VOL. XVII. No. 1 JANUARY 1932

MECCANO MAGAZINE

USING THE MICROMETER
(see page 2)

6D.

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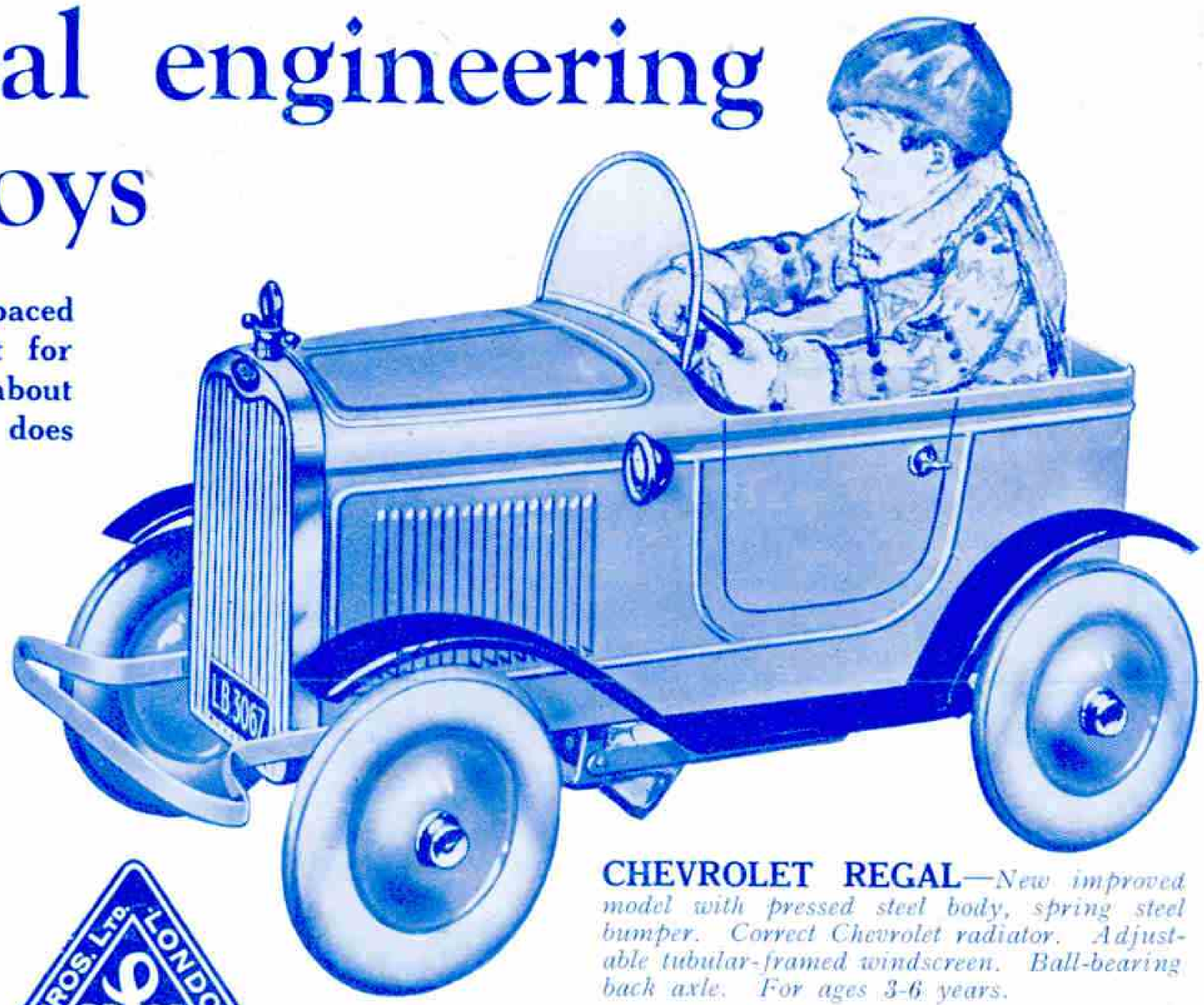

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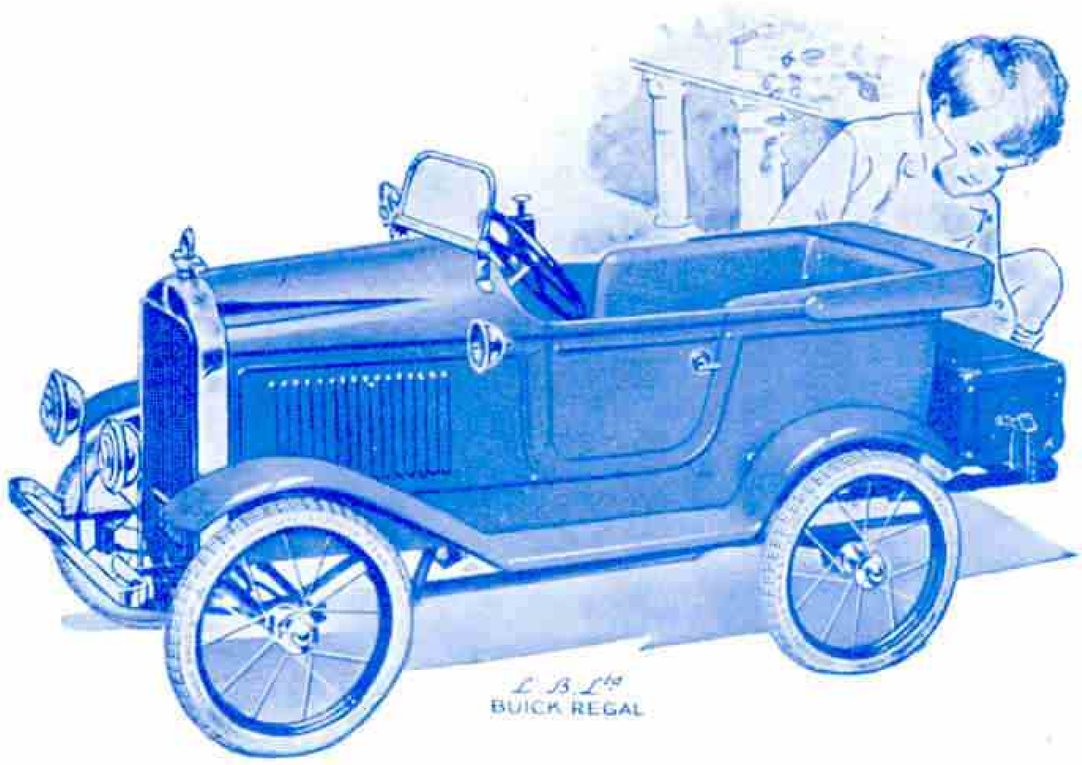
CHEVROLET MAJOR *is longer. For ages 4-8 years.*



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MECCANO MAGAZINE

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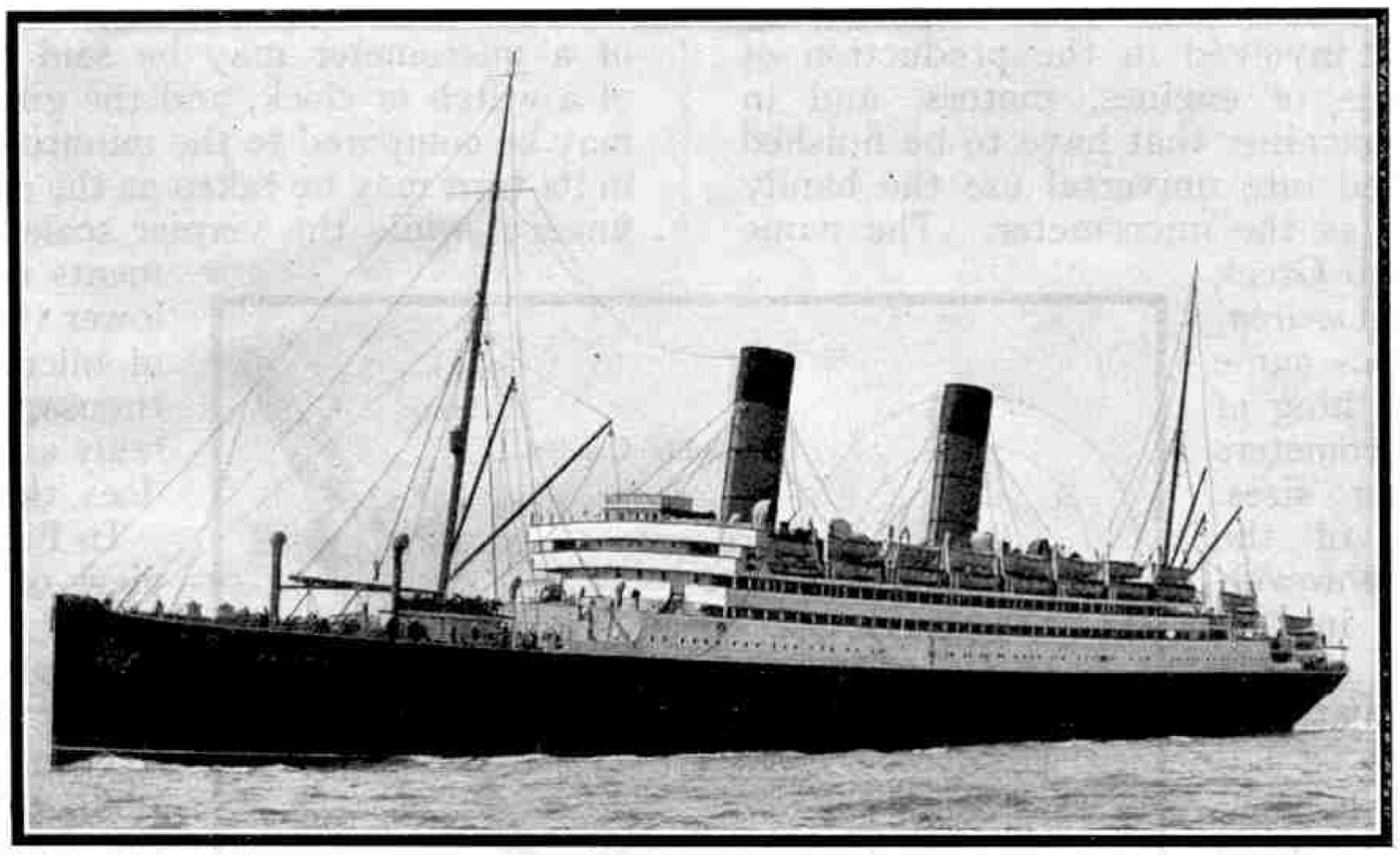
Vol. XVII. No. 1
January, 1932

With the Editor

A Famous Cunarder

The recent announcement that the sister ships *"Carmania"* and *"Caronia"* are to be broken up marks the end of two splendid vessels that 25 years ago were the pride of the Cunard fleet. Particular interest attaches to the *"Carmania,"* for she was the first large Cunarder to be equipped with Parsons turbines of high power, and she played a notable part as an auxiliary cruiser in the early stages of the Great War.

The *"Carmania"* was 650 ft. in length and her gross tonnage was 19,524. She was very speedy, her 21,000 h.p. turbine engines being designed to give her 18 knots. She never had any difficulty in maintaining this speed, and during her trials in November, 1905, nine months after her launch at Clydebank, she attained a speed of 21 knots. It was the success of this installation that led to the adoption of turbines for the *"Mauretania,"* the famous vessel that in 1907 wrested the Blue Riband of the Atlantic from the German *"Kaiser Wilhelm II,"* and retained it until 1930. The *"Carmania"* and the *"Caronia"* were extremely popular ships, and were known as the "Pretty Sisters of the Atlantic."



The famous Cunard liner "Carmania" waiting to be broken up after 25 years' service. This photograph is reproduced by courtesy of the Cunard Steam Ship Co. Ltd.

When the Great War broke out the *"Carmania"* was on her way from New York to Liverpool, and immediately on her arrival, on 7th August, 1914, she was taken over by the Government for service as an auxiliary armed cruiser. The work of conversion was carried out with such speed that the vessel actually went to sea fully equipped for warlike purposes one week after entering port.

The *"Carmania"* took up patrol duties in the Atlantic, and early in September her commander received orders to search Trinidad Island, a lonely spot 500 miles from the coast of Brazil. On approaching the island a large enemy vessel was seen to be sheltering in its anchorage, taking in coal from auxiliaries. This ship hurriedly got up steam and put out to sea, with the *"Carmania"* in pursuit. A great fight followed, during which the vessels closed until the range was not more than 1½ miles. The *"Carmania"* was hit repeatedly, and her bridge was set on fire and practically destroyed. Her pumps were put out of action, and the flames could only be fought with the aid of water buckets handled by the few men who could be spared from the guns. The fight was continued with the utmost determination, however, and eventually the German ship heeled over and sank. Four days later it was discovered that the *"Carmania's"* enemy had been the *"Cap Trafalgar,"* a well-known vessel of the Hamburg South American Line, that also had been converted into an armed cruiser. This vessel was capable of 18 knots, and was slightly superior in armament to the British ship.

After the fight the *"Carmania"* was patched up and escorted to Gibraltar to be refitted. Nine months later she resumed service, and continued on patrol duty until May, 1916, when she was restored to the Cunard Company. At the end of the War her great fight with the *"Cap Trafalgar"* was commemorated by the presentation to her of a piece of plate that had belonged to Nelson and had been with him at the Battle of Trafalgar.

After the War the *"Carmania"* continued to give good service as a liner. She was overhauled at the end of 1923, when her boilers were converted from coal to oil fuel; and in the following year she inaugurated the new Canadian service of the Cunard Company from London to Quebec. She was also the first vessel to be placed on the Cunard London-New York service that was commenced in 1926, and except when engaged in winter cruises between New York and Havana she remained on that service until last year. She made her final voyage in August last, and afterwards was laid up in the Thames to await the time for her to be broken up. Few ships have had such a varied career and, with the exception of the *"Mauretania,"* none has had so strong a hold on the affections of the travelling public.

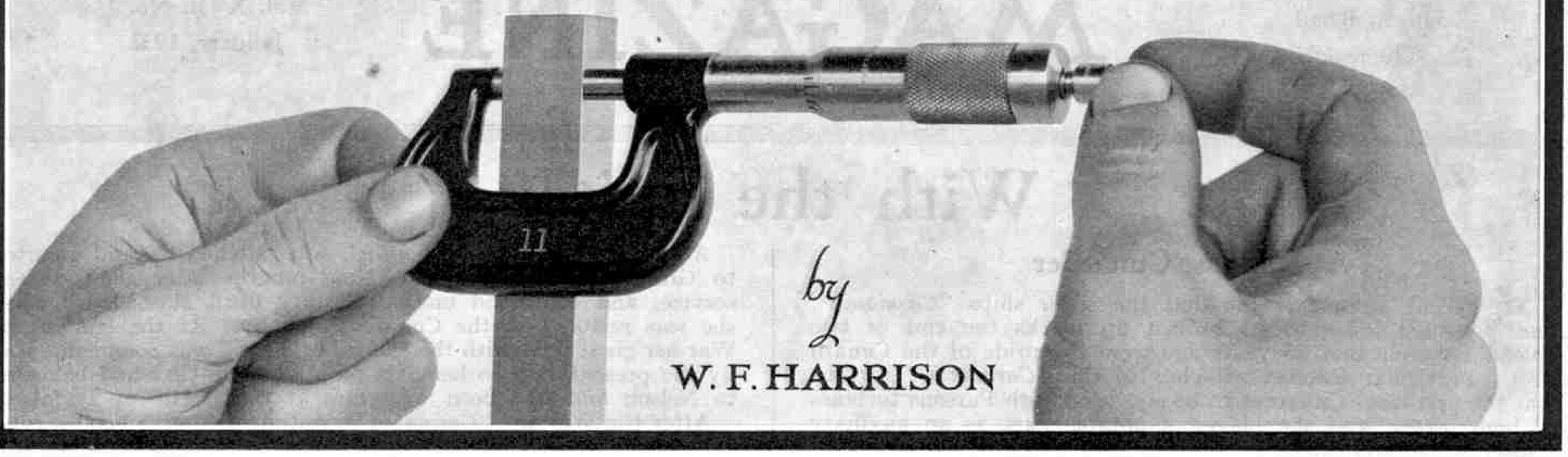
The Guild and the Hornby Railway Company

The past year has been one of uninterrupted progress in the Meccano Guild and the Hornby Railway Company. To-day the number of members of the Guild is nearly 90,000, and in the three years during which the Hornby Railway Company has been in existence it has gained nearly 30,000 adherents. There has been an even more satisfactory expansion of the work of Meccano Clubs and local Branches of the H.R.C. The number of affiliated Meccano Clubs in all parts of the world probably will exceed 400 early in the year now commencing. The Hornby Railway Company also shows great progress, for during 1931 the number of Branches formed or in process of formation has increased from 284 to nearly 400, and the publication on page 57 of this issue of a group photograph of the 200th Branch to receive full recognition is an interesting landmark in the progress of the H.R.C.

The remarkable strides made in the number of clubs and local Branches have been accompanied by an increase in the keenness of members, and there is no doubt that these organisations are helping members to extract more and more enjoyment from their hobbies. They were founded for this purpose. Every boy who wishes to make the most of his Meccano Outfit or his Hornby Train Set therefore should take the earliest opportunity of getting into touch with his fellow enthusiasts in order to share in the pleasure that accompanies membership.

MEASURING TO $\frac{1}{10,000}$ OF AN INCH

THE MICROMETER AND ITS STORY



by

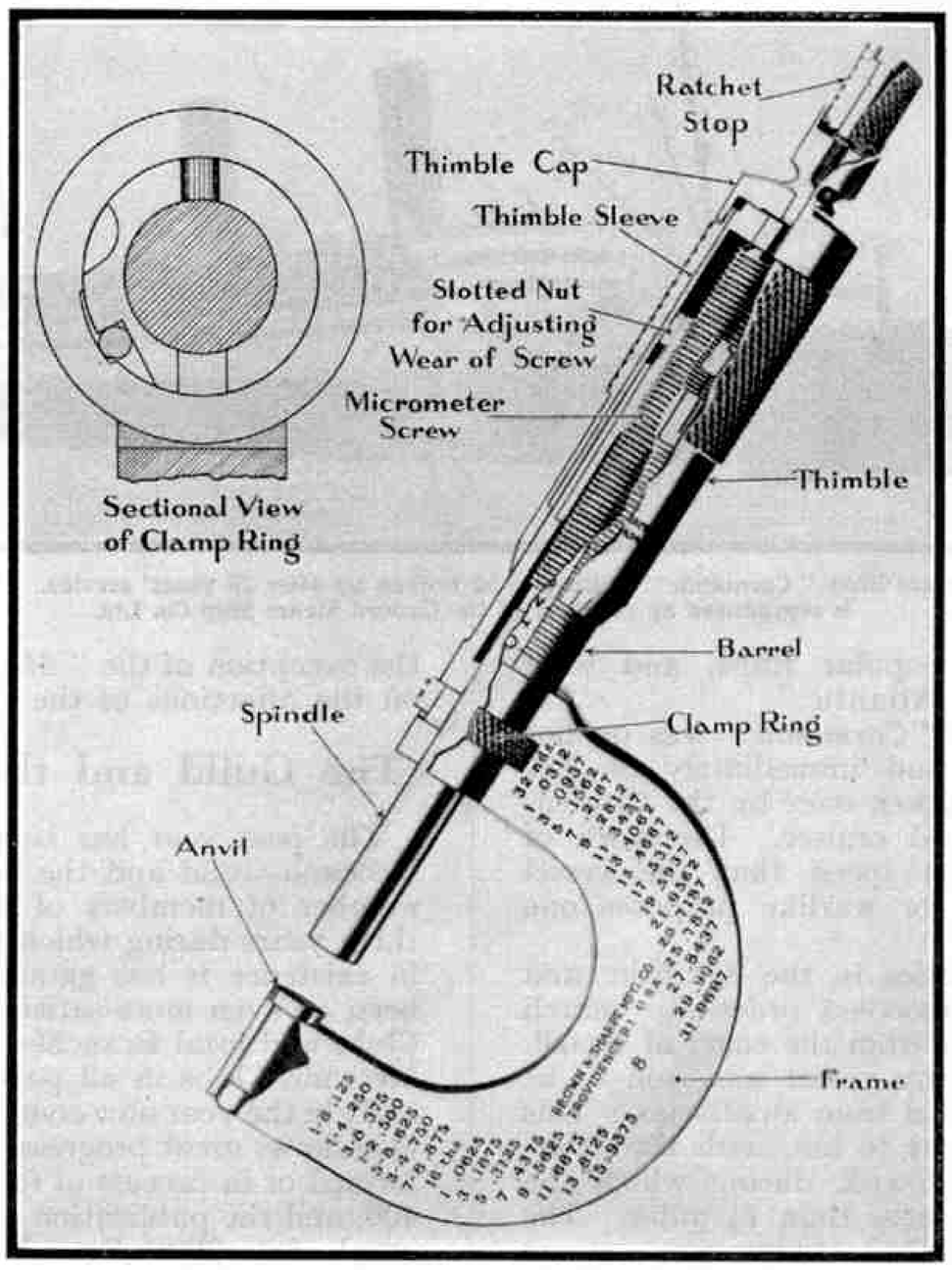
W. F. HARRISON

THE precision work involved in the production of standardised parts of engines, motors, and in fact all modern machines that have to be finished to fine limits, has called into universal use the handy measuring tool known as the micrometer. The name is a combination of two Greek words, *mikros*, little, and *metron*, measure. Although this name appears to imply something of small dimensions, micrometers are made of varying sizes. Whatever the range of the instrument may be, however, whether $\frac{1}{2}$ in. or 144 in., its purpose is always the same—mechanical measurement to the finest perceptible degree.

Before explaining the construction and method of using this simple but most interesting of all measuring appliances, it may be useful to note a definite instance of fine measurement as applied to the Imperial yard. In this connection it was reported some time ago that, after a series of tests extending over five years, the standard measure of length had been found to be two ten-thousandths of an inch shorter than it was in 1852, and that the experts had advised its replacement by one of greater accuracy!

It will be evident that, for this degree of refinement, direct measurement is out of the question; but by means of two or three scales engraved on the barrel and thimble of a micrometer such slight variations can be read with the greatest ease.

The reading of a micrometer is in effect as simple as telling the time from the dial of one's own watch; in fact there is a distinct analogy between the two instruments. The bold figures engraved on the barrel of a micrometer may be said to correspond to those of a watch or clock, and the graduations between them may be compared to the minute divisions. The thimble in its turn may be taken as the equivalent of the moving finger; while the vernier scale drawn on most instruments now in use, or the small lower thimble of the latest type of micrometer, registers a ten-thousandth part of an inch as truly as a high-grade stop watch does the fraction of a second.



Courtesy [*Brown & Sharpe Mfg. Co.*

Fig. 1.—Sectional view of Modern Micrometer Caliper.

In Fig. 1 is shown a sectional view of a modern micrometer caliper, the chief mechanical principle involved in it being the simple one of a screw free to move in a fixed nut. The slight projection on the left of the frame is called the anvil, and between this and the movable spindle is placed the work to be measured. As the frame is stationary, the spindle, which is attached to the thimble, approaches the anvil or recedes from it as the thimble is revolved. The divisions marked on the barrel, seen most clearly in Fig. 2, conform to the pitch of the enclosed screw, which is 40 threads to the inch. Thus each division marks one turn of the thimble and equals .025 in; and every four divisions serve to represent .0, .100 in., .200 in., or tenths of an inch, each engraved in plain figures 0, 1, 2, etc., just above the line parallel with the axis of the hidden spindle.

The bevelled edge of the thimble is graduated into 25 parts, and is figured every fifth division, 0, 5, 10, 15, and 20. When 25 of these graduations have passed the horizontal line on the barrel, the spindle, having made one revolution, has moved .025 in. Thus, when

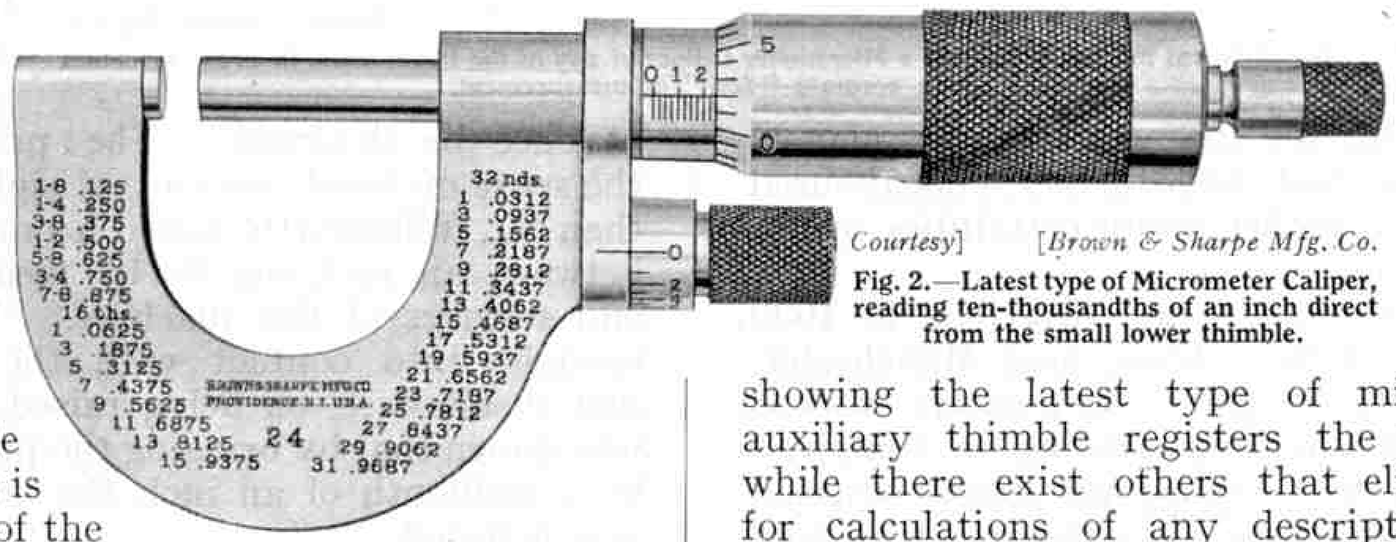
the spindle moves only far enough to allow one graduation marked on the thimble to pass the horizontal line on the barrel, it will have registered 1-25th of .025 in., or .001 ; that is one thousandth of an inch.

The milled clamp ring, shown both in position and in section in Fig. 1, is a device for locking the spindle in position and preserving the setting for repetition work. To this end a slight turn of the ring locks the spindle by tightening an inner band that encircles it.

The ratchet stop, shown in both Fig. 1 and Fig. 2, facilitates the quick opening of the micrometer, and furnishes the same degree of pressure for each measurement, thus eliminating the difference in personal touch, a distinct advantage when the same instrument is to be used by various hands.

A practical example of the method by which the micrometer may be read when opened haphazard may now be given, and it can be followed best by a reference to the barrel and top thimble of the latest type of instrument shown in Fig. 2. Here it will be noticed that the last figure to be seen engraved on the barrel is 2, which is 2-10ths or .200 in. Beyond this one graduation is visible, and of these graduations it will be remembered that each represents .025 in. On the bevelled edge of the thimble itself the reading shows two graduations from zero to the line that coincides with the horizontal one on the barrel. Thus the reading is .200, .025, .002, equals .227 in. It will be noted that on the frame of the micrometer shown in each illustration a table of equivalents in eighths, sixteenths and thirty-secondths of an inch is engraved.

Fig. 2 shows a feature that is claimed to be the most outstanding development of the micrometer caliper since the original instrument came into general use. This is the small lower thimble, by means of which ten-thousandths of an inch may be read directly. Thus, to the reading of the main barrel and thimble in thousandths, all that is needed is to add that of the small auxiliary thimble, which turns to indicate the ten-thousandths.



Courtesy] [*Brown & Sharpe Mfg. Co.*

Fig. 2.—Latest type of Micrometer Caliper, reading ten-thousandths of an inch direct from the small lower thimble.

In most instruments in common use to-day the method of reading in ten-thousandths of an inch is by a vernier scale. This scale consists of a series of ten divisions equally spaced and drawn lengthwise on that part of the barrel that in Fig. 1 has been cut away in order to show the micrometer screw. These ten divisions correspond in overall space with any nine graduations on the thimble. As each graduation marked on the thimble is known to represent one thousandth, or ten ten-thousandths of an inch, the actual difference in space between one graduation of the thimble and a division of the vernier scale will equal one ten-thousandth of an inch.

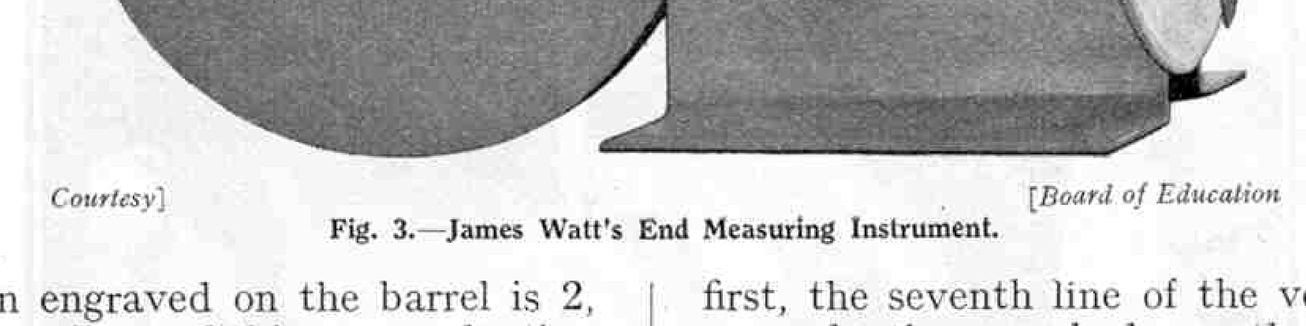
To make this point as clear as possible, it may be stated that the lines comprising the vernier scale are numbered 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, the first zero line being drawn immediately above the bold figures on the barrel. When the micrometer is closed, the two zero lines of the vernier scale correspond exactly with lines marked on the thimble.

Suppose the micrometer to be opened, and closed again after the insertion of a piece of material a ten-thousandth of an inch in thickness. Then the line 1 marked on the vernier will coincide with a graduation on the thimble. If the instrument be opened again and closed on seven pieces of material equal in thickness to the first, the seventh line of the vernier will correspond to a graduation marked on the thimble. But as the purpose of the micrometer and its vernier scale is to indicate the size of work not known beforehand, the method of reading may now be indicated.

First take a reading for thousandths in the manner already explained. Then notice which numbered line on the vernier comes opposite a graduation on the thimble. If the zero lines of the vernier coincide with any graduations whatsoever on the thimble, there are no digits to add when reading in ten-thousandths, and the figures previously cited might be rendered .2270 in. But if any other line from 1 to 9 on the vernier scale, say 7, is seen to come opposite a graduation marked on the thimble, the correct reading of the micrometer would be .2277 in.

Although, as may be seen in Fig. 2, showing the latest type of micrometer, the lower auxiliary thimble registers the ten-thousandths, and while there exist others that eliminate the necessity for calculations of any description, the pleasure of using a micrometer of any type is enhanced by a thorough understanding of the principles on which it is constructed.

As far as can be ascertained, the micrometer has behind it a history extending to 1639, while the vernier scale dates back over 300 years. When the latter was invented in 1631, by Pierre Vernier in France, it was in the form of a quadrant placed upon a mobile sector. According to one authority it was called the "Nonius," from the 90 degrees comprised in the first-named part of this calculating device. Others again ascribe the



Courtesy] [*Board of Education*

Fig. 3.—James Watt's End Measuring Instrument.

name to a Portuguese mathematician, who invented a method similar in principle but more complicated in practice, about the middle of the 16th century. Whatever its origin, this designation was retained for many years until, at the instigation of Lalande, the eminent astronomer, Vernier's method was most appropriately re-named after its inventor.

In the early stages of its development, both in England and on the Continent, the micrometer was used mainly in connection with astronomical observations. Publicity was first given to the idea by Huygens in 1659, when he described an appliance for determining the apparent diameter of an object seen through a telescope. This at first was nothing more than a series of metal strips varying in thickness, which he inserted in the focus of a telescope and afterwards measured with a fine compass. This was followed a few years later by Auzout's micrometer, which consisted of two silken threads, one of which was fixed, and the other movable in a direction parallel to it by means of a fine screw.

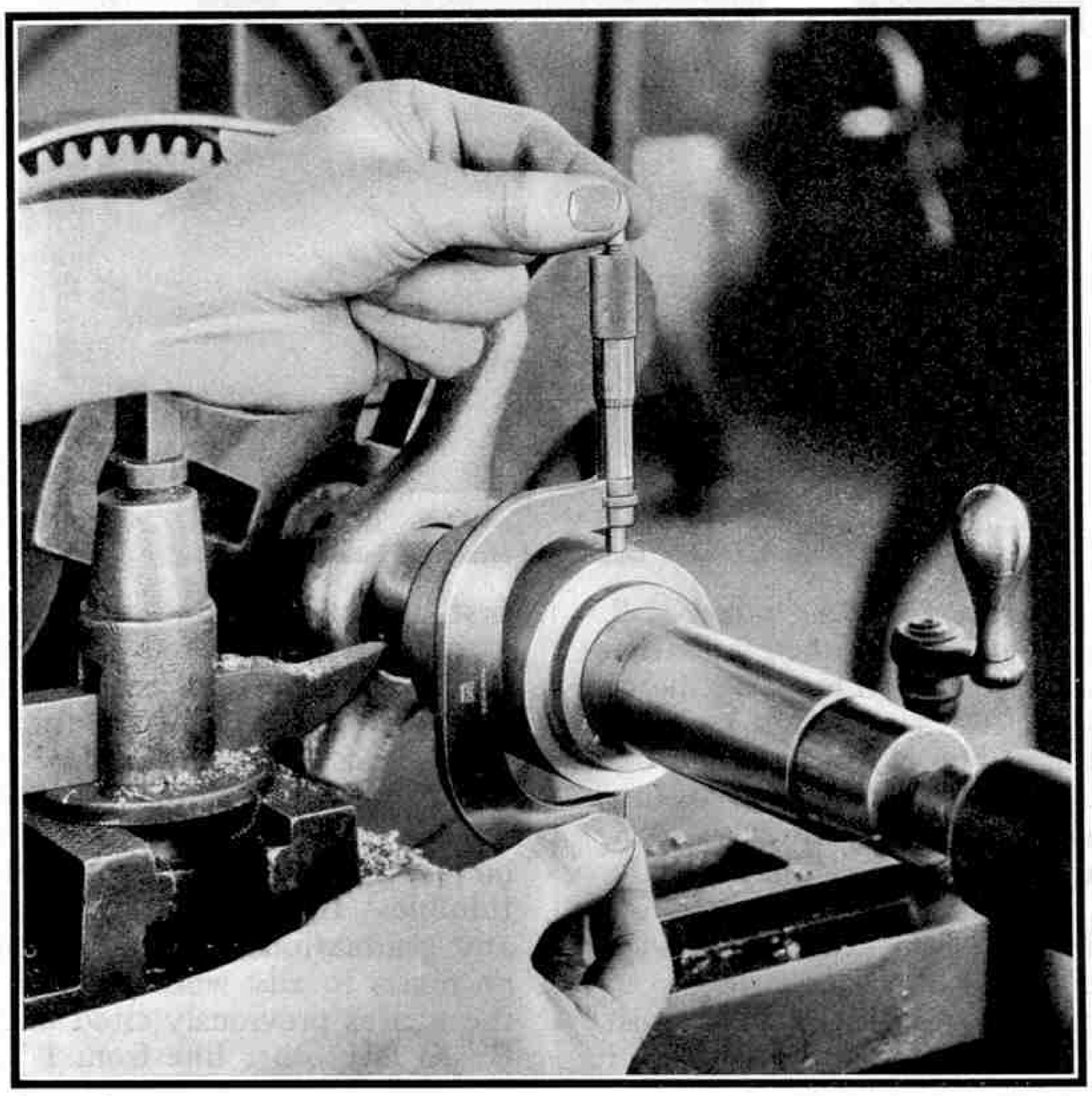
This notable improvement was described in one of the transactions of the newly formed Royal Society in 1666. Shortly afterwards it was pointed out by a Lancashire correspondent, Mr. Richard Towneley, that William Gascoigne, one of a brilliant band of young Yorkshire and Lancashire astronomers, had devised nearly 30 years previously a measuring instrument of as great accuracy as that made by Auzout. For some years Gascoigne had made use of it "not only for taking the diameters of the planets and distances on land, but had further endeavoured out of its preciseness to gather many certainties in the heavens."

Gascoigne's micrometer, seen and described in 1639 by William Crabtree, of Broughton, near Manchester, consisted of two fine metal plates or pointers worked by a single screw, the mechanism being so contrived that the optical axis of the telescope was always situated midway between the two edges. The distance traversed by the pointers was registered by means of an index on a dial divided into 100 equal parts.

While for astronomical purposes the micrometer was perfected and refined to a degree beyond the scope of the present article, it may be said that nearly two centuries had to elapse before it came into even limited use in the best engineering shops in England.

James Watt has left it on record that he was often baffled and thrown into despair by the incapacity of his workmen. He found on occasion that his cylinders when bored were an $\frac{1}{8}$ in. greater in diameter at one end than the other; and it was confidently predicted that his steam engine could never be brought into general use because of the difficulty in having the different parts manufactured with sufficient precision. Such experiences turned Watt's attention to the construction of an end measuring appliance. He invented one about the year 1772, crude in appearance by the side of modern examples, but embodying the same principle as that of the latest measuring tool.

This instrument is shown in Fig. 3. The fixed jaw on the left corresponds to the anvil of present-day micrometers, while the movable jaw, actuated by a finely threaded screw, is the forerunner of the modern spindle. The screw has 18 threads per inch, while the dial, seen on the right of the illustration, has 50 divisions, each further sub-divided into two. By this means the pointer registration indicates a movement of the measuring face of 1/1800 of an inch. Geared with the screw is a small worm wheel, and a double fingered pointer that registers on the small dial and indicates 1/256 parts of an inch; that is, 1/8 of 1/32.



Courtesy [*Brown & Sharpe Mfg. Co.*

A convenient method of holding a Micrometer Caliper of any of the larger sizes, in order to obtain an accurate "feel" or measurement.

Early in the 19th century Maudslay was using in London a micrometer constructed on the lathe principle, by which work could be measured to a ten-thousandth part of an inch; while at the Great Exhibition of 1851 one of his most brilliant pupils, Whitworth, demonstrated a measuring machine of such sensitiveness that by its means the difference of a millionth part of an inch could at once be detected. The principle employed was the sense of touch instead of sight. What Sir Joseph, then Mr. Whitworth, called a gravity piece, was placed between an inch bar to be measured and one of the end surfaces of the machine. When this piece was brought into contact with the two surfaces, so as just to allow it, on being raised, to fall by gravity, it was shown that by bringing the planes into closer contact by a millionth of an inch the fall of the gravity piece was arrested.

It will be readily understood that this particular appliance was not adapted for workshop use, and the same may be said of another measuring appliance on which Sir Joseph used to place a square bar of steel representing the Imperial Standard yard. Having adjusted the gravity piece as before, in order to fall by its own weight, he showed that its fall could at once be arrested by the heat imparted to the bar by the slightest touch of the human fingers, thus demonstrating the lengthening of the steel yard owing to such a small amount of heat.

(*Continued on page 23*)

New Giant Ditch-Making Machine

Implement that Digs Four Miles of Trench in One Day

IN preparing land for cultivation and in keeping it in the best condition it is necessary to dig ditches. In some instances this is done to provide drainage channels, and in others the trenches are for irrigation purposes. To make these by employing men to dig with spades is very costly and tedious, and if ditching on a large scale is to be carried out in this manner, the services of an enormous number of labourers are required.

In order to speed up the work of trench construction and to reduce its cost, machines of many types have been tried. For instance, dragline excavators have been used with success, particularly on large irrigation projects. Powerful machines of this kind are not specially adapted for cutting ditches of comparatively small cross section, however, and finishing off the sides of the channels usually requires manual labour.

Another proposal that has been put into practice is to use explosives. When this method is employed the charges are placed in holes bored at intervals along the line on which the trench is to be made. This is not very satisfactory, however, for afterwards the explosion debris has to be cleared away.

The cost and trouble of making ditches may now be very greatly reduced by the employment of a machine recently introduced by J. Fowler & Co. (Leeds) Ltd., Leeds. This cuts a trench of the desired width and depth at remarkable speed. When in action the implement is hauled by a steel cable attached to a powerful traction engine. The cutting blade ploughs its way through the earth and not only shapes the ditch, but leaves the sides well trimmed and places the excavated soil at a distance from the edge of the trench in order to prevent it from falling back.

The machine is very adaptable, for it cuts ditches of several types. For instance, in one the width at the bottom is about 12 in., and at the top is 3 ft. In another type the sides have a gentler slope, the width at the bottom being 8 in., while that at the surface level is 6 ft. 6 in. In each case a clear space, or " berm," as it is called, is left on each side of the trench, none of the material dug out being deposited within one foot of the edge.

Ditches of the two sizes mentioned are almost standard and the machines usually are constructed to dig one of them. The depth may be varied, but if a trench of any other width is to be dug a different cutter must be used. Ditches of the second type are more usual for both drainage and irrigation work, for the slope of the sides is not very steep and there is less likelihood that heavy rains will wash the soil into the trenches.

The ditching machine is very strongly built, for it encounters considerable resistance, and is hauled by a traction engine that develops up to 80 h.p. This engine is kept stationary and drags the implement towards it, the actual effort being reduced by the use of a double rope that passes from the winding pulley on the traction engine down to a sheave pulley on the machine and back to the draw-bar of the engine.

Above is a view of the Fowler Ditching machine ploughing its way through the earth. The sides of the trench cut by the implement are neatly finished off and the excavated soil is placed well away from the edges.

The machine is operated by means of a rope hauled in by a stationary traction engine. This is kept in position by scotching the wheels in the manner shown on the left. For these illustrations we are indebted to the courtesy of J. Fowler and Co. (Leeds) Ltd.

If the ditcher were to encounter any tough obstacle during the passage of its blade through the earth, there would be a tendency for the traction engine to be pulled backward. In order to prevent any movement of this kind scotches are fixed on to the large driving wheels of the engine and heavy abutments are placed in convenient positions behind them.

In order to begin work, the engine runs along the line of the proposed ditch to a distance of about 100 yds. The wheels are then scotched and the ditcher is dragged along by means of the connecting rope at a speed of about a mile an hour. When it reaches the traction engine this again runs forward, the rope meantime being paid out, and is then rescotched ready for a second pull.

The speed at which the ditcher works is remarkable. Although a proportion of the time is spent in moving and scotching the traction engine, little difficulty is experienced in cutting three to four miles of ditch in one day. Five men only are needed to operate the machine while cutting trenches of this total length, and in order to do the same amount of work in one day by hand the services of a hundred times as many men would be required.

The Fowler ditching machine has been given thorough trials in practical conditions. In work in a South European country it was found that the cost of operations amounted to only $\frac{3}{4}$d. for each yard of ditch cut, in spite of the fact that the length excavated per day was less than the possible output of the

(Continued on page 77)

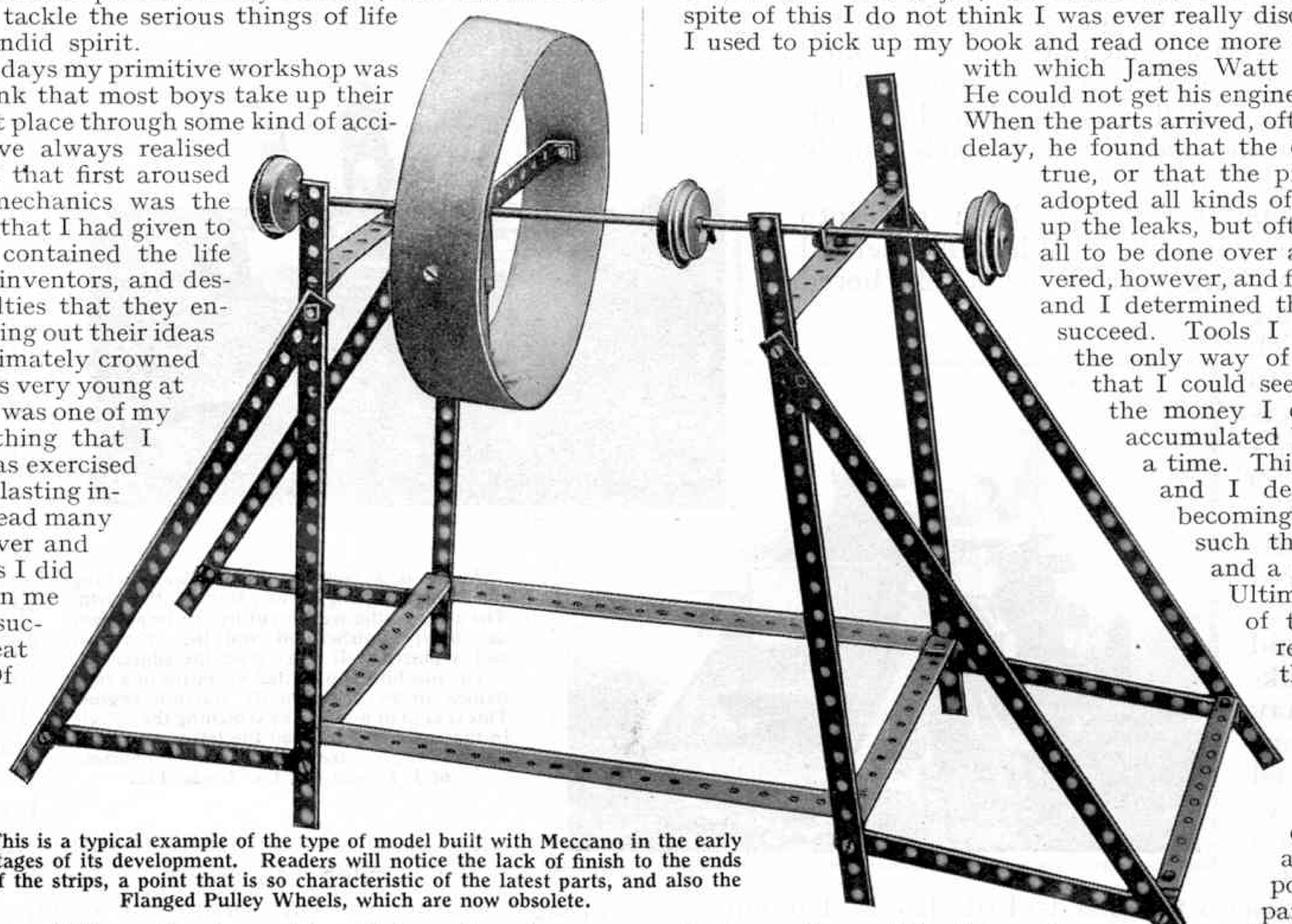
The Life Story of Meccano

Romance of the World's Greatest Toy

By Frank Hornby

EVERY normal healthy boy has hobbies, and I often think that the earnestness and thoroughness with which he follows them is an index to the kind of man he will make when he grows up. A boy without a hobby always seems to me to lead an aimless and rather miserable existence; and whenever I come across such a boy I long to sit down beside him and talk to him, find out what his interests are, and start him off then and there on a suitable hobby. It always gives me the greatest pleasure to see a boy following his hobbies with keenness, trying to find out more about them, and to improve his knowledge and skill in every possible way. I know that this keenness will become part of the boy's nature, and that when he grows up he will tackle the serious things of life in the same splendid spirit.

In my boyhood days my primitive workshop was my hobby. I think that most boys take up their hobbies in the first place through some kind of accident; and I have always realised that the accident that first aroused my interest in mechanics was the reading of a book that I had given to me. This book contained the life stories of famous inventors, and described the difficulties that they encountered in working out their ideas before success ultimately crowned their efforts. I was very young at the time, and this was one of my first books. Nothing that I have read since has exercised such a strong and lasting influence on me. I read many of the chapters over and over again, and as I did so there grew up in me a great desire to succeed as these great men had done. Of all the stories in this book the one that fascinated me most was that of Palissy and his discovery of a white glaze for earthenware. I used to read with unfailing enthusiasm of how Palissy struggled on in the face of failure after failure. I well remember how I used to picture him sitting by his furnace day and night, and how excited I used to be at the point where, when all his fuel was exhausted, he broke up chairs and tables and tore down shelves to feed his furnace!



This is a typical example of the type of model built with Meccano in the early stages of its development. Readers will notice the lack of finish to the ends of the strips, a point that is so characteristic of the latest parts, and also the Flanged Pulley Wheels, which are now obsolete.

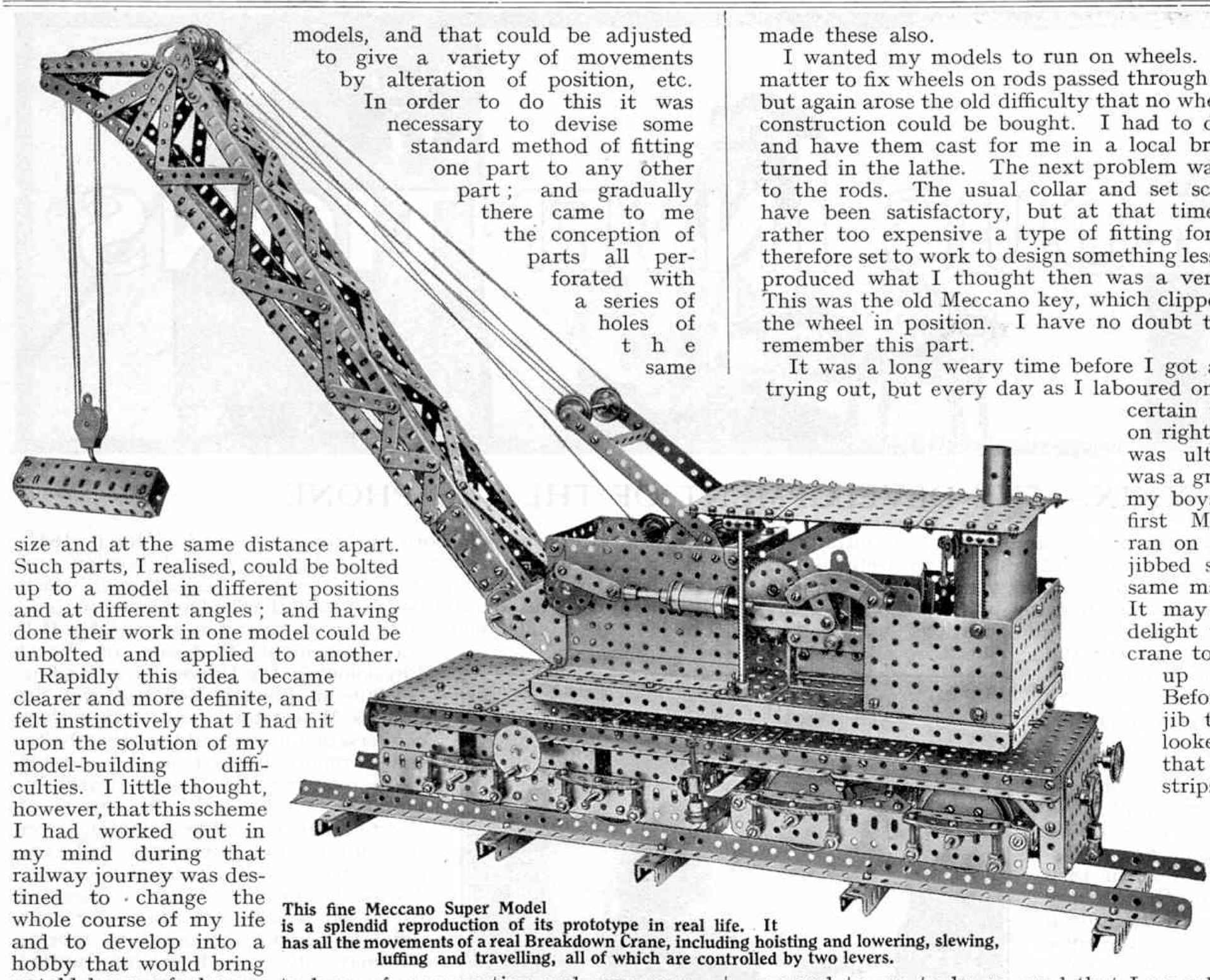
It was one thing to decide to become an inventor, but quite another to know how to set about it. At that time perpetual motion was being very widely discussed, and I conceived the idea of trying to invent a machine that should solve the problem. I felt that if I could make such a machine I should have accomplished something very wonderful. I certainly should! I little knew when I set to work that I was attempting an impossible task, and it was fortunate that this was so, for I worked away in my little workshop with the utmost enthusiasm, and also began to study the principles of mechanics. In the end I failed, as thousands had done before me; but in the effort I had learned something of engineering, and had considerably improved my mechanical skill.

After my setback in regard to perpetual motion I turned my attention to simpler and more practical matters, and during the next few years I produced a number of small inventions. Most of them were of little or no practical use, but the perfecting of each one was a source of the utmost pleasure and excitement. I have forgotten now what most of these inventions were about, but I do remember one of them—a submarine, which on being placed on the water and set going submerged itself and continued to propel itself for some distance under the water. There was just one little flaw in this invention—the vessel would not come to the surface again of its own accord! And so my submarine never brought me fame or fortune.

At this period my little workshop was my paradise where I spent my spare time in working out all kinds of ideas as they came to me. Although I was happy at my work I had many difficulties to face. I was badly handicapped by the lack of suitable tools, those I possessed being so few and so crude that, however much care I took over a job, the result was often disappointing. In spite of this I do not think I was ever really discouraged. Often I used to pick up my book and read once more of the difficulties with which James Watt had to contend. He could not get his engines made properly. When the parts arrived, often after weeks of delay, he found that the cylinder was not true, or that the pipes leaked. He adopted all kinds of schemes to stop up the leaks, but often the work had all to be done over again. He persevered, however, and finally succeeded; and I determined that I also would succeed. Tools I must have, and the only way of obtaining them that I could see was to save all the money I could, and as it accumulated buy one thing at a time. This was slow work, and I despaired of ever becoming the owner of such things as a lathe and a drilling machine. Ultimately I got most of the tools that I really needed, but the weary waiting turned my thoughts in the direction of interchangeable parts that could be used for a variety of purposes, instead of parts that had to be made specially for each particular job. Looking back over those days I can trace in those vague ideas the germ of the Meccano system.

After I was married and had boys of my own I still made models as eagerly and enthusiastically as ever; and when my boys were old enough it was my delight to make mechanical toys for them and join in their play. We were always working and playing together, always thinking out something new; and most of my spare moments were spent in planning out new ideas and games. By this time I had a fairly good equipment of tools, but I still felt that a great deal of time and labour was wasted in laboriously making parts that would only serve for one particular model, and were useless for the next model I devised.

One snowy Christmas eve I was making a long railway journey, and as I sat in my corner seat my mind was as usual turning over new schemes for my boys' enjoyment. At that time we were experiencing trouble in our little workshop through lack of a number of small parts for building up a splendid model crane that we were making. I had tried in all directions to buy these parts, but apparently nothing of the kind existed. Clearly it would be a long and monotonous process to make them, and as I thought over the matter in the train I was more impressed than ever before with the waste of time and labour involved in making a part specially for a single purpose. I felt that what was required was parts that could be applied in different ways to many different



This fine Meccano Super Model is a splendid reproduction of its prototype in real life. It has all the movements of a real Breakdown Crane, including hoisting and lowering, slewing, luffing and travelling, all of which are controlled by two levers.

models, and that could be adjusted to give a variety of movements by alteration of position, etc. In order to do this it was necessary to devise some standard method of fitting one part to any other part; and gradually there came to me the conception of parts all perforated with a series of holes of the same size and at the same distance apart. Such parts, I realised, could be bolted up to a model in different positions and at different angles; and having done their work in one model could be unbolted and applied to another.

Rapidly this idea became clearer and more definite, and I felt instinctively that I had hit upon the solution of my model-building difficulties. I little thought, however, that this scheme I had worked out in my mind during that railway journey was destined to change the whole course of my life and to develop into a hobby that would bring untold hours of pleasure to boys of every nation and every age throughout the world.

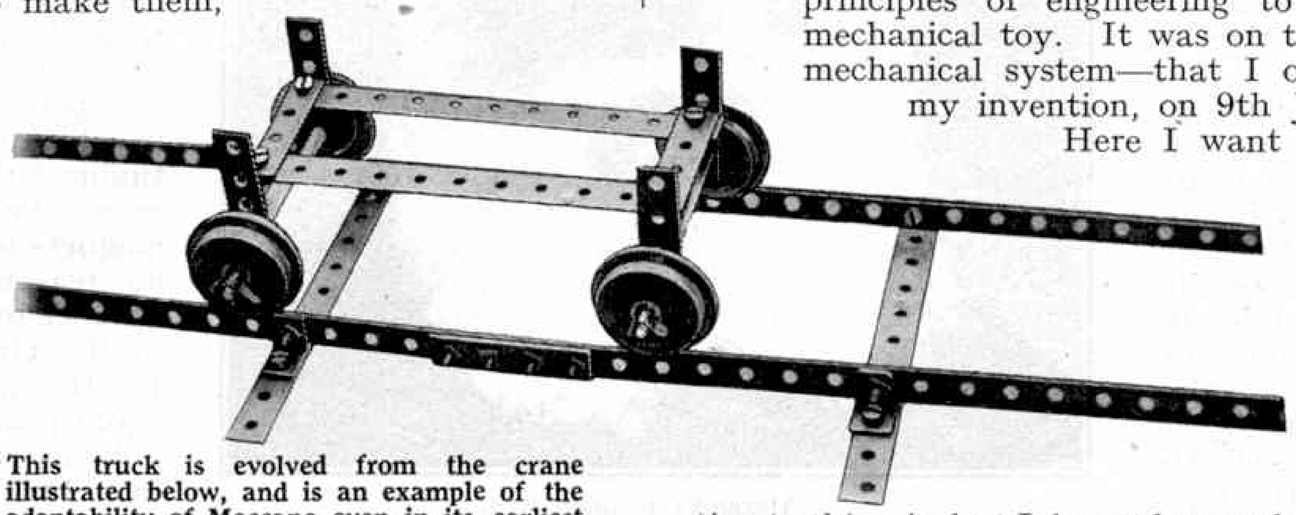
As soon as I possibly could I set to work to translate my ideas into practice. I began with the simplest parts, and I used copper to make them, because it is a soft metal and was easy for me to work. I quickly realised that making parts more or less at random, simply because I thought they would be useful, would not do. Before any real progress could be made it was necessary to think out carefully a series of parts of the most useful types and sizes, keeping in mind the relation they would bear to one another when built into models. First of all I determined to deal with the simplest type of part, the strip. After careful thought I decided that I would make all my strips half-an-inch in width, with equal sized holes along the centre at half-inch intervals. I first made a $2\frac{1}{2}$ in. strip, then a $5\frac{1}{2}$ in., and so on up to a $12\frac{1}{2}$ in. strip, which, I remember, seemed to me at the time quite an enormous part! It was a long job to make all the strips that I required, but I spurred myself on with the thought of how useful they were all going to be, and so I never got tired of the work.

The dimensions of the strips, the size of the holes, and the distance between them that I adopted at that time have never been changed during all the years in which Meccano has existed. I look upon it as very remarkable that I should have been fortunate enough, with so little experiment, to hit upon what have proved to be the best standard dimensions.

Nuts and bolts were my next trouble. I had expected to be able to buy these, but although I sought high and low I could not find any that were suitable for my purpose. Once again I had to fall back on my own resources and make every nut and bolt myself. This job seemed as though it would never end! Now cropped up the difficulty of fastening the strips together at right angles; and for this purpose I devised angle brackets, and I made these also.

I wanted my models to run on wheels. It was quite an easy matter to fix wheels on rods passed through the holes in the strips, but again arose the old difficulty that no wheels of suitable size and construction could be bought. I had to design my own wheels and have them cast for me in a local brass foundry and then turned in the lathe. The next problem was to fix the wheels on to the rods. The usual collar and set screw would, of course, have been satisfactory, but at that time this seemed to me rather too expensive a type of fitting for my requirements. I therefore set to work to design something less costly, and ultimately produced what I thought then was a very effective substitute. This was the old Meccano key, which clipped on the rod and held the wheel in position. I have no doubt that many readers will remember this part.

It was a long weary time before I got all my parts ready for trying out, but every day as I laboured on I felt more and more certain that I was proceeding on right lines and that success was ultimately assured. It was a great day for me and for my boys when I built up my first Meccano crane, which ran on wheels and luffed and jibbed splendidly, just in the same manner as a real crane! It may be imagined what a delight we took in taking the crane to pieces and building it up again several times. Before we attached the jib the base of the crane looked so much like a truck that we added a few more strips and made it into a real truck, and I shall never forget the fun we had playing with the model in this way. At this stage I carefully considered the system that I had developed, and it seemed to me to be so good that I consulted a patent agent in regard to obtaining some protection for it. On the advice of this agent I at once took out patents.



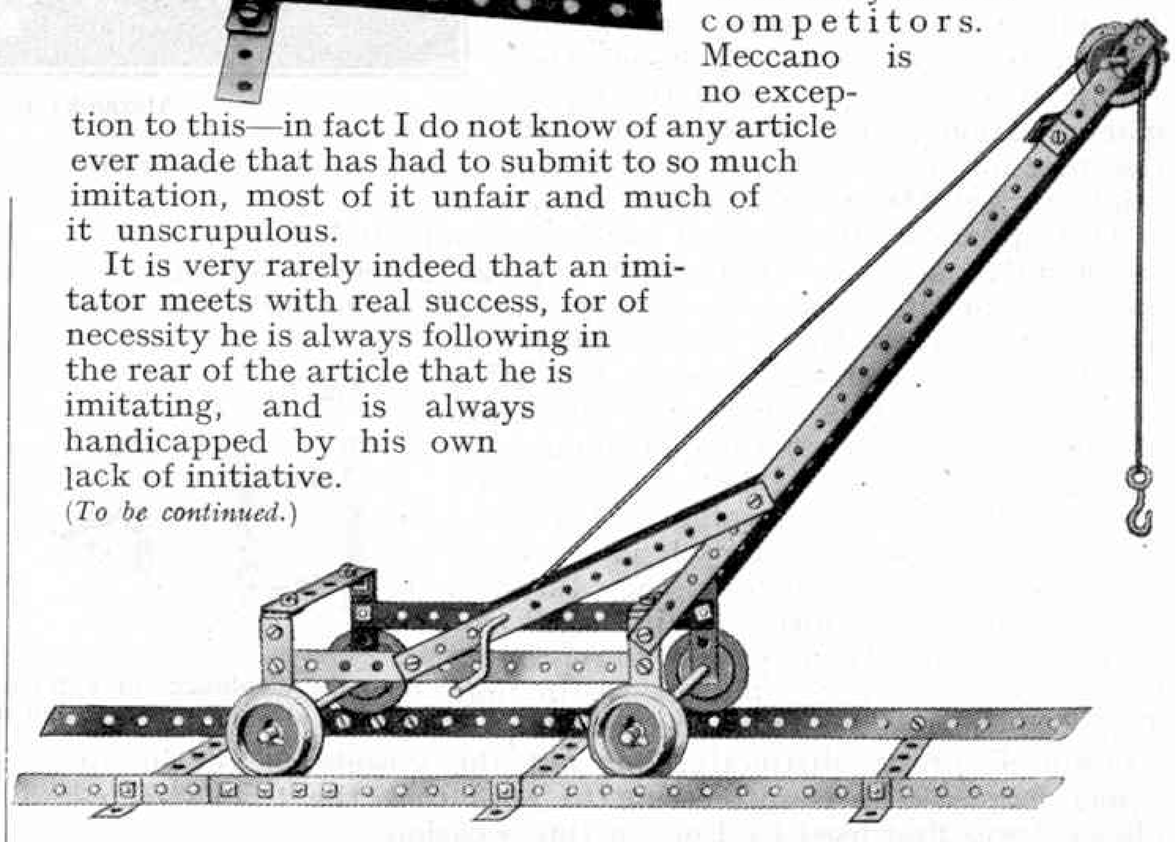
This truck is evolved from the crane illustrated below, and is an example of the adaptability of Meccano even in its earliest stages.

I claim that Meccano is the original application of the basic principles of engineering to a metal constructional or mechanical toy. It was on this basis—that is as a metal mechanical system—that I obtained the first patent for my invention, on 9th January, 1901.

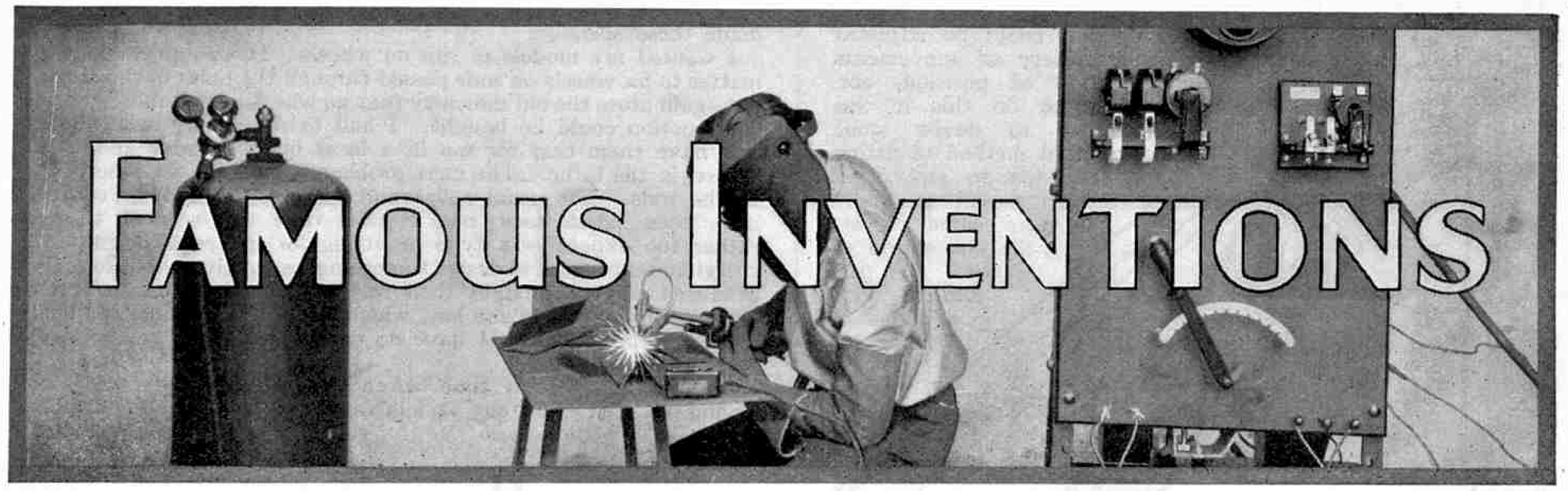
Here I want to digress for a moment in order to say something about the many imitations of my invention. Probably no article or commodity of outstanding merit was ever produced that was not imitated by envious competitors. Meccano is no exception to this—in fact I do not know of any article ever made that has had to submit to so much imitation, most of it unfair and much of it unscrupulous.

It is very rarely indeed that an imitator meets with real success, for of necessity he is always following in the rear of the article that he is imitating, and is always handicapped by his own lack of initiative.

(To be continued.)



A simple model of a crane constructed with one of the first Meccano Outfits 30 years ago. Some idea of the enormous progress made may be obtained by comparing this model with one of the latest Meccano Super Models, the Railway Breakdown Crane shown above.



XXIX.—THE DEVELOPMENT OF THE TELEPHONE

OF the many thousands of inventions brought out during the past century one of the most interesting and useful is the telephone. Within the space of 66 years this instrument has developed from a crude scientific toy into a means of communication involving millions of conversations every day throughout the world. To-day the telephone is so much used and so indispensable in our daily life that we are inclined to wonder how our grandfathers managed without it.

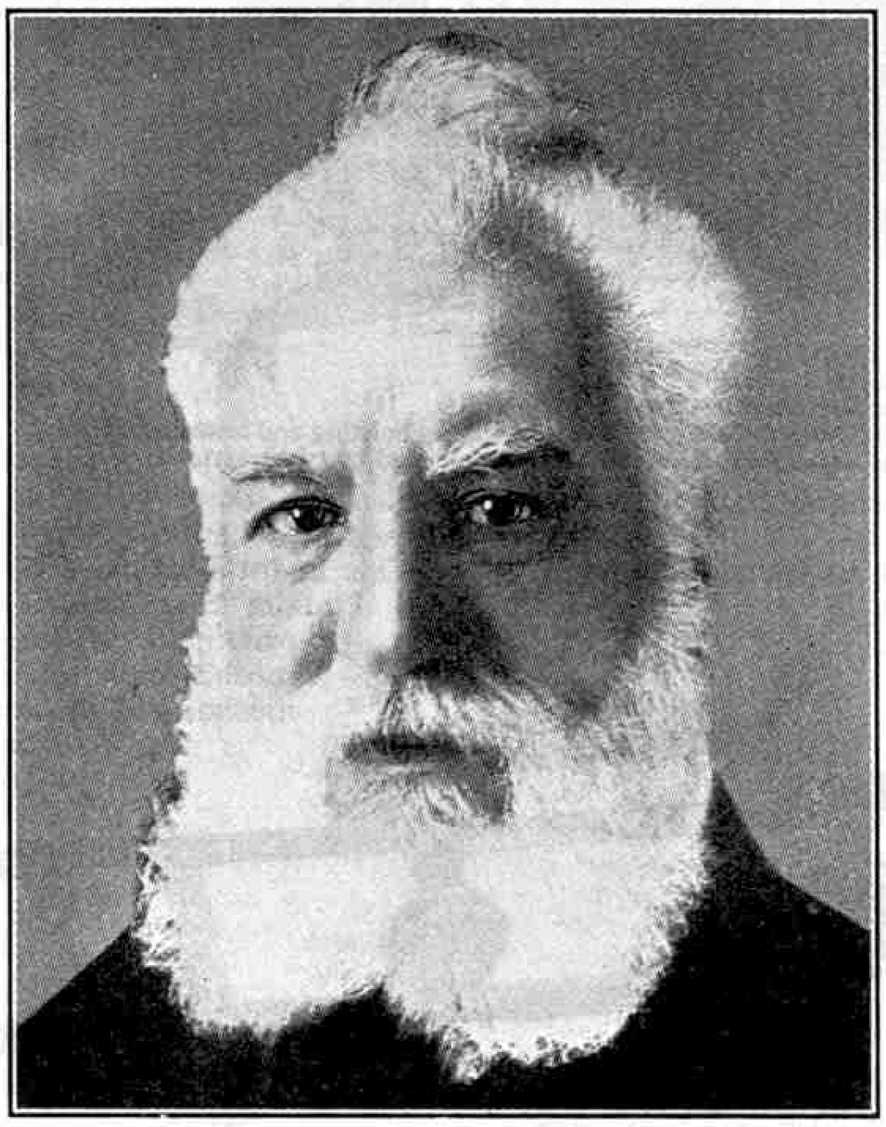
The first successful attempt at the construction of an electric telephone—that is an instrument by means of which vibrations set up by the voice or by some musical instrument are transmitted by electricity—was made in 1860 or 1861 by Johann Philipp Reis, science master in a school at Friedrichsdorf, Germany. In his apparatus the voice was made to act upon a point of loose contact in an electric circuit and which, by bringing those parts into closer or less close contact, varied the resistance offered to the current.

Reis's transmitter consisted of a box having a hole covered by a tightly-stretched membrane to which was attached a little strip of platinum. When the membrane was caused to vibrate by sounds produced close to the box, the platinum strip moved to and fro against a metal point that closed the circuit of a battery. The receiving instrument consisted of a soft iron wire fixed upon a sounding board and surrounded by a coil of insulated wire. The vibrations of the membrane of the transmitter opened and closed the circuit at a great speed, and the rapid magnetisation and demagnetisation of the wire produced a tone of the same pitch as the one that originally set the membrane vibrating.

This apparatus transmitted musical sounds and melodies with considerable accuracy, but there is great difference of opinion as to whether it was able to transmit speech. Professor Silvanus Thomson states that Reis's telephone could and did transmit speech, but other experts dispute this. Probably the truth of the matter is that this telephone was able to transmit words, but so imperfectly as to be of no practical value. This defect was admitted by Reis himself in a lecture delivered in 1861 before the Physical Society of Frankfort. "Hitherto," he said, "it has not been possible to reproduce human speech with sufficient distinction. The consonants are for the most part reproduced pretty distinctly, but not the vowels as yet in an equal degree." It is interesting to note that the term "Telephony" was first used by Reis on this occasion.

The inhabitants of Friedrichsdorf appear to have thought a great deal of the work of Reis, for they erected a statue to him.

The first really successful telephone was invented by Alexander Graham Bell, who was born at Edinburgh on 3rd March, 1847. He studied at the Universities of Edinburgh and London and adopted the family calling, that of a teacher of elocution, in which sphere of work his grandfather and his father had achieved success. In 1870 the family removed to Canada, and two years later Bell was appointed Professor of Vocal Physiology in the University of Boston.



Alexander Graham Bell.

While in London Bell had met Sir Charles Wheatstone, and during their conversation he learned that Helmholtz, the German physicist, had succeeded in reproducing the vowels clearly by vibrating tuning forks by means of electro-magnets. When thinking over this information afterwards Bell conceived the idea of a musical telegraph. To use his own words: "I imagined to myself a series of tuning forks of different pitches, arranged to vibrate automatically . . . each fork interrupting at every vibration a voltaic current, and the thought occurred, 'Why should not the depression of a key like that of a piano direct the interrupted current from any one of these forks, through a telegraph wire, to a series of electro-magnets operating the strings of a piano or other musical instrument, in which case a person might play the tuning-fork piano in one place and the music be audible from the electro-magnets in a distant city?' . . . I saw no reason why the depression of a number of keys at the tuning-fork end of the circuit should not be followed by the audible production of a full chord from the piano in a distant city."

Bell's work at the University left him little time for experiment, but before long he gave up his post and commenced giving private lessons. One of his pupils at that time was Mabel Hubbard, whom he afterwards married, and whose father assisted him considerably by financing his experiments.

Bell now had more time to devote to experimental work on his telegraph. During a visit to Washington he made the acquaintance of Professor Henry, the famous American scientist, and through him he obtained an assistant, Thomas A. Watson, who will always be remembered as the first person to hear a clearly-spoken message over the telephone. Watson was an apprentice at Williams' Electrical Shop, 109, Court Street, Boston, and in rooms over the shop they worked together for three years trying to perfect a musical telegraph. By 1874 they succeeded in evolving a device by which 10 or 12 Morse signals could be sent at the same time over a single wire. The "harmonic telegraph," as Bell called it, made use of a phenomenon known as sympathetic vibration, and led him to try to develop from the instrument a "talking telegraph" by which speech could be made visible to deaf people. Bell's theory was that by studying the vibrations of a magnetic needle caused

Fig. 2

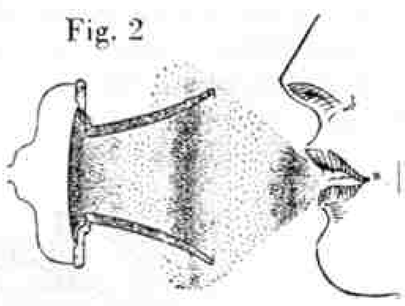
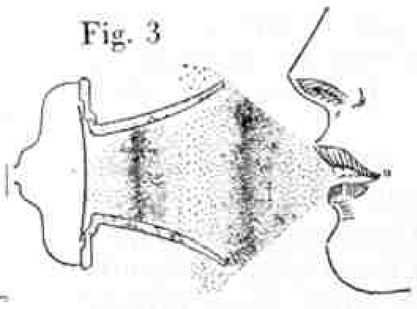


Fig. 3



How the diaphragm of a transmitter vibrates when sound waves fall upon it.

to move by the sounds of speech, a deaf person could learn to interpret the sounds represented by the vibrations and thus "see" what was being said. With characteristic patience Bell and Watson continued their experiments, never thinking that they would end by inventing the first practical telephone.

On a hot and oppressive afternoon in June, 1875, Bell and Watson were toiling away as usual, testing some new arrangement of their apparatus. Watson, who was working in a room by himself, was experiencing a great deal of trouble with the spring of his instrument which, instead of vibrating freely, was continually sticking to the pole of its magnet. After this had gone on for a while Watson naturally became irritated and plucked repeatedly at the spring to make it free itself. Suddenly Bell, who was working in another room, came running into Watson's room in a state of great excitement, shouting: "What did you do then? Don't change anything. Let me see!" He had heard in his room a faint reproduction of the twanging of the spring as Watson plucked at it! The vibration of the spring over the pole of its magnet had generated an electric current and thus transmitted the sound.

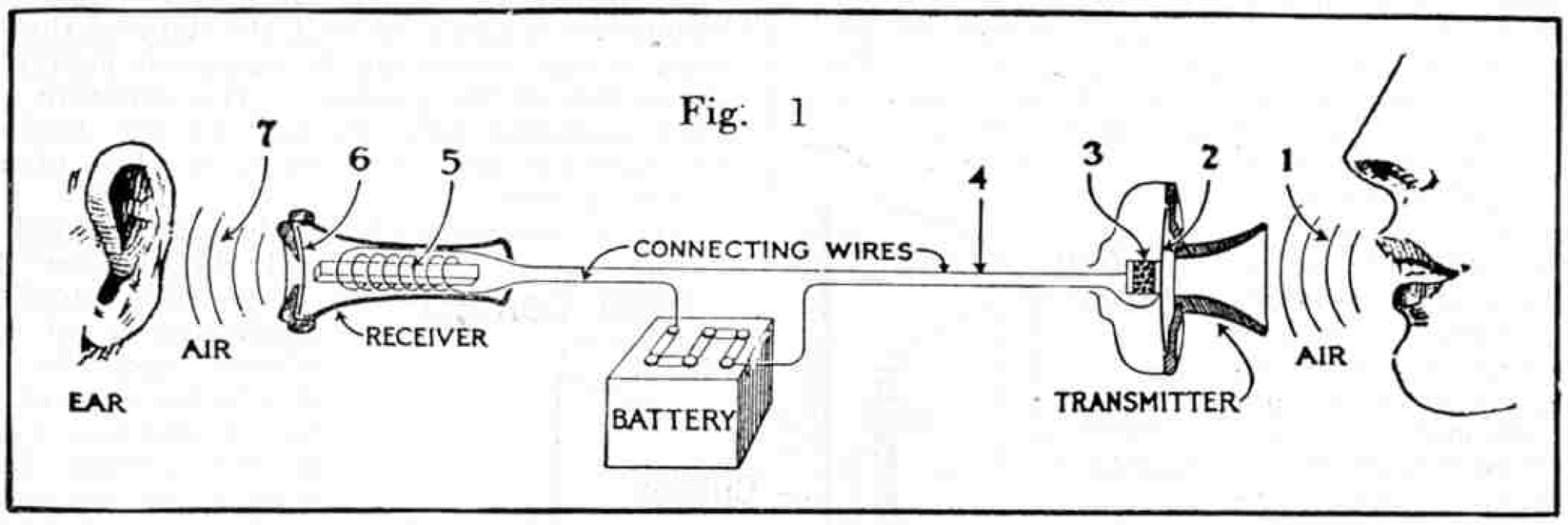
It was fortunate that the man who heard the reproduction of the sound of the twanging spring had sufficient imagination to be able to realise the enormous importance of this occurrence. Bell saw at once that, if this sound could be transmitted, there was no apparent reason why a more perfect apparatus should not transmit any other sounds, a melody, or even speech. He instructed Watson to attach to one of the harmonic telegraph receivers a small drumhead of gold-beater's skin, the centre of which was to be joined to the free end of the receiver spring. Watson had this arrangement ready the following morning. When Bell talked against the drumhead the steel spring was forced to follow the vocal vibrations, and generated an electric current that varied in intensity according to the variations in the density of the air in front of the drumhead. To their great delight the simple contrivance transmitted the tones of the human voice, instead of merely the tone of the moving spring.

The talking telegraph was now quickly forgotten and the two men worked desperately hard to produce a telephone that could transmit music and speech. For nine months they toiled, and on 10th March, 1876, Bell spoke the first words that ever passed clearly and distinctly over a pair of electric wires. The telephone line had been extended down two flights of steps to the ground floor, and Watson, listening intently at the receiver, heard Bell's voice and the words "Mr. Watson, please come here, I want you." They were simple words, but they deserve to be remembered.

After a few more weeks spent in making improvements in certain parts of the apparatus, Bell decided that the time was ripe for introducing the invention to the public. At that time the Centennial Exposition was just about to open at Philadelphia, and Bell erected his telephone in an obscure corner in the Education Building. No one took much notice of it, however, and when the judges arrived at this exhibit at the end of their day's work they were tired and hungry and disinclined to trouble about such an apparently insignificant affair. They stared at the apparatus in a lifeless sort of manner, and were just thinking of departing for their hotels when in walked Dom Pedro, Emperor of Brazil, accompanied by the Empress Theresa and their suite.

The Emperor had once visited Bell's class at Boston University, and he now greeted him warmly and asked to be told about the new invention. Bell explained briefly and told the Emperor to listen while he himself went to the other end of the wire and spoke into the transmitter. Almost immediately the weary judges were galvanised into activity, for the Emperor, dropping the receiver in his excitement, called out: "It talks, it talks!"

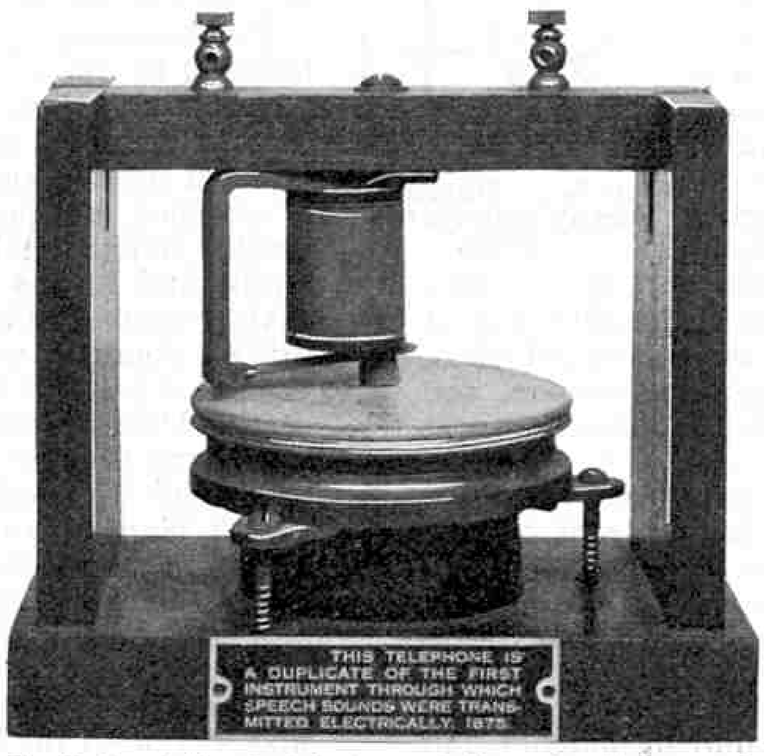
Fig. 1



This interesting diagram shows clearly the parts played by the transmitter and the receiver during a telephone call.

The judges had now forgotten all about such things as fatigue and hunger and one by one they listened to the marvels of the instrument. Professor Henry took up the receiver, and was followed by Sir William Thomson (afterwards Lord Kelvin), who said most emphatically: "It is the most wonderful thing I have seen in America."

On the following day the exhibit was moved from its out-of-the-way corner to the most prominent position in the exhibition. This brought Bell immediately into public notice, and in response to a great demand he delivered a large number of lectures in various parts of the United States, on the proceeds of which he married and sailed to Europe for his honeymoon. Bell's father-in-law now took in hand the commercial exploitation of the invention and one or two small exchanges were soon established. The first great success was won when one of the largest subscribers to the Western Union Telegraph Company asked for telephones to be installed as a substitute for the printing telegraph. After legal arguments it was decided that the Bell Telephone Company had the right to instal the telephones in preference to the Western Union, and thus the telephone commenced its upward path to success. Soon afterward Bell and Watson sold their shares in the company and retired from active work in connection with the telephone.



Duplicate of the first instrument through which speech sounds were transmitted electrically, 1875.

Bell's application for a patent for his telephone was filed in the Patent Office of the United States on 15th February, 1876, and it is an interesting and remarkable fact that on the same day an American inventor, Elisha Gray, of Chicago, also lodged a patent for an instrument for electrically transmitting the human voice. Careful inquiry was made, it was proved that Bell's application was the first to be lodged, and the patent was therefore awarded to him.

Bell used the same instrument both as a transmitter and a receiver. As a receiver it was excellent, but the currents generated by it were so small that it was of little use as a transmitter. The working of Bell's telephone is demonstrated very clearly in Fig. 4, which is an adaptation of one of the figures in his original patent. Two of these instruments were used, one for transmitting and the other for receiving, and the magnetic coils were connected together by two copper wires, one of which was broken to include a battery in the circuit. Thus current flowed from the battery through each coil and back to the battery.

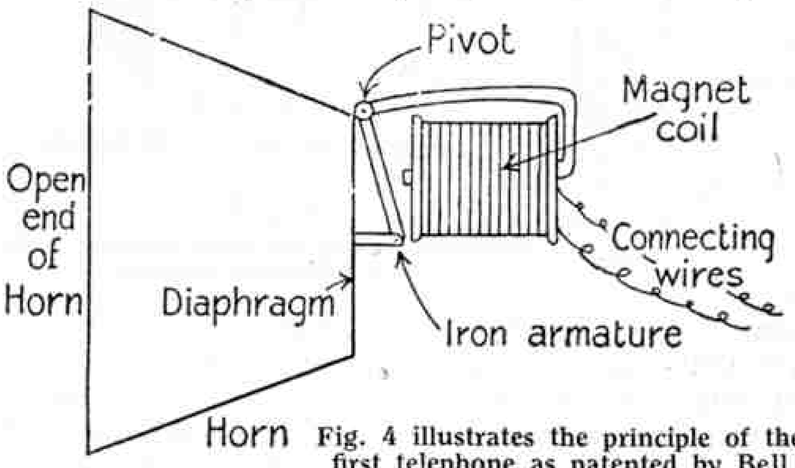


Fig. 4 illustrates the principle of the first telephone as patented by Bell in 1876.

In order to operate the instrument it was necessary to speak into the horn, thus causing sound waves to strike the diaphragm stretched across the narrower end of the horn. This diaphragm was a piece of gold-beater's skin, tightly stretched yet pliable and elastic, and it moved in and out in almost exact accordance with the sound waves that impinged upon it. In this way the sound was converted into mechanical movement. By means of a short rod, a soft iron armature pivoted as shown in the figure was attached to the centre of the diaphragm. This armature was placed immediately in front of one pole of the electro-magnet, the other pole of which was magnetically connected with the other end of the armature through its pivot. When the circuit was completed by connecting up the coils and the battery, the core of the electro-magnet became strongly magnetised, as also did the iron armature owing to its nearness

to the electro-magnet. In this way there was produced a very strong magnetic "field"—a space in which a strong magnetic influence exists—between the armature and the core of the magnet.

When the diaphragm of Bell's instrument vibrated owing to some sound being made in front of it, the armature moved to and fro on its pivot. When a magnet is moved across a strong magnetic field in which there is a coil of wire, a minute electric current is set up in that coil, and thus there was induced in the magnet coil of Bell's instrument a fluctuating electric current in accordance with the original sound and quite distinct from the constant current supplied by the battery. The fluctuations of current passed through the coil of the receiver varied the strength of the pull exerted by the magnet core upon the iron armature. Consequently the armature moved toward or away from the core according to whether the magnetic attraction had been increased or decreased. These movements were communicated to the diaphragm of the receiver, where they produced corresponding sound waves, or in other words reproduced the original sound made before the first diaphragm.

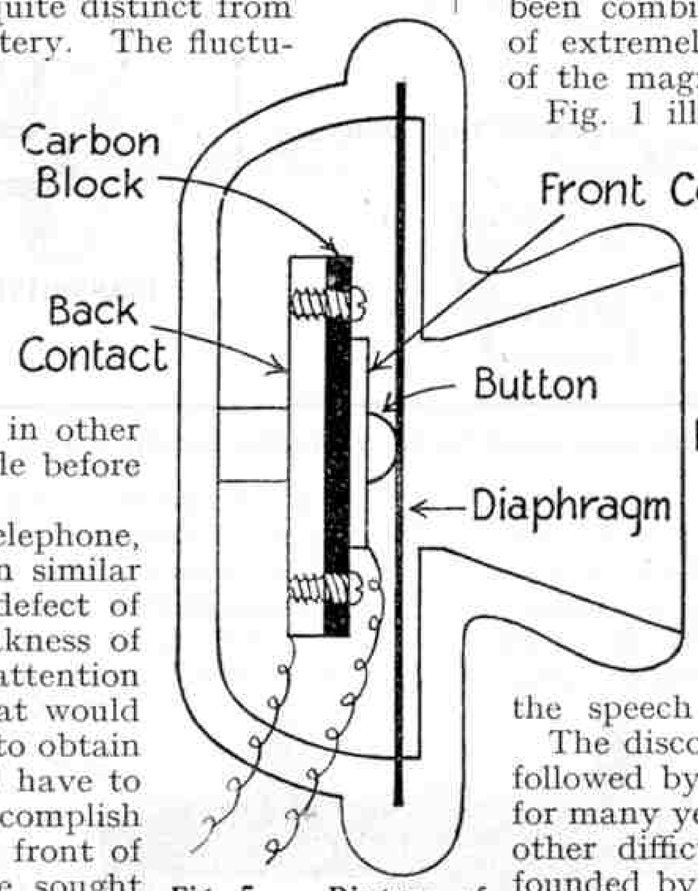


Fig. 5. Diagram of Edison's improved transmitter.

While Bell was at work on his telephone, Thomas A. Edison was experimenting on similar lines. Edison realised that the great defect of Bell's telephone lay in the extreme weakness of the reproduced sounds, and he turned his attention to inventing an improved transmitter that would give louder signals. It was obvious that to obtain these the variations in the current would have to be larger, and it seemed impossible to accomplish this by means of one magnet moving in front of the pole of another. Edison therefore sought other methods, and in the end invented the carbon microphone, a diagram of which is shown in Fig. 5. The transmitter included the usual mouthpiece and a mica diaphragm, and behind the latter was a button pressing against the front contact, to which one of the line wires was attached. Behind this contact was a thin slip of compressed carbon, and behind this again the back contact, to which the other line was attached.

The current supplied by the battery had to pass from one of the contacts to the other, and it was found that, as the front contact moved in and out in accordance with the movement of the diaphragm, so the resistance of this part of the path of the current varied. An instrument of greatly increased sensitiveness was thus produced for converting sound waves into fluctuations of an electric current. Previously the fluctuating current had been actually made in the transmitter itself by a moving magnet, but now the source of power was removed from the transmitter to the battery, and the transmitter itself merely acted as a kind of tap to control the amount of electricity that was flowing.

It is interesting to note that the word "microphone" applied to Edison's transmitter was first used by Wheatstone in 1827 to describe an apparatus to increase the loudness of extremely feeble sounds.

The transmitter invented by Edison was a great improvement on Bell's instrument, but it was soon followed by still more efficient microphone transmitters. To record all these in detail would involve descriptions of several similar inventions that would be of interest to few readers. The general features of a modern microphone transmitter are a diaphragm and a block of carbon slightly apart, the space between them being filled with finely ground carbon granules. The diaphragm, carbon block and granules are contained in a small ebonite case having a mouthpiece at the front and a pair of terminals at the rear. One terminal is connected with the diaphragm and the other with the carbon block, and wires from the terminals lead to the battery and to the receiver. The movement of the diaphragm when a voice causes it to vibrate varies the pressure upon the carbon granules, and sets up corresponding variations in the current passing through them. No matter how small the sound vibrations are, they alter the resistance of the carbon; and as these vibrations are magnified in the receiver the sound reproduced there is magnified also. The modern microphone transmitter therefore, is a much more sensitive instrument than the transmitter produced by Bell, and it can be operated effectively on a line of great length where the original invention would be quite useless.

The telephone receiver also has been greatly improved since Bell produced his historic instrument in 1867. We have seen that Bell's original receiver consisted of a single-pole electro-magnet, a moving armature, and a diaphragm that would follow the movement of the armature. It worked well, and the receivers of to-day are exactly the same in principle. The single-pole electro-magnet, however, has been replaced by a double-pole permanent magnet, so that the duty of the current through the coils of wire wound on the magnet is merely that of varying the magnetism of the magnets. The armature and diaphragm have been combined into one unit, for the diaphragm is now a disc of extremely thin iron placed in close proximity to the poles of the magnets.

Fig. 1 illustrates clearly the parts played by the transmitter and the receiver during a telephone call. The sound waves 1 cause the diaphragm 2 of the transmitter to vibrate, and the resulting variations in the pressure on the loosely-packed carbon granules 3 bring about changes in the current flowing through the wires 4 and the coil 5. In turn these produce variations in the intensity of the magnetic field produced by the current, and the vibrations of the diaphragm 2 are thus reproduced in the similar diaphragm 6, which is attracted by a magnetic system 5. The air 7 is then set in motion, vibrating in exactly the same manner as the air affecting the diaphragm of the transmitter, and by this means the speech of the distant speaker is reproduced.

The discovery of the principle of the telephone was not at once followed by the establishment of a successful commercial system, for many years' hard work were necessary before the technical and other difficulties that arose could be overcome. The company founded by Bell and Watson passed through difficult times before it attained prosperity. The necessary development work was greatly hampered by lack of funds and by the competition of rivals, and it was not until Theodore Vail joined the company that it carried out any ambitious schemes. Vail was an enterprising young man who, from being a telegraph operator, had risen to a position that enabled him to reorganise the mail service of the United States. He was placed at the head of the Bell Telephone Company and immediately began to reorganise it and to extend its operations.

Vail planned and worked on a large scale, and he caused a sensation by proposing to link up by telephone important cities and towns in which exchanges were established. The possibility of a conversation over long distances was openly derided, but Vail paid no attention to criticism and began the construction of a line between Boston and New York, which are 243 miles apart. The first section of the line extended from Boston to Salem, a distance of 16 miles, and this was soon completed. It was a great success, and was the first telephone trunk line in the world. Successive portions were then erected and brought into action, and eventually subscribers in the two cities were able to speak to each other by telephone without difficulty.

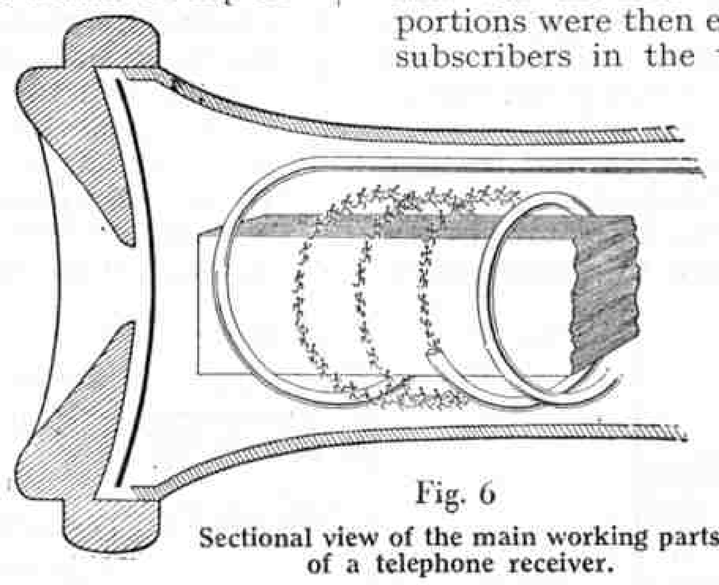


Fig. 6

Sectional view of the main working parts of a telephone receiver.

Encouraged by the success of his first bold scheme, Vail planned an extension of the telephone system across the North American continent. Gradually the great trunk line made its way westward. The first section to be completed was that from New York to Chicago, which was declared open for public service on 18th October, 1892, Bell himself opening the line by speaking from New York to Chicago. Later the line was extended successfully to Omaha, Denver and Salt Lake City; and finally it was carried across the western mountains to San Francisco, California.

The line from New York to San Francisco is more than 3,390 miles in length. It contains 2,960 tons of copper and is supported on 130,000 poles. The first telephone conversation over its entire length took place on 25th January, 1915. Bell and Watson took part in the opening ceremony, when the inventor, in New York, repeated the words of his first telephone message to his assistant in 1876. "Mr. Watson, please come here, I want you," he said. To this, Watson, in San Francisco, replied: "It will take a week now!" When it was erected, the telephone line across the United States was the longest in the world, but it lost this distinction a few months later, when the Company completed a line 4,200 miles in length across Canada.

In the next article in this series we shall describe how the telephone exchange has developed from a small affair of a few lines to the marvellous modern exchange that automatically controls many thousands of lines.

THE NEW "H.M.V." RECORDING STUDIOS

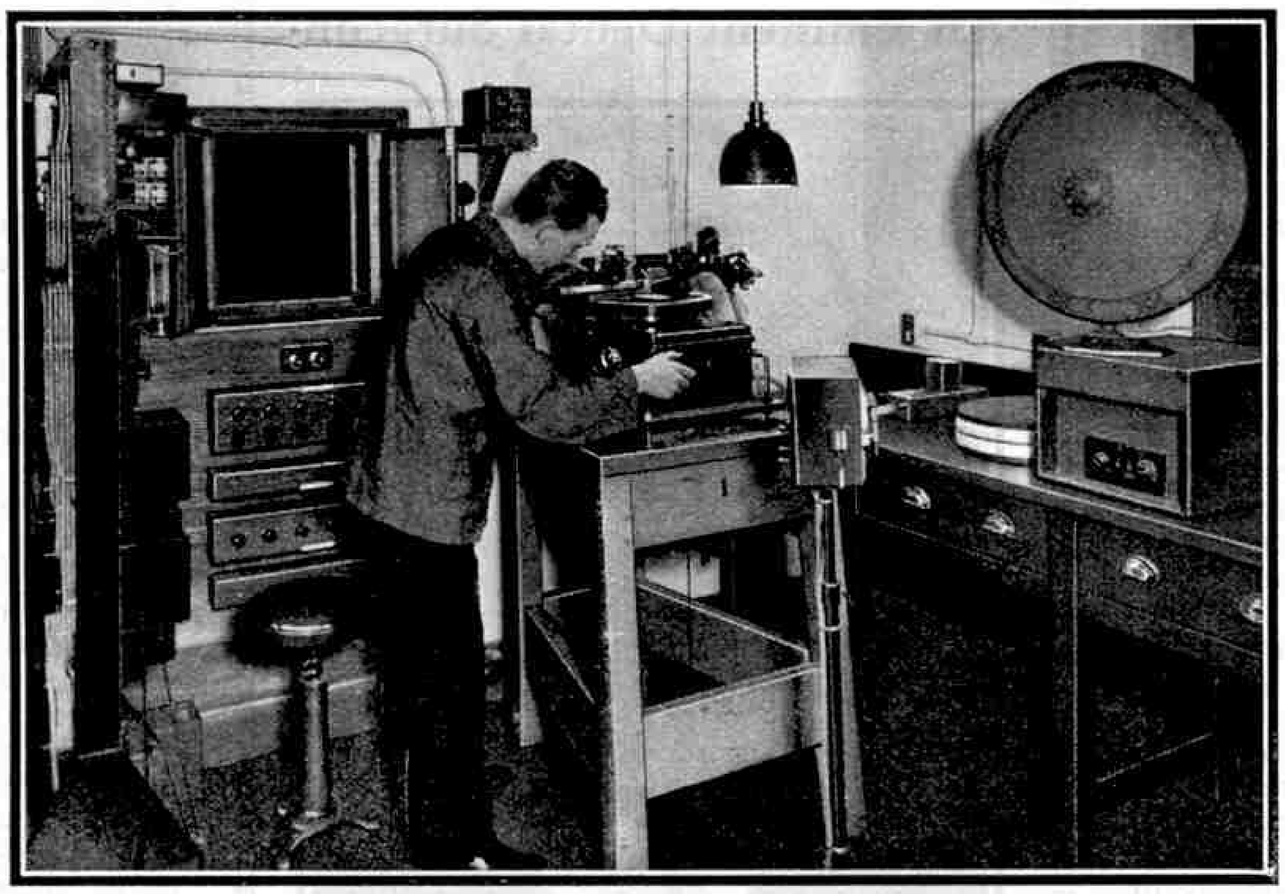
TOWARDS the close of last year an interesting event in the gramophone world took place when Sir Edward Elgar, O.M., conducting the London Symphony Orchestra, inaugurated the new London studios built by The Gramophone Company Ltd. These are believed to be the only premises of their size in existence that have been specially built for gramophone recording. The site, which is centrally situated in Abbey Road, St. John's Wood, was chosen in order that interference and vibration from railways and heavy transport should not affect the recording. The brick walls of the three recording studios have a minimum thickness of 13½ in., and are constructed in such a manner that there can be no interference from outside noises, and that the sound from one studio cannot interfere with the others.

The three studios are separated by corridors and rooms, and it is therefore possible to hold recording sessions in each studio at any one time. A separate recording room is built adjacent to each studio, and each one houses two complete recording outfits. A control room is situated centrally for the three studios, so that at any moment they can all be linked together for recording work such as sketches, dramatic work, etc., and the performances in each studio can all be merged together and recorded on a single record. A special room is also provided for the transferring of records; that is, for the preparation of composite records of the Aldershot Tattoo type. Playing discs with multiple turntables are used, and extracts from a number of existing records can be recorded on a single disc.

As many as six microphones can be used at one time in each studio, and each microphone has a separate control, which ensures that all records will be made with correct balance of instruments and vocalists.

The walls of each studio have been designed to eliminate any echo effect, and as the three rooms vary in size from 32,000 cu. ft. to 200,000 cu. ft., either a single instrumentalist or a large symphony orchestra and chorus can be recorded in natural conditions. The medium and large studios have stages at one end, the latter seating up to 250 musicians, while the auditorium accommodates 1,000 people.

The largest studio is nearly as large as the Queen's Hall, and considerably larger than the Kingsway Hall. The walls of this studio are designed to "break up" the sound and avoid unpleasant resonances. Close to it is a buffet that can cater for 150 musicians at short notice. A modern form of air cleaning and ventilating plant has been installed in order that in each studio the artists will be able to perform at any time of the year in comfortable conditions.



The first recording taking place at the new "His Master's Voice" recording studios. Photo by courtesy of The Gramophone Co. Ltd.

Over 4½ miles of cable connect the studios with the central control room, while the main battery room, situated on the ground floor, is connected with each recording room. Thus the batteries are kept in a central position and can be easily regenerated by the modern accumulator charging installation. Separate rooms are provided for the maintenance of the recording instruments and for the grinding of the sapphire cutting points, while a floor is devoted to administration offices, rehearsal and audition rooms. Artists can visit these rooms, and after recording their performances have the discs "played back" immediately, and so hear the results of their work, without any period of suspense!

A garage has been constructed at the side of the main building to accommodate the well-known "His Master's Voice" mobile recording van. Matters have been arranged so that the electrical equipment in this van may be connected with the central charging room in order to avoid removing the batteries for recharging.

Haydn's "Toy" Symphony

No composer loved a joke more than Joseph Haydn, affectionately known as "Papa" Haydn. He once said of himself: "A mischievous fit comes over me sometimes that is perfectly beyond control." At the age of 17 he was dismissed from the Choir School of St. Stephen's, Vienna, for cutting off the pigtail of an unlucky chorister who happened to be sitting just in front of him! He had somehow obtained a new pair of scissors, and the temptation was simply too great. In 1791, while he was in London, he wrote the "Surprise" Symphony, in the quiet slow movement of which a sudden and unexpected loud chord is introduced. "There all the women will scream," said Haydn!

The "Toy" Symphony (Col. DX 311, 4/–) is at the same time a joke and a delightfully charming piece of music. It is written for an orchestra consisting of toy instruments—trumpet, drum, triangle, whistle, cuckoo and quail—supported by two violins and a bass. The work is splendidly played by the British Symphony Orchestra under the direction of the famous conductor Weingartner, and its simple gaiety is quite irresistible.

More Party Novelties

Several readers have asked for more records suitable for party use. Among the most amusing recent issues is the "*Limerick Puzzle Record*" (H.M.V. B3986, 2/6). On this Claude Hulbert speaks six different limericks on each side, the last line of each one being separated from the rest. Starting the record in the ordinary way, you may hear the first four lines of any verse. Then you lift the needle to the inner ring of grooves and complete the verse with any one of six lines, but you cannot tell which one it will be until you actually hear it. By placing the needle in all the possible grooves, 64 different limericks may be obtained, and the results are both amusing and unexpected.

Another good record is "*Tantalising Tunes*" (Parlophone R1082, 2/6). On this Ian Macpherson takes his orchestra through a series of tunes, and the listeners, provided with paper and pencil, are asked to write down the name and composer of each tune. An even better record of the same type is "*Guess The Tune*" (H.M.V. C2298, 4/–), played by the New Mayfair Orchestra. All the tunes are thoroughly familiar, but they have been so well selected and arranged that it is not easy to name each one quick enough. You find yourself saying: "Dear me, I know that so well," and by the time you have recalled its name the record is well on with the next tune! At the close the record gives the correct answers, and then you wonder how on earth you failed to get them right!

Unbreakable Records

Gramophone enthusiasts who have had the painful experience of seeing a pile of records slide off a table on to the floor will appreciate the unbreakable nature of the Filmophone Flexible Records. These 10-inch double-sided records, sold at 1/6 each, are made on a flexible and transparent base, and their extreme lightness and thinness makes them ideal for carrying about in a portable gramophone. They play quite well with any good needle, but for the best results the special Filmophone trailing needles should be used, and these are obtainable at 1/– per box of 200. There is already a long list of titles available.

* * * *

Railway enthusiasts will find "*The Next Train*" (Parlophone E3839, 2/6) very amusing. It consists of a quaint conversation at a wayside station between a would-be passenger and an individual who combines the whole of the official positions of the station, from porter to stationmaster!

XXVII.—A DENTAL SURGEON

THE profession with which we are to deal this month is one that is of the greatest importance to the individual and to the nation, but as yet it has scarcely received its due share of attention. The possession of sound teeth is one of the chief necessities of good health, and very serious results may follow neglect of this fact. It is the work of dentists to combat diseases of the teeth and of the tissues in which they are set, and they are as deeply concerned with the preventive and educational side of the profession as with the actual cure of diseased conditions.

As a profession dentistry may be said to have come into existence as recently as 1878, or 54 years ago, for in that year a register was compiled of those who had secured dental qualifications by training and examination. The number of dentists then included was about 5,000, and in 1913, or 45 years later, there were only 5,140 names on the register. Thus there had been practically no increase in the number of fully qualified dentists, although the population of the country had grown considerably.

There is no doubt that during this time the teeth of the nation were not receiving the attention they needed. This was due largely to the lack of knowledge of the effect of unsound teeth, and partly also to a general reluctance on the part of individuals to submit to what was popularly regarded as unpleasant treatment. The War brought home the seriousness of the position thus created, for the medical examination of recruits showed that from a dental point of view a deplorable condition of affairs existed.

The first result of the revelations of the War period was the passing of the Dentists' Act of 1921. This greatly improved the status of the profession, and gave official standing to many previously unregistered dentists who possessed sufficient knowledge and skill to entitle them to recognition. The Act also made it illegal for persons not registered to practice dentistry or to describe themselves as dental surgeons, and thus finally raised the profession to the same rank as that of medicine and surgery.

The passing of the Dentists' Act was followed by improvements in facilities for dental treatment. The care of the teeth now forms an essential part of National Health Insurance policy, in which the position of dentists is as well recognised as that of medical men. An even more important development has been the introduction of dental inspection of schools, together with the establishment of clinics in which the teeth of school children may be filled and other steps taken to preserve them and to check the ravages of disease. In addition, there has been an awakening on the part of the general public in regard to the importance of care of the teeth. These factors have extended the scope of the dentist, and have introduced new activities that help to make the profession more secure than it was when private practice among comparatively indifferent people offered practically the only means of making use of dental training.

It is curious to find that in spite of this improvement in prospects there has been a decrease in the number of dental students. The total number of registered dentists in 1930 was only 14,381 and of these about 7,000 had qualified by examination. In the previous year the number of students registered was only 298, compared with 361 in 1913; and unless many more students present themselves for training during the next few years, the number of dentists qualified in accordance with the Act of 1921 must decrease.

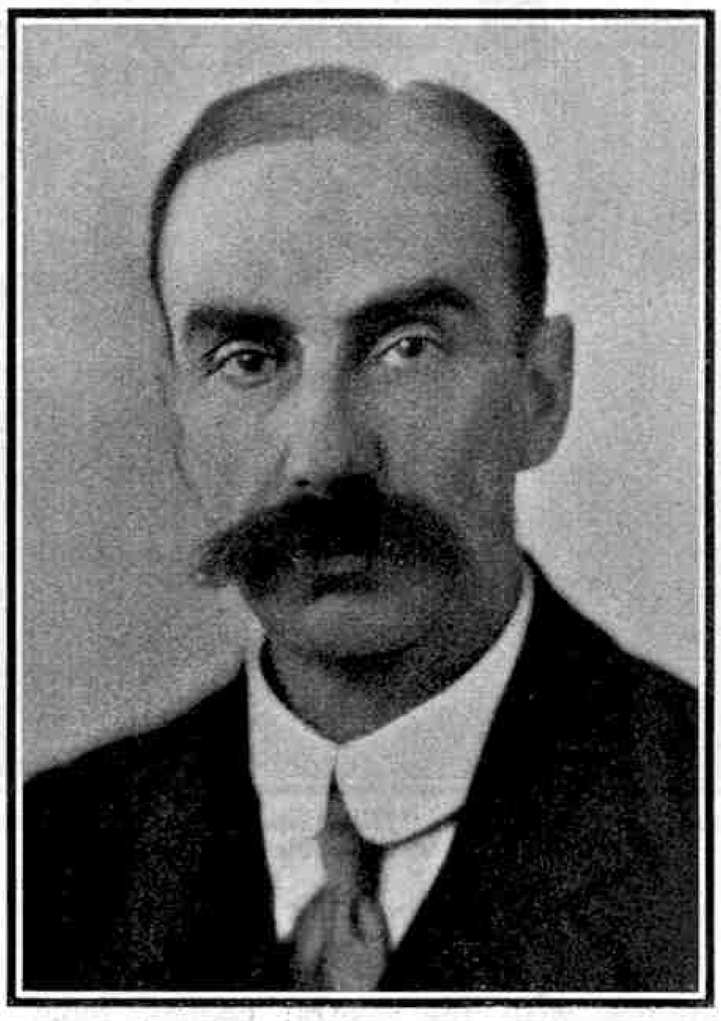
In this connection it is interesting to note that at the present time there are the equivalent of about 500 full-time dental officers working in school clinics. It has been estimated that this number should be increased to 1,300 in order to give one dentist to every 4,000 school children needing dental treatment annually. Sir George Newman, the principal medical officer of the Ministry of Education, states that in a complete scheme one dentist is necessary for every 2,300 school children. The introduction of such a scheme would involve an increase of about 1,600 in the number of registered dentists now employed.

At present there is one dentist for every 3,200 people in Great Britain. It is clear that already there is a shortage of registered dentists and that the shortage is likely to become more severe. For those who are qualified, the prospects in the profession are good, and they will become even more attractive if trade revives and economic conditions improve. Those who are attracted by the profession therefore may feel assured of a reasonable return for their efforts in securing the necessary qualification, or for any outlay involved in commencing private practice, while there are likely to be improved prospects of securing reasonably well-paid official posts.

It has been suggested that one of the causes of the decrease in recent years in the numbers of dental students has been the higher standard of training now required. The practice of dental surgery is more scientific in character than in former years as a result of recent changes in the regulations for qualification. This has added slightly to the cost of training, and may have kept out a certain proportion of students who would have entered the profession, but on the other hand the raising of the standard undoubtedly will tend to give dentistry a better status.

The present regulations emphasise the necessity for a sound preliminary education up to matriculation standard. The matriculation examination of a university must be passed if a dental degree is to be obtained, and either that examination or a recognised equivalent should be taken by all who enter the

An Eminent Dental Surgeon



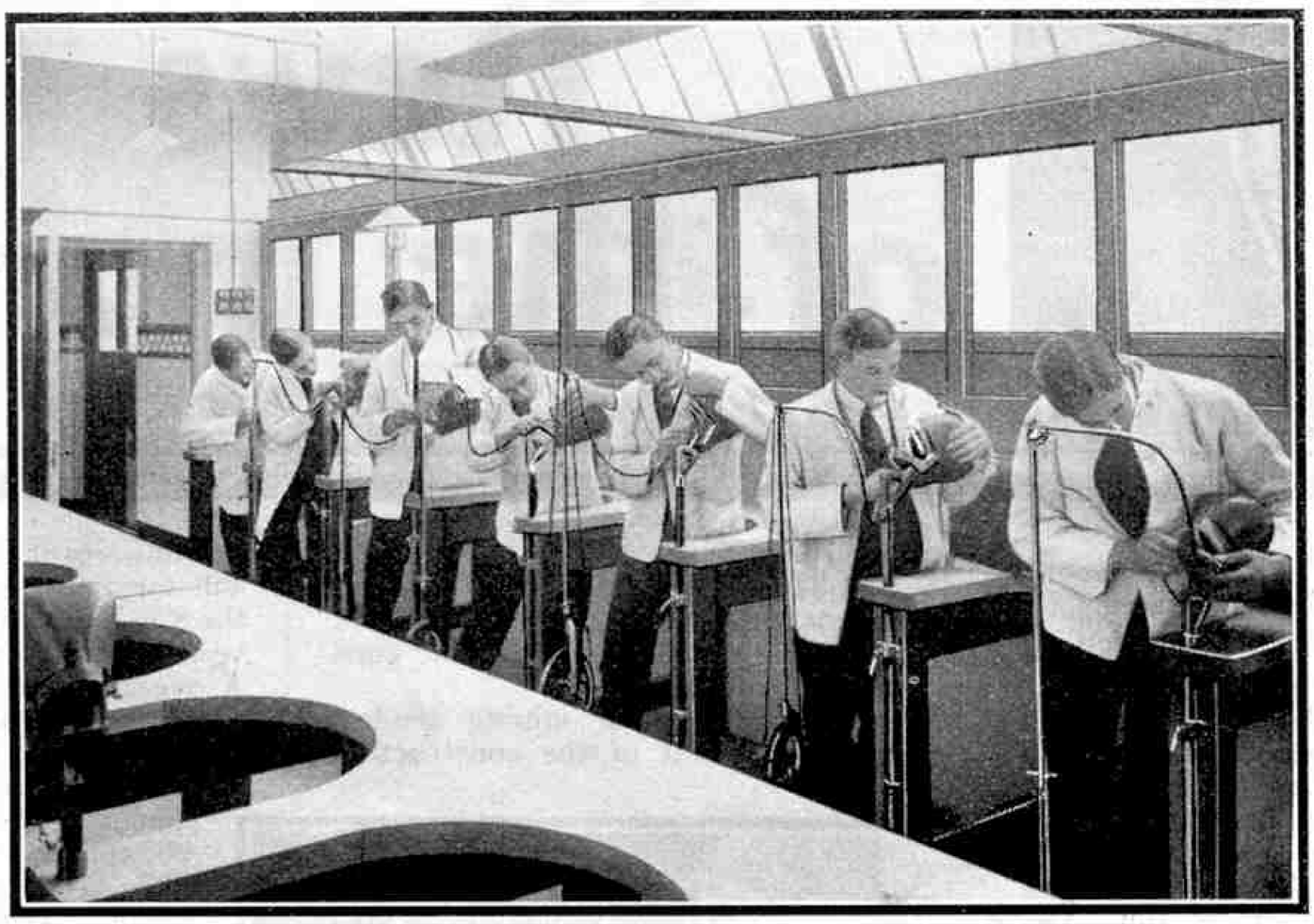
Sir Norman G. Bennett, M.A., M.B., B.Ch. (Cantab) L.D.S.Eng., is President of the British Dental Association and Consulting Dental Surgeon of St. George's and the Royal Dental Hospitals, London. He was educated at St. John's College, Cambridge, and received his professional training at St. George's Hospital and the Royal Dental Hospital.

Sir Norman is Editor of the "Science and Practice of Dental Surgery," and is a frequent contributor to its pages. He has also written articles in standard works on Surgery and Dental Surgery.

profession. In certain instances, those who are satisfied with the minimum qualification for inclusion in the Register of Dentists may take the School Certificate or some other recognised preliminary examination, provided that approved subjects are included.

The next step after passing a recognised preliminary examination is to take a second examination in chemistry and physics. Success in this may be followed by registration as a dental student. The Register of Dental Students is kept by the General Medical Council in the same manner as that of medical students. The minimum age is 17 and no fee is required. Registration is necessary at this stage, either with the General Medical Council or with the bodies granting dental qualifications. Application should be made to the Secretary, The General Medical Council, 44, Hallam Street, London, W.1. It may be noted that the registration of dental students is subject to exactly the same regulations as that of medical students.

After passing the preliminary examination in chemistry and physics, and registering with the General Medical Council or the Dental Licencing body, the student may commence his actual professional education. Two courses are open to him. He may qualify for the Licence in Dental Surgery, the possessor of which is entitled to use the letters L.D.S. after his name, or he may aim at securing a degree in dental surgery. The course of study for a degree is longer than that required for the Licence, and deals more thoroughly with the scientific and medical aspects of the profession. The regulations enforced at different dental schools vary, and both the Dental Licence and the degree entitle their holders to registration as dental surgeons in the Dentists' Register issued by the General Medical Council.



Students of dental surgery engaged in practical work on the model, which is usually called the "phantom." For this photograph we are indebted to the courtesy of Professor W. H. Gilmour, M.D.S., Director of the School of Dental Surgery of the University of Liverpool.

The course of training for the Licence in Dental Surgery, the minimum qualification for registration, extends over four years and may be taken at any one of a number of recognised institutions in Great Britain and Ireland. The examinations are conducted by the Royal College of Surgeons of England, Edinburgh and Dublin, and the Royal Faculty of Physicians and Surgeons, Glasgow, in addition to the universities in which dental schools have been established. The training may also be obtained in the dental schools of well-known London hospitals.

The courses arranged at various centres are practically of the same character, and three or even four examinations must be passed at stated periods in order to secure qualification. The regulations of the University of Liverpool are a typical example of those in force. There the first examination covers zoology, botany and dental metallurgy. The subjects of the second examination are anatomy, dental anatomy, physiology and dental mechanics. Candidates must satisfy the examiners in general pathology, dental pathology, and bacteriology, dental materia medica and therapeutics and dental prosthetics in the third examination and in medicine, surgery, dental surgery and clinical dental surgery in the final examination.

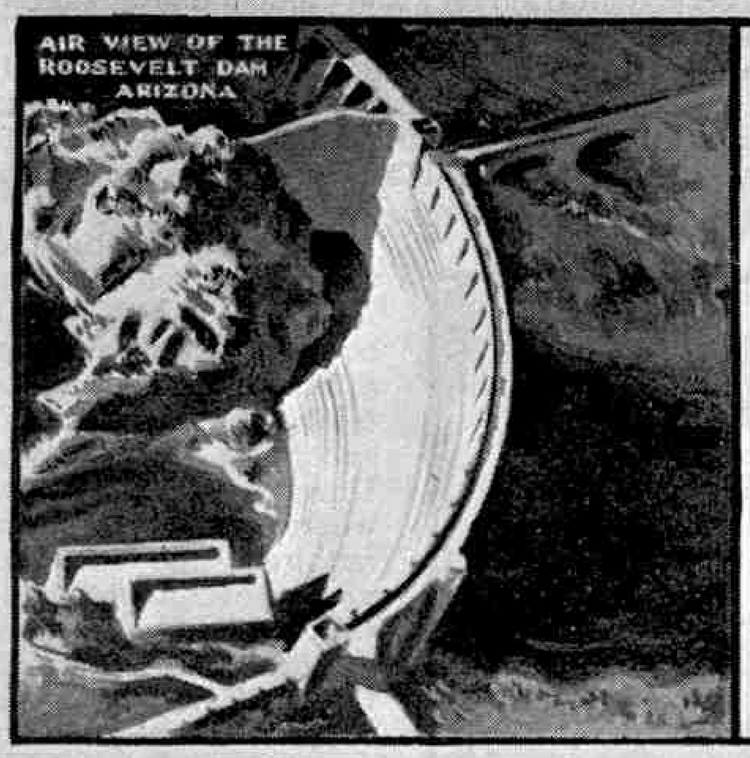
The cost of training varies with the dental school chosen. In addition to actual tuition fees the cost of books, instruments, microscopes, examination fees and club subscriptions must be included. In round figures the total sum required during the four years' training may be put at from £300 to £400.

The course of study for the degree of Bachelor of Dental Surgery, or its equivalent, entered upon after matriculation, extends for five years, except at the National University of Ireland where four years are required, and the University of Manchester at which 5½ years must be spent. The examination in preliminary science subjects usually is the same as that required for medical students, and at certain universities later examinations in such subjects as anatomy and physiology are required in qualifying for a medical degree. Generally speaking, the courses of training followed are similar to those for the Licence. A higher standard is required, however, and the time that must be spent in the study of dental mechanics and in dental hospital practice is longer. Naturally general medical subjects figure largely in the examinations, as they do in those for the Licence, the reason for this being the close connection between the condition of the teeth and general health. Higher degrees in dental surgery are granted by practically all universities. These are intended generally for those who intend to become specialists, and candidates usually are required to submit an account of original work, an examination in dental subjects being included in certain instances. In Scotland special diplomas in advanced dental surgery or in dentistry in public health are granted by various authorised bodies.

A busy scene in a Liverpool school dental clinic. Our illustration is reproduced by kind permission of the Liverpool Education Committee.

It is often a great advantage for a dentist to be also in possession of medical qualifications, and in this connection it is interesting to note that the degree of M.Ch.D. of Leeds University is only granted to holders of the degree of B.D.S., who have qualified for registration in medicine and surgery.

When a student has completed the courses qualifying for registration as a dentist, he must make application to the General Medical Council, and when his name has been placed on the register he is then entitled to practice. He may then endeavour to obtain an official appointment of the type that we have already mentioned, or he may enter upon general practice. In this respect a dentist is in a similar position to that of a medical man. He may either endeavour to found a practice for himself in a district in which there is room for an additional qualified dentist, or he may purchase an already existing practice, or enter into a partnership. When an attempt is made to found a new practice a period may elapse during which returns are very low, and generally speaking, it is regarded as more satisfactory in the long run to purchase a share in an existing connection or to buy one outright.



Engineering News of the month.

New Caterpillar Tractor Vehicles

Two novel vehicles designed to carry loads across rough country have been built by Vickers-Armstrongs Ltd., the makers of the Carden-Loyd light military tank. The vehicles are capable of carrying loads of 30 cwt. and 6½ tons respectively, and they haul trailers of proportional sizes. The smaller of the two is known as the Carden-Loyd tractor truck, and the other as the Vickers-Armstrongs cross-country lorry.

The Carden-Loyd tractor truck has as unusual appearance, for it consists of a lorry body mounted on a "hull," or unit, that makes use of caterpillar tracks. A six-cylinder engine developing 55 h.p. at 2,400 r.p.m. is mounted in the "hull" at a low level and immediately behind the driver's seat. A five-speed gearbox is provided, and on the level the vehicle is capable of a speed of 20 m.p.h. The weight of the tractor is very evenly distributed and its passage across any but the softest ground leaves practically no mark. The machine is steered by means of levers controlling the movements of the tracks, and when one of these is stopped while the other continues to run at high speed, the tractor pivots round within its own length. The vehicle is capable of climbing steep banks and of crossing trenches that are not too wide for it to span.

The Vickers-Armstrongs cross-country lorry, the heavier of the two vehicles, has an overall length of 21 ft. 4 in., a width of 7 ft. 6 in. and a height of 9 ft. Its unloaded weight is 7 tons, and the engine develops 80 b.h.p. A gearbox with five forward speeds and a reverse is fitted, and the maximum speed is 18 m.p.h. This vehicle also makes use of caterpillar tracks, half-tracks being fitted on each side; and it is capable of travelling over rough ground and of fording streams that measure even up to 3 ft. in depth.

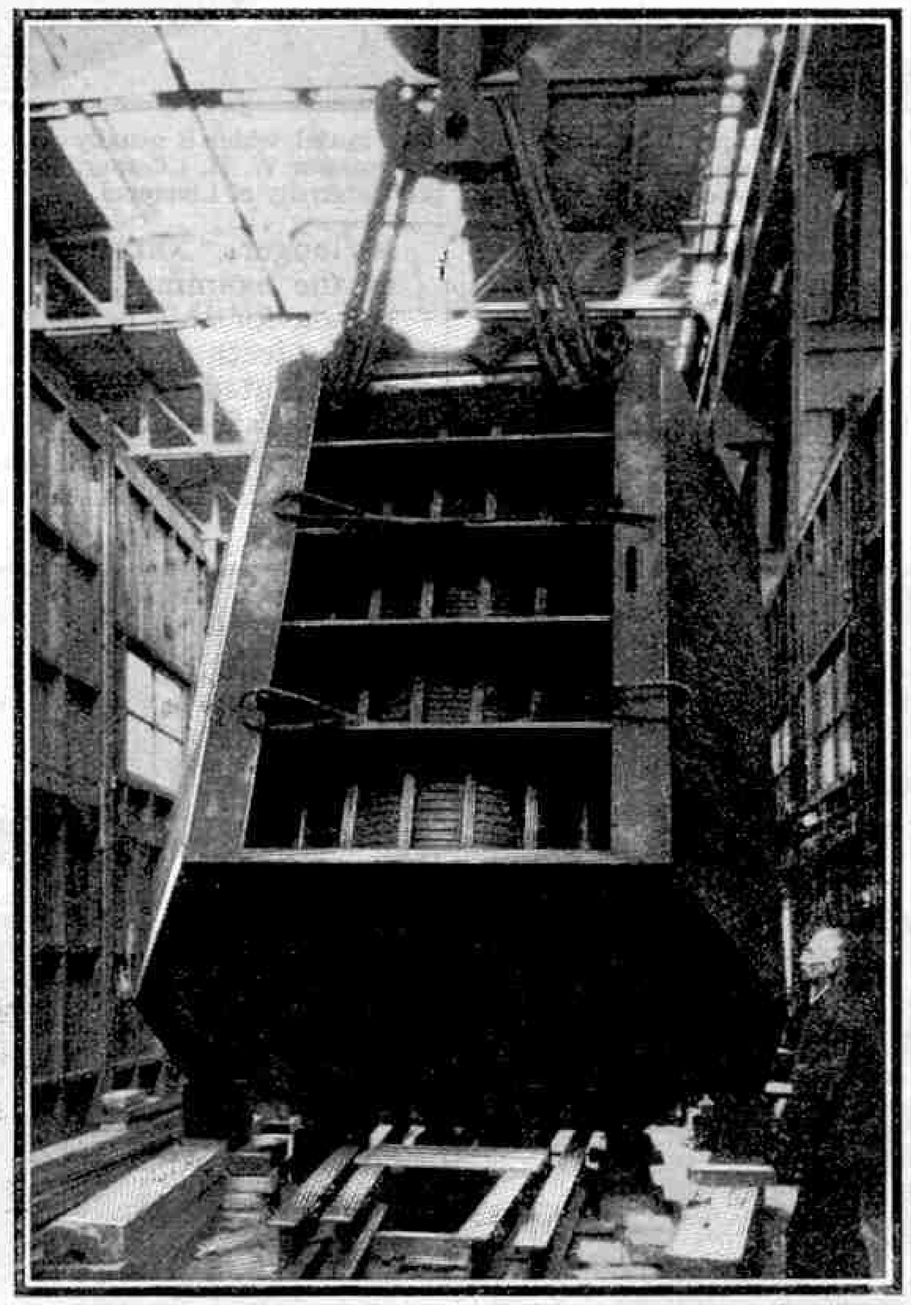
Recent Additions to British Navy

Two destroyers recently were launched at the Barrow works of Vickers-Armstrongs Ltd., and two others were successfully floated out of the dock at Portsmouth Dockyard in which they were constructed. The vessels built by Vickers-Armstrongs are named "*Cygnet*" and "*Crescent*," while those constructed at Portsmouth are "*Crusader*" and "*Comet*." Each vessel is fitted with propelling machinery of the geared turbine type, having a designed output of 34,000 h.p. and giving a speed of 35 knots. The armament of each of the destroyers includes four 4.7 in. guns and eight torpedo tubes.

The "*Nightingale*," a mining tender, also was floated out of the construction dock at Portsmouth at the same time as the "*Crusader*" and the "*Comet*." This vessel has a displacement of 255 tons and a designed speed of 10 knots. Immediately after the three vessels had been named, the keels of a flotilla leader to be named "*Duncan*," and a cruiser to be called "*Neptune*," were laid down.

The cruiser "*Leander*," built at Devonport Dock, also has been launched. Work on this vessel was commenced on 8th September, 1930, and it is thought that she will be ready for service early in 1933. An important feature is that 6 in. guns will form her main armament, instead of the 8 in. guns that have been used on other vessels of this type recently constructed. A great saving of deck space has been obtained by leading all the uptakes from the boilers into one funnel.

After the "*Leander*" had been launched the keel of a new cruiser to be called "*Orion*" was laid down. This vessel will be of the same type as the "*Neptune*."



A critical moment in the building of a 62,500 kv.a. stator at the Ironbridge Power Station. The core has been completed and the stator is being turned over before the stator bars are inserted. Photograph by courtesy of British Thomson-Houston Ltd., Rugby.

Wire Rope Seven Miles in Length

A wire rope seven miles in length, nearly five in. in thickness, and weighing 56½ tons, has been made by The Whitecross Co. Ltd., Warrington. It is in one continuous length, and the task of making it occupied 100 men for eight weeks.

The rope is made in six strands, each of 19 wires, wound closely round a manilla core, and has a breaking load of about 57 tons per sq. in. It is to be used for hauling the trains on the Glasgow District Subway, which was described on page 561 of the "*M.M.*" for July last. It will be subjected to constant bending under tension and it was necessary therefore to give it a sufficient degree of flexibility without reducing its tensile strength. For this reason the wire was given special heat treatment, and a thorough microscopic examination of the rope was carried out at every stage of manufacture. When finished the rope was transported to Glasgow in two cradles carried on 35-ton bogie wagons.

Interesting Swing Bridge in Cheshire

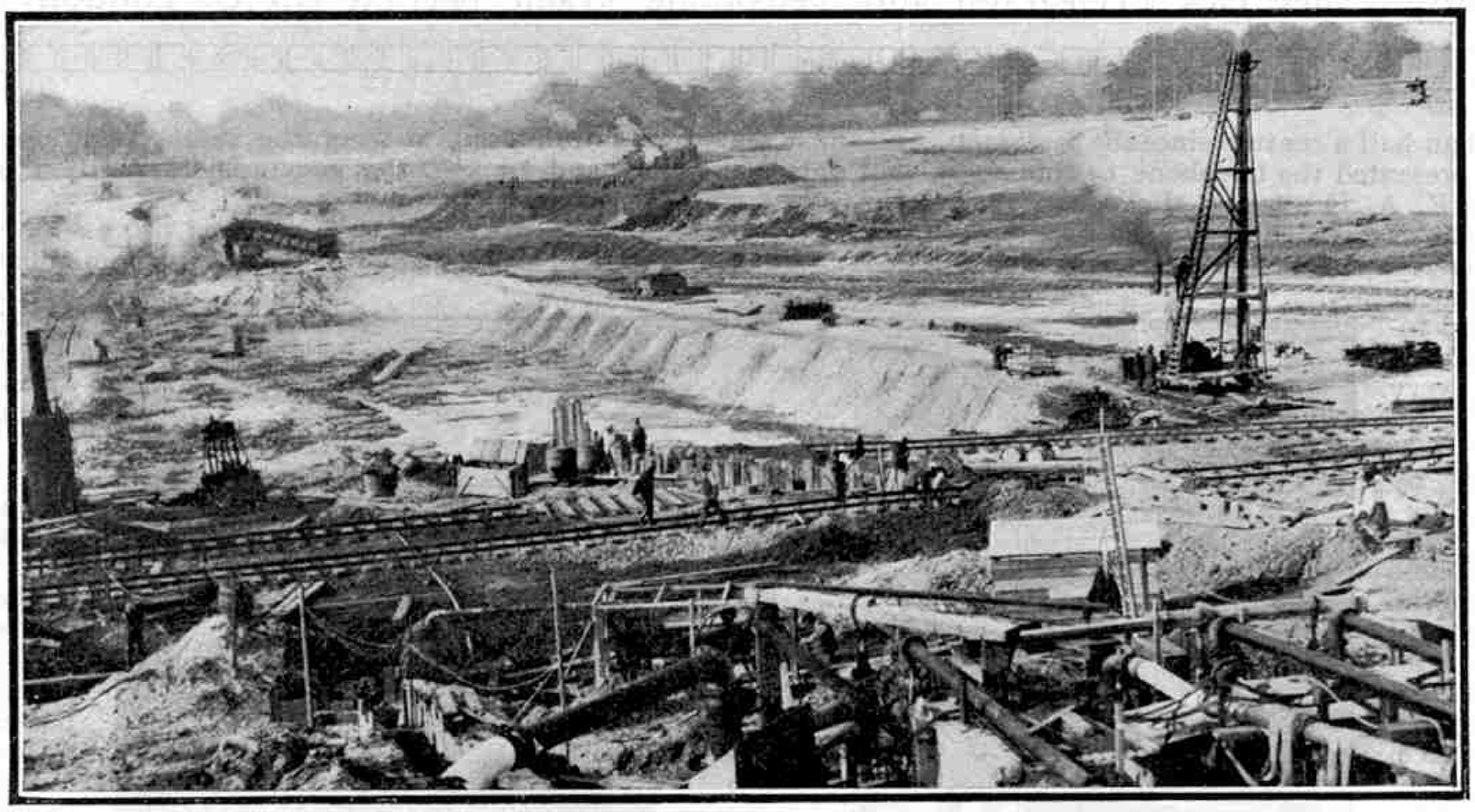
A swing bridge is to be constructed at Acton Bridge across the River Weaver, a tributary of the Mersey that flows through Central Cheshire. The bridge is being built in connection with a road improvement scheme. It will have a swing span of 243 ft. 4 in., and will carry a roadway 28 ft. in width in addition to two footpaths, each 5 ft. 6 in. in width. The moving span will have a weight of approximately 520 tons, and of this weight about 420 tons will be carried by a circular buoy or pontoon, the remaining 100 tons being supported by the roller path. Swing bridges of this type move quickly and require little power. A structure similar to that at Acton Bridge already built across the Weaver at a different point may be opened and closed again by the expenditure of one-fifth of a unit of electricity.

The New Graving Dock at Southampton

The upper illustration on this page shows work in progress on the site of the graving dock to be built at Millbrook, Southampton. When completed, this will be the largest graving dock in the world, for it will be 1,200 ft. in length and 45 ft. in depth. Its entrance will be 135 ft. in width. The construction of the dock has been decided upon as being more economical than enlarging the famous floating dock at Southampton, which is the largest of its kind in the world, for constant dredging below this is necessary in order to enable it to be used.

The new graving dock is to be ready for service in 1933, and it is being built in order to provide accommodation for the giant Cunard liner now partly constructed at Clydebank. Pumping operations on the site have been completed, and the soft mud first encountered in the excavation work has been removed with great speed by means of large steam shovels that were kept at work day and night. The more solid material is now being dealt with.

It is interesting to note that the construction of the new graving dock is part of a gigantic scheme for the extension of Southampton Docks that has been undertaken by the Southern Railway. Work on this is proceeding steadily, one of the two sections having been almost completed and operations in connection with the second now having been begun.



Work in progress on the site of the new graving dock at Southampton. When completed this dock will be the largest in the world. It will be 1,200 ft. in length, and 45 ft. in depth, and its width at the entrance will be 135 ft. For permission to reproduce this photograph we are indebted to the Southern Railway Magazine.

Lifeboat that is Useful when Capsized

A steel lifeboat of a new type has been developed in Italy. This is extremely buoyant and possesses efficient means of getting rid of any water that may be shipped; but its most remarkable feature is a concave bottom that makes it serviceable as a raft even when overturned.

A lifeboat of the new type that has already been built is 36 ft. 9 in. in length and 13 ft. 6 in. in width. It is capable of carrying 145 persons, and 80 may find refuge on it when it is capsized. The boat carries the usual equipment, but in addition doors are provided in the bottom of the hull in order to give access when it has been overturned to airtight metal tanks in which supplies of food and dry clothing are stored. Two bilge keels assist in reducing the roll of the vessel.

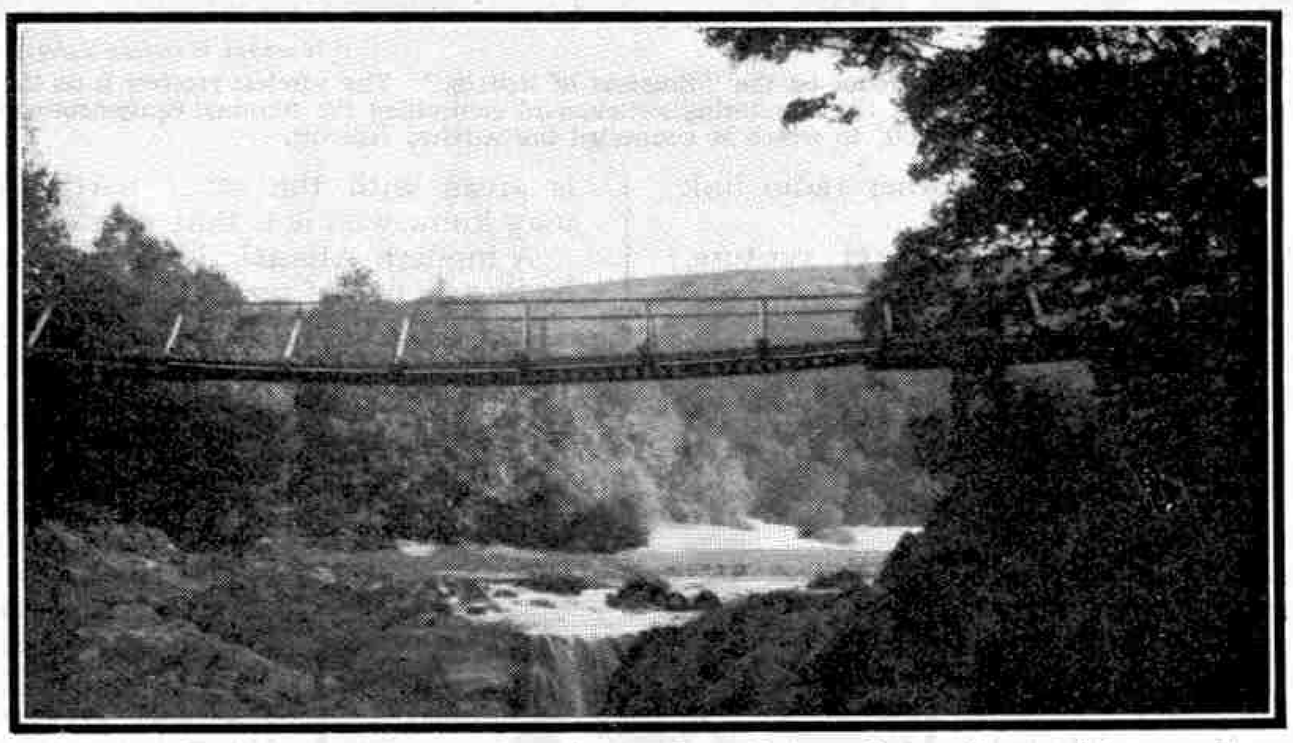
Pneumatic Jack for Heavy Motor Vehicles

A pneumatic jack has been introduced in the United States to enable wheel and brake adjustments to be made rapidly to motor coaches and other large motor vehicles. The jack consists of a platform, 23 ft. in length, that raises vehicles by the axle, and it is capable of lifting a load of ten tons with an air pressure of only 110 lb.

The jack is operated on the same principle as the ordinary hydraulic press, for the platform is raised by forcing oil from a tank into a cylinder provided with pistons. An oil lock valve is fitted in order to prevent the platform from falling if the air pressure on the oil in the tank is accidentally released, and a second valve ensures that the oil in the cylinder shall not return too quickly when a vehicle is being lowered. The controls are interconnected and it is impossible to carry out operations in the wrong order.

* * * *

The new White Star liner, the "*Georgic*," launched on 12th November last, was the largest British-built vessel to be launched in 1931. She is 680 ft. in length, has a displacement of 28,000 tons and is fitted with propelling machinery that has a designed output of 20,000 s.h.p.



Small suspension bridges of the type shown in the above photograph are often used to span rivers where traffic is not sufficiently heavy to justify the building of more permanent structures.

Launch of Giant Italian Liner

The "*Conte di Savoia*," an Italian liner of 48,000 tons, recently was launched at Trieste. The vessel is to undertake her maiden voyage next summer, and as her keel was laid down on 4th October, 1930, she will be in service less than two years after the work of construction began. As noted on page 300 of the "*M.M.*" for April, 1931, the "*Conte di Savoia*" is fitted with gyroscopic stabilisers in order to enable her to maintain an even keel in rough weather.

The new vessel has been built on modern lines, great attention having been paid to efficient streamlining of the hull, which has a bow of the bulbous type similar to that of the German liner "*Bremen*." She is comparatively short, being only 811 ft. 9 in. in length. Her breadth is 95 ft. 9 in., and she draws only 30 ft. 6 in. of water.

The "*Conte di Savoia*" is to be driven by turbine engines developing 120,000 h.p. Her designed speed is 27 knots, but it is expected that her actual maximum speed will be much greater. It is interesting to note that the "*Bremen*" and the "*Europa*," the gross tonnage of which is slightly greater than that of the Italian vessel, have engines of less power, and it is believed that the "*Conte di Savoia*" will wrest the Blue Riband of the Atlantic from the German vessel.

The new liner is intended for service between Naples and New York, and the voyage between these places will be made in seven days. The scheduled time for the crossing from Gibraltar to New York will be five days.

Power Station in Disused Coal Mine

What is perhaps the world's most unusual power station was erected recently at Kremnitz, near Pressburg, Czecho-Slovakia. The station has been built in a disused coal mine at a depth of 800 ft. below ground level. Its equipment includes two water turbines, each capable of developing 3,600 h.p., and these are operated by the water of a small river that is diverted into the mine through penstocks. Water from the tail races of the turbines is led away through a series of caves and underground passages. Some of this exhaust stream passes through natural channels, but canals also have been built.

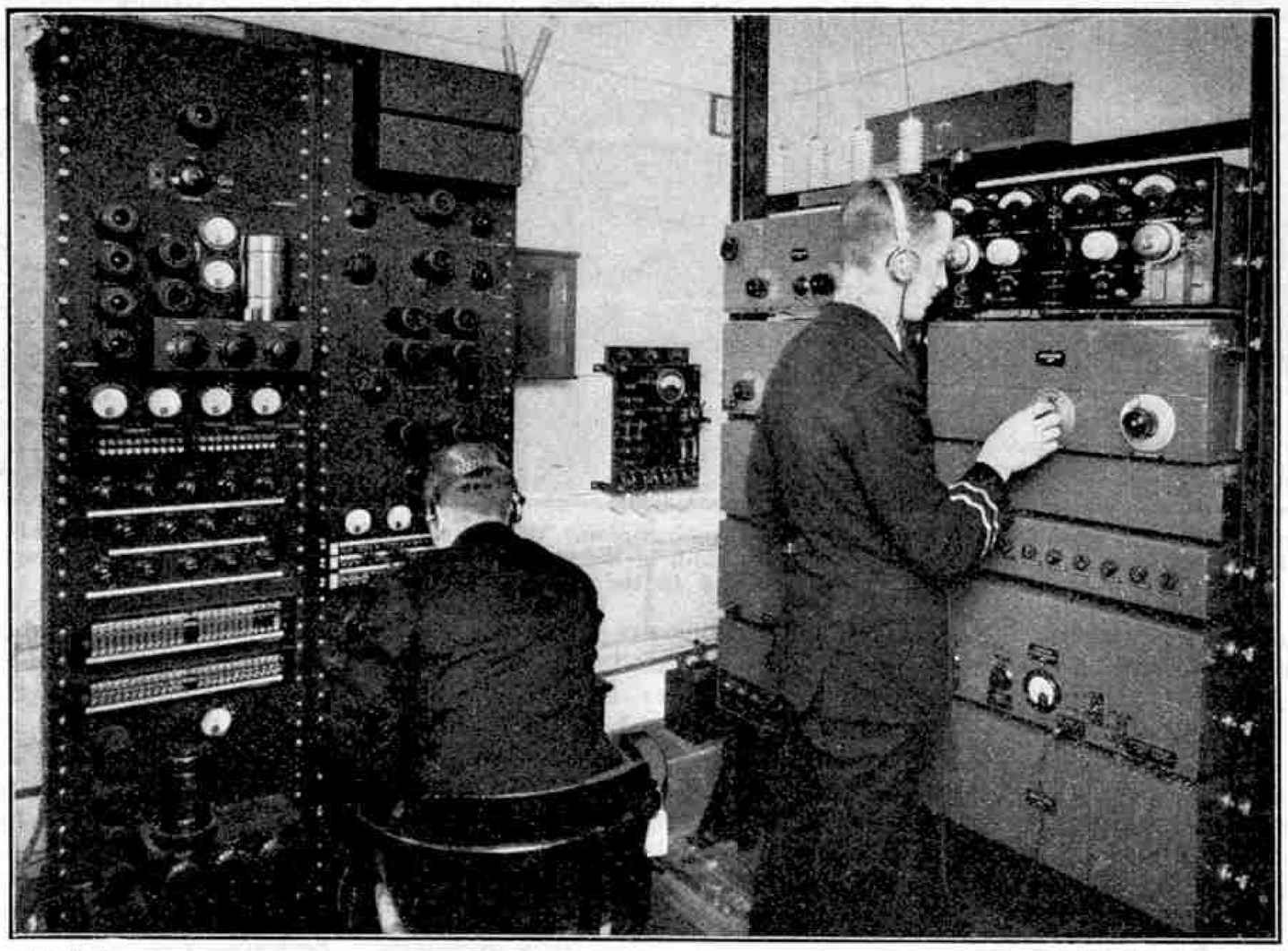
Telephone Service with Ships at Sea

How Messages are Transmitted

By James Jack (Telegraph and Telephone Traffic Section G.P.O. London)

IT is little more than half a century since the Scotsman, Alexander Graham Bell, presented the telephone to the world, and only 25 years since R. A. Fessenden, the American experimenter in wireless telephony, succeeded in transmitting speech from the United States to his receiving station at Machrihanish in Scotland. Since then development has been rapid, and to-day, with a broadcast receiving set in every second house, it is no longer possible to astonish the public by any achievement, however marvellous, in the region of wireless telephony. Yet the latest developments of wireless or radio telephony bid fair to alter the world's conception of time and distance.

In the enterprise of commercial radio telephony the British Post Office has taken a leading part. In co-operation with the American Telegraph and Telephone Company, the first long-distance service in the world was opened between London and New York in 1927. Already this link serves the whole of North America and Cuba on the one hand, and practically the whole of Europe on the other, with an extension to Australia by means of another radio link from Great Britain.



Courtesy [*Marconi Wireless Telegraph Co.*

The Marconi telephone receiving room on the "Empress of Britain." The wireless receiver is on the right. In front of the operator's chair is the monitoring switchboard controlling the terminal equipment panels on the left, to which is connected the wireless receiver.

Telephone service with ships at sea was the next venture, and last year saw the White Star liners *"Majestic," "Olympic"* and *"Homeric,"* and the United States liner *"Leviathan,"* talking alternately with London and New York as they ploughed their way across the North Atlantic. This year the new Canadian Pacific liner *"Empress of Britain"* and the Red Star liner *"Belgenland"* have joined the fleet of "telephone" ships.

Let us try to realise what exactly is involved. Ship to shore wireless telegraphy, with which we are all familiar, can be carried on by the production of sound of varying pitch and amplitude, so long as it can be interrupted at will to form the characters of the Morse alphabet. Wireless telephony, on the other hand, has succeeded in transmitting not merely a sound, but the volume, timbre and pitch of the human voice itself, with all its delicate variations, in such a manner that individual voices can be recognised. Moreover, when one of the stations is a ship, the distances increases or diminishes with every turn of the propeller, and this complicates the work of maintaining communication. It has been found that the use of several wavelengths is necessary to ensure reliable communication with ships in different parts of the Atlantic, and the degree of usefulness of a particular wavelength varies with the time of day and the season of the year. As the ship goes westward or comes eastward, the wavelength must be altered to meet the radio conditions obtaining at the time, and to suit the geographical position in which the ship happens to be.

Mr. James Jack, the author of this article.

In order to follow the operating process by which a telephone subscriber on the shore is placed in communication with someone on board a ship in mid-Atlantic, let us suppose that Mrs. Jones in Liverpool wants to talk to her husband on the *"Homeric."* The lady asks the exchange operator for "Trunks," and then passes in her call, quoting the name of the ship and stating, if possible, whether Mr. Jones is a first-class or second-class passenger. Having done so, she replaces her receiver and awaits developments. Liverpool Trunk Exchange passes the call forward immediately to the London Trunk Exchange, where it is again recorded for treatment by the "Overseas" telephonists. The call particulars are then passed out to the ship immediately, or at the next opportunity if the ship does not happen to be in communication with London at the moment. The name of the caller is given with the other particulars, so that the called person may know who it is that wants to talk with him.

A modern Atlantic liner is a floating city, and Mr. Jones may be in any one of many different places frequented by passengers; and so a messenger is despatched to find him. When at length he presents himself at the telephone cabin on deck, word is passed back to London that Mr. Jones is available and ready to talk. Mrs. Jones is then rung from London, and husband and wife are soon reunited by telephone.

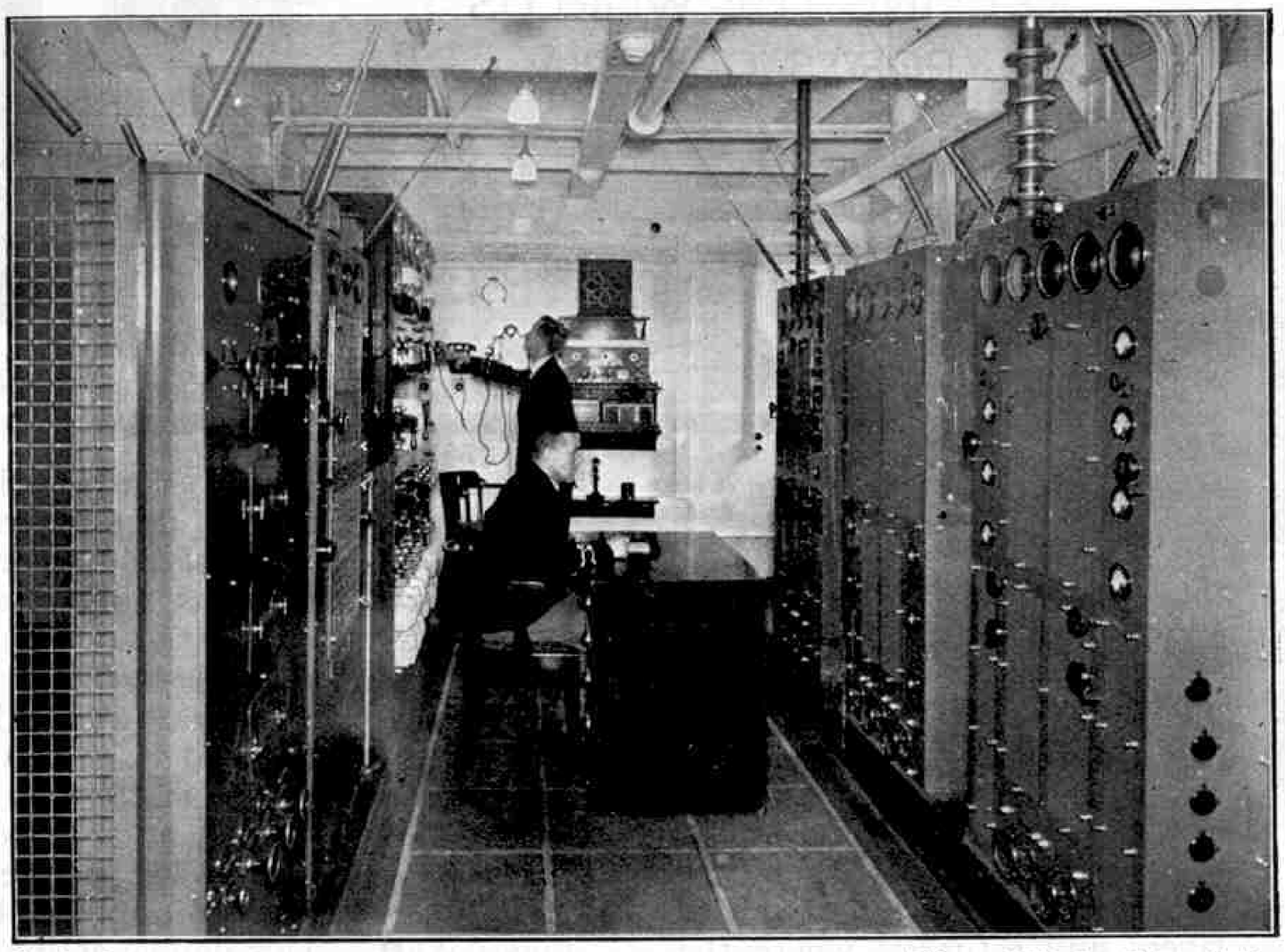
Consider now the path of the conversation. Mrs. Jones's voice travels to Liverpool Trunk Exchange, where it is switched to London Trunk Exchange by means of an underground four-wire repeater trunk. The speech passes through the operating switchboard and thence to the radio apparatus room in the same building, where the technical controls are situated. From there it passes north again by underground trunk to the Post Office wireless station at Rugby, where it is thrown into the air from an aerial "array" 200 ft. high, directed to form a beam towards the ship. The speech waves are picked up by the ship's aerial, and after passing through the ship's receiving apparatus are delivered to the ear of Mr. Jones.

The speech of Mr. Jones travels back by a slightly different route. It is passed into the air by means of the ship's transmitter, picked up by the Post Office wireless short-wave receiving station at Baldock in Hertfordshire, and thence transmitted via underground trunk lines

to London, through the radio apparatus room to the operating switchboard, and so back to Liverpool Trunk Exchange and Mrs. Jones. In spite of the immense distance and the many different links involved, the speech travels instantaneously, and cannot be distinguished in that particular from an ordinary telephone conversation.

Each call requires the co-operation at one stage or another of 10 operators, and the continuous attention and vigilance of five operators.

The functions of the five vigilants are as follows. First there is the London Advance Calling Operator, whose duty it is to keep in touch with and secure the attention of the shore subscriber, so that conversation may be commenced without delay. Second, the London Controlling and Observing Operator who controls the connections, advises the passage of time at three minutes, six minutes, etc., and terminates the connection at a specified duration if the caller does not desire to exceed a specified time, or to incur more than a specified fee. She calculates with a stop-watch any intervals in which part of the conversation is lost or made ineffective through fading or atmospherics, and credits the calling subscriber with the total time rendered ineffective in this way. Third comes the London Technical Operator, who controls the power and amplification in order to maintain even volume, and otherwise supervises the connection on the technical side. If, for example, the caller is a very quiet talker, or allows his voice to drop, the technical operator increases the amplification. Fourth comes the Ship's Technical Operator, and fifth the Ship's Commercial Operator, whose functions are similar to those of the technical and control operators on shore.



Courtesy] [*Marconi Wireless Telegraph Co.*

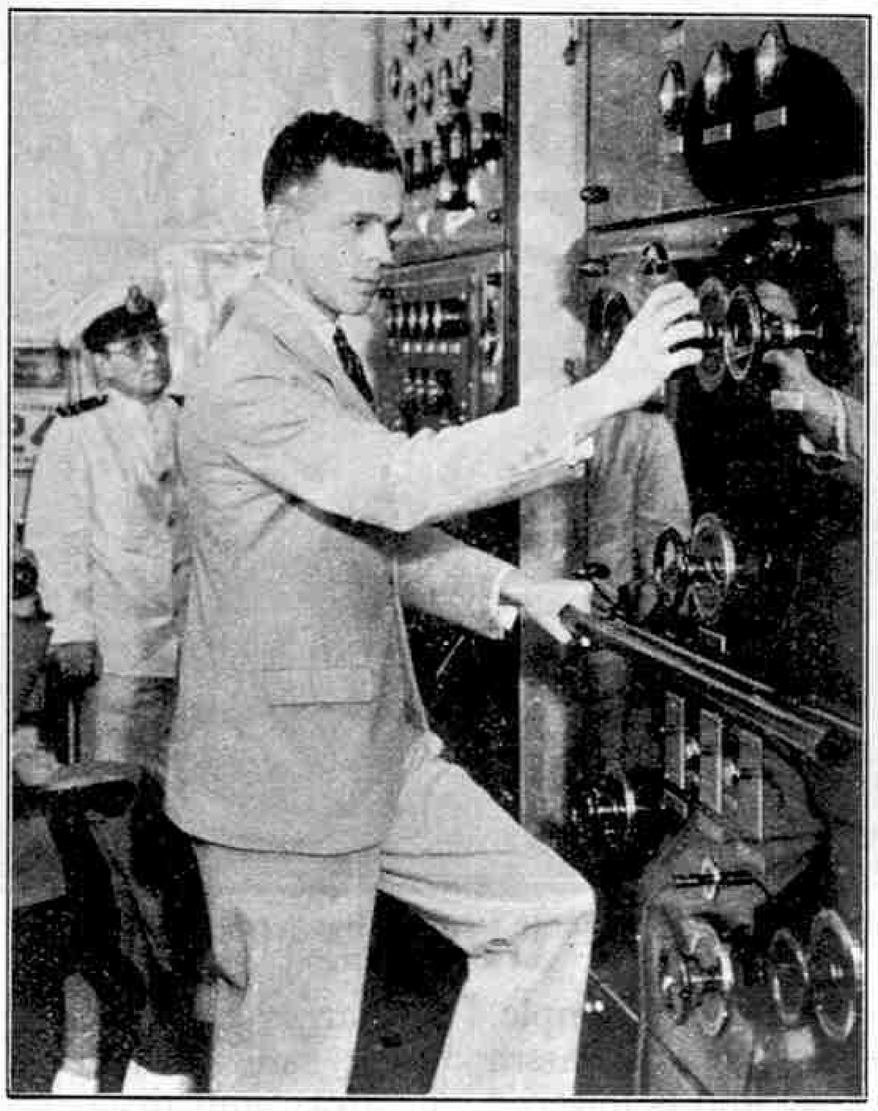
The Marconi telephone transmitter on the "Empress of Britain." The main switchboards and rectifying units are on the left, and the modulating and oscillating units on the right.

A rather interesting device used in marine telephony, as in other wireless telephone services, is the voice-operated valve switch that closes the return channel when speech is passing outward. Without its aid, the extraneous radio noise entering the land circuit via Baldock would find its way to Rugby, where it would introduce a disturbing factor in Mrs. Jones's outgoing speech. A somewhat similar device is fitted on the ship.

Service between London and the ship is arranged on a timetable, so that both ship and shore will know when and on what wavelength to listen for each other. For this purpose the Atlantic Ocean is divided into two equal parts or zones at 37 deg. 50 min. west of Greenwich. While in the eastern half of the Atlantic each ship works alternately with London and New York in three and two hour periods respectively. When the ship passes into the western half of the Atlantic that ratio is reversed. As the ship sails westward, her clock is put back one hour every midnight until the five hours' difference of time between London and New York is equalised. This necessitates a sliding timetable. Thus, if on the first day out from the British port the ship was scheduled to work with London 9 a.m. till noon and 2 p.m. till 5 p.m., London time, on the following day the service would not begin until 10 o'clock, and on the third day at 11 o'clock, and so on, the reverse process being applied on the homeward journey.

Telephone service with the ships in the North Atlantic is very inexpensive. Three minutes' conversation—that is three minutes net with all periods of noise and fading deducted—costs £4/10/- from any place in Great Britain, and £4/16/- from any place in Ireland or the Isle of Man. When the distance is considered—anything up to 3,000 miles—the costly apparatus, and the close co-operation required among the operators and engineers at widely separated points, the fact will be appreciated that a facility has been placed at the service of the public remarkable alike for convenience and low charges.

The service aims at a high standard of efficiency. For instance, if a caller aboard a ship desires to speak with someone on shore, and the latter is not available at his ordinary telephone, the London operators will endeavour to trace him—over the greater part of Europe if necessary—in order to fix up a telephone appointment with him. The service is what is called a "personal" service. That is, the Post Office does not consider it has "delivered the goods" until the caller is actually in communication with the person whom he has named, or with an accepted substitute. In many cases the caller finds it convenient to mention a possible alternative, for example, Mr. Brown or his secretary, his works manager, his partner, someone who can talk business, or someone who can speak a particular language. The call is not timed on until some person, principal or acceptable substitute, is obtained and connected.



Courtesy] [*International Marine Radio Co.*

Tuning in the transmitter when talking from S.S. "Belgenland" at Hong Kong to Baldock in Hertfordshire.

The ship installations are not provided by the Post Office, but by private companies. Thus the International Marine Radio Company own and operate the installations on the "*Majestic*," the "*Belgenland*" and the "*Olympic*"; the Marconi Company are responsible for the "*Homeric*" and the "*Empress of Britain*," and the American Telegraph and Telephone Company operate the service on the "*Leviathan*." Many more ships will no doubt be equipped in the near future. The range of the service is not confined to London. A person on board ship can speak via London to almost every country of Europe, and to Australia and South America.

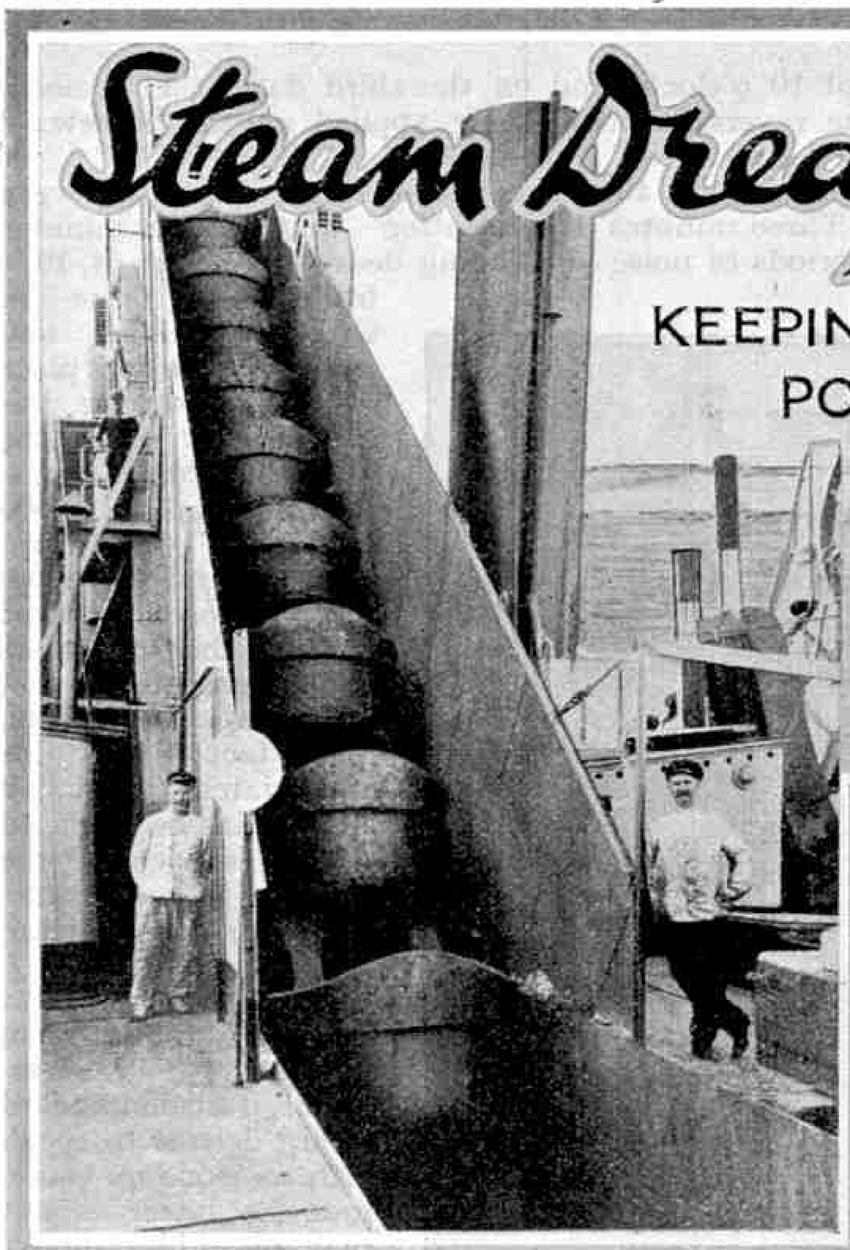
A conversation between a B.B.C. official in London and the Captain of the "*Homeric*" was broadcast by the B.B.C., and recently a conversation was carried on via London and Buenos Aires between the Captain of the "*Majestic*" in the North Atlantic and an aeroplane flying 4,000 ft. above the latter city. These are only two of the many wonderful feats accomplished.

Service with ocean greyhounds, however, is not the whole horizon of the marine telephone service, and steamers that cross between our island and Continental ports will soon be brought within its scope.

This interesting article is reproduced by courtesy of the Editor of "*Mersey*."

Steam Dredgers and Their Work

KEEPING THE WORLD'S PORTS CLEAR

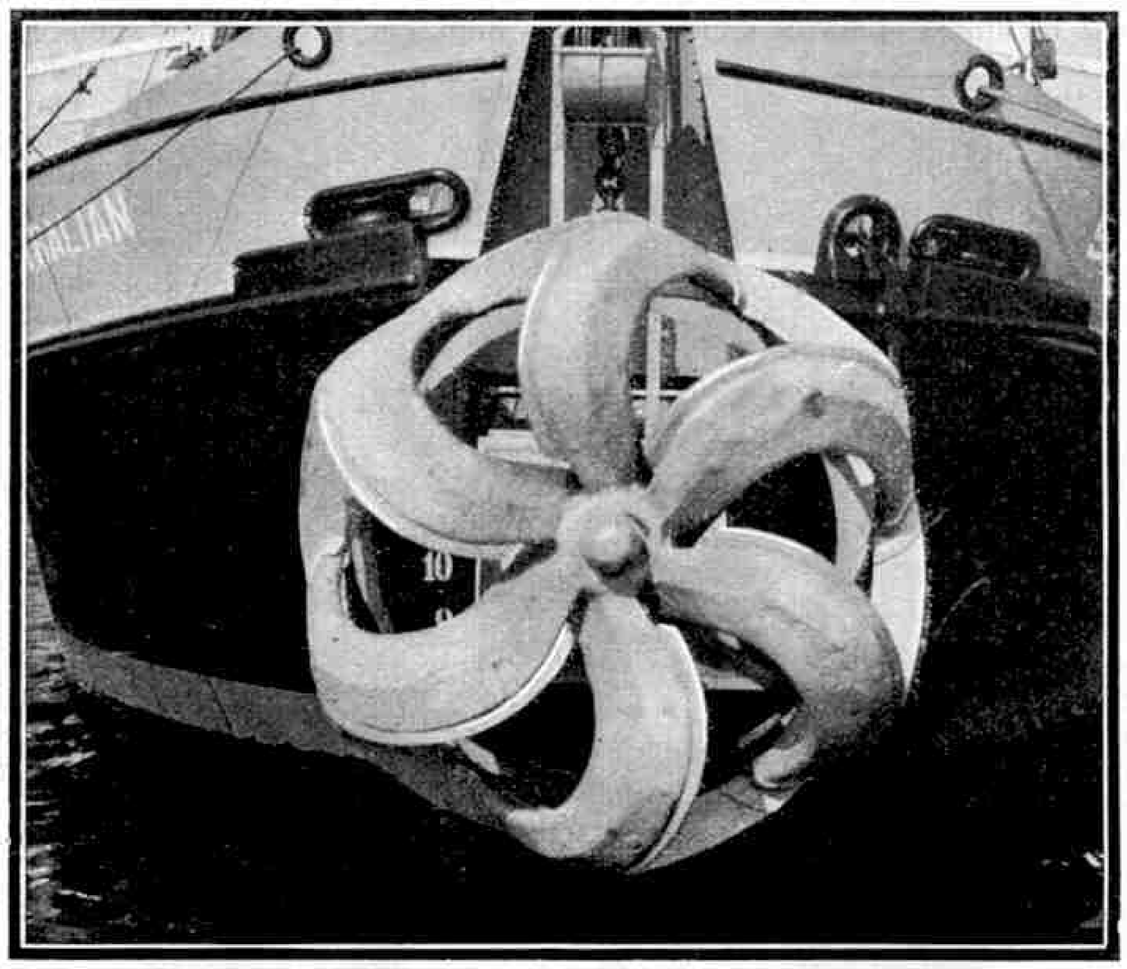


(Above) A large steam dredger at work, with barge alongside, on the Suez Canal. (Left) The 25.4 cu. ft. capacity buckets of the dredger "La Puissant" at Port Said.

MANY of the most important ports in all countries are situated on rivers and estuaries where the natural depth of water is not sufficient to allow the largest ships to enter. To add to this difficulty every tide sweeps into the channel vast quantities of sand and silt, and although much of this is carried out to sea again by the following ebb tide, a sufficient amount is left behind to accumulate and quickly silt up the channel entrance. The task of securing and maintaining a sufficient depth of water in such channels is carried out by the powerful steam dredgers that are so familiar a feature round our coasts. The importance of the work done by these rather unlovely vessels can scarcely be overestimated. Without them many of our greatest ports would quickly become inaccessible. It has been stated that if dredging in the Mersey were stopped the port of Liverpool would be closed to deep water traffic in a week!

Various types of dredgers are now in use, the oldest and the most familiar type being the "bucket" or "ladder" dredger. The principle on which such dredgers work is very simple. A strong girder suspended from a central rigging passes through a well in the centre of the vessel and is lowered to the depth at which dredging is to take place. On this girder is a linked-up chain of 40 or 50 steel buckets. The chain is reached by heavy tumblers, which usually are actuated through steam-driven gearing. This system of dredging was invented as far back as 1778, when the first bucket dredger was built and launched at Hull. The name of the inventor is not known, and the dredger itself was crude and primitive. It was fitted with 11 buckets, and the motive power was provided by two horses which rotated a pair of horizontal beams on the deck of the dredger. The machine was able to work in 14 ft. of water and its output was about 30 tons per hour.

Some years later, about the end of the 18th century, steam power was applied to dredging, the engine for the first steam-driven dredger being constructed by James Watt. This double-acting engine had a cylinder 18 in. in diameter by 16 in. stroke, and steam was supplied at a pressure of from 5 lb. to 10 lb. per sq. in. The oak hull of the vessel was 60 ft. in length and 21 ft. in breadth, and the bucket ladder could be lowered to a maximum depth of 18 ft. A splendid proof of the excellence and durability of the workmanship of the men who built this engine is provided by the fact that the dredger was in use in the River Tay as recently as 1905.



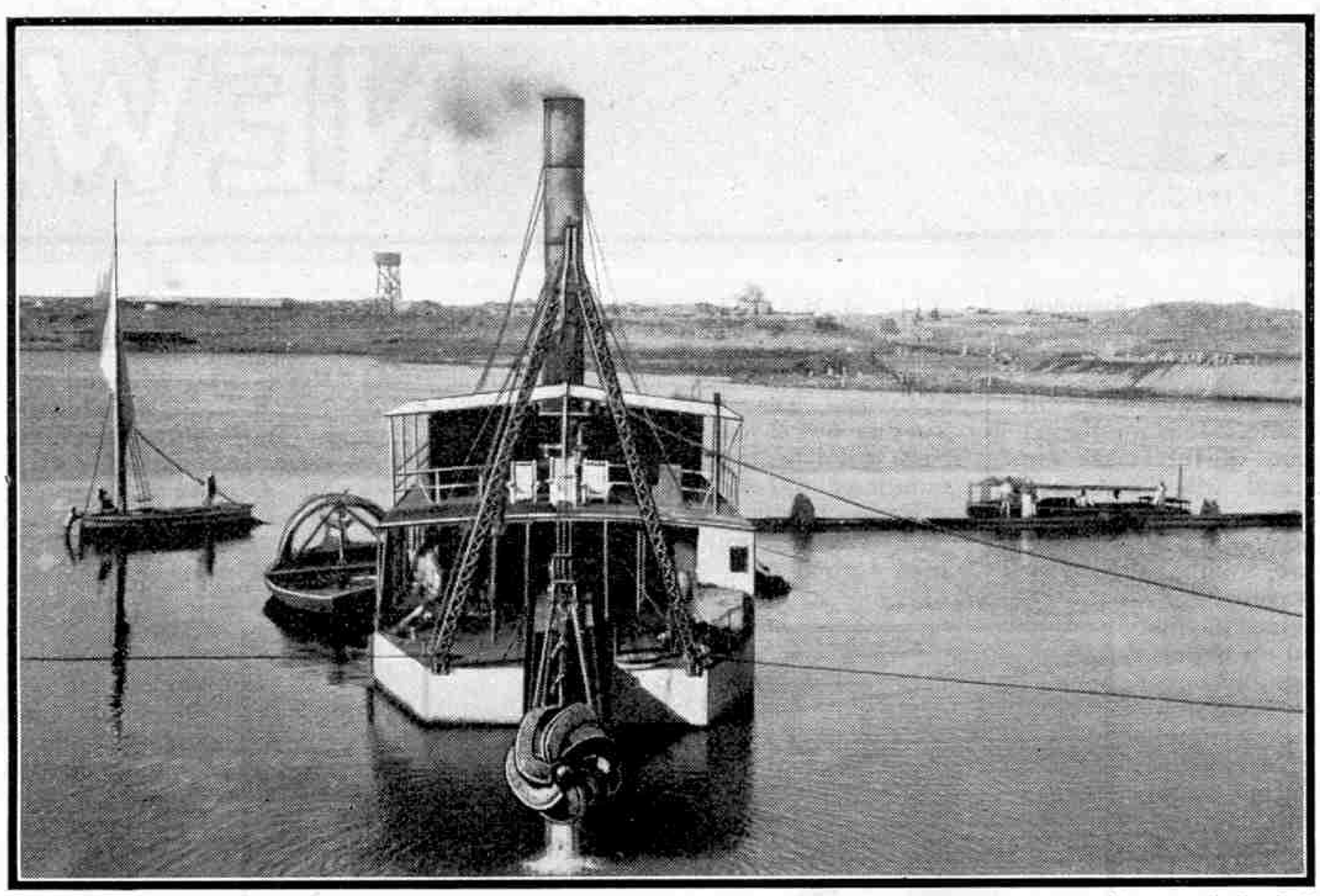
The rotating cutter of a large suction dredger at the Gusto Dockyard at Schiedam.

As time went on the bucket dredger was improved greatly in design and construction, and it has now reached dimensions equal to those of the ocean liner of 50 years ago. It is interesting to note, however, that the principle of bucket dredging has remained exactly the same as it was in the earliest vessels.

Modern bucket dredgers are divided into two main classes, barge loading dredgers and hopper dredgers. The barge loading dredger, when engaged in dredging operations, is attended by barges for the purpose of collecting the dredged mud or sand—which is known as "spoil"—and taking it away and discharging it out at sea. These barges are moored alongside the dredger underneath a form of chute. The full buckets are hauled up on the endless chain until they reach the top of the structure, when they are automatically tipped and emptied, the spoil

falling down the chute into the hold of the barge. Barge loading dredgers as a rule are not fitted with engines for propulsion, and have to be towed by tugs to and from the dredging ground.

A hopper dredger is invariably a self-propelled vessel, the same engine often being used for both the propeller and the dredging apparatus. This type of dredger does not discharge its spoil into barges, but loads it into its own holds, and when these are full carries it out to the depositing ground where it is quickly discharged through openings in the bottom of the holds. One of the great advantages of the hopper dredger is that it can be used in narrow channels or confined spaces, where a barge loading dredger with its barges would not have room to operate.



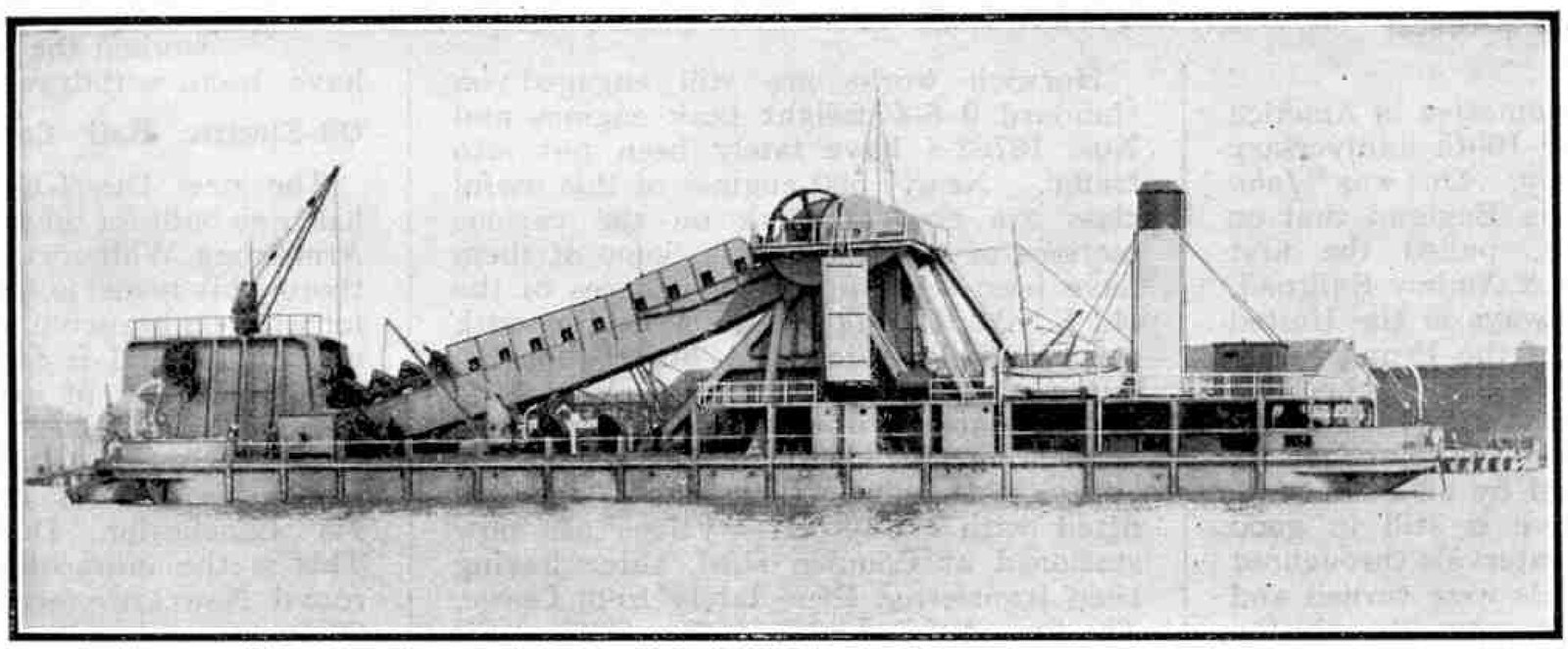
Courtesy] [*Lobnitz & Co. Ltd.*

A cutter suction dredger built for the Sudan Government. The floating pipeline is seen in the background.

The bucket dredger has been brought to a high degree of efficiency, and many great engineering undertakings have been successfully carried out by its aid. At Blyth, on the Northumberland coast, for instance, the deepening of the entrance channel involved the removal of a million tons of solid rock overlaid by large boulders. In this case a vessel fitted with rock-breaking apparatus, working on a similar principle to that of the pile driver, was brought into use to break up the rock; and with this assistance a bucket dredger proved capable of dredging rock at the rate of 250 tons per hour. The successful completion of the Panama and the Suez canals would not have been possible without bucket dredgers.

Less familiar, at any rate around the coasts of the British Isles, is the "suction" dredger, or "hydraulic" dredger as it is called in the United States. This type of dredger, instead of scooping up material from the sea or river bed as is done by the bucket dredger, sucks up the spoil through a pipe by means of a powerful centrifugal pump. The material thus brought up is loaded into the vessel's own holds in the case of hopper suction dredgers, or is discharged into hopper barges alongside, or on to adjoining land. The work of the pump is often assisted by a rotary cutter, which breaks up the material before this is drawn into the suction pipe. The cutter consists of a series of blades mounted on a rotating shaft, and means are provided for raising or lowering the cutter to work at different depths according to the depth of the bed that is being dredged. Another type of suction dredger combines the qualities of a dredger and a rock breaker, and is capable of cutting through and removing solid rock without the necessity of breaking up the rock beforehand by blasting or otherwise.

The time taken for a hopper suction dredger to dredge a full load varies considerably, according to the capacity of the vessel and the number of suction pipes in use. When the holds are full the vessel hauls the pipes on board and steams out to sea to the dumping ground, which as a rule is several miles out, where there is little chance of the spoil being washed back again into shallow water. When this ground is reached the material is discharged through valves, usually hydraulic, in the bottom of the holds.

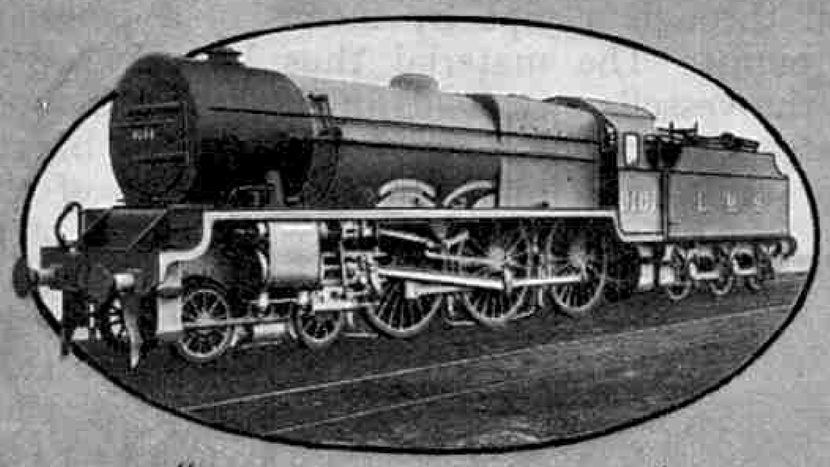


Courtesy] [*James Dredging, Towage and Transport Co. Ltd.*

A modern deep water bucket dredger having a capacity of 1,500 tons per hour.

When a suction dredger of the barge loading type is required to discharge its spoil some distance from the dredger, either on land or in the sea, a floating pipeline is used. This line consists of a number of pipes connected by lengths of

(*Continued on page 68*)



RAILWAY NEWS

"Super-Kings" to be built at Swindon

The first of the new series of 2–6–0 "Mogul" mixed traffic locomotives has just been finished at Swindon and will shortly be put into traffic. It is numbered 9300. Other engines of this class are nearing completion and will be turned out in quick succession.

Of the 2–6–2 tank engines of the new "61" series, five more, numbered 6125 to 6129, have been completed. More than twenty engines of this class are now engaged on suburban traffic in the London area. The bridges on the Uxbridge branch recently were strengthened to enable them to carry these heavy and powerful locomotives.

Five more of the new batch of 0–6–0 tank engines have been built and are numbered 5405 to 5409. As these engines are to be used chiefly on local passenger services they are fitted with duplicate regulator gear in order that they may be employed on "push and pull" auto-trains.

The experimental eight-wheeled tender, which was fitted first to engine No. 5919, *"Worsley Hall,"* is now being tried on No. 5001, *"Llandovery Castle."*

It is probable that five "Super-Kings" will be put in hand at Swindon early in the new year.

Centenary of America's Oldest Locomotive

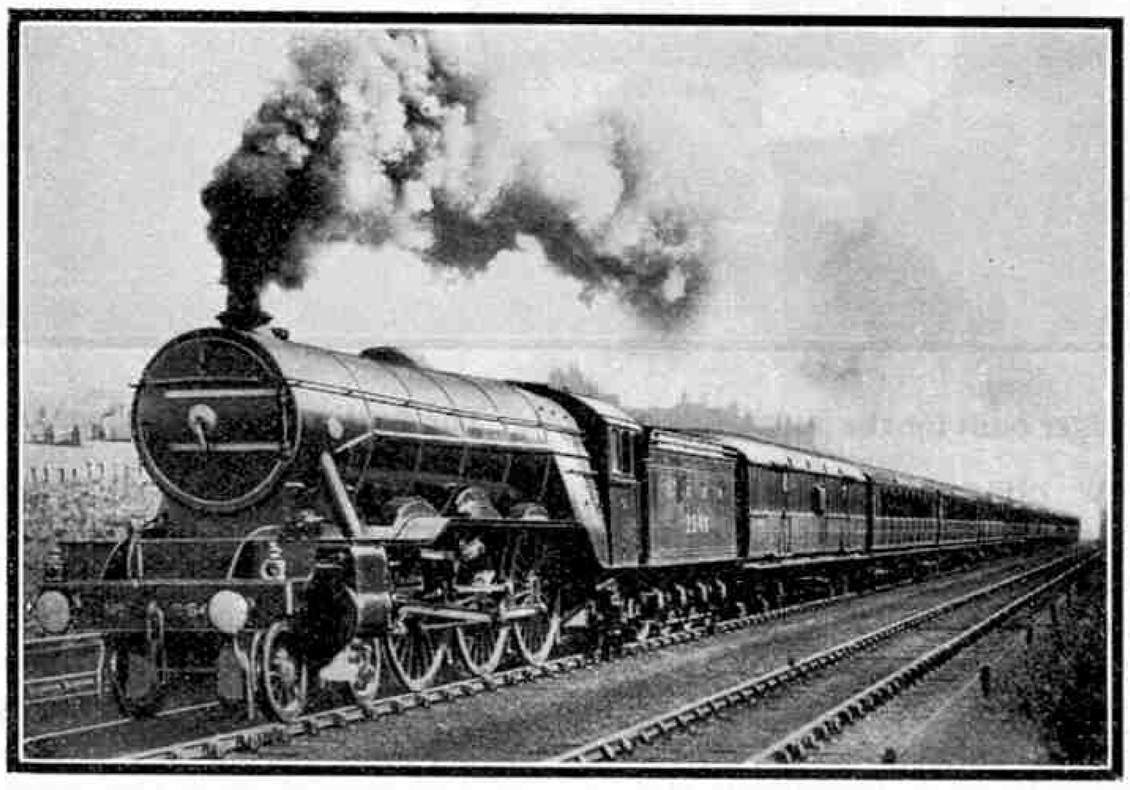
The oldest steam locomotive in America recently celebrated the 100th anniversary of its first public journey. This was *"John Bull,"* an engine built in England that on 12th November, 1831, pulled the first train over the Camden & Amboy Railroad, one of the earliest railways in the United States, and now part of the Pennsylvania Railroad system. This historic locomotive is preserved in the Smithsonian Institution, Washington, where the centenary of its first run was celebrated by an exhibition. The veteran locomotive is still in good working order and at intervals throughout the exhibition its wheels were turned and sharp blasts were blown on its whistle. Compressed air was used instead of steam to put life into the boiler of the old engine, however. Early passenger cars and sections of the original rails used on the Camden & Amboy Railroad were shown alongside the veteran locomotive.

It is interesting to recall that as recently as 1893 *"John Bull,"* then 62 years old, made the journey from Washington to Chicago in order to take part in the great exhibition held to celebrate the 400th anniversary of the discovery of America by Columbus.

L.M.S.R Locomotive News

Some of the new series of 0–8–0 standard freight locomotives have been completed at Crewe. They bear the numbers 9620-6. Further 4–4–0 passenger engines of Class 2 have been sent out into service and are numbered 657-9.

From Derby works additional 2–6–2 tank engines numbered 15553-5 have been turned out.



The down "Flying Scotsman," hauled by the "Pacific" locomotive No. 2548, "Galtee More," passing New Southgate. It is ascending the 1 in 200 gradient that terminates at Potter's Bar. (Photograph, Railway Photographs, Liverpool).

Horwich works are still engaged on standard 0–6–0 freight tank engines and Nos. 16762-4 have lately been put into traffic. Nearly 500 engines of this useful class are now at work on the various sections of the L.M.S.R. Some of them have been sent to take the places of the old L.N.W.R. tank engines in dealing with empty stock trains and other shunting duties at Euston. They are also taking a large share in working the heavy goods traffic on the old North London line.

Five of the nine "Claughtons" that are fitted with "Caprotti" valves are now stationed at Camden shed, three having been transferred there lately from Crewe. The five at Camden are: No. 5927, *"Sir Francis Dent"*; No. 5947; No. 5948, *"Baltic"*; No. 6023, *"Sir Charles Cust"*; and No. 6029. Only one other "Claughon," No. 5972, fitted with ordinary piston valves, is at present located at Camden.

The scrap-heap has claimed two more 2–4–0 "Jumbos." These are No. 5002, *"General,"* and No. 5075, *"Balmoral."* Other recent withdrawals include the 4–4–0 "Precursors" No. 5193, *"Thunderbolt,"* and No. 5273, *"Jason"*; and the 4–6–0 "Experiment" No. 5484, *"William Cawkwell."*

L.N.E.R. "Atlantics" Reconstructed

Two of the 4–4–2 "Atlantic" locomotives—Nos. 727 and 2171—of the former N.E.R. "Z" class have been reconstructed at Darlington, the interesting alterations made including the fitting of "boosters." Mr. Gresley has applied his system of articulation to these engines in a novel way, for in each case the original trailing wheels have been replaced by a four-wheeled bogie which is equipped with a "booster" and carries the weight of the trailing end of the engine and also of the leading end of the tender. Cabs of Mr. Gresley's standard design have been provided and external exhaust steam pipes similar to those on the "Pacifics" and "Sandringhams" have been fitted. The reconstructed engines are equipped with the automatic vacuum brake and new straight-sided tenders have been supplied.

Darlington works have turned out further 0–6–0 goods engines of the "J39" class. These are numbered 2963 to 2968.

Three of the 2–4–2 tank engines of the G.E.R. "F4" class—Nos. 7176, 7222 and 7236—are now stationed at St. Margaret's shed, Edinburgh, and work on the Gifford branch. The 4–4–0 tank engines of the "D51" class that formerly worked the traffic on this branch have been withdrawn for scrapping.

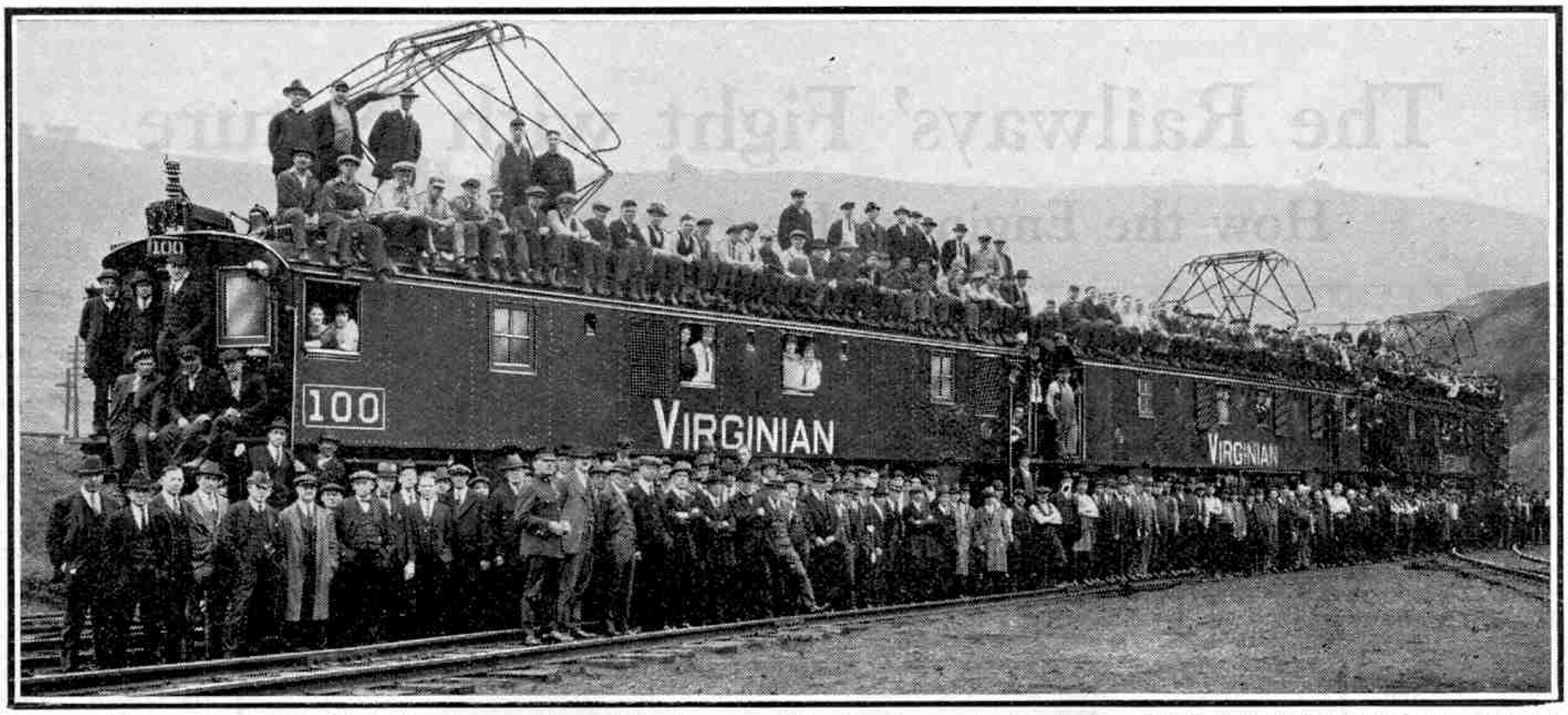
Oil-Electric Rail Car on the L.N.E.R.

The new Diesel-Electric rail car that has been built for the L.N.E.R. by Sir W. G. Armstrong, Whitworth and Co. Ltd., is being thoroughly tested in service. It is designed for work on branch lines and short-distance main lines, and is capable of carrying 60 passengers and of attaining a maximum speed of 65 m.p.h.

One successful trial run was made from Newcastle Central Station to Blackhill, via Lanchester, Durham and Birtley. This is the most difficult stretch of line round Newcastle, with gradients of 1 in 66 for several miles.

On the outward journey a typical suburban service was run, with nine stops. Despite safety restrictions on the line the car gained 6½ minutes on the scheduled time of 45 minutes. So silent was the running of the car that when it reached Blackhill the stationmaster was not aware of its arrival. The return journey was made at express speed, 64 m.p.h. being attained.

The Diesel engines use heavy oil and it is claimed that the car can be operated at half the cost of a steam train of the same capacity.



Giant electric locomotives of the Virginian Railroad. Current is supplied to these powerful engines from overhead conductors. (Photograph, Railway Photographs, Liverpool).

New Luxury Saloons for G.W.R.

For some years past there has been a steady increase in the number of trans-atlantic passengers using Plymouth as a port of arrival or departure. To make the railway journey between London and Plymouth even more attractive, the G.W.R. have recently put into service on the boat-trains two saloon coaches of an exceptionally luxurious type. They have been designed and built at the Company's Swindon works and six more are under construction. By the gracious permission of His Majesty the King, each of the new coaches will be named after a member of the Royal Family. The first two bear the names *"King George"* and *"Queen Mary,"* and the others as they are completed will receive the following names: *"Prince of Wales"*; *"Duke of York"*; *Duke of Gloucester"*; *"Princess Mary"*; *"Duchess of York"*; and *"Princess Elizabeth."*

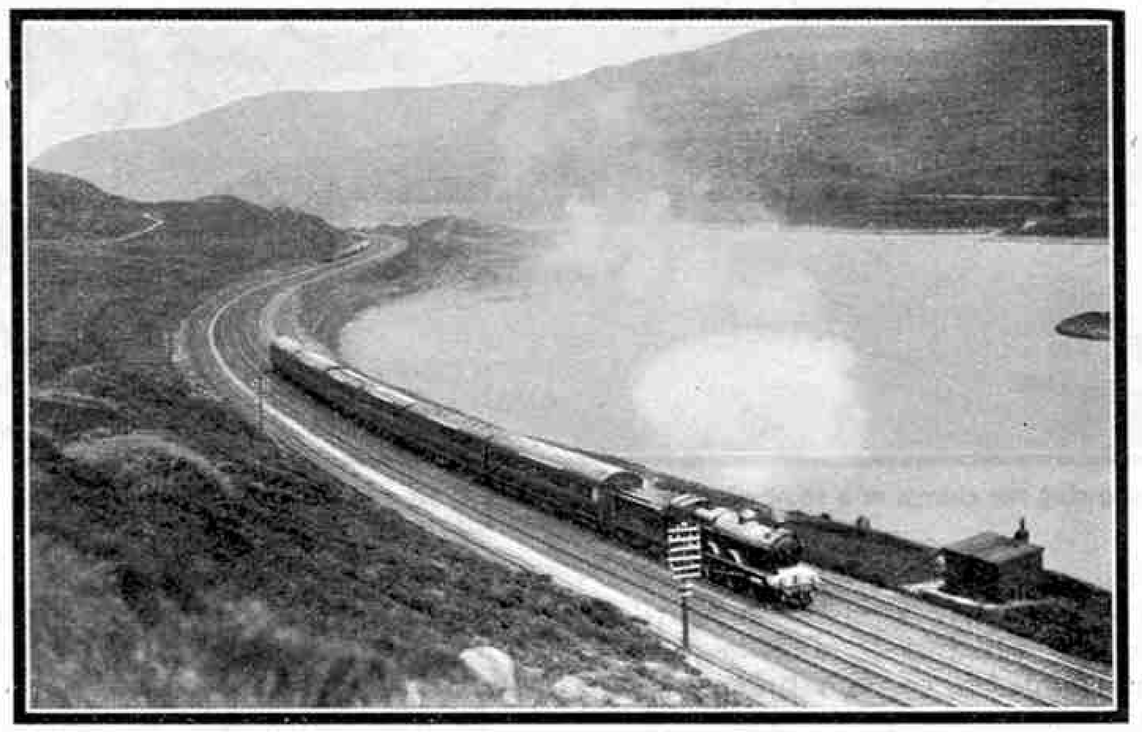
The vehicles are 66 ft. in length and are largely constructed of steel. They are bow-ended and have tapering recessed doorways at each end, providing a wide comfortable step for passengers entering or leaving. The coaches are 9 ft. 7 in. in width. Each contains a saloon seating 17 persons; a small saloon, with accommodation for eight passengers, that is separated from the larger one by double sliding doors; and a coupé compartment for four in addition to accommodation for luggage. Privacy is given to the coupé compartment by the absence of windows on the corridor side.

In the interior decoration anything in the way of over-elaboration or ornament has been avoided. Each saloon is panelled in highly polished natural light French walnut veneer, with dark burr walnut pilasters on panels between the deep windows. The ceilings are panelled in flat stippled vellum and the saloons are lit by concealed electric lights. The chairs which are of the comfortable wing type, are upholstered in brown patterned moquette and the floors are covered with heavy carpets.

Veteran Locomotives of S.R.

Two more of the three-cylinder 2–6–0 tender engines of the "U1" class have been built at Eastleigh and put into service. They are Nos. 1908 and 1909. The five 2–6–4 three-cylinder goods tank engines of class "W" are now building at Eastleigh and will be numbered 1911 to 1915.

Only two of the famous *"Gladstones,"* the 0–4–2 express engines of the former L.B.S.C.R., now remain in service. These survivors are Nos. B172 and B197.



An L.N.E.R. express approaching the western entrance to Woodhead Tunnel. The engine is one of the G.C. section "Atlantics," and the lake in the background is one of the reservoirs of the Manchester Corporation.

Air-Cooled Milk Tanks

Four new milk tanks, each capable of holding 3,000 gallons, have just been brought into use by the G.W.R. in connection with the conveyance of milk between Devizes and Paddington. These tanks are glass lined and they are insulated by means of slab cork two inches in thickness.

An unusul feature of their construction is that as a further safeguard a sheet metal canopy is fitted over the top half of each tank in order to keep off the direct rays of the Sun. A space $1\frac{5}{8}$ in. in width between the tank and the canopy allows free circulation of air as an aid to cooling.

Opening of the Bermuda Railway

The building of a new railway is a rare event nowadays. One that has just been completed and opened for traffic in the main island of Bermuda therefore, is of great interest. The island lies in the Atlantic about 600 miles from the coast of the United States, and the need for some form of mechanical transport had long been felt. The standard gauge of 4 ft. $8\frac{1}{2}$ in. has been adopted. The line is $21\frac{1}{2}$ miles long and runs from the town of St. George in the east to Somerset in the west, passing through Hamilton, the capital, about midway. Inlets of the sea are crossed at eleven different points and numerous bridges of steel and others of the wood trestle type had to be built. The line is single throughout, but a number of passing loops are provided. British-built rail cars, propelled by petrol engines, are used to operate the services.

Train for Weeding S.R. Track

The work of keeping the railway track free from weeds may seem to be of little importance, if not altogether a waste of time and money. Yet really it is essential to the safety of the railway, as unless the growth of weeds is kept in check, dirt and other matter collect in the ballast and impair the effective drainage of the permanent way.

A special weed-killing train is the latest mechanical device employed on the Southern Railway. It consists of two old tenders coupled together and specially adapted with spray pipes, through which liquid weed killer is forced. The effective range of the sprayed liquid is about 10 feet and the operation is controlled by a man who rides on an adjoining truck and who is able to adjust the pressure in the tanks as necessary.

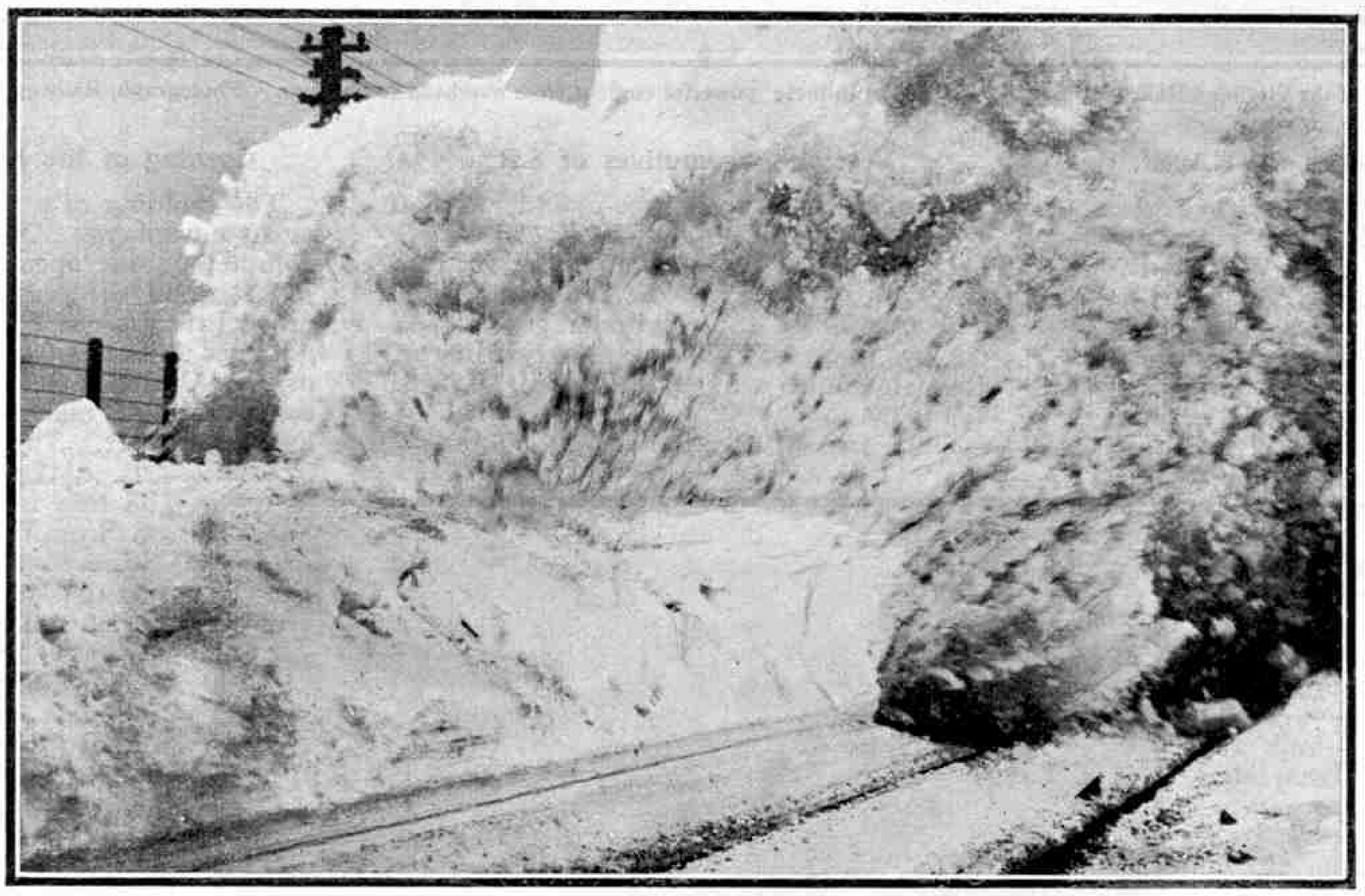
The experiments have shown that the cost of eliminating weeds by this method is less than that of hand weeding, for a large staff is necessary if the work is carried out in this manner.

The Railways' Fight with Nature

How the Engineer Keeps the Track Clear

RAILWAYS share with roads the disadvantage that, however carefully and skilfully they are constructed, communication by means of them is liable to be interrupted by various forces of nature, which may range from heavy snowfalls to earthquakes, according to the part of the world in which the railway or road exists.

Snow is a menace to railways on account of its habit of drifting rather than the actual depth of the fall. In this country heavy falls are comparatively rare and the unexpected visitation at Christmas in 1927 was a revelation to many people of the extent to which snow can interrupt the working of railways. One snow-drift in the south of England was 15 ft. in depth and completely blocked the main line of the Southern Railway between Basingstoke and Salisbury. Another drift that blocked the Amesbury branch of the same railway reached a depth of 18 ft. A snow-plough was quickly on the scene, but although it was pushed by four locomotives it made little impression, and ultimately assistance had to be sent to dig out both the plough and the locomotives! In the end a clearance was effected, but several days elapsed before normal traffic was restored.



A fine illustration showing the charge of a snow-plough. The plough itself and the locomotives propelling it are completely hidden by the shower of snow that is flung up.

Two types of snow-plough are used by British railways. The first is a steel structure resembling the bow of a battleship. This plough is attached in front of the buffers of a locomotive, and as it is pushed forward it throws the snow to right and left of the track. For heavier falls and deep drifts a plough of similar type but of such dimensions as to extend the full height of the loading gauge is employed. These ploughs are independent six-wheeled vehicles and are provided with a rear compartment in which the snow-clearing gang are accommodated. They are pushed forward by two or more locomotives.

These types of snow-plough are not sufficiently powerful to deal with the heavy falls and immense drifts encountered in mountainous countries. For such work rotary ploughs of enormous power are employed. A rotary plough consists essentially of a propeller fitted with a large number of blades. This is fixed on the front of a locomotive and is made to revolve at a very high speed as the engine moves forward. If the propeller were not enclosed in any way the effect would be to hurl the snow backward, but this is prevented by surrounding the propeller, except at the front, with a casing. As the snow is unable to pass backward it is whirled round and forced through an opening at one side of the casing, and thus is thrown clear of the track.

On some of the more exposed portions of railways that traverse mountains the snow trouble is so serious that even the most powerful ploughs could not be relied upon to cope with it. In such cases protection is given to certain stretches of track by building over them structures known as snow sheds. These structures have sloping roofs, and are usually built of timber. Sometimes concrete is used, however, and this material has the advantages of being cheap and easy to prepare, and at the same time of providing immunity against fire, which is an ever-present danger with wooden structures, as the result of accidental ignition by sparks from the engines.

The torrential rains that occurred in various districts on the G.W.R. and L.M.S.R. systems in July, 1927, created considerable damage. This was the case especially in the Birmingham district, where a large volume of water found its way on to the G.W.R. line near Smethwick, rising to about 1 ft. 8 in. above rail level and creating a water course 2 ft. 8 in. in depth and 30 ft. in width. At this point the G.W.R. line is on a falling gradient of 1 in 233 and the flood continued its downward course to Galton Junction, where the L.M.S.R. track joins that of the G.W.R. Here the railway is on a high embankment composed of sand. The flood found its way over the embankment and poured down the 30 ft. slope to the Birmingham Canal which runs parallel with the railway.

The sandy embankment soon proved unable to withstand the scour of the rushing water and showed signs of weakening. The boundary fence began to move downward, and suddenly there was a great rush. With a thundering roar, some 4,000 tons of sand plunged into the canal, completely blocking the waterway for a distance of about 100 yards. The collapse of the embankment left a huge gaping chasm beneath the main L.M.S.R. up and down lines, and under the up line the gap was about 200 ft. in width.

It was impossible to restore the huge amount of displaced sand, and the district engineer sent to headquarters an urgent request for about 400 wagon loads of ashes or other suitable material. This was soon speeding towards Smethwick from various localities. The task of building up the embankment was continued day and night, operations during the hours of darkness being carried out by the aid of powerful lights. The mishap occurred on a Monday night and the first trains passed over the reconstructed track on the following Friday morning.

In addition to damage by heavy rainfall, the G.W.R. have on several occasions been inconvenienced by the misbehaviour of the sea in localities where their railway runs along the Welsh coast. In October, 1927, an exceptionally severe south-westerly gale was experienced, chiefly along the shores of Cardigan Bay. The storm immediately followed a high spring tide, and the combined forces of the sea and air wrought great damage to the permanent way and telegraph and telephone systems. In the vicinity of Gogarth Halt a motor boat about 10 tons in weight was carried up the Dovey estuary by the flood tide and stranded on the G.W.R. line, while at Harlech and other places on the Company's system, the floods washed away the railway embankments and displaced several bridges.

During the extremely wild weather that prevailed early in 1930 a breach was made in the G.W.R. main line near Dawlish,

where the railway runs alongside the sea. The sea-wall was undermined, and the earthwork supporting the railway was washed out, with a result that both the up and the down tracks were suspended in the air. For several days no traffic could pass along this line, and local trains were diverted via the Teign Valley line. The through expresses, such as the "*Cornish Riviera,*" were compelled to travel between Exeter and Plymouth by the Southern Railway route, G.W.R. engines and men being employed, accompanied by an S.R. driver to act as pilot. In spite of great difficulty owing to violent seas, repairs to the damaged line were pushed rapidly forward, and within a week the line was reopened for traffic, but for some time only the up line was available.

Sand is sometimes a very serious enemy of the railway engineer. In Columbia, U.S.A., the Union Pacific Railway have always been in combat with it along the Oregon-Washington branch of their line. The track here passes along the valley of the Columbia River and this river is fed by countless streams that originate in the melting snows and glaciers of the Rocky Mountains. Disintegration of the snow and ice takes place simultaneously over a large area and reaches its maximum in June when, in places, the flood level of the river rises as much as 60 ft. above the normal level. The rushing mountain streams bring down with them great quantities of worn-away rock in the form of sand. It is estimated that some millions of tons of material are swept down to the valley in this manner every year, and although the greater proportion of this is carried out to sea by the swift flow of the river, there remains along the banks of the river a sufficient quantity to constitute a serious menace to the railway.

The deposit of sand is greatest in the district between Wallula and the Dalles. Here the river, when at flood level, inundates large stretches of the valley, and as it recedes, leaves behind a thick carpet of mud. The rainfall in this part of the country is very small and the hot sun quickly dries up the moisture in the mud. Every breeze that rises then carries the fine dry particles of sand across the desert valley in waves of ever-changing size and form, and it is this phenomenon that has given rise to the name "sand-seas."

It is only necessary for the sand to cover the railway track to a depth of one inch to render the line impassable, and it became obvious at the time the railway line was constructed that on every windy day it would be necessary to carry on a vigorous warfare with the invading sand-seas. The method at first adopted was to station at various points gangs of men provided with shovels and horse-drawn ploughs, but the wind-driven sand was hardly removed from the railway before it returned again, sometimes in greater quantity than before; and it became obvious that more drastic methods would have to be adopted to overcome the difficulty.

The snow-plough gets snowed-up! The relief gang is seen digging out the helpless locomotives of the plough that caused the upheaval shown in the previous illustration.

A scientific study of the movement of the sand and of means of controlling it was then undertaken by the railway engineers and this resulted in the adoption of various forms of "sand-panels." These are extensive wooden screens, sometimes as high as 20 ft., and erected in a vertical position a few feet to windward of the rail track. An opening about 4 ft. in width occurs at the base of the screen and through this aperture the sand-bearing wind is deflected by the screen. On reaching the lee-side of the sand-panel the wind quickly decreases in velocity, with the result that the particles of sand fall to the ground, forming a dune on the opposite side of the track. This dune is then removed before it can attain such dimensions as to encroach on to the railway line.

A more recent method of combating sand-seas is that of spraying the sand with crude petroleum, the purpose of which is to render the fine particles of sand less mobile, by covering them with a thin coating of oil. Where this method is adopted a special train known as the "sand-oiling train" is utilised. The body of this train consists of several tank cars each containing crude petroleum, with a special van containing a heating plant through which the crude petroleum is passed on its way from the storage cars to the spraying hose. The object of the heating is to render the oil more fluid.

The oil is pumped under pressure through the hose and is ejected through the nozzle in the form of fine spray. In this manner an even film of from one-eighth to one-quarter of an inch in thickness is sprayed over the sand, thus effectively preventing movement by the wind. In some places spraying has to be carried out every year, but elsewhere one treatment will last two or three years.

Micrometer and Its Story—(*Cont. from page 4*)

In his own workshops in Manchester Sir Joseph installed end measuring machines or micrometers built on principles somewhat similar to those of Maudslay, and in a speech delivered in 1856 he stated that his workmen found it easier to work to ten-thousandths of an inch from end measurements than to hundredths from a foot rule.

Admirable as were these machines, they still suffered from one important defect—they were not portable. They were constructed on lathe principles, with fast and loose headstocks; and work of all descriptions had to be carried to them. Some of them had been brought to a degree of refinement surpassing even that of the machines on which micrometer parts are made to-day, but in so far as they were fixtures they stood somewhat apart from the line on which the micrometer as we know it has developed. In order to realise this it is necessary to make another brief reference to the first micrometer of which there is any record.

Gascoigne's instrument of 1639, described as being "small, not exceeding in weight, nor much in bigness an ordinary pocket watch; and marking above 40,000 divisions in a foot," is in some respects a closer approximation to the measuring tool of to-day than those just mentioned. James Watt's end measuring instrument may be said to have heralded the entry of the portable micrometer into the workshop. Thus, with the Vernier scale still unrelated to the end measuring tool, matters stood until the middle of the 19th century.

Two forces were already at work independently in the production of the micrometer caliper before Sir Joseph Whitworth exhibited his "Millionth" measuring machine in 1851. In 1848 there had been patented in France a micrometer caliper known as the "Systeme Palmer"; while in 1850 an American instrument maker, Mr. J. R. Brown, invented a caliper made on the vernier principle, this being described at the time as the first practical tool for accurate measurement adapted for use by the ordinary machinist.

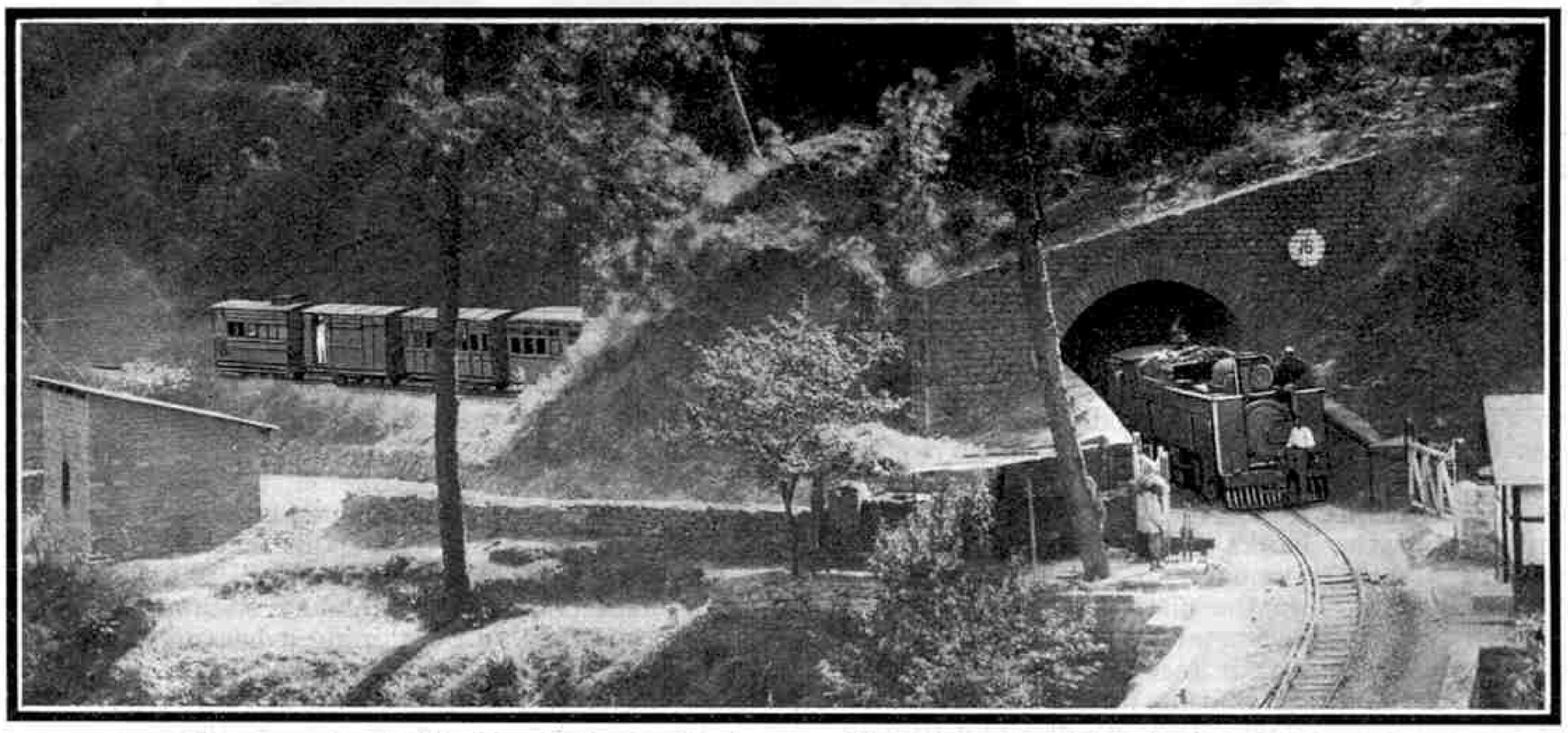
In 1855 Brown was joined in business by Mr. Lucian Sharpe, and in 1867 the two partners, while on a visit to Europe, saw the "Systeme Palmer" caliper at the Paris Exhibition. Impressed by its possibilities, they adopted with improvements the principle of the French tool in their pocket sheet metal gauge. Ten years later they brought out a micrometer caliper in which the screw was still exposed as in the "Systeme Palmer." After absorbing the micrometer business of the Victoria Machine Company, however, they placed on the market in 1885 an improved measuring appliance in which the movable spindle was controlled by a hidden screw.

An Interesting Indian Hill Railway

Some Features of the Kalka-Simla Line

By S. Trickey

THE development of Indian railways presents a remarkable story of great achievement in the face of many difficulties, engineering and otherwise. The first railway in India was the Great Indian Peninsula line from Bombay to Thana, a distance of about 21 miles. This was opened on 18th April, 1853, and the day was made a public holiday. An enormous crowd of natives assembled to witness the opening ceremony; indeed the mass of people was so dense that it was only with the utmost difficulty that the line was cleared sufficiently to allow the first train to pass. This was accomplished successfully, however, and the train, hauled by three locomotives and carrying some 500 passengers, made the inaugural trip amidst prolonged shouts of enthusiasm. It was thought at first that the intense conservatism of the Indian people would cause them to view with suspicion the new mode of travel, but this was not the case. They crowded the two trains that ran in each direction every day, and an improvement in the service had to be made immediately.



Scene on the Kalka-Simla line just before reaching Sonwara, 16 miles from Kalka.

To-day the total route mileage of Indian railways is about 40,950. Of this total 16,269 miles are State line worked by the State; 13,303 miles are State line worked by companies, and the remainder are operated under a complicated variety of arrangements. The Bombay-Thana line was built to a gauge of 5 ft. 6 in. and this is now the standard gauge for the most important Indian railways, having a total route mileage of about 20,070. There are, however, various smaller gauges in extensive use, including about 16,880 miles of 3 ft. $3\frac{3}{8}$ in. gauge, and about 4,000 miles of 2 ft. 6 in. and 2 ft.

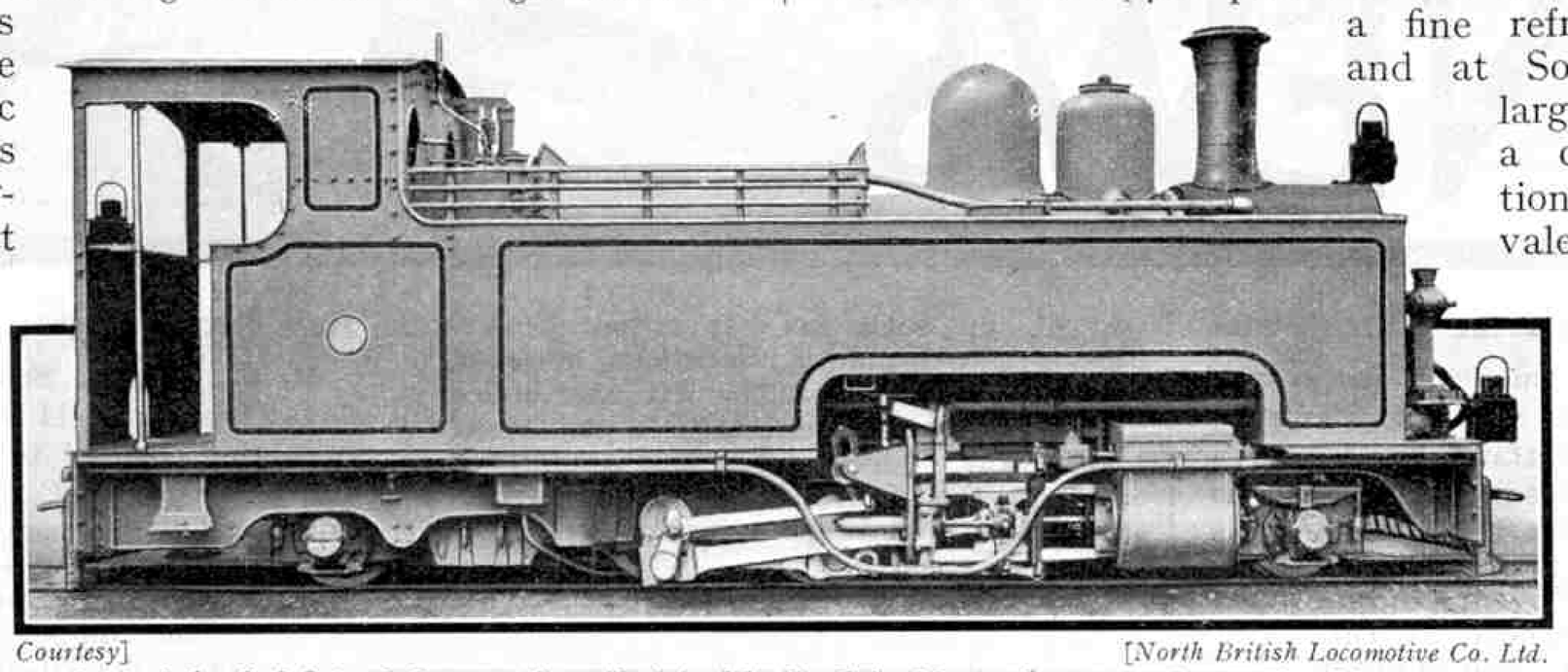
A good deal has been written about the main lines in India, while the smaller lines have been comparatively neglected. Many of these small lines are of considerable engineering interest, however, and have features peculiar to themselves. In this article we propose to give a brief description of one of them, the Kalka-Simla railway.

This line, which has a gauge of 2 ft. 6 in. connects Simla, the summer headquarters of the Government of India, situated on the Himalayas, with the terminus of the 5 ft. 6 in. gauge line at Kalka at the foot of the mountains. It gives access also to a number of other hill stations, the most important being Kasauli, Dharampore, Subathu, Dagshai, Solon and Chail, which lie in the vicinity or along the alignment of the railway. The line was constructed by the Delhi-Umballa-Kalka Railway Company. The company's interest in the railway was purchased by the Government of India and the line was made over to the North Western Railway, a Government-owned line, to work from 1st January, 1907.

The Kalka-Simla line is about 60 miles in length and is laid with 62-lb. rails. The ruling gradient is about 1 in 33, and there is an abundance of reverse or S-shaped curves, most of which are of about 120-ft. radius. In the course of its journey the line climbs from Kalka, which is about 2,143 ft. above sea level, to Simla railway station, 6,808 ft., and it passes through more than 100 tunnels. Most of these tunnels are very short, but there are three, at Koti, Barogh and Summer Hill, of considerable length, the one at Barogh, which extends for nearly a mile, being the second longest in India. The longer tunnels are not popular with travellers. It is necessary to close the shutters of the passenger coaches in order to prevent smoke from entering in disagreeable quantities, and each time the train enters a tunnel the driver has to switch on the electric lights throughout the train. The picturesque and varied nature of the scenery more than compensates for such small inconveniences, however, and makes the journey one of great interest in spite of its necessarily low speed, which does not exceed about 10 miles per hour.

The trains are hauled by tank locomotives of the 2–6–2 type built in Glasgow by the North British Locomotive Co. Ltd. These locomotives have two cylinders 14 in. in diameter by 16 in. stroke. The coupled wheels are 2 ft. 6 in. in diameter and the bogie

wheels 1 ft. 9 in. ; while the total wheelbase is 17 ft. 6 in. The working pressure is 180 lb. per sq. in. and the tractive force at 75 per cent. boiler pressure is 14,112 lb. The tank capacity is 715 gallons, and the fuel capacity 25 cwt. ; and the total weight of the locomotive in working order is 34 tons 19 cwt. 2 qrs. These sturdy little tanks handle comfortably over the steep gradients passenger trains consisting of five or six bogie coaches, and goods trains of three bogie wagons. The traffic on the line has grown considerably in recent years, and in order to cope with it two articulated locomotives of the 2–6–2 + 2–6–2 type have been introduced.



Courtesy *[North British Locomotive Co. Ltd.*

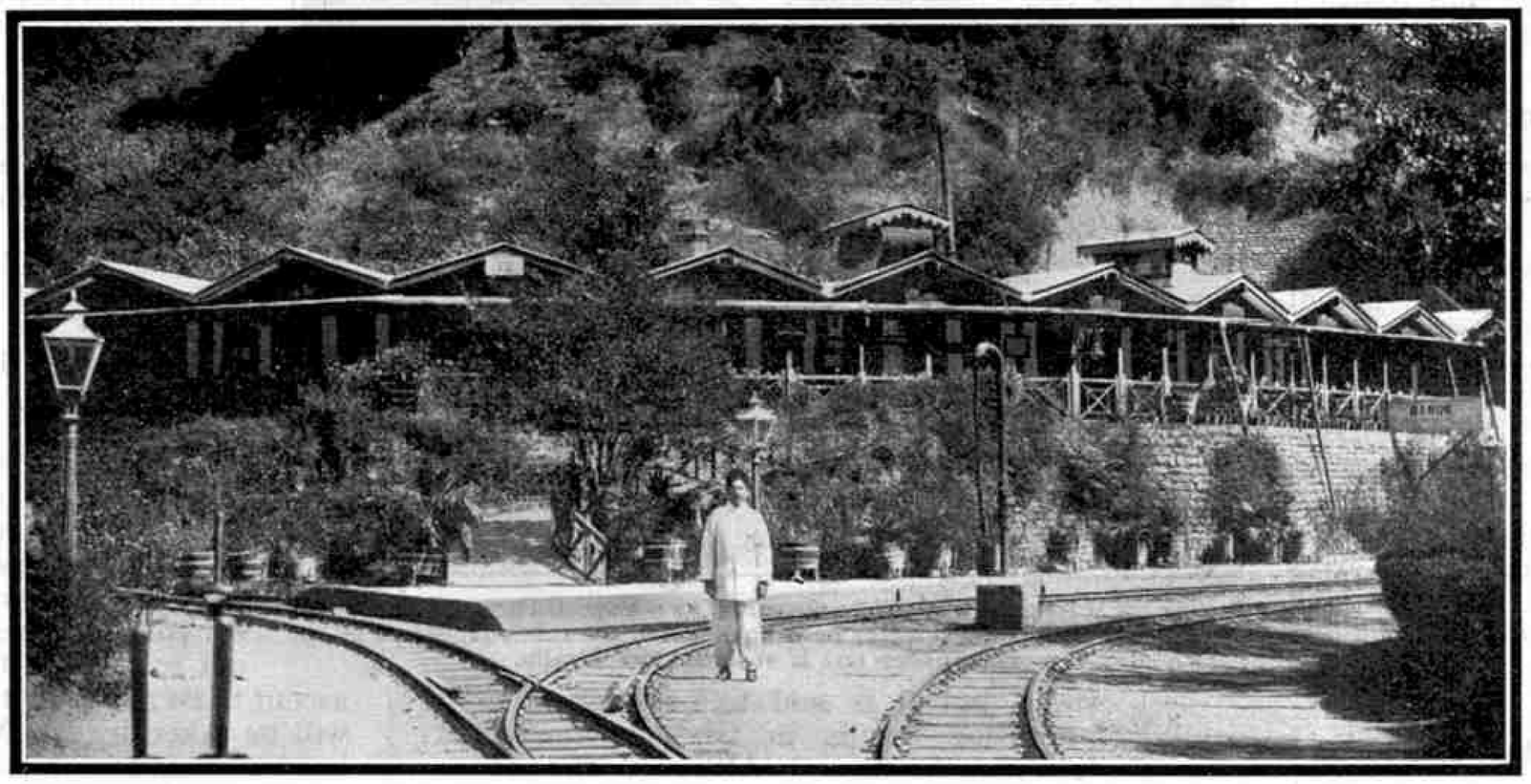
One of the 2-6-2 tank locomotives that tackle the 1 in 33 gradients on the Kalka-Simla line.

There is a good road connecting Kalka with Simla, and there has sprung up a considerable passenger traffic by motor vehicles. With the object of meeting effectively this road competition the railway have introduced rail motor coaches, which carry passengers and mails from Kalka to Simla quicker than can be done by the road vehicles. The latest of these rail coaches are of 85 h.p. and are capable of travelling at a speed of 20 miles per hour up the 1 in 33 gradients of the line. The steam-hauled mail trains take 6 hrs. 6 min. for the up journey, including a stop of 25 min. at Barogh for refreshments ; the petrol-driven rail coaches take only 3 hrs. 50 min. for the up journey.

The traffic on the railway is largely a seasonal one. The season begins in April, when the Government Offices and private firms transfer their staffs from the winter headquarters at Delhi and elsewhere to spend the summer in the cooler climate of Simla ; and it ends with the general return to the plains during October. The railway does not close down, however, but runs a restricted service throughout the winter months to supply the transport requirements of the permanent population of the district.

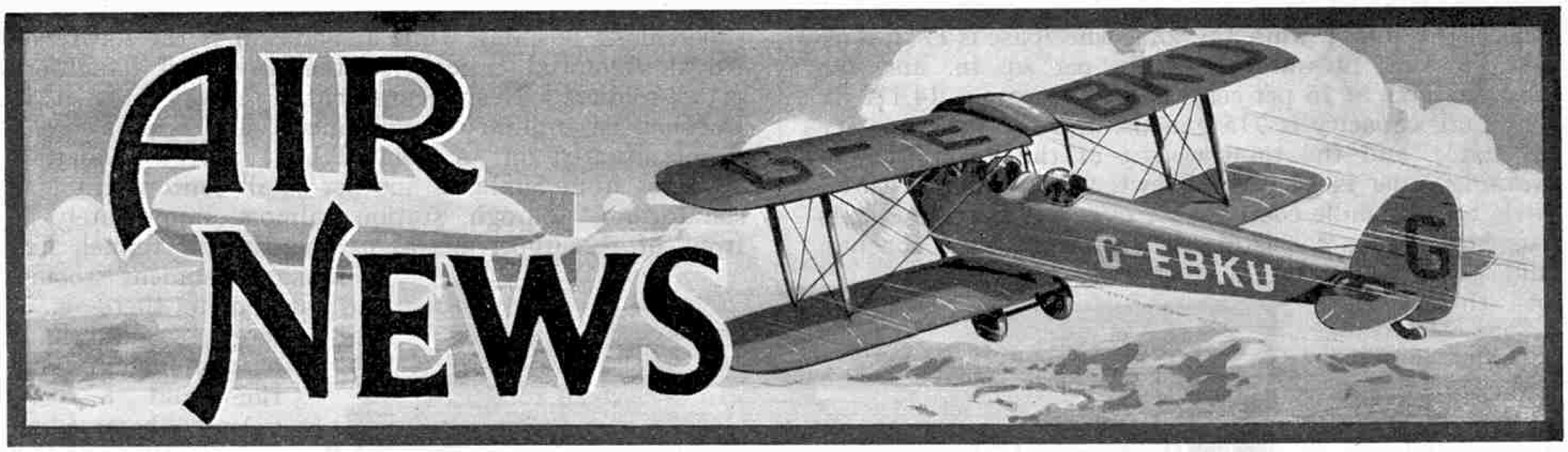
It may be of interest to mention very briefly the various hill stations served by the Kalka-Simla railway in the order in which they are reached from Kalka. First is Kasauli, a military cantonment and convalescent depot with a Pasteur Institute for the prevention and treatment of rabies. Dharampore has a fine tuberculosis hospital, while at Sanawar is the Lawrence Royal Memorial School for the sons and daughters of ex-soldiers. Near Kumarhatti railway station is Dagshai, a military cantonment and convalescent depot situated on an isolated hill ; and at Sabathu, 23 miles from Simla, is another small cantonment and sanatorium. Barogh station, almost immediately in front of the upper portal of the Barogh tunnel, has a fine refreshment room ; and at Solon there is a large sanatorium, a cantonment station and a convalescent home. Chail is the summer headquarters of the Maharajah of Patiala, to whom this hill station belongs; and Taradevi is situated on a narrow saddle between adjacent ranges and commands a magnificent view of Simla. Jutogh is a military cantonment, and the lofty aerials of the Marconi station there form a prominent landmark. Summer Hill is a suburb of Simla and has a number of residences for members of the staffs of the Government Offices in Simla.

Finally we come to Simla itself, the city of the Viceroy and the headquarters of the Government of India and the Government of the Punjab during the summer. It is also the summer headquarters of the Army. The normal population is about 15,000, increasing to fully double this number in summer. There are many notable buildings, such as the Viceregal Lodge, and two theatres. A popular feature is the great football tournament held every year during September.



Barogh Station, in front of the upper portal of the Barogh Tunnel, the second longest tunnel in India.

It is interesting to recall that Robert Stephenson was the consulting engineer of the Great Indian Peninsula Railway which, as stated at the beginning of this article, was the first railway in India. Stephenson was appointed in 1849, in which year the Act authorising the incorporation of the company was passed ; and he continued to advise the company up to his death in 1859. Another interesting point is that the first section of the line lay across the Bombay swamps, and that this obstacle was overcome by similar methods to those employed by George Stephenson in taking the Liverpool and Manchester Railway across Chat Moss. Alternate layers of interwoven mangrove trees and earth were sunk into the swamp until a solid foundation was secured.



Speedy Flights Across the United States

Mr. Doolittle, an American airman who in 1925 won the Schneider Trophy, recently flew from Ottawa to Mexico, a distance of 2,500 miles in 12¾ hours. His actual flying time was 11¾ hours and his average speed more than 215 m.p.h. Mr. Doolittle stopped at Washington for lunch and afterwards descended at Birmingham, Alabama, and Corpus Christi, Texas, in order to refuel. It is interesting to note that by road or rail the journey from Ottawa to Mexico would have taken more than a week!

The flight was made in a Laird "Super-Solution" racing biplane equipped with a supercharged Pratt & Whitney "Wasp Junior" engine. In September, 1931, Mr. Doolittle flew from Los Angeles to Cleveland, a distance of 2,000 miles, at an average speed of 223 m.p.h. in the same machine. After refuelling at Cleveland the airman continued his flight eastward to Newark, New Jersey. He completed the journey from the Pacific Coast to the shores of the Atlantic Ocean at an average speed of 219.8 m.p.h., and reduced the previous record by a little more than an hour.

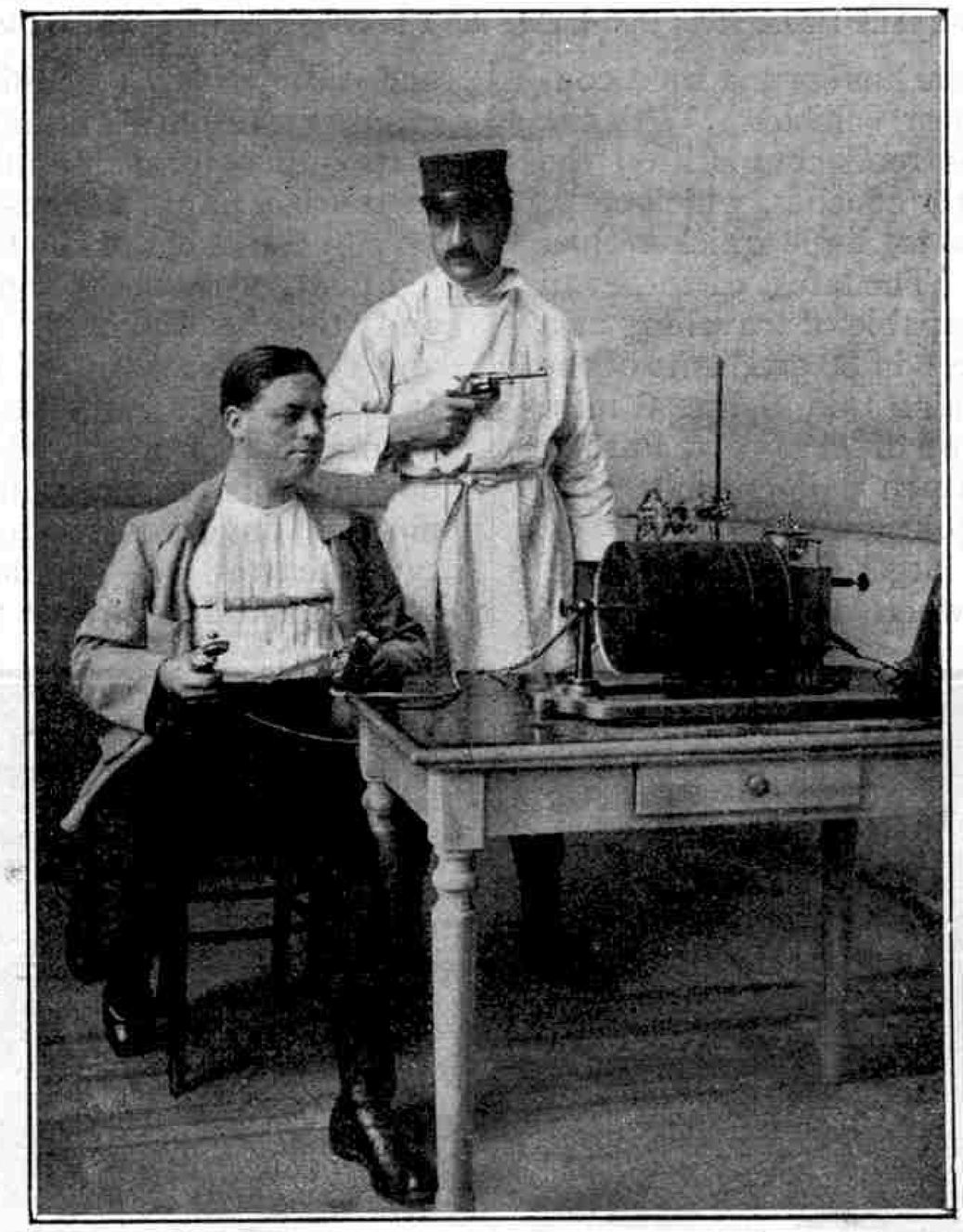
Success of British Engines in Poland

British engines were fitted to a very large proportion of the 24 entries in the recently completed "Round Poland" Challenge Flight, 80 per cent. of the actual number employed being made in this country. They included 17 Cirrus "Mark III" engines, five Cirrus "Hermes," three D.H. "Gipsies" and three Armstrong Siddeley "Genets." First, second, fourth and fifth places were secured by aircraft employing Cirrus "Hermes" engines, the first and second machines home being an R.W.D. 5 and an R.W.D.4 respectively.

The Oehmichen Helicostat

On page 886 of our issue for November, 1931, we described the Oehmichen Helicostat, which may be regarded as a novel combination of a non-rigid airship and a helicopter. A remarkable feature of this machine is that the balloon may be separated from the chassis in a few minutes. It also may be emptied quickly, and the gas stored in an underground tank. Refitting the machine for service involves very little delay, for it may be ready in 10 minutes if the balloon has been detached, and only 55 minutes are required when it is necessary to fill up with gas. It is not always essential to dismantle the balloon, however, for the machine may be left unattended if a wind of not more than 15 ft. per second is blowing. Even when the wind speed exceeds this figure, light anchors driven into the ground are sufficient to ensure its safety.

The helicostat is still in the experimental stage, but it is said to have given very promising results in trials conducted a few months ago. Although the motor fitted to it develops only 40 h.p., the machine has already attained a speed of 50 m.p.h. and it is claimed that it can be kept hovering over a fixed point at any altitude. An airman recently held an experimental machine of this type stationary for 30 minutes at a height of 1,000 ft., thus establishing a record. Further developments of this interesting combination of the balloon and the helicopter will be awaited with interest and it will be particularly valuable to compare its progress with that of pure helicopters.



Testing the reaction of a would-be airman to an unexpected noise. The French medical officer fires the revolver he is holding and the shock registered by the man under test is recorded graphically.

More Record Flights in Light Aeroplanes

Mr. C. W. A. Scott's record of nine days, four hrs., 11 mins. for the flight from this country to Australia has been surpassed by Mr. C. H. Butler, who in a Comper "Swift" single-seater light aeroplane completed the journey in nine days, two hrs., 29 mins.

The Comper "Swift," which has been described as the world's smallest aircraft, was illustrated on page 274 of the *"M.M."* for April, 1930. The machine employed by Mr. Butler was standard except for the fitting of tanks to increase the fuel capacity by 42 gallons. The only delays experienced on the journey were due to rainstorms accompanied by high winds, and the ability of the Comper "Swift" to complete the journey in record time is a proof of its excellence and reliability.

Another flight for which new figures have been set up is that to Capetown. Miss Peggy Salaman, accompanied by Mr. Gordon Store as second pilot and navigator, completed the journey of 7,050 miles in five days, six hrs., 40 mins., thus reducing Commander Glen Kidston's record established in April of last year by about 28 hrs. Their performance is highly creditable, for they employed a standard D.H. "Puss Moth," the maximum speed of which is 127 m.p.h., while Commander Glen Kidston's flight was made in a high-powered machine cruising at 140 m.p.h. and capable of a speed of 180 m.p.h.

Exploring the Upper Atmosphere

Professor Piccard, the Belgian scientist who last year attained an altitude of nearly ten miles in a specially-designed balloon, is to continue his work on the stratosphere, or upper atmosphere, but is not to take part himself in a further ascent to be made next summer. His place will be taken by Mr. Max Costyns, a well-known Belgian engineer, who will work under the Professor's direction.

It is interesting to learn that a British effort to explore the upper atmosphere also is to be made. This will be carried out by Messrs. Oswald and Eustace Short, the pioneer manufacturers of aircraft who founded the well-known firm of Short Bros. (Rochester & Bedford) Ltd. They gained considerable experience of ballooning during the early days of aviation and are designing a special balloon for work at great altitudes in which it is hoped to attain a height of 15,000 ft.

Cierva "Autogiros" for Private Owners

Two new types of "Autogiro" recently have been designed and constructed, and for the first time this interesting aeroplane has been placed on the market for sale. The new machines are of the open and the cabin types, and are known as the C.19 Mark IV and the C.24 respectively. They incorporate a new three-bladed cantilever rotor system that entirely eliminates the need for the use of interbracing and suspension cables. A mechanical rotor starter is provided and the rotor blades may be folded in order to enable the machine to be housed in a small space.

The C.19 type machine is equipped with the Armstrong Siddeley "Genet Major" engine, developing 100 h.p. It has a maximum speed of 105 m.p.h. when fully loaded and a minimum horizontal speed of 25 m.p.h. when maintaining level flight. The cruising speed is 90 m.p.h., while the initial rate of climb is 630 ft. per min., and the service ceiling 11,000 ft. When the machine is descending at an angle of 40° to the horizontal, the rate at which it approaches the earth is 13 ft. per second. Under average conditions, and at sea level, the Mark IV "Autogiro" requires a run of only 30 yards in order to take off, and has a range of 250 miles at normal cruising speed.

The "Autogiro" C.24 two-seater cabin machine was designed by the Cierva Autogiro Co. Ltd. and is constructed by the De Havilland Aircraft Co. Ltd. It is fitted with a D.H. "Gipsy" Mark III inverted engine, and its performance is better than that of the C.19 Mark IV, its maximum speed being 120 m.p.h. and its cruising speed 100 m.p.h. The take-off run is only one quarter of that required by an ordinary aeroplane of approximately similar performance.

New High Speed Trophy

M. Louis Blériot has founded a prize in the form of a trophy that is to be awarded to the first person who maintains a speed of 370 m.p.h. for a period of at least 30 minutes. The trophy will be retained by each holder until his speed has been beaten by a margin of at least five per cent., and will become the property of the man who first attains a speed of 620 m.p.h.

M. Blériot is a famous pioneer of aviation. He was the first pilot to succeed in crossing the English Channel, a feat that he accomplished on 9th July, 1909, in a 25 h.p. Blériot monoplane. Later he became a successful designer and manufacturer of aeroplanes. He does not stipulate that the records must be made in an aeroplane, but it is clear that only aircraft could hope to maintain such high speeds for long periods.

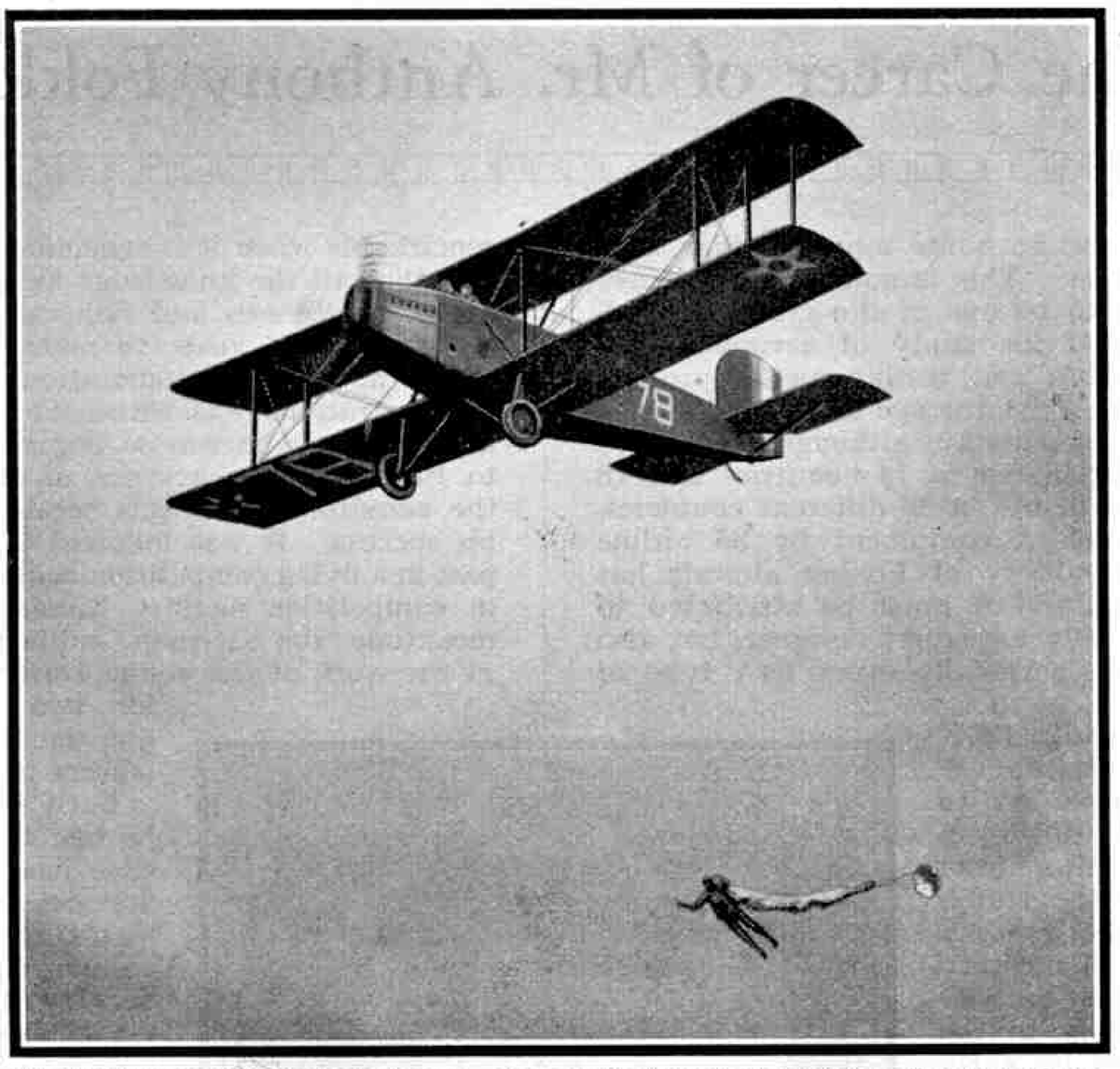
New Work for the "*Spider*"

Captain C. D. Barnard's Fokker monoplane, the "*Spider*," which was used last summer for joy-riding in all parts of the country, is now to be employed for conducted tours in the East. Eight passengers, each with a limited amount of luggage, will be carried on each trip.

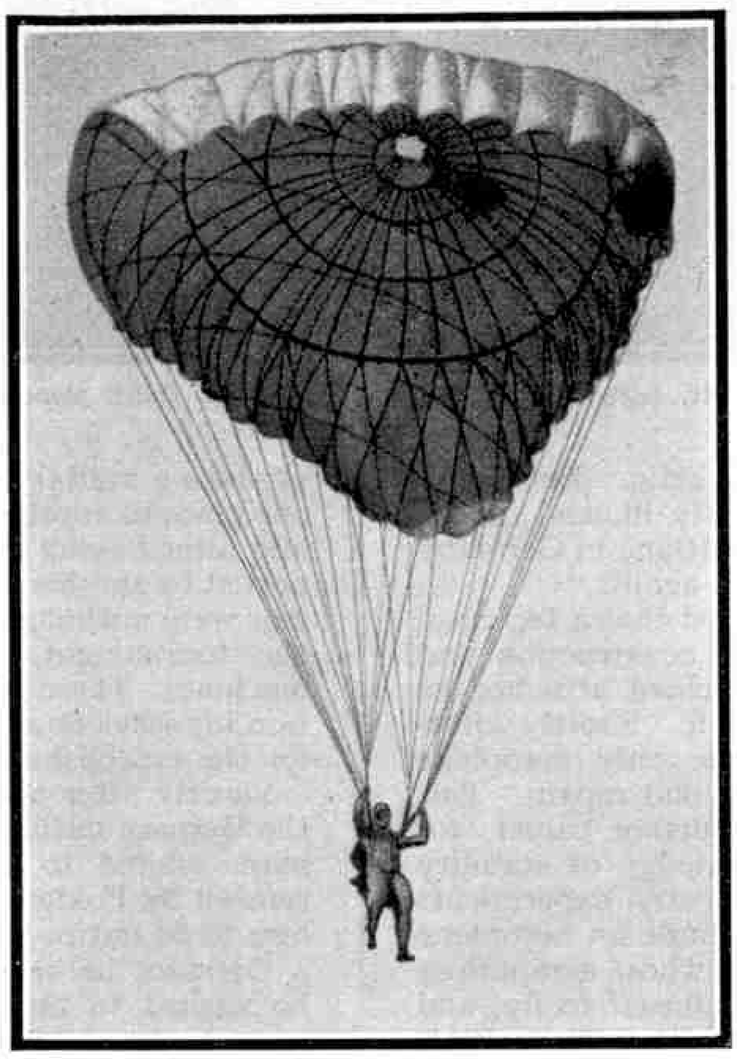
The Air Mail Route to South America

Early in November, 1930, four new despatch boats were put into commission on the ocean section of the Compagnie Generale Aeropostale's mail route between Toulouse and Buenos Aires. The vessels ply between Dakar, on the west coast of Africa, and Natal, Brazil. Their average speed is 16 knots.

Letters carried between Toulouse and Buenos Aires by this route travel 5,850 miles by aeroplane and 2,050 miles by despatch boat. The time taken on the outward journey is eight days and on the return journey nine days, and the use of this service makes possible a saving of 13 days.



The beginning of a parachute descent. The small pilot parachute that pulls out the large canopy is clearly seen. This illustration, and the one below, are reproduced from official photographs of the United States Army Air Corps.



The parachute well open. The jumper can alter his direction by pulling on the shroud lines.

Atlantic Flight Planned

Two Irish airmen are contemplating a double flight across the Atlantic in the Spring of 1932. They are Col. J. C. Fitzmaurice, who crossed the Atlantic in 1928 in the "*Bremen*," and Captain J. P. Saul, navigator of Commodore Kingsford-Smith's machine, the "*Southern Cross*," during the transatlantic flight made in 1930 by the Australian pilot. The airmen intend to use a Sikorsky S.38 amphibian similar to the machine illustrated and described on page 884 of our November 1931 issue. The aeroplane will be equipped with two Pratt and Whitney "Wasp" engines, and will carry about 880 imperial gallons of petrol, a quantity that should be sufficient to enable it to remain in the air for 26 hours. A pay load of about 500 lb. of mail will be carried.

It is anticipated that the flight will commence from Roosevelt Field, New York. A halt will be made at Harbour Grace, Newfoundland, for refuelling, and the undercarriage will be dropped when beginning the flight across the Atlantic Ocean. The European destination of the two airmen will be Dublin, where it is hoped that it will be possible for the machine to be safely put down in the Bay. On arrival a new undercarriage will be fitted to the machine to enable a tour to be made of the capitals of Europe before returning to America. The westward flight will be made across the South Atlantic to Pernambuco, Brazil, after which the two men will fly up the west coast of America to San Francisco.

Maiden Flight of Giant American Airship

Late in September the United States airship "*Akron*" made her maiden flight at Akron, Ohio. The vessel is the first of two dirigibles to be built by the Goodyear-Zeppelin Corporation, and their construction was explained in an illustrated article on page 600 of the "*M.M.*" for August, 1930. On her trial flight she carried about 112 persons, and the flight lasted for nearly two hours, during which time a distance of about 125 miles was covered. Night had set in before the vessel returned, but the landing was successfully carried out with the aid of floodlights. The landing party consisted of about 250 people.

As a result of her successful trial flight, the "*Akron*" was formally accepted on 20th October by the U.S. Navy Department and the order for the construction of the second of the two vessels was then given.

Croydon—Capetown Air Service

The air service between London and Capetown is to be opened on the 20th of this month and the mails carried on the first journey are expected to reach Capetown eleven days later. The northward service will commence on 25th January, the scheduled date for its arrival at Croydon being 5th February.

At present the African air service extends only as far as Mwanza, on the southern shores of Lake Victoria.

A Famous Dutch Aviation Pioneer

The Career of Mr. Anthony Fokker

IN the world of aviation there is no name more familiar than that of Anthony H. G. Fokker. This famous Dutch pioneer is universally acknowledged to be one of the greatest of all designers of aircraft. He started his study of aeroplanes by constructing small celluloid models and testing and improving them until they flew to his liking. At the age of 20 he designed and constructed an aeroplane, and to-day, although he is only 41, his machines are built under license in 14 countries and 18 factories. Fokker machines are in use in 30 different countries, and they are employed as standard equipment by 35 airline companies. The growth in popularity of Fokker aircraft has been little short of phenomenal, and it must be attributed to the fact that Mr. Fokker is not only an expert designer, but also a very efficient pilot. He tests personally every new type of machine that is produced.

Fokker was born on 6th April, 1890, at Kediri in the Dutch East Indies. A few years later his parents returned to Holland, where they settled down in Haarlem, a town about 14 miles from Amsterdam, and the centre of the Dutch bulb-growing industry. Fokker's early education was received at an elementary school, but later he entered a higher burgher school, which corresponds roughly to the English secondary school. From his early boyhood he was greatly attracted by practical mechanics and anything connected with engineering, and he was always busily employed with the construction of some new appliance in the little workshop that he had fitted up in the attic of his father's house.

For some time Fokker had a steam railway and a story is told that when his experiments were stopped by his father because of the amount of gas he was using to raise steam, he "tapped" the neighbour's gas pipe, and thus secured a free supply!

When Wilbur Wright surprised everybody by his excellent flights in Europe in 1908 and 1909, and aviation claimed the attention of the whole world, Fokker became interested in the new sport, and constructed several small celluloid gliders by the aid of which he studied the problems of flight. He was not satisfied with testing models, however, and as his father refused to buy him an aeroplane, he commenced to build a glider in his attic. Before the machine could be completed he became seriously ill, and on his recovery his father sent him on a trip along the Rhine in Germany in order that he might become strong and well again.

Mr. Anthony H. G. Fokker, the famous Dutch pioneer in aircraft design.

While Fokker was on this holiday he discovered that a technical college for the study of motor and aeroplane construction had been opened at Mainz. There was a flying school attached to the college, and he immediately became a pupil. Shortly afterwards the school disbanded, however, as the only aeroplane that it possessed was crashed and damaged beyond repair. This accident had a great influence on Fokker's further career, for it decided him to put into practice the knowledge of stability in aeroplanes that he had gained from his early experiments with models. In the winter of 1910-1911 he built an aeroplane of his own design, with the aid of two workmen whose sympathies he had enlisted. On this machine he taught himself to fly, and he took his International Pilot's Certificate on 24th May, 1911.

After carrying out numerous flights on this machine, Fokker decided that it ought to be made safer; and after experimenting with various improvements and modifications he finally placed the wings in a pronounced V-shaped position with a comparatively high centre of gravity. This gave the aeroplane a high degree of lateral stability in spite of the fact that it was not fitted with ailerons, and in consequence the machine attracted a great deal of attention throughout Europe. This success is all the more remarkable when it is remembered that Fokker was still only 21, and that all the knowledge he possessed had been obtained from his own successes and failures.

Fokker paid visits to many of the larger towns in Holland, where he gave demonstrations of his machine. One of these demonstrations was witnessed by the manager of an aerodrome near Berlin, who was so impressed by it that he invited Fokker to Berlin to give a series of exhibition flights. Fokker visited the aerodrome, and this occasion marked the real beginning of his success. It was followed up in August, 1912, when he took part in a flying competition held in Russia, and had many successes in competition against Russian and French aircraft. In the meantime the German military authorities became interested in the work of the young Dutchman, and gave him a trial order for two aeroplanes, in addition to requesting him to teach a number of army officers to fly.

Early in 1913, encouraged by the success he had achieved, Fokker decided that the time had come to set up a factory. The first essential for success in this enterprise was Government support in the form of orders. On 13th May he made a cross-country flight from Berlin to the Hague via Soesterburg, on which occasion his associate Bernard de Waal acted as pilot. The flight was a great achievement for those times, and the aeroplane was confidently offered to the Dutch authorities. The Dutch Government highly commended Fokker's work and his flight, and said they were very proud of him; but no help in the form of orders was forthcoming! The machine was next offered to the British Government, but the army authorities turned it down; while in France the aeroplane market at that time was overcrowded.

It is interesting to note in passing that a few years later there was a great deal of trouble in England for those who had not accepted Fokker's overtures! When it was too late, enormous sums were offered him as an inducement to come to this country.

A tournament held in Germany in the summer of 1913 solved Fokker's problems, and proved to be the turning point of his career. This tournament was organised to produce a military aeroplane that could be transported easily from one place to another by motor lorry; could be quickly reassembled, and after having made a flight could be taken to pieces and transported to another town. Cross-country flights as regular undertakings were unthought of in those days. Fokker won the first prize in the tournament, and accordingly was given an order for 10 machines. These proved so successful that Germany, in order to retain his services as a constructor, offered him a three-year contract for the establishment of a factory and flying school at Schwerin.

Shortly after the opening of this factory war was declared, and the German authorities, afraid of losing this important and useful man, offered to allow him to be naturalised. This offer was refused by Fokker, and when the authorities threatened to compel him to be naturalised, and to close his works if he did not become a German, he replied that he intended to leave the country as he wished to remain a Dutchman. He was then forbidden to leave Germany for the duration of the War, and when he would not agree to this he was forced against his will to become a German.

The first order received by the Fokker Works after the outbreak of war was for 24 aeroplanes. These were modified and improved until the Fokker scout machines became famous for their manœuvrability and their superiority over the aircraft used by the British Royal Flying Corps. The Fokker monoplane produced in the autumn of 1915 was really the first effective fighter machine to be used in the War. It was a small single-seater, and it carried

A three-quarter front view of a Fokker F.VII 3-m monoplane. This machine is similar to the famous "Southern Cross" in which Air Commodore Kingsford-Smith has made so many record flights. For permission to reproduce the photographs accompanying this article we are indebted to the courtesy of N.V. Nederlandsche Vliegtuigenfabriek.

a fixed machine gun arranged to fire through the airscrew.

During the War two other large German aeroplane factories were erected, one in Budapest and the other in Reidichendorf; and a great tribute was paid to the Fokker D7 scout machine by the German army authorities, who issued an order that all aeroplane builders were to construct only this type of aircraft. Altogether more than 8,000 of these machines were built, and their qualities were so excellent that after the Armistice the Allies claimed the extradition of all those that remained.

The Fokker scout machine won for itself such a wide reputation that it is often thought that it was the only aeroplane constructed by Fokker during the War; but this is not the case. The Fokker Company constructed also several reconnaissance machines, in addition to two or three types of flying boats, a few types of float seaplanes, and a huge multiple-engined aeroplane with two fuselages. Fokker produced also several triplanes, and the "circus" led by the famous German "Ace," Baron von Richthofen, employed Fokker machines extensively. The British Parliament was the scene of many vehement debates when it became known that the Dutchman who had become the terror of the air had offered his services to England, but that these had been declined, with the result that he went over to Germany.

Fokker was in many ways greatly ahead of other aircraft designers, and it is generally admitted that he was the first to employ steel tube framework for wing and tail surfaces. Those who read the article on the Fokker "Safety 'Plane" published in the "*M.M.*" for May last will remember that this method of construction was made use of even in 1911 when this machine was built. At that time Fokker made all joints by nuts and bolts; but afterwards he introduced the method of welding the tubes, particularly for the construction of the fuselage, landing gear and auxiliary planes. It is interesting to note that this method of construction has remained characteristic of all Fokker aircraft, and is now being adopted more and more by other manufacturers.

Another typical feature of Fokker design is the thick section wing built on the cantilever principle. This is a valuable feature, both from the aerodynamic and the constructional point of view; for a thick section cantilever wing can withstand great strains, while at the same time it is comparatively light. When Fokker first thought of this idea he fully accepted the consequences of taking the revolutionary step of building his machines with cantilever wings attached to the fuselage merely by means of four bolts.

At the end of the War Fokker realised that conditions in Germany would not give him much scope, and consequently he decided to close his factories there and to return to Holland, where he established his present firm, known as N.V. Nederlandsche Vliegtuigenfabriek. The first Fokker machine to be used by airline companies was the F.11.

The Dutch firm rapidly proceeded to introduce new types of aircraft, and in 1921 a branch of the parent company was opened in the United States. Three years later this branch assumed the form of an independent company, and now, after various affiliations, is running several factories.

Many splendid flights have been carried out on Fokker machines, among which the most famous are those of Captain Einar Lundborg and Air Commodore Kingsford-Smith. It was Captain Lundborg who rescued General Nobile and the marooned crew of the airship "*Italia*" from the Arctic. Air Commodore Kingsford-Smith's most famous flight was the east-to-west crossing of the North Atlantic in his Fokker monoplane the "*Southern Cross*," in which he has since completed a flight round the world. This latter flight was commenced on 13th May, 1928, at Oaklands Field, near San Francisco, and the machine was flown across the Pacific Ocean, a flight that had not previously been accomplished. The total distance covered on this section of the journey was 9,263 miles, the flying time being 83 hrs. 35 min. A flight was then made from Melbourne to Perth, the distance of 2,000 miles being covered non-stop in 23 hrs. 24 min. A return non-stop flight to Sydney was next made, and afterwards the machine was flown from Australia to New Zealand over the Tasman Sea, this being the first time that this stretch of water had been crossed by air.

After an unsuccessful attempt at a flight from Sydney to London, which nearly ended in disaster, the "*Southern Cross*" started out again and completed the journey in 12 days 23 hrs. The machine was then taken to the Fokker Works at Amsterdam, where it was overhauled in preparation for a trans-Atlantic flight. This flight was commenced from Portmarnock, near Dublin, on 24th June, 1930, and 31½ hrs. later a landing was made at Harbour Grace, Newfoundland. Later the "*Southern Cross*" was flown non-stop to New York, and thence across America to San Francisco in order to complete the world flight.

Although the performance and safety qualities of their machines are naturally the first consideration of the Fokker companies, great attention is paid also to the comfort of passengers. The success achieved in this direction may be judged from the fact that at the 1930 Paris Aero Show a Fokker exhibit was awarded the "*Grand Prix de Confort et d'Elégance*," by vote of the visitors.

Fokker flying his "Spider" monoplane at Haarlem in 1913.

Power for Your Model Aeroplanes!

The Meccano Aero Clockwork Motors

AEROPLANES in flight are elusive subjects for the model aeroplane enthusiast to study. Once they have left the ground, they either fly at a great height so that their salient features can only be distinguished with difficulty, or they flash past overhead at low altitude so that a great deal of neck twisting is necessary to see them!

Aeroplanes may be seen to advantage, however, when they are taxi-ing along the runway of the airport preparatory to "taking off" or when landing. The observer then gets a splendid "close up" view of the machine in action, and an excellent impression of its grace and power may be obtained.

To bring this action and realism to the model aeroplanes built with the Meccano Aeroplane Constructor Outfits Nos. 1 and 2, we have introduced two special clockwork power units known as the Meccano Aero Clockwork Motors Nos. 1 and 2.

The No. 1 Aero Clockwork Motor is designed to fit into the fuselage of the Meccano aeroplane models and to drive the Propeller at high speed. The No. 2 Aero Motor is of more ambitious design, and in addition to rotating the Propeller of the model to which it is fitted, it also drives the landing wheel axle, so that the complete model taxies about the floor or table under its own power in a most realistic manner.

It is quite a simple matter to incorporate either the No. 1 or No. 2 Motor in a model, but a definite order of assembly of the various units should be followed so as to avoid having to remove one part in order to fit another in place.

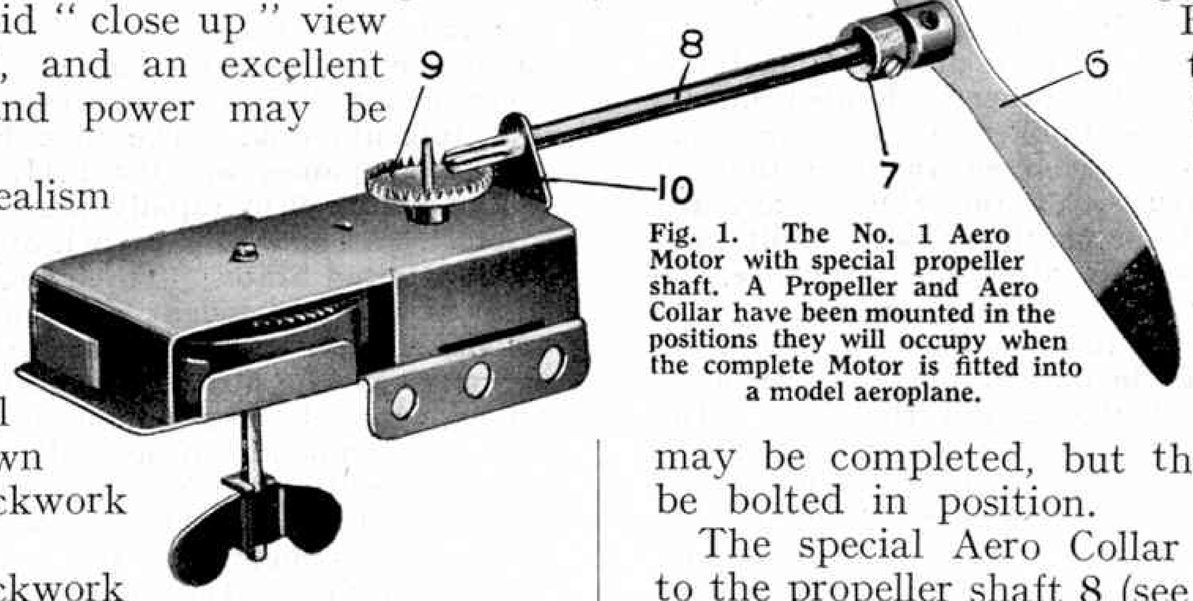


Fig. 1. The No. 1 Aero Motor with special propeller shaft. A Propeller and Aero Collar have been mounted in the positions they will occupy when the complete Motor is fitted into a model aeroplane.

The No. 1 Aero Motor

The No. 1 Aero Clockwork Motor, which is illustrated in Figure 1, is supplied complete with the special propeller shaft 8, and Propeller Control Rod. A Propeller 6 (Aeroplane Part No. P34) and a special Aero Collar 7 (Aeroplane Part No. P52) are shown attached to the propeller shaft 8 in the illustration. These are not supplied with the Motor, but they are of course contained in the Standard Meccano Aeroplane Outfits. The Propeller Control Rod is engaged with the Propeller when the Motor is being wound, and thereby prevents the propeller shaft from rotating. By a slight movement of the Control Rod, the Propeller may be released.

To commence building a model in which the No. 1 Motor is to be incorporated, the Propeller Control Rod 1 should first be fitted to the Fuselage Top Front 3 and Fuselage Front 4. This assembly is shown in Figure 4. The plain end of the Control Rod 5 is pushed through the slot in the Fuselage Top Front and continued through the small hole in the Fuselage Front 4. Actually in building the model, the Fuselage Sides Front should be secured to the Fuselage Top Front and Fuselage Front at the same time as these are bolted together, but they have been removed in the illustration in order to show the Control mechanism and propeller shaft 8 clearly.

After the Control Rod 1 has been secured in place, the fuselage of the model may be completed, but the undercarriage should not be bolted in position.

The special Aero Collar 7 should next be secured to the propeller shaft 8 (see Figs. 1 and 4). The Collar is mounted on the shaft so that the toothed end of the shaft 8 engages with the contrate 9 when the Collar 7 rests against the inside face of the Fuselage Front 4. The correct position for the Collar on the shaft can be obtained by pushing the shaft into place and holding the Motor in the position it will occupy when bolted in place. The shaft is then removed, and the Collar locked in the correct position on the shaft by means of its grub-screw.

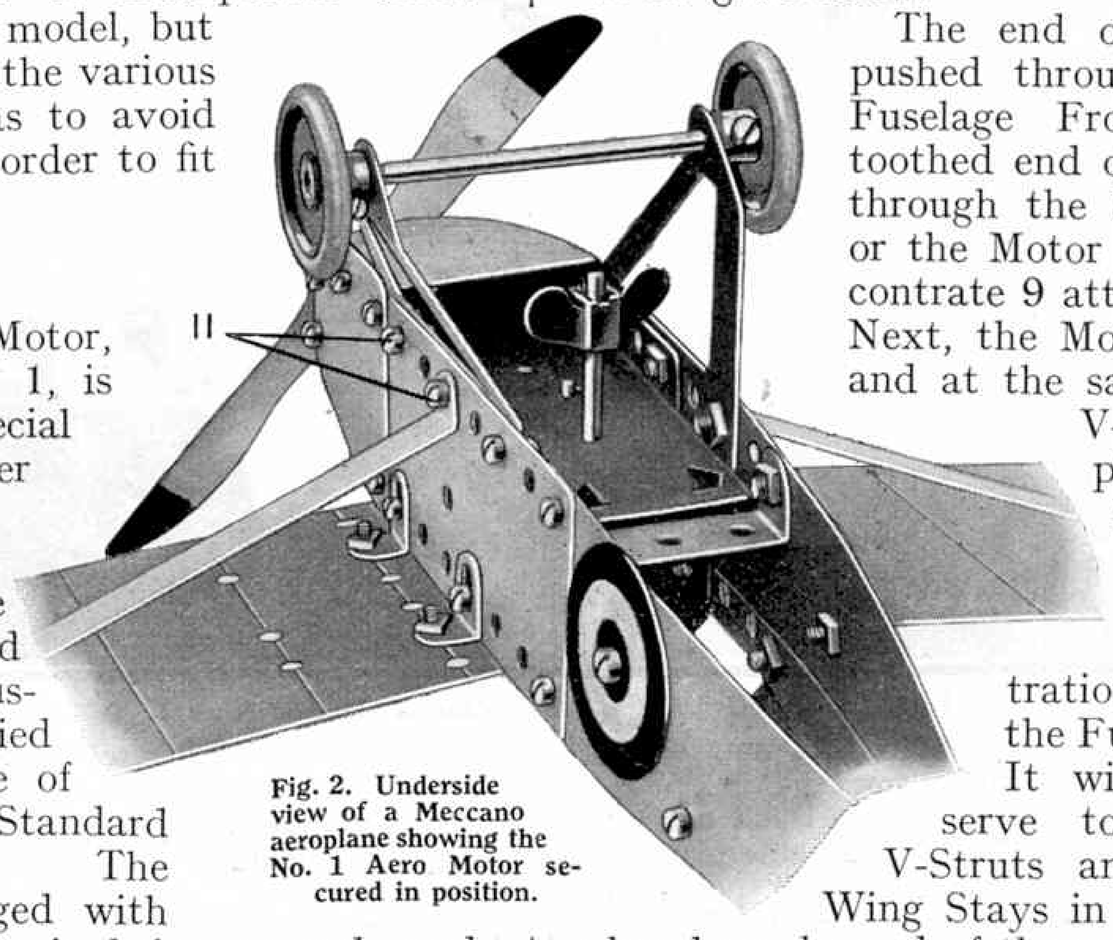


Fig. 2. Underside view of a Meccano aeroplane showing the No. 1 Aero Motor secured in position.

The end of the propeller shaft 8 is pushed through the upper hole in the Fuselage Front 4 (see Fig. 4). The toothed end of the shaft 8 is now passed through the hole in the bearing lug 10 or the Motor so that it engages with the contrate 9 attached to the Motor Spindle. Next, the Motor is lowered into position and at the same time the Undercarriage V-Struts of the machine are placed on each side (see Fig. 2). The Motor is held in place rigidly by means of four bolts 11 of which two can be seen in the illustration. These bolts pass through the Fuselage Sides Middle sections. It will be seen that they also serve to hold the Undercarriage V-Struts and the lower ends of the Wing Stays in place. The Propeller 6 is placed on he end of the propeller shaft 8 that projects through the upper hole in the Fuselage Front, and locked in position by means of its grub-screw. The boss of the Propeller must not be pushed tightly against the front face of the Fuselage Front or considerable

friction will result and the Motor will not run well.

Care should also be taken to see that the propeller shaft is free to turn in its bearings and that the toothed end of the shaft engages correctly with the teeth of the contrate 9 on the Motor. If there is any stiffness in the drive, the Propeller will run slowly or may even refuse to turn at all. A little Meccano Lubricating Oil applied to the teeth of the contrate 9 will improve the running.

When the Motor is being wound, the looped end of the Propeller Control Rod 1 is moved to the forward end of the slot 2 so that the plain end 5 (see Fig. 4) engages with the Propeller 6 and prevents it from rotating. To release the Propeller 6, the Control is moved to the rear of the Slot 2, and it should not be forgotten to shout "Contact" in the approved aeroplane fashion when performing this operation!

The Motor drives the Propeller at high speed for a surprisingly long period, and the complete effect is most realistic. When using the Motor, the Propeller Control Rod 1 must on no account be pushed to the forward end of the Slot 2 while the Motor is running as damage will result.

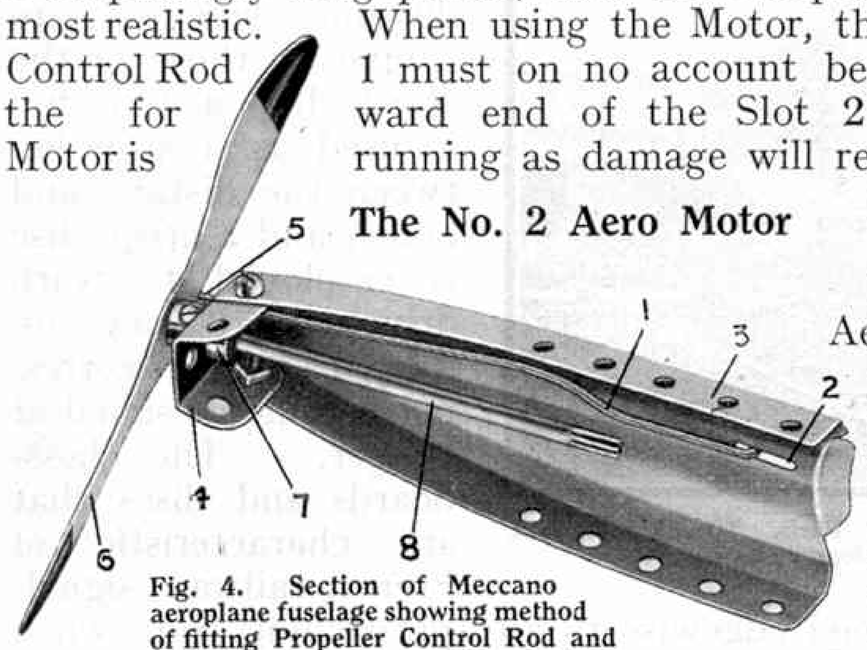


Fig. 4. Section of Meccano aeroplane fuselage showing method of fitting Propeller Control Rod and arrangement of propeller shaft.

The No. 2 Aero Motor

The No. 2 Aero Clockwork Motor is shown in Fig. 5. The Motor is supplied complete with the propeller shaft 21 fitted with special pinion, the landing wheel axle 13 also fitted with special pinion, the wheeled Tail Unit 14 and Propeller Stop Control. The Propeller 6 and Aero Collar 7 are contained in the standard Meccano Aeroplane Constructor Outfits. The No. 2 Motor is suitable for fitting to aeroplane models built with either a No. 1 or No. 2 Outfit and the Motor enables a greater degree of realism to be obtained than is the case with the No. 1 Motor.

The assembly of a model in which the No. 2 Motor is to be incorporated should be commenced by first fitting the Propeller Control Rod to the Fuselage Top Front and Fuselage Front of the machine. The Control Rod is assembled in exactly the same way as the Control Rod supplied with the No. 1 Motor described previously.

After the Propeller Control Rod has been fitted, the construction of the fuselage may be proceeded with, but the undercarriage should not be fitted to the fuselage at this stage. The Aero Collar 7 is secured to the Propeller Shaft 21 so that the special pinion on the end of this shaft engages with the Contrate 17 when the Collar rests against the inside face of the Fuselage Front. The end of the propeller shaft 21, complete with Collar 7 should be pushed through the upper hole in the Fuselage Front. The rear end of the propeller shaft 21 is next pushed through the hole in the bearing lug 16 that projects from the frame 12 of the Motor. It is a good plan to apply a little oil to the teeth of the Contrate 17 before the Motor is finally bolted in position.

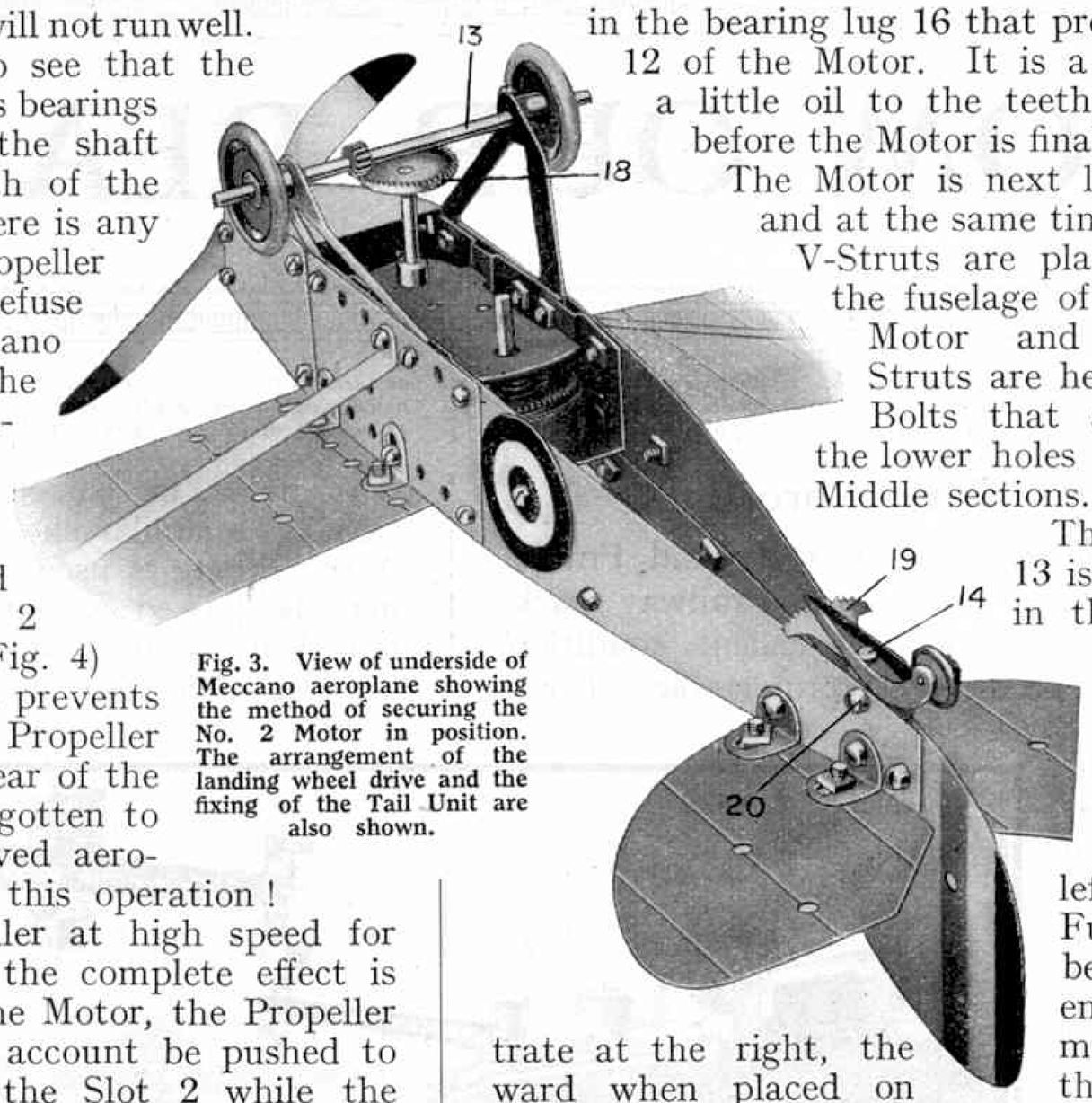


Fig. 3. View of underside of Meccano aeroplane showing the method of securing the No. 2 Motor in position. The arrangement of the landing wheel drive and the fixing of the Tail Unit are also shown.

The Motor is next lowered into position and at the same time, the Undercarriage V-Struts are placed on each side of the fuselage of the machine. The Motor and Undercarriage V-Struts are held in place by 7/32" Bolts that are pushed through the lower holes in the Fuselage Side Middle sections.

The landing wheel axle 13 is pushed into position in the Undercarriage V-Struts as shown in Fig. 3. It is essential that the special pinion on the shaft 13 engages with the Contrate 18 at the left-hand side of the Fuselage (viewed from below). If the pinion engages with the Contrate at the right, the model will travel backward when placed on the ground! A 1" Fast Pulley complete with Rubber Tyre should be placed on each end of the axle 13. These Pulleys should be adjusted so as to keep the special pinion on the axle 13 in engagement with the contrate 18. The Propeller 6 may now be placed on the projecting end of the propeller shaft 21 and locked in position by means of the grub-screw in the boss of the Propeller. Care should be taken to see that the shafts 21 and 13 are free to turn in their bearings, while a little oil applied to the teeth of the contrates 17 and 18 will improve the running of the mechanism.

The wheeled Tail Unit is illustrated in Fig. 5, while in Fig. 3 it is shown secured to the model aeroplane. The Unit enables the direction in which the model taxies to be altered at will. In addition, the Unit reduces the friction between the tail of the machine and the ground. The Tail Unit is secured in position by means of a 3/8" Bolt 20 (see Fig. 3) which passes through the two perforated lugs 15 of the Unit (see Fig. 5) and through the Fuselage Side Rear sections. The model may be made to travel in any forward direction by adjusting the position of the wheel frame 14 on the toothed rack 19.

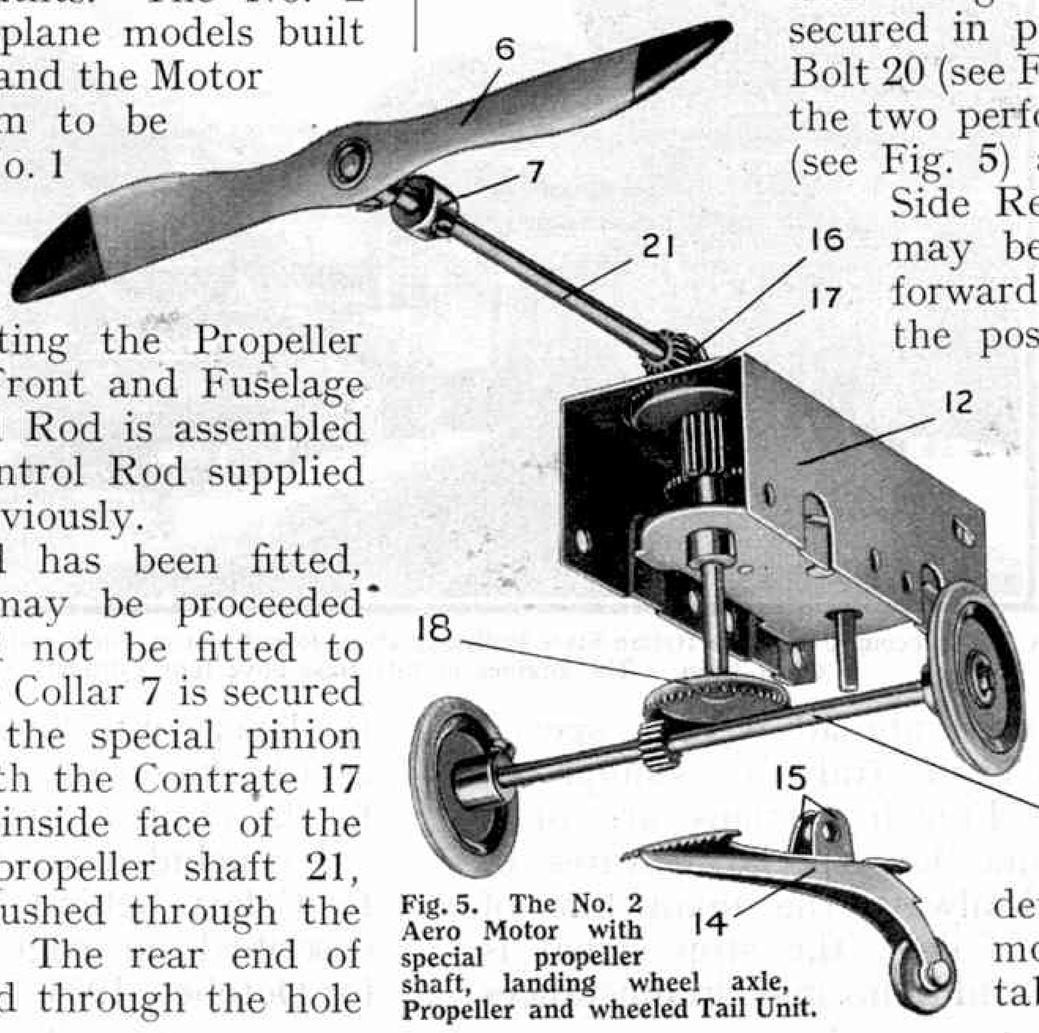


Fig. 5. The No. 2 Aero Motor with special propeller shaft, landing wheel axle, Propeller and wheeled Tail Unit.

The model is operated by first pushing the Propeller Control Rod to the forward end of the slot in the Fuselage Top Front (see Fig. 4) so that the Control Rod engages with the Propeller and prevents it from rotating. The Motor is then wound by means of the detachable key, and the model placed on the floor or table.

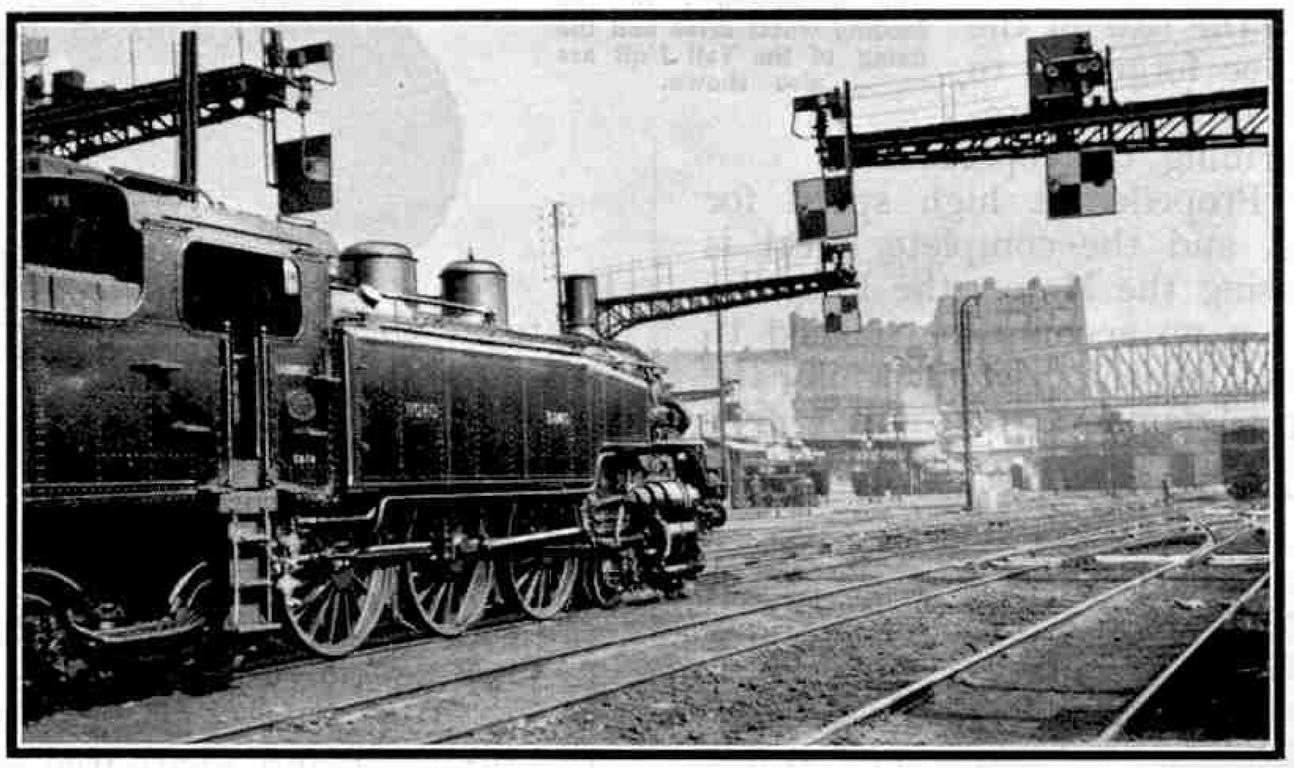
(Continued on page 77)

FROM OUR READERS

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

A Railway Tour Abroad

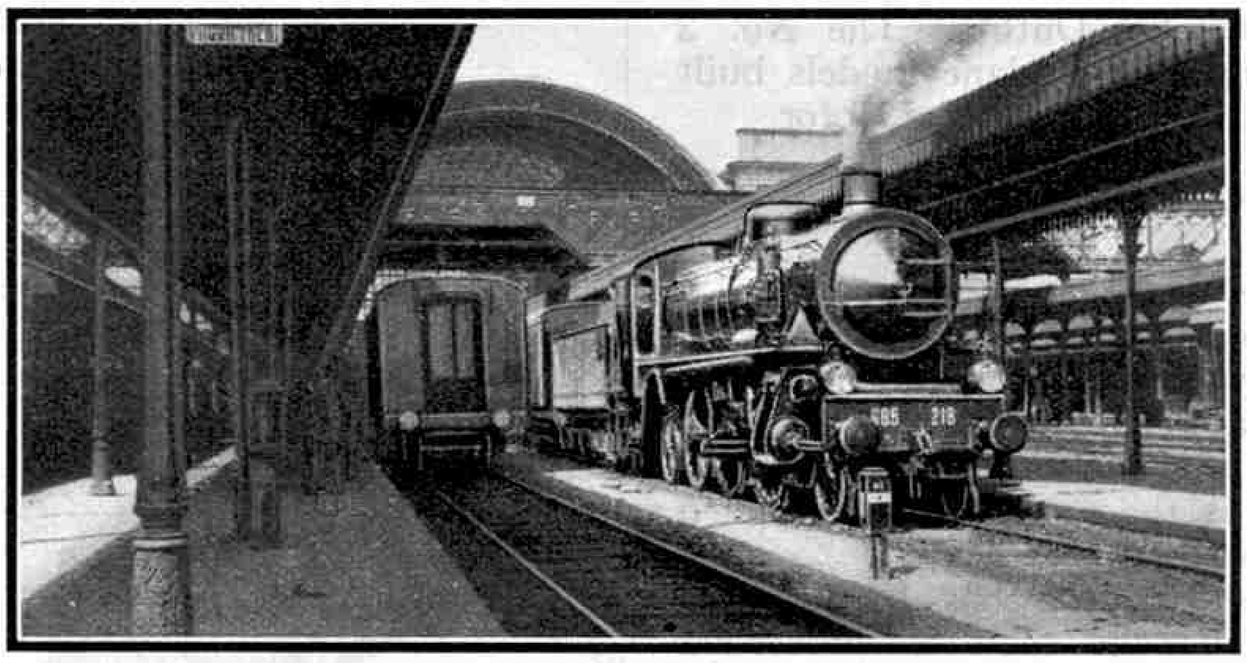
While on a tour in Switzerland, Italy and France, I was greatly interested to find that the railway tracks over which I travelled were in excellent condition, and the trains were speedy and comfortable. I was particularly impressed by the calm and cleanliness of the Swiss Electric Railways. The train in which I travelled to Italy climbed up to the mouth of the St. Gotthard Tunnel with apparent ease, and on the run down the southern slopes of the Alps the brakes became so hot that a great quantity of smoke was formed by the burning of oil. I was greatly amused to see Swiss gangers and shunters carrying umbrellas, which they used freely in order to protect themselves from the effects of sudden showers.



A "Baltic" tank engine of the Nord Railway in the Gare du Nord, Paris. The characteristic chessboard signals employed on French railways are clearly shown.

The Italian State Railways are now very reliable and the time-keeping is excellent. Many new lines are being constructed. These are chiefly electric, the principal one being the line from Bologna to Florence, which passes under the Apennines through a tunnel 11 miles in length.

The finest run I experienced in Italy was from Florence to Rome. The train was 23 minutes late at Florence, but reached Rome on time, covering 197 miles in five hours, although its weight was 480 tons. One change of engine only was made throughout the run, four-cylinder 2–6–2 locomotives being employed.



A 2–6–2 locomotive of the Italian State Railways about to pull out of Turin station at the head of its train. The engines of this class have four cylinders.

The signalling systems used abroad were a special attraction. That employed in Italy is similar to English practice, but the French systems are of a different type and each line has special features of its own. On the Nord Railway, the main line of which runs from Paris to Calais, the stop signal is a red and white chessboard, and in normal circumstances may never be passed when at danger. The distant signal is a similar chessboard coloured green and white. A semaphore is used as a permissive block signal that may be passed at danger, but shows that the line is not clear, while a signal consisting of a red disc with a white edge may be passed, but trains are required to pull up about 600 yds. further on, unless they are given a signal by flag to proceed.

On the Paris, Lyons and Mediterranean system, the stop and distant signals are similar to those of the Nord, but a red disc is used as a stop between the distant and home, and a green disc is employed to warn drivers that they are likely to find the corresponding home signal at danger. The chessboards and discs that are characteristic of French railway signalling are turned edgewise to an approaching train when the line is clear. At night this indication is given by a white light, which is contrary to British practice. Red, green and orange lights are employed in night signalling on French railways, while purple lights are used in order to give route indications.

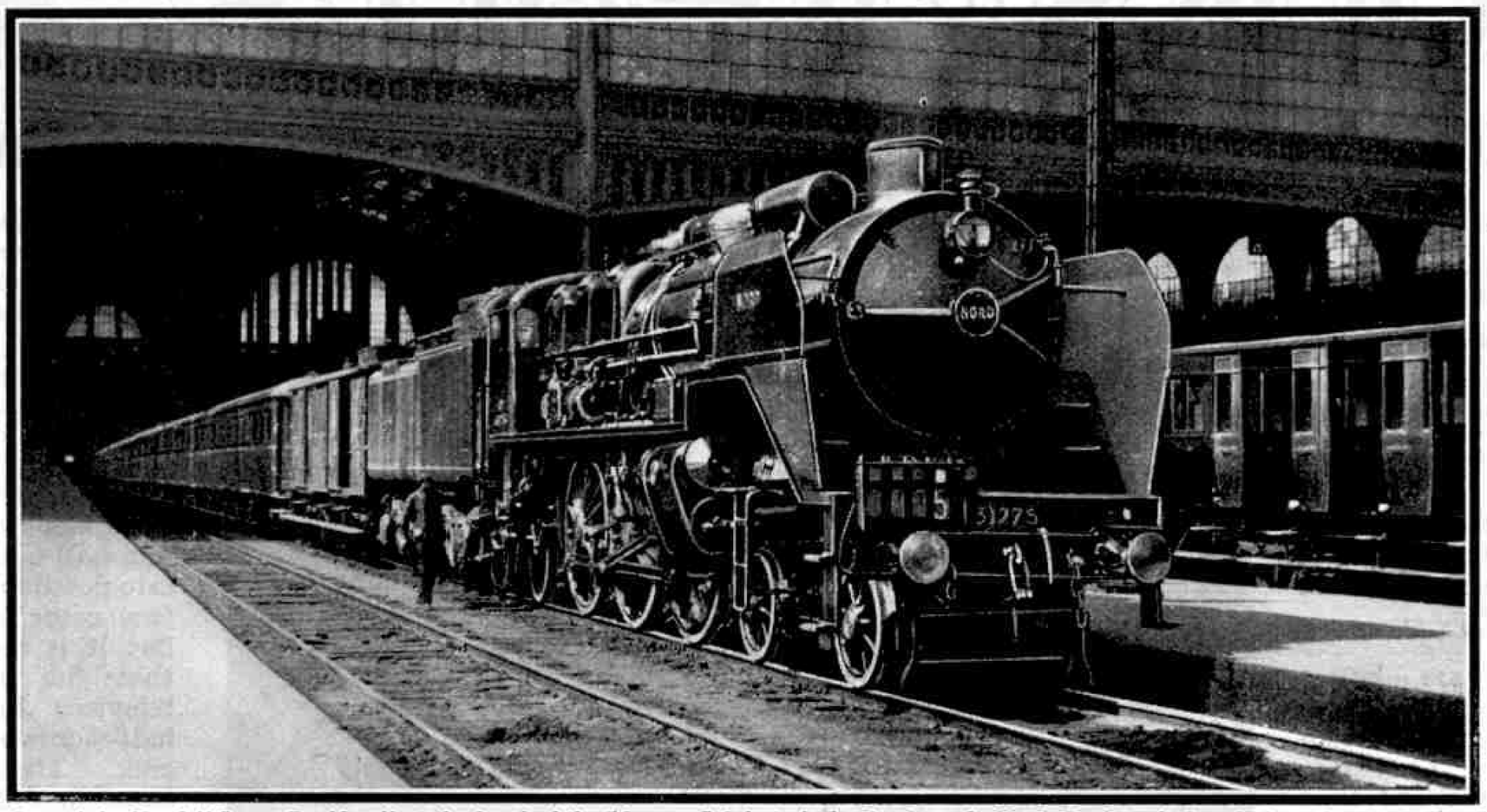
Signalling in Italy is on similar lines to the practice followed in Great Britain, semaphore arms and shunting discs being employed. In many installations the points and signals, both of the semaphore and disc types, are worked electrically. Current is only used for changing signals to the "off" position. These turn back to normal when the lever controlling them is replaced, air pressure acting as a brake on the movement in order to prevent damage to the electric lamps.

I concluded my tour with a splendid run from Paris to Calais behind one of the new "Super-Pacifics" described on page 790 of the *"Meccano Magazine"* for October, 1931.

B. J. HOLDEN (Horley).

A Burning Gas Well In Texas

I spent a short time recently at Strawn, Texas, the centre of a district in which oil and gas are obtained. While I was there, a new well "came in," the drill penetrating the strata containing gas, which rushed up the bore under high pressure, bringing with it rocks and dirt. Unfortunately one of the rocks broke an electric light globe. This caused the gas to ignite, and in a few seconds the head of the well was a roaring mass of flames.



One of the Nord "Super Pacifics" at the head of the 10 a.m. Calais train in the Gare du Nord, Paris. A description of a locomotive of this class was given on page 790 of our issue for October, 1931. Photograph by our reader, B. J. Holden, (Horley).

I saw nothing of the fire until early next morning. It was dark when I awoke, but the glare of the fire lit up the entire district. Later I went as near the well as possible, to find that the flames reached a height of nearly 100 ft. I visited the well again at night, and found that a large crowd had assembled to watch the efforts then being made to extinguish the fire. After several attempts by various means had failed, pipes were laid down on all sides of the fire and jets of steam directed on to it. These blew the flames out almost immediately, and at last the rush of gas could be brought under control. H. DOLPHIN (Bradford).

Pooch

We found him one morning sitting in our back porch. The dog was thin, and hungry—we never have filled him up yet—and looked so bewildered and foolish at the same time, that we just had to keep him.

He is part Airedale, police dog, terrier, and, to look at his feet, part snowshoe rabbit! His paws are almost 4 in. across and he isn't much over a year old. I have seen him kill a big mouse with one blow of his paw. He weighs about 50 lb., is about 2 ft. high, and his appearance is not attractive, for his build is that of a dachshund on stilts!

Pooch, the subject of the story by our American reader, Quentin Stiff.

We also have a 10-year old "Pup" who has licked every dog in the country and is the gentlest dog that we ever saw. At first Pup wouldn't play with Pooch at all. In fact he was very disgusted and jealous, but he soon got over that and for a while they beat any circus going. But now Pup is blind in one eye and is too old to play very much.

Pooch can run rings around Pup. I have seen him hold his own with a jack rabbit just after I had missed it. Once when my brother wounded a jack rabbit, Pooch just followed it along and kept knocking it over as often as it got up, until my brother came up and killed it.

One of our neighbours, who lives just across the road, also has a dog, and as soon as Pooch finishes his meal he races across the road and generally gets another meal. Once he couldn't eat all of the other dog's meal so he picked up the dish and carried it all the way home in his mouth, where he could eat it at his leisure.

When he barks, if you couldn't see him you would think that there were a couple of St. Bernards gone wild. Everything that moves—and he sees everything—must be informed of his presence, or so he thinks.

We don't know what he will be like when he is older, as he sometimes shows the utmost cunning, while at other times he acts dumb. His eyes are always void of any expression. His real name is Rex, but Pooch fits him better than any other name we have ever heard of.

QUENTIN STIFF (New Jersey).

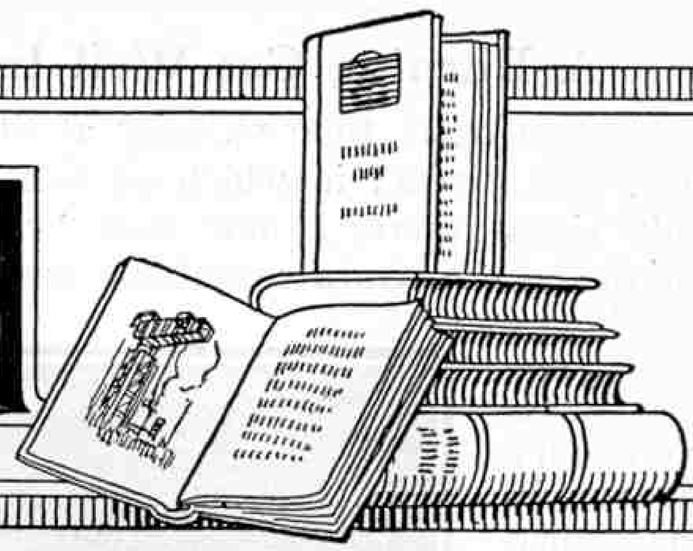
The Walvis Bay Water Supply

Before 1924 the only water obtainable at Walvis Bay, the chief port of South West Africa, was obtained by evaporating sea water and condensing the steam. A four gallon tin of this cost 6d., and the natives who carried the precious liquid to the buyer's houses usually lost about a gallon from each tin by splashing.

Walvis Bay could scarcely develop as a port without an ample water supply. The nearest place from which it was obtainable was Rooibank, 21 miles away, and there a large pond was dug in the course of the Kusib River. At that point the bed of the river is about $1\frac{1}{2}$ miles in width, but water only flows down it about once in every seven years! A suction pump brought water and sand from the bottom of the pond, which grew to a respectable size after continuous digging and pumping. The water reaches Walvis Bay through cast iron pipes.

The Rooibank pond was dug by natives from Damaraland, who knew nothing of the ways of white men. Many of them were at first incapable of handling a spade, and the goggles issued to them for protection were worn as ornaments. E. F. SPEIRS (Transvaal, S.A.).

Books to Read



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.

"From Telegraphy to Television"

By Lt. Col. CHETWODE CRAWLEY, M.I.E.E.
(Warne. 6/-)

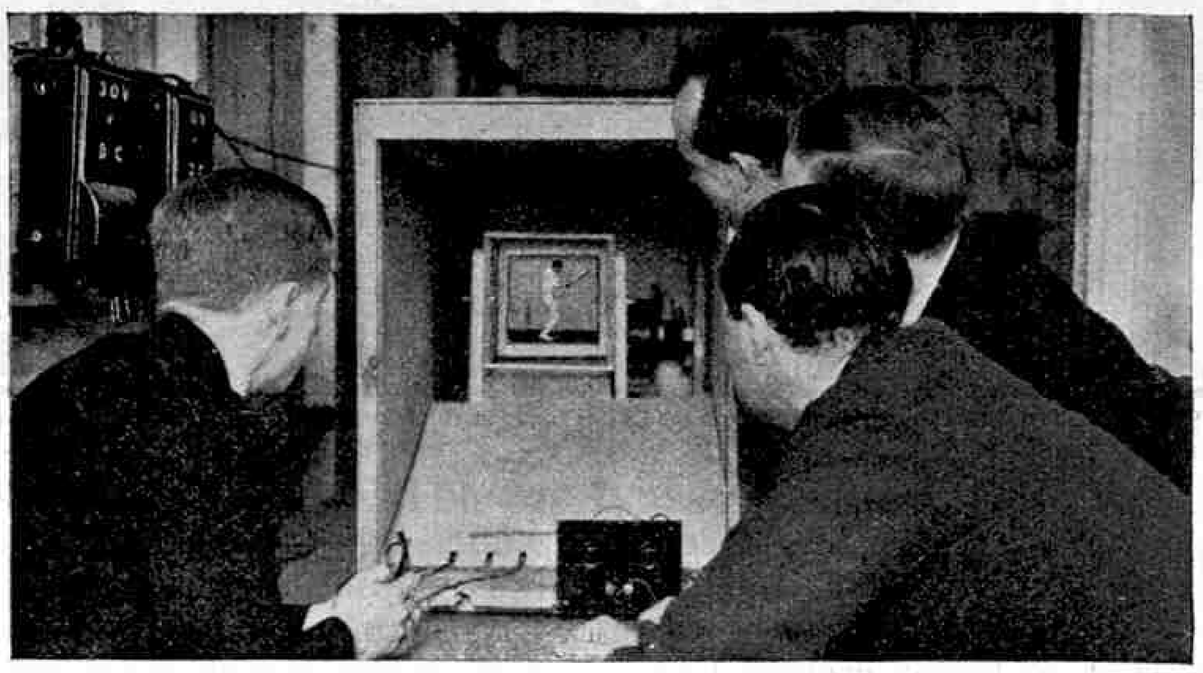
Few writers are better qualified to tell us the story of electrical communication than Colonel Chetwode Crawley of the General Post Office, who is a regular contributor to the technical press on this subject. The discoveries in electricity—and particularly in wireless—are among the outstanding achievements of the past fifty years, and far from our having reached finality, as some think, we are but on the threshold of even greater discoveries in the future, for wireless telegraphy and telephony hold tremendous and romantic potentialities.

It is to enable the reader to grasp the wonders of wireless as at present demonstrated, and to have some idea of what the future holds in store for us, that this book has been written. It commences with the story of electrical communication from the earliest times, when curious experimenters were probing into the secrets of that little-understood force, electricity. From these pioneer efforts, the evolution of wireless is simply and clearly set out with an avoidance of technicalities. Step by step we see how discovery and development have followed each other in the great field of telegraphic and telephonic activity. After a brief historical survey Colonel Crawley takes us behind the scenes in a telegraph office, a telephone exchange, and a cable station. He reveals the inner working of wireless as it affects ships both in near and far waters and the chapters on "Safety of Life at Sea" and "Ships' Commercial Communications" are of absorbing interest.

Of television, the latest development in wireless, the author has much to say. We learn that the first demonstration of true television was given by Mr. J. L. Baird on 27th January, 1926, in London. Mr. Baird, the son of a Presbyterian minister, had been interested from an early age in scientific research.

"Some years ago he invented a new form of selenium cell that led up to his interest in television problems. Early in 1925 he gave a public demonstration of the transmission of outlines, by wireless, at Selfridge's shop in Oxford Street, and this was a distinct advance on the shadowgraph transmissions which had previously been attained. He then set out to obtain true television, and his first successful effort was in October, 1925. Up till then he had been using the head of a ventriloquist's doll as the object to be televised, and at last he succeeded in seeing the doll's face at the receiving end, not as an outline but as a detailed image. He rushed out and persuaded Mr. Taynton, who was then an office boy in the office below, to take the place of the doll before the televisor, but to Mr. Baird's great disappointment nothing at all appeared at the receiving end. He made all possible adjustments of the receiving apparatus, but still nothing appeared, so eventually, feeling very sad and dejected, he went back to the transmitter. There he found that the boy, being bothered by the strong lights used for illuminating his face, had pushed his chair back out of focus. "In the excitement of the moment," says Mr. Baird (who is a Scotsman), "I gave him half-a-crown to get back into position." This time the face came through all right, but it is interesting to note that the first person ever televised had to be given half-a-crown for the experience. The apparatus used in these first demonstrations of television is now in the South Kensington Museum.

The book is well illustrated with 24 plates and numerous line illustrations in the text.



The Baird "televisor," showing the reception of a picture of Strudwick, the cricketer, at the wicket. (See below).

"Enquiry" at the Gerrard Telephone Exchange. These are two of the illustrations in "From Telegraphy to Television" reviewed on this page.

"The Quest for Power"

By H. M. and M. VOWLES
(Chapman & Hall. 15/-)

This book, the story of Man's inventions throughout the ages from prehistoric times to the present day, is divided into three parts of approximately equal length.

Part I tells of Man's apprenticeship of muscular toil, extending over half a million years. We learn how he made and used flint tools, discovered fire and metals, controlled water for irrigation, and learned how to transport material by land and water. In this period Man acquired the rudimentary skill and knowledge that were necessary before he could succeed in harnessing the forces of Nature.

Part II deals with the age of power—a period that cannot have been one-hundredth the length of its predecessor. During this time water-wheels and windmills were the first prime movers. The coming of the steam engine was the signal for a host of inventions and discoveries, while the steam turbine, the internal combustion engine, and the hydraulic turbine transformed power development. The electrical transmission of power leads to the conclusion that "with this splendid gift of science has come the promise of a new way of life for all mankind, the possibility of human existence being freed for ever from the body and soul-destroying drudgery of uncongenial toil."

In Part III we learn much of the materials—mainly coal and steel—with which present day results have been achieved. A final chapter deals with the World Power Conference and the possibilities of the future. "The end is nowhere in sight,"

we are told. "On the contrary, it is clear that such developments are even now only in their initial stages, a mere foreshadowing of what is still to come. So, gradually, first one and then another onlooker wakens to the fact that we are now faced with changes different from any we have ever known before, changes which must revolutionise the whole life of man from top to bottom. With this realisation comes a desire to know more about past and present progress in power engineering; to arrive at some clear understanding of what it is that has made these amazing changes possible, and of how the never-ending quest for power is likely to react on human affairs in the years to come."

There is a great deal of information in this admirable book that will interest Meccano boys, not only in the part that deals with the development of craftsmanship, but more particularly in that dealing with the coming of steam, water-power, and electricity. As the authors remark, "there never was a time when such a widespread interest was taken as now in machinery, and the giant forces which have been harnessed to drive it. Whichever way we turn we find a mechanical invasion of human affairs in full swing. In factories, in offices, on the farm, in the home, throughout whole continents, we see power-driven machinery increase and multiply, spreading to the ends of the earth and the uttermost parts of the sea. Great power schemes are constantly being developed, power cables and their supporting towers are rapidly becoming familiar features of the countryside, while the products of power and machinery affect each of us from the cradle to the grave."

"The Autobiography of James Nasmyth"

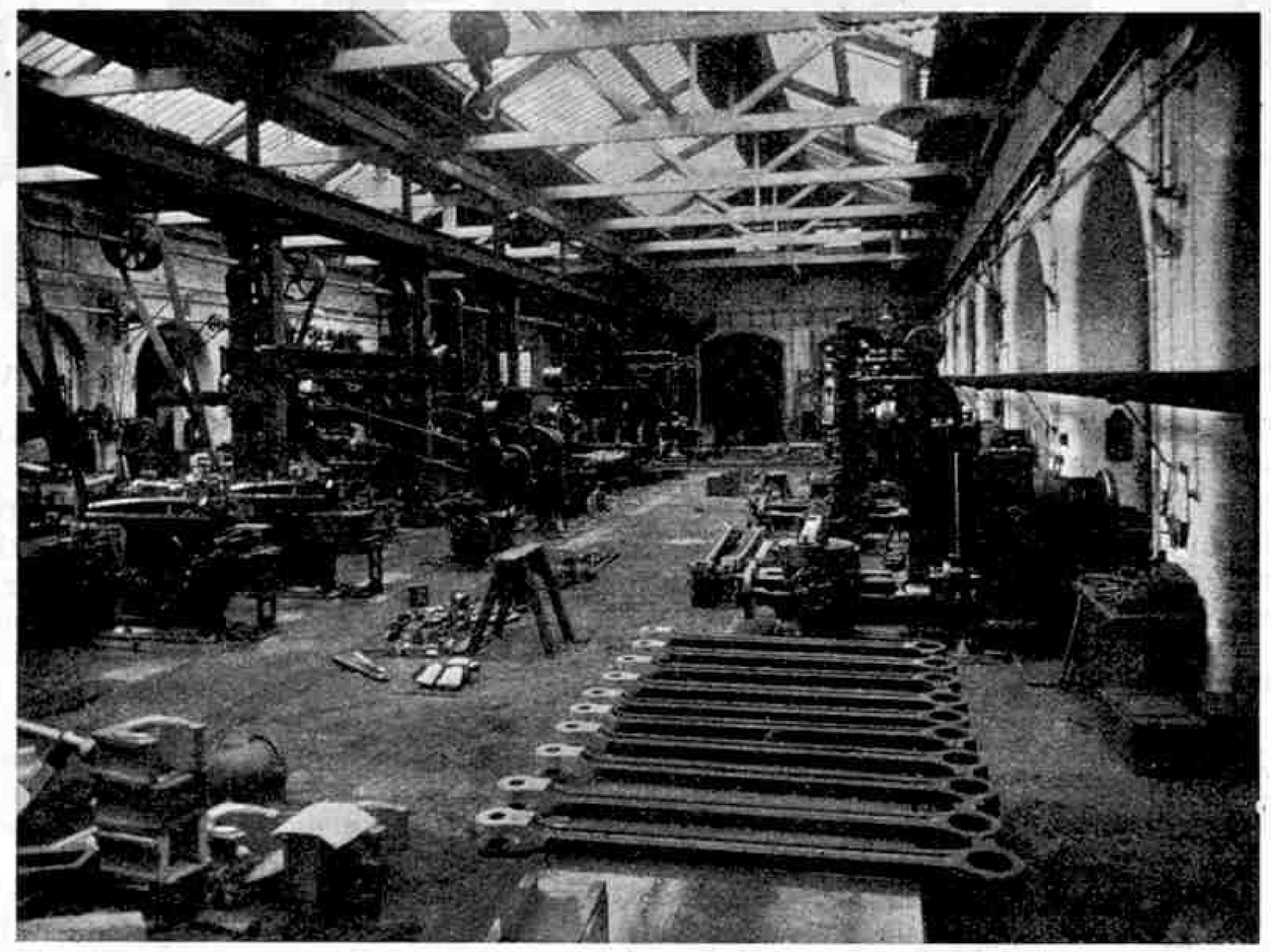
By A. F. Collins
(Cambridge University Press. 3/6)

As the Editor remarks in his Preface, most boys are intensely interested in craftsmen and their work, as is evidenced by the fact that they read with enjoyment books describing the achievements of the engineer and the inventor. To those boys this book will particularly appeal.

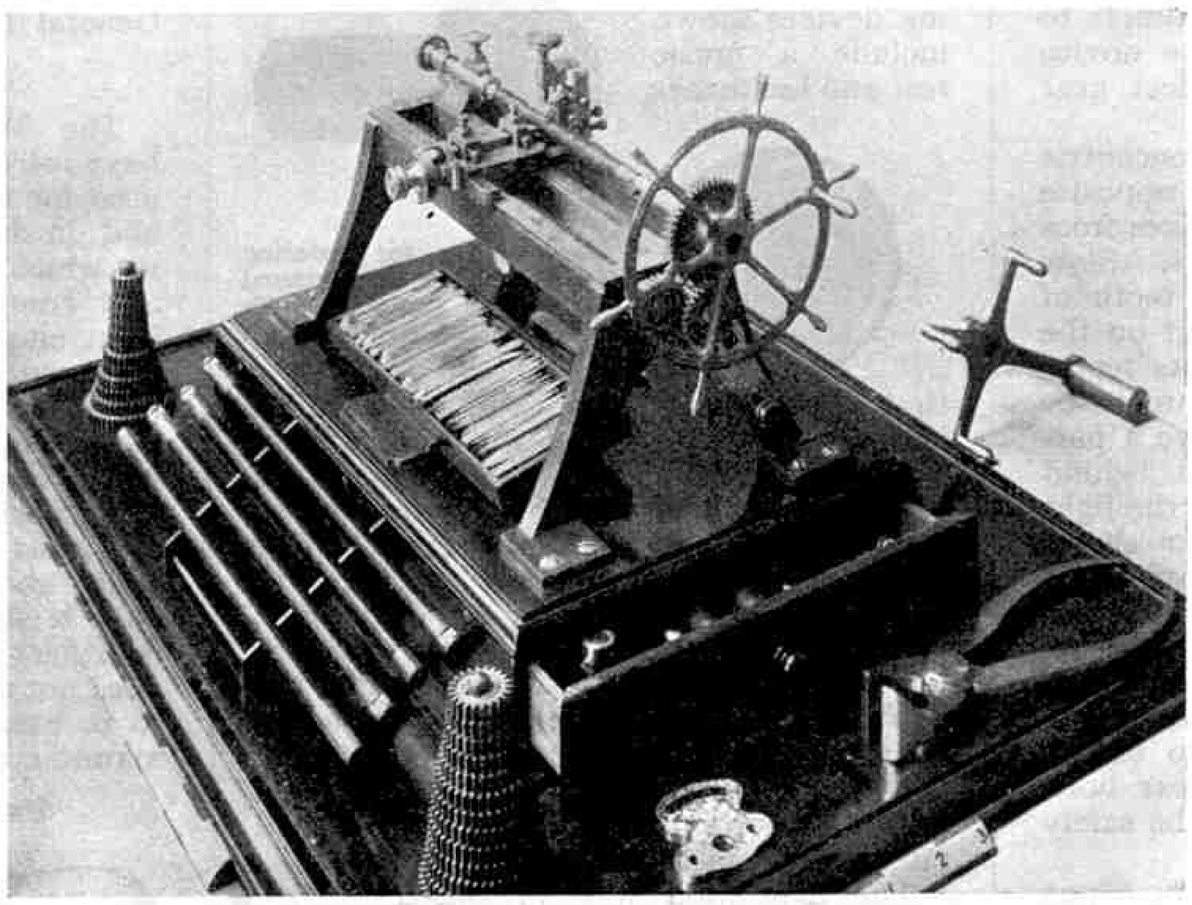
Our readers are well informed of the great changes that were brought about in industry by the application of steam-power; they know how in the later years of the 18th century James Watt and others turned the steam-engine from a clumsy contrivance, suited only for pumping water from mines, into a more economical and convenient mechanism that could be used as the driving force in countless factories. The increased use of steam brought its difficulties and problems, not the least of which was the discovery of craftsmen who could efficiently carry out what are to-day comparatively simple engineering operations. For example, in the time of Watt, cylinders were so badly cast and bored that steam leaked in all directions, and pistons could only be kept steam tight by packing them with paper, cork, putty, or even old beaver hats!

As invention progressed, however, a type of craftsman came into existence that was almost unknown until the 19th century. He was the skilled engineer who was able to work to the most precise measurements. His craftsmanship has resulted in all kinds of mechanisms being made in metal with the utmost exactness and at a speed that was undreamed of by engineers only a century ago.

One of the greatest of the men who bridged the gap between the crude workmanship of the late 18th century and the complicated and accurate automatic machinery of to-day, was James Nasmyth, whose life story is given in this book. We read of his youthful work as an amateur craftsman, and of his later training under Maudslay, one of the most accurate and ingenious workers of his day. We are told how Nasmyth started in business on his own account with only one assistant, making his own machines and equipping his simple workshop himself; how his business grew into the great Bridgewater Foundry that eventually sent locomotives to all parts of the world; and how he came to invent the steam-hammer in connection with which his name is best known. The most interesting feature of the book, however, is not the story of the growth of his business, nor even of his great invention, but it is the way in which is revealed to us the fascination that fine craftsmen always had for Nasmyth and the respect in which he held every man who really "knew his job."



A part of Bridgewater Foundry as it is to-day. This, and the illustration below, are from "The Autobiography of James Nasmyth" reviewed on this page.



The "screw-generating machine" invented by Maudslay. "The parent of a vast progeny of perfect screws whose descendants are to be found in every workshop throughout the world." (See above).

"Pilot's 'A' Licence"

By John F. Leeming
(Pitman & Sons Ltd. 3/6 net)

This interesting and thoroughly practical little book, which is now in its fourth edition, describes in a simple manner exactly what must be done before a pilot can be granted his "A" certificate. The first part of the book is devoted to the clearing up of difficulties in regard to the many formalities to be complied with before the certificate can be issued, and the field covered by the technical examination that must be passed by candidates for Royal Aero Club certificates is also fully dealt with. A particularly useful feature is a series of questions covering the whole of the syllabus of the examination in navigation. There is also a section containing miscellaneous but nevertheless important information on such matters as the regulations in force for the renewal of licences, and the procedure to be followed before flights can be made to other countries. A list giving the names and addresses of all the light aeroplane clubs and flying schools in this country is included.

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

The Universe *by* F. Allen. (Nicholson & Watson, 5/–)

Nature by Night *by* R. Thompson. (Nicholson & Watson, 12/6)

Peter Garner, Cadet *by* J. F. C. Westerman. (Ward Lock, 3/6)

Bill of Billabong *by* M. G. Bruce. (Ward Lock, 3/6)

The Arabian Nights *by* A. E. Jackson. (Ward Lock, 3/6)

Wonder Book of Science *by* H. Golding. (Ward Lock, 6/–)

The Land of the Arab *by* Robert Harding. (R.T.S., 2/–)

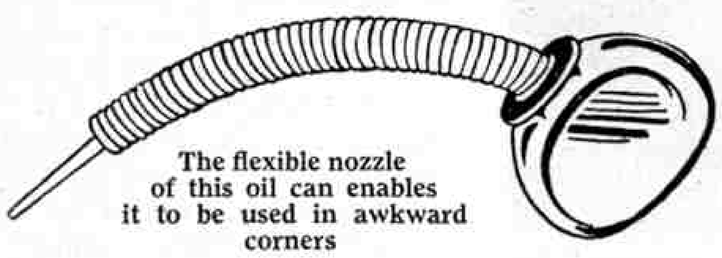
The Adventures of Paddy the Beaver *by* T. W. Burgess. (John Lane, The Bodley Head. 2/–)

Romance of the Merchant Ship *by* Ellison Hawks. (G. G. Harrap. 7/6)

Early Man, His Origin, Development and Culture *by* G. Elliot Smith and Others. (Ernest Benn. 8/6)

Oil Can with Flexible Nozzle

An oil can that will reach awkward places without difficulty is an invention that will be greatly appreciated. Instead of the usual rigid metal nozzle, a flexible tube has been fitted and this may be bent and pushed into out-of-the-way corners and yet allow a clear passage for the oil. A handy pattern is being made specially



The flexible nozzle of this oil can enables it to be used in awkward corners

for cyclists and motor-car owners and is to be sold in several different sizes.

Making Gear Changing Easy

A very interesting gear changing indicator invented by a London engineer enables the driver of a motor car to bring gear wheels into mesh when they are travelling at the most favourable speeds relative to each other, thus avoiding violent clashing and possible damage to the teeth of the wheels. It is very simple to use, and with its aid an absolute novice has no difficulty in making perfect gear changes.

The indicator consists of two concentric cylinders that are rotated in opposite directions by means of flexible drives from the shafts carrying the gear wheels. Slots corresponding in number to the teeth of the wheels in the gear box are cut on the outer and inner cylinders, the slots representing the toothed wheels that are to be brought into mesh in order to give a particular gear ratio being situated behind each other in such a manner that the light from a lamp within the cylinder shines through both of them. The slots are cut at an angle, those on the inner cylinder being approximately at right angles to those on the outer cylinder. They seem to be in motion except when the cylinders are rotating at the correct speeds to ensure easy meshing. Then they appear horizontal, and the gear wheels may be safely brought into mesh.

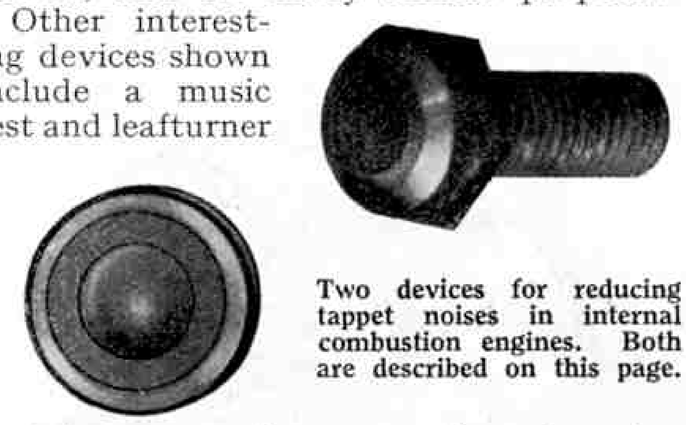
In practice the gear lever is first put into neutral and the engine is either speeded up or allowed to slow down until the illuminated slots corresponding to the change that is to be made are seen to be horizontal. A quick movement of the lever then brings the appropriate gear into action. It is interesting to note that declutching is unnecessary, for the load is taken up evenly. The indicator is small and may be mounted near the windscreen in such a position that the driver may watch it while looking ahead.

Recent Interesting Inventions

At the International Exhibition of Inventions recently held in London, several interesting and useful devices were shown. Many of these are domestic in character, and practically all promise to become important from a commercial and industrial point of view.

One interesting invention is a safety razor blade with which four shaving edges are obtained by means of a special method of grinding, introduced by Mr. J. A. Brook, of Huddersfield. The blade is made of surgical steel, and in effect its edges are hollow ground. In order to take full advantage of the special feature of the blade it must be used in certain positions in turn, and an adaptor has been designed to enable an ordinary holder to be converted for its use. The exhibitor of the "Four-edge" safety razor, as this device is called, also showed a handy little tool, well-made of rustless steel, in which used razor blades may be fitted and used as scrapers for removing posters, bills and paint from windows, labels from bottles, and for many similar purposes.

Other interesting devices shown include a music rest and leafturner



Two devices for reducing tappet noises in internal combustion engines. Both are described on this page.

that turns over the pages of music automatically when a small lever or foot pedal is pressed; a carving dish, made of chromium plated steel, in which is a spiked tray that holds the meat firmly in position, thus enabling it to be cut to advantage and with a minimum of trouble; and a comb with hollow teeth through which lotions may be forced into the hair and scalp. A comb that removes dead grass from lawns without damaging the roots, and an accumulator with a removable stopper instead of the usual pitch cover also are included.

The exhibition was organised by the Institute of Patentees in order to draw attention to the ingenious devices of modern inventors. The Institute encourages inventors in every possible way, giving them expert advice on technical problems and on Patent Law, and helping them to market their inventions. Full details of the Institute and its work may be obtained on application to the Secretary, 39, Victoria Street, London, S.W.1.

Silent Valves for Petrol Engines

Two devices to decrease the noise caused by clicking valve stems in internal combustion engines are shown in the illustration in the centre of this page. The one on the right is the "Fabroil" tappet-adjusting screw for use in side valve engines. The cupped head shown in the illustration contains a pad of highly compressed cotton fibre that is interposed between the metal surfaces usually in contact, and the tapping of the valve stem on the adjusting screw is therefore eliminated. At the same time the screw has a longer life than one of the ordinary type, for the pad has greater wearing qualities than steel.

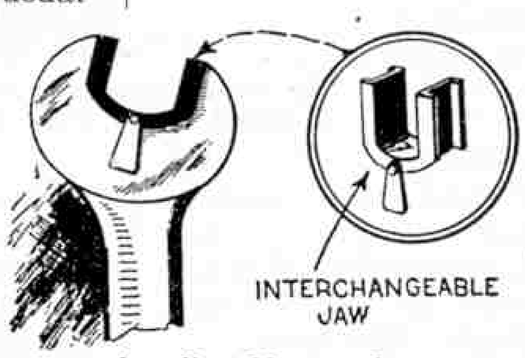
The second device shown in the illustration is called the "Tex-oil Silencer." It performs the same function for overhead valve engines as does the Fabroil screw for side valve engines. The Silencer is placed in position on the valve stem with the rocker arm resting on it, and its top is so shaped that it acts as an oil-cup, while the bottom is in the form of a valve stem seat.

Both the Fabroil screw and the Tex-oil Silencer have been developed by the General Electric Company of New York.

A New Veneer

The Westinghouse Electric Company have introduced a new veneer that may be used for furniture, table tops, wall panels, and in fact for practically any purpose for which wood, glass, hard rubber, marble and composition of various kinds have been employed. The name "Micarta" has been given to the new material, which is made by pressing specially-prepared paper and resins together while hot. It has a very hard and lustrous finish, does not absorb moisture, and cannot be readily scratched or marked by hot dishes. Mild acids and alkalis do not affect it, nor does it show stains from cigarette burns. Another interesting property is that it does not readily warp, and for this reason it is extremely suitable for use in the manufacture of refrigeration show cases.

Useful Open End Wrench



An adjustable wrench.

The novel type of wrench illustrated on this page is the product of an American inventor. By the use of interchangeable jaws the same handle may be used for various sizes of nuts. A spring clip on the jaws holds them in the required position in the handle when the tool is in use.

Electric Clocks

A revolution in methods of timekeeping will probably result from the introduction of the telechron, an electric timekeeper invented by Mr. H. E. Warren, an American engineer. This is operated and regulated by means of alternating current supplied from central power stations, and is being installed in many large hotel and office buildings.

The new clock does not need winding, runs practically without attention for very long periods, and does not gain or lose time. Instead of the springs, levers, and gear wheels of the ordinary clock, all of which need regular cleaning and oiling, it contains a tiny synchronous electric motor. This motor is operated by alternating current, and the rate at which it runs depends on the frequency with which the direction of the current changes. So long as this remains constant, the motor of the electric clock runs at the exact speed necessary to keep time. The frequency of the current supply is controlled by means of a master clock installed at the power station, and this in turn is regulated by time signals from the Naval Observatory in Washington.

The use of the telechron will prevent the annoyance of having several clocks in one house or building that do not agree with each other. How much trouble and waste of time this causes cannot be estimated, but the need for more exact timekeeping is shown by the fact that the telephone company operating in New York has a revenue of about £120 a day from people who ring up to ask for the exact time!

A telechron alarm clock also has been introduced. This is absolutely accurate, and as it is driven from the electric mains it may be made to ring continuously for practically any length of time. A special switch is provided to put the alarm mechanism out of gear on holidays and Sundays.

Electric Rail Brake for Use in Shunting

An all-electric rail brake for use in railway hump yards has been introduced by the Westinghouse Brake and Saxby Signal Co. Ltd. As in the case of the mechanical retarders employed at Whitemoor, and described on page 851 of the "*M.M.*" for November, 1930, braking is effected by means of beams alongside the running rails.

The brake beams are not rigidly fixed, but may move over a limited distance towards or away from the rails. Their movements are controlled by means of electro-magnets, and when these are excited the brake beams move inward and grip the wheels of wagons passing through the retarder. The greater part of the reduction in speed is electro-magnetic in character, however, being caused by the opposing effects of eddy currents induced in the tyres of the wheels and in the brake beams themselves by the rotation of the wheels in the magnetic field. The retarding forces due to friction form less than 30 per cent. of the total.

Electric Machine that Tests Heart Action

The Westinghouse Electric Company have developed a portable instrument that records on a photographic film the electric currents that accompany heart action. The instrument is called an "electric cardiograph," and the information that it gives medical men is very useful in detecting heart trouble, and in enabling them to decide on correct treatment.

The portable electric cardiograph is very light and is entirely self-contained, no accessory equipment being needed. Dry batteries provide the necessary current for its operation, and these need renewal only at long intervals. In order to use the instrument, electrodes are attached to the two arms and to the left leg of the patient. The minute currents generated by the heart and flowing through the body are transmitted by means of these electrodes to circuits within the instruments, where they are amplified by means of thermionic valves. A mirror galvanometer is used to detect them, and the vibrations of the beam of light reflected from this are recorded on a cinematograph film.

Individual records may be taken at any time, for sections of the film can be cut out for immediate development. This enables the operator to place the information given by the instrument at the disposal of a doctor without delay.

A device by means of which nuts may be tightened when there is little room in which to move a spanner.

An Ingenious Spanner

The device shown in the accompanying illustration is useful when a nut in an out-of-the-way corner has to be tightened and there is little room in which to operate a spanner. The specially-shaped nut on the right is slipped over the one to be moved, and both are then turned by means of the key shown, the serrations of which fit into those of the combined nut. It will be seen that the nut need only be turned through a very small angle in order to bring it in a new position in which the key may be fitted on it.

A folding air raft built by the Supermarine Aviation Company. It is chiefly intended to be carried on aircraft flying over water, and is large enough to accommodate two persons.

Microphone That Excludes Unwanted Noise

In making talking picture records extraordinary precautions have to be taken in order to exclude unwanted noise, and occasionally scenes have had to be retaken because of the accidental intrusion of such an apparently insignificant noise as the hum of a bee. These records therefore are usually made in the very early hours of the morning, when general noise is at a minimum. Difficulties of this kind will be greatly reduced by the use of a form of microphone that is directive in action and picks up very little external noise.

The new device is called the ribbon microphone because its central feature is a piece of duralumin ribbon, 3 in. in length and 3/16th in. in width, placed between the poles of a magnet enclosed in a perforated aluminium case that allows free entrance for the sound waves. These waves cause the ribbon to vibrate, and its movements in the strong magnetic field produce variations in a current passing through it and through the primary windings of the output transformer with which it is connected. These are amplified and transmitted to the recorder in the usual manner.

The ribbon microphone responds only to sound waves reaching it from the front and from the back, noises made at the sides having no effect upon it. Unwanted sounds therefore may be practically cut out by directing the flat side of the microphone towards the place where those to be recorded are produced.

Wireless Set Tuned by Word of Command

A wireless set that tunes itself to a chosen station at the word of command has recently been invented. The receiver is designed to select any one of 16 European stations, and certain code words spoken in the direction of the set bring about the required changes. The device installed responds only to certain sound vibrations, and acts through a relay on the tuning mechanism employed. A similar device is employed for opening garage doors without trouble, the note of a special horn causing a spring lock to open.

New Uses for Fountain Pens

Devices shown at the recent exhibition of the Institute of Patentees by Allied Engineering Industries Ltd. pointed out additional uses that a fountain pen may have. In the end of one of these pens, called the New Era Lighter, is a small petrol lighter. Another contains a device intended to prevent alteration of cheques. This is called the Safetygraph Cheque Protector. It consists of a small wheel with sharp projections that are coated with ink of a distinctive colour by means of a pad. When the projector is run over the writing on a cheque, the paper is perforated and ink driven right into it. Erasion of the writing is then impossible and if efforts are made to alter a cheque treated with the roller, the ink used leaks through the holes and the fraud is readily detected.

MECCANO

ACCESSORY OUTFITS

Meccano Accessory Outfit No. 2a

are the stepping stones to bigger and better models

Meccano Accessory Outfit No. 3a

BOYS,
think of the hundreds of additional models you could build if you converted your present Outfit into the one next higher by means of an Accessory Outfit. Maybe you would be able to build some of the fine examples illustrated below, or even bigger ones than these. Meccano Accessory Outfits connect all the main Outfits from No. 00 to No. 7. A No. 00 may be converted into a No. 0 by adding to it a No. 00a Accessory Outfit—a No. 0a would then convert it into a No. 1, and so on.
Get the Accessory Outfit you require to-day—and have more fun!

MECCANO LIMITED
Old Swan, Liverpool

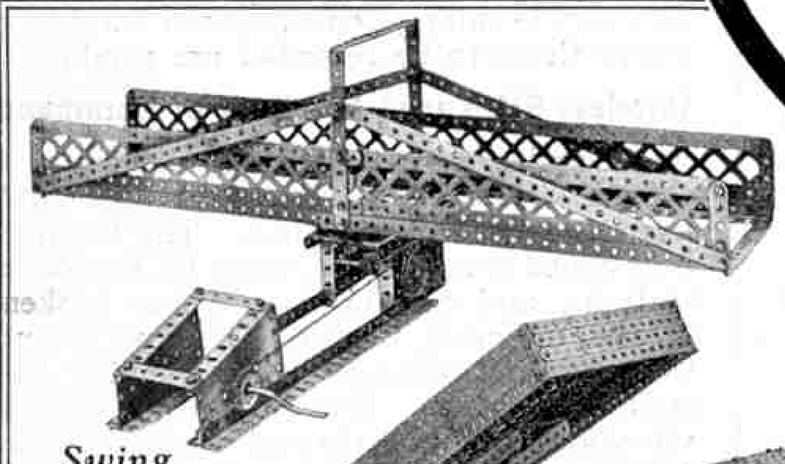
Price List of
Meccano Accessory Outfits

No. 00a converts a No. 00 Outfit into a No. 0	1/6
No. 0a converts a No. 0 Outfit into a No. 1	5/6
No. 1a converts a No. 1 Outfit into a No. 2	7/-
No. 2a converts a No 2 Outfit into a No. 3	12/6
No. 3a converts a No. 3 Outfit into a No. 4	26/-

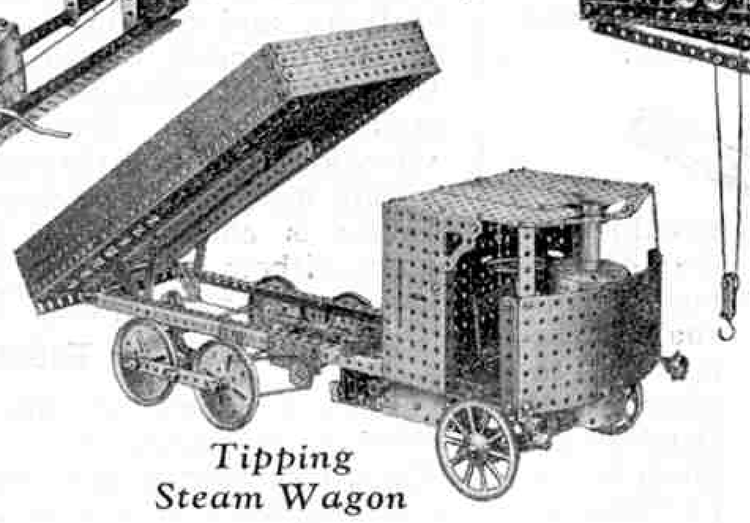
Price List of
Meccano Accessory Outfits

No. 4a converts a No. 4 Outfit into a No. 5	17/6
No. 5a* converts a No. 5 Outfit into a No. 6	55/-
No. 5a† converts a No. 5 Outfit into a No. 6†	97/6
No. 6a† converts a No. 6 Outfit into a No. 7	235/-

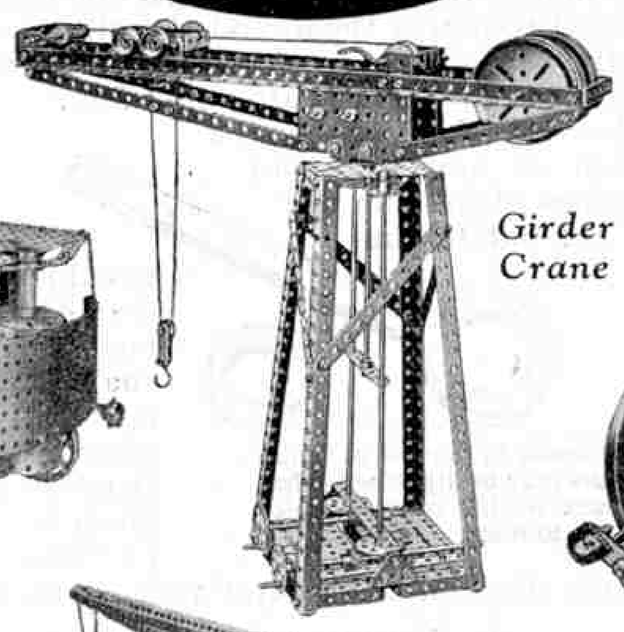
* Carton. † Enamelled cabinet.



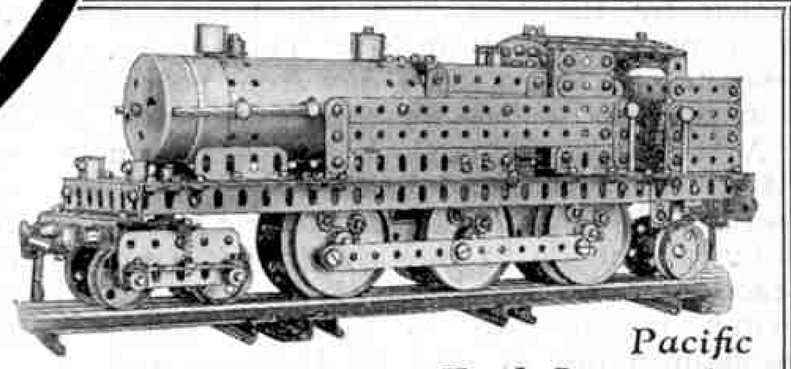
Swing Bridge



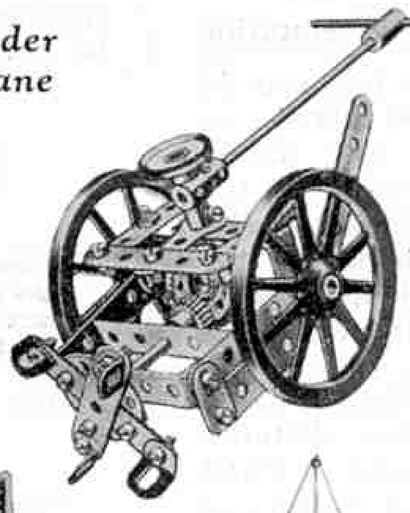
Tipping Steam Wagon



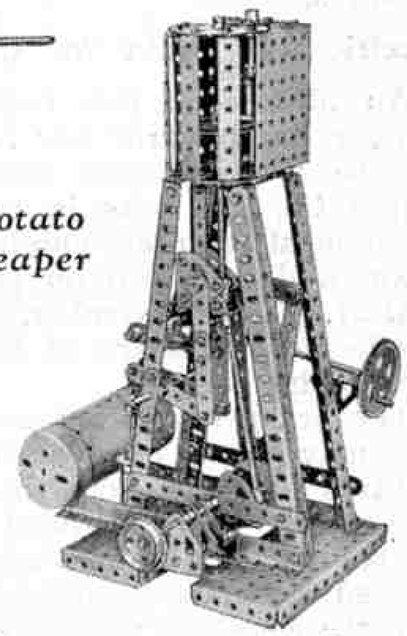
Girder Crane



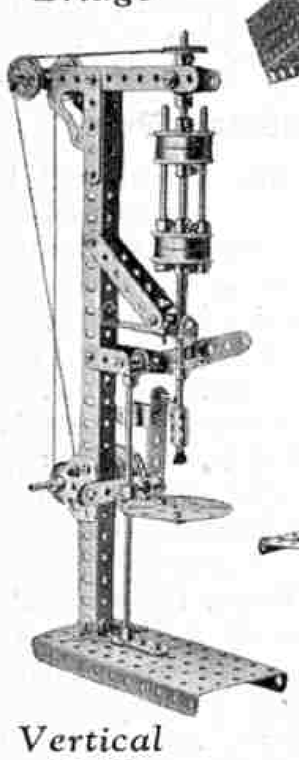
Pacific Tank Locomotive



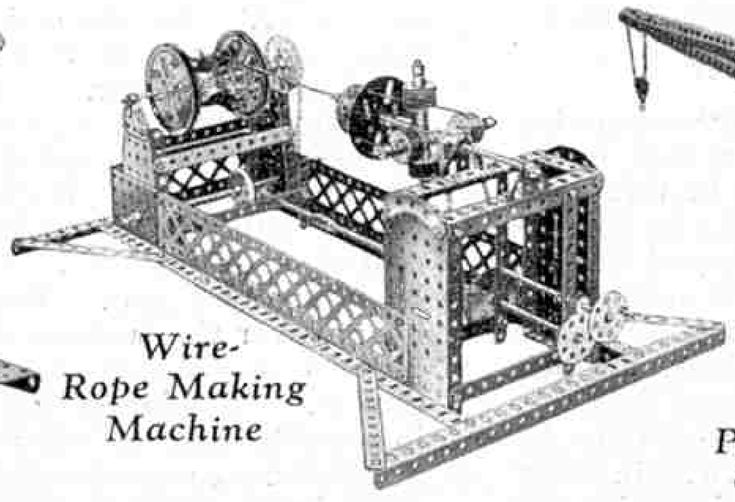
Potato Reaper



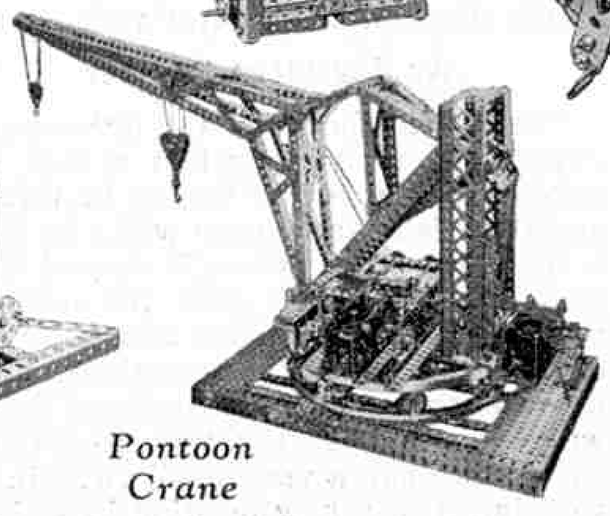
Vertical Marine Engine



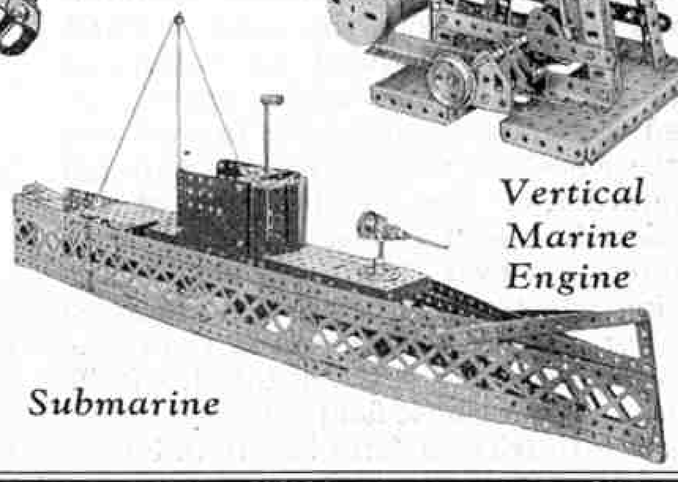
Vertical Drill



Wire-Rope Making Machine



Pontoon Crane



Submarine

A Wonderful Meccano Illusion

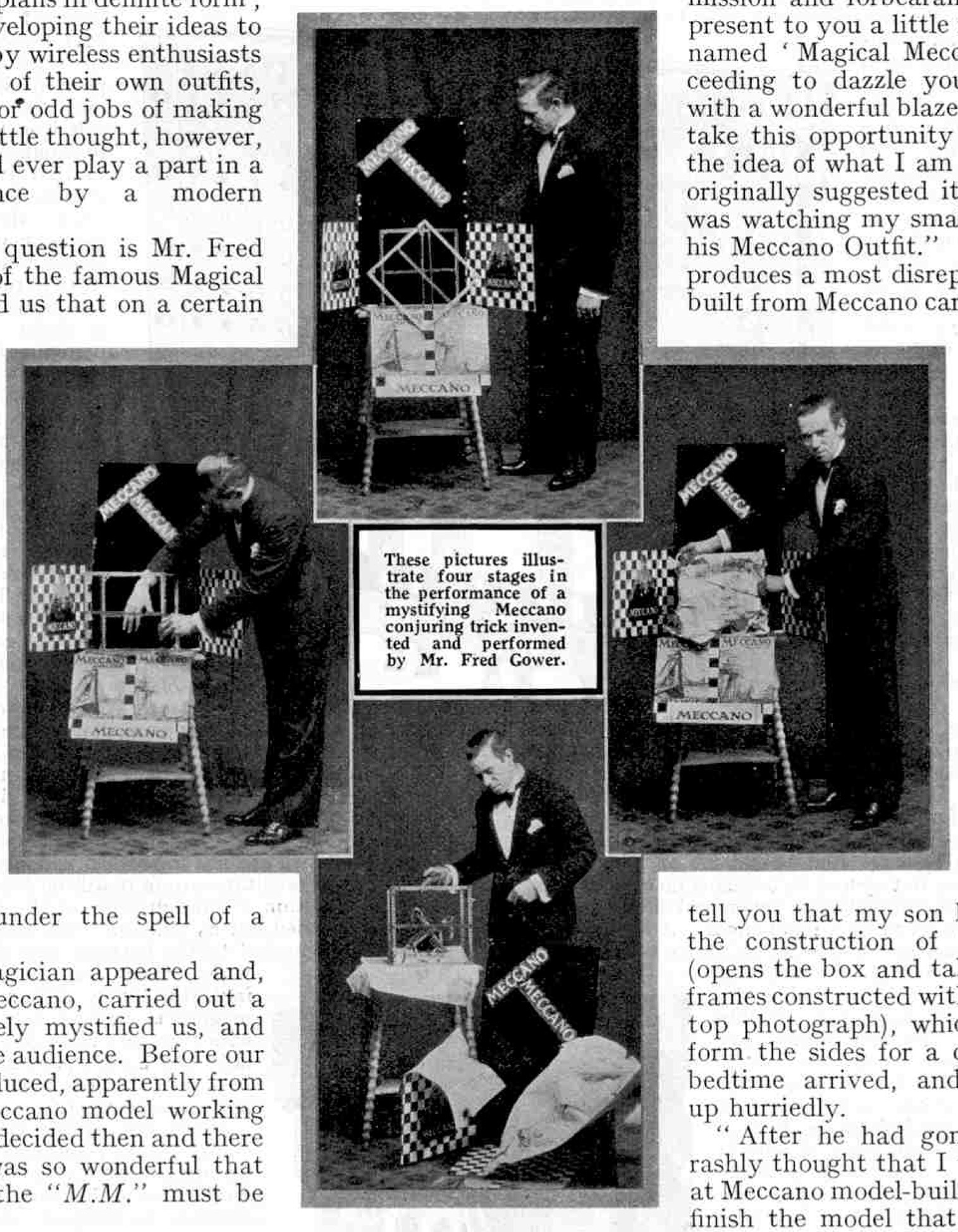
Can you Solve the Mystery?

A Prize for the Best Solution

MECCANO has shown its adaptability over and over again, and often in remarkable circumstances. Quite apart from its original function of providing the world of boys with the means for carrying out real engineering in miniature, it has been used by engineers for expressing their plans in definite form; by inventors for developing their ideas to a practical finish; by wireless enthusiasts in the construction of their own outfits, and by everybody for odd jobs of making and mending. We little thought, however, that Meccano would ever play a part in a striking performance by a modern magician!

The magician in question is Mr. Fred Gower, a member of the famous Magical Circle. He informed us that on a certain evening he intended to present in public an illusion centred round a magical Meccano model, and in due course we took our place among a vast audience filling a London hall. We knew what we could do with Meccano parts with the aid of a screwdriver and a spanner, and we were almost bursting with excitement to see how the familiar parts would behave when they came under the spell of a magician!

Presently the magician appeared and, with the aid of Meccano, carried out a trick that completely mystified us, and astounded the whole audience. Before our eyes Mr. Gower produced, apparently from empty space, a Meccano model working away merrily! We decided then and there that this illusion was so wonderful that all the readers of the "*M.M.*" must be told about it.



These pictures illustrate four stages in the performance of a mystifying Meccano conjuring trick invented and performed by Mr. Fred Gower.

In this article we give an account of the trick in the words of the illusionist, with a note here and there to show how matters appear from the point of view of the audience. After that we leave readers to puzzle out the solution for themselves. For convenience of explanation the trick is divided into four "acts," each of which is shown in one of the accompanying illustrations.

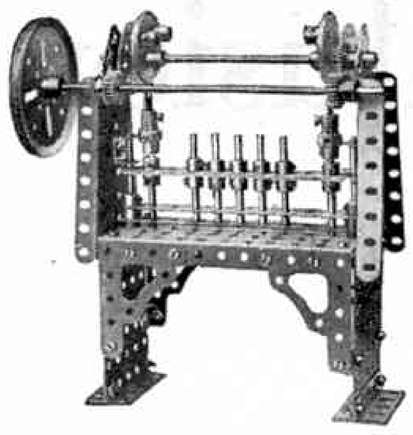
After acknowledging the applause with which he is greeted, Mr. Gower at once takes his audience into his confidence.

"Ladies and gentlemen," he says, "With your permission and forbearance I would like to present to you a little illusion that I have named 'Magical Meccano.' Before proceeding to dazzle your bewildered eyes with a wonderful blaze of magic, I wish to take this opportunity of explaining that the idea of what I am about to show you originally suggested itself to me while I was watching my small son playing with his Meccano Outfit." (Here the conjurer produces a most disreputable-looking box built from Meccano cardboard posters and showcards, and containing a Meccano Outfit).

"I hope you will excuse this box in which I carry my apparatus about. I admit that it is more like one of Heath Robinson's creations than a Meccano carton, but that is because I am far from being an adept at carpentry. However, ladies and gentlemen, to resume my story I must tell you that my son had just completed the construction of these four frames (opens the box and takes out four square frames constructed with Angle Girders, see top photograph), which he said were to form the sides for a doll's house. Then bedtime arrived, and he had to pack up hurriedly.

"After he had gone to bed I rather rashly thought that I would try my hand at Meccano model-building, and if possible finish the model that my son had commenced. So I bolted the four walls together like this (fastens the four sides together to form a cubic frame, photograph on left). However, having performed this Herculean task very creditably, I am ashamed to say that I got rather tired of model-building. I decided to pack up, and so taking a few sheets

(*Continued on page 68*)



Suggestions Section

Edited by "Spanner"

(254) Indicating Device for Electric Bell

(Developed from suggestion by H. W. Webb, London, N.23)

In large offices and other establishments where it is necessary to summon messengers to the different departments, a system of electric bells is generally employed. The person requiring a messenger touches a bell push, which completes an electric circuit and causes a bell to ring in another department. If several bells are used it is difficult to distinguish between them by sound, and some means must be provided to show clearly in which room attention is required. The best known device for this purpose is in the form of a box with a number of small "windows," behind each of which a pendulum can be made to swing. Each push is arranged to operate one of the pendulums when the bell is rung, and as these are all numbered it can be seen at a glance which department issued the summons. This system is employed in many hotels and in private houses as a means of communication between the different rooms and the kitchen. Each indicator may also be used to summon several individuals according to the number of rings given on the bell.

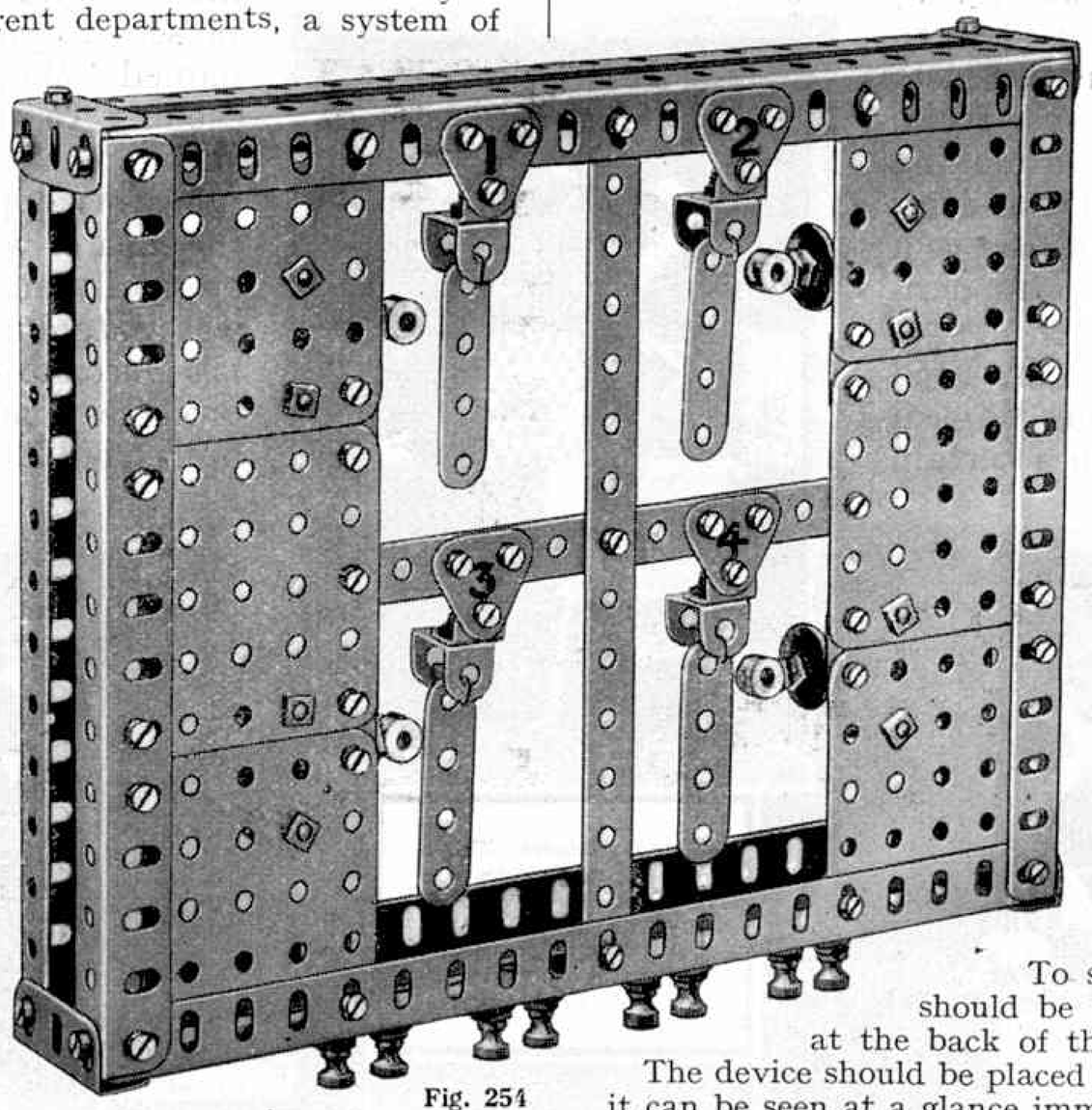


Fig. 254

A Meccano model of one of these indicators is shown in Fig. 254, and the practical uses of the model will suggest themselves to most readers. The frame should be built up as follows. Two $9\frac{1}{2}''$ and two $7\frac{1}{2}''$ Angle Girders are bolted together in the form of a rectangle and at each corner a $1\frac{1}{2}''$ Girder is secured. Further $9\frac{1}{2}''$ and $7\frac{1}{2}''$ Angle Girders are bolted to these. Three $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates are attached to the side Girders of the frame, but spaced by a washer on each securing bolt, except those passed through the upper and lower Girders. Flat Brackets join the Plates at their inner edges. A $7\frac{1}{2}''$ and a $5\frac{1}{2}''$ Strip divide the open space into four sections, above each of which a $1''$ Triangular Plate is bolted. These Plates form a convenient means of numbering the indicators, and also support the Double Brackets from which the pendulums are suspended. The pendulums consist of $2''$ Strips, and to minimise friction so that they swing quite freely, they are each suspended from a length of wire attached to the Double Bracket. The centre of each piece of wire is shaped in the form of a deep V to prevent lateral movement of the Strips, and the ends are passed through the holes in the Brackets and bent underneath.

The pendulums are set in motion by electro-magnets placed behind the plates at the sides of the model. The arrangement of one of the magnets is shown in Fig. 254a. The Bobbin is wound with four layers of No. 23 gauge S.C.C. wire, and is covered with several layers of paper to protect the windings. Two Angle Brackets are attached by $1''$ Screwed Rods to the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate to form a support for the solenoid, which is clamped in position by a $1\frac{1}{2}''$ Strip passed over the ends of the Rods. A soft iron Core is inserted in the solenoid, and should be arranged so that its inner end is within approximately $\frac{1}{4}''$ of the pendulum when the latter is hanging perpendicularly. A Collar is screwed on to the end of the Core so that the $2''$ Strip is prevented from touching the iron, which has a slight tendency to become permanently magnetised after a long period of use. The Collar prevents the Strip from remaining attached to the Core after the electric current is cut off. The three remaining magnets are arranged in a similar manner, and all four are connected in pairs to four sets of terminals secured to the lower Girder of the frame of the model, but insulated by means of Insulating Bushes and Washers.

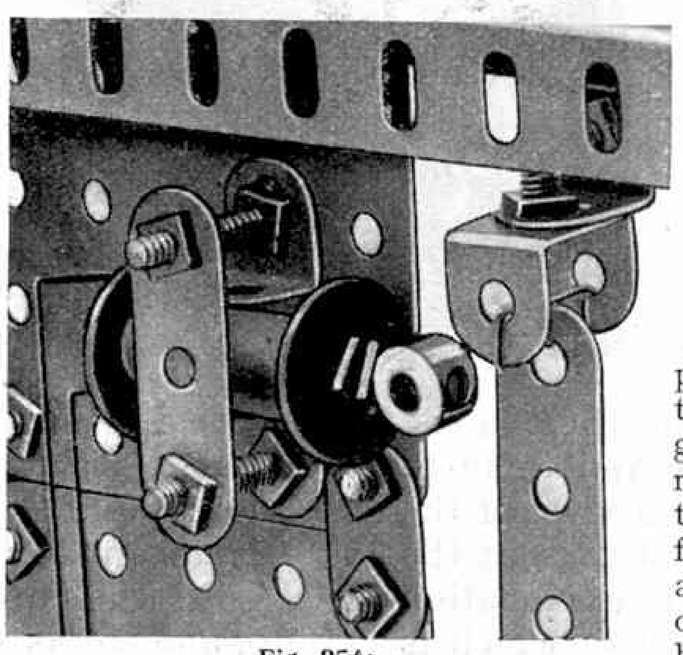


Fig. 254a

To secure the model in position, screws should be passed through the Angle Girders at the back of the frame.

The device should be placed in some prominent position so that it can be seen at a glance immediately the bell rings. If used in the house, probably the most suitable position is above the door leading from the kitchen, as it is generally necessary for the person answering the bell to pass through this door. In this case the indicators would operate from the front door, dining room, lounge, etc., according to individual requirements. The positions of the battery and bell are not important so long as the latter is easily heard, but to facilitate wiring it will be found more convenient to place them within a short distance of the indicator. The wiring should be carried out as follows. One wire from bell push No. 1 should be connected to the battery, and the other to one of the wires from the electro-magnet operating indicator No. 1. The remaining wire from the magnet is connected to the bell and another wire from the bell is led to the battery. Similarly bell pushes Nos. 2, 3, and 4 are arranged in series with the magnets of indicators 2, 3, and 4 respectively.

When one of the electro-magnets becomes energised, the pendulum is attracted and swings up against the Collar on the end of the Core. Immediately the current is switched off, the pendulum is released and continues to swing to and fro for a considerable time. Thus a glance at the indicator shows from which room the summons was sent. It is essential that the pendulums should swing perfectly freely, as they must continue to oscillate for a considerable period after the current is cut off, to allow sufficient time for persons hearing the bell to observe the indicator.

(255) Reversing Gear

(J. Hinderton, Warrington)

The very compact form of reversing gear shown in Fig. 255 possesses several distinct advantages over other types of reversing mechanism. In both forward and reverse positions the ratio between the driving and driven shafts is 1 : 1, so that these always rotate at equal speeds.

The design of the gear box obviates the necessity for either of these shafts to be slidable, so that the adaptability of the device is increased considerably.

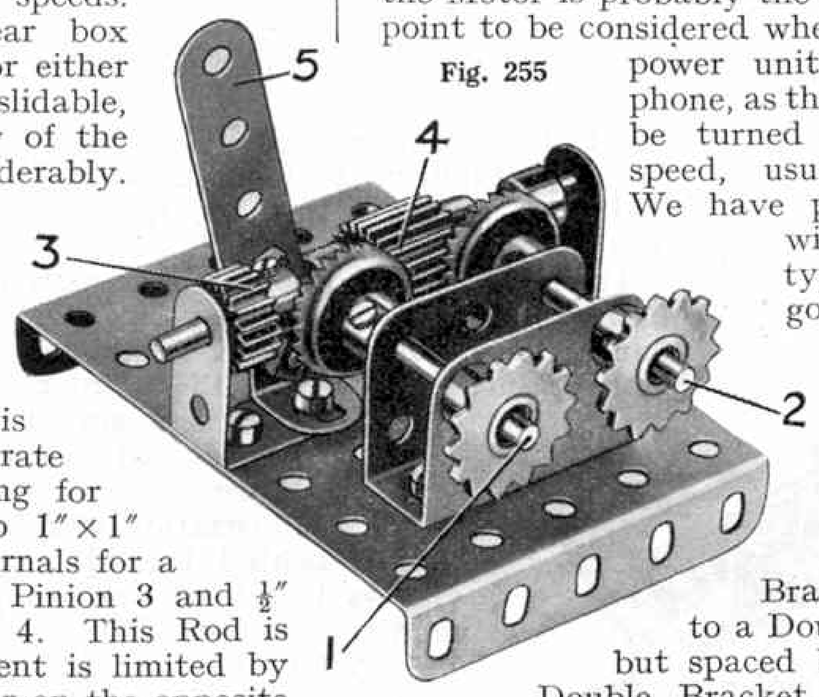


Fig. 255

The driving shaft 1 and driven shaft 2 are journalled in a Channel Bearing secured to the base plate, and each carries a ¾" Sprocket and ¾" Contrate. A washer is placed between each Contrate and the Channel Bearing for spacing purposes. Two 1"×1" Angle Brackets form journals for a 3" Rod carrying the ½" Pinion 3 and ½" diameter ½" face Pinion 4. This Rod is slidable, but its movement is limited by the Pinion 3 and a Collar on the opposite end of the Rod. The 2½" Strip 5 is pivotally connected to an Angle Bracket attached to the base and carries in its second hole a bolt, the shank of which fits into the space between the boss of the Pinion 3 and a Collar on the same rod. In the position shown the Pinion 4 meshes with both Contrates, so that the shaft 2 is rotated in the opposite direction to the driving shaft. When the lever 5 is moved over to the right, the Pinion 4 continues to mesh with the Contrate on the Rod 2, but slides out of engagement with the other Contrate, and the Pinion 3 engages this Wheel. It will be seen that in this position both shafts 1 and 2 rotate in the same direction.

(256) Centrifugal Speed Governor

(J. Harcourt, York)

The novel type of governor shown in Fig. 256 is particularly suitable for incorporation in a model gramophone. An efficient means of controlling the speed of the Motor is probably the most important point to be considered when designing the power unit for a gramophone, as the turntable must be turned at a constant speed, usually 78 r.p.m. We have previously dealt with different types of Meccano governing devices, but Harcourt's idea is worthy of mention on account of its extreme compactness.

Two Angle Brackets are secured to a Double Arm Crank but spaced by washers. A Double Bracket is secured between the Angle Brackets, and two Flat Brackets 1 that are bent slightly are held by the same securing bolts. The shorter arm of a 1"×½" Angle Bracket is pushed under the Double Bracket at each side, and the Rod inserted in the boss of the Crank is pushed through to hold the brackets in position. A 1½" Strip is secured to each side Bracket, but in Fig. 256 one of these is shown removed to reveal the position of the Steel Balls. When the two Balls are in position, the 1½"×½" Double Angle Strip 2 is passed over the end of the Rod and held in place by a Compression Spring.

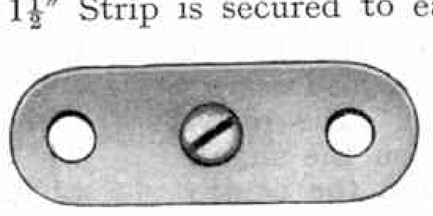
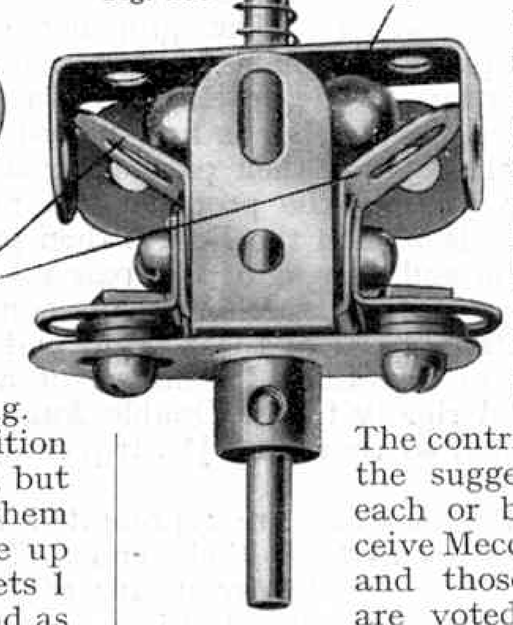


Fig. 256



The Steel Balls occupy the position shown when the governor is stationary, but as it rotates, centrifugal force causes them to move outward. As the balls move up the inclines formed by the Flat Brackets 1 they raise the Double Angle Strip 2, and as the speed increases the balls continue to fly outward until their movement is checked by the arms of the Double Angle Strip. The 1½" Strips at the side of the governor serve the dual purpose of keeping the balls in position and of preventing the Double Angle Strip from rotating independently of the governor.

To control the speed, the Double Angle Strip should be pressed downward by means of a Strip or other suitable part, the position of which can be varied by operating a Screwed Rod. Another method of regulating the movement of the Double Angle Strip is to place a Bush Wheel face downward under the Compression Spring on the governor shaft, and insert a short Screwed Rod in its boss. The latter Rod should not grip the axle, which must revolve freely in the wheel, and a nut should be placed in position to hold the Screwed Rod secure in the boss. The longitudinal bore of a Threaded Boss should be passed over the end of the Rod, and a further Screwed Rod, placed parallel to the governor shaft, and inserted in the transverse hole of the Threaded Boss, can be made to alter the position of the wheel.

Suggestions Voting Competition

Competitions organised in the past to ascertain which suggestions meet with the most popularity with "*M.M.*" readers, have been so successful that we have decided to organise a Voting Contest for the best suggestion published during 1931. The total number of suggestions published from January to November (inclusive) is 43, from Nos. 211 to 253, and many varied subjects have appeared among them. "Spanner" receives so many interesting ideas that he finds it difficult to pick out the limited number for publication each month. By means of voting competitions he is able to find out which subjects are of the greatest interest to the majority of readers, and so he is better able to meet their requirements. Competitors are asked to write down on a postcard the number of the suggestion that they consider to be the best, and the numbers of the three next best in order of merit. All the votes will be recorded, so that the four most popular suggestions can be ascertained at the close of the contest.

A separate section is provided for Overseas readers, and the voting in this section will in no way influence the Home Section voting. It will thus be possible for two different sets of suggestions to be voted best, and the opinions of Home and Overseas readers will form an interesting comparison. In each section a prize of Meccano Parts value one guinea will be awarded to the sender of the list most nearly corresponding with the final result of the voting, and in addition 12 consolation prizes will be awarded to the "runners up." The contributor who submitted the suggestion voted best in each or both sections will receive Meccano parts value 10/6, and those whose suggestions are voted next best will receive consolation prizes.

Post cards must be addressed to Suggestions Voting Competition, Meccano Ltd., Binns Road, Old Swan, Liverpool, and must be posted so that entries in the home section are received not later than 29th February, 1932. Overseas entries will not be accepted after the 30th April, 1932.

Miscellaneous Suggestions

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

(M.140). Non-Skid Tractor Wheels.—One of the difficulties of model tractor construction is to prevent wheel-slip when dealing with heavy loads. The miniature Dunlop Tyres give a good grip upon most surfaces, but on loose ground even these will not prevent the wheels from slipping round. R. E. Bradfield (Didcot, Berks.) uses Sprocket Chain to overcome the difficulty, by forming a loop of Chain to fit round the Tyre and pressing tacks through the Chain at regular intervals. The heads of the tacks rest on the Tyre, and the points should be cut off so that only a short length protrudes through the Chain to give a positive grip.

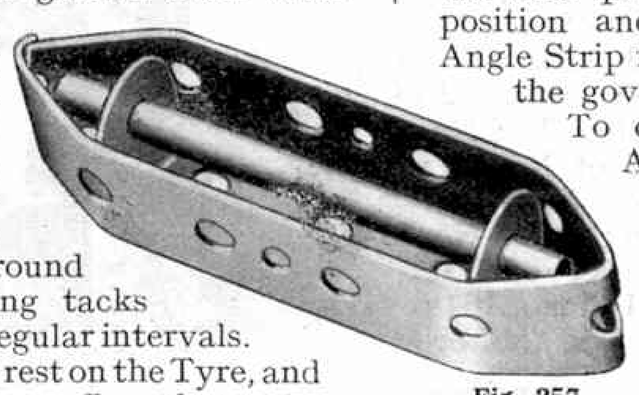


Fig. 257

(M.141). Simple Caterpillar Track.—E. Whalley (Blackburn) suggests an ingenious method of constructing caterpillar track from the tins in which Nuts, Bolts, and Spring Clips, etc., are purchased separately. The lids are secured to a length of Sprocket Chain by bolts passed through their centres and held in place by nuts. The chain passes between two 3" Tyres fitted on Pulleys that are mounted close together on the same Rod, and the tins rest on the Tyres.

(257) Loom Shuttle

(G. Hugel, Mulhouse, France)

The shuttle illustrated in Fig. 257 is particularly suitable for use in small model looms, as the only three parts used in its construction are contained in the smaller Meccano Outfits. It is not generally advisable to bend Meccano parts, but in this case we think the excessive bending of the 5½" Strip is justified by the results. The Strip is bent across its centre hole as shown, and one of its rounded ends is filed off, so that the flat edge so formed can be held under the other end of the Strip when bent over. A 1½" Double Angle Strip is forced between the sides of the shuttle, and the 2" Axle Rod, held in its end holes, carries the thread for the weft. The thread should be passed through a small hole drilled in the centre of the shuttle for this purpose.

New Meccano Models

Racing Seaplane—Electric Engine—Breakdown Crane—Boat Lowering Gear

THE splendid performance of the British Supermarine S6B Seaplane in the recent Schneider Trophy event, and the amazing achievement of Flt. Lt. Stainforth in raising the world's speed record to 407.8 m.p.h., will have fascinated every Meccano boy. Model-builders consequently will be keen to construct the realistic little model of one of the machines shown in Fig. 1.

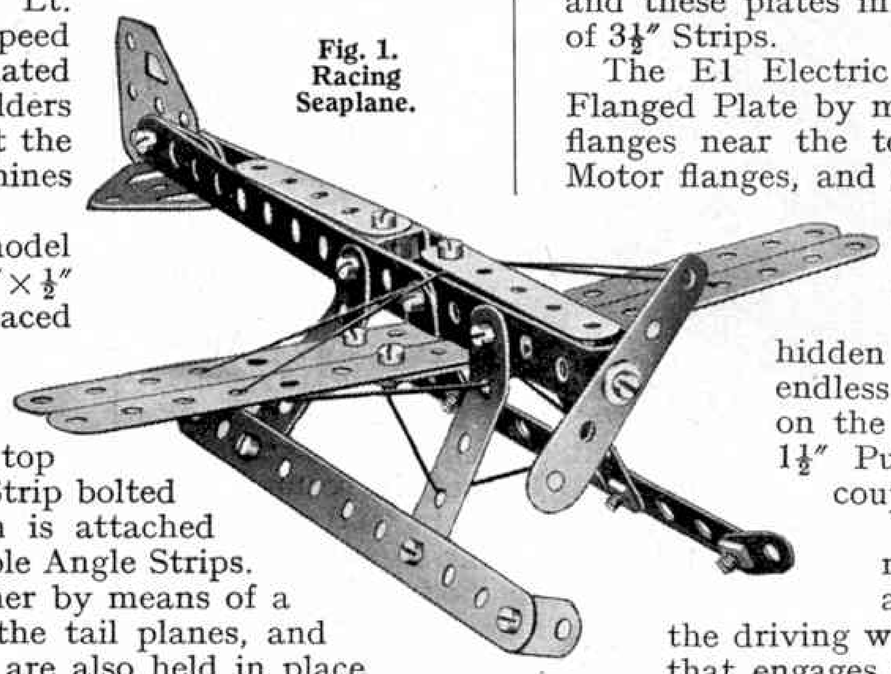


Fig. 1. Racing Seaplane.

The sides of the fuselage of the model consist of two $5\frac{1}{2}''$ Strips and two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. These are spaced apart at the centre by a Double Bracket, and a $2\frac{1}{2}''$ trip is secured to this to form a cover for the rear top portion of the fuselage. The front top part of the fuselage consists of a $2\frac{1}{2}''$ Strip bolted to an Angle Bracket, which in turn is attached to the end flanges of the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The tail of the fuselage is held together by means of a bolt. Two Trunnions representing the tail planes, and a Flat Trunnion forming the rudder, are also held in place by the bolt securing the tail end of the fuselage. The wing of the machine is built up from four $5\frac{1}{2}''$ Strips overlapped and bolted together, and is held to the underside of the fuselage by means of two Angle Brackets. The propeller of the model consists of a $2\frac{1}{2}''$ Strip pivoted on a $\frac{3}{8}''$ Bolt which also serves to hold the front portion of the fuselage in place. The pivot is assembled as follows. A Washer is first placed on the shank of the $\frac{3}{8}''$ Bolt, and the Bolt is then passed through the centre hole of the $2\frac{1}{2}''$ Strip forming the propeller. A nut is screwed on to the shank of the Bolt, and the Bolt is then passed through the perforations in the end flanges of the pair of Double Angle Strips forming the front of the fuselage. A second nut is now secured on the projecting shank of the $\frac{3}{8}''$ Bolt and the two nuts are rotated in opposite directions by means of a Spanner, so that the Bolt is locked rigidly to the Double Angle Strips. The Nuts should be adjusted so that the $2\frac{1}{2}''$ Strip may rotate freely on the $\frac{3}{8}''$ Bolt.

The "floats" of the machine are represented by $5\frac{1}{2}''$ Strips having Flat Brackets secured to their ends. The floats are held to the fuselage of the model by means of "float struts" consisting of $2\frac{1}{2}''$ Strips. Meccano Cord is secured as shown to brace the wing and float struts.

The Meccano Racing Seaplane is composed of the following parts: 8 of No. 2; 7 of No. 5; 2 of No. 10; 1 of No. 11; 3 of No. 12; 21 of No. 37; 2 of No. 37a; 1 of No. 38; 1 of No. 40; 2 of No. 48a; 1 of No. 111c; 2 of No. 126; 1 of No. 126a.

Electric Locomotive

The model electric locomotive shown in Fig. 2 makes use of the overhead cable system for supplying current to the Electric Motor. The current is fed to the Motor from the overhead feed cable by means of the "pantograph" mounted on the roof of the engine. It then passes through the Motor windings to the frame of the engine, and so to the rails via the wheels. One pole of the battery is connected to the rails while the other is joined to the overhead cable, so that a complete circuit is made.

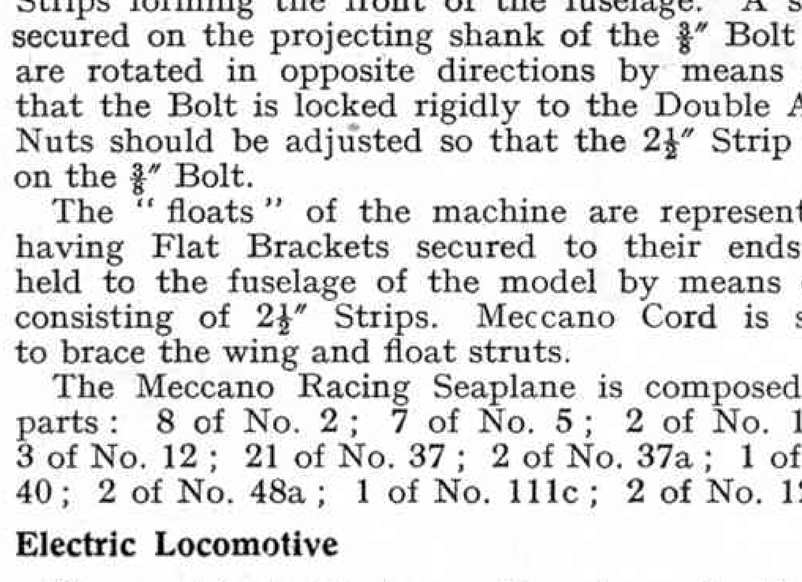


Fig. 2. Electric Locomotive.

The main frame of the Meccano model consists of two $12\frac{1}{2}''$ Angle Girders, spaced apart at the ends by means of $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. Two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates are secured in between the Girders, and these plates in turn are spaced apart at the top by means of $3\frac{1}{2}''$ Strips.

The E1 Electric Motor is supported between the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate by means of a $3\frac{1}{2}''$ Strip secured across the Motor flanges near the top, and two Angle Brackets bolted to the Motor flanges, and to the $12\frac{1}{2}''$ Girders at the base. A $4\frac{1}{2}''$ Axle Rod is mounted in the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates and carries a $1\frac{1}{2}''$ Pulley and a Worm. The Worm can be seen in the illustration, while the $1\frac{1}{2}''$ Pulley is of course hidden behind the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. An endless length of Cord is passed round the Pulley on the armature shaft of the Motor and round the $1\frac{1}{2}''$ Pulley, so that the Motor armature shaft is coupled to the shaft carrying the Worm.

An additional frame is arranged below the main Girders as can be seen in the illustration, and this serves to support the axles carrying the driving wheels. One of these axles carries a $\frac{1}{2}''$ Pinion that engages with the Worm on the shaft coupled to the Motor. In the model it will be seen that both $\frac{3}{4}''$ Flanged Wheels and $1''$ fast Pulleys have been used for the road wheels. If eight $\frac{3}{4}''$ Flanged Wheels are available these should be used, as they will provide better running.

The pantograph mounted on the roof of the locomotive consists of eight $2\frac{1}{2}''$ Strips and three $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The $2\frac{1}{2}''$ Strips are pivotally connected to the Angle Strip by means of bolts and lock nuts. The lower pairs of Strips are pivotally secured to four Angle Brackets and these in turn are secured to a sheet of stiff cardboard, size $2\frac{1}{2}'' \times 3\frac{1}{2}''$, which forms the roof of the engine. The cardboard serves to insulate the pantograph from the frame of the model. The pantograph is kept pressed against the overhead cable by means of a Spring (part No. 43) anchored between two of the pivoted $2\frac{1}{2}''$ Strips. One terminal of the Motor is connected to the pantograph frame while the remaining Motor terminal is joined to the frame of the model. For details of overhead feed cable supports suitable for use with the model, see the *"M.M."* for May 1928, page 431.

Parts used in the Electric Locomotive are as follows:—6 of No. 3; 2 of No. 4; 12 of No. 5; 2 of No. 6a; 2 of No. 8; 8 of No. 10; 12 of No. 12; 1 of No. 15a; 4 of No. 16; 4 of No. 20b; 1 of No. 21; 4 of No. 22; 1 of No. 26; 1 of No. 31; 1 of No. 35; 94 of No. 37; 6 of No. 37a; 1 of No. 40; 1 of No. 43; 1 of No. 46; 10 of No. 48a; 2 of No. 48b; 2 of No. 52; 2 of No. 53; 2 of No. 54; 4 of No. 59; 4 of No. 111c; 4 of No. 125; 1 of No. 164; 1 Electric Motor.

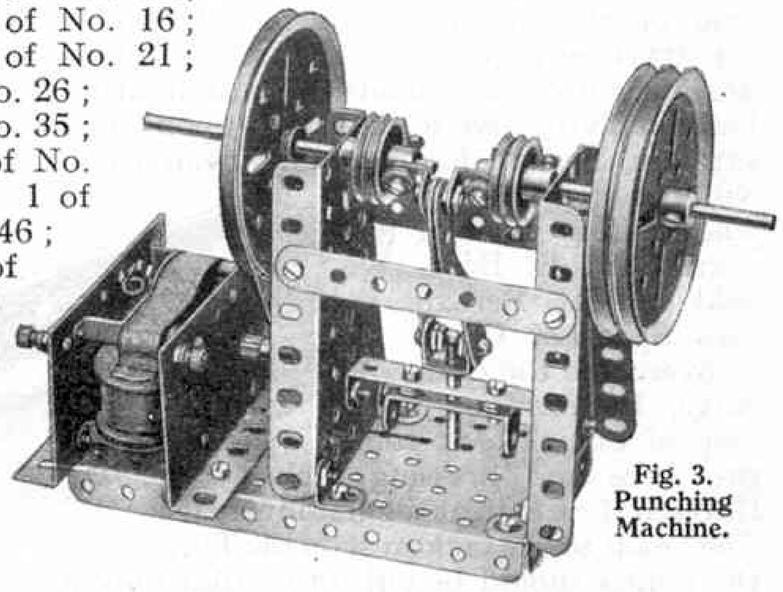


Fig. 3. Punching Machine.

Power Punching Machine

The simple model of a punching press shown in Fig. 3 is driven by means of a Meccano E1 Electric Motor. It will be found particularly suitable for inclusion in a Meccano workshop along with other power-driven models.

The crankshaft of the model consists of two $3\frac{1}{2}''$ Axle Rods, one of which carries two $3''$ Pulley Wheels butted together to form a flywheel, while the other carries one $3''$ Pulley. Each $3\frac{1}{2}''$ Axle Rod is fitted with two $1''$ fast Pulleys. An Angle Bracket is clamped to the boss of one of each of the pairs of $1''$ Pulleys, a standard Bolt having two Washers placed under its head being used for this purpose. The Angle Brackets form the web of the crankshaft and they carry a $\frac{3}{8}''$ Bolt that forms the crank pin.

Two 2½″ Strips forming the connecting link between the crankshaft and the punch itself are secured on the ⅜″ Bolt, three nuts being used to space the 2½″ Strips between the webs of the crankshaft. The lower ends of the 2½″ Strips are pivotally secured by means of bolts and locknuts to a Double Bracket, to which the punch (a 1½″ Rod) is secured. The crankshaft is driven by means of an endless length of cord that passes round the pulley on the armature shaft of the Motor, and round the 3″ Pulley on the crankshaft.

In order to build the Punching Machine the following parts will be required: 8 of No. 2; 2 of No. 3; 1 of No. 4; 2 of No. 6a; 4 of No. 12; 2 of No. 16; 1 of No. 18a; 3 of No. 19b; 3 of No. 22; 1 of No. 24; 2 of No. 35; 48 of No. 37; 4 of No. 38; 1 of No. 40; 1 of No. 48; 8 of No. 48a; 1 of No. 52; 1 of No. 111c; 2 of No. 126a; 1 Electric Motor.

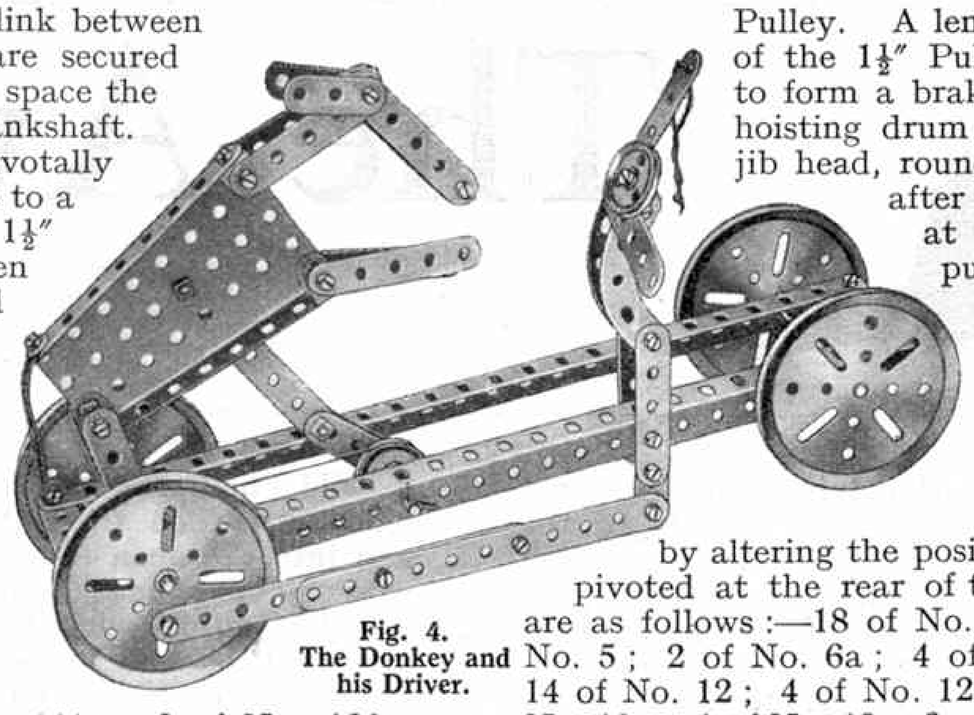


Fig. 4. The Donkey and his Driver.

Donkey and Driver

The model shown in Fig. 4 provides a very amusing effect when pushed along the ground. The donkey prances up and down, and the driver sways to and fro, brandishing his whip in front of the "animal."

The frame of the model consists of two 12½″ Angle Girders, connected at the ends by 2½″ Strips. A 3½″ Axle Rod is journalled at each end of the frame, and these Axles carry 3″ Pulleys that form the travelling wheels. The body of the donkey consists of a Sector Plate and two 2½″ Strips are secured to this to form the neck. Two 2½″ Strips form the head, while two 1½″ Strips are used to represent ears. Four 2½″ Strips are used for the legs, and the hind legs are pivoted on the rear axle, which carries a 1″ Pulley driving a similar Pulley mounted on the crankshaft built up as follows. Two Cranks each carrying 1½″ Rods are secured together by a ⅜″ Bolt passed through their elongated holes. Three nuts on the Bolt hold the Cranks rigidly in alignment, and a 3½″ Strip is free to pivot about the bolt shank. This Strip is pivotally connected to the Sector Plate.

The driver is built up from 2½″ Strips and Curved Strips; a 1″ loose Pulley Wheel forms his head. The legs are pivoted to one of the Angle Girders of the frame, and one of them is connected to a 3″ Pulley on the rear axle by means of two 5½″ Strips overlapped and bolted together to form a strip 7½″ long.

When the model is pushed forward, the connecting link causes the driver to sway to and fro, and at the same time the crankshaft driven by means of a length of cord gives an up-and-down movement to the donkey. To complete the model, the driver's whip should be made from a short length of cord, while several lengths of cord may be attached to the Sector Plate to form the donkey's tail.

The Meccano Donkey and Driver contains the following parts:—2 of No. 2; 1 of No. 3; 12 of No. 5; 2 of No. 6a; 2 of No. 8; 2 of No. 10; 4 of No. 11; 5 of No. 12; 2 of No. 16; 2 of No. 17; 4 of No. 19b; 2 of No. 22; 1 of No. 22a; 26 of No. 37; 6 of No. 37a; 6 of No. 38; 1 of No. 40; 2 of No. 48a; 1 of No. 54; 2 of No. 62; 2 of No. 111c.

Motor Breakdown Crane

The prototype of the model shown in Fig. 5 is generally mounted on a motor lorry for dealing with disabled cars on the road. As will be seen from the illustration, the jib of the model is of very sturdy construction, and consists of two channel section girders built up from Angle Girders and connected together by 3″ Strips. Bracing is added by further Strips that are joined across the middle by Axle Rods.

Two 1″×1″ Angle Brackets are pivoted at the head of the jib, and a 2″ Rod is passed through each of these, and carries a 1″ fast Pulley and a 1″ loose Pulley. The hoisting gear consists of a Sleeve Piece pushed over two Flanged Wheels that are secured on a Rod journalled in the side Girders of the jib. The Rod carries a 57-teeth Gear that meshes with a ½″ Pinion on a second Rod carrying a Crank at each end and also a 1½″ Pulley. A length of Cord, passed round the groove of the 1½″ Pulley, is attached to a weighted lever to form a brake. Two Cords are wound on to the hoisting drum and passed over the Pulleys at the jib head, round the single sheave pulley block, and after passing over the remaining Pulleys at the end of the jib are secured to the pulley block. Hooks are formed from 1″×1″ Angle Brackets and Threaded Pins.

The base is built up from Strips and Girders, and the jib is pivoted on a Rod passed through its centre and inserted in Double Brackets. The angle of the jib can be varied, by altering the position of the Crankhandle in the 3″ Strip pivoted at the rear of the base. The parts used in the Crane are as follows:—18 of No. 2; 6 of No. 3; 2 of No. 4; 12 of No. 5; 2 of No. 6a; 4 of No. 8; 8 of No. 10; 4 of No. 11; 14 of No. 12; 4 of No. 12a; 2 of No. 15; 3 of No. 15a; 4 of No. 18a; 1 of No. 19; 2 of No. 20b; 1 of No. 21; 4 of No. 22; 2 of No. 22a; 1 of No. 26; 1 of No. 27a; 14 of No. 35; 94 of No. 37; 4 of No. 37a; 10 of No. 38; 1 of No. 40; 2 of No. 45; 4 of No. 48a; 4 of No. 59; 2 of No. 62; 2 of No. 111; 4 of No. 111c; 2 of No. 115; 4 of No. 125; 1 of No. 163; 1 of No. 164; 1 of No. 165; 1 of No. 166.

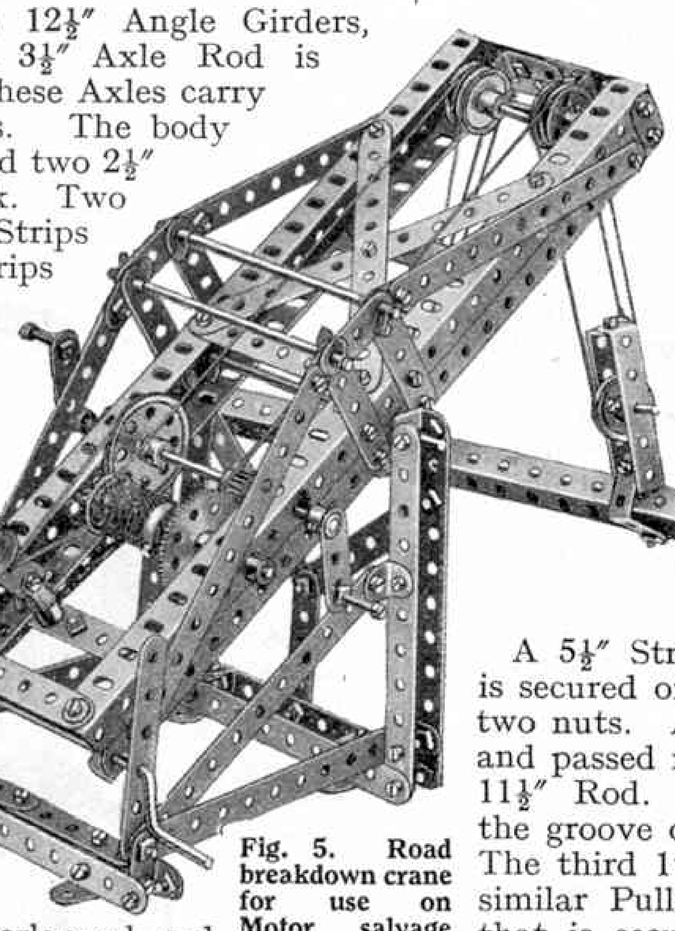


Fig. 5. Road breakdown crane for use on Motor salvage lorry.

Boat Lowering Gear

The model appearing in Fig. 6 represents the type of boat lowering gear now employed on modern liners.

For the base frame, two 12½″ Angle Girders are spaced apart by 2½″×½″ Double Angle Strips and Sector Plates are secured vertically to these and braced by 2½″ Strips. The supports for the boat are formed by Flat Brackets attached to Double Angle Strips which are secured to the side Girders by means of Angle Brackets. An 11½″ Rod passes through the centre holes of these Double Angle Strips and also through the Sector Plates at each end of the model and carries three 1″ Pulley Wheels. A 1½″ Rod is passed through the third hole from the upper end of each Sector Plate, and a ½″ Reversed Angle Bracket forms a second journal for the Rod, which carries at one end a Spring Clip, and at the other a 3″ Pulley.

A 5½″ Strip is secured to each Pulley and a 1″ loose Pulley is secured on the upper end of these by means of a ⅜″ Bolt and two nuts. A length of cord is secured to each of the 5½″ Strips and passed round the groove in the Pulley to a 1″ Pulley on the 11½″ Rod. After passing twice round this and back around the groove of the 3″ Pulley, it is again secured to the 5½″ Strip. The third 1″ Pulley on the 11½″ Rod is connected by cord to a similar Pulley on a 2″ Rod passed through a Double Bracket that is secured to the left-hand Sector Plate. Operation of a Bush Wheel on this Rod causes the arms to swing outward.

The boat is built up from 5½″ Strips and 2½″ Curved Strips. Two 1½″ Strips and four Angle Brackets space the sides apart. The 2½″ Strips at each end are extended by Flat Brackets to each of which a length of cord is attached and passed over the Pulleys at the upper ends of the swinging arms. The cord passes round guides to the Crank Handle on the right hand side of the model. As the cord is wound in the boat is raised from its support and can then be swung outward by operating the hand wheel at the left.

In order to build the Boat Lowering Gear the following parts will be required:—13 of No. 2; 2 of No. 5; 2 of No. 6a; 2 of No. 8; 8 of No. 10; 1 of No. 11; 10 of No. 12; 1 of No. 13; 1 of No. 17; 4 of No. 18a; 1 of No. 19; 2 of No. 19b; 4 of No. 22; 2 of No. 22a; 1 of No. 24; 7 of No. 35; 60 of No. 37; 6 of No. 37a; 8 of No. 38; 1 of No. 40; 4 of No. 48a; 2 of No. 54; 2 of No. 90a; 3 of No. 111c; 1 of No. 115; 2 of No. 125; 2 of No. 126a.

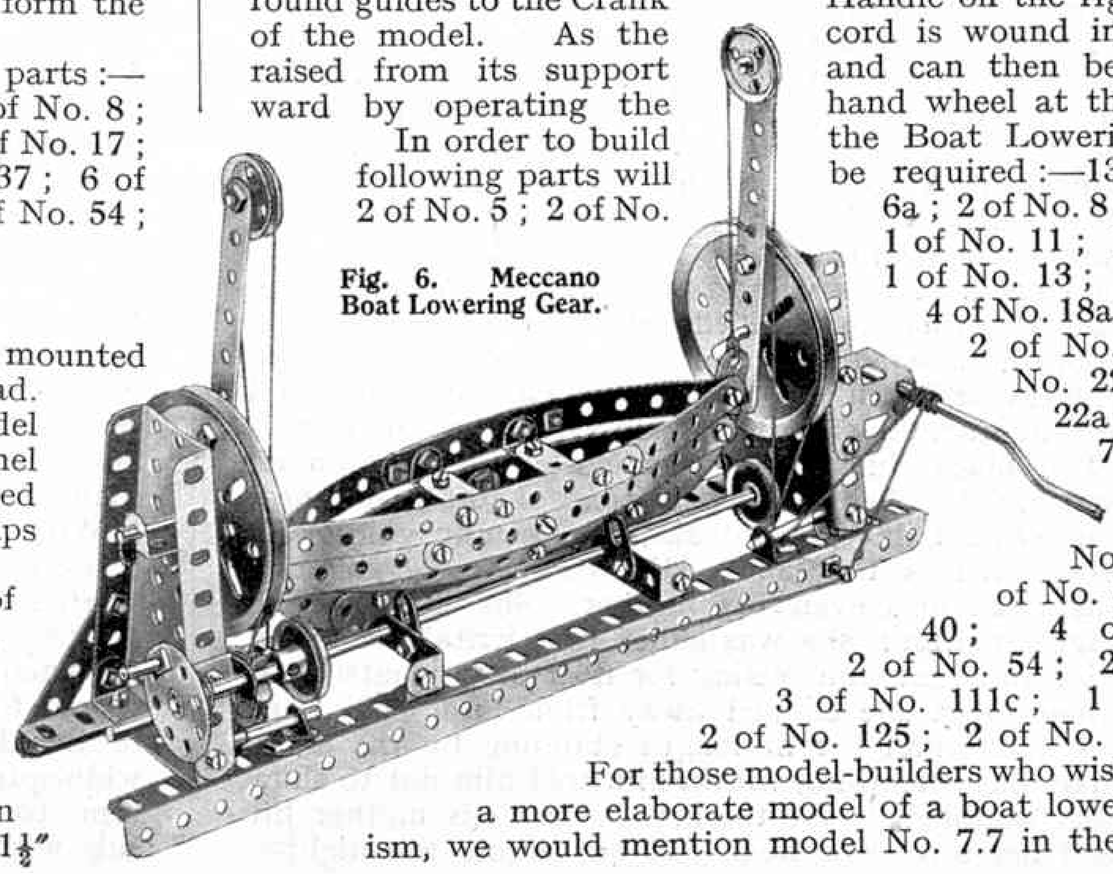


Fig. 6. Meccano Boat Lowering Gear.

For those model-builders who wish to construct a more elaborate model of a boat lowering mechanism, we would mention model No. 7.7 in the 5-7 Manual.

The Avenger of

How a Bull Moose

By A. P. M

THE northern stars, like the sparks of a dying camp fire, had filmed and retreated before the advance heralds of the dawn. It was as though the world of solitude, having spun its course throughout a night of gladness, had suddenly died, leaving behind the tang of fir, faint odour of fern and pungent scent of dew-drenched moss. So rested the far-sweeping forest, dark and silent, a fabric cast from God's great loom whose shuttle had ceased to move.

Then, somewhere deep in the darkness, a single note awoke, and with the strength of sweetness stirred the wilderness to a sigh. Silence again, then the note of the wood bird grew into a gushing song, and a faint murmur grew up among the trees. Later the murmur deepened to a glad rustling, and as if in answer to the wild bird's summons there was light, and sound, and life throughout the solitude.

Deep within a cane-like thicket of birch a cow moose stood, flanks heaving, forelegs widespread and head sagging low above a tiny brown atom of life at her feet. She was young, scarcely yet two-thirds grown, and beautiful in spite of her ungainly lines. Strength lay in the massive shoulders and tapered body, and above the long heavy nose that tenderly touched at intervals the new-born calf on the moss, glowed a pair of great limpid eyes that told of intelligence and indomitable spirit. The calf was scarcely three hours old. With quivering muscles, distended nostrils and quick nervous glances about her, the mother licked its crumpled hair, occasionally dropping to her knees when the strain upon her stilt-like forelegs became too great for comfort.

Days passed, green sweet-scented days, which in time gave place to longer, warmer days of golden sunlight. Late summer found the calf grown to a sturdy little fellow, with a great liking for fun and an equally great dislike for discipline. Now it was not always a caress that he received from his mother; sometimes, in punishment for foolhardiness or greediness, it was a butt from her hard head that sent him to his knees. The birch thicket was still their home, but often the cow led him afield when the lights of morning and evening sprayed the lake and the forest. By the time the summer days grew shorter and the evenings began to take on the crisp of chill, the mother paid little or no attention to him, except when he got himself into danger.

Once when he had tarried too long in the water-pastures and night had overtaken him, he was trailed by a pair of blood-hungry lynxes. Sensing his danger, he bleated frantically for his mother, who seldom strayed far from him. She came to his rescue just in time. The lynxes fought gamely, and one of them paid the supreme penalty of its indiscretion. The bull calf observed how its mother coped with this situation; he learned how his hoofs, as hard as tempered steel, should be used for the killing stroke.

A few evenings after this adventure he met a small black bear face to face on the runway. Believing this his opportunity to try his own prowess against a menace, he promptly charged and struck. The bear, himself nothing more than a cub, gave a grunt of pain, or fear, and went crashing off through the brambles. To the bull calf this was a victory; it gave him confidence in his ability to fight his own battles in the future. Also it had the effect of making him disobedient to his mother; for which he promptly received such chastisement that for many days following he was the most obedient of sons!

The days shortened. At dawn and twilight a white mist hung above the lakes, distorting the reed-beds into huge monster shapes. The leaves drooped, showing tinges of red and gold where green had been. The dwarf thorn tree against which the young bull had rubbed his itching, fly-stung head, stood garbed in berries of crimson. The black ducks that had nested in the remote marshlands, and had quacked to him in voices of soft friendliness throughout the summer days and dusks, now swung voicelessly with their broods across the lake. His world was changing; everything was changing, even his mother. She had become utterly indifferent to him; she was sullen and irritable. Often she charged him and sent him reeling for no reason whatsoever.

One September night she slipped away from him. He went seeking for her and found her at length standing by the shore of the reedy lake, but something within him told him not to show himself. Closely huddled in the thicket, he saw his mother lift her head, heard her send a strange call out across the night—a wild, half-sobbing, half-challenging note, mellow, but far-reaching. Then from the timber sounded an answering note, and into the open came crashing another moose, a gigantic bull with massive head topped by wide-sweeping antlers. It was well for the calf that he was hidden safely from sight, well for him that he had heeded that inner warning. He stole softly away into the forest and hid himself in its densest jungle.

For two weeks and two days the young bull tarried close to

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his place of concealment, which was miles remote from his old feeding ground. He longed to seek his mother, to bask and browse under her protecting eye; but it is doubtful if the mother moose so much as gave her homesick son a thought. The new mate of her choosing was a kingly fellow, high of shoulder, and with a seven-foot spread of antlers. His colour was black, shading to brown on withers, neck and head; from the knees down he was a fawn grey. He weighed well over three-quarters of a ton and stood almost as tall as a horse. On neck and sides he bore many scars of battle, denoting the fact that he was no young gallant of the wild, but rather a veteran in the ranks of love and war. He had reached full maturity, which meant that he must have lived for fifteen years or more, for compared to that of other roamers of the forest the growth of the moose is slow.

With horn and hoof the big bull had dug a "wallow" in the black earth of their birch-girdled trysting place and had demonstrated to his new mate's satisfaction his ferocity, strength and mastery. A change had now come over him. His ferocity had departed, and the rumbling threats and challenges that he had voiced for days and nights were stilled. No longer in very fear of her life was the cow forced to seek the thickets that his wide-spreading antlers debarred him from entering. She followed him to the lake and out into the shallows and fed side by side with him. That day the bull calf came back to the birch

the Northlands

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thicket. Neither his mother nor her mate paid the slightest attention to him; as long as he behaved himself he would be allowed to stay with them. Throughout the remainder of the autumn season he fed with his mother, slept close beside her and was content.

Then came the snow and a tightening of the lakes to glassy floors, through which the dead water-grass gleamed dully. The bull calf had never experienced a winter. He browsed now on the tender bark of saplings that the older animals forced down with their weight; he pawed the snow with his hoofs and found certain roots that satisfied his hunger. When he chiselled the bark from a standing sapling it was on one side only. He did not know that if he had girdled the tree it would have died; but Nature had his training in hand and what she counselled was for a common protection.

When the snows deepened and the cold became intense, other moose came into the protected zone and herded with them, and for a wide space the snow was kept trampled. This "yard" was the dwelling place of perfectly friendly and neighbouring animals. One night, when spring had come bounding in and the splitting ice on the lakes cracked like rifle shots, the young bull's mother nosed him from his sleep and slipped off through the night. He followed her. If her antlered mate saw her go he made no move to prevent her. Perhaps he had experienced other similar desertions; or possibly he realised that the mate who was leaving him was quite a different creature from the docile cow that had mooed him a welcome on that September night. At any rate he did not follow. He was growing weary of herding, and he intended to wander off soon to a spot where for many summers he had been alone.

He was a lone monarch of the wilderness. Grandly, superbly, silently he bore his loneliness.

After deserting her mate the cow became more gentle with the calf. They found a thicket some two miles from the one in which he had first seen the light, and for six weeks they roamed the dense forest together, usually returning to the shelter of the birches at night. Then one early summer evening she slipped away from him and was gone for several days. When next he saw her, a little sprawling-legged calf struggled along beside her. She left the new-born beside him, with its long cream-lined ears wobbling to and fro and its big slate-blue eyes gazing in astonishment at the world. The yearling brother stared at it, wondering what sort of creature it was. Then he went slowly towards it and touched it gingerly with his nose. Presently he licked its rusty brown hair, and it bleated shrilly. At the calf-cry came the mother, at her side another sprawling calf, the very counterpart of the one the young bull had just caressed.

This was too much for the elder son, and with a snort he plunged among the trees. He moved swiftly, his stride a long swinging trot like a fast walk. When he came to a log he did not leap it, but simply stepped over it. He was going back to the wintering yard. But when he came to the place where the moose had herded amicably together during the long cold season he found it deserted. He was angry, and in his heart was a great yearning. Then hunger assailed him and he forgot his loneliness. He went down to the lake and after he had fed he remained shoulder deep in the cool water; the flies were troublesome and he could withstand them in this way.

Sunset flamed above the forest and passed out before quick twilight in a flame of brilliant colours. The young bull ate again of the plentiful lily-sprouts and dozed contently in the deepening shadows. Far away a dog wolf howled, and closer at hand a fox puppy yapped querulously. The young moose paid no attention to these sounds; reaching the shore he broke into his long walking-trot. From somewhere the challenge of a lynx to another of his kind came wailing and full of menace. The young bull quickened his pace; he needed his mother and he was going back to her.

He found her lying beside her fawns, and he dropped to his knees and curled up close to her. She touched his wet hair with her nose, and her rough tongue swept his face on which had hardened the blood left from the vicious stings of the flies. He did not feel the caress, however, for he was sound asleep.

Summer passed and autumn came again. The bull calf was an ungainly fellow now, awkward of form and movement, but with the promise of tremendous strength in his chunky shoulders and heavy neck. Two sharp prongs had broken through the itching velvet of his skull, and as he waded the lily pond to rid himself of hungry flies, or crashed his way through almost impassable brambles, there glowed behind the limpid softness of his eyes a vigilance and a challenge. He conceded no other forest creature the right of supremacy. By heredity he was monarch of that wind-swept forest, and he knew no fear. What his enemies—and he had enemies in plenty—mistook for fear was caution, perhaps his greatest asset.

He was learning many valuable lessons. He had no terror of any animal of his world, but for two at least he held respect. One of these was the lumbering porcupine, the other was the skunk; and to them he always acceded the right of way. Never as long as he lived would he forget the festering nose that forced him into fasting for long days following an encounter with one of those stupid, spine-armed lumberers of the trails: neither would he soon forget the animal that nimbly avoided his striking fore-feet and, with snow-ridged tail twitching angrily, cast about him a blue stinking haze that blinded and choked him and gave him a sickness that left him weak and trembling.

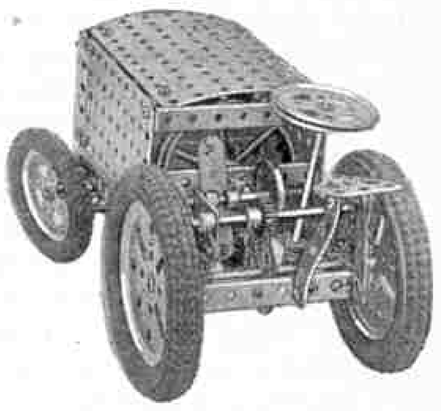
Two more summers passed. The young bull now was three years old and a stalwart fellow for his age, standing six feet nine inches at the shoulders. He was now equipped with flat horns and a wild heart ready to do and to dare. His last year of life with his family had not been pleasant owing to his having acquired certain fixed notions of his own. More than once chastisement had fallen upon him, but this he had not minded greatly. Something deep within him was stirring to life, making his blood run riot and his spirit become wild and rebellious. One golden September night he heard a low plaintive moo from the shore of a lonely lake, and throwing up his head he sent an answering bellow through the stillness. Then he heard the call of another bull, and as he crashed towards the sound the killing lust possessed him, the mists that parted before him glowed blood red. It was well for him that still close to him clung the guardian that ever whispers caution to the inexperienced dweller in the solitudes. It was in obedience to that whisper that he checked his rush at the very edge of the timber, the sharp horny hoofs of his braced fore-feet ploughing deep furrows in the sward. Another dark, looming shape, distorted to giant proportions by the mists that rose from the moonlit lake, had lunged from the timber, and as the young bull shrilled his angry challenge he saw a strange thing happen. From a clump of willows along the shore a streak of fire darted like a shooting meteor, and a sharp crack like the splitting of a maple in keen frost shattered the silence and numbed his heart with terror. He saw the other bull sink slowly to earth and lie still.

Then he found himself back in the timber, fleeing blindly. Not until he had reached the safely of the dense lowlands did he pause, and with panting sides and drooping head stand trembling. All about him the fallen trees massed protectingly; the odour of dead water weeds rose to choke him, and mosquitoes swarmed about his eyes and stung him. Not far away a dog wolf howled, and was answered by the hunting pack far distant. These were everyday things; they no longer disturbed him, for he understood them. But something had come into his life that night for the first time, and that he did not understand. Dawn found him back in the thicket on the edge of the lake. Anger, curiosity, and fear had urged him there, together with that growing feeling in his wild heart that bade him seek a mate, and fired his spirit to go forth and do battle. In the dim light of morning he read on the trampled moss and stained sward what had happened there, and again his eyes filmed to red. A copper cartridge glittered among the rocks on shore. He heaved himself erect and struck it with his heavy hoofs, crushing it and robbing it of the lustre that taunted him.

Boys, you MUST have this new Book

Get a copy to-day

PRICE 9d.



Novel Momentum Tractor.

DO IT NOW!

We advise every keen Meccano boy to obtain his copy of the Book of New Models now, while supplies are available.

The book contains illustrations and details of the best of the new models and new movements submitted in recent competitions, together with many others that have been designed by our own experts. All the models shown in the book are of outstanding interest and variety.

HOW TO OBTAIN THE BOOK

The 1931 Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free.

There are special editions for Australia, New Zealand, South Africa and Canada and details of the prices of the book in these countries are as follows :—

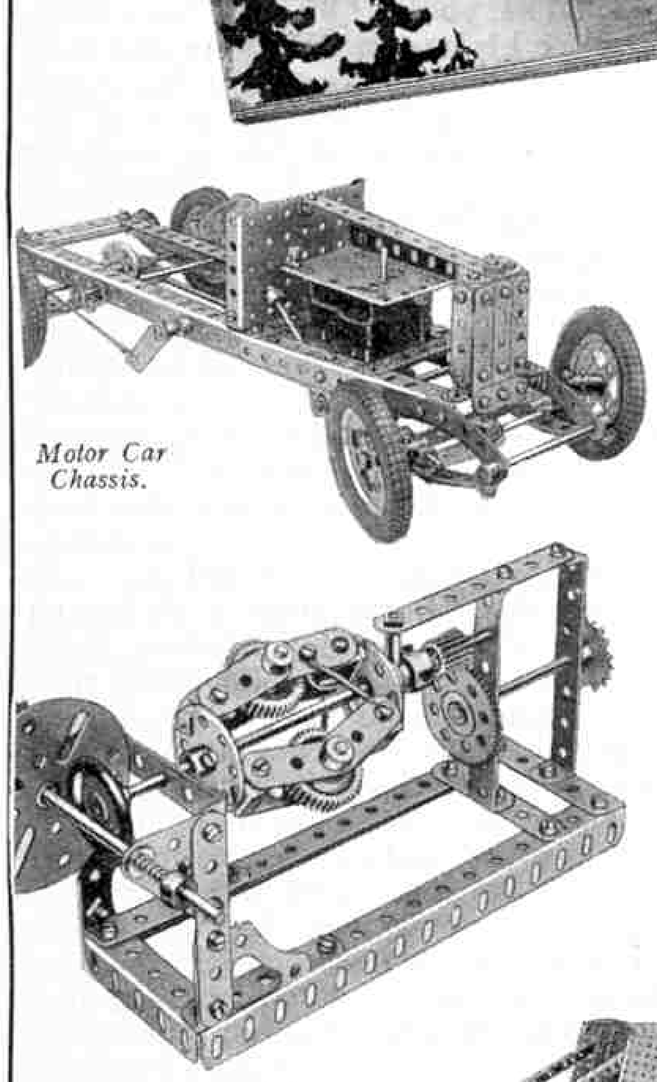
AUSTRALIA : Price 2/– from dealers or 2/2 from E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832K).

NEW ZEALAND : Price 1/– from dealers or 1/2 from Models Ltd., P.O. Box 129, Auckland (Kingston Street).

SOUTH AFRICA : Price 1/– from dealers or 1/2 from Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

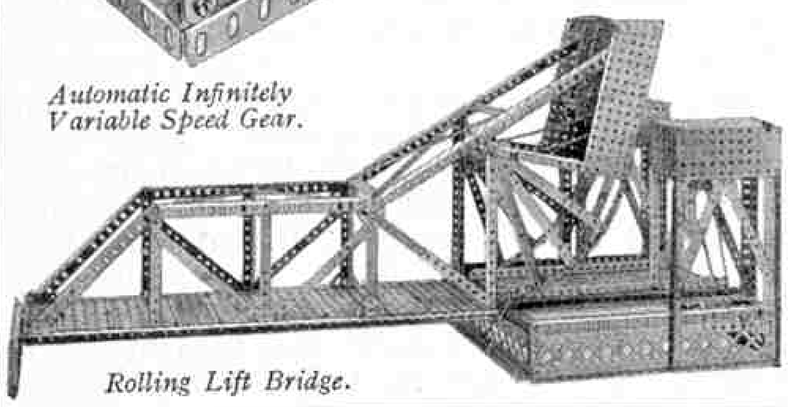
CANADA : Price 25 cents from dealers or 30 cents from Meccano Ltd., 34, St. Patrick Street, Toronto.

Readers living in countries other than those mentioned above should order from Meccano Ltd., Old Swan, Liverpool, England, sending a remittance of 1/2 with their orders.

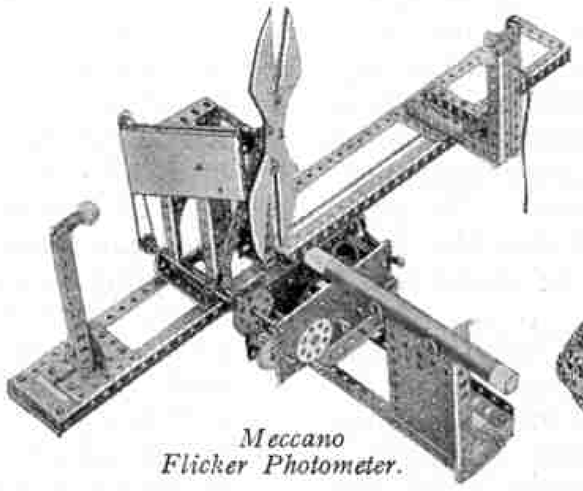


Motor Car Chassis.

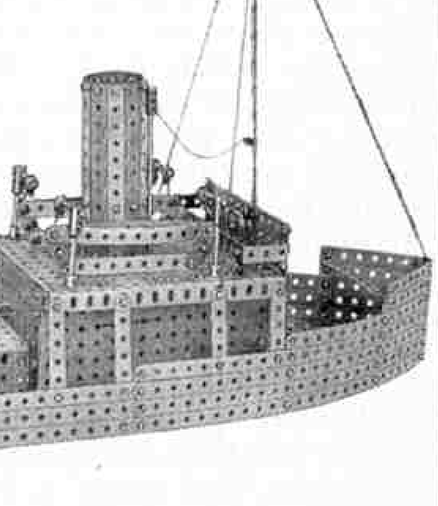
Automatic Infinitely Variable Speed Gear.



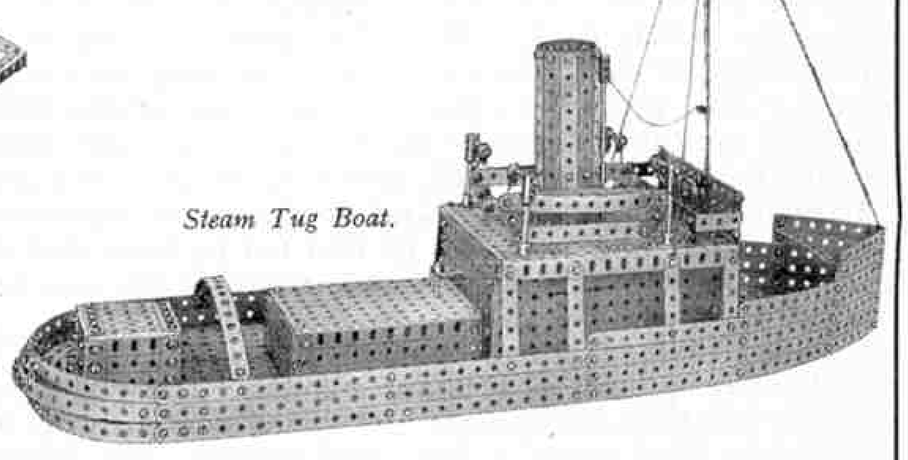
Rolling Lift Bridge.



Meccano Flicker Photometer.



Single Cylinder Marine Engine.



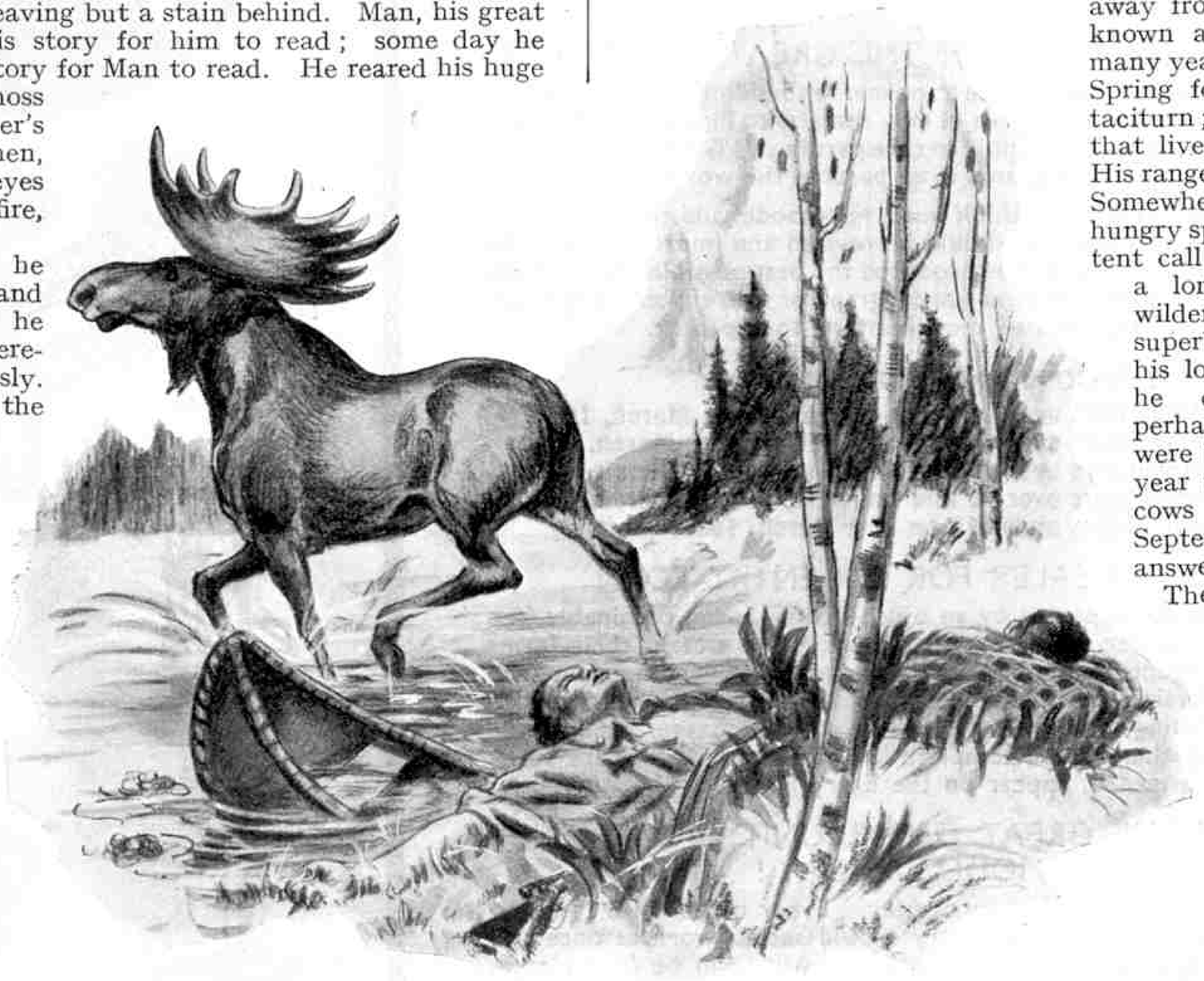
Steam Tug Boat.

MECCANO LIMITED OLD SWAN LIVERPOOL

Far out in the lake, lifting in the spreading light above its surface, were succulent water plants waiting to be eaten, but the bull moose thought nothing of food. He would not eat again until the flame within him had been quenched. There was no terror in his eyes now; only anger. What Man, his enemy, had done to that full-grown bull, he himself would have done in another way if he had been able. But what they had done to the greater bull he knew they would do also to him if they got the opportunity.

His world was full of wonderful lessons, many of which had been learned at great cost; but here was one, the reading of which greatly perplexed him. Last night he had heard a cow moose call from the shore of that lake. Now he knew that no cow had been there; only a terrible something that had spirited away one of his kind, leaving but a stain behind. Man, his great enemy, had written this story for him to read; some day he himself would write a story for Man to read. He reared his huge bulk and struck the moss that the human slayer's hands had touched; then, with lowered head and eyes deep with smouldering fire, he sought the thicket.

The following night he heard another cow call, and answered. This time he approached her whereabouts more cautiously. He found her, and at the same time found a rival, a battle-scarred bull much stronger and craftier than himself. He fought valiantly for what he considered his rightful possession, but was ignominiously vanquished. The whipping tamed him somewhat, and for several days and nights he hung moodily about the thickets, nursing his wounds. Soon afterwards he again contested possession of a mate with a bull not much larger than himself. This time he was the victor, but not for long, for an old bull came upon him while he was spent with the conflict, gored him mercilessly and led the cow away.



When at length the big bull waded to shore, two men lay lifeless in the shallows.

Providing that he does not fall a prey to his enemies, the moose lives longer than any other animal of the forest. At fifteen years of age the bull measured seven feet six inches from shoulder to hoof, weighed close on 2,000 pounds and had antlers with a spread of well over eight feet. By right of might he was the undisputed sovereign of his realm, and only occasionally did one of his fellows dispute with him for possession of a mate. Some of these he maimed, some he killed; but all he vanquished completely. In spite of these battles the first snows of winter always found victor and vanquished yarding peacefully together, their enmities forgotten. So the big bull might have gone on for many years until old age forced him aside and down before the onslaught of a younger bull; but in his sixteenth year something happened to change the whole course of his wild life.

It was at the very beginning of August that he heard the low moo of a cow sounding from the shallows. At the edge of the thicket, as once on a night long before, he paused, sniffing the breeze, to make sure that the call was real. He had never forgotten that night when he had seen one of his kind sink before the flash of the hunter's rifle, and never forgotten the story that he had read on the moss next day. Neither had he forgotten his desire to write his own story for Man, his enemy, to read. So now he listened for a moment to the call of caution, probing the shadows along the shore with keen burning eyes. As he watched he heard on his right a crashing of the brush, and his mate of other seasons stepped into the moonlit glade. She raised her head to sound again the summons, but even as she did so there darted from the rushes along the shore a streak of fire, and the cow crashed down to earth.

Then reason utterly left the great bull; he charged straight for the spot from which the killing fire had leaped. Other red tongues flashed to meet him as he plunged forward; something hot seared his shoulder; he heard the hoarse voices of his mortal enemies shouting their fear. Through a red haze he saw a long, dark object shoot from shore; then, his hoofs biting deep holes in the sward, he launched his two thousand pounds of destroying force. There was a cry and rending of wood as he struck the canoe with terrific force, his hoofs splitting it like match-wood.

When at length the bull waded to shore, two men lay lifeless in the shallows, their bodies beaten to a pulp. One of them in his hurry and terror had dropped his rifle, and it lay gleaming on the shore. The bull battered it deep into the earth, and without so much as a glance at the slain cow, passed into the thicket.

That autumn he went mateless, and during the winter the herd yarded without him; far away from the range he had known and controlled for so many years he wandered alone. Spring found him sullen and taciturn; in September nothing that lived was safe before him. His range now knew no bounds. Somewhere within his wild, hungry spirit sounded the insistent call to wander. He was a lone monarch of the wilderness, and grandly, superbly, silently he bore his loneliness. At night as he dozed he dreamed perhaps of gladder days that were behind him. Year by year the soft calls of the cows came to him each September, but he never answered.

The big bull gave up roaming afar through the boundless sweeps, and for long intervals he would remain in one impregnable spot of the forest tangle, standing motionless with sagging head. As he aged, his sleep grew sounder. Seldom now did the dawns find him kneeling for the juicy sprouts that grew close to earth, because his joints were stiff. Instead he pressed down the saplings with his great weight, and fed on their buds, bark and leaves. Sometimes he waded in the lake, but not often did he swim in it. He grew less and less active; day by day he dreamed more, standing with drooping head; he was nearing the end of his days.

It was in late spring that the last dream came to him. The preceding winter had been hard; food had been difficult to obtain; his teeth were poor, his eyesight was failing. But he had weathered it, fighting off night after night a pack of timber wolves who had guessed his weakness. In the colourful dawn he wandered down to the lake and, wading out, drank deeply of the cool water. Slowly he waded back to shore and sought the dense timber.

The way back to his sleeping place seemed very long that morning; the trail was all up-hill, the thickets seemed impenetrable. He grew very tired, and longed to drop on his knees and sleep. At length he staggered back to his bed, but his head was sagging and his eyes were filming. He dropped upon the spicy leaves, mooing softly. His long nose descended jerkily to lie upon his knees, and then with a long weary sigh he slept.

We are indebted to the courtesy of the "Canadian National Railways Magazine" for permission to reproduce this interesting nature story.

* * * * *

Moose are found in almost every part of Canada from the Atlantic coast to the Rocky Mountains, and moose hunting in Ontario, Quebec, New Brunswick and Nova Scotia offers special attractions to those who live in the more densely populated eastern provinces. Care is taken to preserve these creatures, and there seems little likelihood of their becoming extinct. They can only be hunted under licence, and then only at certain seasons of the year. They find protection in great sanctuaries such as the Laurentides National Park, which is 2,500 sq. miles in extent, and roam almost unmolested in the great forests that stretch from Quebec across Northern Ontario to Winnipeg.—*Editor, "M.M."*

MECCANO

MODEL-BUILDING COMPETITION

500 IN PRIZES

THERE IS STILL TIME TO ENTER THIS GREAT COMPETITION

Now that Christmas has passed, Meccano model-building activities are at their height, and there are thousands of new recruits to Meccanoland. Every one of these new enthusiasts is eligible to take part in this Grand Competition that is open to entrants in all parts of the world.

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

SECTIONS AND AGE LIMITS

Section A. For competitors over 18 years of age on 31st March, 1932.
Section B. For competitors over 16 and under 18 on 31st March, 1932.
Section C. For competitors over 12 and under 16 on 31st March, 1932.
Section D. For competitors over 10 and under 12 on 31st March, 1932.
Section E. For competitors under 10 on 31st March, 1932.

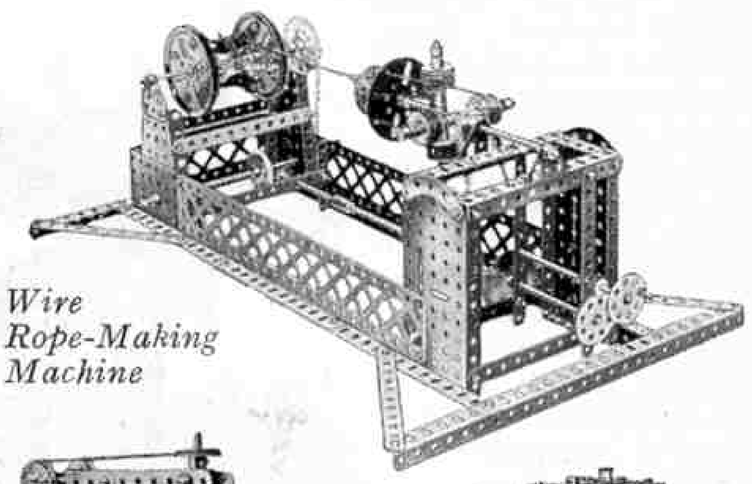
ASK YOUR DEALER FOR AN ENTRY FORM

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

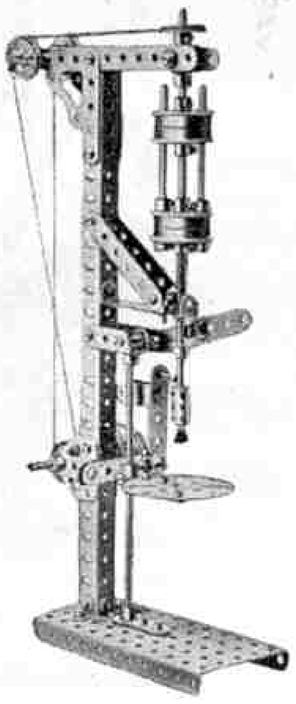
DO NOT MISS THE GREAT OPPORTUNITY—COMMENCE YOUR MODEL TO-DAY!

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

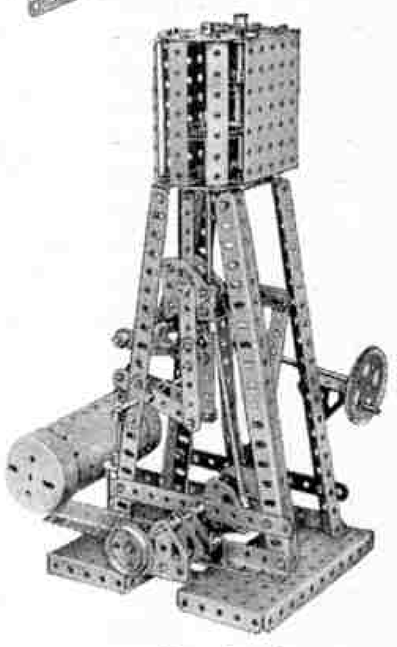
CLOSING DATE, 31st MARCH, 1932.



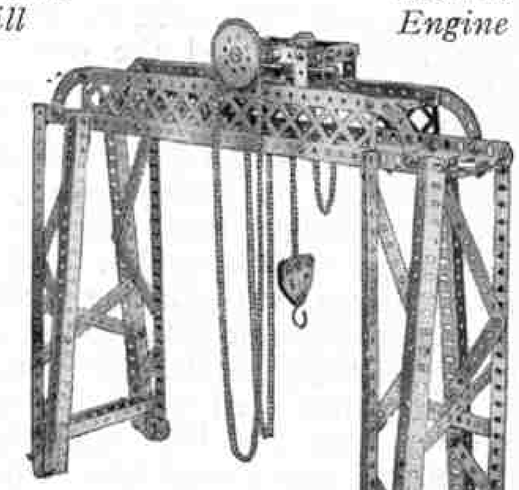
Wire Rope-Making Machine



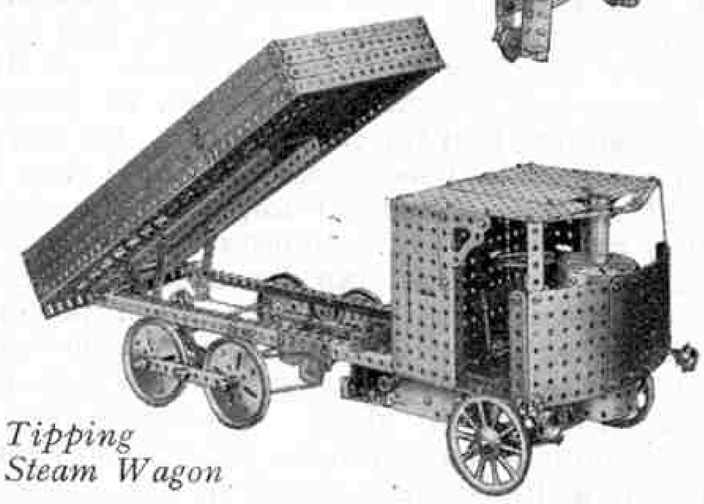
Vertical Drill



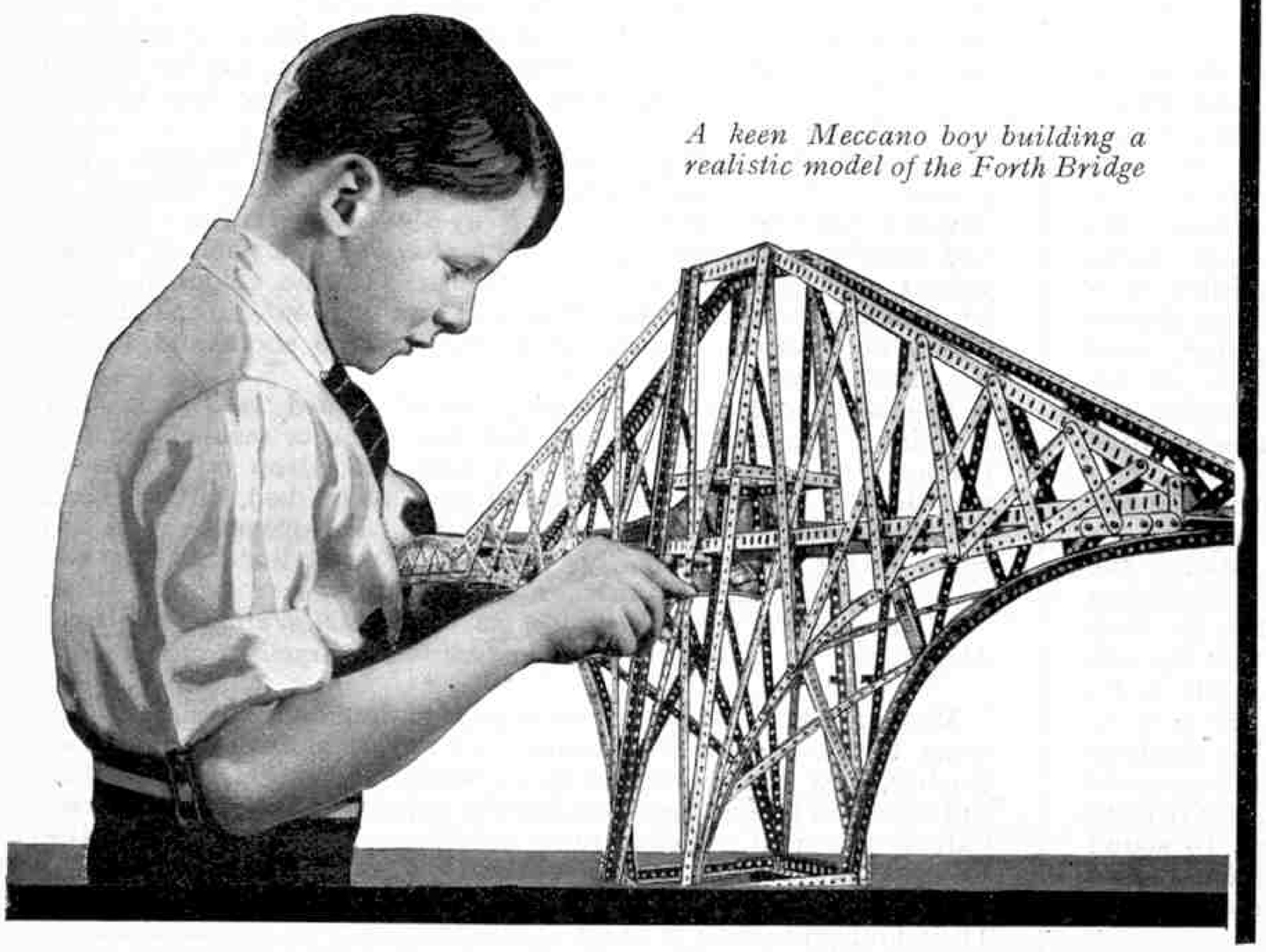
Vertical Marine Engine



Gantry Crane



Tipping Steam Wagon



A keen Meccano boy building a realistic model of the Forth Bridge

MECCANO LIMITED OLD SWAN LIVERPOOL

Results of Meccano Model-Building Contests

By Frank Hornby

"No. 00 and No. 4 Outfits" Contest (Overseas)

The full list of prize-winners in the Overseas Section of the "No. 00 and No. 4 Outfits" Contest is as follows :—

Section C (for No. 00 Outfit Models).

FIRST PRIZE, Meccano goods value £2-2s. : M. A. Wahid, Mysore, S. India. SECOND PRIZE, Meccano goods value £1-1s. : A. L. Fell, Remuera, Auckland, New Zealand. THIRD PRIZE, Meccano goods value 10/6: R. Tennant, Launceston, Tasmania, Australia.

SIX PRIZES of Meccano parts to convert a No. 00 Outfit into a No. 1 Outfit: E. Bonnici, Valletta, Malta; Y. Goedbloed Pk., Gapinge; G. J. Harry, Landsborough, Queensland, Australia; I. E. Gillanchers, N. Invercargill, Southland, New Zealand; A. Dickie, Tuturau, Mataura, New Zealand; J. R. Whyte, Toronto, Canada.

SIX PRIZES of a No. 00a Accessory Outfit: D. Davies, Cape Town, S. Africa; A. Brighton, Sydney, Australia; N. Tompkins, Calcutta, India; R. Burman, Bangkok, Siam; B. A. Romesh, Jubbalpore, India; P. Farnworth, Wellington, New Zealand.

Section D (for No. 4 Outfit Models).

FIRST PRIZE, Cheque for £3-3s. : Jan Hers, Potchefstroom, S. Africa. SECOND PRIZE, Cheque for £2-2s. : R. Turner, Subiaco, W. Australia. THIRD PRIZE, Cheque for £1-1s. : E. Kaye, Baringhup West, Victoria, Australia.

SIX PRIZES of Meccano goods value 10/6: John Williams, Capetown, S. Africa; N. Bowler, Melbourne, Australia; P. Rose, Natal, S. Africa; J. Gittings, Johannesburg, S. Africa; W. L. Barry, Christchurch, New Zealand; M. Frankel, Muizenberg, Cape Town, S. Africa.

SIX PRIZES of Meccano goods value 5/-: J. Youngson, Adelaide, Australia; B. Thomas, Brisbane, Australia; T. Lewis, Village Deep, Johannesburg, S. Africa; E. Driver, Clevedon, Auckland, New Zealand; J. Fry, Sydney, Australia; C. Hamilton, Ontario, Canada.

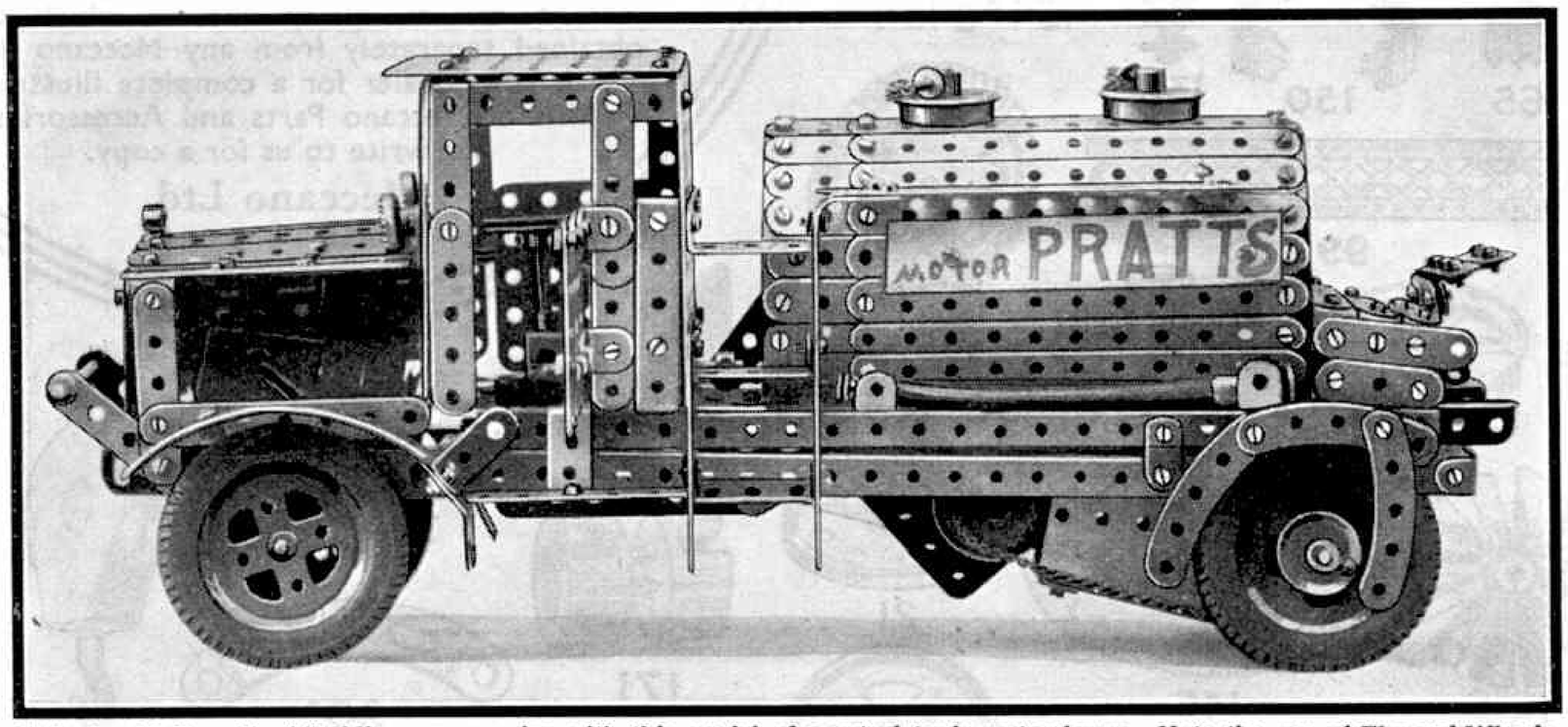
In addition a number of Engineer's Pocket Books and Certificates of Merit have been awarded.

A model of a saloon motor car propelled by a Clockwork Motor won First Prize in the Section for No. 4 Outfit models. It was built by Jan Hers, Potchefstroom, S. Africa, and embodies a modified form of Ackermann steering gear, Sprocket Chain drive to the rear axle, and a friction-type clutch. The saloon body is built chiefly from Strips.

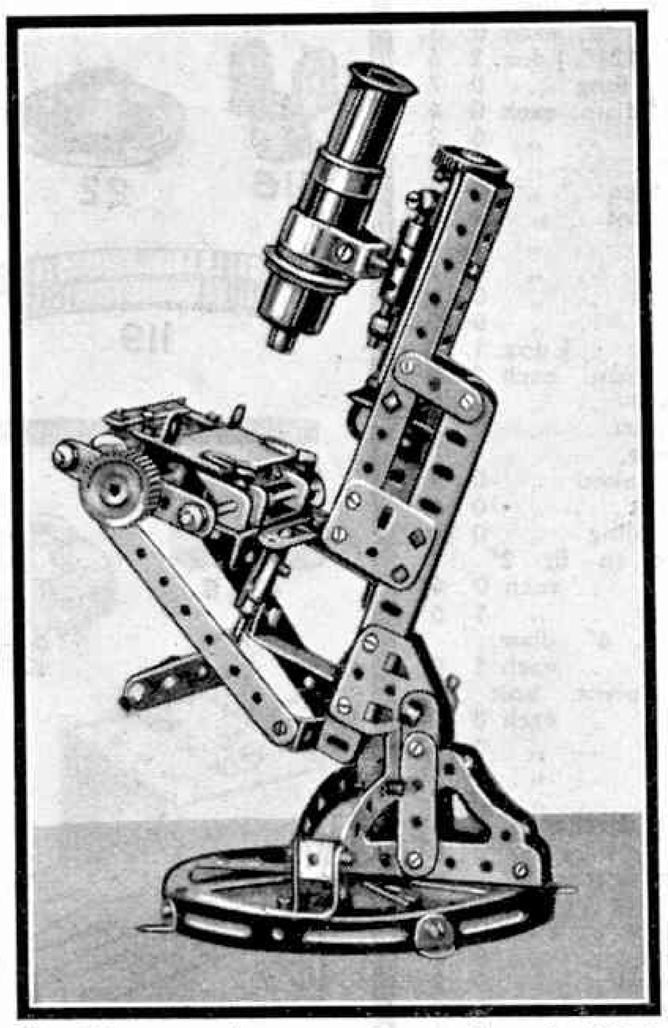
Second Prize in this Section goes to Ron. V. Turner, Subiaco, Australia, for a model of a block-setting crane. From the limited parts at his disposal, Turner has succeeded in building a really good example of this type of crane.

Eric Kaye sent a model of a windmill pump, in which the rotary motion of the fan is changed into reciprocating motion suitable for operating a pump by means of a connecting rod and a counterbalanced crankshaft. The head carrying the fan blades and the tail vane swivels on roller bearings so that it is free to adjust itself to the direction of the wind. The neat manner in which the model is constructed reflects great credit on its builder, who was awarded Third Prize in Section D.

In the Section for models built from No. 00 Outfits, First Prize was won by an Indian boy M. Abdul Wahid, of Mysore, Southern India, who submitted a workable model of a telpher span and a model of a lace jennier. The telpher is operated by hand.



Malcolm McDonald of Dublin, won a prize with this model of a petrol tank motor lorry. Note the use of Flanged Wheels as manhole doors, and the Sprocket Chain drive to the rear axle.



The Meccano microscope shown above is fitted with lenses, a mechanical stage and fine-focusing mechanism. It was built by R. E. Banks of Newton.

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

In the Section for No. 7 Outfit models four competitors tied for First Prize, and in order to overcome the difficulty in the fairest possible manner, it was decided to combine the First, Second and Third Prizes and to divide the total amount equally among the four competitors. The full list of awards is as follows :—

Section A (for No. 2 Outfit Models).

FIRST PRIZE, Cheque for £3-3s. : G. S. Thomson, Woodhall, Pinner, Middlesex. SECOND PRIZE, Meccano goods value £2-2s. : B. Parnell, Brighton, Sussex.

FIVE PRIZES of Meccano No. 2a Accessory Outfits: A. Rothin, Wolverhampton; H. Kennard, Eastbourne, Sussex; A. Bullock, Brighton, Sussex; J. V. Reed, Heywood, Lancs.; D. Crowley, Birmingham.

FIVE PRIZES of Meccano goods value 5/-: R. H. James, Sharrow, Sheffield; John George, Bordon, Hants.; H. L. Holder, Harrogate; F. G. Waterman, Ipswich, Suffolk; D. Noad, Slimbridge, Gloucester.

TEN PRIZES of "Famous Trains" by C. J. Allen: R. A. Tilbury, Bishop's Waltham, Hamps.; C. Pegler, Slimbridge, Gloucester; W. E. Clarke, Birmingham; W. T. Austin, Wolverhampton; B. Penn, West Dean, near Salisbury; R. S. Brown, Low Fell, Co. Durham; T. Pearson, Littlestone-on-Sea, Kent; W. Stewart, Lenzie, Glasgow; K. Dalzell, Gravesend Kent; G. K. Whytock, Edinburgh.

Section B (for No. 7 Outfit Models).

FIRST, SECOND and THIRD PRIZES added together and divided among the following four competitors, each receiving a Cheque for £1-11s.-6d.: Malcolm McDonald, Ranelagh, Dublin; J. H. Lock, Dorrington, near Shrewsbury; J. Dickinson, London, N.W.10; R. E. Banks, Newton, near Cambridge.

TEN PRIZES of Meccano goods value 10/6: L. Boston, Paddington, London; W. Jones, Cardiff; W. Ridgeway, Leeds; A. Johnston, Newcastle-on-Tyne; G. Taylor, Nottingham; K. A. Siddons, Woodbridge, Suffolk; R. Tallett, Hayes End, Middlesex; W. J. Clayton, Clondalkin, Co. Dublin; M. W. West, London, S.W.5; B. J. Pleass, Woldingham.

FIVE PRIZES of Meccano goods value 5/-: C. N. Marston, Halifax; H. W. Webb, Wood Green, N.22; P. Radley, Clapton, E.5; J. R. Church, Langton Matravers, Dorset; L. Hollyoak, Coventry.

The most interesting model entered in this Contest is a microscope by R. E. Banks. The model is fitted with a mechanical stage, the fixed portion of which consists of a $2\frac{1}{2}''$ Angle Girder, to which a Flat Trunnion is attached, the Trunnion in turn being bolted to the main frame. Two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are attached at right angles to the $2\frac{1}{2}''$ Angle Girder, and a third $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is then bolted across their flanges. A $4\frac{1}{2}''$ Strip is bolted to each end of the front $2\frac{1}{2}'' \times \frac{1}{2}''$ Angle Strip, the ends of the $4\frac{1}{2}''$ Strips being attached to a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted to the bottom of the $5\frac{1}{2}''$ Angle Girders of the body.

The moving stage consists of $2\frac{1}{2}''$ Strips bolted together to form a square. In the centre holes of two opposite Strips a Bolt is lock-nutted and then is screwed into a Collar on a Rod that slides in Double Brackets. A $2\frac{1}{2}''$ Double Angle Strip bridges the ends of the Rod and a Threaded Boss is attached in its centre hole. A Screwed Rod is threaded into the Boss and through the Strip of the frame.

M. McDonald won a prize with a model tank lorry, and a metronome clock formed the entry from J. Dickinson.

MECCANO

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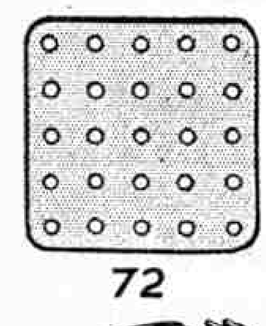
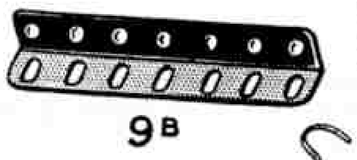
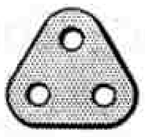
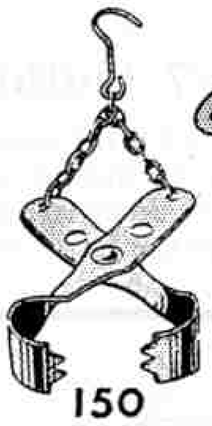
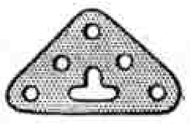
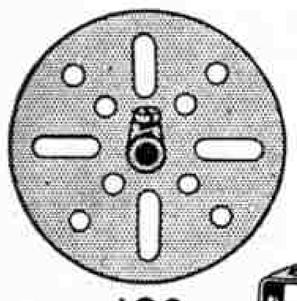


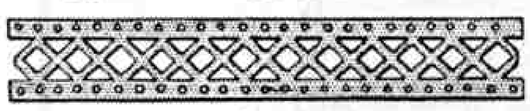


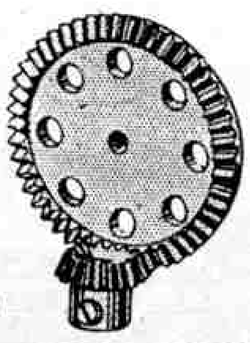


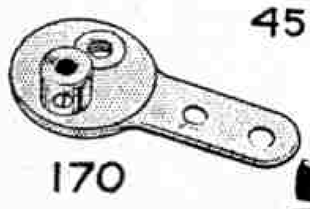


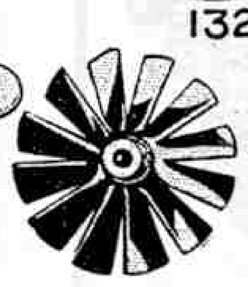


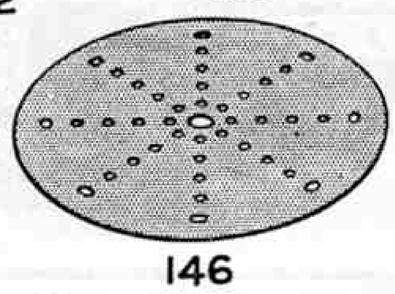


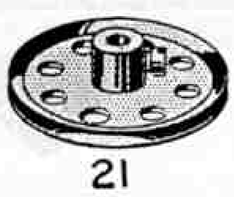


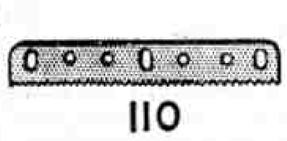


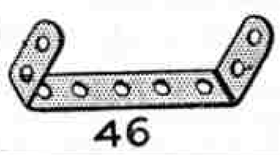


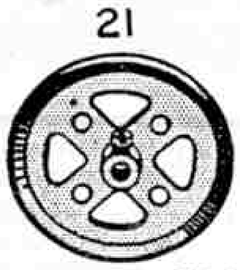


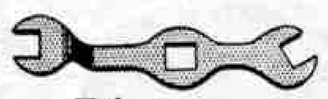


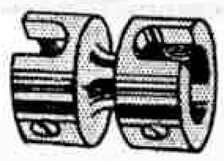


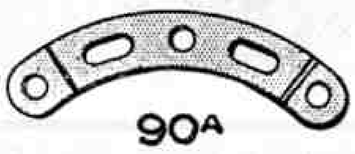


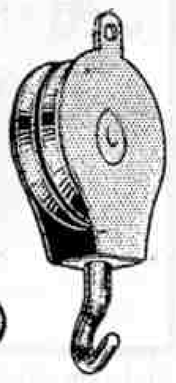


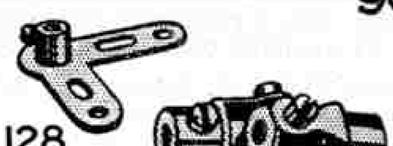


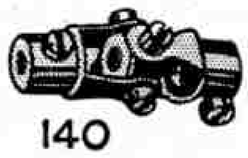


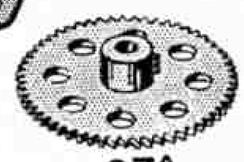


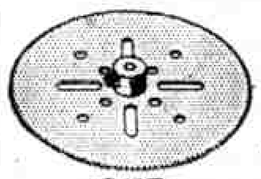


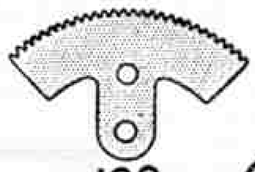


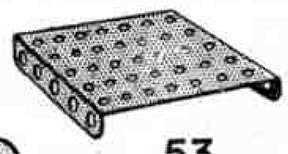


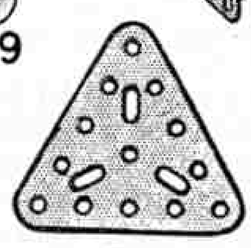


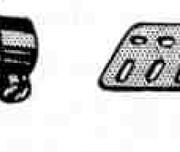


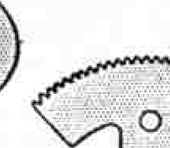


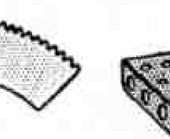


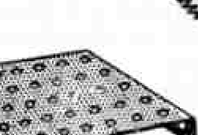


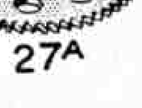


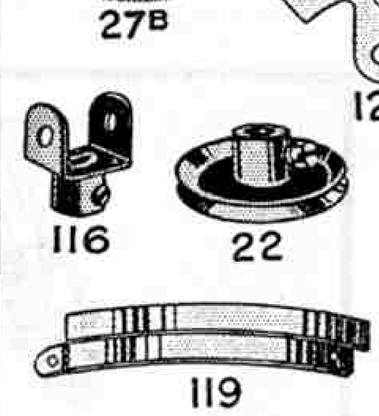


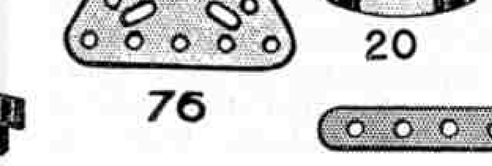


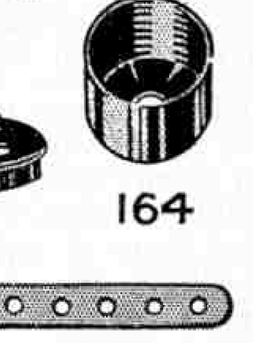












Prices of the Meccano Parts illustrated on this page.

No.		s.	d.
3.	Perforated Strip, 3½″ ½ doz	0	4
9b.	Angle Girder, 3½″ ,,	0	8
20.	Flanged Wheel, 1⅛″ diam. each	0	5
20a.	Pulley Wheel, 2″ dia. with centre boss and set screw each	0	5
21.	Pulley Wheel, 1½″ dia. with centre boss and set screw each	0	4
22.	Pulley Wheel, 1″ dia. with centre boss and set screw each	0	3
27a.	Gear Wheel, 57 teeth to gear with ½″ pinion each	0	6
27b.	Gear Wheel, 133 teeth to gear with ½″ pinion (3½″ diam.) .. each	1	3
28.	Contrate Wheel, 1½″ diam. each	0	9
29.	,, ,, ¾″ diam. each	0	6
30.	Bevel Gear, ⅝″, 26 teeth each	0	9
*30a.	,, ,, ½″ ,,	0	6
*30c.	,, ,, 1½″ ,,	1	6
	Can only be used together		
31.	GearWheel, 1″ dia. each	1	0
32.	Worms .. .. ,,	0	5
34.	Spanners .. .. ,,	0	2
44.	Cranked Bent Strip ,,	0	1
45.	Double ,, ,, ,,	0	1
46.	,, Angle Strip, 2½″×1″ ½ doz.	0	6
53.	Perforated Flanged Plate, 3½″×2½″ .. .. each	0	3
63a.	Octagonal Coupling ,,	0	8
63b.	Strip Coupling .. ,,	0	8
64.	Threaded Bosses .. ,,	0	2
65.	Centre Fork .. ,,	0	1
72.	Flat Plate, 2½″×2½″ ,,	0	2
76.	Triangular Plate, 2½″ ,,	0	2
77.	,, ,, 1″ ,,	0	1
80a.	Screwed Rod, 3½″ ,,	0	3

No.		s.	d
90a.	2½″ Curved Strip, 1⅜″ radius, 4 to circle each	0	1
94.	Sprocket Chain, 40″ ..	0	6
96.	,, Wheel, 18 teeth, 1″ diam. .. .. each	0	3
99.	Braced Girder, 12½″. ½ doz.	2	6
103d.	Flat Girder, 3½″ long ,,	0	7
109.	Face Plate, 2½″ diam. each	0	4
110.	Rack Strip, 3½″ .. ,,	0	2
113.	Girder Frame .. ,,	0	3
116.	Fork Piece, Large .. ,,	0	3
119.	Channel Segment .. ,,	0	4
123.	Cone Pulley .. ,,	1	3
126a.	Flat Trunnions .. ,,	0	1
128.	Boss Bell Crank .. ,,	0	3
129.	Rack Segment .. ,,	0	5
131.	Dredger Bucket .. ½ doz.	1	0
132.	Flywheel, 2¾″ diam. each	2	0
133.	Corner Bracket .. ,,	0	1
136.	Handrail Support .. ,,	0	3
138a/z.	Ship's Funnels, Raked ,,	0	9
139.	Flanged Bracket .. ,,	0	2
140.	Universal Coupling ,,	0	10
142a.	Dunlop Tyre to fit 2″ diam. rim .. each	0	4½
143.	Circular Girder .. ,,	1	0
146.	,, Plate, 6″ diam. over all .. each	1	0
147.	Pawl, with pivot bolt and nuts .. each	0	3
148.	Ratchet Wheel .. ,,	0	6
150.	Crane Grab .. ,,	0	7
152.	Pulley Block .. ,,	0	9
154a.	Corner Angle Bracket, ½″, right hand .. ½ doz.	0	6
154b.	Corner Angle Bracket, ½″, left hand .. ½ doz.	0	6
157.	Fan, 2″ diam. .. each	0	4
160.	Channel Bearing .. ,,	0	2
164.	Chimney Adaptor ,,	0	2
169.	Digger Bucket .. ,,	2	0
170.	Eccentric, ¼″ throw ,,	0	9
171.	Socket Couplings .. ,,	0	9

WEAVING WITH THE LOOM

The Loom is one of the most fascinating of the Meccano Super Models. Its construction is described in Super Model Leaflet No. 16a, and when completed it forms a miniature power loom with which all kinds of hat bands, ties, belts and other articles may be woven in a variety of patterns and colours, merely by turning a handle! The model includes the picking motion for driving the Shuttle from side to side in the slay, the shedding motion of the heald frames, the rocking of the reed, and the take-up action by which the finished material is wound on to rollers at the front of the machine. All these mechanisms are operated through cranks and gearing by a common shaft to which the operating handle is attached in order that they may be brought into action in the correct order.

The operation of the model is simplicity itself, but it is of course necessary that the various mechanisms shall be adjusted correctly in the first place if entirely satisfactory material is to be produced. Adjustment of the model is quite a simple matter and by running the machine for a short period so as to produce a sample length of cloth, it will soon be seen where adjustments are needed. It is important that the picking motion functions correctly and the Axle Rods throwing the picking sticks must be arranged to work exactly in step. The tension of each of the lengths of Spring Cord to which the ends of the sticks are attached is also important for if one is slack, the Double Brackets will not drive the Shuttle backward and forward at the correct time in the slay. In order to enable the Shuttle to travel smoothly, it is a good plan to line the base of the slay with a strip of tin plate or zinc. The metal should be cut in a long strip $\frac{1}{2}$" wide and the exact length of the slay. A hole drilled in each end will allow it to be secured in position to the Angle Girders.

The bobbin spindle of the Meccano Shuttle (part No. 104) is provided with a spring. The purpose of the spring is to limit the rotation of the bobbin spindle and enable the weft thread to unwind at even tension. If it is found that the weft thread in the woven material is too slack, or if the bobbin in the Shuttle tends to jam, it is a good plan to try adjusting this spring. Further small adjustments of this kind will be found to cure any irregularities that may appear in the material, and when once adjusted the Loom will be found to run for long periods without any further attention.

In a model of this type correct lubrication is particularly important, as many of the Rods and bearings are subject to considerable pressure. Meccano oil, or grease such as the petroleum jelly used in Meccano Grease Cups, should be applied to the main bearings, while the Gears, cams and other working parts should also be oiled. Be careful not to apply too much lubricant, or oily cloth will result!

GEARING DESIGN

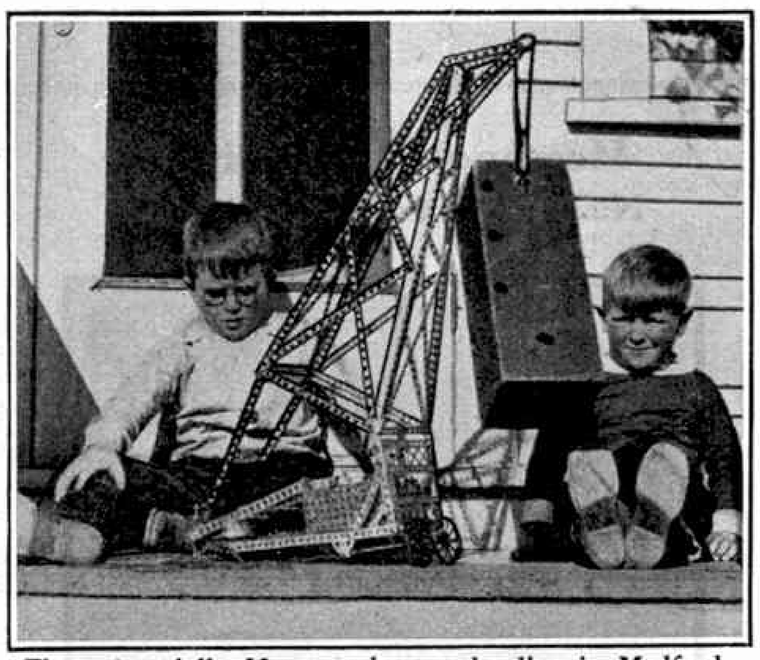
Gearing forms one of the most interesting features of the Meccano system, and by making use of the large range of Meccano Gear Wheels, Pinions, Worms, Racks and other toothed parts, it is possible to reproduce practically every gear system used in actual engineering. If good results are to be obtained, however, it is essential to arrange the gearing carefully and a little knowledge of the main principles of gearing will be helpful to many model-builders.

Gearing may be used for two main purposes—reducing speed and increasing torque or turning effort; and increasing speed, with a corresponding reduction in torque.

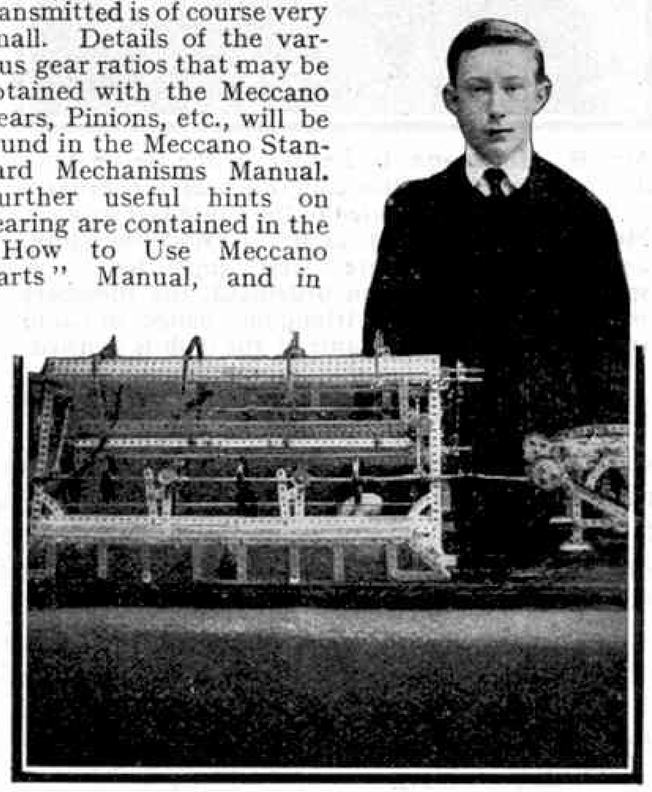
Reduction gearing should be used when a heavy load is to be moved at a slow speed while a step-up gear ratio may be employed when a light high speed drive is required. The amount of reduction or step-up gearing used depends on the load to be moved, and the speed and power of the motor. For example, in the Meccano Traction Engine, Super Model No. 22, the reduction gearing between the armature shaft of the Meccano 6-volt Motor and the road wheel Axle, is no less than 600 : 1! This enables the Motor to run at full power and to provide a slow speed drive of exceptional strength to the road wheels of the model. The fact that the model is capable of drawing a boy seated on a trailer with ease shows how powerful this drive is. In such cases as this where a considerable strain is imposed upon the final stages of gearing, it is essential that each wheel boss should carry two Grub Screws.

Reduction gear ratios as large as this are rarely required in Meccano models, however. Lower ratios are usually satisfactory. For instance, in small mobile models operated by the Meccano No. 1 or No. 2 Clockwork Motor, a reduction of 3 : 1 between the driving shaft and the road wheels will generally be sufficient. If the model travels too fast, however, or if it is too heavy for the Motor to drive satisfactorily this ratio may be increased to advantage.

In mobile models operated by the Meccano Electric Motors, a larger reduction is needed as the Electric Motors run at much higher speeds than the Clockwork Motors. Thus the "high" gear ratio in the Meccano Motor Chassis is 27 : 1, while when low gear is engaged in this model, a total reduction of 80 : 1 is brought into action between the armature shaft of the Motor and the rear road Axle. A step-up ratio is not often required in models driven by the Meccano Electric Motors, owing to the relatively high speed of the armature shaft itself. It may sometimes be necessary to drive a Meccano Fan or the Propellers of model Aeroplanes at very high speed and the step-up gearing ratio may then be employed. This type of gearing is only suitable for very light drives as the power transmitted is of course very small. Details of the various gear ratios that may be obtained with the Meccano Gears, Pinions, etc., will be found in the Meccano Standard Mechanisms Manual. Further useful hints on gearing are contained in the "How to Use Meccano Parts" Manual, and in addition to the information contained in these books model-builders will find that a careful study of models shown in the Instruction Manuals will help them to find the most suitable methods of gearing different models.



These two jolly Meccano boys, who live in Medford, Oregon, U.S.A., are here shown testing a splendid crane that they have built, by causing it to lift a heavy stone block. The load appears to be quite an easy task for the model!



The model shown in this illustration is a loom designed for weaving the delicate material known as tulle. It was built by a French boy, Albert Wills, and was awarded a prize in a Meccano Model-building Competition.

MECCANO SOLENOIDS

By winding Meccano Cotton Covered Wire on to a Meccano Bobbin (Electrical part No. 301) and connecting the ends of the winding to a battery, an electrical solenoid is formed, and a Meccano Pole Piece or a standard Axle Rod will be held in place in the core by electro-magnetic force. This principle is used in the Meccano Electric Engines described in the June and November 1930 issues of the "*M.M.*" If a Pole Piece is anchored in place in the core of the Bobbin, the complete assembly becomes an electro-magnet and it may be used for lifting Meccano parts. An electro-magnet is also employed in Meccano Electric Bells, Relays, etc.

A number of model-builders who use Meccano Transformers operating from alternating current electric mains, are apparently uncertain as to whether solenoids will be effective when this type of current is used owing to its differing from the direct current supplied by an Accumulator or dry battery. For all practical purposes in Meccano electrical work, alternating current supplied by the Meccano Transformer is just as effective as direct current. When using a Transformer for supplying current to a solenoid, it is interesting to note how a Pole Piece placed loosely in the core of the solenoid vibrates at high speed while being drawn into the core of the Bobbin. This vibrating action is due of course, to the alternating nature of the supply.

A single solenoid built up round a Meccano bobbin should never be connected directly to an Accumulator or Transformer, as too large a current will flow. If one solenoid only is required, a Meccano Resistance Controller therefore should be connected in series with it. It is permissible to connect two or more solenoids to an Accumulator or Transformer, provided the solenoids are placed in series with each other in order to give as high resistance as possible.

Although alternating current is suitable for use with all Meccano mechanisms, it cannot be employed for driving the Hornby Electric Locomotive of the Permanent Magnet type. For this, an Accumulator or other source of direct current supply is essential. The large 3E Hornby Electric Locomotives work quite satisfactorily from a Transformer, while the two Meccano 6-volt Motors are suitable for use with either alternating or direct current.

BALL BEARING FOR AXLES.—A small ball bearing unit for journals of horizontal shafts would have few uses in the Meccano system. If necessary Double Arm Cranks may be used for reinforced bearings and if proper attention is given to correct alignment there will be very little friction. Friction will be minimised if journals are kept constantly oiled. (*Reply to K. H. Robinson, Letchworth*).

SPROCKET GEARING.—Special new parts for use with the Meccano Sprocket Wheels would prove interesting additions. Your idea for a Worm that can be meshed with a Sprocket Wheel is novel, but it is doubtful whether this type of Worm gearing would prove satisfactory in operation. A rack, for use with the Sprockets, having a number of small slots cut in it is also of interest, your idea apparently being for the Sprockets to engage with the slots in the part so as to form a rack and pinion action. We are afraid that the motion in this case would be very rough and irregular, however, and consider it a much better plan to make use of the existing Meccano Rack Strips in conjunction with the Meccano Pinions, Gears, etc. These parts have "spur" teeth, of course. (*Reply to E. Boldero, Auckland, N.Z.*).

BEARING PIECE.—Your suggestion that a bearing strip, $1\frac{1}{2}$" in length and $\frac{1}{8}$" in thickness should be introduced is interesting. This would be of use for journalling shafts that were required to run at a high speed. A neater Bearing that is quite as efficient may be formed from a Meccano Double Arm Crank, part No. 62b. This possesses the advantage that the boss of the Crank is fitted with a threaded bore so that a Meccano Grease Cup may be inserted and the bearing lubricated automatically. (*Reply to R. L. Mote, Roseville, N.S.W.*).

HANDRAIL SUPPORT. A handrail support manufactured with a boss drilled to take a standard Axle Rod in place of the threaded projection at present fitted, would be quite a useful innovation. We have been considering the production of a part of this type for some time now, and if we decide to introduce it, an announcement will appear in the "*M.M.*" (*Reply to J. Hamilton, Belfast*).

"A Happy New Year!"

Once more I have the pleasure of wishing "A Happy New Year" to all members of the Meccano Guild. The past year has been one of the most successful in the history of the Guild. Recruiting has been well maintained and the number of members shows a very satisfactory increase. Even more gratifying progress has been made by clubs at home and overseas, and the vigour of the movement is illustrated by the fact that of the 71 clubs not yet affiliated, practically all are new organisations. A very large number of these probably will become eligible for affiliation early in the New Year and the total number of clubs then will exceed 400. To reach this number will be a magnificent achievement, and a prosperous new year for the Guild already seems to be assured.

There is still need for active recruiting in spite of the remarkable progress made during 1931. The Guild must be strengthened in numbers in order that it may continue to extend its influence among the youth of the world, and more clubs must be established to give Meccano boys better opportunities of meeting each other for the enjoyment of their favourite hobby. I hope that every member will make up his mind to do his bit on behalf of the Guild by following out its rules to the best of his ability, and also by bringing its merits to the attention of his friends.

A Feature of Club Work

An interesting feature of 1931 has been the growing tendency of neighbouring clubs to work together to a certain extent. I welcome the growth of a co-operative spirit, for it is sure to lead to real progress. A lone member may do excellent work for the Guild, but he will be more successful in his efforts, and he certainly will obtain more fun for himself, if he becomes a member of a club. Similarly a club will exert a greater influence when working in conjunction with other organisations within the Guild than when keeping strictly to itself. Meeting keen members of other organisations is sure to result in an increase of enthusiasm in any club taking part in such a movement and there is the added benefit that members are able to realise more completely that the Guild is world-wide in character.

It is not always possible for clubs to work together, of course, for many of them are separated from their nearest neighbours by too great a distance. In other cases joint meetings occasionally may be held, or officials may meet in order to exchange views on club proceedings. This has been done in Middlesbrough, Edinburgh, Glasgow and other centres, and recently a successful conference was held in London, where the Leaders and secretaries of many clubs met on the invitation of the officials of the South Croydon and Purley M.C. Recruiting methods and club programmes were among the topics discussed at the conference, and no doubt the result of the exchange of ideas that followed will be an improvement in the general outlook. The conference was so successful that it was decided to make it an annual event.

Meccano Club Leaders

No. 56. Mr. R. Herrmann

Mr. R. Herrmann is Leader of the Berlin M.C. The first meeting of this club was held in February, 1931, and it was affiliated to the Guild last August. Members show great skill in Model-building, and competitions are well supported. A sports section has been organised, the members wearing an attractive triangular badge, in Guild colours, on which the name of the club is worked.

Club Magazines and Monthly Bulletins

An interesting topic that arose at the conference of the London clubs was the form that club publications should take. It was generally agreed that it is advisable to publish a magazine of some kind, but it was reported that in certain instances difficulty was experienced in keeping up the standard of contributions. This is particularly noticeable in small clubs, and in those not fortunate enough to possess a keen and enthusiastic editor.

I am a firm believer in the value of a club magazine and often have urged that efforts should be made to start one in every established club. Where there is any difficulty in maintaining interest, however, the plan of issuing a monthly Bulletin should be adopted. This may include short reports of recent events, together with a programme of meetings to be held the following month, and it also should contain comments on any features of interest in connection with club work.

The practice of issuing a monthly Bulletin has been followed in certain clubs for a considerable time. A production of this kind is more satisfactory than a magazine that varies considerably in merit and interest. Wherever possible, copies should be made by means of a jellygraph or some other convenient duplicating process, and these should be widely distributed. When used in this manner, a Bulletin serves a useful purpose in keeping members and friends of a club in touch with progress, and it may be enlarged into a regular magazine when a suitable opportunity arises.

Introducing New Hobbies

Last month I pointed out the value of hobbies in introducing variety and interest into club work, and mentioned several that were suitable for Meccano clubs.

The first step to be taken in introducing a special hobby is to find a member of the club who has a good knowledge of the hobby proposed. Members who wish to pursue the new activity should then meet under his leadership in order to make arrangements in regard to the time of meetings and the supply of the necessary materials. If a sufficient proportion of members show decided interest in the new hobby, a club night should be devoted to it periodically. Alternatively a special section may be formed, but whatever plan is adopted the scheme should be thoroughly discussed and approved by all concerned before work is started.

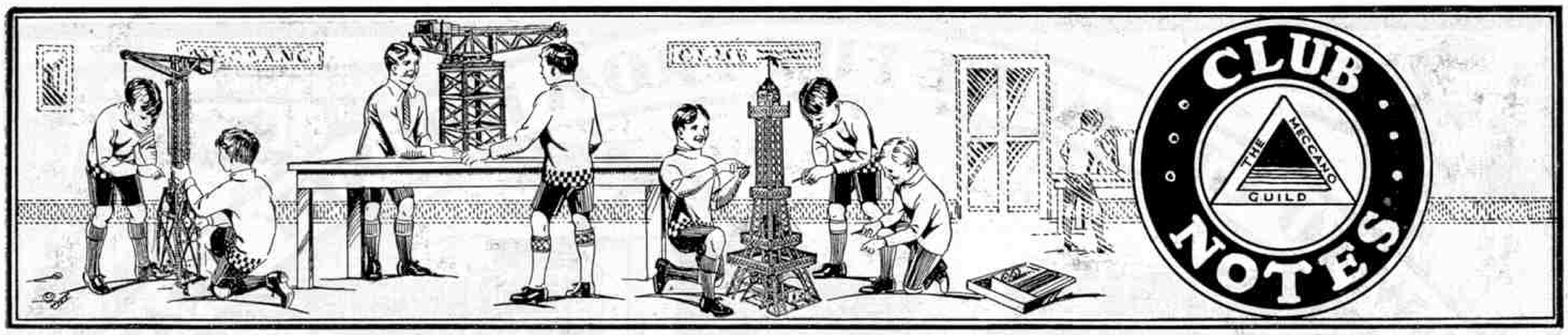
Proposed Clubs

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 :—

AUSTRALIA—W. J. T. Watson, 595, Parramatta Road, Leichhardt, N.S.W.

INDIA—S. A. Gazdar, Mowji Street, Runchore Lines, Karachi.

LONDON—E. Steele, 18, Mayton Street, N.7.



Braintree County High School M.C.—Members have been occupied in preparations for the Exhibition on School Speech Day. The models built for the purpose were of a high standard and the display was very successful. Meetings devoted to light entertainment have included a Gramophone Morning and a Table Tennis Tournament. Great use is made of the Episcope available for the use of the club. A series of lectures on the technical side of wireless have been given. Club roll: 23. *Secretary:* P. Allen, St. Edmunds, Bocking, Braintree.

Holy Trinity M.C.—A special Meccano Night is held fortnightly. Many excellent models have been built, including a splendid Lift in which the batteries employed for lighting purposes were concealed in the balance weight. On one Model-building Evening, Mr. S. Wilson, Leader of the club, brought new Meccano parts for examination and explained their use. A Tool Cabinet has been obtained for the use of the Woodwork section. The Model Railway section has extended its layout, and a new station 3 ft. in length has been made. The Meccano Aeroplane Constructor Outfits have aroused great interest, and a special meeting was devoted to work with them. Visits of outstanding interest have been paid to Beckton Gas Works and Croydon Aerodrome. As an experiment, the club is now being run largely by members, the results so far having been very encouraging. Club roll: 45. *Secretary:* J. A. Hines, 331, Liverpool Road, Islington, N.1.

Ashton-in-Makerfield M.C.—Has now been affiliated and is making good progress. A Simplicity Contest has been held, the First Prize being divided between two competitors, each of whom obtained 15 marks out of 16. At other meetings models built by members were inspected and criticised, and one of the new Aeroplane Constructor Outfits was used for Model-building purposes. An interesting Exhibition was held during Meccano Week, early in December, when models constructed by members were displayed, together with the Workshop and Transporter Bridge on loan from Headquarters. Club roll: 16. *Secretary:* H. H. Crook, 63, Bolton Road, Ashton-in-Makerfield.

King's School M.C.—The excellent programme arranged has included Debates, Contractors' Nights, Hornby Train Evenings and Lectures. A Debate on the motion, "*That Road Transport Will Supersede Rail Traffic,*" was keenly contested and lost by 16 votes to 6. A Lecture on "*Railways*" proved very enjoyable. Mr. F. Berridge, Superintendent of the local Power Station, gave an interesting description of the plant in his charge, and kindly arranged a visit to the station as a sequel to his talk. Club roll: 23. *Secretary:* R. Grant, King's School, Peterborough.

Clacton High School M.C.—Mr. R. Ellis has been obliged to resign the Leadership and Mr. J. L. Howl has kindly agreed to take his place. A novel Electrical Evening proved a great attraction. Members were asked to bring to the club room anything of an electrical character and short explanations of interesting points then were given. Models of excellent design have been submitted in Model-building Contests, and the secretary has given a Lecture on "*Motor Cars and the Motor Industry.*" A visit is to be paid to Clacton Post Office, the interior of which has been reconstructed. Club roll: 23. *Secretary:* D. E. Mills, "Isworth," Vista Road, Clacton-on-Sea, Essex.

Gorse Hill Baptist (Swindon) M.C.—A satisfactory increase in membership is recorded and excellent meetings have been held. Models are being built, and other preparations made, for the club's stall at the Annual Sale of Work of the Intermediate Christian Endeavour. A large sign consisting of the word "Meccano" worked in Meccano strips will be mounted above the stall. Club roll: 21. *Secretary:* C. P. Culley, 5, Ipswich Street, Swindon, Wilts.

Great Baddow M.C.—The Exhibition of models arranged for the opening of the Session was highly successful. Among the models displayed were the Bennie Railplane, Wire Rope Making Machine, Steam Hammer, Bridges, Cranes, and others. A large number of people attended on each evening, and a good sum of money was realised. The Annual Outing was held in August, and a party of over 30 travelled to Harwich where they inspected the Train Ferry. To complete the day the party travelled to Dovercourt. Club roll: 37. *Secretary:* Miss D. K. French, Jeffreys House, Great Baddow.

Orwell M.C.—A recent Open Night was well attended and visitors were greatly interested in a Lecture on "*The Toplis Level Luffing Crane*" by Mr. J. Finlayson, Leader of the club, who illustrated his talk with a Meccano model. Other interesting talks have been given by Mr. Finlayson on "*What is Meccano?*" and by Mr. A. Miller, Assistant Leader, on "*The Motor Car.*" Model-building is actively pursued. One evening recently was devoted to the construction of models of all kinds, and another to building various types of aeroplane models. Club roll: 26. *Secretary:* Miss E. D. Hepburn, Rutherburn, Milnathort.

Our photograph shows the members of the Blackburn No. 1 M.C. football team. This is only one of the many activities of this old-established club, which was affiliated in March, 1922, and continues to make excellent progress. A recent exhibition was very successful, the receipts being used to secure a larger club room.

Stamford Hill M.C.—Affiliation with the Guild was celebrated by a special meeting, at which a Lecture on "*Gliding*" was given. The club has been divided into two sections, one for Meccano Model-building and the other for Hornby Train operations. An interesting feature is that members of each section explain and demonstrate their products to those of the other. For instance, a large model of a Transporter Bridge recently built by the Meccano section was shown in working order to the members of the Hornby Train section, who in return explained the working of the Miniature Railway they have designed. A magazine is to be started and many contributions from members already have been received. Club roll: 8. *Secretary:* A. Goodman, 17, Cranwich Road, Stamford Hill, London, N.16.

St. Peter's (Wolverhampton) M.C.—An excellent football ground has been secured, a local Playing Field authority having kindly lent one free of charge on learning that the club is connected with the Meccano Guild. Excellent matches have been played and a full programme is assured. An excellent Hornby Train layout has been designed and very efficient work is carried out on it. A visit was paid to Pratt's Bakery, when "sampling" proved particularly interesting! Mr. Pratt, the proprietor of the Bakery, has offered a prize for the best essay describing the visit. Excellent entries have been submitted in Model-building Contests, and prizes of Meccano parts have been awarded to the winners. Club roll: 29. *Secretary:* F. Mann, 25, Queen Street, Wolverhampton.

1st Eston Scouts M.C.—Great enthusiasm followed the announcement that affiliation to the Guild had been secured. National Rat Week provided inspiration for an interesting competition. The ingenious models produced included one that was almost too efficient, for the hand of one of the section leaders was trapped in it! An interesting Model-building Competition for steering mechanisms was held, each model being tested practically. A Meccano Treasure Hunt also was organised. Four copies of the "*M.M.*" are available in the club room, and a monthly competition for finding certain items in different parts of the Magazine has proved attractive. A No. 2 Aeroplane Constructor Outfit has been bought for the use of members. Club roll: 22. *Secretary:* C. Moore, 15, William Street, Eston.

The Mall School (Middlesex) M.C.—Competitions of various kinds are prominent in the programme, speed testing for model cars being particularly enjoyed. A Lecture entitled "*Queer Customs*" by Mr. W. R. Shearman, Leader of the club, dealt with national customs through the ages and proved very attractive. A Lantern Lecture entitled "*Everyday Life on the Business Line,*" kindly loaned by the L.M.S.R., was shown on Visitors' Night, when a display of models also was arranged. Club roll: 48. *Secretary:* K. Harrison, 51, Newry Road, St. Margarets, Twickenham, Middlesex.

Bridlington School M.C.—This club recently received affiliation to the Guild, and good progress is reported. A Model-building Competition proved very popular, and several interesting lectures have been given. A football team is to be formed at an early date. Club roll: 20. *Secretary:* N. B. Underwood, Bridlington School, Bridlington.

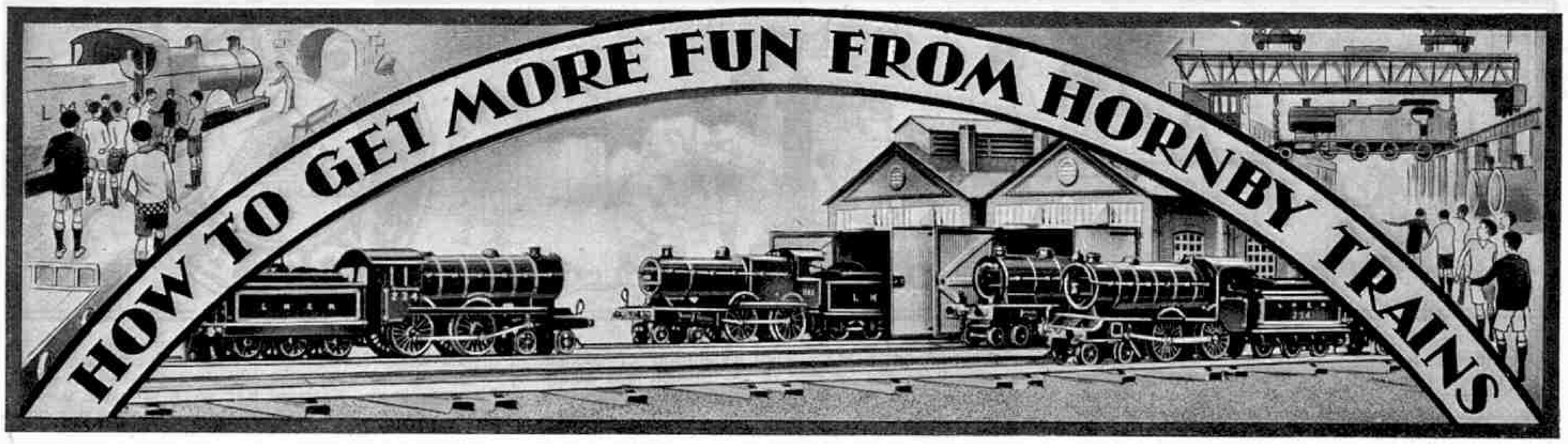
South Croydon and Purley M.C.—Members have been divided for Model-building Competitions into two sections in accordance with the sizes of their Outfits. The most successful of recent Contests were a Blindfold Competition, and one in which models of Cranes were to be submitted. A Treasure Hunt was held, points being awarded to the winner, as in other competitions. A prize is to be awarded in each session to the first member to secure 100 marks in the series of competitions arranged. Club roll: 30. *Secretary:* A. I. K. Bawden, 9, St. Augustines Avenue, South Croydon, Surrey.

AUSTRALIA

Melbourne M.C.—Models constructed at home by members and brought to the club room for inspection have included a Lifeboat, Meccano Orrery, Grandfather Clock, Weighing Machine and Wire Rope Making Machine. A model of outstanding excellence was a Film Projector by means of which a length of about 800 ft. of Australian news reel film was shown on a small screen. An interesting visit was paid to the Head Office of the Victorian Railways, where the Train Control Rooms were inspected. A Parents' Evening was the occasion of a display of models and a Hornby Train Layout. Club roll: 51. *Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

SOUTH AFRICA

Malvern Methodist M.C.—The club continues to make excellent progress. Model-building is of a high standard and competitions are frequently arranged. Much attention is given to sport, and cricket matches are now being played regularly. A visit to the Meccano Exhibition arranged by Mr. A. E. Harris, the Agent of Meccano Ltd. in South Africa, was very much enjoyed. After inspection of the models, tea was provided and a football was kindly presented to the club by Mr. Harris. Hat Debates are greatly enjoyed and some of the subjects dealt with have been "*Advances of Engineering,*" "*Safety First,*" and "*How to Train for Football.*" Club roll: 56. *Secretary:* H. G. Price, P.O. Box 8, Cleveland.

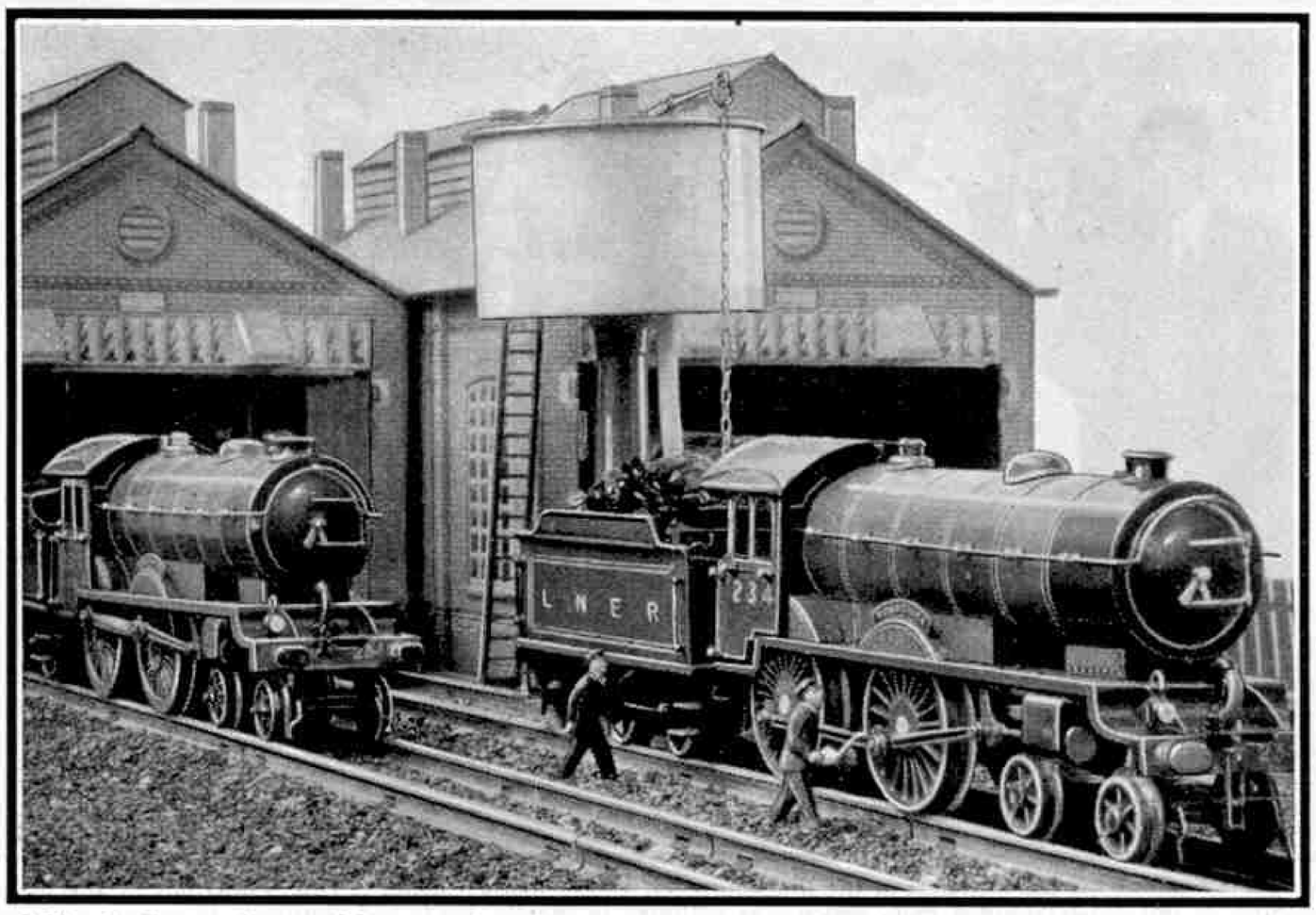


XXXIX.—LOCOMOTIVE WORKING ARRANGEMENTS

WHEN considering railway services as a whole it may seem a comparatively simple matter to provide the train of coaches and the necessary locomotive to form, say, "the 8.45 a.m." from one station to a certain destination; and if this is a local suburban train the return of the same engine and coaches to the starting point soon after their arrival at the terminus seems easy enough. A little consideration of the various factors to be taken into account makes one realise, however, that even if rolling stock is available, the provision of suitable locomotive power for each and every train is not an easy problem.

Some engines are not suitable for fast work; some may be too heavy for certain parts of the line, while the loads of certain trains may be beyond the powers of a particular class of engine. When we include also goods trains, and remember that an engine may have to be stopped for a trifling repair and thus be unable to take its scheduled turn, we do not envy those who are responsible for the working arrangements of the locomotives under their charge. It is not always possible to provide an engine really suitable for the work in hand. This, however, sometimes provides the opportunity for certain engines to display unexpected powers of speed if in good order and well driven. These exceptional exploits cannot, however, be taken to indicate the possibility of employing a whole series of such engines upon the same work.

Considerable interest is usually taken in the appearance of a strange locomotive at the head of any particular train. Any H.R.C. member who sees an instance of this invariably writes to Headquarters to pass on the information. On a miniature railway the arrangement of locomotive duties is quite an important part of the work, especially where working by timetable or to a system arranged beforehand is carried out, as is quite general now. The number of trains run and the service thus afforded is dependent on the number of engines that are available and the manner in which they can be made to perform as much useful work as possible. Where several engines are employed, a miniature railway operator will find it useful to note down the various duties of each, as a wrong move when trusting to memory might disorganise the service considerably. The pads of special forms that were introduced some time ago for timetable working on Hornby layouts are extensively used, but perhaps the most popular is the Engineman's Job Card or E.J.5, as it is marked for reference. Large numbers of these are required, as different sets of working arrangements may be planned out, so that the duties of every engine may be arranged quite differently in each case.



A Hornby Locomotive receiving attention before the start of its day's work. An engine should be examined, and oiled if necessary, before taking its turn of duty, and the miniature engineman is apparently keenly engaged in this duty.

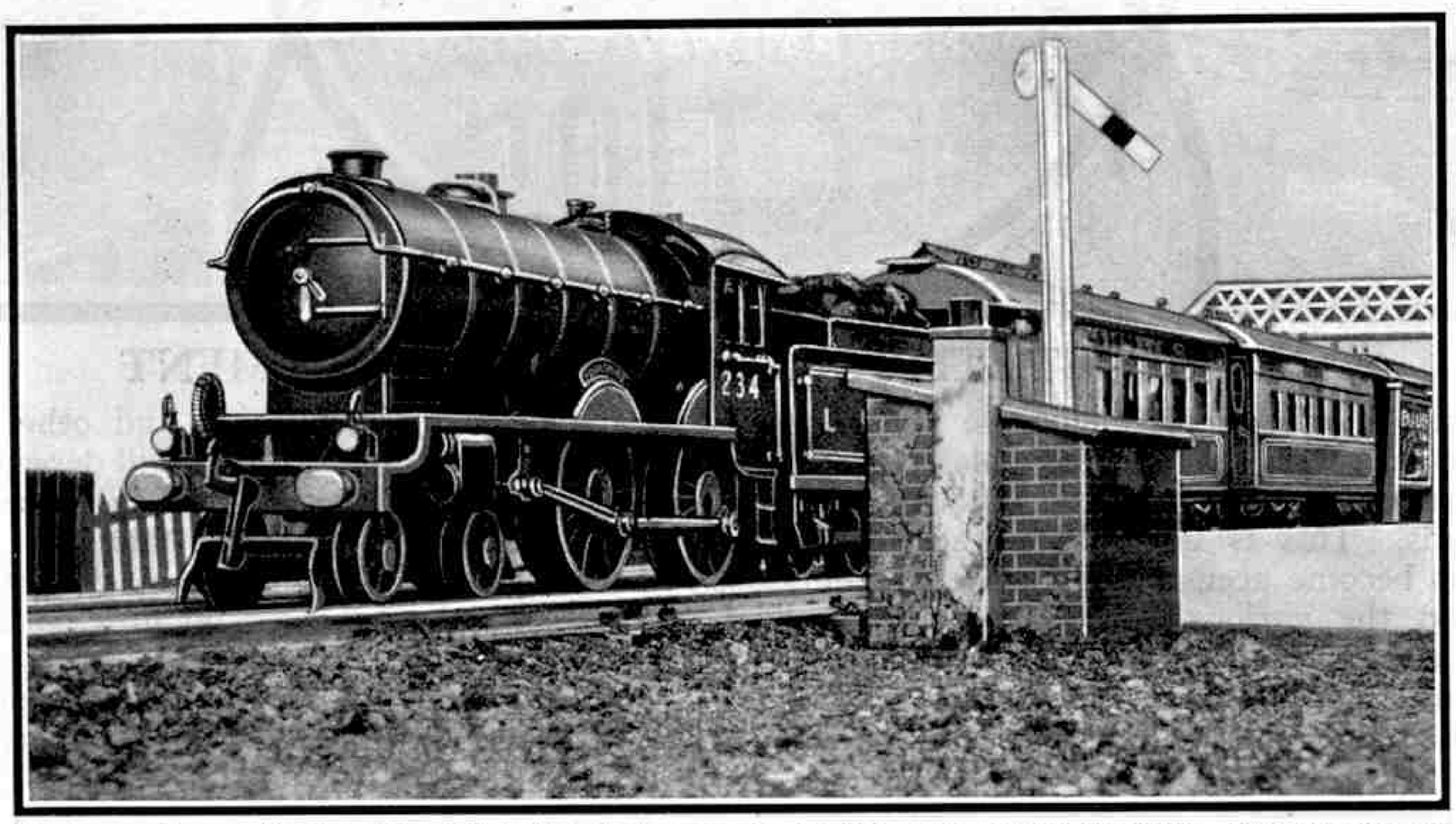
One of these sheets duly filled up is reproduced on the next page, and readers will be interested in it for it shows the variety of duties that an engine may be required to perform during a single period of working. This period may represent "a day" if required, according to the fancy of the operator and the duration of the train running generally.

We will imagine the engine has been brought from the shed and halted by the water column. Attention is given to any small details that may require it, such as a spot of oil on the piston rods, crank pins and elsewhere. An illustration of an engine being prepared to leave the locomotive yard appears on this page, and the realism of the scene will appeal to readers. The shed is situated at Marley, a little distance away from the main station, Glasborough, so that the engine is run "light" for some distance, leaving the yard at 8.15. The details entered so far on the Job Card show that the engine is of the 4–4–0 wheel arrangement, belonging to class D.49—an L.N.E.R. "Shire." It bears the number 234 and belongs to Marley Shed. It is part of the stock of the

Edgemoor H.R.C. Branch, and the duties allotted to it on the card shown are in connection with the arrangements of Timetable No. 1.

The station where it is to commence its daily round is known as Glasborough, and the engine first runs into No. 4 road. Here a van is to be collected, and after attaching this the engine draws forward a short distance and then sets back into Platform 1, alongside which a train of coaches is waiting to form the 8.30 express to Edington. After a gentle start—for the engine has a heavy load to deal with—a brisk run to the first stop at Benton Junction is made. Here Platform 1 is again to be used, and the next move of the engine is to take the van that has come empty from Glasborough and shunt it into a siding for the time being. The engine then returns to the train and is coupled up. Some time is allowed for these operations to be completed, and at 8.33 the train is away again, soon arriving at Edington.

The now empty train is backed out of the station by the engine into the carriage sidings, and the engine thus runs to the locomotive road. Here water is taken and the engine turned in readiness for the return trip; and it waits on a lie-by road until it is time to proceed to Platform 2. As the train waiting there is an ordinary "stopping passenger," a single headlamp by the chimney replaces the express indication that was in use on the down journey. Stops are made at Heaton and Disbury, both wayside stations, and then Benton Junction is again reached. This serves a busy town, and a great deal of parcel traffic is forwarded by passenger train. Therefore the van that was left there on the down journey is now loaded up and standing in the up sidings ready to be attached. The run to Glasborough is quickly completed, and after disposing of the train into the carriage sidings the engine runs into the station. It then reverses to the sheds, running "light."



The Locomotive mentioned in this article is here shown on an express train passing a wayside station. This non-stop run is its last trip of the "day," as the Job Card reproduced below shows.

After a brief rest, during which the coal stage and water column are visited, it again runs down to Glasborough. Here a fast goods, milk and parcels train has been assembled at Platform 1, so after the engine is coupled up the lamps are placed in the correct positions and a start is made. No checks are experienced, and the first stop as scheduled on the sheet is on the loop line, avoiding the main platform at Benton Junction, which serves as an examination road for freight trains. Soon this is left, and a smart run to Edington follows, the train being run into a platform reserved for parcels and similar traffic and known as the "Milk Dock."

Upon arrival the engine is detached and runs forward up to the buffer stops. A crossover and loop line is provided to allow engines to be released, and this is a valuable feature, for occasionally the luggage vans are left at the platform for a considerable time. This time, however, the dock is to be cleared quickly, so the engine runs round the train and is attached at the other end. The now empty vans are hauled by the engine, running tender first, out to the Edington storage sidings. Here again the engine runs round the train and proceeds light to the locomotive road in the station. It is turned and waits in the lie-by road until signalled to Platform 2, where here it takes up the last turn of its working "day"—an express run through to Glasborough without a stop. Shortly after its arrival there the coaches are backed into the sidings and the engine returns to the station. When the appropriate signal is given, it runs light to the depot, where it belongs.

A careful study of the sheet reproduced enables the various movements of the engine to be traced quite easily. It should be remembered that movements in the engine shed yard, and not governed by signals, are not entered on the sheet, as they are made when required as the opportunity occurs. Similarly any use

(Continued on page 68)

Timetable No. 1 E.J.5

THE HORNBY RAILWAY COMPANY

EDGEMOOR Branch

Engineman's Job Card

Engine No. 234 Type D19. 4-4-0 Sheds MARLEY

Time	From Platform	Class	To Platform	Time	From Platform	Class	To Platform
8·15 a.m.	OFF SHED	LIGHT	4 G'boro'	9·00 am	OFF SHED	LIGHT	1 G'boro'
8·20	4	WITH ONE VAN	1	9·5	1	FAST GOODS	Ex. Road B'ton Jc. Milk Dock
8·30	1	Ex. PASS.	1 B'ton Jc.	9·7	Ex Road	-do-	Edington
8·31	1	WITH VAN	Sidings	RUNS ROUND			
8·31½	Sidings		1	9·11	Milk Dock	EMPTY	Edington Storage Sdgs
8·33	1	Ex PASS.	4 Edington	RUNS ROUND			
8·36	4	EMPTY	Sidings	9·12		LIGHT	Edington Loco Rd.
8·37	Sidings	LIGHT	Loco Road	9·13	LOCO TURNED		
8·38	LOCO TURNED			9·14	Lie-by		
8·39	Lie-by			9·15	-do-		2 4
8·45	-do-		2 2	9·16	2 4	Ex. PASS.	G'boro'
8·46	2	STOPPING	Heaton	9·17½	G'boro'	EMPTY	Sidings 4
8·46½	2 Heaton	-do-	1 Disbury	9·18	Sidings 4		G'boro'
8·47	1 Disbury	-do-	2 B'ton Jc.	9·18½	G'boro'	LIGHT	Sheds
8·47½	2 B'ton Jc. Up		Up Sidings				
8·48	Sidings 2	WITH ONE VAN	2 B'ton Jc.				
8·49	B'ton Jc. 2	STOPPING	B'mouth 3				
8·49½	B'mouth 3	-do-	G'boro'				
8·51	G'boro'	EMPTY	Sidings 3				
8·51½	Sidings 3		G'boro'				
8·52	G'boro'	LIGHT	Sheds				

(Signed) R.W. Whitworth SUPERINTENDENT

The Engineman's Job Card referred to in this article. It refers to the duties of a Hornby L.N.E.R. "Yorkshire" Locomotive and enables all the movements of the engine while in service to be followed readily.

XXXVII.—STATION LAYOUT AND EQUIPMENT

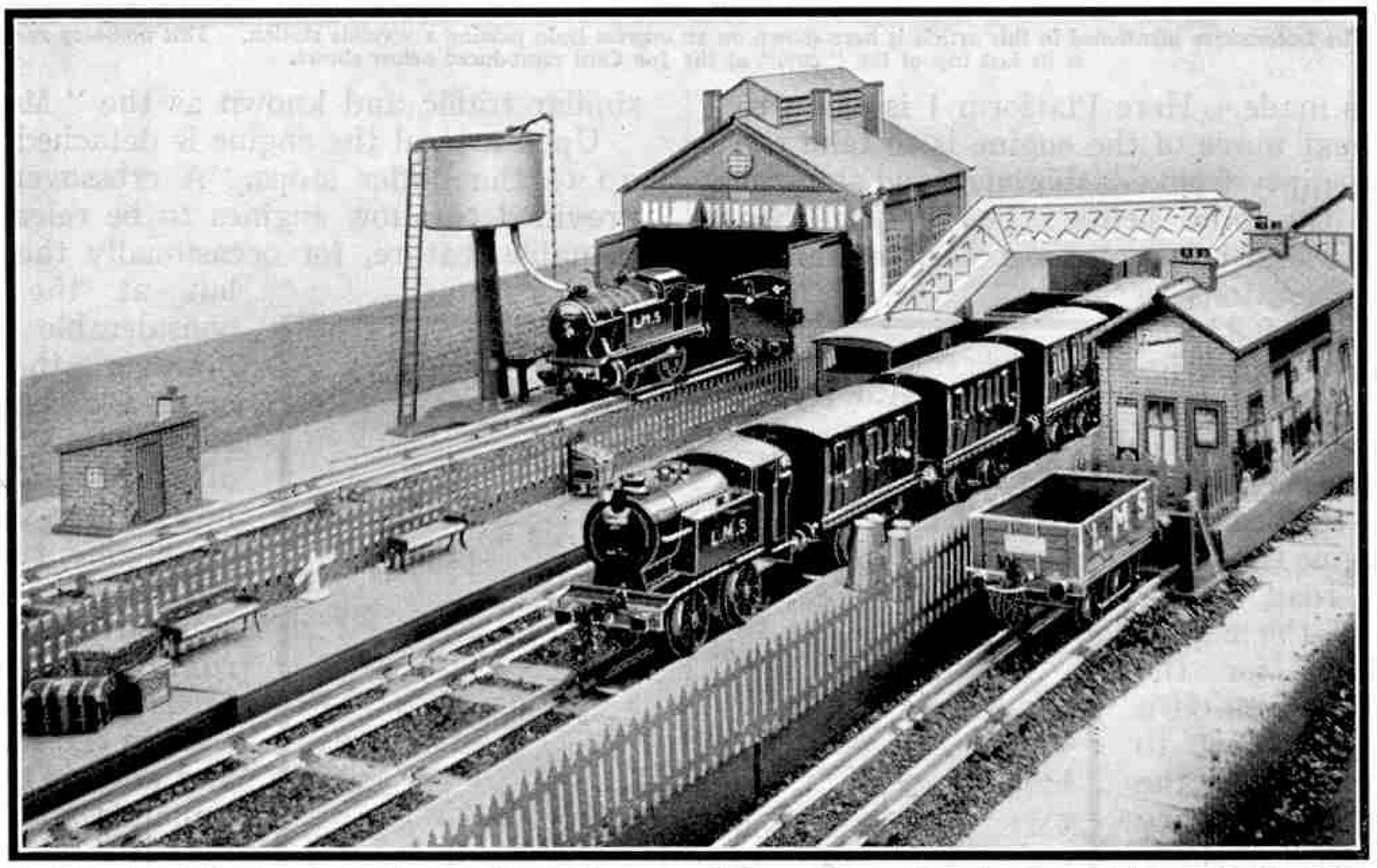
IN the earliest stages of enthusiasm for the miniature railway hobby, attention is directed chiefly to the train and the operation of the locomotive with various train loads. This is in itself an advantage, for beginners thus become accustomed to the handling of the engine and the various vehicles. Different processes, such as winding up the engine, making up the train, and the numerous small points that must be watched become more familiar; and as soon as the locomotive is reasonably well run in, a close knowledge of its capabilities under various conditions is gained.

This is of particular value as the layout develops—as even the simplest does in time—and a larger variety or perhaps a more frequent service of trains is run. In order to run a train service in the correct manner it is necessary of course to have appropriate starting and stopping places. A station therefore is an early necessity on a layout, for this would remain a very deserted track without one or more according to the extent of the line. Therefore some general hints upon station layout will probably be welcomed by "*M.M.*" readers, particularly those who are Junior Section members of the H.R.C.

An obvious step is to purchase a suitable station and to place it at the lineside, the stopping of trains being arranged for either by means of a brake rail or by a little experiment in finding the amount the engine should be wound so as to bring the train to a stop at the platform, as frequently advised in these pages. This certainly gives us a base of operations, but the spectacle of a station simply placed anywhere on the line is not very exciting. The necessary atmosphere or setting is lacking, and it is upon the degree of skill shown in producing this by the suitable arrangement of the station and other accessories that the effectiveness of the whole will depend. For instance, in the first place there should be some means of access to the station building or platform from the road. The Hornby Paled Fencing may here be pressed into service in order to mark off in a suitable manner, the station approach or a roadway.

The extent of the station will of course depend upon the amount of traffic dealt with. A usual arrangement, which gives a well-balanced effect where double track is employed, is to use two stations, one for each track. Connection between the two platforms may be afforded by one or other of the Hornby Footbridges that are available. Extra length of platform can be obtained by the use of Hornby Passenger Platforms, which may be added at both ends of the centre section if required. The use of these suggests another possible arrangement that is shown in one of the accompanying photographs. The station building and perhaps extra platform sections form one side, but for the other track platforms alone are used, finished off at each end with ramps. This plan is seen in real practice and it is a useful arrangement in miniature. The absence of the station building on one side gives a clearer view of parts of the layout that may be situated beyond it, and of course the management of trains is made more easy in such circumstances.

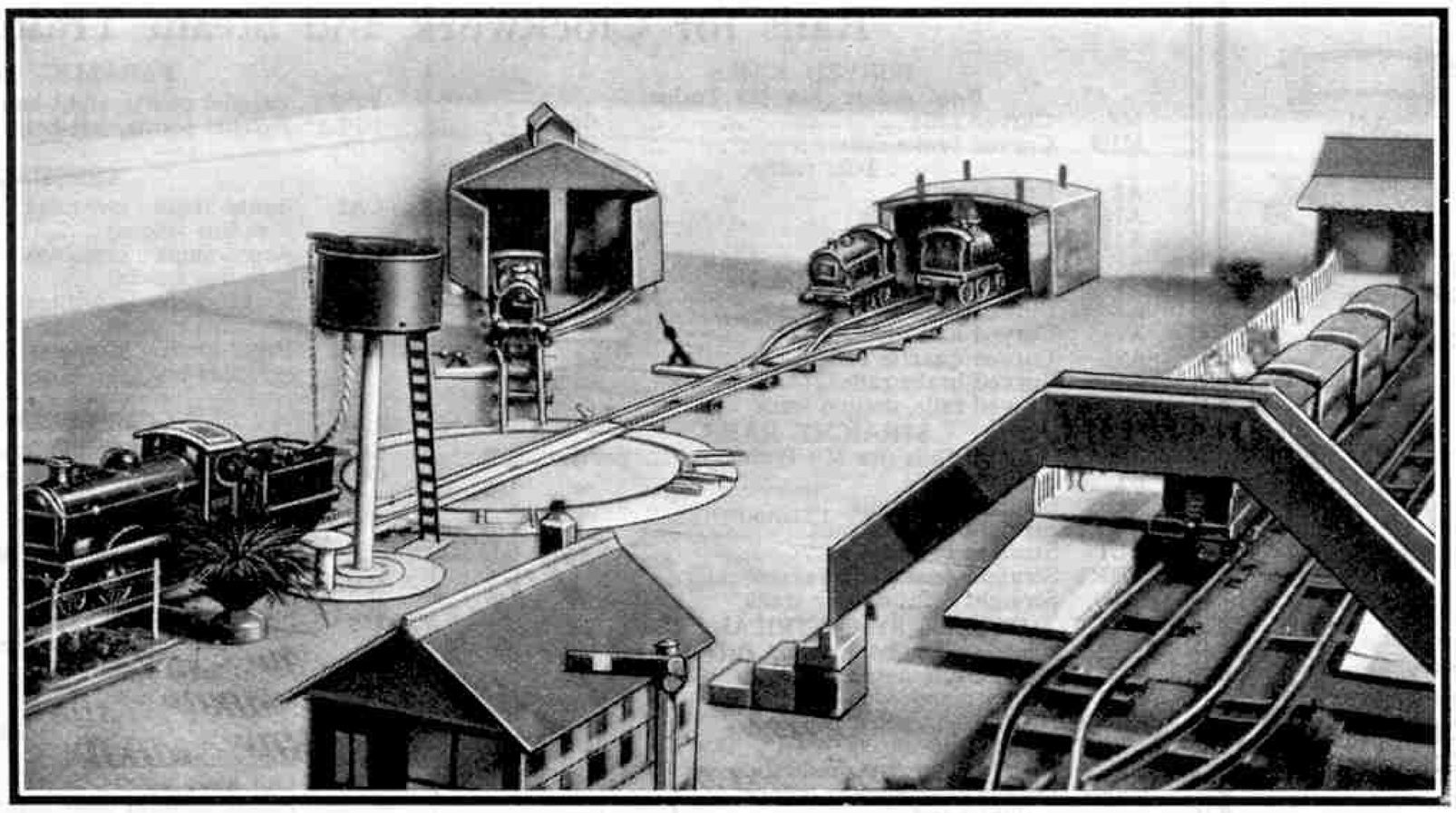
A feature that may be taken advantage of is the difference in width between the centre platform section and the ordinary platforms. This allows a siding line to be accommodated behind the extended platform, terminating in a buffer stop; and this is also shown in the illustration referred to. Then again, where branch line traffic is a feature, the removal of the



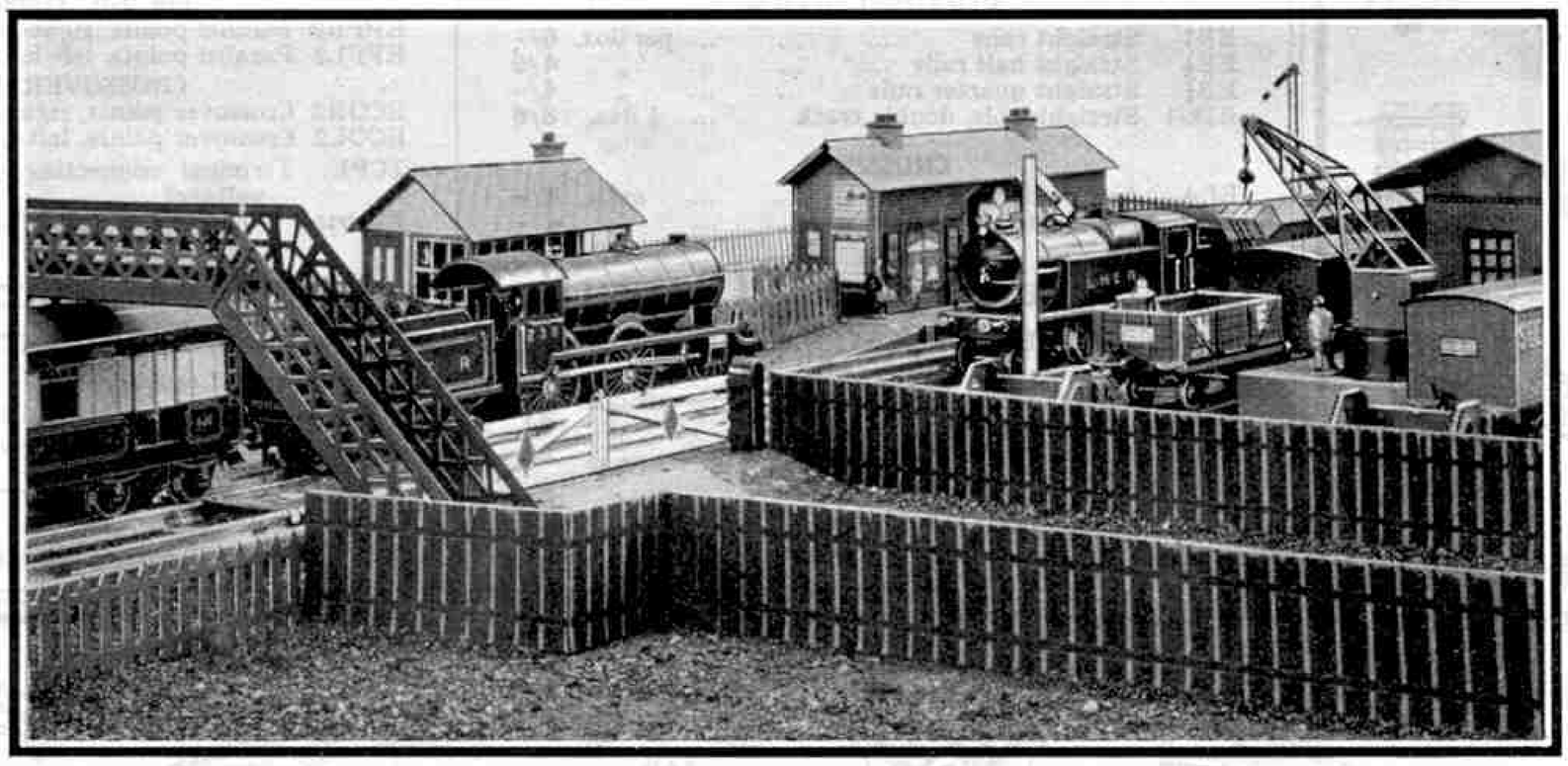
An interesting station layout on a Hornby railway. Passenger Platforms are used to make up a useful form of station with the building on one side only. The engine yard and small siding are arranged as described in this article.

railings, which are attached by Nuts and Bolts, allows the branch train to make use of the "bay" thus formed. Where a simple siding is used, it may be for storage purposes only; or if required it may form part of the goods yard layout. The exact arrangement of this will depend a great deal upon the particular conditions to be fulfilled on the railway. Goods stations and yards were dealt with in these pages quite recently, so that various schemes will no doubt be fresh in the minds of readers.

A Signal Cabin is an essential feature of every station, so that a miniature station on a Hornby layout should not be without one somewhere in the vicinity. Its position will be governed by local conditions and the necessity for a good viewpoint. Occasionally it may be necessary, where the Control System is installed and the Lever Frame accommodated within the Cabin, to consider the ease of handling from the operator's point of view rather than the convenience of the imaginary miniature signalman. A Level Crossing is another interesting suggestion in connection with station layouts, and one of our photographs shows an effective arrangement of railway, roadway and crossing. For the benefit of pedestrians a Footbridge is provided in addition, and this arrangement will be found on numerous occasions in actual practice. The whole scheme is well carried out, and as a glance at the photograph shows, the crossing adds considerably to the charm of the scene.



A terminus station layout on the miniature railway of J. Thomas of Swanage. The station buildings are erected at the rear and the two platforms are thus left clear so that there is no hindrance to the operation of trains in and out.



An effective arrangement for a wayside station. The Level Crossing provides a way over the line for the road, and the use of the Footbridge, Signal Cabin and Goods Platform completes an attractive scheme.

On smaller layouts, where perhaps a single well-arranged station is the centre of operations, it may be convenient to have the locomotive depot and carriage sidings near by. In such cases the arrangement shown in the photograph on the previous page may be applied. Here of course the management of the engines in the yard is considerably eased by the station arrangement, as suggested in a previous paragraph, for the station building is situated upon one side only, the other track being served by a platform alone.

Occasionally it is more convenient to employ the island platform type of station. This is very common on the Great Central main line of the L.N.E.R., and is of course used on other lines, so that there is every justification for its employment in miniature, even for important stations. This scheme is of particular value where space on either side of the track is limited, for an island platform, as its name implies, is situated between two running lines. This type of station thus has several advantages, and of course requires fewer accessories to complete it than where two independent platforms are in use. This feature naturally appeals to those who require the utmost effect with the minimum equipment.

Terminal stations in miniature are often considered to be a difficulty, but it is really quite simple to produce an effective arrangement. The platforms of a terminus all run towards what is known as the circulating area or concourse at the buffer stop end. Here the main station offices are usually situated, and the buildings are sometimes completed by the erection of a tower with a clock. King's Cross is a very well-known example of a terminus finished off in this manner. On a Hornby layout a similar scheme may be followed. The centre section of the Railway Station may be used to represent the circulating area, and it is complete with a suitable building. Sections of Passenger Platform may be attached end on to the platform face, and extend as far as necessary to form the arrival and departure platforms.

Most readers will be familiar with the pattern of locking device used on Hornby Platforms to secure a number of sections together. This arrangement is also provided on the platform face of the centre section of the Railway Station, so that the making up of terminal platforms is not only easy, (Continued on page 68)

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

NOTTINGHAM HIGH SCHOOL.—Meetings have been devoted to laying and testing the track. The main line is double track, with 30 ft. between the stations, and a Branch line is to be added. Four officials are in charge of the track, each with his own staff to assist him. A committee has been appointed to discuss such matters as competitions and exhibitions. A model-building competition has been held, the prizes being a copy of *"Famous Trains"* and the *"Meccano Book of New Models."* Secretary: F. Nabarro, 4, Grosvenor Avenue, Mapperley Park, Nottingham.

HORNSEA.—The Branch members are divided up into Junior and Senior Apprentices and Engineers, and as the membership is very large meetings are held for each section on different nights. The signals and points are each operated by one boy, and one boy is in charge of each locomotive being run. These duties are changed from time to time. Electricity has been installed throughout the layout and some interesting night operations have taken place. Secretary: R. Hill, 1, Clifford Street, Hornsea, E. Yorks.

EXHALL.—The Branch track has been considerably increased in scope and a large New Year Exhibition organised. As it was necessary to purchase more rails to complete the track in time, the members all paid up their month's subscription in advance! Secretary: M. Melville, The Vicarage, Exhall, Nr. Coventry.

OXTON (BIRKENHEAD).—It is hoped to hold four Track Meetings, four Debates and two Lantern Lectures during the season. The members are divided up into Carpenters and Electricians, and after track operations have been carried out for an hour they proceed with their constructional work. Electric colour-light signals have been successfully installed. Secretary: P. K. Woodhouse, 58, Beresford Road, Birkenhead.

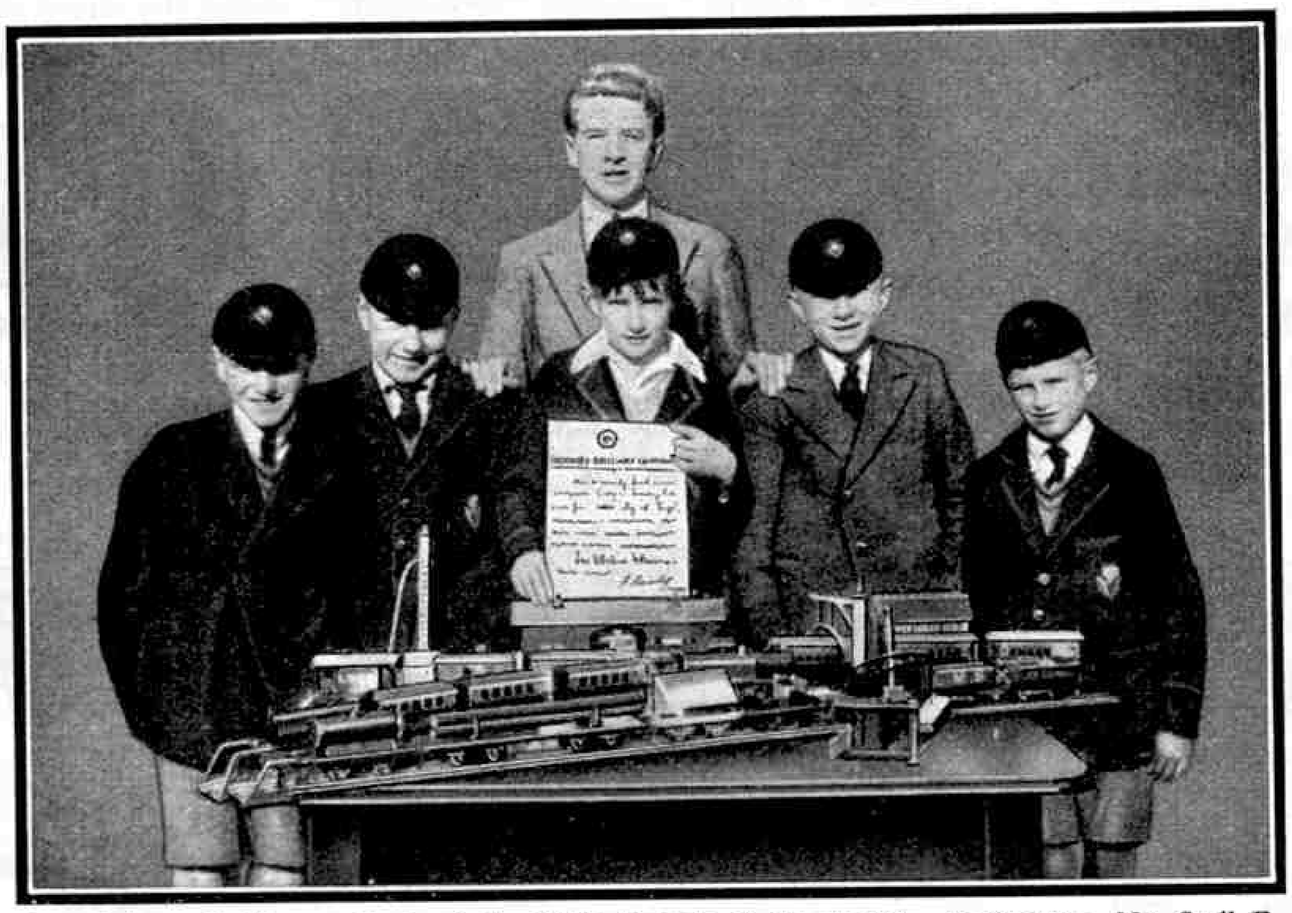
HOLEBARN (NORTHFIELD).—A new track has been planned and a member has volunteered to instal the Hornby Control System. Another member is going to electrify the track. New members are urgently needed and should apply to the Secretary: Ian K. H. Cooke, 165, Hole Lane, Northfield, Birmingham.

"BELFORT" (CATFORD).—The activities of this Branch are hampered owing to the lack of a club room, and anyone who can help in this matter is asked to communicate with the Secretary: F. B. Graves, 133, Bromley Road, Catford, London, S.E.6.

WESTBURY HOUSE SCHOOL.—The members are at work on electrifying the Branch track and it is intended to instal electric lighting throughout the layout. Secretary: E. H. Godber-Ford, Westbury House, West Meon, Petersfield, Hants.

FIRST BOLTON.—A committee of five members has been elected to run the Branch. All future meetings are to be held in a local Mission Room. A debate on the popular subject *"Road v. Rail"* has been held, and the *"Road"* was defeated by 7–1. New members are needed and should apply for information to the Secretary: A. Ainley, 11, Stirling Road, Astley Bridge, Bolton.

FLIXTON (WESLEYAN).—The Branch track has been extended considerably and over two-thirds is now double track. It has been necessary to add a third line at the wayside station to avoid congestion. Speed tests were held and the best speed was attained by a No. 1 Tank Engine, a No. 2 Special Tank hauling the heaviest load. A train crash was arranged and was systematically cleared! Express trains, slow passenger and goods trains are operated. Secretary: J. P. Haworth, Woodthorpe, Rothiemay Road, Flixton, Nr. Manchester.



Our photograph this month is of the 200th Branch of the H.R.C. Chairman: Mr. Cyril R. Clarricotes; Secretary: A. G. Osborn. The members are seen with part of the Branch's railway equipment, which includes three wayside stations and two termini.

Branches in Course of Formation

ARMAGH—J. B. O'Hare, 12, College Street, Armagh, Co. Armagh.
BOWDON—N. M. Makin, "Arden," Cavendish Road, Bowdon, Cheshire.
CHAPELTOWN—Cyril Platts, 50, Smith Street, Chapeltown, Nr. Sheffield.
CHESHAM—R. M. Phillips, "Beecroft," Botley Road, Chesham, Bucks.
CRAYFORD—H. Smale, 4, Heath Road, Crayford, Kent.
DUNDEE—Walter Brown, c/o Blyth, 260, Hilltown, Dundee.
EASTLEIGH—J. Hawtree, 61, Arnold Road, Eastleigh, Hants.
HOLCOMBE BROOK—R.G.W. Heller, Plane Tree House, Holcombe Brook, Nr. Bury.
LONDON, N.19—K. Fensom, 54, Gladsmuir Road, Highgate, London, N.19.
NOTTINGHAM—John Cooper, 33, Broughton Drive, Wollaton Park, Nottingham.
NUNEATON—M. Hanson, 145, Earls Road, Nuneaton, Warwickshire.
READING—C. W. Whiteley, "Hill Top," Westwood Road, Tilehurst.
RUNCORN—J. Blake, 27, Lord Street, Runcorn.
THURMASTON—Keith Mann, 8, Colby Road, Thurmaston, Nr. Leicester.
WELWYN GARDEN CITY—E. Lowe, 31, Attimore Road, Welwyn Garden City.

OVERSEAS

AUSTRALIA—J. Sheridan, Sandgate Street, Deagon, Brisbane, Queensland.

Branches Recently Incorporated

200. SKEGNESS—Anthony G. Osborn, Lumley Lodge, Skegness.
201. "ACACIAS" (HEREFORD)—B. Bolt, "Acacias," Ferndale Rd., Moor Park, Hereford.
202. ST. ALBANS—A. W. West, 6, Oswald Road, St. Albans.
203. FIRST CHERTSEY—V. Longman, 2, Chantry Road, Chertsey.
204. "BROOKE HOUSE" (STREATHAM)—L. F. Ling, "Brooke House," Rotherhill Avenue, S.W.16.
205. ST. CHRISTOPHER (JUNIOR SCHOOL)—C. Morris, "Maryland," Sollershott W., Letchworth.
206. FIRST BOURNEMOUTH—R. P. Common, 13, Uplands Road, Bournemouth, Hants.

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.

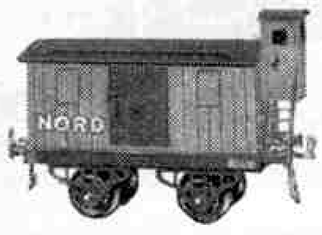
Ask your dealer to show you the full range of Hornby Rolling Stock.

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

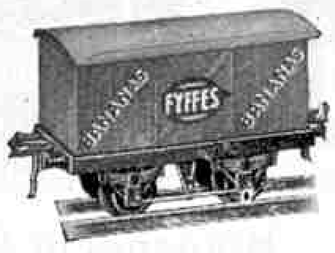
PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/6**

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

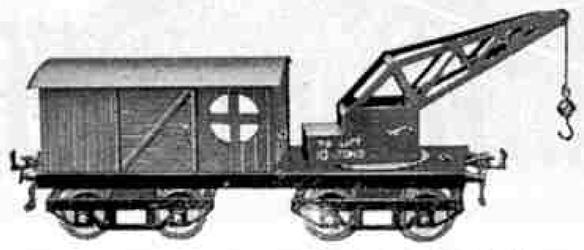
OIL TANK WAGON "CASTROL"
An attractive model Enamelled green with letter ing in red. Price **2/6**



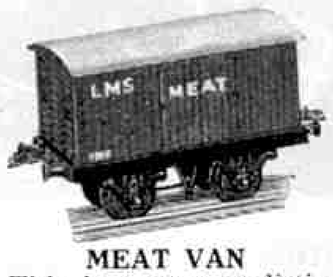
BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in co lours. Opening doors. Price **4/-**



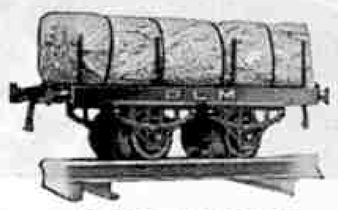
BANANA VAN
An attractive model, finished in yellow and green. Price **3/-**



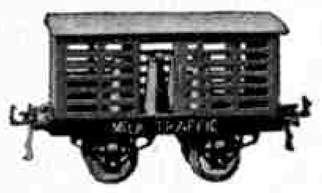
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**



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



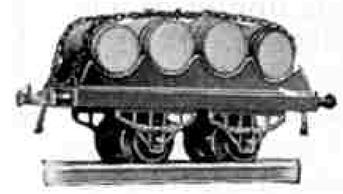
FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/9**



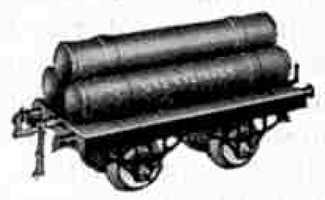
MILK TRAFFIC VAN No. 1
Fitted with sliding doors. Complete with milk cans. Price **3/-**

***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" and either "Speisewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **15/6**

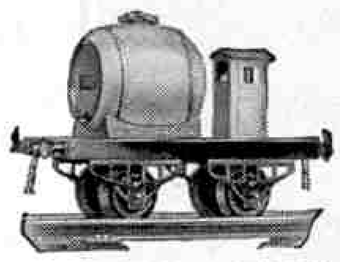


BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/9**

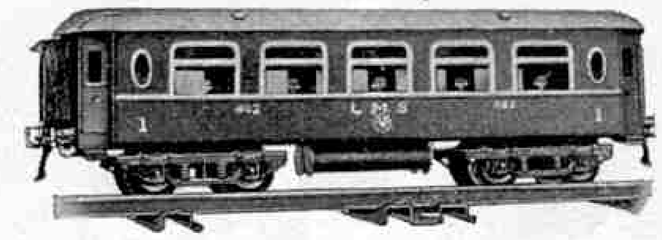


GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**

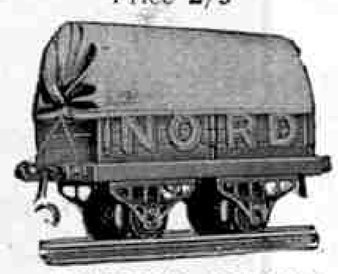
SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



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

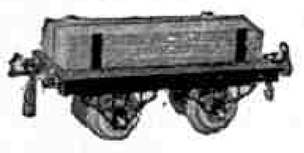


No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**



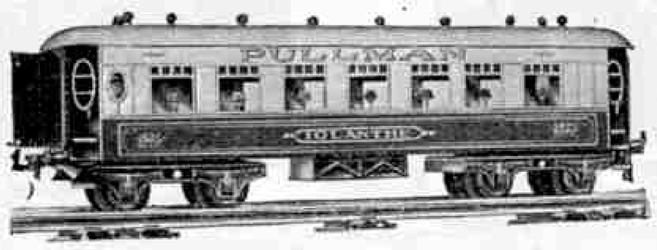
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/-**

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

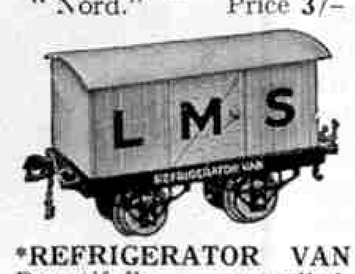


TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**

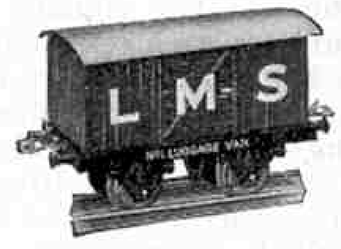
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



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

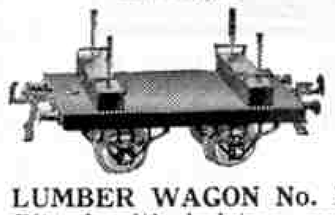


***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/-**

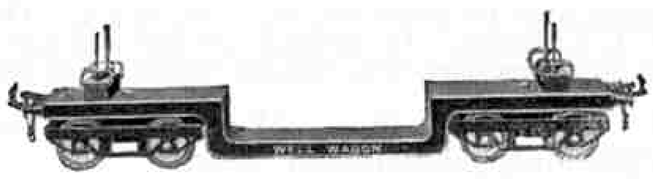


***LUGGAGE VAN No. 1**
With opening doors. Price **3/-**

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

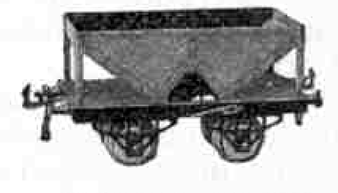


LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/-**

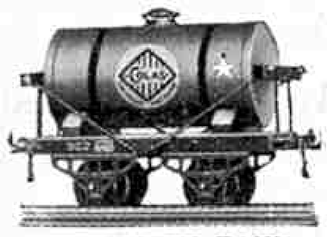


TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

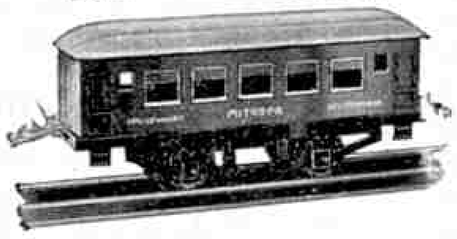
CRANE TRUCK
Finished in brown and blue. Price **3/6**



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

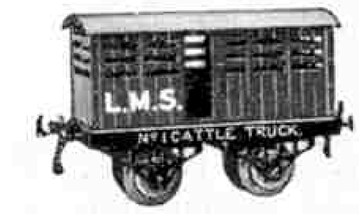


BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**



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

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



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

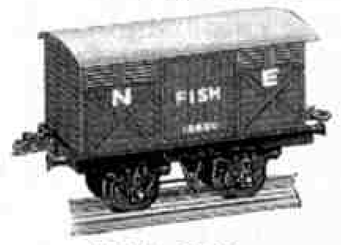
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**

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

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

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

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



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

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

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

H.R.C. COMPETITION PAGE

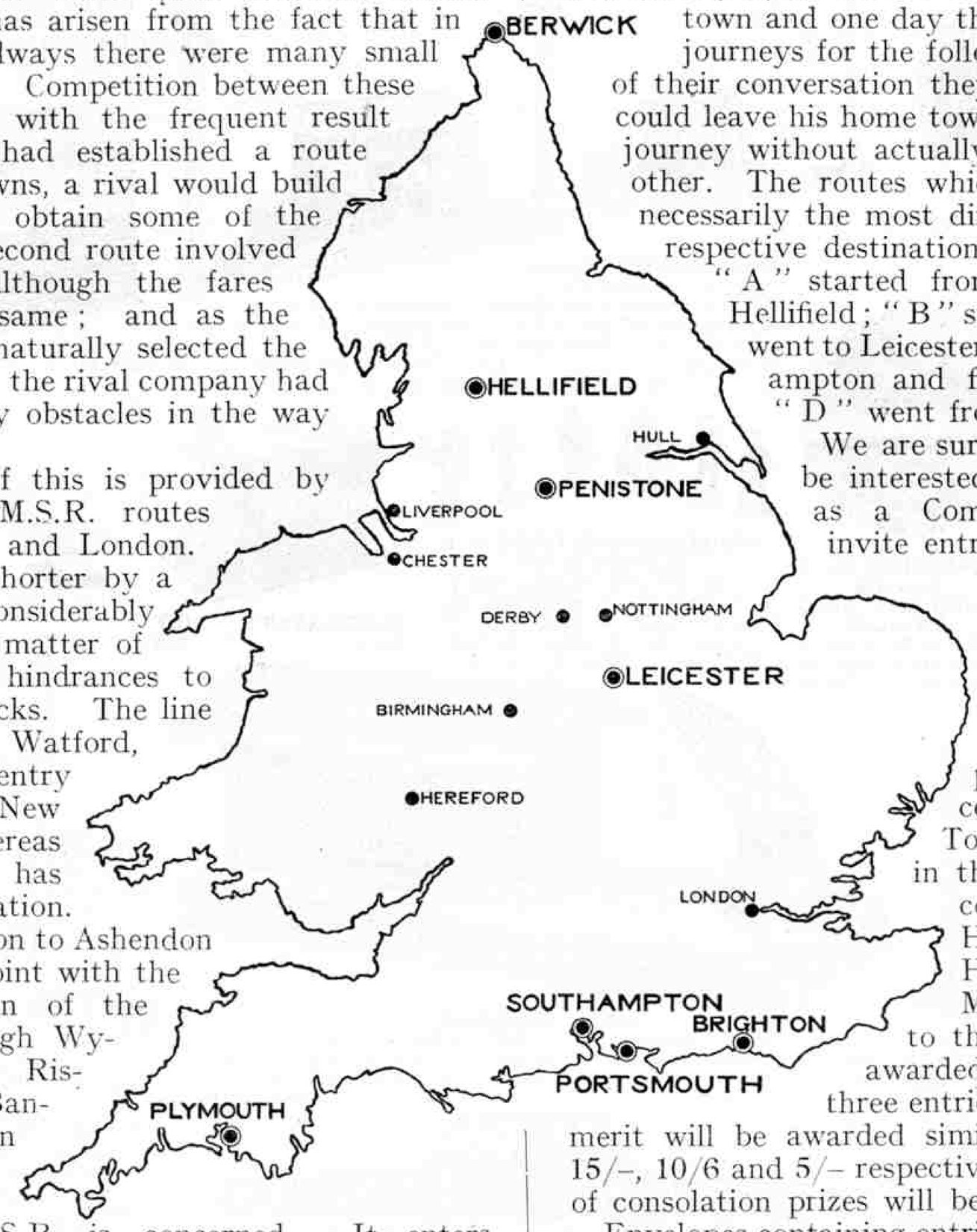
Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name,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

A NOVEL ROUTE-FINDING CONTEST

The complexity of the British railway system in many districts makes it possible to journey from one centre to another by two or more quite different routes. This state of affairs has arisen from the fact that in the early days of railways there were many small independent systems. Competition between these was extremely keen, with the frequent result that when one line had established a route between two large towns, a rival would build another in order to obtain some of the traffic. Often this second route involved a greater mileage, although the fares necessarily were the same; and as the line first in the field naturally selected the most favourable route, the rival company had to contend with many obstacles in the way of gradients.

A good example of this is provided by the G.W.R. and L.M.S.R. routes between Birmingham and London. The G.W.R. is the shorter by a few miles, but is considerably more difficult in the matter of gradients, and such hindrances to running as service slacks. The line from Euston passes Watford, Bletchley, Rugby, Coventry and runs into New Street Station; whereas the Paddington line has quite a different location. From Northolt Junction to Ashendon Junction the line is joint with the Great Central section of the L.N.E.R., passing High Wycombe and Princes Risborough. It serves Banbury and Leamington direct, whereas these are on branch lines as far as the L.M.S.R. is concerned. It enters Birmingham through Solihull and Small Heath, and the trains are accommodated in the underground station of Snow Hill.

When a journey involves travelling over two or more different lines it is interesting to trace on a railway map the tracks passed over. This was done on one occasion by four travellers whom for convenience we will call A, B, C and D. Each lives in a South Coast town and one day they met and discussed their journeys for the following week. In the course of their conversation they found that each of them could leave his home town and complete his railway journey without actually crossing the route of the other. The routes which they adopted were not necessarily the most direct ways of reaching their respective destinations.



"A" started from Brighton and finished at Hellifield; "B" started from Portsmouth and went to Leicester; "C" started from Southampton and finished up at Berwick, and "D" went from Plymouth to Penistone.

We are sure that H.R.C. members will be interested in the routes taken, and as a Competition this month we invite entrants to map out the route adopted by each traveller, and state the towns passed through. The best method of doing this will be to trace on a sheet of paper the map on this page and the towns concerned.

To the competitor who sends in the solution comparing most correctly to that held at Headquarters a prize of Hornby Train material (or Meccano goods, if preferred) to the value of 21/– will be awarded. To the senders of the three entries judged next in order of merit will be awarded similar goods to the value of 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be given.

Envelopes containing entries should be clearly marked H.R.C. "*Railway Route Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, not later than 30th January. The closing date for Overseas competitors is 30th April. Entries received after these dates cannot be entertained.

Drawing Contest

About this time of the year snowfalls are frequent and they often cause delays on our railway systems. The only way of combating a serious block is by means of Snow Ploughs and an interesting article dealing with work of this kind appears on page 22 of this issue.

The subject for our Drawing Contest this month is "*A Snow Plough at Work.*" Many members probably will not have seen one working but this should not deter them, for the illustrations in the article referred to give useful guidance.

Prizes consisting of Hornby Train or Meccano goods to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded to the senders of the four best entries submitted.

Entries should be marked "*Snow Plough Drawing Contest*" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th January. The Overseas closing date is 30th April.

COMPETITION RESULTS

HOME

October "Mutilated Names Contest":—First: F. D. N. Spaven (1022), Corstorphine, Scotland. Second: E. J. Gibson (1959), Bradford. Third: A. F. Agnew (20882), Dublin, S.W.7, I.F.S. Fourth: N. H. Sims (6992), Salisbury.

October "Tank Wagon Drawing Contest":—First: C. A. Brunt (10229), Leeds. Second: L. Parish (18054), Coventry. Third: E. A. Smith (18407), Moreton, Cheshire. Fourth: A. S. Lucking (3556), Witham, Essex.

October "Essay Contest":—First: A. Longbottom (21964), South Kirkby, Nr. Pontefract. Second: F. Downing (23725), Silverdale, Staffs. Third: W. G. L. Young (23220), Holyhead. Fourth: R. Wood (179), Gorton, Manchester.

OVERSEAS

July "Another Impossible Train Contest":—First: D. B. Ray (8854), Johannesburg, S. Africa. Second: J. A. Rodriguez (3647), Montreal, P.Q., Canada. Third: A. Schwartz (24271), Mazabuka, S. Africa.

July "Questions Contest No. 2":—First: R. B. McMillan (9592), Melbourne, Australia. Second: M. L. Morgan (22858), N.S.W., Australia. Third: G. E. Schulz (15425), Coromby, Australia. Fourth: B. Chiles (9191), Port Elizabeth, South Africa.

HORNBY SERIES

HORNBY ACCESSORIES

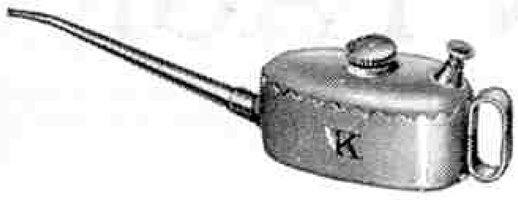
HORNBY SERIES

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

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

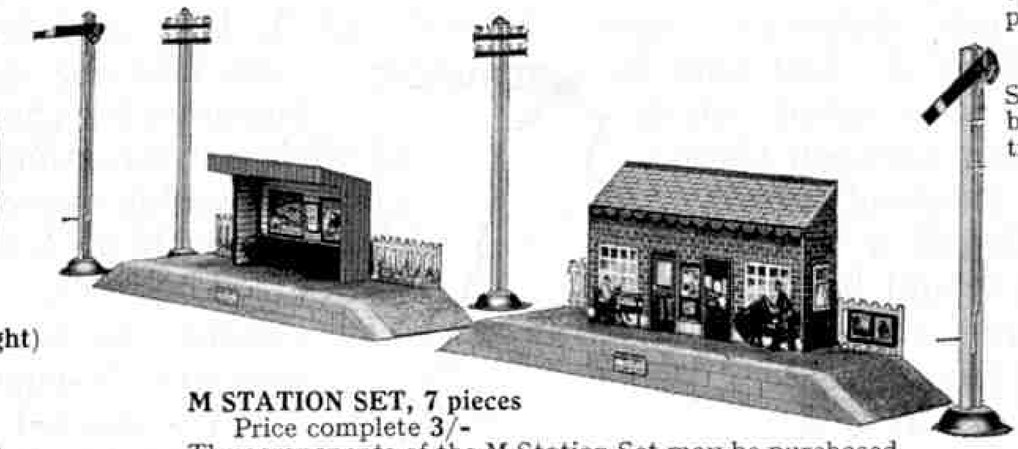
MECCANO LTD., OLD SWAN, LIVERPOOL

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



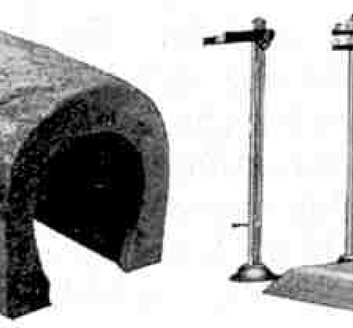
OIL CAN No. 2 (" K " Type)
This miniature Oil Can operates perfectly. The oil is ejected drop by drop by depressing the valve. Polished Copper. Price **3/6**

TUNNEL No. 1 (Straight)
8 ins. Price **2/6**



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

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

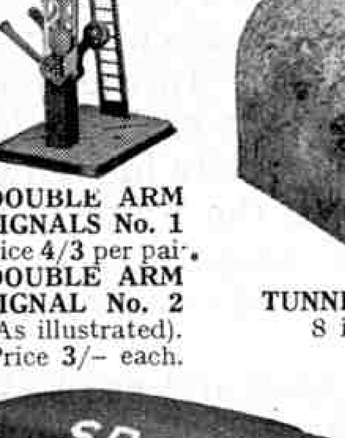


TURNTABLE No. 2
Price **4/6**
TURNTABLE No. 2 (Electrical)
Similar to Turntable No. 2, but fitted with electrical rails ... Price **8/6**

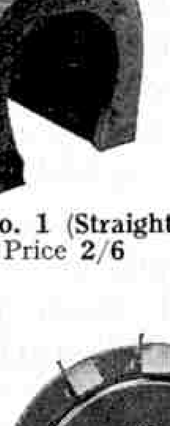
MODELLED MINIATURES No. 1 STATION STAFF
These splendid models, which are beautifully enamelled in colours, add the final touch of realism to Hornby Station Platforms. Price **2/-** per set.

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

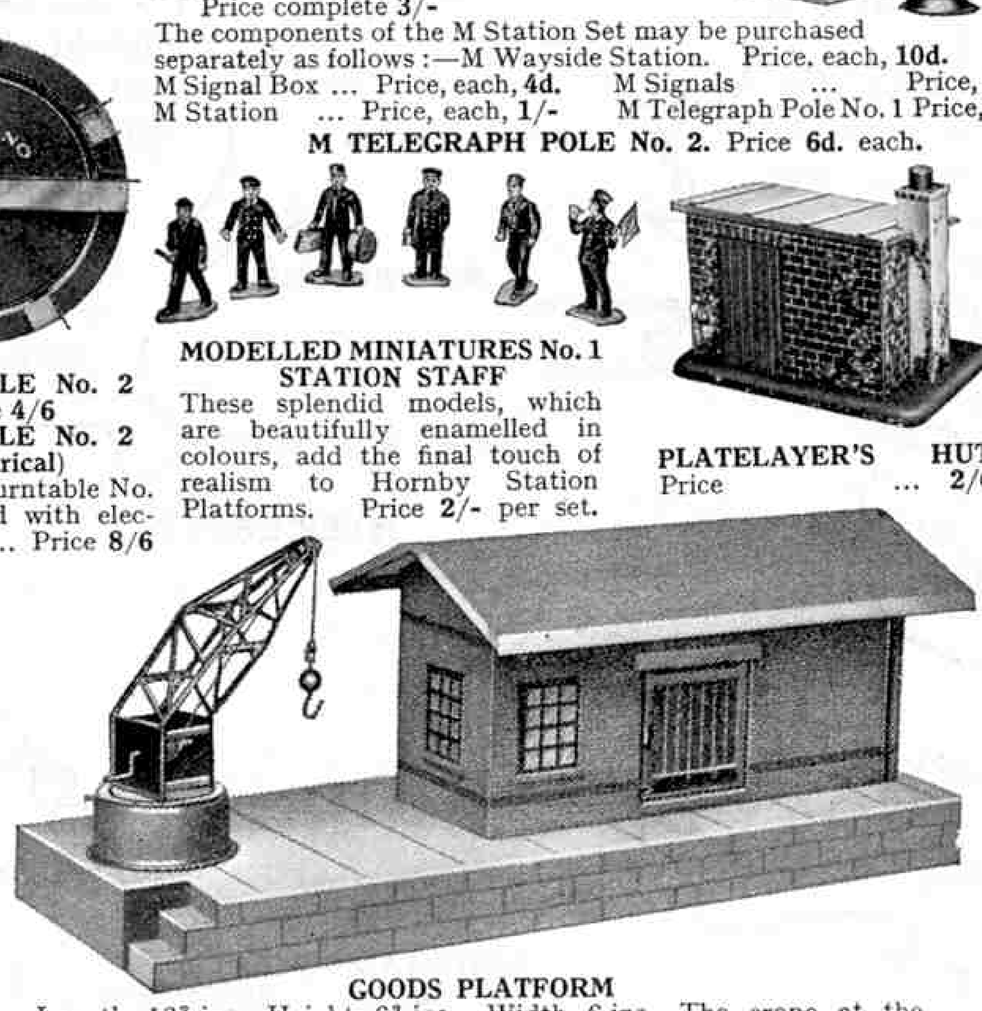
FOOTBRIDGES
No. 1, without signals. Price **4/-**
No. 1a, with detachable tin-printed signal posts and arms ... Price **4/9**
No. 2, with detachable enamelled signal posts and arms (as illustrated). Price **7/6**
Signals only, for No. 2 footbridge. Price ... ... per pair **3/9**



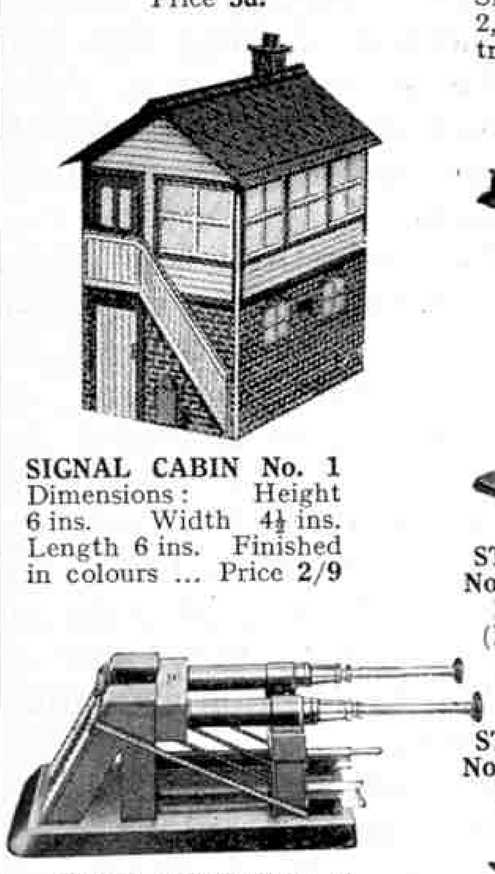
SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price **2/9**



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



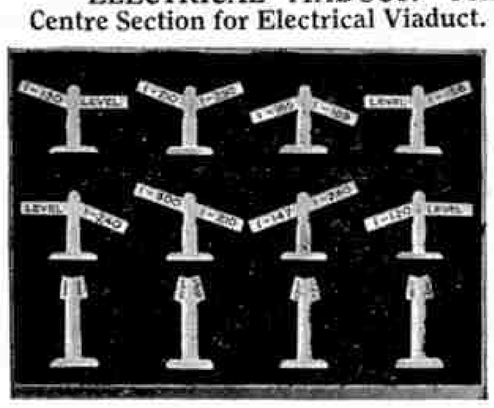
GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **12/6**



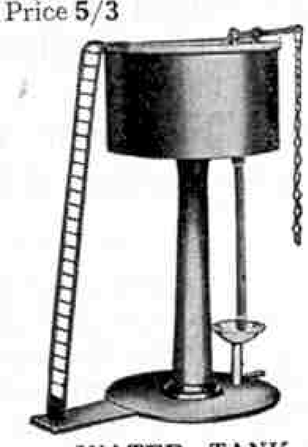
BUFFER STOPS No. 2
(Hydraulic) Price **5/6**

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

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



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

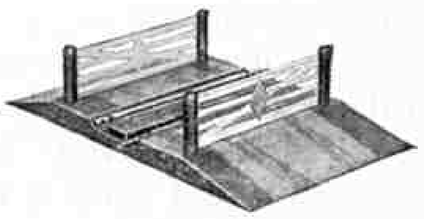


WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever. Price **8/6**

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. They are provided with lugs for attachment to paled fencing, etc. Packet of 6 (3 large, 3 small). Price **6d.**

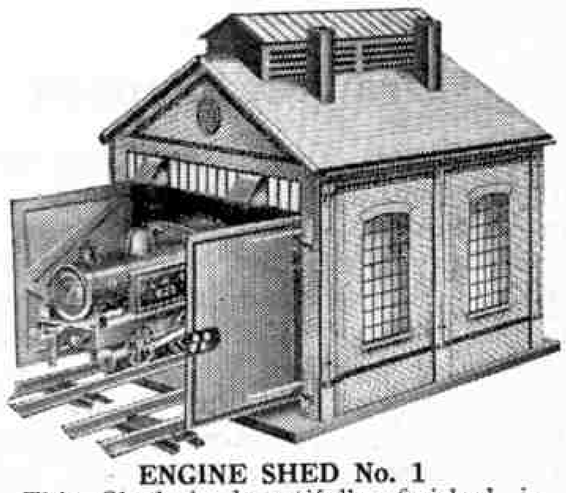
POSTERS IN MINIATURE are reproductions of familiar national advertisements. They are intended to be pasted on the Station Hoardings or the Poster Boards described above, and are beautifully printed in full colours. Packet of 51 ... Price **6d.**



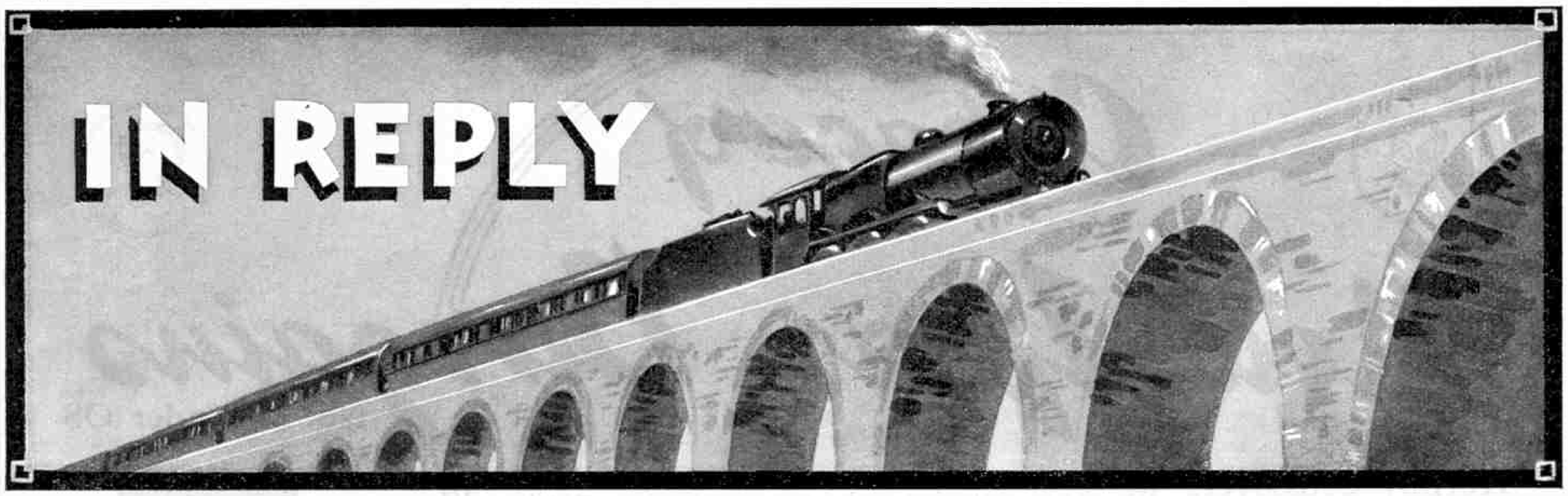
M LEVEL CROSSING
Suitable for a single track. Gauge 0 rails in position. Price **1/6**

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

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



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



Suggested Hornby Train Improvements

CHOOSING A NEW LOCOMOTIVE

At this time of the year we always receive large numbers of letters containing queries from model railway enthusiasts concerning the choice of new Hornby Locomotives. These queries show that the differences between the various types of these locomotives in regard to the radius of curves they require are not sufficiently realised. As an unsuitable choice may cause great disappointment, we take this opportunity of summarising the curve requirements of all Hornby Locomotives.

First of all it must be remembered that the No. 3C and No. 3E Locomotives, the No. 2 Specials, the Metropolitan Locomotives, both clockwork and electric, and the No. 2 Electric Tank cannot be used on curves of a smaller radius than 2 ft. The use of Hornby A2 or EA2 Curved Rails for such engines is essential. As regards the No. 1 Specials and No. 1 Locomotives, both tender and tank, these will negotiate 1 ft. radius curves fairly well, but the use of such curves limits to an appreciable extent their power and length of run. We therefore strongly advise the use of 2 ft. radius curves for these engines.

The No. 0, M3 and M1 Locomotives, each of which now has reversing gear fitted, will run with perfect success on 1 ft. radius curves.

The M0 Locomotive is the only one in the Hornby Series that is suitable for the 9 in. radius rails.

The No. 3 and No. 2 Locomotives are essentially passenger designs, but their occasional employment on goods trains, especially of a fast nature, is not unrealistic. The remaining engines may be used more or less indiscriminately for goods or passenger work, and the No. 1 Special, No. 1 and No. 0 Locomotives are available in goods or passenger traffic colours as required. The M3 Tank and the M1 and M0 engines are in passenger colours only.

A very attractive engine is the No. 1 Electric Tank. This can only be operated from a six-volt accumulator, but complete control is afforded by the combined reverse and resistance switch, without the necessity of touching the engine at all. Needless to say the employment of this engine, especially in conjunction with stock fitted with automatic couplings, makes possible a degree of realism not hitherto attainable.

TERMINAL STATIONS

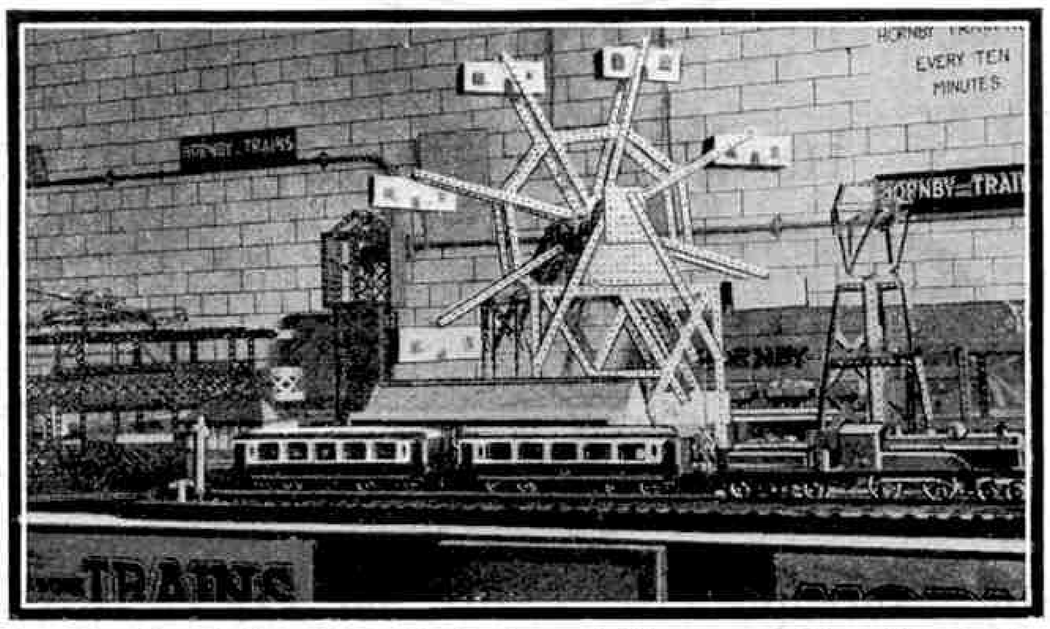
Terminal stations are frequently suggested by H.R.C. members for inclusion in the Hornby Series, but, as we have pointed out on many occasions, the introduction of such stations is not practicable. Any one form or size of any station is unlikely to satisfy more than a few model railway owners, on account of the great variation in their requirements. This would be particularly the case with a terminal station. A further point of importance is that a terminal station of sufficient size to be really useful would be a very costly production and one that for this reason would have a very limited appeal.

Fortunately Hornby Station units are made so that any number of them may be joined together to form an effective whole, so that there is little difficulty in building up a suitable terminal station. The Junior Section pages this month give special attention to stations, and a scheme is described that may be easily employed for a terminus. As an alternative platforms may be arranged in wood or stout cardboard, and the whole arrangement spanned by a roof built up of Meccano Strips and Girders. This method of construction has been adopted by many readers with effective and highly realistic results. In planning a terminal station that is intended to be roofed over, care should be taken to provide sufficient facilities for handling the locomotives and trains that arrive or depart.

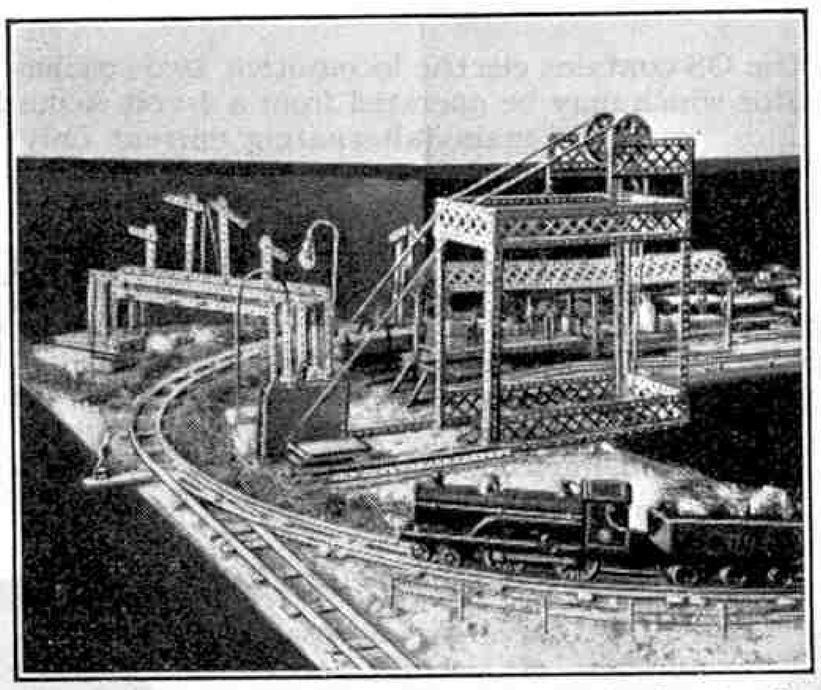
SEMI-PERMANENT LAYOUTS

It is often said in objection to an elaborate layout with many rails, points and crossings that its use involves great waste of time in cases where the track must be taken up after use and laid down afresh when next required. This is certainly true when there is no definite plan of arrangement, but the difficulty can be avoided by making the layout what is known as "semi-permanent," and this plan is being adopted more and more by H.R.C. members. The idea is to divide the layout into sections of convenient size, and then to mount each section upon suitable pieces of three-ply wood. Arranged in this manner even a large and elaborate layout can be laid down or taken up in a very few minutes, and in between operations the sections on their wooden bases are easily stored away in some corner.

Another advantage of this arrangement is that the track is rigidly secured by screws through the sleepers to a firm base, with the result that better and smoother running is assured. Again, many lineside effects may be incorporated that would be almost or entirely impossible with the line laid on the table or floor. The Hornby Connecting Plates will be found satisfactory for joining the rails between sections, but if desired additional security may be obtained by using Meccano Strips screwed across the joints.



An attractive display of Hornby Trains and Meccano models. This is the season for such displays on the part of Branches and Clubs, and considerable interest is invariably aroused.



An interesting corner of a Meccano-Hornby layout. A signal gantry and other accessories made of Meccano parts will be noticed, and the colliery winding gear at the lineside is very effective.

ELECTRIC LIGHTING FOR SIGNALS.—We agree that signals are much more attractive if lit up electrically. You will be interested to know that we are now considering various schemes for the electric lighting not only of Hornby Signals, but of other accessories such as Stations and Level Crossings. We hope to make an announcement on this matter before very long. (*Reply to L. Bamford, Birmingham*).

MINIATURE PASSENGERS.—Since the introduction of the Hornby Modelled Miniatures No. 1 (Railway Staff), we have received many letters of congratulation, accompanied by requests for a similar series of miniature passengers. We have this matter under consideration, but no definite decision has yet been made. (*Reply to R. F. Ledson, Leicester*).

DETACHABLE NAMEBOARDS FOR SIGNAL CABINS.—Detachable nameboards would certainly add to the attractiveness of these already popular accessories. It is not easy, however, to devise a satisfactory scheme that will give a choice of names such as you suggest. We shall give the idea careful consideration as soon as opportunity occurs. (*Reply to R. Critchley, London*).

ALTERATION IN THE DESIGN OF POINTS.—We were interested in your scheme that a short section of rail, equal in length to an existing Quarter Rail, should be added to the facing end of Points. This would certainly allow the standard sleeper to be applied, so that Connecting Plates could readily be used, but the objection is that the length of points thus altered would upset their relation to the existing straight rails which at present are identical in length. (*Reply to E. V. Scriven, Milford Haven*).

ADDITIONAL ELECTRIC LOCOMOTIVES.—Increased interest appears to be taken nowadays in electric railways and locomotives, so that it is probable that electric versions of the No. 2 Special Tender Locomotives would prove popular. The question of the electrification of other engines in the Series has been engaging our attention for some time. We agree that the projecting brush holder caps do not add to the beauty of an engine, but they are readily accessible without removing the motor from the housing. (*Reply to D. Miller, Selby*).

G.W.R. SPECIAL SALOONS.—We cannot at the moment consider the production of such vehicles. Their special character renders them of interest to followers of the G.W.R., but we could not introduce them unless they become typical of British railway practice generally. Pending developments in our coach building programme we suggest that you use the No. 2 or No. 2 Special Pullman coaches, the colours of which closely resemble those of the G.W.R. vehicles. (*Reply to V. Dakin, Westbury*).

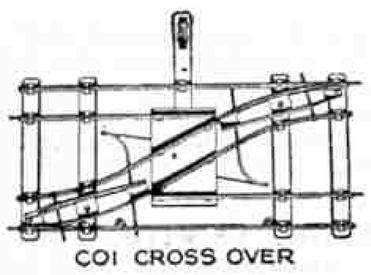
L.N.E.R. (N.B. SECTION) "ATLANTIC" LOCOMOTIVE.—Your suggestion that we should manufacture one of these engines is of interest, but probably only Scottish enthusiasts would greatly favour their introduction. Then again the use of standard designs, such as the "Shires" and the "Flying Scotsman" engines on the duties formerly carried out almost exclusively by these "Atlantics" makes their introduction rather pointless, as the Hornby No. 2 Special or No. 3 L.N.E.R. Locomotives may be used. (*Reply to R. Crichton, Berwick*).

A page of New Year Bargains

Here are some special bargains for Meccano and Hornby Train enthusiasts. Do not miss this opportunity.

These goods are being offered at the greatly reduced prices indicated, because they are not now listed in our catalogues. They are of the finest quality and will give every satisfaction.

Hornby Crossovers OS (1 ft. radius)

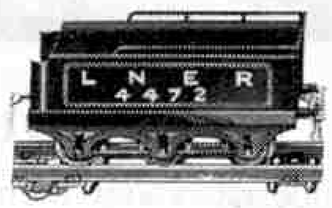


C01 CROSS OVER

Here is a bargain line that will appeal to all boys who possess a Hornby Railway. The Crossovers may be used in all double tracks that are constructed from single Hornby Rails (1 ft. radius), but will not fit the latest Hornby Double Track Rails.

Reduced price **3/3**.
Postage 6d. extra.
Previous price 6/– each.

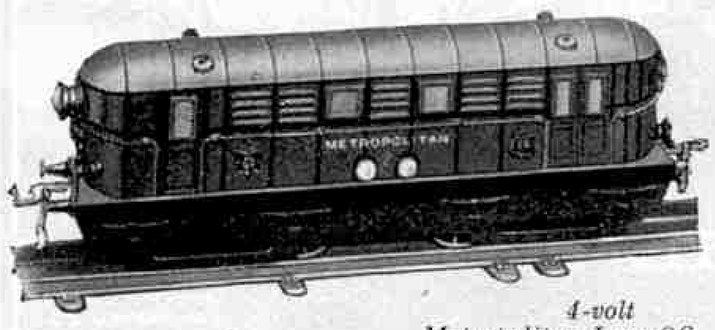
No. 2 Tender OS



This fine tender is well designed and powerfully built. It is a beautifully finished model and is available in L.M.S., G.W., L.N.E. and Southern Railway colours.

Reduced price **2/6**.
Postage 4d. extra.
Previous price 3/6.

Hornby Metropolitan Locomotive OS (4-volt Electric)

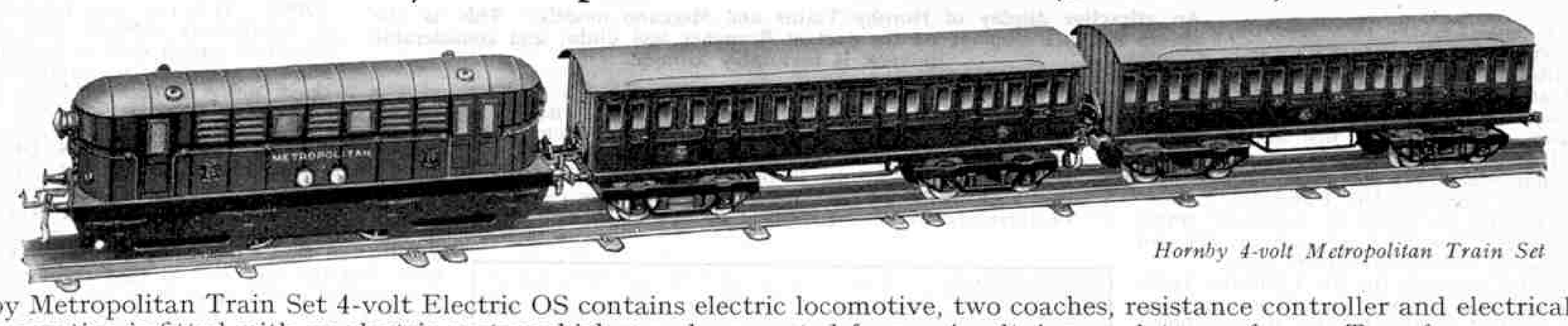


4-volt Metropolitan Loco OS

This realistic 4-volt Electric Metropolitan Locomotive is fitted with a 4-volt electric motor which may be operated from a 4-volt Accumulator or from a Transformer connected to the main (alternating current only).

Reduced price **30/–**
Postage 9d. extra.
Previous price 47/6

Hornby Metropolitan Train Set OS (4-volt Electric)



Hornby 4-volt Metropolitan Train Set

Hornby Metropolitan Train Set 4-volt Electric OS contains electric locomotive, two coaches, resistance controller and electrical rails. The locomotive is fitted with an electric motor which may be operated from a 4-volt Accumulator or from a Transformer connected to the main (alternating current only).

Reduced price **60/–**. Postage 1/3 extra. Previous price 95/–.

Meccano No. 5 Outfit Cabinets OS

No. 5 Oak Cabinet OS

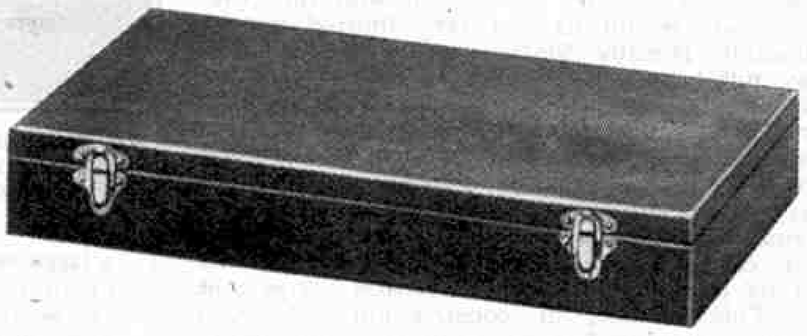
These Cabinets are not quite suitable for the latest contents of the No. 5 Outfit and are therefore being disposed of at a bargain price. They are strongly built of oak and are exquisitely finished. Made in two sections, upper and lower, each of which is fitted with wooden partitions, and provided with lock and key.

Dimensions : Length 17½". Width 12½". Depth 3¼". Reduced price **25/–**.
Postage 1/3 extra. Previous price 35/–.

Special Storage Boxes

We also have for disposal a number of useful wooden storage boxes. These boxes are strongly made and are fitted with two strong spring clasps.

Special price **2/–**.
Postage 9d. extra.



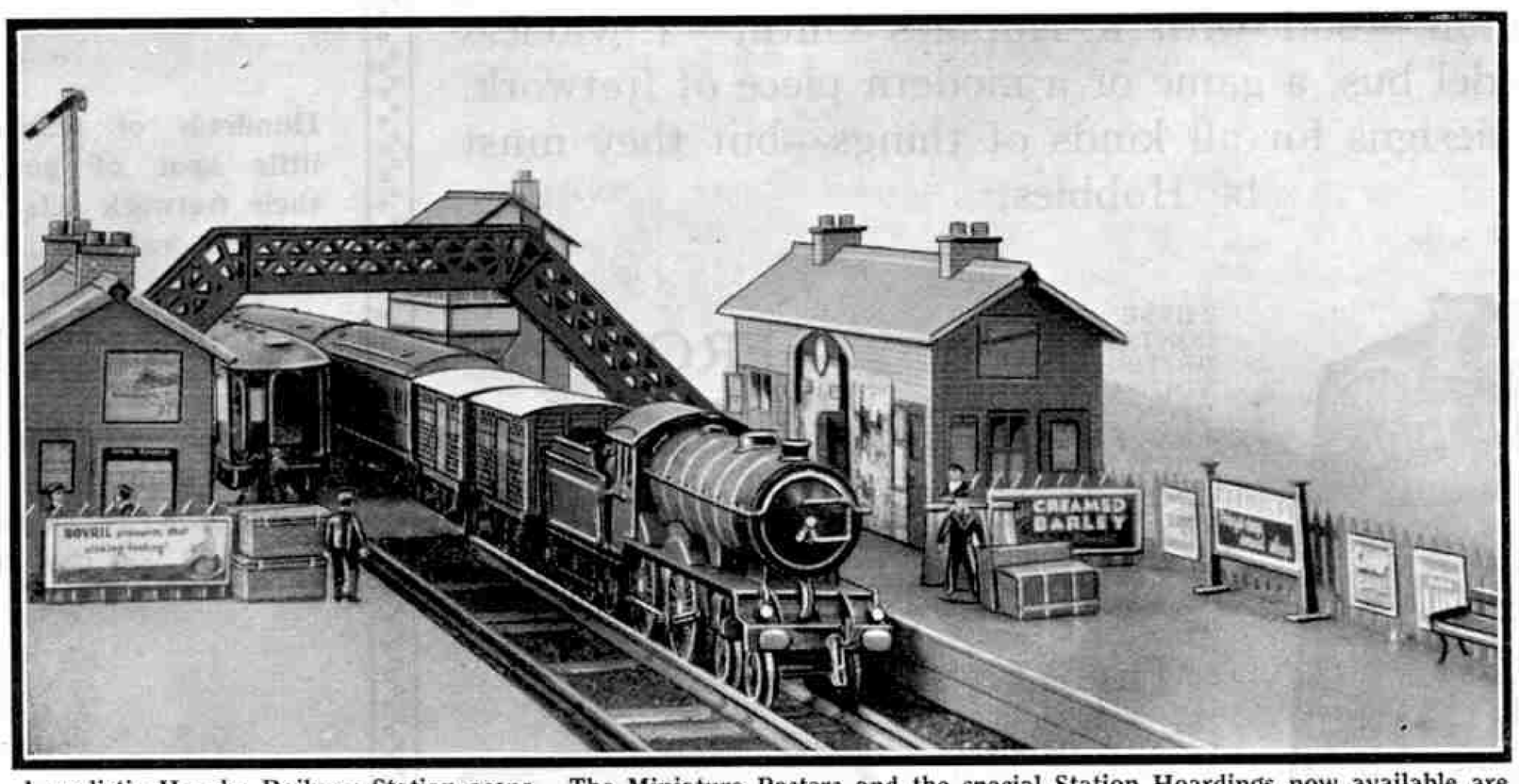
Special Storage Box

MECCANO LIMITED OLD SWAN LIVERPOOL

Hornby Miniature Posters

By "Tommy Dodd"

FOLLOWING the announcement last month of the introduction of miniature railwaymen into the Hornby Series, there are some further interesting items to be mentioned that I am sure will appeal strongly to Hornby Railway owners. These have appeared at an opportune time, for the Junior Section pages this month deal with stations generally, and it is in connection with the effective appearance of stations that these introductions apply. A glance at the photograph on this page shows that there is a remarkably real atmosphere about the station. The presence of the figures and the items of luggage suggests activity, but it will be noticed that various miniature advertisements are displayed at different points. Miniature Posters and a Station Hoarding for their effective display are the latest additions to the Series, and a few remarks about them and their use will be of interest.



A realistic Hornby Railway Station scene. The Miniature Posters and the special Station Hoardings now available are shown in this photograph.

It is interesting to visit our local station and try to imagine what it would look like if all the advertisements displayed upon walls, fencing and elsewhere were removed. It would not appear like our station at all, and certainly would be a dreary-looking place! Even a temporary space left during the short interval between the removal of one advertisement and the fixing of the next attracts our attention.

A very popular form of station advertisement is the metal sheet finished by a special enamelling process. These sheets are familiar to us all, if only for the sound they make when struck! They have the advantage of permanence, for their special coating makes them practically impervious to weather conditions. They may be attached as easily to brickwork as to wood, and need no special board or support. Their attachment is usually effected by hook nails. Many of them are quite striking, but owing to their varied sizes, and the more or less haphazard methods applied in positioning them, according to the practice in vogue until comparatively recently, their full effectiveness is seldom attained.

Up-to-date methods undoubtedly favour the employment of posters, which have been truly described as the "heavy artillery" of modern advertising. The railway companies themselves have long employed posters to encourage travel, and all readers will have seen the various invitations to "Come to Scotland," to stay on the "Drier side of Britain," to visit the "English Riviera," or the various districts recommended by "Sunny South Sam." This attractive form of advertising is now widely employed to bring before the public the advantage of the various commodities, luxuries and necessities that are offered by those who manufacture or retail these items.

This up-to-date form of advertising may now be applied to Hornby railways, for miniature Posters are available in packets each containing 50. These Posters are small scale reproductions, in the original colours, of the most famous posters that cover the hoardings of our towns and cities. The Posters are gummed on the back, so that they may be readily attached to the miniature Station Hoarding that is now available, and the accompanying photograph shows how well this accessory looks when in position on the platform.

The popular Paled Fencing, whether attached to Hornby Stations or used by the lineside, affords a splendid opportunity for the use of the new Posters. It would not be practicable to attach these to the Fencing by means of the gummed back, however. In order to overcome this difficulty special Poster Boards have been provided in the form of a small metal plate with two hooked lugs to hook over the top rail of the fence. A Poster is easily gummed to one of these Boards, which is then attached where desired. A specimen Poster Board is included in each packet of Posters. The Boards are made in two sizes, and are obtainable in packets each containing three large Boards and three small ones. The Poster Boards are readily detachable, and may be moved about as required.

The new Station Hoarding is certain to be a popular accessory on account of its attractive and at the same time realistic appearance. Its use on a station platform is obvious, but it also looks effective when placed in a suitable position by the lineside or by any miniature roadway that may form part of the scenic accessories of the layout. In addition to displaying posters the Hoarding may be used as a timetable board by attaching to it suitable portions of actual timetables.

Everything for Fretwork British-made by Hobbies

THERE'S no better hobby for any fellow than fretwork. And there are no better tools for him to use than Hobbies. They are the only ones made in England. They last a lifetime and provide a delightful and inexpensive hobby. Almost anything can be made in wood with a Hobbies Outfit—a wireless speaker, a model bus, a game or a modern piece of fretwork. Wood, tools, designs for all kinds of things—but they must be Hobbies.

Hundreds of fellows make a nice little spot of pocket money with their fretwork sets. Calendars, toys, wireless cabinets, tables, cabinets—all manner of things can be made in your spare time and turned into money. As soon as you have a Hobbies Outfit (no matter what the price) you can begin. A special booklet all about it is available free on application as below. Get one now and you can make money.

THESE OUTFITS CONTAIN SOUND BRITISH TOOLS YOU CAN RELY UPON FOR LASTING SERVICE. THERE ARE NONE SO GOOD, OR SO RELIABLE. INSIST ON HOBBIES ALWAYS.

FROM 1/- to 45/-

THE BEST TO BUY

THE NELSON SET

A card containing a modern, comfortable handframe and wide range of tools. Polished oval cutting table, an archimedean drill and bit, sandpaper block, hammer, 6-in. rule, dozen saws, wood design and complete instructions.
(Postage 9d.) PRICE **6/-**

The A1.

The most popular tool kit in the world. A complete range of tools, including special lever handframe, a 48-page handbook of instructions, and wood and designs for making six simple pieces of work. Complete in strong hinged box.

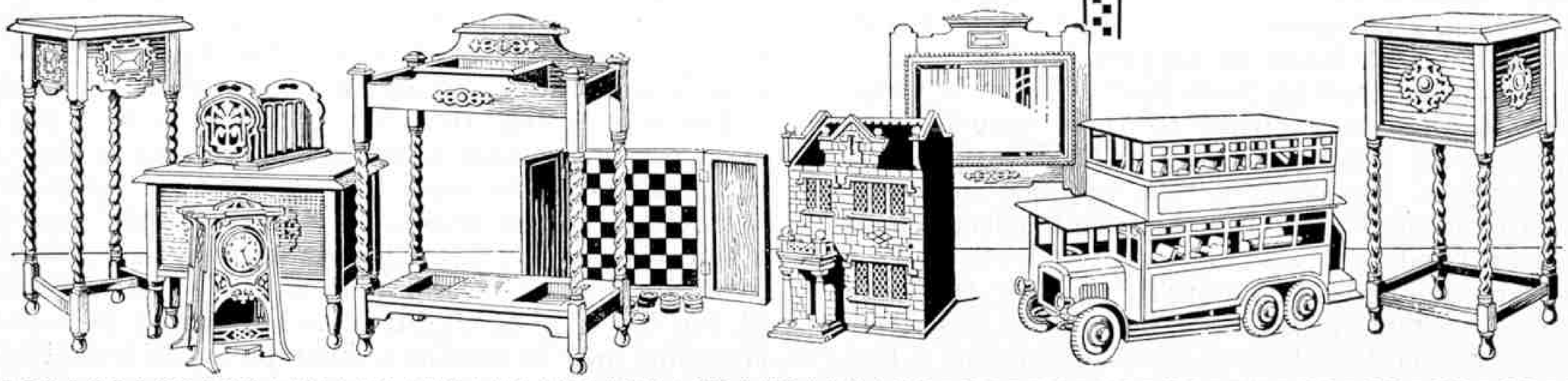
PRICE **10/-**
(Postage 1/-)

Hobbies

Ask for Hobbies at any Ironmonger or Stores. Hobbies own branches in London, Glasgow, Manchester, Birmingham, Sheffield, Leeds, Southampton, Brighton. Or direct from Hobbies Ltd. (Dept. 96), Dereham, Norfolk.

FREE

Write to Hobbies Ltd., Dept. 96, Dereham, Norfolk, and ask for the interesting free booklet "Father and Son." It tells you all about Fretwork and Hobbies.



Competition Page

Which were the Most Popular Covers in 1931?

Few of our contests have achieved so remarkable a degree of popularity as the Cover Voting Contest that has been held each year to decide the most popular "*M.M.*" cover of the preceding volume. The outstanding feature of the contests in past years has been the remarkable diversity of opinion disclosed by the voting and, in inviting our readers to record their favourite among the 1931 covers, we do not anticipate that there will be anything approaching unanimity on this occasion. The 1931 covers maintained such an excellent level of merit that it is difficult to say that this, or that, was the best of the year, and we shall study the voting with much interest.

For the benefit of new readers we must explain that in the above illustrations the coloured covers that appeared on the various issues of the "*M.M.*" during 1931, are reproduced in a reduced form in their order of publication—January to June in the upper row, and July to December in the lower. The reproductions are intended for reference purposes only. They convey nothing of the brilliancy of the colour of the originals, but new readers will find them of great assistance in forming their judgment. Those readers who possess copies of the 1931 issues, or are able to obtain them, should make a careful study of the originals before completing their entries.

Referring to each cover by its month of issue, each competitor is asked to write the following two things on a post card :—

A. The 1931 cover he likes best of all.

B. His idea of the order of popularity of the covers as decided by the massed vote of all the competitors.

This list must cover the whole year, every month being included. The name of the month must be given, and its number in the volume. Competitors need not place their own favourite cover at the head of list B, unless they believe that it will prove to be the popular choice of the remaining competitors. They should place it in the position in which they anticipate it will be placed by the massed vote.

The entrant's name and address must be added to the card, which should be addressed " Cover Voting Competition, Meccano Magazine, Binns Road, Old Swan, Liverpool." No competitor may submit more than one entry.

Prizes of Meccano products, to be chosen by the winners, to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors whose lists most accurately forecast the final result. In addition there will be a number of consolation prizes. In the event of a tie for any of the prizes, preference will be given to the entry displaying the neatest or most novel presentation. Closing date, 30th January. Overseas, 30th April.

Christmas Joke Contest

Rather more than a year ago we offered prizes for the best joke or short story heard at a party. The competition was so great a success that we feel sure our readers would welcome an " encore."

Therefore we ask all our readers to write down on a post card the best joke or short humorous story they heard during the Christmastide that has passed. To the four best stories, in order of merit, we will award prizes of Meccano or Hornby Trains to the value of 21/–, 15/–, 10/6 and 5/– respectively. No competitor may win more than one prize, however.

Entries must be addressed " Christmas Jokes Contest, Meccano Magazine, Old Swan, Liverpool," and should reach this office not later than 30th January. Overseas closing date, 30th April.

Competition Closing Dates

HOME

Christmas Letter	30th January.
Cover Voting Contest	30th January.
Christmas Jokes	30th January.

OVERSEAS

Book Votes	30th January.
Pet Drawings	30th January.
Missing Words No. 2	29th February.
Crane Drawing Contest ...	29th February.
Christmas Decorations ...	31st March.
Christmas Letter	31st March.
Cover Voting Contest	30th April.
Christmas Jokes	30th April.

Watch the Closing Dates :

Competitors, both Home and Overseas, are particularly requested to make a careful note of the closing dates of the competitions.

Competition Results

HOME

Crane Drawing Competition. Section A, Joint First Prizes : First and Second Prizes combined and divided between Wm. Stewart (Glasgow) ; F. H. Parks (Peacehaven) ; and H. J. Daymond (Liverpool). Section B, First Prize : J. Clarke (Manchester). Second Prize : Section B, F. Twigge (Manchester). Consolation Prizes : K. Bellingham (Stafford) ; E. Clarke (Bristol) ; M. Evans (Wellington) ; C. A. Hobson (Birkenhead) ; L. W. Jarvis (Swanley Junction) ; J. Macken (Bromley) ; J. Pelham Napper (Dundee) ; T. R. Simm (Charlton, S.E.7) ; P. L. Smith (Buxton).

OVERSEAS

May Photo Contest. First Prizes : Section A, R. Watson (Fort Garry, Man.) ; Section B, A. Coldham (Peachland, B.C.). Second Prizes : Section A, C. F. Carrel (Hawera, N.Z.) ; Section B, F. G. Noel-Barham (Pretoria, S.A.). Consolation Prizes : A. Abdulrahim (Karachi) ; J. Credie (Cape Town).

August Photo Contest. First Prizes : Section A, A. A. Boult (Wellington, N.Z.) ; Section B, L. A. Seton (Montreal). Second Prizes : Section A, A. K. Moosbhoy (Karachi) ; Section B, A. Dempster (Warwick, Queensland).

Wonderful Meccano Illusion—(*Cont. from p. 39*)

of a popular daily paper—I will try not to make any funny remarks about the paper having nothing in it—I wrapped up the partly constructed model and placed it in the cupboard. Now, ladies and gentlemen, I want you to try to imagine that this table is the cupboard." (Wraps model in paper, which he secures with rubber bands, right-hand photograph).

"Presently I had dinner, and afterwards, feeling at peace with the world, I switched on the radio. It so happened that I was just in time to hear the concluding remarks of a most interesting lecture by Professor Cotter-Pinion on applied mechanics. His remarks renewed my enthusiasm, and I sprang up, my head full of big ideas, nuts and bolts, girders and strips. I decided to finish off the neglected Meccano model (walks over to the table on which the model is lying, still wrapped up). Imagine my surprise on removing the paper (tears off paper) to find a complete Meccano working model. This, I think you will admit, is truly 'Magical Meccano.'" (The tearing away of the paper reveals a model of a windmill rapidly revolving, bottom photograph).

In view of the keen interest that this puzzling trick is certain to arouse, we offer a prize of 10/6 to the reader who submits the best and most detailed explanation of how the trick is performed. This offer will remain open until 31st May. Letters should be addressed to "Magical Meccano," Meccano Ltd., Old Swan, Liverpool.

Every "M.M." Reader should possess

The Romance of Transport

By ELLISON HAWKS,
Editor of
The Meccano Magazine.
With 48 Illustrations. 7/6 net.

"The author has produced a succession of fascinating word-pictures, in which the romance of travel through the ages is spread out before our eyes. The interest of this remarkable volume is greatly enhanced by the large number of illustrations. A volume that can be recommended without reservation."—Rev. J. H. MARTIN in "*M.M.*"

The Romance of the Merchant Ship

By ELLISON HAWKS.
Another fascinating new volume by your Editor, with 40 Illustrations. 7/6 net.

Obtainable from all booksellers. For catalogue containing other books by Mr. Hawks, write to HARRAP'S, 39, Parker Street, London, W.C.2

H.R.C. Junior Section—(*Cont. from page 57*)

but also they are securely held in position while in use. Of course where a large terminus is required there is no reason why an additional centre section and platforms should not be joined up to the original formation. The possibility of adding fresh units in this manner is a useful feature, and owing to the standard sizes of the components the space required for any particular arrangement is easily arrived at.

In one of the accompanying photographs of part of the layout of J. Thomas of Swanage, this type of terminus station is employed. The all-over roof usually seen over full-sized termini is not used, as unless such a roof is sufficiently lofty, and all arrangements are extremely perfect, the management of trains in the station is rendered difficult to the operator. The locomotive yard is conveniently arranged, for although the sheds appear to be some distance from the station, the engines may be easily reached, as the layout is placed upon the floor. The question of reaching over does not affect the operator to the same extent as in the case of a railway raised up on a sub-structure, which has to be somewhat broad at points where a large number of tracks and buildings have to be accommodated.

The other extreme in the matter of stations are the "halts" found on branch lines in country districts. These are often very simple in character and usually quite small. For this kind of structure the Wayside Station of the "M" Series is particularly useful, and may solve the problem of providing sufficient accommodation for passenger traffic in a part of the layout where little space is available. For more developed areas the "M" Station is a more elaborate affair, and may be usefully employed on a branch line served by a motor-train consisting of an engine and perhaps only a single coach.

Interesting introductions for the improvement of the realistic effect of the Stations of the Hornby Series have recently been made. The miniature railwaymen were dealt with last month and on page 65 of this issue "Tommy Dodd" is giving special attention to the Hoardings, Posters and their Boards.

A view of the imposing Avenue of the Colonies at the Philadelphia Exposition of 1926, giving some idea of the spacious lines on which the Exposition was arranged.

Dredgers and Their Work—(*Cont. from page 19*)

leather, rubber, or canvas hose, or by metal joints, each pipe length being supported by a pontoon. If the material is pumped on shore it may be turned to useful purpose in the reclamation of marshy land. In the case of a reclamation scheme carried out by suction dredgers near one of the largest seaports in New Zealand, the harbour authorities were able, in the course of a single year, to defray the entire cost of the plant from the proceeds of the sale of the land reclaimed. For this same seaport a special type of suction dredger was built to deal with coarse gravel. It proved capable of dealing with 3,000 tons of heavy gravel per hour, and it carried special pumps to dredge boulders up to 1 ft. in diameter. Boulders weighing as much as 112 lb. were sucked up and passed the pumps and delivery pipes without causing stoppage or damage to the plant.

One of the largest cutter suction dredgers ever built was employed in the Bombay reclamation scheme. This dredger is capable of removing 2,000 cubic yards per hour at a depth of 70 ft., the material raised being discharged through a floating pipeline 5,000 ft. in length and 42 in. in diameter. The lower end of the dredger suction pump is equipped with a spiral cutter operated by a compound engine at the head, and a triple-expansion steam set drives the centrifugal suction and discharge pump.

Modern suction dredgers are fitted with a variety of mechanical appliances of the most efficient type. An indicator is provided by means of which the dredging master can tell at a glance the depth at which the cutter or the suction head is working. The whole of the dredging operations are governed by a system of controls grouped conveniently close together.

Cutter suction dredgers are used to a considerable extent in tin mining in the Federated Malay States. The cutter first of all breaks up the gravel that bears the ore, and this material is then sucked up by the pumps and passed to sluice boxes, where the unwanted spoil is washed away, leaving the ore.

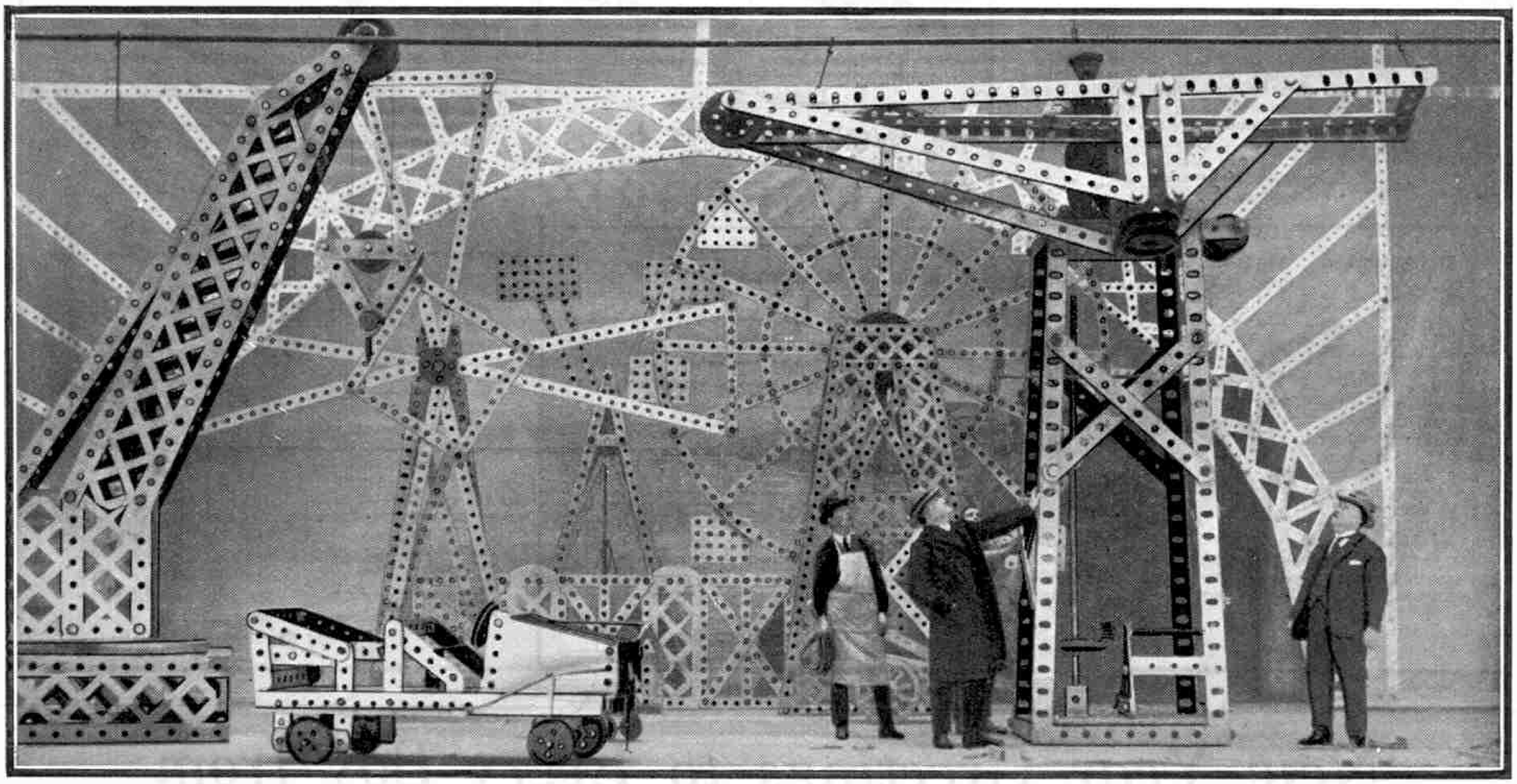
How To Get More Fun—(*Cont. from page 55*)

of the turntable in the yard is not shown. Miniature railway owners may prefer to include these details, but if the sheets are kept with as few entries as possible they are easier to follow, especially when an intensive service is being worked.

Another point is that definite arrival times are not shown. This allows for the fact that with a heavy load a clockwork engine will take rather longer over the journey than with a lighter one. Sufficient time must be allowed, too, for minor shunting movements, coupling up and similar operations. Where no entry is to be made on the sheet, a blank space may be left or a line drawn. This is shown in the sheet at 8.39, for instance, where the engine remains on the lie-by road at Edington. Obviously no entry under "Class" or "Platform" is required. Where light engine movements along the main line are made, the word "light" appears in the appropriate column; but for movements in stations or sidings, where the engine is travelling alone, there is no need for an entry. The method of indicating a movement where the engine returns to the same road as when running round a train, is shown in the sheet between 9.7 and 9.11 and again between 9.11 and 9.12.

Meccanoland in Glasgow

Giant Working Models in Pantomime Scene



IT is now many years since Mr. Julian Wylie, the famous pantomime producer, suddenly thought of Meccano when he was searching for a novel idea for a scene in one of his productions. Immediately there flashed across his mind a vision of gigantic Meccano models all working and surrounded by a host of real Meccano boys. He developed the idea quickly, and as his staff were full of enthusiasm for the new idea, great models built from giant Meccano parts were assembled on the stage in a remarkably short time. The effect surpassed his highest expectations and the success of the scene was assured.

Meccanoland first made its appearance in pantomime at the Empire Theatre, Liverpool, in the 1926-7 season. There it aroused tremendous enthusiasm, and was amazingly popular with young and old alike. Its success was repeated two years later at Drury Lane Theatre, the famous London home of pantomime, and again last year at the Palace Theatre, Manchester, where it formed one of the outstanding attractions of the Wylie pantomime.

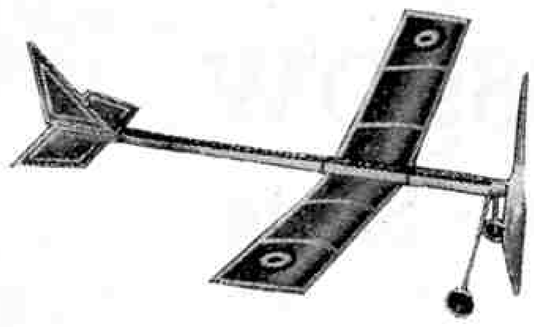
This season it is Glasgow's turn. Mr. Wylie is presenting "*Dick Whittington*" at the Theatre Royal in that city, and since 12th December, when the first performance of the pantomime was given, the Meccano enthusiasts of Clydeside have had the opportunity of enjoying the now famous Meccanoland scene. Clydeside is one of the chief centres of engineering in the British Isles and a great stronghold of Meccano boys of all ages; so that it is scarcely necessary to remark that the scene has been greeted with as much enthusiasm as it received in previous years in Liverpool, London and Manchester.

One of the chief reasons for the great popularity of Mr. Wylie's innovation is the intense realism of Meccano, which is true engineering in miniature. This has been borne in mind in planning the giant models. The parts from which these are built are of course much larger than those contained in the familiar Outfits, and if they had been made of steel it would have been necessary to use giant cranes to handle them. They are made of wood throughout, therefore, but in every other respect they are scale models of the real Meccano parts, and are used in exactly the same manner. They are finished in aluminium paint, and in the intensely brilliant stage lighting the monster Aeroplane that flies, the Windmill, the Hammerhead Crane, the Motor Cars, Lorries and other working models in the Meccanoland scene look exactly as if made of polished steel. These models have been built up during two months of intensive preparation for the pantomime, and readers will be interested to know that real Meccano models were first prepared to act as guides for the stage carpenters, who greatly enjoyed the fun of building the giant replicas.

Miss Fay Compton, the principal boy in "Dick Whittington," Theatre Royal, Glasgow, the pantomime in which the wonderful Meccanoland scene is included.

The scene on the stage when the Meccano models are brought together is truly wonderful. Over everything there is a wonderful glow of light from banks of lamps with a total of thousands of candle power. The colour is changed at will by the operator, who manipulates switches by means of which he is able to vary the effects with startling rapidity and to blend lights of every colour and intensity into the most wonderful combinations. The models themselves are all working energetically, and the Meccano boys, easily distinguished by their regulation jerseys, and the members of the chorus, each wearing a hat crowned by a Meccano model in miniature, show even greater energy in carrying out their parts. All on the stage during this scene thoroughly enjoy themselves, and their enthusiasm is communicated to the audience.

Mr Wylie, who is himself a Meccano enthusiast, has probably been responsible for a larger number of successful entertainments than any other living producer. His work in connection with pantomimes must have been stupendous, for he has seldom been content to produce one at a time, and on several occasions has guided the fortunes of five at once, two of them in places as far apart as Edinburgh and London.

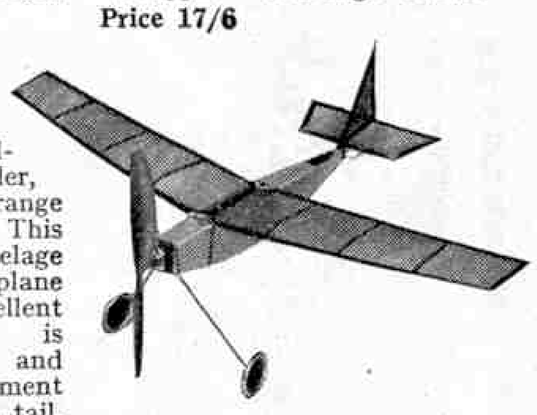


The "DEMON" Tractor. **Price 7/6**

Length 25½ in., span 23 in. Fitted 10 in. hand-carved and balanced propeller, patent double-bearing and shock-proof chassis, covered yellow proofed silk with identification discs. Weight and wind resistance are reduced to a minimum in this model, giving the utmost duration of flight.

Weight, 3¼ ounces. Distance, 850 feet.
Speed, 16 m.p.h. Ceiling, 80 feet.
Rises from the ground.
(Patent No. 296946).

The Warneford "Whippet" Fuselage Model. Price 17/6



Length 20⅜ in., span 30 in., fitted 11 in. hand-carved and balanced propeller, and covered orange proofed silk. This beautiful Fuselage Model Aeroplane has an excellent performance, is very strong, and has full adjustment of main-plane, tail, and fin. It dissembles and folds so that it fits into a very small box for storage and transport. The finish is in keeping with the usual Warneford high standard.

Weight, 4⅜ ounces. Distance, 550 feet.
Speed, 17 m.p.h. Ceiling, 50 feet.
Rises from the ground.

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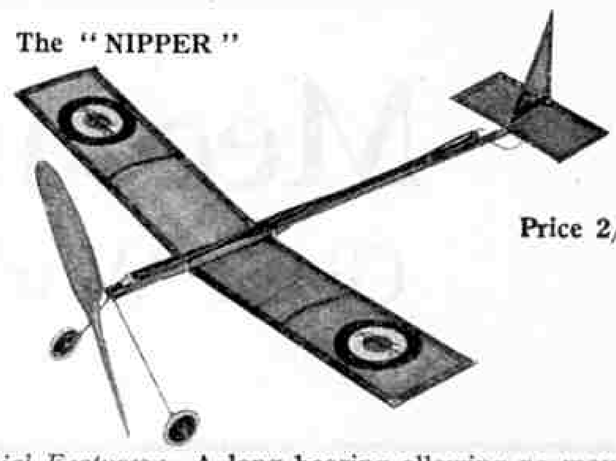
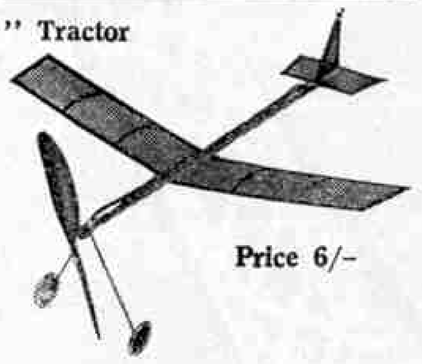


Price 2/6

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



Price 6/-

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.

Weight, 2⅛ ounces. Distance, 750 feet.
Speed, 12½ m.p.h. Ceiling, 60 feet.
Rises from the ground.
Patent No. 296946.

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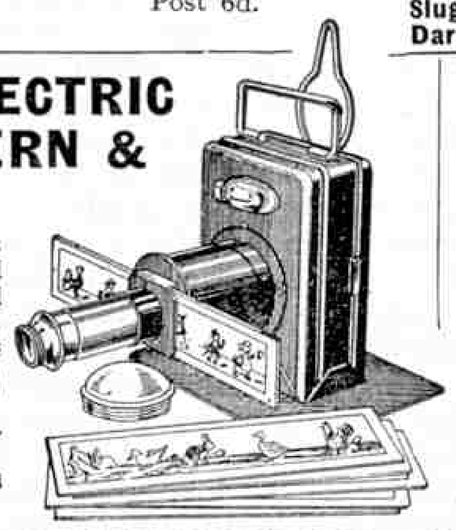

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CALLING THE TUNE

"D'you know, I believe I must need glasses, Bill," said a burglar to his partner.

"Glasses, mate? What makes you think that?"

"Well, last night I turned what I thought was the knob of a safe, and a dance band began to play."

* * * *

Bill: "Last night I saw a real man-eating tiger."

Dick: "That's nothing, in a restaurant just now saw a man eating chicken."

* * * *

Policeman: "Here now, what's all the noise about?"

Circus Proprietor: "It's quite all right constable. It's only the two-headed lady having a quarrel with herself."

* * * *

Tommy was standing on the pier watching the ship putting out to sea, when a kindly old man turned to him.

"What is that?"

"A cruiser."

"Where is it going?"

"On a cruise, sir."

"What makes it go?"

"It's screw, sir."

"You are a bright boy, where did you come from?"

"From Crewe, sir."

* * * *

Mrs. Newlywed: "I hope you like the cigarettes I gave you? If we can collect 500 coupons from that brand we shall get a banjo."

Mr. Newlywed: "If I smoke 500 packets of those cigarettes I shall need a harp."

* * * *

Critic: "The drawing of the horse is good, but where is the wagon?"

Artist: "Oh, the horse will draw that."

* * * *

The admiral who was conducting an examination for the Navy was addressing one of the candidates.

"Who, in your opinion, are the three greatest sailors in history?"

"I'm sorry, sir. I did not catch your name when I entered the room," replied the student, "but the other two are Nelson and Beatty."

* * * *

The small town boy was on holiday in the country, and had just seen a haystack for the first time.

"What kind of a house is that?" he asked.

"That's not a house, that's hay," was the reply.

"You can't fool me," said the boy from town. "Hay doesn't grow in a lump like that!"

* * * *

BEGINNING AFRESH

Mr. Smith: "This fool of an editor has got a notice of my death in his paper. I'm going down to show him that I'm still very much alive."

Mrs. Smith: "Why worry. Another notice in the 'Births Column' to-morrow will bring you to life."

* * * *

Waiter: "How did you guess that we've a new dishwasher in the kitchen?"

Customer: "The finger prints on the plates are different."

PLAYING FAIR!

Instalment collector: "Are you aware, sir, that the instalments on your piano have fallen badly behind?"

Householder: "Well, your firm's slogan is 'Pay as you Play' isn't it?"

Collector: "But what's that got to do with it?"

Householder: "I can only play very slowly."

* * * *

Jimmie was always talking about his grandfather, who was one of his favourites.

"How old is he," he was asked one day.

"I don't quite know," he replied. "We've had him quite a long time, though," he added airily.

* * * *

Manager (pointing to partially-smoked cigarette on floor): "Boy, is this yours?"

Office boy (politely): "Not at all, sir. You saw it first."

* * * *

NO ADVANTAGE ON EITHER SIDE

"Ever ridden a horse before?" the sergeant asked the recruit.

"No, sir," he replied.

"Then I have got the very horse for you," said the sergeant. "He's never been ridden before, either."

* * * *

The office boy, a notorious shirker, had asked for an increase in salary.

"H'm," considered the chief. "What are you doing now, my boy?"

"Various odd jobs, sir," the boy replied.

"In that case," said the manager, "you'd better make a bolt for the door."

* * * *

"My aunt in Venice is sending me a gondola for my birthday. Do you know how to play it?"

"Such ignorance! You don't play a gondola, you throw it over your shoulder like a shawl."

* * * *

The judge was reproving one of the barristers.

"If a witness alters a statement he has previously made, that is not necessarily proof that he has been untruthful. For instance," he continued, "when I left my house this morning I could have sworn that my watch was in my pocket. It was some time before I remembered that I had left it at home on the table in my dressing room."

When the judge was at dinner that night his wife remonstrated with him.

"It was quite unnecessary for you to send half-a-dozen men for your watch to-day," she said.

"Good heavens!" cried the judge. "What do you mean? I didn't send anyone. What did you do?"

"I gave it to the first one who called," his wife told him. "He told me exactly where it was."

* * * *

Employer: "I told you to do this two months ago, Brown. Why hasn't it been done before?"

Brown: "I'm very sorry, sir, but I forgot."

Employer: "Forgot, indeed! What would you say if I forgot to pay you your wages at the end of the week?"

Brown: "Well, sir, I should tell you about it right away, not wait two months and then kick up a fuss about it."

* * * *

During a tour of Scotland that was being made by a travelling circus, one of the gorillas caught a chill and died. It was accordingly left by the roadside, and a short time later a native passing along the road saw it. He scratched his head, and considered for a moment.

"It's no a McKenna and it's no a Macintosh," he exclaimed. "I'd better gang up to the hall and see if any of the English visitors are missing."

A WEIGHTY CONVERSATION

"You say your friend speculated on a large scale," remarked the waggish one. "May I ask what was the use of the large scale?"

"Certainly," replied the cheerful idiot. "He needed it to weigh the consequences."

* * * *

The train puffed into the railway station and while some of the passengers were alighting and others entering, a farmer who had come for a case of goods chatted with the guard.

"You are early to-day," he said.

"Yes," replied the guard. "We had the wind behind us."

* * * *

The decorator's son was making out his father's weekly accounts.

"What shall we charge Mr. Brown for that job we did for him? I've got 15 hours' work down against him."

"That will be 38/–," replied his father.

The boy started to enter this figure on the bill when his father stopped him.

"On second thoughts," he said, "I think we'll make it a round figure. Put down 40/–."

He paused and considered for a moment and then changed his mind again.

"No, Bill, don't do that. Make it 42/6 so that it doesn't look as if we'd been making a round figure of it."

* * * *

The small boy was searching diligently on the ground near a lighted lamp post. A man who came along asked him what he was looking for and was told that the boy had lost a penny.

"Where did you lose it?" asked the man kindly.

"Up the lane," replied the boy.

"Well, why are you looking for it here?"

"It's too dark to see up there, sir."

* * * *

Billie: "What have you got in that bag, grandma?"

Grandma: "Buns. And if you can guess how many there are I'll give you them both."

* * * *

First Diner: "I'll have a steak."

Second Diner: "I'll have one too—a tender one."

Waiter (shouting to cook): "Two steaks—one tender."

* * * *

Pat: "What would ye do if ye should meet a real, live ghost?"

Mike: "Faith an' I'd drop down dead and run for me loife."

* * * *

Mrs. Gossip: "During my life I've lived in seventeen different houses, and they've all had even numbers."

Mrs. Listen: "How odd!"

* * * *

Magistrate: "And is this the first occasion on which you have appeared before the Court?"

Prisoner: "Say, guv'nor, do I look like an amateur?"

* * * *

FATHER TIME UP-TO-DATE

Customer: "I'm going to a fancy dress ball this evening, dressed as Father Time. Have you a scythe you could sell me?"

Shopkeeper: "No, sir, I'm sorry I haven't a scythe but I've got a very nice mowing machine here."

* * * *

Policeman: "What are you standin' about 'ere for?"

Loafer: "Nuffink."

Policeman: "Well, just you move on, then. If everybody was to stand in one place how would the rest get past?"

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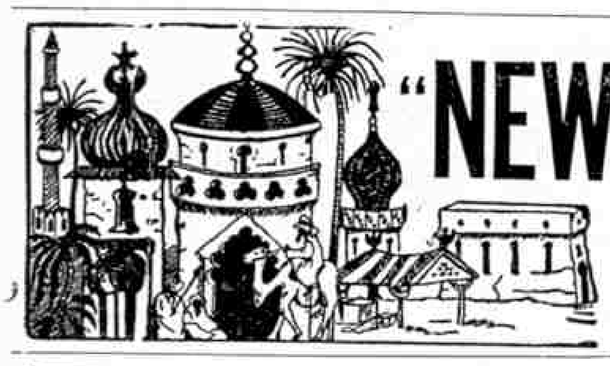

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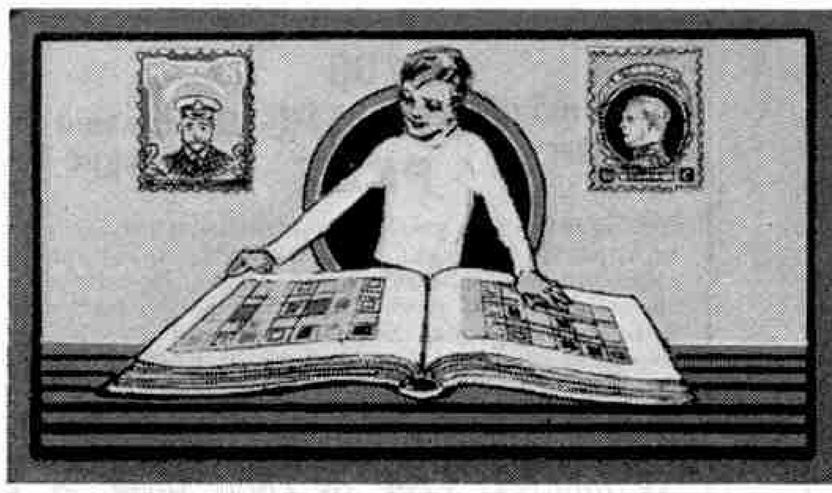

Stamp Collecting

MORE STAMP STATUARY

IT is an interesting feature of statues on stamps that with very few exceptions they commemorate events associated with war and conquest. This is particularly the case among the South American States, where most of the statue stamps are from centenary issues celebrating the establishment of independence from Spain's restrictive government.

After this statement it seems almost contradictory to find that the statue most frequently encountered on South American stamps is not that of a soldier, however. The honour falls to Christopher Columbus, the great Genoese navigator who discovered America, when he reached the island of San Salvador in the West Indies on 12th October, 1492. The best stamp statue of Columbus is to be found in the quadricentennial commemorative issue made by the Central American republic of Salvador in 1893. The 5p. value of this issue shows the splendid statue erected in Genoa in honour of the great discoverer. Although the reproduction of this stamp is our only illustration of a statue of Columbus, readers who care to search their catalogues will find many other specimens among the issues of South and Central America and the West Indies. For instance, Peru offers a splendid example on the 2 sols value of its splendid Universal Postal Union issue of 1907/8.

The life story of Columbus was dealt with in detail in an article that appeared in our issue for March, 1928, and it is unnecessary to recount here the changes in the fortunes of the great navigator and in his relations with the Spanish Court. Sufficient is it to say that when he died in 1506, Spanish dominion was firmly established throughout the South American continent.

There are conflicting reports in regard to the resting place of the remains of Columbus. Spain claims that his body was removed to Havana and, subsequently, in the early days of the 18th century, to Seville; but the navigator himself appears to have desired to be buried in the island of Hispaniola, now known as the Republic of Santo Domingo, the centre of Spanish trading operations in the New World. It seems probable that the body taken to Spain was that of Diego, his son, and in support of that theory there is the fact that a coffin bearing the name Christopher Colon, was discovered in 1877 in the Cathedral of Santo Domingo. The Dominicans were so convinced of the authenticity of their discovery that a great mausoleum was built in the cathedral to provide a fitting tomb for the discoverer of their country. The mausoleum is illustrated on the 2p. value of a series issued by the Dominican Republic in 1899 to help in raising of funds to build it. The cathedral itself, possibly the oldest church in America, is illustrated on page 75, on which the mausoleum stamp also is shown.

Early in our article we remarked that the majority of South American stamp statues were in honour of those who had led the fights for independence, and in a sense these statues provide a link with Columbus. The struggles for freedom were the culminating point of the widespread dissatisfaction with Spanish rule that had existed since Columbus first took possession of America for Spain.

The outstanding personality among the revolutionary leaders was Simon Bolivar, a statue of whom is shown on the 5c. stamp of Peru's 1907/8 U.P.U. issue, illustrated on this page. A wealthy Spaniard of noble birth, Bolivar first became inspired with the movement for freeing the Spanish South American colonies after a visit to the United States in 1809, and he displayed so great a capacity for leadership that in 1814 he was appointed Captain-General of the revolutionary forces operating against the Spanish in New Granada and Venezuela. He was then a young man, barely 30 years of age, but in a very short time he had earned for himself the name of Bolivar the Liberator. In 1819 he led the revolutionaries in the great battles of Tunja and Boyaca and, following decisive victories, he proclaimed the new "Republic of Colombia," the territory of which covered that of the states we know to-day as Colombia, Venezuela and Ecuador. He was elected President of the Republic in 1821. Subsequently he effected the independence of Peru and Bolivia, and the second of these states actually is named after him. From this point he endeavoured to form a Union of South American Republics, but this proposal was unacceptable to Argentina and Chile, and he was unable to make progress with the scheme.

In his later years Bolivar met bitter opposition in Colombia and was accused of endeavouring to found a new imperial dynasty with himself at the head. To refute this he decided to go into retirement. He allowed himself to be dissuaded from this course, however, and when he died in 1830, still a comparatively young man, he was regarded not as a new Napoleon but as a second Washington.

Bolivar's name is revered throughout the South American continent and no man has figured more frequently in South American stamp design. His portrait has dominated Venezuela's stamp issues since 1879, the issue of 7th December, 1930—the centenary of his death—being a really excellent picture. Peru used his portrait as the main theme of its issue of 1924 in commemoration of the battle of Ayacucho, in addition to the equestrian statue on the 5c. value of the 1907/8 issue. Panama issued a special Bolivar Congress commemorative in June, 1926, among the designs for which another splendid piece of memorial statuary is shown. On 17th December, 1930, the lower values of this issue were re-issued with an overprint in commemoration of the centenary of Bolivar's death. Ecuador's independence centenary issue of 1930 included a 10s. value with a Bolivar statue depicted on it.

Colombia, of course, has associated Bolivar's name with many of its stamps, and in common with the remainder of what might be termed the "Bolivar" states it made the 100th anniversary of the Liberator's death the occasion for a special commemorative issue, a 4c. pictorial showing the scene at his deathbed. This stamp does not feature a statue, of course, and for our Colombia Bolivar statue we must turn to the 5p. issue of 1903. This illustrates the national monument commemorating the great battle of Boyaca, the winning of which sealed the success of Bolivar's independence campaign.

Almost equally well known among the republican pioneers of South America are Generals Carrera, O'Higgins and San Martin, each of whom is represented by a statue in Chile's independence centenary commemorative of 1910. The 50c. value, illustrated here, shows the monument erected in honour of Carrera who, in company with O'Higgins, led the Chilean rebels in the early days of their revolt. Carrera was born in Santiago in 1785, and served in Spain in the Napoleonic war. He was a man of many faults, and quarrels with O'Higgins and other leaders were common occurrences. Ultimately he was dismissed by

(*Continued on page 75*)

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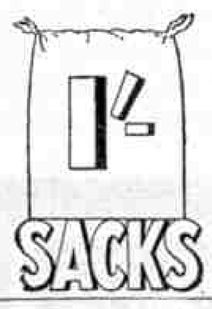

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Stamp Collecting—*(Continued from page 73)*

the National Assembly following a heavy defeat by the royalist forces in 1814, and after various further adventures in Argentina he was shot in 1831 as a result of his efforts to bring about a rebellion there.

O'Higgins, an equestrian statue of whom is shown on the 30c. value of the Chilean issue, was educated in England and was living quietly on his estate in Chile when the revolution broke out in 1810. He quickly distinguished himself, and his association with San Martin was almost one long story of triumph.

San Martin ranks second only to Simon Bolivar in the history of South American independence, and undoubtedly Bolivar's work in Colombia would have been prolonged considerably had not San Martin realised that Chile was the key state in the struggle. Once Chile was freed, an attack on Peru from the south became possible, and to that end he left his command in Northern Peru and established himself at Mendoza in the Argentine, preparatory to a joint attack with O'Higgins. This expedition, involving the transit of an army of 4,000 men and 1,000 horses over the Andes through passes exceeding 13,000 ft. in altitude, is an epic of military history and merited the success that followed.

The full story of the Chilean fight for independence was recounted in our article on the Chilean 1910 commemorative issue that appeared in the "*M.M.*" for October, 1926. San Martin's subsequent triumphal entry into Peru on 9th July, 1821, and the final victory of the republican forces at the battle of Ayacucho are now matters of history, glorious in the annals of the South American republics. It is not surprising that so many of the stamps of that continent show statuary commemorative of rebel leaders.

A Modern Boy's Paradise

Those of our readers who are in London this month should make a point of visiting the Dorland Hall, Lower Regent Street, W.1, where a combined Models Exhibition and Pageant of Postage Stamps is being staged from 6th to 23rd January.

Both the model-building enthusiast and the stamp collector will be well catered for. In addition to a big range of trade exhibits by leading stamp firms, a special demonstration of stamp printing by Messrs. Waterlow & Sons, and popular 10-minute talks and lantern lectures on stamp collecting, there will be a wonderful display of working models representative of most branches of engineering and every form of transport, rail, road, sea and air.

The admission charge will be 1/–, but arrangements have been made for readers carrying a copy of the January "*M.M.*" to be admitted free on 7th January.

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

Notes on Recent New Issues

Air Stamps Going "Up"

In the reviews of the new season's catalogues that appeared in our October and November issues, we necessarily had to confine ourselves very largely to general impressions. Subsequent browsing among the mass of facts and figures brings to light many additional points of interest, however, the most striking of which is perhaps the rapid appreciation of air stamp values.

Practically all varieties are "up" again, and the indications are that they are far from reaching their zenith. This applies particularly to the rarer examples, such as the "Hawker" and "De Pinedo" air stamps of Newfoundland in mint condition, the last recorded auction prices for which are £250 and £225 respectively. As instancing what an extraordinarily good investment these two stamps have proved, it may be recalled that not more than five years ago it was possible to secure mint "Hawkers" in the open market for something like £50 apiece, while "De Pinedos" were being offered at between £30 and £40! "Used" copies of the same stamps are now £200 for the former and £80 for the latter.

All the Newfoundland air stamps have been advanced, and the inverted error of the "Halifax" issue now stands at £75 as against £50 only last year. The extremely rare manuscript "Martinsyde" overprint is listed by Stanley Gibbons for the first time, but unpriced. Three hundred pounds would be a fair estimate of its value. The most sensational rise of all is in the solitary official air post stamp of Colombia, issued on 18th June, 1918. This has made a sudden leap from £25 to £125 for unused specimens and from £16 to £50 used. The 24 cents U.S.A. air mail stamp of 1918, with inverted centre, maintains its proud position as the most valuable air stamp at £500.

* * * *

A posthumous honour is conferred with the appearance of Spain's first definitive republican issue. The portrait design shows Senor Pablo Inglesias Posse, who was one of the founders of the Spanish Socialist party in 1879 and leader of the Republican movement when he died in 1925.

* * * *

The U.S. commemorative issues promised for 1932 will contain two specially interesting issues, in celebration of the Olympic Games and of the Washington Bicentenary. The Olympic Games set probably will consist of six denominations, but the Washington issue will provide no less than 12 new stamps with designs showing portraits of well-known statesmen and incidents in Washington's life.

An Historic Cathedral

The latest of many interesting Dominican Republic issues is a set of six stamps, 1c. to 10c., taking as their design the famous old Cathedral of Santo Domingo, to which reference is made in our Stamp article this month as the site of the Mausoleum of Christopher Columbus. In conjunction with the stamp illustrating the mausoleum,

this new set provides an interesting historical story worthy of writing up in any stamp album.

Almost simultaneously the Dominican Republic has issued a new air stamp series, a specimen from which is illustrated also. The interesting feature of this design is the ancient sundial that dates back to 1753, to the days when the French were in possession of the island. The air mail set also consists of six stamps, the values in this case ranging from 10c. to $1.

New Guinea Commemorative

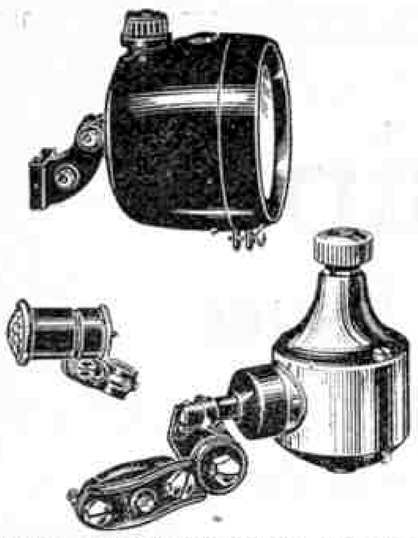
If the production of New Guinea's mandate commemorative may be taken as a guide to the quality of Australia's forthcoming general issue, the philatelic world may look forward with pleasurable anticipation. New Guinea's stamp is easily the finest piece of stamp designing and engraving that the Australian Printing Office has achieved.

The design, which is illustrated here, is used for the whole of the long set of 13 values, 1d. to £1, in commemoration of the 10th anniversary of Australia's mandated administration of the territory. It shows a Bird of Paradise, a species that is found only in the Papuan region.

The same stamps were also issued for air mail purposes, a simple, almost crude, device representing a biplane, being overprinted.

* * * *

Canada's recently issued surprise stamp, a 10c. value showing a portrait of Sir Georges Etienne Cartier, is a tardy addition to the Confederation issues of 1927. Sir Georges Cartier ranks with the foremost of the fathers of the Confederation, for he was joint Prime Minister with Sir John Alex. MacDonald, and was principally responsible for bringing Quebec into the Confederation. We hope to illustrate the stamp next month.



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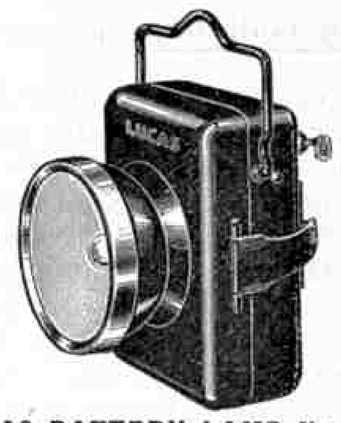

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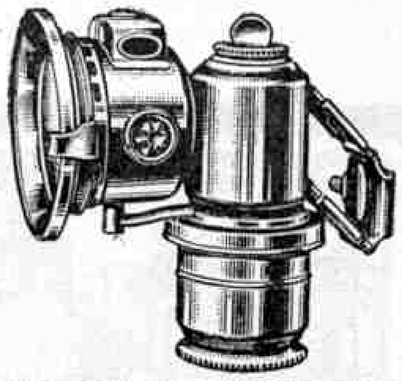

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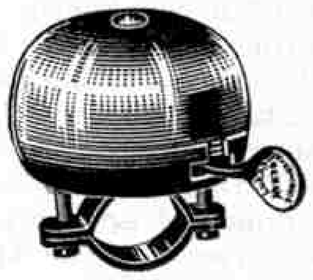

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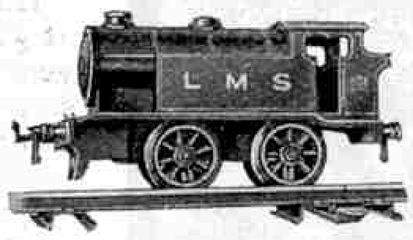

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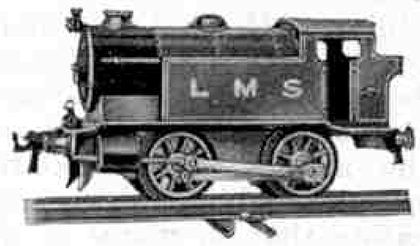
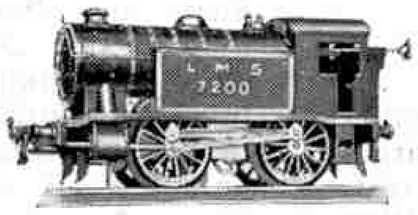
M3 TANK LOCOMOTIVE. This is the powerful Locomotive (reversing) supplied with the new Hornby M3 Tank Goods Set. It is a handsome and extremely reliable model that will give long and excellent service. Available in either red or green. **Price, 7/6**

No. 1 TANK LOCOMOTIVE. This strong and durable Locomotive is capable of any amount of hard work. It is fitted with brake mechanism and reversing gear, and is supplied in colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Locomotives. **Price, 13/6**



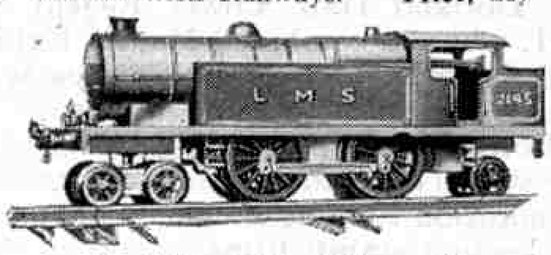
No. 1 Tank Locomotive



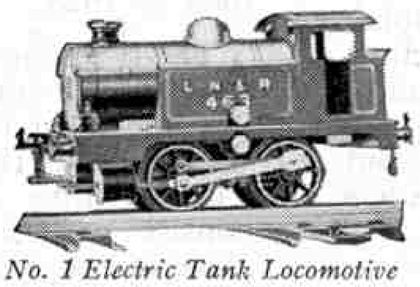
No. 1 Special Tank Locomotive

No. 1 SPECIAL TANK LOCOMOTIVE. This splendid Locomotive which is fitted with brake mechanism and reversing gear, has remarkable power and gives a very long run. It is available in the colours of the L.M.S., L.N.E., G.W. and Southern Railways. **Price, 18/**

No. 2 SPECIAL TANK LOCOMOTIVE. This Locomotive has great length of run and exceptional pulling power. It is fitted with brake mechanism and reversing gear. In every respect it is a perfect model, beautifully finished in the colours of the L.M.S., L.N.E., G.W. and Southern Railways. **Price, 25/-**



No. 2 Special Tank Locomotive



No. 1 Electric Tank Locomotive

No. 1 ELECTRIC TANK LOCOMOTIVE. This Locomotive is of the permanent magnet type, and may be run from a 6-volt accumulator. It can be stopped, re-started, reversed and the speed varied by the operation of levers at the side of the track. It is supplied with a terminal connecting plate, speed and reverse control switch and 3 feet of flex, and it is available in the colours of the L.M.S., L.N.E., G.W., and Southern Railway Locomotives. **Price, 32/6**
This Locomotive cannot be run from the mains supply.

MECCANO LTD. - OLD SWAN - LIVERPOOL

Fowler Ditching Machine—(*Cont. from page 5*)

machine. By the cheapest alternative method the cost would have been 4¼d. Thus the saving effected amounted to more than 80 per cent. The difference between the costs is even more strikingly shown by comparing the expenditure per mile of ditch. With the Fowler machine the cost works out at a little more than £6 per mile; if the alternative method had been adopted this would have been very nearly £32.

Its remarkable speed of operation and extremely low running cost will make the Fowler machine invaluable in breaking new land in comparatively undeveloped countries, and also in improving old agricultural areas. It will be particularly useful in countries where artificial irrigation is necessary, for with its aid shallow distribution canals may be cut with very little trouble; and also in the tropics and elsewhere where violent rains are experienced and water often must be carried away quickly by means of an elaborate system of draining ditches.

Solutions to December Puzzles

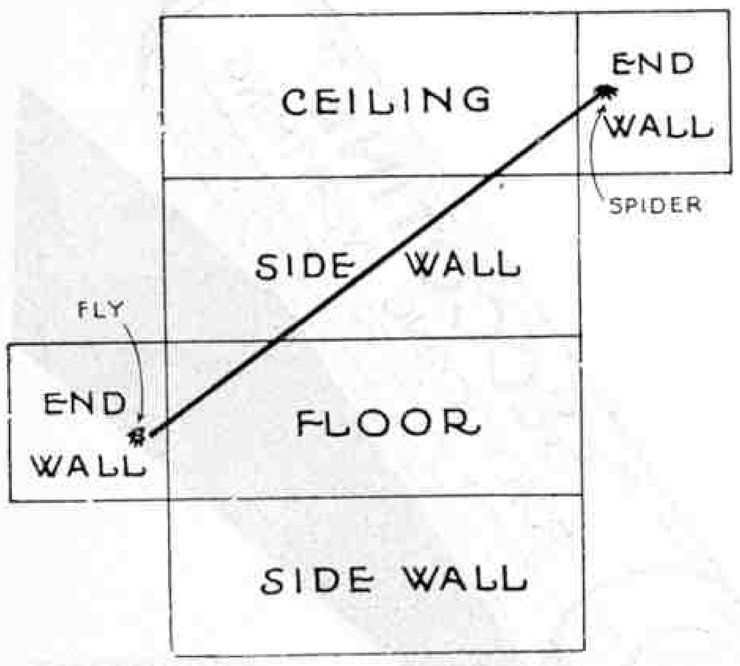
No. 1. There were 15 aeroplanes included in the square. The names began in the top left-hand corner and were as follows:—
Wapiti, Desoutter, Hercules, Moth, Gadfly, Lincock, Argosy, Avian, Bulldog, Gamecock, Bluebird, Hornet, Siskin, Redwing, Martlet.

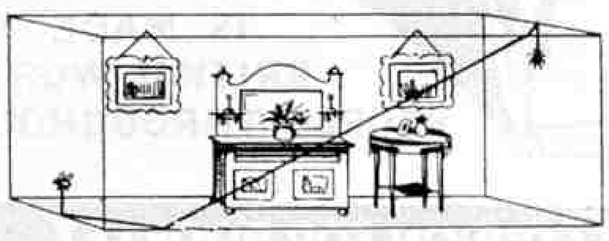
No. 2. Nine ears of corn were in the box. Two of the ears carried out each time by the mouse were on its head.

No. 3. Hornby was the answer to this acrostic.

No. 4. The sentence was "Red Root Put Up To Order."

No. 5. The following illustrations show clearly the route taken by the spider.





No. 6. Two minutes were lost every hour by the grandfather clock, the alarm clock gaining one minute in the same time. It is therefore evident that in an hour's time the alarm gained three minutes upon the other and that in twenty hours it gained sixty minutes. During those twenty hours the alarm clock gained twenty upon the correct time from which it may be deduced that the race must have started the previous morning at twenty minutes to twelve o'clock.

No. 7. The word square was:—
NICHE
IDLER
CLARA
HERDS
ERASE

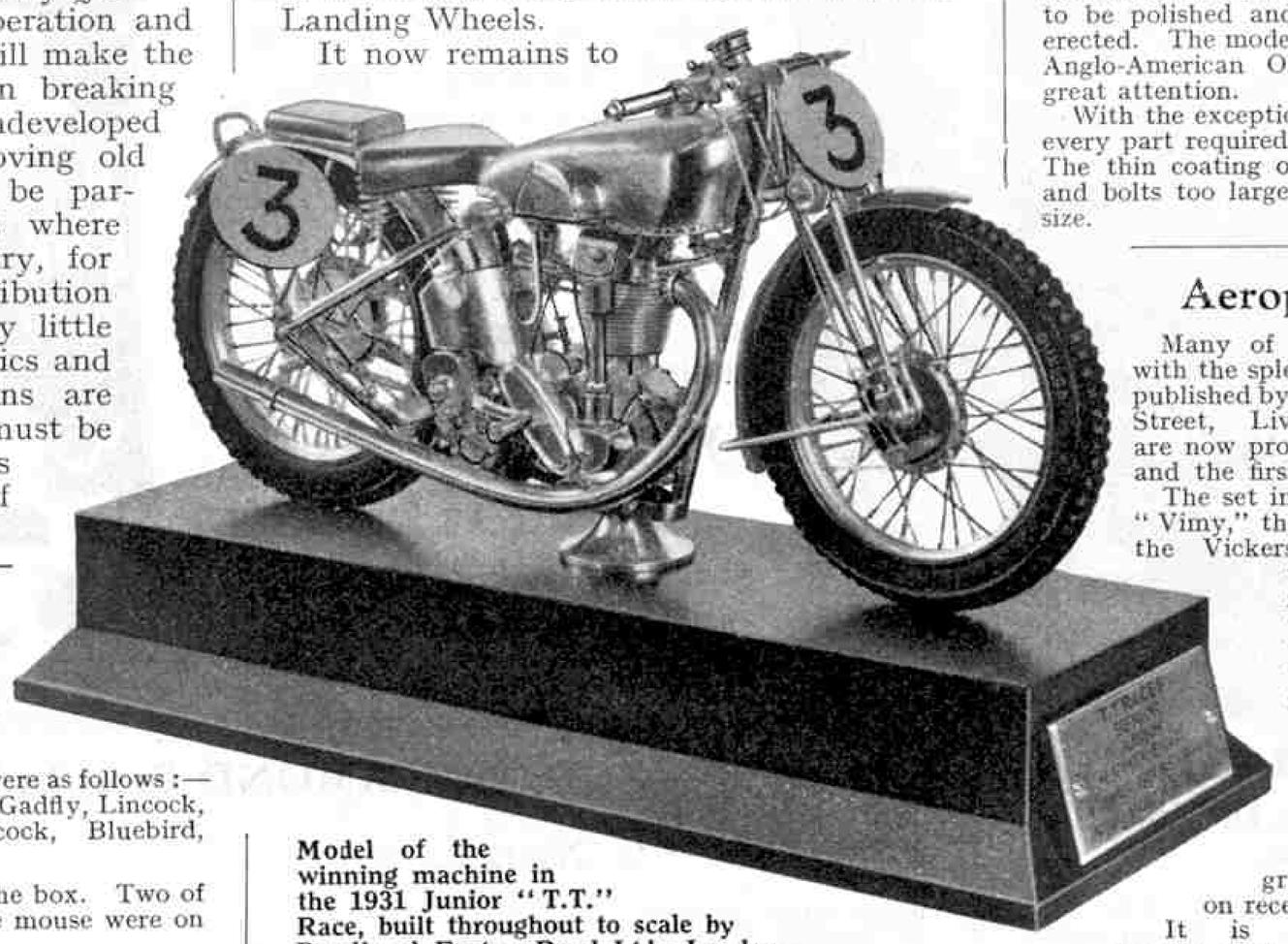
No. 8. Swarm; warm; arm. (*Cont. in next column*)

Aero Clockwork Motors—(*Cont. from page 31*)

If the model aeroplane is required to travel in a straight line, the wheel frame 14 (see Figs. 3 and 5) should be adjusted on the toothed rack 19 so that the small tail wheel is in the same plane as the main Landing Wheels. If on the other hand, the model is required to follow a circular path, the wheel frame 14 should be moved to one side of the rack 19 so that the tail wheel is out of line with the Landing Wheels.

It now remains to place the model on the floor or table and draw the Propeller Control to the rear of the slot, when the model will run forward at a good speed with the Propeller rotating rapidly.

In using No. 2 Motor the Propeller Control Rod must never be pushed to the forward end of the slot in the fuselage Top Front when the Propeller is revolving, as damage will result.



Model of the winning machine in the 1931 Junior "T.T." Race, built throughout to scale by Bond's o' Euston Road Ltd., London.

Air Pistols for Target Practice

A hobby in which many of our readers are interested is that of shooting either with an air rifle or an air pistol. As a means of developing skill and accuracy in the use of eye and hand, there are few recreations superior to shooting, and the ability to place a succession of shots within a limited space on the target is a sure sign of fitness of both mind and muscle.

For those who wish to take up this hobby, Webley & Scott of Birmingham, the well-known manufacturers of firearms, have introduced an interesting series of air pistols for which no license is required. These range in price from 20/– to 45/–. In spite of their low cost they are made exactly like the ordinary automatic pistol, and they provide splendid shooting practice. They are remarkably accurate, and have given excellent results in the hands of experts who have tested them. In addition they are simple and safe to handle, and may be recommended to all who wish to obtain good shooting practice either indoors or in the open air. Full details of the pistols and of suitable pellets and darts for use with them may be obtained from Webley & Scott Ltd., 81, Weaman Street, Birmingham.

No. 9. The letter was "X," making "lax," "tax," "sex," etc.

No. 10. One of the words Tommy was required to discover had already been used by his mistress. It was "facetious." The other word was "abstemious."

No. 11. Following are the solutions to the clues given in this puzzle:—
1. Oaks; 2. Roar; 3. Leyd; 4. Ever; 5. Bide; 6. Avon; 7. Rene.,
The names of the famous speed kings were:—
Orlebar and Kaye Don.

No. 12. "He who laughs last, laughs longest," was the jumbled proverb.

No. 13. As there was only a quarter of the bun between four boys, the time must have been a quarter to four!

An Interesting Motor Cycle Model

A splendid scale model of the 350 c.c. Norton motor cycle on which Mr. P. Hunt won the International Junior T.T. Race of 1931, was shown at the recent Motor Cycling Exhibition at Olympia, London. The model was made by Bond's O' Euston Road Ltd., the well-known manufacturers of models and light engineering equipment. It is one-sixth the size of the original, and is exact in every detail. The engine is complete with all customary fittings, including valve gear and carburetter parts and controls. The chains are correct in scale, the spokes of the wheels are fitted with square-headed nipples, and even the cooling fins of the cylinder are correctly tapered and spaced. After the machine had been constructed it had to be completely stripped down to be polished and silver-plated, and was then re-erected. The model was exhibited on the stand of the Anglo-American Oil Company, where it attracted great attention.

With the exception of the tyres and certain screws, every part required was made by Bond's themselves. The thin coating of plating made some of the nuts and bolts too large, and they had to be reduced in size.

Aeroplane Photographs

Many of our readers are already familiar with the splendid series of railway photographs published by Railway Photographs, 23, Hanover Street, Liverpool. This enterprising firm are now producing photographs of aeroplanes, and the first 12 are ready.

The set includes photographs of the Vickers "Vimy," the first machine to fly the Atlantic; the Vickers Supermarine Rolls-Royce S.6 that won the Schneider Trophy in 1929; the Vickers "Victoria" troop carrier used for the evacuation of Kabul; the Blackburn "Lincock" single-seater light fighter, and the Westland "Wapiti" general-purpose machine. The photographs are postcard size and are sold at 3d. each or 2/6 per dozen post free. A specimen card, together with a list of the first 12 photographs available, will be sent on receipt of 4d.

It is intended shortly to publish another selection of photographs, and thus readers of the "*M.M.*" who are interested in aviation will be able to make an interesting and representative collection of aeroplane photographs.

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if you cannot call. We pay carriage in Great Britain and guarantee satisfaction.

There is always a complete range of Hornby Trains and Meccano Outfits in the Toy Department at

Kendal Milne & Co

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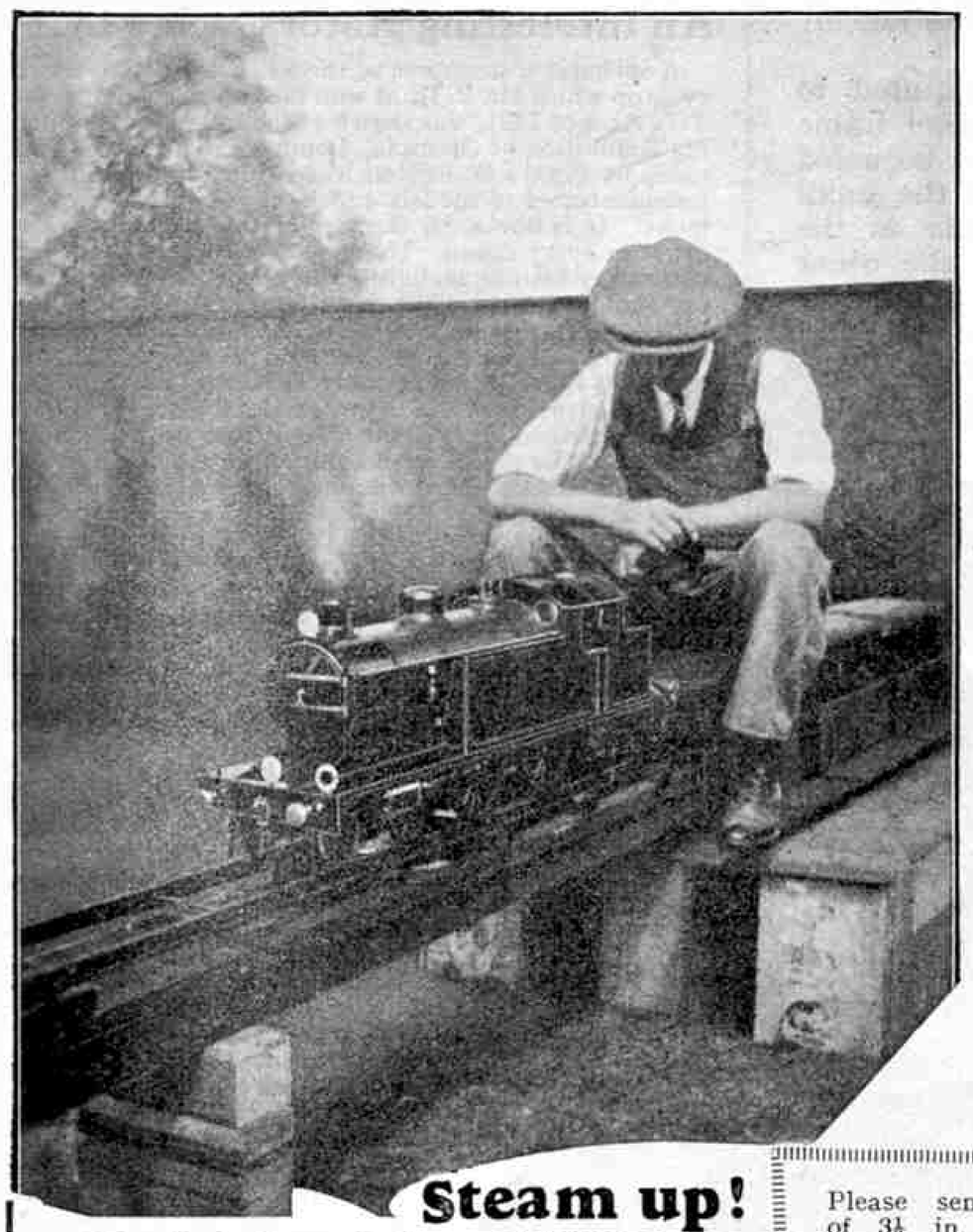


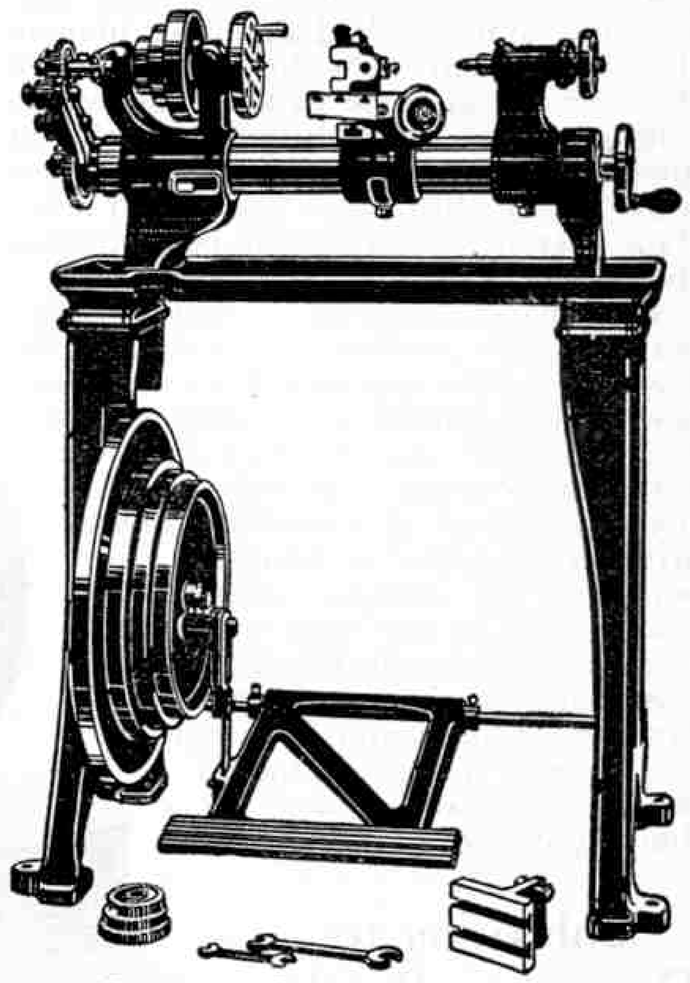
Making Model Locos

Why not build proper scale models that *work*, locos, speed boats, donkey engines—

You can do real engineering work if you own a lathe, the great essential for the serious workshop, for the model engineer. But !—make sure you get a *good* lathe—a Drummond. You need a tool that is accurate, strongly built, and handy to use. The many special features of these tools will greatly help you.

DRUMMOND LATHES

Send for our catalogues for full technical details. This coupon saves a letter.



Drummond 4½in. Lathe, with Treadle.

Steam up!

1 in. Scale Loco, built on DRUMMOND 4 in. Lathe.

Read what the maker says :—

". . . I had this lathe (Drummond 4 in.) for six years, and at the end of that period it was as good as ever, and the most accurate lathe I have ever had."

Please send me lists of 3½ in. and 4 in. lathes and copy of "Lathe Work," post free.

Please write distinctly. If without a letter, send unsealed for ½d.

To DRUMMOND Bros. Ltd., East Hill, Guildford

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Address.....

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The proof is not in what we say, but in what Seccotine DOES! All over the world boys use Seccotine for strong joints. The Air Force use Seccotine. So does the Admiralty. It is used on such important work because it is THE BEST. It grips like a lion. It sticks tighter than anything else in the world. INSIST on Seccotine—you'll be glad.

SECCOTINE IS MADE BY BRITISH WORK-PEOPLE THROUGHOUT

Obtainable everywhere in tubes **4½d., 6d.** *and* **9d.** *Ask your Dad to write to us for* IMPORTANT FREE BOOKLET.

Dept. M., McCaw, Stevenson & Orr Ltd., The Linenhall Works, Belfast

POST COUPON FOR BOOKLET

To Dept. M., McCaw, Stevenson & Orr Ltd., Belfast.

Please send me post free, free copy of your booklet describing extraordinary uses.

Name .....

Address.....

.....

FIRMAS *Regd. Trade Mark.* (HEAT SECCOTINE) **Boiling Liquids** cannot affect articles mended with FIRMAS, Seccotine's younger brother, **6d.** a tube.

Have you got your Meccano Engineer's Pocket Book?

Every engineer should be able to make a sketch of an engineering structure or mechanism; not a work of art, but just a clear reproduction of the main details, shown in correct proportion. It is difficult for any but an experienced draughtsman to make such sketches on plain paper, because there is nothing to help the eye to secure correct proportions. When squared paper is used, however, a great deal of the difficulty disappears at once. One small but prominent detail of the structure is decided upon as a standard and allotted a certain number of squares. Then it is easy to sketch in the remainder of the structure in fairly correct relative proportions, allotting to each detail so many squares according to how its size compares with that of the feature taken as standard.

The Meccano Engineer's Pocket Book provides an ideal engineer's sketch book, with squared paper. It may be obtained direct from Meccano Ltd., price 1/-, post free.

Meccano Super-model Leaflets

The latest editions of the Meccano Super-model Instruction Leaflets are of great interest to all "*M.M.*" readers. In these leaflets the largest Meccano models are described in detail, and so clearly and simply that the most inexperienced Meccano enthusiast can build such splendid structures as the giant Block-setting Crane and the Transporter Bridge; or can put together without difficulty the intricate mechanisms found in the Motor Chassis, Motor-cycle and Sidecar, Grandfather Clock, or Loom.

Send to Meccano Ltd., Liverpool, for the free descriptive leaflet that tells all about the range of Super Model Leaflets.

An Ingenious Toy Aeroplane

An ingenious toy aeroplane, the "Sum-Flite," has been introduced by British Games Ltd. This consists of a small model aeroplane made of very light wood, held captive by a cord, and rotated at high speed. The rotating power is obtained from several strands of elastic, housed in a circular column. The lower end of these strands is attached to a winding handle and the upper end to a rotating arm, which carries at its extremity a 24-inch length of cord to which the aeroplane is attached. A clamp holds the complete unit to the edge of the table. When the winding handle has been turned the necessary number of times, the aeroplane is held in mid-air and given a slight push, and off it starts on its journey. The model travels at a high speed for about five minutes, and looks surprisingly realistic in flight.

"Sum-Flite" is obtainable for 4/6 from all good-class toy shops and sports dealers.

Making Perfect Joints

We are often asked which is the most effective means of making satisfactorily stuck joints for cardboard and wooden models. In our experience the use of Seccotine gives excellent results with very little trouble and at little cost. Seccotine will stick and repair practically everything.

An interesting booklet describing the uses of Seccotine can be had from the Manufacturers:—McCaw, Stevenson & Orr Ltd., The Linenhall Works, Belfast, on mentioning the "*M.M.*"

House Flags and Funnels

The new edition of the sheet of house flags and funnel markings issued by "*The Journal of Commerce*," Liverpool, is proving remarkably popular with "*M.M.*" readers who are interested in shipping. The sheet contains illustrations of the flags and funnels of more than 400 of the principal British companies, reproduced accurately in colour, and is thus very valuable for reference. It may be obtained on paper at 1/9, or mounted on cloth and folded in cover at 3/9, post free in each case.

NEW HORNBY ACCESSORIES

We have introduced 16 varieties of Hornby Train Name Boards for No. 2 Pullman Coaches. These Name Boards 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 St.)
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

The Name Boards are supplied in packets containing four of a kind.

Price per packet 4d.

Roof Clips for Hornby Train Name Boards

These clips are for use with coaches that are not fitted with brackets to take Name Boards. There are two types, one to suit No. 2 Special Pullman and No. 2 Special Pullman Composite Coaches, and the other to suit No. 2 Pullman and No. 2 Saloon Coaches.

Prices:

Roof Clips No. 2
(For No. 2 Pullman and No. 2 Saloon Coaches)
Per packet of twelve, 1/-

Roof Clips No. 2 S
(For No. 2 Special Pullman and No. 2 Special Pullman Composite Coaches)
Per packet of twelve, 1/-

Meccano Ltd., Old Swan, Liverpool

The Meccano Book of New Models

A copy of the "Meccano Book of New Models," described on page 46 of this issue, will keep any bright Meccano boy busy for months! The first section of the book is devoted to the best of the latest Meccano models, among which are a power press, flying boat, traffic control signal, tank locomotive, paddle steamer and steam shovel. Then follow pages of "New Meccano Mechanisms," representing the pick of the suggestions and ideas published recently in the "*M.M.*," described simply and clearly.

Another important section of the book shows some of the latest prize-winning models. These include a splendid model of the "*Flying Scotsman*" locomotive, a realistic triple-expansion marine engine, several ships, an old-type motor car, and the new Tyne Bridge. Finally there is a page of very valuable hints regarding the use of the new Meccano Parts.

No Meccano boy's library is complete without a copy of this book.

MECCANO WRITING PADS are supplied in two sizes, each consisting of 50 printed sheets of tinted paper with cover. Price—Large, 1/- each, and small, 6d. each (post free). **ENVELOPES** to match. Price, per packet of 50, 8d. post free.
Meccano Ltd., Old Swan, Liverpool.

Converting Hornby Rails for Electric Trains

Hornby Railway enthusiasts who possess only the ordinary type of rails for use with clockwork trains can add very greatly to the interest and excitement of their railways by converting them so as to enable electric locomotives to be used. Provided that the clockwork-type rails are of the latest Hornby pattern, with sleepers having two central slots, this can now be done quite easily by means of parts that have been specially introduced for the purpose.

It should be clearly understood that converting the ordinary type of rails in this manner does not interfere in the least with their usefulness for clockwork trains.

The parts required for this conversion are as follows:—

Straight Centre Rails ... ... 1/- per doz.
Curved Centre Rails ... ... 1/- per doz.
Insulators ... ... 3d. per doz.
Clips ... ... 6d. per doz.

For the conversion of one standard rail-length of track, the parts required are three Insulators, three Clips and one Centre Conductor Rail. First of all the Clip is pushed from beneath into the slots in one of the sleepers, and an Insulator is placed in this Clip. The Centre Rail is then carefully pushed into the Insulator, and in order to tighten it up the jaws of the Clip are closed down firmly upon the Insulator. The same operations are then carried out for each Clip and Insulator. Care should be taken that the ends of the Centre Rails coincide with the ends of the corresponding Running Rails.

"How to use Meccano Parts"

A New Manual

Every keen Meccano enthusiast wishes to carry out his model-building operations in accordance with correct engineering principles. In order to do this he must know the special functions of each of the parts that comprise the Meccano System, and to assist him in acquiring this knowledge there is published a special manual entitled "*How to Use Meccano Parts.*" In this manual all the parts in the system are listed and classified, and the uses of each individual part are described in detail. The descriptions are assisted by half-tone illustrations and sectional diagram showing the parts actually in use in Meccano structures and mechanisms. An important section of the book is devoted to the various forms of Meccano motive power, and gives much useful information regarding the use of the Meccano Electric and Clockwork Motors and the Meccano Steam Engine. This manual forms an ideal constructor's guide and book of reference, and should be in the possession of every Meccano boy who wishes to build more and better models.

"*How to Use Meccano Parts*" may be obtained, price 6d., from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Old Swan, Liverpool, price 7d. post free.

Accessories for Radio Enthusiasts

Readers who are interested in the construction of radio sets know the importance of making sound connections between the various components. The "Eelex" range of terminals, plugs and sockets has been specially designed for this purpose. These are made in a wide variety of types, suitable for every wireless fitting; and a feature that will appeal greatly to Meccano model-builders is that a standardised form of plug and socket construction is employed throughout, so that the parts are interchangeable. We have received samples of the Eelex "S" type plugs and sockets, which are designed for use in wireless apparatus working direct from the mains. The special feature of these plugs is that they are entirely shrouded in insulating material and have no exposed metal parts. We have tested the samples submitted, and we find them to make positive contact and to be thoroughly efficient in operation. These and all other Eelex plugs and sockets may be obtained in six distinct colours, so that the possibility of a wrong connection being made is reduced to the minimum. Illustrated leaflets and full particulars of the Eelex specialities may be obtained by any "*M.M.*" reader from Eelex Products, 118, Bunhill Row, London, E.C.1.

Be kind to your bike!

You balance your bicycle with a pedal precariously on the curbstone, or lean it against a wall or post—and what happens? More often than not it falls and is damaged. Scratches and entanglement, twisted handlebars, broken spokes, damaged lamps, scraped handle-grips—these all result from falls.

The "Avecta" Cycle Stand

will enable you to stand your machine anywhere without the slightest risk of falling.

It is a permanent fitment and lies along the front down tube when the machine is being ridden.

Ask your cycle dealer to show it to you.

PRICE

2/9

EACH.

If unobtainable locally, write to the manufacturers.

HERBERT TERRY & SONS LTD., Manufacturers, REDDITCH, Eng. **Est. 1855**

TRADE MARK

A STEADY SOUND BASE

is a real necessity to all Mechanical Models. In Plasticine you will find a material that will stop slipping, wobbling, or any kind of movement on a slippery surface.

Let us send you a list of over 150 uses to which Plasticine has been put, you will then see how well it combines with Meccano Construction.

The New Octagon Box with Tool, etc., and 8 colours, **1/6**, by post **2/-**.—The Corona Box—a full pound in 10 Colours, **1/6**, post **2/-**. Other Outfits from **6d.** to **£1/1/-**.

Write for Free Lists—

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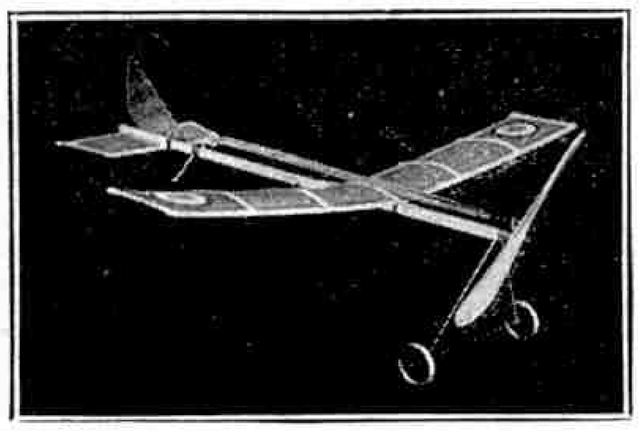

Wing Span 16½" Weight under 1¼ ozs.

THE FAMOUS S.S.S. PUP

Price **1/11**

Fitted with 7" unbreakable propeller operating in a special ball-joint bearing to absorb shock. Simplicity of design combined with high flying efficiency. Covered with Yellow Oiled Proofed Silk with identification discs.

A MAGNIFICENT FLYER
LOOPS, STUNTS
AND RISES FROM THE GROUND

OTHER MODELS

S.S.S. MOTH	Price	2/6
,, RED IMP	,,	4/-
,, BLUE BIRD	,,	6/-
,, SEAGULL	,,	7/6
,, HAWK	,,	10/-

Obtainable at all the leading stores, and all branches of W. H. Smith & Son Ltd.

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Sole Manufacturers:

SEAGULL SCIENTIFIC SPORTS CO.

(Dept. M), 1133, LONDON ROAD, LEIGH-ON-SEA

Telephone No.: Leigh-on-Sea **76277.** **ESSEX**

A real 'man size' liquid pistol for 1/9

LOOKS just like a real automatic and shoots a strong jet of water about 25 feet. It is strongly made from metal with blued steel finish and there are no rubber parts to perish or wear out. It's a pistol that will last a lifetime.

That's the pistol you should have—one that will really **do** something. Get one from your nearest dealer—only **1/9**—but be sure it's a DAISY as illustrated above.

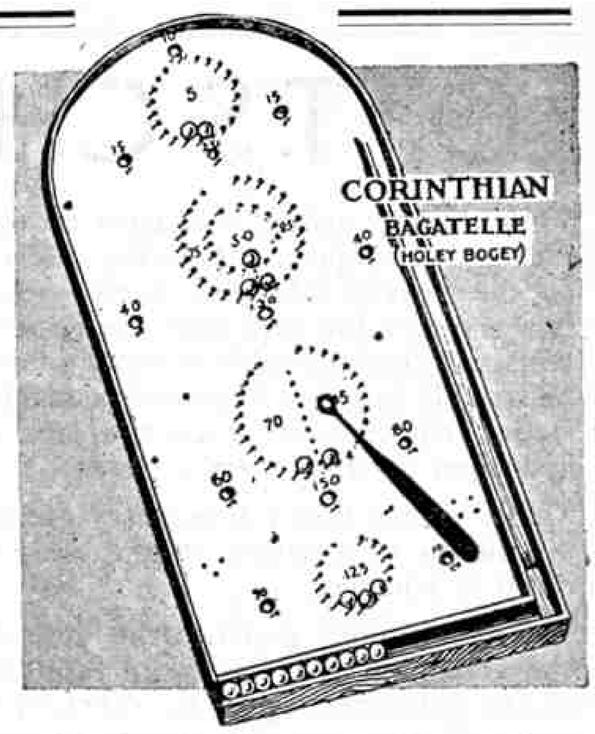
A catalogue showing all DAISY Air Guns will be sent free on application.

DAISY AIR RIFLES

(Made in U.S.A.)

Wm. E. Peck & Co. of London, Inc., 31, Bartholomew Close, London, E.C.1.

"WHAT A GAME . . "



Yes, Yes, 50—no, 60—no, 90—yes, 90. Ah ! a good start. Now another shot—15, no—40, no—good. All " lost " balls back, because the ball went into " the triangle." What excitement. Play on, Ted. See if you can beat 850.

EVERY SHOT GIVES A THRILL

Fascinating to the last degree. Just as entertaining for Aunts and Uncles, and Mothers and Fathers. They simply cannot resist it.

Our slogan is EVERY HOME ITS CORINTHIAN, and we are confident that **Corinthian Bagatelle** is going to be a boon to many thousands of homes this winter. There is no end to the number of games that can be played—" Highest score," " Lowest score," " Hidden number," " Nearest 500," " Cricket," " Golf," " Penalties." Never was there such a board as this, and it can't wear out, no cloth to tear. Nothing to replace, first cost—last cost.

The skilful shot will reap its reward, but the lucky chap will always have a few happy flukes.

Remember, **Corinthian Bagatelle** is the Master Board, and do not be put off with a copy.

Corinthian is fitted with the Springy Steel Pin, which adds so much to the game. N.B. Springy Steel.

Ask your local dealer to demonstrate. In case of difficulty, write to the manufacturers.

HOLEY BOGEY
CORINTHIAN BAGATELLE

The MASTER Board

As supplied to H.M. the King, H.R.H. the Prince of Wales, and many members of the Royal Family. 21/– each. Packing and postage, 1/6 extra. Ask at your local dealer or at any London Stores or from Abbey Sports Co. Ltd., Dept. M.M.3, 125, Borough High Street, London, S.E.1.

ABBEY SPORTS CO. LTD., 125, Borough High Street, London, S.E.1

the firm that introduced Toc-Toc Bat-Pistol and Clico Potato Pistol. Also wholesale agents for Warneford Aeroplanes.

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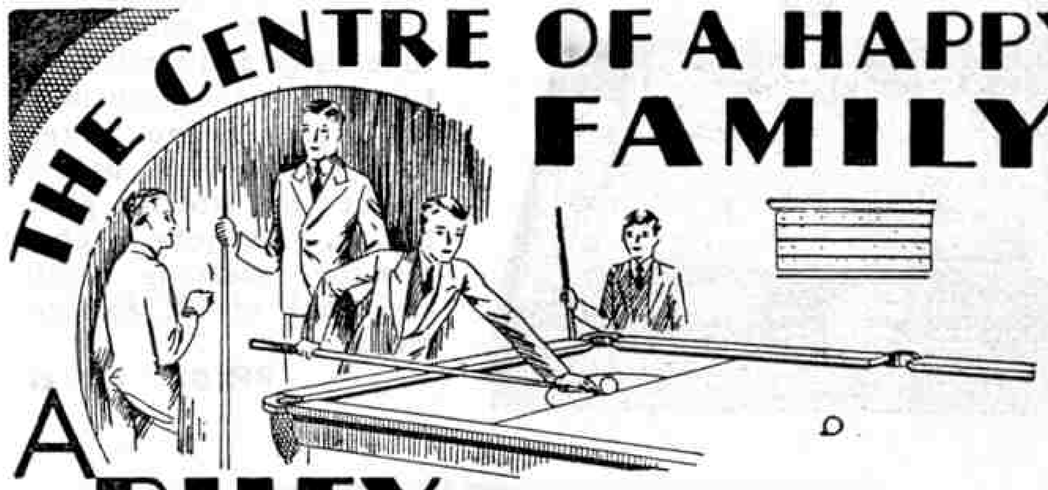

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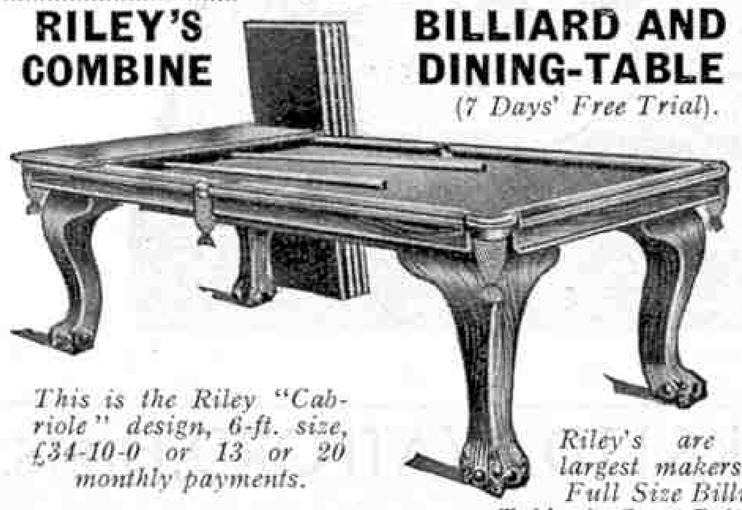

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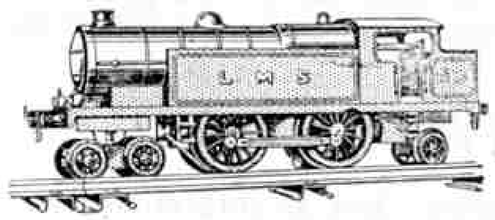

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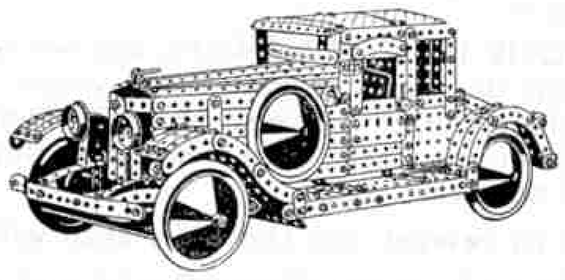

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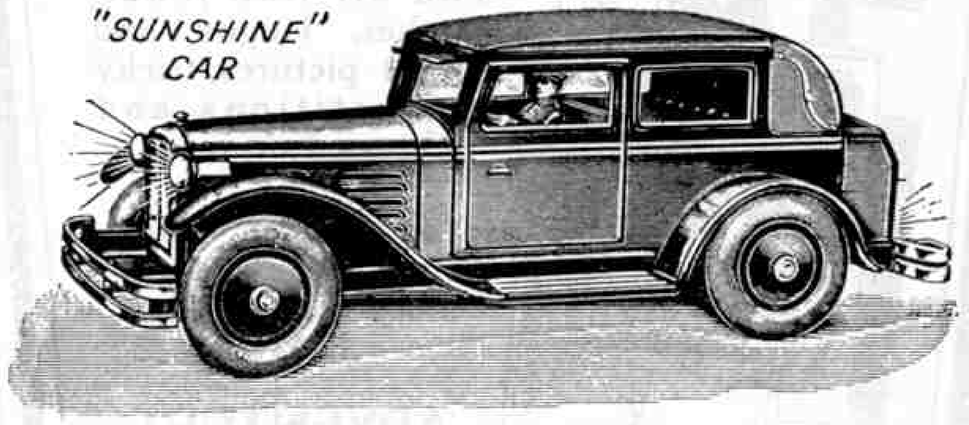

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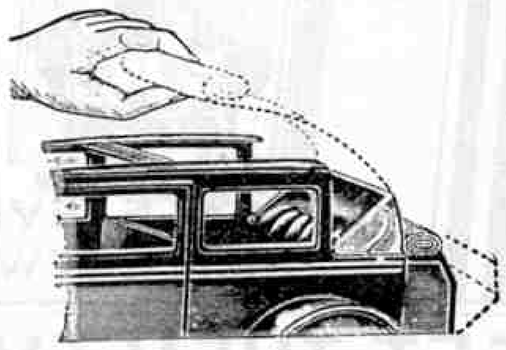

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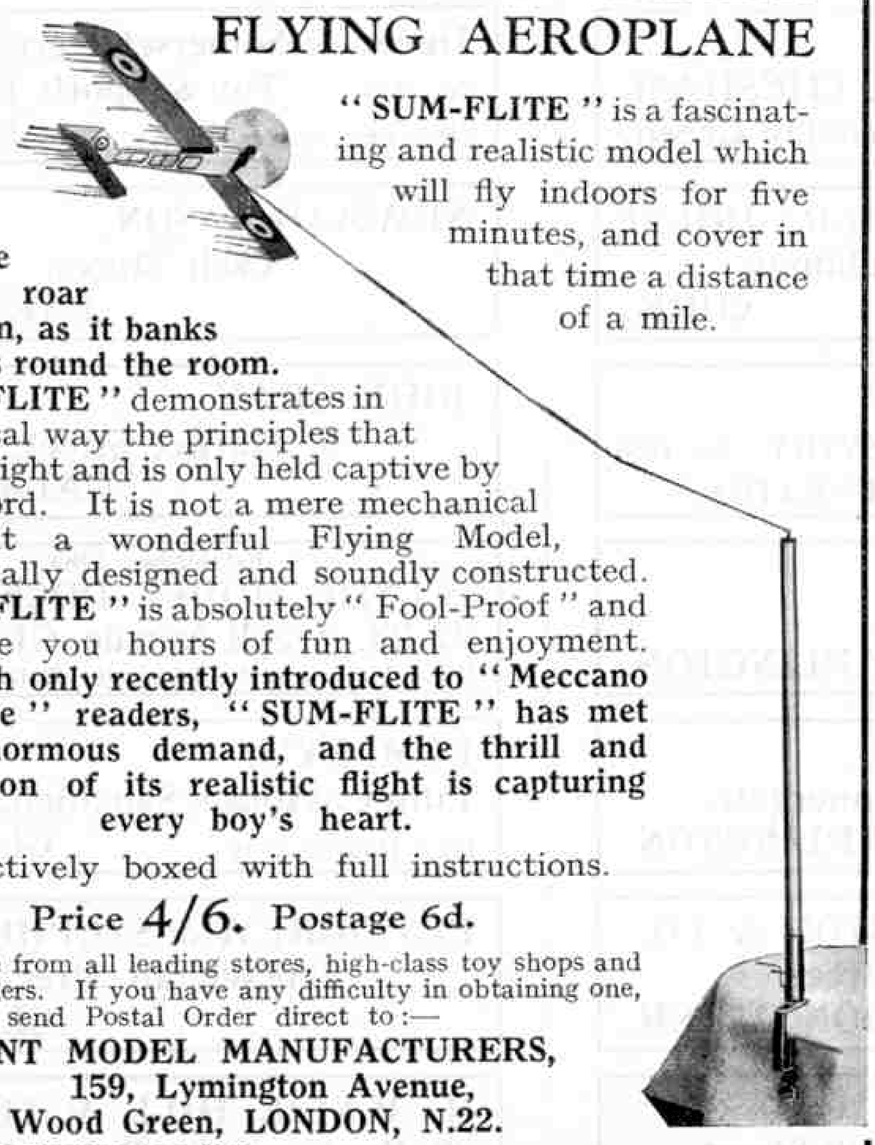

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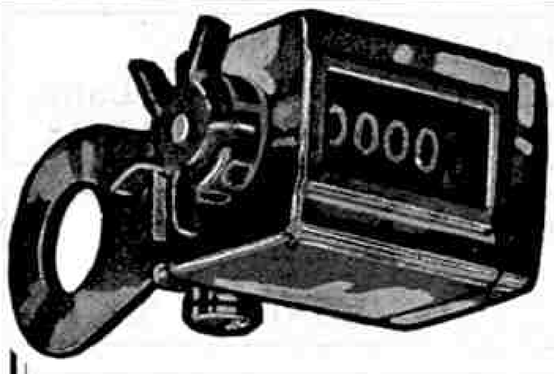

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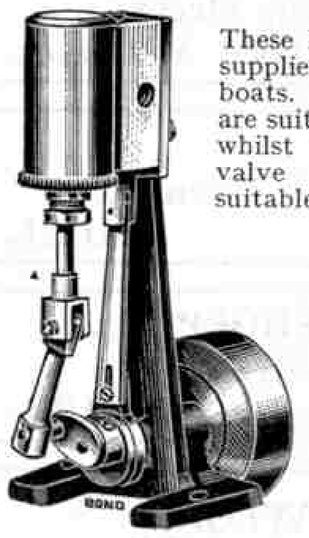

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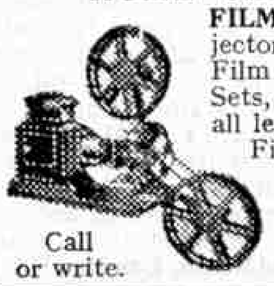

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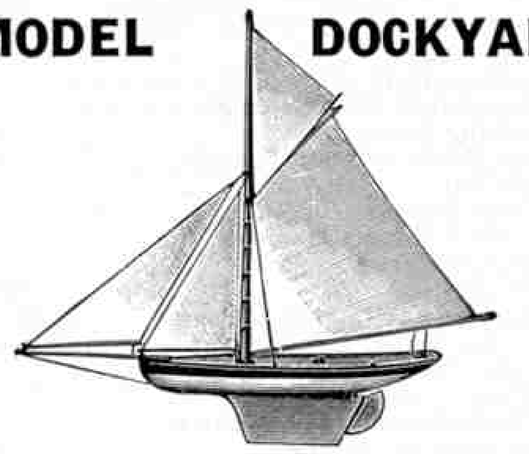

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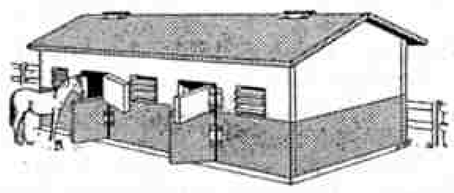

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Sale. No. 8 Erector Set, complete with motor, perfect condition, cost £5/5/-, sell £3 or nearest offer. Also Gauge O Clockwork Locomotive and Tender, perfect condition, cost £1/5/-, take 16/- or nearest offer.—Apply, H. L. O'Neill, Esq., Brinny Rectory, Upton, Co. Cork, Ireland.

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Sale. 55/- Cinematograph, 40/- (also accessories); 'K' Boat, 9/6; Sutcliffe Warship, 9/6; No. 2 Skisail Monoplane, 8/6; 27 "Meccano Magazines," 1928-1931, 8/6; 5/- Microphone Button (unused), 3/11. All good condition.—Race, St. Catherines, Lincoln.

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Sale. Powerful Marklin Clockwork Loco (4–4–2). Excellent condition, Cost 39/6, 15/- or nearest.—Shaw, 40, Chadwell Road, Grays, Essex.

For Sale. Three Bassett-Lowke Carriages, one Mail Van, Ground Gear Electric Lines, about 25, Two Points, two Hydraulic Buffers, all excellent condition, Gauge One. £3. Near offer.—John Joyce, 20, Soho Square, W.1.

Long Barrel Shot Pistol, Adjustable Wire Stock. Scarcely used, .410 Bore, 10/-. Adjustable Ball-Bearing Roller Skates, 6/-.—T. Smith, Merok, West Melton, Rotherham.

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List M11 just published, with over 50 new titles. **New feature: Real Photographs of Aeroplanes.** First set of 12 now ready. Railway or Aeroplane List along with specimen card on receipt of 4d. Please state which list is required. All our photographs are postcard size and we have only two prices:—3d. each, 2/6 per dozen (post free). **Railway Photographs, 23, Hanover St., Liverpool.**

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Binding cases for back numbers of the Magazine may be obtained from Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These are supplied in two sizes (1) for six copies price 3/6 and (2) for twelve copies price 5/3, post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown here. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding 6 and 12 copies. These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
OLD SWAN, LIVERPOOL, ENGLAND.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

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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).

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NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

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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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 }	
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

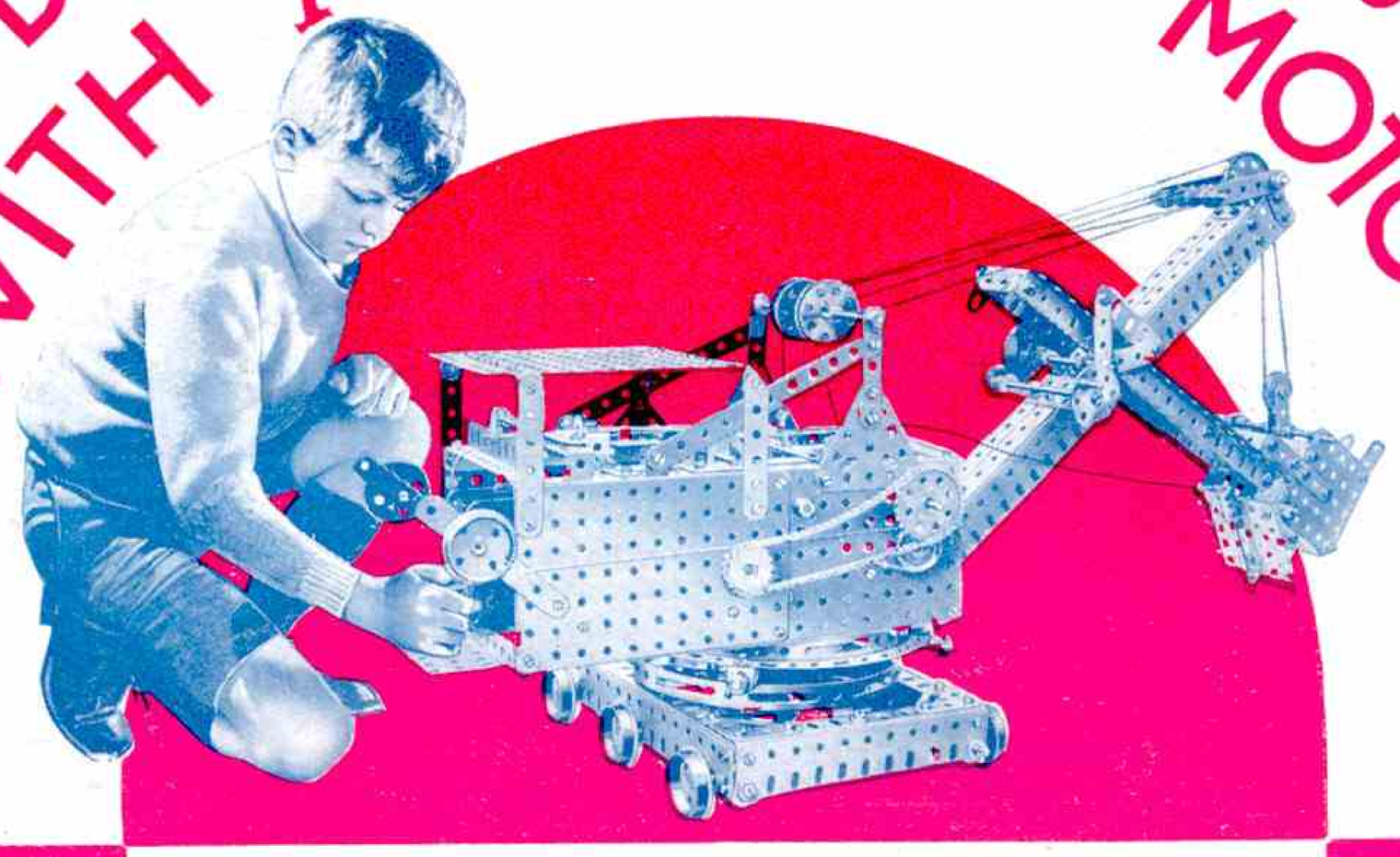
Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose one of the new Locomotives, the cost of which is not less than 12/6 (or, in other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

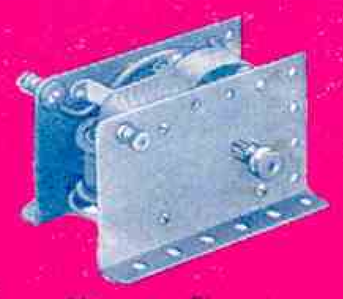
MECCANO LTD.
Special Service Dept., Old Swan
Liverpool

DRIVE YOUR MODELS WITH MECCANO MOTORS



Building a Meccano model is the greatest fun in the world. Excitement increases steadily as the model grows, part by part, under your hands. Finally there comes the greatest thrill of all. You connect your completed Crane, Motor Chassis or Traction Engine to a Meccano Motor or Steam Engine, and see it work in exactly the same manner as the real thing!

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. Particulars and prices are given below.



Meccano Electric Motor No. E 1 (6-volt)

MECCANO ELECTRIC MOTOR No. E 1
(6-volt)

This is a highly efficient electric motor (non-reversing) that will give excellent service. A 6-volt accumulator will operate it, but it may also be driven from the mains (alternating current only) through the 6-volt transformer described on this page. Price **7/6**

Meccano Electric Motor No. E6 (6-volt)

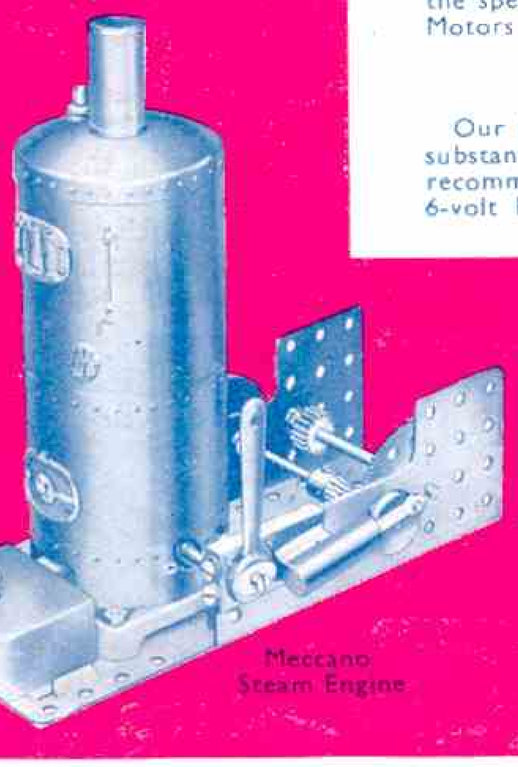
MECCANO ELECTRIC MOTOR No. E 6
(6-volt)

This excellent reversing motor may be run from a 6-volt accumulator or, by employing the transformer described on this page, from the mains (alternating current only). Price **15 6**

IMPORTANT— Meccano 6-volt Motors will not run satisfactorily from dry cells.

RESISTANCE CONTROLLER

By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. Price **4 6**



Meccano Steam Engine

ACCUMULATOR

Our 6-volt 20 amp. Accumulator is of substantial construction and is specially recommended for running the Meccano 6-volt Electric Motors. Price **28/6**

Transformer

TRANSFORMER

By means of this transformer the Meccano 6-volt Electric Motors may be driven from the mains supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at standard frequencies. The supply voltage and frequency must be specified when ordering. Price **22/6**

MECCANO CLOCKWORK MOTOR
No. 1 (Non-Reversing)

A long-running and highly efficient clockwork motor (non-reversing), fitted with brake lever. Price **5 –**

Meccano Clockwork Motor No. 1

MECCANO CLOCKWORK MOTOR
No. 2 (Reversing)

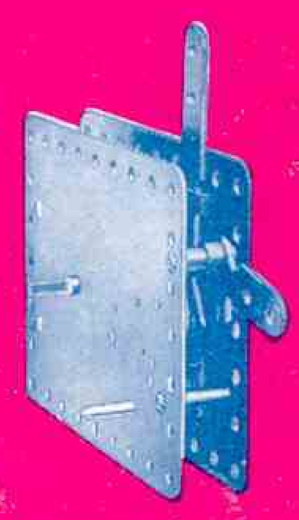
This strongly-built reversing clockwork motor is a compact self-contained power unit. An efficient governor controls the powerful spring that is fitted on the motor, and ensures a long steady run at each winding. Price **10 –**

MECCANO STEAM ENGINE

On actual test this powerful steam unit has lifted over 56 lbs. The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risk of the spirit becoming heated. Price **25 –**

Meccano Accumulator

Resistance Controller



Meccano Clockwork Motor No. 2

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