18. This plough played a decisive part in Yarrow's life, for it was so successful that he was able to sell the rights to a manufacturer, who employed him to push its sale in London. The salary paid for this responsible work was only £100 a year, but the money saved out of it enabled the youthful inventor later to set up in business for himself as an engineer and shipbuilder. At first he was unsuccessful, but after a hard struggle for two years he began to build steam launches and almost immediately became famous. Subsequently he turned his attention to other types of vessels, and first from his yard on the Thames, and later from that on the Clyde to which he removed in 1906, there came a constant stream of highly efficient river steamers and torpedo boats. He also invented the famous Yarrow water-tube boiler, and I hope to tell the full story of this and of his other activities in an early issue of the *"M.M."*

It is interesting to note that Sir Alfred Yarrow formed a link between the days of the stage coach and those of air transport. When he was born the stage coaches were regular means of transport and railways were new, but he lived to fly over London in an Imperial Airways machine when he was 88 years of age. He was so greatly impressed by the wonderful advantages of this new means of transport that only two months later he made an air tour of Europe in a three-engined monoplane, covering a distance of more than 3,000 miles.



Dr. W. S. Bruce. We reproduce this photograph by courtesy of Dr. R. N. Rudmose Brown, of Sheffield University.

Across the Antarctic Continent

The interesting announcement was made recently that a British expedition is to attempt to cross the Antarctic continent. The enterprise is being planned by Mr. Hubert G. Watkins, the leader of the British Air Route Expedition of 1930-31 to Greenland, who is only 25 years of age. Mr. Watkins proposes to land on the shore of the Weddell Sea, and after wintering there to set out on a march of 1,400 miles to the great Ice Barrier in the Ross Sea. It is fitting that a British expedition should attempt such a march, for the idea originated with a British explorer, and the only effort so far made to carry it out was due to Sir Ernest Shackleton.

The proposal came from Dr. W. S. Bruce, a Scottish explorer who made his first visit to the Antarctic in 1892. Dr. Bruce was so keen on Polar work that on his return he did not rest until he had found support for an expedition to explore the uncharted seas beyond South Georgia, the bleak island that is now a centre of the whale oil industry. In two long cruises in Antarctic waters, Dr. Bruce surveyed 4,000 miles of unexplored ocean, and in 1904 he discovered new land on the eastern shore of the dreaded Weddell Sea. To his discovery he gave the name of Coats Land, and then it became his ambition to explore it more thoroughly, and eventually to march right across the South Pole to the opposite shore of the Antarctic continent. This was a daring proposal, for the Pole had not then been reached. Unfortunately he could not raise sufficient funds to attempt the feat and had to be content with accompanying an expedition to Spitzbergen. There he stayed for a considerable time, and helped in the development of the coal mines that now form the island's chief industry.

In the meantime Sir Ernest Shackleton, the hero of the great march towards the South Pole described in the *"M.M."* for June last year, had turned his eyes toward the Weddell Sea, and Dr. Bruce agreed to leave the field to him. Sir Ernest went south in the "*Endurance*" in 1914, and the story of his adventures is told in our issue of July, 1931. Ice conditions in the Weddell Sea were very severe that year, and after he had discovered a southward extension of Coats Land his vessel was nipped in the ice and overwhelmed, After desperate adventures he and his men reached Elephant Island, a bleak place on the edge of the ice pack, and there most of the crew remained, starving and almost shelterless. Their leader set out on a perilous voyage to South Georgia for assistance and they were rescued four months later.

To-day more is known of conditions in the Weddell Sea than was available to Bruce or Shackleton, and Mr. Watkins also will be able to use aeroplanes to survey Coats Land and to plan the early stages of his route. In order to avoid travelling over ground that has already been covered he does not intend to march across the Pole, but will pursue a course to King Edward VII Land, which was discovered by Captain Scott in 1901. This course will cover a vast stretch of land that is at present entirely unknown, and should help to solve many of the problems of the frozen continent that surrounds the South Pole.

Gyro-Stabilisers for Ships

Steadying Vessels in Rough Seas

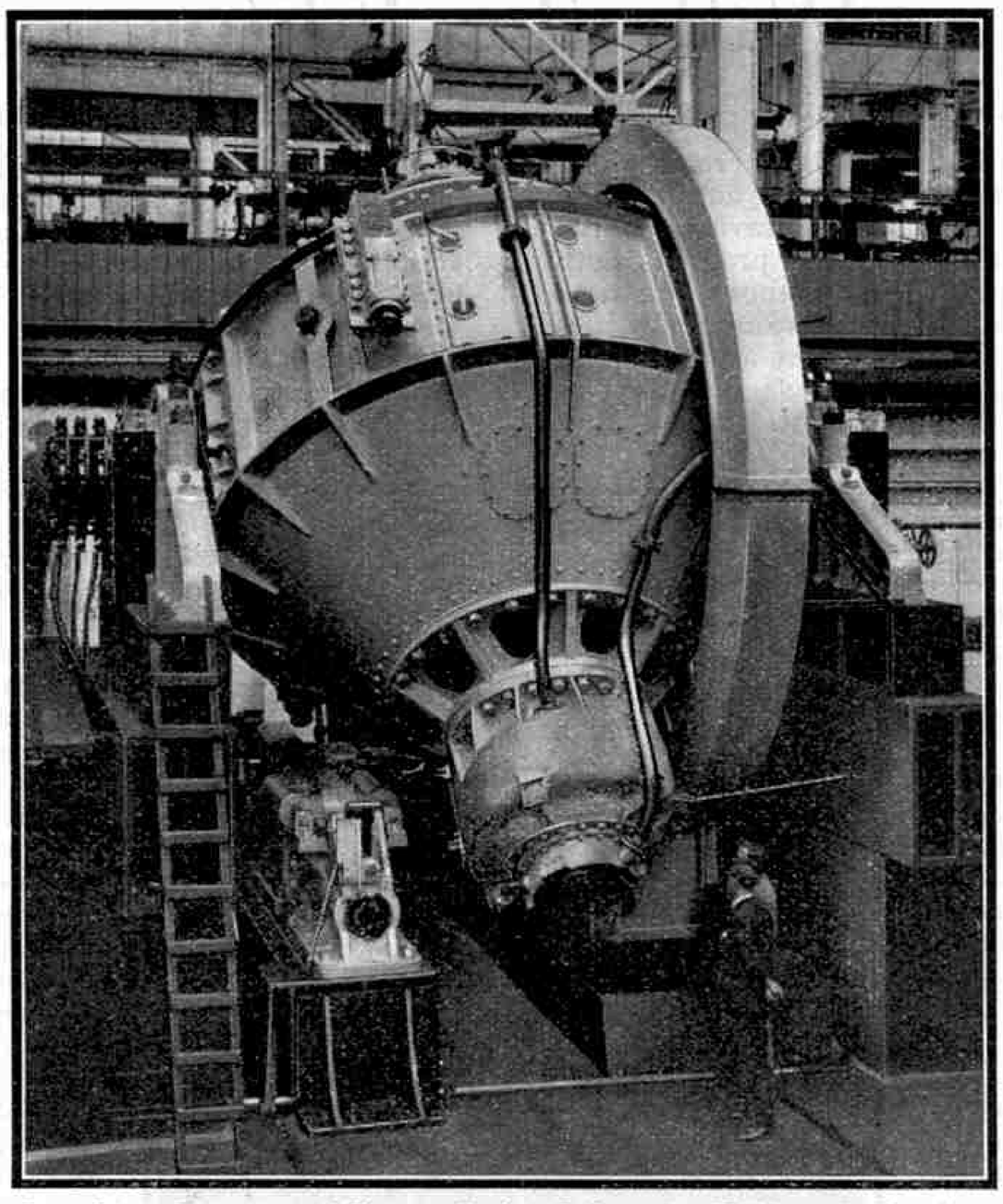
THE steadiness of vessels in a seaway is of the greatest importance from many points of view. The most obvious is that of the seasick passenger. There seems to be some doubt whether pitching or rolling is chiefly responsible for seasickness, but any means of reducing rolling undoubtedly would help to bring relief to those who find it necessary to make voyages overseas, and are not "good sailors," to use the customary expression. A reduction in the rolling powers of vessels also would be welcomed by members of engine room staffs, by those responsible for stowing cargo, and in fact, by all who are concerned with ships in any capacity. In addition, a successful device for this purpose would be appreciated in warships, for a vessel rolling only slightly would form a steady platform for heavy guns, and increased accuracy of fire would follow its introduction; while the employment of means of preventing rolling of aircraft carriers would greatly lighten the task of the pilot of an aeroplane alighting on one of these floating aerodromes.

Many inventors have suggested schemes for preventing the rolling of vessels at sea. One of the earliest of these was Sir Henry Bessemer, the inventor of the process of steel-making known by his name. Bessemer's idea was to build passenger accommodation separately from the rest of a vessel and to suspend it from the hull by means of trunnions mounted on an axis running fore and aft. He hoped that the inner section of such a vessel would remain more or less horizontal, even when the hull in which it was suspended rolled violently. An experimental vessel was not a success, however, although the inventor tried to use hydraulic control in order to keep the suspended portion of the vessel level in rough weather.

A more practicable device than that of Bessemer was invented by an engineer called Frahm, who introduced what he called "anti-rolling tanks" for the purpose of checking this kind of movement. These tanks are placed at the sides of the vessel in which the device is employed and are connected by means of pipes. Water in the tanks flows from side to side as the vessel rolls, but the liquid always moves later than the hull and its weight therefore opposes the rolling movement. The Frahm anti-rolling tanks do not prevent rolling altogether, but they reduce it to a considerable extent, and they have been installed in many vessels, including the *"Bremen"* and the *"Europa,"* the fastest liners now afloat.

Many inventors also have tried to make use of the gyroscope to check the rolling of vessels. The most successful of these was the American Dr. Elmer A. Sperry, who invented the gyroscopic compass and many other invaluable devices of a similar character. The earliest Sperry gyro-stabilisers were installed in pleasure yachts and proved remarkably successful in keeping rolling within reasonable limits, enabling vessels of this class to weather Atlantic storms without taking a drop of water aboard or causing passengers to miss a meal.

Larger vessels also have been equipped with Sperry gyro-stabilisers, and our cover this month shows a giant one built for the steam yacht *"Savarona."* This vessel has a displacement of 5,600 tons and is the largest yacht in the world. The gyro-stabiliser fitted to it has a gyro wheel 11 ft. in circumference and nearly 50 tons in weight. When it was installed it was expected to restrict rolling to within two degrees of each side of the upright position, and it is reported to have been very effective in stormy weather encountered by the *"Savarona"* during a passage across the North Sea.



One of the three gyro-stabilisers to be installed on the 45,000-ton Italian liner "Conte di Savoia." For our photograph, and for the diagram below, we are indebted to the Sperry Gyroscope Company Ltd.

Other vessels on which stabilisers have been installed are the *"Pigafetta,"* a 2,000-ton Italian destroyer leader, and the *"Hosho,"* a Japanese aircraft carrier of 10,000 tons. Both installations have given complete satisfaction, and it is clear that the system devised by Sperry more nearly gives stability than any other yet suggested. It is now to be tried in the *"Conte di Savoia,"* the 45,000-ton Italian liner launched last year at Trieste. As mentioned on page 15 of the *"M.M."* for January, 1932, three gigantic stabilisers are being installed in this vessel. They have been made by Vickers-Armstrongs Ltd., Barrow, under the supervision of the Sperry Gyroscope Company Ltd., the electrical portions being supplied by the Metropolitan-Vickers Electrical Company Ltd. If they are successful in preventing rolling, the example of the Italian ship-owners responsible for their use no doubt will be followed by the owners of other luxury liners, and it may almost be said that a new era in sea travel then will begin.

The central feature of a gyroscope, whatever the purpose for which it is designed, is a flywheel with a very heavy rim that may be rotated at high speed. The axis of such a giant spinning top tends to retain its original direction in space, and all efforts to alter this direction are strongly opposed. The wheel behaves in a very curious manner when interfered with, however, and the gyro-stabiliser makes effective use of this behaviour. The diagram (Fig. 1) reproduced on this page will help to explain how it does this. It shows a heavy horizontal wheel that is supposed to be rotating at high speed in the direction shown by the arrow M. Any attempt to push away the upper end A of its shaft would be strongly resisted, and at the same time the wheel would turn in the direction indicated by the arrows N and L. Efforts to bring A forward would be followed by a turning movement in the opposite direction.

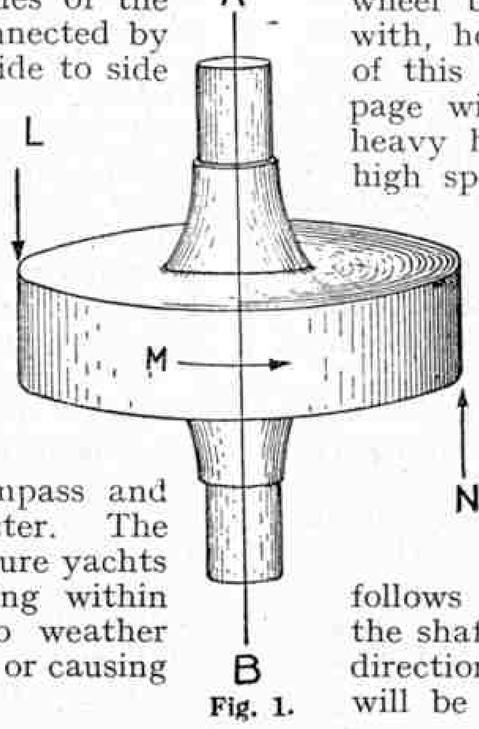
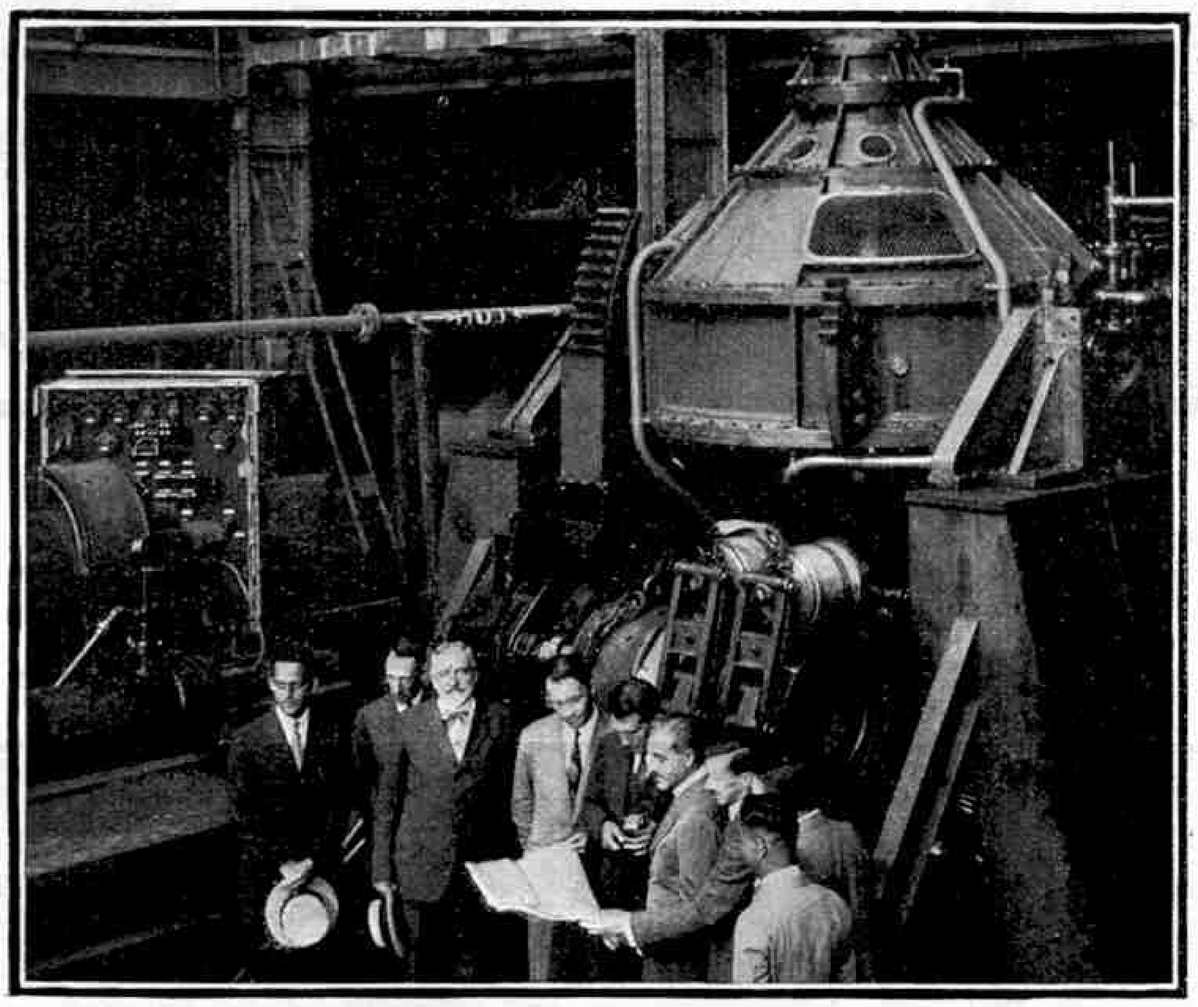


Fig. 1.

The rotor of a gyro-stabiliser installed in a ship is horizontal and is mounted in a casing with supporting bearings across the vessel, or athwartship. If the shaft of the rotating wheel is tilted forward, therefore, the turning movement that follows will be communicated to the vessel, while tilting the shaft aft will cause movement of the ship in the opposite direction. A gyro-stabiliser installed in a vessel therefore will be effective if its rotor is so heavy and powerful that

its turning movement is sufficient to prevent the ship from rolling, and if a system is devised whereby the axis is tilted forward when the ship rolls in one direction and aft when she rolls in the other.

By imagining the heavy wheel shown in the figure on page 170 to be mounted in a vessel, and supposing the view to be that seen from a position aft, it will be realised that the upper end of the axis must be tipped forward to counteract a roll to starboard, and aft to prevent rolling to port. In the Sperry gyro-stabiliser these movements are brought about in a very ingenious manner, the beginning of a roll setting the giant spinning top in action. The chief agent in this is a small and very sensitive gyroscope consisting of a rotor mounted in much the same manner as that of the stabiliser itself, but placed with its axis athwartship. When the roll commences this axis is tilted, and the gyroscope then turns in the peculiar manner already described. This has the effect of closing a switch that supplies current to a direct current motor geared to a toothed ring surrounding the casing of the gyro-stabiliser. The motor immediately springs to life and tilts the axis of the rotor of the stabiliser in the required direction. A roll in the opposite direction closes other contacts that cause the direct current motor to rotate in the opposite direction, and thus to tilt the stabiliser in the opposite sense.



Naval officers and engineers inspecting the stabiliser built for the Italian destroyer leader "Pigafetta." This photograph and the one below are reproduced by courtesy of the Westinghouse Electric Company.

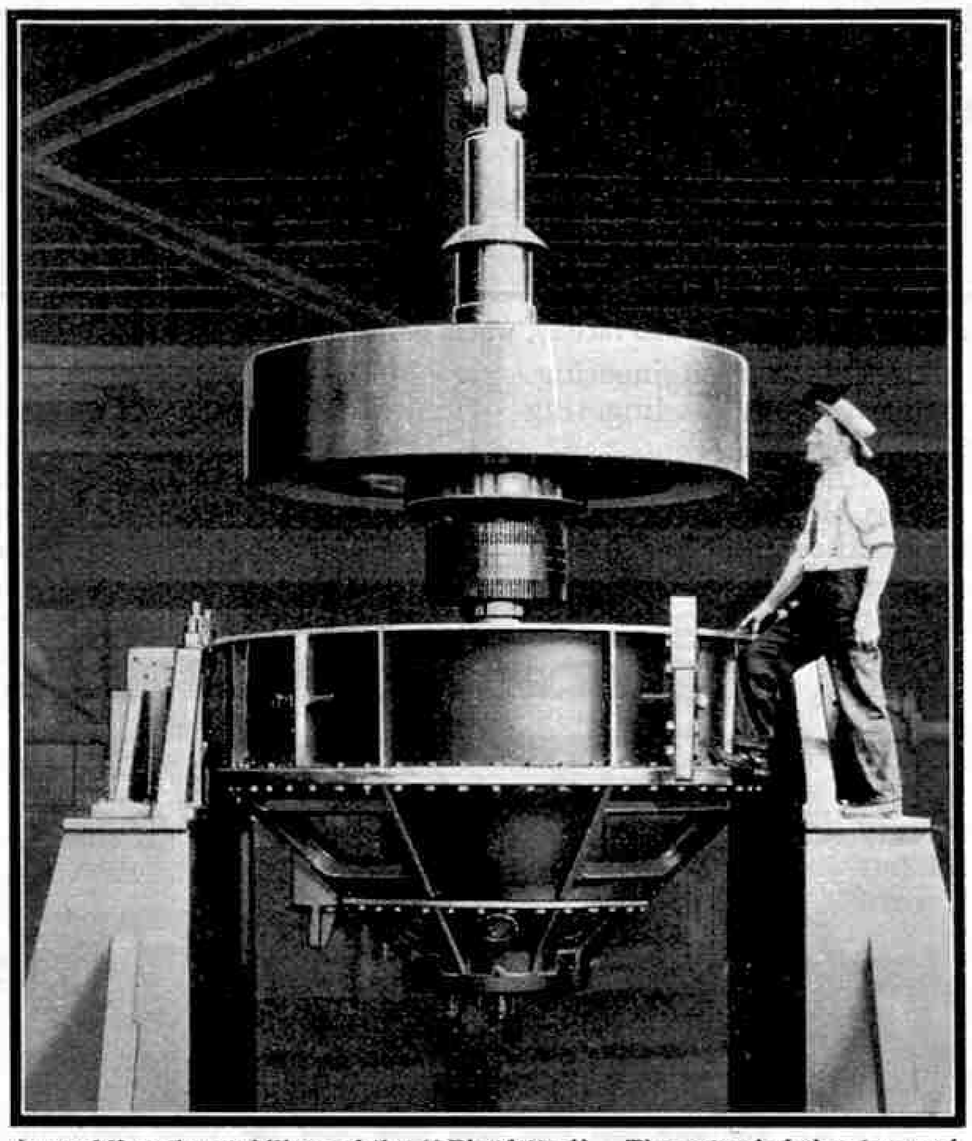
It will be seen that the small gyroscope acts as a trigger, bringing the stabiliser into action when required. The stabiliser itself has a range of movement of 60° forward and 60° backward, and the whole range of 120° may be covered in from 8 to 18 seconds. The anti-rolling force comes into play immediately the forward or aft movement of the gyro-stabiliser begins, and as the control gyroscope acts less than a quarter of a second after the sideways movement commences, a roll is checked long before it becomes really noticeable. In trials carried out in rough weather with a vessel of 1,200 tons, the greatest roll experienced was one of only 3°, but heavy rolling commenced immediately the stabiliser was put out of action, the vessel swinging violently from side to side until it heeled over at an angle of 37°, and in one instance of as much as 44°.

The rolling of a vessel in a heavy sea is not due to the pounding of the waves on her sides, as is often supposed, but is caused by the rise and fall of the water, first on one side and then on the other. A single wave causes a small roll, and larger movements are due to the building-up action of a series of waves. The gyro-stabiliser checks the development of heavy rolling by limiting the effect of the wave that begins the movement. A vessel that is held steady in a seaway by this means is subject to less strain than one that heels over at large angles, for she simply rises and falls with the waves, which do not break violently against her as they do on rigid blocks of masonry, such as sea walls. This is shown by the absence of the creaks and groans that are so commonly heard on ships. In addition, the steadiness of a stabilised vessel enables her to be steered more accurately and easily, and less engine power is wasted; while a higher average speed may be maintained in rough weather.

The action of a gyro-stabiliser has been likened to that of moving a weight across the deck of a vessel in order to counteract the rolling, but it takes place silently and smoothly, for the necessary force is applied gently and is only just sufficient to bring about the desired effect. The power exerted by a stabiliser is proportional to the amount of roll, and by checking a roll at its very commencement the necessity for a tremendous effort to right the vessel is avoided.

The size of a gyro-stabiliser depends on that of the vessel in which it is to be installed. That of the *"Savarona"* shown on our cover weighs nearly 110 tons, and the vessel in which it is fitted is one of 5,600 tons displacement. The rotor itself weighs 45 tons, as already mentioned, and makes 930 r.p.m., being driven by a 200 h.p. electric motor. It is so accurately balanced that it would continue to run for more than two hours after cutting off the power, and the motor that tilts it at the bidding of the control gyroscope is itself of 75 h.p.

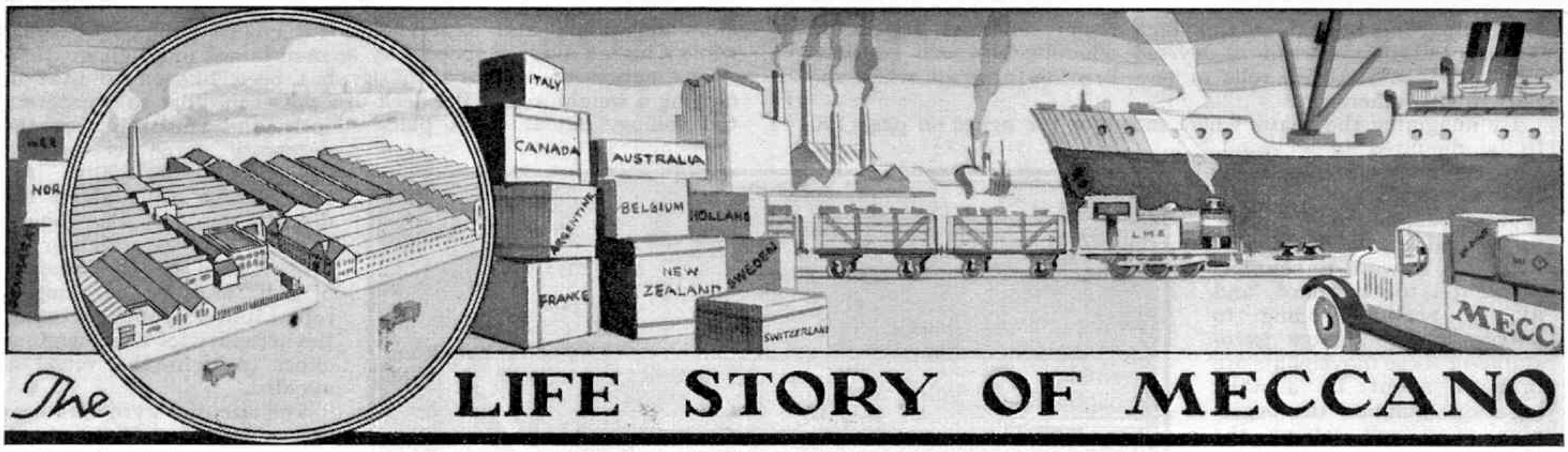
The *"Conte di Savoia"* is much larger than the *"Savarona,"* and therefore requires a heavier gyro-stabiliser. Actually three separate stabilisers are to be employed in this vessel and the rotor of each is 13 ft. in diameter and weighs 100 tons. The usual working speed of these spinning wheels is to be 800 r.p.m., but in very bad weather this may be increased to 910 r.p.m., and their circumferences will then whirl round with a velocity of 422 m.p.h. or about 15 m.p.h. in excess of the world's record seaplane speed. They are so finely balanced that they continue to run for about four hours when the power is cut off, but an electrical brake reduces this to little less than an hour; while their huge weight makes it necessary to allow a period of from 80 min. to 90 min. to work up to full speed when starting from rest. Separate control gyroscopes are provided for the three stabilisers, and their rotors have speeds of 6,000 r.p.m.



Assembling the stabiliser of the "Pigafetta." The rotor is being lowered into position.

It is interesting to know that the axes of these gyro-stabilisers were not tilted during their running trials at Barrow, for it was doubtful if the foundations of the shop in which they were erected were strong enough to withstand the powerful thrusts that would have been exerted! It is calculated that the forces on the bearings of each stabiliser when in action may be from 42 tons to 109 tons, according to the speed of the rotor and the rate at which its axis is tilted; and the combined efforts of the three stabilisers are expected to be sufficient to prevent the vessel from rolling.

Although the chief purpose of a gyro-stabiliser is to keep the vessel in which it is fitted on an even keel, it also may be used to cause a ship to heel over when necessary in backing off a sandbank or in other circumstances where an artificial roll is likely to be of use. This is done by reversing its action when the rotor is running at low speed. The power to produce a roll in this manner is particularly useful in war vessels, for by this means the angle of elevation of the guns may be increased and their range lengthened.

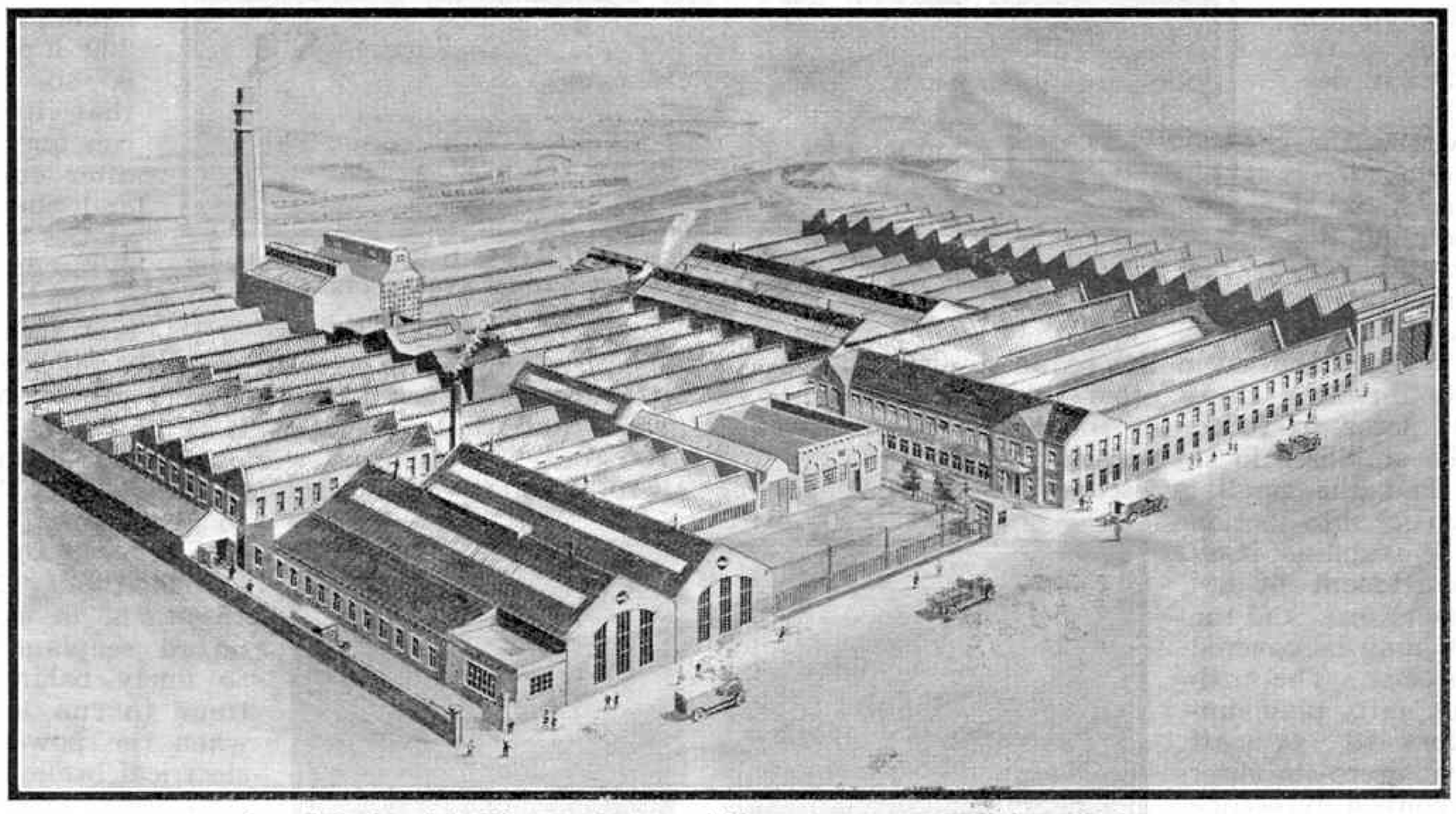


The LIFE STORY OF MECCANO

By Frank Hornby

THE output from my first factory was of course small at its best, but nevertheless Meccano began to attract much attention.

I received gratifying letters from boys and from parents in every part of the country, and these gave me a great deal of encouragement at a time when I badly needed it. By this time I had begun to describe Meccano as "Real Engineering for Boys," and in order to make quite certain that I was justified in doing so I submitted outfits to some of the leading engineers and professors of engineering. Their replies surpassed all my expectations. Each expert expressed the utmost interest and pleasure in the invention, and assured me that I was working on correct engineering principles, so that any boy who followed the hobby enthusiastically and intelligently would inevitably acquire a sound knowledge of real engineering. These favourable opinions scattered to the winds my last lingering doubts and filled me with renewed energy.

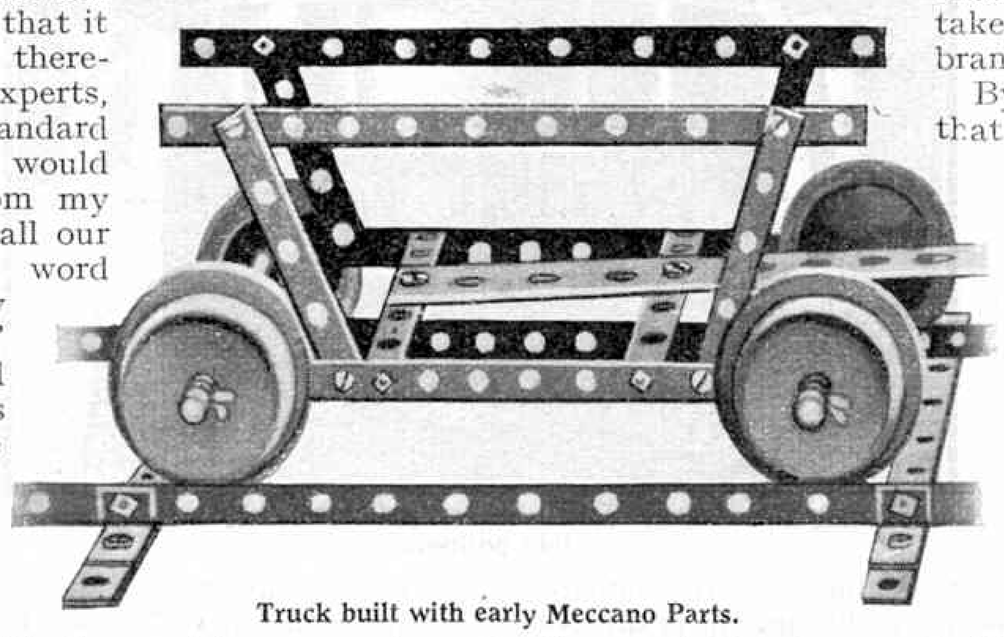


An aerial view of the Meccano factory, which now covers an area of nearly five acres.

I had supplied a Manual of Instructions with every Outfit from the very beginning. The first edition of this Manual was printed hurriedly and with little thought for appearance, my sole object being to have it ready in time for inclusion in the first outfits. I now began to feel that this Manual was not good enough for the purpose, and also that it was not distinctive in appearance. I therefore set to work, with the assistance of experts, to design a Manual that should be a standard type of publication that all boys would immediately recognise as coming from my firm. You will have noticed that in all our advertisements, leaflets, etc., the word "Meccano" is printed in a specially designed type-face—the letter "C" is rather unusual in its formation, and the final "O" slopes a little. This and other little peculiarities give the word an artistic and distinctive appearance, and this special design is our exclusive property.

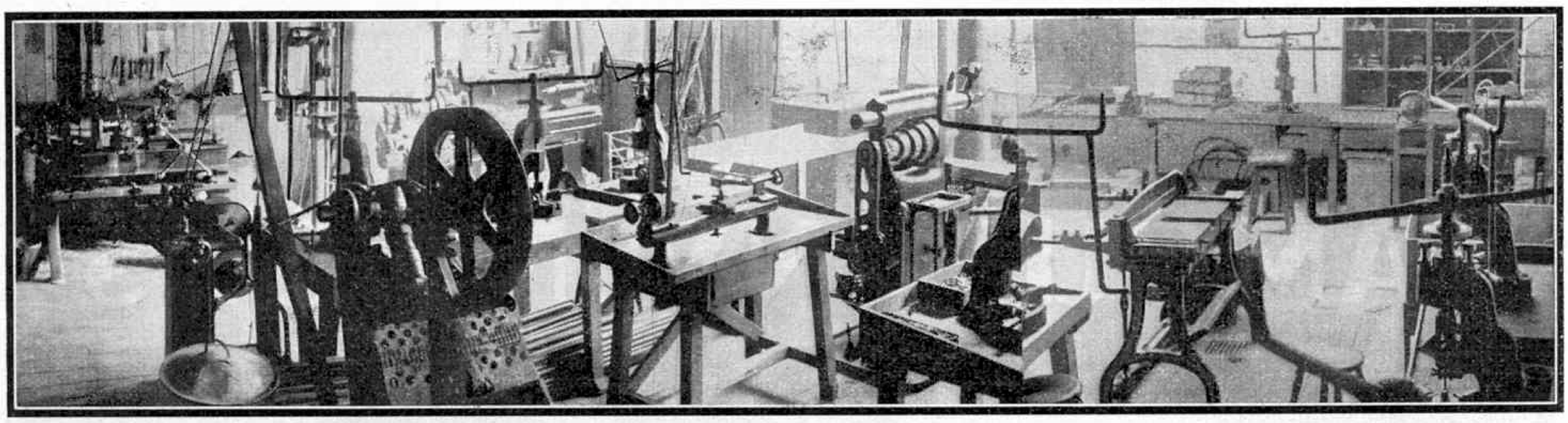
At the top of the cover of the Manual of Instructions there is a drawing of two boys in easy boyish attitudes working away at a Meccano model. The model itself has been changed occasionally, and the boys' clothing has been brought up to date from time to time; but otherwise the drawing has not been altered. I think you will agree that the cover of the Meccano Manual is a most artistic production, and you may be sure that no changes will ever be made in it without good reason. The same cover is issued for every country in the world, but we make a distinction by changing the colours, using certain colours for certain countries to facilitate identification for storing and packing.

You will have noticed that in all the Meccano Manuals the instructions for building the various models are written in technical language; that is to say correct engineering terms are used in every case. When you are talking with an engineer or a mechanic you may use with confidence any word or phrase employed in the Meccano Manuals of Instructions. Your meaning will be understood perfectly, because you will be speaking the language of engineering. I have no hesitation in saying that any boy who has built a series of Meccano models from the instructions provided in our Manuals will be able to read intelligently and understand any book on engineering, or a description of any engineering feat that he may come across. I attach the greatest importance to this matter of correct technical description of models, not only because I like everything connected with Meccano to be accurate, but also because technical accuracy is of such great importance to the thoughtful boy who intends later on to take up a career in one of the many branches of engineering.



Truck built with early Meccano Parts.

By this time it had become quite obvious that our tiny factory in Duke Street, Liverpool, was utterly inadequate for dealing with the demand for outfits. Many parts were still made by various manufacturers, but even with this assistance we could not turn out parts in sufficient quantity. We did our best, and worked long hours every day, but the resources of the little factory had reached their limit, and the output could not be increased. There was therefore nothing for it but to move into larger premises and install more machinery. I spent a good deal of time in searching for a suitable place, and ultimately I decided upon a building that previously had been used as a motor car works, in West Derby Road, Tuebrook. I well remember how impressed I was with the size of the building. It seemed to me more suitable for constructing railway locomotives than Meccano parts, and even after all our machinery and benches were installed the uncovered floor space



that remained gave me a fright!

Before we moved into the new premises at West Derby Road I carefully planned a layout for the various machines and benches, based upon the experience gained in the existing factory; and I was now able to carry out many improvements that previously had been impossible on account of lack of space. First of all I moved in the old machinery and got it working, and then gradually I added one new machine after another. Eventually I had an equipment that, I felt sure, would not only enable me to manufacture practically the whole of the parts myself, but also to produce them in sufficient quantity to meet all possible demands in the future. Never had I made a bigger miscalculation! The popularity of Meccano increased at a rate that I had never contemplated in my wildest imaginings. Dealers who previously had ordered a few outfits, almost in fear and trembling, now began to order on a continually increasing scale and to clamour for immediate delivery. In the effort to grapple with the situation I added machine after machine until the vacant floor space that had worried me earlier on was completely covered; and still the output was not large enough.

During my occupation of this factory I improved my outfits in many important respects. For instance, I abandoned the old tin containers, and the Meccano outfits were now displayed in strong cartons with all the parts looking smart, neat and orderly in their separate compartments. Another far-reaching change was made in regard to the strips. Up to that time these had been made of tin with turned-over edges; but now I began to make them of rolled steel, heavily nickel-plated. This change, as will easily be realised, marked a great step forward in the style and quality of the outfits. I also recognised that the key with which the wheels were fastened on the rods, although satisfactory in most respects, was not sufficiently strong and rigid for use in large working models in which considerable stresses existed. I therefore introduced the more effective set screw which, as will be remembered, I had turned down earlier as being too costly for the purpose. Thus it came about that the key that I formerly manufactured by the million was superseded and gradually disappeared.

In less than two years the position in this factory became similar to that in the old one. I had not sufficient machinery to cope with the demand for parts, and at the same time it was impossible to cram another machine into any part of the building. Thus another move became necessary. At first I thought of looking round for a larger building that might be vacant, but after considering the matter carefully from every point of view I decided against this step. The popularity of Meccano had already increased far beyond my expectations, and I realised that if this growth were to continue on a similar scale it would be foolish to move into a larger building that could only serve the purpose for a comparatively short time, and then have all the trouble and worry of a further change. Finally I decided that the only satisfactory method of meeting the needs of the business was to buy a plot of land and erect a factory for myself. It was essential that this land should be in a suitable position, and large enough to accommodate not only a factory adequate for present needs, but also any extensions that might become necessary in the future. Finally I purchased a piece of land at Old Swan, a district away from, but within easy reach of the centre of the city, convenient for the principal railway stations and, as far as possibly could be foreseen, large enough to provide for all future requirements.

The designing and planning of the new factory was a long process, demanding the most serious thought. The experience I had already gained was of the utmost value to me at this time in enabling me to decide upon the most effective and economic arrangements, and to avoid features that had proved to be unsatisfactory. Beyond this there was the health and convenience of the workers to be considered, and in this respect I determined to produce an ideal factory. As soon as the plans were completed building was commenced and was pushed forward with the utmost rapidity; and presently there came into being the great Meccano Factory in Binns Road, the name of which is familiar to hundreds of thousands of boys all over the world. It covers an area of nearly 5 acres of land, with every workshop on the ground floor, glass-roofed and, to a certain extent, glass-sided. Its perfect efficiency is proved beyond doubt by the enormous output that continues steadily week in and week out, and I am confident that there are few factories in which the working conditions are so pleasant.

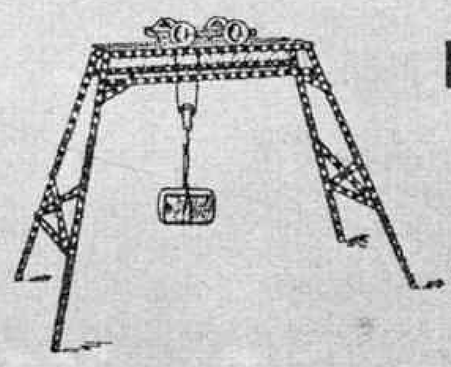
I take great pride in my factory, and I welcome the thousands of Meccano boys who visit it every year. They are conducted by special guides from shop to shop, every process being thoroughly explained to them; and they leave with eyes shining with excitement and enthusiasm. They have realised a long-cherished ambition—they have seen the home of Meccano! I wish every boy could see the Meccano Factory, but unfortunately this is impossible. For the benefit of those who, on account of distance or other circumstances, are unable to pay it a visit, I propose in a later article to describe the factory as well as I can, and to explain the many and wonderful processes by which the raw material is converted into the perfectly-finished parts that you all know so well.

As a rule the transferring of plant and machinery from one factory to another involves an almost complete stoppage of work for a period, and great dislocation of business generally. In this case, however, the machinery was transferred from the old factory to the new one without a stoppage of even a day. Two large new gas engines were first installed, and completely new shafting and belting was set up throughout the works. Then each lathe, press or other machine was carried over separately, fixed in the position that had been prepared for it, and set to work immediately. This involved an immense amount of careful organisation, but the labour was amply repaid, for the whole removal was conducted from start to finish without a hitch.

The working conditions in the new (*Continued on page 238*)

MECHANICS MADE EASY.

A Patent Adaptable Mechanical Toy.



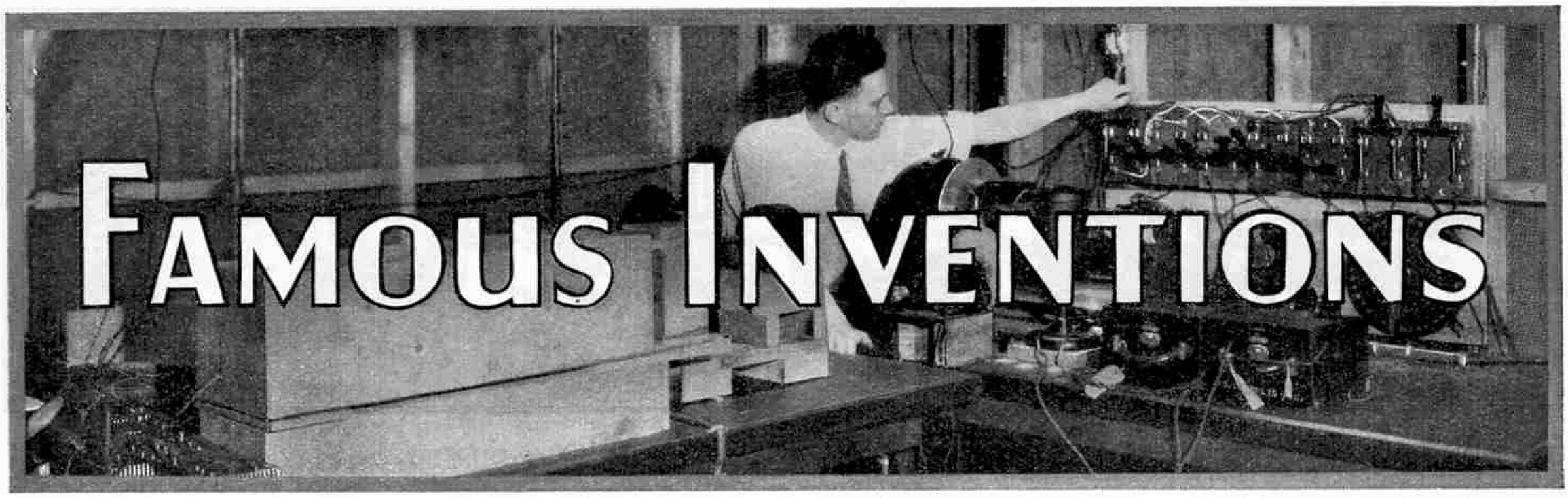
With which boys may exercise their ingenuity in constructing **Cranes, Bridges, Waggons, Shafting,** &c.—in fact, an endless **Variety of Models.** The Metal Strips being perforated with holes. equi-distant, enables them to be formed into the shapes (among others) enumerated. No expense for tools. Charming occupation, and **Toy indestructible.** Price, **7s. 6d** Wholesale from—

GEORGE PHILIP & SON, Ltd., 32 Fleet Street, LONDON.
PHILIP, SON & NEPHEW, South Castle Street, LIVERPOOL, and STOKE-ON-TRENT.

MANUFACTURERS—

FRANK HORNBY, 18, James Street, LIVERPOOL.

One of the earliest advertisements issued by Mr. Hornby for "Mechanics Made Easy," under which name Meccano first appeared.
The upper photograph shows the interior of the first Meccano factory.

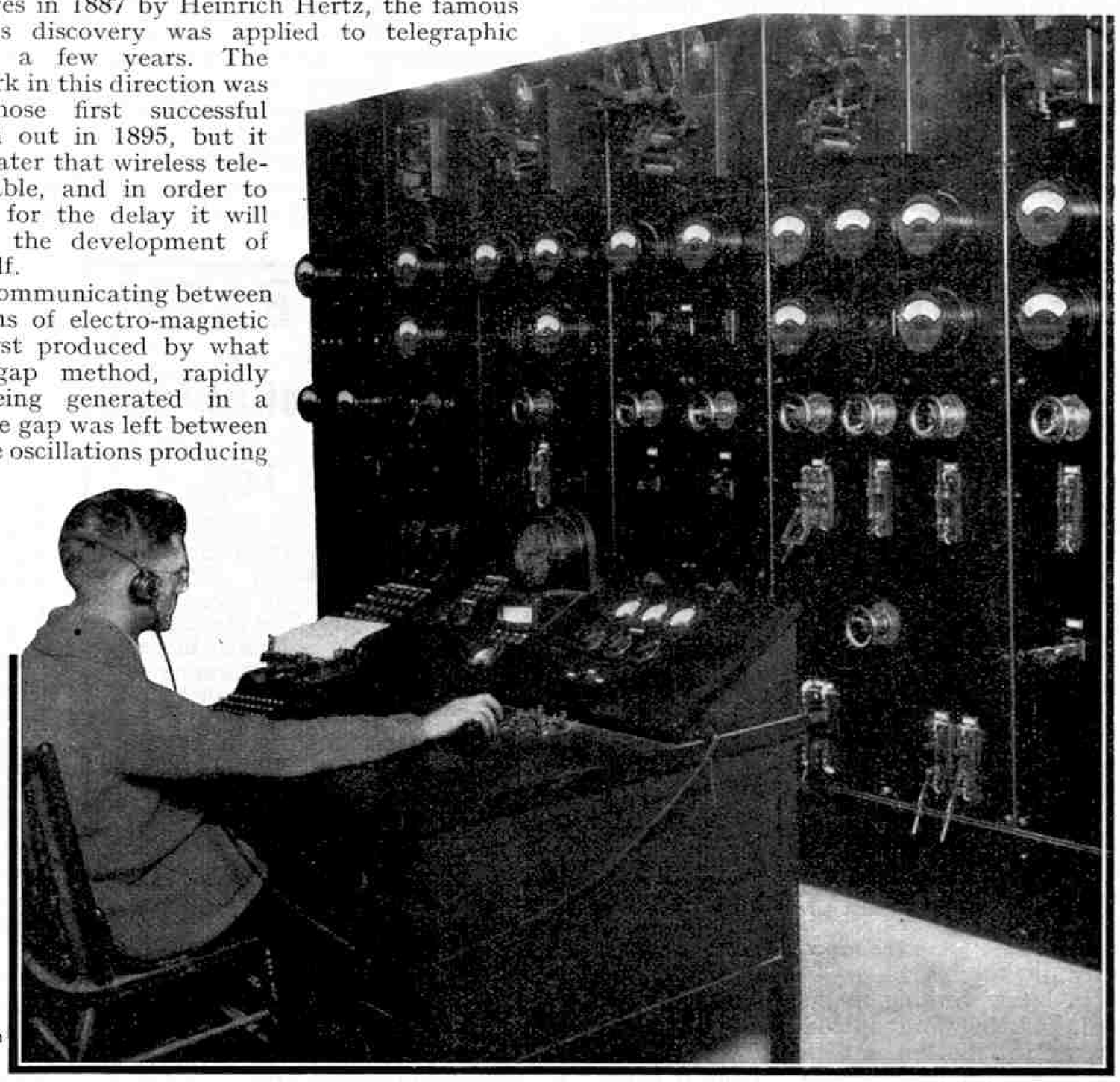


XXXI.—THE WIRELESS TELEPHONE

WIRELESS telephony is one of the outstanding developments of the present century and in common with many other famous inventions it has been brought to efficiency by the successive work of many investigators. It was a natural outcome of wireless telegraphy, the story of which begins with the discovery of electro-magnetic waves in 1887 by Heinrich Hertz, the famous German scientist. This discovery was applied to telegraphic communication within a few years. The leader in the pioneer work in this direction was Senatore Marconi, whose first successful experiment was carried out in 1895, but it was not until 20 years later that wireless telephony became practicable, and in order to understand the reason for the delay it will be necessary to trace the development of wireless telegraphy itself.

Wireless is the art of communicating between distant points by means of electro-magnetic waves. These were first produced by what is called the spark gap method, rapidly oscillating currents being generated in a circuit in which a minute gap was left between two metallic spheres, the oscillations producing a spark across the gap. Hertz detected them by means of what he called a "resonator," which consisted of a wire bent into the shape of a circle, but having a small spark gap at one point. The electro-magnetic waves produced minute oscillatory currents in the resonator when this was held in certain positions, and these oscillations gave rise to sparks across the tiny gap left in it.

The apparatus first employed in wireless telegraphy was a development of that used by Hertz, but the system did not become practicable until various inventions had been introduced. These included aerials, which are necessary for the transmission and reception of the electro-magnetic waves in long distance telegraphy, and the use of tuned circuits, a practice with which all interested in broadcasting are familiar. Improved means of detecting the waves also were discovered. The resonator was useless for practical work and it was replaced by the coherer, the magnetic detector and other more sensitive devices. These were employed to respond to the oscillatory currents in the receiving aerials, and telephones included in the circuits of the receivers showed when signals were being sent, long and short buzzes being heard as the operators at the transmitters depressed their keys to dispatch messages in Morse code. Telephones are still employed for this purpose in wireless telegraphy, although large commercial stations now use machinery in high speed work.



The interior of the Rocky Point Wireless Station, America.

Although telephones were employed in the receiving circuits of early wireless telegraph systems, wireless telephony was completely out of the question, for continuous currents are necessary in order to give reproductions of the human voice, and the spark gap transmitter was incapable of producing continuous electro-magnetic waves. This point was appreciated by many inventors, and efforts were made to discover new types of transmitters in order to overcome the difficulty.

The first step towards the introduction of wireless telephony was taken by William Duddell, an English electrical engineer, who in 1900 invented what he called the "singing arc" that emitted continuous oscillations of constant strength, and he demonstrated that the sound of the human voice could be transmitted through the ether by means of the incessant stream of electric waves sent out by the oscillations. When an arc consisting of two carbon rods close together is connected on one side to a direct current dynamo and on the other side to a condenser, the condenser becomes charged and discharged alternately, and if the resulting variations in the current through the arc do not occur with a frequency greater than 30,000 cycles per second the arc gives off a musical note. It was this peculiarity that gave rise to the name of "singing arc." Duddell's discovery made wireless telephony a practical proposition, but as the highest frequency he could obtain with the singing arc was only about 10,000 cycles per second he could not accomplish much with it.

The same year that Duddell invented the singing arc, Reginald A. Fessenden, Professor of Engineering at Pittsburgh University and an enthusiastic experimenter in wireless telephony, succeeded in transmitting speech clearly over distances up to 12 miles by the continuous arc method. Three years later he carried out successful tests up to a range of 25 miles and he created great interest in Washington by carrying out public demonstrations of wireless telephony.

The progress made by Fessenden was small compared with the



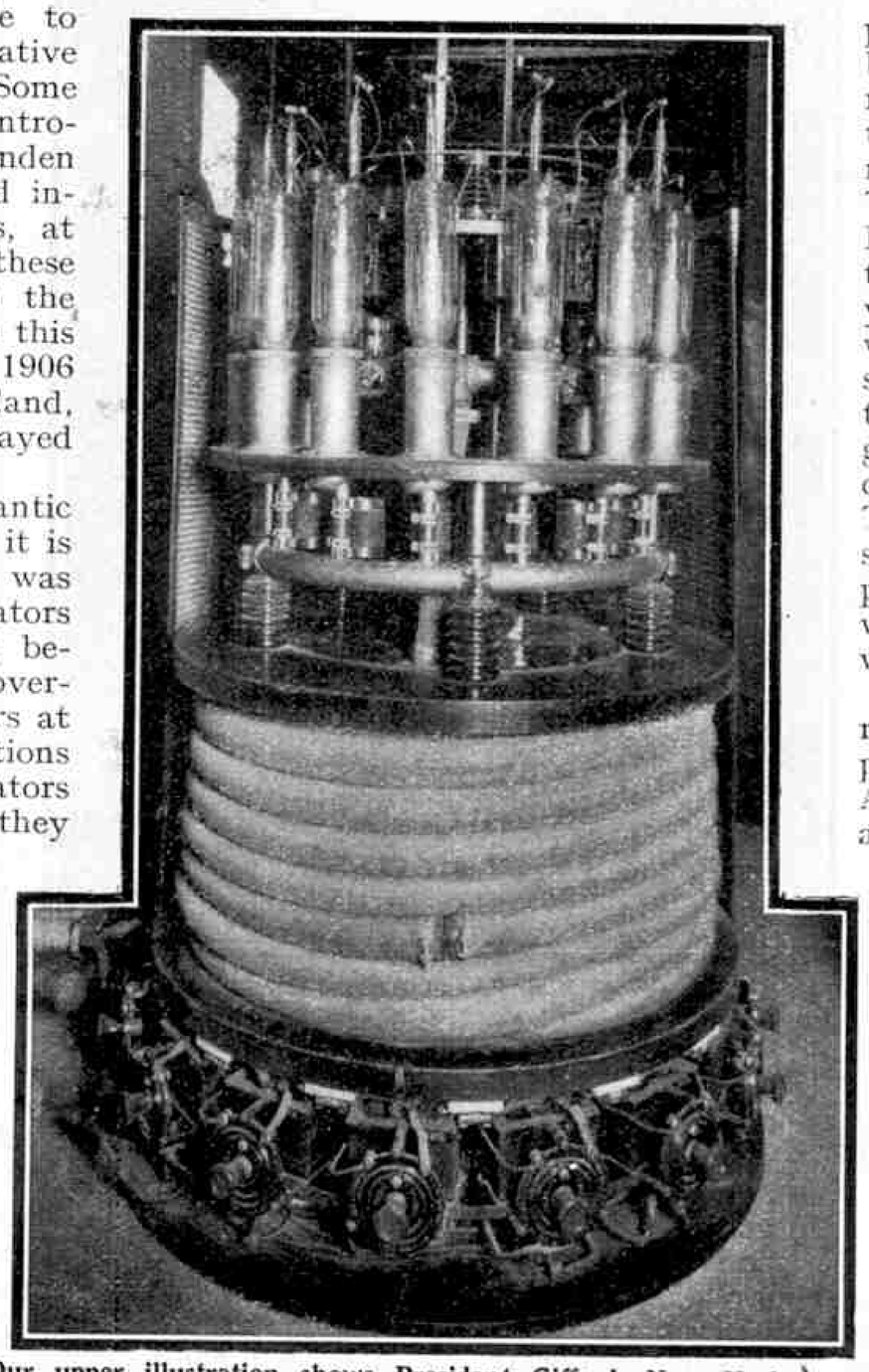
achievements of Valdemar Poulsen of Copenhagen who, in 1903, greatly improved the singing arc by placing the carbon electrodes in a chamber containing hydrogen, coal gas or other gas of high thermal conductivity. Using two transmitters coupled together he was able to obtain a current of approximately 10 amps. and succeeded in transmitting speech from Berlin to Copenhagen, a distance of 290 miles. Poulsen was not able to transmit over greater distances owing to the inability of the transmitter to carry a sufficiently powerful current. He found that if the ordinary telephone transmitter he used was subjected to a current greater than its ordinary supply of about 30 milliamperes the carbon granules soon burnt out, and he constructed a water jacket to keep the granules cool but it did not prove very effective.

The problem was taken up by other investigators and many attempts were made to improve the arc by devising some alternative way of generating continuous waves. Some inventors tried to solve the difficulty by introducing a high frequency alternator. Fessenden developed an alternator of this type and installed it, together with three dynamos, at Brant Rock, Massachusetts. Two of these dynamos operated at 50,000 cycles and the third at 100,000 cycles per second. With this equipment he transmitted speech during 1906 from Brant Rock to Jamaica, Long Island, a distance of 200 miles, and also relayed conversation over land lines.

Speech was transmitted across the Atlantic for the first time in November 1906 and it is interesting to note that the transmission was quite unintentional. Telephone operators employed by Fessenden, and conversing between Brant Rock and Plymouth, were overheard several times by telephone operators at Machrihanish, Scotland. The conversations were heard so clearly that the Scottish operators sent reports of them to Brant Rock, where they were verified from the station records and proved to be correct. It may be mentioned here that in 1907 Fessenden showed that wireless telephone conversations could be carried on like wired telephone talks; that is, that there was no necessity to switch over from receiver to transmitter and back again.

Dr. Goldschmidt, a German scientist, also solved the problem of wireless telephony by using an alternator. He invented a rotating field alternator, in which a low frequency current was transformed, its frequency being increased as desired. Goldschmidt's alternator proved successful, and machines of this type were installed for trans-Atlantic service in the high-power wireless station at Hanover, Germany. This station co-operated with an American long-distance station at Tuckerton, New Jersey. The exceedingly high speeds of rotation eventually proved too much for the alternators, however, and they failed about August, 1914.

Another successful experimenter was G. F. W. Alexanderson, of the General Electric Company of New York, who invented an alternator giving frequencies of 100,000 cycles. In this alternator a steel disc having 300 to 400 teeth revolved at about 20,000 r.p.m. between the poles of stationary magnets, and the teeth deflected the magnetic flux from the magnets and induced alternating currents in the fixed coils. A 50 Kw. alternator of this type was installed in the high-power wireless station at New Brunswick, owned by the Radio Corporation of America, to make possible trans-Atlantic communication. The alternator proved too weak for continuous transmissions under all conditions, however, and after a time it was replaced by a similar alternator of 200 Kw. Alexanderson alternators were installed in other American wireless stations, including the trans-Atlantic station at Rocky Point, Long Island; and in this country they were installed at the Caernarvon station.



Our upper illustration shows President Gifford, New York, conversing with Sir Evelyn Murray, London, at the inauguration of the trans-Atlantic wireless telephone service, 7th January, 1927. In our lower photograph may be seen a bank of amplifying valves at an American high-power wireless station.

The high-frequency alternator made possible long-distance wireless telephony, but there was still much room for improvement, especially in devising a transmitter that could carry a sufficiently powerful current for efficient long-distance working. This difficulty was not overcome until Dr. Lee de Forest, the famous scientist, invented the three-electrode valve in 1907. For some years the valve was used only in connection with the reception of wireless telegraphic signals, but in 1913 the discovery was made that it could be utilised to serve as a generator of continuous oscillations, and this discovery revolutionized wireless telephony. The development of the thermionic valve is so interesting that we have dealt with it on page 196, in a special article in connection with a wonderful new valve at the Rugby wireless station.

Other scientists took up the new line of research, with the result that increasingly powerful transmitting valves were produced. After ten years of research and development a transmitting valve of 50 Kw. was invented by Dr. Irving Langmuir. Six of these valves, giving a power of 15,000 volts, were substituted for the large Alexanderson alternators at the Rocky Point station, America, and were subjected to a 16 hr. test. The valves proved very satisfactory, and signals were transmitted to England so effectively that the operators at the receiving station did not detect any change in the method of transmission.

During 1915 the Bell Telephone Company of America carried out many successful tests in wireless telephony, and on 29th September of that year a wireless conversation was held across the entire continent, a distance of 2,500 miles. The transmissions were made from the Government high power naval wireless station at Arlington, Virginia, and were received at the naval wireless station at Mare Island, California. The War prevented unrestricted trans-Atlantic experiments between America and Europe, but in 1915 facilities were granted by France for a test between Arlington and Paris, 4,500 miles apart. The experiments were carried out over a period of several weeks, during which time a representative of the company was allowed the use of the Eiffel Tower wireless station for ten

(*Continued on page 238*)



XXIX.—A SURVEYOR

A SURVEYOR usually is looked upon as a man who measures land and takes angles and levels in order to prepare plans and maps. This is an important branch of the surveyor's work in countries that are not yet thickly populated, but in those that have been settled for a considerable time almost the only occasion on which a practising surveyor is called upon for a detailed survey is when a very accurate large scale plan of a small area is required for some special purpose. Ordnance Survey maps are sufficient for other purposes, and the greater part of a surveyor's activities are directed to managing estates, valuing land, buildings and minerals, and measuring and estimating the work of builders, road makers and other craftsmen.

The surveying profession is divided into four sections, which are concerned with land agency, urban agency, buildings and quantities, and mining respectively. The work of the mining surveyor is distinct from that of surveyors practising in the other three sub-divisions. He deals with the valuation, management and development of mineral estates, prepares plans of underground workings, settles boundary disputes and generally gives advice in connection with mining problems. This branch of the profession usually is regarded as suitable for a young man who has connections with an established firm, with which an opening is assured for him. There are prospects for mining surveyors abroad, however, and a young man of ability and possessed of an adventurous spirit would find opportunities in Africa, South America and other countries in which mineral wealth is now being developed.

No hard and fast line can be drawn between the three other sub-divisions of the profession. A surveyor in general practice in a provincial town may act as land agent for a group of small country estates, and all surveyors at times find it necessary to make use of their knowledge of building construction and measurements of builders' quantities. The prospects of the three branches differ considerably. Land agency attracts many boys who think of becoming surveyors, for it involves an outdoor life in the country, and there is very keen competition for posts of this kind. The break-up of large estates has reduced the number of owners who can afford to maintain a resident agent, however, and this branch of the surveying profession should not be selected except by those who are sure of obtaining a good position or have private means.

Surveyors in general practice benefit by the changes that have made the position of the land agent insecure, for the growth of towns has increased the amount of property they may be called upon to manage or value. Prospects in this branch of the profession therefore are good. This is true also of the building and quantities section, for their services are required in connection with the expansion of towns and the development of factories. The surveyors to counties, municipalities or district councils share in work of this kind, and the introduction of town planning schemes and other developments have increased the importance of the positions held by these officials.

Surveying differs from most of the other professions that have been dealt with in this series in that it is what is known as an "open profession." This means that anyone may call himself a surveyor and may accept commissions to carry out work connected with the profession. In order to attain any degree of success, however, and certainly to obtain any salaried position of importance, it is necessary to receive a thorough training and to become a member of the Chartered Surveyors' Institution, full details of which may be obtained from the Secretary, 12, Great George Street, Westminster, London, S.W.1.

No specialisation while at school is necessary in preparation for the career of a surveyor, and a general education up to Matriculation standard is all that is required. Mathematics and science are useful subjects for one who intends to take up surveying, of course, but if he prefers other subjects, there is no reason why he should not offer them when he sits for the Matriculation examination, or a suitable equivalent, for technical subjects will be studied when undergoing definite training as a surveyor. The Chartered Surveyors' Institution holds a preliminary examination for those who wish to qualify for the profession, but those holding a Matriculation certificate or one of equal standing are exempt from taking it.

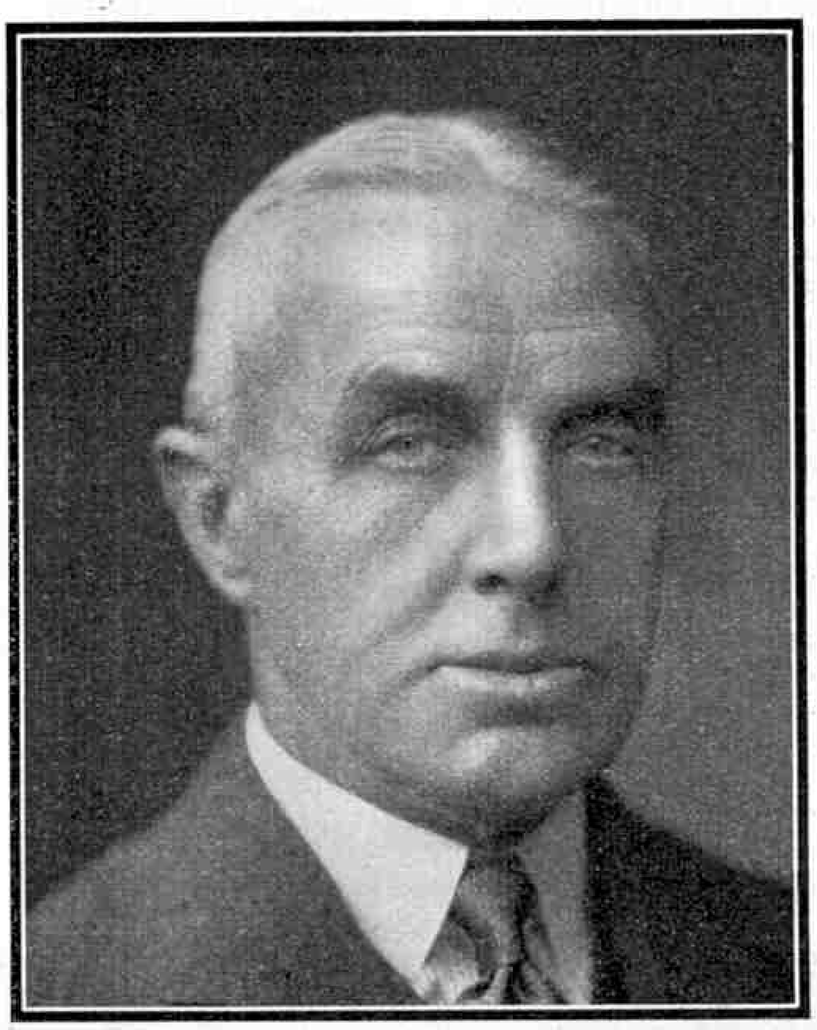
The time to begin specialisation is immediately after leaving school, and two courses are open to the future surveyor. One of these is to enter a university and to study civil engineering, or to follow a course in other subjects closely allied to the profession. The second course is to enter the office of a surveyor who practises in the special branch of the profession favoured by the candidate, and it should be noted that a university course also must be followed by a period of practical training with a practising surveyor.

Those who attend a university will find their preparation more expensive than taking up work directly with a surveyor. Nevertheless this course should be taken where possible, for those who take full advantage of the opportunities it gives them should in the long run outdistance the less fortunate members of their profession. The period during which graduates are required to serve articles is two years, while a small premium usually is required.

It may be noted that the Surveyors' Institution offers an annual scholarship of £100 per annum tenable at Cambridge University for three years, in addition to three one-year post graduate studentships of £125 that are intended to enable selected candidates to extend their studies at home or abroad and carry out original work. Full details of these scholarships may be obtained from the Secretary of the Institution.

Those who do not attend a university secure their training by serving articles, usually for a period of three years, with a member

An Eminent Surveyor



Mr. J. E. Bidwell, M.A., is President of the Chartered Surveyors' Institution. He was educated at Charterhouse and Trinity College, Cambridge, and qualified as Professional Associate of the Institution in 1894. Two years later he became a Fellow, and last year he was elected President for 1931-32.

of the Institution, or some other person substantially engaged in the profession of surveying. A premium is required and this may be nominal, but usually is from 100 guineas to 300 guineas. Before articles are signed care should be taken to ensure that the surveyor to whom the pupil is to be attached is engaged in the chosen branch of the profession, while it is an advantage to enter an office in which the general range of business is wide, in order to give the pupil opportunity for grasping the practical details of as many classes of work as possible.

Practical office and field work while serving articles must be supplemented by study in preparation for the examinations of the Surveyors' Institution. In this preparation the Institution itself gives valuable help, particularly to those who enter it as Students. An articled pupil is entitled to admission as a Student if he is between the ages of 18 and 21. If he is admitted, he is entitled to attend meetings of the Institution, to receive its Journal and to use its library, while studentship also carries with it certain privileges in connection with the professional examinations for which he is preparing.

It has already been pointed out that two professional examinations follow the preliminary test. These are the intermediate and final examinations. The first of these cannot be taken until the age of 19 years has been reached. It is divided into four special sections in order to cover the various types of activity in which members of the profession are engaged, and in each case a satisfactory standard must be reached in a typical subject in the chosen section. For instance, a candidate who elects to be examined in Sub-Division I, which deals chiefly with land agency, must secure a pass in agriculture ; while in Sub-Division II, which is concerned mainly with valuation, the special subject is the application and use of valuation tables. Sub-Division III is intended for those whose future practice is to be concerned with building work, and those taking this section of the examination must pass in bills of quantities or constructive and working drawing, according to the exact nature of the qualification they wish to obtain. The chief subject in Sub-Division IV, mining surveying, is the principles of survey work underground.

A written examination is held in each subject and the examiner must be supplied with evidence of practical work in the form of plans and sections from an actual survey undertaken by the candidate, while in addition there is an examination in practical surveying and field work. An interesting point is that the pass standard for Students of the Institution is the attainment of 500 marks out of a maximum of 1,000 marks, but a candidate who has not taken advantage of the privilege of joining the Institution must secure 550 marks.

Successful candidates in the intermediate examination who are not already Students must join the Institution as Probationers, and Students who pass the test or attain the age of 21, also become members of that class. The next step is to take the final examination. This is planned on the same lines as the intermediate examination, and a candidate may only enter in the Sub-Division in which he has already passed the lower test, while it is essential to secure a pass in a typically important subject. The holder of an approved University degree has the privilege of taking a single examination instead of being compelled to pass separately the intermediate and final examinations.



The Library of the Chartered Surveyors' Institution, Westminster, London, S.W.1. For our photograph we are indebted to the courtesy of the Secretary of the Institution.

Success in the final test is a qualification for election to the class of Professional Associates of the Institution and those who have passed may be admitted to this class if they are not less than 21 years of age and are actually engaged in professional work as surveyors in one of the recognised branches of the profession. They then make use of the initials P.A.S.I. Fellowship of the Institution (F.S.I.) is granted to Professional Associates who have held for five years positions equal in responsibility to that of a partner in an established business and are still in practice. This class also may be reached directly by candidates over 30 years of age who have been in practice not less than five years on their own account. If their applications are approved by the Council of the Institution, they then take a special examination in the branch of surveying in which they are interested.

The period of training being complete and the qualifying examinations having been passed, the young surveyor should then be in a position to command a salary of from £150 to £200 a year. This should steadily increase as experience is gained, and there is no better way of gaining the necessary additional knowledge of the practice of the profession than by working in association with a sound established firm. The age of 30 years generally is regarded as the best at which to commence a separate business or to secure a partnership. The further prospects of a surveyor then depend upon the class of business carried on and also on his own energy, ability and the reputation he gains for sound judgment and fair dealing.

There are good prospects for those who aim at official positions involving a qualification in surveying. Reference already has been made to the work of Surveyors to local authorities. These bodies also appoint official valuers for work in connection with rating and other activities. Similar appointments in Government service are available, while there are openings for surveyors in the estate and rating departments of railway companies and other large public bodies dealing extensively with land and buildings. Posts of this type are specialised in character, of course, and those who wish to take up such careers would be well advised to serve their articles with members of the Chartered Surveyors' Institution already engaged in them.

It is interesting to note that surveying is closely associated with two other professions, architecture and auctioneering. The branch of surveying in touch with architecture is that dealing with the quantities of materials to be employed in the erection of buildings. The calculations required must be detailed and exact, particularly where large buildings are concerned, and knowledge of the principles of architecture is a great advantage, if not a necessity, but the work is profitable. The auctioneer is largely concerned with the sale of land and buildings and his work is so closely connected with certain branches of the field open to the surveyor that in many instances the two professions are combined.

An interesting development of survey work is the increasing employment of aircraft for mapping unknown country. Surveyors engaged in this work must be familiar with photographic methods employed and also should be competent air pilots, for although they may not be called upon regularly to pilot the machines in which they carry on their work, there is always the possibility that circumstances may arise in which they would be required to take charge.

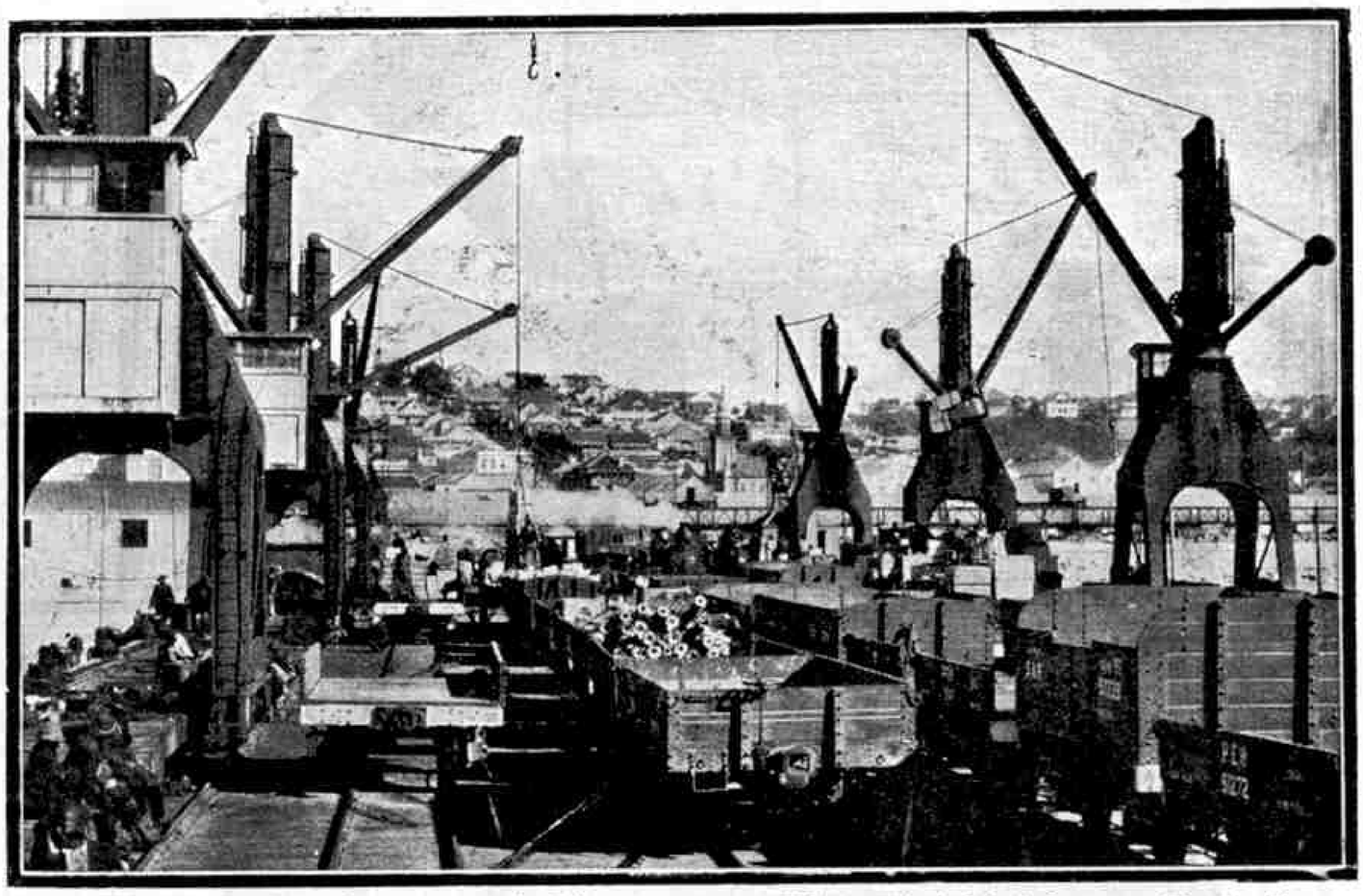
Port Elizabeth, Past and Present

The Discovery of Algoa Bay

ALGOA Bay on the south coast of Africa, on the shores of which stands Port Elizabeth, appears to have been discovered on 14th September, 1486, by the great Portuguese navigator Bartholomew Diaz, when he rounded the extreme south-easterly point of the continent and dropped anchor in the bay. The origin of the name is interesting. The capital of the Portuguese dominions in the East was the port of Goa on the Malabar coast. Algoa was the last port of call for Portuguese vessels outward bound to Goa, and its name is made up of two Portuguese words meaning "to Goa." In a similar manner Delagoa Bay, the first place of call for vessels homeward bound from Goa, means "from Goa."

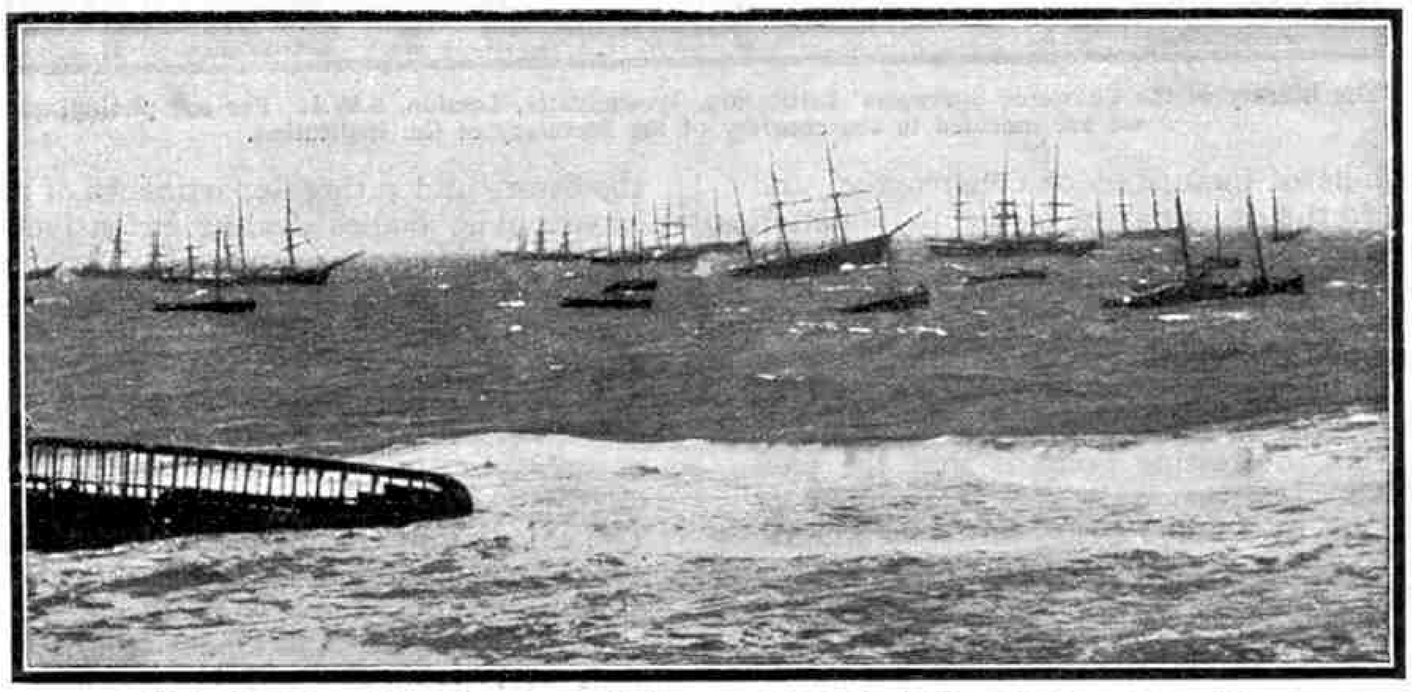
Port Elizabeth owes its origin to a band of British settlers who arrived there in April 1820. It was so named by Sir Rufane Shaw Donkin, the Acting Governor of the Cape, in memory of his wife. He laid the foundation stone of the first house of the town, and also erected a stone pyramid bearing the inscription: "One of the most perfect of human beings who has given her name to the town below." From the few huts and the military blockhouse of those distant days the city has grown steadily in size, and has achieved a commercial and industrial position of great importance.

Algoa Bay is an open roadstead with excellent holding ground where vessels can ride with absolute safety. The prevailing winds are westerly with occasional strong winds from the south-east, and the harbour is naturally protected except for about seven points of the compass. Extensive harbour development is now in progress, the most important item of which is the construction of a long breakwater at enormous cost. This breakwater was commenced in 1922 and is already over 3,000 ft. in length. When it is completed it will afford protection that will enable lighterage work to be carried out in quiet water at all times, and it will form a portion of a greater scheme for berthing ocean-going ships if such a development should become necessary. Vessels of the deepest draught can now lie in the roadstead in safety at all times, and be discharged or loaded to and from three jetties, each provided with hydraulic cranes and other necessary facilities, and equipped with railway sidings directly connected with the main railway system of the country. Ample warehouse accommodation is also available.



Port Elizabeth of to-day; a typical jetty scene. We are indebted for our illustrations to the courtesy of the South African Railways and Harbours Magazine.

The floating equipment of the port consists of 44 general lighters with a capacity of 4,670 tons and four refrigerator lighters, with a capacity of 400 tons, for dealing with perishable products. These lighters are handled by four powerful tugs, three of which are equipped with up-to-date salvage and fire appliances. There is also a specially-equipped vessel for supplying water to shipping. The traffic dealt with at the port has increased rapidly, especially during the past 10 years. During the year ended 31st March, 1920, the total traffic handled amounted to 377,150 tons; in the year ended 31st March, 1929, the total was 793,359 tons.

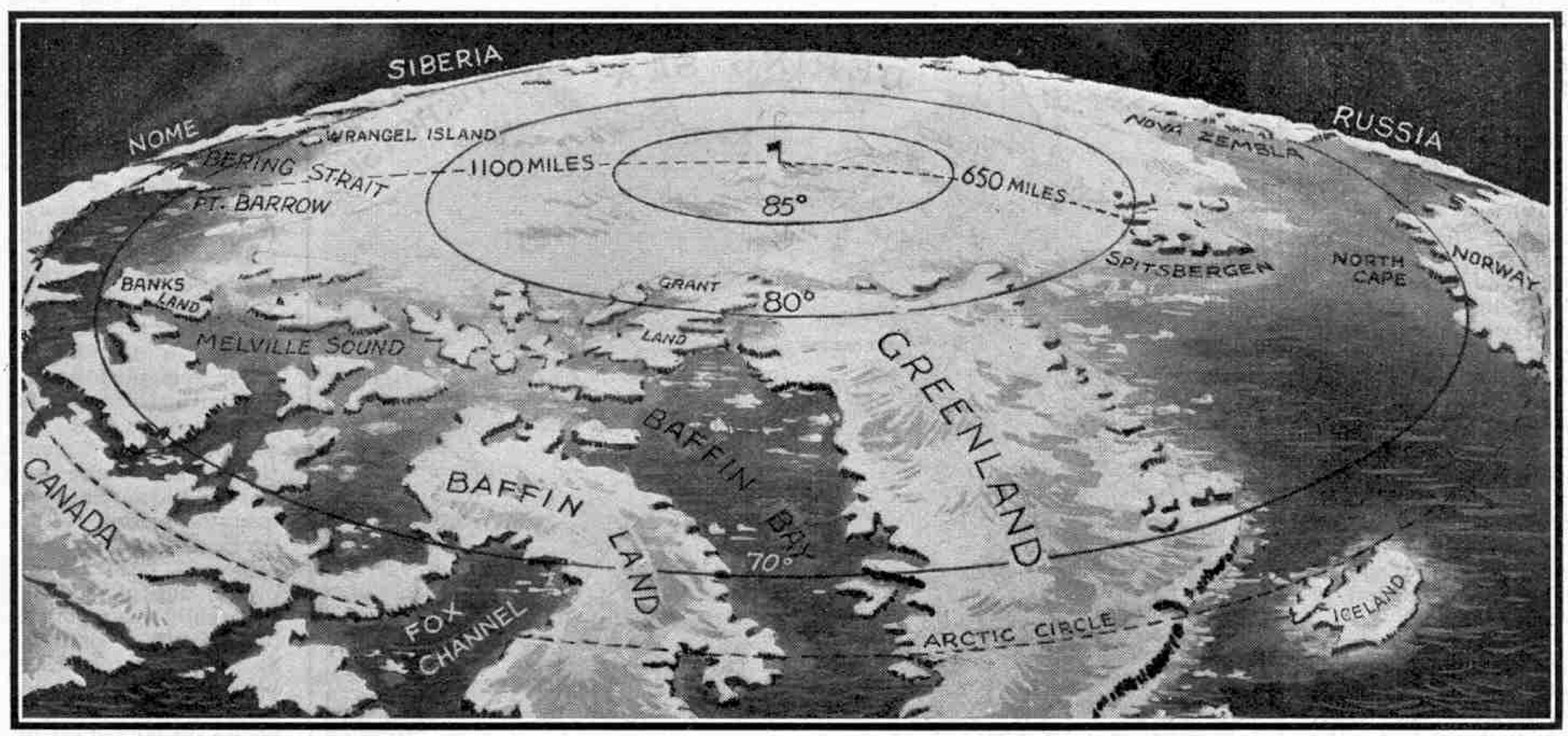


Shipping in Algoa Bay about the beginning of the present century.

The export trade of the port consists mainly of wool, hides, skins and mohair. Ostrich feathers formerly contributed very largely to the port's trade, but this export has shrunk to a very small amount as the result of a change in fashion. An export which, though still comparatively small, is growing steadily, is that of oranges.

Exploring the Arctic by Air

Europe to America via the Polar Regions



UNTIL recent years the region around the North Pole was regarded as a wilderness of barren land and frozen ocean. Interest in it centred almost entirely in the heroic efforts of generations of explorers, who penetrated into its icy fastnesses and endured great hardships in the hope of discovering new lands, or of reaching the Pole itself.

As a result of the strenuous work of these pioneers, the geography of the North Pole and of its immediate surroundings is now fairly well known. The great Arctic archipelago north of Canada has been explored, and the northern coast of Greenland has been mapped with great thoroughness. Similarly effective work has been done in Spitsbergen and Franz Joseph Land, and to-day it may be said that only two regions remain unexplored. In the map of the North Pole and its surroundings reproduced on page 180, these regions are shown surrounded by dotted lines. Until a few years ago the narrow corridor lying between them also was unexplored, the whole forming a great area that was regarded as practically inaccessible. As far as our knowledge of it went, this was a dreary waste of sea ice of incredible roughness, the mountain ridges into which the floes were forced by the tremendous pressure on them making travel extremely difficult, if not altogether impossible.

On the edge of this ice-bound region, Peary, the discoverer of the North Pole, believed that in 1905 he had seen the mountains of a previously unknown island to which he gave the name Crocker Land. He was unable to approach sufficiently near to verify his belief, and the later efforts of other explorers also failed. Farther to the south a memorable journey over the sea ice was made nine years later by Stefansson, who with two companions travelled a considerable distance northward from the coast of Alaska before turning to the east in order to reach Banks Land. In a later journey over the sea ice Stefansson discovered two new islands, Borden Island and Meighen Island, but these were on the outskirts of the Canadian archipelago.

Before any really useful knowledge of the conditions in this unexplored area could be gained it was necessary to adopt an entirely new method of travel. Nansen had often longed for wings to enable him to cover a greater area of the frozen North than was possible by laboriously hauling sledges over the rough ice. At that time the balloon afforded the only means of air travel, and in 1897 the first attempt to reach the North Pole by air was made by Andrée, a Norwegian explorer. With two companions Andrée left Spitsbergen in a specially designed and constructed balloon in the hope that the prevailing winds would carry him across the Pole; but the three explorers were never seen again, and their fate remained a complete mystery for 33 years. In the autumn of 1930 the bodies of two of them were found in a tent on White Island, north-east of Spitsbergen. The entries in their diaries showed how the balloon had been forced downward after travelling a total distance of 372 miles, during which it had been blown first in one direction

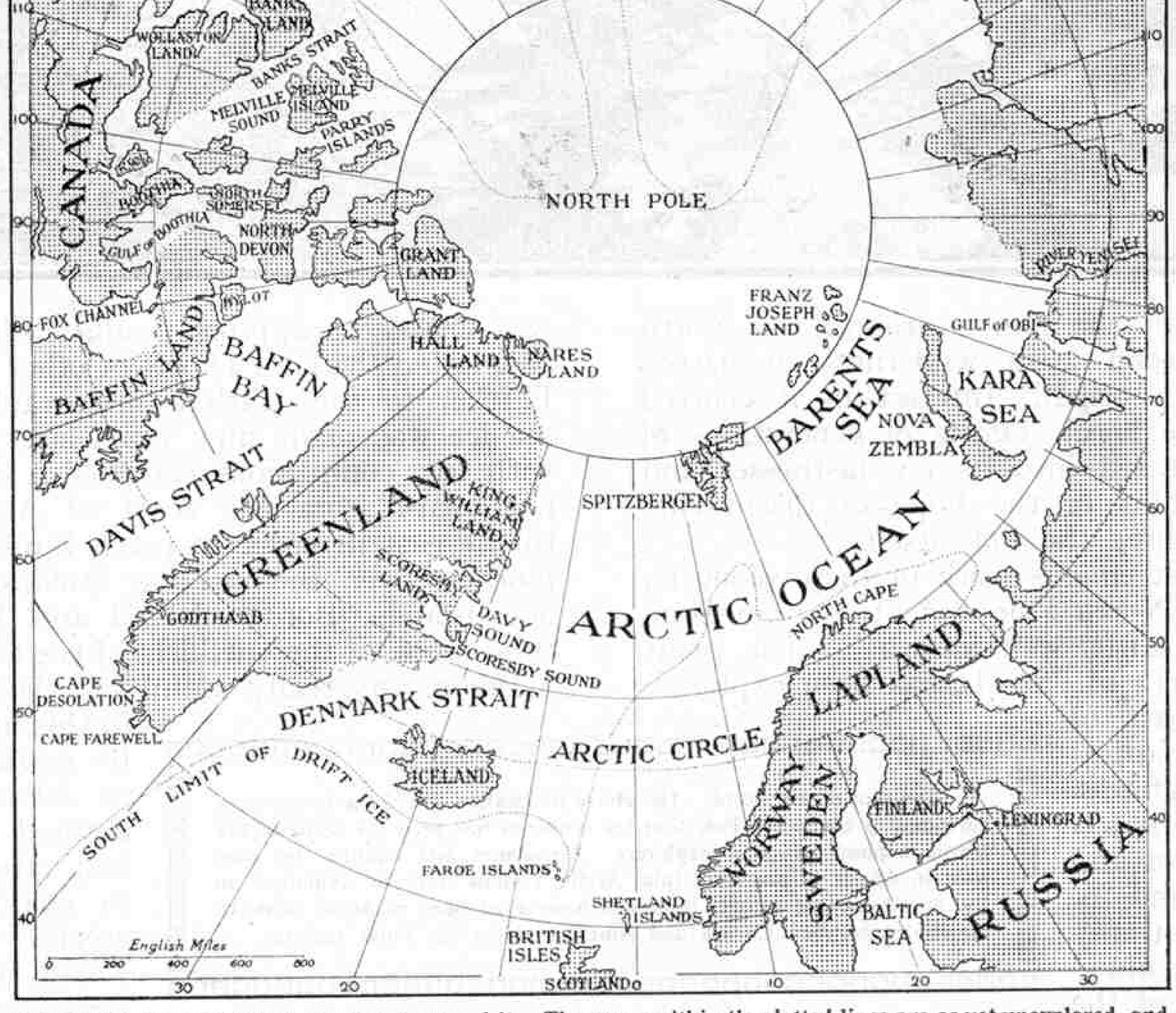
The roof of the world. The above illustration shows the frozen area surrounding the North Pole that for centuries has been the scene of the heroic exploits of great explorers. Aeroplanes and airships are now used in efforts to penetrate into Arctic regions and, as explained in the accompanying article, proposals have even been made to establish air routes between Europe and America across the Polar regions.

and then in another, with the result that they were only 288 miles from their starting point.

Even after the discovery of the bodies, the reason for the failure of Andrée and his men to return after their heroic balloon voyage remained a mystery. One of the three had died and been buried, but his companions had sufficient food and other necessaries, and a good stock of ammunition with which to shoot seals or bears if the necessity arose. They were experienced in Arctic travel, and undoubtedly should have been capable not only of surviving the winter on the island, but also of making their way back to Spitsbergen unaided in the following spring.

A possible explanation of the mystery is suggested by the positions in which the bodies were found. They were not in their sleeping bags, but were stretched out on opposite sides of their stove, which was half full of paraffin and in perfect working order. It has therefore been suggested that the two men were poisoned, in the confined space within the tent, by carbon monoxide formed by incomplete combustion of the paraffin. The author of this suggestion is Stefansson, who himself once had a narrow escape from a similar fate in a snow hut in Arctic Canada.

Modern aeroplanes and airships were first seriously used in Arctic exploration in 1922, when Amundsen, the discoverer of the South Pole, took two aeroplanes into the Arctic. Unfortunately accidents prevented any useful work from being done at the time. In the following year Amundsen tried again, and with five companions flew northward from Spitsbergen in two Dornier-Wal flying boats, fitted with skis in order to enable them to take off from smooth ice surfaces. The two machines reached a latitude of 88° 38′ north, but head winds had reduced their ground speed, and half the petrol supplies had been used. The two machines were therefore landed. Unfortunately one of them became firmly wedged in the ice, and the weather conditions were so bad that it was not until nearly a month later that the explorers were able to commence the return flight in the remaining machine. The chief cause of delay was the difficulty of getting the aeroplane into the air, and it was necessary to move many tons of ice before a smooth place from which to take off was cleared.



The Polar Ocean and the lands that surround it. The areas within the dotted lines are as yet unexplored, and the "corridor" between them has only been seen from the air.

The next great event in the exploration of the Arctic by air was the flight of Commander Byrd from Spitsbergen to the North Pole and back. This flight was made on 9th May, 1926, and it illustrates in a striking manner the great advantages of air travel as compared with the laborious methods that necessarily had been followed by previous explorers. From Spitsbergen to the North Pole is a distance of 650 miles. This was covered by Byrd in nine hours, whereas less than 20 years earlier Peary had taken close upon two months to travel across the sea ice from the coast of Grant Land to the Pole, a distance of less than 500 miles. Further than this, Byrd's flight was made under far more comfortable conditions than those experienced by Peary, who was compelled to drag with him food and fuel for the long journey, in addition to the necessary surveying and other instruments.

The failure of his aeroplane dash in 1925 had shown Amundsen that there were no safe landing places on the frozen surface of the Arctic Ocean. He therefore decided to make use of an airship in his next venture. On 11th May, 1926, two days after Byrd's famous flight, the veteran Norwegian flew from Spitsbergen across the North Pole to Alaska in the "*Norge*," an Italian airship with a capacity of 672,000 cu. ft. and a range of 3,000 miles. The Pole was reached at 2.30 a.m. on the following day, and the flags of three countries — Norway, Italy and the United States—attached to steel-pointed staffs, were hurled downward by representatives concerned in the flight. These remained standing with their points embedded in the ice as the "*Norge*" continued her flight towards Alaska. She flew over the section of the Arctic Ocean that had hitherto been completely unexplored and eventually was reported off Point Barrow. Storms then blew her back over the sea, and a severe battle followed before she landed safely in Teller, a small trading post and reindeer centre, her crew being too exhausted to take the vessel onward to Nome. During her flight of 71 hrs., the "*Norge*" crossed 2,500 miles of frozen sea.

Amundsen and his companions kept a sharp lookout for new lands or other objects of interest in the unexplored portion of the Polar basin over which they passed, but even from their elevated position they were unable to discover anything. It seems scarcely likely that land remains to be discovered in the two areas yet unvisited, but this is not quite certain, and the result of further investigation will be awaited with interest.

An explorer who early saw the advantages to be gained by the use of aircraft in Arctic work is Sir G. Hubert Wilkins. In 1926, this famous Australian, then Captain Wilkins, was a rival of Byrd and Amundsen for the honour of being the first to fly over the North Pole. His base was in Alaska, and he intended to make Point Barrow his starting point. This made it necessary to transport stores from Fairbanks, the northern terminus of the railway from the south coast of Alaska, and Wilkins made use of two Fokker aeroplanes for this purpose. Unfortunately both were severely damaged while trying to cross the Endicott Mountains that intervened between Fairbanks and Point Barrow. Wilkins himself was injured and his effort to reach the Pole had to be abandoned.

The Australian explorer was by no means disheartened, however, and success came to him in the late winter of 1928, when he flew

across the Arctic in the opposite direction to that followed by Amundsen in the "*Norge*." The flight was made in a Lockheed Vega monoplane with a Wright "Whirlwind" 225 h.p. engine. The explorer was accompanied by Lt. Eielson, and the 2,200 miles from Point Barrow, in Alaska, to Spitsbergen were covered in 21½ hours' flying time.

It is interesting to find that Sir Hubert Wilkins has turned his attention to a third means of penetrating into the Arctic. Last year he became interested in the submarine and acquired a vessel that formerly belonged to the United States Navy, and proposes to cruise under water from Spitsbergen to Alaska. At first thought a submarine may appear to be far from an ideal vessel in which to explore the frozen North, and the scheme seems more like a romance of the Jules Verne type than the proposal of a serious scientific explorer. Sir Hubert believed that exploration of the Arctic by means of a submarine will yield important results, however, and by means of the vessel he hoped to reach the great unexplored areas between the North Pole and Bering Strait. As already mentioned, he flew over a portion of this in 1928, but he thought that a submarine would give him a chance of examining it more closely during summer.

Special preparations were needed to equip the submarine for its novel purpose. Above its deck what may be described as sledge runners were firmly fixed in order that the vessel should be able to slide along the under surface of the ice that covers the Arctic Ocean. A special ice saw also was installed for the express purpose of boring holes in the ice. This saw is circular, and was to be rotated horizontally at the top of a cylinder projecting above the submarine. As it forced its way upward it was to be followed by an inner cylinder designed to form a shaft by means of which the explorers could emerge from their vessel.

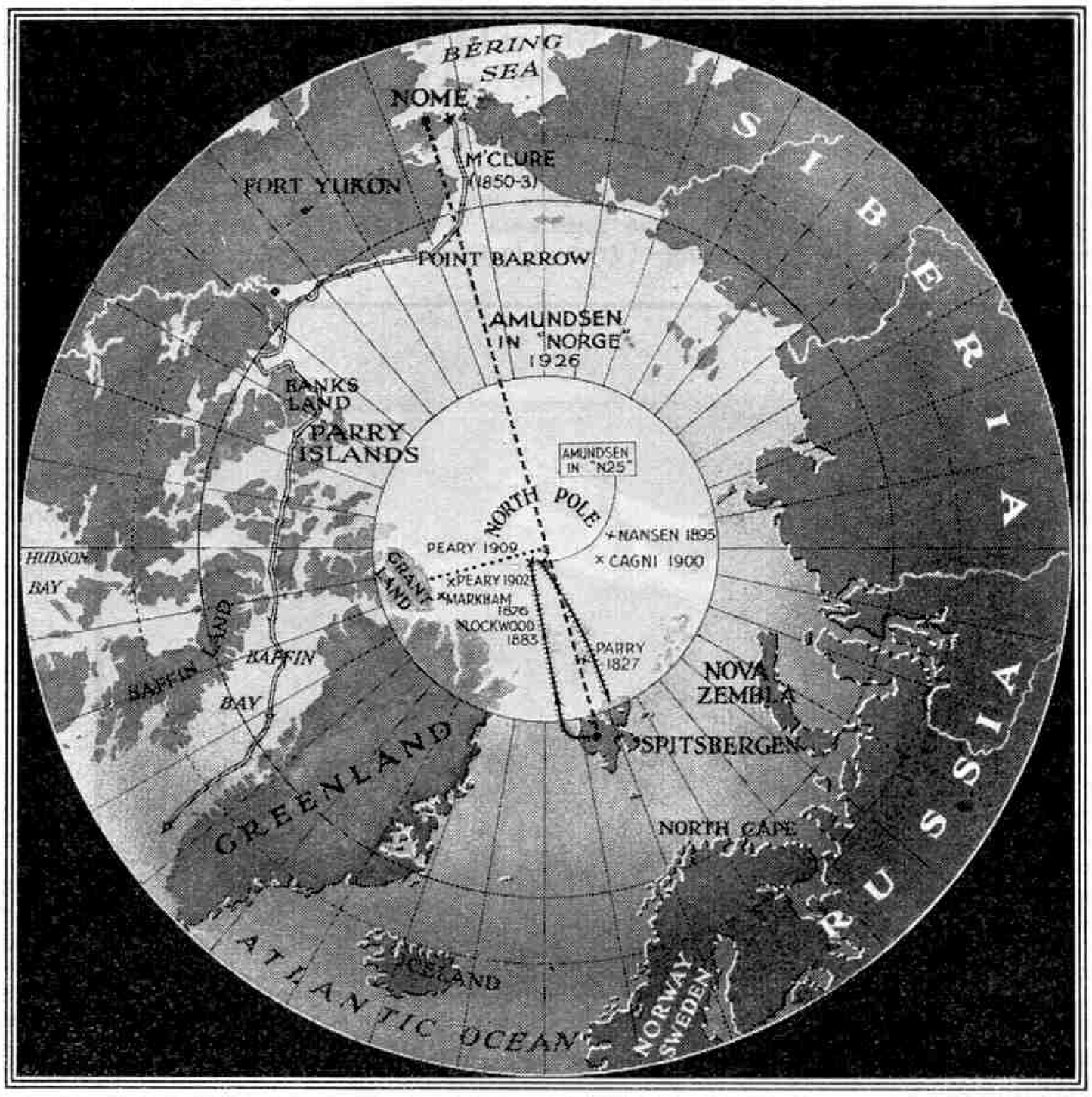
Sir Hubert proposed to make his way through the ice at various selected places, and thus to make a fairly complete survey of the route followed. Unfortunately the vessel was damaged in a stormy passage across the Atlantic Ocean and the start northward from Tromsö, Norway, was made too late to allow any extensive under-water voyage. Trials of the equipment were made in the ice-strewn waters north of Spitzbergen, however, and the experience convinced Sir Hubert that it is possible to reach the North Pole by submarine.

Interest in the Arctic has recently taken a new turn, for the flights of Byrd, Amundsen, and Wilkins have suggested the possibility of air lines across the surroundings of the North Pole. The shortest routes from Europe to Japan, Alaska and Western Canada lie across the Arctic. An ordinary map does not make this clear. For instance, on Mercator's projection, and on the similar maps of the world that appear in every atlas, Polar distances are greatly exaggerated, owing to the necessity of representing the curved surface of the earth on a flat sheet of paper. How much they are distorted may be seen on comparing the distance from Liverpool to Winnipeg, Manitoba, by way of the North Atlantic and Hudson Bay, with that by the ordinary sea route to Montreal, followed by a rail journey westward. Although on a map of the kind referred to the first of the two routes appears to be much longer, it is actually shorter than the southern one by about 600 miles. This is shown clearly on a globe.

There is an even more striking illustration of the value of the Polar regions as a short cut. From Liverpool to Yokohama, Japan, is a distance of 11,000 miles by ordinary route, but it would be reduced to one of 6,000 miles if an air line across the Pole could be established.

The invention of aircraft may enable us to make use of the shorter distances that an Arctic route affords. Regular services by land and sea to the Polar regions are at present impossible, but serious proposals have been made to establish an air route from England to Canada and New York across the huge ice-covered plateau of Greenland. It is a remarkable fact that this would not involve any ocean crossing more than 400 miles in width. This air line is of exceptional interest, for it would give easy access to western Canada as well as to Chicago and other inland cities of the United States.

The first calling places on the suggested route would be the Faroe Islands and Reikjavik, the capital of Iceland; and the flight across Greenland would be followed by one across Baffin Land and Northern Labrador. Machines for Quebec, Montreal and New York would then turn southward, while those for the West would continue their journey across Hudson Bay.



Map showing the directions of Amundsen's Arctic flights. The first was made by seaplane and nearly ended in disaster; but a successful flight in the airship "Norge" from Spitsbergen to Alaska was made in the following year.

Before such an air line as this can be established it will be necessary to survey thoroughly the country over which it will pass, and to carry out a series of experimental flights. The route is not entirely unknown, for the United States naval airmen who flew round the world in 1924 returned to their own country from Great Britain by way of Iceland and Labrador. More recently almost the same route was followed by von Gronau, a German aviator, who piloted a flying boat from the shores of the Baltic Sea to Nova Scotia, calling on the way at Reikjavik, Ivigtut in Greenland, and Cartwright in Labrador. In addition Canadian Government machines have recently been engaged in survey work in Northern Labrador, in connection with a scheme for the development of the ports on Hudson's Bay.

Two expeditions in Greenland, in addition to carrying on general scientific investigations, examined the possibilities of establishing an air route across the country. One of the expeditions was German in origin and the other British. If an air line is to be established it will be necessary to find places for aerodromes. Careful surveys were therefore made by these expeditions of the eastern and western coasts of Greenland, and also of the great Ice Cap itself. It is interesting to find that the suggested route was surveyed by the members of the German expedition with the aid of motor sledges driven by air propellers, and capable of travelling over smooth ice at 50 m.p.h. Where the ice surface was too rough to allow these sledges to be used, reliance had to be placed on dog teams, or upon ponies from Siberia or Manchuria that are accustomed to ice and snow. Even then crevasses were serious obstacles; while the glaciers by which access to the central ice must be gained are so difficult that during their inland journeys the German explorers were compelled to use dynamite in order to make a path.

A knowledge of air conditions likely to be met with on the proposed air route is just as important as the discovery of good landing places, and a careful record was kept of the weather encountered by the expeditions in various parts of Greenland. The strength and direction of the prevailing winds is of great importance, and for this reason information regarding air currents at various heights was obtained by means of small captive balloons to which recording instruments were attached.



Teleprinters to Speed-Up Business

It is understood that a new system of communication now being developed by the British Post Office will enable letters to be typed and read at their destination simultaneously with their typing at the place from which they are despatched. Machines called teleprinters are to be used for this purpose. In appearance they resemble typewriters, but they are also telegraph instruments, and as a message or letter is typed on the teleprinter at the despatching end it is automatically reproduced on that used for receiving. Each machine may be used both for transmission and reception and a typed copy is made for filing purposes at the despatch end.

Teleprinters installed in offices or works will be put into touch with each other through exchanges, exactly as telephones are now, while private lines may be installed in special cases. The introduction of such a speedy means of communication would revolutionise business, for it would make the use of the ordinary postal system unnecessary, and also would greatly reduce the necessity for telephone calls.

Teleprinters have been in use in the telegraph systems of Europe and America for some years. These consist of a typewriting keyboard transmitter and a printing receiver. Telegraphic impulses in a special code are transmitted direct to the line by the operation of the keyboard, and these are automatically translated by the receiver into printed letters on tape that may be pasted on a telegraph form for delivery. Apparently the proposed system is a development of that used for telegraphy, and in it the principles of the telephone services are incorporated, subscribers being placed in direct communication with each other when necessary.

Opening of Lloyd Barrage

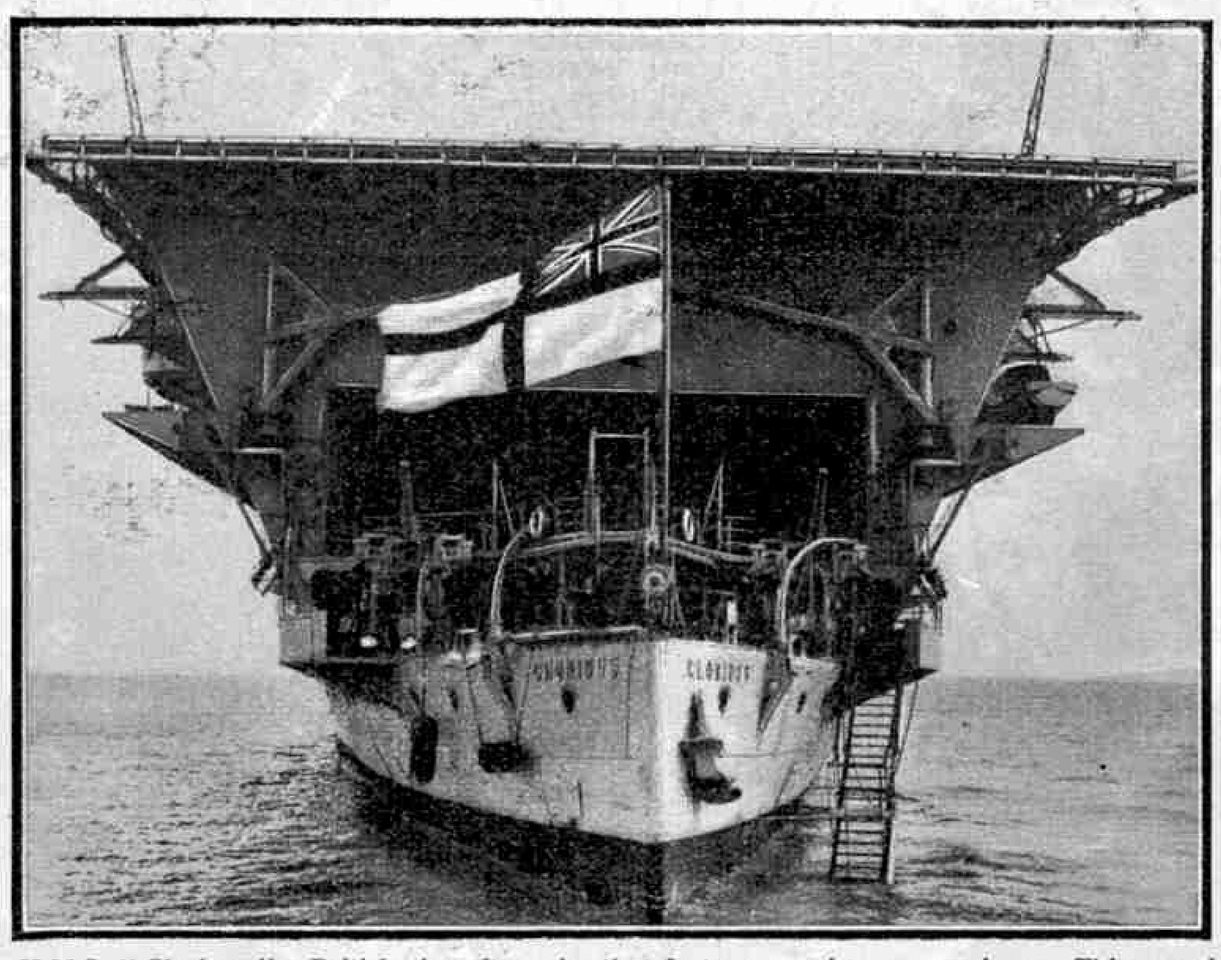
The Lloyd Barrage across the Indus at Sukkur, in Upper Sind, India, was opened on 13th January. It will enable over 5,000,000 acres of land to be irrigated by means of 6,000 miles of canals and 31,000 miles of water courses. The cost of the scheme is about £10,000,000, and we hope shortly to publish an illustrated description of the Barrage.

Proposed Salvage Work on the "*Lusitania*"

An interesting effort to reach the wreck of the "*Lusitania*," the famous Cunard liner, is projected by Capt. H. H. Railey, an American submarine expert, in conjunction with Mr. Simon Lake, a pioneer submarine inventor. The "*Lusitania*" was torpedoed off the coast of Ireland in 1915. The vessel lies upright at the bottom of the sea about eight miles from the Kerry coast, with her highest deck at a depth of 175 ft. below the surface.

The wreck will be reached by means of a long steel tube that will be lowered from the salvage vessel employed. This tube is already in existence, for it was built at a cost of £6,000 for the purpose of recovering gold from a vessel that sank off the Dutch coast in 1799, but it has not yet been used. It is provided with balancing chambers in order to enable it to remain in position, and its use will have the great advantage over the employment of diving bells and similar means of underwater exploration that the pressure of air within it will be normal.

At the lower end of the tube there is an air lock, through which divers may make their way to the deck of the sunken vessel, together with a special observation chamber from which they can be watched while at work. Powerful lights carried inside this chamber will illuminate the wreck and will facilitate the recovery of the valuables.



H.M.S. "Glorious," a British aircraft carrier that first saw service as a cruiser. This vessel has a displacement of 22,700 tons and is equipped with geared turbines that develop 90,000 h.p. and give her a speed of 32 knots. See "British Aircraft Carriers" on page 198 of this issue.

South African Bridge 1,000 Ft. in Length

An interesting engineering development in South Africa is the construction of a steel bridge across the Buffalo River at East London. This will replace a timber structure, erected nearly 25 years ago at a cost of £20,000, that carries a roadway and a railway track, but has proved unable to cope with modern road traffic conditions.

The new structure will have three combined rail and road spans, each of which will be 100 ft. in length. The remaining part of the roadway will be carried on nine spans, each 55 ft. in length and supported on steel columns; while there will be five additional rail spans, each of which will be 55 ft. in length. The rail spans will be supported by concrete piers carried on concrete cylinders, 14 ft. in diameter, built on solid rock at a maximum depth of 110 ft. below low water level.

The overall length of the bridge will be about 1,000 ft. The deck of the rail bridge will be 35 ft. above low water level, while the roadway will be 22 ft. higher, and will be 22 ft. in width with footways four feet wide on each side.

It is expected that nearly 1,800 tons of steel will be used in the erection of the new bridge, and its cost, including that of the necessary new approaches, will be nearly £115,000.

Important Indian Railway Bridge Opened

A new railway bridge across the Hooghly River at Bally, about eight miles from Calcutta, was opened a short time ago by the Viceroy of India. The bridge is 2,600 ft. in length and is made up of nine spans, seven of which are 350 ft. in length, the remaining two spans each being 80 ft. in length. The bridge provides direct access to the Calcutta Docks for the East India Railway and the Bengal-Nagpur Railway and forms an important alternative to the Howrah Bridge at Calcutta, which has hitherto been greatly overworked. The Bally Bridge has been built almost entirely of Indian materials and nearly all the work involved has been carried out by Indians.

* * * *

Mr. Gar Wood the American motor boat pilot, attained a speed of 111.712 m.p.h. on 5th February, thus exceeding Mr. Kaye Don's record of 110.28 m.p.h.

Powerful Cranes for South African Ports

A 60-ton floating crane of the slewing and derricking type, built by Cowans, Sheldon & Co. Ltd., Carlisle, recently arrived at Capetown after being towed from the Tees, where part of it was constructed and tests were carried out. The crane is electrically operated, the necessary current being supplied by a generator driven by an oil engine, and during trials it lifted loads of 15 tons more than its designed capacity.

The crane is intended for use in the docks at Capetown and is provided with two lifting blocks. One of these is to be used with loads up to 20 tons. It operates at a maximum radius of 93 ft. 6 in. and is designed to raise loads to a height of 110 ft. above water level. The second block will be employed when weights of from 20 tons to 60 tons are to be raised. Its greatest working radius for full loads is 80 ft. and it gives a height of lift above water level of 100 ft. The crane is speedy in action, for with a 60-ton load it can be slewed through a complete circle in three minutes, and the jib can be derricked through its full range in about 10 minutes.

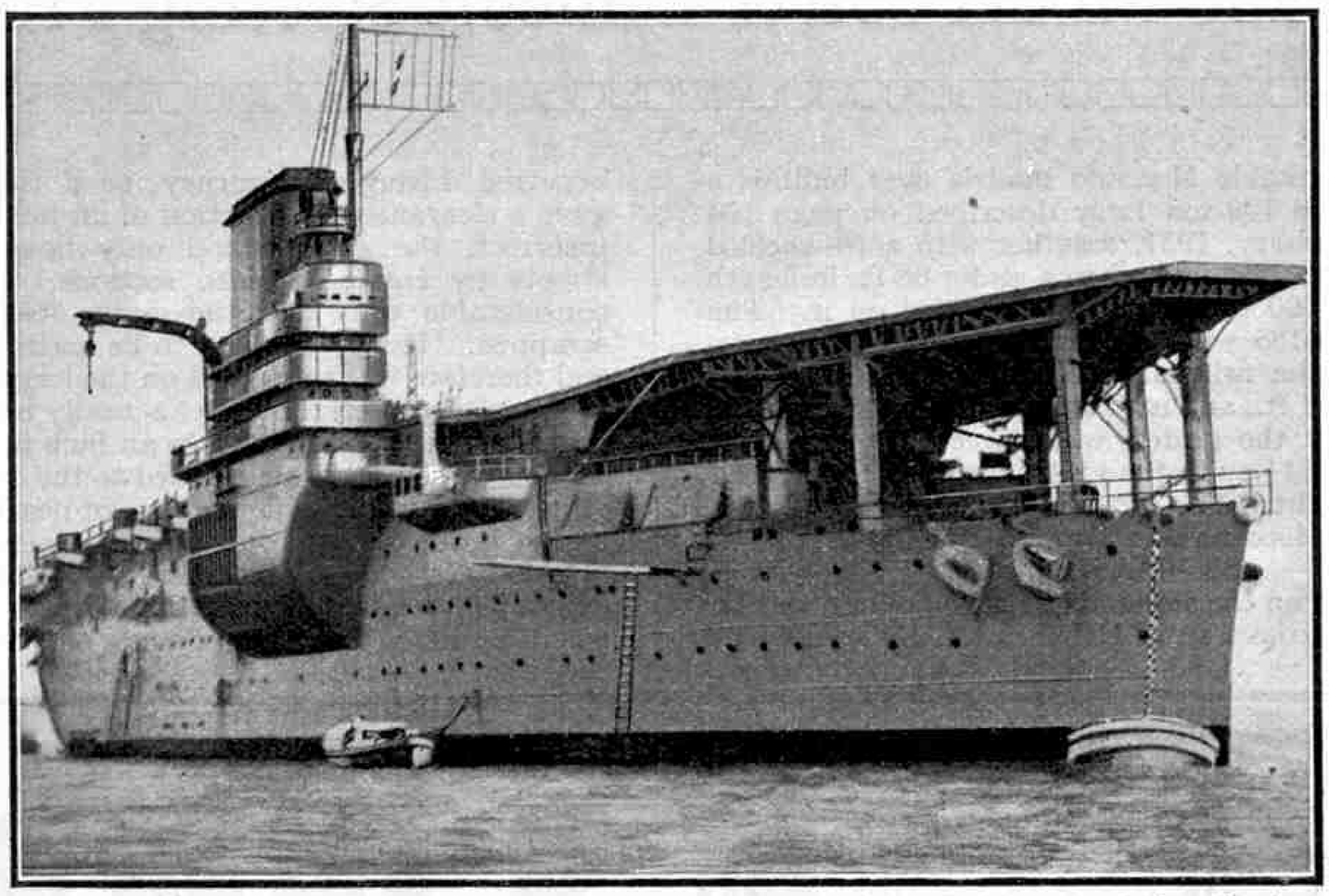
The pontoon of the crane is of the non-propelled type, is 160 ft. in length, and has a moulded beam and a moulded depth of 56 ft. and 12 ft. respectively. It houses the necessary machinery, while the control cabin is situated on the framework of the crane in order to give the operator a clear view of the load and of the deck of the pontoon.

The port of Durban is to be equipped with an even more powerful crane than that at Capetown but this will not be of the floating type. It will be used for the purpose of unloading weights up to 80 tons from vessels berthed alongside and as a depth of water of 30 ft. is available, it will be capable of dealing with loads from the largest vessels now using the port. Special foundations are to be built in order to support the weight of the new crane.

Spanning an Historic River

A bridge that is to be built across the Tigris at Mosul is of special interest, for it will consist of metal spans constructed during the War, and since stored at the War Disposals Depot at Didcot. These spans are of a special portable design, and were intended to facilitate the rapid erection of bridges to meet various war-time emergencies.

The contract for the steelwork of the new bridge has been secured by Sir Wm. Arrol & Co. Ltd. The structure will be 984 ft. 6 in. in length and will have eight spans, each about 120 ft. in length. Causeways of masonry will be erected on each side.

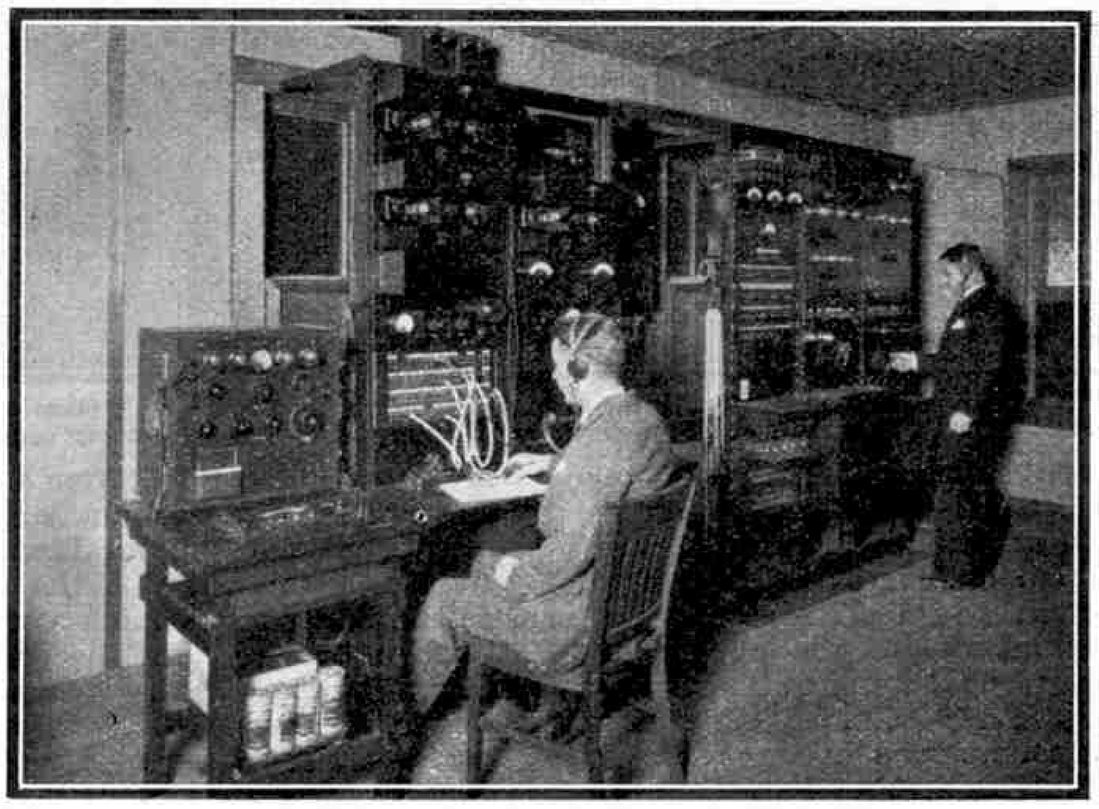


The "Bearn," an interesting French aircraft carrier. This vessel has a flying deck that extends from the stern to the bows, the funnels and wireless masts being placed on the starboard side of the carrier. (See page 198.)

Submersible Bridges in India

It is interesting to note that in India bridges frequently are built below the high flood levels of the rivers they span. The reason for this is that many Indian rivers are very small streams during certain months of the year, but in the rainy season become raging torrents that overflow their banks and sweep away anything in their course that is not securely rooted to the ground. Such rivers would threaten tall piers and long approaches with destruction, and bridges across them therefore are built with low and heavily constructed abutments in order to prevent them from being swept away by floods. In most cases such bridges are impassable for only a few days of the year.

Submersible bridges usually are constructed of brick, reinforced concrete or similar material. They have no openings in which debris may lodge, to add to the pressure, and their piers are streamlined in order to reduce their resistance to the torrents that flow past them in the wet season. Bridges of this kind are cheaper to build than tall steel structures.



In the wireless telephone receiving station, Houlton, America. The wireless receiving unit is on the right and the operator on the left transmits wireless calls by land line to New York. See article, "The Wireless Telephone" on page 174 of this issue.

High-Temperature Steam Turbines

Two 75,000 k.w. turbo-alternators now being built by the British Thomson-Houston Company Ltd. for the new Barking extension of the County of London Electric Supply Company are the largest yet ordered in this country. The turbines, which are of the three-cylinder type, are designed to operate normally with steam at a pressure of 600 lb. per sq. in. and a temperature of 800°F., and the maximum steam pressure and temperature at which they will work are 700 lb. per sq. in. and 850°F. respectively.

Two 67,200 k.w. turbo-alternators also are being built for the Battersea Power Station of the London Power Company. One of these is being supplied by the British Thomson - Houston Company, and the other by the Metropolitan-Vickers Electrical Company. In each case the turbine is of the three-cylinder type designed to operate with steam at 570 lb. per sq. inch and 850°F.

These four turbo-alternators use steam at very high temperatures, and the engineers of the British Thomson-Houston Company believe that in future, steam temperatures of between 900°F. and 1,000°F. will be employed regularly. A large turbo-alternator installed last year in the Delray Power Station of the Detroit Edison Company makes use of steam at a temperature of 1,000°F., and now has been in service long enough to show that satisfactory results may be obtained from the use of steam at higher temperatures than have hitherto been employed in commercial service. This turbo-alternator develops 10,000 k.w. at 3,600 r.p.m., and was designed for the comparatively low steam pressure of 365 lb. per sq. in.

Italian Motor Liner Launched

The present activity in the Italian shipbuilding industry was illustrated recently by the launch of the "*Neptunia*," a vessel of 20,000 tons, while this event will be followed in a few months by the launch of a sister ship to be called the "*Eridania*."

The new vessel is a quadruple-screw passenger and cargo vessel built for service between Italy, Brazil and the River Plate, and she is expected to commence operations next August. She has an overall length of 589 ft., her length between perpendiculars being 556 ft., and her moulded breadth is 76 ft. 6 in. She is fitted with four sets of Diesel engines developing 17,800 b.h.p. and will have a service speed of 19 knots.

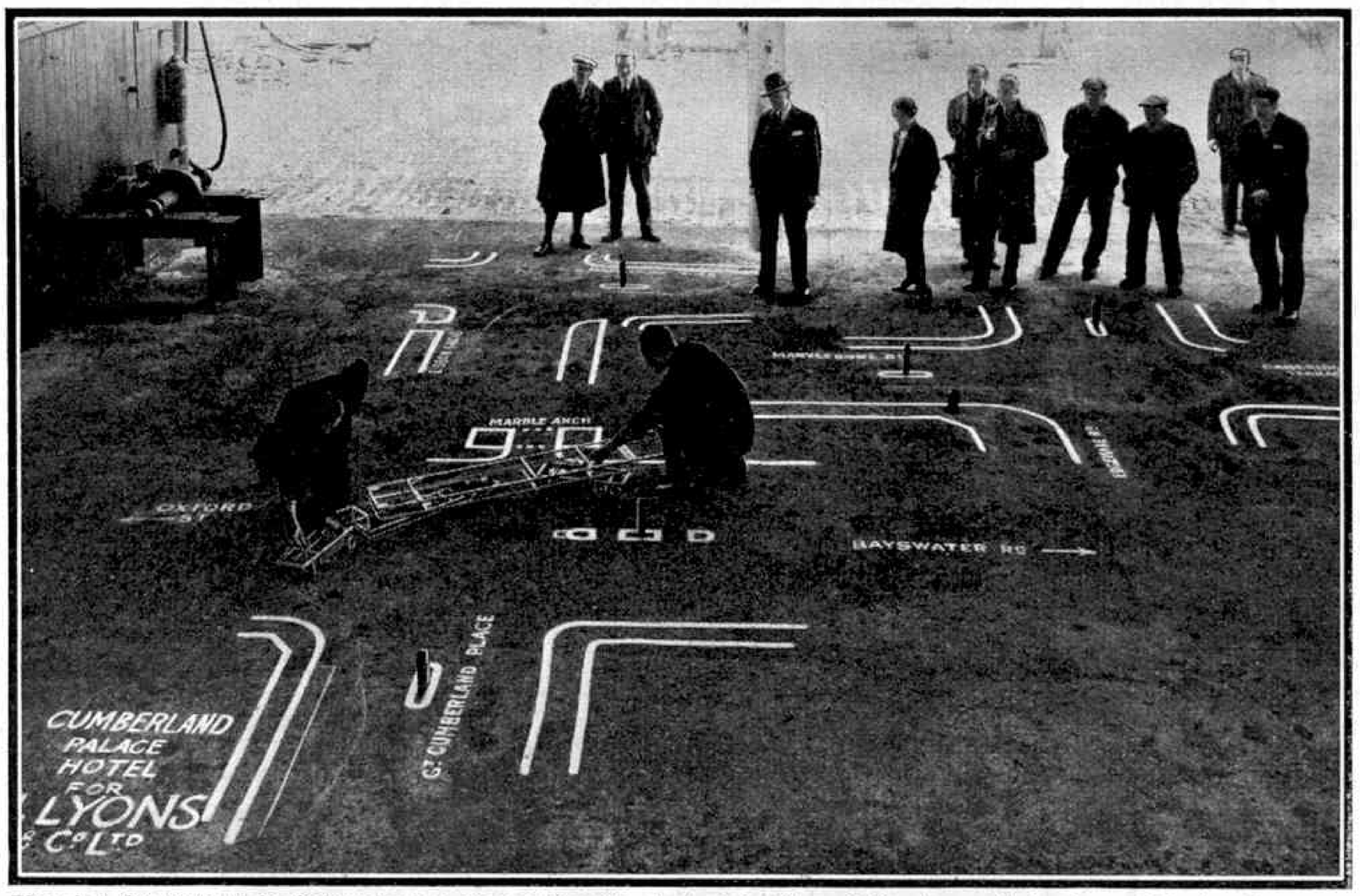
The "*Neptunia*" will have a crew of about 260, and will have accommodation for 180 cabin passengers, 710 tourist third class passengers, who will be provided with cabins, and 650 ordinary third class passengers, who will sleep in dormitories.

Transporting a Girder Weighing 99¼ Tons

Meccano Model Solves Difficult Steering Problem

ONE of the most remarkable Meccano models ever built is a representation of the 100-ton lorry described on page 104 of our issue for February, 1931, together with a 16-wheeled trailer that was attached to this lorry when a girder 68 ft. in length and weighing practically 100 tons had to be carried on it. The model illustrated on page 185 will be seen to be an exact reproduction in miniature of the original, including the load. It is built to a scale of 1¼ in. to 1 ft., and is 11 ft. 6 in. in length from the head lamps to the rear of the girder, which overhangs the rear trailer. Its total weight is 1½ cwt., the girder itself accounting for half of this enormous weight. The number of wheels is 58, however, and thus each of the Meccano 3 in. Dunlop Tyres fitted carries a load of less than 3 lb.

The model was exhibited on the stand at the Birmingham section of the recent British Industries Fair of M.R.S. Ltd., Liverpool, the owners of the 100-ton lorry. There it attracted the interested attention of visitors, practically all of whom were engineering experts, and they were greatly impressed by the faithfulness with which every feature of the great lorry and its trailer were reproduced. The unanimous opinion was that the model is a great achievement, and supplies proof, if indeed proof is still needed, that Meccano model-building is true engineering in miniature.



Planning the route to be followed when transporting the giant girder through London. Scale plans of the turnings were marked out in chalk and a Meccano model of the lorry and its load was used to find the best course to follow.

The performance of this wonderful model is as remarkable as its appearance. It is fitted with a Meccano E.1 Electric Motor and pulls its heavy load with remarkable ease. Even the addition of a weight of five cwt. failed to reduce the speed during its trials, and it is doubtful if so small a motor has ever surpassed the feat accomplished by that employed in the model. The motor was a standard production, taken from stock, and this achievement is a wonderful testimonial to the powers of Meccano motors, while the model is a splendid proof of the adaptability of the Meccano system.

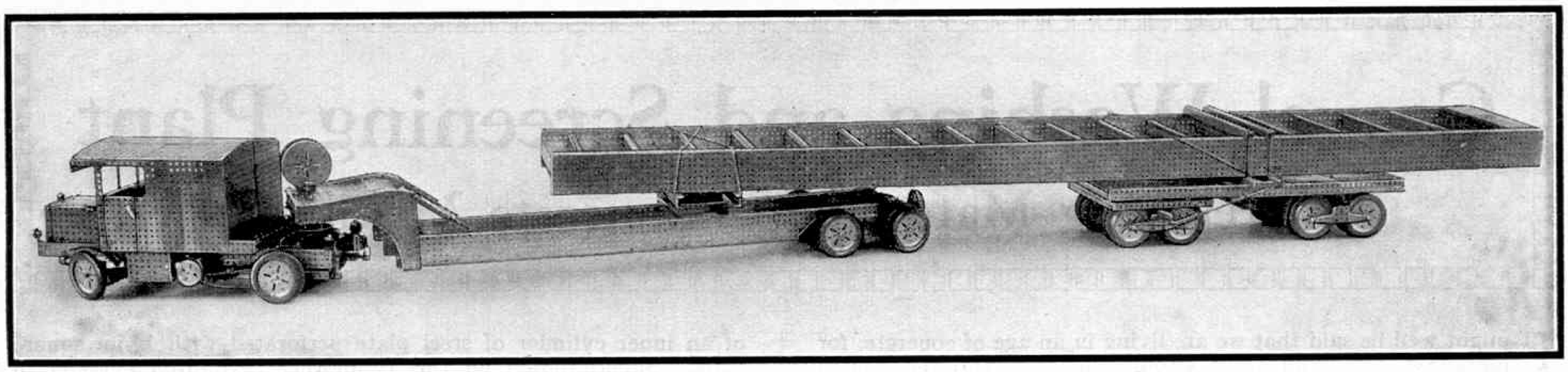
The original of the model has been employed in transporting girders required in the erection of the Cumberland Palace Hotel now being built near the Marble Arch, London. The girders were built by Dorman Long & Co. Ltd., Middlesbrough, and among them is one that is believed to be the largest and heaviest ever made. It is 68 ft. in length, 10 ft. 4 in. in depth, and 2 ft. 4 in. in thickness, while its weight is 99¼ tons and it contains no less than 2½ tons of rivets. A second girder is only slightly smaller and weighs 82 tons. Both were brought by rail from Middlesbrough to the L.N.E.R. goods yard at Marylebone.

The task of conveying these huge girders to the site of the hotel was undertaken by M.R.S. Ltd., Liverpool, and the giant 100-ton lorry already referred to was employed. The larger of the two girders was moved first. The only route available included a number of awkward right-angled turns, and it was necessary to exercise great care and forethought both in planning the route and in deciding upon the means to be employed, for if a breakdown had occurred during the journey, or if the calculations, which only gave a clearance of a fraction of an inch at each corner, had been incorrect, the girder could only have been removed from the streets by cutting it into sections. This would have taken a considerable time and the girder itself would have had to be scrapped. It was too long to be carried on the lorry alone. One end therefore was supported on the lorry and the other carried on a 16-wheeled trailer, the girder actually resting on turntables, 8 ft. in diameter, made of steel plate an inch in thickness. The necessity for using a second vehicle added to the difficulty of dealing with the girder, for a trailer at a distance of nearly 60 ft. from the driver of a lorry is not easy to control, and efficient means of steering such a vehicle have been sought for years. The problem was solved after experiments with models built from Meccano parts, however, which led to the discovery of a new and reliable principle. This is to couple side extensions from the load-carrying turntable to the steering gear of the trailer. In this manner the movements of the rear end of the girder itself control the steering of the trailer and keep it under control by causing it to track perfectly behind the forward vehicle.

Even when the design of the combined vehicle was settled, there still remained the difficulty of negotiating the corners between Marylebone goods yard and the site of the hotel. There were three that threatened difficulties. These were the turnings from Lisson Grove into Marylebone Road, from Marylebone Road into Edgeware Road, and finally from the junction of Bayswater Road and Oxford St. into Great Cumberland Place, where the hotel is being erected. Refuges in the middle of the roadway and electric main fuse boxes on the pavements at each of these turnings added to the difficulties because they reduced the width of available roads at corners to 15 ft. It was necessary to survey the route very closely before the actual journey was attempted, therefore, and trial runs were made with an exact scale model of the lorry and trailer on reproductions of the turnings marked out in white paint on a large concrete floor. The model was constructed of Meccano parts and reproduced exactly the pivoting and steering arrangements of the giant vehicle on which the girder was to be transported.

After a number of trials, the exact courses to be steered at the turnings were discovered, and these were marked out in chalk on the roads at the actual corners to be negotiated. The manhole covers and gully grates that were likely to be crossed by the wheels were then covered with steel plates, and everything was made ready for the actual journey.

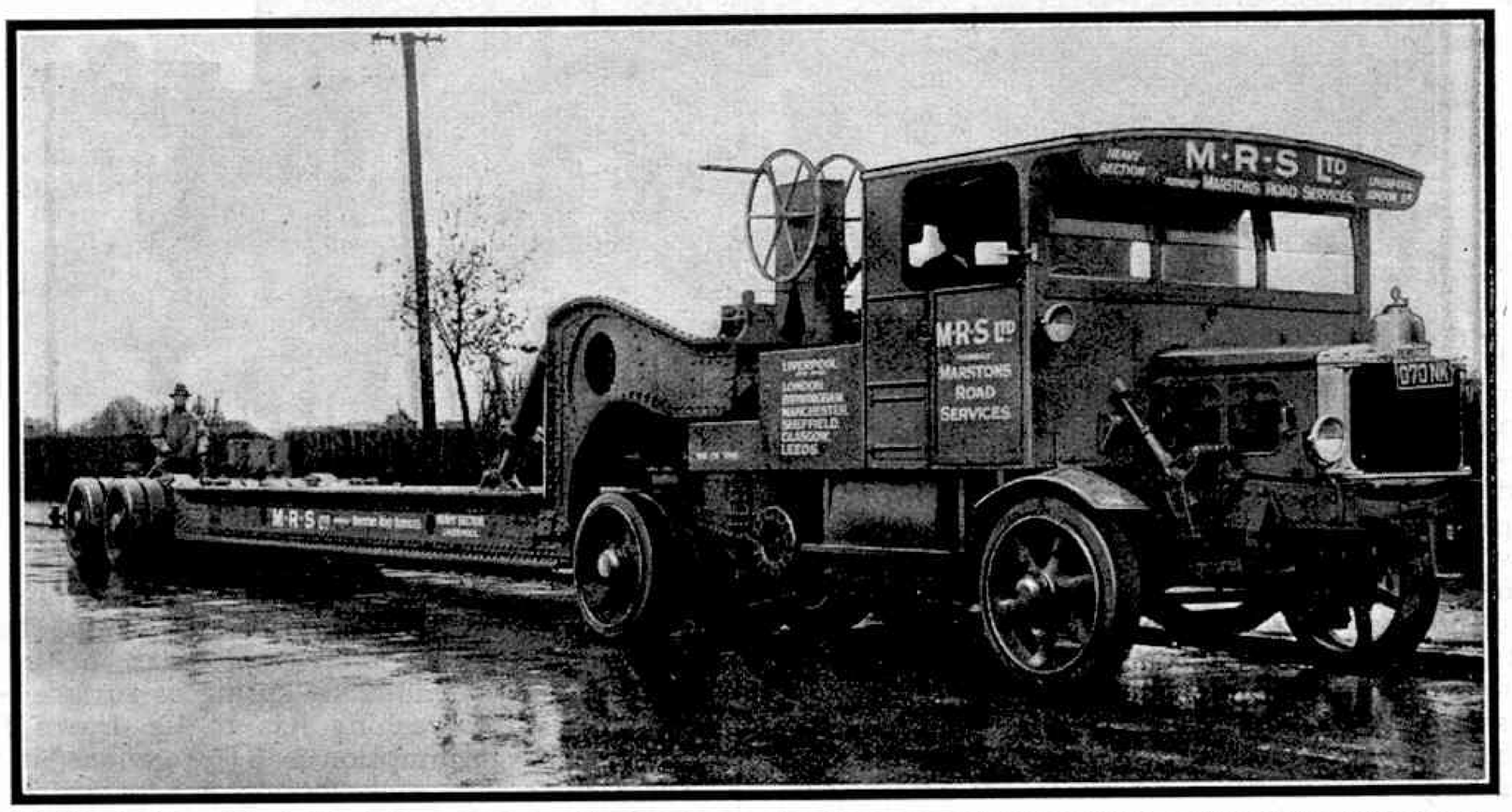
The morning of Sunday, 25th October, was the time chosen for the transport of the first girder. Special permission had to be obtained from the London County Council authorities and the police, for during the slow passage of the girder it was necessary to close certain streets entirely to traffic. To add to the difficulties, it was learned that the Horse Guards were to be on parade at the



time when it was expected that the lorry would be passing from Bayswater Road to the Marble Arch. A friendly warning was issued that the march of the Horse Guards could not be held up in any circumstances, for the Royal Standard would be carried because the King was in residence in London.

The whole of the day before the actual journey was spent in transferring the girder to the lorry and trailer, and in so placing it that the load was distributed evenly over the 30 wheels of the two vehicles. The weight of the girder and the lorry was 164 tons, but owing to the number of wheels and the width of the rubber treads this gigantic total imposed no more strain per square inch of road surface in contact with the tyres than is caused by an ordinary omnibus.

All was ready at 11 a.m. on Sunday, and a crowd of interested sightseers estimated at between 15,000 and 20,000 then saw the 60 h.p. tractor-trailer haul the girder out of Marylebone goods yard into Lisson Grove. Unfortunately the people walked over the guiding chalk marks, completely obliterating them, and they also made matters more difficult by preventing the driver of the lorry from obtaining a clear view of the edges of the pavement, which were expected to give useful help in steering. Excellent progress was made at a speed of about 1½ m.p.h. however, and the first turning, that from Lisson Grove into Marylebone Road, was made entirely according to plan. When the outfit was straightened out, however, it was found that the girder had slipped about a foot towards the near side of the rear trailer. It was returned to its correct position by adjusting the levels of the girders at the front of the combined lorry and trailer, and progress was resumed.



The illustration at the head of the page shows the Meccano model of the giant girder mounted on the 100-ton lorry and its trailer. The lower photograph gives an excellent idea of the 100-ton lorry itself. For this photograph, and that on the opposite page, we are indebted to M.R.S. Ltd., Liverpool.

The turning from Marylebone Road into Edgeware Road was only made after considerable delay, for a projection from the turntable on the trailer threatened to destroy an electric main fuse box at the corner. The rear end of the girder was slightly out of its expected position, probably owing to the lack of exact guidance that followed the obliteration of the chalk marks. A few inches extra clearance would have allowed the passage of the load, but for lack of this it was necessary to make no fewer than six reversals of the entire outfit.

Even then the trouble was not at an end. In order to negotiate the fuse box it was necessary to disconnect the steel wire connecting the girder to the turntable of the trailer. The lorry and its trailer then assumed the shape of a capital letter Z, and destruction threatened a lamp post on a refuge in the middle of Edgeware Road. In order to overcome the new difficulty, a steam tractor was connected by cable to the front of the trailer, and this was forcibly hauled sideways while the lorry itself pulled forward. The obstacle was satisfactorily negotiated in this manner. The special steering arrangement then was re-connected, and as a result the whole load straightened out when the lorry proceeded forward.

The trouble at the corner of Marylebone Road and Edgeware Road caused a delay of nearly three hours, but after that no difficulty was experienced. The turning from Marble Arch into Great Cumberland Place was made in a few minutes, the pivoting and steering arrangements working perfectly; and after its long and slow journey the girder was drawn up alongside the site of the hotel in readiness for lifting into position.

The whole of this enormous weight was drawn by a 4-cylinder petrol engine of standard design. This is normally of 60 h.p. and actually used less than a gallon of petrol during the journey. On the following Sunday the second girder was dealt with in a similar manner. It was moved early in the morning, and as few people were present the route chalked on the road could be followed without difficulty. The result was that the girder was taken to its destination in 40 minutes without a hitch.

The whole story of the movement of the giant girders from the goods yard to the site on which they were to be erected illustrates the adaptability of Meccano and justifies the claim that it is engineering in miniature. The discovery of the new principle of steering a trailer was made during experiments with miniature vehicles built of Meccano parts and in actual practice the idea worked as well as in trials with the models. In addition, the use of a reproduction in Meccano of the girder mounted on the lorry and trailer not only enabled the route to be planned beforehand, but actually was necessary in order to make certain that the gigantic loads could be moved safely by road.

The contract for the removal of girders from the L.N.E.R. goods yard at Marylebone to the site of the Cumberland Palace Hotel was an extensive one, and in addition to the two already dealt with, girders weighing from 40 tons to 75 tons were included. These were not as long as the giant girders weighing 99¼ tons and 82 tons respectively, and it was not necessary to make use of the trailer.

Until a few years ago the transport of these giant girders by road would have been regarded as impossible, but as the article, already referred to, in the "*M.M.*" for February, 1931 shows, it is quite easy to move locomotives, boilers, parts of electrical machines and large castings in this manner. The giant lorry has 14 wheels, four of which are removed when loads of less than 65 tons are to be carried, and it is claimed that the distribution over these of the enormous weight carried means the imposition of only slight strains on road surfaces. In addition, the maximum speed of the lorry is restricted to five or six miles per hour, while the rear axles are of the oscillating type and the wheels remain in close contact with the ground. All these features are faithfully reproduced in the Meccano model illustrated on this page, and this will be fully described in an early issue of the "*M.M.*" The model itself, exhibited on the stand of M.R.S. Ltd. at the Birmingham section of the British Industries Fair, has aroused widespread interest.

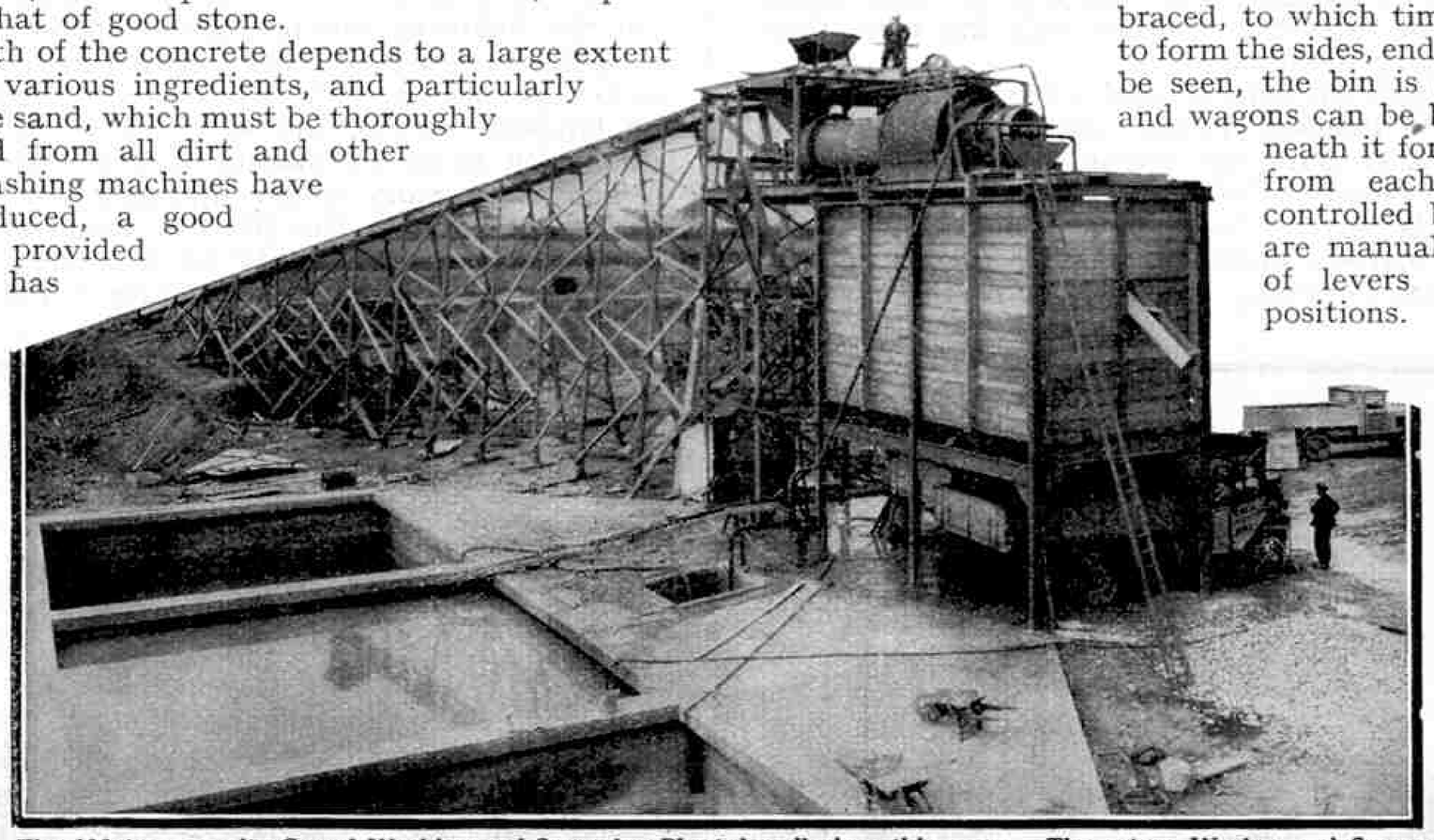
Gravel Washing and Screening Plant

Preparing Material for Concrete Making

IT might well be said that we are living in an age of concrete, for nowadays this immensely strong and comparatively cheap material is used for almost every type of building construction. It is employed for laying the foundations of bridges, for clothing the steel framework of huge skyscrapers, constructing moles and breakwaters, houses and churches, and for the backing of wharves and docks. Although concrete was known and used by the Romans, it is only in recent years that its exceptional qualities have been fully appreciated and utilised.

Concrete is a conglomerate mixture of coarse pieces of stone, broken brick or crushed slag, mixed with sand and Portland or other cement. The composition can be formed into blocks of any required size, and these, after exposure to the weather, acquire a hardness equal to that of good stone.

The ultimate strength of the concrete depends to a large extent on the purity of the various ingredients, and particularly is this the case with the sand, which must be thoroughly washed and separated from all dirt and other impurities. Special washing machines have therefore been introduced, a good example of which is provided by the plant that has recently been installed at the Thorpe Gravel Pits Ltd., Thorpe, Norwich. These pits cover an area of about 28 acres, and the gravel consists of approximately 10 per cent. of clay, 20 per cent. of sand and 60 per cent. of gravel between $\frac{1}{8}$ in. and $1\frac{1}{8}$ in., and 10 per cent. of gravel from $1\frac{1}{2}$ in. to 8 in., intermixed with hard flints. The washing plant, a general view of which appears on this page, was built and erected by Marshall, Sons & Co. Ltd., of Gainsborough, and is designed to deal with an output of 400 tons of gravel per day of 10 hours.



The 400-ton capacity Gravel Washing and Screening Plant described on this page. The rotary Washer and Screen can be seen on top of the storage bin, under which a motor lorry is receiving a load of material. The washing water is drawn from the three reservoirs seen in the left foreground. For this illustration we are indebted to the courtesy of Marshall, Sons & Co. Ltd., Gainsborough.

In addition to washing and separating the sand from the other materials, the machine also separates and grades the gravels into compartments in a huge storage bin, and these are afterwards sold for road-surfacing and other purposes.

The gravel is taken from the pit by a steam-driven excavator, and after the larger flints have been removed, the material is loaded into side-tipping wagons, each of which has a capacity of 1 cu. yd. These wagons are then hauled up a timber gantry, which is built on a gradient of 1 in 6, by means of a Marshall belt-driven friction winch. This gantry is shown in the accompanying illustration, which gives a general view of the plant. On reaching the top of the gantry, the material is tipped into a hopper, the outlet from which is controlled by a mechanical reciprocating feeder that feeds the material into the washer. This feeder is a drum 4 ft. in diameter by 12 ft. long, and in the illustration can be seen on top of the wooden box-like structure. The gravel is fed into one end of the drum where it encounters a turbulent stream of water, which rushes in at the other end and thoroughly cleanses it of clay and dirt. In addition washing is facilitated by a number of agitator propeller blades fitted inside the drum. The drum is partially closed at each end by a concentric ring and is driven by an electric motor at a speed of 9 r.p.m., so that the gravel is turned over and over and gradually propelled towards the discharge end. When it reaches the outlet, the gravel is lifted out axially on to the grading screens by peripheral elevating blades, while just before this occurs it is given a final washing with clean water.

The screen, which grades the various sizes of gravel, consists of an inner cylinder of steel plate perforated with $1\frac{3}{4}$ in. square holes. Superimposed on this is another perforated cylinder in which the holes are $\frac{7}{8}$ in., and over this again are two screens of woven steel-wire cloth with meshes of $\frac{1}{2}$ in. and $\frac{3}{16}$ in. square respectively. The second of these meshes is kept clear by a series of tapping rollers, which are operated by cams from a main driven shaft. As the gravel passes through the various perforations in the cylinders or screens, the various grades of material are sorted out, and each grade is collected on a steel chute and conveyed to a separate compartment in a huge storage bin. The bin has a capacity of about 120 tons, and is easily recognised as the box-like structure seen in the illustration. It consists of a framework of rolled steel sections rigidly tied and braced, to which timber planking is bolted to form the sides, ends, and bottom. As will be seen, the bin is designed so that lorries and wagons can be berthed directly underneath it for loading, the discharge from each compartment being controlled by special gates, which are manually operated by means of levers placed in convenient positions.

All the sand contained in the gravel is eliminated in the washer and is carried by the water into a dewaterer, the height of this being such that the contents can easily be discharged into a lorry. The overflow of water, both from the washer and the dewaterer, now containing clay and sludge, runs down by gravity into one of the reinforced concrete settling reservoirs visible in the foreground in the illustration. These reservoirs play an important part in the economical running of the plant, because, no spring or surface water being available, the water for washing has to be drawn from the mains. As the hourly consumption is 5,000 gallons, it was decided to build three reservoirs each having a capacity of 41,000 gallons, and to fill each in turn. After the clay and the sludge have settled, a process which only takes 24 hours, the clear water is syphoned into a sump and then pumped back into the washer by a centrifugal pump.

As each reservoir is emptied, the clay is pumped out on to the adjacent property. The whole of the plant is driven by a 25 h.p. electric motor, which is supplied with current from the local mains system. The motor is housed in the small hut under the inner end of the gantry, and drives a main shaft at 200 r.p.m. From the main shaft belts convey the drive to the washer, feed mechanism and screen, and to all the other driven parts of the plant.

The products of this plant are washed sharp and soft sand, washed and graded gravels of various sizes, and unwashed gravel from 3 in. to 8 in. Each of these materials has its uses in various forms of foundation work for buildings and roads.

Before concluding we would like to mention that Meccano model-builders on the look-out for new subjects will find the gravel washing plant well worthy of attention. In building a model of this kind, incorporating as it does so many novel features, the constructor's ability and ingenuity is put to a thorough test, and by thinking things out for oneself the greatest pleasure from Meccano is obtained.

We shall be glad to receive photographs of any models built by readers, and those that are suitable will be published in the "*M.M.*"



NOTES ON NEEDLES—THE FIBRE TYPE

LAST month I mentioned that fibre needles have been the cause of much controversy among gramophone enthusiasts. It has always been admitted that fibres have a much smaller wearing effect on records than steel needles, but for a long time this advantage was outweighed by the liability of fibres to break down on loud records, and to produce a small and rather dull tone. The first of these disadvantages has been overcome by the introduction of fibres hardened by a special "doping" process, so that they will stand up to practically any recording. Deficiencies in tone have been remedied by specially designed sound-boxes. Properly used, fibre needles will give as great a volume of tone as is required in any ordinary room, and with ample brilliance, but without any harsh "steeliness." At the same time one has the comforting knowledge that there is no perceptible wear on the records. Indeed the number of times a record can be played by fibre needles without deterioration has never been determined.

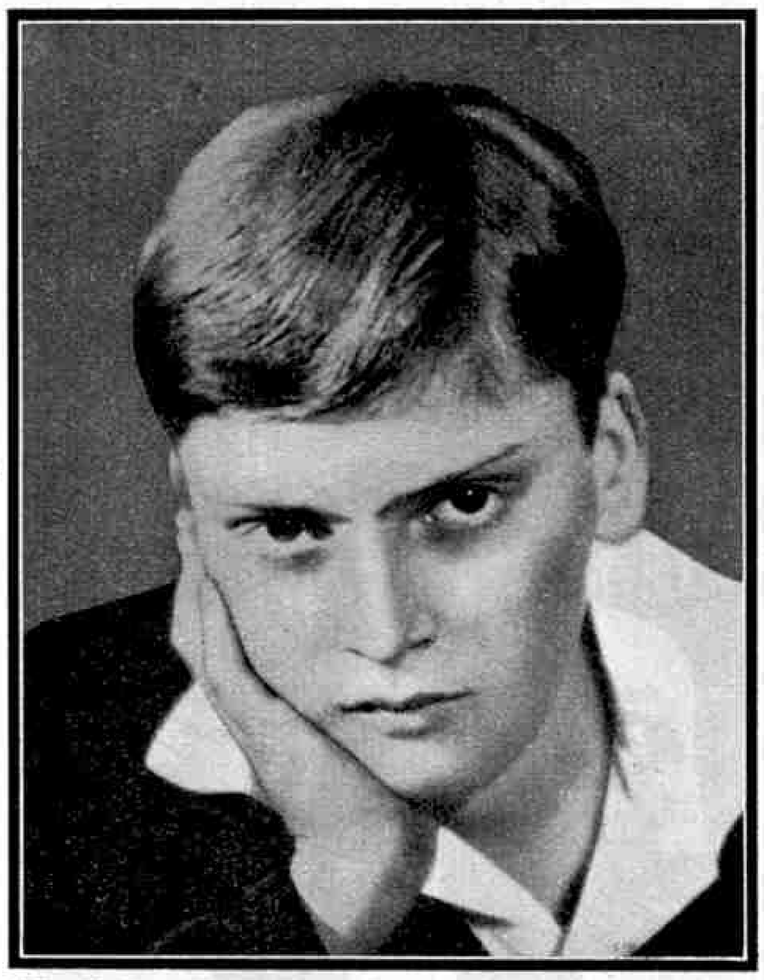
It must be admitted that fibres are a little more trouble than steel needles. In the first place they require a sound-box specially made and tuned for them. Ordinary commercial gramophones are fitted with sound-boxes designed for steel needles, which have a round shank. Fibre needles are triangular in shape, and many gramophone makers cut a triangular slot in their sound-boxes, so that these will take either steel or fibre needles. Such sound-boxes give very disappointing results with fibres, however. I advise readers who already possess gramophones and who wish to adopt fibre needles and put an end to record wear, to write for details of special sound-boxes to E.M.G. Hand-Made Gramophones Ltd., 11, Grape Street, London, W.C.2, a firm that specialises in fibre needle reproduction.

Whereas steel needles are used once and then thrown away, fibre needles are used for several records, a fresh point being produced each time by cutting a thin slice off the end. This is done by a special scissor-like cutter, of which there are three or four good makes. The cut must be made cleanly, so that there is no trace of a "tail" left on the needle. It should not be taken for granted that the cutter will always produce a perfect point. Sometimes, and particularly before the knack of using the cutter has been acquired, a ragged point will be produced. For this reason it is advisable to examine the point after each cut before inserting the needle in the sound-box, for an imperfect point is almost certain to cause annoyance by breaking down in the middle of a record. Generally speaking the shorter the needle the crisper the reproduction, but when a needle has become so short that it projects less than $\frac{3}{8}$ in. from the socket it should be discarded. It should be noted that the longer the projecting portion of the needle the easier is the work for the point. For this reason a long needle will often prove successful in playing a record of unusual difficulty on which short lengths are liable to break down.

It is important that fibre needles should be kept as dry as possible, and special dry-air bowls are now obtainable for storing them. These bowls are air-tight vessels containing a chemical filling that absorbs all moisture.

The ideal gramophone for use with fibre needles is one with a large external horn. My own instrument, a Mark XA model made by E.M.G. Hand-Made Gramophones Ltd., has a horn that resembles in size a ship's ventilator, but its tone is wonderful, the reproduction being perfect from the lowest tones to the highest. Many people object to an external horn, however, and fortunately good results with fibre needles can be obtained from gramophones of the ordinary type with internal horns. The one thing that is absolutely necessary is a sound-box specially designed for fibres.

As I have already said, fibres require a little more care than steel needles, but the extra trouble is amply repaid by purity of tone and complete absence of wear on the records.



Yehudi Menuhin, the boy violinist who, at the age of 15, is famous throughout Europe and America. For this photograph we are indebted to the Gramophone Co. Ltd.

A Boy Violinist's Triumph

The majority of great instrumentalists have shown signs of unusual talent at an early age, but few have developed such remarkable musical and technical ability in childhood as Yehudi Menuhin, the wonder violinist whose portrait appears on this page. At the age of 15 he is master of his instrument, and has already achieved a great reputation throughout America and Europe.

Yehudi was born in California. His parents were keenly fond of music, and were regular att nders at the concerts given by the San Francisco Orchestra under the direction of Alfred Hertz. The birth of Yehudi put a stop to their concert-going for a while, for they had nobody to leave him with at home, and if there is one thing concert directors dislike it is babies among the audience, with the constant risk of howls at awkward moments! The love of music proved too strong, however, and before the boy was a year old his parents took him with them to one of the orchestral concerts, hoping for the best, and provided with a bottle of milk for use in emergencies. They need not have worried; the child never made a sound, and appeared to be soothed by the music. After this Yehudi became a regular concert-goer, and his interest in the orchestra was unmistakable, the violins in particular seeming to fascinate him.

When he was three years old he was given a small toy violin, which he promptly smashed; apparently it did not sound right! A year later he was provided with a real violin and commenced lessons. His progress was extraordinary, and at the age of seven he played at one of the San Francisco orchestral concerts that he had begun to attend so early. Since that time he has gone on from triumph to triumph, astonishing all his hearers with the brilliance of his execution and his grasp of the greatest works written for the violin. Apart from his playing he is just an ordinary healthy, happy boy, and is not in the least spoiled by his success.

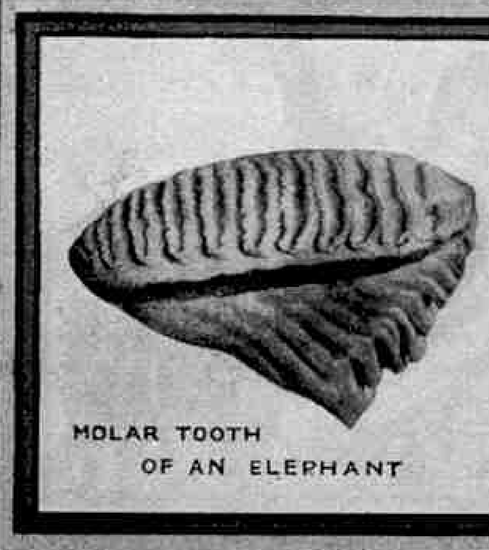
Yehudi has made some splendid records for "His Master's Voice," and I strongly recommend these to all readers who are interested in the violin.

"Broadcast" Records

The output of Broadcast records continues as merrily as ever, and the all-round excellence of these discs is well maintained. Sandy Powell sets out to buy a greyhound, and manages to extract an extraordinary amount of fun from the proceedings. This record (775), and also the one in which Sandy tries his hand at conducting a tram (675), are well worth adding to any collection of humorous records. "*The Bugginses at the Pantomime*" (780) is also very funny on the whole, but drags a little here and there. A record of a different type that is well worth hearing is a suite from the successful Drury Lane production "*Cavalcade*." In this a series of the most popular tunes from pre-war times up to to-day are splendidly rendered by orchestra and chorus (Broadcast "Twelve," 3121, 1/6). Eugene's Hungarian Gipsy Band provide a good record of three of Brahms' Hungarian Dances (3124, 1/6), and Tommy Handley, the famous wireless comedian, describes in typically droll fashion his troubles and trials with an obstinate wireless set (3133, 1/6).

Military Band Music

There are some particularly interesting military band records to report this month. First place must be given to the march "*Silver Trumpets*" by Viviani, magnificently played by the Grenadier Guards Band (Col. DB714, 10 in. 2/6). The Grenadiers certainly have never been heard to greater advantage than here. The trumpet tone is perfect, and there is a fascinating swing about the whole march. Another good Columbia record is Friedemann's popular "*Slavonic Rhapsody*," played by the B.B.C. Wireless Military Band (DX317, 12 in. 4/–). From H.M.V. comes a splendid record of Thurban's "*Americana Suite*" by the Coldstream Guards Band (C2335, 12 in. 4/–). The recording is remarkably realistic but is rather on the loud side for a small room. The Welsh Guards play the well-known march "*Under the Double Eagle*" and the "*Soldiers' Chorus*" from "*Faust*" in exhilarating style on a Broadcast "Twelve" (3136, 1/6), and on an Imperial record (2611, 1/3) the Irish Guards Band give a good account of two old favourites, "*Colonel Bogey*" and "*ons of the Brave.*"



Of General Interest

Rapid Freezing Preserves Qualities of Foodstuffs

An interesting process has been introduced for the purpose of obtaining sugar in minute crystals. Sugar in this form dissolves far more quickly than the ordinary product, and in America is greatly in demand for use in iced drinks.

The starting point of the new process is syrup obtained by evaporating juice from the sugar cane. The syrup is sprayed as a mist or thin film into vacuum chamber that is kept at a low temperature, when the sudden cooling results in the formation of extremely minute crystals. The process is quite automatic and the product is more uniform than that obtained by crystallisation in the ordinary manner.

In certain respects the process is similar to that now being adopted on a large scale for freezing food products. Slow freezing of meat or fish in ordinary refrigerating plants results in the formation of crystals of ice that penetrate and tear the tissues, robbing the food of its shape and also of much of its value. By freezing rapidly very tiny crystals of ice are formed and the damage to the tissues is greatly reduced. Careful thawing then gives a product that is very little different from the original.

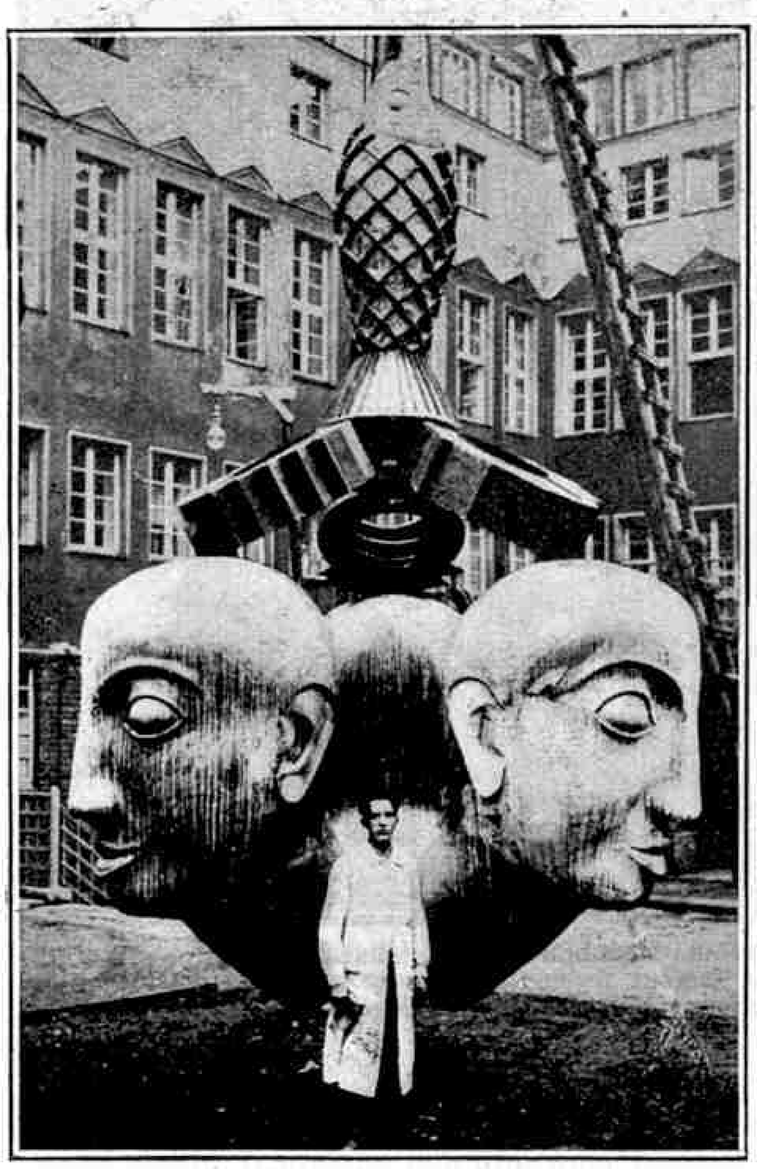
Abalone Fishing in the Pacific Ocean

From a comparatively small area off the coast of California nearly 120 tons of rainbow-coloured shells are brought up every year. They are worth about £1,000 a ton, and in them occasional finds of pink or grey pearls are made.

The shells are those of the abalone, a univalve or creature covered on one side by a shell, that clings to rocks, kelp, and gravel at the bottom of the ocean. They are obtained by divers. Dressed in the usual heavy underwater kit, these men descend to depths of from 60 ft. to 100 ft., and when a colony of abalones is discovered they quickly turn the shell fish on their backs by means of a flat steel bar that has a chisel tip at one end and a sharp point at the other. It is then an easy matter to load them in baskets to be hoisted to the surface. The work must be done quickly, for if the abalone is allowed to grip the surface beneath it, it cannot be removed except by breaking the shell, which, of course, would thus be made practically worthless.

The kelp, or giant sea weed, is a great danger to the abalone hunter, for it grows so luxuriantly that it forms an underwater forest through which he must force his way. Its smooth stalks are often more than 100 ft. in length and are as tough as leather. They are washed to and fro by the currents and constantly threaten to entangle the diver himself or the tube by means of which he obtains his supply of air. Usually a man stationed in the boat cuts the long streamers by means of a sharp knife blade mounted on a long pole in order to give more light to his companion below.

The shell of the abalone is dried and sent to manufacturing jewellers, who make rings, necklaces, pendants and bracelets from it. The flesh of the creature also is useful, for it is good to eat, either fresh or tinned, and the Californian fisheries produce about 3,000,000 lb. annually.



A curious piece of bronze statuary weighing two tons. The heads are supposed to represent "The Press."

Diamonds made to Work

It is surprising to find that more than half of the diamonds produced annually are destined for industrial use and not for employment as jewels. Only inferior specimens are made to work, of course, and the value of the diamonds so employed is much less than that of the stones retained as gems.

The hardness of the diamond makes it suitable for drilling glass, porcelain and similar materials. It is also invaluable for boring or sawing through rock, and the cutting edges of rock drilling tools are made of bort, a black form of diamond that is useless as a jewel. Small diamonds are used as bearings for watches, chronometers and accurate electrical instruments. In these positions they do not wear and consequently seldom require renewal. One little known use of the diamond is in making thin wire from rare metals, such as platinum, silver and gold. For this purpose tapered holes are drilled in the diamonds and tiny billets of these metals are drawn through them.

Although large outstanding diamonds are very rarely found, the world's total annual production is surprisingly great. It has been calculated that if all the diamonds produced in 1929 could be combined into a single cubical block, this would weigh more than 1½ tons and its height would be about that of an average man.

Africa is still the greatest source of the diamond, 85 per cent. of the world's production coming from that continent, and half of them from South Africa. Formerly the greater proportion of these came from the celebrated diamond mines at Kimberley or on the Rand, millions of tons of the blue clay in which they occur having been dug out and carefully searched. More recently diamonds have been discovered in alluvial ground on the shore of Namaqualand. These are of remarkably high average size. It is interesting to find that they only occur in sand deposits containing shells of a certain prehistoric oyster, and diamond seekers use the shells as a guide.

History in a Word

The origin of the word "parchment" is an excellent example of the manner in which words may be reminders of historical events, for it came into use as the result of a war that broke out in 250 B.C. between the Greek rulers of Egypt and Asia Minor. At that time sheets or rolls of papyrus were used for writing purposes. These were made from the inner bark of the papyrus plant, which grew only in Egypt, and when the trouble arose the inhabitants of Asia Minor were unable to obtain supplies. It was then discovered that specially prepared skins of the sheep and other animals were equally suitable. The new writing material was called "pergamene," from Pergamos, the city in which the ingenious inventor lived, and in course of time this was corrupted to the word that is still used.

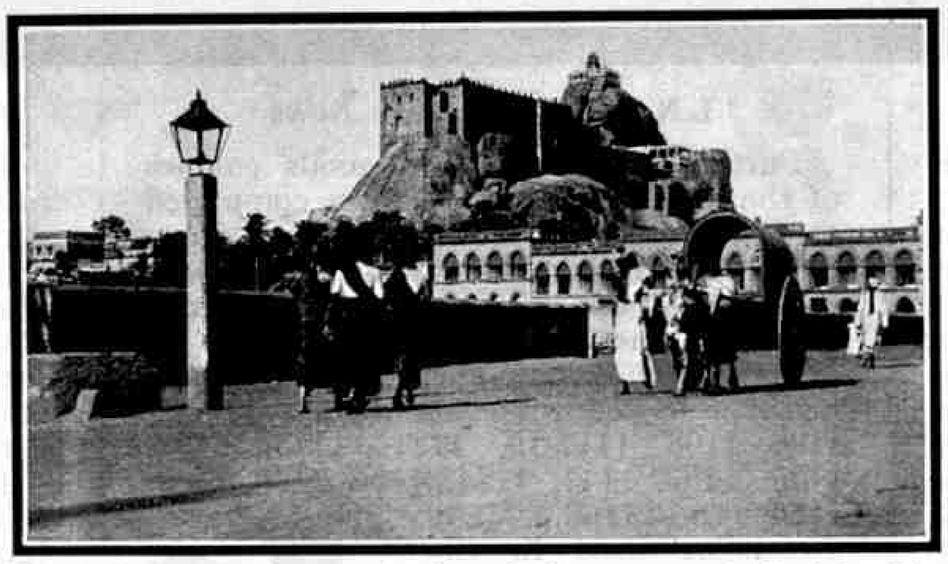
It is interesting to note that the name "Pergamos" is derived from the Greek word "pyrgos," meaning a tower, and is therefore connected with the English place name endings "borough" and "bury." Thus the word "parchment" also reminds us of the days when monarchs and rulers lived in towers and castles, and important towns were strongly fortified.

The Wastefulness of Nature

If all the codfish eggs laid in one season survived and developed, the oceans would be completely choked with fish. Similarly the atmosphere would soon be monopolised by insects if there were no check on their survival, and many plants produce seed in such large numbers that if all of these came to maturity, they would very quickly over-run the surface of the globe.

Fortunately the productive energies of animals, plants and insects are checked by the efforts of natural enemies. For instance, young plants have to struggle for existence against the grubs, insects, and fungi that attack and destroy millions of tiny seedlings, and except in very favourable circumstances only a small proportion of the seeds actually produce full-grown plants. On one occasion a certain plant in a field in this country was found by actual count to produce nearly a million seeds within a year, but six months later the number of young plants of the same kind in the neighbourhood was only 108. Apparently no plant has any chance of survival unless it gives seeds in such numbers that it can afford such wastefulness.

The record for productivity appears to belong to bacteria. The lifetime of certain typical microbes seems to be less than 20 minutes. At the end of this period they divide into two, and these in turn live their allotted period before themselves dividing further. They are therefore capable of astonishingly rapid growth. If the microbes in a single glass of sour milk were provided with sufficient food and allowed to live in the most suitable conditions they would form a mass larger than the earth in five days! Fortunately the actual conditions do not appear to suit microbes, for actually only one in a thousand billion has a reasonable chance of survival.



The Rock Fort, a photograph of an Indian scene submitted by Miss S. Savitro in a competition in the "M.M."

Lion's Roar Louder than Noise of Niagara

In interesting experiments that have recently been made, it has been found that the loudest noises are produced by aeroplane engines running at flying speed, pneumatic drills and riveters, steamship sirens and printing engines. Those who are familiar with noises of this kind scarcely require to be convinced of their loudness by such experiments, but it is interesting to find that measurements show them to be near the supportable limit. A sound that is loud enough to give pain to the ear has an intensity of about 130 decibels, this being the name given to the unit of sound, while that of each of the noises referred to is more than 100 decibels.

Measurements also show that at present the intensity of the noise in the interior of an aeroplane cabin is very nearly 100 decibels. The roar of a lion is as loud as that made by the millions of tons of water per minute that rush over the brink of Niagara Falls. This noise has an intensity of 85 decibels, and a passing tube train is only slightly less noisy. A very interesting comparison has been made between the traffic noises of New York and those of London, and it has been definitely proved that the noises in New York streets are 10 decibels louder than those of the streets of London.

A curious feature of the measurements is the revelation that the energy required to produce even the loudest noise is very small. If 100,000 people talked continuously in loud tones the total amount of energy expended would only be sufficient to keep a small electric bulb alight.

Turning Waste into Wealth

The city of Birmingham derives an income of about £60,000 a year from material that its inhabitants have thrown away as useless. The refuse deposited in dust bins is dealt with in a careful and scientific manner in order to produce this large revenue. Of the total amount received last year £7,655 was obtained from the sale of scrap metal; £6,901 came from the disposal of clinkers; and bottles, waste paper, rags and similar materials accounted for another £5,000. It is interesting to note that no less than £3,786 was received for grease that had been extracted from the refuse.

A Factory without Windows

It is reported that an American firm has planned a new factory that will have no windows. Light for working purposes will be supplied by hundreds of 1,000-watt lamps, and these will radiate a sufficient proportion of ultra-violet rays to give the workers as much benefit as they would get from continuous sunshine. The lighting scheme is designed to give uniform illumination from all angles, and in order to increase its effectiveness the inside walls and ceilings of the factory are to be painted blue, green and white. The machinery will be painted orange, for the purpose of increasing the visibility of working parts, and it is expected that this step will reduce the accident rate below that obtaining in ordinary factories.

The air within the factory will be completely changed every ten minutes, and before being passed into circulation, it will be filtered, washed and brought to the most suitable temperature.

A very interesting feature of the scheme is that a serious attempt is to be made to reduce the amount of noise during working hours. All heavy machinery will rest on cork foundations, and the walls and ceilings will be treated with special material in order to deaden all sounds.

Preventing Dust on Roads

Many readers of the *"M.M."* are no doubt familiar with calcium chloride, the chemical that is chiefly remarkable for its power of absorbing moisture from the atmosphere. When a small piece of this is left exposed to the air it takes up so much moisture that it is actually dissolved in a very short time. For this reason it must be kept in bottles fitted with airtight corks or stoppers in order to prevent the contents from becoming liquid.

It is interesting to find that calci m chloride is now employed to solve the problem of keeping down dust on roads. The chemical is applied to the surface in the form of thin flakes, and by taking up moisture from the atmosphere it prevents dust from rising just as effectively as if the roadway were watered. It is said that only two dressings of calcium chloride flakes are required each summer.

The same chemical also is being employed to facilitate the setting of concrete. When road surfaces of this material have been completed, it has been the practice to cover them with sacking and to keep this wet for several days in order to supply the moisture taken up by the concrete in setting. This is a costly and tedious process and may be avoided by mixing with the concrete a small proportion of calcium chloride. The chemical absorbs the necessary moisture direct from the air and the concrete sets more quickly than when the old method is employed.



Rice fields in Java. The water buffaloes employed enjoy wading through the muddy swamps in which this cereal is grown.

A Wonderful Deep Sea Aquarium

The largest privately-owned aquarium in the world is that established by Mr. W. K. Vanderbilt on the north shore of Long Island, New York. For more than 25 years Mr. Vanderbilt has explored the oceans in various yachts that he has owned, and the wonderful specimens of deep sea creatures he has collected are now maintained in his marine museum.

One of the cases in the aquarium is 40 ft. in length and is a faithful reproduction of a typical scene at the bottom of the ocean. Among the coral reefs and sea growths in it is a sunken wreck and round this swim fishes of all kinds. The collection also includes a whale that weighs four tons, and a devil fish of half that weight, in addition to specimens of the tiniest creatures to be found in the ocean. Perhaps the most remarkable exhibit is a group of pilot fish. These have suction plates on their heads, by means of which they fix themselves on other fish. In this manner they secure free lodging and travel about with their hosts at no cost to themselves.

A new yacht, the "Alva," has recently been completed for Mr. Vanderbilt, and in it he is about to commence an eight months' cruise round the world in search of more rare specimens for inclusion in his wonderful aquarium.



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

In addition to the fast runs made on the Great Northern section of the L.N.E.R. —of which an account was given in last month's "*M.M.*"—some notable runs also have been made on the more difficult Great Eastern section. On the first of these, the three-cylinder 4–6–0 locomotive No. 2800, "*Sandringham,*" ran from Liverpool Street to Cambridge, covering the 55¾ miles in 62½ mins. When account is taken of the number of service and permanent way repair slacks, and signal checks, this meant sterling work on the part of the engine and its crew. A maximum speed of 77 m.p.h. was attained near Great Chesterford. The load was 235 tons behind the tender.

Another remarkable run was made by the same engine from London to Norwich on a Sunday in January, when with a train weighing 290 tons, the distance of 115 miles was accomplished in an overall time of 129 min. 10 sec., but of this 63 sec. had been occupied by a special stop at Stanway box, near Colchester, and 6 min. 34 sec. by the stop at Ipswich, leaving an actual running time of only 121 min. 33 sec. The 48.7 miles from London to Stanway were done in 55 min. 47 sec., notwithstanding four slacks. For the 20 miles from Stanway to Ipswich, 21 min. 6 sec. were taken. The fastest stage was the last one, from Ipswich to Norwich Thorpe, a distance of 46.3 miles which was run off in 44 min. 40 sec., in spite of the long slack required by the junctions and swing-bridge at Trowse and the ascent of the stiff Haughley bank. Speed was approximately 80 m.p.h. thrice in the course of the run from London to Norwich. These runs constitute records for this section of the L.N.E.R.

Wireless on L.N.E.R. Expresses

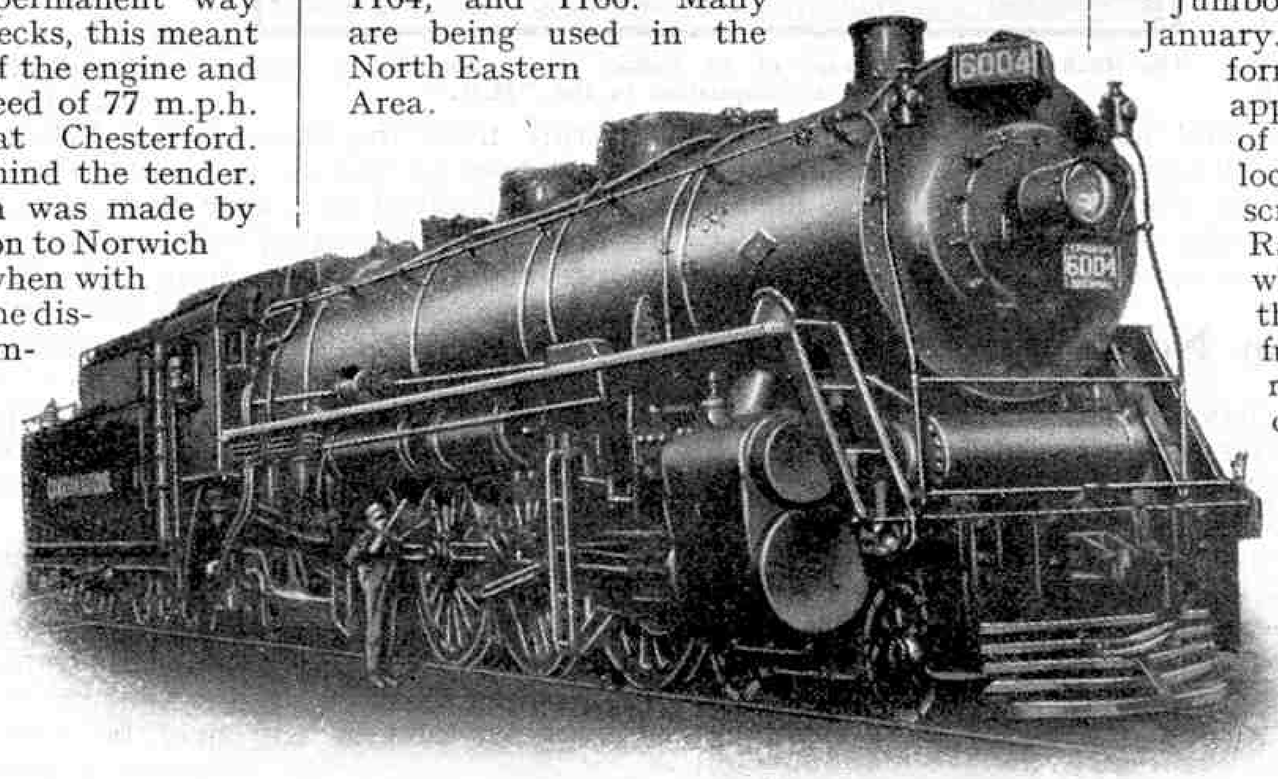
Rather more than a year ago the L.N.E.R. fitted one of the trains running between King's Cross and Leeds for the reception of wireless programmes by the passengers who were travelling on the train. They are now contemplating installing wireless apparatus on the "*Flying Scotsman*" and other expresses.

Famous Canadian Express Speeded Up

The "*International Limited,*" operated by the Canadian National Railways, has had 25 minutes cut off its running time for the journey of 848 miles between Montreal and Chicago. It now covers the distance in 17 hours 30 minutes, including 17 stops.

L.N.E.R. Locomotive News

Further 0–6–0 standard goods engines of the "J39" class have been completed at Darlington and are numbered 2969 to 2971. During last year Messrs. Armstrong, Whitworth and Co. Ltd. built twenty engines of the 2–6–0 type—class "K3"—for the L.N.E.R. These engines were given the following numbers:—1100-2, 1106, 1108, 1117-19, 1121, 1125, 1133, 1135, 1137, 1141, 1154, 1156 1158, 1162, 1164, and 1166. Many are being used in the North Eastern Area.



A massive 4-8-2 or "Mountain" type locomotive of the Canadian National Railways. The "6000" series to which the engine shown belongs have a total weight of 257½ tons, and of this no less than 101¼ tons are available for adhesion.

"King Arthurs" Work from Charing Cross

With engine No. 1910, a 2–6–0 of the "U1" class, Eastleigh works completed the order for twenty engines of this class, the building of which was begun early last year.

Engines of the 4–6–0 "King Arthur" class are now working on some of the expresses between Charing Cross and Folkestone, Dover and Deal, which hitherto have been worked only by 4–4–0 engines.

Sunshine Windows on Canadian Trains

All the newer observation carriages on the Canadian National Railways transcontinental expresses have been fitted with extra wide windows of quartz glass which admits the ultra-violet rays. These "sunshine parlours," as they have been called, are proving very popular with the travelling public.

More Steel Sleepers on G.W.R.

The G.W.R. already have a total of 94 miles of track equipped with steel sleepers, 198,000 of these having been laid on selected stretches of line. During 1932 the Company propose to lay about 50 more miles of track with sleepers of this type.

More Locomotives for the Scrap-Heap

The scrapping of locomotives belonging to the older classes is proceeding apace on all the British Railways and is likely to be accelerated considerably in the near future. The responsible authorities are bent on having standardised locomotives of up-to-date design, with the result that many of the types and classes that have long been familiar will soon be seen no more.

The most famous of the L.N.W.R. "Jumbos" ceased running at the end of January. This is No. 5031, "*Hardwicke,*" formerly numbered 790. Urgent appeals are being made from a number of quarters that this distinguished locomotive should be saved from the scrap-heap and preserved in the Railway Museum at York or elsewhere. It is much to be hoped that these endeavours will prove successful. It will be a cause for lasting regret if an engine of this historic class is not preserved, and if one is to be kept, surely none is more worthy of the honour than "*Hardwicke.*"

Of the 6 ft. "Jumbos," No. 5084, "*Bee,*" has been broken up and the only one now remaining is No. 5095, "*Tartarus.*" It is interesting to note that whereas most of the "Jumbos" put in about sixty years' service—with much rebuilding, of course—some of the L.N.W.R. compounds of the "John Hick" class were broken up within eight years of building. Recent withdrawals on the L.M.S.R. have included, in addition to "Jumbos," a considerable number of old L.N.W.R. engines of the "Renown," "Precursor," "Experiment," and "Precursor" tank classes. During 1931 about 70 engines of the Northern (Scottish) division also were scrapped.

On the G.W.R. three of the two-cylinder 4–6–0 express engines have been claimed by the scrap-heap. These are:—No. 2909, "*Lady of Provence*"; No. 2910, "*Lady of Shalott*"; and No. 2985, "*Peveril of the Peak.*" When first built in 1905, the third of these engines was of the 4–4–2 "Atlantic" type, numbered 185. It was converted into a 4–6–0 in 1912. Nos. 2909–10 were built in 1906 and have always been of this type. Of the 4–4–0 "County" class, 30 have been cut up and the remaining 10 are soon to suffer a like fate. All the "Cities" and "Flowers"—4–4–0 engines with inside cylinders and 6 ft. 8 in. coupled wheels—have gone with the sole exception of No. 3717, "*City of Truro,*" which was presented in March last to the Railway Museum at York.

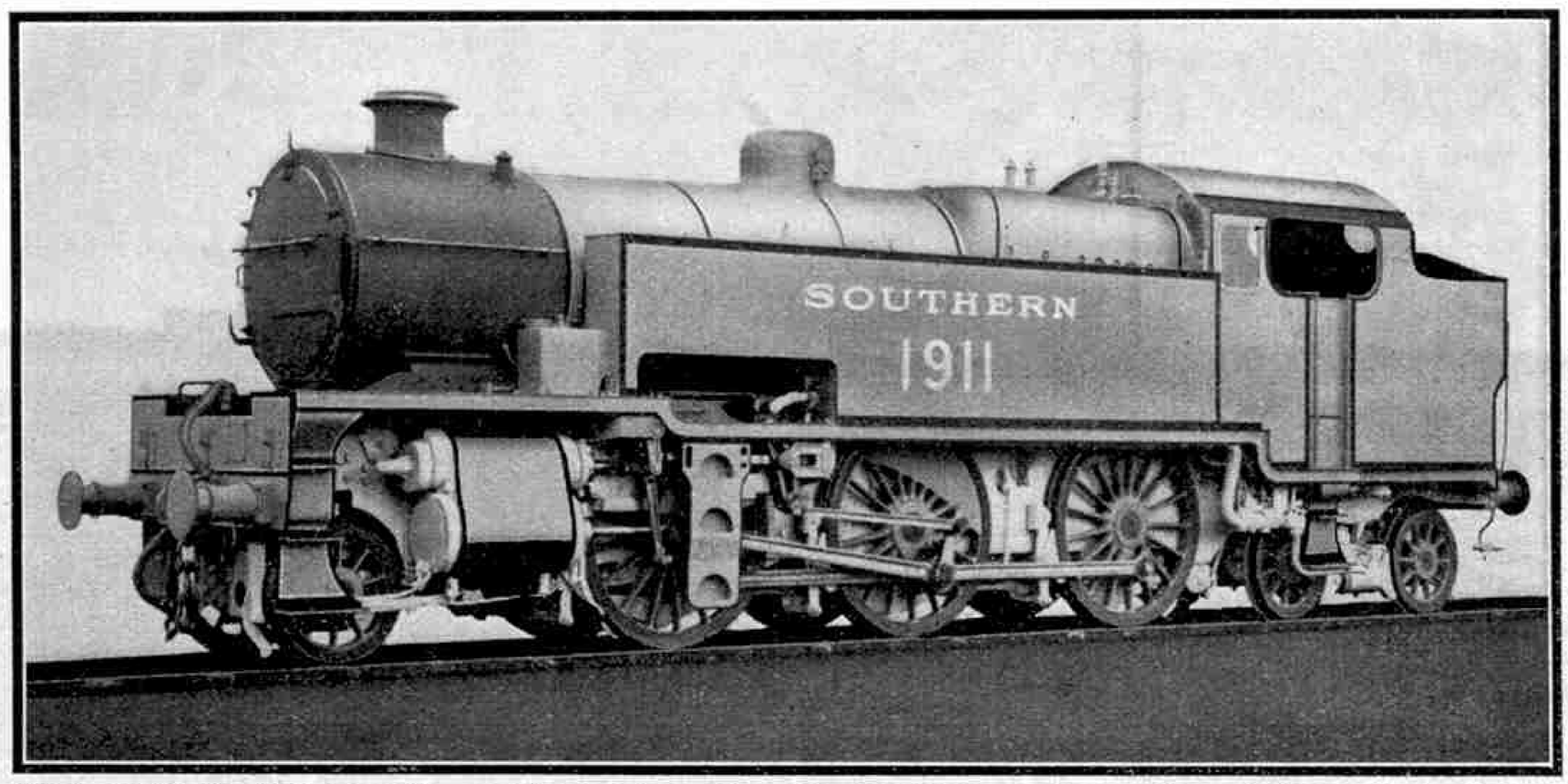
New Goods Tank Engines on S.R.

The Southern Railway are now putting into service a new series of three-cylinder 2–6–4 goods tank locomotives. The first two of these are out and are numbered 1911 and 1912, the upper illustration on this page being a photograph of No. 1911. The engines have been built at Eastleigh works, where three more of the same type are in course of construction, and a further 10 will be built at Ashford Works.

The engines, which have been designed by Mr. R. E. Maunsell, C.B.E., Chief Mechanical Engineer of the S.R., will be known as Class "W." Except for the addition of side tanks, bunker and trailing bogie, they are practically identical with the three-cylinder goods tender engines of Class "N.1," and are intended mainly for the heavy goods traffic in the metropolitan area and other short distance goods workings elsewhere. They are fitted with a powerful and graduated steam brake working in conjunction with the vacuum brake on the train when required, the brake blocks being applied to all wheels except the leading pony track.

A commodious and comfortable enginemen's cab with side windows has been provided, and the back of the bunker is curved so as to make the engines as short as possible, while facilitating coal trimming.

The cylinders are 16½ in. in diameter and have a stroke of 28 in. The diameter of the coupled wheels is 5 ft. 6 in. and the boiler pressure 200 lb. per sq. in., giving a tractive effort of 29,452 lb. or 13.15 tons. The total heating surface is 1,810 sq. ft. and the grate area 25 sq. ft. The side tanks with the tank below the bunker hold 2,000 gallons of water and the bunker carries 3½ tons of coal. The total weight in working order is 90 tons, 14 cwt. and the total adhesive carried on the coupled wheels is 57 tons 5 cwt.



S.R. locomotive No. 1911, one of the new 2-6-4 tank locomotives of the "W" class. These engines, which are fully described on this page, have three cylinders and are intended for local goods work.

Light Refreshments on Excursion Trains

The L.M.S. Railway are introducing an entirely new feature by the provision of "Buffet Cars" on long distance excursion trains. The purpose of these cars is to cater for the growing number of excursion travellers who prefer light refreshments to a set meal, and "snack cars" therefore will provide such things as freshly-cut sandwiches, bread and butter, cakes, rolls and butter, biscuits and cheese, fruit, milk, etc.

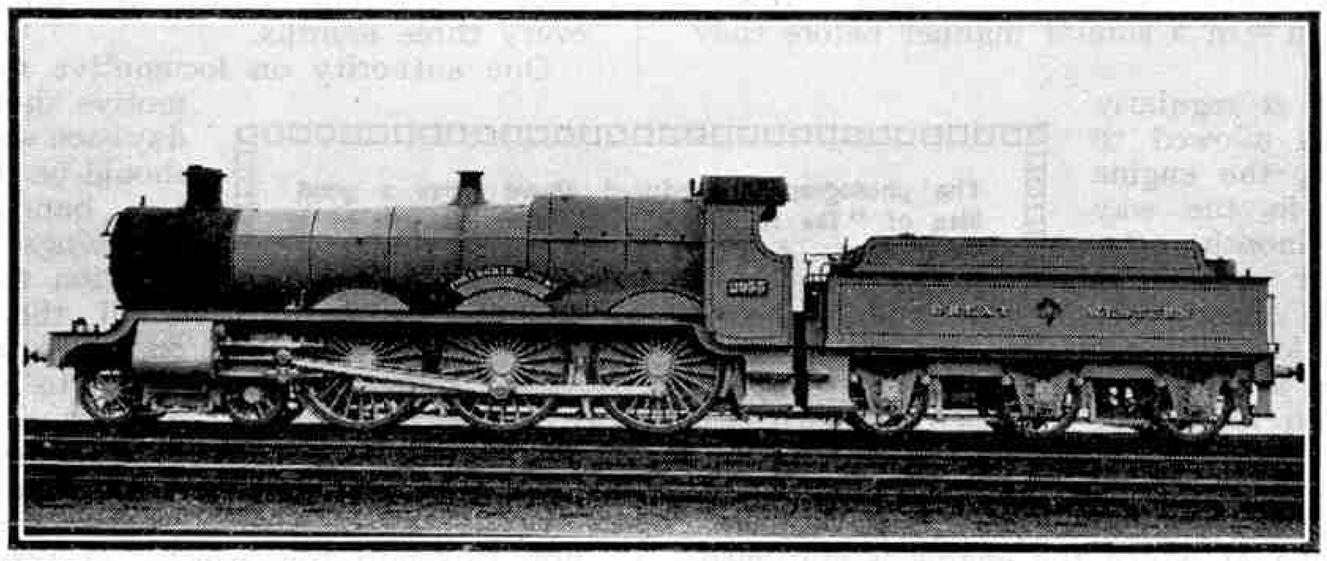
Lentz Valve Gear for L.M.S.R. Engines

During 1931, the L.M.S.R. constructed 132 new locomotives. Of these, 70 were built at Crewe, 47 at Derby and 15 at Horwich.

Crewe works have turned out additional 0–8–0 standard freight engines which are numbered 9629 to 9634. Derby works are engaged upon some 4–4–0 passenger engines of Class 2, of which Nos. 661-5 have been completed, and also upon the new standard 2–6–2 tank engines, of which Nos. 15555-9 are the latest out. The last of these—No. 15559—has been sent to the Caledonian section, where it is being tried on a variety of services.

Following the lead of the L.N.E.R. and the G.W.R., the L.M.S.R. are now carrying out tests with what is known as the R.C. (rotary cam) type of Lentz valve gear. Five of the standard 2–6–0 locomotives have been fitted with the gear, which is used to operate poppet valves disposed horizontally above the cylinders. The aim of this gear is principally to reduce maintenance costs and tests will be carried out in comparison with other engines fitted with the normal Walschaerts valve gear and piston valves.

The Lentz system of valve gear was fully described on page 756 of the *"M.M."* for October, 1930. It will be interesting to compare the results with those of the trial of the Caprotti valves recently carried out on the L.M.S.R.



G.W.R. two-cylinder 4-6-0 locomotive No. 2955, "Tortworth Court," one of the "Court" series of the "Saint" class. The engines are remarkable for the length of piston stroke, which is 30 in., although the cylinder diameter is only 18½ in.

More "Castles" Building at Swindon

New construction at Swindon during the year 1931 comprised 93 engines of various types, and included 40 of the 4–6–0 "Hall" class, built for general passenger and long distance excursion traffic. The remaining engines were all tanks. Among them were 47 of the 2–6–2 type, 51XX and 61XX classes, for fast suburban traffic, and six 0–6–0 type, 54XX class. The engines of the 54XX class are to be employed for auto services, which are being accelerated, and will be used with leading and trailing cars.

In addition, 60 engines of the 0–6–0T type were purchased from private firms.

In the course of the year there were also built at Swindon 295 carriages and coaching vehicles, including 45 for main line use, with corridors and lavatories, and 120 non-corridor for suburban and general services. Five sleeping cars, four luxury saloons, 10 composite restaurant cars and five pairs of restaurant car sets were also included in the vehicles built during the year.

In face of the continued industrial depression, work at Swindon is going forward somewhat quietly at present. Numerous engine parts for the new batch of "Castles" have now been completed in the machine shops and the erectors are about to commence their share of the work of building the engines.

Several "Kings" are among the engines now being overhauled in readiness for Easter and the summer traffic.

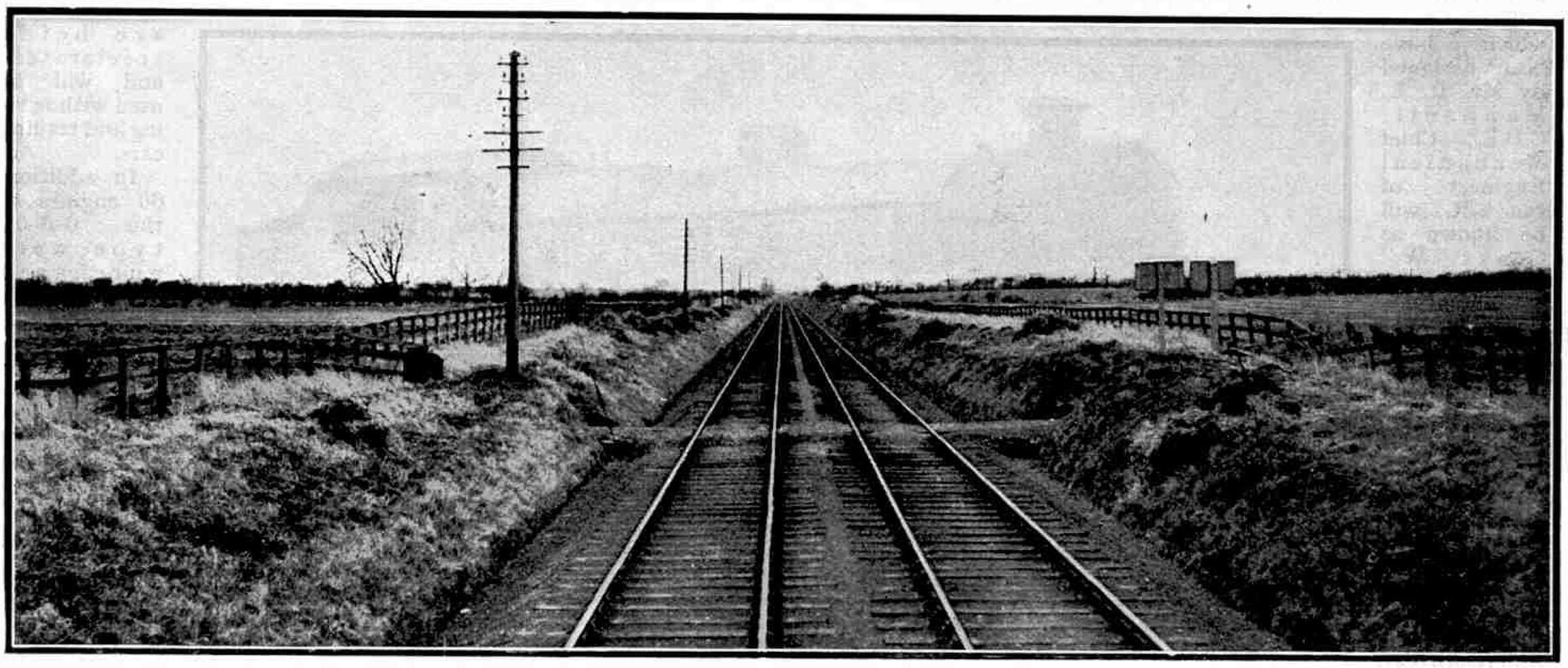
The total number of G.W.R. engines equipped with automatic train control apparatus at the end of 1931 was 2,538.

L.M.S.R. Tilbury-Dunkirk Route to be Closed

The L.M.S.R. have decided to discontinue the cross-Channel service between Tilbury and Dunkirk. The service was instituted in May, 1927, but, unfortunately, it has not realised the success that was hoped for. Fog in the Thames estuary has been a frequent cause of delay. Arrangements are being made for the steamers that have been employed to be placed in service between Dunkirk and Folkestone, and for the Southern Railway to take up the interests that are being relinquished by the L.M.S.R. This step will result in an interesting addition to the extensive services between this country and the Continent already provided by the Southern Railway.

The Active Life of a Locomotive

How Repairs and Renewals are Carried Out



WHEN a newly-built locomotive is handed over to the operating department for regular duty, it does not go straight away into main line high speed service. It may start work on pick-up goods trains or possibly make several trips on local passenger trains, to enable the lubrication to be properly adjusted, and to allow the rubbing surfaces of axles, eccentrics, coupling rod pins and so on to acquire a glassy smoothness and hardness. Until this is done the engine cannot be considered to be in perfect working order, fit to run for four or five hours at express speed without a stop and without anything "heating up," an essential condition in modern railway working. This explains why large express locomotives, in their early days, are to be seen apparently wasting their time on relatively unimportant trains. Newly-repaired engines are "run in" in a similar manner before they are returned to full duty.

Provided that the boiler is regularly washed out and no mud is allowed to collect in the water spaces, the engine should require very little in the way of repairs for the first few months after leaving the shops. Boiler washing is done at intervals which may vary from every third trip for long-distance passenger engines to once a week for shunting engines. It is an interesting fact that the water in Scotland is remarkably pure for locomotive purposes, and consequently boiler washing is required far less frequently than in England. Washing is done at the shed at which the engine is stationed, with the idea of removing scale, which is a bad conductor of heat and injurious to the boiler. At the same time the fire brick arch should be cleaned and the fire tubes swept out, although the latter operation may very well be carried out after each trip. Jets of steam or compressed air from a portable apparatus are used for this purpose in some sheds.

After the engine has been hard at work for two or three months, it begins to show signs of decreasing efficiency, due to wear having taken place in the valves, more particularly when piston valves are concerned, on the pistons and the slide blocks. The steam tightness of the pistons and piston valves depends on the split rings, which probably have lost their spring. If the engine has ordinary flat valves, these probably have worn unevenly, which necessitates facing up in the planing machine. The slide block may be so worn as to require the insertion of liners.

The photograph reproduced above gives a good idea of "the road" as seen from the cab of a locomotive. A stretch of straight track such as this, through level country, encourages the driver to show the paces of his engine, to the keen delight of railway enthusiasts who are travelling on the train, or watching it pass.

By this time, especially if the water used is not of first-class boiler quality, two or three dozen fire tubes will require taking out on account of leaking, caused by an accumulation of scale and the consequent burning of the ends of the tubes. A specially heavy deposit of scale is to be expected on the top of the firebox, where the ebullition is most violent, and this has to be removed, otherwise apart from loss of evaporative efficiency, there is danger of the plates being burnt. Small cracks that develop through the stay holes may be dealt with in the running shed by drilling out, tapping, screwing in a rivet and riveting the end over. When the boiler feed water is of particularly bad character, tubes may have to be removed for the purpose of cleaning the boiler about every four months, and the fusible plugs may be changed every three months.

One authority on locomotive running states that each locomotive should have one recognised shed day each week, on which occasion the boiler should be thoroughly washed out, the firebox, bars and smokebox cleaned, and trimmings and bearings attended to, in addition to a general "look round."

All the foregoing work is carried on in what are called the running sheds, to one of which all locomotives are attached. When a driver brings his engine into the locomotive yard after the completion of its run, it is his duty to thoroughly inspect all parts of it, so as to make sure everything is in order, or, if not, to report the defects. A book is kept in the shed for the purpose of receiving reports from drivers as to repairs required.

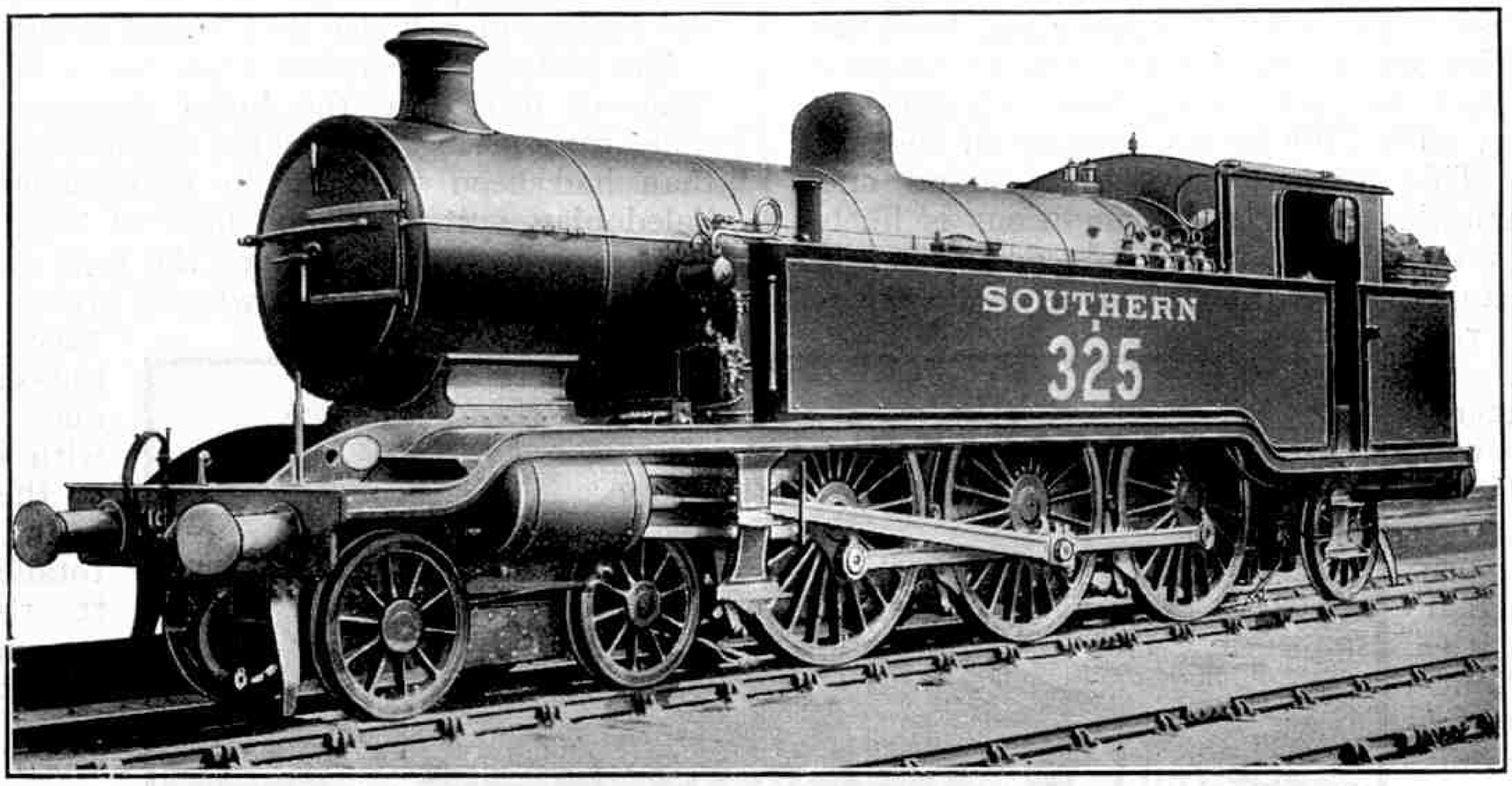
One of the jobs frequently undertaken in the running shed is the refitting of the brasses in the axle boxes of the driving wheels, which under certain conditions tend to heat up and cause the white metal linings to run out, after which the brasses become badly scored. Many up-to-date sheds have a device known as a "wheel drop pit," by means of which a pair of wheels on their axle can be dropped right down beneath the engine after the hornstays and springs have been removed. They are then brought to one side, and lifted up to floor level again. Otherwise, some appliance, such as a "sheer legs," must be used to lift up one end of the engine while the wheels are pulled out.

Besides the examination by the driver after his daily trip, all locomotives are periodically examined in the shed by an examiner, who pays special attention to looking for such defects as cracks

in axles, which are quite difficult to find; and defective springs, often due to a broken leaf. The liability of flaws occurring in such parts as crank axles, connecting and coupling rods has nowadays been greatly reduced by highly scientific design and the use of special alloy steels. This, of course, does not do away with the necessity for great vigilance in the inspection of these parts, as the breakage of one of them with the engine in motion would probably cause a serious accident.

Piston rings in a modern locomotive have a fairly strenuous time and require frequent renewal. They wear thin and are liable to break up, in which event some of the pieces may get into the valve chest, doing great damage, and finally being blown up the chimney by the exhaust steam. The difficulty or otherwise of renewing piston rings depends on the accessibility of the cylinder covers, which, of course, have to be removed before the pistons can be drawn out. After the cylinder cover has been removed, the connecting rod is disconnected from the sliding crosshead, allowing the piston to be drawn out of the cylinder so that the rings are released.

Other jobs carried out in the running sheds are the making of cylinder and valve cover joints, that is, the provision of new packing to render the covers steam tight; also the remaking of safety valve and dome cover joints. Water accumulating in the cylinder due to condensation of the steam is a fruitful cause of leaky cylinder covers, although the general adoption of superheating has done much to reduce the liability to this. The remaking of the front covers of the cylinders is fairly straightforward, but the back covers are more troublesome owing to the dismantling of the motion they necessitate.



One of the 4–6–2 tank locomotives of the Southern Railway. Two of these were built for tne former L.B.S.C. Railway, the one illustrated having Stephenson link motion and the other Walschaerts gear. They are now employed mainly on semi-fast trains between London and the South Coast, as the principal expresses are worked by the larger 4–6–4 "Baltic" tanks, and the "King Arthur" tender engines.

The late Mr. C. J. Bowen Cooke, who was chief mechanical engineer of the former London and North Western Railway from 1909 till 1920, says in one of his books that, if no special defect occurs, a locomotive may run from 80,000 to 100,000 miles between visits to the works for heavy repairs, but it is advisable to send the engine to the shops after 70,000 miles or so, because by this time the tyres will have worn hollow and the flanges consequently become deeper and also sharp at the tips. This makes them liable to take the wrong road at points. A special device is therefore employed to enable the sharp edge to be removed. The axle boxes will require attention also, and some fire tubes will be in need of replacement. Fairly heavy repairs can be done in some running sheds, which may have a wheel lathe, but heavy boiler repairs are always done in the main locomotive shops. It would not pay to keep the expensive plant and skilled operators for this work at so many different places. For the same reason modern practice tends to concentrate numbers of locomotives at a few large sheds. More light engine mileage may be involved, but this drawback is outweighed by the advantages to be gained in regard to repairs and supervision.

Some figures dealing with the life of the locomotive and the most important parts of it may be of some interest. It may be remembered that arising out of the Railways Act, by which the British railways were amalgamated into four large groups, a Rates Tribunal was set up which, among other things, held an enquiry into the working costs of the four new systems. This involved the production of figures giving the life of the chief items of equipment, and the figure taken as an average for the locomotive was 33 years. During this time, of course, very heavy replacements will have been made, possibly quite changing the appearance of the engine.

For instance, the life of the boiler will be about eight to ten years, during which time the locomotive may have run 300,000 to 350,000 miles. A locomotive is said to be rebuilt when it receives a new boiler. Definite mileages are laid down to mark the times for testing boilers, which may be 200,000 to 250,000 miles, representing five to six years' life, and further tests at closer intervals should follow this.

Copper fireboxes last from five to nine years, but the nature of the water and fuel is the deciding factor. Steel fire tubes will last about four years if they have been renewed previous to this at their firebox ends, and a good deal of "spot" replacement, that is renewal of the worst tubes, will have been done in this time.

The tyres of driving wheels will survive a mileage of 50,000 before requiring to be re-turned, but leading bogie wheels will require "shopping" at half this mileage. Their job of "finding the road" puts a lot of work on them. Trailing wheels and the tender wheels will have a tyre life of 30,000 to 40,000 miles.

The brick arch, that is the structure inside the firebox that prevents cold air from the fire door getting direct access to the tubes, has a very short life, lasting only 10 to 14 weeks. Fortunately its renewal is neither a very expensive nor difficult job, and can be carried out in the running shed. All the figures quoted are, of course, averages, but careful inspection of all new materials used tends to uniformity in rate of wear.

Regular shed inspections and regular visits to the works will keep an express passenger engine fit for duty for many years. As time goes on its efficiency will grow less, however, and new and improved designs will come to the front. Presently we shall find that it is taken off the heaviest duties and put to lighter tasks. This is the beginning of the end. The next visit to the shops reveals that very extensive repairs are required. A consultation is held, and the verdict is announced—scrapping!

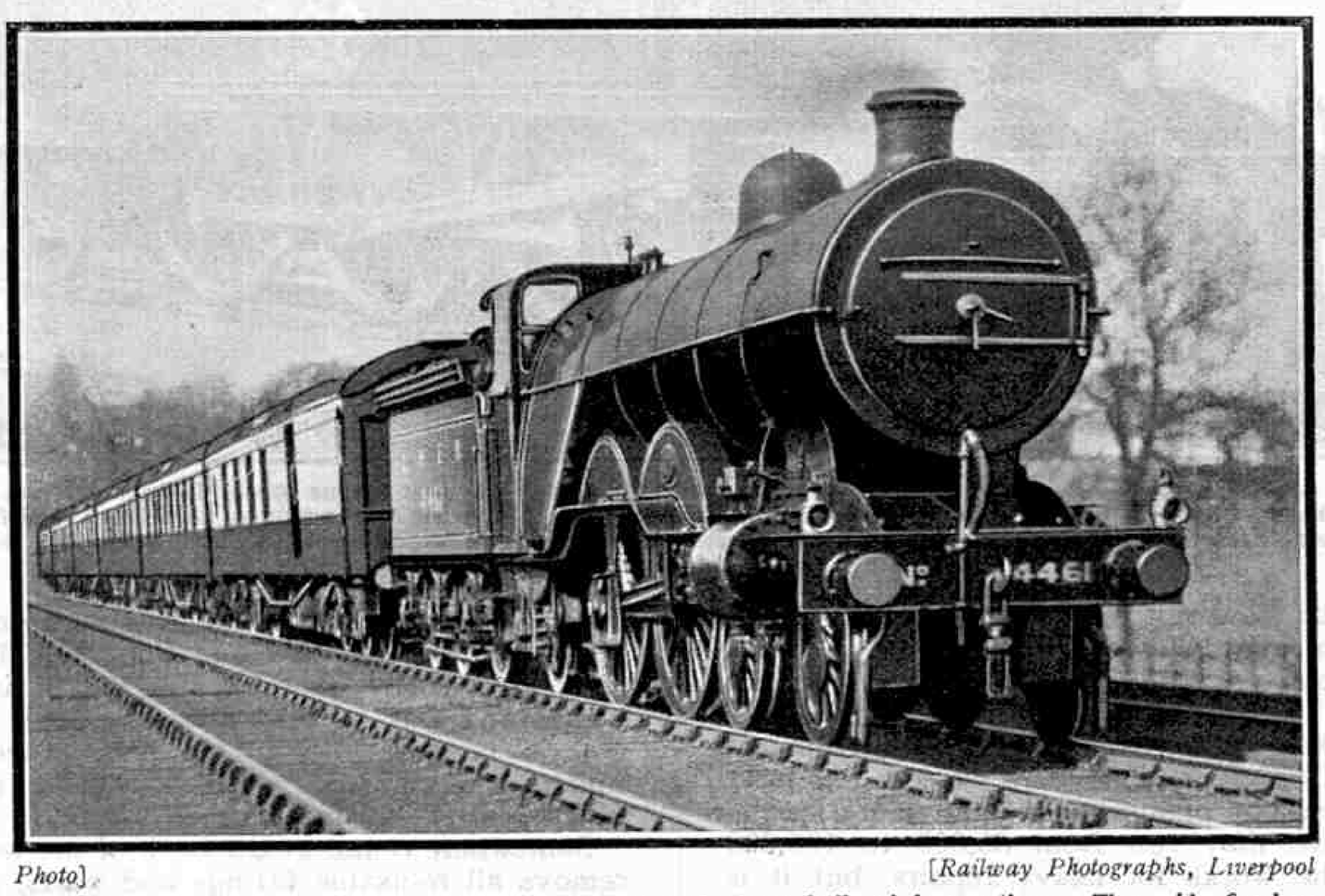
Somewhere round at the back of the works a gang of specialists remove all re-usable fittings and parts, and then rapidly reduce the remainder to pieces of convenient size. The one-time pride of the road becomes just a heap of iron and brass, some of which may quite possibly find its way into new castings and a useful life in a locomotive of a later type.

The regular repairing of a large number of locomotives, as may be imagined, calls for an extensive plant and a high degree of organisation if the engines are to be kept out of traffic for as short a period as possible. Delays in repair work are to be avoided, as an engine laid up represents a large amount of capital lying idle. A great deal of attention has been devoted to this question during recent times, and perhaps the most notable step towards reduction in repair time has been the reorganisation of the Crewe Works of the L.M.S.R. This has entailed the building of a complete new erecting shop, to take the place of several shops of various sizes in different parts of the works. Work is carried on here on the "moving belt" system, which means that the locomotives being dealt with are connected by a steel cable and on being passed down the shop are stripped in a definite order by successive gangs of men at different stages. When stripping is complete practically only the main frames remain. These are then transferred to another road and the return to the starting point commences. The parts to be renewed are attended to in the various shops concerned, and are then returned to the belt and are refitted on the engine in definite stages as before. Boilers requiring heavy repair are replaced from stock or by repaired boilers from other engines of the same classes. When the engine is completed it is drawn out of the shop and coupled to a suitable tender, which has been dealt with similarly. Both are now ready for a further spell of hard work.

A Notable Scottish Locomotive Type

The Development of Large Boilers

THE modern locomotive is characterised by the large boiler that is necessary to generate steam in sufficient quantities, with reasonable regard to economy in fuel consumption, to enable the engine to exert the power required to move the heavy loads that are now customary, in accordance with the scheduled timings. Years ago the prevailing tendency among locomotive engineers was to seek to increase the power of their locomotives by mere enlargement of the cylinders, with little or no increase in the size of the boiler. This method was not a sound one. The coal consumption under such conditions is likely to be out of proportion to the work done, and in difficult circumstances of weather and load such engines may easily be run short of steam. It should be remembered, however, that it was difficult for the engineers of those days to use boilers of any great size, owing to the necessity for limiting the weight of the engines, rails and bridges not being up to their present-day strength.



Photo] [*Railway Photographs, Liverpool*

The G.N.R. "Atlantics" were notable amongst early large-boilered locomotives. The wide fire-box and large boiler barrel ensured the "capacity for boiling water" that their designer Mr. H. A. Ivatt held was the index of the power of a locomotive.

Although large boilers may be regarded as a 20th century development the first steps in this direction were taken in 1896 by Mr. J. F. McIntosh, who from 1895 to 1914 was in charge of the Locomotive Department at the St. Rollox Works of the Caledonian Railway. In that year he produced a class of locomotives that were to make history; namely the famous "Dunalastairs" of the first batch, one of which, as at present running, is illustrated here. The "Race to Aberdeen" had taken place in the previous year between the East Coast and West Coast Routes, and some very fine running had been done, particularly on the Caledonian system by engines of the 4–4–0 type introduced previously by Mr. D. Drummond. This running had been closely observed by Mr. McIntosh, who noted what was required in the locomotives for working over such a difficult route, if the tendency to increase loads and speeds should continue. He saw that the boiler power must be increased to allow for greater demands being made on the engines. The mere increase of cylinder diameter would be of little value, and nominally increased heating surface, without actual enlargement of the boiler, could be gained only by adding to the number of tubes, which beyond a certain point is not desirable. Many boilers have been built with too many tubes packed inside a small diameter barrel, and as a result the steaming qualities of the engine have been adversely affected. Impressive figures of heating surface do not necessarily guarantee the success of a boiler as a steam generator.

Mr. McIntosh therefore took the bold step, for that time, of increasing the boiler diameter, and at the same time giving it a higher pitch from the rail level than had been the case in previous engines on the Caledonian system. The effect of this was to cause the boiler to bulge out over the tops of the splashers of the 6 ft. 6 in. driving wheels, giving the engines a very sturdy and imposing appearance as compared with other engines of the day. The heating surface totalled 1,403 sq. ft., then rather an unusual amount; and of this total the fire-box provided 118¾ sq. ft. These engines caused a considerable amount of comment at the time of their appearance. They were then the most powerful express locomotives in the country, and their boilers were regarded as being quite large.

From the first there was never any doubt as to their capabilities. Before completing her trial trip No. 721, the first of the class, and named "*Dunalastair*," had run three consecutive miles at speeds of 73.8, 76.3 and 79 m.p.h. This speed capacity was very necessary, as the Caledonian Railway had two runs booked at an average speed of 60.9 m.p.h., this being the first occasion upon which a speed of over 60 m.p.h. had been scheduled. This booking was over the distance of 32½ miles between Perth and Forfar, the time allowed being 32 min. It was not the hardest task the engines had to perform, however. There were the 117¾ miles from Carlisle to Stirling to be covered in 125 min., including the Beattock Bank, at an average speed of 56½ m.p.h.; while from Stirling to Perth the same speed had to be maintained, although the Dunblane Bank is in parts steeper than Beattock, being 1 in 73 against 1 in 75.

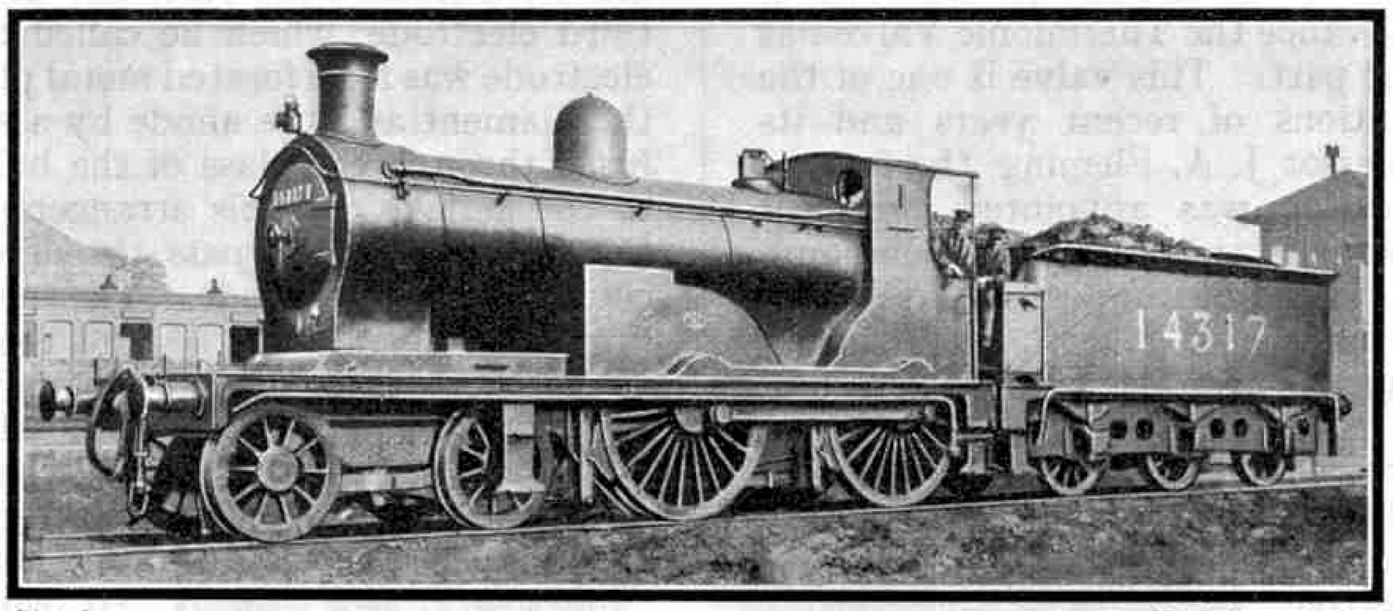
The engines did not disappoint expectations. From Carlisle to Stirling, with loads of 140, 161 and 170 tons, members of the class covered the distance at speeds of

61.2, 60.4 and 60 m.p.h.; on two occasions the run from Perth to Aberdeen, 89¾ miles, was completed in 88 and 87 min. respectively, at an average speed of 61.3 and 62 m.p.h.

Subsequently an agreement between the East Coast and the West Coast rivals was reached to restrict the acceleration, and as a result these timings were eased. The loads continued to grow, however, and increased locomotive power became necessary. Mr. McIntosh therefore wisely decided to develop his successful design still further. The result was the second class of "Dunalastairs," the first engine being No. 766, which soon after its appearance was named "*Dunalastair 2nd*," although the class were preferably known as the "Breadalbanes," from the name of No. 779. In this class the heating surface rose to 1,500 sq. ft., the firebox area remaining as before; but the longer boiler was accommodated by increasing the distance from the bogie centre to the driving axle by 1 ft. The cylinders were enlarged from 18¼ in. to 19 in. diameter, and the boiler pressure increased from 160 to 175 lb. per sq. in. Bogie tenders holding 4,125 gallons replaced the six-wheeled vehicles with which the first "Dunalastairs" had been provided.

Owing to the slackening of the services these fine engines had perhaps less chance than their predecessors to distinguish themselves in the matter of speed, but nevertheless the work required of them was of a very high order, owing to the constant increase of loads. Their performance was in fact sufficient to attract the attention of the locomotive authorities of the Belgian State railways, who ordered five similar engines to be built in Glasgow. Further, when Mr. McIntosh produced his third series, known as the "900" class, with a longer fire-box and an increase of the heating surface to 1,540 sq. ft., and of the boiler pressure to 180 lb. per sq. in., the Belgian authorities did the same, and actually constructed 140 locomotives of this type. This was a distinct compliment to the performance of the Caledonian engines, and to the ability of Mr. McIntosh as a designer.

In 1904 still another development of a similar design took place in the shape of the particularly handsome "140" class. Still larger boilers, with 180 lb. pressure per sq. in. were provided, and were notable for being slightly coned after the practice obtaining on the G.W.R. This coning was not apparent from the outside, however, as the lagging plates were arranged in such a manner as to make the boiler appear perfectly cylindrical.



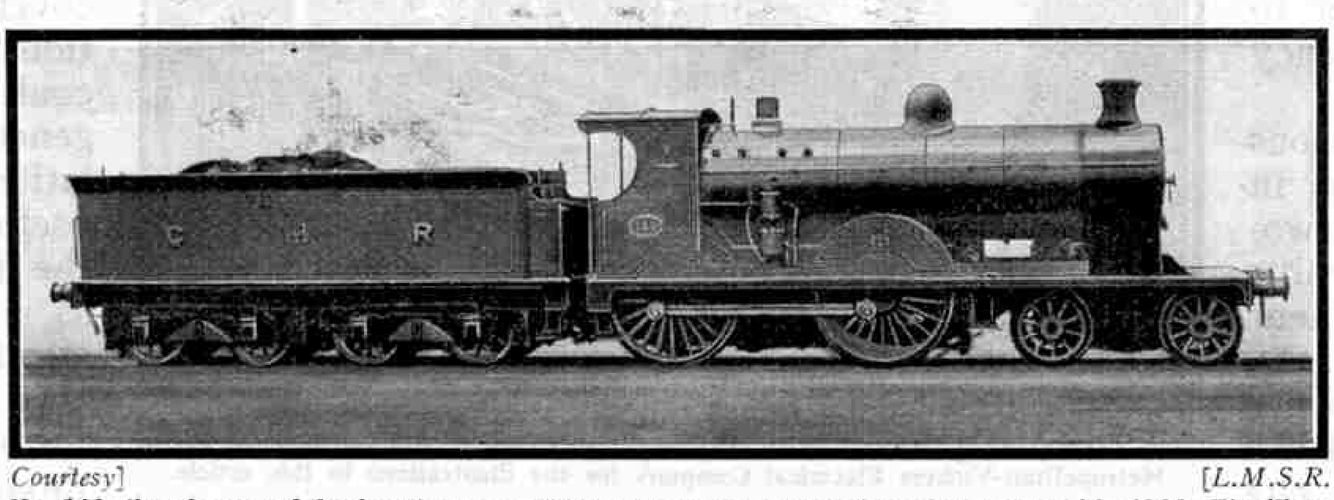
Photo] [*J. J. Cunningham*

One of the first "Dunalastairs," No. 14317, at Ayr. This locomotive was originally No. 727, and was built in 1896 at St. Rollox Works.

With the introduction of the superheater further engines of the type were put in hand complete with this apparatus. These engines were thus the fifth class of "Dunalastairs" in the matter of size, but were actually the seventh series to be constructed at St. Rollox. The latest engines appeared in 1913 and 1914, and they have huge bogie tenders with a capacity of 5,000 gallons of water and six tons of coal.

It is a remarkable fact, and one that affords sufficient evidence of the excellence of the first design, that apart from necessary increases in size, the general characteristics of these successive classes of engines were the same. They have always been noted for their neat and symmetrical appearance, which even the somewhat drab present-day L.M.S.R. finish cannot hide. Naturally they looked far more effective when finished in the Caledonian livery of blue with black and white lines and gold letters, and chocolate brown underframes.

Other engineers were not slow to follow the lead given by the appearance of the first "Dunalastairs." Specially notable among early large-boilered locomotives was No. 251 of the Great Northern Railway, one of the English partners of the rival East Coast route. This engine appeared in 1902 to the designs of Mr. H. A. Ivatt, and was a development of the first English 4–4–2 or "Atlantic" express locomotive that he had turned out in 1898. No. 251 had a boiler 5 ft. 6 in. in diameter, quite a remarkable size for that period; and following American practice, a wide fire-box spread across the frames was incorporated, thus taking full advantage of the small trailing wheels of the "Atlantic" type. With a heating surface of some 2,500 sq. ft. to generate steam to supply two cylinders of the moderate dimensions of 18¾ in. × 24 in., Mr. Ivatt had produced an engine that could not easily be run "out of breath." This was a complete reversal of the practice of previous years on the same line under Mr. P. Stirling, whose final batch of his famous 8 ft. "single-wheelers" had large cylinders 19½ in. × 28 in., and small boilers with a heating surface of 1,000 sq. ft. or so, and consequently were not highly successful.



Courtesy] [*L.M.S.R.*

No. 140, the pioneer of the fourth series of "Dunalastair" locomotives that appeared in 1904. The illustration shows the symmetrical proportions of the engine, and gives some idea of its handsome appearance in the Caledonian blue livery.

Remarkable progress has taken place since then, so that now we do not regard these Ivatt "Atlantics" of the L.N.E.R. as being really large, when we have the immense Gresley "Pacifics" with boilers having a maximum diameter of 6 ft. 5 in. and a heating surface of 3,445 sq. ft., and working at a pressure of 220 lb. per sq. in. The boiler of the L.N.E.R. "Garratt" locomotive is even larger, having a diameter of 7 ft. and a total heating surface of 3,640 sq. ft.

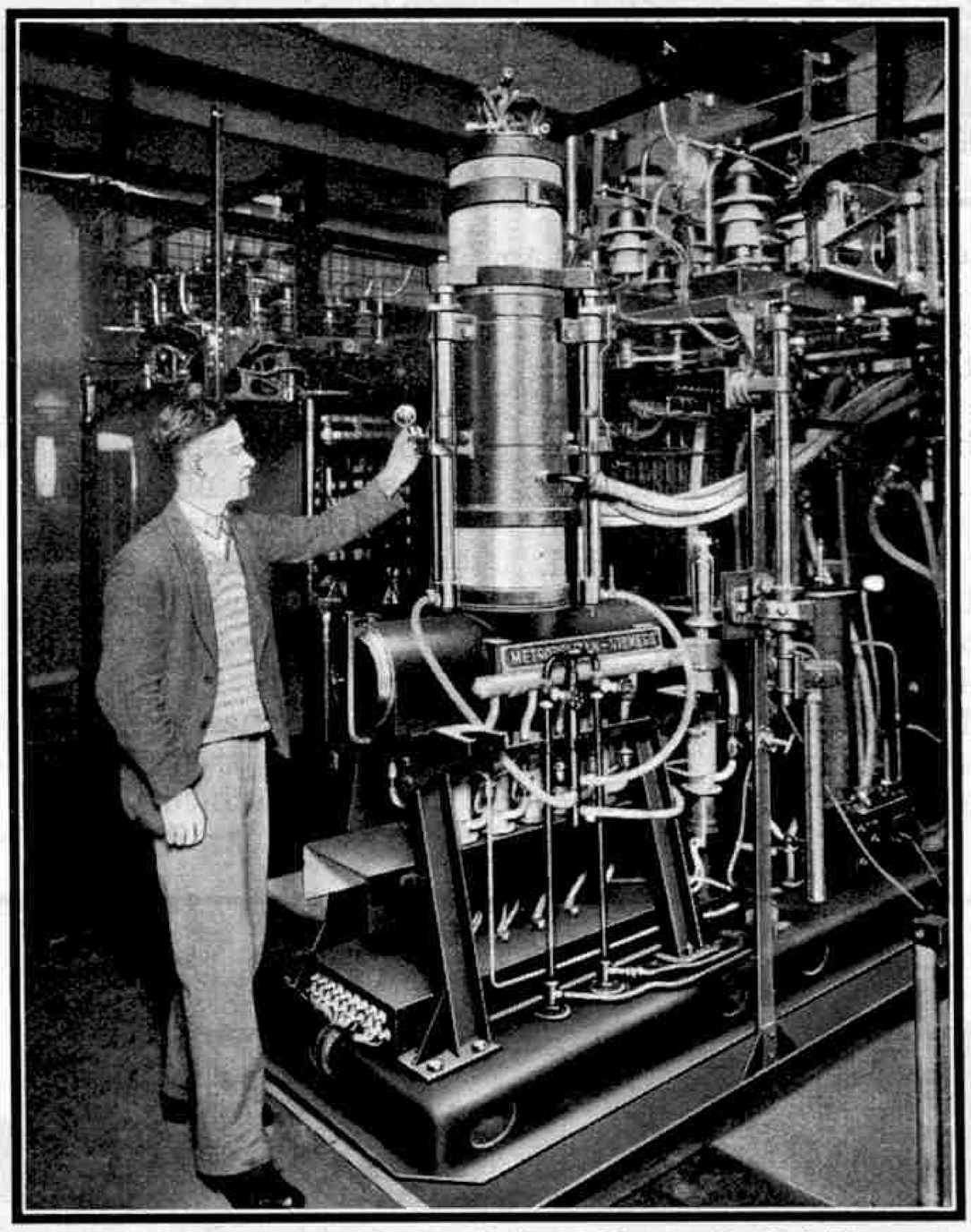
The World's Greatest Wireless Valve

A Triumph of British Engineering

FEW branches of electrical science have made such rapid progress as that of wireless communication, and in this rapid advance the Thermionic Valve has played a very important part. This valve is one of the most remarkable inventions of recent years and its discovery is due to Professor J. A. Fleming, the famous scientist. In 1899 Fleming was appointed electrical adviser to Marconi's Wireless and Telegraph Company, and in this capacity he carried out important researches on technical problems relating to wireless communication.

The oscillations received from a transmitting station by an aerial consist of alternating currents, half positive and half negative, and in the case of high frequency currents the oscillations come in at the rate of hundreds of thousands or even millions per second. The chemical rectifiers for converting the alternating currents into direct current which were in use at the time that Fleming carried out his researches were only satisfactory for dealing with low frequency currents, and he turned his attention to discovering some device that would act as a sufficiently rapid rectifier to be used with high frequency currents.

Fleming's investigations led to his introduction in 1904 of the "diode" or two-electrode valve. This valve was simply a carbon filament electric lamp in which the leg of the filament was enclosed in a small cylindrical metal plate called the "anode." When the alternating currents raised the filament to a certain temperature its molecules vibrated at so great a speed that electrons, particles of negative electricity, were thrown off from the filament. This behaviour of the molecules had been noticed by Edison in 1883 during experiments with electric lamps, and was known as the "Edison effect." The discharged electrons were attracted to the anode, which was connected to the positive terminal of a battery, but they could not be made to flow back to the filament. In this way the alternating currents were converted into direct current. The two-electrode valve was an improvement on the chemical rectifiers, but it proved costly to produce and maintain, and for this reason it did not come into general use.



The 500 Kw. Valve at Rugby Wireless Station. The attendant is holding up an ordinary Receiving Valve to show the comparative size. We are indebted to the Metropolitan-Vickers Electrical Company for the illustrations to this article.

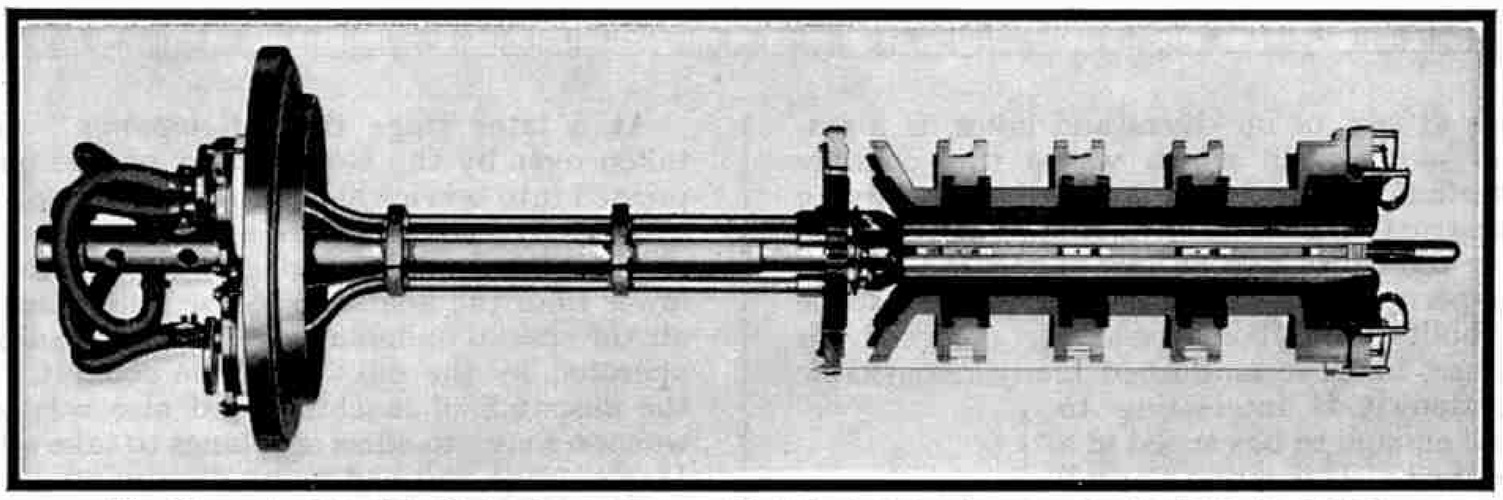
In 1907 Dr. Lee de Forest, another famous scientist, greatly increased the efficiency of the valve by adding a third electrode, which he called the "grid." The new electrode was a perforated metal plate supported between the filament and the anode by a separate wire that was fused through the glass of the bulb, and was connected to the aerial. By this arrangement the electrons from the filament had to pass through the grid before they could reach the anode. The negative charge carried by the grid varied with the character of the incoming oscillations, being strengthened when the grid received the positive half of an oscillation and correspondingly weakened when the negative half was received. Every time the stream of electrons was allowed to reach the anode a current of much greater strength than that received from the aerial was produced in the plate circuit, where a telephone earpiece converted it into sound waves. In this way the three-electrode valve served as an amplifier in addition to being an efficient rectifier.

The three-electrode valve attracted the attention of many scientists, and the discovery in 1913 that in addition to acting as a receiver it could be made to serve as a generator of continuous oscillations, greatly increased its usefulness. From that time the development of the valve as a transmitter has gone steadily forward and to-day this remarkable apparatus forms the heart of every modern system of wireless communication. The wireless beam stations that keep us in close touch with the Dominions; the trans-Atlantic telephone and our great broadcasting systems are all based on the discovery and evolution of the thermionic valve as it is now known.

In spite of this rapid advance the wireless engineer's efforts to increase the power at his disposal have been severely limited by the fact that the valve consists of a highly evacuated glass bulb in which are sealed permanently the electrodes necessary for its operation. The difficulties of constructing and operating this type of valve have increased enormously as greater and greater outputs have been required. Cooling, deterioration of the vacuum and the great expense of replacement when the valve failed have also presented difficult and in some cases

insurmountable problems. For many years therefore scientists have been endeavouring to devise an ideal valve in which all these drawbacks would be eliminated. It was realised that such a valve must have a vacuum that would not deteriorate with age ; that it must be one in which the great difficulty of sealing off the electrodes under vacuum during the process of manufacture would be avoided ; and in which the filament could be replaced or other repairs executed, and the valve quickly and easily again placed in operation.

The maintenance of a continuous vacuum was achieved under laboratory conditions by means of a mercury vapour pump, but owing to the high pressure of mercury vapour the method involved cooling with liquid air. Such a costly and unwieldy process was impracticable for commercial purposes, and a more satisfactory solution of the problem was sought. This longed-for solution was discovered in a very interesting and unexpected manner.



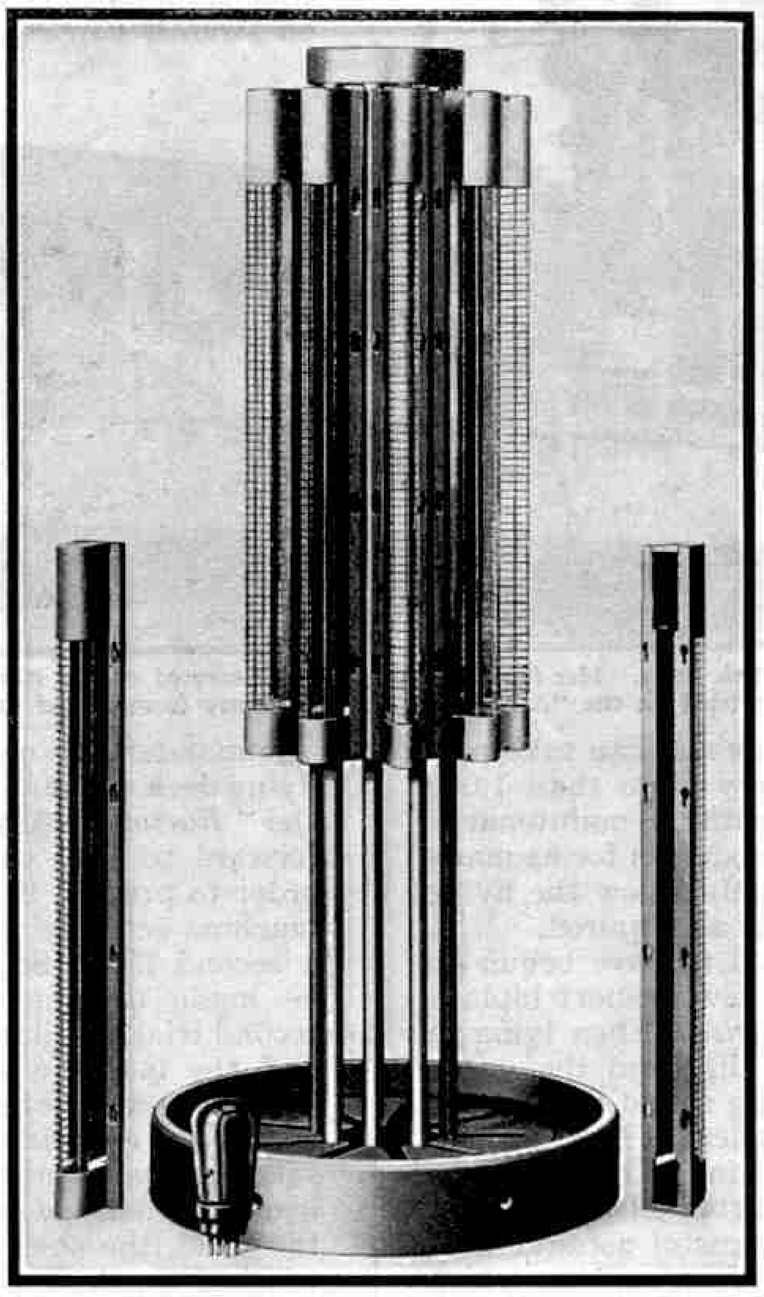
The Filament of the Valve is in nine sections, and in this photograph one section is shown in position.

Some three years ago experiments in no way connected with wireless communication or thermionic valves, and indeed not expected to be of any industrial consequence, were begun in the research laboratories of the Metropolitan-Vickers Electrical Company. These experiments led to the production of oil distillates having remarkable properties. They could be boiled at a fairly low pressure without decomposition, and yet at room temperature their rate of evaporation was so small that they could be placed inside a wireless valve without impairing the vacuum. It was quickly realised that here was the ideal liquid to replace the mercury of the vapour pump as, on account of its low volatility, cooling could now be effected with water, and the cumbersome and expensive liquid air process eliminated. This was a vitally important step, for it removed the continuously evacuated valve from the realm of laboratory apparatus and placed it at the service of the engineer.

In 1930 a valve incorporating the new development and designed for an input of approximately 25 kw. was constructed, and after being tried out in the laboratory it was put into actual continuous service at the Rugby wireless station. There its behaviour was watched not only by the makers but by G.P.O. engineers who had from an early stage shown a keen interest in the tests. The valve proved so satisfactory in operation that the G.P.O. entrusted the makers with the design and manufacture of a 500 kw. valve of the same type.

The making of this huge valve involved many months of careful designing, constant experiment and detailed testing, and the overcoming of numerous mechanical difficulties. A very high degree of accuracy was called for, and some of the parts had to be correct to one hundred thousandth of an inch. At last the valve was completed, tested and declared satisfactory.

The new valve is by far the largest and most powerful wireless valve in the world, and is capable of operating the main transmitter at Rugby, a task previously performed by a bank of 50 high power valves. It has a filament current of approximately 500 amps., or about 5,000 times that of a receiving valve, and its filament emission is 160 amps., which represents an almost inconceivable electron flow of 300 thousand billion electrons per second. The cooling of a valve of such power is no mean task and 40 gallons of water a minute are required to effect this. Any gas evolved during the operation of the valve is rapidly removed by the pumps, and an exceedingly high vacuum is maintained even when the valve is working at the highest power inputs. One result of this continuous evacuation is that the valve improves with age—a contrast to valves of the permanently sealed type. The pumps, with the exception of a simple type of primary extractor, have no moving apparatus, and mechanical trouble is therefore a very remote possibility.



The "Grid" of the Valve, with two of the nine sections removed. Each section controls the electronic emission from one filament section.

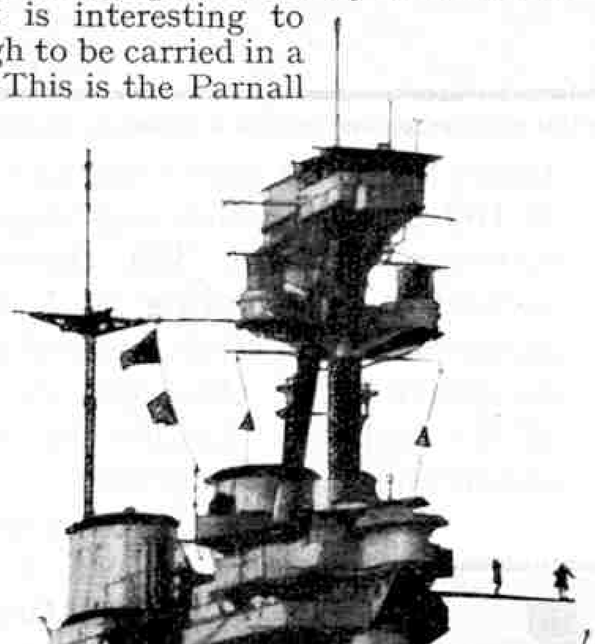
The valve stands 10 ft. high and is 14 in. in diameter, and it is built on a welded steel bedplate 8 ft. long by 3 ft. wide. The anode is made of steel and is approximately 26 in. long and 14 in. in diameter, and weighs 3 cwt. The filament is in nine sections, as also is the grid, each section of which controls the electronic emission from one filament section. No glass is used in the construction of the valve, steel, porcelain and copper being the only materials employed. The complete valve is over a ton in weight. In the event of filament or other repairs being necessary the valve can readily be taken to pieces, the repairs executed with ordinary engineering tools, and the whole reassembled and placed back into operation in the course of a few hours, truly a remarkable feat.

It is interesting to note that the G.P.O. regarded the new valve as an achievement of such astounding importance and merit that it exhibited the valve at the Albert Hall, London, during the Faraday Centenary celebrations last year. Though this valve is at present the largest in the world, the new developments which have made possible its manufacture have opened the way to the construction of valves capable of dealing with inputs very much higher than 500 kw.

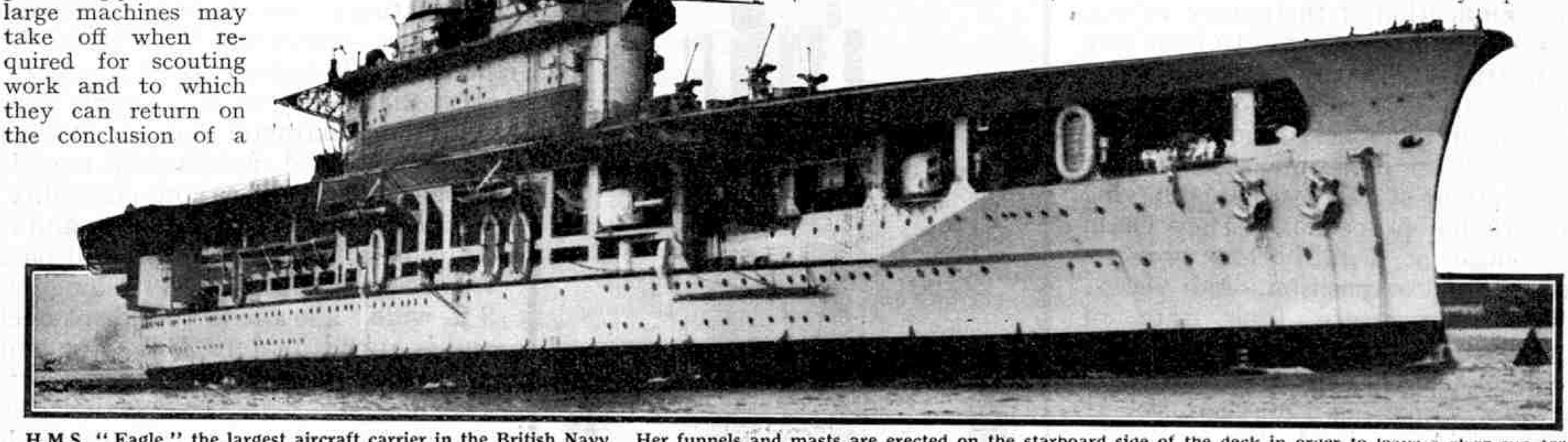
British Aircraft Carriers

Ships that Act as Floating Aerodromes

THE use of aeroplanes at sea, or on rivers and lakes, is a fascinating branch of aviation in which we in this country are specially interested. There is no doubt that the flying boats and seaplanes constructed by British manufacturers are of the highest efficiency, for the world's speed record of 407.5 m.p.h. was made in a Vickers-Supermarine S.6.B. fitted with a Rolls-Royce engine; while British built flying boats, whether designed for military or commercial use, have accomplished many remarkable flights. In this connection it is interesting to note that a seaplane small enough to be carried in a submarine has been designed. This is the Parnall "Peto," which was described on page 220 of the *"M.M."* for March, 1931.



Aeroplanes provided with wheeled undercarriages also may be used in operations at sea. This development has been made possible by the construction of floating aerodromes or aircraft carriers, as they are called. These are large vessels fitted with decks extending nearly their whole length and providing platforms from which large machines may take off when required for scouting work and to which they can return on the conclusion of a flight. These vessels are capable of high speeds and can take part in fleet operations. The largest of them carry more than 1,000 men, of whom over 100 are directly concerned with the maintenance and operation of aircraft, and provide accommodation for as many as 30 aeroplanes in hangars situated immediately below the flying deck, lifts carrying the machines up and down as required.



H.M.S. "Eagle," the largest aircraft carrier in the British Navy. Her funnels and masts are erected on the starboard side of the deck in order to leave a clear run for aircraft. This type of construction was first tried on the "Argus," on which dummy funnels and masts made of canvas and wood were erected.

The story of the aircraft carrier may be said to have begun on 10th January, 1912, when Lt. C. R. Samson flew a Short biplane from a staging erected on board H.M.S. *"Africa,"* then lying in Sheerness Bay. Lt. Samson was unable to alight on the vessel at the conclusion of his flight, and after circling round the Bay he flew away to land at Eastchurch. The battleship *"Hibernia"* also was used in experiments of this kind, and in 1911–12 she was fitted with a special launching deck, constructed of wood, that extended from the bridge to the bows. Successful ascents were made from this vessel and also from the *"London,"* to which a similar deck was fitted.

The first vessel built for the purpose of carrying aircraft was called the *"Hermes."* She was commissioned in 1913 and had only a brief career, for she was torpedoed in the English Channel in November, 1914.

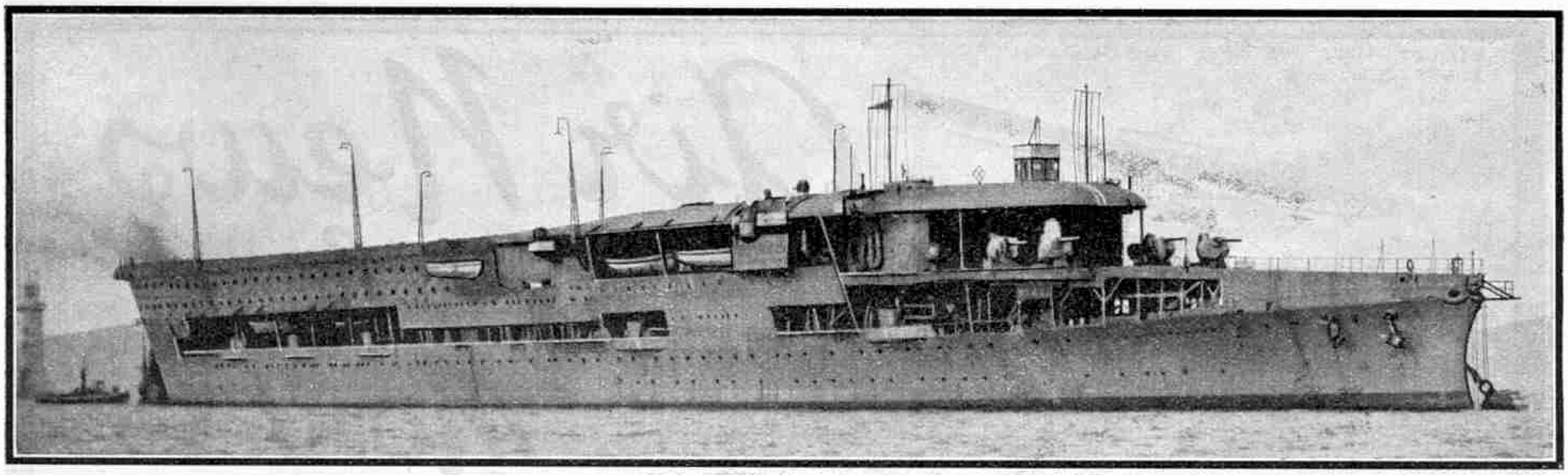
The outbreak of the Great War led to interesting developments, for the value of aircraft as scouts for fighting ships quickly became apparent. The first step was to fit out merchant ships to enable them to carry seaplanes and to provide them with decks from which aeroplanes with wheeled undercarriages could be launched. The first of these was the *"Vindex,"* which was capable of carrying five seaplanes and two single-seater landplanes. The hangar and the flight deck were fitted in the fore part of the vessel.

At a later stage the *"Campania,"* the famous Cunard liner taken over by the Government on the outbreak of the War, was pressed into service as an aircraft carrier. A deck 250 ft. in length was erected on this vessel, and from it seaplanes fitted with removable wheeled undercarriages were launched. The wheels were lower than the floats, of course, and when the machine was in the air the special undercarriage was released by means of a mechanism operated by the pilot from the cockpit. This device speeded up the despatch of machines and also was serviceable when the sea was too rough to allow seaplanes to take off in the ordinary manner. It was crude and had many disadvantages, however, and when the cruiser H.M.S. *"Furious"* was converted into an aircraft carrier in 1916, she was fitted with a trolley running on rails along the deck on which seaplanes could be carried when taking off. On attaining flying speed the machines rose from the trolley and this was prevented from falling overboard by means of buffers placed at the end of the track. Such devices were unnecessary when aeroplanes with wheeled undercarriages were used.

So far the problem of how a machine could return to the vessel from which it had been flown had not been seriously tackled. Seaplanes had been chiefly employed and these had simply alighted on the water, to be hoisted into the aircraft carrier by means of derricks. A trial in which H.M.S. *"Furious"* took part showed that aeroplanes could land on the special flying decks constructed on aircraft carriers, however. This was carried out by Squadron Commander Dunning, who in a Sopwith "Pup" alighted on the flying deck of the vessel. When the attempt was about to be made, the *"Furious"* steamed into the wind, and a landing party rushed forward to seize the machine as soon as it touched the deck, in order to prevent it from running over the edge into the sea. The machine actually was seized while still in the air, and on making a second flight Sq. Cdr. Dunning ordered that no effort should be made to stop it until it had alighted. Unfortunately the second trial ended in disaster, for one of the tyres burst on alighting, and the machine slewed round and was carried overboard, the intrepid pilot being drowned.

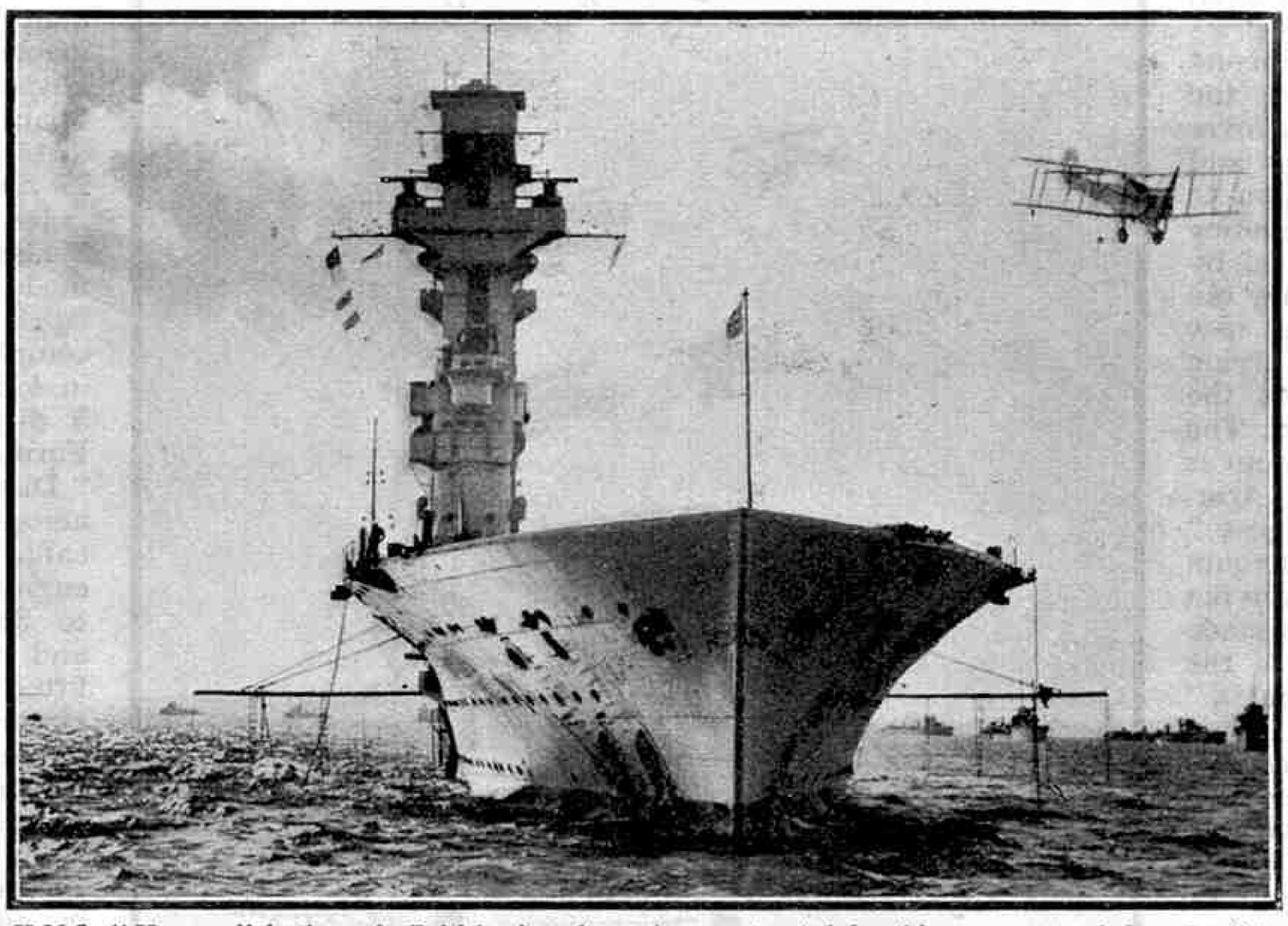
Further experiments were made for the purpose of developing satisfactory means of alighting on aircraft carriers. The pilots soon learned the art of descending on the deck of a vessel steaming into the wind, the chief difficulty being to stop a machine after it had touched the deck, particularly in rough weather when the platform was rolling and pitching. In early experiments different forms of arresting gear were tried. In one of these wire ropes were stretched fore and aft along the flying deck. These were a few inches apart and were raised about six inches above the deck by means of small blocks of wood, while lengths of rope carrying sandbags were thrown across them at intervals. Hooks of special shape were fixed to the undercarriages of machines alighting on the decks. These were supposed to engage in the fore and aft wires, which would keep the machine from turning sideways, while an additional hook let down by the pilot was designed to catch the ropes attached to the sandbags, the resulting drag arresting the progress of the aeroplane.

This method of stopping machines alighting on the deck of an



aircraft carrier was first tried on the "*Furious*." It was not very successful and when the trials were continued in the "*Argus*," the ropes to which sandbags were attached were not used, although the wires running fore and aft were retained. The "*Argus*" was completed in 1918. She was originally designed as an Italian liner but while on the stocks was bought by the British Government and converted into an aircraft carrier of a new type, having a clear landing deck that extended the full length of the vessel. She had no funnels to cause obstructions or to produce atmospheric disturbances by the discharge of hot furnace gases, these being led away through horizontal ducts that ran well aft.

As experience was gained, it was soon found that even fore and aft landing wires were undesirable, for the machines employed became twisted as the result of the severe strains imposed on them. They certainly prevented the machines from going over the sides of the aircraft carriers, but they turned a large proportion of moderately good landings into bad ones. Their use was abandoned, therefore, and now that efficient wheel brakes are available, they are not necessary on the long wide decks of modern aircraft carriers. A pilot of a descending machine now alights on the centre line of the deck, where one or two wide white lines usually are painted in order to guide him. If he alights on one side of the deck, he continues his run in a direction parallel to the centre line, using his brakes to check his machine. There is no risk in this, for palisades are erected along the forward edges of the deck. These consist of stanchions that slope outwards and are placed at intervals of about 8 ft. They are connected by wires and effectively prevent machines from running over the edge of the deck into the sea.



H.M.S. "Hermes" is the only British aircraft carrier constructed for this purpose and is splendidly equipped for the maintenance of aircraft. Above is a photograph of H.M.S. "Furious," the most remarkable in appearance of British aircraft carriers. She has no funnels, smoke being discharged through vents in the rear.

Another effective practical plan has been the provision of a slope at the stern end of the landing deck. Before the slope was provided, the edge of the deck caused many accidents, for a pilot who misjudged his distance by even a few inches severely damaged his machine and ran great risk of falling into the sea. Fear of a mishap of this kind also led pilots to alight too near the forward end of the deck, particularly in rough weather, with the result that they were unable to check their machines in the space available. Now landings are readily and easily made on the sloping portion and no difficulty is experienced when checking the run of aeroplanes along the deck.

In addition to the "*Furious*" and the "*Argus*," the British fleet of aircraft carriers includes four vessels. Two of these are "*Glorious*" and the "*Courageous*." Like the "*Furious*," these were built as cruisers and were converted in 1924. The "*Furious*" herself underwent transformation in 1921, the changes being made as a result of the experiments we have described. Her masts and funnels were taken down and an additional flight deck was built about 30 ft. higher than the original one, the new platform extending over about two-thirds of her length.

The remaining two vessels of the British Aircraft Carrier fleet are the "*Eagle*" and the "*Hermes*." The "*Eagle*" was originally designed as a battleship for the Chilian Navy, but was bought by the British Government in 1917, and her conversion into an aircraft carrier followed. She is the largest British carrier, her tonnage being 22,790, while that of the "*Furious*" is 19,100, but this vessel is 786 ft. in length, while the length of the "*Eagle*" is only 661 ft.

The "*Hermes*" is the first vessel to be specially designed by the British Admiralty as a carrier. She was launched in 1919, and is a lightly protected fast vessel with a wide radius of action. She is only half the size of the "*Eagle*," but her speed and design probably make her more efficient than the larger vessel. An enormous hangar in the after part of the ship is magnificently equipped for repair work and special electric lifts are installed to raise machines to the flight deck. On the starboard edge of this deck is a high narrow super-structure, surmounted by an oval funnel and a tripod mast that supports a control top and a range finder platform. The "*Eagle*" also has a starboard "island," as a structure of this type is called. Its presence is due to constructional difficulties that accompany the practice of leading smoke and furnace gases aft.

Operations on board an aircraft carrier are of an interesting character. When a machine is to take off from the deck, the vessel steams into the wind, thin jets of steam emitted from some point forward showing when the right direction is being followed. The machine is brought up from its hangar by means of an electric elevator. Once on deck the engine is started, and when the order to take off is given by the officer in charge, the chocks are pulled away from the wheels by mechanics, who lie flat on the deck below the wings. The aeroplane roars into full flight in a few seconds, for the speed of the aircraft carrier is added to that of the wind, and therefore a shorter run is required than when a similar machine takes off from an aerodrome on land.

While a pilot is in the air he keeps in touch with his superior officers on board the aircraft carrier by means of wireless. When he wishes to return he manœuvres his machine into a position behind the vessel, which of course, again steams into the wind, the ideal course being one in which his machine crosses the stern at a height of about 20 ft. He cannot switch off his engine and glide in, as the pilot of a machine landing at an aerodrome does, for the carrier is travelling ahead rapidly and he would be left behind if he lost speed.



Air News of the Month

The London-Capetown Air Service

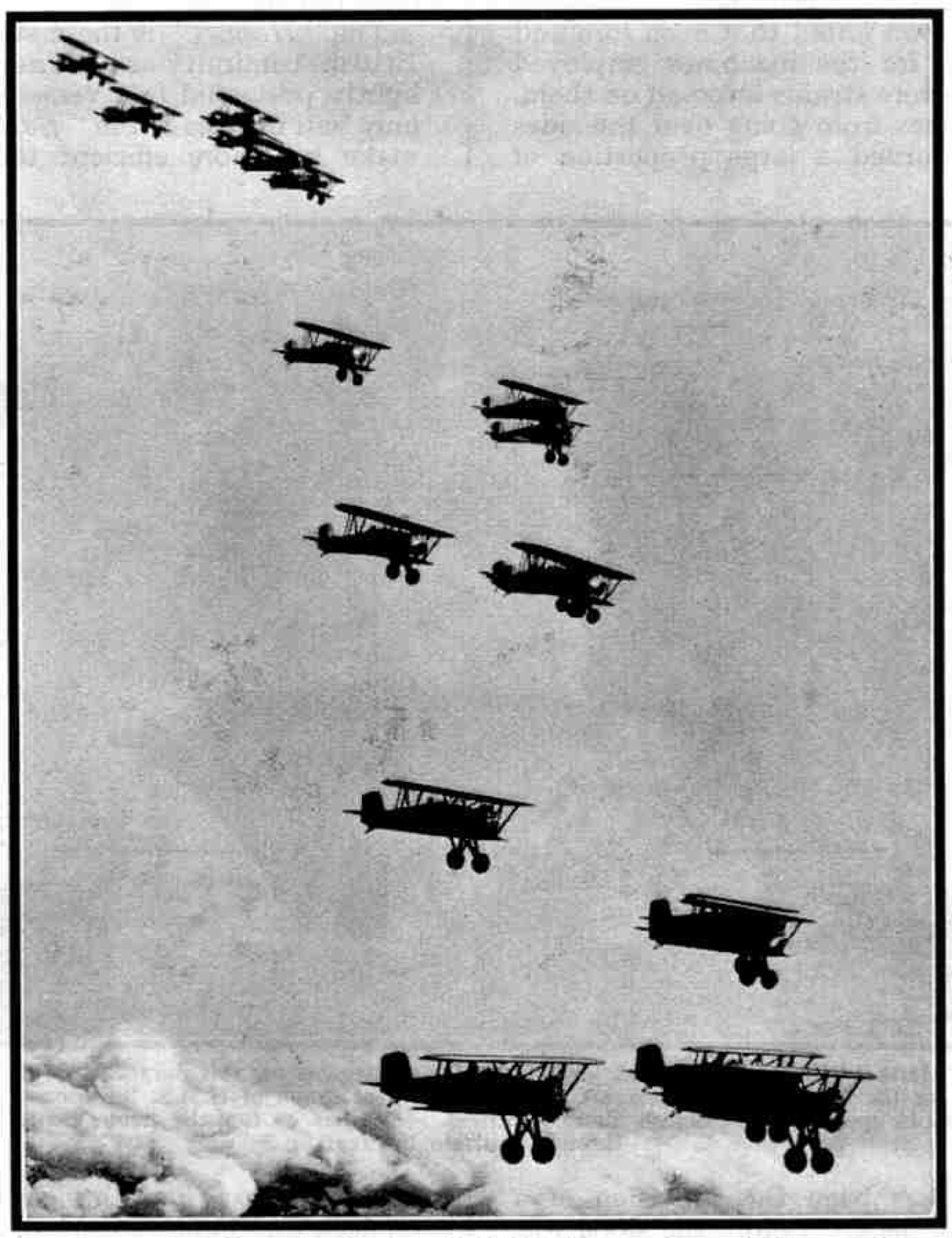
The first machine on Imperial Airways' regular weekly air service between London and Capetown left Croydon on 20th January, the mails being due in Capetown 11 days later, while the first flight in the opposite direction was begun from Capetown on 27th January. Mails only were carried at first, the intention being to institute a passenger service about a month after the first through flight was made. The fare from London to Capetown is £130.

At present five different machines are employed in the course of a single journey over the new route. Passengers and mail are carried from London to Paris in a 38-passenger Handley Page "Heracles" and travel by train to Brindisi, where they are transferred to one of the new all-metal Short "Kent" flying boats for the flight across the Mediterranean Sea to Egypt. The stage from Cairo to Khartoum is covered in a triple-engined Armstrong Whitworth "Argosy." For the section between Khartoum and Kisumu, in Tanganyika Territory, a change again is made to flying boats, this time of the triple-engined Short "Calcutta" type, for there are many rivers and lakes in northern and central Africa on which aircraft of this kind may alight. At Kisumu passengers and mails are transferred to a D.H. "Hercules" air liner and in this machine they complete their journey.

The aircraft employed on the southern section of the African air route later will be replaced by a fleet of Armstrong Whitworth "Atalantas." These are fast monoplane cabin liners, their maximum speed being from 140 m.p.h. to 150 m.p.h. and their cruising speed 120 m.p.h. Each machine is equipped with four Armstrong Siddeley "Double Mongoose" engines, developing a total of 1,360 h.p. These engines are of the supercharged type and are used because certain aerodromes on this section are at altitudes of from 4,000 ft. to 5,000 ft. above sea level. The new liners were described and illustrated on page 367 of the *"M.M."* for May, 1931, while a full description of the Short "Kent" was published on page 310 of our issue for April, 1931.

Flying Below Sea Level

Flying boats of the Short "Kent" type employed on the Mediterranean section of Imperial Airways' Indian and African service operate for a short time below sea level when they land at Tiberias on the Sea of Galilee. The aerodrome is 700 ft. below the level of the sea.



Formation flying above the clouds by United States pursuit, or fighter, machines. This illustration, and the upper one on the opposite page, are official photographs of the U.S. Army Air Corps.

World's Gliding Record

An American glider pilot, Lt. William Cocke, of the United States Army Air Service, claims to have set up a world's gliding record at Honolulu. He is reported to have remained in the air for 21 hours, 34 min. 15 secs., and during this time he attained an altitude of 3,500 ft. and covered a distance of 400 miles.

Recent Interesting Flights

An excellent non-stop flight between London and Algiers recently was made by Flt. Lt. E. H. Fielden, the personal pilot of the Prince of Wales, in a D.H. "Puss Moth" equipped with extra fuel tanks. The distance of 1,080 miles was covered in 11 hrs. 40 min.

Another remarkable long-distance non-stop flight was carried out by Capt. C. R. Diaz and Lt. C. de Haya Gonzales who, in a Spanish-built "Breguet XIX" machine fitted with a 600 h.p. Hispano-Siuza engine, flew from Spain to Spanish Guinea, a distance of about 3,000 miles, in 27 hrs. 10 min.

Record flights from Paris to Madagascar and back have been made by Capt. Goulette and M. Salel, two French airmen, who completed the outward journey in 4 days 7½ hrs. and returned in 5 days. Their machine was a Farman 190 fitted with a Lorraine "Dietrich Algol" engine. This aeroplane is a 4-seater enclosed cabin monoplane in which any engine developing from 200 h.p. to 250 h.p. may be employed, and its maximum speed when fitted with a Gnôme-Rhône "Titan" air-cooled radial engine is 124 m.p.h. Its cruising speed is 105 m.p.h.

Another recent flight from Paris to Madagascar was of special interest, for it was made in an aeroplane fitted with an engine of only 45 h.p. The machine was a "Mauboussin," a high-wing cabin monoplane, to which a Salmson AD9 engine was fitted. Extra petrol tanks giving a range of 745 miles were installed and the journey was made in 13½ days. The pilot was M. Réné Lefèvre, who was the companion of MM. Assolant and Lotti in their transatlantic flight in 1929, and his achievement is another demonstration of the fact that a modern light aeroplane is not a "toy" and is quite suitable for hard work over long distances.

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The first amateur pilot in this country to fly an "Autogiro" is Mrs. J. S. Weir, who at Hanworth recently flew one of the new cabin type similar to that illustrated in last month's issue, for about 20 mins.

Aircraft Engine with No Carburetter

The Pratt & Whitney Aircraft Company, the well-known American manufacturers of aircraft engines, have introduced a petrol engine that has no carburetter, the fuel being injected directly into the cylinders in the same manner as that employed in heavy-oil Diesel engines.

Except for the absence of a carburetter, the new engine is similar to the Pratt & Whitney "Hornet," which was described on page 524 of the "*M.M.*" for July, 1930. It has passed the usual 50 hours' bench test and also has proved satisfactory when tried in a test machine. It has been installed in a Boeing 40-B.4 mail aeroplane for a further test on actual service.

The "Hornet" injection engine is said to be practically unaffected by low air temperature, and to start easily in the coldest weather. Although it is designed for use with ordinary petrol, it is probable that a special fuel that is not readily inflammable will be employed in it. A suitable fuel has been developed by the Standard Oil Company. This fuel has an ignition point of 107°F. which is more than 60°F. above that of ordinary petrol. It is safer to use, therefore, and has the added advantage that it develops more power than petrol.

More "Fireflies" for Belgian Air Force

As reported in the "*M.M.*" for September, 1931, the Belgian Air Force purchased a number of Fairey "Firefly" interceptor machines last year. A further order for more than 60 aeroplanes has now been received by the Fairey Aviation Co., the makers of the "Firefly," the total value of the order being more than £300,000.

Machines of two types are to be supplied. These are the "Firefly" and the "Fox II" two-seater. The "Firefly" is claimed to be the world's fastest single-seater fighter, and the "Fox II" is a bombing machine with a very high performance. Both types are equipped with Rolls-Royce "Kestrel II" supercharged engines. This engine has a weight of 865 lb. and maintains an output of nearly 500 h.p. from ground level to an altitude of 3,000 ft.

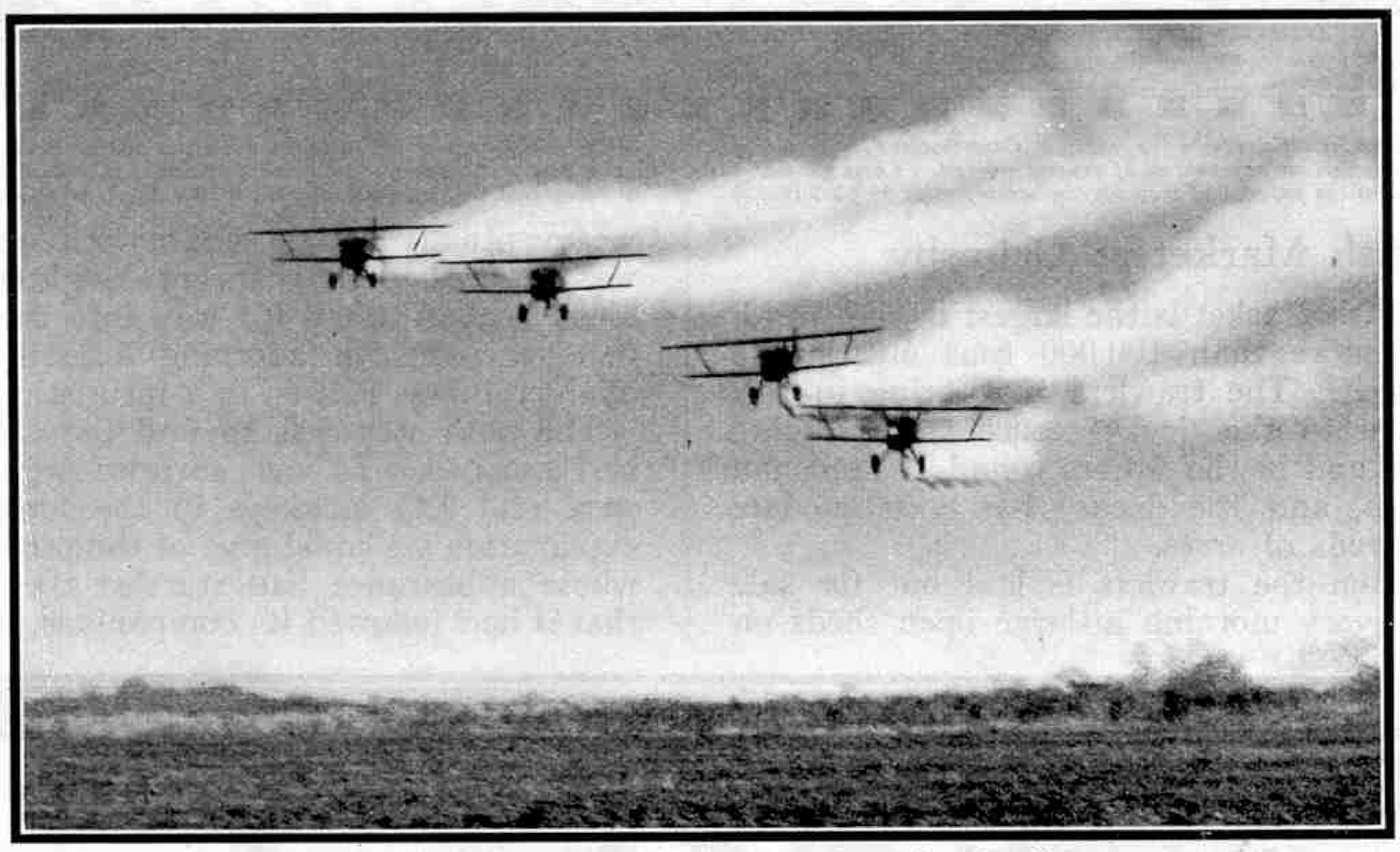
Admiral Byrd to Fly to the South Pole

Rear-Admiral Byrd, the famous American explorer, has announced his intention of making an aeroplane flight to the South Pole next autumn. He hopes to extend his exploration of the Antarctic regions, but also will try to recover an aeroplane that he lost during his expedition in 1929.

Admiral Byrd has had considerable experience of flying in Polar regions. He was the first man to reach the North Pole by air, arriving there from Spitzbergen on 9th May, 1926, and on 28th and 29th November, 1929, he flew over the South Pole in a Ford triple-engined monoplane. The only other explorer to reach both Poles was Amundsen, who arrived at the South Pole by dog team on 16th December, 1911, and crossed the North Pole in the Italian airship "*Norge*" three days after Byrd flew there.

* * * *

A daily air ferry service to be operated this summer between Bristol and Cardiff will bring the cities within 15 mins. journey of one another. Although they are only about 15 miles apart, to travel by train between them necessitates traversing the Severn Tunnel and takes over an hour.



Fighter aeroplanes laying a smoke screen to conceal operations from the enemy.



The Avro "Avian" monoplane, a light aeroplane constructed by A. V. Roe & Co. Ltd., to whom we are indebted for permission to reproduce this photograph.

Novel Uses for Aeroplanes

In America aeroplanes recently have been put to interesting uses of an extraordinary type. For instance, a pilot employed his machine to find the speeds at which birds flew. His method was to pursue the birds selected and to note the speed registered on his indicator when they appeared to be holding their own with their mechanical rival. The fastest of the birds tried out in this manner was the teal, which was found to be capable of 75 m.p.h. Crows and wild geese flew at 56 m.p.h., while wild ducks reached a speed of 46 m.p.h. when trying to escape from the pursuing aeroplane.

A second unusual application of aircraft is being tried in California, where a contract for sowing clover seed over an area of 4,000 acres has been awarded to the owner of an aeroplane. This is an interesting development from the use of aeroplanes for spraying growing crops with insecticides, and if the experiment is successful will open up an entirely new field of work for aircraft.

Fire Detected by Air Mail Pilot

The capacity of the modern aeroplane for producing a noise recently played the chief part in saving an entire family from death in a burning house in the United States. Mr. Gravis, one of the pilots of an American air line company, discovered the fire while flying in a night mail aeroplane from Kansas City to Chicago. He descended as low as possible and circled round the blazing building with the throttle of his engine wide open until the occupants were aroused by the noise, only resuming his journey after seeing that they had escaped. This was the fifth occasion on which Mr. Gravis had detected a fire while flying at night, and each time he was instrumental in warning the inmates of their danger.

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The Singapore Flying Club has recently purchased a Saro "Cutty Sark" four-seater flying boat equipped with two 110 h.p. "Cirrus Hermes" engines. It is the only British Club whose members can obtain tuition in piloting flying boats.

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, 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.

The Fish Market at Grimsby

The Grimsby Fish Market is the largest in the world, and every year more than 100,000 tons of fish are despatched from it. The trawlers that bring in this immense quantity to the docks secure their catches in the North Sea and in the waters round Iceland and the Faroe Islands, and the docks that accommodate them cover hundreds of acres.

Fish landed from the trawlers is laid out for sale about 8 o'clock every morning in large open sheds on the wharves. Cod, ling and similar fish are sold by regular auction, but soles, plaice and flat fish are usually disposed of by what is called Dutch auction, the price being lowered gradually by the auctioneer until a buyer is found. The busiest week in the year is that before Easter. The Wednesday before Good Friday is a particularly important day, and the immense piles of boxes then stacked on the market seem to contain enough fish to feed a nation. By 4 o'clock in the afternoon, however, all are sold, and special express fish trains quickly carry the harvest of the sea to all parts of the country.

C. PATTINSON-KNIGHT (Harrow).



A splendid catch of fish being sold by auction in the Fish Market at Grimsby. The bows of a trawler may be seen on the right of our photograph, which was submitted by our reader, C. Pattinson-Knight, Harrow.

A Monkey Stowaway

One of the strangest cargoes ever carried in a vessel in which I served was a consignment of 120 live monkeys brought from Sumatra to Hamburg. The animals had been caught recently in the jungle in the interior of the island, and were greatly alarmed by the excitement due to their being shipped. They were housed in 12 large cages in the fore-cabin.

We did not sail until next morning and during the middle watch in port the lookout man was startled to observe a ghostly shape gibbering at him from the cowl of a ventilator. When this was reported to the mate, he came to the conclusion that one of the monkeys had escaped, unlikely as this seemed, and decided to make a search in the morning. After a stiff chase we eventually caught the culprit and his appearance was greeted with roars of laughter, for during the night he had found his way into the paint locker and had succeeded in adorning himself with the colours of the rainbow laid on in a futuristic pattern.

The next step was to find the cage from which he had escaped. To our surprise we found that there were still 120 monkeys in the fore-cabin. The only explanation we could give of the presence of the animal whose appearance had startled the lookout man was that it had followed its companions, who had been captured in the forest, and had boarded the ship in the night.

The stowaway was not placed in the cages, but was tethered by means of a piece of light cord fastened to a belt made of lampwick in order to prevent him from getting into mischief. Once he bit through his belt, and a kind of obstacle race was necessary before he could be recaptured. Later he became quite tame and behaved well throughout the voyage. A. HAGUE (Liverpool).

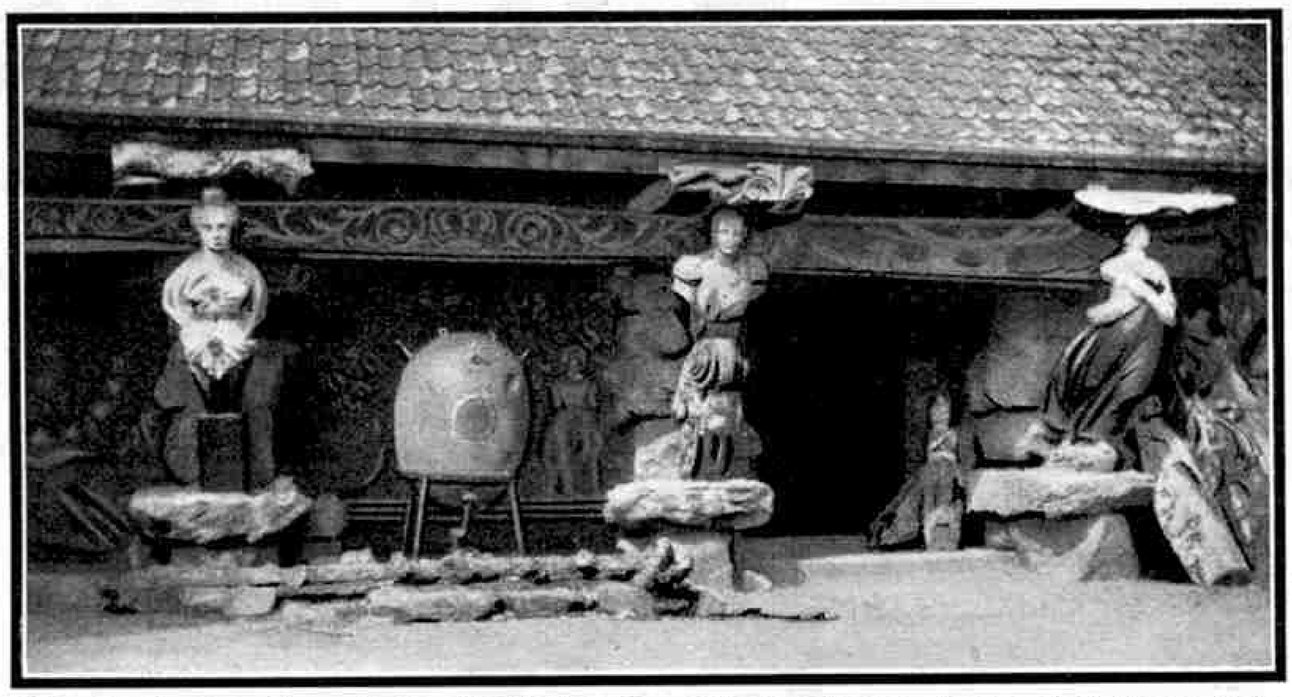
Sand Menace on Scottish Railway

The railway line from Alves Junction to Burghead was closed last September, after 65 years of working. It is a branch of the Highland section of the L.M.S.R., and 30 years ago was extended to Hopeman, about two miles beyond Burghead.

The now disused branch line passes through sandhills and driving sand was always troublesome in spite of the presence of protective sheds about 12 ft. in height on the windward side of the track. Further protection was given by the growth in places of "bent," or long grass, but the good effects of this was counterbalanced by the activities of the rabbits living in the sandhills. In burrowing underground these creatures loosened the sand and this was carried over the line whenever the wind blew from the west. The extent of the trouble may be gauged from the fact that a portion of the original line abandoned when the Hopeman extension was built has been buried in sand to a depth of several feet. J. WILSON (Lossiemouth).

A Holiday in the Scilly Isles

Recently I spent a brief holiday in the Scilly Isles. I reached them by steamer from Penzance, the voyage of about 27 miles taking three hours; and landed at Hugh Town on St. Mary's, the largest island in the group and the one with the greatest population. It is full of interest to visitors, but so also are the other islands. For instance, the earliest of British-grown flowers are cultivated on St. Martin's in fields enclosed by tall hedges. Round Island is remarkable for the lighthouse built on it, its red glow at night being a cheerful reminder of its existence; and it is interesting to recall that one of the earliest lighthouses in the British Isles was erected on St. Agnes. This was merely a tower on which a coal fire was kept burning, but its light could be seen from a considerable distance.



Figureheads of vessels wrecked on the Scilly Isles. A large collection of relics of this kind is to be seen in the Abbey gardens on Tresco, the island next in size to St. Marys, the largest in the group. This photograph was taken by our contributor, C. H. Lees, Clifton College, Bristol.

Perhaps the most interesting of the Scilly Isles is Tresco. The gardens surrounding the remains of the Abbey contain many sub-tropical plants that flourish in the mild climate of the Isles, but I was interested chiefly in what is called "Valhalla," where an amazing collection of the figureheads of vessels wrecked on the islands may be seen. Many stout vessels were wrecked on the shores of the Scilly Isles before the erection of modern lighthouses and the compiling of accurate charts made navigation safer. Among them was the *"Association,"* the flagship of Sir Cloudesley Shovel, the British admiral who began his career at sea as a "powder monkey." The *"Association"* was wrecked in a storm in 1707, and not a man was saved out of the 800 on board. The body of the admiral was cast ashore on St. Mary's.

The lighthouses of the Scilly Isles are of great interest, for in addition to that on Round Island there are others on St. Mary's and Bishop Rock. The lighthouse on St. Mary's is built of iron and replaced one on St. Agnes, the tower of which still stands. The Bishop Rock lighthouse is the most westerly in England. An iron tower was first built on this rocky ledge, but a great storm demolished it just as it was completed in February, 1850. A stone lighthouse was then built. This has since been encased in granite and the great light has been lifted 30 ft. higher.

It was with great regret that I left the Scilly Isles, where I had spent a very interesting fortnight, but on my return to the mainland I found some consolation in the fact that during my absence there had been almost continual rain, while in the islands it had only rained on one day.

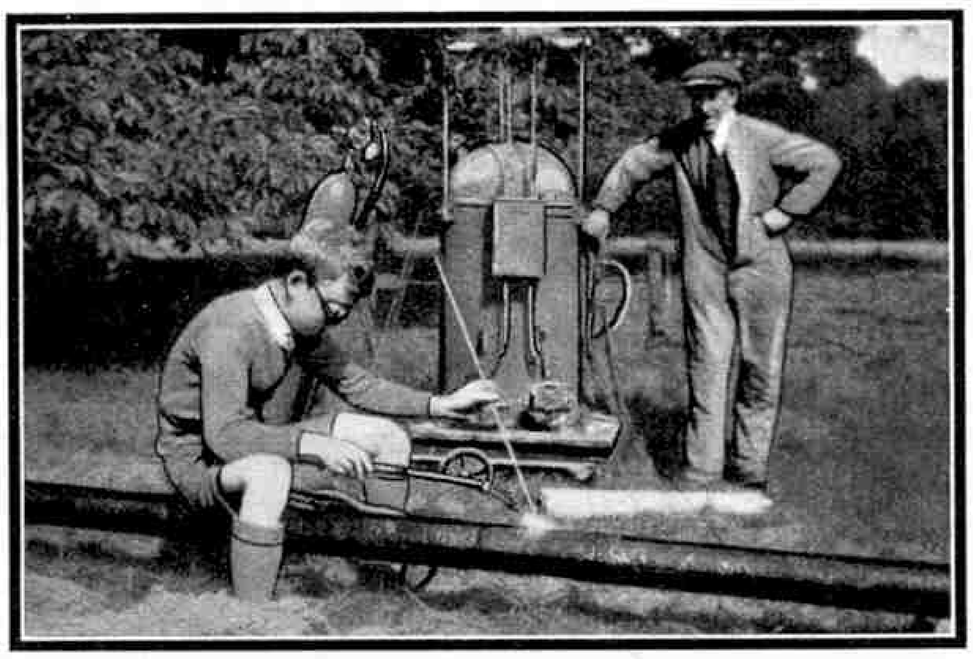
C. H. Lees (Clifton College, Bristol).

Welding a Steel Gas Main

The laying of a steel gas main 4 in. in diameter from Dalkeith to Gorebridge gave me an interesting opportunity of watching a welder at work. The pipes used were made by Stewarts and Lloyds Ltd., in the manner described in the article on page 721 of the September issue of the *"M.M.,"* and the welding plant also was supplied by this firm.

After the trench for the main had been dug, battens were laid across it and the pipes placed on them. The blows of a large mallet on a special driving plug inserted for the purpose brought the sections together, and the joints were then welded by means of an oxyacetylene burner. The acetylene was generated from calcium carbide in a special plant mounted on a trolley. From the generator the gas was led to the burner, where it was mixed with oxygen from a high-pressure cylinder. The hot flame melted the steel at the joints, and with the aid of steel electrodes the main was converted into what is practically a single pipe $4\frac{1}{2}$ miles in length.

After watching the welder at work I tried to follow his example, toning down the glare from the intensely hot flame by the use of a tinted eye-shade. Naturally I felt a little clumsy, but to my delight I succeeded in making a creditable joint. G. Hamilton (Dalkeith).

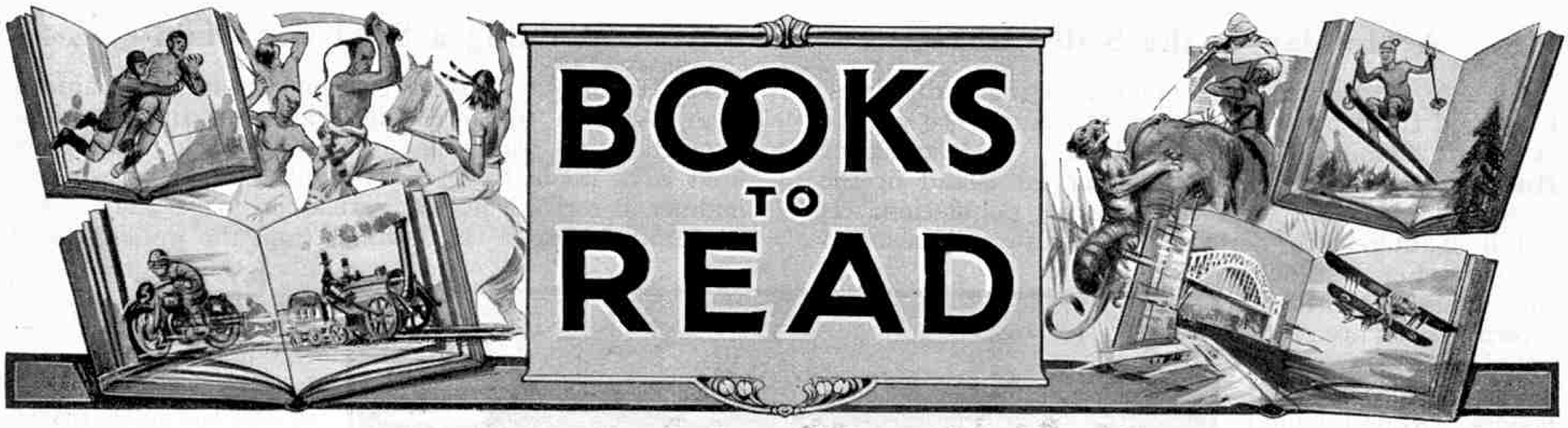


Our reader, G. Hamilton, Dalkeith, temporarily undertakes the duties of the welder during the laying of a steel gas main.

Glassblowers at Work

While visiting the glass works of John Moncrieff Ltd., Perth, I watched with great interest the making of glass tubing. A glassblower dipped one end of an iron tube 5 ft. in length into a tank containing molten glass and turned it round in order to collect the required amount of material on it. This he worked on a small table, blowing down the tube to form a hollow inside the glass. A second workman then attached an iron rod to the free end of the piece of glass, and the two walked away from each other, the first man blowing down the iron tube from time to time. When the stretching of the glass had reduced the tube to the required thickness, it was lifted on to a long bench and allowed to cool.

I was equally interested in the making of glass flasks, which are shaped in a mould. A sufficient quantity of glass is taken from the tank by means of an iron tube, and after being blown out a little, is placed in one side of the mould. The other side is swung over and fastened in position, after which the glass is blown to its full size. The flask thus formed is removed from the mould and is placed in an annealing furnace, in which it is cooled slowly to ordinary temperature. H. G. White (Edinburgh).



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.

"Early Man, His Origin, Development and Culture"

(Ernest Benn Ltd. 8/6 net)

This book contains a series of lectures delivered by recognised authorities on the fascinating subject of the story of Man, so far as we can trace it, from the time when he first showed himself superior to the rest of the animal creation.

The first lecture is by Professor G. Elliott Smith, who describes the fragmentary fossil remains of the oldest known types of human beings, and points out that they show a series of creatures with increasing capacity for thought and action. It appears that improvement in vision has been a great factor in this development, for although the eyes and brains of apes and monkeys are similar in structure to the corresponding organs in Man, they lack the delicate nervous system that has enabled human beings to transform mere vision into understanding.

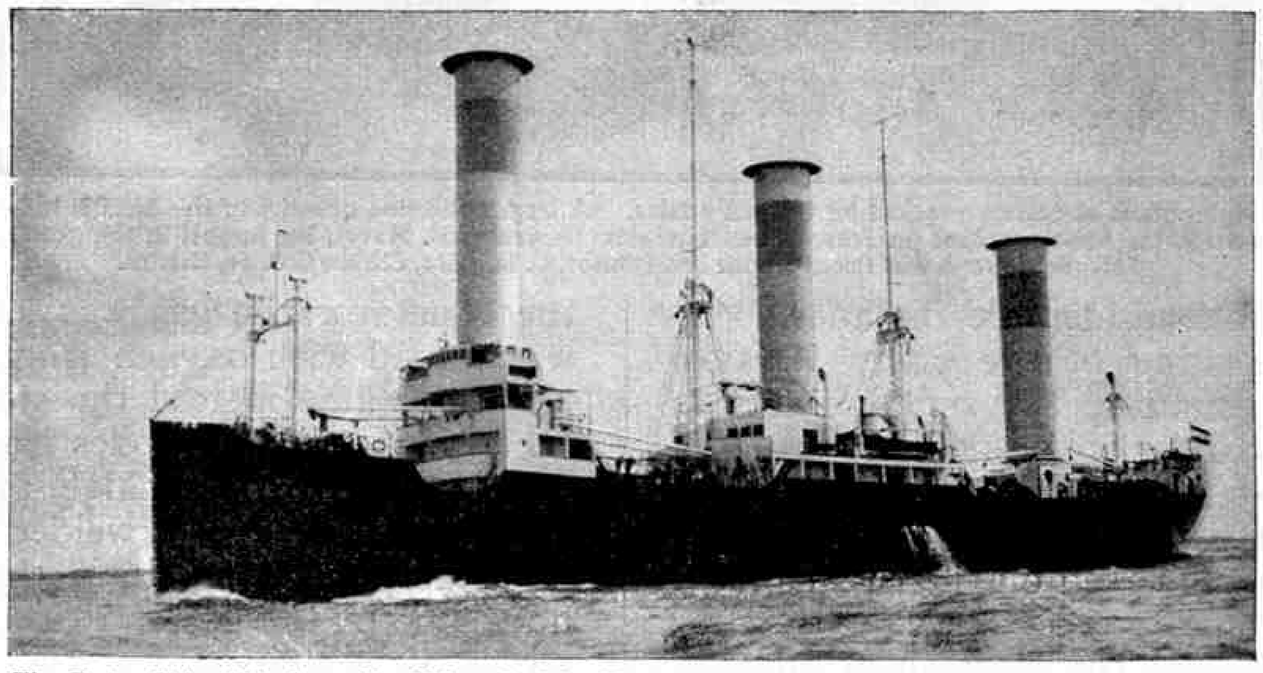
The next two lectures deal with the development of the races of mankind. In one of them Sir Arthur Keith reveals to us the interesting fact that race building is still in progress, and points to the behaviour of young nationalities, such as Finland and Southern Ireland, as illustrations of unconscious efforts to build up new races with distinct languages and customs. The equally interesting story, told by Professor F. G. Parsons, of the development of the modern Englishman, traces the changes in the shape of the head and in brain capacity shown by the inhabitants of these islands from the days of the Long Barrow men of more than 4,000 years ago up to the present time. These changes were influenced chiefly by the successive invasions of different types of humanity, but they appear to be continuing even to-day. The average modern Englishman's head probably is slightly larger than that of his predecessor of only 100 years ago, the change being shown chiefly in the greater height of his skull.

A summary of a lecture on the art of prehistoric periods follows. This deals with the wonderful drawings and carvings executed on the walls of caves, chiefly in Southern France and in Spain, and illustrations of these are given. Then comes what is in many respects the most interesting of the six lectures, that on the beginnings of agriculture, by Professor H. J. E. Peake. No discovery has had a greater effect on human life than that of agriculture. Previously Man had been a wandering food gatherer and hunter, but when he became a farmer and stock breeder he lived in a settled home. Single homes quickly developed into villages, and thus the discovery of agriculture was the beginning of civilisation.

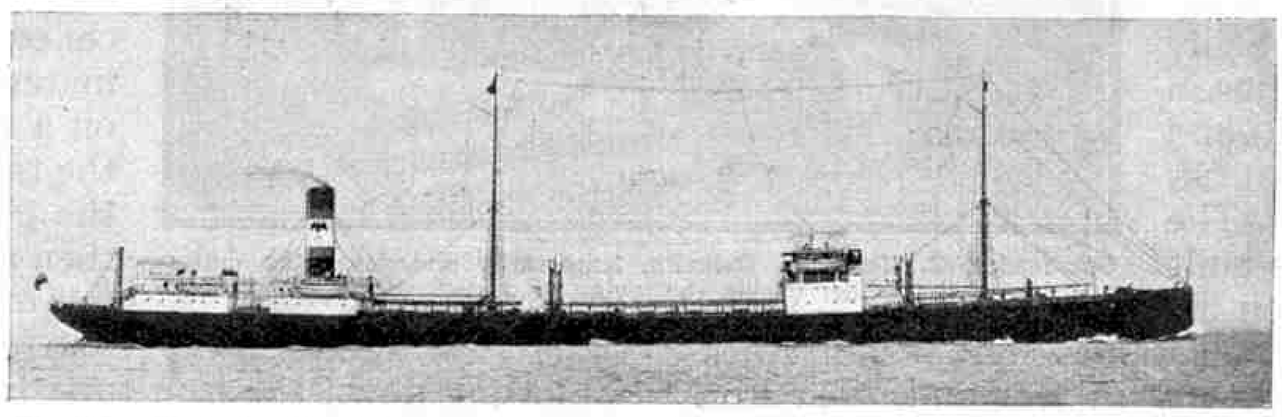
There are two claimants to the honour of being the original home of agriculture. These are Mesopotamia and Egypt. and in an effort to settle the question Professor Peake traces the story of agriculture backward for thousands of years. In Mesopotamia there were settled villages inhabited by people depending on agriculture for a livelihood before the days of the Flood, now believed to have occurred about 4500 B.C.; and pots containing a primitive kind of wheat have been discovered in untouched graves of a prehistoric Egyptian race who almost certainly lived about 7,000 years ago.

Professor Peake's conclusion is that the early inhabitants of the two countries did not discover agriculture, but that both derived their knowledge of it from an intermediate race, possibly from the ancient inhabitants of Syria. He pictures these people living on grass seeds, after having killed off the game on which they formerly subsisted, and suggests that the great discovery was due to a woman living not far from Damascus, who collected seeds of barley and a primitive form of wheat some time between 6000 B.C. and 5000 B.C., and after scattering them on the soil found that they sprouted and yielded an increased store. This agrees with ancient traditions, and it is significant that wild wheat was discovered on the slopes of Mt. Hermon and in other places in Syria in 1906.

The remaining lecture is devoted to the story of the discovery of metals, described by Professor J. L. Myres as one of the principal advances towards civilisation. In ancient times gold was regarded as a life-giver and life-preserver, probably because it does not rust or corrode; and it was identified with the Sun, the source of light and life. Silver was thought to be little inferior, but copper and iron, the two other important metals of antiquity, had no mystical qualities and were valued solely for their usefulness. Copper attracted attention because it could be compressed by hammering, and an edge could be given to tools made from it and from its alloy, bronze; while the superlative cutting qualities of iron tools gave that metal pre-eminence when means of working it were discovered. The native metal was first used in each case, the chief source of iron being meteorites, such as those from which the Eskimos of Greenland hacked pieces to form spear heads and fish hooks. Both metals were then rare. This was particularly the case with iron, which rusts rapidly, and it is not surprising to find that objects made of it were among the personal treasures buried with Tutankhamen about 1352 B.C. Then came the discovery of means of extracting the metals from their ores. This is an easier task with copper ores than with those containing iron, but the appearance of manufactured iron,



The Rotor Ship "Barbara." Although this ship has no sails it is propelled by the action of the wind. From "The Romance of the Merchant Ship" reviewed on the opposite page.



The "San Florentino," a tanker capable of carrying over 18,000 tons dead weight of oil. See above.

probably in Asia Minor about 1350 B.C. ushered in the Iron Age in which we are living to-day.

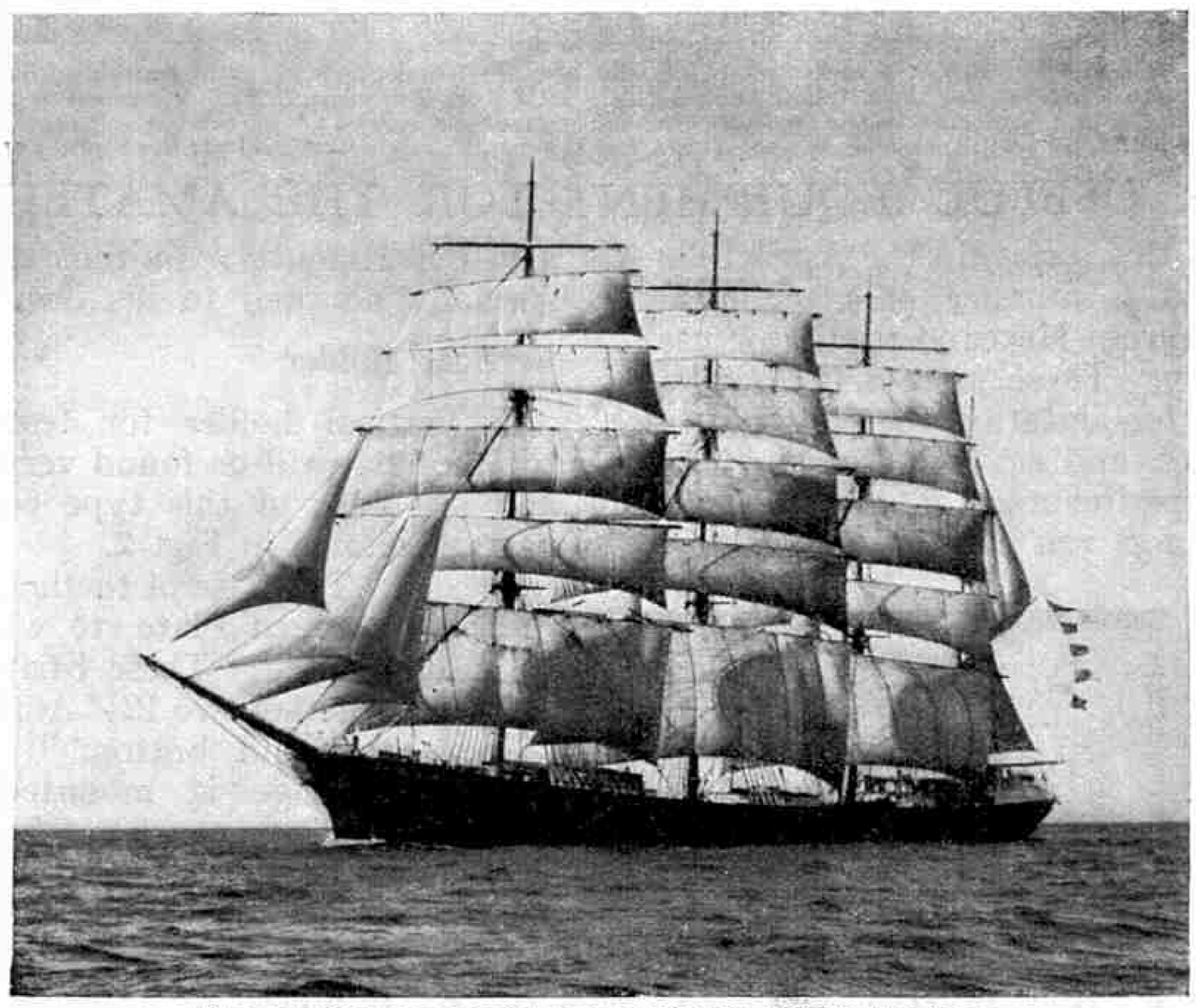
The book contains 13 plates and many illustrations in the text. It is an attractive summary of our knowledge of the original development of Man, and the greatest interest in this fascinating story will be aroused in those who read it.

"The Romance of the Merchant Ship"

By ELLISON HAWKS. (Harrap. 7/6)

From the dug-out and the coracle to the modern liner is a long and splendid story of human achievement, and one that is of particular interest to a sea-girt people such as our own. The story of the merchant ship has been told by many writers, but never with more insight and charm than by Mr. Ellison Hawks.

The history of England can be written in terms of her ships, and the story of mankind in general is to be found in every line and sail of the old craft and in the engine room of the modern vessel. The rise and fall of nations subsequent to the early stay-at-home days has been with the tides and the ships. It is true that the sailing ship has become almost a phantom vessel. Progress has passed her by; but her essential part in world discovery and adventure will never be forgotten. Oars, sails, steam, oil and electricity in turn have been the life of the ship, and this volume tells of each in a fascinating manner.



The American four-masted barque "Golden Gate." See below.

The first navigator was the man who mounted a floating log that afforded an easy journey downstream, or possibly a way of escape from a pursuing enemy or animal. From the log developed the dug-out, which was the first real boat. Subsequently the sail suggested itself as an easier way of progress than by oar or paddle, and long before the day of written history it was in general use. The early records of the oldest nations speak of ships as commonplace features of everyday life. The oldest pictures of ships that remain to us were made by the Egyptians somewhere about 6000 years B.C. The open sea lured the ancient Phœnicians, who lived along the shores of the Mediterranean, to make voyages of astonishing length, even as far as Britain for tin. Then came the wonderful galleys of the Greeks and the Romans. The main scene of ship progress now takes us northward to Britain and Scandinavia. Voyages of almost incredible length were made by the Vikings who, in their open boats, with no shelter or comfort, crossed the northern ocean to Greenland and ultimately to America. British shipbuilding may be said to have begun with King Alfred, who found himself forced to develop a navy to repel the attacks of Scandinavian marauders.

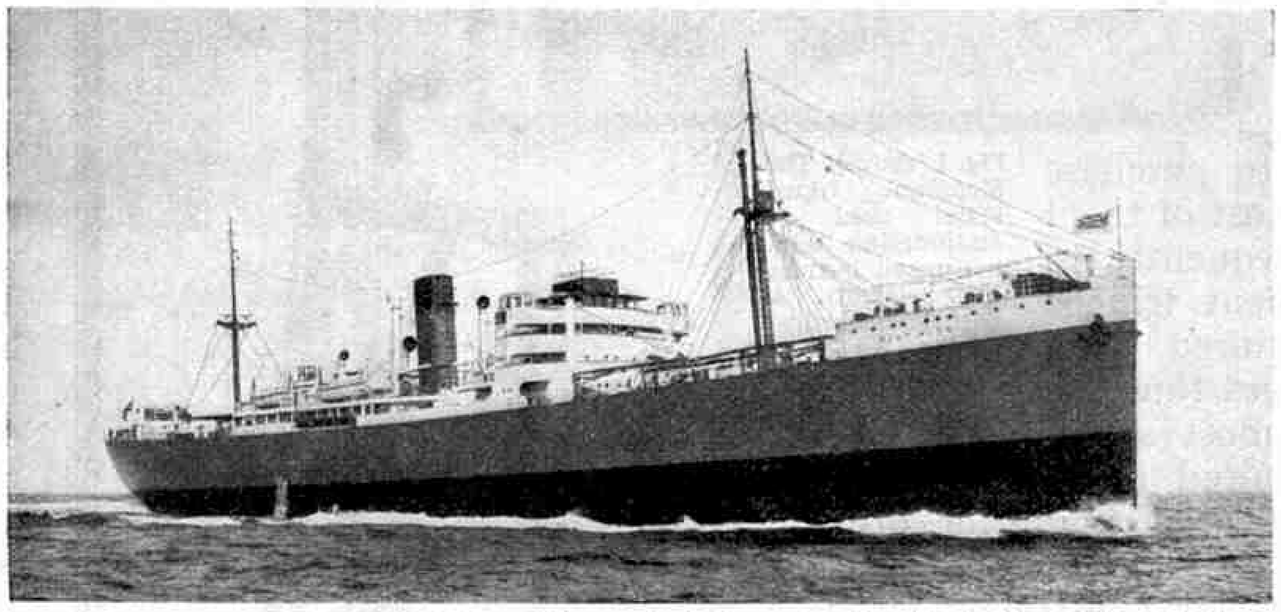
Along with the development of the ship went the growth of the art of navigation. A prominent pioneer in this direction was Prince Henry of Portugal, who in the 15th century instituted a school of geography and navigation. With increasing knowledge, the old fear of the "Green Sea of Darkness," as the Atlantic was called, disappeared; and such men as Columbus, Cabot, Da Gama and Magellan made their wonderful voyages to the West, sailing on day after day into the unknown, undaunted by the wildest storms or the mutinies among their men.

The ships of these great navigators were slow, crude and clumsy, and by degrees the keener brains among shipbuilders introduced modifications in design that had far-reaching effects. The sailing vessel reached her greatest perfection in the tea clippers that made such marvellous passages between western ports and China. The interesting account that Mr. Hawks gives of these amazing ships makes one regret all the more keenly that they have passed away utterly and can never return.

The fact that the sea-going sailing ships have vanished makes it all the more important that a book of this kind should give us a good general idea of their different types, and how they were rigged. Mr. Hawks tackles this difficult subject boldly and with remarkable success. In reading this section of the book it was interesting and almost exciting to come across simple explanations of terms that had often worried us in sea stories.

The story of the steamship is of a very different nature, but is equally interesting. The pioneers in this direction were Americans, prominent among them being Robert Fulton. Great Britain soon tackled the problem, however, and rapidly took the lead. The early days of the steamship, in which almost unbelievable prejudice had to be overcome, provide splendid examples of men who succeeded through sheer determination and strength of personality. The great engineer Brunel turned his attention to the steam propulsion of ships, and worked from the first on the big lines that were characteristic of him. Nobody but Brunel could have planned and carried through to completion the huge "*Great Eastern*," which only failed through being a century before her time. Another prominent figure is Samuel Cunard, who came to this country from Nova Scotia and, in spite of rebuffs in all directions, succeeded in obtaining capital for the building of four ships that developed into the famous company that bears his name.

Mr. Hawks gives us a fascinating account of the struggle for the Blue Riband of the Atlantic, held for 21 years by the wonderful "*Mauretania*," and now claimed by the German vessel "*Europa*." He gives us descriptions of some of the greatest of modern passenger liners, which have been aptly described as hotels that go to sea. A special chapter, and one of the most interesting in the book, is devoted to explaining the huge turbines that drive these monster vessels. From here we are led on to the latest motor ships, and those in which electrical propulsion has been adopted.



The twin-screw motorship "Port Huon," in service between London, Australia and New Zealand. From "The Romance of the Merchant Ship" reviewed on this page.

The passenger liner claims pride of place in point of beauty, but after all the great task of handling the world's transport is carried on by the less ornamental cargo ship. Cargo liners and tramps are given a worthy place in the author's scheme, as also are the specialised vessels—the oil tanker, the dredger, the ice breaker, the cable ship, the tug, the lifeboat, the trawler, and the drifter.

The concluding sections of the book are devoted to a detailed account of the building and launching of a great passenger liner, and a description of modern methods of navigation. We are told how the ship finds her way at sea, and finally how science has revolutionised navigation by giving us the gyro pilot that keeps the ship on her way more accurately than the human steersman.

The whole story is told admirably and in satisfying detail, and is splendidly illustrated by 40 pages of plates and 70 figures in the text.

REV. J. H. MARTIN.

Scientific Apparatus in Meccano

Laboratory Accessories Constructed from Standard Parts

This article is the fifth of a series in which we describe various uses that have been found for Meccano in the field of science. In previous articles we have described an instrument for electrocuting small aquatic animals (see "M.M." for November, 1928); a photo-micrographic device and a microscopic slide projector (January, 1929); and a microtome for cutting sections of plant and animal tissue (February, 1929). In the fourth article in the series we dealt with various apparatus for use in chemical experimental work, and this month we describe several additional pieces of equipment for the chemist.

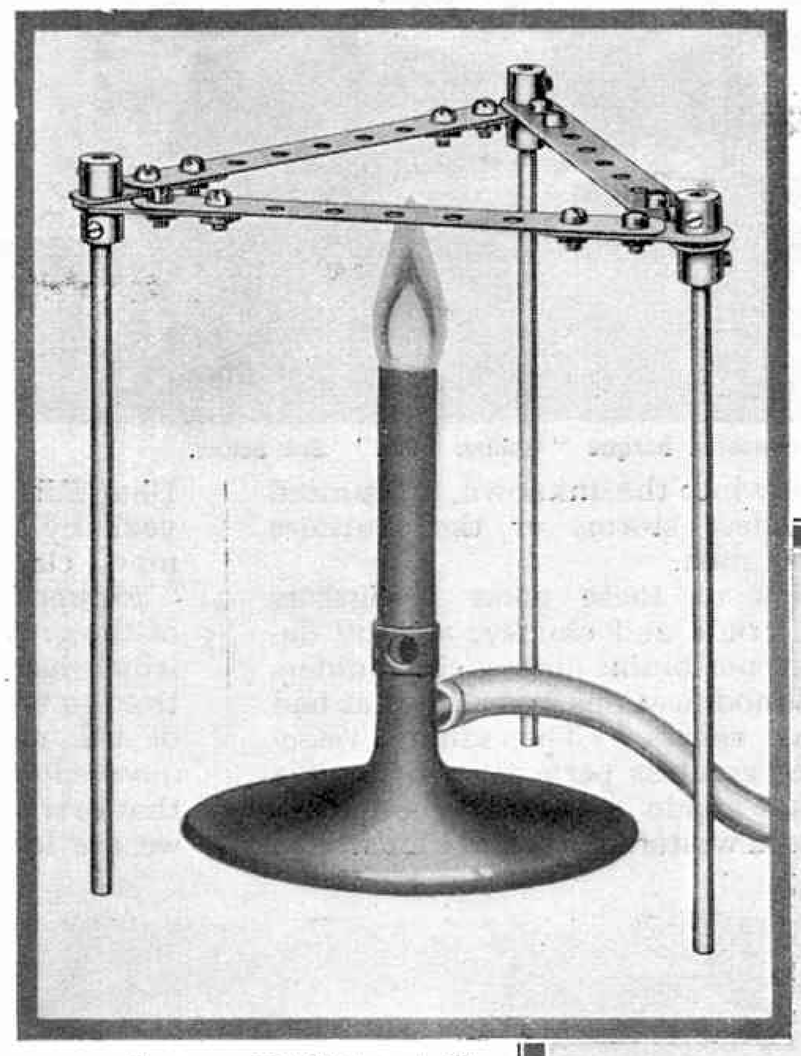
V.—FURTHER USEFUL EQUIPMENT FOR THE AMATEUR CHEMIST

IN the previous article in this series, in the April 1930 "*M.M.*", we described a number of mechanical appliances constructed from Meccano parts, for use in the chemist's laboratory. These included a bottle-shaking device, apparatus for agitating the contents of a beaker, test-tube shakers, and several other articles of use to the chemical experimenter. This month we describe further devices for use in the laboratory, including a tripod, a vertical holder for test-tubes, etc., and a motor-driven stirrer that will be found useful on occasions when it is necessary to keep the contents of a flask or beaker in continual motion for a considerable period.

A Meccano Tripod

A tripod stand is a simple but important piece of laboratory equipment. A tripod is used for supporting a beaker, flask or other vessel in such a manner that heat from a Bunsen burner or spirit lamp may be applied to it from below. Stands of this type may be purchased cheaply, but sometimes several are required for a single experiment, and often it is uneconomical to purchase the number required, as most of them will be of little use subsequently to the experimenter. Excellent tripods can be built up as required from standard Meccano parts, and thus the problem may be solved most satisfactorily, the stands that are not required afterwards being dismantled and the parts used again for other purposes.

A simple pattern of tripod constructed from Meccano parts is shown in Fig. 1. The triangular frame of the stand consists of three $4\frac{1}{2}$" Strips, and six Cranks are bolted to these as shown in the illustration. The legs of the stand consist of $6\frac{1}{2}$" Axle Rods, and these are pushed into the bosses of the Cranks and nipped securely by the Set-screws of the latter. The stand shown in Fig. 1 is a good average size that will be found generally suitable. One of the great advantages of building these stands from Meccano, however, is that different sizes and patterns can be built up by using additional parts. The experimenter can thus devise stands that will be specially adapted to his own particular requirements.



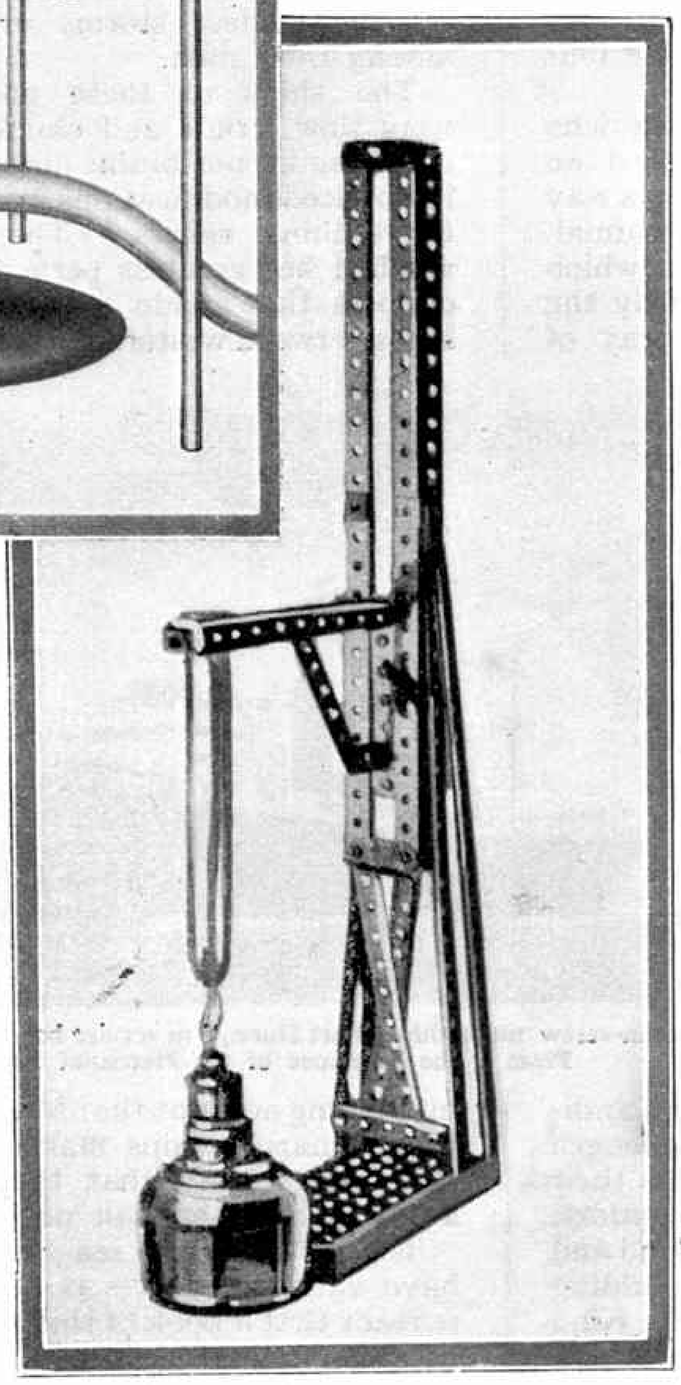


Fig. 1 (above). The Meccano tripod stand used in conjunction with a Bunsen burner. Fig. 2 (right). A useful vertical holder for test-tubes, etc.

Vertical Holder

A vertical holder for test-tubes, lengths of glass tubing, etc., will be found very useful in the laboratory, and a holder of this type constructed from Meccano parts is shown in Fig. 2.

The base of the holder consists of a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate, to which four $12\frac{1}{2}"$ Strips are secured. These Strips support a frame composed of two $12\frac{1}{2}"$ Angle Girders spaced apart at top and bottom by $1\frac{1}{2}"$ Strips. A sliding carriage is mounted on this frame. This carriage consists of a $3\frac{1}{2}"$ Strip having two $1\frac{1}{2}"$ Strips secured at each end, the $1\frac{1}{2}"$ Strips being placed on either side of the flanges of the $12\frac{1}{2}"$ Girders so that the carriage is retained in position in the frame, while capable of being moved up and down when the holder is required to be adjusted. The carriage is normally held in position by means of a bolt passed through the perforations in one pair of $1\frac{1}{2}"$ Strips, and through the flange of one of the vertical Angle Girders.

A Double Bracket is secured to the sliding carriage and two $4\frac{1}{2}"$ Strips are attached to the Bracket, so that they form an arm in which the test tube may be gripped. This arm is held in a horizontal position by means of a strut consisting of a $3\frac{1}{2}"$ Strip attached to the lower part of the carriage by means of an Angle Bracket. Angle Brackets should be bolted to the free end of the horizontal arm so that a test-tube may be held securely in position.

Mechanical Stirrer

Every amateur chemist who has experienced the tedium of stirring liquids by hand for long periods, will welcome the mechanical stirrer shown in Fig. 3.

The device consists of a combined stand and motor-driven stirrer, that enables the contents of a beaker or similar vessel to be agitated continuously and at uniform speed merely by switching on the Meccano Electric Motor. The base frame of the model is built up from two $5\frac{1}{2}''$ and two $12\frac{1}{2}''$ Angle Girders, and two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates are secured to these Girders to form a platform on which a spirit lamp or Bunsen burner may rest. The upright frame consists of two $24\frac{1}{2}''$ Angle Girders spaced apart at top and bottom by $5\frac{1}{2}''$ Angle Girders, the lower $5\frac{1}{2}''$ Girders being bolted to the base framework. The upright frame is braced by means of two $12\frac{1}{2}''$ Strips, the lower ends of which are attached to the base.

A platform for supporting the beaker is next attached to the upright frame. This platform is composed of four $5\frac{1}{2}''$ Angle Girders, which form a rectangular frame; and two additional $5\frac{1}{2}''$ Girders are secured between them to form a "grid" on which a beaker or other vessel may be placed. The open construction of the platform enables heat to be applied to the vessel from below. The platform should be braced to the vertical frame by means of Strips.

In the illustration, a glass preserve jar, fitted with screw lid, has been used to hold the liquid to be stirred. This type of jar is excellent for the purpose, providing that a waxed cardboard cap washer is used so that the liquid being stirred does not come into contact with the metal of the lid. A hole must of course be bored in the metal lid, so that the stirrer rod may be passed through into the jar. A beaker or wide-mouthed flask can of course be employed equally well with the device, but care should be taken to see that the stirrer does not run too fast, or a certain amount of liquid will be lost through splashing. A Meccano Electric Motor supplies the power for the stirrer, and it should be secured by means of its flanges to the top of the vertical frame. In the model a Meccano No. 6 type Motor has been used, but a No. E1 Motor could be employed if slight modifications are made.

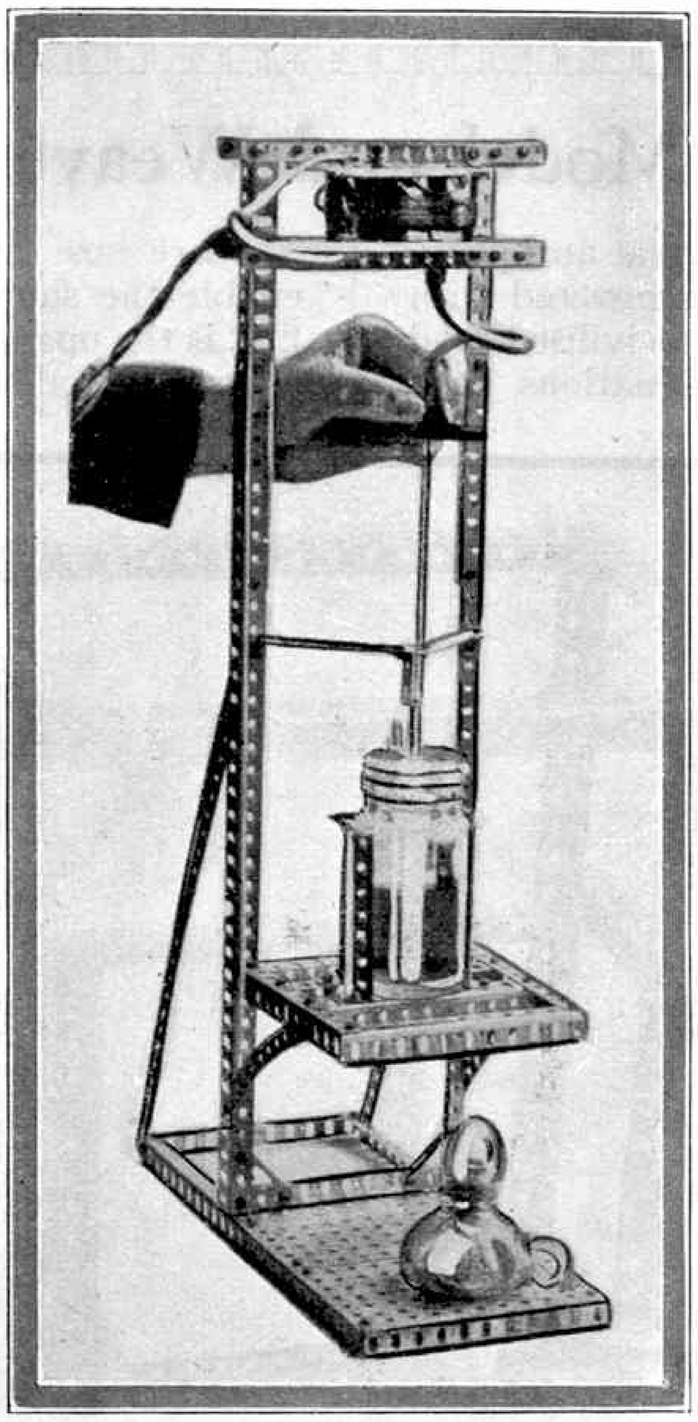


Fig. 3. Meccano mechanical stirrer and beaker stand.

The stirrer unit consists of a glass rod, about 3/16" diameter, bent backward and forward in zig-zag formation at one end to form the actual stirrer. The bending process can be carried out by heating the glass rod in a Bunsen flame, and forming the plastic glass to the required shape with fine-nosed pliers.

The straight portion of the glass rod is secured in the bore of a Coupling and an Axle Rod is also held in the Coupling. The Axle Rod is passed through the end holes of two short Strips that are attached to the side Girders of the vertical frame to act as a guide for the stirrer rod.

The upper end of the Axle Rod is connected to the armature shaft of the Electric Motor by a novel form of drive transmission. This consists of a length of $\frac{1}{4}''$ rubber tubing, one end of which is pushed over a Coupling mounted on the armature shaft while the other end is slipped over the boss of a 2" Pulley attached to the top end of the Axle Rod. The 2" Pulley acts as a flywheel and helps to keep the speed of the stirrer constant. This system of drive transmission greatly increases the adaptability of the device, as the stirring rod can be driven freely even when it is not in alignment with the armature shaft. The lower bearing should consequently be made adjustable so that the stirrer can be used in various positions.

The flexible drive is also useful when open-mouthed vessels, such as beakers, are employed, as it enables the complete stirrer unit to be drawn out of the beaker so that the latter may be removed from the platform. This movement is shown in Fig. 3, but of course it is necessary to disconnect the glass rod from the Coupling when a covered vessel is employed.

New Meccano Models—(*Continued from page 213*)

is supported at its upper end in the centre hole of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, while its lower portion passes through the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. One end of a length of cord is secured to one end of the $2\frac{1}{2}''$ Strip of the front road axle assembly, and the cord is then passed several times round the projecting end of the steering rod. The remaining end of the cord is finally tied to the other extremity of the $2\frac{1}{2}''$ Double Angle Strip. A Spring Clip should be placed on the end of the steering column in order to keep the cord in position, while a Bush Wheel is mounted on the upper end to form the steering wheel. A 1" Fast Pulley is mounted on the driving Spindle of the Clockwork Motor and is connected to one of the 3" Pulleys that form the rear road wheels by means of an endless length of cord.

The sides of the trailer are composed of $12\frac{1}{2}''$ and $5\frac{1}{2}''$ Braced Girders. A $12\frac{1}{2}''$ Angle Girder is secured to each of the $12\frac{1}{2}''$ Braced Girders and a sheet of thick cardboard is bolted to the flanges of the Girders to form the base of the trailer. The front pair of road wheels is mounted on an Axle Rod supported in $1'' \times 1''$ Angle Brackets that are bolted to the cardboard base. The trailer is coupled to the tractor by means of two $5\frac{1}{2}''$ Strips held to the trailer by Angle Brackets. The $5\frac{1}{2}''$ Strips are held to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate of the tractor by means of a lock-nutted bolt.

The rear road axle is mounted in Trunnions which are also secured to the cardboard base by means of bolts. The tractor and trailer contain the following parts:—8 of No. 2; 2 of No. 3; 12 of No. 5; 2 of No. 8; 4 of No. 10; 2 of No. 11; 10 of No. 12; 2 of No. 12a; 2 of No. 15; 1 of No. 15a; 4 of No. 16; 1 of No. 18a; 2 of No. 19b; 4 of No. 20b; 2 of No. 22; 2 of No. 22a; 1 of No. 24; 7 of No. 35; 60 of No. 37; 6 of No. 37a; 7 of No. 38; 1 of No. 40; 1 of No. 45; 8 of No. 48a; 1 of No. 52; 1 of No. 54; 1 of No. 57; 1 of No. 62; 2 of No. 99; 2 of No. 100; 6 of No. 111c; 4 of No. 125; 2 of No. 126; 2 of No. 126a; 1 No. 1 Clockwork Motor.

Model Railway Club Exhibition

The annual exhibition of the Model Railway Club will be held in the Central Hall, Westminster, from Tuesday, 29th March, to Saturday, 2nd April, both days inclusive. This exhibition, which was so keenly appreciated by some 6,000 people last year, will fully maintain its high standard of models of all gauges, from the smallest electric railway to the passenger-carrying steam train that provides such joy to old and young alike. There will be delicate coachwork models, many and varied types of locomotives, and elaborate working layouts completely signalled and controlled from their own signal cabins, and all lighted electrically. We strongly advise all readers who are able to visit this exhibition, for they are certain to find there much that will interest them.

For Sutton (Surrey) Readers

An interesting Model-building Competition was held at Sutton, Surrey, recently by William Pile Ltd., and the entries were judged by a representative of Meccano Ltd. The first prize in the class for boys from five to eight years was won by G. Rowley with an excellent model of a Paddle Boat, and the second prize by M. Parker with a model of a Crane. In the class for boys of from nine to 12 years, A. P. Smallman carried off first prize with a well-designed model Stiff-Leg Derrick, and E. P. Gawne obtained second prize for a Motor Car. In the senior section, 13 to 15 years, first prize was awarded to J. C. Bulstrode for an interesting Travelling Crane, and A. C. Greene gained second prize for a good model of a Traction Engine.

The New Meccano Loom

Build this Fine Model and Weave Real Neckties!

THE art of spinning and weaving is of great antiquity. Even at the time when Britain was covered with forest and its inhabitants were uncivilised and clothed in skins, the people of Eastern nations were wearing woven clothes.

Up to the year 1785 all weaving was done on hand-looms and indeed many of these machines are still in use in parts of Scotland and Ireland, and also in France. In the early days nearly every farmhouse in Lancashire was an independent little factory and hand-looms were to be found in most of the cottages and houses in the towns and villages. The weaver himself generally bought the raw cotton. This was picked by his children, spun into thread by his wife or his elder girls and then woven at the loom by his sons, whilst he carried it to the merchants to sell.

The earliest improvements in the hand-loom were those made in connection with that part known as the shuttle. To understand exactly the functions of the shuttle we must remember that a woven fabric is composed of two elements, the "warp" or longitudinal threads, and the "weft," or cross-threads. If you examine your handkerchief or a tablecloth, you will see exactly what is meant by this. Notice how a woven fabric differs from one of another texture, such as a stocking, jumper, or crochet pattern.

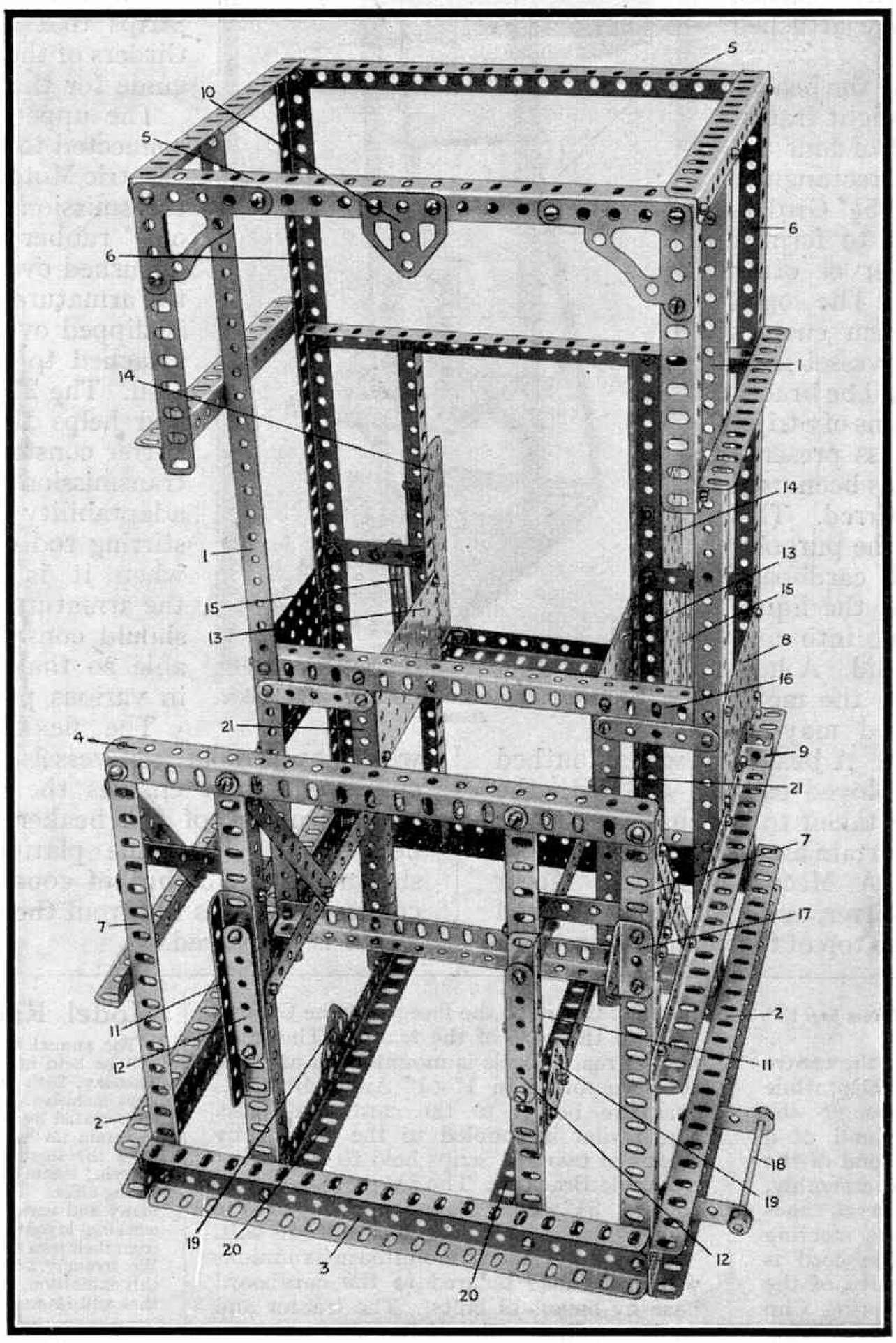


Fig. 1. The Loom framework, showing bearings and supports, etc., for the mechanism.

The interweaving of the warp by the weft, called the "picking motion," is effected by passing a thread from the shuttle between some of the threads of the warp. The shuttle moves from one side of the loom to the other, and each time it passes between the threads of the warp, it leaves behind a thread of weft.

There are three distinct operations necessary to enable the shuttle to accomplish this movement. The first is the opening of the warp, when some of the threads are raised for the second operation of "picking." The third operation, which is called "beating up" the weft, consists of pressing the weft into position by the reed.

Up to the early part of the 18th century, the shuttle had to be "thrown" backward and forward by hand. This was accomplished by two persons, who stood one on each side of the loom. As the shuttle was heavy, throwing it was very hard work, as well as being a very laborious and slow process. In 1750, however, John Kay, of Bolton, invented the "flying" shuttle. This consisted of a "picking stick" that drove the shuttle and saved the weavers from throwing it with their hands.

In 1785 Edmund Cartwright, an English clergyman, invented the power-loom, which enabled cloth of more uniform texture to be produced at a lower cost and in greater quantities.

Strange though it may seem, yet it is a fact that the power-loom was only slowly taken up. It was first used in Glasgow about the end of the 18th century, but about a century ago it was rapidly adopted, especially after it was made so that the cloth was taken up mechanically, instead of having to be continually pulled forward by the weaver.

The Meccano Loom is designed exactly on the lines of the large power looms used in the cotton industry in Lancashire, and is capable of weaving excellent cloth.

The construction of the Meccano model is commenced

by building up the main framework, which is shown in detail in Fig. 1. Four 18½″ Angle Girders 1 and 6 are secured in a vertical position at one end of the base Girders 2, and two 9½″ Girders 7 are bolted in position at their other ends, as indicated in the illustration. A 9½″ Angle Girder 4 bridges the tops of the Girders 7, and two further 9½″ Angle Girders bolted to it carry 4½″ Angle Girders 11. The remainder of the framework may be successfully completed by studying carefully the illustrations.

The next step in the construction of the model is the assembling of the gearing, which is shown in Fig. 2. To make matters quite clear it must be mentioned that the gearing, as shown in the foreground, is duplicated, with the exception of the operating handle, at the other side of the model.

The operating handle which consists of a Circular Plate with a 3″ Rod attached to its face by a Double Arm Crank, is secured to a Rod carrying a ¾″ Pinion that meshes with two 50-teeth Gears 62 and 63 (Fig. 2) fixed on separate Rods that run from side to side of the Loom. The first Rod has secured to it a cam 52 and the second Rod carries a Worm 56.

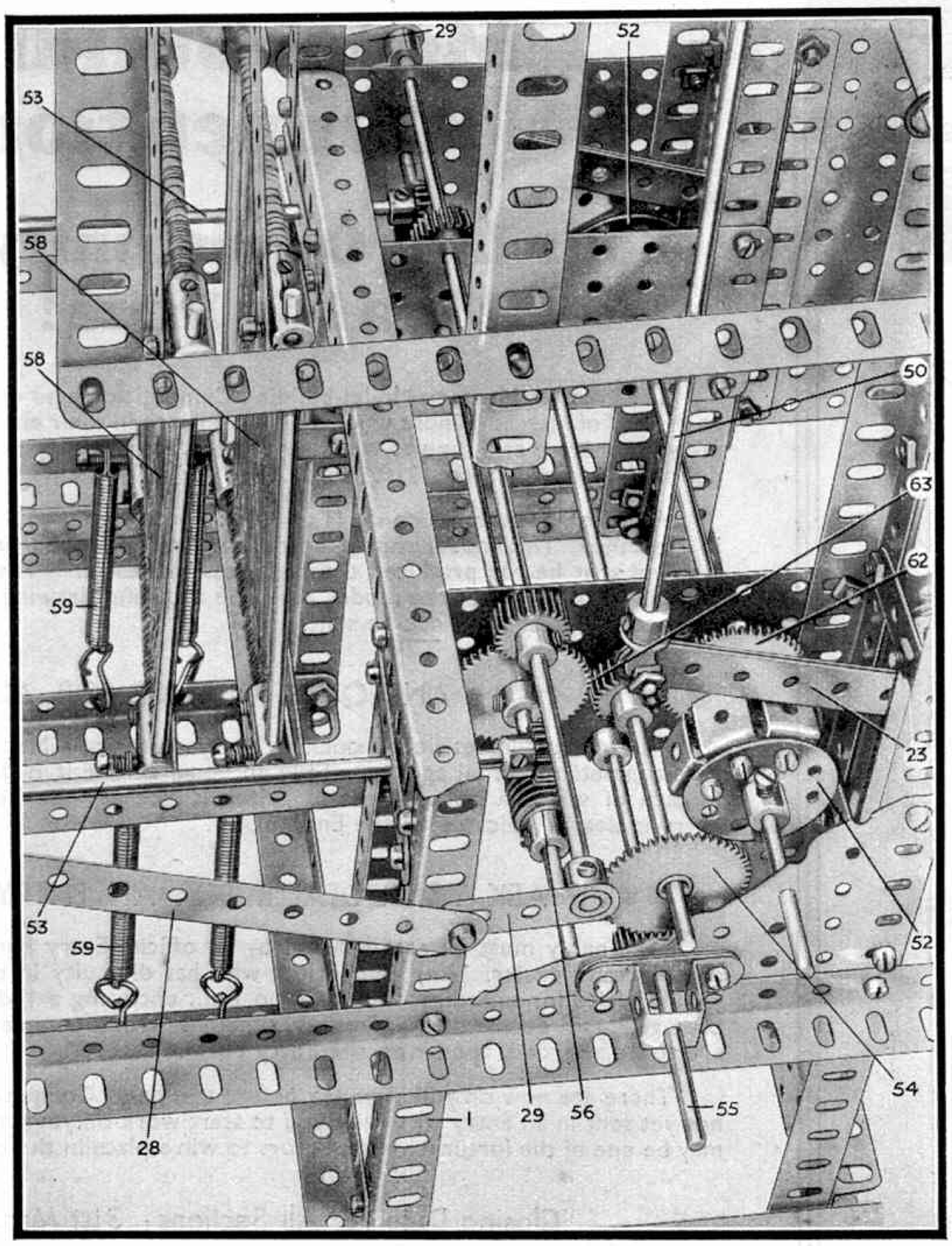


Fig. 2. A close-up view of the "Picking Motion" mechanism.

Two cams are required, one at each end of the Rod, and they should be built up as shown in Fig. 3 and then secured rigidly to the Rod by duplicate set-screws in the bosses of the Bush Wheels, to prevent their rotation on the Rod.

The Shuttle is thrown from side to side of the slay by means of mechanism known as the "picking motion."

The 5½″ Strips 23 (Fig. 2) that ride on the cams are mounted on Pivot Bolts bolted to the 5½″ × 2½″ Flat Plates seen in Fig. 4, and they slide between guides formed from vertically disposed 3½″ Strips.

The free end of each Strip is connected by an End Bearing and a lock-nutted bolt to an 11½″ Axle Rod 50 (Fig. 2), the upper end of which is attached in a similar manner to a built-up crank 1½″ long that consists of two ordinary Cranks bolted together in such a manner that their bosses are at opposite ends. The composite crank is secured by double grub-screws to a Rod 22 (Fig. 4) in the upper part of the loom, which carries also a Crank 36. A Spring 37 attached to the Crank serves the purpose of maintaining the Strips 23 in intimate contact with the cam.

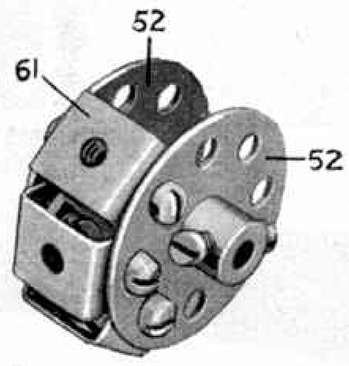


Fig. 3. Cam for operation of the Picking Sticks.

A Coupling is secured on the end of each of the Rods 22, a Pivot Bolt being passed through its end transverse bore and inserted in the tapped bore of a Coupling on the upper extremity of a Rod forming a "picking-stick." The bottom end of the picking-stick is later to be attached to a length of Spring Cord 25. The cams 52 are secured on their Rod in such a manner that the three Double Brackets forming the working face of one cam are diametrically opposite those of the other cam, so that the picking-sticks work alternately, and throw the Shuttle first to one end of the slay and then to the other.

The arrangem nt of the "take-up" motion that draws the wov n cloth through the loom is indicated in Fig. 2. On the Rod of the 50-teeth Gear 63 is secured a Worm 56 that meshes with a ½″ Pinion on a Rod 53. This Rod is duplicated on the far side of the model, and the ends of both Rods terminate in ½″ Bevel Wheels that are in mesh with 1½″ Bevels on the Rod of the upper take-up roller (Sand Roller, part No. 106a). Owing to the gearing employed, a slow "take-up" is imparted to the Sand Roller, and the woven material, after passing beneath it, is wound on to a lower roller (Wood Roller, part No. 106). The lower roller is rotated by frictional contact with the Sand Roller, and both Rollers are kept together by means of a spring tension device. The lower ends of two Tension Springs are hooked on to the frame of the model, and their upper ends are fitted with short lengths of Sprocket Chain which, after passing over 1″ guide Sprockets above the Rollers, are attached to the lower Roller spindle by Hooks. The spindle of the lower Roller slides in a pair of guides 12 so that it is free to move vertically (Fig. 1).

In the Meccano Loom there are two heald frames, but there may be many more in actual looms. As in actual practice, the healds are assembled vertically. The healds serve to lift and depress alternate threads of the warp, so that the shuttle may be passed between the threads.

The healds consist of a number of wires called "leaches," each having in its centre an eye, or "mail," which resembles the eye of a needle. The depression of the warp, already referred to, is made possible by passing the warp threads through these mails.

The warp is the thread that runs longitudinally



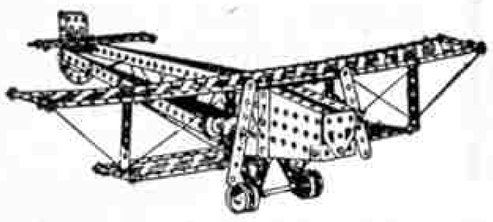
MECCANO

Model-Building Competition

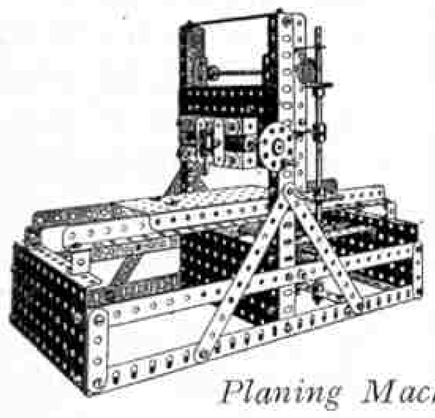
Your Last Opportunity to Win a Big Prize!

The greatest Meccano Model-building Competition ever organised closes for entries at the end of March. Those who have not yet sent in their entries should do so immediately for there is still time to win a big prize. This is the last opportunity—the Contest definitely closes on the 31st March.

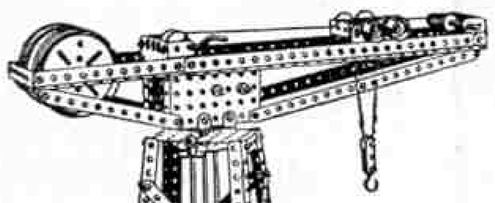
All a competitor has to do is to think out a new model and then build it neatly in Meccano. This model should be revised and improved until the competitor feels satisfied that he has produced the best possible result. Then all that remains to be done is to photograph the model, or make a careful drawing of it, and send it to us. The actual model must not be sent.



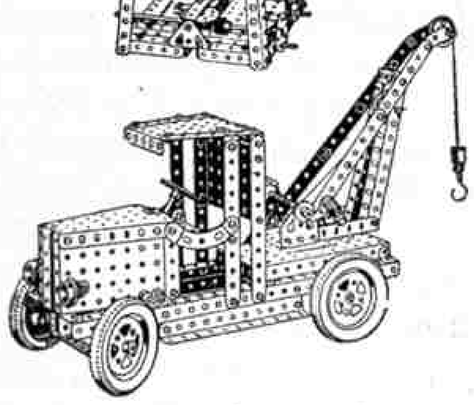
Aeroplane



Planing Machine



Girder Crane



Motor Breakdown Crane

AN EQUAL CHANCE FOR ALL

This great Competition is open to every owner of a Meccano outfit, and in order that competitors of all ages may have an equal chance it is divided into five sections, in each of which a separate set of prizes is offered. The correct section for your entry is clearly indicated on the Entry Form.

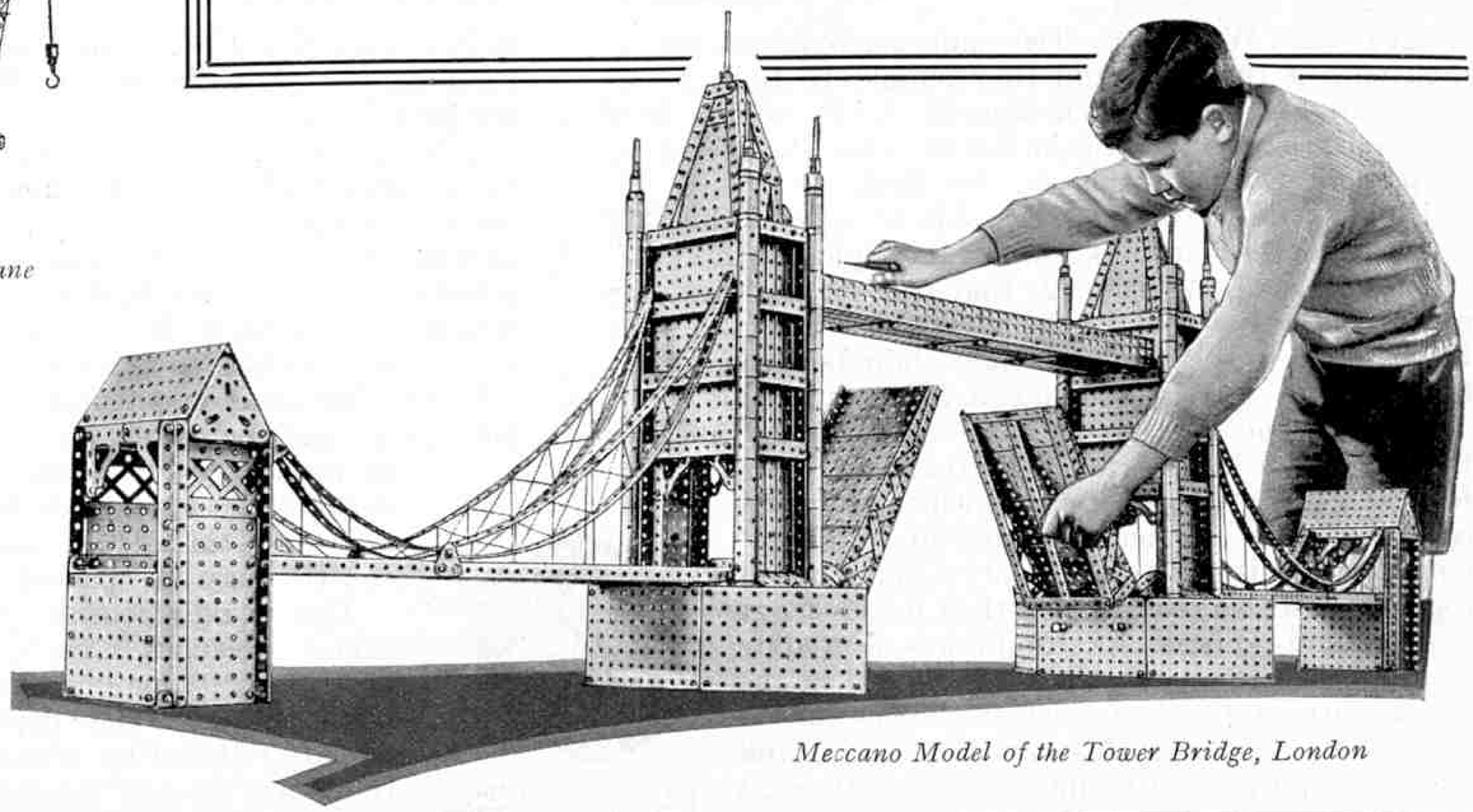
ASK YOUR DEALER FOR AN ENTRY FORM

Each entry must be accompanied by an official Entry Form, obtainable free from any Meccano dealer. 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.

There are now only 31 days left before this great Competition closes. If you have not yet sent in an entry we advise you to start work on your model immediately. You may be one of the fortunate competitors to win a place in the big Prize List!

Closing Date for All Sections: 31st March, 1932

MECCANO LTD.
OLD SWAN
LIVERPOOL



Meccano Model of the Tower Bridge, London

from the back to the front of the loom. The thread at right-angles to it is the "weft."

The construction of the heald frames will be described later.

When the heald frames descend after forming the "shed," the threads of the warp naturally fall slack, unless special mechanism is provided to remedy the matter. Slacking of the warp would, of course, prevent satisfactory work being turned out by the model, and in order to compensate for any sag of the threads, a particularly ingenious device known as a "warp tensioner" is incorporated in the model. This mechanism and its arrangement may be seen in the rear view of the model (Fig. 4), and a study of this illustration in conjunction with the following description will make the matter quite clear. It consists of a Rod journalled in the Plates 14 and carrying two Bush Wheels, to one of which a $2\frac{1}{2}$" Strip 33 is bolted. Two Cranks are bolted to the Bush Wheels as indicated in the illustration, and a Rod is secured in the bosses of the Cranks. The warp threads from the

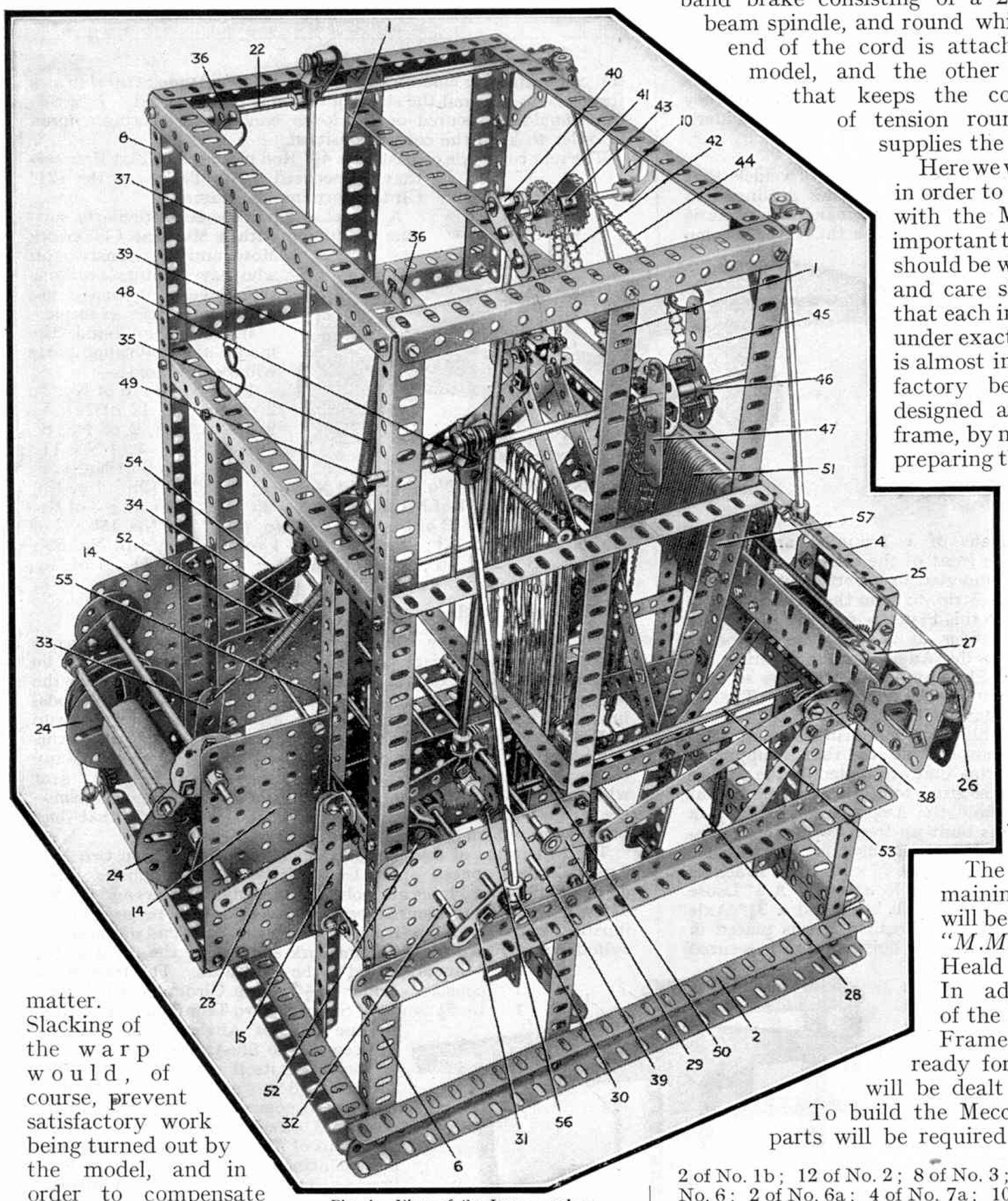


Fig. 4. View of the Loom mechanism from the rear.

"beam" (a Wood Roller with a Face Plate 24 at each end) are first passed over the fixed Rod, then round the movable Rod, and again over the fixed Rod, to the Healds. The necessary tension is supplied by means of a Spring 34 attached to the Strip 33 as shown in Fig. 4.

The beam is restrained from free rotation by a band brake consisting of a 2" Pulley secured to the beam spindle, and round which passes a cord. One end of the cord is attached to the frame of the model, and the other end is tied to a Spring that keeps the cord in a constant state of tension round the Pulley and thus supplies the required retarding effect.

Here we would like to mention that in order to turn out really good work with the Meccano Loom, it is most important that the threads of the warp should be wound evenly on the beam, and care should be taken to ensure that each individual thread is laid on under exactly the same tension. As it is almost impossible to wind a satisfactory beam by hand, we have designed a special type of beaming frame, by means of which the work of preparing the beam is quite easily and efficiently carried out. Another important point that will greatly assist the amateur weaver in producing good work on the Loom is the choice of the right kind of material for the threads. Our experience with the Meccano model Loom has shown that No. 8 "Star Sylko" is the most suitable for the warp threads and No. 40 for the weft.

The construction of the remaining portions of the Loom will be described in next month's *"M.M."* These include the Heald Frames and the Slay. In addition the construction of the Meccano model Beaming Frame for preparing the Beam ready for insertion in the Loom, will be dealt with.

To build the Meccano Loom the following parts will be required:—

2 of No. 1b; 12 of No. 2; 8 of No. 3; 2 of No. 4; 42 of No. 5; 4 of No. 6; 2 of No. 6a; 4 of No. 7a; 10 of No. 8; 17 of No. 8a; 8 of No. 8b; 5 of No. 9; 2 of No. 9a; 2 of No. 9d; 4 of No. 10; 8 of No. 11; 6 of No. 12; 2 of No. 12b; 6 of No. 13; 7 of No. 13a; 6 of No. 14; 5 of No. 15; 6 of No. 16; 3 of No. 16a; 1 of No. 16b; 4 of No. 18b; 1 of No. 20a; 4 of No. 22a; 9 of No. 24; 5 of No. 25; 4 of No. 26; 5 of No. 27; 1 of No. 27a; 2 of No. 30a; 2 of No. 30c; 2 of No. 32; 202 of No. 37; 28 of No. 37a; 102 of No. 38; 10 of No. 43; 3 of No. 45; 2 of No. 46; 1 of No. 47; 4 of No. 53a; 14 of No. 57; 30" of No. 58; 24 of No. 59; 13 of No. 62; 1 of No. 62b; 13 of No. 63; 2 of No. 64; 2 of No. 70; 8 of No. 82; 28" of No. 94; 4 of No. 96; 60 of No. 101; 2 of No. 102; 4 of No. 103c; 1 of No. 104; 2 of No. 106; 1 of No. 106a; 6 of No. 108; 2 of No. 109; 2 of No. 111; 2 of No. 111a; 12 of No. 111c; 1 of No. 126; 3 of No. 126a; 2 of No. 133; 1 of No. 136; 1 of No. 146; 6 of No. 147b; 2 of No. 155; 6 of No. 166.

New Meccano Models

Road Service Lorry—Watt's Beam Engine—Crane—Tractor and Trailer

THE examples illustrated this month are confined to models that may be built with medium-sized Outfits and they should therefore have a wide appeal among model-builders.

Road Service Lorry

The model illustrated in Fig. 1 represents a type of vehicle that is much used by motor engineers and repairers for dealing with disabled motor vehicles, just as the railway breakdown crane is employed for handling engines and rolling stock that have become derailed or damaged on the line.

The chassis of the lorry is built up from two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates and two $12\frac{1}{2}''$ Angle Girders, and a bonnet, cab and supports for the crane are mounted on this chassis. The sides of the bonnet are composed of two Sector Plates held apart by means of a $3\frac{1}{2}''$ Strip. Four $3\frac{1}{2}''$ Strips are used to fill in the top of the bonnet while the radiator is represented by means of a Trunnion and a Flat Trunnion that are bolted to the front of the chassis.

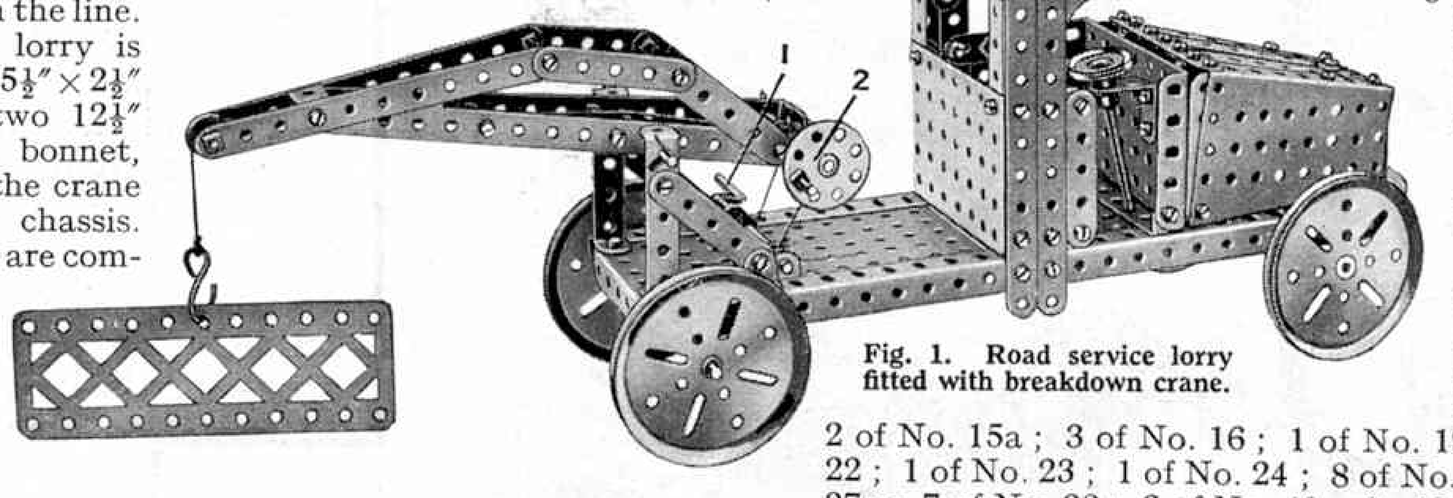


Fig. 1. Road service lorry fitted with breakdown crane.

A $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is mounted in a vertical position by means of a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, to form the "dash," and a $1'' \times 1''$ Angle Bracket is bolted to this Plate to provide a support for the steering column. The sides of the cab are composed of $5\frac{1}{2}''$ and $2\frac{1}{2}''$ Strips bolted to the Angle Girders forming the frame, while a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a $3\frac{1}{2}''$ Strip are secured between the vertical Strips to complete the rear of the cab. The top consists of a further $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and two $2\frac{1}{2}''$ Curved Strips are bolted to the flanges of this as can be seen in the illustration.

The jib of the crane pivots about an Axle Rod that is supported in two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips that are bolted to the chassis of the model. Two $2\frac{1}{2}''$ Strips, secured to the chassis by means of Angle Brackets are used to hold the Angle Girders rigidly in position. The jib of the crane is built up from two frames composed of $5\frac{1}{2}''$ and $2\frac{1}{2}''$ Strips. A Double Bracket is used to space these frames apart at the jib head and two $1'' \times 1''$ Angle Brackets are employed for the same purpose at the lower end. A $\frac{1}{2}''$ Loose Pulley is mounted on a $\frac{3}{4}''$ Bolt at the jib head and a $3\frac{1}{2}''$ Axle carrying a Bush Wheel fitted with a Threaded Pin is placed in position at the lower end of the jib. The hoisting cord is secured to this Rod and is passed round the $\frac{1}{2}''$ Pulley at the head of the jib after which a Hook is secured to its end. The jib of the crane is luffed by means of the Crank Handle 1 which is mounted in $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets bolted to the chassis of the model. One end of a length of cord is secured to the Crank Handle and the other end of this cord is attached to the lower portion of the jib.

The front road wheels are mounted on a $4\frac{1}{2}''$ Axle Rod which is secured in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. A Pivot Bolt is passed through the centre hole of this Double Angle Strip and lock-nutted in position to a further $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip secured between the flanges of the front $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, a Collar being placed on the shank of the Pivot Bolt to provide the correct spacing. One end of a length of cord is attached to one end of the movable Double Angle Strip and it is then passed several times round the lower end of the steering column, the remaining end of the cord being finally tied to the other extremity of the Double Angle Strip. By rotating the 1" Fast Pulley secured to the top of the steering column the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is drawn from side to side and the steering action is thus effected. A Spring Clip should be secured on the lower end of the steering column in order to keep the cord in position.

The rear road axle consists of a $4\frac{1}{2}''$ Rod mounted in Flat Brackets that are secured to the flanges of the $12\frac{1}{2}''$ Girders forming the frame.

A model of this type is particularly suitable for fitting with a Meccano Clockwork Motor and those constructors who have Motors available should certainly make use of them in this example.

In order to build the model the following parts will be required :—

10 of No. 2 ; 6 of No. 3 ; 2 of No. 4 ; 12 of No. 5 ; 2 of No. 6a ; 2 of No. 8 ; 5 of No. 10 ; 1 of No. 11 ; 8 of No. 12 ; 3 of No. 12a ; 2 of No. 15a ; 3 of No. 16 ; 1 of No. 19s ; 4 of No. 19b ; 1 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 8 of No. 25 ; 91 of No. 37 ; 3 of No. 37a ; 7 of No. 38 ; 2 of No. 40 ; 2 of No. 48a ; 2 of No. 48b ; 2 of No. 52 ; 3 of No. 53 ; 2 of No. 54 ; 1 of No. 57 ; 4 of No. 59 ; 1 of No. 63 ; 2 of No. 90 ; 2 of No. 90a ; 1 of No. 111 ; 1 of No. 115 ; 1 of No. 126 ; 1 of No. 126a ; 1 of No. 147b.

Watt's Beam Engine

Most Meccano boys will have read about James Watt's early experiments with steam, and the famous beam engine that he constructed. The example shown in Fig. 2 is a simple but none the less realistic model of this historic engine. The Meccano model incorporates Watt's famous parallel motion and also the "sun and planet" mechanism that was an outstanding feature of this "great-great grandfather of the modern steam engine!" Many readers will know that Watt produced his "sun and planet" gear while being fully aware of the simpler and more efficient mechanism—the crank—his reason being to avoid patent rights that had been taken out on the crank mechanism by a rival.

The bed frame of the Meccano model is built up from two $12\frac{1}{2}''$ Angle Girders spaced apart by $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates. Two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates are bolted to the Angle Girders and further $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates are secured between them as can be seen in the illustration to form a box-frame in which the lower end of the steam cylinder rests. A vertical framework supporting the pivot of the beam is secured to the bed frame. This framework consists of four $12\frac{1}{2}''$ Angle Girders spaced apart by $5\frac{1}{2}''$ and $3\frac{1}{2}''$ Strips. Two Trunnions are secured to one pair of Angle Girders as can be seen in the illustration.

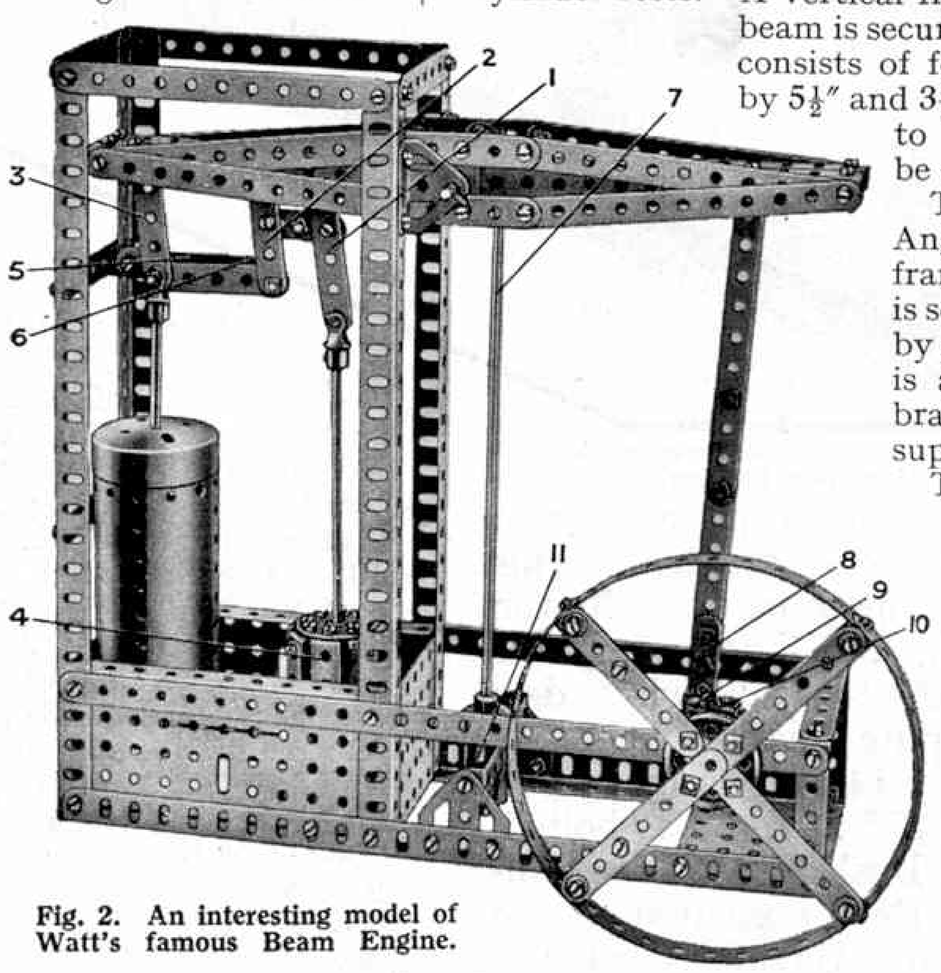


Fig. 2. An interesting model of Watt's famous Beam Engine.

The beam itself consists of two $12\frac{1}{2}''$ Angle Girders and a strengthening framework composed of $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Strips is secured to each side of the main Girders by means of Angle Brackets. A $1\frac{1}{2}''$ Strip is also attached at the centre of each bracing frame to provide additional support.

The parallel motion is built up from three $2\frac{1}{2}''$ Strips, the Strips 2 and 3 being lock-nutted to $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets bolted to the beam. The lower end of the Strip 3 is fitted with an End Bearing that carries the piston rod. The corresponding end of the Strip 2 is pivotally secured to the frame of the model by means of a $\frac{1}{2}''$ Reversed Angle Bracket 6 and a $2\frac{1}{2}''$ Strip 5. An extra link 1 is fitted to the Strip 2 and this transmits the movement of the beam to the condenser pump 4.

The small feed-water pump 11, which consists of a Sleeve Piece fitted on two ¾″ Flanged Wheels, is operated by the 11½″ Rod 7, the upper end of this Rod being secured to the beam by means of a Collar and a ½″×½″ Angle Bracket.

The fly-wheel of the engine is built up from 5½″×2½″ Strips. Four 5½″ Strips are bolted together and bent to shape to form the rim of the wheel, and the rim is held to the 2″ Pulley mounted on the crankshaft by means of four spokes consisting of 5½″ and 2½″ Strips, Angle Brackets being bolted to the ends of the spokes.

The "sun and planet" gear is built up in the following way. A 2″ Rod carrying the fly-wheel is journalled in the frame of the model and also in a Double Bent Strip, and carries a loose Coupling 9 and fixed ½″ Pinion 10. This Pinion meshes with the second ½″ Pinion that is secured on a 1½″ Rod fixed in the end hole of the Coupling 9. A Crank 8 and two 5½″ Strips connect the "sun and planet" gear to the beam.

In order to construct the Beam Engine the following parts will be needed :—2 of No. 1 ; 18 of No. 2 ; 6 of No. 3 ; 2 of No. 4 ; 12 of No. 5 ; 2 of No. 6a ; 8 of No. 8 ; 4 of No. 10 ; 13 of No. 12 ; 1 of No. 13 ; 1 of No. 15 ; 2 of No. 16 ; 1 of No. 17 ; 1 of No. 18a ; 1 of No. 20b ; 2 of No. 21 ; 1 of No. 24 ; 2 of No. 26 ; 4 of No. 35 ; 94 of No. 37 ; 6 of No. 37a ; 8 of No. 38 ; 1 of No. 45 ; 6 of No. 48a ; 2 of No. 48b ; 2 of No. 52 ; 3 of No. 53 ; 4 of No. 59 ; 1 of No. 62 ; 1 of No. 63 ; 6 of No. 111c ; 1 of No. 116a ; 1 of No. 125 ; 2 of No. 126 ; 2 of No. 162a ; 1 of No. 162b ; 1 of No. 166.

Shipyard Crane

The model crane shown in Fig. 3 is of a type that is much used in shipbuilding yards. The model is represented as being driven by steam, but actually it is powered by a Meccano No. 2 Clockwork Motor. With slight alterations it is possible to dispense with the dummy boiler and chimney and use a Meccano Steam Engine to provide all the power. Those model-builders who possess Steam Engines should certainly make use of them in this model.

The No. 2 Clockwork Motor that provides the power for the model, also serves as part of the base-frame of the swivelling superstructure. A 3½″×2½″ Flanged Plate is used to extend the frame, and is held to the side plates of the Clockwork Motor by means of composite strips consisting of 5½″ and 3½″ Strips. The sides of the gear box of the crane are composed of Sector Plates, while the method of fitting the boiler will be clear from the underside view of the model (Fig. 4).

The jib of the crane is built up from 12½″ Angle Girders and 5½″ and 3″ Strips. The head of the jib is provided with two Double Brackets and a ¾″ Bolt is passed through the centre holes of these to support the 1½″ Pulley Wheel. Mountings for the Pulleys forming part of the luffing gear system are formed by two Angle Brackets secured to the upper portion of the jib, these carrying a 2″ Axle Rod.

The drive for the various motions of the crane is taken from a Worm that is mounted on the Clockwork Motor driving spindle. A ½″ Pinion 1 is mounted on an Axle Rod that is free to slide in the gear box side Plates and can be brought in or out of engagement with the Worm by means of the pivoted 5½″ Strip 4. A second Axle Rod is placed in the gear box side plate and carries the ½″ Pinion 2, and the 2″ Pulley Wheel which forms the hoisting drum brake. The Rod carrying the Pinion 2 is also free to slide in its bearings so that it may be brought in or out of engagement with the Worm by means of the lever 4. The lever 4 is pivoted to the side of the gear box by means of a Bolt and lock nuts mounted on an Angle Bracket and carries at its inner end, two bolts arranged with their shanks projecting upwards. Collars are placed on the shafts 1 and 2 and the bolts on the lever 4 engage between the Collars and the bosses of the Pinions 1 and 2 so that these Pinions may be moved in or out of engagement with the driving Worm.

The Pinion 1 when in mesh with the Worm, rotates the slewing drum 5 (see Fig. 4) on the end of which is wrapped a length of cord. This cord is guided round the 2″ Rod 7 and then passed twice round the 3″ Pulley secured to the travelling base and carrying the crane pivot 6. The latter consists of a Pivot Bolt mounted in the centre hole of a 2½″ Strip. This Strip is bolted to two 3½″ Strips, which are secured to the lower side plate of the Clockwork Motor and spaced away by means of Washers.

The Axle carrying the ½″ Pinion 2 forms the hoisting drum. A length of cord is wound round this and passed over the guide Pulleys to the Pulley at the jib-head. It is then taken round the sheave of the crane block, and finally tied to the top of the jib.

The Axle Rod carrying a 57-teeth Gear Wheel 3 forms the luffing barrel. The luffing cord is first wound round this and then passed round one of the two Pulleys mounted on the upper portion of the jib. The cord is then passed down to one of the Pulleys linked to the gear box and is finally passed round the remaining two Pulleys and secured to a Flat Bracket, as can be seen in Fig. 3.

It will be seen from the illustrations that the reversing and brake levers controlling the Clockwork Motor are connected together by means of lock-nutted 2½″ and 5½″ Strips, these being operated by a universally mounted 3½″ Rod. The mounting for this Rod consists of a Swivel Bearing that is held to the side of the gear box by means of a Bolt passed into the boss of the fork piece of the unit. The construction of the travelling base will be followed from Fig. 5.

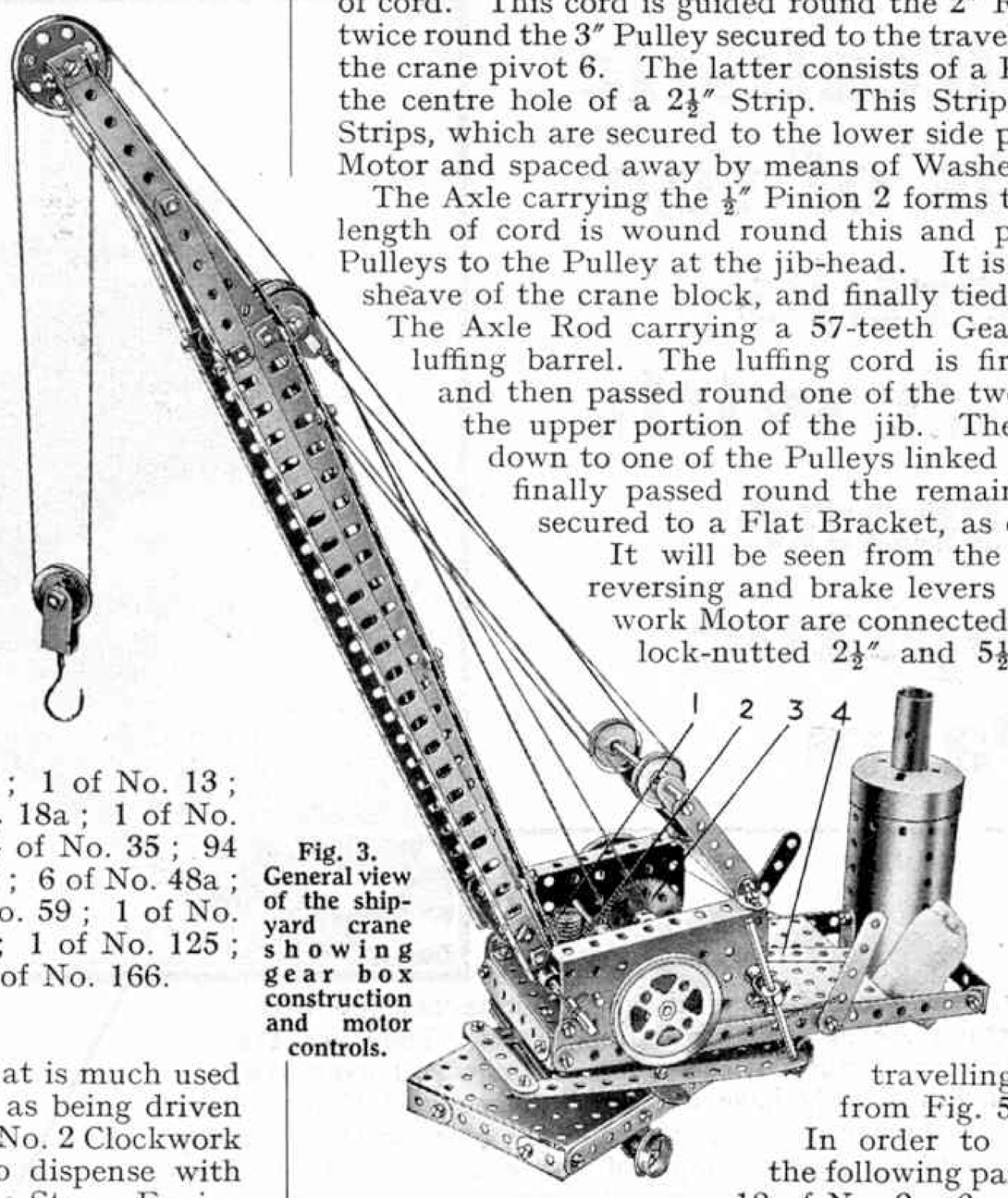


Fig. 3. General view of the shipyard crane showing gear box construction and motor controls.

In order to construct this model the following parts will be required :—18 of No. 2 ; 6 of No. 3 ; 2 of No. 4 ; 6 of No. 5 ; 2 of No. 6a ; 4 of No. 8 ; 5 of No. 10 ; 2 of No. 11 ; 12 of No. 12 ; 4 of No. 12a ; 2 of No. 15 ; 2 of No. 15a ; 4 of No. 16 ; 2 of No. 17 ; 7 of No. 18a ; 1 of No. 19b ; 2 of No. 20a ; 4 of No. 20b ; 1 of No. 21 ; 4 of No. 22 ; 2 of No. 22a ; 2 of No. 26 ; 1 of No. 27a ; 1 of No. 32 ; 4 of No. 35 ; 90 of No. 37 ; 6 of No. 37a ; 12 of No. 38 ; 2 of No. 40 ; 1 of No. 44 ; 2 of No. 48a ; 1 of No. 52 ; 3 of No. 53 ; 2 of No. 54 ; 1 of No. 57 ; 3 of No. 59 ; 2 of No. 62 ; 2 of No. 111 ; 4 of No. 111c ; 1 of No. 115 ; 2 of No. 126 ; 2 of No. 126a ; 1 of No. 147b ; 1 of No. 162a ; 1 of No. 162b ; 1 of No. 163 ; 1 of No. 164 ; 1 of No. 165 ; 1 No. 2 Clockwork Motor.

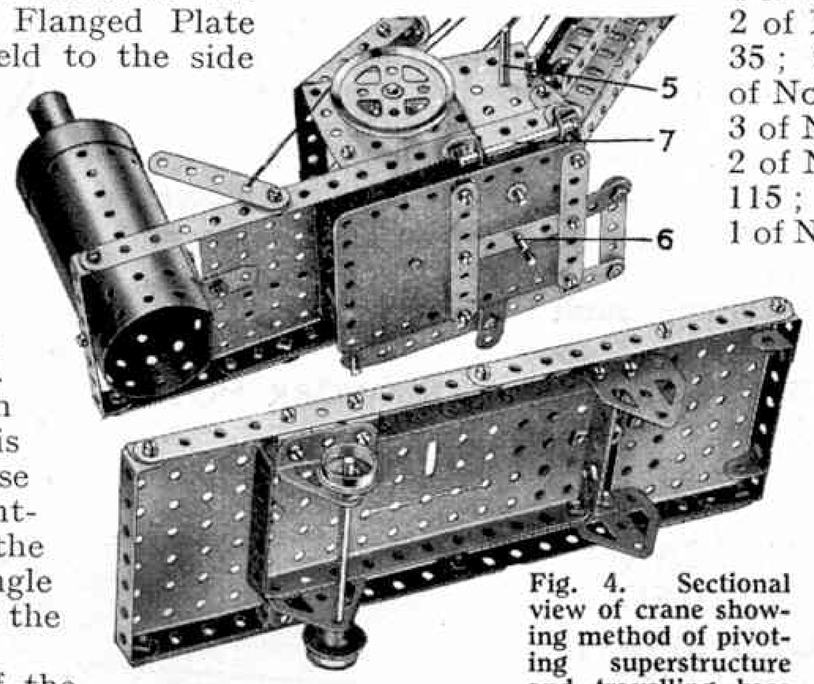


Fig. 4. Sectional view of crane showing method of pivoting superstructure and travelling base assembly.

Road Tractor and Trailer

The final model illustrated this month represents a rather unusual type of road transport vehicle. The petrol engine in this case is situated on a frame that is only large enough to accommodate the transmission gear, road axles, etc., and a seat for the driver, the loading platform normally found in a lorry being absent. The use of a haulage vehicle of this type enables a wide variety of loads to be transported in different types of trailers.

The chassis of the Meccano tractor consists of a 5½″×2½″ Flanged Plate. The No. 1 Clockwork Motor is mounted on this to form the power unit. A Sector Plate is supported above the Clockwork Motor by means of 5½″ and 2½″ Strips and the small cab over the driver's seat is built up from further 5½″ and 2½″ Strips and 2½″ Double Angle Strips, as can be seen in the Fig. 5.

A Flat Trunnion is secured to the front of the 5½″×2½″ Flanged Plate and this carries the pivot for the front road axle assembly. The front road wheels consist of 1″ Loose Pulleys mounted on a 3½″ Axle Rod and held in position by Spring Clips. The Axle is mounted in a 3½″ Double Angle Strip which has a Double Bent Strip bolted to its centre. A Bolt is passed through the top hole of the Double Bent Strip and lock-nutted to the Flat Trunnion projecting from the front of the chassis.

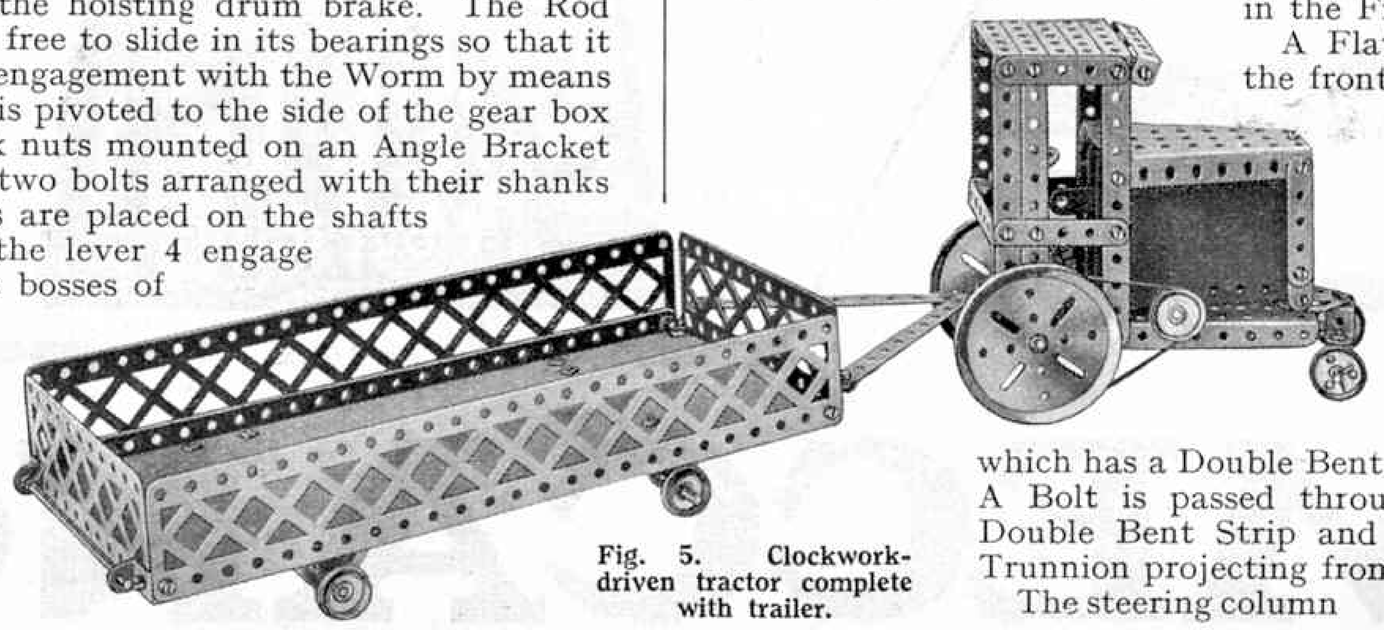
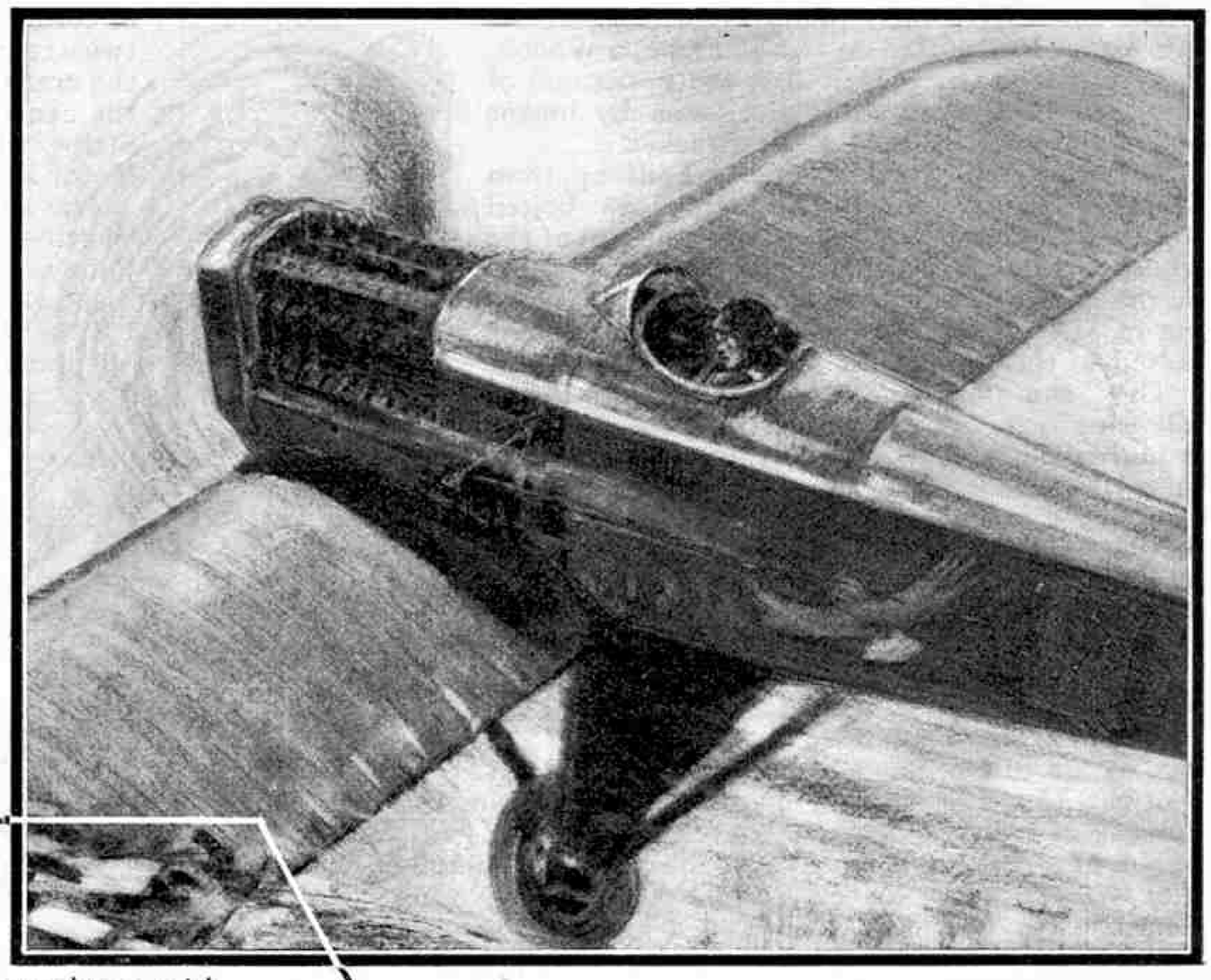


Fig. 5. Clockwork-driven tractor complete with trailer.

The steering column

Continued on page 207

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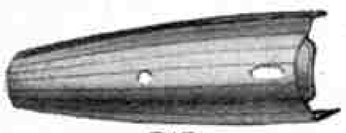
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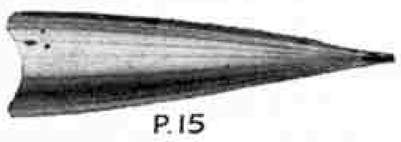

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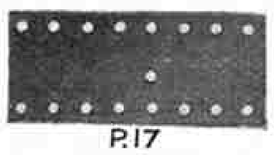

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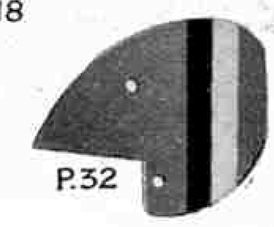

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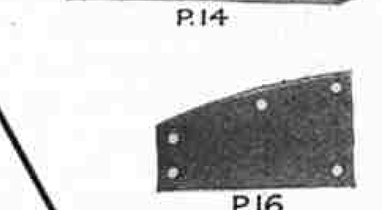

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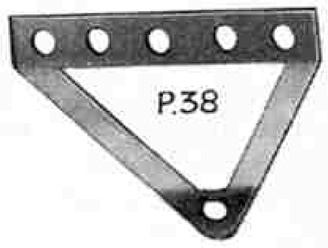

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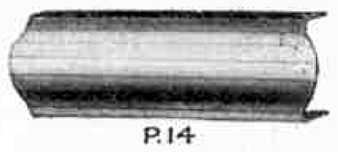
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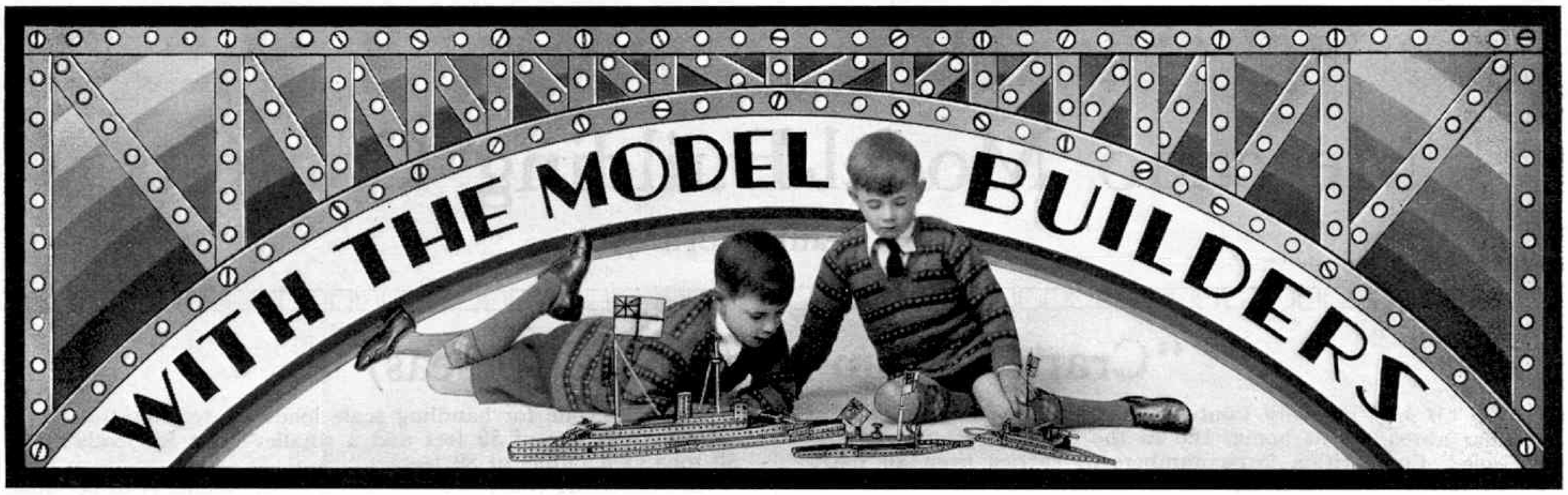
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No. 2 Outfit

MECCANO



A USEFUL PUNCHING SYSTEM

An excellent feature of the Meccano system is that in almost every case the various accessory parts may be employed for every portion of a model, and it is not necessary to make use of non-standard materials in order to obtain a realistic effect. In constructing models of a scientific nature, particularly those concerned with the study of light, it is occasionally necessary to make use of cardboard and other materials.

An outstanding example of this is the Kinetograph or " moving picture machine " which is the subject of Model No. 3.54 in the 00-4 Instruction Manual. This model incorporates a slotted drum that is rotated, and a sighting box through which the " moving pictures " are viewed. As these parts have to be " light-tight," Meccano Plates, etc., are obviously unsuitable for use, and some opaque material, such as stiff black paper or card should be used. Newton's disc, model No. 3.22 (see " 00-4 " Instruction Manual) is another instance where a sheet of cardboard is necessary.

When using cardboard, etc., it is necessary to perforate the edges so that standard bolts may be used to hold it in place. If the holes are merely bored with a bradawl or other sharp-pointed tool, the work of perforating is liable to prove laborious and in addition the finished job will not be very neat. By making use of a simple die and punch constructed from Meccano parts, however, the work can be carried out quickly and efficiently.

A Meccano Axle Rod (about 3" long) is used as the punch and a guide for this may be formed from a pair of Plates or Strips bolted together rigidly at one end so that their free holes register exactly. The cardboard to be perforated is first of all marked out carefully and then placed between the Plates or Strips forming the die. The die, complete with cardboard, is next placed on a wooden board and the Axle Rod punch driven through the card at the required points with a hammer. The result will be remarkably clean-cut perforations of exactly standard Meccano diameter.

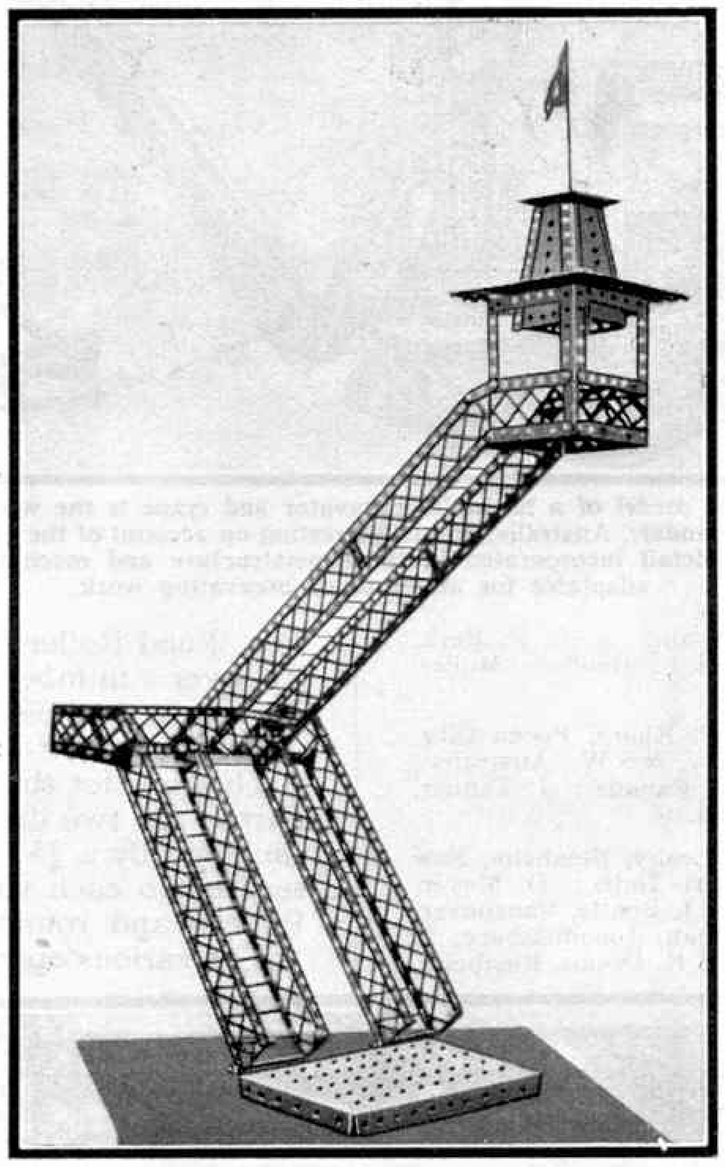
After cutting a number of holes in this way, the Axle Rod may become somewhat blunt, and it should then be sharpened by cutting away the rounded end by means of a file. Those model-builders who have the tools available will be able to convert an ordinary plain Axle Rod into a " cup punch " by boring the end of the Axle for a short distance. A punch of this type will of course be more efficient than the plain Axle, and by making use of a suitably hardened cup punch it is possible to cut holes in sheet tin and other light metals. On the other hand, a thin tube of the correct Meccano hole diameter with its edges sharpened, could be employed.

AN INTERESTING SCIENTIFIC EXPERIMENT

Everybody knows that metals expand when heated and contract when cold, and it is for this reason that railway lines are laid with a small space between each so that they can expand during the summer months without forcing one another out of position. The little model illustrated in Fig. 1, illustrates in a simple and interesting way this expansion and contraction. The base of the model consists of a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate and two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips 2 and 3, are secured to the Plate as shown. The Angle Brackets 4 are bolted by means of their slotted holes to the Double Angle Strip 2 and serve to hold a large needle 5—such as an ordinary darning needle—firmly by its point. The needle should be placed so that its eye rests lightly on the Double Bracket 6 as will be seen in Fig. 1. A pin 7 is now fixed with its point in the eye of the needle, not firmly but just so that it will stand upright with its point resting against the edge of the Double Bracket 6. A small piece of lighted candle is then placed beneath the needle and left until the latter becomes quite hot. If the head of the pin is watched closely it will be seen to move gradually as the needle expands. A piece of cardboard 8 may be cut to the shape shown and bolted to the Double Angle Strip 3. In order that the movement of the pin 7 may be followed more clearly a vertical mark should be made on the card and this mark should be arranged so that it is exactly in line with the pin 7 when the needle is cold. When the needle is heated by means of the candle flame, the pin 7 is pushed out of line with the mark on the card.

RIGHT-ANGLE GEARING

In the Meccano system there are two distinct methods of constructing right-angle gearing. This may be carried out with the Meccano Bevel Gears or the Contrate Wheels may be employed in conjunction with the standard Meccano Pinions. Both methods of gearing are equally efficient, although the Bevel Gears provide a somewhat more sturdy form of construction than the Contrate system, and they are consequently suitable where gearing is driven for long periods at high speed, such as in demonstration models, and



This illustration shows a model of a curious balancing stairway that is erected at Koslin, Germany. The model was built by R. Burford, Hendon, and is shown actually balancing on its pivot rod.

where considerable strains are imposed. By making use of the Contrates and Bevel Gears a wide range of ratios may be obtained. When two $\frac{7}{8}"$ Bevel Wheels are geared together a ratio of 1 : 1 is obtained. A ratio of approximately $1\frac{1}{8}$: 1 may be built up by gearing a $\frac{1}{2}"$ Pinion with a $\frac{3}{4}"$ Contrate Wheel. By substituting a $1\frac{1}{2}"$ Contrate Wheel for the $\frac{3}{4}"$ one, a ratio of 2 : 1 is obtained, while if the $\frac{3}{4}"$ Pinion is replaced by a $\frac{1}{2}"$ Pinion the resulting ratio is $2\frac{2}{3}$: 1. A ratio of 3 : 1 is obtained when a $1\frac{1}{2}"$ Bevel Wheel is meshed with a $\frac{1}{2}"$ Bevel Gear. It should also be noted that these two Gears are designed specially for use together, and it is not advisable to mesh other Bevel Gears with them separately. The reason for this is that the faces of the teeth of Bevel Wheels should be parallel to each other if they are to mesh correctly, and parts Nos. 30a and 30c have been specially designed to enable this to be done. Consequently when a $\frac{7}{8}"$ Bevel is used with the $1\frac{1}{2}"$ Bevel, the teeth only engage for a very small portion of their length, and irregular working consequently results.

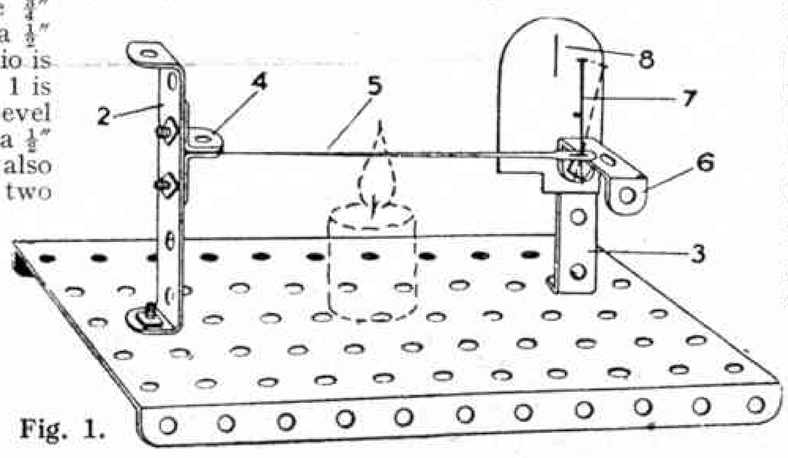


Fig. 1.

SHOCK ABSORBERS IN MECCANO

Several model-builders have written to us suggesting that special parts should be introduced so that miniature shock absorbers may be built. This idea is interesting but it should be borne in mind that several of the existing parts present possibilities if used in this connection. For instance a Friction Disc Damper of the automobile type might be built up from Bush Wheels fitted with suitable arms, the Friction Disc member consisting of a 1" Loose Pulley fitted with a 1" Dunlop Tyre. An interesting type of shock absorber was used recently in the construction of a model of a mammoth road transport vehicle. The shock absorber is of the vertical pattern and consists of a number of Meccano $\frac{5}{8}"$ Rubber Rings supported on a vertical rod and held in place between 1" Fast Pulley Wheels. By adjusting the positions of the Pulley Wheels the degree of compression to which the Rings are subjected may be altered. A shock absorber of this type might also be employed in connection with the construction of " Oleo " legs for large Meccano model Aeroplanes.

Model-builders should also keep in mind the fact that the 2" and 3" Dunlop Tyres and the 3" Rubber Rings may be used to insulate a model from vibration. For instance a 3" Dunlop tyre secured underneath the base of a model Meccano table electric fan will reduce the noise and vibration to a very large extent and there are numerous other instances where tyres may be employed in this manner.

SECURING SPRING CORD

A short time ago we described in this page a new Coupling Hook, part No. 58b, which is designed for anchoring the ends of Spring Cord to portions of a model. This new part greatly simplifies the manipulation of the Cord, but it is not of course always possible to use it for securing the latter, and the older method of attachment has consequently sometimes to be resorted to.

Several model-builders appear to be doubtful as to how this should be done and we are therefore including the following description. When the end of the Spring Cord is to be secured to the model, the end should first of all be heated in a match flame so that the wire is annealed. The wire may then be drawn out with a pair of pliers and twisted round the bolt-head or other part to which the Cord is to be attached. When securing the wire round the bolt-head, it is a good plan to make a complete loop of the soft wire and twist the free end several times round the Cord. If this is not done, there is a liability for the wire to pull out from under the head of the bolt when tension is applied.

NEW CRANK.—We were interested in your suggestion that a new type of Crank having two bosses should be introduced. The bosses would be secured on opposite sides of the web of the crank, and the new unit would prove quite useful in the assembly of crank shafts and in various types of mechanisms. We have made a note of your proposal and shall keep it in mind for future reference. (*Reply to H. J. Murray, Leith.*)

AIRSHIP PARTS.—Your proposed range of special parts on similar lines to the Meccano Aeroplane Constructor parts, that would enable models of airships to be constructed, has certain possibilities. We are afraid, however, that owing to the similarity of form of the airship, the range would provide limited interest from a constructional point of view. You can build an excellent model of an airship by assembling a framework composed of Meccano Strips and Girders and covering this with paper or linen. (*Reply to V. Lang, Toronto, Canada, and J. R. Cox, Manchester.*)

Results of
Meccano Model-Building Contests

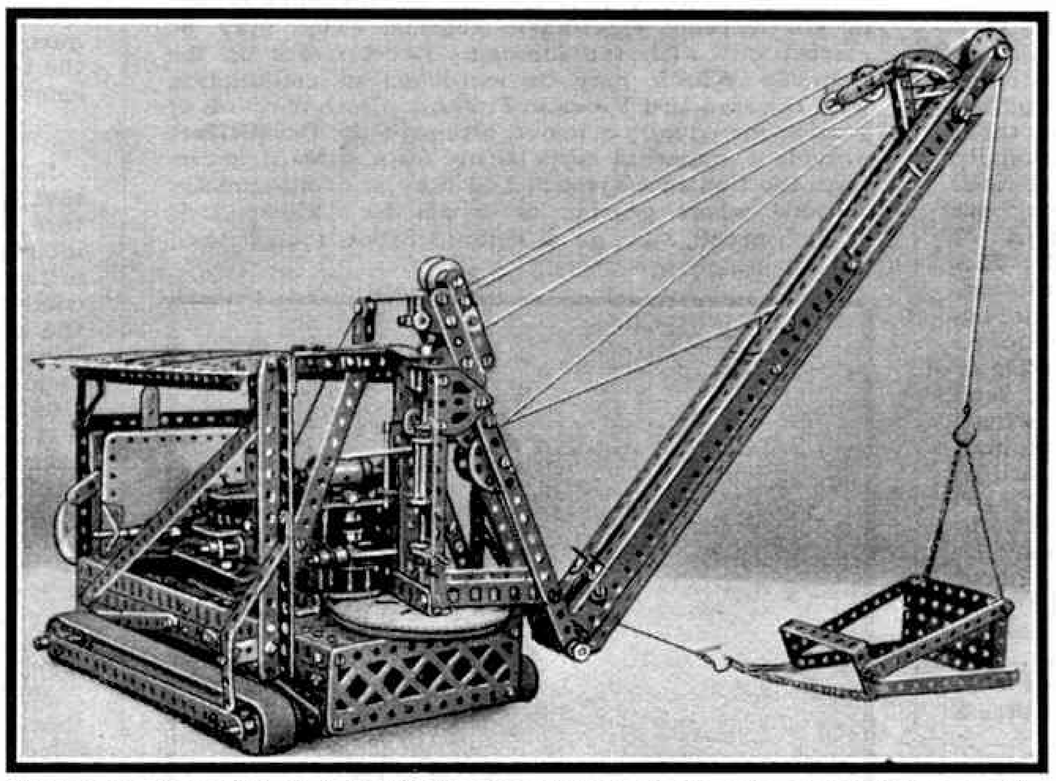
By Frank Hornby

"Crane" Competition (Overseas)

The "*M.M.*" monthly Contests appear to be almost equally popular abroad as at home, and in the Overseas Section of the "Crane" Competition large numbers of entries from all parts of the world were received.

It is pleasing to note that the standard of work done by Overseas boys is rapidly improving. In more than one recent contest the quality of their models has reached a very high standard indeed, and in some cases has excelled the work done by Home competitors. A few of the best entries in the Overseas Section of the "Crane" Contest are illustrated on this and the opposite page, and readers will see for themselves that praise is well merited. I hope the fine work that competitors abroad are turning out will act as an incentive to competitors in the British Isles to do even better, for I am sure that they will not allow their fellow Meccanoites beyond the seas to retain pride of place without a struggle.

The awards in the Overseas Section of the "Crane" Contest have been won by the boys named in the following list.



This splendid model of a backfiller excavator and crane is the work of J. W. Tanner, Annandale, Australia, and is interesting on account of the great amount of intricate detail incorporated in the superstructure and mechanism. It is adaptable for all kinds of excavating work.

FIRST PRIZE (Cheque for £3-3s.): Frank Van Bulck, Brussels, Belgium; SECOND PRIZE (tie, two competitors each to receive a Cheque for £1-1s.): Juan Anglada Roca, Barcelona, Spain; A. C. F. Beck, Rotterdam, Holland. THIRD PRIZE: (Cheque for £1-1s..): Geoffrey Muller, Rosebank, Cape Province, S. Africa.

SIX PRIZES of Meccano or Hornby goods value 10/6: K. P. Khare, Poona City, India; C. Heckford and R. Harman (joint award), Sydney, N.S.W., Australia; P. L. Bargellini, Firenze, Italy; J. Rodriguez, Montreal, Canada; J. Tanner, Annandale, Australia; D. Heeramaneck, Bombay, India.

TWELVE PRIZES of "*Famous Trains*" by C. J. Allen: R. Leahy, Blenheim, New Zealand; D. Mills, Durban, S. Africa; S. Desai, Navsari, India; D. Maver, Maitland, S. Africa; D. Thomas, Victoria, B.C., Canada; J. Bootle, Vancouver, B.C., Canada; M. de'Lima, Bombay, India; K. Bowman, Johannesburg, S. Africa; A. Lancefield, Saskatoon, Saskatchewan, Canada; K. Orams, Blenheim, New Zealand; Miss Nell Bedlington, Milford, Auckland, New Zealand; R. Cain, Durban, S. Africa.

CERTIFICATES OF MERIT: H. Wilmot, Port Elizabeth, S. Africa; A. Robert, Johannesburg, S. Africa; W. Wadley, Johannesburg, S. Africa; A. Johnstone, Piora, N.S.W., Australia; N. Parton, Sydney, N.S.W., Australia; J. Hedley, Johannesburg, S. Africa.

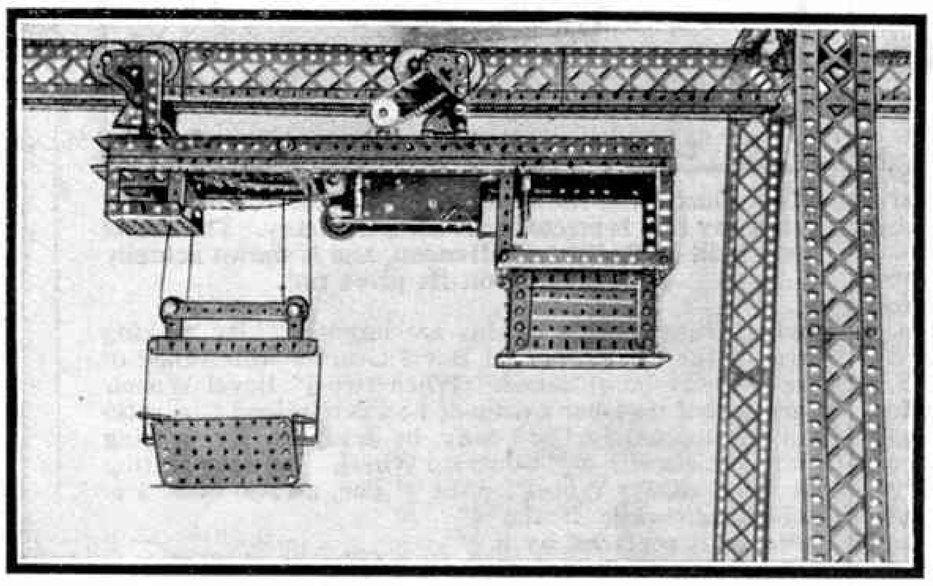
The novel 150-ton electric tower-type jib crane shown here won First Prize for Frank van Bulck, Brussels, Belgium. In this type of crane the tower is in the form of a tripod anchored to the foundations, and the machinery and jib is carried on a vertical revolving centre mast that reaches down to quay level, where its foot is mounted in massive roller bearings. Due to this method of construction the slewing axis is much closer to the edge of the quay than is possible in the ordinary type of cantilever crane. The tripod tower spans the quay sidings and carries a roller race at the top, for the lateral support of the mast. In the Meccano model the three legs of the tripod are joined by two triangles at the level of the quay. The jib is luffed by means of two driven screws, and all movements are electrically controlled by means of two Electric Motors, one of which drives the luffing and rotating motions while the second Motor operates the hoists. There are two hoist blocks, one for handling scale loads up to 150 tons at a maximum radius of 53 feet and a smaller hoist for loads up to 50 tons at a radius of 89 feet.

An interesting constructional detail of the model is to be found in the geared roller race at the top of the tripod that supports the mast. On the top of the tripod is fixed a rigid structure composed of four built-up channel section girders, each consisting of two $12\frac{1}{2}''$ Angle Girders joined by a $12\frac{1}{2}''$ Flat Girder. The four girders thus formed are connected to form a square frame by means of a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate at each corner and by Corner Brackets and $5\frac{1}{2}''$ Angle Girders on the under side. A $1'' \times 1''$ Angle Bracket is bolted to these Angle Girders and also to the centre hole of each of the built-up channel girders forming the frame. To the four Angle Brackets is then bolted the circular roller race, which is composed of eight Channel Segments.

The arrangement of the hoisting cord for the hoist of 150 tons is as follows. A $\frac{3}{4}''$ diameter $\frac{1}{2}''$ wide Pinion in the gear box is in constant mesh with a 50-teeth Gear Wheel on the hoisting drum, which is composed of two Wood Rollers. One end of the hoisting rope is attached to a Wood Roller and is then led under an Axle Rod located in the jib, over a number of guide Pulleys and then round each of four 2" Pulleys in the hoist block; thence it passes over a Pulley in the jib, under the Axle Rod and finally is secured to the second Wood Roller.

The rope for the 50-ton hoist also is secured to a double hoisting barrel, the two drums each consisting of a Sleeve Piece capped at each end by a $\frac{3}{4}''$ Flanged Wheel. One end of the hoisting rope is secured to each winch barrel and the rope is led over two guide Pulleys and round the sheaves of a three-sheave Pulley Block.

The various operations of the crane are controlled from a central cabin built on the front of the mast between the side members, so that a good view of the hoisting operations is obtained by the driver. The gear box, which is of a very complicated type, is situated at the rear of the superstructure to which the jib is hinged.



A fine electric trolley hoist by J. A. Roca, Barcelona. The trolley travels on Pulleys running on the flanges of Angle Girders, the axles of the Pulleys being Sprocket Chain driven from an Electric Motor.

It is some considerable time since Juan A. Roca won a prize in a Meccano Competition but in the "Crane" Contest he succeeded in tying with A. C. Beck for Second Prize. His model is a fine reproduction of an electrically operated gantry crane, a photograph of which is reproduced here.

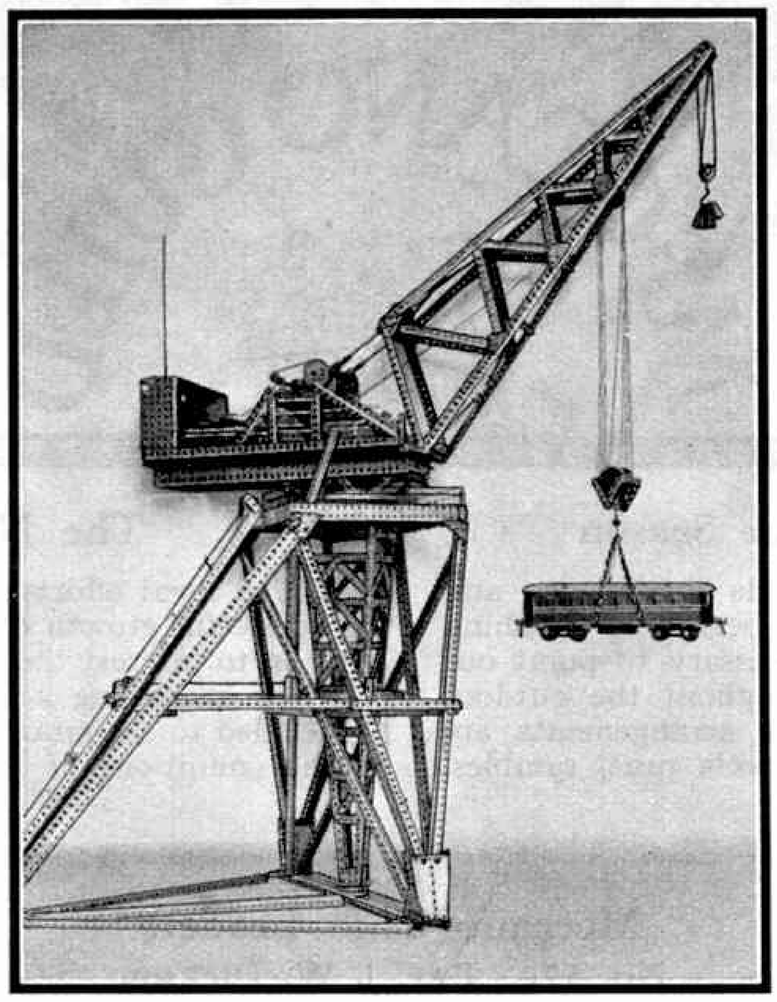
A study of the illustration will show that the mechanism is particularly neat. The trolley is suspended from two four-wheeled bogies that travel on the flanges of Angle Girders forming a runway or gantry. The axles of the rear bogie are driven by Sprocket Chain from an Electric Motor the drive from which may be imparted through a gear box either to the trolley bogie or to the hoisting and lowering mechanism. The gantry itself takes the form of a I-section girder, the web of which is made from Braced Girders joined end to end. Flat Plates would make a stouter girder but Roca probably did not have sufficient of these for the purpose.

A. C. Beck, the other tying competitor for Second Prize, built a model of a level-luffing shipyard crane, which is not only of considerable dimensions but also incorporates a great amount of detail work. Unfortunately the photograph Beck submitted is not suitable for reproduction.

Geoffrey Muller's model is a big hammerhead crane, the boom of which swivels on a roller bearing (made up from Channel Segments and Flanged Wheels) that is supported on a strong girder-built tower. The model is complete with travelling hoist-carriage and gear box, the latter being housed in a cabin at the rear of the boom.

A wonderful crane built recently at the Vickers-Armstrong yard at Walker-on-Tyne gave K. Khare, Poona, India, the idea for his successful entry in this Contest. This crane is said to be the largest in the world and a distinguishing feature is a smaller travelling crane running on rails laid along the top of the main jib. It was used during the fitting-out of the luxury liner "*Monarch of Burmuda*," and is so tall that it will easily lift great loads clear of the ship's funnels. The jib of the small travelling crane model is mounted on a novel ball-bearing unit built up by Khare himself. It consists of a Bush Wheel into the eight holes of which Bolts are secured. Several Steel Balls are then placed between the Bolts and a 2" Pulley bolted to the underside of the jib is then lowered on to the Balls, the centre pin on which the jib rotates being passed right through the Bush Wheel and the Pulley, so serving also to hold the Balls in their correct places.

A large gantry crane is the subject of the model sent by C. Heckford and Reg. Harman jointly. The prototype is used in steel works and shipyards for handling large steel and iron plates, electro-magnets being used in place of the customary hoisting hook. In the model the magnets are hoisted and lowered together by means of a single handle. The travelling trollies also are operated by a Crank Handle. The whole of the magnetic hoisting gear is suspended from a swivelling spreader-beam hung from the main gantry trolley, which in turn is suspended by means of four $1\frac{1}{8}$" Flanged Wheels from a rail that extends from end to end of the gantry. The whole of the weight is carried by a Meccano Ball Race and the trolley is traversed by means of two hauling chains, which are driven by an Electric Motor. The gantry is carried on eight coupled wheels, which run on parallel rails supported by a number of towers. The current for the electro-magnets is supplied from the gantry track.



This tower jib crane won First Prize for Frank van Bulck, Brussels, Belgium. It is chiefly noteworthy for its graceful yet solid construction and good proportioning. The gear box and luffing mechanism is complete in the smallest detail.

In regard to the model submitted by John A. Rodriguez, readers will be interested to know that I intend to make this model, which is a reproduction of a Ransome and Rapier Mobile Crane, the subject of a special article in a future issue of the "*M.M.*"

J. W. Tanner's model is a representation of a Byer's "Bear Cat" Crane, a type well known in America. The principal features of this ingenious machine are its remarkable adaptability and mobility. Besides being of use as a crane the machine is equally useful as a shovel, dredge, skimmer, backfiller and ditcher. Tanner's model also is adaptable to any of these and in addition he has devised dragline and pile driving attachments.

The general construction of the chassis, mast and jib are shown in the accompanying photograph.

The caterpillar tracks are made up from pieces of a bicycle inner tube and black tape held on Flanged Wheels butted together.

No. 1 and No. 6 "Outfits" Contest (Overseas)

The entry in this Contest did not come up to expectations, but the quality and ingenuity displayed by many of the models submitted was very good indeed. The awards are as follows :—

Section C (for No. 1 Outfit Models)

First Prize (Meccano or Hornby Train goods value £2-2s.) : Arthur Ack. Hing, Bendigo, Australia. Second Prize (Meccano or Hornby Train goods value £1-1s.) : George Jeffrey, Moose Jaw, Saskatchewan, Canada. Third Prize (Meccano or Hornby Train goods value 10/6) : Raymond Kelly, Auckland, New Zealand.

Six Prizes of No. 1A Meccano Accessory Outfits : D. Lamb, Antwerp, Belgium ; D. Ziegler, Zurich, Switzerland ; M. Thomas, Udamalpet, S. India ; G. Mauger, Balingup, W. Australia ; O. Ingamells, London, Canada ; D. Tzitzinias, Salonica, Greece.

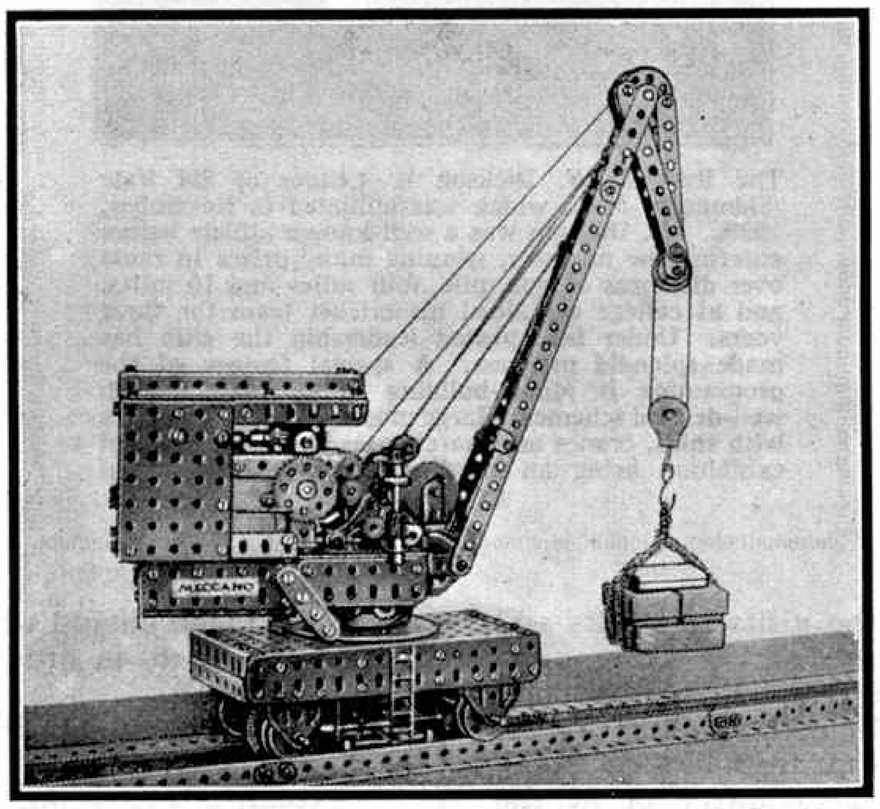
Six Prizes of Complete Bound Manuals : N. Golightly, Vancouver, Canada ; P. Blower, Durban, S. Africa ; B. Silva, Colombo, Ceylon ; T. Arksey, Namao, Alberta, Canada ; A. Eden, Ashburton, Canterbury, New Zealand ; D. Davies, Capetown, S. Africa.

Section D (for No. 6 Outfit Models)

First Prize (Cheque for £3-3s.) : L. G. Eustratiadi, Istambul, Turkey. Second Prize (Cheque for £2-2s.) : Gordon E. Schulz, Coromby, Victoria, Australia. Third Prize (Cheque for £1-1s.) : J. Tuinman, Alphen aan den Rijn, Holland.

Six Prizes of Cheques for 10/6 : A. Rowlands, Johannesburg, S. Africa ; R. Porter, Dunedin, New Zealand ; P. Montgomery, Christchurch, New Zealand ; S. Roberts, Capetown, S. Africa ; S. F. Marquand, Hawkes Bay, N.I., New Zealand ; D. Parton, Sydney, Australia.

Six Prizes of Meccano or Hornby Train goods value 5/– : N. Bowler, Melbourne, Australia ; J. Youngson, Adelaide, Australia ; I. Hamid, Poona, India ; D'Arcy Graham, Carstairs, Alberta, Canada ; S. H. Nathani, Bombay, India ; K. Lewis, St. John's, Newfoundland.



A travelling steam-driven crane by D. R. Heeramaneck, Bombay, India.

First Prize in the Section for No. 6 Outfit Models was won with a powerful model of an electric locomotive driven by a Meccano 6-volt Motor. It is interesting to note that this is the first occasion on which the principal prize has gone to a Turkish competitor.

An eight-wheeled articulated model of a "Sentinel" Steam Wagon fitted with differential, realistic steering and chain drive to the axles, won Second Prize.

First Prize in the Section for No. 1 Outfit Models was awarded for a pleasing model motor-cycle built by Arthur Ack. Hing.

No. 2 and No. 7 "Outfits" Contest (Overseas)

The full lists of prizewinners in the Overseas Section of the No. 2 and No. 7 "Outfits" Contest are as follows :—

Section C (for No. 2 Outfit Models)

First Prize (Cheque for £3-3s.) : P. Rawson, Melbourne, Australia ; Second Prize (Meccano or Hornby Train goods to the value of £2-2s.) : R. Williams, Singapore, Straits Settlements.

Five Prizes of No. 2A Meccano Outfits : O. D. Roberts, Capetown, S. Africa ; R. Jessel, Bombay, India ; S. Boothman, Pretoria, S. Africa ; D. Richards, Adelaide, Australia ; J. Parkinson, Wellington, New Zealand.

Five Prizes of Meccano or Hornby Train goods value 5/– : G. Chandra, Bareilly, U.P., India ; C. Rowe, Capetown, S. Africa ; D'Arcy Graham, Carstairs, Alberta, Canada ; C. Boogaerdt, Vlandingen, Holland ; H. Wilmot, Port Elizabeth, S. Africa

Ten Prizes of "*Famous Trains*" by C. J. Allen : J. Appelby, Calcutta, India ; N. Phillips, Sierra Leone ; R. Babajee, Bombay, India ; J. E. Wilmot, Port Elizabeth, S. Africa ; E. Stoner, Pleasant Point, S. Canterbury, New Zealand ; S. Frankel, Muizenberg, Capetown, S. Africa ; A. Harvey, Gisborne, Poverty Bay, New Zealand ; E. Williamson, Palmerston North, New Zealand ; N. Robertson, Capetown, S. Africa ; H. Cook, Johannesburg, S. Africa.

Section D (for No. 7 Outfit Models)

First Prize (Cheque for £3-3s.) : A. Brighton, Sydney, Australia. Second Prize (Cheque for £2-2s.) : N. Tomkins, Calcutta, India. Third Prize (Cheque for £1-1s.) : Peter Speers, Lahore, Punjab, India.

Ten Prizes of Meccano or Hornby Train goods value 10/6 : R. Bond, Sydney, Australia ; C. Haynes, Bombay, India ; F. James, Ontario, Canada ; J. Stonehouse, Toronto, Canada ; D. Lewis, Christchurch, New Zealand ; I. Dayes, Colombo Ceylon ; J. Roberts, Adelaide, Australia ; P. Hope, Amsterdam, Holland ; D. Rome, Madrid, Spain ; M. Frankel, Capetown, S. Africa.

Five Prizes of Meccano or Hornby Train goods value 5/– : J. Fisher, Winnipeg, Canada ; G. Price, Dunedin, New Zealand ; A. Prince, Johannesburg, S. Africa ; E. de Pucchi, Milan, Italy ; C. v. Mourey, Utrecht, Holland.

The best model in the "No. 7 Outfit" Section is a well proportioned motor car, by A. Brighton. The car is of the two-seater coupé type and in addition to the usual mechanical features includes a folding "dickey" seat, luggage grill and spare tyre.

I hope to be able to illustrate one or two of the other entries in future issues of the "*M.M.*"



Preparations for the Outdoor Season

The second of the two winter sessions ends this month and Leaders and officials of Meccano clubs are beginning to think of summer programmes. It is no longer necessary to point out the advantages of continuing meetings throughout the outdoor sessions, for to-day in practically all clubs arrangements are made to enable members to enjoy cricket, cycle runs, rambles, excursions and other summer recreations with their companions of the winter months.

It is not too soon to begin to make plans for the spring and summer sessions, for practically all outdoor activities require a certain amount of preparation and their success depends entirely upon the efficiency with which these preparations are carried out.

The Summer Programme

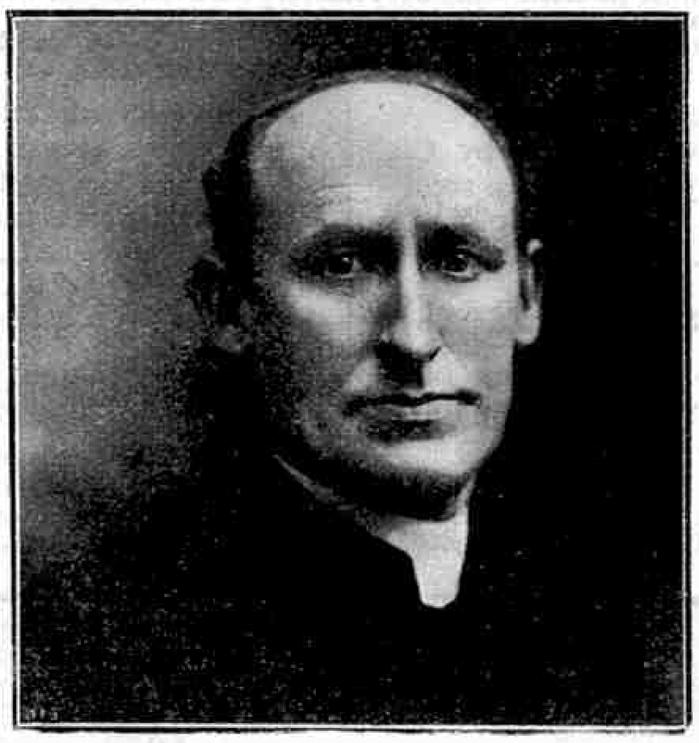
The kind of programme to adopt depends upon the size and resources of the club and upon its position, for an organisation with headquarters in the centre of a large city or town will not have the same opportunities as in the country. The first step therefore is to make a review of possible summer work. Cricket naturally will be the first thought, and if this is adopted now is the time to make enquiries about a ground and to approach other clubs in order to arrange a well-filled fixture list. Cycling is a healthy pursuit that undoubtedly is increasing in popularity and a cycling section could easily be organised in most clubs. Another excellent recreation that may be made very interesting and has the advantage of being inexpensive is rambling, and a few interesting excursions on foot should be arranged even in clubs in which cricket and cycling sections are formed. The pace of a country ramble is slower than that of a cycle run, of course, and the excitement of a hard-fought game is absent, but it will be found to give members splendid opportunities to learn to know each other and to form firm and lasting friendships.

Summer is a suitable time for many of the visits to works and places of special interest that are a feature of the programme of every Meccano club, and also is the only season in which the pleasures of camping may be enjoyed. In certain clubs a permanent camp is formed at a suitable site not far from headquarters. In others a special camping holiday in the country or at the seaside is arranged. In each case forethought and careful preparation are necessary unless camp life is to be uncomfortable drudgery, and those who look forward to a holiday under canvas should lose no time in making the necessary enquiries.

The sad fact must be admitted that the British climate is not ideal and that practically every summer there are occasions when outdoor pursuits are impossible. For this reason it is a wise plan to keep the club room in order for the purpose of holding indoor meetings when outdoor activities are impossible owing to bad weather, for the best substitute for an interrupted game of cricket, or for a ramble under uncomfortable conditions, is the brisk exercise of table tennis or some other attractive indoor game.

Meccano Club Leaders

No. 57. Rev. J. W. Dickson



The Rev. J. W. Dickson is Leader of Sid Vale (Sidmouth) M.C., which was affiliated in November, 1930. Mr. Dickson was a well-known athlete before entering the ministry, winning many prizes in races over distances of one mile, four miles and 10 miles, and at college captained his cricket team for three years. Under his spirited leadership the club has made splendid progress. A special feature of the programme is Model-building in accordance with well-defined schemes, a large model of a dock complete with ships, cranes and warehouses shown at a recent exhibition being an excellent example of work of this kind.

The New Recruiting Campaign

The loyal efforts of members have played a great part in the wonderful growth of the Guild in past years, for they have been keen to interest their friends in the aims and objects of the Guild. Their recruiting activities have been so successful that I have decided to encourage others to follow their example by simplifying the conditions of award of the Recruiting Medallion. For the benefit of those who have joined the Guild recently I may explain that at present this Medallion is awarded to those who recruit three new members for the Guild, and that the introduction of six more recruits, making nine in all, entitles a member to have his name engraved on this medallion. In future the number of recruits that must be secured to qualify for the higher award will be six. Thus a Medallion will be awarded to members recruiting three of their friends, and this will be engraved on recruiting three more, making a total of six.

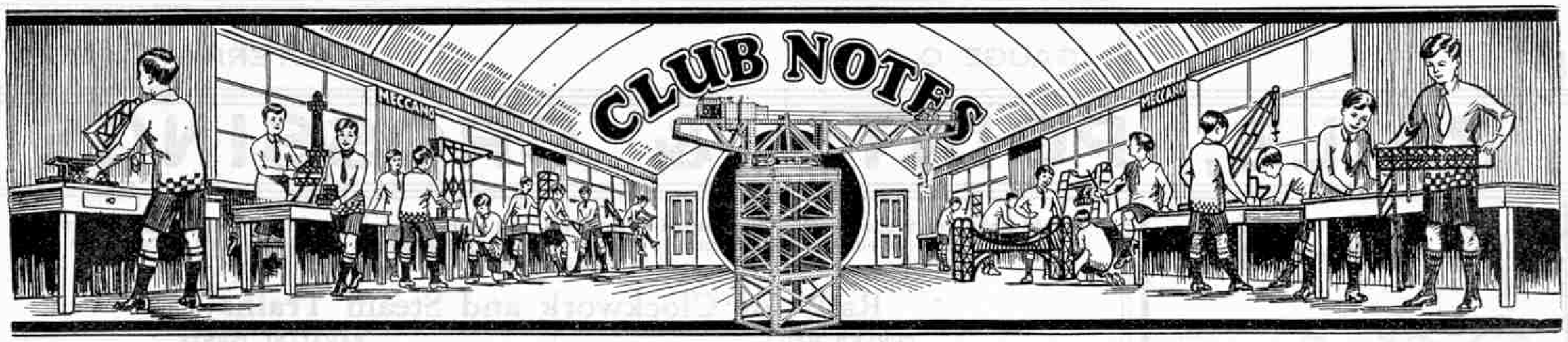
In the past these awards have been made without any reference to the period spent in recruiting and difficulties occasionally have arisen when a long interval has elapsed between the beginning and end of a member's activities. In order to avoid trouble of this kind I have introduced a time limit of three months for the recruiting of three members, while those who wish to have their Merit Medallions engraved must secure their recruits within six months of the date of their first new member.

I feel sure that the revision of the conditions under which Recruiting Medallions are awarded will stimulate members to greater activity, and I hope that all those who have not already taken part in this movement will immediately decide to do their best to extend the influence of the Guild among their friends. I shall be very pleased to forward supplies of leaflets explaining the aims and objects of the Guild to any member who writes to me for them. These leaflets also incorporate application forms for the use of new members and those taking part in the campaign should write their names and addresses on the forms they distribute in order to enable me to recognise their recruits.

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 :—

BRIGHTLINGSEA—L. R. Collins, 18, Dean Street, Brightlingsea.
DODDISCOMBSLEIGH—F. Miller, 3, New Buildings, Doddiscombsleigh, Nr. Exeter.
GLASGOW—Charles Hughes, 13, Houldsworth Street, Glasgow, C.3.
KEW GARDENS—Kenneth Sides, Sillingstone, High Park Road.
LARNE—Gilbert Hunter, 2, New Terrace, Bank Road.
LIVERPOOL—S. Wright, 26, Garfourth Road, Garston.
LONDON—F. R. Cambridge, 77, Sussex Street, Poplar, E.14.
LONDON—G. Stenzleit, 151, Albany St., Regent's Park, N.W.1.



Chertsey M.C.—The chief recent event was an Exhibition organised in conjunction with the local Branch of the H.R.C. This was opened by the Rev. M. C. Taylor, President of the Club. Nearly 200 visitors inspected the Hornby Train Layout and the splendid display of models, which included Aeroplanes, Ships, Motor Cars and Cranes. Photographs and articles made by members were on sale, and the total proceeds, including admission fees, exceeded £2. Excellent reports of meetings now appear regularly in the "*Surrey Herald*," and an interesting feature is that visitors are frequently present during ordinary meetings of the club. Club roll: 35. *Secretary:* V. Brown, Arbon Grove Cottage, Lyne, Chertsey.

Elm Road (Beckenham) M.C.—An outstanding event was the visit of a party of members to the Exhibition of the South Croydon and Purley M.C. A lantern lecture on "*The Development of the Southern Railway*" has been given. This was illustrated by means of slides kindly loaned by the S.R. and was so popular that a series of similar lectures is to be given. Keen interest is taken in Model-building Contests. In two recent competitions members were asked to design cranes and "anything on wheels" respectively, and many original models of great merit were entered. Excellent use is made of the extensive Hornby Train Layout owned by the club and organised track work is carried out regularly. Club roll: 28. *Secretary:* C. Price, 52, Queen's Road, Beckenham, Kent.

Mallow M.C.—Successful Model-building Contests have included a number designed to encourage speed in designing and building models and several Blindfold Competitions, as suggested recently in the "*M.M.*," which have proved very popular. A large club model of a Steam Lorry and Trailer attracted great attention when exhibited in a local shop window. Another interesting event was a visit from Mr. M. O'Callaghan, the former Leader, who was delighted with the progress of the club. Storage arrangements for the club's Meccano parts have been overhauled. These are now kept in boxes that are carefully labelled and indexed, the system greatly simplifying the task of checking the stock. Club roll: 18. *Secretary:* W. J. Roche, 8, Spa Walk, Mallow.

Middlesbrough M.C.—The club has suffered a great loss in the death of Mr. A. Bradley, the former secretary, a resourceful and energetic official. The club made splendid headway during his term of office and his cheery presence will be greatly missed. Recent club work has included a Hat Night; a lantern lecture on "Airships and Balloons"; a "Ghost Night," always a popular feature of the programme; and "Members' Night," when members themselves took over official positions and arranged the programme. Hornby Train Nights and Games Evenings also have been held. Club roll: 69. *Secretary:* Mr. D. Allick, 20, Wellesley Road, Middlesbrough.

Roe Green M.C.—On Model-building Evenings members have constructed models for entry in a special competition in which models of dockyard items had to be submitted. Two evenings devoted to Meccano Model-building are followed by one for operations on the club's Hornby Train Layout. A series of speed tests of locomotives with various loads have been made in order to secure the information necessary for building up a timetable. Woodwork and indoor games also figure on the programme and an "Aerodrome Scene" is now being designed and constructed. Club roll: 12. *Secretary:* P. J. Wallis, 345, Stag Lane, N.W.9.

Victoria (Bradford) M.C.—Model-building Contests are the chief features. Prizes are given to members having the highest marks in each session, and competition is keen, interest being maintained throughout. A lantern lecture on "*Astronomy*" was given by one member, while another contributed a conjuring display. A Swimming Night is held once a month. Club roll: 8. *Secretary:* P. C. Rhodes, Ardsley House, 131, Victoria Road, Eccleshill, Bradford, Yorks.

Churcher's College (Petersfield) M.C.—Outdoor work has continued, visits to places of interest being well supported in spite of unfavourable weather, while the Football Teams have been very active. The indoor programme has included Model-building, a Debate on the motion "*That Travel by Sea is Preferable to Travel by Air*," Games and Competitions. Club roll: 30. *Secretary:* A. Hardy, Churcher's College, Petersfield, Hants.

Fulstow Junior M.C.—Model-building Evenings and Hornby Train Nights have been varied by the inclusion in the programme of lantern lectures and indoor games, while the Football Team is enjoying a good season. A party of boys from a local school have visited the club. Bagatelle and Midget Golf matches were played, the visitors being defeated, and refreshments were kindly provided by Mr. and Mrs. W. R. Phillips. An interesting report of this event appeared in the local press. Club roll: 16. *Secretary:* J. C. Phillips, P.O. Fulstow, North Thoresby S.O., Lincs.

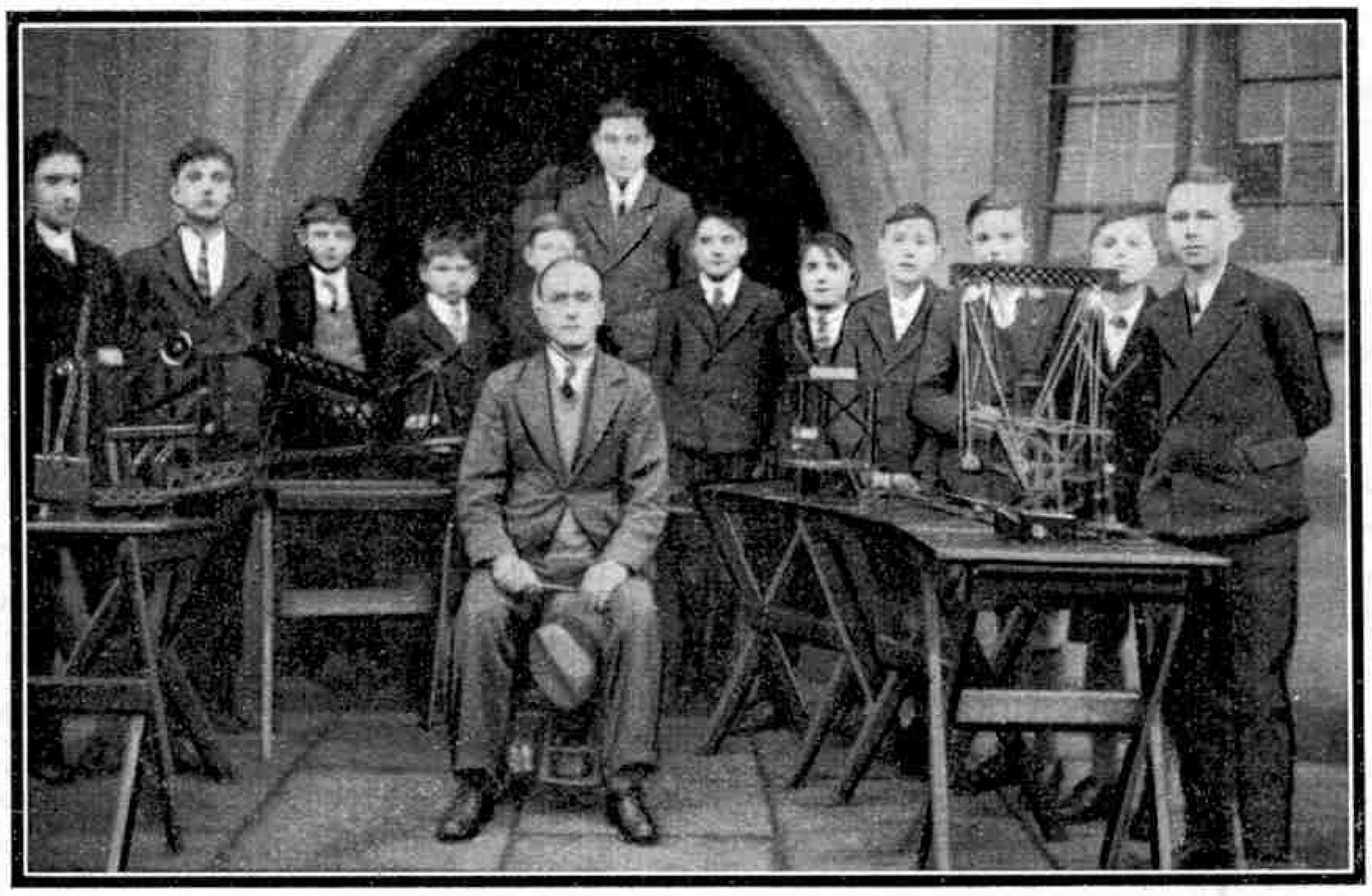
King's Lynn M.C.—The club recently held its first Exhibition. This was a great success, the chief exhibit being a splendid model of a Dock, showing how modern structures of this kind are built. An extensive Hornby Train Layout, a large number of working Meccano models, electric games of skill and a stall of general interest were other attractions, while gymnastic exhibitions were given at intervals by the secretary and one of the members. An excellent newspaper report was given of the event, and special mention was made of the untiring efforts of Mr. I. J. Thatcher, the President, on behalf of the club. About £6 was realised, this sum being freely contributed by visitors, no charge being made for admission. Club roll: 20. *Secretary:* A. S. W. Horn, Stanton House, The Chase, King's Lynn.

Horsforth M.C.—Favourable progress is being made, and the club's exhibition was very successful, the Hornby Train Layout being a special attraction. Model-building is the chief activity pursued, and great interest is taken in lectures by Mr. H. Freeman, Leader of the club. Club roll: 15. *Secretary:* M. E. Dickinson, 55, Long Row, Horsforth.

Heywood Regent Street School M.C.—The Concert and Exhibition held in the Central Hall of the School was attended by more than 200 visitors. The chief prize-winning models were a movable Crane and a representation of the Quebec Bridge. A lantern lecture on "*London*" has been given by Mr. G. N. Chaplin, the Leader, whose slides were reproductions of his own photographs, while Mr. J. P. Lunt, B.Sc., the President, gave a talk on "*Famous Scientists*," those dealt with including Galileo, Edison and Faraday. Club roll: 50. *Secretary:* W. Dodgson, 31, Manchester Road, Heywood.

Churchill M.C.—Members recently have specialised in building model aircraft. Mr. C. E. Blake, Leader of the club, is an expert in this work and has given the members valuable instruction. Other hobbies followed are Woodwork, Book-binding and Stamp Collecting, and the chief recreation this session is Boxing. Club roll: 21. *Secretary:* Mrs. C. E. Blake, School House, Churchill, Oxford.

Ipswich M.C.—Interesting recent events have been a presentation, on the occasion of his marriage, to Mr. H. J. Wright, the founder and Leader of the club, who has recently resigned, and the presentation of a clock to Mr. J. Vick, a keen worker, who has removed to Croydon. The new Leader is Mr. A. Everett, and he has arranged an interesting programme that has already included a Firework Display, a Night cycle ride and other cycle runs, visits to works, and Games Evenings, in addition to a series of Model-building Contests. Further talks on "*The Navy During the Great War*" have been given by Mr. Johnson. Club roll: 20. *Secretary:* P. Samson, 81, Tuddenham Road, Ipswich.



Mr. W. B. Biggers, B.A., Leader of the Oxford Central School M.C. and members of the club with models built for an extensive Model Fair. The splendid working models in the Fair include Auto-Swing Boats, Joy Wheels and Roundabouts and many of them are fitted with electric lights. The club was affiliated to the Meccano Guild in February, 1930, and as our photograph suggests, a special feature of its programmes is the construction of large club models.

Sid Vale M.C.—A novel item on the programme was a Model Carnival, when 16 tableaux constructed with the aid of Meccano parts were shown. Most of these were lighted electrically, and the First Prize was won by the secretary, who exhibited a scene described as "The Old Rustic Bridge by the Mill." The scheme was very successful and is to be repeated. An excellent Social has been held and other meetings have been devoted to construction of special types of models. Club roll: 25. *Secretary:* R. Gliddon, Sheffield House, Sidmouth.

AUSTRALIA

Woodville M.C.—The plan is followed of discussing models built at home by members, recent models brought to the club room for this purpose including Aeroplanes, Steam Shovels and various types of Bridges and Ships. To one meeting members brought parts of a model of a Suspension Bridge designed by Mr. R. Patrick, Leader of the club, and these were assembled in the club room. Excellent Model-building Competitions have been arranged. In one of these members were restricted to the use of parts named in a list, and in another working models of Lighthouses were to be constructed. Candles were used for lights submitted in the second competition, and most of the members carried their models home with the lights burning! Club roll: 25. *Secretary:* D. P. Patrick, 22, The Grove, Woodville, South Australia.

CANADA

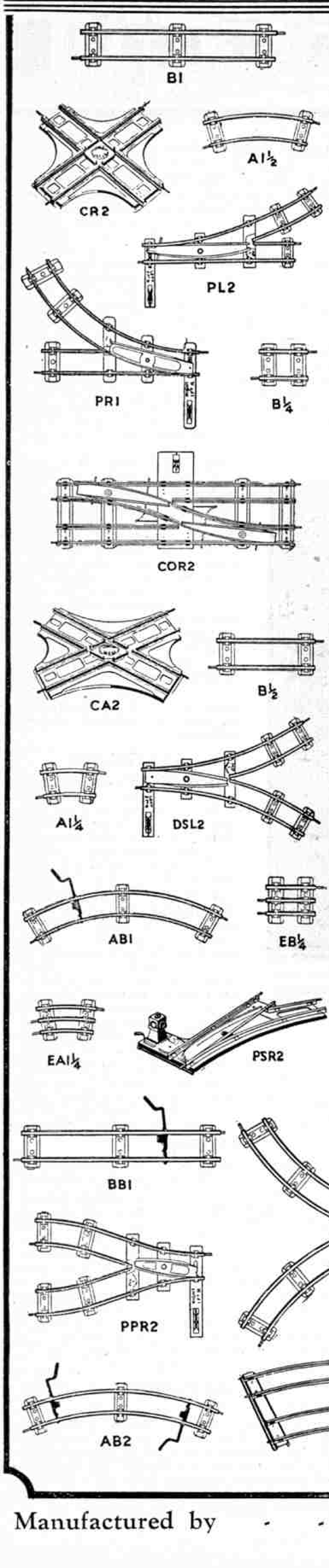
Victoria (British Columbia) M.C.—A very successful meeting was held to celebrate the club's first birthday. A short address by Mr. C. B. W. von Storch, Leader of the club, was followed by a humorous story, read by Mr. F. Cox, and a debate on the question "*Will Man Ever Reach the Moon?*" the majority of members expressing their belief that he will do so. A demonstration of special Meccano models was then given, and the evening concluded with a paper by Mr. Bryce on "*Byrd's Polar Flight of 1926.*" At other meetings Meccano models of television scanning discs were displayed, and papers on the "*Empress of Britain*," "*Airships as large as Steamships*" and other interesting topics were read. Club roll: 10. *Secretary:* M. D. Bryce, 908, Heywood Avenue, Victoria, B.C.

NEW ZEALAND

Blenheim M.C.—Excellent progress has been made since affiliation was secured. Model-building in preparation for the Exhibition has been the chief activity, and the resulting display was a great success. The works of the Marlborough Electric Power Board were visited and other meetings have been devoted to Games. Club Roll: 25. *Secretary:* K. J. Orams, Redwood Street, Blenheim, N.Z.

GAUGE O — ALTERNATE PEGS

RAILS, POINTS & CROSSINGS



Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. They make possible an almost endless number of realistic and railway-like layouts. Only the finest materials are used in their manufacture.

Rails for Clockwork and Steam Trains

CURVED RAILS

9-in. radius (For M0 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 M0 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.
BBR1	Straight brake and reverse rails ...	„ 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)	„ 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 M0 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	„ 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	„ 9d.
BC¼	Straight centre quarter rails ...	„ 6d.

ICR	Insulators for insulating centre rails	„ 3d.
CCR	Clips for fixing centre rails... ...	„ 6d.

Manufactured by - - MECCANO LIMITED - - OLD SWAN - - LIVERPOOL



Branch Notes

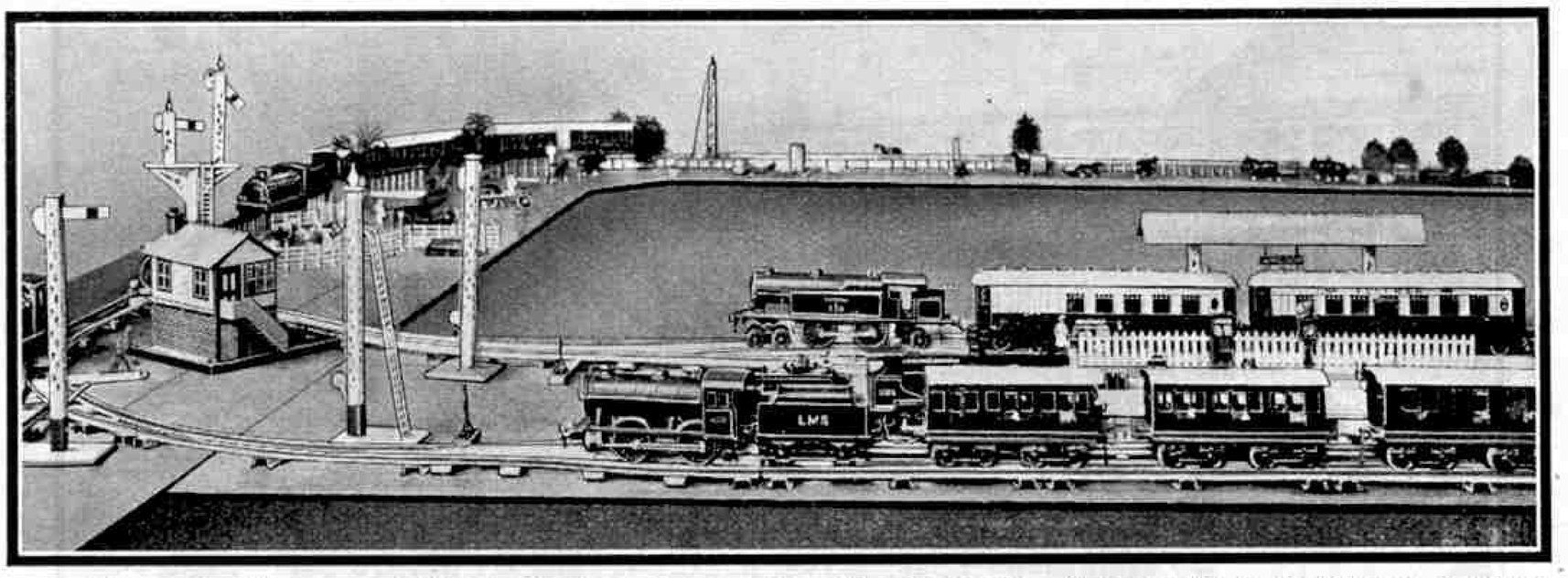
SKEGNESS.—The members are erecting shelves on brackets around the club room, on which the track is to be permanently laid. Collections taken at each meeting have enabled many accessories to be purchased. A visit is to be paid to the Station Yard at Skegness, and talks are to be given by some of the L.N.E.R. officials. Secretary: A. G. Osborn, Lumley Lodge, Skegness.

ELMSIDE (EXETER).—A novel feature has been inaugurated in Directors' Meetings, which are to be held monthly. Various points concerning the Branch layout are discussed regularly by a Committee with a view to the general improvement of the railway. An interesting step has been the recent construction of a Meccano Workshop complete with lathes, drills and other machine tools driven through overhead shafting in the approved manner. The shop is served by a siding run off the railway and special wagons have been allocated to deal with the traffic. Secretary: J. Blaker, c/o 60, Elmside, Exeter.

BOWDON MODEL RAILWAY CLUB.—An interesting and varied programme has included timetable working and trials of locomotives for power and length of run. Debates upon the relative merits of L.M.S.R. and L.N.E.R. locomotives, and of tender and tank engines, also have been held, while a further novelty was a cinematograph show. A permanent track is to be installed, and an attractive series of track meetings and other events is being planned. Secretary: N. M. Makin, "Arden," Cavendish Road, Bowdon.

ST. AGNES CHURCH (HOVE).—A successful Exhibition has been held at which a demonstration of train operations by timetable was greatly enjoyed by visitors. Meccano models lent by Headquarters and others built by members also were displayed and aroused much interest. An entertainment including a sketch presented by the members brought the proceedings to a close. The net receipts formed a handsome contribution to the church funds. Secretary: R. Jenkins, 8, Frith Road, Hove.

PORTSMOUTH (NORTH END).—Attention has been devoted to accessories on the Branch layout. Telegraph Poles correctly wired have been erected and the various buildings finished off with brick paper. Some of the new Hornby Posters have been effectively used in appropriate places. The inclusion of miniature figures gives a life-like appearance to the layout and actual loads are now handled on the line. A successful social has been held, the prizes for various competitions and games being Hornby accessories. Secretary: C. Mortby, 35, Beresford Road, North End, Portsmouth.



Part of the excellent layout operated by the Wimborne Grammar School Branch, No. 92. Chairman, Mr. A. M. Hooper; Secretary, J. K. Bennett. The track is mounted on a raised baseboard and very complete lineside effects are provided. A notable feature of track operations is that gravity shunting is employed for the marshalling of wagons and coaches, thus saving locomotive power. Photograph reproduced by courtesy of Panora Ltd.

MAIDSTONE.—An interesting talk on actual experiences in connection with the surveying and laying of narrow gauge railways in Africa was given by Mr. S. B. Fletcher, a Branch member. Successful track meetings also have been held, and the Annual Dinner of the Branch was greatly enjoyed. The election of Officers for the current year has taken place. A visit to the S.R. Works at Ashford is proposed. Secretary: W. Hills, The Orchard, Lord Romney's Hills, Ashford Road, Maidstone.

PEEBLES.—Members are exceptionally keen and attendances at recent meetings have been excellent. A Branch party has been held, and the proceedings enjoyed by all. Interesting future developments are anticipated, and intending members should lose no time in getting in touch with the secretary. Secretary: J. Struther, 62, Valatho Crescent, Peebles.

OVERSEAS

ASHFIELD (SYDNEY).—It has been decided to run the Branch jointly with the Meccano Club, the combined organisation being known as the Sydney Meccano and Hornby Railway Club. An excellent representation of Sydney Harbour Bridge, upon which a pair of railway tracks are mounted, has been presented for use on the Branch layout. A raised substructure is being erected for this and as many as six roads will be available at the important stations. A temporary single line track, operated strictly in accordance with regulations, is at present in use. Automatic signalling on the colour-light principle is to be installed. Secretary: T. Watson, 595, Parramatta Road, Leichhardt, N.S.W., Australia.

MANAWATU (N.Z.).—Interesting competitions held at recent meetings have shown members' knowledge of railway working to be satisfactory. An interesting display was given in connection with a garden party at a local school, both electric and clockwork trains being run on an extensive layout. Competitions to test railway knowledge also have been held. Secretary: R. Hall, 110, Albert Street, Palmerston North, New Zealand.

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:—

ARBROATH—Harry J. P. Roberts, 24, Millgate, Arbroath, Angus.

LEICESTER—C. Simpson, 86, St. Michael's Avenue.

MANCHESTER (FAIRFIELD)—T. Battersby, Kingswood, Manchester Road, Fairfield.

PENDLETON—A. Prestwich, 11, Wardlesworth Street, Eales Old Road, Pendleton.

ROBY—G. Ryder, Roscote, Station Road, Roby, Nr. Liverpool.

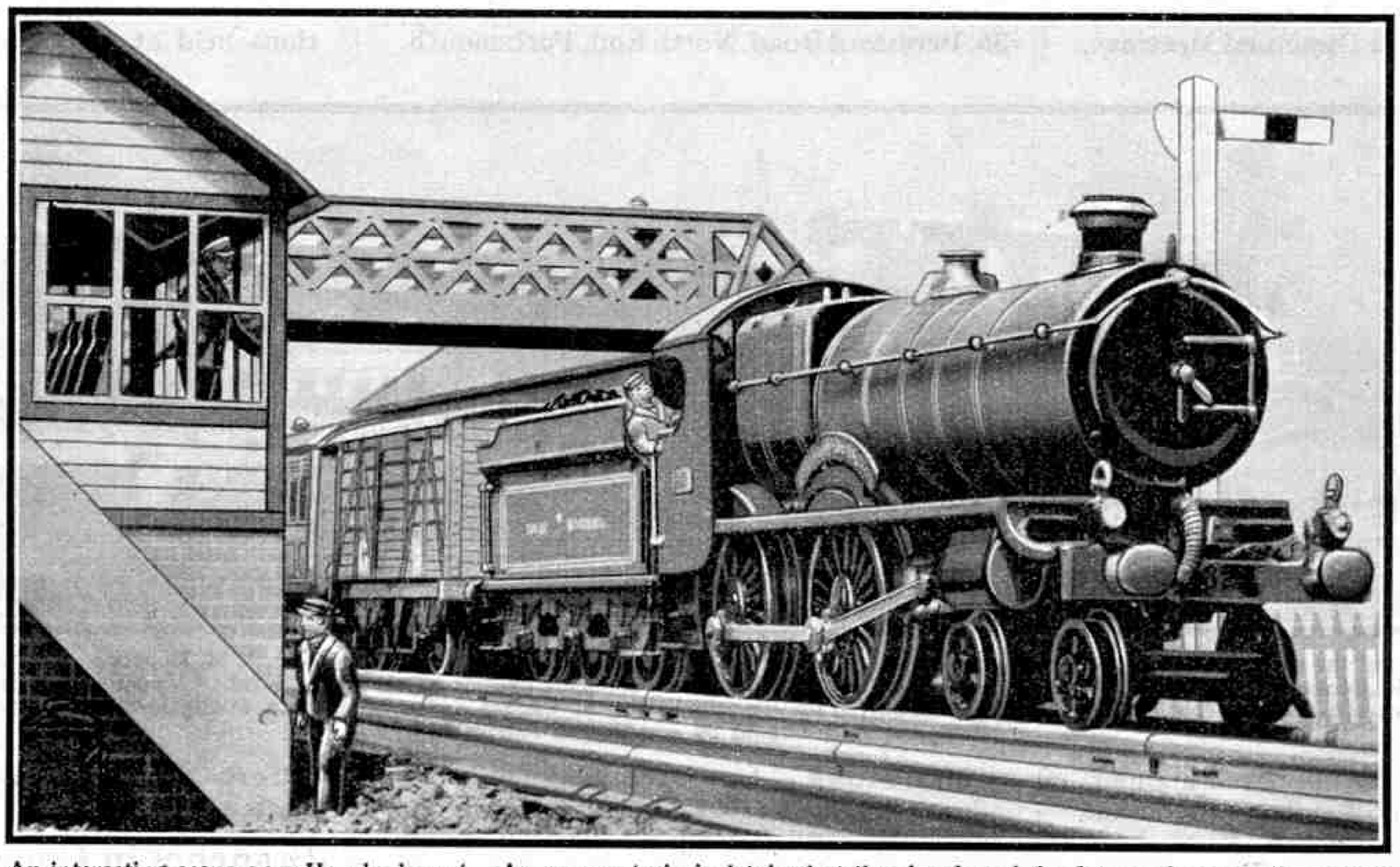
SHAFTESBURY (DORSET)—W. G. King, Donhead St. Andrew, Shaftesbury.

VANCOUVER—A. Wallace, 2170, Trutch Street, Vancouver, B.C., Canada.



XLI.—SIGNALLING AND THE HORNBY CONTROL SYSTEM

AFTER a layout has developed from the elementary stage the provision of various accessories is usually taken in hand seriously. Of the many effective additions that may be made to the track none are perhaps more important than signals and the various other items required for the safe operation of the line. The progress of the science of signalling from the crude methods of the earliest times to the practically perfect systems of to-day is a very remarkable and interesting achievement. "*M.M.*" readers will be familiar with the various types of signals and their functions, for some useful articles on the subject of signalling generally have appeared from time to time in the H.R.C. pages.



An interesting scene on a Hornby layout. An express train is detained at the signal, and the fireman is proceeding to the Cabin in order to advise the signalman of the presence of the train, as required by the regulations.

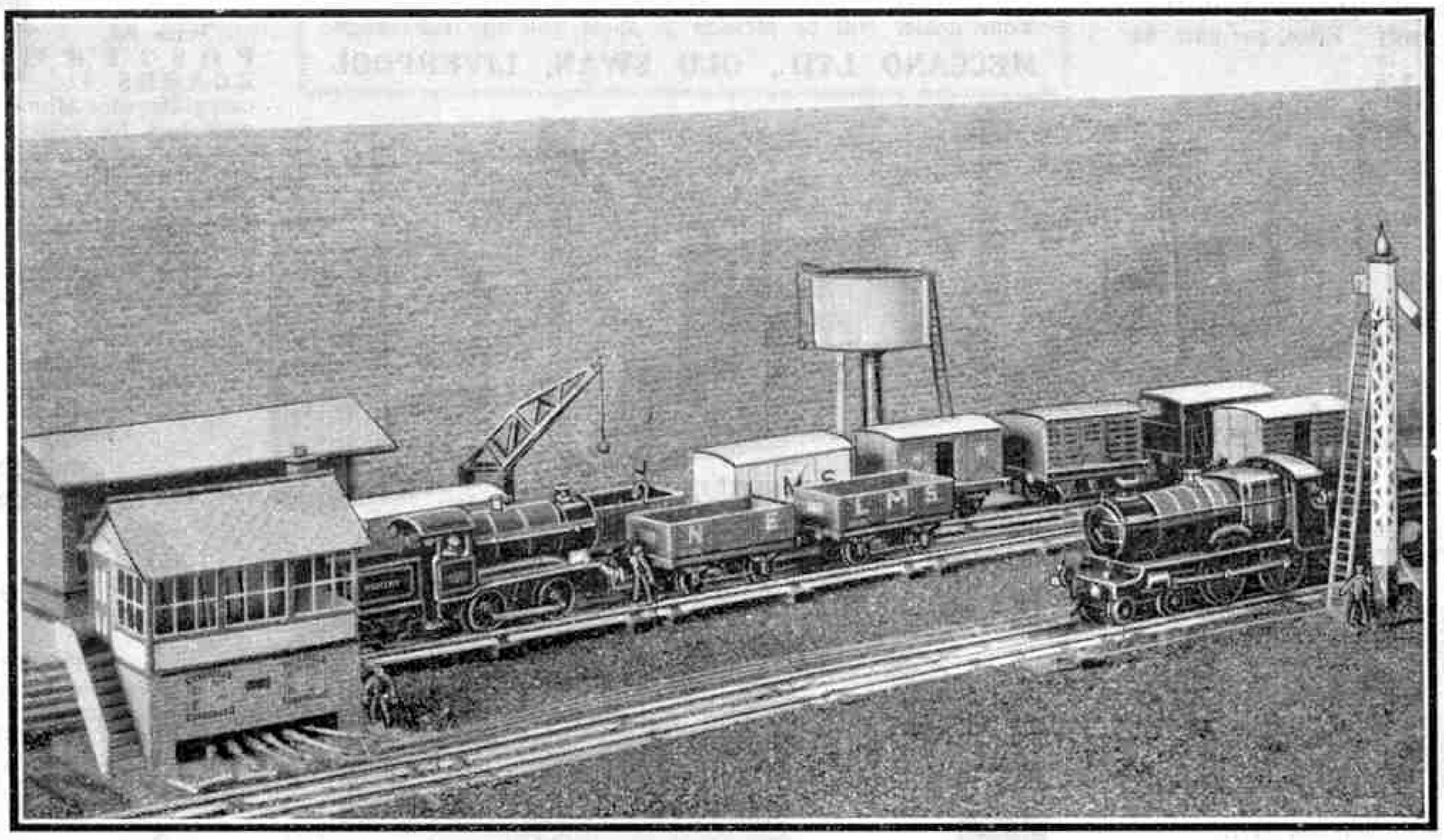
The application of signals to a layout is quite an important subject, for although no lives are at stake in the event of a derailment or mishap, owing to incorrectly set points or signals, the appearance of the line is improved in a surprising way when the signals are disposed in an appropriate manner. Each station should be provided with the necessary signals, and each points or siding should be duly protected, except perhaps in the case of points used in marshalling or storage sidings, though the points on the main line leading into such yards should of course have the necessary signals near them.

As a general rule signals in this country are placed to the left of the track to which they apply, but this is of course not always possible. If the line is running through a cutting on a left-hand curve, a signal will probably be placed on the right-hand side of the track, as it will be "picked up" more clearly there by the driver of an approaching train. On the G.W.R. signals are frequently placed in between the up and the down tracks, but this is only possible as a result of that railway having been laid by Brunel to a rail gauge of 7 ft. $0\frac{1}{4}$ in. When this gauge was done away with the position of the station platforms made it necessary to retain the original overall width of two tracks, even though the gauge of the rails was reduced to the standard 4 ft. $8\frac{1}{2}$ in. This position for the signals is a useful feature, for G.W.R. locomotives are arranged to be driven from the right-hand side, so that the engine men of that company are assured of a good view of the signals. At busy junctions special arrangements have to be made to accommodate the large number of signals necessary, and gantries are therefore used. As far as possible the small signal posts or "dolls" are placed so that they are above the lines to which they apply, and in this manner the risk of confusion is reduced to a minimum.

Hornby layouts can be very completely signalled, for ordinary Single Arm, Junction and Gantry Signals are available. In addition there is the interesting Double Arm Signal, which has a "home" or square-ended semaphore mounted in the usual position, while below it is a "distant" or fishtailed semaphore. The purpose of this signal is puzzling to beginners, but actually its functions are quite simple to follow. A "home" signal is a definite "stop" indication when at danger, but a "distant" signal may be passed when in the danger position, as it serves as an indication of what is the position of the "home" signal in advance.

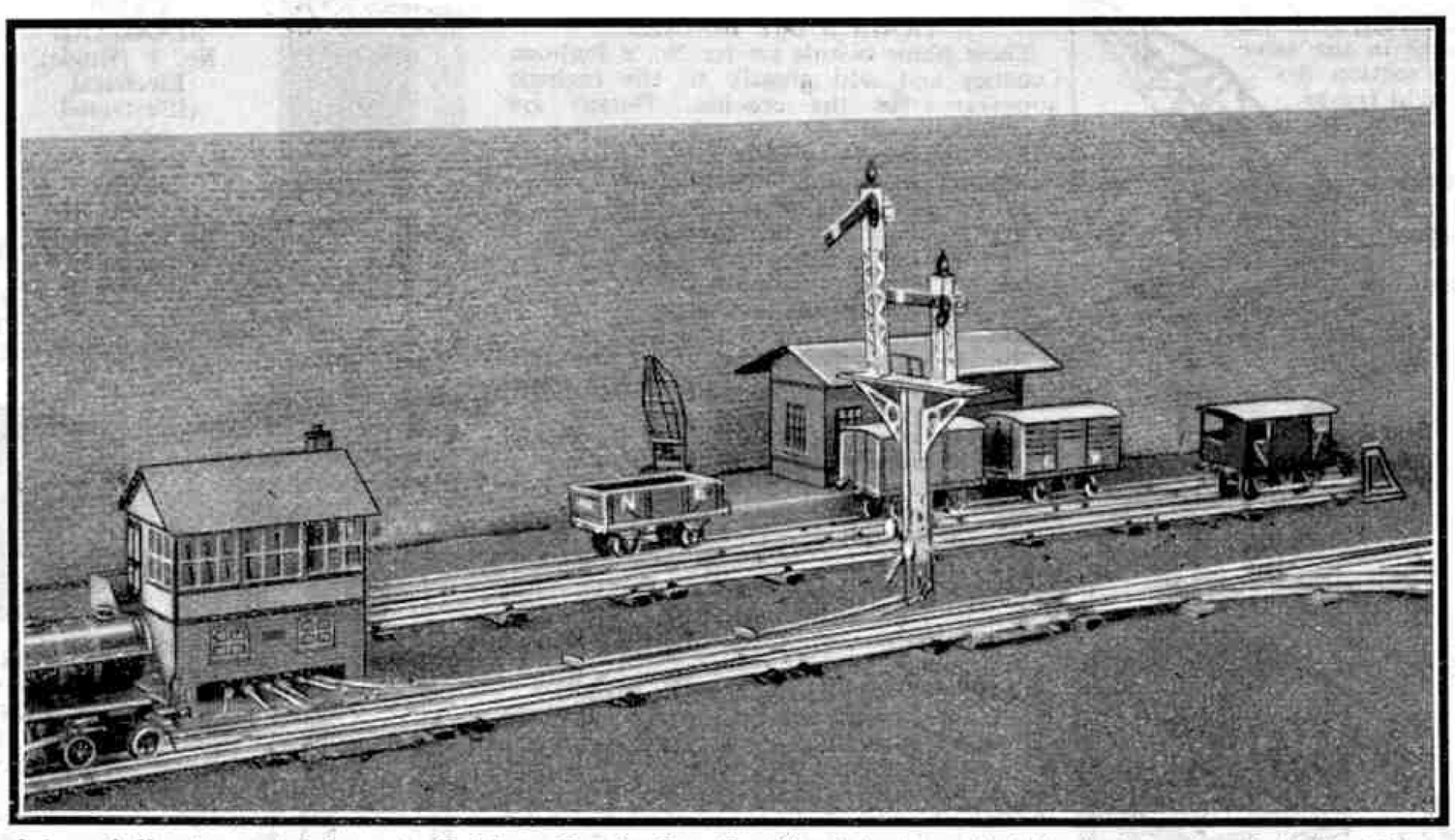
The "distant" is therefore placed a sufficient distance ahead of it to enable the driver of a train to slow down and be ready to stop at the "home" signal if this should be still at danger when he reaches it. This distance depends upon the gradients and other conditions, but where sections are short as in busy areas,

and the distance between two "home" signals is limited, a "distant" arm is placed upon the post of the first "home" signal, and shows what indication the driver may expect at the next "home" signal. It would not do of course for the "distant" upon the same post as a "home" arm to show "line clear" when the latter is at danger, so that special arrangements are made to prevent this and to ensure that when the "home" arm returns to the danger position the "distant" will follow suit, for the two arms are of course operated by different signalmen. As may well be imagined, the limited space available for most miniature railways makes the Hornby representation of this signal a necessity in many places, so that it is a very useful one.



Part of a layout where the Hornby Control System is installed. The provision of the wires at the side of the track, and the manner in which control of the Signal shown is effected, give the line a very realistic appearance.

While Signals and Points operated in the ordinary way by a hand lever are quite satisfactory, the charm of a signalling system is only realised to the fullest extent when its operation can be carried out from a central point, such as a signal cabin. This was made possible some time ago by the Hornby Control System. This System has recently been revised and improved, and is now concerned only with Points and Signals. It has no reference to the control of clockwork or electric locomotives as is sometimes supposed. The former are controlled by means of the Brake Rail or Brake and Reverse Rail as appropriate, and the latter by the Resistance Controller or, in the case of the No. 1 Electric Tank Locomotive only, the Reverse and Resistance Switch.



A branch line turnout duly controlled by a Hornby Junction Signal is shown in this photograph. Both the Points and the Signal are operated from the Lever Frame situated in the Signal Cabin.

The various components of the System have been described in the *"M.M."* by *"Tommy Dodd,"* who gave them detailed attention in the November issue of last year. There is in addition much useful information in the special leaflet dealing with the Hornby Control System, and readers who have not yet obtained a copy should lose no time in doing so. As regards the possibilities of the System and its actual installation, a few remarks, and in particular the two of the accompanying photographs that show the System in use, will probably be welcome.

In order to obtain the best results from the Control System, it is advisable to screw the rails down to whatever baseboard may be used, so that there is the necessary rigidity to withstand the pull and thrust imparted to the wires. This may cause some enthusiasts to wonder how the screwing down may be accomplished and yet the Control System Guide Brackets be attached to the rails at the same time, as the sleepers are pierced with two holes only. The solution is of course that neither the screwing down nor the attachment of Guide Brackets is necessary at every sleeper, and by careful consideration and experiment the suitable arrangement of both may be carried out. It is not necessary to place a Guide Bracket at both the adjacent sleepers at a rail joint, for instance. The sleepers not occupied by a Guide Bracket, therefore, may be the ones through which the screwing down is effected.

The mention of Guide Brackets brings us to another point, the neatness or otherwise of the wiring. Although it is not always possible to keep to the same arrangement of wiring, efforts should be made to keep the various wires as straight as possible and as parallel to one another as circumstances allow. The conditions should be studied, and the requirements of the various Points and Signals, and of course the Rodding Traverse and Rodding Compensator where these are employed, should be noted. The arrangement of the various wires should be schemed out carefully and the actual operation of wiring up should be done efficiently. The control of the various Points and Signals will be rendered easier as a result of buckles and twists being eliminated, and the appearance will be improved.

HORNBY SERIES

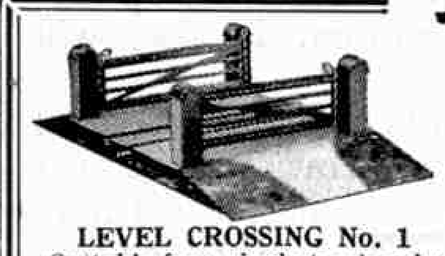
HORNBY ACCESSORIES

GAUGE 0

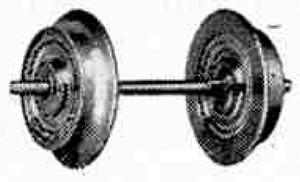
There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

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

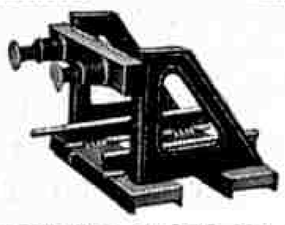
MECCANO LTD., OLD SWAN, LIVERPOOL



LEVEL CROSSING No. 1
Suitable for a single track only and has gauge 0 rails in position. Price **3/6**



MANSELL WHEELS
Price, per pair, **4d.**



BUFFER STOPS No. 1
(Spring) Price **1/-**



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.**



MODELLED MINIATURES
No. 1. STATION STAFF
Price **2/-** per set.



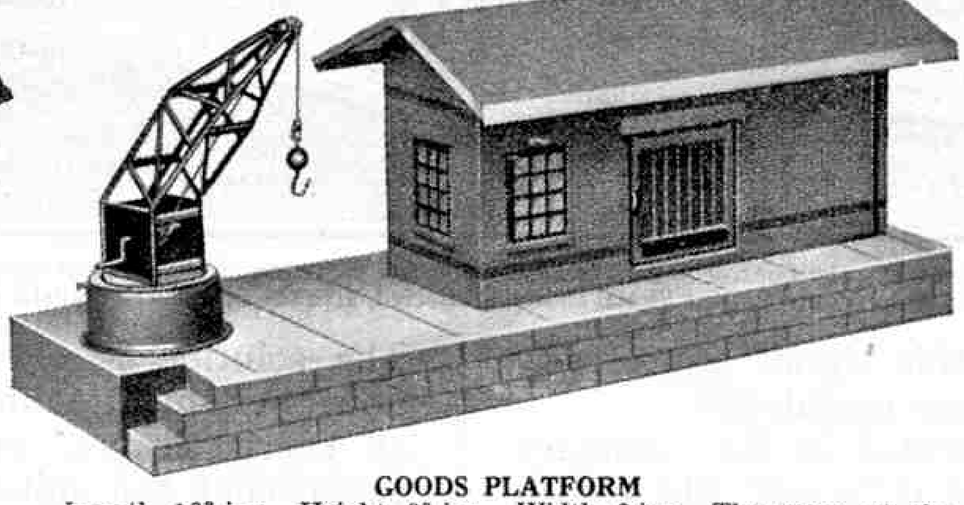
Two No. 1 and one No. 2 Cuttings are illustrated here.

CUTTING No. 1 (END SECTION)
(Illustrated)
Base measurement: Length 7 11/16 in., width 6 in. Price, per pair, **3/-**

CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(Illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1), between which they are fitted, but they may be used independently.
Base measurement: Length, 10¼ in., width 6 in. Price **2/-**

CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**

CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 10¼ in., width 6 in. Price **6/-**



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**



PLATFORM CRANE
Fitted with a crank and ratchet mechanism.
Price **4/9**

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.**

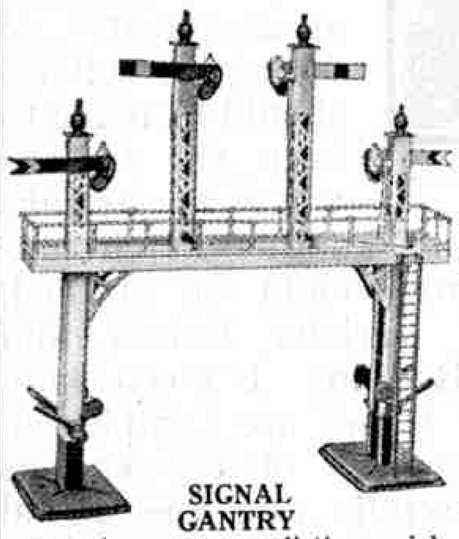
CLIPS FOR TRAIN NAME BOARDS
These clips are for use with coaches that are not fitted with brackets to take the Name Boards. There are two types; No. 2S, for No. 2 Special Pullman and No. 2 Special Pullman Composite Coaches; and No. 2, for No. 2 Pullman and No. 2 Saloon Coaches. Price per packet of twelve,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



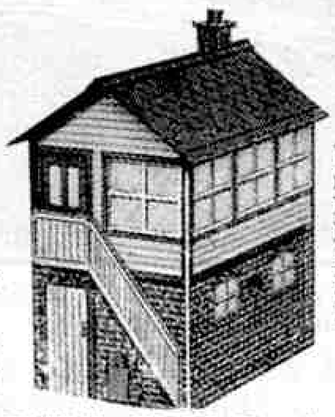
RAILWAY ACCESSORIES No. 7
Watchman's Hut. Brazier, Shovel and Poker ... Price **1/6**



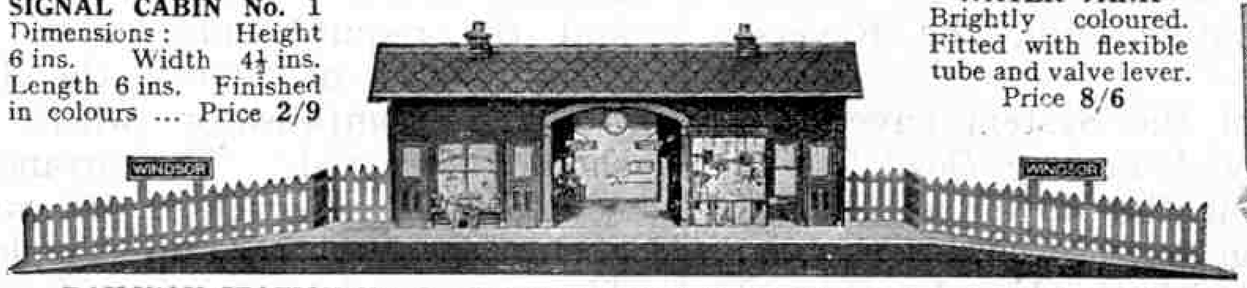
TUNNEL (Metal)
Realistic and finished in colours ... Price **5/9**



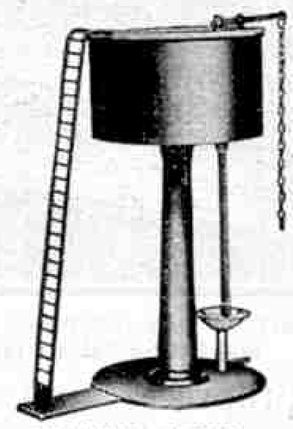
SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**



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



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**



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

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.**

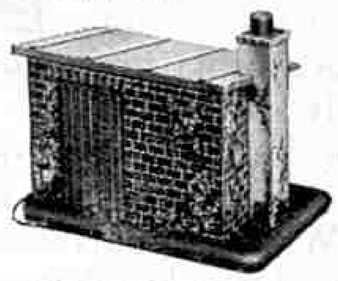
POSTERS IN MINIATURE are reproductions of familiar national advertisements. They are intended to be pasted on the Station Hoardings or the Poster Boards described above, and are beautifully printed in full colours. Packet of 51 ... Price **6d.**



No. 1 FOOTBRIDGE,
Without Signals
Price **4/-**

FOOTBRIDGE No. 1A
Well constructed. Complete with signals. Price **4/9**

No. 2 FOOTBRIDGE, complete with Detachable Signals (as illustrated).
Price **7/6**



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



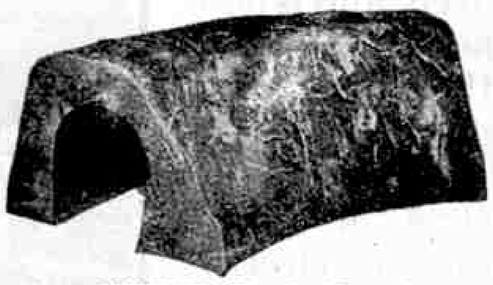
LAMP STANDARD No. 1 (Single) Electrical
(Illustrated above)
Price **3/6**

LAMP STANDARD No. 2 (Double) Electrical
Price **4/3**



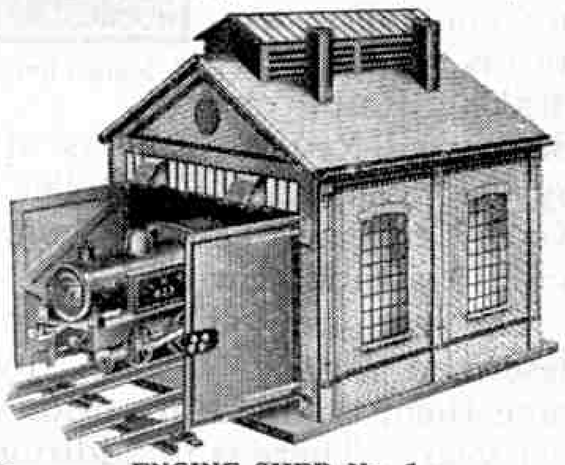
TUNNEL No. 1 (Straight)
Length 8 ins.
(as illustrated). Price **2/-**

TUNNEL No. 2 (Straight)
Length 15⅜ ins. Price **4/-**



TUNNEL No. 3 (Curved)
Length 13 ins. Price **4/6**

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



ENGINE SHED No. 1
This Shed will accommodate Locomotives of the M Series, No. 0 and No. 1 types.
Price **15/-**



Suggested Hornby Train Improvements

CORRIDOR CONNECTIONS

These fittings are necessary on modern express trains where restaurant cars are provided, so as to enable all passengers to take advantage of the facilities. They usually take the form of steel front and rear frames connected longitudinally by tie-bars that are pivoted in "scissors" fashion and enable the "gangway" to extend or close up as necessary. The floor portion is of special form, and the whole is covered by the stout leather or canvas "bellows." Pullman practice has developed a special type of gangway that is extremely strong and acts like a huge buffer. Owing to its special construction it is effective in absorbing shocks as between one vehicle and another, and such gangways have frequently shown their value in preventing telescoping in mishaps. These Pullman fittings are of characteristic form with almost flat tops, as compared with the rounded upper contours of the connections used by most railway companies.

Corridor Connections are of course provided in the Hornby Series for all vehicles where their use is appropriate. Thus, the No. 2 Special Pullman, the No. 2 Pullman and Saloon Coaches, the "Riviera Blue" vehicles and the Mitropa Coach are all provided with them. It has often been suggested that the smaller Pullmans in the Series should be similarly fitted, but the alterations involved would add to the cost of the vehicles, and trouble would probably be experienced in negotiating the small radius curves usually used when such stock is employed. The Hornby Corridor Connections are based upon actual Pullman practice, and they are realistic and effective in having a steadying effect on the train as in actual practice. A single connection is provided between two coaches, as two independent gangways would not be so simple or reliable. To finish off the end of a train in an appropriate manner End Plates are provided.

The fitting of these accessories is not difficult, although it may appear to be so if the right method is not followed. The Connection should be compressed lengthways and held between finger and thumb. It should then be applied to the coach end in such a manner that the small tongues projecting sideways from the metal frame of the Connection are slipped inside the opening provided at the end of the coach. The Connection is now turned until quite upright, still keeping it compressed, when the top comes under the projecting portion of the roof. The small "hook" at the top of the Connection should be entered into the hole provided for it, the Connection being lifted slightly to enable this to be done. It will now drop into the correct position.

In order to attach it to the next coach the vehicles are coupled up, and the free end of the Connection applied to the other coach. Particular care is now necessary as the "bellows" may become dented if the fingers slip, and such dents are hard to remove. The Connections are sufficiently flexible to allow of their being twisted slightly as is necessary to secure the Connections to the second coach. Due care will result in the operation being carried out successfully, and once it has been done no difficulty will be experienced when repeating it. End Plates are attached in a similar manner, and provide a finish to the ends of a train which, completely vestibuled in this way, is very steady in running and of course looks extremely well. Connections may be obtained separately at 1/–, postage 2d., and End Plates are 1/4 a dozen, postage being 1½d.



An interesting miniature steam locomotive that is capable of hauling a number of passengers. The prototype represented is one of the famous 4-4-0 express locomotives designed by Mr. Adams for the former L.S.W.R. They were used on the principal services on that line for many years.

ELECTRIC LOCOMOTIVE MAINTENANCE

Hornby Electric Locomotives are extremely reliable, but it sometimes happens that after prolonged use a little difficulty in starting, or sluggishness in general running, is noticed. In the case of new locomotives this may be put down largely to the general stiffness that is inherent in all machinery that has had little use. This wears off gradually as the engine is used, and satisfactory service follows. When trouble in starting or running occurs at a later stage, however, assuming that the power supply is satisfactory, the following points should be carefully looked into.

The Controller should be examined to see that good contact is being made between the switch handle and the resistance coils. Similarly the collector shoes on the engine should be making good contact with the centre rail, and the small springs that govern them should be in good order. The brushes of the motor, which may be got at by removing the brush holder caps that project at the side of the engine, should be making good contact and should be clean. The brush springs may require to be extended a little owing to wear having reduced the length of the brushes themselves. The commutator, collector shoes and rails must be kept clean and free from oil, and the lubrication of bearings should be carried out according to the Instruction Leaflet provided with each engine. The locomotive wheels should be examined to see that they are secured in the correct position, and the nuts of the crank pins, in the case of outside cylinder locomotives, must not foul the slide-bars. An important point is that the fuse wire employed on the Terminal Connecting Plate should always be similar to that supplied, which is 3 amp. lead wire.

Where the power supply is satisfactory, and the rails are known to be in good order—having been tested as shown in the Instruction Leaflet applying to the locomotive in question—if the engine does not respond to the treatment suggested it is best to send it to the Service Department, Meccano Ltd., Binns Road, Old Swan, Liverpool, for examination. Full details of the trouble experienced should be enclosed with the engine. If required, estimates are furnished before proceeding with the necessary work.

IMPROVING THE APPEARANCE OF GOODS ROLLING STOCK

A very fascinating part of the work on a miniature railway consists in effecting small alterations and improvements to the rolling stock generally. The question of improving the running has already been dealt with, but attention to various details such as the following will result in a more realistic appearance. Thus, the solebars of certain wagons are finished in black for ease of manufacture, whereas the body of the vehicle may be grey, or in the case of the S.R. brown. If some paint is obtained of the same shade as the body colour, or as near as possible, the solebars may be painted over with it, and the whole look of the wagon or van will be considerably improved. The buffers may be left black if required and the axle-guards and tie-bars certainly should be; but if preferred the stocks or sockets of the buffers may be painted, leaving the heads and shanks black. A further addition will be the imitation of the various ironwork details seen on actual wagons. These may be marked on by means of Indian ink, using a fine pen for the purpose. The actual arrangements depicted will of course depend upon the type of wagon and the company represented, so that miniature railway owners will make use of their own observations for such details.

In a similar manner the white-painted Refrigerator Van looks very well if the various embossings representing the planking are faintly marked with Indian ink. The details of the van are immediately thrown up in a satisfactory manner. The Banana Van, too, being lightly coloured, may be treated in the same way. Numerous details of this type will suggest themselves to keen model railway owners who require their rolling stock to represent the real thing as faithfully as possible. The carrying out of details to such a degree in the process of manufacture would of course entail greatly increased costs, but those who desire such effects may easily carry out the work themselves.

IRISH LOCOMOTIVES AND ROLLING STOCK.—We agree that there are many fine locomotives and excellent rolling stock in service in Ireland that would be very worthy of reproduction in the Hornby Series. We have found, however, that the interest of Hornby Railway owners is centred chiefly on the four railway groups of Great Britain, so that the locomotives and stock of our manufacture represent in form and colour the equipment of the L.M.S.R., L.N.E.R., G.W.R. and S.R. Should we have any reason to believe that a demand for stock of the G.N. of Ireland and the G.S. Railways is likely to arise, we shall of course reconsider the position. (*Reply to H. Farrell, Dublin.*)

S.R. "ATLANTIC" LOCOMOTIVES.—Although we are aware that the S.R. have a number of 4–4–2 express locomotives, we hardly think it would be advisable to renumber and rename our No. 3 Locomotive to represent one of these. The "Lord Nelson" class, after which our No. 3 Locomotive is named, are the chief express engines on the S.R., and the "Atlantics," although capable of very good work, are somewhat overshadowed by these and other recent classes of engines. Similar remarks apply to the L.N.E.R. (G.N.) engines of the same wheel arrangement which, except for certain details, are almost identical, and from which the S.R. design was developed. The question of tenders also would be a difficulty, as the standard tenders now in use would not be suitable. (*Reply to R. Curry, Newhaven.*)

ELECTRIC M3 TANK LOCOMOTIVE.—The M3 Tank Locomotives are proving extremely popular owing to their power, length of run, and general handiness on any layout. We know of several miniature railways where numbers of these engines form a very useful "link" for intensive suburban work. Many owners of electric railways have suggested that these engines should be included in the range of Hornby Electric Locomotives, so that you will be pleased to hear that we are at present considering the application of electric motors to them. *Reply to V. Dinsdale, Cambridge, and others.*)



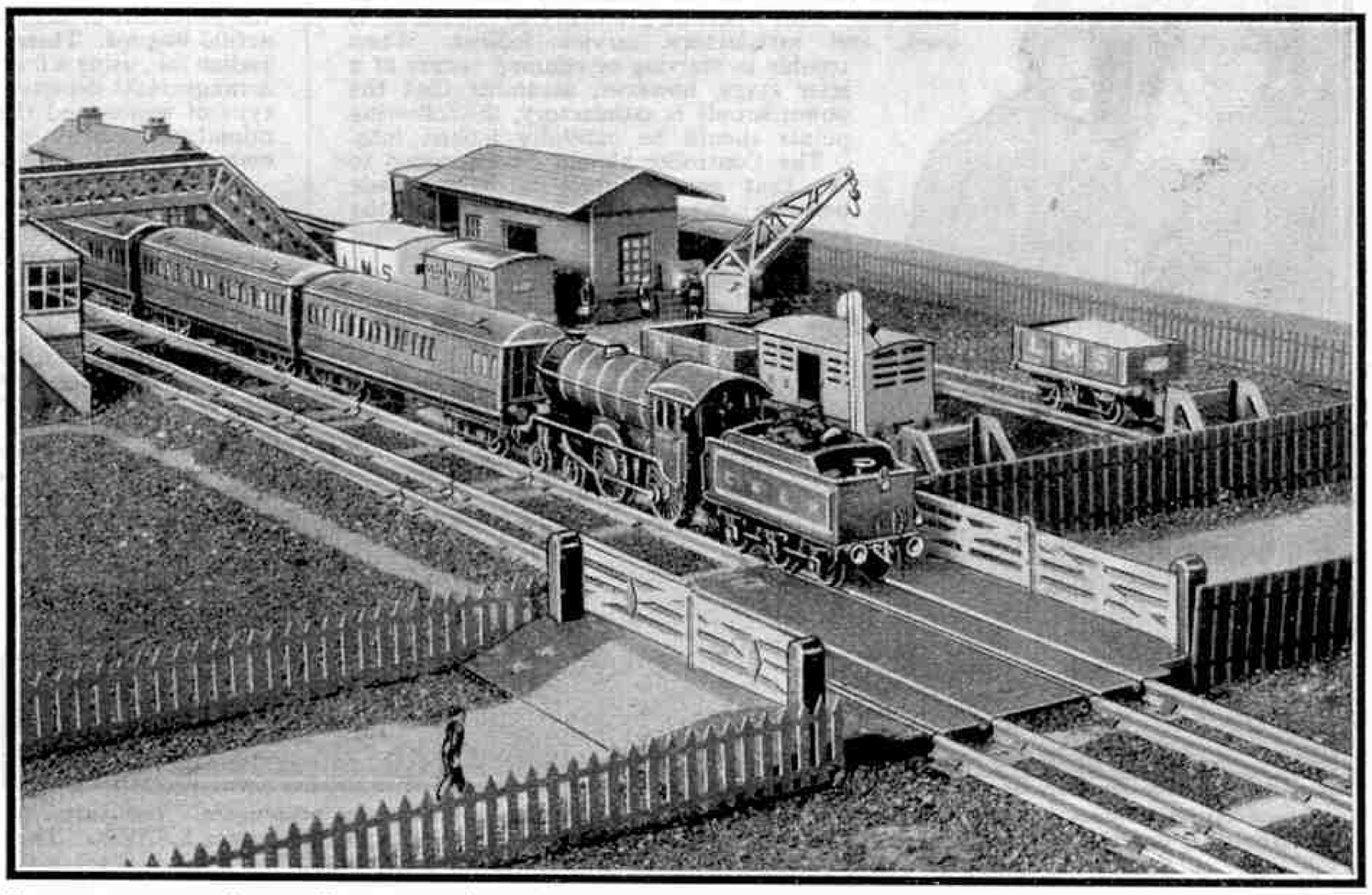
XXXIX.—HORNBY LOCOMOTIVES AND THEIR DUTIES

ONE of the greatest attractions of the miniature railway hobby is the great variety of problems that have to be considered in connection with it. It may seem simple enough to obtain a few rails, place one or two accessories near them, and run a locomotive and train upon the "layout" thus formed. This perhaps is the impression of those who know little or nothing of miniature railways. Fortunate owners of Hornby Railway systems of course know otherwise, and are kept fully occupied in seeing to the hundred-and-one different items that require attention in the layout, operation and development of their lines.

An examination of the different questions addressed to Headquarters by H.R.C. members would speedily show the variety of phases that the miniature railway owner must consider. Suggestions receive attention as far as possible on the H.R.C. "In Reply" Page, but a consideration of the queries that are received dealing with train operation and other general subjects is useful, and forms the basis of many of the articles in these pages. It will probably prove of interest, therefore, if a popular query is dealt with this month in the question of engine duties, not so much as regards the obvious purpose of the various locomotives, but the different tasks they may undertake in order to work the services in a satisfactory manner.

The duties for which different locomotives are suitable, and engine power generally, is an interesting subject. The types of traffic dealt with and the layout of the line itself of course affect to a certain extent the engines to be employed. Tank engines have received attention quite recently, so that we need not deal with them again except briefly. On layouts where express passenger traffic is a feature—and most boys want to operate in miniature the best-known trains of the four groups—a No. 3 or No. 2 Special Tender Locomotive is desirable. As regards actual power, there is for practical purposes no difference between them, as the No. 3 engines are now fitted with the same clockwork movement as developed for the well-known No. 2 Specials. It has great power and length of run, so that an engine fitted with it is well equipped for fast long-distance travelling.

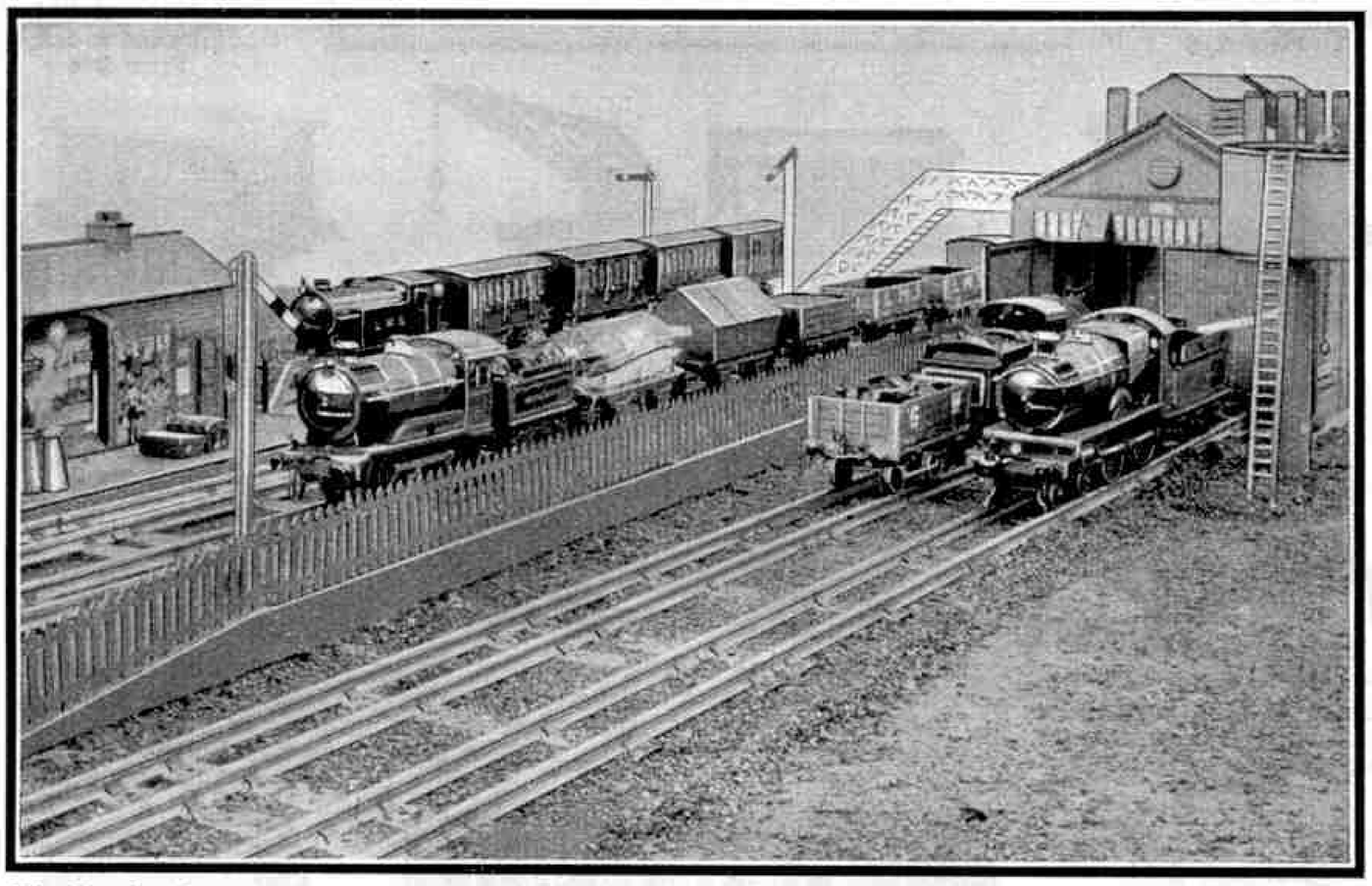
A difficulty arises on layouts where only a few important expresses are run, and if such engines were confined to these duties alone they would be idle for a great part of their time. It is fortunate, however, that the following of real practice enables us to overcome the trouble. The utmost service is obtained from locomotives in these days, so that even the most important express engines are to be seen on odd jobs, filling in their time between main line turns in a useful manner. Thus the working of empty coach trains from terminal stations to storage sidings can quite well be done by an express engine in between more important duties. Readers will remember how in the January "*M.M.*" a day's work of a Hornby Locomotive was described, and how one of its runs was made with a fast goods train. Before resuming passenger work the empty vans were taken out of the siding by this engine running tender first. One of our photographs shows a No. 2 Special Locomotive similarly engaged with empty coaches.



Express passenger locomotives may quite well be employed on various duties in order to fill in the time between main line turns. In this photograph a Hornby No. 2 Special Locomotive is running tender first with a train of empty coaches.

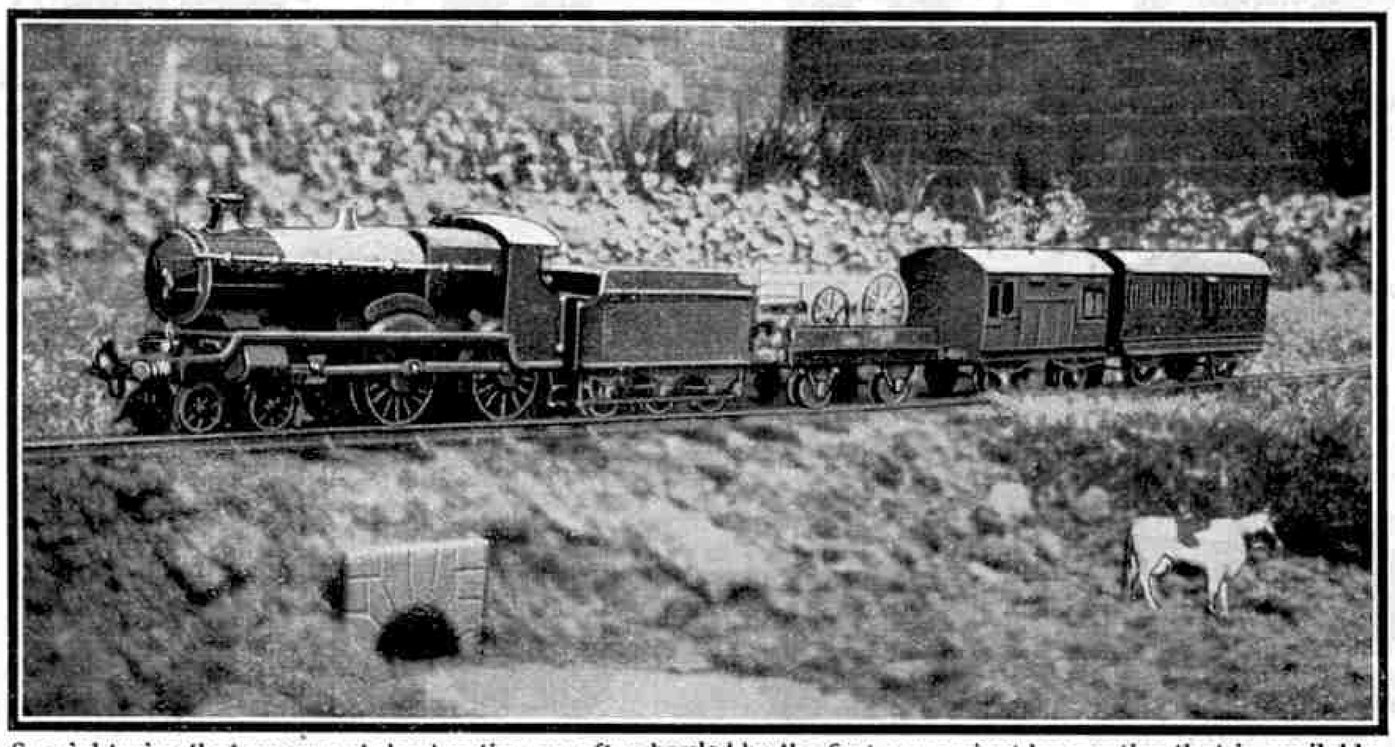
Express goods, parcel and perishable trains, of which large numbers are run in these times of rapid transportation, may of course be regularly hauled by passenger engines. Although the speed may be high compared with the ordinary goods or mineral train, the loads are not as a rule unduly heavy. Interesting trains of a special kind, which may be required to run at short notice, such as the "horse and carriage" train shown in another of our photographs, may also be hauled by such an engine if it happens to be convenient.

Similar remarks apply to the No. 2 Special Tank Locomotive, but particular reference has been made to tank locomotive duties previously. The special advantage of a tank engine is that it does not require to be turned at each end of the journey, though this is often done now in actual practice with large tank engines where time allows. An additional advantage on a Hornby layout is that the No. 2 Special Tank can be accommodated on the largest Turntable that is available in the Series—the No. 2—whereas to turn a No. 3 or No. 2 Special Locomotive and Tender, without parting them, requires a triangle junction to be included in the layout. It is interesting to remember, however, that the parting of the engine and tender in order to turn them has occasionally been carried out in actual practice owing to the turntables not being big enough to accommodate a large engine and tender complete. Incidentally it may be pointed out that whole trains may be turned right round by means of a triangle junction, so that such a formation is a useful feature, and is becoming very popular with H.R.C. members as they realise its value.



The Hornby No. 0 and M3 Tank Locomotives are shown at work in this photograph. The former engine looks very well at the head of the goods train passing the station, while the M3 Tank is engaged on branch line service.

As representing the "mixed traffic" type of engine that is so extensively used on our railways, the Hornby No. 1 Special Tender Locomotive is extremely useful. It is of compact design, and the simple wheel arrangement of both engine and tender enables them to run with great freedom, so that long journeys are often recorded. It can be accommodated on the No. 2 Turntable quite easily, so that no difficulty is experienced in dealing with it in the locomotive yard. Outside cylinders and dummy steam pipes, and its satisfactory power, make it up-to-date in character, and it is very suitable for miscellaneous duties. The same qualities are found in the newly-designed No. 1 Locomotive, but being smaller it is naturally less powerful. Typical British practice is followed in the No. 0 Locomotive, for this is of inside cylinder design, and except for lacking one pair of driving wheels, represents fairly well the characteristic goods engines of our railways. It is of course quite useful for passenger work, and its use thus will be quite in order. Goods engines, especially of older types, are quite often used for passenger duties, and they do some smart travelling on occasions. A No. 0 Locomotive in G.W.R. style is shown in one of the accompanying photographs on a goods train, and readers will notice that the engine suggests the real "2251" class of 0-6-0's that were introduced a year or two ago by the G.W.R. for medium-weight duties on main lines and branches. A railway that makes a feature of goods traffic should certainly possess one of these neat engines.



Special trains that are run at short notice are often hauled by the first convenient locomotive that is available. A G.W.R. "County" class 4-4-0 Locomotive is here shown on a "horse and carriage" train.

The No. 1 Tank Locomotive is included in the article on tank engines previously referred to, and as it is the tank equivalent of a No. 1 Tender engine, and bears the same relation to it as the No. 1 Special Tank does to the corresponding tender engine, detailed mention of it is not required. It should not of course be confused with the familiar No. 1 Tank of former years. The present No. 1 Tank is of new and up-to-date design, and like all locomotives now in the Hornby series is capable of very long runs.

For lighter work, where trains are frequent but made up to moderate weights, the M3 Tank is very useful.

As it is a tank engine a reversing mechanism of new design is fitted, and the No. 0 Locomotive in its latest form has also been brought into line in this respect with the other engines in the Hornby Series. For local branch work, too, the M3 Tank has its uses, and in one of our illustrations one of them can be seen employed on such duties. Probably the branch line on most layouts is composed of older rails than the main line—most likely 1 ft. radius curves that were originally in use would be employed if still in order—but if the rolling stock passing over the branch track is limited to four-wheeled vehicles, and the M3 Tank is in use, satisfactory service will be obtained. The engine has a wheelbase of moderate length, and as no coupling rods are provided it negotiates sharp curves quite freely. Such an engine can be very usefully employed on almost any layout and, where several of them are in use, they can be easily stabled, for they are of compact design and take up little room. Four of them can be accommodated in a No. 2 Engine Shed.

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**



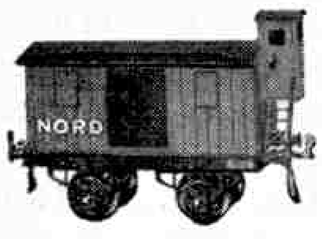
PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/6**



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



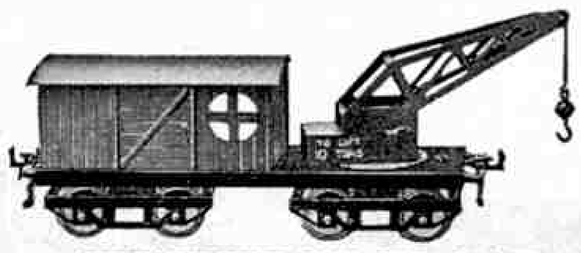
OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/6**



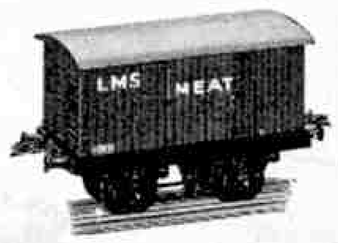
BRAKE VAN (Fr nch Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**



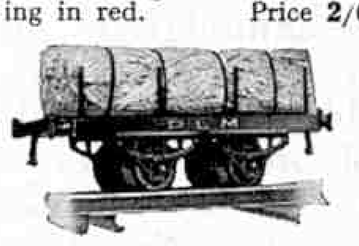
BANANA VAN
An attractive model, finished in yellow and green. Price **3/-**



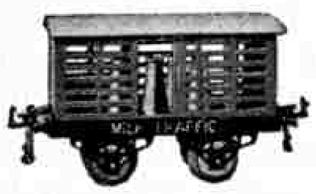
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**



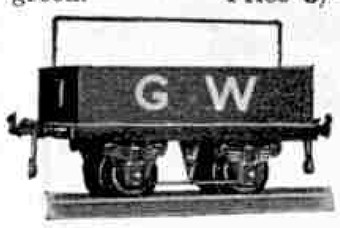
MEAT VAN
This is a very realistic model. Available lettered L.M.S. only. Price **2/6**



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



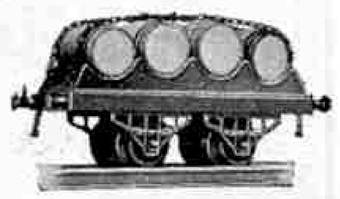
MILK TRAFFIC VAN No. 1
Fitted with sliding doors. Complete with milk cans. Price **3/-**



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



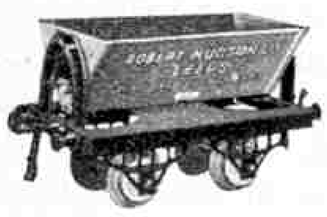
MITROPA COACH No. 3
Lettered "Mitropa," with either "Spiesewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **15/6**



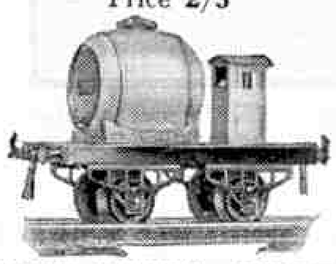
BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/9**



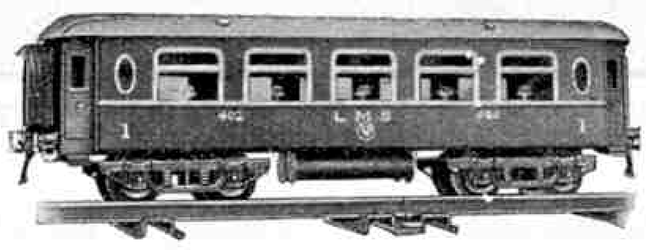
GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**



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/-**



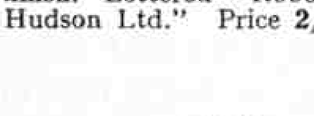
No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**



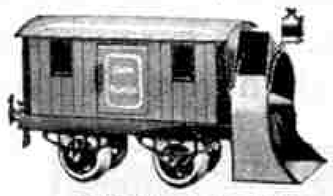
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/-**



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



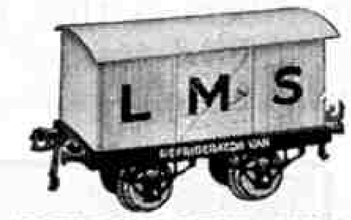
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



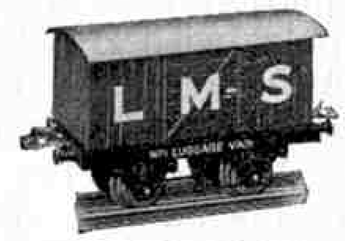
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



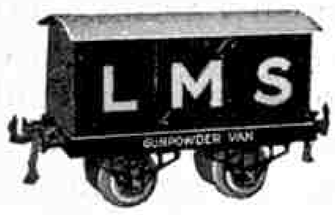
HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/-**



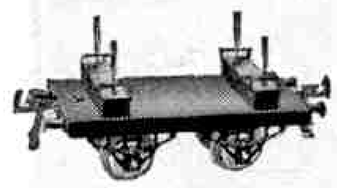
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/-**



***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**

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

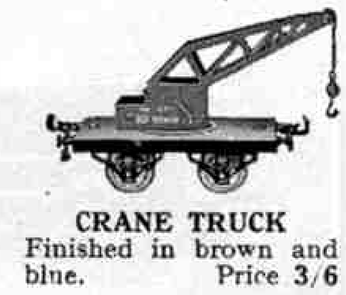
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**



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**



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/-**

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.*

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

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. he name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

"MISSING LINKS"

The custom of providing names for locomotives dates back even to before the days of the primitive "*Rocket.*" Many of the early locomotives bore names such as "*Fury,*" "*Planet,*" "*Comet,*" "*Globe,*" and "*North Star.*" To-day the majority of express passenger engines carry names. The G.W.R. and former L.N.W.R. always made a feature of naming their engines, but the L.N.E.R. and S.R. did not consider the matter seriously until some time after grouping, although the North British, Great Central and L.B.S.C. railways had numbers of named engines. Some of the L.N.E.R. "Pacifics" bear names suggestive of speed, such as "*Felstead*" and "*Colorado,*" the names of famous racehorses. The S.R., a line that carries a great amount of Naval traffic, has given appropriate names to its locomotives such as "*Lord Nelson,*" "*Sir Francis Drake*" and "*Howard of Effingham.*"

5--4	D-l--n.	-9-0	-la-d H--ilt--.
-004	L--ns-e-ha- -a-t--.	-91-	L--d -a--r.
4--5	C--do--r --l-.	-4-5	G--- S--an.
8-1	S-- --a-c-s -ra--.	-063	-a-h -b--y.
2-6	H--t-o--s-i--.	-5-	--- -ed -ni--t.
-53-	B-r--g-ri-.	-11-	-ren-di-- -u-rds-a-.
5--8	-ar-.	-019	K--g-- T--p-ar.
-563	Wi--i-- -hi-el--.	5---	W-n-e-m-r-.
-4-7	-a-k--w.	-837	C--nt- -- St---or-.
-4-4	B--ch- H---.	-42-	-o-th -or-l-n-.
2-6	L--c-s---e.	-80-	-an-r--gh--.
-7-	--r P--an--s.	-32-	-t-ph-n-o-.

The study of locomotive names and numbers is a hobby in which all H.R.C. members take an active part, and among the most enthusiastic members there is keen competition to see who can collect the largest number of names and numbers in a given time.

Name and number contests have been announced in these pages before, and have proved very popular as there are not many railway enthusiasts who do not take an interest in this very fascinating hobby. For our competition this month we have picked the names and numbers of 24 locomotives. These are shown in the panel on this page, but some of the letters and figures have been purposely omitted. The missing letters have been indicated by a "dash." Competitors are required to decipher the names and numbers represented and to give also the wheel arrangement and owning railway company.

To the senders of the four most complete and correct entries received in each section—Home and Overseas—will be awarded Hornby Railway material (or Meccano products if preferred), to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be given. Only one sheet of paper should be used on the reverse side of which must appear the competitor's name, H.R.C. membership number and full address. Enthusiasts who are not members of the H.R.C. are not allowed to compete. Non-members who wish to secure one of the prizes should obtain an application form for membership from Meccano Ltd., and become a member at once.

Envelopes should be marked H.R.C. "*Missing Links*" Contest and posted to reach H.R.C. Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st March. The Overseas closing date is 30th June.

A Station Layout Contest

The planning of layouts is one of the most important phases of miniature railway work, and it is certainly one of the most interesting. In the majority of cases lack of space is a handicap, so that to secure as far as possible the desired results the economical use of track is necessary.

With this in mind we have decided to hold a Station Layout Contest. Competitors are required to draw up a plan for a Hornby passenger station consisting of two main line platforms. Loop lines and sidings may be shown. An Engine Shed and Turntable must be included, and they must be accessible from all tracks. The length of the layout must not exceed 8 ft. and the width should be no more than 3 ft. 6 in. Drawings should be made to scale as far as possible.

To the senders of the four best entries received in each section—Home and Overseas—Hornby Railway material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– will be awarded respectively. In addition a number of consolation prizes will be given.

Envelopes containing entries should be clearly marked H.R.C. "*Station Layout Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st March. The closing date for the Overseas Section is 30th June.

Painting Contest

It is a considerable time since we held a painting contest on this page, and during recent months we have received many requests from H.R.C. members for another contest of this nature. We have pleasure, therefore, in announcing a Painting Contest this month. The subject that has been chosen is "*A Goods Train.*" All members are familiar with the sight of a goods train and the subject should prove a popular one.

To the senders of the four best entries received in each section—Home and Overseas—prizes consisting of Hornby Railway material (or Meccano products if preferred) to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded. In addition to these a number of consolation prizes will be given to those boys whose work shows neat and painstaking efforts.

On the back of each entry the sender's name and full address must be shown. All entries must bear the competitor's H.R.C. membership number, omission of which will result in disqualification.

Envelopes containing entries must be clearly marked H.R.C. "*Goods Train Painting Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st March. The closing date for the Overseas Section is 30th June. Entries received after these dates cannot be entertained.

COMPETITION RESULTS

HOME

December "Christmas Loco Contest."—The following four members were successful in gaining the principal awards consisting of No. 2 Special Locomotives and Tenders :—K. E. Milburn (26029), Chingford, London, E.4. K. Costain (5108), Bolton, Lancs. D. A. Smith (7576), West Bromwich and P. A. Vicary (25935), Cromer, Norfolk. **The following members were awarded consolation prizes to the value of 10/- each :**—W. J. Young (9656), Salford, Lancs.; J. Everitt (542), Norbury, London, S.W.16; D. M. Henderson (23466), King's Heath, Birmingham; J. Robertson (3408), Perth; E. A. Taylor (25924), North Harrow, Middx.; J. T. Trotter (11447), West Dulwich, London, S.E.21; J. H. Owen (25954), Radford, Coventry; J. Aylard (25864), Southgate, London, N.14; R. C. Storrar (8625), Letham Ladybank, Fifeshire, Scotland; A. S. Taylor (17088), Winchmore Hill, London, N.21; E. W. Russell (2361), Streatham, London, S.W.16; E. L. Price (13490), Harrow, Middx.

December "Railway Joke Contest."—First: M. H. Duncan (5176), Sandicove. Second: L. E. Copeland (20208), Herne Hill, London, S.E.24. Third: J. S. Hill (12629), Edinburgh. Fourth: C. C. O. Young (24182), Bedford.

OVERSEAS

September "Hidden Stations Contest."—First: D. J. White (9333), Dunedin, New Zealand. Second: W. G. Hallack (17578), Capetown, S. Africa Third: B. J. Laidlaw (21410), Johannesburg, S. Africa. Fourth: J. G. Gnanadurai (1964), Trichinoply, S. India. Consolation Prizes: W. Reeve (9192), Hobart, Tasmania; H. D. Webber (8853), Johannesburg, S. Africa; W. L. Butler (17411), Capetown, S. Africa; J. A. Coates (23863), Verdun, Que., Canada; B. Chiles (9191), Port Elizabeth, S. Africa; H. C. Key (24764), Entally, Calcutta; A. Arthur (24176), Sydney, Australia; W. Fagg (8557), Milton, Otago, New Zealand; A. Schwartz (24271), N. Rhodesia, S. Africa.

September "Locomotive Drawing Contest."—First: A. C. Davies (23637), Darlington, Western Australia. Second: S. D. Kurlawala, Tardeo, Bombay, India. Third: D. J. White (9333), Dunedin, New Zealand. Fourth: D. Adams (17401), Roseville, Sydney, Australia.

HORNBY TRAINS

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES

M2930 Locomotive	1/–
M0 Locomotive	1/4
M1/2 Locomotive No. 3031	2/3
No. 0 Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera " Blue " Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera " Blue " Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/–

OBSOLETE TYPES

George V Locomotive } These models were identical	3/3
No. 00 Locomotive } These models were identical	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan H.V. Locomotive	20/–



A keen Hornby Train enthusiast operating a Hornby No. 2 Special Locomotive, L.N.E.R. "Yorkshire."

Boys! Exchange your old Hornby Locomotives for magnificent new models

Thousands of Hornby Train enthusiasts have already taken advantage of our wonderful Part Exchange offer and are now the proud owners of brand new Locomotives in place of their old ones. They realise that the Hornby Part Exchange Scheme represents the finest and most generous offer ever made to owners of Hornby Locomotives.

Perhaps you, too, have a Hornby Locomotive that you have been using for some years and would now like to exchange for one of the fine new models featured in the latest Hornby Catalogue. If you have you should carefully study the range shown in the catalogue, and select the up-to-date Hornby Locomotive you want. Then, carefully pack up your old Hornby Locomotive and post it to us, enclosing your order for the new one and the necessary remittance. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the accompanying list from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase.

If you prefer to do so, you can effect the exchange through your dealer, who will be pleased to give you all the information you require.

The allowance that will be made for your old Locomotive is shown in the list of Part Exchange allowances for Hornby Locomotives given on this page. Please note that the catalogue price of the new Hornby Locomotive you purchase *must not be less than double the Part Exchange allowance made for your old Locomotive.*

No matter what the age or condition of your old Locomotive, you can exchange it under our "Part Exchange" plan. It is important to note that we cannot accept more than one old Locomotive in exchange for a new Locomotive.

If you decide to send your old Locomotive to us address your parcel to "Special Service Department, Meccano Limited, Old Swan, Liverpool," and be sure to enclose with it your own name and address written in plain characters.

What you have to do

Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose one of the new Locomotives, the cost of which is not less than 12/6 (or, in other words, not less than double the Part Exchange allowance we make for your No. 1 Tank Locomotive).

You decide, say, to have a No. 2 Special Tank, the price of which is 25/–. Pack up your old No. 1 Tank and deduct 6/3 from 25/– (the price of the new No. 2 Special Tank), enclose a remittance for 18/9 plus 1/– carriage on the new Locomotive—19/9 in all. Send the Locomotive and the remittance to Meccano Limited, Liverpool.

Alternatively, you can take your old No. 1 Tank Locomotive to your dealer with a remittance for 18/9, and he will give you the new No. 2 Special Tank Locomotive that you require.

MECCANO LTD.
Special Service Dept., Old Swan
Liverpool

Trains and their Names

Coach Roof Boards in the Hornby Series

By "Tommy Dodd"

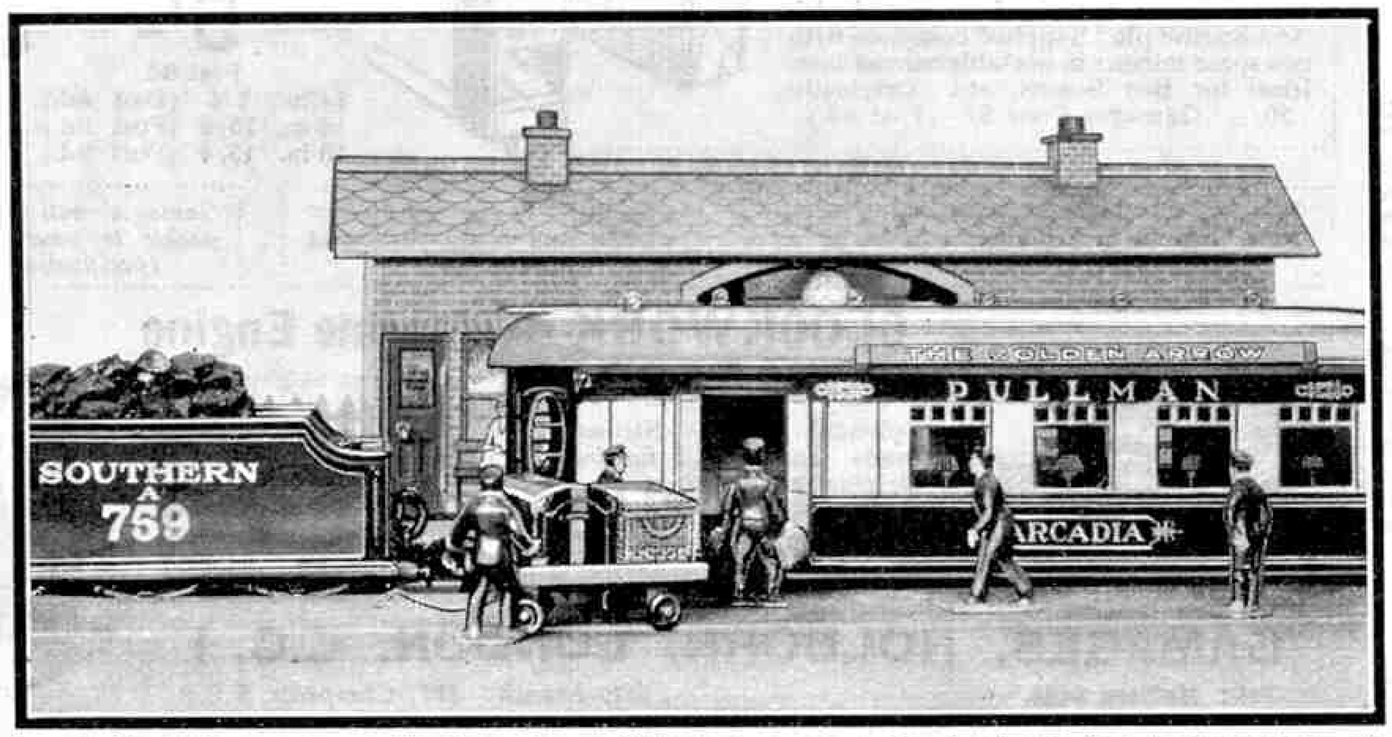
THE majority of "*M.M.*" readers would probably find it difficult to imagine their favourite express locomotives, and the crack trains drawn by them, undistinguished by names, with the number of the engine and the departure time of the train as the only means of referring to them. For instance, a few years ago the 11 a.m. went out of Waterloo for the West headed by, perhaps, locomotive No. 736. Now the same train has become the "*Atlantic Coast Express*," the engine bears the name "*Excalibur*," and the interest in the train has correspondingly increased. The reason is that the "11 o'clock" and "No. 736" sound extremely matter-of-fact, whereas the "*Atlantic Coast Express*" attracts attention at once, and we have visions of golden sands washed by the broad Atlantic rollers.

The naming of trains has been given a great deal of attention in recent times, not only in England, but also on the Continent and in America. There is little doubt as to the advertising value of a smartly-kept train of modern vehicles of uniform build, bearing a suitable name associated with the destination or districts served. If the locomotive also is named, the effect is complete. As indicating the purpose of the trains concerned, such titles as the "*Norfolk Coast Express*" of the G.E.R. and the "*Cornish Riviera Express*" of the G.W.R. are good examples, and were adopted early in the present century by the companies concerned. Similarly effective was the "*Lothian Coast Express*" of the N.B.R. Each of these trains actually carried its title, the last-mentioned title being displayed upon the engine also.

The chief expresses of all our railway groups now bear names, and the titles chosen are on the whole pleasing and effective. "*The Royal Highlander*" of the L.M.S.R. and the "*Aberdonian*" of the L.N.E.R. immediately impress themselves upon the memory even of the most uninterested traveller. Of all the named trains of the present day, the best known is "*The Flying Scotsman.*" Although the title has been adopted officially only during comparatively recent years, the name has always been a byword for comfortable and convenient service, and of course additional interest is now aroused by the non-stop running over the 392.7 miles to Edinburgh in the summer.

Particularly appropriate are the G.W.R. train names. The "*Cornish Riviera Express*," "*Torbay Limited*," and "*Cambrian Coast Express*" speak for themselves, and imply all the good qualities of English rail travel. For those visiting the Continent the S.R. provide luxurious travel by "*The Golden Arrow*," and this striking title, together with the points served—"London and Paris"—appears upon the coach roof boards.

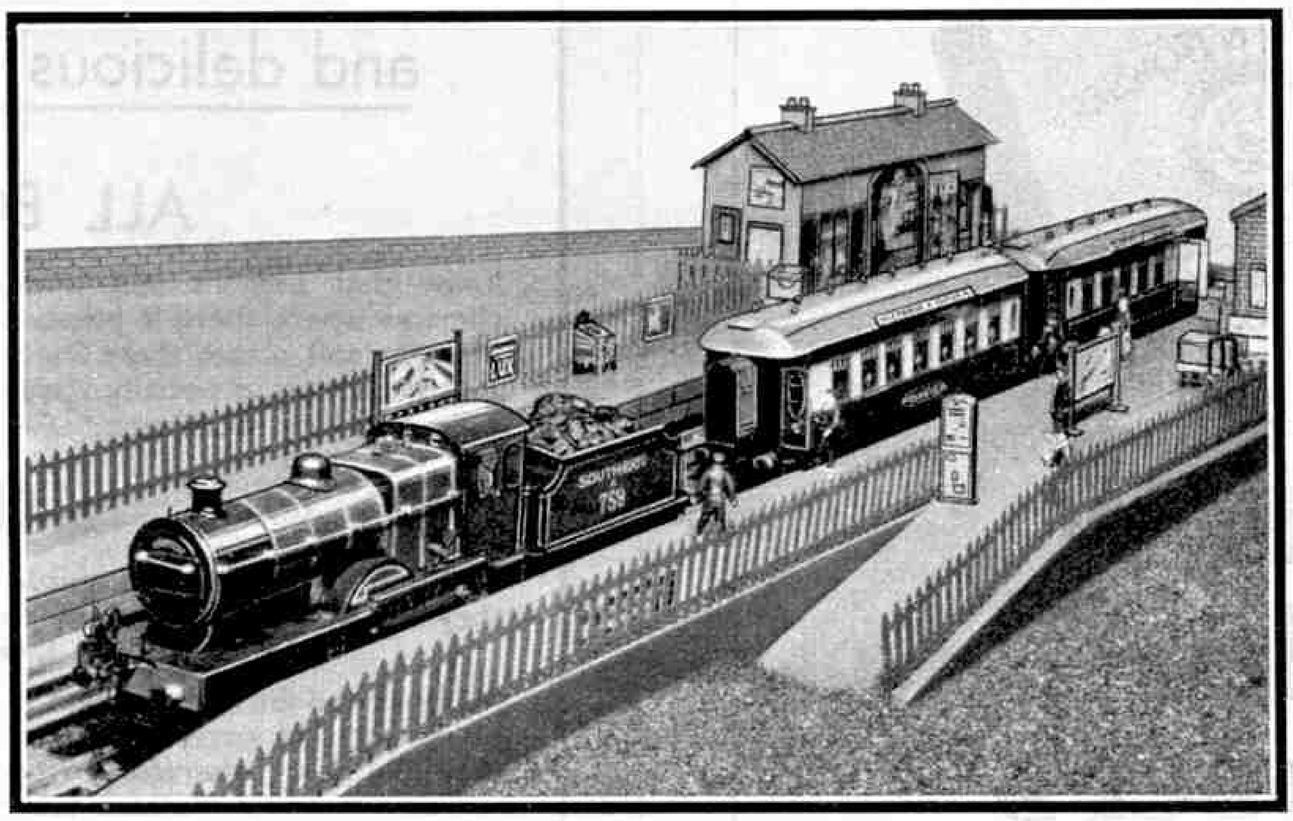
In order to enable Hornby enthusiasts to label their trains in real railway-like fashion, there have been introduced a series of Hornby Train Name Boards and Destination Boards, the style of which is shown in the accompanying illustrations. These Boards are designed to be attached to the No. 2 Pullman and Saloon Coaches and the No. 2 Special Pullman and Composite Coaches. The principal expresses of the four groups are represented, so that their miniature counterparts may be appropriately named. These 16 varieties of Boards are available in packets containing four of a kind.



A realistic platform scene. The importance of the train accounts for the bustle that is displayed by the miniature figures, and the effect is completed by the title displayed upon the Roof Boards.

The Boards are attached to the latest type of No. 2 Special Pullman Coaches by means of brackets fitted to the coach roof. In order to enable owners of older Pullmans to make use of the Boards, special Clips are available in packets of one dozen. These are made in two varieties, one for the No. 2 Special Pullman Coach and Composite Coach, and the other for the No. 2 Pullman and Saloon Coaches.

The attachment of the former pattern is effected in the following manner. The coach roof is first removed by gentle upward pressure of the thumbs, and turned upside-down. One of the clip attachments is applied to the roof, so that the right-angle bend at one end of the Clip is hard up to the gutter or edge of the roof. The flat central portion of the attachment is then gently pressed with the thumbs so that it follows the curve of the inside of the roof. If this is done carefully the bent portion of the other end of the attachment will slip into position under the other edge of the roof. This is carried out in the same way for the second attachment at the other end of the Board.



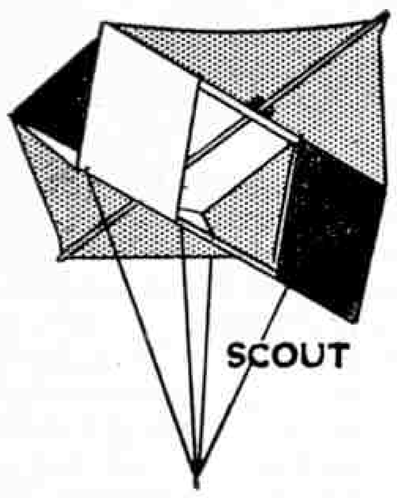
A Hornby Locomotive backing on to its train. The Destination Boards indicate clearly the points served by the train. In this and the picture above the separate Clips that are now available are used for the reception of the Boards.

Care must be taken to see that the Clips are right way round; that is to say with their open ends facing the centre of the coach; and that they are in the right position lengthways for receiving the Board, which should be tried in them. The roof is replaced and the Clips are bent round the edge of it. The second pattern of Clips, for the No. 2 Pullman and Saloon Coaches, are slightly different. The coach roof should be removed by unscrewing the brass ventilators. The Clips are laid across the sides of the coach in the correct position lengthways as before, with the Clips pointing downward. The roof is then attached, and the ventilators are screwed up again. The portions of the Clips projecting should be turned up over the edge of the roof.

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GAMAGES

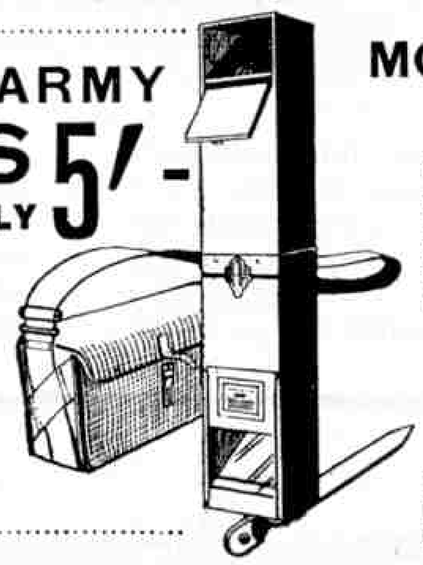
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The SCOUT KITE

A strongly made Kite at a rock-bottom price. Size 29 in. Price **2/6** 36 in., **4/6**; 46 in., **7/6** (Post 6d.). Post 4d.

BOYS! REAL EX-ARMY PERISCOPES 5/- FOR ONLY



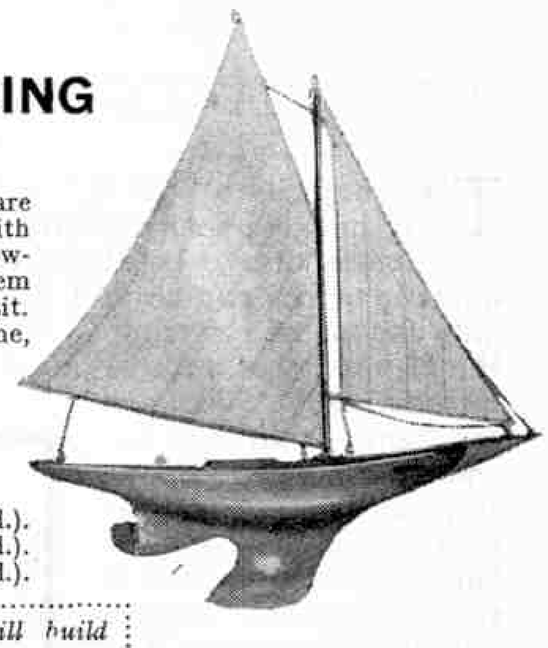
Every boy is fascinated by the Periscope. And now is a chance to secure the "real thing" at an amazingly low price. These instruments are ex-Army stock. Strongly constructed in wood case, with optically corrected mirrors and prism. Fitted with steel ground pin. Supplied complete with two spare mirrors in portable canvas case. Ideal for Boy Scouts, etc. Originally 50/-. Gamages Price **5/-** (Post 6d.)

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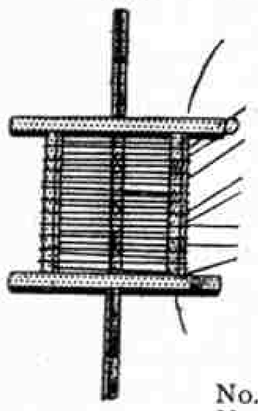
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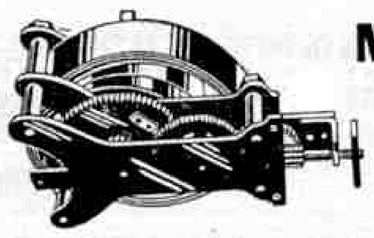


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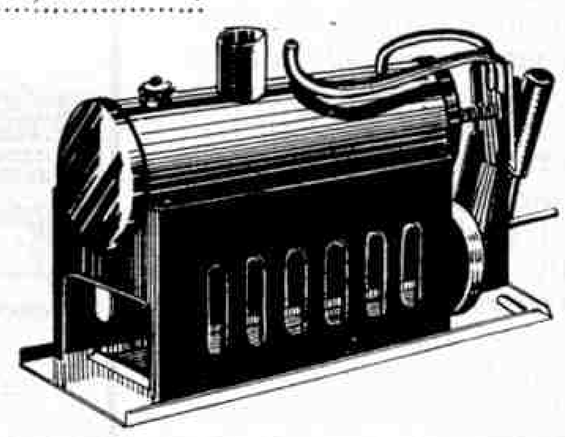
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know that Lemons and Oranges are grown in pleasant climates where there is plenty of sunshine, which, combined with the soil, makes these fruits what they are, full of health-giving qualities, especially vitamins, without which we cannot grow and be strong. All boys (and all girls, too)

LIKE

fresh Lemonade and Orangeade made from Kia-Ora because they know Kia-Ora is made from the finest of fresh fruit and Tate and Lyle's cane sugar.

All Boys and Girls know that it is only necessary to add five or six parts of water to one of Kia-Ora to make the drinks they like best; therefore, when Mother is ordering Squash please ask her to say

KIA-ORA

Sold Everywhere

Large Bottles, 1/11. Full Half Bottles, 1/-

KIA-ORA LTD., Blackfriars, S.E.1



HOT ON THE SCENT

Maid: "Please, ma'am, the gorgonzola cheese has run out."

Irritable old Lady: "Well, why don't you chase it?"

* * * *

Stern Father: "Billie, I should like to spend a whole day without once scolding or punishing you."

Billie: "Well, father, you have my consent to do so."

* * * *

"Don't forget to notice the correct time when you pass the station."

"I can't, I haven't a watch."

"That's no excuse, write it down on a piece of paper."

* * * *

The country visitor was in the village general store and noticed that one of the customers was treated with particular courtesy, not only by the shop-keeper but also by the rest of the customers.

After the man had gone, the visitor made inquiries about him.

"Oh, he's our scarecrow designer," said one inhabitant.

"But why treat him with such courtesy?"

"Because he's such an expert," was the reply. "Why, one of his scarecrows frightened all the crows in the neighbourhood so much that they brought back all the corn they had stolen the previous week."

* * * *

Constable: "I distinctly saw you put out your left hand, miss, and then turn to the right."

Lady Motor Cyclist: "Ah, but you see I'm left-handed!"

* * * *

Coal Merchant: "Did you find any dust in that bag of coal you bought from me last week, ma'am?"

Customer: "I found some coal in that bag of dust, my man."

* * * *

"Will you have another piece of cake, Tommy?"

"No, thank you. Mother says I don't want any more."

* * * *

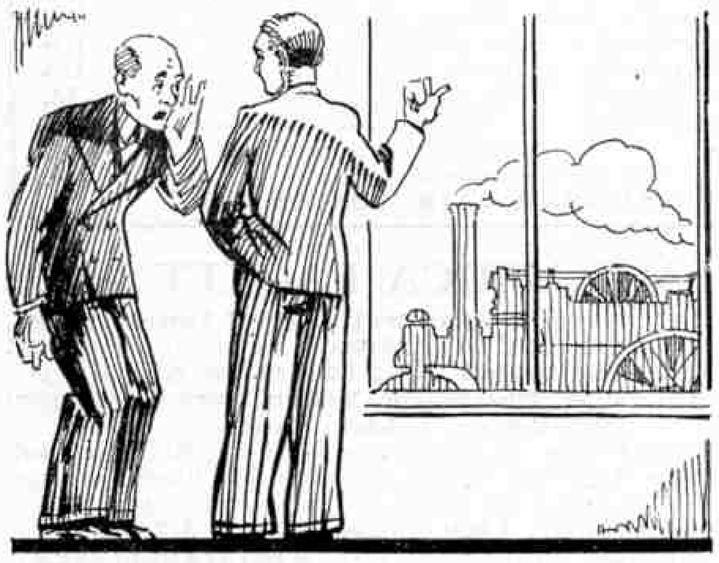
The "dear old lady" was in conversation with the lion tamer who had just had some trouble in quelling a number of his charges that had become restless.

"You must find your job awfully trying," she said.

"Yes, I do, ma'am," admitted the trainer. "What with my bronchitis and these draughty cages, I often think the game's not worth the candle."

* * * *

QUITE SPOILED



Brown: "I'm sorry to annoy you, but I think your boy is spoiled."

Evans: "Not a bit of it. You don't know what you're talking about."

Brown: "All right, if you don't believe me, come out here and see what the steam roller has done to him!"

* * * *

"Please Mr. Timkins, father says will you please lend him your fishing rod?"

"Why, I didn't know he was a fisherman."

"He's not, but our drain-pipe is blocked up with leaves!"

A SLIPPERY RACE

Teacher: "Willie, tell me what is understood by the Yellow Peril."

Willie: "Please, sir, a banana skin on the pavement."

* * * *

George's 21st birthday party had been a great success and before going to bed George's father was talking to him about his responsibilities.

"Now you are of age, you should help me," he said.

"Certainly, father," replied George. "What would you like me to do?"

"Well, to begin with you can pay off the last two instalments on your baby carriage!"

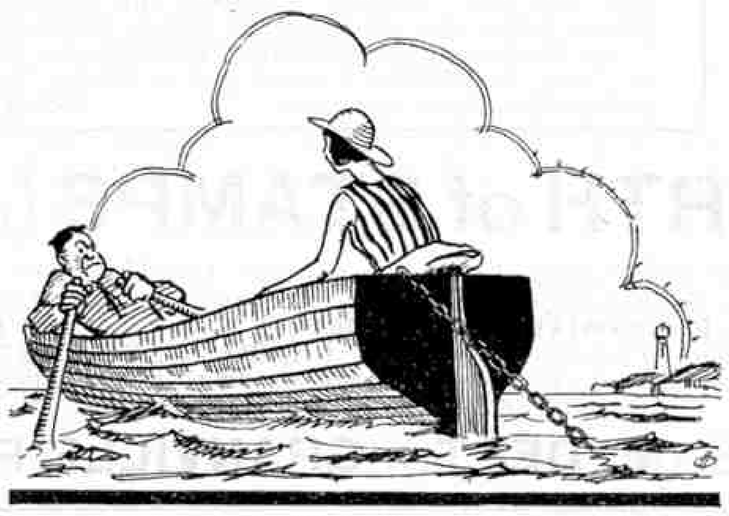
* * * *

"'Ow do you like your new neighbour, Mrs. Smith?"

"Oh, she's all right but she's 'aughty, and if there's aught I do 'ate its 'aught."

* * * *

AN IMPORTANT DETAIL



"I never saw anything like this tide," said he. "I've been pulling steadily for ten minutes, and we don't seem to have moved a foot!"

"Oh, Bill," said his companion, "I've just thought of something. The anchor fell overboard a little while ago, and I forgot to tell you!"

* * * *

Jim had suffered from a bad cold for several days and his friend Jack had advised him to sleep with his window open.

"Well," he said, when the two met, "Did you take my advice?"

"Yes," replied Jim.

"And have you lost your cold?" demanded Jack.

"No, I haven't, but I've lost my watch and my pocket book."

* * * *

Sambo had joined a debating society and the day after his first meeting he was being questioned by his friends.

"What was de subject ob de debate, Sambo?"

"De subject were, 'What is de most benefit to mankind, de sun or de moon?'" replied Sambo.

"And which side did you uphold?"

"De moon's. I jes' argued dat de sun shines by day when we doan' need de light, but de moon shines by night when dat light mos' certainly am needed. An dey couldn't answer dat, sah!"

* * * *

Schoolmaster: "I am sorry to say, Mrs. Brown, that your son cannot be made to stop talking."

Mrs. Brown: "I'm afraid you will have to forgive him for that. When he was a baby he was accidentally vaccinated with a gramophone needle."

* * * *

Willie's birthday was approaching.

"What will you get me for my birthday, mother?" he asked.

His mother lost her patience. "Anything to keep you quiet" she snapped.

"Well, then, buy me a drum," said Willie

* * * *

The actor had been entertaining some friends at a hotel and had been very annoyed by the slowness of the waiter.

When the bill was brought the actor presented the exact amount, plus one halfpenny.

"You've made a mistake, haven't you, sir?" inquired the waiter. "This is a halfpenny."

"No, it's quite right," replied the actor. "I never give less."

A COLLECTOR OF LEATHER EDITIONS

Prison visitor: "I feel so sorry for you, my man. What brought you to this?"

Convict: "Only my love of books, ma'am."

Visitor: "Your love of books?"

Convict: "Yes, ma'am, I always did like a good pocket book."

* * * *

A little boy who had swallowed a coin had been X-rayed and the coin had been located. He was sent home and his mother given dietary instructions and told to bring him back to the hospital in a few days' time.

At the end of a fortnight the mother had not reappeared and a nurse was sent to her house to enquire about the boy.

"Well, nurse," said his mother, "when I got 'ome I went through my purse again and found that it wasn't a shillin' as Jimmy had swallowed. It was only a halfpenny, and I didn't think it was worth worrying about such a small coin."

* * * *

Waiter (affably): "These are the best eggs we've had for years, sir."

Diner: "Take them away then and bring me some new ones."

* * * *

"Why aren't you still a member of the choir, Willie?"

"I had a cold one Sunday and so couldn't go to church, and someone asked if the organ had been mended."

* * * *

Mistress: "You're a long time filling that pepper box Bridget."

Bridget: "Yes, mum, you see it's such a terrible job getting the pepper through the little holes at the top!"

* * * *

Private Murphy was the giant of the regiment, and was much taller than the sergeant-major.

"Heads up, there, Murphy," shouted the sergeant-major one day when the men were on parade. "That's better. Now don't let me see you again with your head down."

Murphy was annoyed. "Am I to be always like this," he demanded, staring away over the sergeant-major's head.

"Yes," said the sergeant-major.

"Well, then," said Murphy, "I'd better say good-bye to ye. I'll never be seeing yez again."

* * * *

ONE VICTIM HAPPY!



Kind Old Gentleman: "What are you crying for, my little man?"

Little man: "A tramp stole my brother's spade just now."

"But he didn't steal yours, did he?'

"No, sir."

"Then why are you crying?"

"Because I've got to clear the snow away all by myself, now."

* * * *

Professor: "Waiter, I thought I ordered a pork chop half an hour ago. Have you forgotten it, have I had it, or didn't I order it?"

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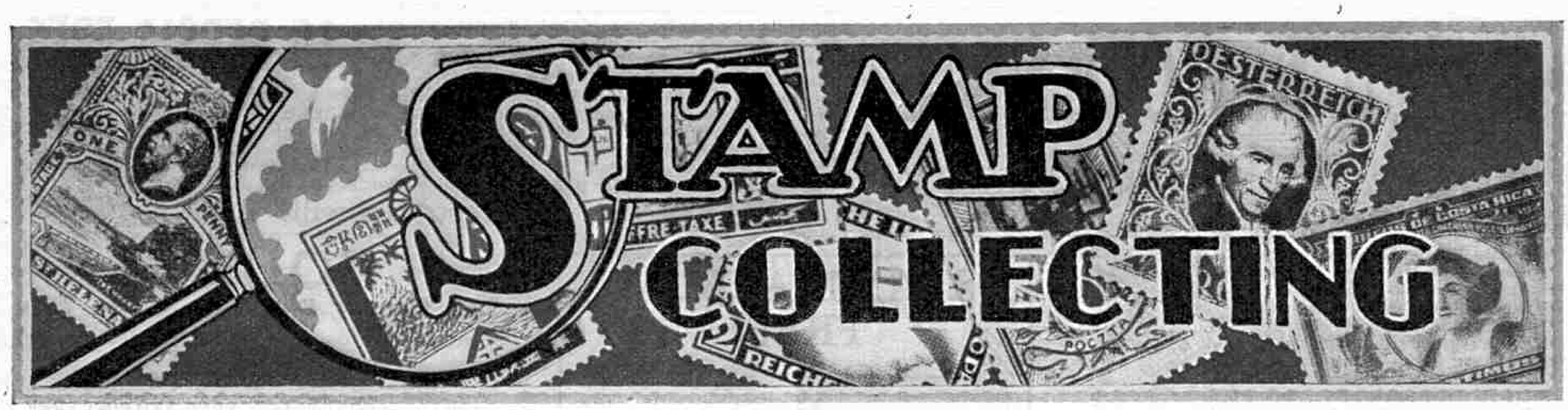
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BRITAIN'S OLDEST COLONY

NEWFOUNDLAND is probably better known to young stamp collectors as the jumping-off point for many famous air flights than as Britain's oldest colony, but it became British territory as long ago as 1497, a year before Columbus discovered the mainland of the New World. Its discoverers were John Cabot and his son Sebastian, who set out from Bristol on the good ship "*Matthew*" with a crew of 17 men, to find a North-West passage to China. They crossed the Atlantic in their 50-ton vessel in 50 days and, locating this great new island, became the first white men to set foot upon the North American continent. On his return home, John Cabot reported this "new founde land," and Newfoundland it has remained to this day. From the first the English exercised the chief authority along the coast, but it was not until 1583 that Britain formally took possession. The ceremony of annexation at St. Johns, the capital of the island, performed in the Queen's name by Sir Humphrey Gilbert, half-brother to Sir Walter Raleigh, is believed to have taken place at the spot where there now stands Newfoundland's memorial of the Great War, which, by the way, is illustrated on the 10c. stamp of Newfoundland's "publicity" issue of 1928.



For many years past Newfoundland stamp issues have enjoyed great popularity with stamp collectors, and the newest issue, with which we propose to deal in this article, is a worthy successor to the many splendidly produced sets that have preceded it. It has one special claim to fame, however. Included among its designs is the first stamp portrait of Princess Elizabeth, the five-year-old daughter of the Duke and Duchess of York. This very charming portrait appears on the 6c. stamp, 12 copies of which were presented to Her Royal Highness on New Year's Day, the day on which the issue appeared in Newfoundland.

Three other new Royal portraits are included in the issue, the head of H.M. King George, flanked with laurels, appearing on the 2c. stamp; a simple but excellent medallion of H.M. Queen Mary on the 3c., and H.R.H. The Prince of Wales on the 4c. stamp. In this portrait the Prince is shown in his uniform as Colonel of the Welsh Guards. It is undoubtedly the best stamp portrait of the Prince that has yet appeared on any British issue.

The full set of stamps comprises 12 issues, and the remaining stamps are representative of the Dominion's primary industries and the features of its communal life. Thus the design of the 1c. stamp shows a net full of cod fish, the source of the greater part of Newfoundland's wealth. Incidentally, in its inscription, the stamp pays further tribute to the important part that the fisheries have played in building up the Dominion's prosperity. In this inscription the cod fish is described as "Newfoundland currency."







Very shortly after his arrival in Newfoundland, Cabot was struck by the vast quantities of fish in the surrounding waters. On his return to England his glowing report of the possibilities attracted considerable attention, and led to the foundation of Newfoundland's present great position among the fish-producing countries. The first commercial exploitation of Newfoundland's fisheries was in 1502, and to-day more than 1½ million quintals (1 quintal = 112 lb.) of fish products, valued at over 2½ million pounds sterling, are exported each year. Besides the cod, Newfoundland produces herring, salmon, haddock, halibut, turbot and trout, and it may safely be said that the greater part of the population is engaged in some branch of the fishing industry. The sailing of the fishing fleet from St. Johns is depicted on the 30c. stamp, the highest value of the set.



Next in importance to the cod fishing is the sealing industry. The Hair Seal, valued principally for its oil and leather, is found in large numbers on the ice-floes to the north during the months of March and April, and some 200,000 seals are killed every season by a small fleet of sealing steamers working from St. Johns. A specimen seal—a baby whitecoat—is shown on the 15c. value, while the departure of the sealing fleet is taken as the subject of the design of the 25c. stamp.

St. Johns is the capital city of the island, and tradition has it that Cabot named it so because it was upon 24th June, the festal day of St. John, that he sailed into this natural harbour. That may or may not be so, but there is no gainsaying the magnificence of the landlocked harbour and its striking approach. As the inbound steamer approaches the shore, a narrow opening suddenly appears in the rocky wall, as if some convulsion of nature had rent the rampart asunder and the sea had rushed in. Hills from 500 ft. to 600 ft. in height stand guard on each side of this opening, and as the vessel glides between them the traveller raises his gaze, not without a feeling of awe, to an almost perpendicular precipice 300 ft. in height on his right, above which rises the crest of Signal Hill, 510 ft. above the level of the sea. Here stands the Block House, where vessels approaching the harbour are communicated with by signal and guided safely into the Narrows.

The Block House is part of the magnificent Cabot Tower, Newfoundland's memorial to John Cabot, illustrated on the 9c. value of the 1928 issue. Just as in days of old the daring navigator guided his tiny ship across uncharted seas to Newfoundland's shores, so to-day his memorial tower sends forth its warning and guidance to the ships that follow in his train. On the left, the hill rises still higher by 100 ft.—picturesque, rugged, broken. From its base a rocky promontory juts out, forming the entrance to the Narrows, on the summit of which is Fort Amherst Lighthouse. Formerly batteries of formidable guns rose one above another amid clefts of these rocky precipices, but long ago the cannon were removed and the garrison withdrawn.

The Narrows leading to the harbour are nearly half a mile in length and not till two-thirds of the distance is passed does the city open to view, as the harbour tends towards the west of the termination of this narrow channel and is completely protected from the swell of the ocean. Within ten minutes of leaving the open waters of the Atlantic, a steamer can be safely moored at its wharf in this almost land-locked harbour. Vessels of the largest tonnage can enter at

(*Continued on page 237*)





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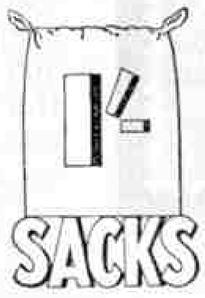
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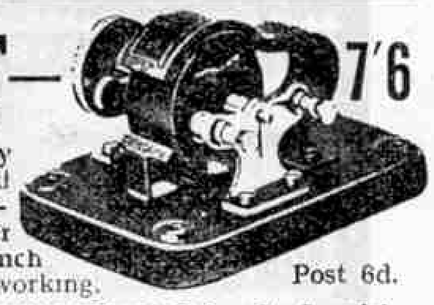
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Stamp Collecting—(*Continued from page 235*)

all periods of the tide, for the rise and fall does not exceed five feet. At its entrance, between Signal Hill and Fort Amherst, the channel is about 1,400 ft. in width, and at its narrowest point 600 ft. The harbour is over a mile in length and between a quarter and a half mile in width. It has a mud bottom and is from 30 ft. to 60 ft. in depth with a maximum depth in the centre of 90 ft.

Although the city has suffered much from disastrous fires—on three occasions more than half the city has been destroyed—it still retains much of its old world atmosphere and charm. Nevertheless, it does not lag when progress should be made, and in anticipation of a rapidly growing popularity as a holiday centre, a great modern hotel was opened in 1926. In the normal course, a city's hotel accommodation is not a matter of interest to the stamp collector, but the Newfoundland Hotel is different. It was the principal feature of the 5c. stamp of the 1928 issue, and claims the distinction of being the only hotel in the world to have enjoyed the publicity of a special postage stamp.

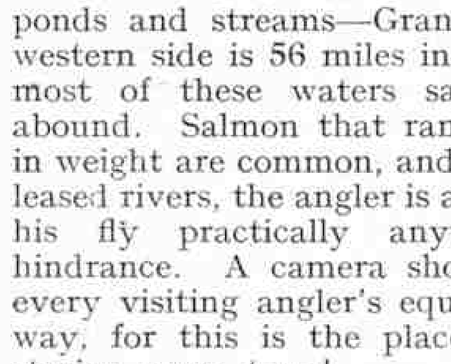




Newfoundland has been described as an angler's paradise, and indeed it would be a fastidious follower of Izaak Walton who failed to find sport to his complete content. Almost one-third of the surface of the Island is fresh water lakes, rivers, ponds and streams—Grand Lake on the western side is 56 miles in length—and in most of these waters salmon or trout abound. Salmon that range up to 40 lb. in weight are common, and as there are no leased rivers, the angler is at liberty to cast his fly practically anywhere without hindrance. A camera should be part of every visiting angler's equipment, by the way, for this is the place where fishing stories come true!

Salmon fishing is not only a sport in Newfoundland; it is a principal industry and every year fresh salmon to the value of £150,000 is exported. An excellent picture of a leaping salmon is used for the design of the 10c. stamp.

Fishing is not the only sport that Newfoundland has to offer. Its hunting and shooting also present outstanding attractions, for partridge, wild duck and geese, snipe, curlew and many varieties of seabird are to be found in big numbers. The native caribou and the moose, the latter imported from Canada, are the only species of the deer family found in the Island, but to-day these animals are protected by game laws, and when found may be shot at with cameras only. The caribou, a splendid animal of the reindeer family, was the emblem of the famous Royal Newfoundland Regiment, and this emblem will be found incorporated in the designs of all the regimental memorials on the battlefields of France and Flanders. It has been featured in Newfoundland stamp designs previously, but in the present issue the 5c. stamp shows the animal in its native habitat and gives a splendid portrait of this monarch of the woods.



The 14c. (black) stamp provides another link with the Royal Newfoundland Regiment, for the subject of this design is a splendid Newfoundland dog, similar to the dog mascot of the regiment during the Great War.

The Newfoundland dog shares with the St. Bernard the honour of being principally famed as a life-saving dog. A glance at its powerful frame—with its broad back, great girth, strong loins, powerful neck, deep square chest, small close-lying ears and powerful tail—makes readily apparent the Newfoundland's peculiar adaptability for swimming. No other breed can keep afloat so long in heavy seas. Its coat is flat and thick, rather coarse in texture and oily in nature, important factors in resisting the strain of long periods in the water.

The head of the Newfoundland dog is typical of a noble breed. It is broad and massive, with small brown eyes set well apart above a short, clean cut, square muzzle. When fully grown, the dog stands approximately 28 in. in height and is between 140 lb. and 150 lb. in weight. The breed is found in two colourings, black, or white with black or bronze markings.

Newfoundland is the home of another popular breed of dog, the Labrador, which for many years has been a favourite sporting dog, owing to its splendid qualities as a retriever. This dog also is strongly built, wide through the chest, ribs, loins and hindquarters. Its distinguishing feature is a short, dense coat, free from "feather," and an otterlike tail, thick at the root and tapering toward the tip. Usually a Labrador is coloured black, but in recent years yellows of the breed have come greatly into prominence.



Appropriately enough, the final stamp in our review of this new issue, the 20c., takes as its design a view of Cape Race on the South East corner of the island, at which point the eastbound traveller takes his last glimpse of Newfoundland and the New World.



In illustrating this brief stamp story of Newfoundland we have found it necessary to confine ourselves to the use of specimens from the new issue. The collector who sets out to achieve the same end in his album would find it helpful to include a number of stamps in addition to those mentioned in the course of our article. The 1897 issue, commemorating the 400th anniversary of the island, and each of the 1910, 1911, 1923 and 1928 issues provide interesting material, including maps, industrial pictures and views of the island, at very little cost.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Stamp Gossip

Curious Post Offices

We who live in the civilised places of the earth are inclined to take almost all the amenities of our time as simple matters of course. We post a letter and feel that the earth has turned upside down should the missive fail to reach its destination on time. We know little of the difficulties of running a postal service in some parts of the earth, but a certain island in Patagonia boasts as a recognised Post Office a simple barrel, chained to a rock on the sea coast, from which boats from passing steamers collect the mails for posting. A notice board prominently labelled *Post Office* stands in a conspicuous position nearby.



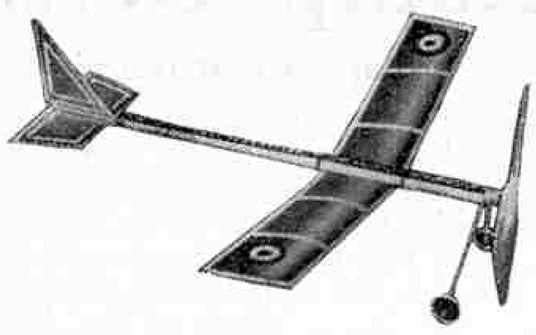
In the Tonga Islands, up to a very few years ago, it was quite a common occurrence for the mail steamer to find the conditions unsuitable for dropping a boat to take the mail ashore. On such occasions, the use of a rocket apparatus had to be resorted to, and on one memorable occasion the contents of the mail bag were blown to smithereens in mid-air!

Until the British Government established a Post Office at St. Kilda off the West coast of Scotland, the mail service was very infrequent and the islanders were compelled to adopt primitive methods of despatching their urgent messages. The practice was to cut a hole in a large piece of wood carved very roughly in the shape of a boat. In this cavity would be placed the letter, sealed in a bottle or canister labelled with a request to the finder to open and post urgently. A lid would be fixed over the cavity and the whole contrivance attached to an inflated sheepskin bladder and cast into the sea when a westerly wind was blowing. Many such messages went astray no doubt, but in the majority of cases the letters were delivered at their destinations on the mainland in little more than a week!

Canal Zone Air Issue

The Panama Canal Zone Administration's definitive series of air stamps appeared in November last. It consists of six stamps, 5c., 10c., 15c., 20c., 40c. and $1, with a design shewing a typical cargo boat passing through the Gaillard Cut between Contractors and Gold Hills. Overhead a three-engined aeroplane is flying in an easterly direction. The inscriptions are superimposed on the design, "Canal Zone Postage" at the top and "Air Mail" at the bottom.

Approximately 100,000 of each of the 5c., 10c. and 15c. values were printed, the quantities for the other values being 20c., 501,400; 40c., 52,500; $1, 51,000. The large quantity of the 20c. is explained by the fact that this is the air letter rate to Cuba, Guatemala, Honduras, Mexico, Nicaragua and the United States.

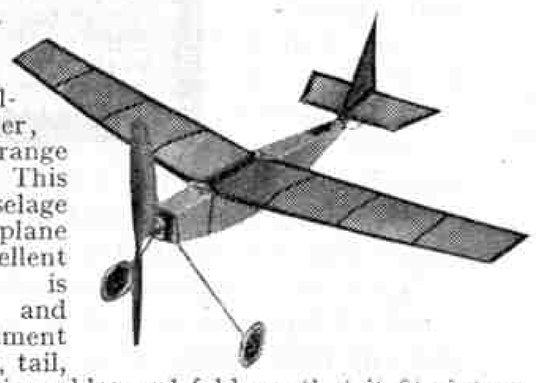


The "DEMON" Tractor. **Price 7/6**

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.

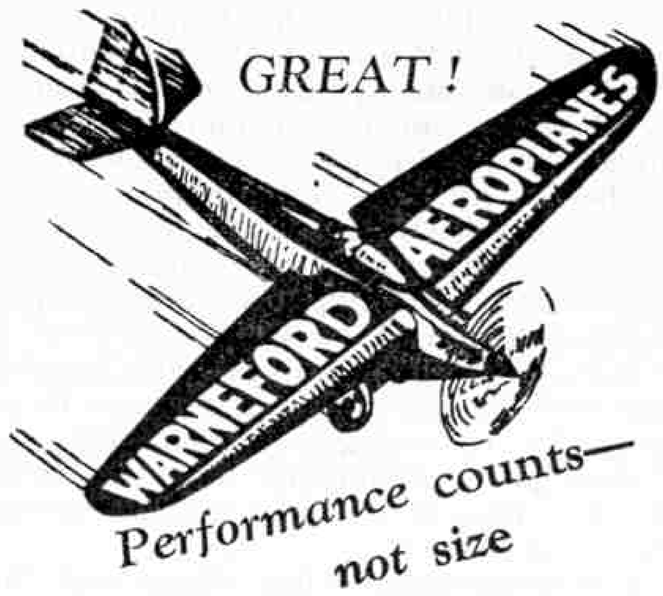
Weight, 3¼ ounces. Distance, 850 feet.
Speed, 16 m.p.h. Ceiling, 80 feet.
Rises from the ground.
Patent No. 296946.

The Warneford "Whippet" Fuselage Model. Price 17/6



Length 20⅝ 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

THE WORLD'S BEST FLYERS

WARNEFORD

FREE!

JOIN THE W.J.A.L.

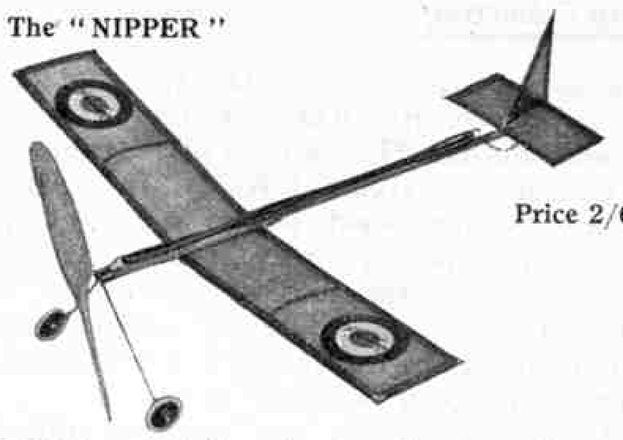
FULL PARTICULARS, WITH FINE ILLUSTRATED FOLDER, POST FREE ON APPLICATION.

MODELS FROM 1/6 TO 35/-

Sole Manufacturer:

F. J. MEE, Warneford Flying Aircraft, GREENWICH, LONDON, S.E.10.

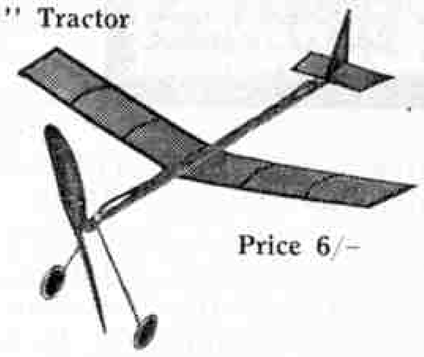
The "NIPPER" **Price 2/6**



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 20⅝ 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.

Famous Inventions—*(Continued from page 175)*

minutes each night. In the wireless room of this powerful French station he listened intently night after night without any result until the 21st October when, just as he was about to retire, he heard the voice of the speaker at Arlington, and caught the words "and now good night." The experiments were continued for many nights before he again heard any of the transmitted speech, and even then it was only occasional words that he could hear.

At that time the necessary power was obtained by grouping together large numbers of transmitting valves, but as valves of greater power were produced the number necessary for wireless telephony was reduced. It was only after years of painstaking experiment, coupled with the gradual development of more powerful apparatus, that wireless telephony became possible on a commercial scale.

The wireless telephone service between New York and London was inaugurated on 7th January, 1927. At the American end a group of officials of the American Telephone and Telegraph Company were seated round a table in the directors' room on the top floor of 195, Broadway, New York City. With the exception of President Gifford, who was seated at the head of the table, each man wore a headpiece provided with a single earphone. At the London end Sir Evelyn Murray sat in his office in London. At this end also was the same operator who in 1915 had caught the first intentional message ever heard across the Atlantic.

President Gifford picked up the telephone in front of him and, as if making an ordinary telephone call, said to the operator: "Please connect me with Sir Evelyn Murray in London." Instantly the others seated at the table held their headphones more tightly to their ears, and their intense expressions indicated their keen interest and suppressed excitement.

After a few minutes a voice came distinctly over the telephone, "Hello, is that you, Mr. Gifford?"

The voice was that of Sir Evelyn Murray, and as Mr. Gifford heard him he looked up with a triumphant smile at his fellow directors.

"Yes, this is Mr. Gifford," he replied.

Static interferences were troublesome at first, but afterwards the two men then conversed comfortably for some time. Mr. Gifford concluded by congratulating the British officials and extending to them the good wishes of the American Telephone and Telegraph Company. Sir Evelyn Murray replied in suitable terms and declared the service formally opened. It was then turned over to waiting subscribers and on the first day 31 calls were put through.

From that time the use of wireless telephony increased steadily, and in addition to the service between this country and North America wireless telephone services are now in operation between England and Canada; Capetown; many of the countries of South America; Australia and New Zealand; French Indo-China and French Morocco. Wireless telephone communication is available also to and from the "*Majestic*" and other large liners on the North Atlantic service. It is also possible to converse by wireless telephone with the pilots of the great air liners employed on the Imperial Airways and other important air services.

The Story of Meccano—*(Continued from page 173)*

factory were almost unbelievably better than those in the previous one. For the first time I found it possible to carry out each process in the most economic manner, without being hampered by restrictions of space, or worried as to whether the floor would stand the strain! This reminds me of one very striking change. In my old building the noise of the big presses was terrific. In the new factory, however, all the floors were specially prepared with concrete beds to receive presses and other heavy machines, with the result that when the workshops were in full swing there was no vibration and very little noise.

So far I had concentrated entirely on the factory, and my clerical staff still remained in the old building. I now set to work to build ample office accommodation alongside the new factory.

(To be continued)

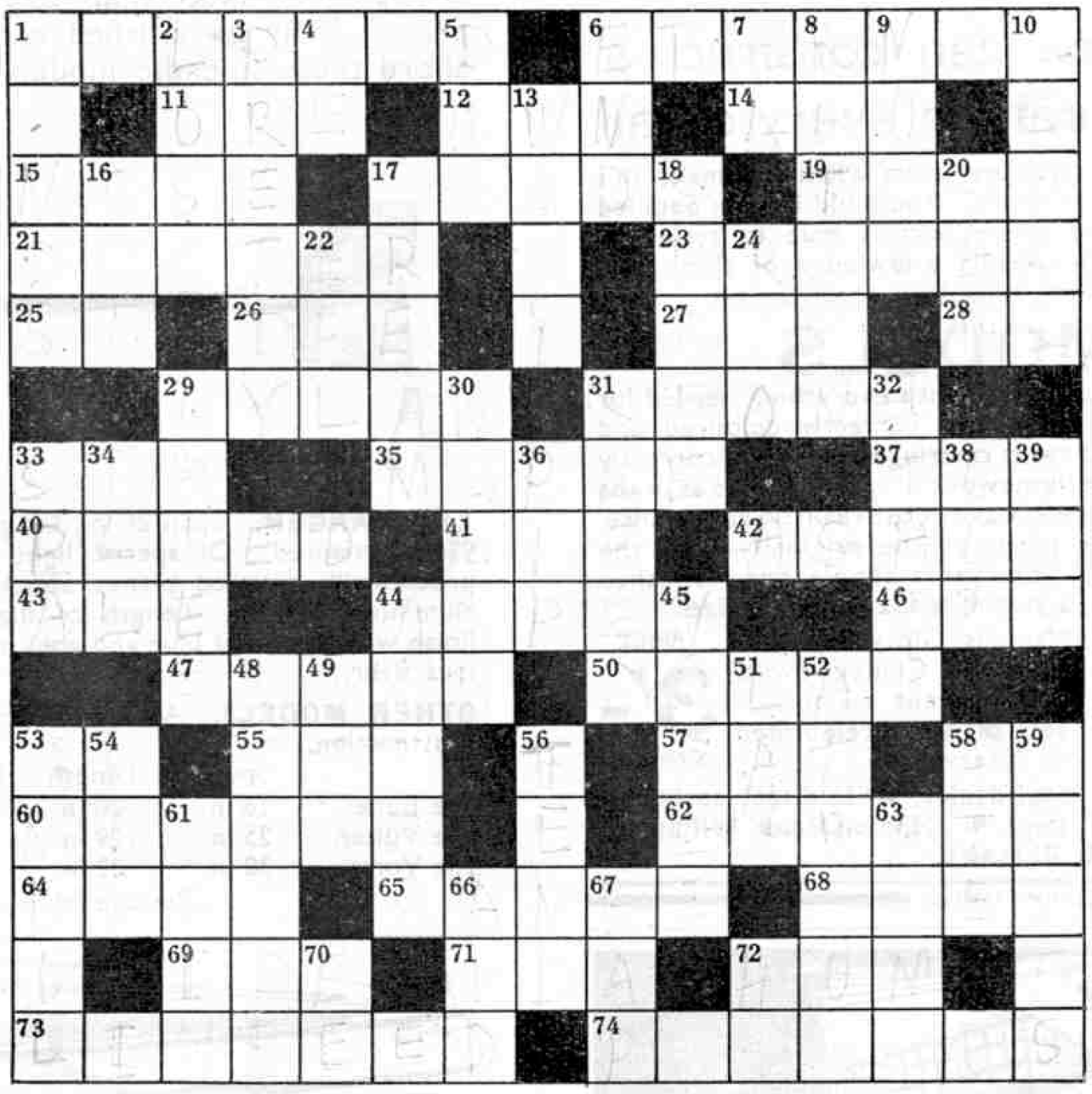
Scale Model Aeroplanes

Readers who are aeroplane enthusiasts will be interested in the Aeromodels outfits for home construction. The component parts are printed in correct colours on wood and cartridge board, ready for cutting up and assembling. The outfits include an excellent set of instruction sheets and blue prints that make the task of constructing the models perfectly straightforward for any boy possessing normal skill with his fingers. The present series of models are not constructed to fly, but their accurate presentation makes them of exceptional interest, and in photographs it would be difficult to distinguish between the models and the real machines.

The first model in the Aeromodels series is that of a D.H. Gipsy "Moth." It is designed to a scale of ½ in. to 1 ft., and has a wing span of 15 in. Other outfits will be issued shortly, including one to build the Comper "Swift" machine on which Mr. C. A. Butler made his record-breaking flight to Australia. The price of each outfit is 3/-, or 3/6 post free from Aeromodels, Hooton Road, Willaston, Cheshire.

Competition Page

MARCH CROSSWORD PUZZLE



CLUES DOWN

1. Forwards
2. Deprivation
3. Good to look at
4. Pronoun
5. Deer
6. Finish
7. Spanish article
8. Come back
9. Mid-day
10. Contract
13. Cautious
16. Away
17. Fish
18. Rushing water
20. Choicest part
22. Long fish
24. Famous S. American Port
29. Short
30. From Wales
31. Rest
32. Upper air
33. Health Resort
34. Sick
36. Tear
38. Over (poet.)
39. Unity
44. Flower
45. Stately
48. Land-owners
49. Part of a circle
51. Set
52. Fore-court
53. Abolish
54. Tool
56. Incline
58. Consumed
59. Examinations
61. Unavailing
63. Peak
66. Help
67. Breach
70. Suffix
72. Exclamation

CLUES ACROSS

1. A chemical element
6. Everlasting
11. Mineral
12. Possess
14. Sign of Zodiac
15. An organ
17. Ornaments
19. Garment
21. Cleaning rag
23. Trims
25. Street (Abbrev.)
26. Starting point
27. Atmosphere
28. Pronoun
29. Regulation
31. Building Material
33. Form of address
35. Bird
37. In addition
40. Worked
41. Resting place
42. Greyish-brown
43. Beverage
44. Quivering
46. Before
47. Showy
50. Pertaining to the Poles
53. Exclamation
55. Skill
57. Animal
58. Position
60. Beginner
62. Lyre-shaped
64. Close
65. Series
68. Chills
69. Fish
71. Girl's name
72. Drone
73. Seed used for food
74. Books

It is now some seven or eight years since the Crossword Puzzle was introduced into Britain, but there are no signs that its tremendous popularity is waning. Every month we receive quite a number of requests for further competitions of that type, and in setting the puzzle appearing on this page we know that it will prove a popular contest with most readers.

As far as possible every effort has been made to avoid setting unfair traps and the clues will be found perfectly straightforward. Beyond this it is unnecessary to make any explanation of the requirements of the competition, for the rules governing the solution of crossword puzzles are well known to all our readers. Every word will be found in Chambers or any other good dictionary.

Prizes of Meccano parts or Hornby Train accessories (to be chosen by the winners from our current catalogues) to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions, in the order in which they are opened, on the morning following the closing date. In addition there will be a number of consolation prizes, and, in awarding these, neatness and style of presentation will be taken into consideration. These prizes will be duplicated for Overseas competitors.

Entries should be addressed " March Crossword Puzzle, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 31st March. Overseas closing date, 30th June.

Competitors who wish to preserve their *"M.M.'s"* intact need not cut out the crossword illustration. It will be in order to make a copy of the square and fill that in.

"Happy Snap" Photo Contest

In the February *"M.M."* we published a reader's photograph of a donkey rolling on the ground in a fit of helpless laughter.

We make no secret of our opinion that in certain animals the sense of humour is very well developed, and it occurs to us that other of our readers may have succeeded in photographing an animal in the act of enjoying a joke or expressing happiness. Such photographs would be exceptionally interesting, and as an encouragement to readers to send them along for inspection we offer prizes for the best photographs of *" Happy Animals."* The entries will be divided into two groups, A for those from competitors aged 16 and over, B for those from competitors under 16, and Meccano products or Photographic Materials to the value of 10/6 and 5/– respectively, will be awarded to the best and second best photograph in each of the two groups.

Many of our readers perhaps have never had an opportunity of photographing a laughing animal, and in order that they may not be debarred from this " Happy Snap " Contest, we offer similar sets of prizes for humorous or jolly photographs of children.

This is a splendid opportunity for our readers to make good use of some of last summer's snapshots, and we look forward to a really big number of entries, which should be addressed to " Happy Snaps, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 31st March. Competitors may enter photographs for both sections of this competition, if they wish,.

The closing date for Overseas entries will be 30th June.

COMPETITION RESULTS

Fractional H.P. Motor Essay. The judging of this competition has now been completed. It proved an exceedingly difficult task that resolved itself into differentiation between minor points. There is not space here to go into details closely, but we hope to publish the winning essay in an early issue. In the meantime the prizes have been awarded as follows: 1. G. F. PONTING, 19, Station Road, Marlow, Bucks.; 2. F. W. SHAW, Jnr., 183, West Boulevard, Harborne, Birmingham; 3. NORMAN F. KEITH, Sydney, N.S.W., Australia.

The first three essays were so very close in merit that it was decided to add a further prize to those originally offered, and accordingly N. F. KEITH has received a B.T.H. " Synchro-Blue " Gramophone Motor value 39/6.

HOME

Christmas Jokes. 1. T. DUNNING (Huddersfield); 2. T. B. BELLIS (Hoole, Ches.); 3. E. S. PEERLESS (Hove); 4. R. A. S. MUSKER (Hightown, Liverpool). Consolation Prizes: P. DAVIES (Lyme Regis); D. MARTIN (Herne Hill, S.E.24); A. GRIFFIN (Liverpool).

Cover Voting. 1. S. COLEMAN (Sheffield); 2. K. A. BAK (Leicester); 3. W. BROMAGE (Nuneaton); 4. W. H. HORRELL (Wolverhampton).

Model No. 1



At last! Now you can construct a scale model accurate in every detail

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.

AEROMODELS

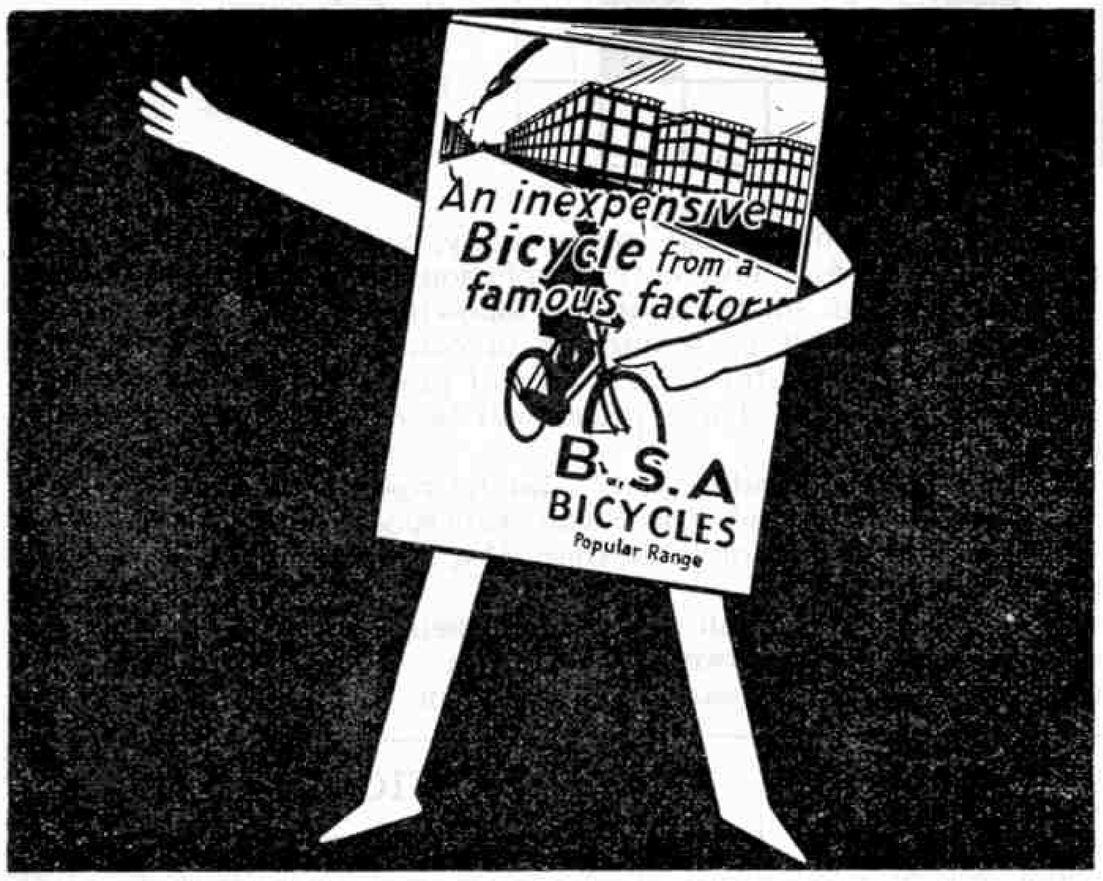
are unique constructional sets, complete with everything needed for building perfect models. The parts are correctly coloured and printed on cardboard, metal and stout cartridge, etc. The correctly cambered wings are built up on a framework of spars and ribs as in the real machine, and the finished model has a most realistic appearance. Elaborately detailed plans—scale copies of the originals—make the actual construction a fascinating job, yet a simple one. Finished model has a wing-span of 15 in. and is 1/24th actual size.

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 P.O. for 3/6, to AEROMODELS (Dept. M), Hooton Road, Willaston, Wirral, Cheshire.

Trade enquiries invited.



I am the Catalogue that every Bicycle buyer needs

I tell you, emphatically, that for sheer value for money B.S.A. Bicycles have no equal—that the boy who chooses a B.S.A. Bicycle has a machine that is unequalled in design, workmanship and in quality of materials.
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Prices from £4-12-6 or
2/- a week

Roadster models from £4-19-6 or
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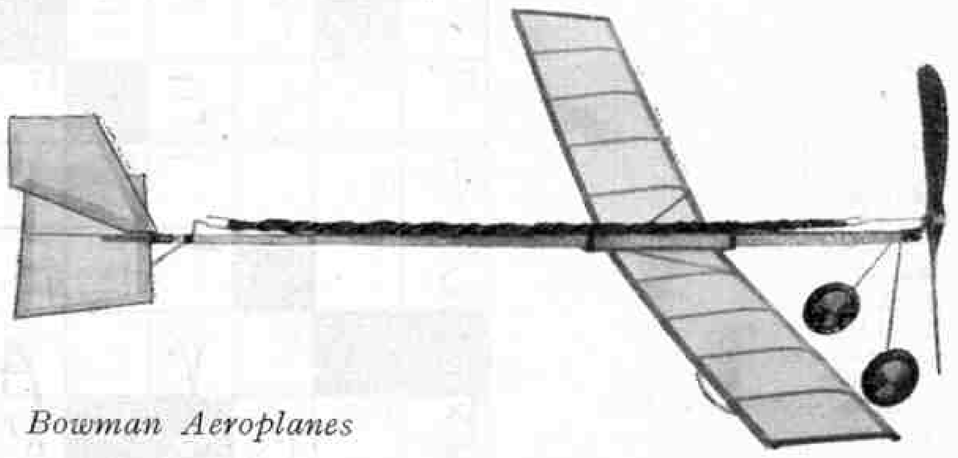
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Please send
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Name.....
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BETTER MAKE LARGER SIZE BETTER PERFORMANCE

The above usual characteristics of Bowman Models are fully carried out in these marvellous new Bowman Aeroplanes. Note their size, performance and then the price! Why be satisfied with toys when you can now afford these splendid models?



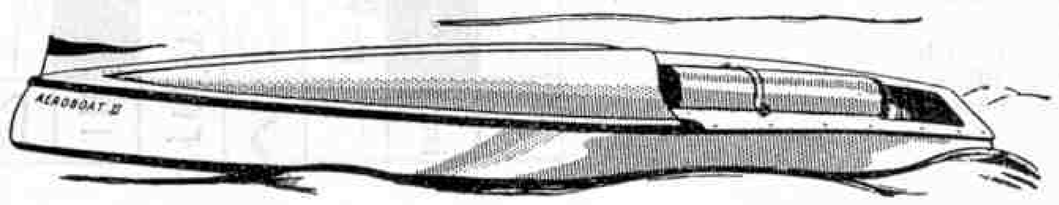
Bowman Aeroplanes

THE RANGER. Span 24 in., Length 24½ in., Propeller 9½ in. balanced. Of special light construction. Best proofed-silk covered planes, shock-proof chassis with aluminium wheels. Length of flight, 650 ft. Superb finish with discs and blue and gold lettering. A marvellous flyer. **4/6**

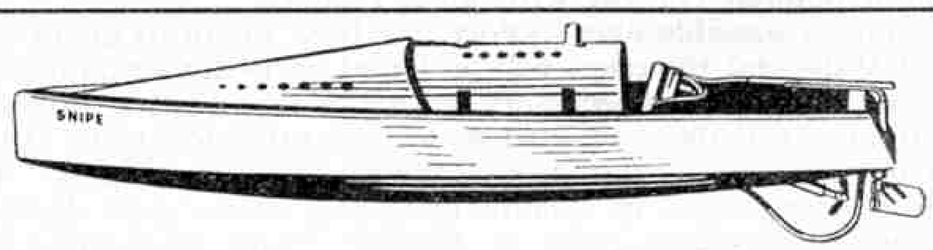
OTHER MODELS. All similar to above in general construction.

	Span	Length	Propeller	Flies	Price
The Bullet	18 in.	20 in.	8½ in.	500 ft.	**2/6**
The Vulcan	25 in.	29 in.	9½ in.	750 ft.	**6/6**
The Vortex	30 in.	32 in.	10½ in.	850 ft.	**8/6**

Postage 6d. on all models.



BOWMAN 'AEROBOATS' were the sensation in model boat circles last year. These long, rubber tension drive speedsters have been winning races on ponds all over Britain. 'Aeroboat II' (Length 30 in., Beam 3 in.) 'AEROBOAT I' **17/6.** 'GREYHOUND' **8/6** **15/6**



BOWMAN STEAM LAUNCHES are acknowledged everywhere to be masters of the water. Long, fast cruises for two miles and over have proved them to be not merely toys but real launches in miniature. The 'Snipe,' 23 in. long (runs 30 mins. non-stop), Price **22/6**
The 'Swallow,' 20 in. long (runs 20 mins. non-stop) Price **17/6**

FREE: Write to-day for free leaflets describing all the Bowman Boats (clockwork, steam and aero) and the wonderful new Bowman Aeroplanes, to Bowman Models (Dept. M.M.7), Dereham, Norfolk.

Bowman Models can be seen in all Halfords and Hobbies branches and in good shops everywhere.

BOWMAN
MODELS

BRITISH AND GUARANTEED

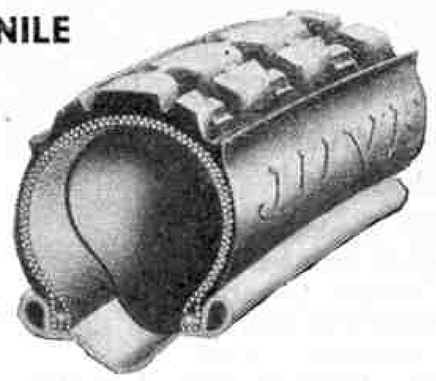
Listen, you fellows,

here are two tyres that have been specially designed and built for you. One is a Roadster tyre with a tread of tough but lively black rubber. The other is a real Sports tyre with a very fast hard-wearing red tread. They are made by **DUNLOP,** and you know what that means. It means they are the best tyres you can buy.

DUNLOP JUVENILE

SIZE (wired type)
22″ x 1⅜″
24″ x 1⅜″
24″ x 1½″
26″ x 1½″

COVER 5/6 TUBE 2/6



DUNLOP SPORTS JUVENILE

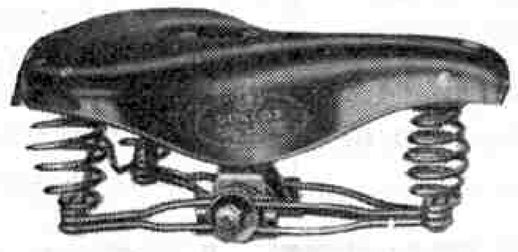
SIZE (wired type)
24″ x 1⅜″
24″ x 1½″
26″ x 1½″

COVER 4/6 TUBE 2/-



When you buy a new cycle be sure it is fitted with a

DUNLOP WATERPROOF SADDLE



Dunlop saddles are absolutely waterproof. Your Dad will tell you how important that is. They are comfortable, they never sag nor lose their shape, and they require no "breaking-in."

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- 50 YEARS -

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COMPLETE WITH PUMP, TOOLS AND BAG, REFLECTOR, ETC. ALSO FREE INSURANCE.
All sizes in stock from Boys' to Men's.

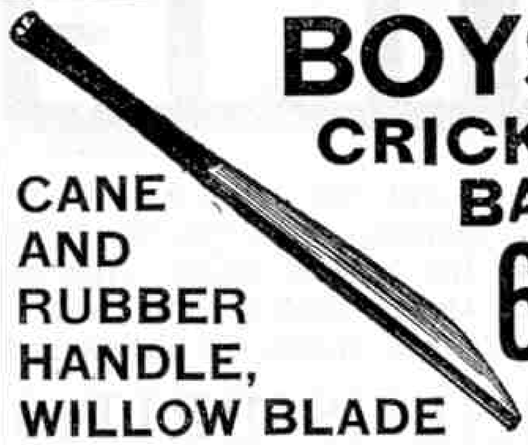
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LYCETT Saddle. DUNLOP Tyres. RENOLD Chain, etc. Guaranteed 50 Years, including Insurance and Accessories. **70/-**

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All Machines sent Carriage Paid.

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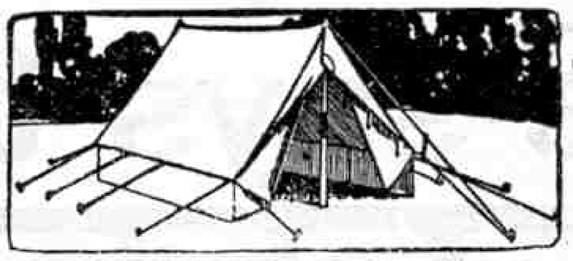


BOYS!
CRICKET BATS
CANE AND RUBBER HANDLE, WILLOW BLADE
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Carriage 9d.

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HIKING OUTFITS
KHAKI SHIRTS, **4/11**; KHAKI SHORTS, **4/6** and **4/11**; Black Shirts, 4/11 and 6/6; Rucsacs, 3/6, 4/6, 5/6, 6/6; Hiking Packs on frame, 16/–, 16/9, 18/–, 18/6, 19/9, 22/6. Stoves, Billy Cans, Axes, Stockings, Knives, etc., all in stock.

Send for illustrated sports and athletic catalogue, 3d. post free.

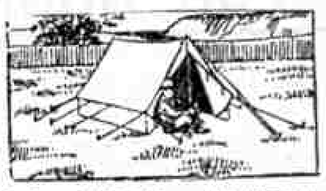
YOUR TENT FOR THE HOLIDAYS



10/6
Carriage 9d.

6 ft. LONG, 4 ft. 3 in. WIDE, 3 ft. 6 in. HIGH WITH 6 in. WALLS.
Similar to above with superior white tent cloth. Complete with jointed poles, runners, pegs, etc., and packed into a neat waterproof bag with a handle grip. Weight when packed, 5 lbs.
Easy to carry, and simple to pitch ... **14/6**
With Green Rotproof Cloth **18/6**
Carriage 9d. extra.

JAS. GROSE LTD.
Improved Tents



7 ft. LONG, 5 ft. WIDE, 4 ft. HIGH. WITH 1 ft. WALLS.
Supplied with jointed poles, lines, pegs, mallet and bag. Weight when packed, 10 lbs. Plenty of Room for Two Persons. Easy to Pitch. Ideal for Week-Ends in the Country, etc.

IN WHITE DUCK TENT CLOTH, 22/6
IN GREEN ROTPROOF CANVAS, 27/6

Send for special HIKING and CAMPING list, 3d. post free

New Models Ahoy!

JUST ARRIVED
from the Northampton "shipyards."

SERIES 88. Spanking Boats from the tip of their bows to the red ensign fluttering astern. Fitted with bollards, fairleads, ventilator, windscreen, etc. Hand finished white with blue and orange line.

Clockwork ... **21/-**
Electric **25/-**

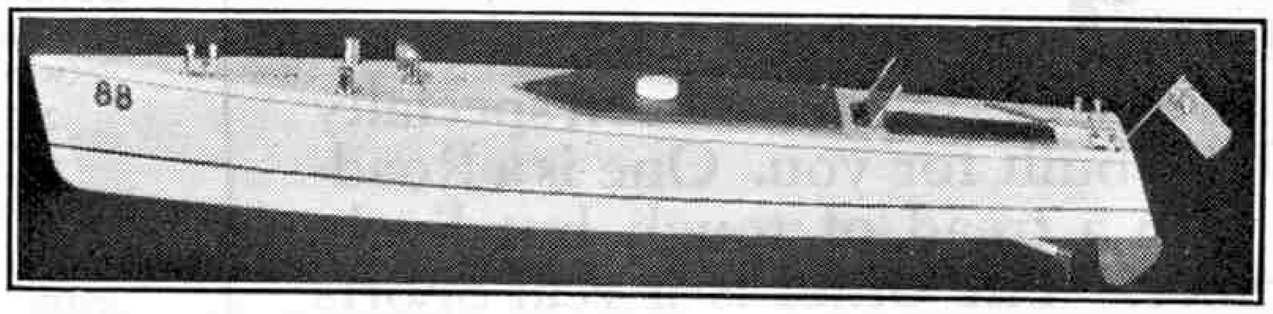
Dimensions : Length, 21 in. ; Beam, 3¼ in.

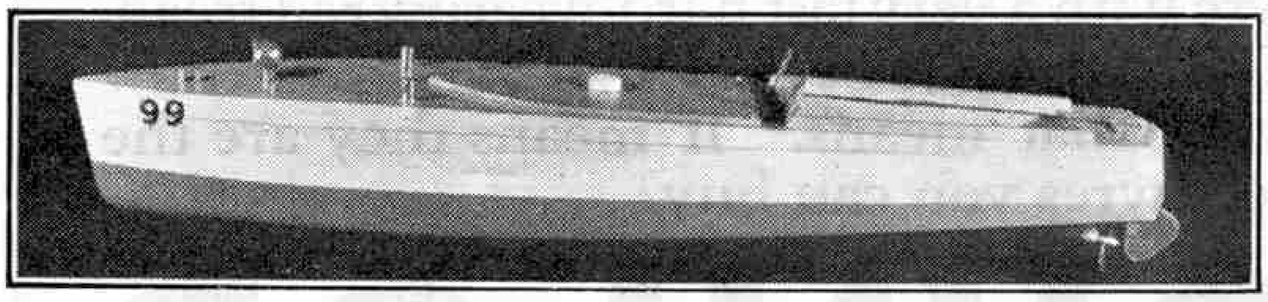
SERIES 99. Smart, modern design ; decks in Mahogany, lined planking, windscreen, etc. Finished white, assorted colour boot topping.

Clockwork **15/-** to **27/-**
Electric ... **21/-** to **33/-**

according to length and beam. (15/- Model : Length, 19 in. ; Beam, 3¼ in.)

Other models from **10/6**.





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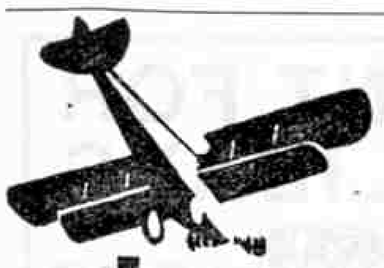
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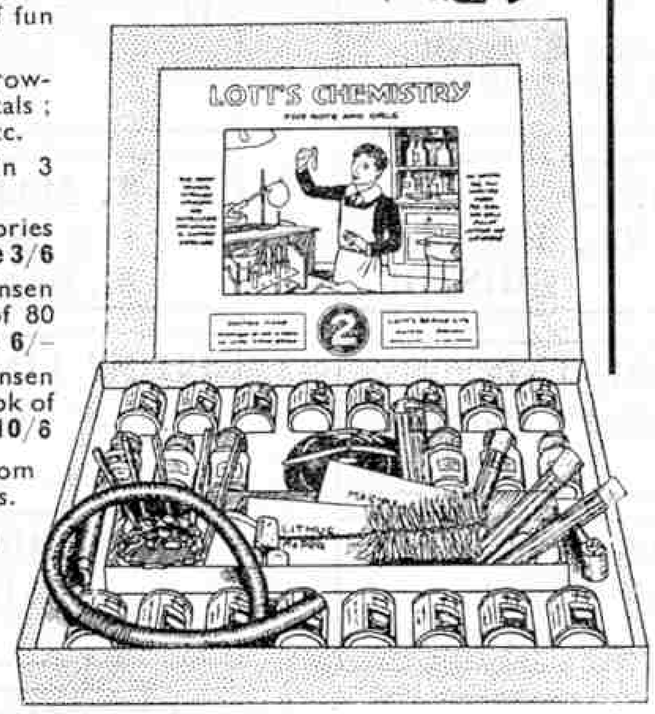
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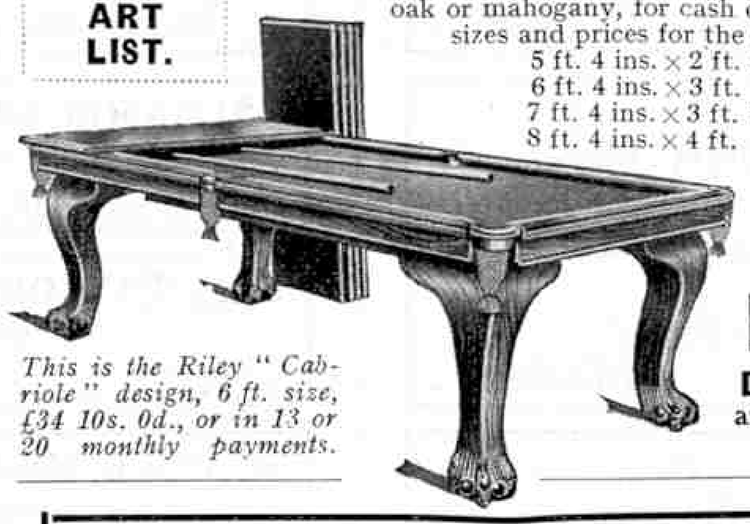
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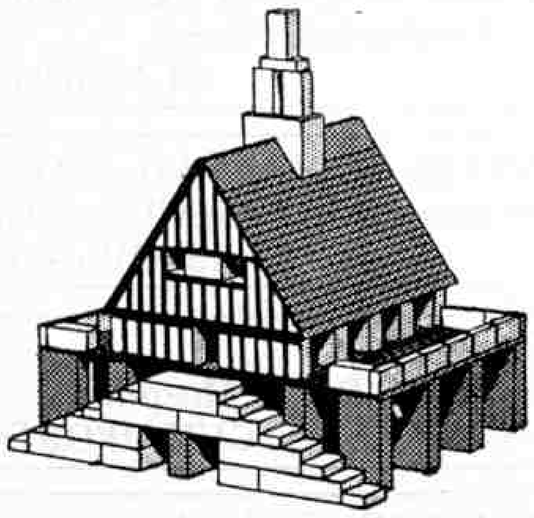
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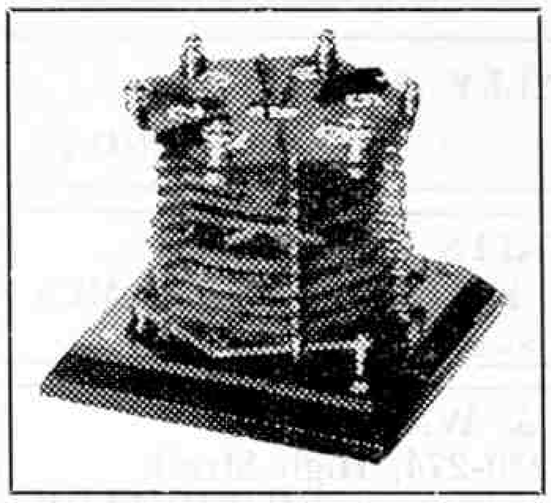


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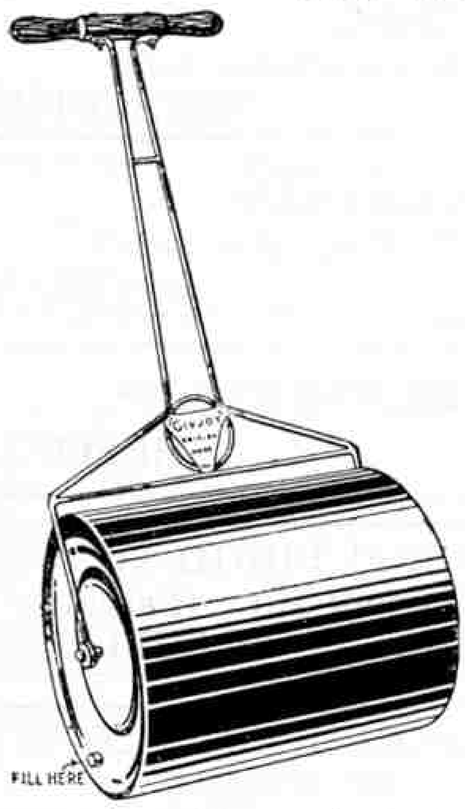
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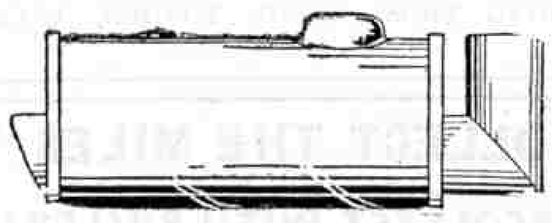
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EDITORIAL AND ADVERTISING OFFICE:—

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.

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Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

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Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the 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.

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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.

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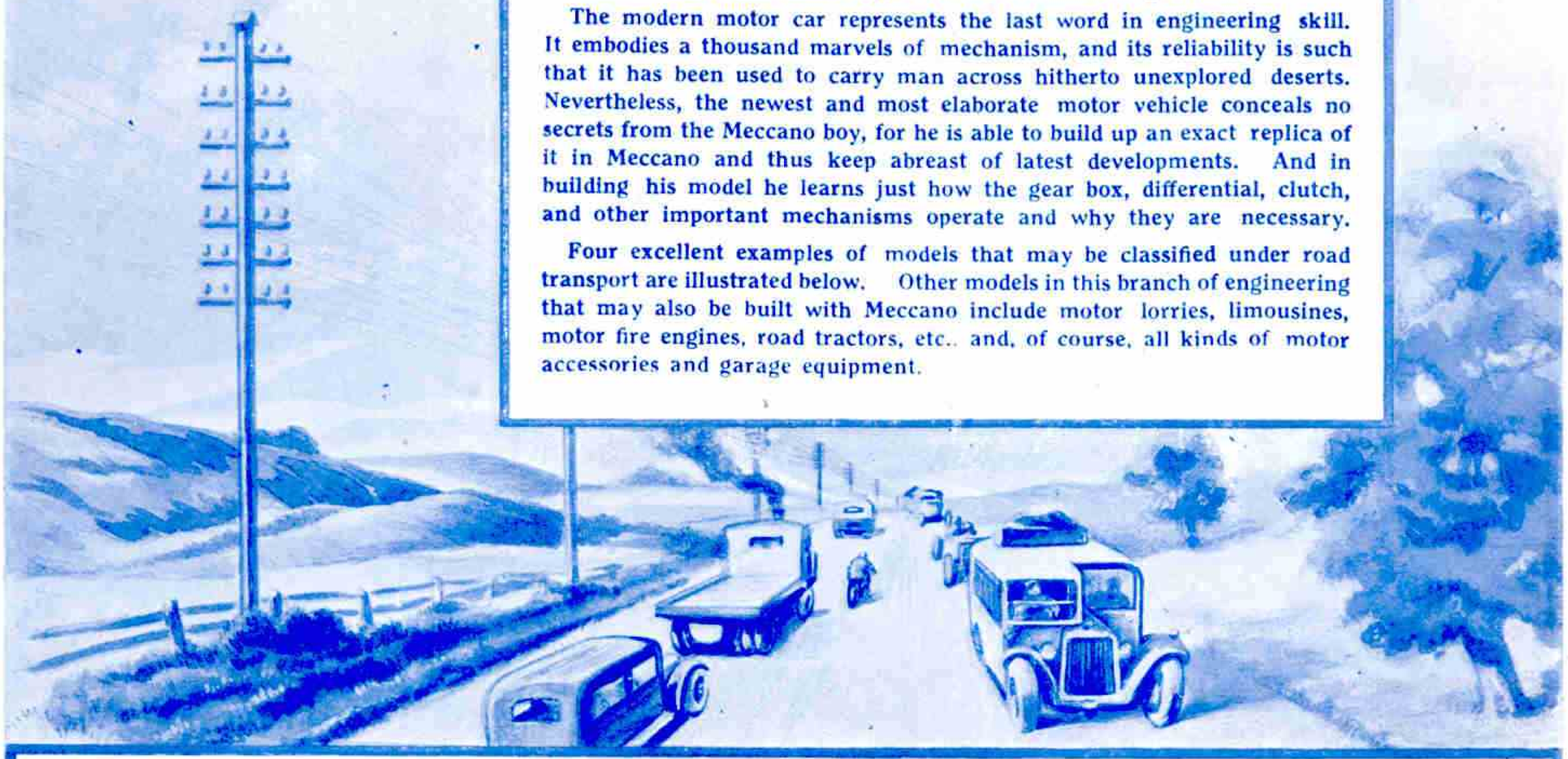
EXAMPLES OF MODEL CONSTRUCTION

1.—Transport by Road

LESS than 30 years ago practically all long-distance overland transport was carried by rail, and the appearance of a motor car was of sufficient novelty to attract a crowd of interested sightseers! To-day, one out of every twenty inhabitants of Great Britain owns a motor vehicle of some type, while all over the country the roads are thick with motor vehicles of every imaginable type, bent on business or pleasure.

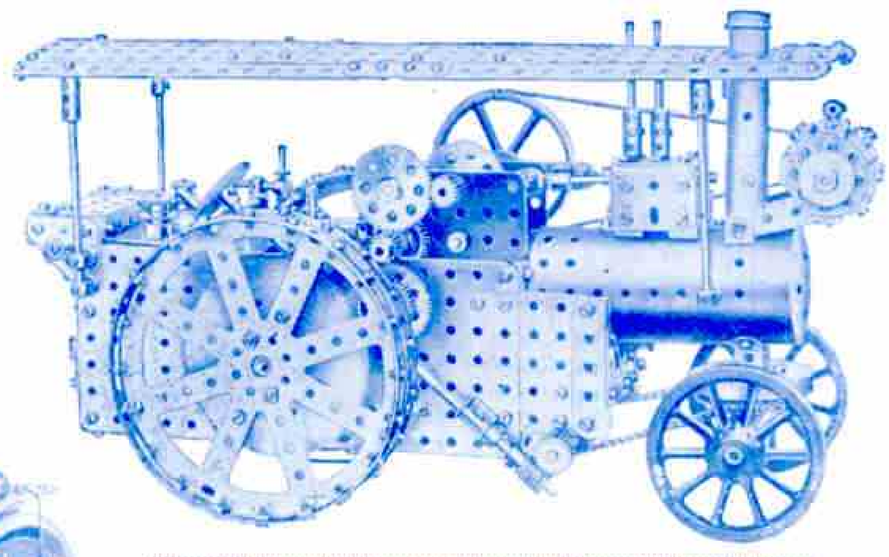
The modern motor car represents the last word in engineering skill. It embodies a thousand marvels of mechanism, and its reliability is such that it has been used to carry man across hitherto unexplored deserts. Nevertheless, the newest and most elaborate motor vehicle conceals no secrets from the Meccano boy, for he is able to build up an exact replica of it in Meccano and thus keep abreast of latest developments. And in building his model he learns just how the gear box, differential, clutch, and other important mechanisms operate and why they are necessary.

Four excellent examples of models that may be classified under road transport are illustrated below. Other models in this branch of engineering that may also be built with Meccano include motor lorries, limousines, motor fire engines, road tractors, etc., and, of course, all kinds of motor accessories and garage equipment.



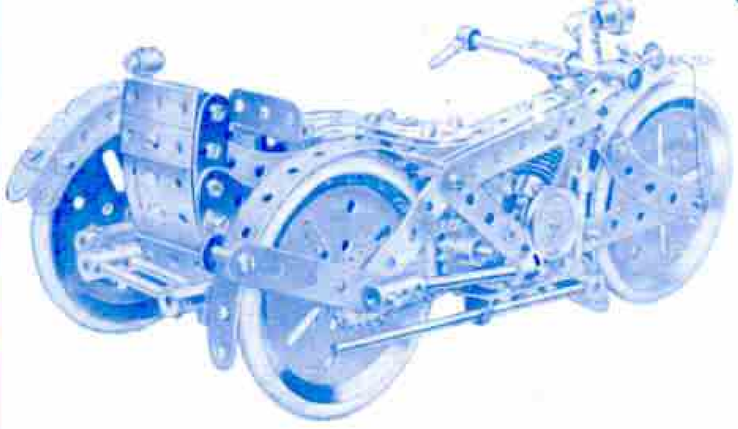
MECCANO MOTOR CYCLE AND SIDECAR

The Meccano Motor Cycle (below) incorporates head and side lamps, sprung saddle, exhaust pipes, chain drive, Klaxon horn, luggage carrier, etc., while the sidecar, which is of graceful streamline design, is mounted on springs. The twin-cylinder engine is composed primarily of two Worms. See Instruction Leaflet No. 3 (Price 2d. post free).



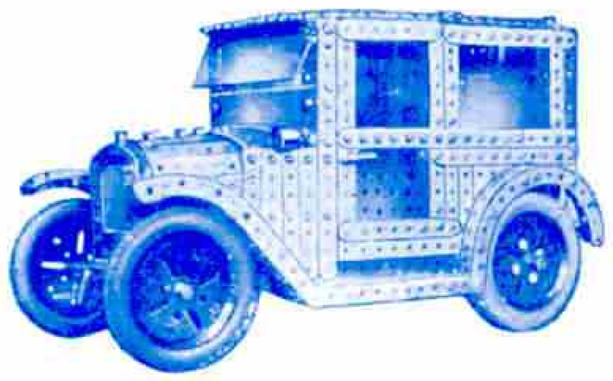
MECCANO TRACTION ENGINE

Driven by a Meccano 6-volt Motor, which is mounted in the space occupied by the firebox in the prototype, the Traction Engine (left) will easily haul a boy of average weight. It is fitted with two-speeds forward and reverse controls, worm and chain steering gear, and brake. For detailed illustrations and complete instructions for building, see Special Instruction Leaflet No. 22 (Price 2d. post free).



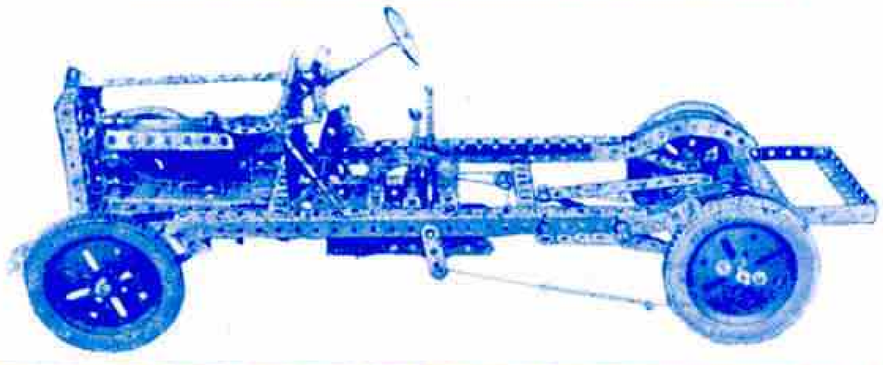
Meccano Outfits range in price from 2/6 to 450/–, and may be obtained from all leading toy stores. Ask to see them.

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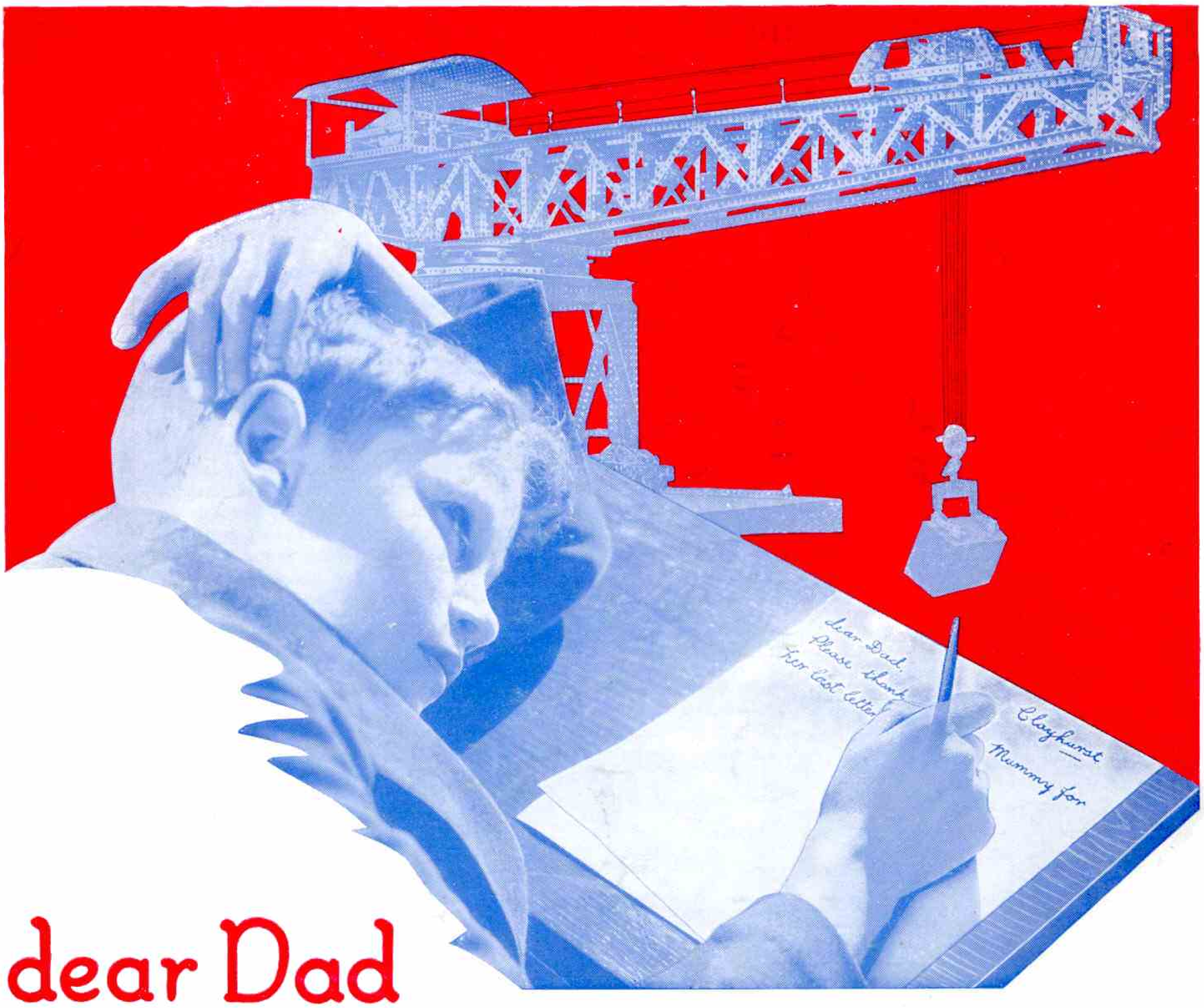
MECCANO MOTOR CHASSIS

This model (right) is driven by a 6-volt Electric Motor and includes a gear box, clutch, differential, laminated springs, Ackermann steering, torque rods, etc. Full instructions for building the model are contained in Special Instruction Leaflet No. 1 (Price 3d. post free).



MECCANO MOTOR CAR

The model shown above is of a "baby" car of a well-known make. It is built entirely from standard parts with the exception of the windscreen and windows. The model is complete with steering gear and if desired may be driven by a Meccano Clockwork or Electric Motor.



dear Dad

Please thank Mother for her last letter. I hope you are quite well. Last week I was second in maths. It's not long now to Easter. When I come home I'm going to buy a lot of new Meccano parts and have a shot at building a Meccano Super Model like the ***Block-Setting Crane.*** *I have several ideas for* ***new models, too. We'll have great fun together*** . . . . . .

When you have Meccano you are able to build hundreds of real engineering models. One day a crane, the next a steam wagon, the day after a pit-head gear. There is endless variety, endless fun, for Meccano is real engineering in miniature—all the parts are miniatures of the corresponding parts in engineering practice. They are all standardised and interchangeable and can be used over and over again to make hundreds of different working models.

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MECCANO

MECCANO LIMITED (DEPT. 70) OLD SWAN LIVERPOOL

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