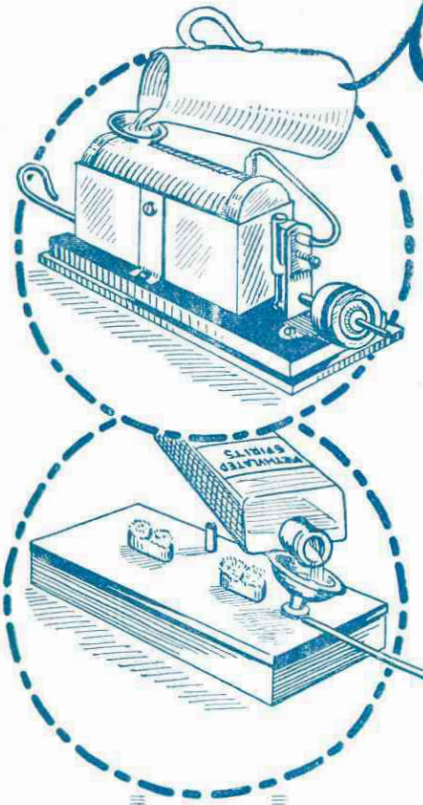
JUNE 1924

MECCANO MAGAZINE

PRICE 2D

VOL. IX
No. 6



Water and 'meth'— and away she goes!

Hours of joy for any boy!

Here's a lovely Launch for you—one of which you will be proud and the other boys envious. She has a real engine which generates a nice turn of speed and keeps the boat going for 20 or 25 minutes with one filling. You can't get such splendid value anywhere else—it beats the German boats hollow.

PEGGY

The Launch of Speed and Beauty

British Made

The hull is 31 inches long with a 4½ inch beam. The boiler and engine are of brass and the firebox encased to obtain greatest heat in a short time. The exhaust pipe to stern creates a realistic "tuff, tuff," and the boat can be guided by the movable rudder and tiller. The boat is beautifully finished in three colours and the power unit is strong, safe and simple.

FREE A fully-illustrated 16-page Catalogue will be sent free upon application, or can be obtained at any branch or agent.

Complete with Lamp, Filler and Instructions

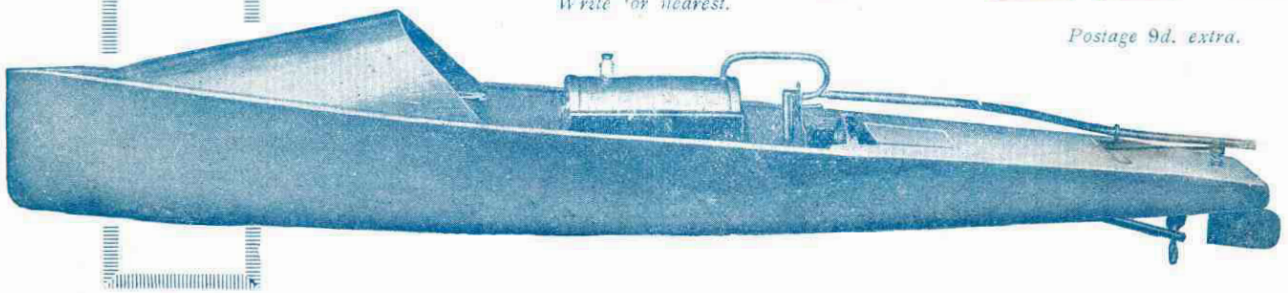
HOBBIES LIMITED

Peggy Dept. - DEREHAM - NORFOLK

And of all Branches and Agents in every town. Write for nearest.

22/6

Postage 9d. extra.



ANOTHER NEW MECCANO MODEL NEXT MONTH. READY 1st JULY. PRICE 2d. ORDER NOW!

EDITORIAL OFFICE
Binns Road,
LIVERPOOL

MECCANO MAGAZINE

PUBLISHED
IN THE INTERESTS
OF BOYS

I WOULD thank those hundreds of readers who have written to me during the past fortnight, saying delightful things about the cover of our May issue. As I mentioned on this page last month, I am having some beautiful covers prepared for our future issues, and no expense is being spared to make the cover of the "*M.M.*" worthy of the Magazine and all that it stands for. This month the subject of our cover is a blast furnace, which is described in detail in our new serial feature, "The Story of Iron and Steel." The cover shows a row of blast furnaces by night, one of which is discharging the molten metal. As a very small boy I well remember being taken by my father to see his furnaces discharging their glowing contents, and the sight was one I shall never forget! I was vividly impressed by the intense light of the furnace-mouth, by the smoke and steam, and by the terrific heat. Here molten metal was running along channels in the sand as easily as water runs along a furrow, making it difficult to realise that in a few hours' time the glowing stream from the furnace would become hard and solid iron. If any of my readers ever have an opportunity of seeing the wonderful sight that forms the subject of our cover, they should not miss it for worlds!

Our Covers

The large number of letters I receive every day covering almost every topic under the sun, fully bear out my contention that Meccano boys are more observant and more keenly interested in the daily happenings in the world around them than are other boys. Most of the letters I receive contain at least one point of general interest. One may be a new idea for making something—not necessarily a Meccano model—and another a method of doing something in a new manner. Or there may be an account of some unusual occurrence or incident, 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 recent letters from two of my correspondents.

New Experiences

One of the main objects I always have in view in editing the "*M.M.*" is that of keeping every Meccano boy informed of just such matters as are covered by these letters; to tell them, in short, "what other Meccano boys are thinking and doing." I have not the time to do this as thoroughly as I wish, and therefore I intend to call upon Meccano boys to help me. My plan is that each Meccano boy who at any time has a new idea to put forward, or an interesting experience to describe, should write it down in the form of a short article, and send it to me, marking the envelope "Ideas" in the left top corner. 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 likely to prove of general interest to my readers will be published in a special page each month and paid for at our usual rate. Illustrations may be sent, if desired, either drawings or photographs.

I want to make it quite clear that no boy need hesitate to send in an article because he may not be very good at composition. So long as he states the facts clearly, I will, if necessary, have his article put into proper shape, ready for publication.

Ideas Wanted

I have recently returned from a visit to the British Empire Exhibition at Wembley, and I am very enthusiastic about it. I should like to think that every Meccano boy who can possibly do so will visit this wonderful Exhibition. It is not merely a collection of interesting and curious things, but a representation in miniature of the British Empire. Thousands of Meccano boys may never have the opportunity of visiting our Overseas Dominions, and very few indeed will ever be able to see more than a small part of the Empire. Although the Wembley Exhibition cannot take the place of a tour of the Empire, it can, and does, give an accurate picture of everyday life and activities such as we can never get from books. The Exhibition is a great demonstration of the vastness of our Empire, and every boy who visits it will come away feeling prouder than ever that he is British. I am arranging a special Essay Competition for those who visit Wembley, and full particulars will be found on page 166.

A Great Exhibition

The section of the Exhibition in which I was most interested, and that which I feel sure will appeal most strongly to my readers, was the Palace of Engineering. Here, in a great hall, which has an area five times as large as Trafalgar Square, are displayed all manner of wonderful machines and inventions. One of the most interesting exhibits is the Constantinesco Torque Converter, recently described in the "*M.M.*" I know that my readers will be interested to hear that the inventor of this wonderful device is using Meccano to demonstrate the principles of his Converter.

Size is no drawback to the exhibits in the Palace of Engineering. For instance, there is more than one full-size locomotive, a corridor coach, and other similar interesting exhibits. The original "*Locomotion*," the first passenger locomotive, is there, too, having been brought specially from Darlington for the Exhibition. It would require a whole "*M.M.*" to describe fully the wonders of this great Exhibition, and its marvels must be seen to be appreciated, for no pen can do justice to the triumphs of British engineers there displayed.

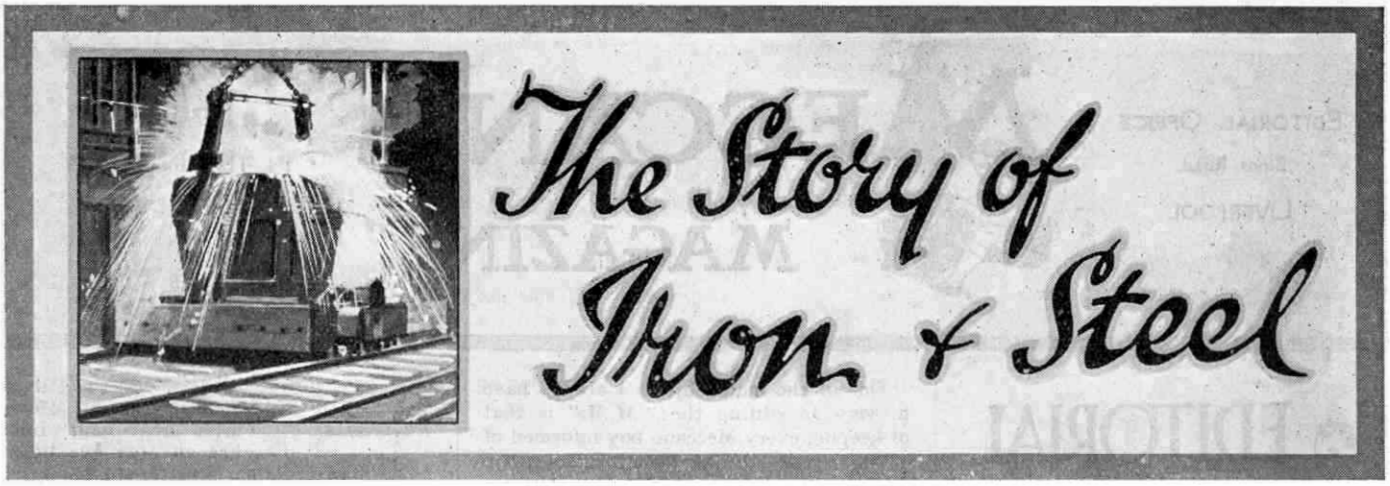
Triumphs of Engineering

And now just a word in regard to our next issue. We shall continue the story of Robert Stephenson, with an account of some of his bridge-building achievements and some details of the construction of the famous Britannia Tubular Bridge over the Menai Straits. Our article on Iron and Steel will deal with the wonderful processes employed in the manufacture of steel, which will also be the subject of a striking cover design. The wonders of Magnetism will be described in the Electricity article, and another new Meccano model will be illustrated. A special Railway article will deal with the story of railway carriages, and I also hope to publish an account of some very interesting experiments with the Meccano model of the Torque Converter, contributed by one of our readers. Radio will be represented by a description of Marconi's early experimental work, which led up to his great achievement—the conquest of the Atlantic. In addition to this very full programme there will be the usual Guild News and Club Notes, and Stamps, Competitions, Puzzles, and Fireside Fun.

Our Next Issue

IMPORTANT NOTICE.

We are constantly asked to supply back numbers of the "*M.M.*" We print only sufficient copies to fill our regular orders, and back numbers cannot therefore be supplied. In order to prevent disappointment our readers are advised to place a regular order, with a Meccano dealer, a newsagent, or direct with us.



II. THE BLAST FURNACE. CAST AND MALLEABLE IRON

IN the early days of iron manufacture the ore and fuel were simply placed together in a rough furnace. Sufficient heat was applied to melt the iron out of the ore, and it collected at the bottom of the furnace. Gradually the process was improved, notably by the use of a forced draught and the employment of certain materials, such as limestone, as "fluxes" to unite with impurities in the ore. To-day all ore is smelted in what is called a blast furnace.

A Typical Furnace

The accompanying diagram (Fig. 1) gives a good idea of the construction of a typical blast furnace. The circular shaft, shaped as shown, is lined with firebrick which will stand an enormous amount of heat. The top of the shaft is closed by a conical stopper called the "bell." This stopper may be lowered to allow a charge of iron ore, limestone or coke fuel to be shot into the furnace. The blast pipe (P) which runs round the hearth is also shown, together with two of the nozzles called "tuyères" (pronounced "twyers") by which the blast is conveyed to the interior of the furnace. These tuyères have to withstand a terrific heat, and to prevent them from melting they are surrounded by pipes through which cold water constantly circulates, or water-jacketed as it is called. The diagram also shows the two openings (S) and (I) through which the slag and the molten iron respectively are drawn off. Finally, there is an opening near the top of the shaft to lead off the hot gases produced.

The earliest blast furnaces were open at the top, and were very conspicuous objects at night with their fierce flames flaring out and illuminating the surrounding country. After a while, however, it came to be realised that the gases escaping from the open top could be made use of, and about 1836 the close-topped furnace came into general use. The size of the furnace has gradually been increased, and a large modern furnace is about 100 ft. in height. These improvements have resulted in a corresponding increase in output. In 1800 a furnace produced little more than 20 tons of iron per week; to-day a Cleveland furnace can produce 1,300 or 1,400 tons per week.

The Hot Blast

Iron manufacturers had endeavoured to get the furnace blast as cold as possible, on the assumption that the coldness of the air in winter was the cause of the best iron being produced during that season. In 1828, however, their ideas received a severe shock, for James Beaumont Neilson, a Scottish gas engineer, calmly proposed that the blast should be heated! Neilson was manager of the Glasgow gas works, and was consulted by an ironmaker with regard to a defect in a blast furnace. After a good deal of thought he hit upon the idea of heating the blast air, thus increasing its volume and enabling it to do more work in the furnace. At first his idea was ridiculed, and the ironmasters were very indignant at the impudence of a mere gas engineer in assuming to talk to them about ironmaking! But Neilson proved to be right, and the hot blast not only resulted in a great saving of fuel, but also in increased output from the furnaces.

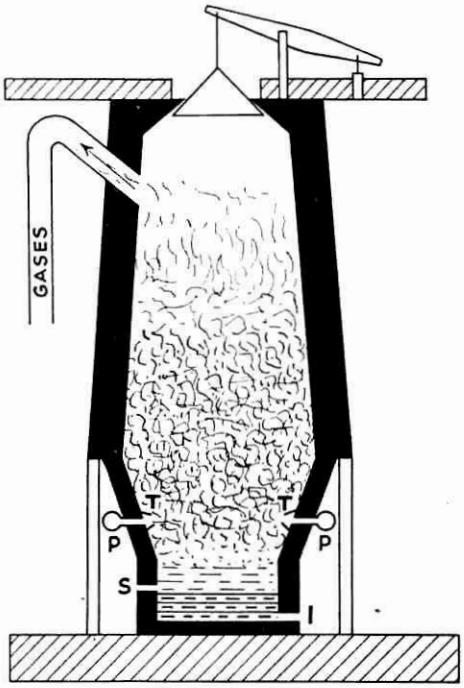


Fig. 1. Diagram of Blast Furnace
T = Tuyères S = Slag outlet
I = Iron outlet P = Blast-pipe

Making Use of Waste Gases

At first the blast was heated by passing it through pipes heated by a special furnace, but now the gases produced in the smelting furnaces, instead of being allowed to escape into the air and be wasted, are passed into what are called "regenerative" stoves, invented by E. A. Cowper about 1860. These stoves, which are upright circular chambers from 60 to 100 ft. in height and from 20 to 26 ft. in diameter, are built of steel plates with a double inner wall of firebrick. The gas from the blast furnace is passed into the stove, mixed with air and burned, the hot gases thus produced heating a brickwork stack inside the stove and then passing away through a chimney. When the brickwork is hot enough the furnace gas and the air are shut off, and the cold air from the blowing engines is driven into the stove.

In passing through the stove the blast becomes heated to a temperature of from 1,100 degrees to 1,500 degrees Fahrenheit, and is then sent direct to the tuyères in the furnace hearth. When we remember that water boils at 212 degrees, we may form some idea of what a temperature of 1,500 degrees means. The blast continues to pass through the stove until the brickwork is cooled to a certain point, and then the blast is shut off and furnace gas and air are again admitted to re-heat the stove. In order to avoid any interruption in the heating of the blast three or four stoves are arranged in a group, and one heats the blast while the others are being heated by the combustion of the furnace gas.

In Great Britain the pressure at which the blast enters the furnace varies from about 4 lb. to 12 lb. per square inch. The blowing engines are usually driven by steam, but large gas engines are also used, and in some cases the blowing plant is electrically operated. Several furnaces may be blown from one big main, or each furnace may have its own blowing engine. The latter is the modern method, its great advantage lying in

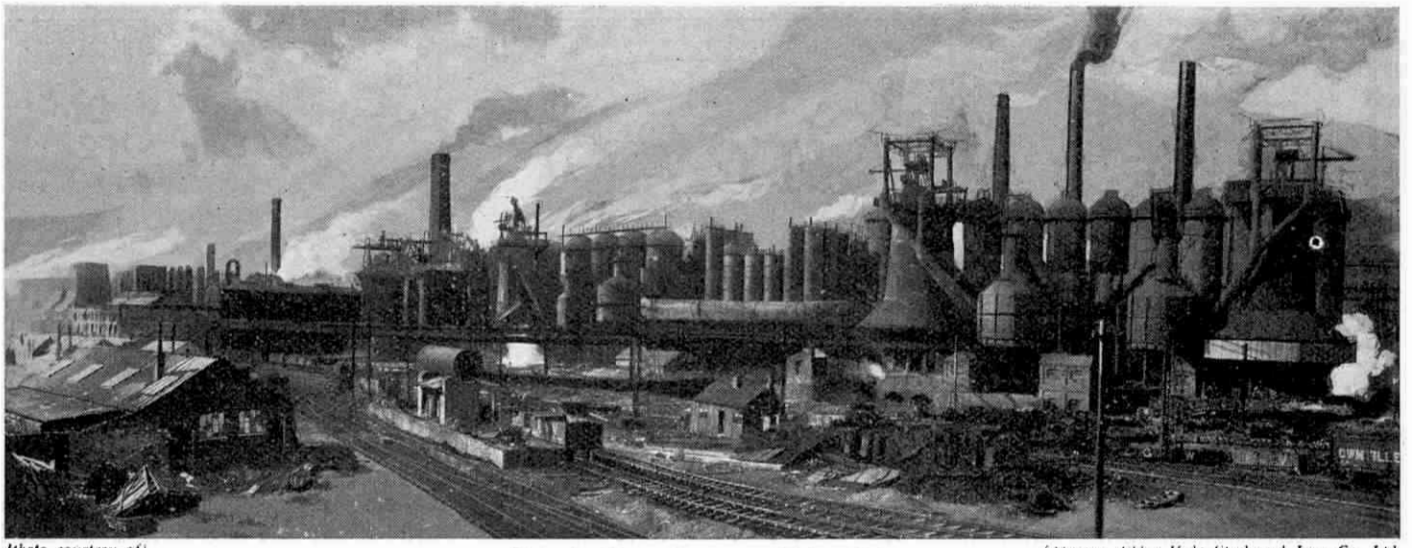


Photo courtesy of] **Victoria Blast Furnaces, Ebbw Vale** *[Messrs. Ebbw Vale Steel and Iron Co. Ltd.*

the fact that it enables the blast pressure to be adjusted to suit the varying requirements of each furnace.

The gas produced in the furnaces is not all used up in heating the blast, but there is usually sufficient of it to be burned to raise steam for the engines, or, after purification, to be used in gas engines.

What Happens in the Furnace

Let us imagine that the furnace fire is started, that a charge of ore and limestone has been put in, and the blast turned on. The full heat is not reached at once but takes some days to develop. Furnaces are kept burning day and night for months, or even years, the fires being extinguished only when repairs to the furnaces become necessary. When a furnace is started it is said to be "blown in," and when it is stopped it is "blown out."

It is easy to understand that coke is used to heat the furnace, and that iron ore is necessary to produce the iron. But why is limestone added? We have already mentioned that its use is as a "flux." In the ore are certain materials that must be got rid of in order to obtain the iron, and a flux is something that mixes readily with these unwanted materials. The actual processes that take place while the furnace is in action are too complicated to describe in detail, but roughly speaking some of these materials are drawn off in the form of gases as already described, and others mix with the limestone and form a substance called "slag." The iron and the slag fall to the bottom of the furnace, and as the iron is heavier than the slag it drops to the lowest level. The slag rests upon the iron, only mixing with it to a very small extent, both being drawn off through separate openings.

The slag is taken from the furnace in a sort of huge ladle resting in a truck. It is carried to a convenient place and tipped out, forming the slag-heaps that are such a conspicuous feature near all iron-works. A good deal of the slag is utilised for making the foundation of roads, and for laying between the "sleepers" on which railway lines are carried, in the latter case being known as "ballast."

Pig Iron

We must now see what happens to the iron. When it is drawn from the furnace in a molten state it may be run into special vessels to undergo further treatment (to be described later), or it may be run into what is called a "pig bed." This is a large bed of sand sloping gently away from the furnace. Depressions are made in the sand to act as moulds for the iron. Rows of these moulds cross the bed, and across the ends of the rows pass channels leading to the main channel from the furnace. Three or four times every 24 hours the iron is tapped by cutting away the plug of clay that closes the tapping hole. The molten metal then flows along the main channel into one of the secondary channels and so into the moulds. When all the moulds in that particular section are filled, the iron is diverted into another channel with its set of moulds, and so on.

The iron in the main channel is called a "runner," that in the secondary channel a "sow," and the moulds are called "pigs." When the metal has solidified, but is still hot, the pigs, which weigh rather more than a hundredweight each, are broken off the sows by means of heavy hammers, and the sows and runners are broken up into pieces of a convenient size to be handled.

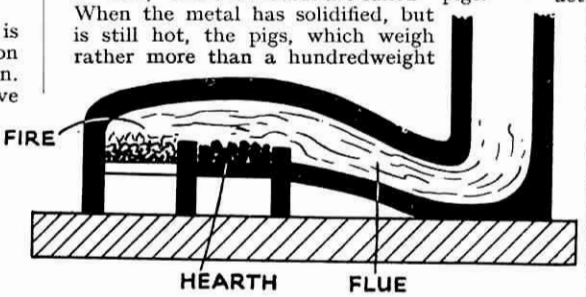


Fig. 2 Diagram of Reverberatory Furnace

Foundry Castings

The quality of the pig iron obtained in this manner varies considerably and is usually judged by breaking some of the pigs and noting the appearance of the fracture. Generally speaking, the best iron has large crystals and open grain, while inferior qualities have smaller crystals and closer grain.

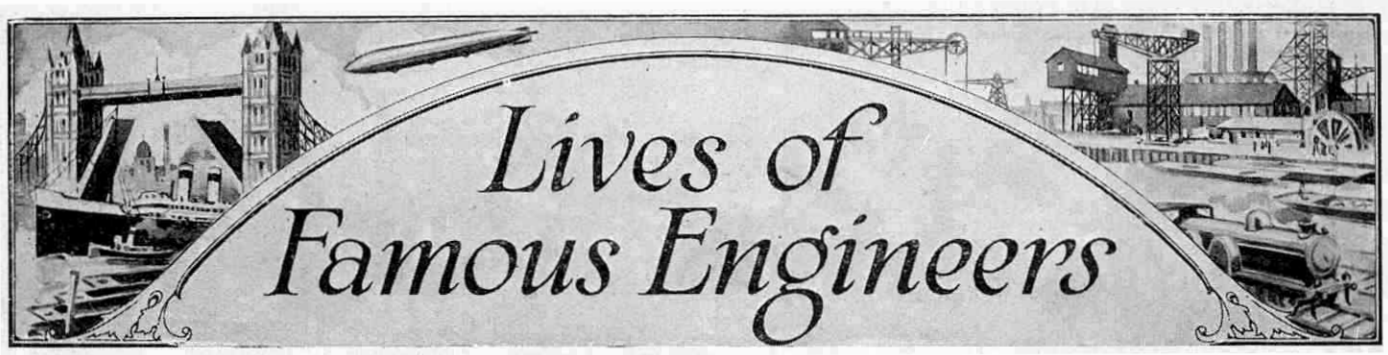
If the pig iron is not intended for steel-making, it is used, according to its quality, either for making castings or for making into "wrought" or "malleable" iron.

The higher qualities of iron are used for making castings in the foundry. The pigs are broken into pieces and are re-melted in a furnace called a "cupola," which is really a small blast furnace, and then run off into the required moulds. The best castings are made from a mixture of different qualities of iron, the choice of mixture being determined by the purpose for which the casting is intended. If a casting has to undergo a large amount of machining it is important that it should not be so hard as to cause excessive wear of the tools. On the other hand, if a casting is not to be machined, extreme hardness is of no importance.

Wrought or Malleable Iron

Wrought or malleable iron is made from the lower qualities of pig iron by a process known as "puddling." This is carried out in what is called a "reverberatory" furnace, introduced in 1784 by Henry Cort, a Lancaster man. Cort, while acting as a Navy agent, became impressed by the poor quality of British iron as compared with that from foreign countries, and he set about to try to improve the British product. The reverberatory furnace by which he achieved success, as modified by later experience, is shown in Fig. 2. It will be seen that in this furnace the iron and the fuel are not mixed together, but kept separate by a low wall. The flames, on their way to the flue, give up most of their heat to the roof of the furnace, and on account of the curved shape of the roof the heat is "reverberated" or reflected back on to the metal below. The floor of the hearth in which the iron is placed consists of an iron plate covered with "fettling," a substance such as hematite ore, containing oxide of iron. Some scrap iron is also put in, and when the hearth is heated to a high temperature pig iron, broken into small pieces, is introduced.

When the charge has melted, the impurities in the pig iron unite with the oxygen in the fettling, slag is produced, and the iron boils vigorously. A long iron bar, or "rabble" is inserted through a hole in the wall of the furnace, and the metal is thoroughly stirred in order that its impurities may be got rid of more easily. Finally the iron stiffens, and the puddler with his rabble rolls it into ball-like masses, which are then removed. The iron is immediately hammered under a powerful steam hammer, during which process the slag mixed with it is expelled, Finally the iron is rolled into bars.



V. ROBERT STEPHENSON: Builder of Railways and Bridges

In our concluding article on the work of George Stephenson, contained in last month's issue, we referred briefly to his only son, Robert. The life of Robert Stephenson was very eventful, and the story of the great engineering works he carried out is full of interest.

ROBERT STEPHENSON was born on October 16, 1803, at Willington Quay, a village on the north bank of the Tyne, about six miles below Newcastle. At the time of his birth his father was employed as brakesman at the local colliery, but about two years later the family removed to Killingworth, where the first locomotive was subsequently erected.

In 1806 Robert's mother died, and his father, remembering his own difficulties through lack of education, determined that his son should have the best education he could possibly provide for him. By a great effort he managed to send the boy to a school at Newcastle, and in the evenings father and son worked together on mechanical problems. It was in this manner that Robert learned to read a drawing of a machine as readily as he could read a page of a book.

A Shock for the Pony

Robert was as full of high spirits as any other boy, and was always ready for some fun. On one occasion, after reading the story of Benjamin Franklin's lightning experiment with a kite,* he determined to try this for himself. He expended his small savings on the purchase of about half-a-mile of copper wire, which he attached to a large kite. The lower end of the wire was insulated by a few feet of silk cord. When his kite was flying well, he brought the end of the wire just over the back of his father's pony, which was tied to a railing waiting for its master to come out of the cottage. The result was that the pony received a shock so severe that it was nearly knocked over! George Stephenson came out of the cottage in time to see this performance, and though he called Robert a mischievous scoundrel, he was secretly delighted at the success of the experiment.

Robert Goes to Edinburgh

Robert left school in 1819, and became an apprentice at the Killingworth Colliery. The experience he gained there was very valuable to him, but his father was anxious that he should have a proper training in technical science. Consequently, Robert left the Colliery in 1822 and went to Edinburgh University, where he studied very hard for six months, giving special attention to Chemistry and Geology.

On his return to Killingworth he had acquired what was in those days a good technical education and this was backed by practical experience at the Colliery. He gained further valuable engineering knowledge by assisting his father in the preliminary survey for the Stockton and Darlington Railway, and by then felt ready to launch out for himself.

Mining in South America

An opportunity occurred for him to go to South America to take charge of the engineering operations of the Colombian Mining Association. He decided to accept the offer, and sailed for South America in 1824. After landing at La Guayra, Venezuela, he began a remarkable journey of over 1,200 miles, entirely on mule-back. This journey made a great impression upon him, and in later years he used to speak in enthusiastic terms of the wonders of mountain and valley that were revealed to him. Finally he reached Bogota, and after an interview with the commercial manager of the mining company, he went on to the site of his intended labours on the eastern slopes of the Andes.

Opening-up an Ancient Mine

After a long and careful survey of the region, he decided to commence operations at an ancient mine that had been worked in bygone days by the Spaniards. The old workings were completely overgrown and lost, and everything had to be begun over again. The task of cutting roads and opening-up the mine was not to the liking of the native labourers, and Stephenson had a great deal of trouble with them. If they were not watched continually they deserted in large numbers. A party of Cornish miners were on the way out from England, and Stephenson hoped that on their arrival matters would improve, but they turned out to be even more troublesome than the natives. They were a quarrelsome, drunken lot, and at times quite unmanageable.

Stephenson stuck to his task, however, and by great efforts contrived to keep the work going. The harassing nature of his position was so aggravated by hostile criticism of his reports to the Board of the Company at home, and by attacks of fever that made him very weak, that he determined to leave at the end of his engagement, which was for three years. As soon as his decision reached London great efforts were made to induce him to remain, but another attack of fever, together with the fact that his father wanted his assistance, strengthened his decision to return home.

A Strange Meeting

In 1827 Stephenson left for the port of Cartagena, intending to proceed at once to New York, but he had to wait a long time for a ship. The delay worried him very much, especially as yellow fever had ravaged the town. While sitting one day in the public room of the hotel at which he was staying, he noticed two men whom he saw at once were English. One of them was a tall thin man, very shabbily dressed, and apparently in poverty. On inquiry Stephenson was astonished to learn that his was Trevithick, the builder of the first railway locomotive.

Trevithick had left England in 1816, taking with him steam engines for draining and working mines in Peru. He was received with the wildest enthusiasm on his arrival at Lima, and it was actually proposed to erect a statue of him in solid silver! Afterwards, however, everything went wrong with his schemes, and he learned the bitter truth of the Spanish proverb: "A silver mine brings misery, a gold mine ruin!" Trevithick and his friend had lost everything during their journey across country from Peru. They had forded rivers and wandered through forests, finally arriving at Cartagena practically penniless. Stephenson lent Trevithick £50 to enable him to reach England, and eventually he arrived safely at his home in Cornwall.

A Stormy Voyage

At last a ship arrived at Cartagena and Stephenson set sail, but he had to pass through a terrible experience before he reached New York. He gave a graphic account of his voyage in a letter to a friend:—"At first we had very little foul weather, and indeed were for several days becalmed amongst the islands, which was so far fortunate, for a few degrees further north the most tremendous gales were blowing, and they appear—from our future information—to have wrecked every vessel exposed to their violence. We had two examples of the effects of the hurricane, for, as we sailed

* Described in last month's "*M.M.*" (p. 133).

north, we took on board the remains of two crews found floating on dismantled hulls. The one had been nine days without food of any kind, except the carcasses of two of their companions who had died a day or two previously from fatigue and hunger. The other crew had been driven about for six days, and were not so dejected, but reduced to such a weak state that they were obliged to be drawn on board our vessel by ropes. A brig bound for Havannah took part of the men, and we took the remainder.

"To attempt any description of my feelings on witnessing such scenes would be in vain. You will not be surprised to learn that I felt somewhat uneasy at the thought that we were so far from England, and that I also might possibly suffer similar shipwreck, but I consoled myself with the hope that fate would be more kind to us. It was not so much so, however, as I had flattered myself; for on voyaging towards New York, after we had made the land, we ran aground about midnight. The vessel soon filled with water, and, being surrounded by the breaking surf, the ship was soon split up, and before morning our position became perilous. Masts and all were cut away to prevent the hull rocking, but all we could do was of no avail. About eight o'clock on the following morning, after a most miserable night, we were taken off the wreck, and were so fortunate as to reach the shore."

Stephenson Returns to England

Stephenson was none the worse for his trying experience, and after a short tour in the United States and Canada he took ship for England and arrived safely at Liverpool. By this time the Liverpool and Manchester Railway was nearing completion, and the heated controversy had begun as to how the trains should be drawn. The ultimate triumph of the "*Rocket*," with the resulting decision of the promoters to employ locomotives, was described in the article on George Stephenson in our last month's issue.

While the works of the Liverpool and Manchester Railway were proceeding, George Stephenson was asked to undertake the construction of a short line of about 16 miles in Leicestershire, to open up communication between Leicester and the colliery districts in the western part of the county. As he had already 30 miles of railway in hand, he felt that he could not undertake any further work, but he recommended his son for the post. Robert was appointed, and towards the end of 1830 commenced the construction of the line. The engineering difficulties, with the exception of one tunnel, were comparatively slight, and the work was successfully carried out.

Constructs the London—Birmingham Railway

Robert Stephenson now came into prominence in connection with a much bigger undertaking—the construction of a railway between London and Birmingham. George Stephenson was consulted as to the route, and was then appointed engineer of the line in conjunction with his son. This project met with even stronger opposition than the Liverpool and Manchester line. Canal proprietors, landowners and road trustees combined to fight against it, and a bitter struggle followed. Pamphlets were published warning the public to beware of the scheme, and the promoters were held up to ridicule as being only fit for a madhouse. Public meetings were held in every county through which the line would pass, and strong resolutions against it were carried unanimously.

Robert Stephenson

The opposition of the landowners was so strong that it was extremely difficult to make the survey, and at some points the work had to be done secretly at night by the aid of lanterns. Robert Stephenson stuck to the work with the dogged perseverance he had inherited from his father, and in his anxiety to make sure of selecting the best line he walked the whole distance between London and Birmingham more than twenty times!

The Bill for the railway came before Parliament in 1832, and passed through the House of Commons but was thrown out by the House of Lords. Nothing daunted, the promoters presented another Bill in the next session, and this time it passed both Houses almost without opposition. The explanation of this sudden change appeared later, when it became known that the promoters had agreed to pay landowners about £750,000 for land originally estimated at £250,000! The preliminary difficulties having been surmounted, no time was lost in commencing operations. Robert Stephenson, with the consent of his father, was now appointed sole engineer, and by the beginning of 1840 work was in satisfactory progress.

Difficulties of Construction

The length of the line to be constructed was about 112 miles, and the engineering difficulties proved to be very great. Huge excavations had to be made in order to construct a level road from valley to valley. Among these was the Tring cutting, which is 2½ miles in length, and for a quarter of a mile is 75 ft. in depth. Another great work was the Blisworth cutting, which is 1¼ miles in length and in places 65 ft. in depth, passing through stiff clay and hard rock. A million cubic yards of material were dug, quarried or blasted out of this cutting, and 800 men and boys were employed on the work.

Eight tunnels were constructed on this line, their total length being 7,336 yards. The chief difficulty was encountered in the tunnel under Kilsby Ridge, a few miles from the scene of the battle of Naseby. During the excavation it was unexpectedly found that an extensive bed of quicksand existed under a bed of clay 40 ft. in thickness, lying between two trial shafts that had been sunk. Work was proceeding at the bottom of one of these shafts when the roof suddenly gave way. A deluge of water burst in, and the workmen were only saved from death by means of a raft, on which they were towed by one of

Robert Stephenson's Tubular Bridge at Conway

Illustration shows Conway Castle and the Tubular Bridge. Beyond are the towers and supporting chains of the Suspension Bridge

(Cont. on page 165)

BUILD YOUR OUTFIT INTO A No. 6

WITH

MECCANO

ACCESSORY OUTFITS

For convenience, Meccano parts are sold in nine Outfits of varying size, numbered 00 to 7. The quality and finish of the parts are of the same high standard throughout the series, but as the Outfits increase in size they contain larger quantities and greater varieties of parts. Each Outfit may be converted into the one next higher by the purchase of an Accessory Outfit. Thus, if a No. 2 is the first Outfit bought, it may be converted into a No. 3 by adding to it a No. 2a. A No. 3a would then convert it into a No. 4, and so on up to No. 7. In this way, no matter with what Outfit you commence, you may build up by degrees to a No. 7 and so be able to make *all* the many hundreds of models shown in the Books of Instructions.

PRICE LIST

Complete Outfits

No. 00	3/6
No. 0	5/-
No. 1	8/6
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/-

No. 5 Outfit. This Outfit builds 309 splendid working models. A No. 5a Outfit, costing (carton) 50 /– or (wood) 80 /–, converts this Outfit into a No. 6, with which 360 models may be built.

PRICE LIST

Accessory Outfits

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/-

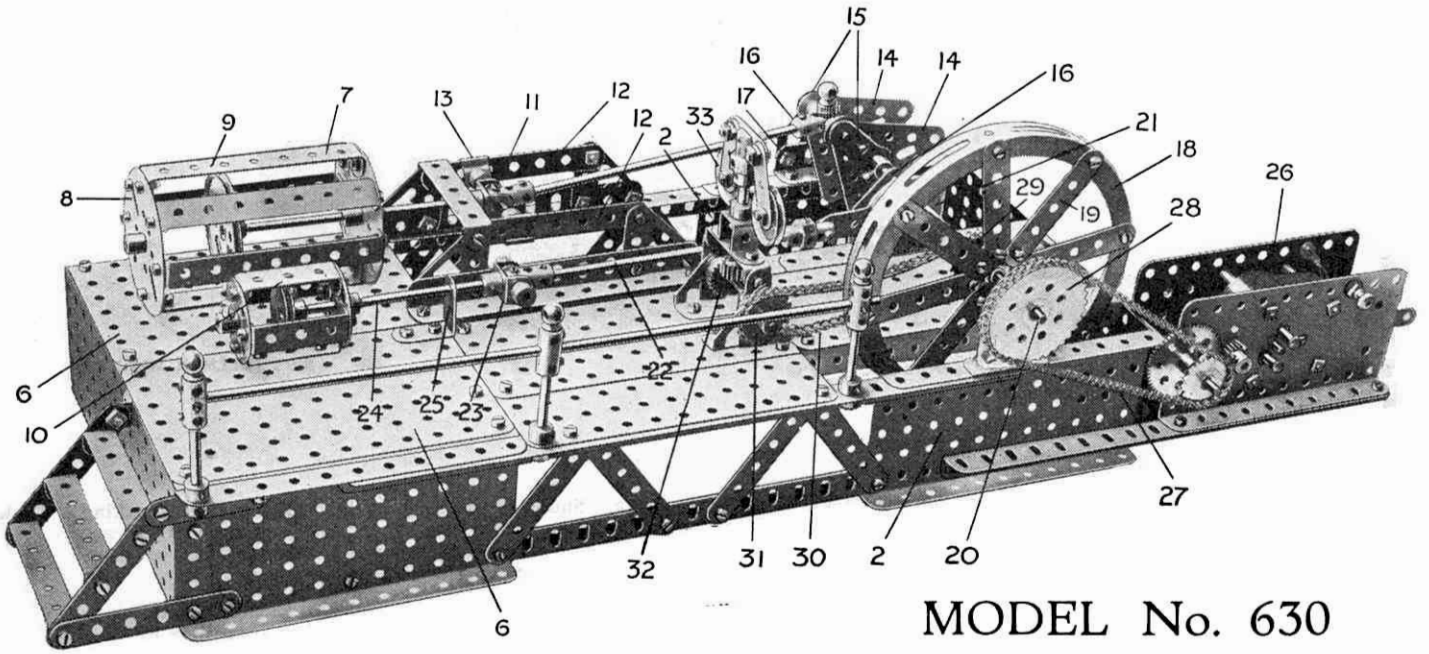
BUILD BIGGER AND BETTER MODELS

No. 6 Outfit. This Outfit builds 360 splendid working models. A No. 6a Outfit, costing 210 /– in splendid oak cabinet, converts this Outfit into a No. 7, with which any Meccano model may be built.

ACCESSORY OUTFITS ARE OBTAINABLE FROM ANY MECCANO DEALER

MECCANO LTD. Binns Road LIVERPOOL

A NEW MECCANO MODEL



MODEL No. 630

Horizontal Steam Engine

THIS month we have chosen as the subject of our new model a horizontal steam engine of the single-cylinder type, such as may be seen driving machinery in mills or factories. In this engine steam is admitted to the cylinder first at the front of the piston and then at the back. The piston is thus pushed alternately backwards and forwards, and from this movement such engines are called "reciprocating." The type of reciprocating engine illustrated is one of the simplest, and yet in spite of its simplicity the combined efforts of many inventors were necessary to produce it.

It is interesting to go back to the early days of the steam engine and see how it has developed, step by step, from a mechanical curiosity to a perfect working apparatus.

First Practical Steam Engine

James Watt is commonly regarded as the inventor of the steam engine, but as a matter of fact a number of engines using steam had been produced before his time. Watt's great work lay in bringing the steam engine to a state of practical perfection.

The idea of using steam in a cylinder appears to have originated with Denis Papin, a Frenchman, and about the year 1688 he constructed a working model to illustrate his idea. The first really practical engine was constructed in 1710 by Thomas Newcomen, an Englishman, and it was used as a pumping engine. It consisted of a vertical steam cylinder, the piston of which was connected to one end of a beam pivoted in the middle. The other end of the beam was attached to rods working the pump. Around the cylinder was a jacket, to which cold water could be supplied.

When the piston in the working cylinder was at the top of its stroke, being raised by the weight of the pump rods, steam was admitted to the cylinder so as to drive out all the air. The steam was then shut off and cold water was admitted to the outer jacket. This condensed the steam in the working cylinder so that a partial vacuum was produced, and atmospheric pressure forced the piston down, thereby raising the pump rods. Each time this occurred one stroke of the pump was made and the operation was then repeated. Newcomen's engine, improved later in some details by its inventor, was used extensively in pumping water from mines. It will be seen that the engine was not a true steam engine, for the forcing down of the piston was done by atmospheric pressure.

James Watt's Great Idea

A model of the Newcomen engine came into the hands of James Watt for repair, and while engaged on this task he hit upon the idea on which the modern steam engine is based.

In the Newcomen engine the working cylinder was first heated by steam and then cooled by water to condense the steam. Watt saw that this alternate heating and cooling resulted in a great waste of energy, and endeavoured to find some means of keeping the cylinder at an even temperature. It took him a long time to solve the problem, but at last he succeeded by condensing the steam in a separate vessel, instead of in the working cylinder itself.

Talkative Workman Causes Trouble

Watt's improved engine, patented in 1769, was used entirely for pumping, as Newcomen's had been. In 1781 Watt took out another patent for an engine in which the reciprocating motion of the piston was converted into rotary motion, so that ordinary machinery could be driven. Watt had intended to obtain this rotary motion by means of the now familiar crank and flywheel, but he found himself prevented from doing so because a Birmingham button-maker named James Pickard had succeeded in obtaining a patent for this device a few months previously. Pickard apparently got the idea from one of Watt's workmen, who had been talking too freely and bragging about the great things that the rotary engine was going to accomplish.

Watt was very angry when he found what had happened, and for a while he was puzzled to overcome the difficulty thus created. He determined not to be beaten, however, and after trying various schemes he decided to use a device invented by his best workman, William Murdock. This device was called the "sun-and-planet" motion, and was utilised on Watt's rotary engines until Pickard's patent expired, after which the simpler and more efficient crank and flywheel were substituted.

Watt's Final Improvements

Up to this time Watt's engines were "single acting"—that is to say the

A New Meccano Model (*cont. from page* 151)

cylinder was connected to the condenser only on one side of the piston, so that work was only performed during one stroke of the piston. In 1782 Watt took out a patent for connecting the cylinder to the condenser both back and front of the piston, thus making the engine "double acting," and consequently much more efficient.

In the same year he obtained another patent for a method of securing greater economy in the use of steam. The principle involved in this final improvement was that of shutting off steam from the cylinder when the piston had only travelled part of its journey, and leaving the rest of the thrust to be carried out by the expansion of the steam.

The brilliant inventions we have briefly described were Watt's chief contributions towards the perfecting of the steam engine. Watt found the steam engine a clumsy mechanism, very inefficient and wasteful of fuel, and only capable of working a pump. Through his inventions it became efficient and economical, and capable of working machinery of almost every kind.

Constructing the Model

This fine new model of a Horizontal Steam Engine may be made with a No. 6 Outfit, and its construction presents no difficulty. Begin by building the platform, an underneath view of which is shown in Fig. A.

Parts required for Construction of Meccano Model 630 Horizontal Steam Engine

2	of No.	3	1	of No.	13	1	of No.	29	2	of No.	63b
11	"	4	2	"	14	160	"	37	3	"	70
8	"	5	1	"	15	20	"	38	2	"	76
1	"	6	1	"	15a	1	"	45	26	"	94
5	"	6a	2	"	16	4	"	48	1	"	95
7	"	8	2	"	16a	4	"	48a	3	"	96
1	"	8a	5	"	17	6	"	48b	2	"	109
3	"	9	2	"	18a	2	"	50	2	"	116
1	"	9d	1	"	20a	7	"	52	1	"	118
3	"	9f	1	"	22	2	"	52a	2	"	126
4	"	10	2	"	22a	4	"	53	3	"	126a
2	"	11	3	"	24	16	"	59	4	"	133
2	"	12	3	"	26	4	"	62	3	"	136
1	"	12a	2	"	27a	6	"	63	1	4-volt Elec. Motor	

Three 12½" girders (1) are bolted to rectangular plates (2) at each end of the frame, other 12½" girders (3) being bolted to the remaining flanges of the girders. The ends of the bed frame are formed by small rectangular plates (4), and 3" strips (5) brace the inner part of the frame.

As shown in the illustration on page 151, a portion of the top of the bed frame is enclosed by flat plates (6), and on these is bolted the cylinder (7) formed of face plates (8) connected by 3½" double angle strips (9). The valve-casing (10) is formed of bush wheels connected by 1½" double angle strips and is also bolted to the bed frame.

The cross-head (11), the construction of which will be followed from the illustration, is guided on the strips (12) by eye pieces (13) at each side. The crank is made up of triangular plates (14) representing the balance weights, secured to cranks (15). The main or crank shaft (20) is journalled in flat trunnions (16) secured to 1½" girders (17), which are in turn bolted to the flanges of the rectangular plates (2).

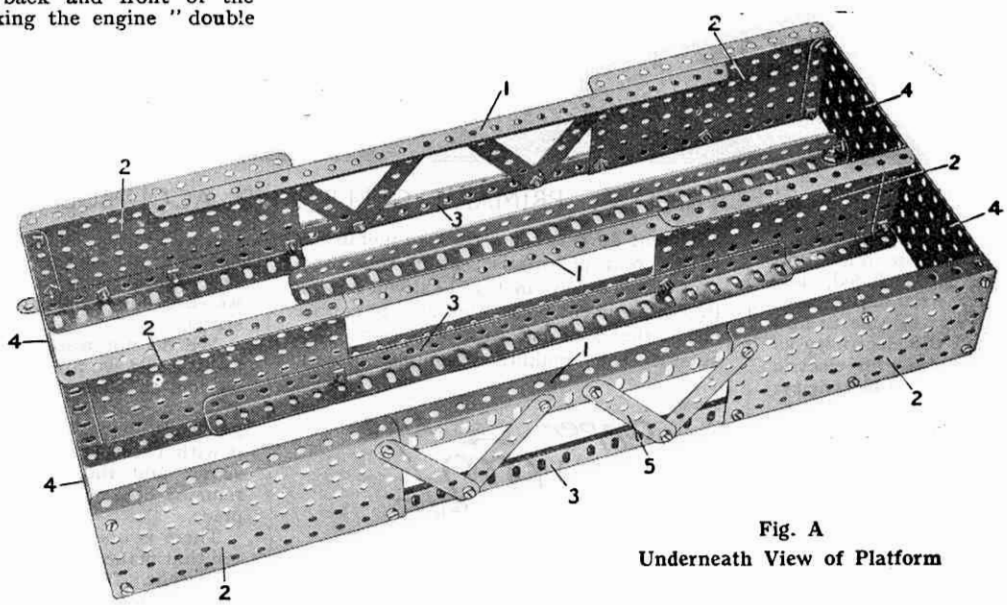


Fig. A
Underneath View of Platform

Driving Details

The fly-wheel is made of a large wheel flange (18) connected by strips (19) to a bush wheel secured to the shaft (20). The eccentric (21) is pivotally connected by a rod (22) to the fork piece (23) on the valve rod (24), which slides in the 1" angle bracket (25). The motor (26) drives by sprocket chain (27) a 2" gear wheel (28) on the shaft (20). A 1" sprocket wheel (29) drives, by sprocket chain (30), another 1" sprocket wheel (31) in the governor.

A contrate wheel (32) on the rod of the sprocket wheel (31) drives a ½" pinion on the vertical rotating rod of the governor, the weights of which are formed by two pulley wheels (33) pivotally hung by 1½" strips, lock-nutted in the outer holes of a horizontal 1½" strip. This strip is bolted in the slot of an octagonal coupling secured to the top of the vertical rod of the governor.

In the operation of an engine such as the model represents, the valve (10) controls the admission of steam to each end of the cylinders (7), thus causing the crank shaft (20) to be driven. When the engine speed increases too much, the weights (33) of the governor fly out and shut off steam, causing the engine to slow down again. The governor thus keeps the engine speed constant.

The Meccano Clock

Full instructions for building the Meccano Clock are now available in the form of a beautifully-printed leaflet, with numerous illustrations. This will be sent, post free, to any address, price 4d. Similar leaflets dealing with the Meccano Chassis and Loom are also in stock, price 4d. each, post free. If ordered at the same time a copy of each leaflet will be sent, post free, price 10d. the three.

Interesting Paragraphs

Duct Keels for Liners

It is reported that two Orient liners are to be fitted with duct keels. The chief advantage of this system is the fact that the water-tight bulkheads have not to be pierced for piping, and the ship is therefore more seaworthy should any collision occur.

* * * *

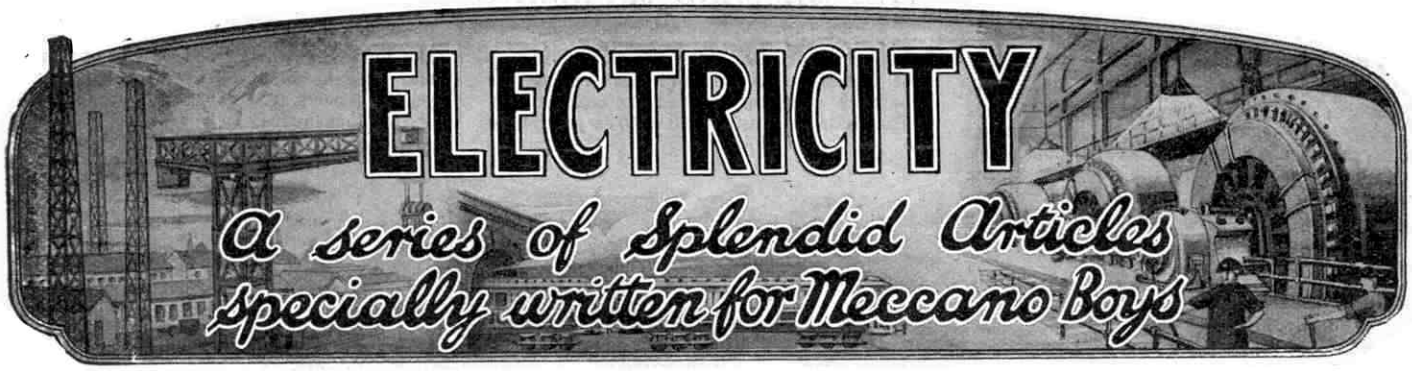
A Powerful Overhead Travelling Crane

An overhead travelling crane recently installed in the River Rouge repair shop of the Detroit, Toledo and Ironton Railway at Detroit, Mich., lifts a locomotive weighing 100 tons and turns it end for end in one minute. The grab has two sets of falls spaced 7 ft. apart, and is mounted on a turntable.

* * * *

Hydraulic Tunnel at Niagara

The new hydraulic pressure tunnel of the Niagara Falls Power Company, which has cost some £500,000 to construct, was recently opened for public inspection. This tunnel, which is 4,300 ft. in length and has a diameter of 32 ft. with a 2 ft. thick concrete lining, runs from an intake on the upper river, half a mile above the Falls, to another intake on the banks of the lower Gorge. The tunnel carries a volume of water sufficient to operate three hydro-electric power units, each of 70,000 horse-power capacity, in the power-house addition below the Gorge bank.



IV. CURRENT ELECTRICITY: PRIMARY CELLS AND ACCUMULATORS

IN our previous article we saw that if a metal rod is held in the hand and rubbed, electricity is produced, but it spreads at once over the rod and escapes through the hand. If we are able to find some means of renewing the electricity as fast as it escapes, we obtain an electric current, or a continuous flow of electricity.

Voltaic Cells

Fig. 17 is a diagram of a Voltaic Cell, from the name of its originator, Volta, whom we have already mentioned. The cell consists of a glass jar containing water to which has been added a little sulphuric acid. Two metal strips, one of zinc and the other of copper, are placed in the jar as shown at Z and C. If the two strips are connected by a piece of wire, an electric current flows in the direction indicated by the arrows. The current is produced by a difference of "electrical potential" between the zinc and the copper.

Electrical Pressure

To understand the meaning of electrical potential we may make use of a simple illustration with water. If we pour water into a vessel, a certain amount of water pressure is produced. This could be made to do work by allowing the water to flow out through a small opening in the vessel on to a model water wheel. The amount of pressure available depends upon the height of the water, and this again depends upon the quantity of water and the capacity of the vessel, for it is clear that a certain quantity of water will reach a greater height in a small vessel than in a larger one.

A certain quantity of electricity in a conductor produces a certain electric pressure, the amount of this pressure depending upon the quantity of electricity and the electrical capacity of the conductor, for, as in the case of water vessels, conductors vary in capacity. This electrical pressure is called "potential." Water always tends to flow from a high level to a lower level, and in the same way electricity tends to flow from a conductor of high potential to one of lower potential.

The whole subject of electrical potential is complicated, but to put the matter in the simplest way, we regard a positively electrified body as being at a relatively high potential, and a negatively electrified body as being at a relatively low potential. We assume, therefore, that an electric current flows from a positive conductor to a negative conductor.

When we connect by a wire the two strips of metal in a voltaic cell, a current flows because the two metals are at different potentials. From the direction of the arrows in Fig. 17 it will be seen that the current flows from zinc to copper inside the cell, and from copper to zinc outside, thus making a complete round

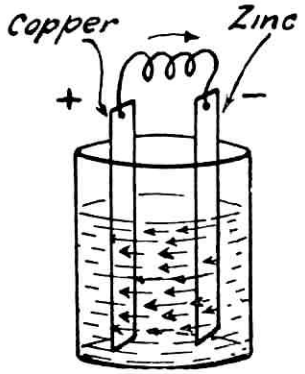


Fig. 17. Voltaic Cell

called a "circuit." If we break the circuit by disconnecting the wire, the current ceases to flow. The copper strip where the current leaves the cell is called the positive pole, and the zinc strip the negative pole.

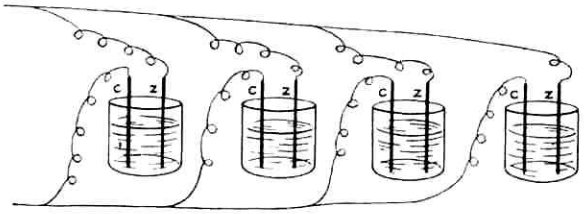


Fig. 18. Connecting in Parallel

Chemical Action

The difference of potential between the two strips is maintained by chemical action between the zinc and the acid, resulting in weakening the acid and eating away the zinc. The current continues to flow as long as this chemical action goes on. When we wish to stop the current, we disconnect the wire joining the metal strips.

We do not want the zinc to be eaten away while we are not using the cell, but we find that chemical action still goes on. We can stop this, however, by "amalgamating" the zinc, that is, by covering it with a thin coating of mercury or quicksilver, and then as long as the circuit remains broken, no chemical action takes place.

There is one great defect in the voltaic cell that makes it almost useless as a source of current. This defect is that the current it produces does not remain at full strength, but soon begins to weaken rapidly. This weakening is caused by bubbles of hydrogen gas which gather on the surface of the copper strip during the chemical action. These bubbles soon form a film on the copper, and they weaken the current partly by offering increased resistance to its flow, and partly by trying to set up another current in the opposite direction. A cell in this condition is said to be "polarized."

Types of Cells

Many cells have been devised to reduce or prevent polarization. One of the most effective of these is the "Daniell" cell. This consists of an outer vessel of glass containing a circular copper plate. Inside this plate stands a round pot of unglazed porous ware, in which is a rod of amalgamated zinc. The outer vessel is filled with a very strong solution of copper sulphate, and the porous pot with dilute sulphuric acid. When the circuit is closed and the current flows, the hydrogen set free by the action of the zinc on the acid passes through the porous pot into the outer vessel. Here another chemical action takes place, resulting in the splitting up of the copper sulphate solution into copper and sulphuric acid. There is now no free hydrogen to cause polarization, and instead of gas, pure copper is deposited on the copper plate.

Much more familiar than the Daniell is the Leclanché cell, used for ringing electric bells. In this cell carbon is used in place of copper. In the outer glass jar is a zinc rod immersed in a solution of sal-ammoniac. The inner porous pot contains a carbon plate surrounded by a mixture of crushed carbon and manganese dioxide. Hydrogen is liberated by the chemical action in the outer jar, but before it can reach the carbon plate and cause

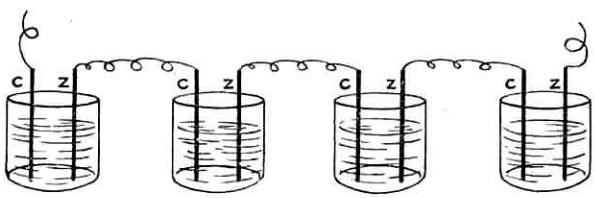


Fig. 19. Connecting in Series

polarization, the oxygen in the manganese dioxide combines with it. If the cell is used to give current continuously for several minutes, the hydrogen is produced faster than the manganese dioxide can deal with it, and the cell becomes polarized, but recovers completely after a short rest.

The so-called "dry" cells are the most popular of all to-day. They are not really dry, if they were there would be no current. They are simply Leclanché cells in which the liquid is absorbed into a moist paste. For convenience, the outer vessel is made of zinc, to serve instead of the zinc rod, and there is no porous pot, the space between the zinc vessel and the carbon plate in the middle being filled with the paste. The cells are sealed at the top, and are placed inside closely-fitting cardboard tubes. The great advantage of dry cells is the ease with which they can be carried about and placed in any position. Millions of tiny dry cells are used in pocket flash lamps.

How a Current is Measured

We must now learn something about the manner in which an electric current is measured. We know that water flows from the reservoir to our houses on account of a difference of level, which produces a water-moving or water-motive force. In a similar manner a difference of electric potential, such as exists between the plates of a voltaic cell, produces an electricity-moving or electro-motive force, which is measured in "volts." The rate of flow of water in a pipe is stated in gallons per second, and the rate of flow of an electric current is stated in "amperes." To put the matter briefly, volts represent the electric pressure at which a current is produced, while the current itself is measured in amperes.

Water flowing through a pipe is resisted by friction against the walls of the pipe. In the same manner, an electric current meets with resistance, although of a different nature. The amount of this resistance is small in a good conductor, but very great in a bad conductor. It is also greater in a thin wire than in a thick one, and greater in a long wire than in a short one.

Resistance is measured in "ohms." The resistance of a circuit must be overcome by the electro-motive force before a current is able to flow, and the definition of a volt is that electro-motive force which will cause a current of one ampere to flow through a conductor having a resistance of one ohm. These three units of measurement are named respectively after the three famous scientists, Alessandro Volta, André Marie Ampère and Georg Simon Ohm.

Batteries of Cells

A single voltaic cell gives us an electro-motive force of from one to two volts, according to its type. A Leclanché cell, and a dry cell for instance, give about 1½ volts, and a Daniell cell about one volt.

Many people speak of a single voltaic cell as a "battery." This is quite wrong, for a battery consists of a number of cells coupled together. Different methods of coupling produce different results. If we connect all the positive poles and all the negative poles of several Daniell cells—that is, copper to copper and zinc to zinc—we get a much larger current, but no more electro-motive force than from one cell. That is to say, we get more amperes but no more volts. This arrangement, shown in Fig. 18, is called connecting in "parallel." If we connect the positive pole of one cell to the negative

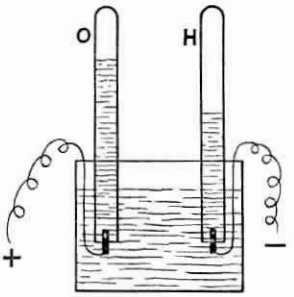


Fig. 20

pole of the next—or copper to zinc throughout—we add together the electro-motive forces of all the cells, but the amount of current is no greater than that of one cell. In other words, we get more volts, but no more amperes. This method is called connecting in "series," and is shown in Fig. 19. It is also possible to increase both volts and amperes by means of a combination of the two methods.

Accumulators

The cells we have already described are called "primary" cells and are quite different from "secondary" cells, or accumulators. Accumulators act as storage tanks, from which we may draw a supply of current whenever we want it, and which will give a much heavier current than any primary cell.

If we pass a current through water to which has been added a little sulphuric acid to increase its conducting power, the water is split up into the two gases of which it is composed—hydrogen and oxygen. An apparatus for demonstrating this (shown in Fig. 20) consists of a glass vessel having two strips of platinum, called "electrodes," which are connected to a battery of Daniell cells (not shown). Two tubes, closed at one end, are filled with the acidulated water and inverted over the platinum strips. When the current flows, the water is decomposed. Oxygen is formed at the strip connected to the positive pole of the battery, and hydrogen at the other strip, and each gas rises into the tube above it, displacing the water. Almost exactly twice as much hydrogen as oxygen is produced, and the process is called the "electrolysis" of water.

A voltaic cell, as we have seen, is liable to trouble through polarization, caused by hydrogen collecting on one of the plates and trying to set up another current in the opposite direction. In the electrolysis of water a similar opposing electro-motive force is set up, and when the battery current is stopped and the platinum strips are connected, a current begins to flow in the reverse direction, and continues to flow until the two gases have recombined, and the strips are once more in their original state. In this way the apparatus acts as an accumulator, for an electric current is supplied to it, and it gives back another current. It is important to understand that this apparatus—as is the case with all other accumulators—does not actually store up electricity, but energy. We may say that the electrical energy supplied to it is converted into chemical energy, and that this chemical energy is then converted back again into electrical energy. For practical purposes, however, this apparatus is not of much service.

The First Successful Accumulator

The first really useful accumulator was made in 1878 by Gaston Planté. The electrodes consisted of two strips of sheet lead made into a roll, but not touching each other, and placed in dilute sulphuric acid. A current was passed through, first in one direction and then in the other, and after several reversals of current one lead plate was found to be changed into a spongy condition, and the other was coated with peroxide of lead. This process is called "forming." When the process was complete, the accumulator was ready to be charged and used. During the charging oxygen was taken from one lead plate and transferred to the other. During discharge, that is while the accumulator was being used to supply a current, this oxygen went back to its original place, and the current continued until the surface of both lead plates became chemically inactive. The accumulator, of course, could be charged and discharged over and over again.

Very many improvements have been made in accumulators since the time of Planté, but the working principle remains the same. All modern accumulators, except the very smallest, have several pairs of plates, all the positive plates being

(Cont. on page 156)

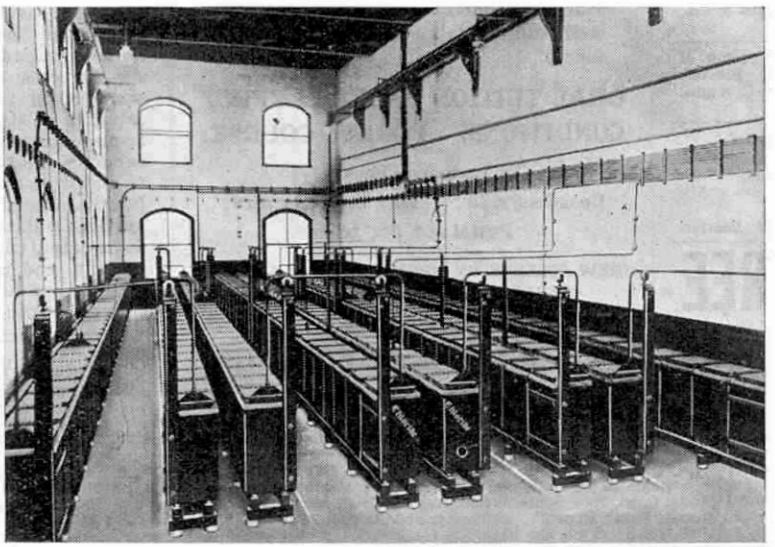


Photo by [*Messrs. Chloride Electrical Storage Co. Ltd.*

Battery of 264 cells at Blackburn Electricity Works. Capacity 1,400 ampere hours

"*M.M.*" Back Numbers

In the advertisement columns of the "*M.M.*" a reader recently offered 2/6 per copy for certain early numbers of the "*M.M.*" in order to complete his file. This offer indicates the value placed upon the "*M.M.*" by Meccano boys, and we suggest that you should see that your file of copies is complete. Have your Magazines tastefully bound by some local bookbinder or keep the Magazines in the special spring-back binder illustrated here. This binder has a strong stiff back, holds a large number of copies, and keeps them neat and clean. Covered in black imitation leather, tastefully tooled, lettered gold, its price is 3/- (post free) from—

MECCANO LTD.
BINNS ROAD - LIVERPOOL.

Electricity—(*cont. from page* 155)

connected together, and all the negative plates together. This has the same effect as connecting voltaic cells in "parallel," that is more current is produced.

The electro-motive force of a single accumulator cell is about two volts, and in order to get a higher voltage several cells are connected in "series." Accumulators are rated as regards their current-giving capacity in "ampere-hours." For example, an accumulator that will give a current of six amperes for one hour, or of three amperes for two hours, is said to have a capacity of six ampere-hours. Sometimes accumulators are rated by their "ignition" capacity, that is their capacity when used to supply current for ignition purposes in petrol motors. The ignition capacity of an accumulator is about twice as great as its actual capacity for supplying a steady current, and in buying an accumulator it is necessary to make sure that the capacity stated is actual ampere-hours.

NEXT MONTH:—
MAGNETS

PERFORATIONS

When the first postage stamps were issued by Great Britain in 1840 they were supplied in unbroken sheets, with no aid to assist in detaching an individual stamp from its neighbours. Consequently, postal officials and correspondents were compelled to cut the stamps apart as best they could, and we can readily imagine the resulting bother and waste of time, especially when no scissors were available! To prevent this, perforating was introduced.

A Useful Invention

One evening Henry Archer, a newspaper reporter, was sitting at the reporters' table of a London newspaper when he saw that another reporter, wishing to stamp a letter he had written, was pricking a series of holes in the space between the stamps with the aid of a pin, being unable to find either knife or scissors at the time. In this way he was able to separate a stamp from the others with accuracy and ease.

Fig. 1. Perforation Gauge

Archer was a man who had cultivated the habit of noticing small things, and he at once realised how great would be the benefit to the public if stamps could be sold ready "pricked." Within a very few weeks he designed a machine for perforating stamps and put it before the interested but critical Post Office authorities, who lent him sheets of stamps to experiment upon. Stamps perforated by Archer during these trials are exceptionally interesting to stamp collectors, for they

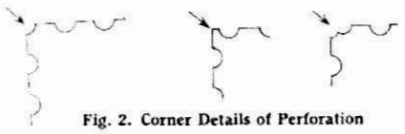


Fig. 2. Corner Details of Perforation

serve to illustrate the invention of what is practically the only improvement that has been made to stamps since they were first used. These experimental stamps are very rare, the lowest-priced of the three varieties being quoted at 50/- and the highest at £20.

Archer at last made a machine that satisfied requirements, and our first officially perforated stamp was sold on January 28, 1854. Since this date the majority of the stamps of the world have been issued perforated, and it is not very often that one can find a current stamp imperforate.

Difficulties of Perforating

There are two methods of treating the paper to enable the stamps to be separated easily. These are known as "perforation" and "roulette." In perforating a portion of the paper is actually removed, while in rouletting the paper is merely pricked or cut, no portion being removed.

To perforate stamps is not as simple a matter as might be supposed. At first thought it would seem that a large number of small punches could easily be arranged to perforate a whole sheet of stamps at one blow, there being holes drilled in the table below to receive the punches and the tiny discs of paper they would remove. Machines of this nature have been made and are called Harrow perforators, but in practice the punches continually break off and the holes in the bedplate as often become clogged with the little discs of paper.

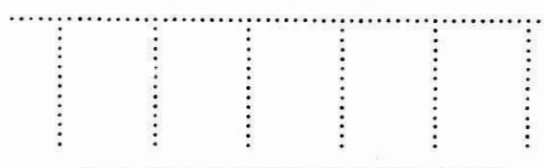


Fig. 3. Arrangement of Punches in Comb Perforator

Single-line and Comb Perforations

Perforating is now done by two types of machines. One of these machines punches only a single line at once and is known as a single-line perforator. When perforating is being done with this type of machine, the sheet of stamps is turned after the horizontal perforations have been made, and the vertical divisions are then punched. The second type of machine has punches arranged in the form of a comb, the space between the "teeth" being equal to the width of one stamp (Fig. 3). In this manner three sides of every stamp in one row are perforated at the same time. The sheet of stamps is then moved upward one row and the second row is punched, thus completing the perforation of the first row and at the same time three sides of the second row.

Stamps perforated by a single-line machine may be distinguished from comb-perforated stamps by the appearance of the corner of the stamp. With a comb perforator there is always *one* hole exactly at the corner (Fig. 2), while with a single-line perforator there will usually be two holes partially overlapping each other at the corner or no hole at all. The two right-hand diagrams in Fig. 2 illustrate two varieties of single-line perforation.

Although some stamps may show double holes only at one corner, this is sufficient to indicate a single-line perforation. These double holes are caused by vertical and horizontal rows being perforated at separate operations, with the consequence that the two holes seldom exactly coincide where the rows cross one another, i.e., at the corners of each stamp.

As typical examples of the two styles of perforations it may be mentioned that the current British stamps are comb-perforated, and many, if not all, of the current stamps of the United States are single-line perforated.

(*Continued on page* 165)

Why I Collect Stamps

by Master Leslie Dugdale

This Essay won the First Prize in our recent Essay Competition for Stamp Collectors

When I turn over the well-thumbed pages of my stamp-album, a host of old friends smile cheerfully at me—friends I have known since I bought my first packet of stamps. There are varicoloured Kings and Queens; Rajahs and Presidents. Explorers and men of historical fame are also among my acquaintances. All are eager to greet me at the mere turning of a page. I am the proud owner of a miniature Zoo, an Aviary, a fine group of beautiful Buildings and Statues, and a whole army of busy Natives.

There are many reasons why I collect these stamps—artistic, geographical, historical and political reasons—for postage stamps give one a breadth of vision such as is equalled by no other hobby.

In the older issues of stamps we find past history. In the issues between 1914 and 1919 we have a complete and very compact history of the Great War, while with new issues, especially those of Neurope, as it is termed, we can learn of the political condition of each country.

We learn of the more obscure parts of the globe, the strange occupations and customs of the natives and the curious names of currencies. We see the splendid architecture of the chief towns, and the animals and birds that are peculiar to each land.

We must study variations in printing, the texture and watermark of the paper, the perforation and the gum, if we would know all about our treasures, and this teaches us to appreciate detail.

Then there is the fascination of the sheer beauty of our stamps, for all stamps are meant to be artistic and attractive in their various designs.

The common stamp of to-day is the rarity of to-morrow, so that which brings us pleasure to-day may bring us untold wealth in future days. The pleasure of collecting for the financial sake of the stamps is, however, as nought compared with that to be derived from stamps in the ordinary way.

I have named many of the reasons that bind me to stamps—for they have been dear to me since first I glued them in an old exercise book—without naming them! Philately's main attraction for me is its glamourous "magic carpet," for when I gloat over my collection by fire-light I can "put a girdle round the earth"—in an instant I can be transported to any clime my fancy wills. This, and the indescribable "something" that has made philatelists of thousands of men and boys, is "the reason why I collect stamps."

SIGNALLING TO AMERICA

How Marconi Transmitted his First Signals Across the Atlantic

WIRELESS TELEGRAPHY has become such an important feature in the everyday life of the world that it is difficult to realise that 25 years ago it did not exist as a practical means of communication. The enormous advance in wireless communication since that time has been due very largely to the inventions of Marconi, who at the age of 50 is in a position to look back upon a succession of achievements such as few men have accomplished.

Marconi did not invent wireless telegraphy any more than Watt invented the steam engine, Stephenson the locomotive, or Morse the land telegraph. What Marconi did was to take hold of a crude idea—something that was, indeed, little more than a scientific curiosity—and develop it into a practical system of wireless communication on a commercial basis.

The Beginnings of Radio

Guglielmo Marconi was born on April 25, 1874, at Bologna in Italy, his father being Italian and his mother Irish. He was educated at the University of Bologna, and electricity, which he studied under Professor Righi, became his chief interest. It was probably from Righi that Marconi received his original inspiration.

In order to understand the vast importance of Marconi's work it is necessary to try to obtain some idea of the state of things when he first began to experiment. About the year 1863 the famous British scientist Clerk Maxwell advanced the theory that electricity, like light, travels through space by means of the ether. Some twenty years later a German scientist, Heinrich Hertz, became greatly interested in this theory, and in 1888 he succeeded in demonstrating experimentally the existence of wireless waves. The apparatus used by Hertz consisted of an "oscillator" to produce the waves and a "resonator" to detect them. The oscillator consisted of two metallic plates joined by a metal rod having at its centre a spark-gap between two polished brass balls. The resonator was simply a circle of wire having a similar spark-gap. The oscillator was connected to an induction coil, and when a spark jumped across the gap between the brass balls, a similar spark leaped across the spark-gap of the resonator, although this was some distance away from the oscillator and not connected with it in any way.

Hertz's experiments excited widespread interest among scientists, and very soon several workers were endeavouring to find some means of using the Hertzian waves for wireless communication.

Invention of the Coherer

The first difficulty was to devise an apparatus much more sensitive than Hertz's resonator, for the detection of the waves. Such an apparatus, called a "coherer," was invented in 1890 by Edouard Branley, a Frenchman. The coherer consisted of a glass tube containing metal filings. Through each of the closed ends of the tube was passed a wire, which terminated in a silver plug. Both plugs were very close together but not actually touching each other. (See Fig. 1). When the wires were connected to an electric battery it was found that as long as the filings lay loosely in the tube they offered a very high resistance and the battery current could not pass. When electric waves reached the coherer, however, the filings cohered and their resistance was so greatly reduced that the current was able to pass without difficulty. This current then operated either an ordinary telegraph sounder or a Morse printer.

Guglielmo Marconi

In order to cause the filings to de-cohere and return to their original loose condition in which they offered high resistance, it was necessary to give the tube a gentle tap. In 1895, Popoff, a Russian physicist, introduced a tapping arrangement which automatically returned the filings to their original state after the passage of an electric wave.

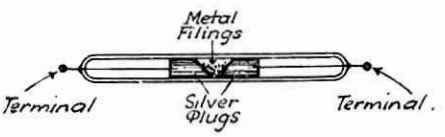


Fig. 1. Coherer

Marconi Sets to Work

These discoveries of Hertz and his successors paved the way for wireless telegraphy, but it was left to Marconi to weld them together into a practical system. His first transmitting apparatus consisted of an oscillator on the lines of that used by Hertz, but in an improved form, and his receiver was a coherer similar to that of Branley, but more sensitive.

Marconi's first experiments were conducted in his father's garden near Bologna. After several attempts he succeeded in transmitting signals over a distance of about a mile. He soon found that his opportunities for experiment were too limited in Italy, and in 1896 he came to England and readily obtained the assistance of Sir William Preece, Chief Electrician to the British Postal Service.

Success in England

Marconi commenced experiments with his oscillator in a room at the General Post Office in London, and the receiving apparatus on a roof more than 100 yards away. These experiments were successful, and afterwards he moved his apparatus to Salisbury Plain for further tests on a larger scale, before representatives of the Army and Navy. Here he succeeded in transmitting signals over a distance of about two miles, and thus proved that his system was of practical value. By the end of 1897 he was able to transmit over a distance of 15 miles, while in the following year signals were successfully exchanged between Wimereux, near Boulogne, and Chelmsford, a distance of over 80 miles. It was also found that messages could be passed between the South Foreland Lighthouse and the East Goodwin Lighthouse without any difficulty, through fog, rain, or storm.

By the beginning of 1900 regular communication was established between ships and land stations over a distance of 100 miles. Shipping companies then realised the great value of Marconi's invention and began to instal wireless apparatus on their ships. The British Admiralty also saw the possibilities of wireless, and in July 1900 they contracted for the installation of the Marconi system on 26 warships and six land stations.

Wireless Tuning

In 1897 Sir Oliver Lodge pointed out the greatly improved results to be obtained by "tuning" the wireless transmitter and receiver. Wireless tuning consists of adjusting the aerial of the receiving station so that it has the same natural rate of oscillation as that of the transmitting station.

A simple analogy will make clear the principle of tuning. Suppose we have two tuning forks of the same pitch placed close together. If we strike one fork so that it sounds its note strongly, the other fork will also begin to sound, although more faintly. On the other hand, if we

(Continued on page 161)

Signalling to America

—(*cont. from page* 159)

try the experiment with two forks of different pitch the second fork will remain silent.

The explanation of this is that the two forks of similar pitch have the same natural rate of vibration, whereas the other fork vibrates at a different rate. When we strike the first fork it vibrates at a certain rate and sets in motion in the air sound waves of a certain length. When the first wave reaches the other fork of the same pitch it sets it vibrating slightly, and as this fork has the same rate of vibration as the first fork, the succeeding waves as they arrive add their impulses until the second fork sounds. In the case of the fork of different pitch, however, the first wave sets it vibrating, but as this fork has a different rate of vibration from that of the first fork, the succeeding waves reach it at wrong intervals. Instead of adding together their impulses they interfere with one another and consequently the fork does not sound.

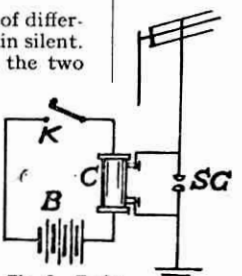


Fig. 2. Early Transmitting Apparatus

Avoiding Confusion

In exactly the same manner, if a wireless receiving aerial is tuned so that its rate of oscillation is the same as that of a particular transmitting aerial, it will respond readily to the waves from the latter. Also it will be comparatively unaffected by waves from other transmitting aerials having different rates of oscillation. By means of tuning, therefore, it is possible to pick out the particular message that it is desired to hear and cut out to a great extent all other messages. In this way confusion is avoided.

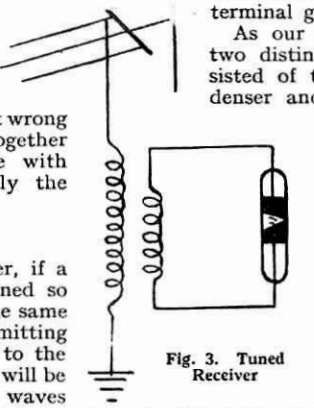


Fig. 3. Tuned Receiver

In his first system Marconi used an aerial that was charged directly. Only a very small amount of energy was available, therefore, and the electric waves quickly decreased in power or "amplitude" as it is called. The result was that the range was very limited and tuning was impossible. The apparatus, shown in Fig. 2, consisted of an induction coil C with a battery B connected to the primary circuit. The secondary circuit was connected direct to the spark-gap SG, which had one ball connected to earth and the other to the aerial.

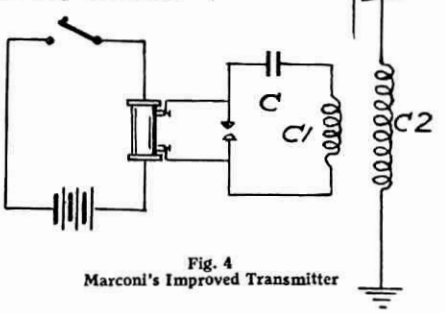


Fig. 4
Marconi's Improved Transmitter

Marconi Improves His Apparatus

Marconi obtained very much better results with an improved apparatus introduced in 1900. The new apparatus, shown in Fig. 4, had a condenser C, which stored up electricity in the same manner as does a Leyden jar. A coil of wire C1 was introduced into the circuit, and discharge was through the induction coil and across a spark-gap as before. The condenser stored up a great amount of energy each time it was charged, and on being discharged it imparted this energy to the aerial by induction from the coil C1 to the coil C2, one terminal of which was connected to the aerial, the other terminal going to earth.

As our diagram shows, there were two distinct circuits. The first consisted of the induction coil, the condenser and the primary tuning coil; and the second of the aerial and the secondary tuning coil. These circuits were tuned so that the oscillations set up by the charge and discharge of the condenser were repeated by induction in the aerial. With this transmitting arrangement more energy was radiated and the waves decreased in amplitude at a much slower rate.

A similar tuning arrangement was also introduced in the receiving apparatus as shown in Fig. 3, the signals being transferred from the aerial circuit to the coherer circuit by induction.

Although these modifications produced better results, Marconi found that his apparatus even yet left a great deal to be desired from the points of view of both speed and sensitiveness. A combination of the coherer detector and Morse printing apparatus made it impossible to work at a greater speed than 17 or 18 words a minute, and the distance over which messages could be received successfully was very limited. Next month we shall describe how Marconi further improved his apparatus and made possible the conquest of the Atlantic.

(To be continued)

Catalogues Received

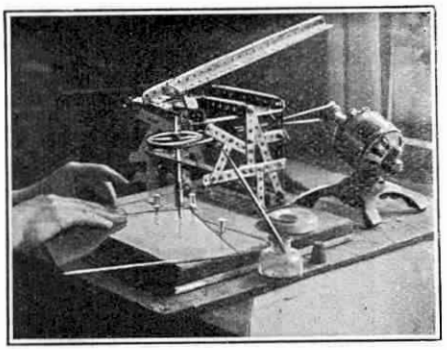
From Messrs. Igranic Electric Co. Ltd. (149, Queen Victoria Street, London), we have recently received an illustrated booklet giving full particulars of their many radio accessories, including coil-holders, variometers, variocouplers, transformers, filament rheostats, vernier-friction pencils, etc. The name of "Igranic" is closely associated with "Honeycomb" Duo-Lateral Coils, and in this connection the firm have published an interesting handbook describing these coils and their uses, and also giving a number of recommended circuits. Both publications are of real interest and help to the wireless enthusiast, and they will be sent (post free) on application, to any reader mentioning the "*M.M.*"

The "Curvograph"

A fascinating device, with the aid of which innumerable beautiful designs may be made, is the latest production of the well-known educational publishers, Messrs. Philip & Tacey. The "Curvograph," as this invention is called, consists chiefly of a metal template, scientifically constructed and accurately machined. Perhaps the greatest charm of the "Curvograph" lies in the fact that no artistic talent is necessary to draw any of the wonderful variety of designs, and it may be used with equal pleasure and success by young and old alike. There are many happy hours of real enjoyment in store for the "Curvograph" owner, and this ingenious device should make many friends among Meccano boys. Each outfit includes a supply of drawing paper, a selection of designs and a pencil, the whole set being neatly packed in a strong cardboard box. Full particulars will be found in our advertising pages.

A Meccano Glass Drill

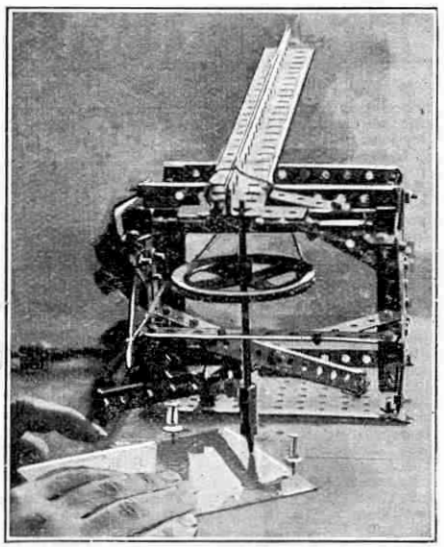
By Dr. E. Bade



AS every handyman knows, drilling a hole in glass, particularly when near the edges, is a very tricky and difficult task. With the aid of this Meccano drilling machine, however, which exerts a uniform pressure all round, it will be found that glass can be cut quite as easily as metal.

The model is made in the form of an inverted "L" and a vertical shaft with a flanged 3" wheel is set up as in the illustration. The shaft is fitted with a coupling or chuck for holding the brass tube at the end, with which the drilling is done. The upper end of the shaft is pressed down by the weight of a hinged piece. A lever, consisting of a 3" perforated strip is attached to the lower bearing of the spindle so that the drill may be easily lifted off the glass.

To drive the drill, the pulley wheel on the machine is connected up by a cord belt to a Meccano or similar make of electric motor. When the spindle is revolving at a uniform rate, insert the glass to be drilled underneath it, and, by means of the small lever, lower the drill on to the glass, when it will commence to bore out a neat hole.



Photos courtesy] Popular Science

The glass should be held as steadily as possible and secured by means of several drawing pins. To prevent splitting, the glass must be continually moistened with turpentine and a little coarse carborundum placed under the drilling tube. If plenty of these are applied, the drill will be found to penetrate a piece of window glass in the space of a very few minutes.

OUR MAIL BAG

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

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

Lester Raskowski (Berlin, Winconsin, U.S.A.).—Congratulations, Lester! Your paper, "Junior High News," is quite a nice bit of journalism. We have no criticism to make from an editorial standpoint, but think that a better grade of paper would improve it somewhat. On the whole, it is a very brightly written little paper. Your drawings also are good. Why not make a few in ink for reproduction in the "*M.M.*"?

E. B. Cullin (Wootton).—To publish the "*M.M.*" weekly is certainly as you say a "bright idea," but we shall have to wait a little while for this. A Nature Section would evidently be acceptable to a large number of our readers, and we shall seriously consider such a feature shortly.

J. House (Bradford).—Although you are in the Infirmary, suffering from appendicitis, you can make an opportunity and give thought to complimenting us on the "*M.M.*" and sending us a contribution for our pages! We admire your spirit, John, and you have our best wishes for a speedy and complete recovery.

E. B. MacCarthy (Tonbridge).—We are glad you enjoy our "Fireside Fun" page, but do not approve of your keeping awake at nights thinking out new tongue twisters. "Good blood, bad blood" is not a bad one, and we got into difficulties right away in trying to repeat it a dozen times!

M. Wong (Shanghai).—There are many Meccano boys in China, and for their benefit we publish a Manual in Chinese, which helps them a great deal. We do not often hear from them, no doubt because they cannot write in English, and your letter is very welcome. We are sending you the catalogues you ask for, under separate cover.

W. E. Lee (Worcester).—If you are too old for Meccano, you must be very old indeed, William! Fathers from 50 to 70 years of age are using it regularly. If you study the matter a little more closely we are quite sure that you will see new beauties and possibilities in the hobby, and—take a tip from us—don't part with your Outfit!

A. Ferruccio (Turin).—We are very interested in your accounts of the subjects that you are studying. These certainly cover a very wide field, and we hope that you will meet with success in your forthcoming examination. We hope, too, that you will be successful in forming a Meccano Club. We are posting a selection of booklets that will help you.

F. Pienaar (Germiston, Transvaal).—You may depend upon our posting the "*M.M.*" to you regularly. We should not like to "shut you off completely from your thousands of friends," as you express it. We thank you for your friendly remarks.

S. Slingsby (Blackpool).—We shall certainly devote space to a Nature column before very long, but we are afraid Astronomy will have to wait awhile until we have a little more space available. Thanks for your eulogistic poetry.

K. Mandala (Ceylon).—

"The poor benighted Hindoo,
He does the best he kindoo,
From first to last
He keeps his caste,
And for pants—why he makes his skindoo!"

We accept your assurance that you composed this yourself, but we certainly seemed to remember having heard something like it before. We are always glad to receive your letters.

R. J. Peace (Halifax).—Thanks for cutting from "*The Motor*," in which Meccano is mentioned. Your suggestion that we "double our staff and work over time" in order to issue the "*M.M.*" oftener convinces us that you scarcely live up to your name! We do not know what the future may bring, Robert, but for the present we assure you that twelve issues a year are a sufficient task!

V. Halpe (Maradana).—"Where can a man buy a cap for his knee, or a key for the locks of his hair? Who travels the bridge of his nose? When he slates the roof of his mouth, can he use the nails of his toes? Who plays the drum of his ears? Can the crook of his elbow be sent to jail? How does he sharpen his shoulder blade?" We just don't know, V. H., and it's a good thing for you that you live so far away that we can't come over to tell you what we think of you for worrying us like this!

Novel Model-Building Competition

£5 for the Best Model of a Dragline

IN our April issue we described the heaviest Dragline in the world, and we announced that Messrs. Ruston & Hornsby Ltd., the makers of the great machine, have offered a prize for the best Meccano model of their Dragline. The prize is a cheque for £5, with second and third prizes added by Meccano Limited of Meccano products to the value of Three Guineas and Two Guineas respectively, to be chosen by the winner from the current Meccano catalogue.

Draglines at Panama

Draglines are excavators something after the design of steam navvies, which were described and illustrated in a recent issue of the "*M.M.*" A Dragline obtains its name from the fact that the bucket is dragged towards the machine on a flexible rope, instead of being mounted on an arm that pivots on a jib as in a steam navvy.

Draglines excavate below the level on which they stand and work towards themselves, travelling backwards when they have excavated all the material within reach. They are used principally for drainage work where the ground is too wet to allow a steam navvy to stand. Draglines were extensively used in the construction of certain parts of the Panama Canal, and in conjunction with steam navvies they accomplished the work of thousands of labourers at a fraction of the cost.

A Monster Excavator

The heaviest Dragline in the world is that known as the Ruston & Hornsby No. 250. It weighs over 300 tons when fully equipped and in working order, and the bucket has a capacity of eight cubic yards. The jib is 120 ft. in length, and a cutting power of 30 tons is exerted on the bucket teeth. The coal bunker of this giant has a capacity of four tons and is filled by a special hoist. The main engines are upwards of 400 h.p., and separate engines of 200 h.p. are fitted for the slewing motion.

We have already illustrated this machine in its entirety and in detail, and this month we are able to give a further view, which clearly shows the method of mounting the jib, and other interesting details.

Photograph courtesy] [*Messrs. Ruston & Hornsby Ltd.*

The Ruston 250 Dragline

Suggestions for Competitors

We hope that a large number of our readers will enter for this competition. Those who intend doing so will note that the jib and the engine platform rotate on the base by means of a wheel-race, which may be seen in the accompanying illustration. The base itself is mounted on flanged wheels which run on rails. These wheels are driven by sprocket chain from gear wheels centrally mounted immediately under the platform. The gear wheels themselves may be driven by axle rods, deriving their power—through bevel gearing—from a vertical shaft, gearing directly to the engine on the platform above.

Those who do not wish to make their model so intricate as to embody this driving mechanism may very well dispose of the driving shaft and chains and simply fix their model to a base mounted on wheels. The wheel-race, on which the platform and jib pivot, might even be eliminated if desired, such modifications as these being quite at the discretion of the model-builder.

Competition Conditions

There is no age limit, and any size of Meccano Outfit may be used. Entrants should state their age and the number of Outfit used, however, as this will be taken into consideration in making the awards. The competition will close on September 30 next. Actual models should not be submitted, but drawings or photographs may be sent together with a description of the special features of the model entered, and on these the awards will be made. We shall illustrate a Meccano model of this 250 Dragline when announcing the results of this competition in our November issue.

BRIGHT IDEAS

These columns are reserved for dealing with suggestions sent in by Meccano users for new parts, new models, and new ways of making Meccano model-building attractive. We are always pleased to hear from any Meccano boy who has an idea which he considers will be useful in the Meccano system.

E. W. Goodman (Dulwich, S.E.).—Sorry we overlooked replying to your idea for a 1 × 1½ double angle strip. We have made a note of it and it will come up for review shortly.

L. Nash (Uxbridge).—We have quite a number of new accessories in view for the Hornby trains. They will be announced as they become ready for the market.

R. Ball (Rainford).—The split coupling you suggest for a big end joint seems to us at first glance to be a rather awkward and expensive piece to manufacture. We shall look into it, however.

Percy R. Newnham (Birmingham).—We incline to the opinion that your suggestion is prompted by some excessive strain, imposed on the wheels of your particular models. We have never had the experience of grub screws failing to hold, even under stress. Your suggested wheels with lengthened cones to permit of two grub screws would add very materially to their cost.

H. V. Small (London, W.C.).—A reversed crank may be made from existing parts, i.e., two cranks bolted together.

N. Carter (Purley).—(1) A 2½" diameter flanged wheel may be formed by bolting the flanged disc to the face plate. (2) We are experimenting with channel sections.

L. Brown (Liverpool). — The Meccano system is continually being improved by the addition of new parts. A new parts list has been sent to you, as requested.

W. O'Brien (Dublin). — The Hornby Tank Loco is 11½" in length, and is fitted at both ends with a special bogey. By the way, the name of this loco has now changed and henceforth it will be known as No. 2 Tank Loco.

J. Johnson (Tunbridge Wells).—A strong application of your screwdriver and spanner to the nut and bolt securing the girder will give you a firm fastening.

"The Editor of the '*M.M.*' as I imagine him"

The Editor of the "*M.M.*" according to Master Eric Mitchells, of Stockton-on-Tees, one of the prize winners in our recent competition

John Candler (Tulse Hill, S.W.).—The objection to a sleeve piece to fit over the Meccano rod is that it would not fit the standard-sized holes throughout the Meccano system.

F. A. Berardt (W. Dulwich, S.E.).—We rather think that the governor on your Hornby engine has become defective. It should control the speed of the engine to ensure it keeping to the track without load.

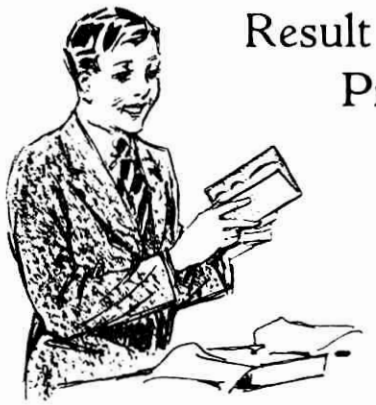
J. Maiden (Windermere). — The adaptability of Meccano is such that very good representations of cylinders and pistons may be constructed from it. To introduce cylinders and pistons, as you suggest, would only be duplication, and moreover they would not serve a general purpose.

J. Cleaver (Wigan). — The couplings on the Hornby Trains are made sufficiently long to permit of free action of the carriage on the narrow radius curves, otherwise the buffers would foul each other.

P. H. Doherty (Streatham Hill, S.W.).—As the formation you suggest is so infrequently employed there would be no object in introducing it when it can be obtained from existing parts.

When is your birthday?

Result of Birthday-Present Scheme



LAST year we announced in these columns a unique birthday-present scheme, under which handsome pocket wallets, in real Morocco leather, were promised to those whose birthdays fell on the same date as that of the inventor of Meccano.

Every Meccano Outfit and every Train Set sold after the date of the announcement has contained a special form, giving full particulars of the scheme. On this form Mr. Hornby—the inventor of Meccano and Managing Director of Meccano Limited—pointed out that Meccano has been in existence for over twenty years, and its career has been one of uninterrupted success. Ever since its early days, when it was known as "Mechanics Made Easy," the hobby has flourished and grown rapidly. In 1908 its name was changed to Meccano, and at the same time the business was established as Meccano Limited. It is thus sixteen years since the present Company was formed—and these have been sixteen years of unbroken success and progress.

"In the course of my work," said Mr. Hornby, "I have met many thousands of happy Meccano boys, and I wish that during this notable year in the history of my firm I could meet all the others to chat over with them old Meccano experiences. What a gigantic and unique gathering it would be, for there are millions of Meccano boys of all ages and of all nationalities. Such a gathering is, of course, quite impossible, but I have thought of a way of celebrating Meccano Limited's sixteenth birthday that will, I hope, bring joy to the hearts of thousands of Meccano boys. I have decided to give a handsome birthday present to those boys who comply with the conditions printed on the special forms included in each Outfit, and whose birthday falls on the same date as my own."

Many thousands of forms have been sent in from all parts of this country and many thousands more from Overseas. These have all been classified and to those lucky boys whose birthday falls on

MAY 2

a handsome Morocco wallet has been despatched. Mr. Hornby wishes these boys "Many happy returns of the day," and hopes that the little birthday gift will serve as a pleasant reminder of the happy date for many years.

Stamp Collecting—(*cont. from page* 157)

After a little practice it is easy to tell the difference, and if you are collecting the stamps of a country in detail you should distinguish between these two styles of perforation.

Measuring Perforations

The size of a perforation is denoted by the number of holes in every two centimetres of the stamp's length. Thus, if your catalogue says that a certain stamp is "Perf. 16," it means that there are 16 holes in every two centimetres. This method of measuring perforations was invented in 1866 by a Frenchman, Dr. Legrand, and this is probably why the metric system is used instead of the English inch.

To save you the trouble of measuring the two centimetres along the side of every stamp you wish to measure and then counting the number of holes, we reproduce here a Perforation Gauge by which the size of any perforation may be found at once (Fig. 1). To use the gauge, take the stamp you wish to measure and slide it up and down the gauge until you find a row where the black dots exactly fit the perforation of the stamp. The number at the end of this row of dots will tell you what size this is. After a little practice you will be able to tell the sizes very quickly and you will even be able to guess them fairly accurately.

Sometimes the sides of a stamp are perforated differently from those at the top and bottom. Such a stamp is said to have a compound perforation and the top and bottom size is always given first. Thus, "Perf. 14 × 15" means that the top and bottom of the stamp are perforated 14 and the sides 15. It is by making use of this rule that we are able to distinguish between "Perf. 14 × 15" and "Perf. 15 × 14."

NEXT MONTH:—

ROULETTING

Lives of Famous Engineers—(*cont. from p.* 149)

the engineers swimming with a rope in his mouth. This accident so upset the contractor who had undertaken the construction of the tunnel that he took to his bed and died shortly afterwards.

Fighting the Water

The problem of dealing with this water was so great that Robert Stephenson sent for his father, who advised pumping out the water from the top by powerful steam engines erected over each shaft. Robert agreed with this, and although other engineers said the scheme was impracticable, the directors ordered the engines to be constructed without delay. Additional shafts were sunk, the engines were erected, and pumping went on continuously for eight months, about 2000 gallons of water per minute being raised from an average depth of 120 ft. The workmen, protected by the pumps, which cleared a space for operations, proceeded with the construction of the tunnel at a number of different points, and eventually the work was completed.

The difficulties encountered at Kilsby added greatly to the cost of the line. The original estimate for constructing the tunnel was £99,000, but it actually cost nearly £300,000, or more than £100 per yard!

Finn and His Companions
by Standish O'Grady
(*Pub. by The Educational Company of Ireland Ltd. Price* 1/3 *net*).

Stories of St. Patrick and the early heroes of Ireland seem to have a peculiar fascination of their own, and this little book is no exception. It tells how St. Patrick is visited by ten warriors of wondrous size and strength, and noble in bearing. The tales these warriors tell, set down as they were told to St. Patrick, are stories of daring deeds performed by the wonderful Finn and his heroic soldiers, and of Ossian, his incomparable son, the warrior and poet. We are told how Finn leapt the dreaded chasm that no man had ever dared to cross, and thereby won the hand of the daughter of the King of Rushy Ciarrai; of how he went hunting with Arthur, King of the Britons, who grew covetous of Finn's wonderful hounds and stole them, thereby rousing Finn's anger. These and a dozen other adventures of Finn and his wonderful companions are told. Fights with strong men and with dragons, trials and hardships endured for the sake of right and justice—all are recounted with such realism that we share the hazards of the battle and the joys of the chase. The book seems to end all too soon, and we hope the author will give us some further stories on the fascinating history and mythology of ancient Ireland.

Junior Mechanics and Electricity
(*Percival Marshall. Price* 3*d. Monthly*).

Full instructions for building scale-model aeroplanes, steamers, tool-grinder and a small model steam-engine and boiler (in which, incidentally, Meccano rods, wheels and bolts prove particularly useful), are only four of the many fine articles in No. 165 of this useful publication. Model railway enthusiasts are particularly favoured in this issue, for, in addition to a design for a model "Atlantic" or "Pacific" loco, there are also articles on easily-made electric signals, model railway accessories, and replies to model railway owners' queries. Wireless, too, is a popular and important feature, while the wonderful story of that famous astronomer, Sir William Herschel and his telescopes will appeal to every Meccano boy, both young and old.

For Model Builders

For over thirty-six years Messrs. Bond's Ltd. (254, Euston Road, London, N.W.1) have been famous for engineering models, and at the present time the name is familiar to the majority of model builders. To fully appreciate the wonderful assortment of models and parts in stock a personal visit is, of course, required, but for the model builder who lives at a distance from London, the firm's new Price List will prove a satisfactory substitute. Numerous photographs, sketches and diagrams illustrate a wide variety of accessories for model railways, and pages devoted to steam and paraffin engines will at once appeal to all boys. Useful information to model builders is also contained in this excellent little booklet, which will be sent (post free) for 4d.

Competition Corner

SECOND COMPETITION

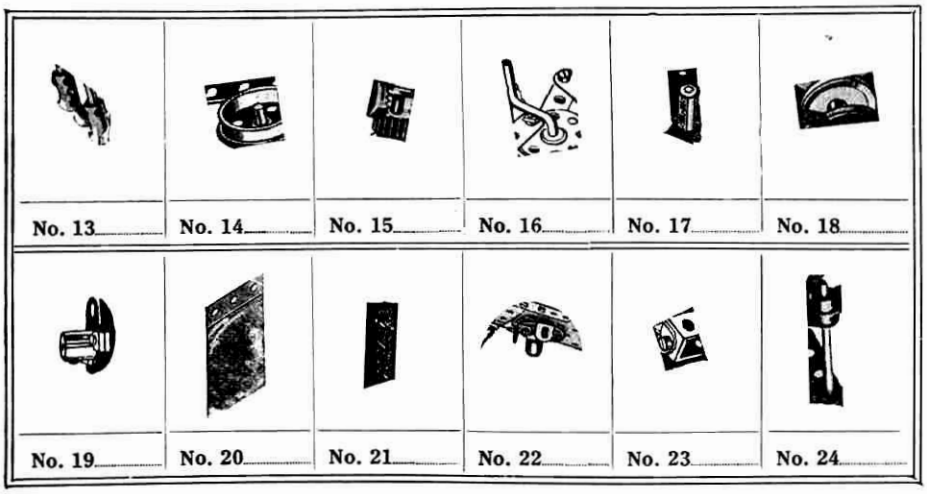
For Lynx-Eyed Readers

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.

SECOND SET



INSTRUCTIONS FOR COMPETITORS:

Above is given the second set of puzzle pictures in this fascinating competition for model builders with sharp eyes and good memories. Each of these twelve pictures has been taken from the Complete Manual of Instructions (No. 23) and represents a part of some Meccano model in the Manual. As each picture is identified the number of the model should be written in the space beneath, to serve as a reference when sending in the final solutions.

There will be three sets of pictures published, as in the last contest of this character, and competitors are required to solve all three sets to qualify for a prize. A Complete Manual of Instructions is necessary to enable readers to solve these puzzle pictures, as many of the models depicted are not featured in the smaller manuals.

Competitors who are experienced model builders will, of course, start with a considerable advantage, as they will more easily recognise parts of models that they have built themselves. Some of the pictures, however, are very "tricky," and even the most expert model builder will have to search very closely before filling in some of the numbers.

Some splendid prizes are being offered in this contest and a full list of these appears above. If no competitor succeeds in numbering all the models correctly, the First Prize will be given to the reader whose results are nearest correct. The other prizes will then be awarded in order of merit. If more than one competitor ties for any prize, the prize will be awarded to the neatest entry.

It should be clearly understood that entrants in this competition are not required to tear out the pages containing the puzzle pictures. When the three sets have appeared, solutions should be written on a post card and the latest date for sending in entries will be announced in the next issue of the "*M.M.*" No entries are to be sent in until the third and last set of puzzle pictures has appeared.

Eighth Photo Competition

Many Meccano photographers are only waiting for the fine weather to take up their fascinating hobby again. In order to encourage these enthusiasts we announce our Eighth Photographic Competition, the subject of which is

"A SUMMER SCENE"

The subject chosen 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, which ever 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 July 31, and for readers Overseas, October 31. Entries should be marked "Photo Contest" in the top left-hand corner of the envelope.

A New Essay Contest

As announced in this month's Editorial (page 145), cash 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 3¼" × 2¼"), 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 September 30 next.

Result of Auto-Scooter Competition

The subject in this essay contest — "Why I should like an Auto-Scooter"—seems to have been a very popular theme. Hundreds of readers entered and gave their reasons for wanting one of these splendid toys. A large number of competitors said that they specially wanted a Scooter on which to do errands for their mothers, one boy frankly admitting that "it is very annoying to be called away from a game to run an errand, but I wouldn't mind if I had an Auto-Scooter to do it on!"

The best essay was received from Master George Rodwell, of Halifax, and the First Prize of a Model-de-Luxe Auto-Scooter has been awarded to him. The Second Prize, a Popular Model Auto-Scooter, has been won by Master Henry Havinden, of Poplar, London. The organisers of this competition were the New Auto-Scooter Co., of Chestergate, Stockport.

Result of First Puzzle Contest

Puzzle Competitions are apparently very popular with readers of the "*M.M.*" and there are few readers who did not puzzle their heads over our knotty problems. It is interesting to find that the majority of competitors found Algebra useful in solving some of the puzzles; no doubt many realised for the first time the advantage of having a knowledge of this much-abused subject! A few competitors, evidently unfamiliar with Algebra, left some blanks on their entries or remarked that a solution was "Impossible!" "Can't be Done!" and "Give it Up!" No competitor succeeded in solving all the sixteen puzzles, but three sent in correct solutions to 14 problems. The three prizes have therefore been divided between these three readers, who will each receive Meccano goods to the value of £1 4s. 6d. The names of the successful entrants are Masters Anderson (Kilmarnock); M. S. Y. Fowler (Teddington); and W. Selby (Bath); and we congratulate them on their outstanding success in a difficult contest.

FOR

OVERSEAS READERS

Result of Essay Competition

Entries from Overseas for the "What I intend to be and Why" essay competition were very numerous and equal in merit to the essays received from readers in this country. The winner of the Overseas section is Master N. Barker, of Fraser Town, Bangalore, South India, who gave some very good reasons for his choice of an engineering career. The prize of Meccano goods to the value of £1 1s. 0d. has been awarded to him, and film-pack cameras have been sent to Masters Ralph Garcia, of San Juan, Trinidad, B.W.I., and Reggie Stone, of Jeppe, Johannesburg, South Africa, the respective winners of second and third prizes.

The Cyclist's Tool-Kit

by "ROVER"

UNLIKE many other pastimes, cycling is at once a hobby and an exercise, and proves itself of equal value either for pleasure or for business. Many thousands of people depend on their machines to take them to and from their work every day, and an occasion such as the recent London transport strike brings into the streets an amazing number of machines of all sorts and conditions.

Running Repairs

But whether a bicycle is to be used for business or pleasure, the most confident and care-free owner is the one who is not only a good rider, but who also understands his machine and is capable of dealing with any trouble that may arise. Many cyclists may and do possess the first qualification, but if a puncture or minor accident occurs their only thought is of the whereabouts of the nearest cycle shop. To the really keen cyclist, the one who is proud of his hobby and takes an intelligent interest in his machine, an accident is "all in the day's run." Short of a buckled wheel or broken frame, such a rider is quite competent to undertake repairs on the spot. Realising that accidents are bound to happen even to the most cautious rider, his tool-bag is regularly overhauled, and when an emergency arises he can rely on not being stranded for want of the right implement.

Tools to Carry

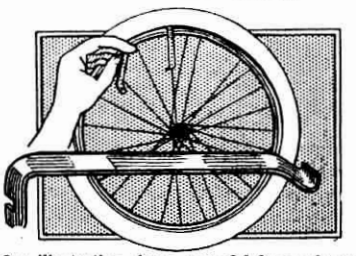
To the new owner of a cycle the question of what to carry in his tool-bag is often perplexing. Few makers equip their machines with a full set of tools, and the young cyclist, unless he has been advised by an experienced rider, is too often inclined to "let it slide," until a long walk home one day reminds him that the bag behind his machine is intended for something more than carrying a packet of sandwiches!

The following list of tools is one that long experience on the road in all kinds of weather has shown to be essential to the average rider, whether the machine is to be used for business or pleasure:—

2 Tyre Levers.	Adjustable Spanner.
Flat Spanner.	Puncture Repair Outfit.
Oilcan.	Spare Wick or Burner.

These should be wrapped up in an oily piece of rag or felt and neatly stowed away in the tool-bag. The oily rag serves both to keep the tools from becoming rusty and to prevent any annoying rattle.

A USEFUL TOOL



Our illustration shows a useful form of tyre lever that hooks round a spoke and facilitates the removing of the tyre

How to Use Them

The flat spanner is for turning the wheel cones when necessary, and care should be taken that the right size is obtained, as the adjustable spanner cannot be substituted. This latter tool serves a variety of purposes, from adjusting the saddle and handlebars to unshipping a wheel. Any good make of repair outfit may be carried, and the contents will not be found to vary very greatly. As described in these columns last month, the essentials of a repair outfit are a tube of rubber solution, sand paper, an assortment of rubber patches for inner and outer tubes, and some French chalk. A spare wick for an oil-lamp is an important item, and may often make all the difference between walking and riding several miles on a dark night. In a case where an acetylene lamp is used, a spare burner should be substituted for the wick.

Extras

The six articles described above should be in every cyclist's tool kit, and provided he is familiar with their use he will be quite capable of satisfactorily dealing with any ordinary trouble that may occur on the road. There are, however, various other items, or "extras," which some cyclists prefer to carry, although these are not necessities and are seldom required in the ordinary course of events. Under this heading is included a piece of valve tubing to replace the one in use should the rubber perish and begin to leak; a screwdriver; a spare nut for the chain bolt; and finally, a piece of flexible wire. This latter item may seem somewhat superfluous, but it is amazing how handy it will prove, from cleaning out a clogged-up oil-hole to making a temporary washer.

In conclusion, it should always be remembered that though the equipment and upkeep of a tool-kit may sometimes be a nuisance, it is well worth the trouble, for you may be sure that when you do want your tools you'll want them badly.

NEXT MONTH:—
Forming a Cycling Club

The Secretary's Notes

As Secretary of a brotherhood of boys with over 35,000 members, I receive many letters every day on all sorts of subjects.

A Mixed Mail Bag

Besides club reports, these contain news of new clubs, newspaper cuttings of concerts and exhibitions, and requests for information about the Guild. There are jolly letters from Guild members abroad, or postcard views of foreign lands, which are always interesting. All these letters are very welcome—even those few with complaints—for they serve to keep me in touch with the Guild and its many activities throughout the world. I am always pleased to hear from Guild members wherever they may be situated, and everyone who writes to me receives a reply. In fact my mail is so heavy that a special staff is necessary to deal with it.

I often receive valuable hints on running a club from Club Leaders and Secretaries. Such letters are particularly useful, for I

How Clubs Commence

am able to pass on this information through these columns. Often I receive letters from a "lone member" either in England or abroad, and we soon become regular correspondents and fast friends. To those who so desire I am able to send lists of Guild members living in their districts, and this often enables "lone members" to found a new Meccano Club and exchange their "loneness" for the jolly companionship of club night. The majority of our most successful clubs have been commenced through the enthusiasm and perseverance of one keen Meccano boy. Now, "lone members," write to me to-day for a list of Guild members living in your district, and see if it is not possible to found your own Meccano Club.

Judging from reports recently received, the clubs which have decided to continue their activities during the summer are

Guild Photographs Wanted

thoroughly enjoying themselves. I hear of a Rambling Club's successful meeting, a Nature Study Section in full swing, and several announcements of the finding of suitable fields for cricket. Though these accounts are very welcome and interesting, I have not, so far this year, received any photographs of clubs taken outdoors, so that my readers will have to picture in their minds the cheery faces of the Rambling Club's members and the little tin boxes of the Nature Study Section! It will, however, be interesting to see which Club sends in the first photograph of the Summer Session and, if clear enough for reproduction, I shall publish it on this page in an early number. I should also like to take this opportunity of reminding club members that I am always glad to receive photographs of any of their exhibitions, sports, or meetings, for publication on this page. Photos should be as clear and distinct in detail as possible, gaslight prints giving the best results, and should be accompanied by a brief description of the event which they depict.

I hear that next month "Rover," the cycling expert, is contributing an article on "How to Form a Meccano Cycling Club." This should

Meccano Cycling Clubs

prove of particular interest and help to any club which is considering the formation of a Cycling Section. The Guild President is very keen on Meccano boys spending as much as possible of their time outdoors during the summer months, and there is no better means of doing this than cycling. For those clubs which, for various reasons, are unable to run a Cycling Section, I am always ready to make alternative suggestions and to assist the Leaders to carry them out.

I should like to draw the attention of Club Secretaries to the valuable information contained in our "Club Notes" columns every month. I am afraid that many

Interesting Guild News

readers skim through the names of clubs, and if they do not find their own club mentioned they turn over the page and have a try at one of the tongue-twisters on the "Fireside Fun" page! Nevertheless, "Club Notes" is one of the most interesting features in the "*M.M.*," representing as it does the activities and achievements of Meccano clubs the world over. It may contain a note of a visit to a gold mine in South Africa; of a week's camping in Australia or New Zealand; of an Exhibition in Holland, or news of club events near at home. These reports are sent in regularly by enthusiastic and capable Club Secretaries and, apart from their own natural interest, the column contains many hints and ideas on outings, lectures and club organisation that might often be adopted with advantage. "Club Notes" should be read by every member of the Guild who takes an active interest in his club and is anxious for its progress.

A Car Load of Happiness

WHENEVER Club members arrange outdoor excursions or picnics in the summer, they invariably manage to have a very good time, and the jolly group of boys shown in the accompanying illustration is no exception to the rule. The photograph is of the Southall (London) M.C., and was taken on the occasion of the Club's visit to Burnham Beeches, some fine woods near London. Such a place is ideal for rambles or picnics and the Southall boys thoroughly enjoyed their day's camping-out. They also enjoyed the fun of riding there and back in their own "car," which, though not fitted with the revolving seats of the Meccano Limousine, was nevertheless quite comfortable!

Mr. E. C. Carpenter, the enthusiastic Leader of the Southall Club, was responsible for the original idea and arrangements of the trip, which might be very advantageously included in the programme of other London clubs this year.

A jolly group of members of the Southall Meccano Club

Special Merit Medallions

FURTHER AWARDS.

Further recent awards of Special Merit Medallions for good work in connection with their Meccano Club have been made to the following members:—

W. Clowe	Observatory (S.A.) M.C.
S. Gerrard	Chard M.C.
D. Rhodes	Leckhampton M.C.
L. Robertson	Holy Trinity (London) M.C.
A. Taylor	Knutsford M.C.

Correspondents Wanted

One of my correspondents in Belgium has asked me to put him into touch with a boy either in England or America who applies Meccano to the principal theories of mathematics and mechanics. I shall be glad to hear from any boy likely to suit my Belgian correspondent. Also, members who wish to be placed in touch with boys interested in the following subjects should communicate with me:—Poultry-Farming, Gardening, Sketching, Conjuring, Cycling, Journalism, Music and Books.

CLUB NOTES

Leckhampton M.C.—This enthusiastic club recently played a football match against the Leckhampton Scouts which resulted in a draw. More members are needed for the coming Session and enquiries from Meccano Boys in that district are invited. *Secretary*: Master B. Rhodes, Cotswold View, Charlton Lane, Leckhampton, Cheltenham.

St. Mark's (London, S.E.13) M.C.—This Club has been organised in connection with the local Church and under the Leadership of the Rev. Noel Mellish. Meetings are held in the Parish Hall every Friday evening from 7 p.m. until 8.45 p.m. At present the Club programme consists of model building and lectures. At the recent Sale of Work held in connection with the Club an Exhibition of models was held and proved a great success. *Secretary*: Master L. Jones, 39, Wellmeadow Road, Hither Green, Lewisham, S.E.13.

Grimsby Central M.C.—The Second Winter Session closed at the end of April, and members are now enjoying summer activities. New members will be welcomed, and full particulars of membership may be obtained from the *Secretary:* Master S. Oliver, 102, Hainton Avenue, Grimsby.

Adelaide (South Australia) M.C.—Although most of the members live several miles from the club-room, all are enthusiastic Meccano boys and there is invariably a full attendance on club nights. The membership now stands at 14, but it is hoped to increase this in the near future. *Secretary:* Master Ted Cornish, 100, Walkerville Terrace, Walkerville, South Australia.

Elizabeth College (House) M.C.—Owing to the prior claim of the school sports, the theatrical performance to be given by the members has been postponed until the next term. The first number of the Magazine "*Meccanotes*," issued by this club, has recently been printed and costs 6d., though it is hoped shortly to be able to reduce the price to 2d. Full particulars may be obtained from the *Secretary:* Master H. Griffith, Elizabeth College M.C., Guernsey.

Norwich Enterprize M.C.—Indoor games, model-building and physical drill are regular items on the programme, and members are looking forward to a record Summer Session. *Secretary:* Master C. R. Agar, 73, Vincent Road, Norwich.

Glenelg M.C.—Was recently affiliated to the Guild and continues to make splendid progress, the membership having been almost doubled. The club is shortly to be divided into a junior and senior section. *Secretary*: Master R. Squire, 41, Osmond Road, St. Leonards, Glenelg, Australia.

Southall M.C.—Owing to the old room being no longer available, this club is shortly taking up temporary quarters in the home of their vice-president, Mr. Haigh. It is hoped to find a new club room in the near future, but meanwhile the members are managing to "carry on" and are as keen as ever. *Leader*: Mr. E. C. Carpenter, 56, Hammond Road, Southall, E.

Meads (Eastbourne) M.C.—A very enjoyable concert was recently given by this club. The programme, which was neatly duplicated in two colours, consisted of pianoforte solos, songs, recitations, and two sketches, including the Meccano play "*Nonsense Nana.*" A social was also held shortly after, which, like most Meccano club socials, was unanimously voted a great success. *Secretary*: Master F. Coombe, Fire Station, 44, Meads Street, Eastbourne.

Redruth M.C.—Though only recently organised, this club is showing every sign of becoming an important branch of the Guild. At present there are 16 members. A lantern lecture on humorous subjects was thoroughly enjoyed. *Secretary*: Master Leonard Trenberth, Tunnel Stores, Redruth.

Clubs not yet Affiliated

Oxton M.C.—A suitable club-room has now been secured and al ocal gentleman having agreed to act as Leader, it is hoped to affiliate this club in the near future. Sections for Nature Study, Stamps, Radio and Outdoor Games, have been organised, and an enjoyable Summer Session is anticipated. *Secretary*: Master R. K. Holden, 13, Alton Road, Oxton, Birkenhead.

Birkenhead M.C.—A series of Country Rambles which will include Nature Study and Photography have been arranged by the Leader for the Summer Session. The club meets every Wednesday at 7 p.m., and any Meccano boy who is interested should write to the *Secretary*: Master Clifford Harrison, 9, Clifford Street, Birkenhead.

Penarth M.C.—Is fortunate in possessing a comfortable Club Room, while a Gramophone and Wireless Set have been placed at the disposal of members. Radio is a popular club hobby and each member possesses a wireless set. A Magazine is regularly published, and any boy interested in the club is invited to write to the Secretary for full particulars. It is hoped to secure a Club Leader in the near future. *Secretary:* Master M. Hallett, 64, Westbourne Road, Penarth, Glam.

How to Run a Meccano Club

by the
Guild Secretary

Last month I promised to give a suggested syllabus that would serve as a guide for new Clubs. This syllabus, which is printed on this page, is merely a suggestion for a programme for two pleasant sessions, and is, of course, subject to any modification the Club Leader may care to make.

Wide Scope of Clubs

In making up your syllabus it is important to remember that the activities of a Meccano Club are by no means confined to Meccano. Meccano is simply the common ground on which the members of the Club meet, and evenings are made considerably more enjoyable by the introduction of other subjects and hobbies, such as Fretwork, Stamp Collecting, Nature Study, and—in season—Cricket and Football Clubs. Then again, such things as a Savings Bank and Library may be arranged in connection with the Club.

Those Clubs that have musical talent among their members may often arrange to have musical evenings with a view to practising for a Club Concert. Many of our most successful Clubs finish up the session with a Concert and Exhibition. Some clubs have concert parties that take part in organised entertainments to raise funds for local charities, such as hospitals, and quite a considerable amount of money has been raised from time to time in this way. Not only is there the satisfaction of knowing that you have done something to help a deserving cause, but also there is a good deal of enjoyment and fun to be derived from the rehearsals and the performance itself.

All these "sidelines" further the interests of the members and help them to enjoy the Meccano evenings all the more.

Suggested Syllabus

Oct.	1—Business Meeting and Short Address by Club Leader. Model Building (if time permits).
„	8—Lecture by Mr. Robinson, Manager of the Electricity Works.
„	15—Model Building.
„	22—Business Meeting. Paper on "Bridges" by Master J. Smith. Questions and Discussion.
„	29—Model Building.
Nov.	5—Visit of Guild Secretary from Headquarters.
„	12—Meccano Lecture: "Lives of Inventors," read by Club Leader, followed by discussion.
„	19—Model Building and Competitions.
„	26—Business Meeting. Lecture: "Steam Locomotives" by Mr. T. Brown, of the G.W.Rly.
Dec.	3—Model Building.
„	10—Adjudication of Models for Exhibition.
„	17—Concert and Exhibition.
Jan.	7—Business Meeting and Model Building.
„	14—Lecture: "Aeroplanes," by Lieut. J. Smith, R.A.F.
„	21—Model Building and Competitions.
„	28—Meccano Lecture: "The Story of our Ships," read by Club Leader, followed by discussion.
Feb.	4—Model Building.
„	11—Papers by Club Members.
„	25—Study of Special Meccano Model. Paper by Leader. (Model loaned by Headquarters).
Mar.	3—Model Building.
„	10—Competitions.
„	17—Paper on "Photography" by Master T. Browne; followed by Business Meeting to discuss arrangements for Concert and Exhibition.
„	24—Adjudication of Models for Exhibition.
„	31—Concert and Exhibition.

Membership Cards

Special cards are supplied to affiliated clubs by Headquarters, and on the inside space is left for the insertion of the programme for the winter sessions. These spaces are filled in by the members after the programme has been arranged. If it is not drawn up at the general meeting, the Secretary would do well to display a printed or neatly-written copy of the programme on the Club notice-board, so that all the members may fill up their membership cards at the commencement of the session.

The Club Record Book

Every Secretary should keep a Club Record Book in which to enter details of each meeting, and also the name of any member who carries through some special achievement. The number of members present, the winning model of the evening, and the name of the Chairman should be noted, and these "minutes" read over at the beginning of the next meeting, and signed by the Chairman.

Entries need not always be connected with Meccano. For instance, one member may win a scholarship of merit; a second may invent something of considerable importance; or a third may perform some brave deed. Each of these things is worthy of record, and should be entered. The book should not be made "cheap," however, and every entry in it should refer only to something of importance.

Reports should be sent to Headquarters each month, with a summary of the work done, number of members on the roll, etc., at the termination of the session. The Record Book will be found of great assistance in rendering the monthly reports, which should contain a brief account of the Club's activities and notes of any contemplated events. All reports of sufficient general interest will be mentioned in the Club Notes in the "*M.M.*"

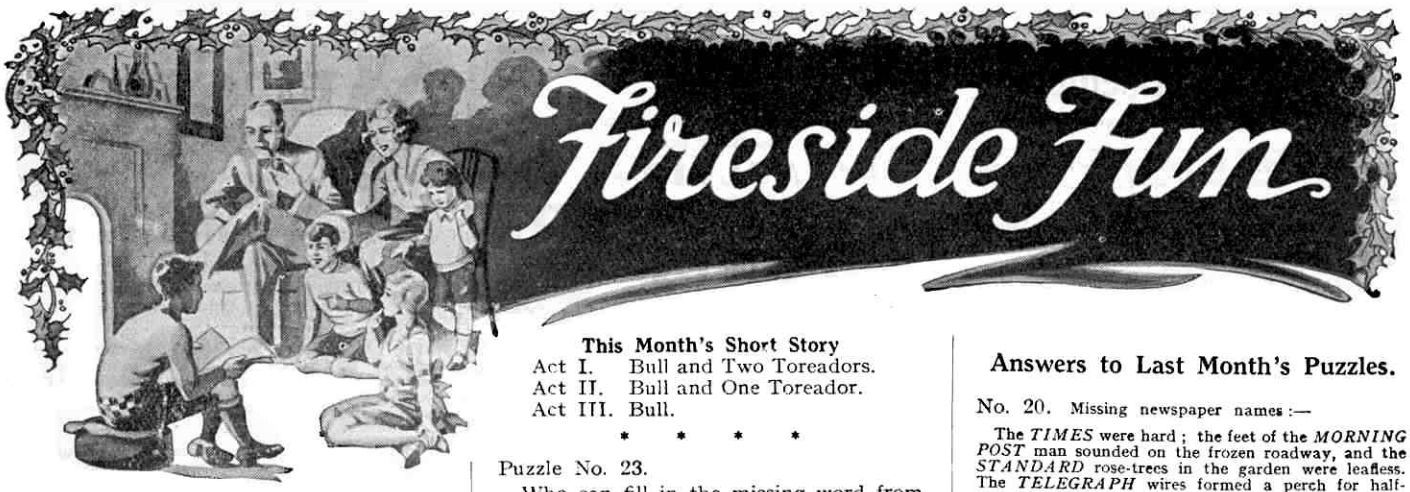
Clubs and Publicity

It should be the aim of every Club to become widely known in its particular locality and thus gain more local support. It is a good idea to appoint one of the members Press or Publicity Secretary. His duty will be to send short reports of the Club's activities and notices of meetings to the local newspapers, and to do everything possible to advertise the existence of his Club.

If no Press Secretary is appointed, the Club Secretary should himself make a point of sending in a report to the newspapers regularly each week

Sometimes shop-keepers will display in their windows a notice about the Club, and when this can be arranged, it generally results in an increased membership. The Parish Magazine, too, is an ideal medium for Club notices, which should include the name and address of either the Club Leader or Secretary, for the benefit of intending members.

(To be continued)



MY remarks on this page last month in connection with tongue-twisters have evidently had a very stimulating effect, for during the past two or three weeks I have received more tongue-twisters than ever. I give below a selection of the more interesting.

* * * *

Master Albert Cull (Bournemouth) has made a determined endeavour to twist my tongue by sending in no less than 13 twisters! These include some very old ones, such as "Peter Piper and the pepper corns," the "Ragged rascal and the rock," and the ever popular "Betty and the bit of bitter butter." One or two are new, however, such as "Sam sells salt sausages," and "A swan swam over a river; swim, swan, swim! The swan swam back again; well swum, swan!"

* * * *

Master D. Lisle (Sefton Park, Liverpool) suggests that I should eat "Flesh of freshly-dried flying fish" with "A box of mixed biscuits" or, if preferred, "With a mixed biscuit box." He concludes his letter by saying "It is a shame, Sam; these are the same, Sam!"

* * * *

Master J. Higgleton (Merthyr Tydvil) has evidently been thinking of the readers who have been trying to twist the Editor's tongue when he evolved the following:—

"A twister of twists once twisted a twist,
And the twist that he twisted was a thrice twisted twist.
In twisting the twist one twist came untwisted
And untwisted the twist that the twister had twisted."

He also mentions that the other day he saw "Three great grey geese in the green fields grazing. Grey were the geese and green was the grazing."

* * * *

Those who are musically inclined will be interested in Master H. Briant's (Dulwich, S.E.22) tongue-twister, which reads:—

"A tutor who tooted a flute
Tried to teach two tooters to toot.
Said the two to the tutor,
'Is it harder to toot or
To tutor two tooters to toot?'"

* * * *

Master Desmond Williams (Ipswich) has made a praiseworthy attempt to twist the Editorial tongue with these "twisters":—

Sunny Sheila surely sells sea-shore shells.

Burly brown bears brutally biting black babies' backs.

Certain cross cooks cooking curry curiously.

This Month's Short Story

Act I. Bull and Two Toreadors.
Act II. Bull and One Toreador.
Act III. Bull.

* * * *

Puzzle No. 23.

Who can fill in the missing word from the last line of this verse?

With seven letters he spells his name;
Three letters he drops, he's just the same;
He drops two more, no change you view;
Nor when he drops another two;
He drops a dozen, he drops a score!
He drops a hundred and eighty more!
He drops a thousand and ninety-six!
The total's extremely hard to fix;
No matter the total that he may name;
Our jolly —— is just the same.

* * * *

"Well, Bloom," a physician asked a young colleague who had just taken rooms, "how's your practice?"

"In the mornings, practically no one comes," was the reply, "and in the afternoons the rush falls off a bit."

* * * *

Puzzle No. 24.

A very popular form of puzzle is that in which missing words are to be supplied where each word must contain all the letters of the previous word. An additional letter is added at each blank and the letters may be rearranged to form different words. Thus "we" may be changed into "wet" the second time and changed to "went" the third time, and so on. Here is a puzzle of this order, contributed by Master W. R. Cox, of Birmingham.

—— do not like —— said the man with the black ——. The —— we have just witnessed was very impressive.

When you —— a man you —— a —— means of identification. There will be a —— against —— when —— of this is realised.

* * * *

Getting a Move on!"

"Join team immediately. Catch first boat. Jones ill." Thus read a telegram received by the reserve member of the village cricket team. Nobly he answered the call by jumping up from his unfinished meal, dashing to his room, seizing his bag, flinging in some things, donning his hat and coat, rushing into the street, and running to the landing-stage.

There was the boat! Could he catch it? Flinging his way through the crowd, he forced a passage to the quayside, turning a deaf ear to the cries around him. The boat was barely a foot away from the landing-stage. He took his courage in both hands, closed his eyes, and giving a tremendous bound, landed on the deck with a crash.

"If I'd been a few seconds later I'd have missed it!" he gasped.

"Missed it!" cried the sailor who helped him up, "Why this boat's just coming in!"

* * * *

Q: What is it that asks no questions, but that you have to answer frequently?
A: A door bell.

Answers to Last Month's Puzzles.

No. 20. Missing newspaper names:—

The *TIMES* were hard; the feet of the *MORNING POST* man sounded on the frozen roadway, and the *STANDARD* rose-trees in the garden were leafless. The *TELEGRAPH* wires formed a perch for half-starved birds, and the *SUN* showed like a *GLOBE* of fire in the sky. To the *SPECTATOR* it seemed a hard, cold *WORLD* and, to tell the *TRUTH*, it was so. A train went by at *EXPRESS* speed, bearing the *WEEKLY DISPATCH* of letters from the country, together with the *MAIL* from a great town. A *GRAPHIC* description of the scene was written in *BLACK AND WHITE* for those who live a *COUNTRY LIFE* and do not hear the *DAILY NEWS*.

(The first correct solution received was from Master C. White, of Weston-super-Mare, to whom the prize of 5/- has been awarded).

* * * *

No. 22. Hidden names of animals:—

(*a*) Chamois. (*b*) Buffalo. (*c*) Heifer. (*d*) Leopard.

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.

Picture post cards are a great convenience to the traveller who has no time to write long letters home. But accidents will happen and sometimes the card selected says something the sender did not intend.

Some time ago a lady who was travelling in Yorkshire wrote on a card that she was about to post to a friend in Brighton: *"Wish you were here."*

In due time came the answer: *"Received your card, but what do you mean? You sent me a picture of a cemetery!"*

In another somewhat similar case, a dear old lady, who was travelling through Scotland, chose a card on which was a coloured picture of a handsome new building. She wrote: *"Am detained here unexpectedly for a few days. Will explain later."*

Great was the alarm of the recipient, however, for she had sent a picture of the new gaol!

* * * *

An English tourist driving through a part of Ireland in a jaunting car passed a man in ragged clothing.

"It must be awful to be in such a state of poverty as that!" exclaimed the Englishman in a sympathetic tone.

"Poverty, yer honor?" said the driver. "It's not poverty that caused him to wear rags. The fact is, that man is so ticklish there is not a tailor in the country that can take his measure!"

Small Advertisements

(*For rates see column* 3)

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

MINIATURE TABLE RAILWAY (Clockwork 21/-, Cost 35/-. Write—Ernest H. Atkins, Mill Lane, Carshalton.

FOR SALE. 4-volt "Seco" Accumulator, good ·.·dition, 10/-.—McLeod, St. Margarets, Sanderstead ·.d, Sanderstead.

HORIZONTAL STEAM ENGINE AND BOILER with all fittings complete, mounted on Baseplate 13"×11". Splendid working model. Price £2. Apply Desmond Bell, "Saxonhurst," Rock Ferry.

ADVICE, HANDBOOK & CONSULTATION FREE. King, Registered Patent Agent, 146a, Queen Victoria Street, London, E.C.4. 37 years' references.

CINEMA FILMS. 100 ft. 1/- Post Paid. Phillips, 64, Ewart Street, Brighton.

PHOTOGRAPHERS!! LOOK HERE!! Dark Room Set, with strong ruby bulb, powerful battery, and switch, the whole mounted on highly polished wooden base, only 2/6 post free. With every fifth order, 2 batteries and 1 ruby bulb given FREE. **A. W. North, 47, Parchment Street, Winchester.**

WIRELESS! Components for Home Constructors at lowest prices. Prompt attention. Lists free.—Dept. M.M., Webb & Goward, Caxton St., Market Harborough.

DID you ask your father?

Have you spoken to him yet about the 300 boys and girls who have no father and for whom we provide everything in this School? What did he say? Is he going to send something? Has he sent already? Are you going to send something—out of gratitude for your father's love and care? Perhaps you have sent. Have you? What did your Meccano Outfit cost? It costs £3 each day to keep our Orphans in bread alone. How many loaves will you buy for them? Here are a lot of questions. Please send your reply to **Mr. Fred. J. Robinson, Sec., 73, Cheapside, London, E.C.2.**

Alexandra Orphanage

(Incorporated as the Orphan Working School and Alexandra Orphanage). Founded 1758.

The 'BRITON'

The latest and best *British-made*

AIR PISTOL 8/6

A handsome and thoroughly reliable little weapon. Finely polished and plated, with vulcanite handle. Incomparable for power and accuracy. Nothing like it at the price. Ideal for the sporty boy. Boxed with supply of Slugs and Darts. No. 1, plated **8/6**; No. 2, all steel, black finish, **10/6** post free.—**FRANK CLARKE, 6, Whittall Street, Birmingham.** (Be sure to address "Mail Order Dept.").

MAKE YOUR OWN METAL TOYS. Our Casting Moulds produce thousands of quick-selling toys such as Lead Soldiers, Cowboys, Indians, Trees, Animals, Birds, Ships, Sailors, Railway Station Staff, etc., without previous experience. Complete Mould 2/6. Illustrated Catalogue, stamp.

A. RODWAYS, 102, Long Street, BIRMINGHAM.

Mention "Meccano Magazine."

CUT THIS OUT.

"Meccano" Pen Coupon. Value 3d.

Send 5 of these coupons with only 2/9 direct to the Fleet Pen Co., Fleet Street, E.C. 4.

You will receive by return a splendid British 14-ct. ... ibed Fleet Fountain Pen value 10/6 (Fine, Medium or Broad Nib). If only 1 coupon is sent, the p... 3d. less for each extra coupon up to 4 (Pocket Clip 4d.). Satisfaction guaranteed. Your own name gilt letters, either pen 1/- extra.

Lever Self-Filling Model with Safety Cap, 2/- extra.

Photographers!

Add richness and colour to black and white prints.

TRADE MARK **'TABLOID'** BRAND

SEPIA TONER

Requires no skill to produce perfect results.

All Dealers 2/-

Burroughs Wellcome & Co. 3, Snow Hill Buildings, E.C.

XX 4004 COPYRIGHT

ELECTRIC LIGHT! MAKE YOUR OWN

These wonderful Dynamos light brilliantly a 4–6 volt lamp, and are very easy to work. Only 5/- Post 6d. A splendid bargain! **5/-**

GREENS (Dept. N.), 85, New Oxford St., London.

A NEW DISCOVERY!

THE "CURVOGRAPH"

A wonderful invention enabling even the most inexperienced to create any number of beautiful designs. The "Curvograph" is an endless source of usefulness and entertainment to both young and old. The outfit (in strong box) consists of a metal template, scientifically and accurately made, pencil, supply of paper, specimen designs and a special drawing pin. It is a splendid toy, though, like Meccano, it is more than a toy. Read what the Editor of the "*M.M.*" thinks about the "Curvograph" on page 161.

2/- will provide the means to originate your own designs.

PHILIP & TACEY LTD.,

69-79, High Street, Fulham, LONDON, S.W.6.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.

Telegrams, "Meccano, Liverpool."
Telephone, 701, Old Swan (6 lines).

• • •

The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 2d. per copy. It will be mailed direct from this office, 1/6 for six issues and 3/- for twelve issues (post free).

• • •

Small advertisements are inserted in these columns at 1/- per line (average seven words to the line), or 10/- per inch (average 12 lines to the inch). Cash with order.

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.

15 DAYS' FREE TRIAL

Packed Free. Carriage Paid. Direct from Works.

£5 5s. CASH OR 2/6 WEEKLY.

Immediate delivery. Shop Soiled and Second-hand Cycles CHEAP. Tyres and Accessories at popular Prices. Satisfaction guaranteed or Money refunded. Write for Monster Size **Free List** and *Special Offer* of Sample Bicycle.

Est. 37 Yrs **Mead** CYCLE COMPANY, Inc. Dpt K.815, BIRMINGHAM.

WONDERFUL WATCH BARGAIN

Genuine sturdy Swiss, beautiful movement, good for a lifetime, and splendid accurate timekeepers. Send 5/- and yours by return. Easily worth double. **5/-**

GREENS (Dept. N), **85, NEW OXFORD STREET, LONDON, W.C.1.**

Bargains for "*M.M.*" Readers

Set of parts for Shock Coil, 1/6, post 2d. Battery Parts, 1/3, post 3d. Electric Light Outfit (complete), 3/9, post 4½d. Wireless Set, really good sound value, 5/9, post 6d. Model Theatre with Charlie Chaplin and many other actors, etc., 3/6, post 7d. Cinema and Films, 9/6, post etc., 1/-. Microscope Outfit, 3/9, post 4½d. Really good Telescope, 3/9, post 3½d. Pocket Cinema and Real Films, 9d., post 2½d.

A MODEL STEAM ENGINE

Powerful Steam Locomotive (complete), 12/6, 15/6 (in box with large track, 20/-, 25/- and 30/-, with carriages and trucks), postage 9d., 1/- and 1/6 extra. Send 4d. (in ½d. stamps) for large, new, illustrated catalogues and lists.

Over 20 years of actual experience in model making.

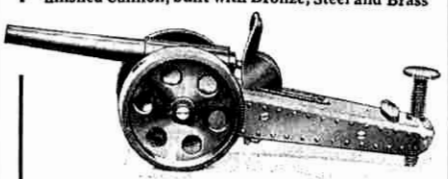
The Midland Scientific (38 P.3)
Queen's Road, Aston,
BIRMINGHAM (England)

Please remit by P.O. only if over 6d. in value

It Bangs! Flashes! and Shoots!

No Caps, Powder, or Special Ammunition

Practise and Beat Father with this beautifully finished Cannon, built with Bronze, Steel and Brass



SOME HOWITZER! A BRITISH TOY!!

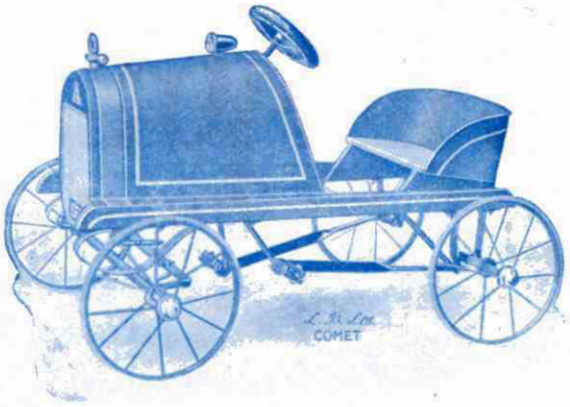
4/9 post free.

Money returned if you do not approve.

HANWELL'S TOYS,
38, Alexandra Road,
NORTHAMPTON.

Lines Bros. Ltd. Children's Motor Cars

You must be sure to see this Trademark.



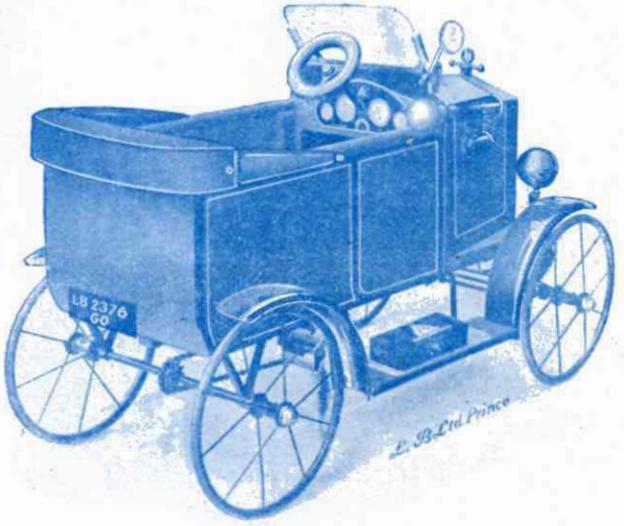
None genuine without this Trademark.

Price at all Good Toy Shops 27/-

The **Comet** Motor is suitable for boys and girls from 2½ to 6 years old. It includes a Lamp, Motometer, realistic Metal Radiator with the famous Trademark. The high-class 10" Wheels are fitted with Wired-on Rubber Tyres. The Comet is easily propelled by double crank action. No strain is imposed on the little owner. It is practically unbreakable.

Lines Bros. Ltd.
761, Old Kent Road
LONDON, S.E.

Build Motor Cars for children of all ages. There are Models at all prices, and styles from Runabouts to Saloons.



These Motor Cars are stocked by most good Toy Shops.

If you wish to make sure of getting all the latest accessories and improvements insist on a Car with the world-famous Trademark.

Price at all Good Toy Shops 94/6

The **Prince** Touring Car is suitable for boys or girls up to 10 years. It is easily propelled by the Rubber Pedals and Cycle Chain, beautifully painted and upholstered in fine colours with many exclusive and realistic features Our novel "Stop" and "Go On" Warning Mechanism only **7/6** extra.

Some of the exclusive features included:

- Dummy Hood with Cover.
- Rubber Bulb Horn.
- Driving Mirror.
- Windscreen.
- Rolls Royce Type Metal Radiator.
- Oil Indicator.
- Wired-on Tyred 12" Wheels.
- Tool Box with Tools.
- Mudguards and Steps.
- Four Lamps.
- Instrument Board.
- Voltmeter.
- Adjustable Seat.
- Rubber Pedals.
- Brampton Chain.
- Starting Handle.
- Motometer.
- Speedometer.
- Clock.
- Number Plates.

If any difficulty in obtaining these Cars, we will put you in touch with the nearest dealer.

TENNIS!
All your Tennis Needs are here—Racquets, Balls, Posts, Nets, Court Markers—no matter what it is, if its for Tennis, Gamages have it—and of very best quality

BOYS! FOR YOUR EVERY NEED —No Matter How Large or Small

CRICKET!
Your Cricket Requirements, too, are fully catered for at this Great Holborn Store—just drop us a card for details of your particular requirements

Come to the World's Great Store for Boys

Call Right away Boys

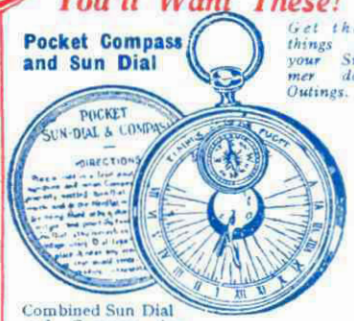
GAMAGES of Holborn

or Post Your Order

You'll Want These!

Pocket Compass and Sun Dial

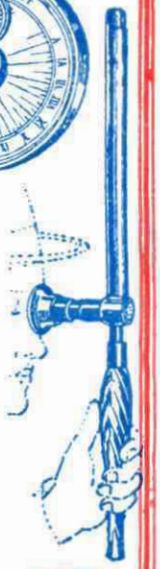
Get these things for your Summer days' Outings.



Combined Sun Dial and Compass (as illustration but without ring, in wood, polished case). Just the thing for Scouting Games during the Summer months. Price ... ... Post Free. **1/-**

Special Offer Ex.-Govt. PERISCOPES

Just the thing for Scouting and all Outdoor Games. Length 22ins. Finished in Field Grey. **Made by the famous firm of R. E. J. Beck Ltd.** and fitted with finest prisms and focussing eye piece. With one of these you can see over walls, hedges, etc., and round corners without being seen yourself Price, post free ... **5/-**



Handle of this Periscope unscrews, ensuring portability

Fine Quality Botanical Lenses

Very useful for Botany, Insect and Pond Life, etc., with 2 powers—7 times and 5 times. The lenses of these magnifiers are **WAR SURPLUS STOCK** and give the finest possible results. In handsome vulcanite frame. Diam. of lenses ¾in. Price **7/6**

Ditto with 1 lens only magnifying 7 times Price ... Post Free. Get one right away. **4/6**

POCKET TELESCOPES

Three-draw Telescope made of Brass. Measures 7½ins. extended, yet folds up into handy size for pocket. Powerful and neat in appearance. Carry one in your pocket this Summer. Price **3/9**

A CAMERA FOR 5/6 COMPLETE!

Make Photography Your Hobby this Summer, Boys!!!

The LITTLE NIPPER CAMERA

Here is the Camera you've been looking for boys. Every boy should know how to take a photograph, develop a negative and make a print. This splendid little camera makes fine photographs. Supplied complete in Box with 20-page Instruction Book, and 1 Plate Holder. Price ... **5/6**

The Little Nipper DEVELOPING and PRINTING OUTFIT

contains all that is necessary to make beautiful little pictures and gives you endless amusement in a most interesting way.

CONTENTS:—Dark Room Lamp, Printing Frame, Stirring Rod, Glass Measure, 2 Dishes, 1 Packet Developer, 1 Packet Plates, 1 Packet Printing Paper, ½lb. Fixing Salt, 1 Album for 12 Pictures, 20-page Instruction Book. Price complete ... **5/6**

Two Gamage Catalogues well worth having!

For full details of our Cameras and Optical Novelties, write for

Photographic CATALOGUE

Beautifully illustrated this splendid booklet will be sent **Post Free on Request**—Send now

No Boy should be without a copy of Gamages New 1924

Summer Sports CATALOGUE

It gives you illustrations and details of every Summer Sport and Pastime under the Sun—and it's free.

More Good Things!

This Month we are showing Goods from the Optical and Photographic Departments but included in our 60 Depts. is a section for everything you'll ever require—come and see for yourselves.

WEATHER HOUSES

Get one of these for your "den," boys. In fine weather the old lady comes out, and in wet weather the old man. Very accurate. Prices 7/6,4/6,3/9,2/6& Post 4d. **1/6**

Compass Whistles

Whistle and Compass combined (as illustration). A splendid whistle for the Scout—get one! Price ... ... Order now to secure. **1/6**

Complete Angler's Outfit

For coarse fishing. Strongly made and well finished Rod, Reel, Line, Tackle and Bait, all complete in fancy box with book of instructions. Ideal for the beginner. Price, only **21/-**

Pocket Microscopes

Very useful for Chemistry, Botany, etc. Pond Water can be examined by means of the saucer slide and 1 plain slide

on top. Fitted with adjustable spring to hold slide firmly. Magnifies 50 diameters (2,500 superficial). Price, post free ... **2/-**

Tripod Magnifying Glass

Extra large Brass Tripod Magnifying Lenses, very powerful. Specially made for the study of Botany, Insect Life, Pond Life, etc. Price ... Post Free. **3/6**

Juvenile Microscopes

All Brass Body, 3 powers—30, 60 and 90, large stage. In polished wood boxes with forceps and slides. Price **21/-** Post Free.

1 power, 30 times. Price **17/6** Mounted Microscope Slides **5/-** doz. Unmounted **6d.** doz.

Send for one to-day

Look Out for Gamages Announcement Next Month

A. W. GAMAGE LTD., HOLBORN, LONDON, E.C.1.

Cheapside House, BENETFINKS

PUBLISHED BY MECCANO LTD., BINNS ROAD, LIVERPOOL.
Printed by Stembridge & Co. Ltd., Albion Street, Leeds