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MECCANO MAGAZINE

FOR BOYS

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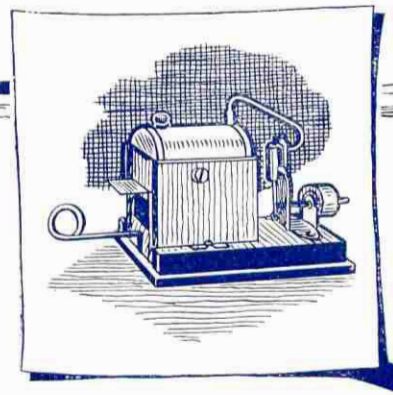
No 7



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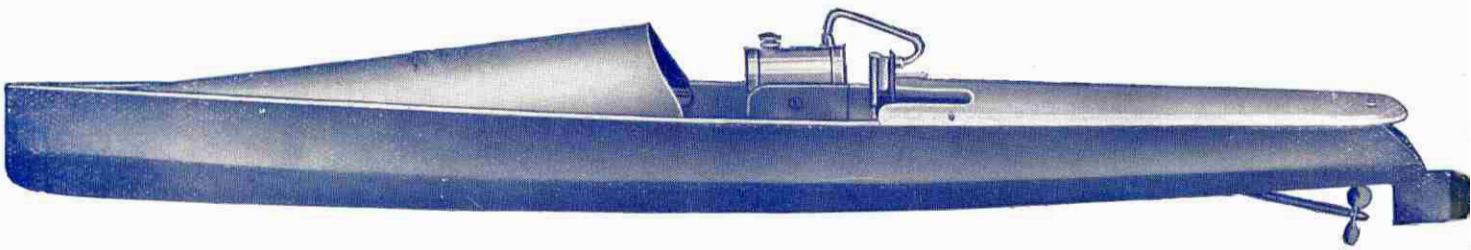

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LIVERPOOL

MECCANO MAGAZINE

PUBLISHED
IN THE INTERESTS
OF BOYS

OUR cover this month shows a huge ladle being filled with molten steel from one of the furnaces at the works of Messrs. Armstrong, Whitworth Limited, Newcastle-on-Tyne. The original photograph was kindly supplied to us by this firm and they mention that it is the most striking photograph that they have ever seen, and was obtained only after many hundreds of attempts. Our artist has worked this photograph up into a picture in colours, and I think my readers will agree that the result is very striking. The subject is, of course, related to our article *"The Story of Iron and Steel,"* which is arousing considerable interest among my readers, as the contents of my mail-bag testifies. It is a wonderful sight to see molten metal coming from the furnace, and the spectator cannot help but admire the genius of the engineers who have devised the huge machines and mechanical appliances for handling the white-hot metal. When we see how easily the workmen handle great quantities of glowing metal, we understand what a great part engineering plays in the life of everyone. This is made even more clear by the detailed description in our article of the different processes by which steel is made.

Our Cover

Last month I invited Meccano boys to contribute some interesting experiences or facts in the form of short articles, and I have pleasure in announcing this month a new feature that will be included as often as space permits. This page, which will be headed *"From Our Readers,"* will be devoted solely to interesting articles from readers, and I shall be pleased to receive contributions. The articles may deal with anything of general interest, such as a new idea for making something; a method of doing something in a new manner; an account of some unusual occurrence or incident, or details of an interesting visit. Illustrations may be sent, if desired (either drawings or photographs), and those articles that are published will be paid for at our usual rates. As previously mentioned, no reader need hesitate to send an article because he may not be very good at composition. If necessary I will have the articles put into shape, ready for publication. I take this opportunity of also reminding my readers that I am always pleased to consider photographs of anything of interest to Meccano boys—and particularly engineering subjects—for publication in the Magazine. Half-a-crown is paid for any photographs published.

From Readers

The British Empire Exhibition at Wembley continues to form the topic of conversation among tens of thousands of people, and rightly so, for the Exhibition is the most wonderful demonstration that has ever been held to show the vastness of our Empire. Last month we announced a special essay competition for those who visit Wembley, and full particulars will be found on our competition page again this month. In our next issue I am hoping to publish an article by Mr. H. Lansley describing the Exhibition. Mr. Lansley will be remembered as the editor of a very successful Meccano boys' paper, *"The Meccano Engineer."* If you are interested in Wembley and the wonderful sights there to be seen, you must not miss this account of a Meccano boy's visit to wonderful Wembley. In connection with the Empire Exhibition I should like to draw the attention of my readers to the special Photographic Competition announced in this issue.

The Great Exhibition

In one of our recent issues I published an article on my interview with Mr. Constantinesco, the inventor of the Torque Converter, and in our April number I described how this wonderful new invention can be constructed in Meccano. This issue includes a special article from one of our readers, describing some interesting experiments with this Meccano model of the Converter. I hope that every Meccano boy will closely study these experiments, for I feel that the Torque Converter is an invention with a very great future. It behoves every Meccano boy to thoroughly grasp the principles on which this invention is based and there can be no better means of doing this than by constructing the model in Meccano. In fact, so realistically does this model work that Mr. Constantinesco, the inventor, has asked us to make for him Meccano models showing the Torque Converter fitted to a Motor Chassis, a Pile Driver, a Winch, and a Tank. We understand that some of these models will be exhibited on the inventor's stand at Wembley, and I think all will agree that this is a high tribute to the efficiency of the Meccano model of this very elaborate invention. I hope to give some further particulars of the application of the Converter to models other than the chassis in a future issue of the *"M.M."* In the meantime, Mr. Knowles's article gives a good indication of the instruction that may be obtained from experimenting with the model of the Converter.

An Interesting Model

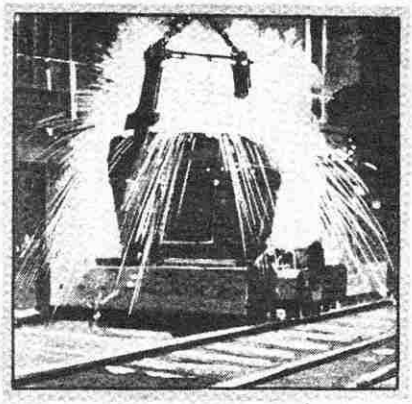
COMPLETE YOUR "M.M." FILES

Those who wish to make up complete sets of *"M.M.'s"* will be interested to hear that we have in stock a few copies of recent issues.

All Magazines up to and including December, [illegible] are out of print. A few dozen copies remain of each number from January to December, 1922, and copies of each of the 1923 issues are also available, with the exception of September and October. Copies will be sent post free, price 3d. each, but early application should be made, as the number available is very small.

For many months past we have been unable to supply dealers and newsagents with as many copies of the *"M.M."* as they have ordered. As I have frequently explained in these pages, we print only sufficient Magazines to meet the orders received. Immediately before we go to press the orders in hand are collected and the total number on order is the number of Magazines printed. After publication we invariably receive additional orders, but these we are not able to execute. The consequence is that there is all-round disappointment—dealers are disappointed, readers are disappointed, and I am disappointed because I never like anyone else to be disappointed! The moral of all this is: "Place a standing order for the *'M.M.'* and place it *now*," either with your regular Meccano dealer, with your local newsagent, or direct with this office. (Subscription rates are given on page 204.)

Sold Out



The Story of Iron & Steel

III. STEEL-MAKING: THE BESSEMER PROCESS

IN our previous articles we have seen how pig-iron is made in the blast-furnace from iron ore, and how wrought or malleable iron is made in the reverberatory furnace from pig-iron. We have now to describe the various processes for making steel, the most valuable commodity in the world.

Early Methods

The process of converting iron into steel was known among the Eastern nations long before it was introduced into Europe. In the Middle Ages the process appears to have been well known in Germany, but at that period very little steel was produced in England. Consequently almost all the steel used in this country was imported from Germany.

Even at that early period Sheffield had acquired a reputation for the manufacture of various useful articles from iron and steel. By degrees the Sheffield manufacturers ceased to import steel from Germany and began to make it themselves. For this purpose they used bars of high-grade Swedish iron. These bars were packed with charcoal in an air-tight vessel and subjected to a high temperature for from eight to twelve days, the exact period of heating determining the temper of the resulting steel. The bars were then taken from the vessel and broken up into pieces of convenient size. The steel produced in this way was known as "blister steel," on account of the fact that the bars were covered with blisters caused by chemical reaction while they were in a plastic or soft condition.

The short bars of blister steel were then hammered lightly to flatten the blisters, and afterwards a number of them were placed together in a welding furnace and welded into a solid mass. Steel made by this process was called "shear-steel," from its special suitability for making tailors' shears. It was also largely used for making clock springs.

Crucible Steel

For a long period shear-steel was the only kind of steel manufactured in this country, but in 1740 a great advance was made by Benjamin Huntsman, a Sheffield clockmaker. One great defect of shear-steel was that it contained weld lines, and Huntsman realised that it would be a great improvement if steel of equal quality could be made without the necessity of passing it through the welding process. After much thought he hit upon the idea of breaking the bars of blister steel into small pieces and melting them in a crucible, afterwards pouring the molten metal into an ingot mould and hammering or rolling it to the required size. This method entirely eliminated the weld lines and produced steel of very fine quality.

A Secret Stolen

Huntsman did not patent his process, but preferred to keep it secret, and with this object he carried on work only at night, with a staff of men all sworn to the strictest secrecy. The other Sheffield steel-makers became alarmed at Huntsman's success, and they determined to find out the secret of his process.

Sir Henry Bessemer

One cold and stormy winter night an iron-founder disguised himself as a tramp and knocked at the door of Huntsman's works, begging for shelter. The workmen took pity on him and gave him a warm corner near the furnace, where he pretended to go to sleep. He was really very wideawake however, and as the men went on with their work the supposed tramp took careful note of the construction of the furnace and of the manner in which the process was carried out. Some hours later the tramp thanked the workmen for their kindness and left, taking with him Huntsman's cherished secret. Before long a rival steel works was making crucible steel.

The process thus commenced continues in use to-day, and by means of it the finest tool steels are made.

The Bessemer Process

For more than 100 years the crucible process remained the only method of making high-class steel. The next change was brought about by Henry (afterwards Sir Henry) Bessemer.

Bessemer was born in England, of French parents, on 19th January, 1813, at Charlton, in Hertfordshire. From his boyhood he was always experimenting with something or other, and he became specially interested in the casting of metal. Among his ambitions was that of producing heavier projectiles for guns. One day, while discussing this matter with an army officer, the latter remarked that it was little use making heavier projectiles until some stronger material could be found for making the guns. This remark caused Bessemer to turn his attention to trying to produce a metal that would combine the hardness and rigidity of cast iron with the toughness of malleable iron.

Early Failures

Cast iron is converted into malleable iron by the elimination of its impurities—carbon, silicon, phosphorus and manganese—which, as we have already seen, is done in the reverberatory furnace. Bessemer came to the conclusion that the same result could be obtained much more quickly by forcing a blast of air through molten pig-iron. The scheme was tried in 1856, but though malleable iron was produced, it was found to be worthless on account of the amount of phosphorus it contained. This difficulty was overcome by using pig-iron containing very little phosphorus. Steel could be made from this iron by means of the blowing process, but here another serious trouble was encountered. It was found impossible to obtain steel of uniform quality on account of the difficulty of gauging the extent of de-carbonisation during the blow.

For a while this drawback appeared to be fatal to the success of the process, but the problem was solved by Robert Mushet, a Scotsman. His idea was to drive out almost the whole of the carbon and then to add to the molten metal exactly the correct amount of carbon to make steel of the desired quality. The carbon was added in the form of *spiegeleisen* or "mirror-iron," a form of pig-iron containing known quantities of carbon and manganese. This iron derives its name from the fact that when broken it forms crystalline plates of very brilliant appearance. Mushet's idea worked excellently, and through it the success of Bessemer's method was assured.

Converting Iron into Steel

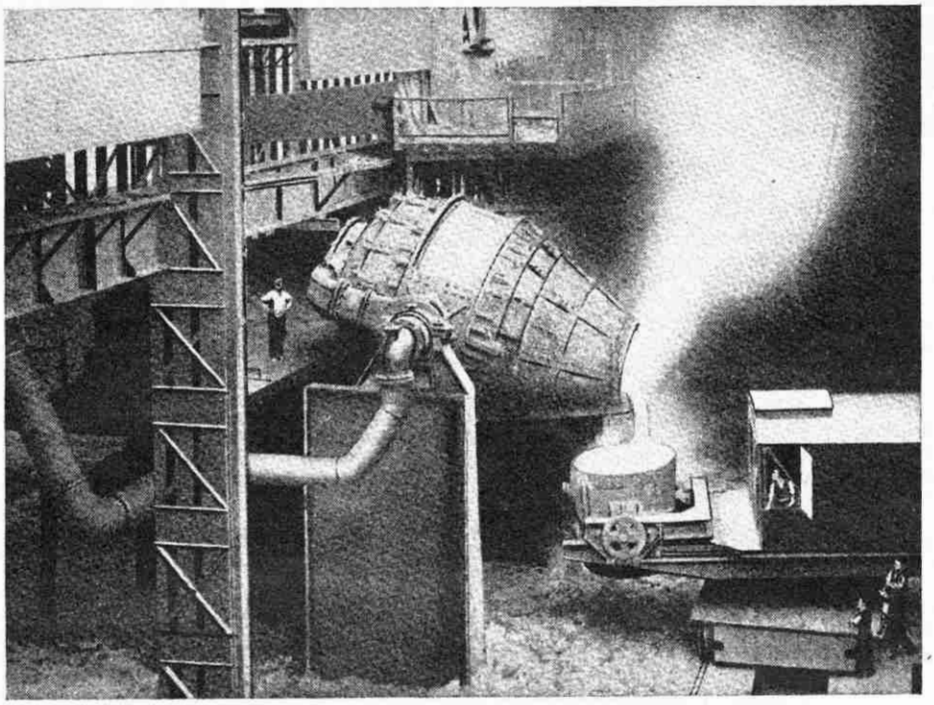
The Bessemer process is carried out in what is called a "converter." This consists of a vessel shaped as shown in the diagram on this page, and suspended on trunnions so that it may be swung into either a horizontal or vertical position, the swinging being controlled by hydraulic mechanism. The converter has an outer casing of malleable iron plates and an inner lining of ganister, which is a compact and hard variety of sandstone. At the bottom of the converter several tuyères carry the air-blast through the lining into the interior. These tuyères act in a similar way to those in the blast-furnace, but in this case the blast is driven through at a much higher pressure—about 25 lbs. per square inch.

The pig-iron is first melted in a cupola furnace—except in cases where the iron comes direct from the blast-furnace—and is then poured into the converter while the latter lies in a horizontal position. The blast is then turned on and the converter is swung into a vertical position. This brings the metal over the tuyères, and the air blast passes through the whole mass of metal with a loud roaring sound.

A Wonderful Sight

A very brilliant spectacle follows, for a fierce flame issues from the neck of the converter. At first this flame is pale in hue, but rapidly grows brighter and brighter, until it becomes dazzling. Showers of sparks stream out, accompanied by fragments of molten slag.

The process is carefully watched by the "blower," an expert workman whose long experience enables him to tell from the variations of the colour of the flame exactly how matters are going on inside the converter. Sometimes the metal becomes too hot during the process, and then the blower gives an order for cold scrap iron to be thrown in to reduce the temperature. Presently the flame begins to drop and becomes quieter, and this is a sign that the last of the carbon is burned away and that no flame-producing substance is left. Exactly at the right moment the blower signals for the converter to be swung down on its side, and the blast is shut off. The necessary amount of molten *spiegeleisen* is then added, and the whole mass of molten metal is poured into a huge bucket or ladle.



A Bessemer Converter Pouring its Molten Contents into Giant Ladle

Steel Ingots

When the steel is to be used at once for making castings it is taken direct to the foundry, otherwise it is run from the ladle into "ingot moulds." These moulds are made of cast iron and are about six feet high, being about 16 inches square at the top and broadening out gradually towards the bottom. They are open both top and bottom, and stand upon an iron plate.

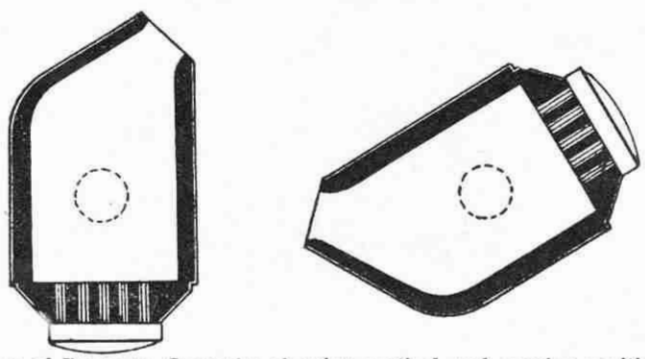


Diagram of Bessemer Converter showing vertical and pouring positions

By means of a truck on which it is carried, the ladle containing the molten steel from the converter is brought over each mould in turn. Then a hole at the bottom is opened and the metal pours out until the mould is filled. The moulds are then allowed to stand until the ingots—as their contents are called—have a solid shell outside, although they are still liquid inside. An overhead travelling-crane is then brought over the rows of moulds, a chain is lowered, and two hooks at its end catch the "lugs" of each mould and lift it off the ingot.

The Soaking-Pit

If these ingots are to be used immediately they are lowered into a "soaking-pit," consisting of a chamber large enough to hold an ingot easily, lined with firebrick and fitted with a lid. This operation, with an electric overhead crane, was the subject of the cover of the May "*M.M.*" The object of the soaking-pit is to bring the ingot to a uniform temperature throughout. If this were not done the ingot would be hard outside and soft inside, and therefore unfit for passing through the rolling mills. In these soaking-pits the ingot gives off heat to the firebrick, until the whole chamber and the ingot are at the same temperature.

The ingots are now ready for the rolling mills, and their subsequent treatment will be described in a later article.

Process Completed

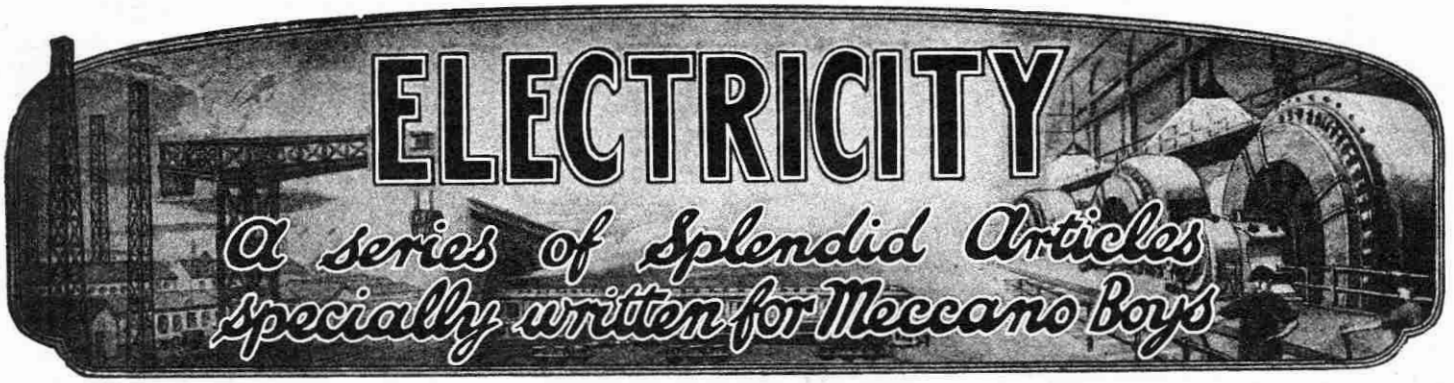
The process we have just outlined is the original Bessemer "acid" process, requiring a converter lining of ganister, which is an acid oxide. As we have seen, however, this process was limited to iron ore containing very little phosphorus, and as such ore forms only a small proportion of the total ore in the world, it became necessary to find some means of adapting the process to deal with ore containing a large quantity of phosphorus.

Mr. G. J. Snelus carried out experimental work with this object, and found that if the converter was lined with a "basic" material the phosphorus could be removed. A basic material may be explained as being a metal in combination with ogygen. It was left to Mr. S. Gilchrist Thomas, a London magistrates' clerk who had made chemistry his hobby, to solve the problem in conjunction with Mr. P. C. Gilchrist, an iron works chemist. Their solution consisted in lining the converter with "dolomite," a mineral consisting of the carbonates of calcium and magnesium. This enabled highly-phosphoric ores to be used with complete success for steel making.

Decline of Malleable Iron

The introduction of the Bessemer process brought about a great change in the

(*Continued on page 202*)



V. MAGNETS AND MAGNETISM

Magnetism, the subject of this article, plays a very important part in the operation of electrical mechanism of nearly every kind. We recommend our readers to carefully follow the explanation of the subject, for without some knowledge of the principles of magnetism it is impossible to understand the working of dynamos, motors, electric bells, and a host of other machines and appliances.

IN certain parts of the world there exists a peculiar kind of iron ore which has the power of attracting iron. If a piece of this ore be suspended so that it swings freely it will always turn to the north. This ore is called "lodestone," and its strange power is due to what is called "magnetism."

The origin of the name magnetism is uncertain, but according to one old story a shepherd named Magnes, who lived in Asia Minor, was one day tending his sheep on a mountain side and happened to touch with the iron tip of his crook a piece of dark-coloured rock. To his great astonishment he found that the rock held his crook so firmly that he could scarcely pull it away. This rock was formed of lodestone, and the name magnetism is said to have come from the shepherd's name, Magnes. Another explanation is that the name is derived from Magnesia, also in Asia Minor, where lodestone is found in large quantities. The name lodestone itself comes from the Saxon word *laeden*, which means "to lead," and refers to the lodestone's power of always pointing to the north if free to do so.

Artificial Magnets

Lodestone is a natural magnet. We can make artificial magnets out of pieces of steel by rubbing them with a piece of lodestone, and these magnets attract iron and turn to the north exactly as lodestone does. A piece of iron may be magnetised in the same way, but there is a very important difference to be noted—iron quickly loses its magnetism, whereas steel retains it. The softer the iron the quicker it loses its magnetism, and the harder the steel the better it retains its magnetism. Consequently, a specially hard quality of steel is used for making artificial magnets, but nowadays such magnets are not made by rubbing them with lodestone, but by means of an electric current, as we shall see later. Magnets are made either in the form of a straight bar or of a horseshoe, as illustrated in the diagram on the next page.

Some Interesting Experiments

A number of very interesting experiments may be made with two bar magnets and a small quantity of iron filings. If we roll a bar magnet among iron filings we find that the filings do not cling to it equally all over, but cluster thickly at each end of the magnet, few or none clinging to the middle. These two points, at which the magnet attracts iron most strongly, are called the "poles" of the magnet.

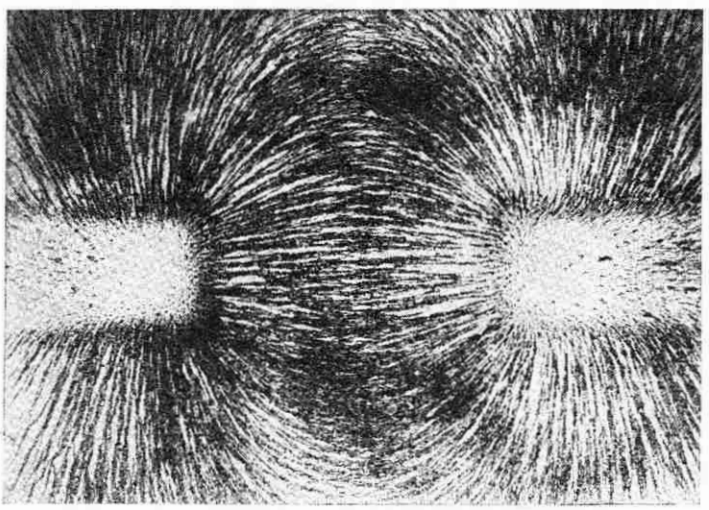
If we suspend a bar magnet from its centre by means of a sort of stirrup of copper wire attached to a thread, it will take up a position pointing north and south. The end which points to the north is called the "north pole" of the magnet and the other end the "south pole." The north pole of a magnet is usually marked with the letter N, or in some other way. If we bring each end of another magnet in turn near each end of the suspended magnet, we find that the two north poles or the two south poles repel one another, but that a north pole attracts a south pole, and vice versa.

These experiments show us that both poles of a magnet attract unmagnetised iron, but that similar poles of two magnets repel one another and opposite poles attract one another. Our readers will remember that this is exactly what happened in our earlier experiments with the charged glass rods, when "like repelled like" and "unlikes attracted."

For experimental purposes it is useful to have a number of small magnets, and these are easily made out of steel knitting-needles or sewing-needles. Place the needle on the table and draw one pole of a bar magnet along it from end to end several times, always starting at the same end of the needle, and lifting the magnet quite clear of the needle at the end of each stroke.

Magnetic Induction

A piece of soft iron may be magnetised by a magnet without actual contact, by what is called "magnetic induction." Place a short piece of soft iron on the table close to some iron filings. Then bring one end of a bar magnet near one end of the iron, and the iron will immediately attract the filings, showing that it is now magnetised. As soon as the magnet is taken away the piece of iron loses its power to attract filings, showing that its magnetism has gone. It is very interesting to repeat this experiment with a sheet of glass, paper, or wood between the magnet and the piece of iron. These substances do not interfere in the least with the action of the magnet, but if a sheet of iron is used the experiment will not work, for iron has the power to "screen" or prevent the action of magnetism.



Lines of Force of Two Opposite Poles

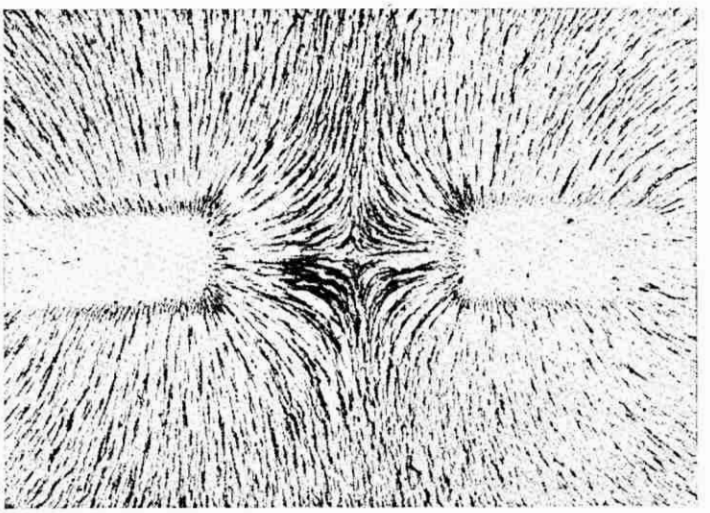
Invisible Lines of Force

Spread a thin layer of iron filings over a sheet of cardboard, and watch the result when a magnet is moved to and fro just beneath the sheet. The effect is very amusing. The filings stand up when the magnet approaches them, and follow it about as if pulled by invisible strings. As a matter of fact, the magnet really does act by means of invisible strings, which are known as "lines of force." These lines of force proceed from the magnet in certain definite directions, and although invisible in themselves, we are able to see them at work, as it were, in a most fascinating manner.

Place a magnet underneath a sheet of glass and sprinkle iron filings thinly and evenly over the glass. The best way of handling the filings is to put them into a little muslin bag and shake the bag gently. Then tap the sheet of glass very lightly with a pencil and the filings

will immediately arrange themselves in a most wonderful manner. The filings become magnetised by induction, and when the gentle tap frees them for an instant from the friction of the glass they take up certain positions, according to the direction of the magnetic force acting on them. In this way we obtain a map showing the general direction of the lines of magnetic force.

By using different combinations of magnets a great many different maps may be made in this way. The illustration on page 176 shows the lines of force of two opposite poles of two bar magnets, and it will be seen that the lines appear to stream across from one pole to the other. The illustration on this page shows the lines of force of two similar poles, and in this case it is very remarkable how the lines from the two poles turn aside as if pushing each other away. Equally interesting maps can be made with a horseshoe magnet.



Lines of Force of Two Similar Poles

Keepers for Magnets

Magnets left with their poles unprotected gradually lose their magnetism. For this reason a horseshoe magnet has its two poles connected by a piece of soft iron, and bar magnets are usually kept in pairs, with a strip of wood separating them, their opposite poles being together, and across the ends a piece of soft iron, called a "keeper" (see diagram below).

It is necessary to remember that magnets lose a great deal of their magnetism if they are knocked or allowed to fall. Allowing the keeper to slam on to a magnet is also injurious, but pulling off the keeper vigorously is good for the magnet.

Magnetic Dip

Let us now magnetise a needle and suspend it by a thread so that it is free to swing either horizontally or vertically. We notice that it not only comes to rest in a north and south direction, but also tilts slightly with its north end downwards. If we could take our needle to some place south of the equator, it would still point north and south, but it would tilt with its south end downwards. The angle that the tilting needle makes with the horizontal is called the "magnetic dip."

The Earth a Great Magnet

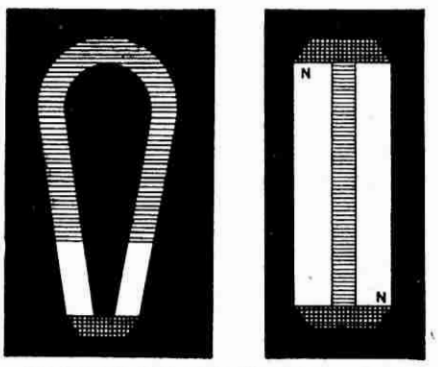
The explanation as to why a suspended magnet always takes up a position pointing north and south was found by Dr. Gilbert, of Colchester, physician to Queen Elizabeth. In the year 1600 he announced his great discovery that the earth itself is a huge magnet, having its poles near to the geographical north and south poles.

We have seen that similar magnetic poles repel one another, and yet the north pole of a magnet turns towards the north magnetic pole of the earth. Evidently, in order to get this attraction, one of these poles must really be a south pole, and it is customary to regard the earth's north magnetic pole as possessing south magnetism, and the south magnetic pole as possessing north magnetism. So we may look upon the north-pointing pole of a magnet as a true north pole, and the south-pointing pole as a true south pole.

The earth's magnetic influence also accounts for magnetic dip. North of the equator, in England for instance, the north magnetic pole of the earth is nearer than the south magnetic pole. Thus its influence is stronger, and a freely suspended magnet dips downwards towards the north. If we take our magnet to a place where the earth's south magnetic pole is the nearer, the magnet will dip downwards towards the south. Could we place our suspended magnet immediately over either of the earth's magnetic poles, it would take up a vertical position; and at the earth's magnetic equator, where the influence of the two poles is equal, the magnet would not dip at all.

The Mariner's Compass

The most valuable application of the peculiarity of a magnet pointing north and south is in the compass. We are all familiar with the ordinary pocket compass, consisting simply of a magnetised needle, pivoted so as to swing freely over a card marked with the 32 points of the compass.



Horseshoe and Pair of Bar Magnets

For use on ships, however, a much more elaborate arrangement is necessary. The single needle of the land compass is replaced by a compound needle consisting of several thin strips of steel, magnetised separately, and suspended side by side. Such a needle is infinitely more reliable than a single needle.

The needle and the compass card are placed in a kind of bowl made of copper. In order to keep this bowl in a horizontal position, no matter how the ship may be rolling, it is supported on "gimbals" consisting of two concentric rings attached to horizontal pivots and moving in axes at right angles to one another. There are also liquid compasses, in which the card floats on the surface of dilute alcohol.

The earth's magnetic poles do not coincide with the geographical poles, and, therefore, a compass needle seldom points exactly north and south. The angle between the magnetic meridian and the geographical meridian is called the "declination," and—as Columbus discovered in 1492—this varies in different parts of the world. In order that navigators may know the exact declination at any part of the world, special magnetic maps are made in which all places having the same declination are joined by a line.

Electric Current and Magnetised Needle

We have already mentioned that artificial magnets are made by means of an electric current, and now we must explain how this is done. If we take a freely-swinging magnetised needle, such as a compass needle, and hold over it a copper wire, nothing happens; but if we send an electric current through the wire, the needle is at once turned to one side, or deflected. As soon as the current is stopped, the needle returns to its north and south position. Further, iron filings cling to the wire while the current is flowing, but drop off when the current is stopped. These facts show us that the wire becomes a magnet during the passage of the current, and loses its magnetism when the current ceases. A spiral of insulated wire through which a current is flowing shows all the powers of a magnet, and, in addition, it has the peculiar power of drawing or sucking into its interior a rod of iron. Such a spiral is called a "solenoid," and will be familiar to those of our readers who possess a Meccano Electrical Outfit.

Electro-Magnets

If we wind a number of turns of insulated wire round a rod of soft iron, and pass a current through the wire, the rod becomes a magnet, but loses its magnetism when the current stops. A magnet made in this way—that is, by the passage of an electric current—is called an "electro-magnet," and it has all the power of an ordinary steel magnet, but in a very much greater degree. In subsequent articles we shall describe some of the many industrial applications of powerful electro-magnets.

If we substitute a bar of steel for the iron, it becomes magnetised by the current in the same way, but, unlike the iron, it retains its magnetism after the current ceases. This enables us to make steel magnets of much greater strength than those produced by rubbing with another magnet. Such steel magnets are called "permanent magnets," for they retain their magnetism; whereas electro-magnets, in which soft iron is used, only possess magnetism as long as the current flows.

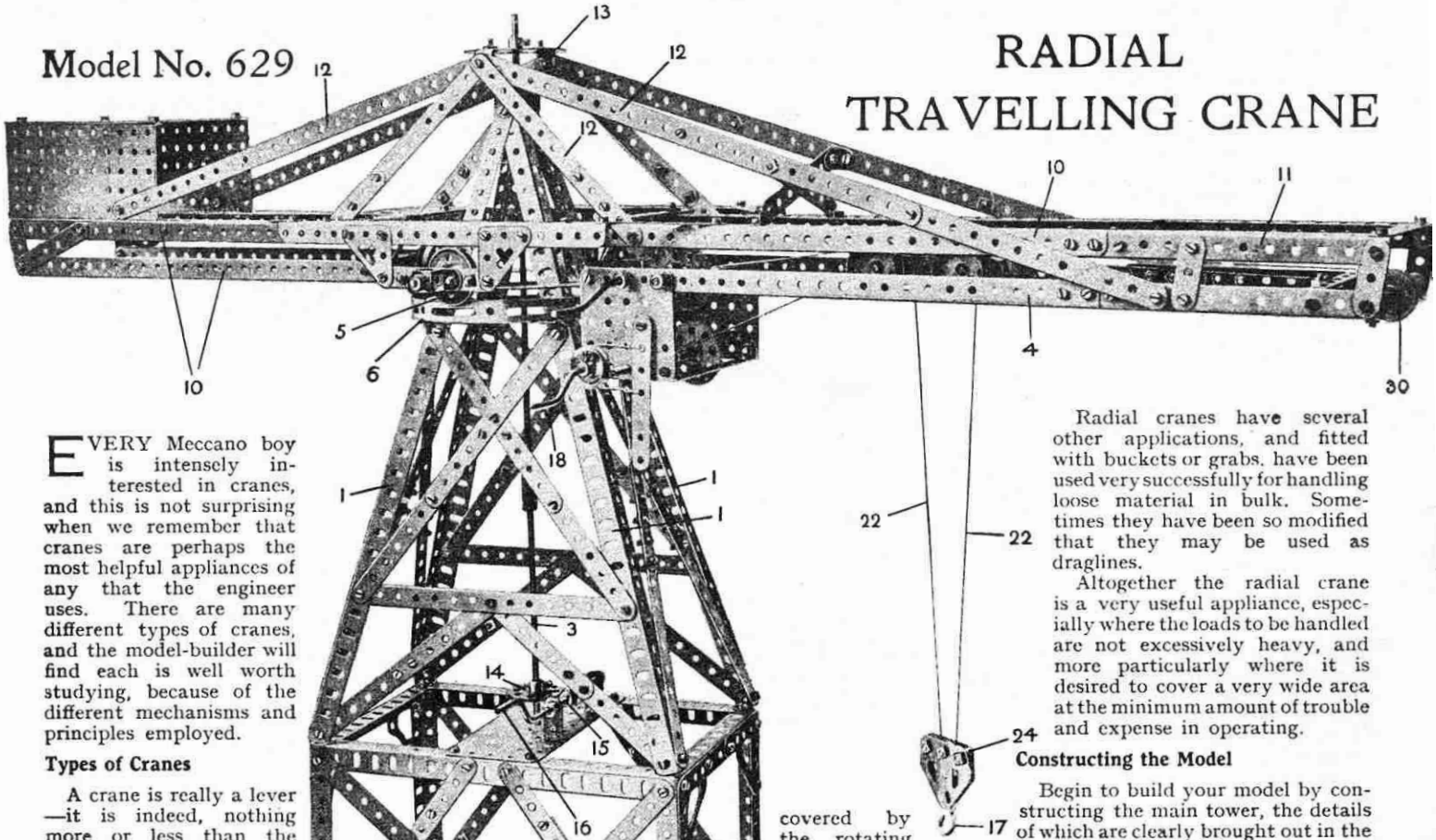
Detecting and Measuring Electric Currents

The deflection of a magnetised needle by a current of electricity provides us

(*Continued on page* 179)

A NEW MECCANO MODEL

Model No. 629 RADIAL TRAVELLING CRANE



EVERY Meccano boy is intensely interested in cranes, and this is not surprising when we remember that cranes are perhaps the most helpful appliances of any that the engineer uses. There are many different types of cranes, and the model-builder will find each is well worth studying, because of the different mechanisms and principles employed.

Types of Cranes

A crane is really a lever—it is indeed, nothing more or less than the scientific application of the crow-bar used for levering by hand, and adapted in the crane to lifting heavy weights with a minimum of effort. In some future issue we hope to deal fully with levers and their functions, as we think the subject will be of general interest to our readers.

Different requirements necessitate special cranes, each designed so as to be most serviceable under the special conditions imposed. There is, for instance, the comparatively small dock-side crane that runs astride the wharf and does not require a great deal of leg-room. Where space is not so important the base of the crane can be designed differently, which is fortunate, for a large base is necessary to give stability in the case of the hammer-head cranes used in our ship-building yards. These giant cranes lift boilers or big guns into position with the greatest ease.

Radial Travelling Cranes

Our new model, which we here illustrate and describe, is a Radial Travelling Crane of the cantilever type. This type of crane is used on the Panama Railways at the docks for handling freight. They stand well back from the quay-side, lift their load from the hold of the ship and then swing round and dump the load on the ground behind the docks.

Radial cranes are also used extensively in iron and steel yards and in timber yards, where it is necessary to drop loads over a large area. The ground covered by the rotating cantilever arm is very considerable, and in some cases the arm is of great length. If it is desired to drop the load close in to the crane it is only necessary to run the travelling bogie inwards along the arm. This enables the load to be dropped at any point between the base of the crane and the end of the arm, and anywhere within the circle through which the arm may be moved.

Other Applications

A modified form of the radial crane is used in ship-building, and mounted on steel trestles alongside the vessel that is being built. In these cases the cranes move on wheels which run on a track laid on the steel trestles.

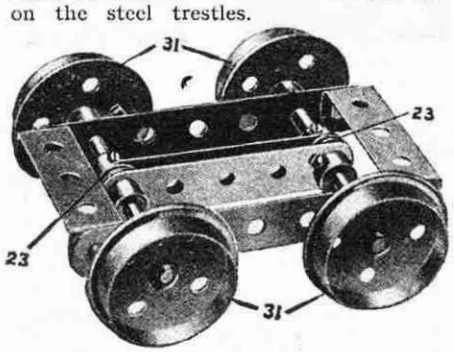


Fig. A. Trolley

Radial cranes have several other applications, and fitted with buckets or grabs, have been used very successfully for handling loose material in bulk. Sometimes they have been so modified that they may be used as draglines.

Altogether the radial crane is a very useful appliance, especially where the loads to be handled are not excessively heavy, and more particularly where it is desired to cover a very wide area at the minimum amount of trouble and expense in operating.

Constructing the Model

Begin to build your model by constructing the main tower, the details of which are clearly brought out in the illustration above. Notice that the inclined corner Angle Girders (1) are connected at the top (as shown in Fig. C) by a Bush Wheel (2) secured by Angle Brackets. This Bush Wheel forms a bearing for the vertical Rod (3) by which the cantilever arm (4) is turned.

The cantilever arm (4) turns on a wheel-race formed of Flanged Wheels (5), which run on a Circular Girder* (6) supported by four 1″ × ½″ Angle Brackets (7) bolted to the corner Girders (1). The cantilever is built up (as shown in Fig. B) from two 9½″ Angle Girders (8) braced by two 5½″ Angle Girders (9) overlapped nine holes. From these, 12½″ Angle Girders (10) extend at one side, and to similar Girders (10) at the other side are connected 5½″ Girders (11).

Rotating the Arm

The inclined Strips (12) are connected at the top, by means of Angle Brackets, to a Face Plate (13) secured to the vertical Rod (3). At the foot of the Rod (3) is a 1½″ Gear Wheel (14) engaged by a Worm Wheel (15) operated by the Crank Handle (16) and in this way the cantilever arm is swung round, the wheels (5) riding on the Circular Girder (6).

The load carried from the Hook (17) is raised or lowered by the Crank Handle (18), a ½″ Pinion (19) on which engages a 1½″ Gear Wheel (20) on a Rod (21) on which is wound a Cord (22). This Cord passes over a ½″ Pulley (23) to the block (24) and back over another ½″ Pulley on the trolley, and is secured to the 3½″ × ½″ Double Angle Strip (25) at the outer end of the cantilever arm.

* The Circular Girder, No. 143, is a new part, which is announced on page 195.

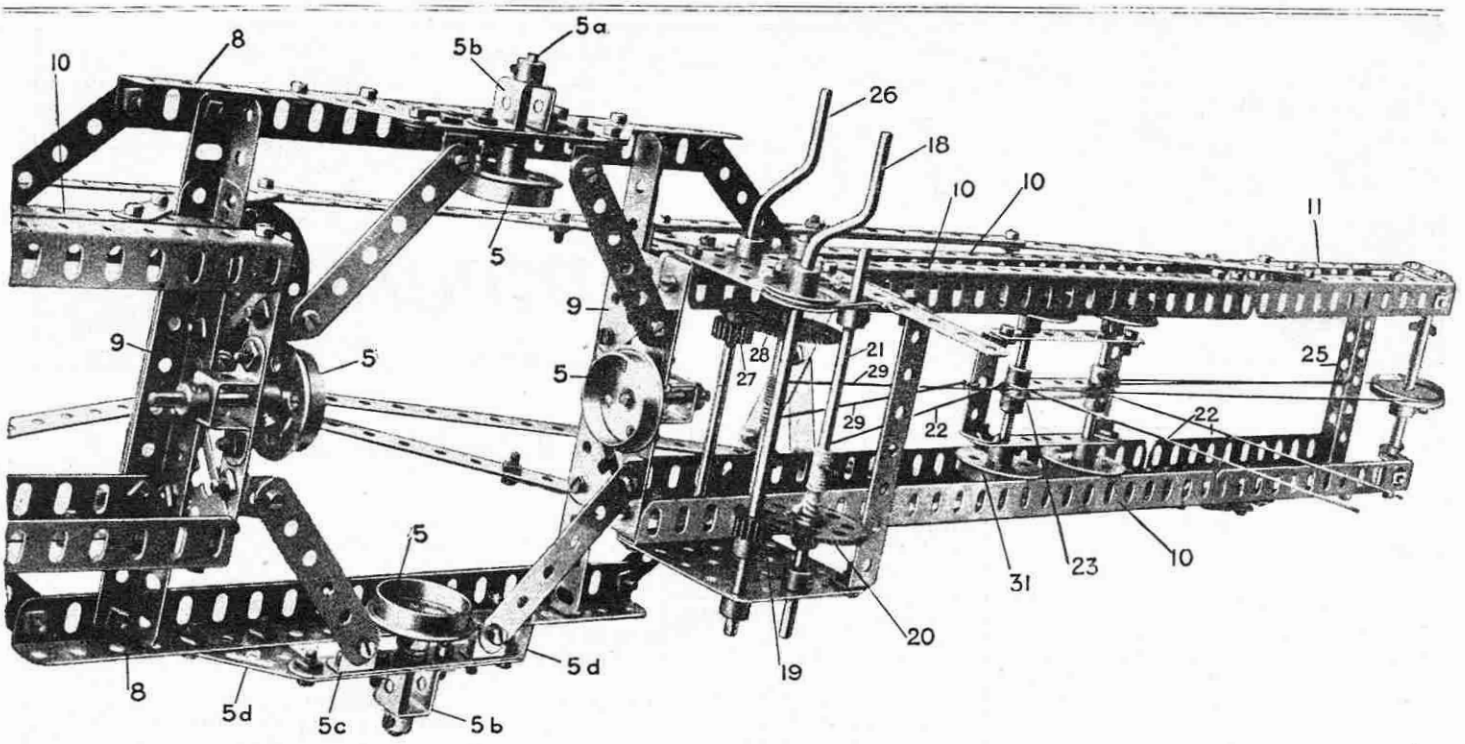


Fig. B. Details of the Cantilever Arm

Consequently, when the trolley is caused to travel along the cantilever arm the load remains suspended at a constant height—an important point and an interesting detail.

The Movement of the Trolley

The trolley is caused to move to and fro along the cantilever arm by the action of the Crank Handle (26). On this a ½" Pinion (27) engages a 1½" Gear Wheel (28) on a rod on which is wound the Cord (29), the opposite ends of which are connected to the opposite ends of the trolley. The Cord (29) passes round a Pulley (30) at the outer end of the jib. By turning the Crank Handle (26), therefore, the Cord (29) winds on and off its rod, and moves the trolley to and fro, its Wheels (31), as shown in Fig. A, running on the Angle Girders (10).

The Wheels (5) are connected to 1½" Rods (5a) which are journalled in Double Bent Strips (5b) bolted to 3½" Strips (5c) carried from the Angle Girders (8) by Corner Brackets (5d).

Parts required :—

6 of No.	1	1 of No.	24
2 „ „	1b	2 „ „	26
28 „ „	2a	3 „ „	27a
23 „ „	3	1 „ „	32
18 „ „	4	2 „ „	35
2 „ „	5	292 „ „	37
8 „ „	6	61 „ „	37a
6 „ „	6a	10 „ „	38
12 „ „	7	1 „ „	40
6 „ „	8a	4 „ „	45
18 „ „	9	1 „ „	46
22 „ „	12	2 „ „	48
4 „ „	12b	4 „ „	48b
1 „ „	13	2 „ „	52
2 „ „	13a	1 „ „	52a
1 „ „	14	1 „ „	53a
1 „ „	15	1 „ „	57
1 „ „	15a	19 „ „	59
3 „ „	16	1 „ „	63
2 „ „	16b	2 „ „	72
4 „ „	18a	4 „ „	108
3 „ „	19	1 „ „	109
8 „ „	20	60 „ „	111b
5 „ „	22	1 „ „	118
3 „ „	23	2 „ „	126

8 of No. 133

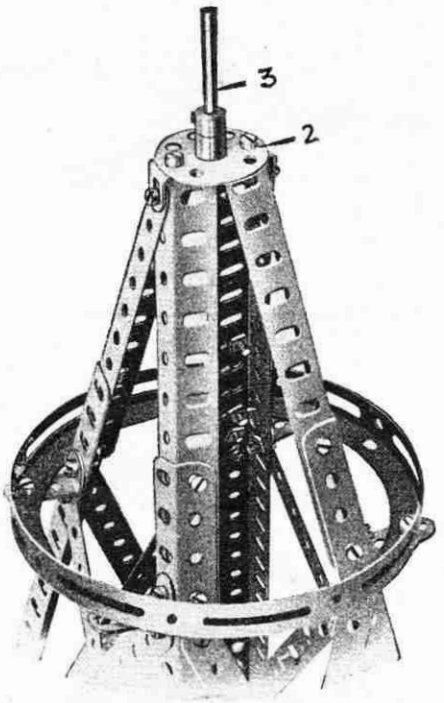


Fig. C. Details of Top of Main Tower

How to Build the Meccano Chassis

The Meccano Chassis is a triumph of model-building. At the British Industries Fair it attracted the attention of H.M. the King and was the centre of marked interest to thousands of other visitors to the Meccano exhibit. Fitted with three-speed gear box (with reverse) differential gear, elliptical springing and other modern refinements, the Chassis is an accurate reproduction of the "real thing." So perfectly does it illustrate the main mechanical features of a modern motor car that it is in use at several schools of motoring for demonstration purposes. Full instructions for building this Chassis in miniature are contained in the special leaflet now ready price 4d. post free.

Electricity *(continued from page 177)*

with a simple means of detecting such a current. An instrument called a "galvanometer" is used for this purpose, and in its simplest form it consists of a magnetic needle, very delicately poised, surrounded by a coil of many turns of wire. The effect of the coil is to make the current pass many times round the needle, and this increases the amount of deflection.

If we make a galvanometer with a long coil of very thin wire, having a high resistance, the amount of current flowing through it will depend upon and be proportional to the electro-motive force. Such an instrument, if properly graduated, will measure the voltage of the current, and is called a "voltmeter." On the other hand, if we provide our galvanometer with a short coil of very thick wire the resistance will be practically nil, and by means of a graduated scale the amount of current flowing—that is, the number of amperes—may be measured. An instrument of this kind is called an "amperemeter," or "ammeter."

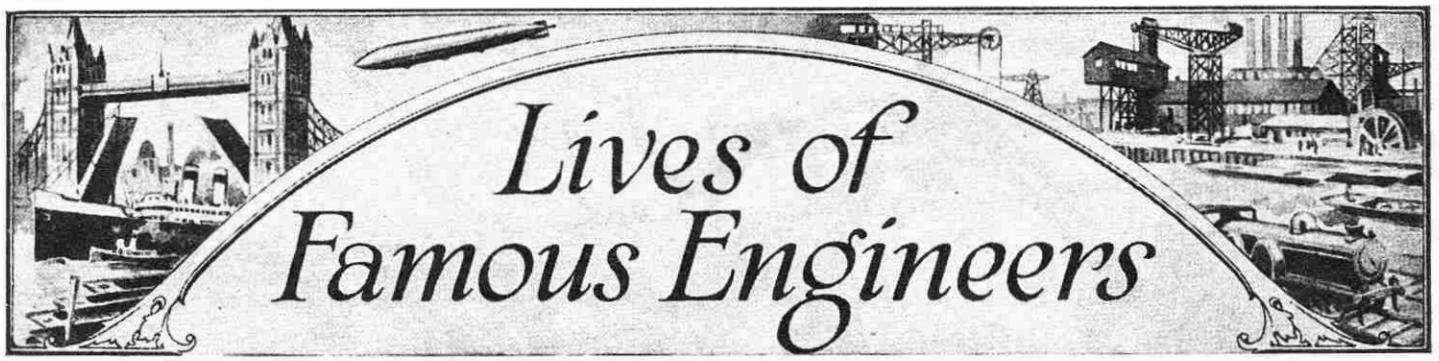
These three instruments, as described, are the very simplest types, and in actual scientific and engineering work more elaborate forms are used to obtain greater accuracy and sensitiveness.

NEXT MONTH:—

DYNAMOS AND MOTORS

£5 for a Model Dragline

We would remind our readers of the novel Model-Building Competition in which prizes of £5 (cash) and £5 5s. 0d. (goods) are being offered for the best model of a Dragline. Full particulars were announced on page 164 of the June "M.M." Closing date 30th September next.



VI. ROBERT STEPHENSON: Builder of Railways and Bridges

IN our article last month we described the rise of Robert Stephenson to a position of great eminence as a railway engineer. We must now turn to his work as a bridge builder.

The remarkable growth of railways during the lifetime of the two Stephensons necessitated a corresponding amount of bridge building, for the railways had to be carried across many rivers, roads, and deep valleys. A new style of building became necessary, for most of the existing bridges were incapable of bearing the strain of heavy railway trains travelling at a high speed.

The railway engineer was also faced with another difficulty. Unlike the road engineer, who could divert his road so as to cross a river or valley at the best and easiest point, the railway engineer had to follow the line of his railway, and therefore, as a rule, had little choice in regard to the position of his bridges. He had to take the ground as it came, good or bad, and consequently he was often faced with the necessity of devising entirely new methods of construction. Yet another problem was the necessity for building bridges over rivers and busy thoroughfares without interrupting the existing traffic.

Iron Replaces Stone

One result of the new conditions was the great use made of iron. In the earlier iron bridges the old arch form was used, the only change being the substitution of iron for stone. It was found, however, that in many cases this type of bridge did not allow sufficient headway, a difficulty that caused George Stephenson, in building the Liverpool and Manchester Railway, to adopt the simple iron beam for crossing roads and canals. This type of bridge was followed by the use of arched beams, held firmly together by horizontal ties to resist the thrusts. Robert Stephenson built a number of bridges of this kind on the original London and Birmingham Railway, and followed these by the magnificent High Level Bridge across the river Tyne.

Newcastle High Level Bridge

This bridge had to cross the ravine between Newcastle and Gateshead, with the river below, and the local authorities insisted that it should carry a road for ordinary vehicles and foot passengers as well as for the railway. The length of the bridge and viaduct from Gateshead station to the Newcastle terminus is about 4000 ft., and the bridge passes over the roofs of the houses on both sides of the valley. In order to obtain a solid foundation for the piers enormous piles had to be driven, and for this purpose a Nasmyth steam hammer was used. It is probable that this was the first occasion on which a steam hammer was employed for bridge pile-driving. The powerful, rapid strokes of the hammer produced such an intense heat that on some occasions the head of the pile actually burst into flames!

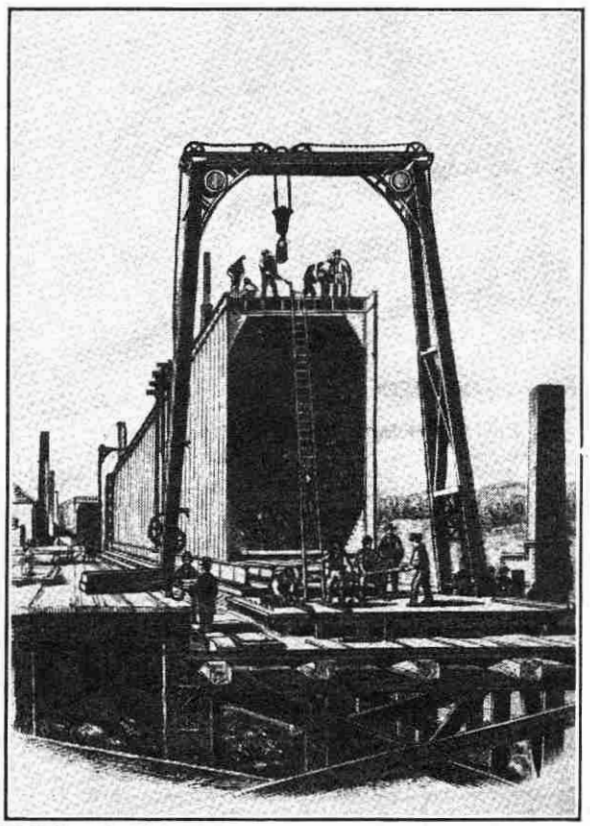
The bridge combines the two principles of the arch and suspension, the railway passing over the back of the ribbed arches as usual, while the carriage road and footpaths are suspended from the arches and form a long gallery. There are six arches, each of 125 ft. span, and the two approaches to the bridge are formed of iron pillars and bearers in conformity with the arches. The bridge, which is one of the finest examples of its type, was opened on 15th August, 1849.

Crossing the Menai Straits

In 1838 George Stephenson surveyed a line for the construction of the Chester and Holyhead Railway. He proposed to make use of the existing suspension bridges built by Thomas Telford across the Conway estuary and the Menai Straits, but in the case of the latter bridge he recommended that the trains should be drawn across by horses so as to avoid setting up serious oscillations in the structure. Apparently the idea of constructing a rigid bridge across the Straits was not then contemplated. Soon afterwards Robert Stephenson took over the construction of the line, and he decided not to use the existing bridges, but to build new ones more suitable to railway traffic.

The problem in regard to the Straits was to throw across such a wide chasm a bridge of sufficient strength to carry the heaviest trains with a good margin of safety, and at the same time of sufficient height to avoid interference with navigation. Robert Stephenson soon selected for his bridge a site about a mile south of the suspension bridge, where the Britannia Rock lies almost in mid-channel. The width of the Straits at this point is about 900 ft., but the rock offered a secure foundation for a central pier.

Stephenson first proposed to construct an arch bridge with two main spans of 450 ft. each, but the Admiralty rejected this plan on the ground that navigation must not be interrupted at all, and even the erection of temporary scaffolding to support the bridge during construction could not be allowed. Finally, Stephenson decided upon a bridge consisting of a hollow beam or tube, through which the trains should run.



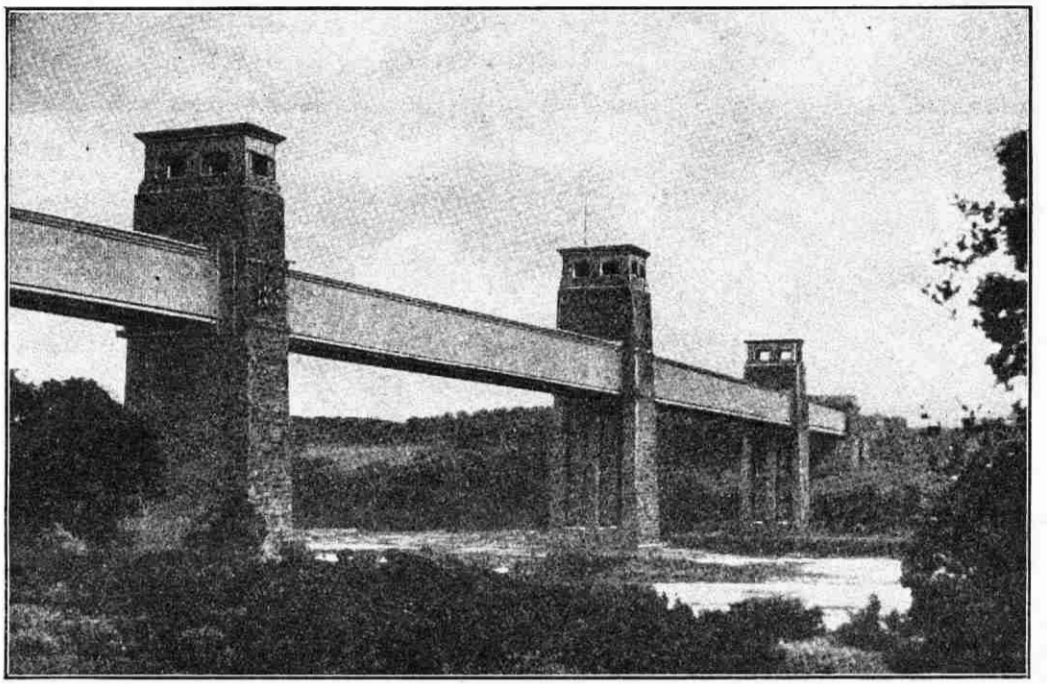
Building the Main Tubular Girder for the Britannia Bridge

Britannia Tubular Bridge

The bridge, which is known as the Britannia Tubular Bridge, consists of giant tubes built of riveted boiler plates, supported on the abutments and on three towers, the centre tower being built on the Britannia Rock. These tubes form two independent continuous tubular beams, each 1511 ft. in length and weighing 4680 tons. The land tubes were built in position on a falsework of timber, but the main tubes were built on platforms at high-water mark on the Carnarvon side

and floated between the piers on pontoons, ready to be raised by hydraulic presses.

On 20th June, 1849, the first tube was afloat, and the pontoons swung out into the current, controlled by guide ropes coupled to capstans on shore. A great crowd of spectators lined both shores of the Straits, watching the proceedings intently. As the pontoons approached their destined place between the piers, the force of the current became so strong that one of the capstans was uprooted, and the tube was in great danger of being carried away by the stream. In this emergency the engineer in charge of the uprooted capstan threw the spare coil of rope into the field behind the capstan. The crowd, men and women and children, rushed to the rope and held on, and the tube was checked in its dangerous progress. Finally the pontoons were manœuvred into the correct position.



The Britannia Tubular Bridge

Stephenson's Forethought Averts Disaster

It now remained to raise the tube to its final position. Stephenson was away in London while the hydraulic presses were being fixed, and when all was ready his engineers wrote to him saying they could raise the tube in two days at the most. Stephenson replied at once that they must not attempt anything of the kind. They must raise the tube inch by inch, and must build up masonry beneath it as it rose. This instruction prevented very serious consequences, for one day, while the hydraulic presses were at work, the bottom of one of them burst. The cross-head and chains, weighing over 50 tons, crashed down on the press, and the tube dropped upon the packing beneath it. Although the tube actually fell less than nine inches, it completely crushed solid castings weighing several tons, and if it had not been under-built the result would have been disastrous. Nobody was hurt, but this accident cost an extra £5000.

The remaining tubes were brought into position without further accidents, and on 5th March, 1850, the bridge was put through a severe test by three coupled locomotives and 24 loaded coal wagons. Afterwards, when a heavy train of several hundred tons crossed at 35 miles an hour, the bridge sagged only half an inch, an amount scarcely 1/25th of that allowed within the danger point.

The Conway Tubular Bridge (illustrated in our last issue) was built on very similar lines to the Britannia Bridge, and therefore does not call for special mention.

Bridging the St. Lawrence

On the death of his father, who left his very considerable fortune to him, Robert Stephenson found himself a wealthy man, and, in fact, he was the first engineer millionaire. He determined to retire very largely from professional work, but he found it impossible to cut himself off entirely from new enterprises. The greatest of his later undertakings was the magnificent Victoria Bridge over the River St. Lawrence, at Montreal, in Canada.

Up to the middle of last century the St. Lawrence river was unbridged from Niagara to the Atlantic, a distance of some 900 miles. With a steadily-increasing population, the necessity arose for a bridge across the river to enable the Grand Trunk Railway system to be extended. In 1852 the Canadian Government requested an English firm of contractors to report on the possibility of building a bridge, and Mr. A. N. Ross, who had superintended under Stephenson the construction of the Conway Tubular Bridge, visited Canada for that purpose. He recommended bridging the river just above Montreal, and advised a tubular bridge on the same lines as the Conway and Britannia Bridges. He returned to England to confer with Stephenson, and the result was the plan of the Victoria Bridge, of which Stephenson was the designer and Ross the joint and resident engineer.

Dangers of the Undertaking

At the point chosen for the bridge the river is a mile-and-three-quarters in width, so that the task of bridging it was very great on account of the length alone. The local conditions added immensely to the difficulty, however, for the river runs very rapidly, as much as eight or nine miles an hour at high water, so that the building of piers was not at all easy. In summer the difficulty was increased by the huge rafts of logs that were floated down the river to the sawmills at Quebec, for these rafts were constantly colliding with the partly-finished piers.

The greatest danger of all, however, was experienced in spring at the time when, after the long winter, the ice from higher up the river, from its tributaries and from the vast lakes, begins to be driven down-stream towards the sea. The pressure from behind is so great that the ice piles itself up against any obstacle, frequently reaching a height of 30 or 40 ft. The strain placed upon the piers by these piled-up masses of ice is tremendous, and the anxiety of the engineers during their construction may be imagined. However, the piers were skilfully built on a foundation of solid rock, and proved capable of withstanding the strain.

The works in connection with the bridge were commenced on 22nd July, 1854, and the bridge was finished and taken off the hands of the contractor on 17th December, 1859. Stephenson, however, did not live to see its completion, his death having taken place about two months previously.

The Victoria Bridge was altered considerably in 1897, when the piers were lengthened and Stephenson's great tubes were replaced by steel trusses. A double railway track was provided in the new bridge, in addition to carriageways and footways.

Stephenson's Last Works

Stephenson also applied the tubular system in a modified form in two bridges across the river Nile at Damietta, in lower Egypt. The modification in these bridges is that the road is carried upon the tubes instead of within them.

The larger of the two, near Benha, contained eight spans or openings of 80 ft. each, and two centre spans, formed by a large swing bridge. The total length of the swing beam was 157 ft., and there was a clear waterway of 60 ft. on each side of the centre pier. The foundations for this bridge had to be sunk 33 ft. on account of the shifting nature of the soil.

These bridges were the last of Stephenson's great engineering works. His health began to fail, and he died on 12th October, 1859, in his 56th year. He was buried in Westminster Abbey by the side of another famous bridge builder and road maker, Thomas Telford.

NEXT MONTH:—

BRINDLEY

First English Canal Engineer

SIGNALLING TO AMERICA

Marconi Transmits his First Signals Across the Atlantic

IN last month's Magazine we described how Marconi tackled the problem of wireless communication, and solved it in regard to messages transmitted over comparatively short distances and at a slow speed. A great deal remained to be done, however, before the conquest of the Atlantic became possible.

As soon as Marconi realised that he had pushed the coherer detector to its limits, and that it could never be made a success for long-distance commercial work, he turned his attention to other possible forms of detectors. After a great deal of experiment he produced the Magnetic Detector, an instrument working on a principle entirely different from that of the coherer.

Marconi, pondering over the experiments of Hertz with electric waves, saw clearly the wonderful possibilities that were opened up, and from that moment his life's ambition was fixed. He determined to solve the problem of wireless communication, and he succeeded. He had many big difficulties to face, but he tackled them all with dogged persistence and overcame them one by one by means of his remarkable inventive ability. Thirty years ago Marconi was unknown; to-day his name is a household word all over the world.

The Magnetic Detector

The magnetic detector consisted of an endless band of soft iron wire mounted on pulleys driven by clockwork and so arranged that the band passed close to the poles of two horseshoe magnets. As the band passed from the influence of one magnet to that of the other, its magnetism became reversed. The change did not take place instantly, however, owing to the fact that even soft iron has some magnetic retaining power, and therefore resists slightly the attempt of one magnet to reverse the effect of another. The moving band passed through two small coils of wire, one connected with the aerial and the other with a sensitive telephone receiver.

When electric waves fell upon the aerial of the receiving station, minute, rapidly-oscillating currents passed through the first coil, and had the effect of making the band reverse its magnetism. The sudden moving of the lines of magnetic force induced a current in the second coil, and a click was produced in the telephone receiver. The clicks continued to follow one another rapidly as long as electric waves were reaching the receiving aerial, being broken up into Morse signals according to the manipulation of the key of the operator at the transmitting station.

Using this improved apparatus, Marconi succeeded, in January, 1901, in transmitting signals from St. Catherines, in the Isle of Wight, to the Lizard, in Cornwall, a distance of about 155 miles.

First Long-Distance Station

Soon afterwards the first long-distance wireless station was established at Poldhu, in Cornwall, and Marconi commenced experiments with a view to signalling across the Atlantic. As his apparatus required more power than had been available in previous experiments, he installed a dynamo driven by an oil engine. The current generated by the dynamo at 2000 volts was raised to a pressure of 20,000 volts by means of transformers, and was then used to charge a number of condensers. These condensers consisted of glass plates coated on each side with tinfoil and immersed in oil, and were really nothing more than huge Leyden jars.

By the end of November everything was ready at Poldhu for the great experiment, and Marconi crossed the Atlantic to make the necessary arrangements on the other side. The place chosen for the attempt was Signal Hill, a bold bluff overlooking the sea near St. Johns, Newfoundland, and here the receiving instruments were set up in a room in a Government building. A large kite was to be used to carry the aerial wire, but for some days it seemed as though the weather was determined that the kite should not be flown. Under the stimulating encouragement of Marconi, however, the little band of workers persisted in their efforts, and finally the weather improved, and the kite was raised to the desired height.

The Atlantic Conquered

The great test took place on Thursday, 12th December. Marconi had given instructions to the operators at Poldhu to commence sending three dots—the Morse signal for the letter "S"—at 3 o'clock in the afternoon, and to continue to send at intervals until 6 o'clock. Taking his seat before the apparatus, with a telephone receiver to his ear, Marconi listened expectantly, and exactly at the appointed time the signal came—"br-br-br"—faint but unmistakeable. Again and again the letter "S" was repeated across the 1800 miles of ocean, and Marconi knew that his great ambition was realised—he had bridged the Atlantic.

News of the success of the experiment was immediately flashed back by cable to the anxiously-waiting operators at Poldhu, and we can imagine the great enthusiasm with which the message was received.

A Notable Voyage

At first the general public were inclined to doubt this wonderful wireless story, but early in the following year Marconi put an end to all doubts by the brilliant success of his experiments on the liner *Philadelphia* on a voyage to New York. This vessel was specially fitted with a complete apparatus for wireless transmission and reception, and as soon as she was clear of the English coast communition was established with the station at Poldhu.

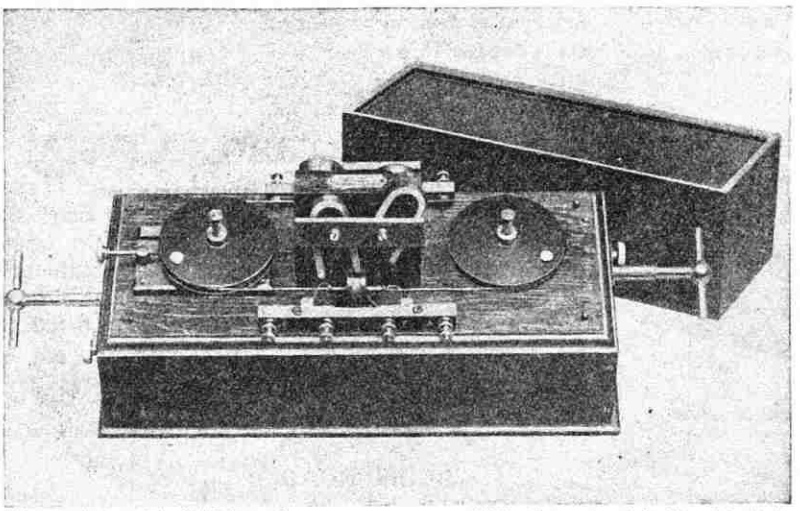
Messages were exchanged between ship and shore at regular intervals up to a distance of 150 miles, but beyond that distance the ship could not send messages, as she had reached the limit of her transmitting range. Poldhu, however, still kept on sending, and day after day, as the ship travelled westwards, messages arrived with unfailing regularity. As the distance between ship and shore increased the signal strength decreased, but readable signals were received up to 2099 miles.

Range Greater at Night

This voyage of the *Philadelphia* effectually disposed of all the arguments of those who had declared trans-Atlantic wireless communication to be impossible. At the same time the fact was established that the range of a transmitting station is much greater at night than during the day. On this occasion station signals were received during the day up to a distance of 700 miles. At night, however, strong signals were received at 1500 miles, and even at 2099 miles the signals were quite readable.

Eight years later Marconi had a better opportunity of investigating this matter while on a voyage to South America. In this case the

(*Continued on page* 185)



By permission of the Publishers of ["*The Romance and Reality of Radio*"

Marconi's Magnetic Detector

"Signalling to America" (*cont. from p.* 183)

signals were being transmitted from Clifden, and up to 4000 miles they were received successfully both by day and night. Beyond that distance, however, signals were only received at night. At Buenos Aires, 6000 miles from Clifden, no signals were received during the day, but at night they came through, not only from Clifden, but from Glace Bay also.

Wireless Waves Travel Best Over Sea

Marconi's experiments on the *Philadelphia* also afforded additional evidence of the curious fact that wireless waves are transmitted more easily over sea than over land. Non-conductors of electricity allow electric waves to pass freely, but good conductors resist the passage of the waves. The land, as compared with the sea, is a poor conductor, so that the electric waves penetrate it and lose a great deal of their energy. Sea-water, on the other hand, being a good conductor of electricity, opposes the passage of the electric waves, and prevents them from losing energy by penetrating the ocean and being absorbed by it.

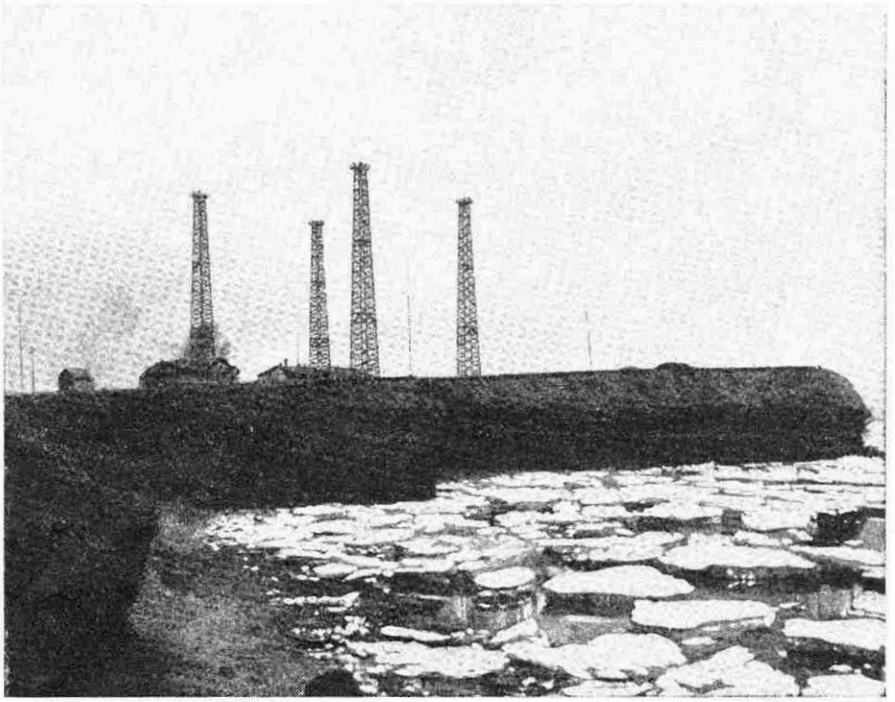
The relative distances to which electric waves may be transmitted over land and over sea vary in different places, but generally speaking, waves transmitted over the ocean will travel five times as far as the same waves transmitted over the land.

Trans-Atlantic Stations

Towards the end of 1902 three powerful stations for trans-Atlantic wireless were erected—at Clifden (Galway, Ireland), Glace Bay (Cape Breton, Nova Scotia), and Cape Cod (Mass., U.S.A.). On 21st December three messages of considerable length were exchanged between Poldhu and Glace Bay, and on the next day Marconi sent the following wireless telegram to King Edward at Buckingham Palace:—

"On occasion of first wireless telegraphic communication across Atlantic Ocean may I be permitted to present, by means of this wireless message transmitted from Canada to England, my respectful homage to His Majesty the King."

A month later congratulatory messages were exchanged between King Edward and President Roosevelt.



The Marconi Wireless Station at Glace Bay

First Ocean Newspaper

Trans-Atlantic wireless telegraphy was now an accomplished fact, and communication by this means quickly became general. Early in 1903 *"The Times"* contracted with Marconi for regular transmission of news from Canada and the United States to London, and a year later the first ocean newspaper, the *"Cunard Daily Bulletin,"* was published on R.M.S. *Campania*, and contained news items received by wireless from Poldhu.

Many great improvements have been made in wireless apparatus and methods since that time, and these will be dealt with in future articles as space permits.

Talking to Australia

Marconi's Latest Achievement

On Sunday, 1st June last, Senator Marconi carried out tests in wireless telephony to Australia with striking success. A non-directional short wave system was used, and the speech transmitted was clearly heard by Mr. E. T. Fisk, managing director of the Amalgamated Wireless of Australasia, who listened on an ordinary valve set at his home near Sydney. The power used in this transmission, which was purely experimental, was only 20 k.w.

Senator Marconi afterwards stated that when the "beam" or directional system was employed with the same waves that were used in this non-directional test, telephony and high-speed telegraphy between England and Australia and many other distant parts of the world would be available.

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WITH

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ACCESSORY OUTFITS

You can build larger and more ambitious models by purchasing an Accessory Outfit, for by doing so you greatly increase its scope. The particulars below show how you may build up your equipment by easy stages, until you are the proud owner of a No. 7 Outfit.

PRICE LIST
Complete Outfits

No. 00	... ...	3/6
No. 0	... ...	5/-
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No. 2	... ...	15/-
No. 3	... ...	22/6
No. 4	... ...	40/-
No. 5	(In well-made carton)	55/-
No. 5	(In superior oak cabinet with lock & key)	85/-
No. 6	(In well-made carton)	105/-
No. 6	(In superior oak cabinet with lock & key)	140/-
No. 7	(In superior oak cabinet with lock & key)	370/-

PRICE LIST
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No. 00a	... ...	1/6
No. 0a	... ...	4/-
No. 1a	... ...	7/6
No. 2a	... ...	8/6
No. 3a	... ...	18/6
No. 4a	... ...	15/-
No. 5a	(carton) ...	50/-
No. 5a	(wood) ...	80/-
No. 6a	... ...	210/-

This illustration shows a No. 3a Outfit which converts a No. 3 into a No. 4 Outfit.

No. 00a OUTFIT
Costs 1/6, and converts No. 00 into a No. 0 Outfit. With it an additional 27 models may be built, making a total of 70 models in all.

No. 0a OUTFIT
Costs 4/-, and converts No. 0 into a No. 1 Outfit. With it an additional 36 models may be built, making a total of 106 models in all.

No. 1a OUTFIT
Costs 7/6, and converts No. 1 into a No. 2 Outfit. With it an additional 57 models may be built, making a total of 163 models in all.

No. 2a OUTFIT
Costs 8/6, and converts No. 2 into a No. 3 Outfit. With it an additional 43 models may be built, making a total of 206 models in all.

No. 3a OUTFIT
Costs 18/6, and converts No. 3 into a No. 4 Outfit. With it an additional 53 models may be built, making a total of 259 models in all.

No. 4a OUTFIT
Costs 15/-, and converts No. 4 into a No. 5 Outfit (carton). With it an additional 43 models may be built, making a total of 302 models in all.

No. 5a OUTFIT (Carton)
Costs 50/-, and converts No. 5 into a No. 6 Outfit (carton). With it an additional 51 models may be built, making a total of 353 models in all.

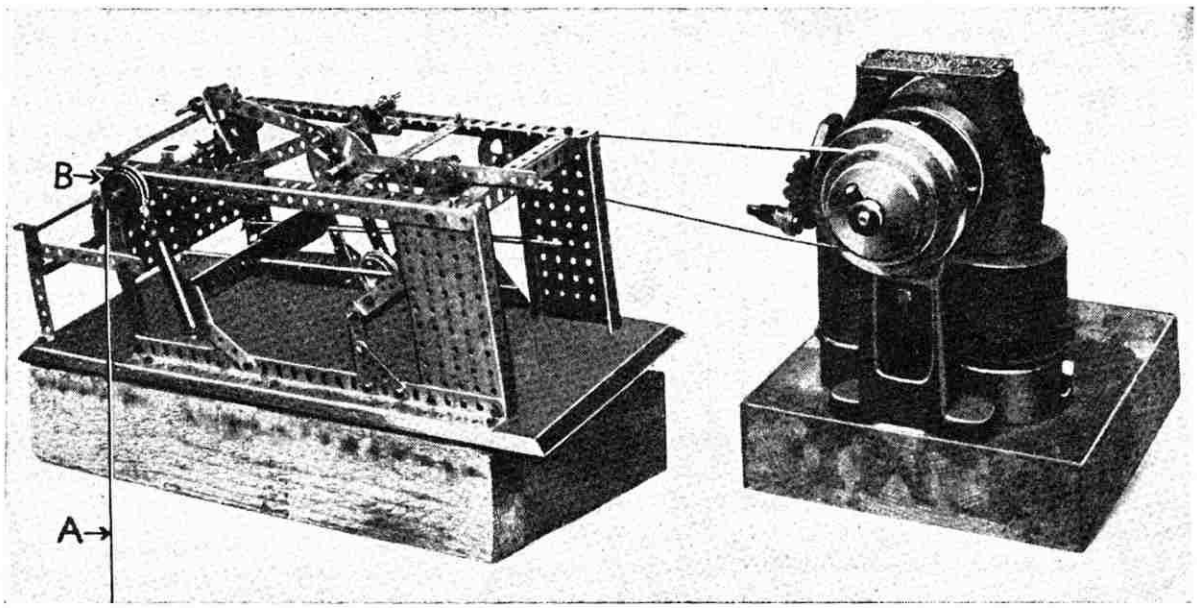
No. 5a OUTFIT (Wood)
Costs 80/-, and converts No. 5 into a No. 6 Outfit (wood). The parts are exactly the same as in the carton Outfit mentioned in the preceding panel, but the cabinet is in wood.

No. 6a OUTFIT
Costs 210/-, and converts No. 6 Outfit into a No. 7 Outfit (oak cabinet). This Outfit builds every one of the 393 models illustrated in the Complete Manual.

OBTAINABLE FROM ALL MECCANO DEALERS

EXPERIMENTS WITH THE TORQUE CONVERTER

A Special Article Contributed by A. V. Knowles



Mr. Knowles' Experimental Model of the Torque Converter, showing B, Pulley Wheel on Main Shaft; A. Piano-wire Carrying Weights

I HAVE written the following notes under the impression that readers of the "*M.M.*" will be interested in some experiments I have carried out with my Meccano model of the Constantinesco Torque Converter, details of which were described in the April issue.

I found it quite easy to assemble this model from the instructions given, although I subsequently made a few modifications to suit my own purposes. For instance, as I built my model for demonstration purposes only, I did not place it in a chassis. Instead I mounted it on a small stand with a wooden baseboard, and then coupled it to a small electric motor of about one-fifth horsepower.

The Meccano Model demonstrating the principle of the Constantinesco Torque Converter has aroused widespread interest. Many enthusiasts have built the model, and we believe the accompanying account of experiments with it, sent to us by a keen Meccano user, will be of interest.—*Editor.*

A Difficulty Overcome

At first some difficulty was experienced on account of the top hole of the Face Plate—carrying the strips to the ratchets—constantly falling over, instead of keeping a mid-position stroke. This trouble was practically entirely eliminated, however, by lengthening the pendulum. This was done by attaching the pendulum weights to a strip from the Face Plate. A longer pendulum requires more power to move it than a short one, and consequently the ratchets gain speed more quickly. By increasing the length of the pendulum, however, we decrease the stroke of the ratchets, and this naturally decreases the back-axle speed. The length of the pendulum, therefore, effects the acceleration and maximum speed.

Increasing the pendulum weight (retaining the original length of pendulum) gives exactly the same effect as increasing the length of the pendulum. As the heavier pendulum requires more power to move it, it consequently produces better acceleration.

Taking Readings

In my experiments I tried to get some "readings" by lifting various weights through certain distances. After many unsuccessful attempts, however, I abandoned this method, except for demonstration purposes. Instead I fitted up a small rope-brake to the end of the ratchet rod, and this idea worked splendidly. By running the model with different loads on the load pillar, I hoped to get some good results by taking the following readings:—Load on load pillar (= W); Spring balance reading (= w); Revolutions of ratchet rod (= N).

By applying the Rope-Brake Formula:—H.P. $= \frac{2\pi RN\,(W-w)}{33{,}000}$ (R = Radius in feet of Brake Wheel) I hoped to obtain results to compare with the input of the motor (H.P. $= \frac{V \times A}{746}$)

Causes of Failure

With the assistance of a few friends I took a series of readings with loads on the pillar ranging from 2 lb. to 9 lb. When we came to work out our results for comparison we had a sad blow, however, for the model appeared to be giving us only about .5 per cent. efficiency! That is to say, although our motor was giving us about 1/5 h.p. we were getting only 1/1,000 h.p. at the load pillar!

Naturally we were rather disappointed at first, but when we came to think the matter over we realised that in dealing with such very small powers as those we were using, the slightest error in our readings would make a big difference. No doubt the intermittent action of the ratchets also caused a big error. We remembered, too, that the friction of the model would undoubtedly absorb a very much larger proportion of the power input than would be the case on a similar apparatus of larger dimensions and greater input.

An Interesting Demonstration

I have recently had the pleasure of demonstrating the Meccano model of the Torque Converter to the members of the Thornycroft Engineering Society. First of all I did a little "brake-testing," showing that the rod moved slower and slower as more load was placed on the brake.

I next wound some cord around the shaft carrying the eccentric and attached

(*Continued on page* 191)

This page is reserved for the publication of articles from our readers. Contributions are invited on any subject of general interest, and further particulars are given at the foot of the page. See also the Editor's remarks on page 173 of this issue.

A Meccano Boy Tells How Wembley was Built

THE year 1924 will always be remembered as the year of the great Empire Exhibition. All over the British Empire, and probably it would be no exaggeration to say all over the civilized world, people are talking of the marvels of Wembley.

The Exhibition is, of course, unique in many respects, and among the features that distinguish it from other previous exhibitions is the fact that it is not housed in temporary lath and plaster structures, but in permanent buildings of massive proportions. The amazing thing about these buildings is that they have all been erected in two years. How has this been done? The answer that at once suggests itself is—by means of an enormous army of workmen. This, however, does not account for the remarkable speed of building, and the secret lies in the use of reinforced concrete or ferro-concrete as it is called.

We Meccano boys are all familiar with the appearance of concrete, and possibly most of us know that it consists of sand and small stones bound together with cement. It is made by mixing the sand and stones thoroughly with cement and water until each stone is covered with wet cement and then, when the mixture dries, it sets into a solid rock-like mass.

Concrete as a building material has many advantages. It does not rust like iron or decay like wood and it needs no protection in the form of painting. It does not gradually deteriorate like so many other materials, but it appears actually to become stronger as it gets older. At the same time, however, concrete has one weak point. It is very strong in resisting a crushing stress, that is to say, a weight pressing directly down upon it, but it offers only feeble resistance to tension or a bending stress. On account of this weakness concrete alone is of little use for beams.

A beam supported at its ends and carrying a weight undergoes compression in its upper part and tension in its lower part. This fact may be demonstrated very simply. Take a wooden lath and cut grooves on both sides of it, as shown in the accompanying diagram. Then support the lath at its ends on two books or boxes, and place a weight on it at the centre. If the grooves are carefully examined it will be seen that those on the top close up while those underneath open out, thus showing that the top of the lath becomes shorter when it bends, and the bottom becomes longer.

As concrete strongly resists compression it would do very well for the upper part of a beam, but owing to its small resistence to tension it would be of very little use in the lower part. In order to overcome this difficulty the concrete is reinforced

with steel, which supplies the tension-resisting power. The steel, in bars or in some other form, is embedded in the concrete while the latter is wet. When the concrete dries it grips the steel very tenaciously, and the resulting structure combines the qualities of the two materials.

Ferro-concrete, so called from the Latin word *ferrum*, meaning "iron," has revolutionised modern building practice, and its use is now so general that it has been proposed to call this the "Ferro-concrete Age."

"PENGLAM."

The Big New Zealand Tunnel

A Great Engineering Feat

Throughout the length of the South Island of New Zealand there runs a great range of mountains called the Southern Alps, which at their topmost limits reach a height of 12,349 ft. above sea level. On one side of these mighty mountains lies the smiling province of Canterbury, while on the other side is the timber country of Westland. These Alps have always been an obstacle to communication between the two provinces. Years ago the Maoris braved the dangers of the mountain passes in their search for greenstone, and later, when gold was found in Westland, white men from Canterbury risked their lives to reach the goldfields. About 60 years ago a road was built across the mountains by way of a rocky defile, known to-day as Arthur's Pass.

As time went on, the need of some easier and quicker means of communication between the two provinces became more acute, and it was decided that a railway must be built. In due course a line was begun, and little by little it crept from both sides up the mountain range. The higher it reached, the greater became the engineering difficulties. Many short tunnels were made and lofty steel viaducts constructed across foaming torrents. At last there remained only a comparatively short distance to be dealt with, but within that space was the most difficult part of the whole undertaking. Fifteen years ago miners commenced—first on the western side and shortly afterwards on the eastern—the enormous task of cutting their way through the solid rock. Drilling machines were used for boring holes, and then great masses of rock were blasted away with dynamite. In this way the miners gradually forced their way into the heart of the mountain.

During the War, work on the Otira tunnel, as it is called, was hindered by scarcity of men, and it was not until ten years after the tunnel was commenced that one day the miners working on the eastern side heard the sound of blasting on the western side. Next the drilling machines were heard through the wall of rock still remaining, and a few weeks later a workman on the eastern side suddenly saw the pick-axe of a workman on the other side coming through the rock. When the barrier was finally cut through, the men on one side shook hands with their fellow-workmen on the other side.

The accuracy of the engineers' plans and calculations for this tunnel was remarkable. In a distance of over five miles the difference in level of the two headings was only $1\frac{1}{8}$ in., and the difference in direction only three-quarters of an inch.

Although the tunnel cuts off the top of the mountain, it runs up a fairly steep slope from the western to the eastern side. A steam engine puffing up this incline would fill the tunnel with smoke, causing discomfort to travellers on the train, and for this reason electric locomotives are employed.

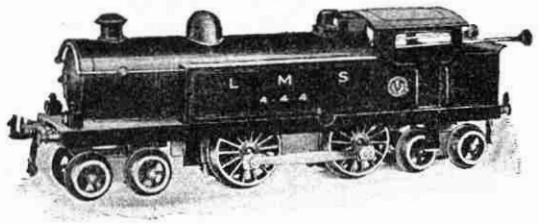
HAROLD GRIFFITHS (New Zealand).

To Contributors

Many of the letters that the Editor receives every day contain at least one point of general interest, which, if written out in the form of a short article, would appeal to readers of the "*M.M.*" We invite our readers to submit such articles for this page, and if of general interest they will be published as opportunity permits. The articles may deal with such subjects as new ideas for making something; new methods of doing things; accounts of some unusual occurrences or incidents, such as what it feels like to be in a sand-storm, or to win a cup on sports day, each of which experiences formed the subject of two recent letters.

Articles should not be longer than 500 words, and they should be written as neatly as possible and on one side of the paper only. Those articles that are published will be paid for at our usual rates. If desired, illustrations may be sent, either drawings, photographs, or rough sketches. No reader should hesitate to send in an article because he may not be very good at composition or cannot sketch any diagrams necessary to illustrate it. If he states the facts clearly and sends rough drawings we will have his article put into shape, if necessary, and finished drawings made by our artists ready for publication.

Hornby No. 2 Tank Loco



This magnificent Tank Loco is a splendid addition to any train system. A glance at the above illustration shows how beautifully this Loco is designed. It is thoroughly representative of the latest type of its class. Measuring 11½ in. in length, it embodies all the characteristics of the Hornby Trains. Suitable for 2 ft. radius rails only.

Beautifully finished in colours; lettered L.M.S or L.N.E.R. Fitted with reversing gear, brake and governor.

Price each 30/-

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BOYS!

A SUBMARINE THAT REALLY DIVES

A Splendid BRITISH-MADE MODEL SUBMARINE

Fitted with clockwork motor and supplied with full instructions for working and for the repair of motor, etc., when necessary. Finished perfectly and in correct Admiralty grey.

The boat is approximately 14 inches long and 5 inches high ; after diving it will rise to the surface of its own accord. The planes and keel are adjustable to regulate depth of diving.

Made to last and never need be scrapped. It is English not German.

From all Stores and Toy Dealers, **20/-** each, or Post Free from addresses below.

SPECIAL NOTICE. We have about 20 only of our Model Aeroplanes left. Aluminium and silk, 3 cylinder valveless motor, worked by compressed air. Length 3 feet 9 inches, wing span 4 feet 2 inches. Will fly 220 yards at least. Complete with pump. Carriage Paid £1 15s. 0d.

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A similar story may be told about you. You live to fulfil some useful purpose and your success will be measured by the extent of your usefulness.

You must be able to stand against the storms and buffetings of life, illness and difficulties.

You must build on the firmest of foundations—good health. Good health is impossible without good teeth—sound teeth are clean teeth.

It is a simple and pleasant matter to keep the teeth in perfect condition by the twice daily use of Gibbs Dentifrice. It cleans and brightens the teeth by removing the greasy food deposits and polishing the millions of tiny waves and facets into which the enamel of a normal tooth is divided.

It is these facets of the enamel (seen only through a powerful magnifying glass) which give the bright, sparkling appearance to clean teeth.

Gibbs Dentifrice is most convenient—a solid cake, protected by an aluminium case—it cannot accidentally spill or squeeze out.

Your chemist can supply you with Gibbs Dentifrice at the following prices. Large size, 1/-; De Luxe, 1/6; Refills, 11d.; Popular size, 7½d.

"THE FORTRESS OF IVORY CASTLES"

FREE! Your little brother or sister will be keenly interested in the Gibbs Fairy Book "THE FORTRESS OF IVORY CASTLES"—a sequel to the famous "Ivory Castle Fairy Book"—an enthralling story comprising 36 beautifully illustrated pages. Sent post free, together with a useful size sample of Gibbs Dentifrice, on receipt of 3d. in stamps to cover cost of packing and postage.

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NINTH PHOTO COMPETITION

Wembley Photographs Wanted

SIX SPECIAL PRIZES

Many Meccano boys will visit the British Empire Exhibition at Wembley this year, and in the many miles of grounds, with their amazing variety of attractions, the glimpses of Colonial life and the wonderful architecture, they will see scenes that will live long in their memories. These scenes, and the exhibits generally, offer a splendid field for the amateur photographer, and there will be many visitors who will take home with them photographic reminders of the greatest Exhibition the world has ever known.

To encourage Meccano boys to take photographs during their visit, we have arranged a splendid photographic competition on entirely new lines. Competitors will be required to send in sets of at least three different photographs illustrating a Meccano boy's visit to Wembley. More than three photos may be sent if desired, and there are no restrictions as to which part of the Exhibition they represent. Snaps of the Palaces of Engineering or Industry and their exhibits, the Overseas sections, and the Amusement Park are equally eligible.

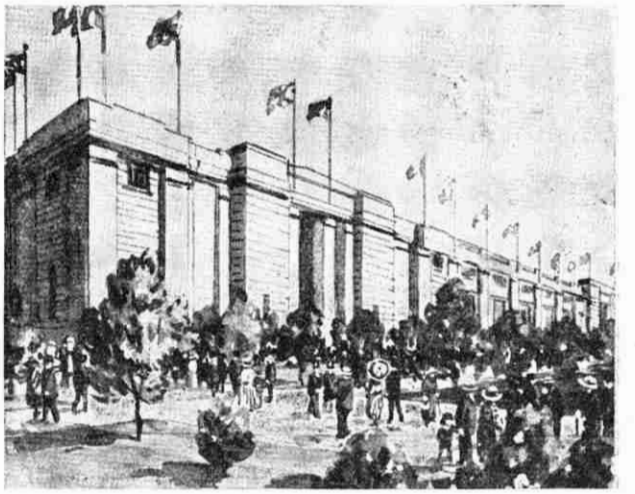
The competition will be divided into two sections :—

(a) For readers of 14 years of age and under.

(b) For readers over 14 years of age.

The first prize in each section—Meccano goods to the value of £1 1s. 0d.—will be awarded to the competitor sending in the set of photographs that best illustrates the spirit of the Exhibition. There will also be prizes of two pairs of Meccano Double Head-phones and two Meccano Crystal Receivers No. 1 for the next two competitors in order of merit in each section.

The conditions of entry are that the back of every print must bear the name, address, and age of the competitor.



The Palace of Engineering, Wembley

Although photos may be developed and printed by persons other than the entrant, the plate or film must have been exposed by him. It should be stated on each print submitted by whom the photos were printed and developed, as in the event of a tie, this fact will be taken into consideration. Any entries not fulfilling these conditions will be disqualified, and it should also be remembered that no photographs can be returned. The closing date of this contest is 30th September, 1924. Mark your envelopes "Exhibition" in the top left-hand corner, and post early to the Editor of the "*M.M.*," Binns Road, Liverpool. The winning set of Exhibition photographs will be printed in the "*M.M.*"

The Torque Converter—(*cont. from p.* 187)

a 5 lb. weight to the other end. Uncoupling "Constantinesco" for a moment, I showed my audience that the motor could not pull up 5 lb., even though going "all out." Re-fixing "Constantinesco," and using piano wire instead of cord, I proceeded to make the model pull, not only 5 lb., but 10 lb., 15 lb., 20 lb. and finally 25 lb., to the great astonishment of all present! At 25 lb. the wire snapped, and the rod, relieved of its load, must have broken all records, for the motor was doing well over 1,000 revolutions per minute, and so the back axle must have been doing something like 500 or more with the eccentric doing about 1500!

Rods are inclined to bend under the great strain of lifting 25 lb. and the vibration of the whole of the model when lifting this weight is terrific—so much so, indeed, that after a brief run it becomes vitally necessary to stop and tighten up a few nuts! The Editor of the "*M.M.*" was careful to explain in his article in the April issue that the Meccano model does not show the working of the actual gear, but only the principle on which it is based. I have no doubt, therefore, that the actual gear does not vibrate in this manner, or if it does Mr. Constantinesco has some means of damping it down by mechanism that counteracts the excessive vibration.

In conclusion I should like to say that since building the model I have spent many hours of my spare time in experimenting with it, with keen enjoyment, for the model is really fascinating to watch. I hope these few notes will encourage those who have not already constructed the model to do so at once, and also suggest a few experiments to those who have built the model.

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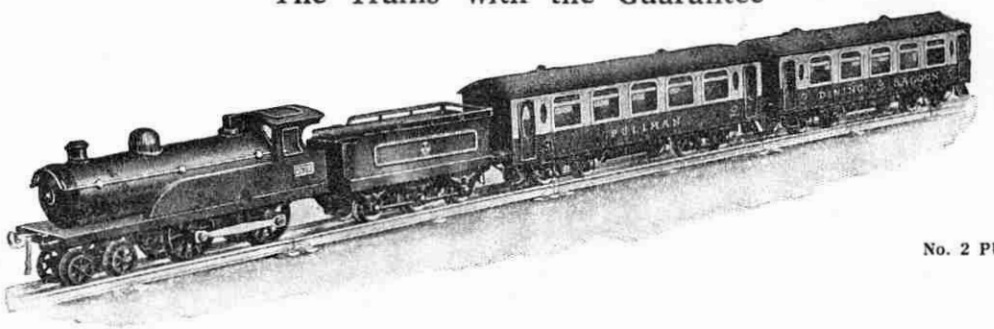
HORNBY CLOCK WORK TRAINS

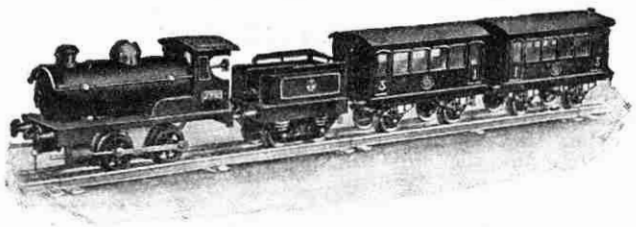
The Trains with the Guarantee



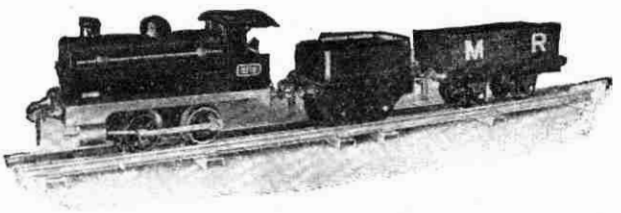
No. 2 PULLMAN TRAIN

You have no idea how much fun you can have with a Hornby Train. Shunting, coupling-up the rolling stock and making up trains to dash around their track as realistically as the real thing, will give you hours of pleasure. Hornby Trains are beautifully finished, strongly made, and will last for ever. One of their most remarkable features is that they may be taken to pieces and rebuilt. All the parts are standardised and any lost or damaged part may be replaced with a new one.

There are over 40 train accessories—stations, signals, lamps, a variety of wagons, level-crossings, turntables, etc., each of which is built in correct proportion and beautifully finished. New accessories are added to the system from time to time. Ask your dealer to show you the latest specimens or send to Meccano Ltd., Binns Road, Liverpool, for a full price list which will be sent (post free) on application.



No. 1 PASSENGER TRAIN



No. 1 GOODS TRAIN

HORNBY TRAIN PRICES

No. 1				No. 2			
Goods Set	25/6	Wagons ... ... each	3/9	Goods Set	45/-	Wagons ... ... each	3/9
Passenger Set	35/-	Tenders ... ... ,,	3/6	No. 2 Pullman Set ...	70/-	Tenders ... ... ,,	4/-
Locos ... ... each	16/-	Passenger Coaches ,,	6/6	Locos ... ... each	30/-	Pullman Cars ...	16/-

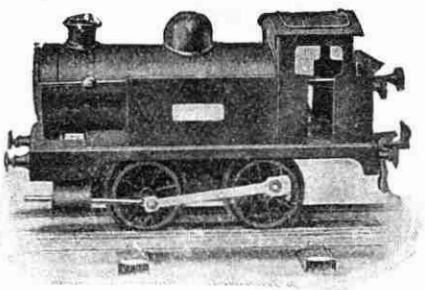
HORNBY TANK LOCOS

No. 2

The Hornby No. 2 Tank Loco is a powerful model embodying all the characteristics of the Hornby Train. It is 11½" in length and is fitted at both ends with a special bogey. Beautifully finished in colours; lettered L.M.S. and L.N.E.R., with reversing gear, brake and governor. Suitable for 2 ft. radius rails only.
Price **32/6**

Guarantee

Hornby and Zulu Trains are tested, and their efficiency is guaranteed. A form of guarantee is furnished with each loco, and we undertake to repair, or replace at our option any loco that fails to run satisfactorily from any cause other than misuse, within 60 days of purchase.



No. 1

The Hornby Tank Loco No. 1 is a strong and durable loco capable of any amount of hard work; richly enamelled and highly finished; fitted with reversing gear, brake and governor.
Gauge 0, in black only **12/6**

FROM ALL MECCANO DEALERS

Drawing Rooms on Wheels

The Story of the Railway Carriage

IN George Stephenson's time railway carriages were built on somewhat similar lines to road coaches. Stephenson's first carriage, which he appropriately named "*The Experiment*," looked more like a bathing machine than a railway carriage! It is difficult for travellers of the present day to realise the immense improvements that have taken place since those days when outside passengers were carried, and the tops of the coaches were used for carrying passengers' luggage.

The Early Coaches

One of the first problems to be solved by railway engineers was that of providing coaches of sufficient length to accommodate the constantly increasing number of passengers. At first the coaches had only two pairs of wheels, but later, when they were made longer, a third pair of wheels was added. Even then the vehicles were not long enough to meet the requirements of accommodation, but it was found impossible to make them any longer, for if this was done the coaches could not take the curves with safety.

After many experiments the solution of the difficulty was found in the "bogie" truck, introduced from America by the Midland Railway. The bogie truck usually consists of a set of four wheels, which work on a pivot and adjust themselves freely to the pressure of the curves. The great advantage of this arrangement is that coaches may be built to almost any length and yet ride easily round curves.

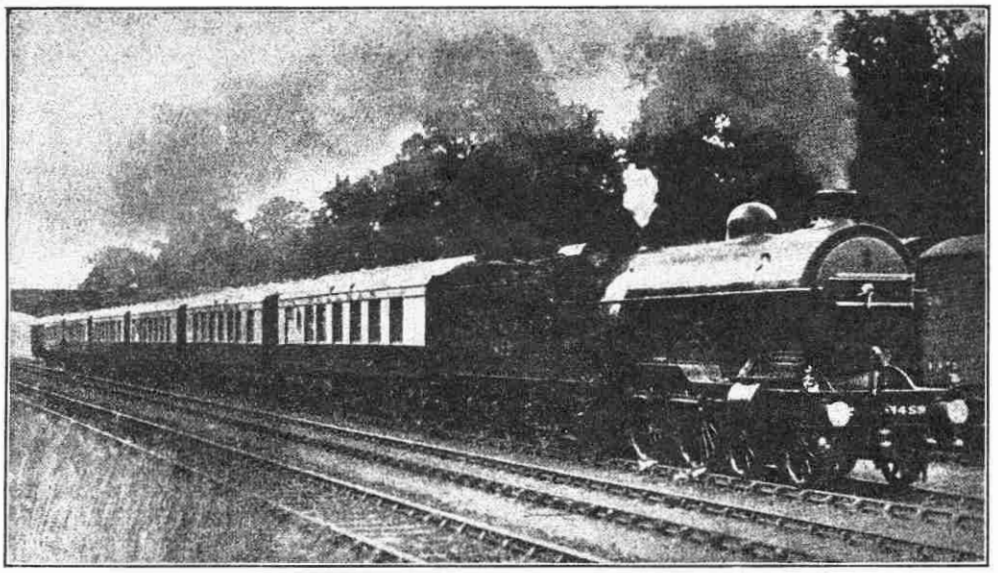
As coaches were made longer, six-wheeled bogies were brought into use, but the four-wheeled bogie is generally preferred.

All-Steel Coaches

Although the early coaches were built entirely of wood, with the exception of the actual running parts, it was not long before the great advantage of steel came to be recognised. Wooden-bodied coaches are always liable to danger from fire in case of a collision, and for this reason all-steel coaches are coming more and more into use.

To-day on British railways the whole of the underwork is made of steel, and even where the bodies are made of wood they are built on a steel framework. The wood used is always of the very best quality and usually teak, oak, pine, mahogany, or walnut.

For a long time British practice was to construct coaches with a number of separate compartments without any communication with one another. This system had the advantage of giving comparative privacy, but it had many disadvantages. By degrees the corridor coach was evolved, and this type of coach is rapidly becoming general for all long-distance trains. Another addition to the comfort of passengers was the introduction of dining and sleeping coaches, and on long journeys it is a great convenience to be able to eat and sleep in comfort on the train.



Photo] [*L. & N.E. Rly.*

The Harrogate Pullman Limited

Pullman Cars

One of the most interesting of recent railway developments in Great Britain is the considerable increase in the number of Pullman cars. There are more than 185 trains now running to which Pullman cars are attached, and in many cases the trains are entirely made up of Pullman cars, with the addition of a van for luggage.

Pullman cars were originated by an American inventor, George Mortimer Pullman, who built the first sleeping car at Chicago in 1859. Four years later he produced the first Pullman car, and in 1867 organised the Pullman Palace Car Co. The Midland Railway introduced Pullman cars into this country in 1874, and at that time the cars were sent over from America in parts and were erected at Derby.

These first Pullman cars were very successful, although there was some prejudice against them because they were thought to be dangerous. As a matter of fact this idea was quite unfounded, and it was proved that they were actually the safest part of the train. It is interesting to learn that the serving of meals on trains originated in a luncheon served on the trial trip of the first Midland Pullman train on St. Patrick's Day, 1874.

Famous Pullman Trains

Perhaps the most famous Pullman train in this country is the "*Southern Belle*," which runs on the Southern Railway between London and Brighton. Originally this train, which was inaugurated on 1st November, 1908, was confined to first-class passengers and ran only on Sundays, but later third-class cars were added and the train ran every day. Ordinarily this luxurious train consists of nine Pullman cars, vestibuled throughout, having accommodation for 368 passengers.

The fame of the "*Southern Belle*" has been somewhat overshadowed by the inauguration (in July last year) of the "*Harrogate Pullman*," a photograph of which we reproduce. This fine train was originally intended to run between London and Harrogate only, but the London and North Eastern Railway subsequently decided to extend the service to Newcastle. The timing of the run is so smart that the train reaches Tyneside only a few minutes later than it would have done had it been booked to run direct, via Selby and York. The train, which was intended in the first instance to be only a summer luxury, proved so popular that it was retained in the winter time table, and is likely to remain a regular feature of the London and North Eastern service.

Starting from King's Cross, the first stop is Leeds, a distance of 185¾ miles, which is covered in 3 hours 25 minutes. Harrogate, 203¾ miles, is reached in four hours, and the whole journey of 279 miles between London and Newcastle, including stops, is accomplished in 5¾ hours. The average running speed for the whole distance is 48.6 miles per hour, and the highest speed attained is 64.6 miles per hour.

A new feature in the Harrogate Pullman train is that two of the third-class cars, instead of being mounted on two six-wheeled bogie trucks according to the standard Pullman practice, are carried on

(*Continued on page* 195)

Drawing Rooms on Wheels—

(*continued from page* 193)

two four-wheeled bogies. Nothing is lost in smoothness of running by this innovation, and there is a valuable saving in weight of about 10,000 lbs.

It is rather surprising to find that there are no Pullman trains on that most enterprising line, the Great Western, famed for its "*Cornish Riviera*" daily express. It must be said, however, that the ordinary restaurant cars of this railway are already magnificent, and very little short of the high standard set by Pullman builders.

Pullman Cars in Scotland

In Scotland Pullman cars are used extensively, particularly on the London, Midland and Scottish route between Glasgow and Edinburgh, one of the busiest lines in the Kingdom. The trains are booked to run between the two cities at times convenient both to business men and holiday makers, and the journey of about one hour for the 46½ miles could scarcely be made in a more enjoyable manner than in a Pullman car.

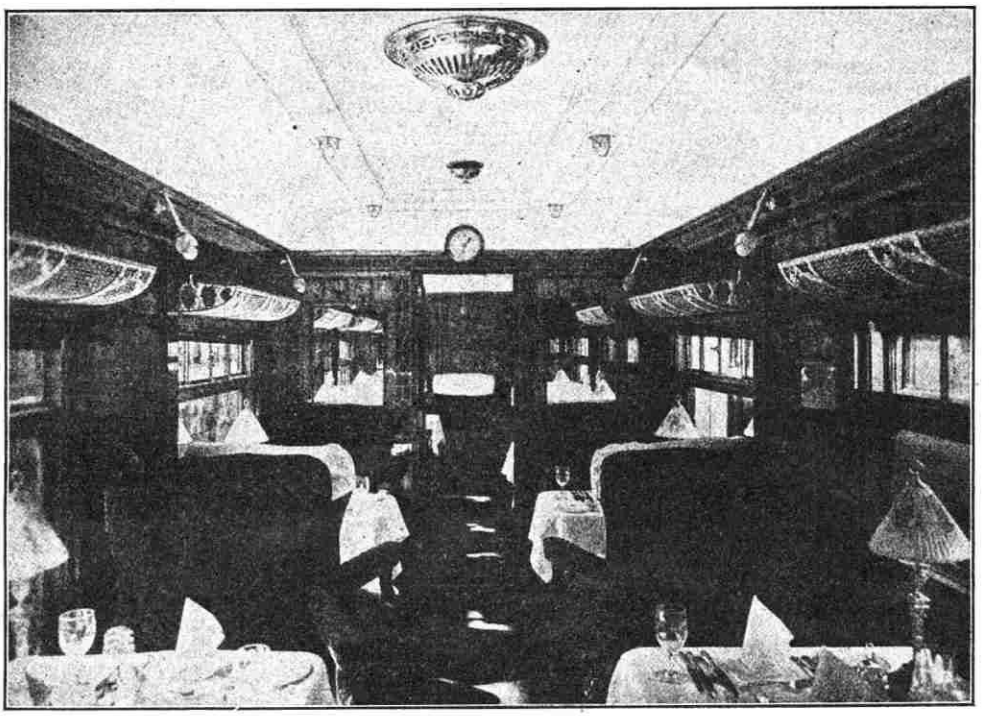
On the Caledonian section of the same railway a specially-built Pullman observation car is running, from which unobstructed views of the remarkably fine mountain scenery are obtained as the train speeds along. This car, the only one of its kind in Great Britain, is fitted up in a luxurious manner and has the appearance of a beautifully-furnished drawing-room.

Cars with Names

An interesting characteristic of the first-class Pullman cars in this country is that they have all been "christened." Thus two of the Harrogate cars are named "*Rosemary*" and "*Iolanthe.*" We give a photograph of the latter car, which shows clearly its splendid fittings, and gives a good idea of the comfort of these travelling drawing-rooms. The "*Iolanthe*" is a first-class buffet car, and has seating capacity for 22 passengers. The decorations are particularly artistic and pleasing, the woods used being pear-tree ground with mahogany trellis and bandings, with a floral relief running through a trellis of vines. Pilasters and friezes are of strap-work design and in keeping with the remainder of the scheme. The chairs are upholstered in blue velour, and the carpet is of a deep blue velvet pile.

Royal Trains

For many years the leading railway companies have provided special coaches for royalty, and, as might be expected, these vehicles are the last word in comfort and luxury. Queen Victoria was extremely particular about the arrangements for her railway journeys. Whenever she travelled, a pilot engine always ran fifteen minutes in front of her train. The line was kept clear of all other traffic, and the most elaborate precautions were taken in regard to signalling arrangements. In 1864 the Queen addressed a letter to the railway companies in which she expressed the hope that the same security in travelling should be secured for all her people as was provided for herself, but, of course, no railway could carry on under such conditions.



Photo] [*L. & N.E. Rly.*

First-class Pullman Car "*Iolanthe*"

Story of the Railway Ticket

Railway tickets are so familiar that we scarcely ever give them a moment's thought, yet their story is interesting. The early railways not only took the road coach as their model for passenger vehicles, but also adopted road-coach methods for booking. A book with counterfoils was used, and in this had to be written twice the passenger's name, together with the date, destination, and fare. The counterfoil was kept for reference, and the other half of the page was torn out and given to the passenger. This process naturally took a great deal of time, and as traffic increased it became a serious source of delay.

Thomas Edmonson, a Lancaster man, born in 1792, was the first to see that this booking system involved a great amount of unnecessary work. His idea, which is said to have come to him while walking in a field, was to abolish the laborious writing of passengers' names, and to issue strips of pasteboard printed with the names of stations, the class, and the fares. These tickets were to be numbered consecutively for accounting purposes, and dated on the day of issue to prevent fraud. With the assistance of a friend who was a watchmaker, Edmonson designed and made machines for carrying out these processes, and then approached the railway companies.

The Newcastle and Carlisle Railway, on which Edmonson was employed, would not have anything at all to do with the scheme, but the manager of the Manchester & Leeds Railway, who was about at his wits' end through the delays caused by the existing booking method, quickly saw the possibilities of the invention. After some discussion he permitted Edmonson to give his plan a trial on his own terms—ten shillings per mile of road per year. The experiment was quite successful, and the advantages of the new method were so obvious that it spread rapidly to all the other English railway companies, and ultimately to the whole of the railways of the world.

Edmonson's income increased with every mile of line on which his ticket scheme was used, and he became a very wealthy man. His idea, small in itself, completely revolutionised railway booking practice. Everybody knew that there was something seriously wrong with the existing method, but Edmonson was the only one who had sufficiently keen observation and intellect to see exactly where the trouble lay, and at the same time to devise a remedy.

New Meccano Parts

Our readers will be interested to know that we are now listing Wire Lines for suspending clock weights. This new part is No. 141, and the price is 9d. each.

Also Circular Girders, No. 143, price 1/- each.

Revised Numbers

Part No. 118, formerly known as Large Wheel Hub, will in future be known as Hub Disc. The price is 1/3 each.

Part No. 119, formerly known as Large Wheel Segment, will in future be known by the name Channel Segment.

NEXT MONTH:—

The
LIGHTING and HEATING OF TRAINS

Stamps for Sale

(*For Advertisement Rates see page* 204)

ASSORTED Mixture Foreign 1/3 per 1000. Popular approvals; any 4 stamps 1d. Any 50, 1/-.—Gall, 37, Avenue, Durham.

NONE FREE—NONE AS CHEAP!! Farthing Stamp Approvals; about 1000 sent.—J. V. Wyk, 439, City Road, Old Trafford.

Congo, Johore, French Soudan, Azores, Patiala, 69 others, 4½d.—Turner, 129, Villa St., Walworth.

BEST APPROVALS! Best discounts, and best gift stamps to applicants.—Fairweather, 64, Barker Street, Lozells, Birmingham.

STAMPS, all different, 70 for 4d.; 100 for 7d.; 200 for 1/3. Assorted mixture 500 for 4d.—Archibald, 20, Woolcomber Street, Dover.

STAMPS. Farthing Appros. About 500 sent.—Fearing (M.), "Travancore," Seafield Rd., Colwyn Bay, N.W.

JUNIOR PHILATELIC SOCIETY. The new members' list is now open and first subscription frees to September 1925. Write for particulars, J.P.S. blue book and sample copy of "The Stamp Lover" FREE. Mrs. H. P. Terry, 22, Kempshott Road, London, S.W.16.

STAMPS. 60 different free to applicants for approvals. All ½d. each. Send postage.—Cox, 135, Cambridge Road, Seven Kings.

1000 DIFFERENT of the British Empire from 1841 at ½d. to 2d. each only.

May I send this interesting and unique selection for you to see?

W. Cheeseman, 10, Addiscombe Road, Watford.

500 DIFFERENT STAMPS, 2/6; 1000 different, 5/-; 200 different unused, 2/-; 500 different unused, 5/-. Selections on approval.—Reid, N.R.P., 6, Fountain Street, Low Moor, Bradford.

COLONIAL AND FOREIGN DUPLICATES from large collection. Approval selections from which pick any 50 for 2/-. Numerous good stamps including high values and mint Colonials.—Miss M. Saunders, 78, Church Lane, London, S.E.7.

FREE. 50 Stamps, all different, to approval applicants for my famous sheets, all ½d. each.—Scott, 154, Wellesley Road, Ilford.

FREE. Packet of MINT Stamps and packet of Mounts to all applicants for my approvals. Special discount.—C. Negus, Bury, Huntingdon.

A RARE OPPORTUNITY. Several small books containing British and British Colonial Stamps at quarter Stanley Gibbon's prices, guaranteed genuine. Lists free.—Appleton, 53, Albany Road, Coventry.

COLLECTORS' DUPLICATES from ½d. to 2d. each, on approval, post free. No new rubbish.—Weaver, 31, Devonshire Road, Palmer's Green, London, N.13.

BEGINNER'S PACKET for 1/-, postage extra. Every fifth letter receives special prize.—Dixon, 24, Hollam Road, Milton, Portsmouth.

SHEET (100) MILLION MARK STAMPS FREE! Request approvals. Enclose postage.—Kraus & Co., 137, Cheapside, London, E.C.2.

Collectors' Duplicates, 40 different, 6d.; 100 different, 1/-.—Cyril Thompson, Sutton Lodge, Thirsk.

MIXTURE CONSISTING DUPLICATES, Unsorted Imported Lots, Remnants from Approvals and Cheap Unsold Packets, 1/3 per bundle, just as they come.—Captain Hall, Great-Cornard, Sudbury, Suffolk.

OCTAGON THESSALY FREE, with approvals, ½d. and 1d. each.—Bodman, 6, Alderman Road, Ipswich.

"THE PHILATELIC MAGAZINE."—The best stamp newspaper, only costs 3d. a fortnight from your newsagent. Specimen free to all mentioning "MECCANO."—Harris, 46, Victoria Street, S.W.1.

THE "DIAMOND" PACKET
contains **1000 UNSORTED STAMPS** from Convents abroad. 1/3 post free. 2 pkts., 2/5; 3 pkts., 3/6; 4 pkts., 4/6; 5 pkts., 5/6.
Nerush, Importer (Dept. E), **2-22, Cathcart Hill, London, N.19.**

STAMPS FREE Applicants for approvals sending postage receive either A COMPLETE SHEET OF 100 unused or 26 different unused, Peace, War, Air Post, etc. 60 page List profusely illustrated, 1d. only.
M. C. WATKINS, Stamp Importer, BARNET.

NORRISCO BARGAINS B
50 different ROUMANIA (Cat. 7/1) only 1/-. Postage extra.

This is a very fine long set which every Collector should have; we guarantee satisfaction or refund cash every time. Full Price Lists, with POCKET BOOK AND PERF. GAUGE FREE on request.

OTHER LONG SET BARGAINS:—

50 Belgium (Cat. 5/6)	-/9	75 Jugo-Slavia (Cat. 23/-)	3/3
40 Brazil (fine set) ...	1/-	50 Lettland (Cat. 25/-)	6/6
75 Chili (Cat. 24/-)	6/9	30 Russia (Cat. 3/5)	-/6
40 Italy (nice set) ...	-/9	50 Turkish War Stamps	3/3

All Postage extra.

BRITISH COLONIALS WANTED in quantities by exchange.

NORRIS & CO. (Dept. M.M.), LEABROOKS, ALFRETON, Derbyshire, England.

15/- WORTH CHOICE STAMPS FOR 3d.

15/- 3D.

Packet No. M.B. contains 2 mint CEYLON; pr. rare UKRAINE, cat. 7/6; 2 Jugo-Slavia; Magyar, 3k.; set 3 Turkey; 2 Schleswig; fine set 10 BELGIUM, 1902, face 5 fr. 60; 5 VENEZUELA, cat. 1/6; also obsolete JAMAICA, 6d., 1/- and 2/- Q.V. The lot 3d. Postage 1½d. Bargain.
Nelson T. Hillier, The Stamp Mart, Horsmonden.

BRITISH EMPIRE.	ALL MINT.
ANTIGUA, Script, ½d. green, 1d; 1d. violet ...	1½d.
BAHAMAS, Script, ½d. green	1d.
CANADA, King George, 2 cent green	2d.
KENYA, Script, 1 cent brown	½d.
WEMBLEY EXHIBITION, 1d. red and 1½d. brown, per pair	3d.
SARAWAK, 1 cent, blue and scarlet	1d.
POSTAGE EXTRA.	ASK FOR PRICE LIST.

ALEC KRISTICH (Member N.R.P. 279),
82, Marchmont Street, Russell Square, London, W.C.1.

FREE FOR POSTAGE
All the following are **MINT** varieties.
Germany, 3, 10, 20, 50, and 100m. on rose-coloured paper.
Germany, 2, 3, 4, 5, 6, 8, 10, and 50m., Posthorn type.
Germany, 5, 10, 15, 25, 40, 50, 75, Numerals.
Germany, 60, 80, 100, 120, and 5m., Workmen.
Germany, 150, 160, 10m., and 25m., Harvesters.
Germany, 10, 40p., 5m., 10m., and 25m., Airpost.
Germany, 20, 40p., 1, 1½, 2, 2, and 5m., Dienstmarke.
Germany, 100m. on 5m. Rhein-Ruhr.
12 **Poland, Schleswig, Wurttemberg, Danzig** to 100m.
All above are mint, these, along with others, making 100 nice varieties free. **Postage 1½d.**
H. Lindsey, 27a, The Square (G.P.O. Box 10), St. Annes-on-Sea.

50 French Cols.	9d.	50 Portugal Col.	9d.
100 U.S.A. ...	1/-	40 Belgium ...	1/-
150 Germany	1/-	50 Railway ...	1/-
150 Austria ...	1/-	50 Poster ...	1/-
150 Hungary	1/-	50 Entire Cards	1/-
50 Czecho-Slov.	1/-	50 War Envs.	1/-
50 Roumania	1/-	300 Postage ...	1/-
50 Sweden ...	1/-	600 Postage ...	5/-
40 Italy ...	9d.	500 Revenue ...	5/-
40 Bavaria	9d.	1000 Revenue	17/6

Postage Extra.

Fine selections ready in separate countries.

J. Russell, Chetwynd, Shanklin Drive, Westcliff-on-Sea.

NO NEW EUROPE RUBBISH
FREE! 25 BRITISH COLONIALS, including West African, Tasmanian, Newfoundland, Jamaica, British Guiana, to applicants for approval selections. Ask to see my famous ½d. stamps.
FLEMING, St. Winifred's, Christleton Road, Chester.

Genuine applicants for our Approvals, sending 2d. stamp for postage, receive **all** the following sets **Absolutely Free.**

FREE

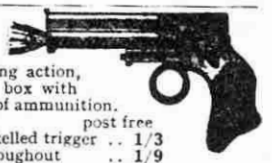
25 diff. Hungary, beautiful used copies.
25 ,, Germany, mostly unused pictorials.
5 diff. Belgium, parcel post, 50c.–1 Franc.
14 diff. Ukraine, catalogued 9/3.
7 ,, Bolivia 1–100c., as sold at 1/-.

R. WILKINSON, Provincial Buildings, COLWYN BAY.

Small Advertisements

(*See also page* 204)

AUTOMATIC PEA PISTOL



Loads 15 shots, repeating action, nicely finished, each in box with instructions and supply of ammunition.

No.	post free
1	Black model with nickelled trigger .. 1/3
2	Brightly nickelled throughout .. 1/9
3	25-shot all-black model 2/6

J. BISHOP & CO.,
12, Argyll Place, Regent Street, LONDON, W.1.

BELL SETS, complete, can be fixed up in a few minutes, only 5/6; Lighting Sets, 2/6; Luminous Paint, 2/9; Water Motors, 5/9; Electric Revolvers, only 7/6; but these are only a few of the bargains on our List, which is free. Send at once.—A. W. North, 47, Parchment Street, Winchester.

FREE VALVE SET
Diagram and Particulars, Post Free 2d.
This instrument covers all Broadcast Stations and Amateur Transmission.
All component parts, complete with Drilled Panel and Cabinet, Post Free 30/-
THE SYMAX ACCESSORIES CO.
261m, Lichfield Road, Aston, Birmingham.

WIRELESS. Quality means Success. **HEADPHONES,** 4,000 ohms. American design. Laminated Magnets. Leather-covered, adjustable Headbands. Unsurpassed for purity of tone, comfort, appearance, and reliability. Money-back guarantee with every pair.
14/6 post free.
All components stocked. Constructional details with every complete set of parts. Send particulars of the set you intend to build or advice on Tested Sets free.
E. SEYMOUR, 17, Weston Road, Thames Ditton.

THE LITTLE SCOUT CAMERA

Complete with plates, fixing salts, developer and instructions, fitted with real convex lens and self-acting shutter, takes excellent pictures 2½"×2".
Post free 3/3
G. W. BEADLE, 14, America Square, London, E.C.3.

STAMPS FOR SALE
(*Continued*)

"The Bazaar, Exchange & Mart," *says* "Suitable for re-sale; an opportunity not to be missed." Series of three books containing 360 different Colonial and Foreign Stamps, cat. £9, price 15/-, or single book 5/-. Selection at ½ prices. Bargain list free. Cash returned if not satisfactory.

Note.—On p. 198 the Editor of the "*M.M.*", in announcing our offer of a consolation prize in the recent stamp contest, refers to us as "*the old established and reliable firm of stamp dealers.*"

We appreciate this kind remark, and as our business was founded in 1871, we can assure every reader of the Magazine that our experience and assistance is always at their service. They can, therefore, deal with us with absolute confidence, and this security is endorsed by the Editor of the "*M.M.*" himself. Our 10/6 collection was chosen as first prize in the Overseas Stamp Essay Competition as the greatest bargain in the December *Meccano Magazine.*
J. H. LACY & CO., 77, Venner Rd., Sydenham, S.E.26.

STAMP COLLECTORS!!
Who buy our ½d., ¼d. and Mixed "Select" Approval Sheets, always ask for more. They satisfy. Write for a trial selection only from The Western Imperial Stamp Co., 46, Drynham Road, Trowbridge.

SET OF TITLES OF COUNTRIES AND 65 DIFFERENT STAMPS FREE

A truly super offer of 65 (30 mint) different stamps inc. Brit. Cols. War stamps, Pict. Set Ukraine, Set Poland, Jamaica, Soudan, Mexico, scarce Laibach, Russian Army stamps, Slesvig, long set 17 mint German Republic, etc. Finally a fine tabulated set (Abyssinia to Zululand), of Titles of Countries all prepared, gummed on reverse, for mounting at top of blank pages of your Album. This will be invaluable to really keen collectors. The whole parcel absolutely free to all genuine applicants for our famous approvals. Send p.c. only. **LISBURN & TOWNSEND, 201a, LONDON ROAD, LIVERPOOL.** (Collections purchased).

ROULETTING

IN our last issue we mentioned that perforations are divided into two classes—perforations proper and roulettes—and we gave descriptions of the various perforations. This month we are to discuss the varieties of roulette. As was pointed out last month, while a perforation entails the removing of a small portion of paper, a roulette consists merely of a series of pricks or cuts, no paper being removed. The word comes from the French and means "a little wheel" (probably being used in connection with stamps because the series of cuts is given to the sheet by small wheels).

There are many kinds of roulette, and it is useful for the stamp-collector to learn their names, so that when he meets any one of them in his stamp catalogue he will know exactly what is meant.

The Earliest Roulette

The earliest method of making a roulette was to place between the blocks of the stamps on the printing plates a notched rule, called by printers a perforating rule. These rules were raised slightly above the level of the printing blocks, so that they pierced the paper and made a series of cuts, by means of which the stamps could be separated with ease. In this manner both rouletting and printing were done at one impression, so that the expense of perforating separately was avoided.

Since the rules were inked as well as the stamp blocks, the slits they made were coloured. Examples of this type of roulette, which is known as "rouletted in colour," are found in the stamps of Luxemburg, Thurn, and Taxis, and Dominican Republic.

In some catalogues all rouletted stamps are described generally as "rouletted," without any indication of the style of roulette. In detailed lists, however, stamps so described are understood to be those consisting of a series of uncoloured straight cuts. This indicates that the rouletting has been done at a separate operation from the printing, so that the rouletting rule is not inked, and therefore the slits are not coloured. This is the most usual type of roulette, and has been used at various times by Nicaragua, Prussia, Chile, and many other countries.

Varieties of Roulette

"Arc-roulette" consists of a series of semi-circular cuts arranged as shown in Fig. 1. This form is usually described by

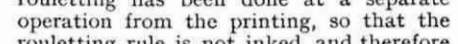


Fig. 1 Arc roulette

its French name of "*percé en arc*," *percé* signifying "rouletted." When arc-rouletting is particularly well done, it is often known as "serrated perforation," but this term is not strictly correct. The stamps of Brunswick, Hanover, and Victoria furnish examples.

A roulette in the form of a series of crosses, as shown in Fig. 2, is variously

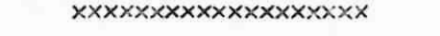


Fig. 2. Cross roulette

called "diamond," "lozenge," or "cross" roulette (French, "*percé en losanges*," or "*percé en croix*"). This is a very rare form of roulette, some of the 1866 issue of Portugal and the first stamps of Madeira being examples.

"Oblique-roulette" has the cuts slanting, parallel to one another, thus ////. The 1867 issue of Tasmania has varieties perforated in this way in two gauges, one between 10 and 10½, the other between 14 and 15. The gauge of a roulette is measured in exactly the same way as that of a perforation, *i.e.*, with the aid of a perforation gauge.

"Pin roulette," sometimes incorrectly termed pin-perforation, consists of a row of pin-pricks. This style is similar to ordinary perforation excepting for the fact that no paper is removed from the holes. The 1859 issue of Trinidad illustrates this style. At first the gauge was 12½, but very shortly after the stamps were issued a machine gauging between 13½ and 14, was used. In either gauge these stamps are scarce, the lowest-priced variety being catalogued at 25/-. On the whole, the second machine appears to have been used more than the first. Later the same stamps, which show Britannia seated and have the word "Trinidad" at the top in white, were issued with ordinary perforation. The French term for pin-roulette is "*percé en points.*"

Fig. 3. Saw-tooth roulette.

When stamps with "Saw-tooth roulette" (French, "*percé en scie*") are separated, the edges appear similar to the teeth of a saw, as is illustrated by the 1861-3 issue of Bremen. This style must not be confused with "zig-zag roulette" (*French, "percé en pointes"*) which also tears so as to leave the edges a series of sharp points. The difference is shown in Figs. 3 and 4, and it will be noticed that the "saw-tooth" style has deeper indentations than the "zig-zag," and that

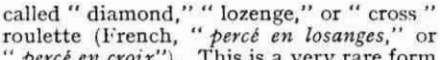


Fig. 4. Zig-zag roulette.

the angles also are different. The "one penny" value of Queensland, issued in 1899, was rouletted in this style, and is found both coloured and plain.

"Serpentine-roulette" consists of wavy lines broken in places, and is often incorrectly termed "serpentine-perforation." Between 1st January, 1860, and 1st July, 1875, this type of roulette was used by Finland in three varieties. These all measure almost the same so far as gauge is concerned, being 7¾, 7½ and 7¼ respectively, but the height of the teeth affords a definite clue in identifying the issues. The first variety has teeth 1¼ mm., the second 1¾ mm., and the third 2¼ mm. in height.

Should we Collect Perforations and Roulettes?

At the end of last century stamp-collectors were very eager to collect as many different gauges of perforation as it was possible to find on the same stamp. Now, however, perforations are going out of favour, for the general collector has over forty thousand different stamps to collect, even when he has ignored all measuring of perforation and shades! One would imagine that there are enough varieties here to keep all but the specialist so busily employed as to leave no time to include minor varieties of perforations.

Of course, the decision as to whether differences in the gauge of perforation should be collected or not rests entirely upon the answer to the question: "What is the object of a stamp collection?" Apart from giving pleasure to its owner, the real object is to illustrate the postal history of a country. On the strength of this, therefore, different gauges of perforations and roulettes are worth collecting when they are the work of different machines, or when they illustrate some particular point concerning a certain machine.

An example is afforded by the current New Zealand stamps (King George), which have the top four rows of each sheet perforated 14 × 13½ and the six lower rows 14 × 14½. Both these gauges should be collected, for they illustrate the fact that two machines are used for each sheet. Where one machine has an irregular perforation—that is, where the gauge varies in a single line of holes—only one stamp need be collected, a note being appended in the margin of the album that this perforation is irregular. These remarks are, of course, for general collectors. Specialists will always collect as many varieties of perforation as possible.

It may be mentioned that the type of perforation is much more important than the gauge, for a different type of perforation always proves that a different machine has been used. Besides this, it is often valuable in settling the date of issue of any particular stamp.

RECENT ISSUES

DOMINICA. A NEW SET.

A complete set of fifteen values of one type was issued for this colony in February, 1922. These stamps have seldom been surpassed by any of the many beautiful stamps of the British Empire. The design shows two medallions, that on the right containing the King's head and that on the left a galleon alongside a jetty. In the background the sun is setting behind the hills, while below it is a glimpse of a town. This left-hand medallion is well worth a close study, the engraving being superb. The values are as follows: (i) Wmk. Multiple Script CA and improved Crown, ½, 1, 1½, 2, 2½, 3, 4, 6d., 1/-, 2/-, 2/6, 4/-; (ii) Wmk. Multiple Crown CA, 3/-, 5/-, £1. Before long these last three will probably be replaced by the same on the new paper. The stamps are on chalk-surfaced paper in sheets of 60 (five rows of twelve) perforated 14.

NEXT MONTH:—

HOW POSTAGE STAMPS ARE PRINTED

Competition Corner

SECOND COMPETITION

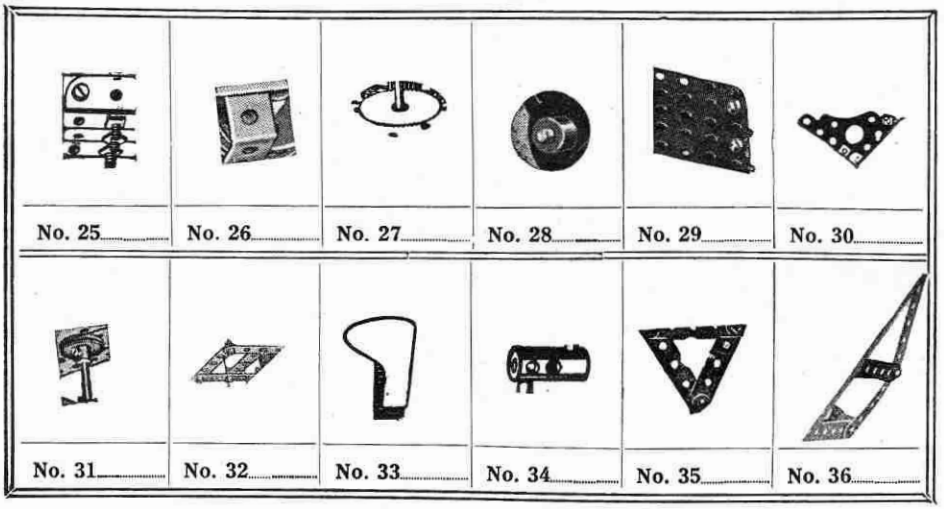
For Lynx-Eyed Readers

FIRST PRIZE: Hornby No. 2 Tank Loco. SECOND PRIZE: Meccano No. 1 Radio Receiver.

THIRD PRIZE: Pair Meccano Double Headphones.

CONSOLATION PRIZES: 12 Meccano Writing Pads; 12 Meccano Complete Manuals.

FINAL SET



INSTRUCTIONS FOR COMPETITORS:

On this page is given the final set of puzzle pictures in the second competition for "Lynx-Eyed Readers." As in the two previous issues the pictures above represent parts of models illustrated in the Complete Manual of Instructions (No. 23). Competitors possessing only old Manuals should endeavour to obtain the latest edition, as some of the models featured were introduced only in No. 23 Manual.

When the above twelve pictures have been solved, the numbers of the models in the last two issues of the "*M.M.*" should be neatly copied on to a postcard. Even if you have not solved all the 36 puzzles you should send in your entry, as other competitors may also have been unable to complete their sets. The postcard should, of course, have the name, address, and age of the entrant written on it, and should be addressed to "Puzzle Pictures," c/o "Meccano Magazine," Binns Road, Liverpool. Nothing else is to be written on the postcard, and any entry not fulfilling these conditions will be disqualified.

These puzzle pictures are admittedly very difficult. We have endeavoured to set a series that will tax the eyesight and intelligence of our sharpest readers, and we look forward with interest to receiving the entries to see how far we have succeeded. There are some splendid prizes being offered in this contest, and the first prize will be awarded to the entrant who succeeds in correctly solving the thirty-six puzzle pictures and the other prizes to the next nearest competitors in order of merit. If no reader solves all the puzzles, the first prize will be awarded to the reader whose answer is most nearly correct. On the other hand, in the event of a tie, neatness will be taken into consideration, and in judging the contest the Editor's decision is final. Typed postcards will be disqualified, as those who submit them do not compete fairly with those boys who are not fortunate enough to have access to a typewriter.

Correct solutions of the puzzle pictures will be published as soon as possible in the "*M.M.*" together with the names of the prize winners. Entries must be received before the closing date, which, in the United Kingdom, is 31st July (Overseas 31st October).

(*Solutions to the First Series of Puzzle Pictures, published in the "M.M." of January, February, and March, will be found in col.* 3.)

Eighth Photo Competition

The subject of this Competition, "A Summer Scene," offers a wide scope and may include views of town or country, holiday snaps, picnic parties or outings, seaside studies, etc. Prints may be mounted or unmounted and printed by daylight or gaslight process, whichever is found to give the best results.

To ensure every competitor having an equal chance the contest will be divided into two sections:—(A) Competitors under 14 years of age, and (B) Competitors of 14 years of age or over.

An important condition of the competition is that every entrant must write his name, address, and age on the back of the photograph submitted, and also state by whom the photo was developed and printed. In the event of a tie for a prize, photographs which have been developed and printed by the competitor will naturally receive preference.

There will be four prizes offered in this contest:—Meccano goods to the value of 10/6 and 5/– as first and second prizes respectively in each section. The closing date for readers in the United Kingdom is 31st July, and for readers Overseas, 31st October. Entries should be marked "Photo Contest" in the top left-hand corner of the envelope.

A New Essay Contest

Prizes are being offered for the two best essays on "My Impressions of the Palace of Engineering at the British Empire Exhibition."

The first prize will be a cheque for One Guinea, and there will be other prizes of film-pack Cameras (taking pictures $3\frac{1}{4}" \times 2\frac{1}{4}"$), for the next four essays, in order of merit.

Essays must not exceed 1,000 words, and should be written on one side of the paper only. Competitors should write their names on the back of each sheet, and state their ages, which will be taken into consideration in making the awards. Closing date 30th September next.

"Lynx-Eyed" Contest

Solution of First Series

Owing to the Overseas Section of this contest not closing until 30th June, it has not previously been possible to publish the solutions to the First Series of Puzzle Pictures. We are now able to give the correct numbers of all the models featured. In this contest Meccano boys certainly lived up to their reputation for smartness, and among the many thousands of entries received several hundreds were correct. Although thirty prizes were awarded, it was impossible to reward everyone who sent in a correct solution. In accordance, therefore, with the rules laid down in the event of a tie, the prizes were awarded to those whose entries were the neatest.

The correct solution to the three sets of Puzzle Pictures, as published in our January, February, and March issues, were as follows:

FIRST SET: Picture No. 1, Model No. 2; (2) 5, (3) 214, (4) 131, (5) 17, (6) 117.

SECOND SET:—(7) 49, (8) 218, (9) 31, (10) 225, (11) 34, (12) 255 or 256.

THIRD SET:—(13) 108, (14) 114, (15) 331 or 332, (16) 68 (17) 312, (18) 65.

(Note.—Nos. 12 and 15 represent the same model, but are taken from the 0–3 Manual, Nos. 23 and 22 respectively.)

We hope that all competitors who were unsuccessful in this contest will have another try at the second Lynx-Eyed Contest, which closes with the set of pictures on this page. Neatness of writing should be carefully observed, as it is of great importance in the event of a tie. Back copies of the "*M.M.*," containing the first and second sets of Puzzle Pictures, may be obtained (price 3d. each post free) from the Editor of the *Meccano Magazine*, Binns Road, Liverpool.

Result of Stamp Essay Contest

Overseas readers seem to be every bit as keen on stamp collecting as Meccano boys at home. The subject of this essay competition was: "Why I Collect Stamps," and readers from Tasmania to Iceland, and from Egypt to Ceylon, told us their reasons for taking up the hobby. Entries came along in many languages, and although nearly every one was different in writing and style, the reasons given in almost every case were identical. Apart from the pleasure given, stamp-collecting also teaches history and geography, and in a really interesting manner. Foreign architecture and the flora and fauna of distant lands are seen and remembered, while observation is keenly developed. These, in brief, were the opinions expressed by many hundreds of Overseas stamp-collectors, all of whom were unanimous in expressing the pleasure and benefit to be gained from their hobby.

The prize of stamps to the value of 10/6 has been awarded to Master R. Lang, of Perth, W. Australia, who chose a packet of 240 various stamps from our advertisers, Messrs. Lacy & Co., the old-established and reliable firm of stamp-dealers, of 77, Venner Road, London, S.E.26.

An essay deserving particular notice was sent in by Master Robert White, of Chesamba, Northern Rhodesia, and in view of its striking merit Messrs. Lacy & Co. very kindly offered to award a consolation prize of a 5/– packet of stamps. This extra prize has therefore been sent to Master White, and we congratulate both our Australian and South African friends on their success, and trust that they will long continue to take an interest in the hobby that they so ably championed.

Missing Line Award

In the April "Mail Bag" column we offered a prize of 2/6 for the boy who sent the best alternative line to a verse contributed by one of our readers. The prize has been awarded to Master W. Freeman, Bridgend, and using his last line, the verse reads:—

"Life is mostly froth and bubble,
Two things stand like stone—
Building models with Meccano,
And working on your own."

Forming a Cycling Club

by "ROVER"

ANY Meccano Club whose members include five or six keen cyclists should certainly run a Cycling Section, especially during the summer months. Great enjoyment may be derived from clubs of this character, and there are few finer ways of spending an afternoon or evening than a-wheel in the country with the companionship of a number of good friends.

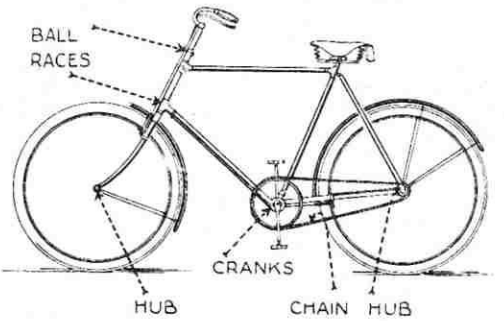
Appointing a Secretary

The formation of a Cycling Club should not be difficult for members of a Meccano Club, as the questions of obtaining sufficient members and a meeting-place have already been settled. All that is necessary is for those members with bicycles to get together and approach the Club Leader. He will, no doubt, arrange for the appointment of a Secretary for the Cycling section, whose duty it will be to arrange meetings for the discussion of plans, to organise runs, and to inform members of the time and place of the start. In the case of clubs with a large number of members, a Committee should be formed and a Secretary and Treasurer appointed.

The Repair Fund

A small weekly subscription might be fixed to cover the cost of postages, printing, and of articles required by the club such as maps, guide-books, etc. Any surplus might be placed to the credit of a Repair Fund so that any member who is unfortunate enough to have an accident and damage his machine may receive assistance from the fund. If the members, or Committee, consider that the accident was not due to carelessness, a sum may be voted towards the cost of the repairs. No fixed amount can be stated, as it will depend largely on both the state of the fund and the extent of the damage. Should there be no accidents, and the fund be in credit at the close of the season, the balance might either be transferred to the general Meccano Club fund, or expended in purchasing eatables for a final picnic. [*There is little doubt, Rover, as to which alternative healthy Meccano boys will choose!* —Editor.]

WHERE TO OIL A BICYCLE



The six parts of a bicycle which most require attention are shown above, and should always be kept well lubricated

Arranging Runs

A meeting of the members should be held at the commencement of the Session and the programme discussed and arranged. Suggestions by members for runs to various places of interest should be carefully considered, and the route and length of the journey determined from a study of a large-scale map of the district. In arranging these outings it should be remembered that an average day's run for a junior club is seldom more than 20–30 miles, and longer distances than these should not be attempted by the younger members. Of course, it can often be arranged for the seniors to go further afield when desired, and meet the juniors at some point on the way home. The pace and endurance of the entire club must necessarily be that of the youngest member, and due allowance should be made for this fact by the pace-makers.

Secretary's Duties

When the programme for the season has been arranged and noted, it should either be printed on a club card, or neatly written

(*Continued on page 202*)

The Secretary's Notes

Many Guild members are going to the wonderful Exhibition at Wembley this year. I have already received letters from readers who have been, and who report having seen a number of Guild badges during their visit. The record up to date is claimed by a London member, who states his highest score is twelve in one day. For the purpose of scoring, he informs me, a Chinese, Japanese, or Indian Guild member counts two, and a member carrying a full-sized Meccano model of the Eiffel Tower is equal to six points! Whether or not this method of scoring is legitimate, I would remind all members to wear their badges, not only at Wembley, but on every possible occasion. The little blue-and-white triangle is a world-wide sign of brotherhood and friendship, and means that the wearer will be pleased to see and speak to any other Meccano boy without waiting for an introduction. Already many firm friendships have been made in out-of-the-way parts of the world and in big cities, through the medium of the Guild badge, and a glance at "Club Notes" this month is a splendid instance of the world-wide influence of the Guild. Nearly all our Dominions Overseas have their Meccano Clubs, whose members, though they may never have seen England, are true sons of the Empire and members of the great brotherhood of Meccano boys.

Wear Your Badge

Our "Club Notes" page shows us that the Meccano hobby is by no means confined to English-speaking nations, for I see that this month there are reports from clubs in Italy and Holland. France, though not represented in these Notes, has many progressive clubs whose reports are dealt with in the French edition of the *Meccano Magazine* also. The Guild badge and all that it stands for are indeed objects to be proud of, and every member, no matter in which part of the world he may live, should strive to be a worthy member of the great brotherhood. I hope that the British Empire Exhibition will be the means of bringing many "lone members" and members from across the seas into contact with their fellow Guild members, with whom they have so much in common.

Clubs in Foreign Countries

South Africa continues its steady progress in the records of the Guild's Overseas Clubs. For some time past the enthusiastic clubs of Capetown and Johannesburg have been increasing their membership, and a few weeks ago came the news of the foundation of a new club in Durban with the Mayor of Durban as Club President. A week after the first meeting the membership had reached 30, with every sign of a steady increase. The club records have now been placed before the President of the Meccano Guild, who was very pleased to grant affiliation. Further particulars of this latest addition to our list of Meccano Clubs will be found in "Club Notes." Guild members the world over will no doubt join me in extending a very hearty welcome to the Durban Meccano Club, and its progress will certainly be followed with very real interest. The home of our new club is a large and popular seaside resort, which also possesses the finest natural harbour on the South African coast.

New South African Club

Meccano Cricket Clubs

Recent reports to hand from Club Secretaries show that up to the present Meccano Cricket Clubs have had a very successful season. Local matches have been numerous, and a good game, closely contested, has usually been the order of the day. One club invariably inserts a small announcement in the local paper at the beginning and middle of the season, stating the strength of the club team and asking for fixtures with other local clubs. This method has been practised for the last three years, and has always resulted in a full fixture-card for the club. I strongly recommend any Club Leader or Sports Secretary who may be finding difficulty in arranging matches for his club, to follow this example. It should be remembered, too, that the Secretary of the local Y.M.C.A. is very often able to arrange cricket fixtures, and also that I am always glad to inform Club Leaders of the nearest Meccano Club to them, with a view to their arranging inter-club games where possible.

There is no better place for putting into practice the Guild spirit than in the cricket field, where many new friends are met. Our President is particularly keen on encouraging Guild members in outdoor sports, and I hope that Guild cricket clubs will increase in number and that each and every one will send me full accounts of all activities.

Meccano Club Leaders

No. 14. Mr. A. J. LEWIS

Mr. A. J. Lewis, one of the pioneers of the Guild in South Africa, was responsible for the foundation of the first Meccano Club in that country. On 21st November, 1919, the first meeting of the Wynberg (South Africa) M.C. was held with an attendance of nine members. The roll was later increased to sixteen, but unfortunately, it was found necessary to close down the Club after some nine months of activity. Mr. Lewis was not discouraged, however, and after overcoming all difficulties was successful in starting the present Wynberg M.C., which was opened on 23rd August, 1923, nearly three years after the closing of his first Club.

As Secretary and Leader of the Wynberg Club, Mr. Lewis has done very valuable work for the Guild, and the present membership of 20, together with the successful record of the Club, is ample proof of his enthusiasm and capability. It was with real regret that we recently learnt of Mr. Lewis' proposed departure from South Africa in the near future. His efficient Leadership and ready aid will be greatly missed by the members of the Wynberg M.C.

CLUB NOTES

Meads M.C.—An enjoyable Social was given last session, and parents and friends of the members were invited. The evening's programme included songs, music and games, and concluded with the presentation of Merit Medallions to Masters L. Cross and F. Laycock for their splendid work in connection with the club. Club roll: 19. *Secretary*: Master F. Laycock, 10, Victoria Place, Eastbourne.

West View (Nottingham) M.C.—The summer session is in full swing, and several club outings are being arranged. In his spare time each member is making a mat on a Meccano frame, and at the commencement of the next winter session a prize will be awarded for the best mat exhibited. Several methods of mat-making were explained in a recent club lecture on "Useful Models to Make," and other interesting lectures given during the last session included "A Walk Round London," "Books," and "Table Games made with Meccano." Latest reports show a membership of 30, which, no doubt, will be increased during the next few months. *Leader*: Mr. H. W. R. Cousens, 494, Mansfield Road, Sherwood, Nottingham.

Davenport M.C.—Interesting features of the last session were an address by Archdeacon Thorpe, a visit to a local church belfry and tower, three paper-chases and a cycle run. It is proposed to hold a camp some time during the summer. A former Club Leader, Mr. Main, has recently returned to the district, and it is hoped that he will once more take an active interest in club affairs. Club roll: 35. *Secretary*: Master A. D. Stoker, 124, Bramhall Lane, Stockport.

Ethersall M.C.—Cricket matches are taking the place of club nights, and members play regularly every Tuesday, while Saturday rambles are proving a very popular innovation. In a recent competition held by a local dealer, the Club Secretary was awarded the first prize for a model of a railway station. Master L. Horsfield has recently retired from the position of Club Secretary and is succeeded by Master Donald Crankshaw, 7, Macleod Street, Nelson, Lancs.

Victoria (Glasgow) M.C.—As a mark of their gratitude and esteem, a watch was recently presented by the members to their late Club Leader, Mr. Penman, on the occasion of his resignation. Mr. McDougall has undertaken the Leadership, and his acceptance of this position is very greatly appreciated by all the members. The club is divided into sections, with a member at the head of each, and a gold medal was offered by the Club Secretary's mother to the member in charge of the best section. This handsome award has been won by Master David Taylor, whom we heartily congratulate on his success. Club roll: 47. *Secretary*: Master Ian Kerr, 57, Victoria Park Drive South, Whiteinch, Glasgow.

White Notley M.C.—A recent model Exhibition, assisted by several side-shows organised by the Secretary, brought in £1 9s. 0d., out of which prizes for club competitions were bought, the remainder going to the club funds. The Exhibition was described in the local press as being "*one of the finest shows ever seen in the parish.*" The Rev. S. Goodhart, the club President, gave a humorous entertainment some weeks ago, which was greatly appreciated. Unfortunately the club will be losing the services of their enthusiastic Secretary very shortly, whose absence will be greatly missed. Club roll: 12. *Secretary*: Master F. Fox, 2, Station Road, White Notley, Witham, Lincs.

St. Mary's (Newington Butts) M.C.—With a total membership of 103, now holds the record of being the largest Meccano Club in the world. To celebrate the event, a meeting of all old boys and members was recently held, the attendance being over 200. Representatives of local newspapers were also invited, and a very enjoyable evening was spent. The club continues to progress, and a Fretwork section has lately been included in the club's activities. A lecture and practical demonstration of the evolution of modern railway signalling was greatly appreciated. *Secretary*: Mr. C. A. E. Curle, 37, Pullen's Buildings, Peacock Street, London, S.E.11.

King Edward's (Birmingham) M.C.—Instead of arranging a programme for the session, this club tried a new method during the past session. At the end of each weekly meeting arrangements and plans for the next meeting were made, and this scheme was found to be very successful. Three dates were fixed, however, for a Mock Trial, Impromptu Concert and a Club Tea, the last event being easily the most popular! *Secretary*: Master N. J. Robertson, 30, Hinstock Road, Handsworth Wood, Birmingham.

Stationer's School M.C.—Activities during the last Session included visits to the Tower of London, Marconi House and the Mint. Papers were read on Model Railways, Working Electrical Models, Motors, Ships, and the Telephone. A club magazine called the "*News Box*" has been produced, the first number meeting with an excellent reception. Membership now stands at 25, but it is hoped to increase this before the end of the Term. *Secretary*: Master S. Martin, 47, Tottenham Lane, Hornsey, N.8.

Surbiton Hill M.C.—Attendance has been below the average for the last session. Model-building, Boxing, Stamp Collecting Competition, Curios and Coin Collecting are popular club activities. Any boy wishing to join should write to the *Secretary*: Master Arthur G. Eley, 102, Tolworth Park Road, Surbiton, Surrey.

Parkstone Congregational M.C.—Splendid progress has been made during the last few months, and the club now possesses a two-valve wireless receiving set. A football team was organised, and the club concert-party has given numerous entertainments throughout the year with great success. An exhibition and concert was held at the close of the last session. *Secretary*: Master Stuart Bridle, "Newton Glen," Sandbanks Road, Dorset.

Redruth M.C.—Summer activities, including country rambles and outdoor games, are being enjoyed by members. Several plays have also been given by the club, who are fortunate in having the use of their club-room free of charge, through the kindness of the Secretary's parents. Club roll: 22. *Secretary*: Master L. Trenberth, Tunnel Stores, Redruth, Cornwall.

Luton M.C.—The past session has been a great success, the programme including model-building, lectures and wireless evenings, several members having constructed their own receiving sets. Meetings are being held fortnightly throughout the summer months. Club roll: 26. *Secretary*: Master L. Goldsmith, 69, Tennyson Road, Luton.

Norwich Enterprize M.C.—A regular summer session is not being introduced, but cycle runs and occasional outings will be arranged. The Club Secretary was recently successful in winning an Apprenticeship Premium and was heartily congratulated by the club members. *Secretary*: Master C. R. Agar, 73, Vincent Road, Norwich.

Knutsford Lecture Hall M.C.—The past session has been very busy, and included a Social Evening with music and games, model building and prize contests, boxing, lectures on "Gas and How it is Made" and other interesting subjects, and concluded with an Exhibition at which 15 members exhibited models. Two models loaned by Headquarters attracted considerable interest. The club roll now numbers 20. *Secretary*: Master L. Shepherd, Grove Lodge, Knutsford, Cheshire.

Holy Trinity (Blackburn) M.C.—The Club Leader reports that last session proved the most successful in the club records. A "Potato-Pie Social" and Musical Evening marked the end of the session. A local gentleman interested in the club kindly gave two prizes for the best models exhibited by members. The monthly rambles arranged for the summer session are very popular and well attended. Club roll: 18. *Secretary*: Master H. Jepson, 11, Pine Street, Blackburn.

Westcliffe and District M.C.—At a recent Social every member brought a girl friend, and the valuable publicity thus afforded resulted in ten new members being secured. The club members are enthusiastic footballers and hope to arrange matches with other Meccano Clubs next season. Club roll: 46. *Secretary*: Master David S. Cecil, 22, Valkyrie Road, Westcliff-on-Sea, Essex.

How to Run a Meccano Club

by the

Guild Secretary

(*Continued*)

It is very desirable that public interest should be aroused in the welfare of your club. Some people cannot understand the possibilities of a Meccano Club until they have attended one of the meetings, when they become as delighted and as enthusiastic as the boys themselves. It is a good plan to arrange to open the club room to visitors one night a month, and to make a point of getting members to invite their parents and friends to come and see the club "at work." Once parents, teachers, and others interested in boys' welfare learn of the useful work done by the club, they will give that help and support that is so necessary to a successful club.

Visiting Night

Club news is printed every month in the *Meccano Magazine* and "Club Notes" should be read by all interested in drawing up the programme for the Session, for often they contain helpful suggestions from other clubs. The column is intended to be more than a brief summary of club doings, and is available for the interchange of ideas. The "*M.M.*" is, of course, the official organ of the Guild, but several clubs publish a magazine of their own, when one or more of their members possess journalistic tastes. Some of these club magazines are printed, others are produced by one of several duplicating processes. A club magazine affords a splendid opportunity for extending the scope of the club, and at the same time gives valuable experience to the boys actually producing it.

Club Magazines

The ambition of every club should be to have its own printed magazine, and one method of achieving this end is demonstrated by one of our clubs which has installed its own printing press and not only prints its own magazine but also tickets, cards, etc., for club use. A brightly-written club magazine, cleanly and neatly produced, will lead to larger sales, and consequently to more members and greater funds. Several clubs have their own printed letter-heading, and in these cases I am always pleased to loan electros of Meccano name-blocks suitable for this purpose. Also I will have suggested designs drawn up for the club's letter paper, if desired. The actual printing must, however, be arranged locally by the club itself.

Club Printing

Special Meccano writing pads, particularly suitable for the use of Guild members, are issued by Headquarters. On each sheet is an illustration of a Meccano boy with a model, and, if desired, the club may print its name below this design. These pads may be obtained from Headquarters (price 1/3 each, post free), and have proved very popular among members.

When a club has been successfully started and continues to make steady progress, a Library generally proves a welcome addition. The first supply of books for the Library should be purchased from club funds. If these will not stand the strain, however, a special exhibition or concert should be arranged to raise funds for this purpose.

Club Libraries

The club subscription may either include the use of the Library, or members may be asked to pay a small extra sum for this privilege. A Librarian should be appointed, and it will be his duty to make out a full catalogue of the books in the Library, showing author's name and title of book and separating the fiction from the other books. If the number of books in the Library is considerable, further classification may be made, such as Science, History, Engineering, etc.

(*To be continued*)

Italy

Allassio M.C.—Last session a Marionette show was given, at which 40 people were present. The puppets were made from Meccano parts and worked by the members, and the entertainment proved a very great success. The proceeds were used for purchasing wireless apparatus for the club, as members have recently added Radio to the club interests. Club roll: 22. *Leader*: Professor A. Dobelli-Zampetti, Villa Merlini, 114, Alassio, Italy.

Holland

Dan Haag M.C.—A lantern lecture was held some time ago, when slides depicting the various processes and machines employed in making Meccano were shown. The Secretary also delivered a lecture on "The Life Story of Meccano," which he had followed from the early numbers of the "*M.M.*" and translated into Dutch for the benefit of the members. Club roll: 24. *Secretary*: Mr. H. G. Van der Sluis, 108, Stadhoudersplein, Den Haag, Holland.

New Zealand

Invercargill M.C.—The last report received from this club gave particulars of an Exhibition of Meccano models—the first to be held in the colony. Thirty models were on view, including the Meccano Loom, which caused great interest. The Club Leader is assisting other Meccano enthusiasts to form clubs in New Zealand, and is doing valuable work for the Guild. Club roll: 70. *Leader*: Mr. W. H. Laytham, 10, Chelmsford Street, North Invercargill, Southland, New Zealand.

Australia

Adelaide M.C.—After the winter recess, this club recently commenced its summer session. Model-building and lectures are regular features, while outings are eagerly looked forward to by members. Some weeks ago a local Meccano dealer displayed several working models, including a beam-engine pump, drop-stamp, vertical saw and plane, which attracted such crowds that the police were obliged to ask the dealer to move the models into a side window. Club roll: 15. *Secretary*: Master T. Cornish, 100, Walkerville Terrace, Walkerville, S. Australia.

Footscray M.C.—Recently joined forces with the local Scouts, whose new hall they are now sharing. This change of quarters will permit of more new members being enrolled, and a very successful session is anticipated. Club roll: 20. *Secretary*: Master H. L. Roach, 48, Stirling Street, Footscray, Victoria, Australia.

India

Calcutta M.C.—Several local gentlemen are taking an interest in the club, and it is hoped to organise an Exhibition and Concert in the near future. Meccano boys in Calcutta are invited to join the club, and full particulars may be obtained from the *Secretary*: Master A. N. Roy Chowdhury, 35-2, Beadon Street, Calcutta.

Ceylon

1st Ceylon M.C.—Has been in existence since March 1922, and several very successful Exhibitions have been held. The club is open to members of the Dharmaraja College, Kandy, and is the first affiliated club in Ceylon. *Secretary*: Master B. K. Billimoria, Dharmaraja College, Kandy, Ceylon.

Model Railways

by Henry Greenly

(*Pub. by Cassell and Co. Price* 1/6).

This book should prove of the greatest interest to all Meccano boys. Mr. Greenly has been for many years a recognised authority on model railway matters, and in his book he gives the results of his great experience. Writing in a clear and interesting style, he covers practically every type of model railway, ranging from gauge 0 indoor lines to 18" gauge outdoor passenger-carrying systems with locomotives one-third full size. The chapters on permanent way, points, crossings and signals are particularly valuable, and there is much useful advice on the construction of bridges, tunnels, stations, locomotive sheds, signal boxes, and all the rest of the accessories that help to give the model railway a touch of realism. The book is well illustrated by photographs and drawings, and forms a valuable work of reference.

The New Antofret

(*Pub. by Hobbies Ltd. Price* 1/- *net*).

The name of "Hobbies" is too familiar to Meccano boys to need any introduction, but the fact that this firm publishes a series of books on various hobbies is perhaps not quite so well known. The latest addition to their list is the "*New Antofret*," which should make a direct appeal to every worker in wood, both young and old. Antofret is a new form of fretwork recently invented by an Italian priest, Mgr. Antonini, after whom the new craft has been named. Its many applications and uses are fully and clearly explained in the book, which also contains excellent illustrations of various objects made by the new craft.

The Story of Iron and Steel—(*cont. from p.* 175)

manufacture of iron and steel. From that time the importance of malleable iron rapidly declined, and it was superseded for one purpose after another by the mild steel from the Bessemer converter. The reason for this was that the material produced by the converter was of very much better quality than the product of the reverberatory furnace, and it was also produced more quickly and in larger quantities. To-day such things as rails, boiler-plates, ships'-plates and girders, which formerly were made of malleable iron, are invariably made of steel.

The Bessemer process filled a great need, but it is probable that it has passed its zenith and is on the decline. Its great drawback is that the steel it produces is liable to be irregular in quality.

NEXT MONTH:—

The Open-Hearth Process and the Electric Furnace

CATALOGUES RECEIVED

We have received the following catalogues this month. Should any of our readers write to the firms concerned, they will assist us by mentioning the "Meccano Magazine."

Messrs. The Igranic Electric Co. Ltd. (149, Queen Victoria Street, London), whose name is already familiar to readers of the "*M.M.*," have recently sent us a copy of their latest catalogue, which is well illustrated and of great interest to the radio experimenter. Tuning-Coils (including the world-famous Honeycomb Duolateral Inductances), Coil-Holders, Variometers, Vario-Couplers, Transformers, Filament Rheostats, Vernier Friction-Pencils and Transformer Coils, are some of the devices described and illustrated. Every piece of apparatus bearing the Igranic trademark is carefully designed by expert workmen, and may be relied upon to give splendid service, as the Igranic Electric Co. has had many years of experience in manufacturing all classes of electrical equipment.

* * * *

Covering the many branches of the photographic art and brightly written in non-technical language, *Photography in the Home* should be included in the kit of every Meccano photographer. Published by Messrs. W. Butcher & Sons Ltd. (Camera House, Farringdon Street, London, E.C.4), the well-known makers of cameras and photographic apparatus, this handy booklet describes everything from the use of flash-powder to the art of micro-photography. In addition, there are many illustrations of cameras, as well as a variety of accessories. Those interested in photography are strongly advised to obtain this booklet, which will be sent post free to any reader mentioning the "*M.M.*"

Metal Casting at Home

The ingenuity of toy makers appears to be almost unlimited, and an excellent illustration of this is provided by the casting moulds advertised in our pages and sold by Messrs. A. Rodways, 102, Long Street, Birmingham. By means of these moulds perfect little castings of animals of all kinds, ships, soldiers, Red Indians, etc., can be made, and those of our readers with Hornby Trains will be particularly interested in the mould for casting a miniature railway station staff. Full instructions are supplied with each mould, and the process is so very simple that it is almost impossible to go wrong. Everything is supplied except the casting material, which may be any kind of old lead pipe or scrap. Most boys will be able to find an old iron spoon or some similar utensil in which to melt the lead, but if not, a suitable ladle may be obtained from the firm. After the models are cast they may be coloured to make them more realistic, for which purpose special materials are supplied.

Forming a Cycling Club—(*cont. from p.* 199)

out, and copies given to each member. Some days before an outing is due to take place, a reminder notice of the event should be put up on the club notice-board for the benefit of forgetful members. These duties fall to the lot of the Secretary of the Cyclist's Section. If it is desired to increase the membership, other boys who are not members of the Meccano Club may be admitted at the discretion of the Club Leader, while notices in the local papers or in a cycle dealer's window are both splendid means of making a cycling club well known in the district.

Additional Attractions

There are many other matters that cannot be dealt with in this column for want of space. For example, wet evenings could be devoted to lectures by club members or visitors on subjects of interest to cyclists, such as "Re-enamelling a Bicycle," "The Principle of a Three-Speed Gear," etc., while inter-runs with other near-by cycling clubs could very easily be arranged. These details, however, may safely be left to any capable and enthusiastic Secretary, who, if he follows the advice given above and has the loyal support and co-operation of the members, should find no difficulty in adding yet another successful branch of activity to his Meccano Club.

NEXT MONTH:—

RULE OF THE ROAD

In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

H. Stafford (Sheffield).—We note that you enjoy our Fireside Fun and our Cycling pages. Yes, we certainly hope to visit the British Empire Fair, and we have no doubt that thousands of Meccano boys will wend their way to Wembley during the next six months. Your suggestion for an exhibition essay competition is good and we may adopt it.

C. Flint (Notts.).—If your sister insists on usingy our Meccano parts and will not return them, the only course left open to you is to see that she gets a Meccano Outfit all to herself. It is awfully difficult to be rough with sisters, so we must be generous instead!

P. C. Thornton (Winchester).—You may assure your "pagan" friend that the number of Meccano boys throughout the world runs into millions—the younger ones are coming in faster than the older ones drop out! Send us your articles on conjuring, and they will be considered.

H. Williamson (Blackpool).—We are glad to hear from you again, and hope you will now write oftener. We shall commence our Nature column in the near future, and we shall also publish some very fine articles on railways. The "*M.M.*" will continue to grow both in size and quality.

J. Grimley (Southport).—We hope you will find the show cards and other things that we have sent to you useful. We are always pleased to assist any boy who proposes attending a carnival dressed as a Meccano boy.

J. Hawkins (Torquay).—Our trouble is how to include in the "*M.M.*" all the good things that we have available, Jack. We have plenty of new and interesting Radio matter, but, as you can see, our space is limited. The size of the "*M.M.*" will shortly be increased still further and this will help us.

G. R. Thompson (Cleethorpes).—We scarcely see the necessity for a special badge for cyclists, George, and it seems to us that it might prove a little confusing to have two Guild badges. Thanks for your kind message.

Mrs. M. A. Watts (Milton).—We are gratified to know that your boy derives pleasure from Meccano, and we appreciate the tribute you pay to all our goods. We should like to have your full address, as a letter sent to you has been returned to us through the post.

W. G. Hartley (Birchington).—We note that in your case R.S.V.P. means "Readers seem very pleased"—this certainly applies to yourself, and we much appreciate your compliments.

L. Kouyoumdjian (Bagdad).—Many thanks for your interesting photograph. It is a far cry to Bagdad and we fear there is little chance of our opening a branch in your city at present! Many of your stores have stocks of Meccano, however, and you should have no difficulty in obtaining what you require. We are always very glad to hear from you.

C. Nicholas (Victoria, Aus.).—We certainly *do* get many letters from Australian Meccano boys. They arrive always by the same mail on Mondays—a big batch of them, and they keep us absorbed for hours, because they are so extraordinarily interesting, just like your own. We have replied to some of your queries by letter. Thanks for your newspaper cutting and your contributions to our "Fireside Fun," which we shall probably be able to use.

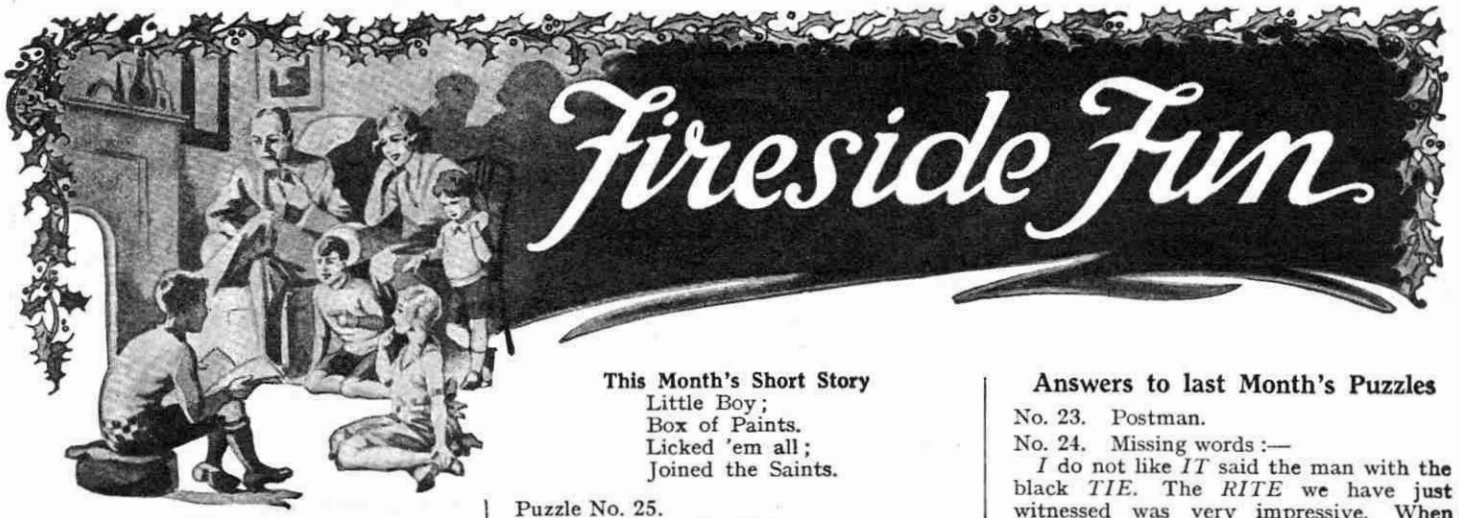
T. Dark (Booval, Queensland).—We are relieved to have your assurance that you are not dead. The recipe for killing the insect pest which you quote:—

"Take the little insect;
Hit him on the head;
Hit him hard and often;
Hit him till he's dead!"

would work well if the farmer had lots of time, but we agree with you that the recipe wasn't worth the money that the thousands of farmers sent to the man who advertised it. We shall shortly publish an article on the N.S.W. new Shore Bridge.

G. H. Nelson (Streatham).—You don't need our permission to write to us. A boy who has used Meccano as long as he can remember has earned the right to be numbered amongst our close friends, and close friends always write to each other often.

J. W. Horton (Bognor).—Thanks for your assurance that you will never give up reading the "*M.M.*" If you think that your mathematics master would be "bucked" if he knew how you are solving our problems by means of algebra, why not tell him?



THE continued popularity of "tongue-twisters" among our readers is very surprising, and I have been hard put to it to keep my tongue from getting into a terrible knot these last few weeks! Whilst I am very pleased to receive really good tongue-twisters, I do sometimes wish, on an extra busy morning, that the perpetrators of some of the twisters could stand in front of me and be made to say their own concoctions quickly half-a-dozen times, under pain of a severe penalty!

What would my readers do if one morning they opened a letter (from Master Basil Frost, of Egham) reading:—

"In Huron, a hewer, Hugh Hughes,
Hewed yews of unusual hues,
Huge ewe sheds of queer hued yews,
Did Hugh Hughes hew for his ewes."

I felt like never wanting to hear of Mr. Hughes again!

Then, another day, I seemed to have fallen into the middle of a bed of thistles, for I received quite half-a-dozen twisters, all of which ran something in this fashion:—

"She sifted thick thistles, twisted thick thistles. Sifting the thick twisted thistles sat she. With strong string she strung them in sheaves; and Cissie, her sister, insisted on shifting the thistles her sister sifted."
(Master G. H. Penketh).

Another person, bearing a much more ambitious name than mine, also appears to have had trouble with thistles (according to Master H. Tattersall, of Elland) who tells me that:—

"Theophilus Thogmorgan Thackeray thrust his thumb through three million three thousand three hundred and thirty three thick and thin thistles. If Theophilus Thogmorgan Thackeray thrust his thumb through all these thick and thin thistles, where are all the thick and thin thistles through which Theophilus Thogmorgan Thackeray thrust his thumb?"

Leaving the thistles and the troubles of Theophilus for the moment, we may try our luck with the day's work as performed by the gentleman queerly known as Mr. Thomas Titmouse. It appears (at least, so says Master Cyril Cruikshank of Insch, N.B.) that:—

"Mr. Thomas Titmouse took two tees to tie two tups to two tall trees. If Thomas Titmouse took two tees to tie two tups to two tall trees, then where are the two tups that Thomas Titmouse tied with two tees to two tall trees?"

So much for this month's twisters! Next month I shall print one of my own twisters, as I think it is now my turn to try to catch out those who have sent me their efforts. I have an idea, too, that I shall succeed, and I fancy that outside all the doctors' surgeries, about 2nd August, there will be long queues of "*M.M.*" readers with their tongues in terrible knots! Those who are not in the queues will probably be receiving attention, lying quietly at home in a dazed condition!

We shall see!

This Month's Short Story

Little Boy;
Box of Paints.
Licked 'em all;
Joined the Saints.

Puzzle No. 25.

Those who pride themselves on their knowledge of Geography will be able to exercise their wits with the following puzzle, contributed by Master A. N. Cowley, of Attenborough, Notts. (to whom the monthly prize of 5/- has been sent). The puzzle is to discover which places these phrases represent:—

1. A pudding connected with roast beef.
2. Something to keep off the rain.
3. What we breathe.
4. A bottle-stopper
5. A coloured motor.
6. Good quality.
7. An untasted dish.
8. A favourite sauce
9. A child's cries.
10. An expensive piece of meat

* * * *

Puzzle No. 26.

Judging by the large number of this class of puzzles that have been received during the past few months, "word squares" are very popular. This is interesting because at one time they enjoyed a remarkable popularity with adults in some puzzle pages in the "grown-ups'" newspapers. The puzzle is to fill in the blanks with letters which themselves form a complete word and yet allow the columns to read from top to bottom as they do from left to right.

E S C A P E
S . . . . S
C . . . . T
A . . . . E
P . . . . E
E S T E E M

* * * *

Q. What is it that will go up down, but will not come down up?

A. An umbrella up a chimney.

* * * *

Q. It has several windows, but no door, and sometimes the roof is used as the floor. What is it?

A. A motor-bus.

(Contributed by Master B. Kirkman, Forest Gate, E.7.)

* * * *

Puzzle No. 27.

What is it?

It's easy made—save care you take,
E'en with care it's easy to make.

(Contributed by Master Alan N. Cowley, Attenborough.)

* * * *

An Irishman was seated in a train beside a pompous individual who was accompanied by a dog.

"Foine dog ye have," said the Irishman. "Phwat kind is it?"

"A cross between an Irishman and an ape," the man replied.

"Shure, an' it's related to both of us," the Irishman retorted.

Answers to last Month's Puzzles

No. 23. Postman.

No. 24. Missing words:—

I do not like *IT* said the man with the black *TIE*. The *RITE* we have just witnessed was very impressive. When you *INTER* a man you *RETAIN* a *CERTAIN* means of identification. There will be a reaction against *CREMATION* when the *IMPORTANCE* of this is realised.

We offer a prize of 5/- for the best puzzle submitted each month, and prizes of 2/6 each for any other puzzles printed.

Puzzles should be expressed as clearly as possible and the answers should be given in each case. Diagrams should be clearly drawn and letters should be addressed "Puzzles," Meccano Magazine, Binns Road, Liverpool.

The conversation had changed from one thing to another, finishing up with high buildings.

The American thought he had them all beaten when he said there was a building in New York so high that it took a person at least twenty-four hours to get to the top.

"Sure," said Pat, "there's a little building I was working on some time ago in good ould Dublin, when one Saturday morning about eleven o'clock I dropped my hammer from the top, and sure and begorra when I went to work on Monday morning the thing hit me on top of the head!"

* * * *

James Mulligan was the only man in the village who could be hired to use a lawn mower or attend to the gardens, and he never lost a chance of impressing the fact upon a listener.

"I've got to get this job through for your ma as quick as ever I can," he announced to the small son of one of his employers. "I'm losing half-a-crown an hour every minute I'm here. There's three people waiting for me now, and I don't know how they are going to get along till to-morrow without me, any one of them."

"Why, Mr. Mulligan," said the boy respectfully, "I don't see how you are losing half-a-crown an hour when mother pays you a shilling an hour, and you couldn't be in more than one place at the same time and —"

"Have you got as far as geometry in your studies?" inquired Mr. Mulligan.

"No," admitted the boy.

"When you do you'll understand a good many things that's hid from you now," said Mr. Mulligan, resuming his leisurely progress over the lawn!

Small Advertisements

(*See also page* 196)

FOUNTAIN PEN. Self Filling. Nickel Plated, Lever Action. Post Free, 1/-.—E. M. Creasy, The Bazaar, St. Ives, Cornwall.

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Advertisements

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 in the same letter.

Small Advertisements. 1/- per line (average seven words to the line), or 10/- per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest circulation figures, will be sent on request.

Press Day, etc. Copy must be received not later than 10th of each month for publication in following issue. Half-tone blocks up to 100 screen.

Remittances. Postal Orders and Cheques must be made payable to Meccano Ltd.

Obtaining the "*M.M.*" Overseas

Readers Overseas and in foreign countries may order the *Meccano Magazine* from regular Meccano dealers, or direct from this office. The "*M.M.*" is sold Overseas at 2d. per copy, or mailed (post free) direct from Liverpool, 1/6 for six issues, or 3/- for twelve issues.

IMPORTANT.

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA:	Meccano Ltd., 45, Colborne Street, Toronto.
AUSTRALIA:	Messrs. E. G. Page & Co., 379, Kent Street, Sydney.
NEW ZEALAND:	Messrs. Browning Ifwersen Ltd., P.O. Box 129, Auckland.
SOUTH AFRICA:	Mr. A. E. Harris, P.O. Box 1199, Johannesburg.

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Buck Belgian Hare, 10 months, 12/6.—Apply 21, Craven Park Road, Harlesden, London, N.W.10.

Horizontal Steam Engine cheap. Write for particulars.—Fielders, Old Bank House, Atherstone, Warwicks.

Good Crystal Set, receives 20 miles, 12/6.—Young, 1, Kirkland Terrace, Inverurie, Aberdeenshire.

Compressed Air Boat, 30 ins. long. Price 13/6. Good condition.—Park Stone, Lytham.

Wanted

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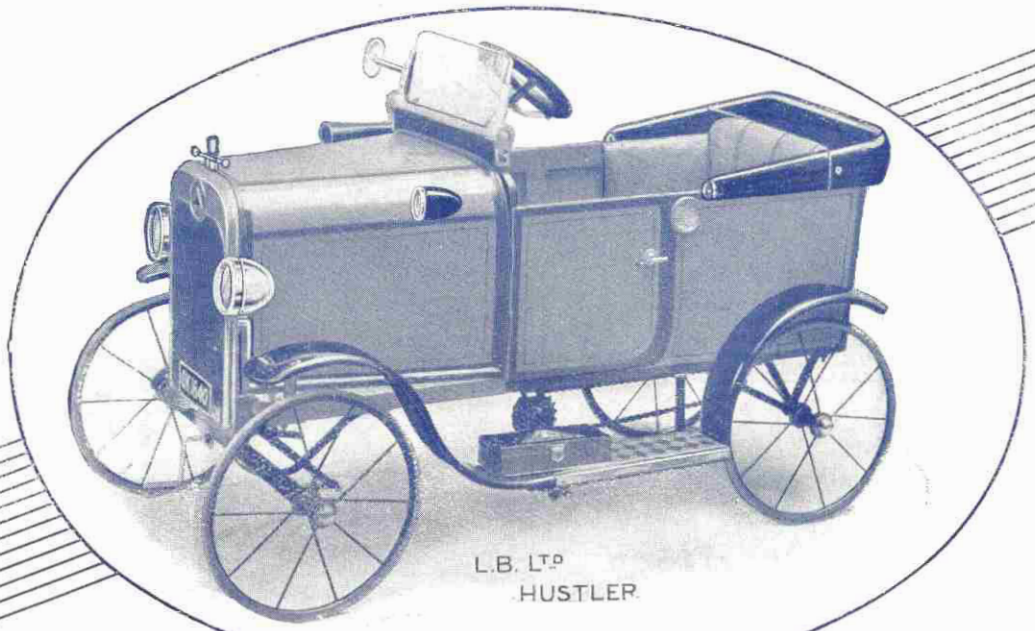

The HUSTLER MOTOR

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"Hustler" No. 2, on 12in. × ½in. wired-on tyred wheels, four lamps (two head and two side), adjustable windscreen, adjustable seat, upholstered body, rubber bulb horn, driving mirror, ratchet starting handle, instrument board, including clock, speedometer, voltmeter, oil indicator, licence disc with licence, radiator with motometer, number plate, mudguards and steps, tool box with spanner and screwdriver, side door with handle, rubber pedals, cycle chain and chain wheels. DUMMY HOOD.

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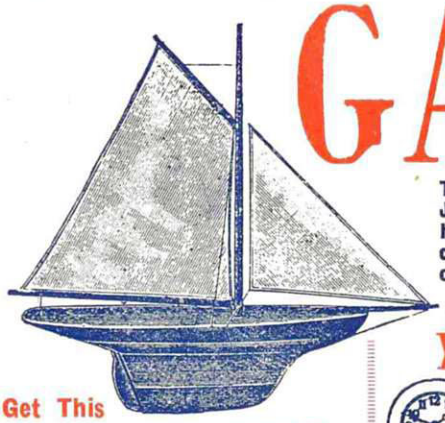

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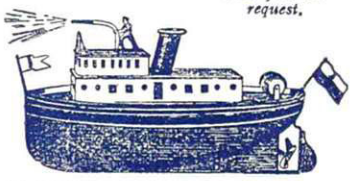


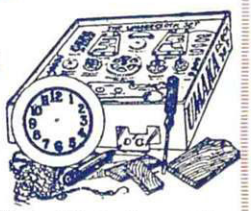
CLOCKWORK FIRE BOAT

Another very interesting model is this Clockwork Fire Boat, as illustration. Nicely enamelled. The fireman squirts water as boat goes along. Size 7½ in. long. Price **7/9** Post 6d.

Larger sizes, **11/6** and **14/6**. Write for full details.

You make it yourself !

A REAL CLOCK for 7/6



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Illustrated is the A.W.G. Altikite, a kite of new pattern, remarkable for the high angle and stability of its flight in either high or low winds. In construction, finish and performance, a real advance in kite design. No. 1 30 in. Price **4/–** 33 in., **6/–** ; 36 in., **8/–** ; 39 in., **10/–** ; Post 6d. extra. 42 in., **20/–** ; 48 in., **25/–**

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Full size. All cane handles. Bound blades **5/11**

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Good quality compo. Full size. From **1/3**

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Khaki Canvas. Full size, 36 × 12 × 8 **12/6**

BATTING PADS
Boys' size. Strong White Drill. Pair **5/6**

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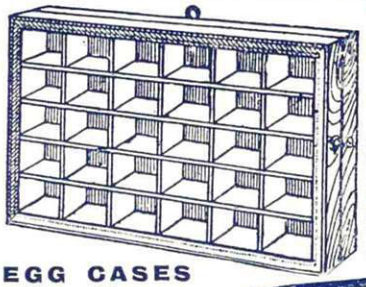
⅜in. butt leather soles. Boys' ... Pair **12/9**

Everything for the YOUNG NATURALIST



Pocket Egg Collection Boxes

Strong and well made Size 8 in. × 4 in. Price **4/6** Post 4d.

EGG DRILLS, 6d., 9d. and 1/– each.

Let us know your requirements, Boys !

BIRDS' EGG CABINETS

Polished. Stained Deal.

Drawers	Width	Height	Depth	Partitions	Price
4	12	13	9	68	**24/–**
6	15	18	9½	116	**32/6**
8	19	25	11	228	**59/6**
10	22	35	14	343	**95/–**

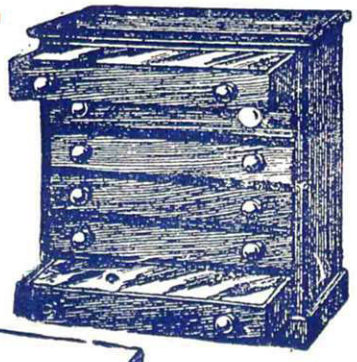
Carriage and packing extra.

EGG BLOWERS 6d., 9d. and 1/– each.

PINK WOOL 1/- per sheet.

BOYS' CLIMBING IRONS complete with straps, **7/6** and **12/9** per pair. Post 9d.

If what you want is not here, we have it in stock.



EGG CASES with partitions, or **BUTTERFLY CASES**

Corked and papered. Glass Framed Top. Suitable for Exhibition purposes.

Polished Imitation Mahogany.

	Price
10× 8 in., 20 pars.	**4/6**
13× 9 ,, 24 ,,	**6/–**
14×10 ,, 24 ,,	**7/–**
16×10 ,, 28 ,,	**8/–**
16×12 ,, 35 ,,	**9/–**
18×14 ,, 48 ,,	**10/6**
18×18 ,, 64 ,,	**12/–**

Carriage and packing extra.

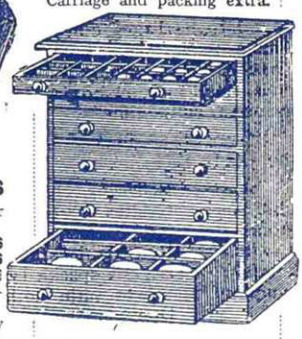
DEAL STORE BOXES

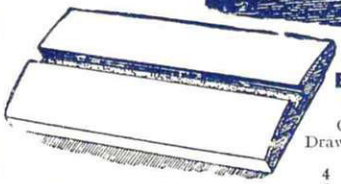
Corked and papered with camphor cells.

Pocket size, 6×4	**2/6**		
Size 8×8	**3/9**	Size 14×10	**7/6**
,, 10×8	**4/6**	,, 16×11	**8/6**
,, 13×9	**5/6**	,, 17×12	**10/–**

Postage extra.

You are quite safe in ordering any of these goods by post.





SETTING BOARDS. Oval or Flat, Corked and Papered. 14 in. long : ½ in., **8d.** ; 1 in., 9d. ; 1½ in., **1/–** ; 2 in., **1/3** ; 2½ in., **1/6** ; 3 in., **1/9** ; 4 in., **2/–** ; 5 in., **2/6**. Post extra. There is absolutely no need of the young naturalist that we cannot supply, so if what you want is not here, you can be certain we have it in stock.

BUTTERFLY CABINETS

Corked and papered.

Draw.	Width in.	Hght. in.	Dpth. in.	Price
4	13	12	8	**27/6**
6	15	16½	9	**36/–**
5	18	22	11	**66/–**
10	19½	27½	12	**£5**

In Old English Oak, **35/–**, **45/–**, **91/6**, **£8/6/–**, Carriage extra

Crates (returnable) charged 2/6

ENTOMOLOGICAL PINS

In 4 sizes. ½ oz. boxes. White, **10½d.** Black, **1/7½**

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