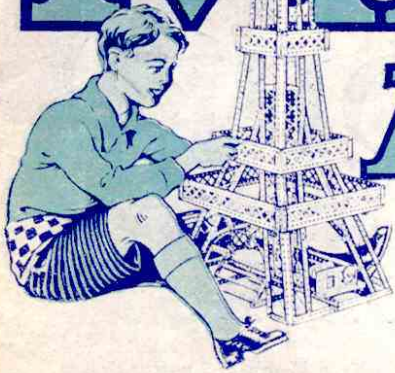


FEBRUARY 1924

MECCANO MAGAZINE



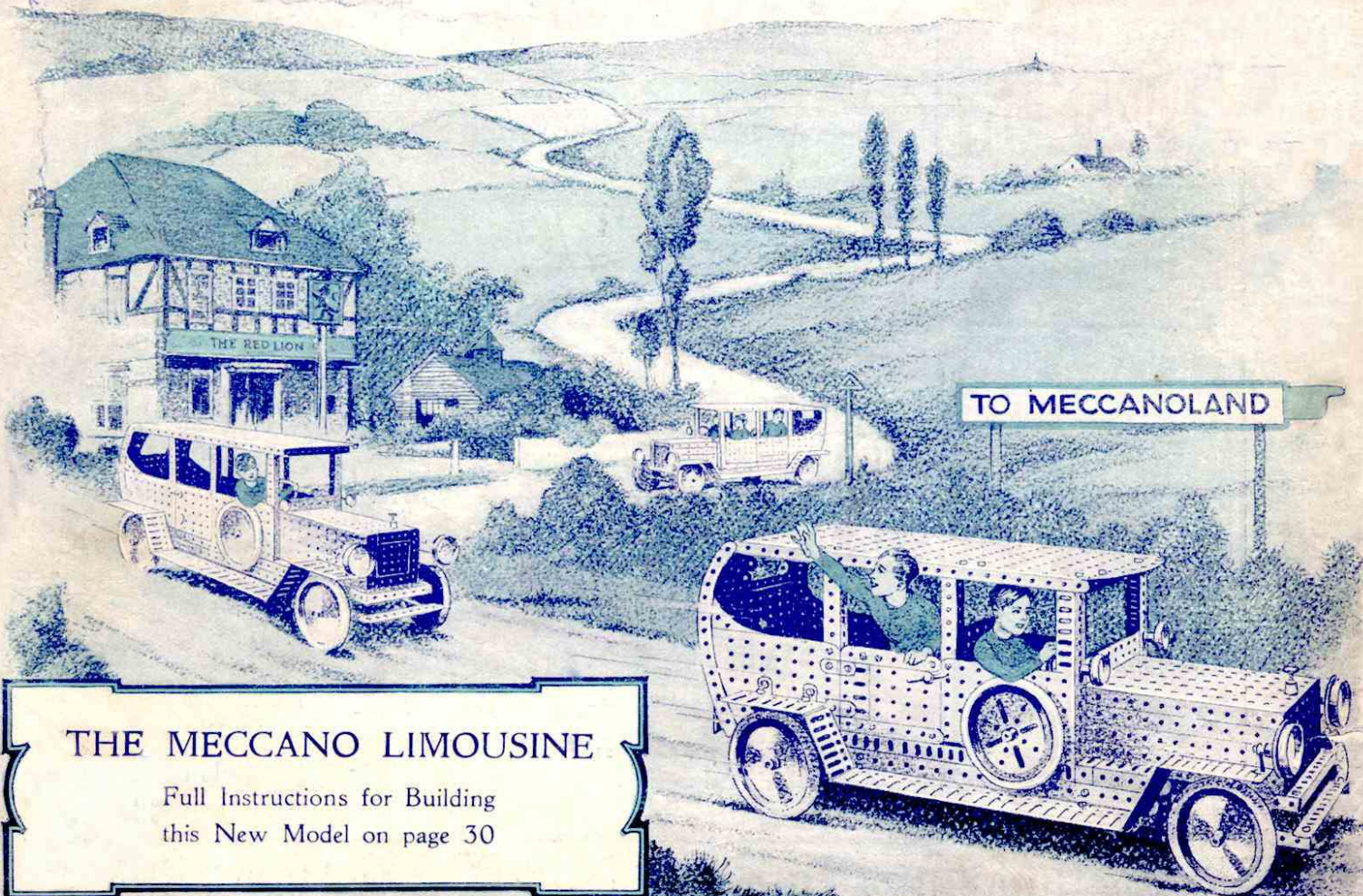
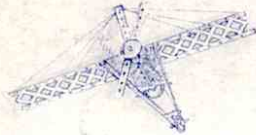
Published in the interests of Boys

PRICE

2D.

VOL. IX

No. 2



THE MECCANO LIMOUSINE

Full Instructions for Building
this New Model on page 30



FRETWORK

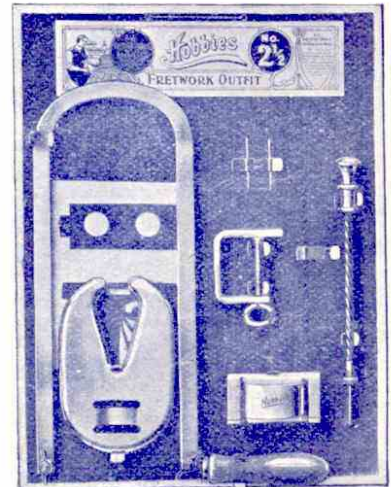
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Binns Road,

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MECCANO

MAGAZINE

PUBLISHED

IN THE INTERESTS

OF BOYS



EDITORIAL

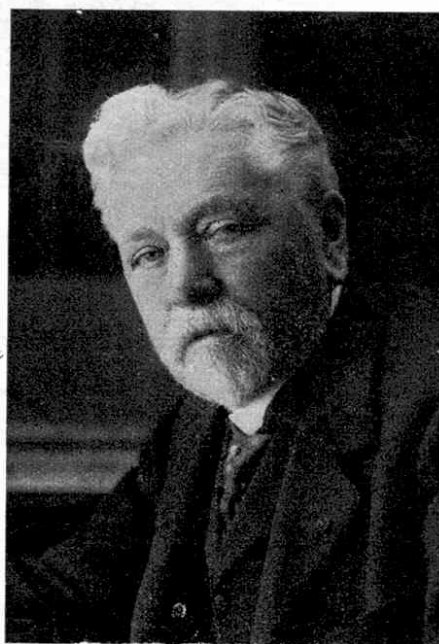
BY the death last month of M. Gustave Eiffel, France has lost one of her illustrious sons, and the world one of its greatest engineers. As the designer of the great Tower at Paris, M. Eiffel requires no introduction to Meccano boys, tens of thousands of whom have built models of his famous engineering structure. When I read the announcement of the passing of this eminent man, I felt that I should like to tell my readers something of his life work on this page.

In the personality of every great man there seems invariably to be something of outstanding importance—some particular quality that other men, less famous, do not possess. M. Eiffel was no exception to the rule, and anyone who has read his life story cannot fail to be impressed by the wonderful qualities of perseverance and cheery optimism that marked his whole career. Famous engineers might ridicule his cherished plans for a Tower 1,000 ft. in height. Friends might attempt to dissuade him from embarking on a project that, they affirmed, would result in disaster. But M. Eiffel, supremely confident in himself, heeded none of them. Brushing aside all objections, he persevered with his task and lived to see the successful fulfilment of his plans, to the amazement of his admiring friends.

Intending from his earliest days to become an engineer, Gustave Eiffel spent the whole of his boyhood with this ambition always in his mind. At school he devoted himself to the study of engineering and mechanical subjects, and work that seemed difficult or distasteful to other boys, became a hobby to him. As he grew older, Eiffel's continual pleadings and steady purpose had their reward, and he was entered a student in the Paris Central School of Arts and Crafts, an institution that has given many famous engineers to France. Here he soon qualified as an engineer, and while yet a young man was appointed to superintend the construction of an iron bridge at Bordeaux. A few years later

The Railway Strike

We regret any delay in this issue not reaching our readers by the 5th Feb., but our publishing arrangements were completely disorganised by the Railway Strike.



The late M. Gustave Eiffel

he was able to establish his own engineering works, and his daring engineering feats brought him world-wide fame.

Later he proposed to construct a Tower that would be higher than anything in the world. Despite adverse criticism, and even open hostility, he set to work. Naturally he met with great difficulties, but bravely overcame them all.

Nothing daunted him—nothing swerved him from his purpose. By steady work, combined with the highest engineering skill, he gave to France a unique structure, known the world over. The Eiffel Tower has stood for 34 years, a magnificent monument to perseverance and engineering knowledge. As a "show object" at the great Exhibition, for which it was originally built, it created wonder and awe in the thousands of people who beheld it. It has done more than this, however, in subsequently serving many practical purposes. For years it has nightly flashed wireless time-signals over continent and

ocean, enabling ships at sea to ascertain their positions and to keep their courses. During the war it played its part, being used for many scientific purposes, including the detection of approaching Zeppelins.

The qualities of the man who carried out this great engineering achievement were of the kind that every boy, whether he intends to become an engineer or not, should strive to imitate. Perseverance holds the key to success in every walk of life, and the old advice of "try, try again" is as true as ever. Every boy who wishes to be successful in life—and what Meccano boy does not?—should choose his path in life, and having chosen, should devote his whole mind to getting on, persevering as did Eiffel and others before him. Many boys do not come to a decision until they leave school and then take the first job that comes along. That is not always the best method of achieving success. Some boys are too lazy to think about the future and put off until it is too late, or until someone else has to make a decision for them. Every boy should think first and decide what business or profession he wishes to follow. Waiting for every boy there is some particular job that he can enjoy. Remember that the man who enjoys his work climbs high up the ladder of success. Make up your mind what you want to be, and go "all out" until you attain your objective. Don't get slack when either failure or success seem near, but keep on trying. Someone has said it is not enough to "keep on," but that we should "keep on keeping on"—which is perhaps even more desirable. Remember that there is always room for good men at the top of the ladder in every walk of life—and it is the man who perseveres who gets there.

The
Secret of
Success

Good Things Coming

In spite of the increase in the number of our pages we find it difficult to print articles on all the fascinating subjects that appeal to our readers. We are pleased at all times to receive suggestions, but we are guided in our choice of subjects by the general demand. There are many good things in store for future numbers of the "M.M."

These include the following articles:—

Stronger Than 1,000 Men:—

Giant Bucket Excavator.

Wonderful New Ccaler.

Story of London's Tube Railways.

Some Interesting Electrical Experiments.

Lives of Famous Engineers.

A Rival to the Forth Bridge.

These articles will appear shortly, and you should place an order now for a copy of the "M.M." regularly every month with your Meccano dealer or newsagent.

THE MECCANO LIMOUSINE

Full Instructions for Building a Splendid Body for Model 701 (Chassis)

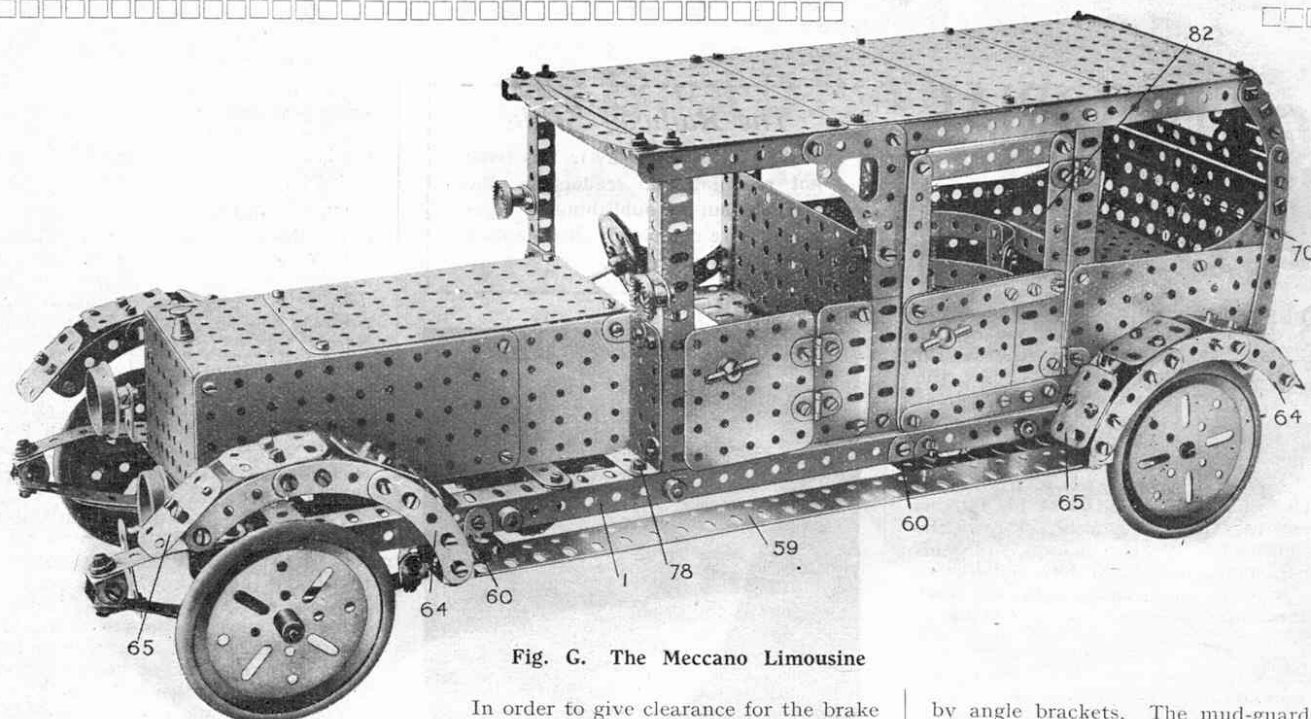


Fig. G. The Meccano Limousine

THOSE of our readers who have built the famous Meccano chassis will be interested to hear of a special limousine body that may be constructed for fitting on to the chassis. This model is shown in the accompanying illustrations, and the following details make clear its construction.

For the addition of this body the chassis is made shorter by replacing the sides of the frame (1 Fig. 701B)* by 18 in. angle girders. As will be seen from Fig. J these girders are braced by three additional $5\frac{1}{2}$ in. strips (2a). The rear cantilever springs (33 Fig. J) are reinforced by the addition of $5\frac{1}{2}$ in. and $3\frac{1}{2}$ in. strips. This necessitates the cardan shaft (Fig. 701C)* carrying the driving pinion (27) being replaced by a $3\frac{1}{2}$ in. rod, to correspond with the shortened frame members.

Running Boards and Mud-guards

The appearance of the model is considerably improved by the addition of running boards (59 Figs. G and J). The running board on the near-side (59 Fig. G) consists of one $12\frac{1}{2}$ in. flat girder, attached by two $1 \times \frac{1}{2}$ in. angle brackets (60 Fig. G) to the 18 in. angle girders (1) forming the frame.

In order to give clearance for the brake lever (53) the running board on the off-side is made up of three flat girders $4\frac{1}{2}$ in., $5\frac{1}{2}$ in. and $2\frac{1}{2}$ in., the latter overlapping one hole (at 61 Fig. J). The $4\frac{1}{2}$ in. and $5\frac{1}{2}$ in. flat girders are connected by a $1\frac{1}{2}$ in. strip (62), the whole running board being then attached to the main angle girder by four $1 \times \frac{1}{2}$ in. angle brackets (63).

The mud-guards for the front and rear wheels are all similar, and are constructed of three curved strips (64) on each side. These are overlapped two holes and four $1\frac{1}{2}$ in. flat girders are attached to them

by angle brackets. The mud-guards are connected to the ends of the running boards (59) by angle brackets.

In constructing the body, begin by bolting together two $12\frac{1}{2}$ in. angle girders (66 Fig. H) and six $5\frac{1}{2}$ in. vertical angle girders (67) to form two side frames, connected by a $5\frac{1}{2} \times 2\frac{1}{2}$ in. flat plate (68) and a $5\frac{1}{2} \times 3\frac{1}{2}$ in. flat plate (69). Then bolt on the rear $5\frac{1}{2} \times 3\frac{1}{2}$ in. flat plate (70) by means of a $5\frac{1}{2} \times \frac{1}{2}$ in. double angle strip (71) and $5\frac{1}{2}$ in. curved strips (72). The back window is fashioned from two $5\frac{1}{2} \times \frac{1}{2}$ in. double angle strips, one above and one below, and four $1\frac{1}{2} \times \frac{1}{2}$ in. double angle strips, two at each side. These are reinforced by two $2\frac{1}{2}$ in. strips bolted on the inside. The lower side panels (73) consist of two $4\frac{1}{2} \times 2\frac{1}{2}$ in. flat plates, bolted to the curved strip (72) and to the uprights (67). The driver's seat is a $5\frac{1}{2}$ in. flat girder (74) fastened to a $3\frac{1}{2}$ in. angle girder, which in turn is bolted to the plate 69.

The main doors are formed by two $4\frac{1}{2}$ in. vertical strips and one $3\frac{1}{2}$ in. strip at the top. The lower panels consist of a $2\frac{1}{2} \times 2\frac{1}{2}$ in. flat plate and a $2\frac{1}{2}$ in. flat girder, braced at the top and bottom of the panel by two $3\frac{1}{2}$ in. strips. The method of attaching the hinges will be plainly seen from the accompanying illustrations.

The base of the body consists of three $5\frac{1}{2} \times 3\frac{1}{2}$ in. flat plates (75) the front plate overlapping the second by one hole.

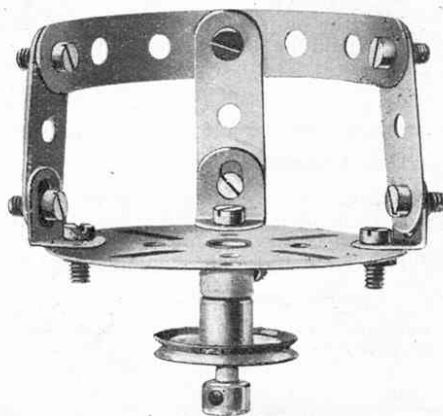


Fig. K. Revolving Seat

* The figures referred to are those appearing in the Chassis Instruction Leaflet (price 4d. post free). They were also printed in the "M.M." for September and October, 1923.

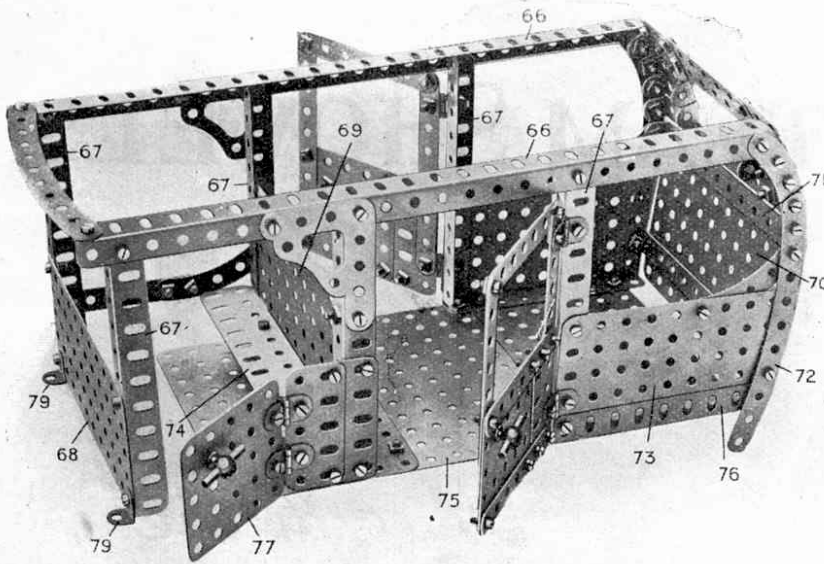


Fig. H. The Limousine Body

The front plate is bolted to a $4\frac{1}{2}$ in. angle girder, which is also bolted to the lower edge of the front plate (69), the rear plates being bolted to the $4\frac{1}{2}$ in. angle girders (76). The front door (77) is a $2\frac{1}{2} \times 2\frac{1}{2}$ in. flat plate, hinged to a $2\frac{1}{2}$ in. flat girder, which overlaps another $2\frac{1}{2}$ in. flat girder, bolted to the vertical angle girder (67).

The body is secured to the chassis by four bolts (78 Fig. G), those at the front passing through angle brackets (79 Fig. H) and being secured to the main side girders at 80 Fig. J. The rear bolts pass through holes in the rear plate (75) and through holes (81 Fig. J) in the rear $5\frac{1}{2}$ in. bracing strip. The top is enclosed by three $5\frac{1}{2} \times 3\frac{1}{2}$ in. flat plates and one $5\frac{1}{2} \times 2\frac{1}{2}$ in. flat plate. The back seat (82) is a $5\frac{1}{2} \times 2\frac{1}{2}$ in. flanged plate bolted to the rear plate (70).

The construction of the two revolving seats will be readily seen from the detail view (Fig. K). They revolve on 1 in. rods running from the face plate boss through a loose 1 in. pulley, a collar and set screw being fitted to the lower end of the rod.

The handles of the doors are made with hand rail supports and one inch rods as shown in the illustration.

No.			
18b	1" Axle Rods	...	5
20	Flanged Wheels	...	2
20a	2" Pulley Wheels	...	1
22	1" " Fast	...	2
29	$\frac{3}{4}$ " Contrate "	...	2
32	Worm	...	1
37	Nuts and Bolts	...	104
37a	Nuts	...	150
48	$1\frac{1}{2} \times 1\frac{1}{2}$ " Double Angle Strips	...	4
48d	$5\frac{1}{2} \times 1\frac{1}{2}$ " "	...	4
52	$5\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plates	...	1
52a	$5\frac{1}{2} \times 3\frac{1}{2}$ " Flat Plates	...	9
53	$3\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plates	...	2
53a	$4\frac{1}{2} \times 2\frac{1}{2}$ " Flat Plates	...	2

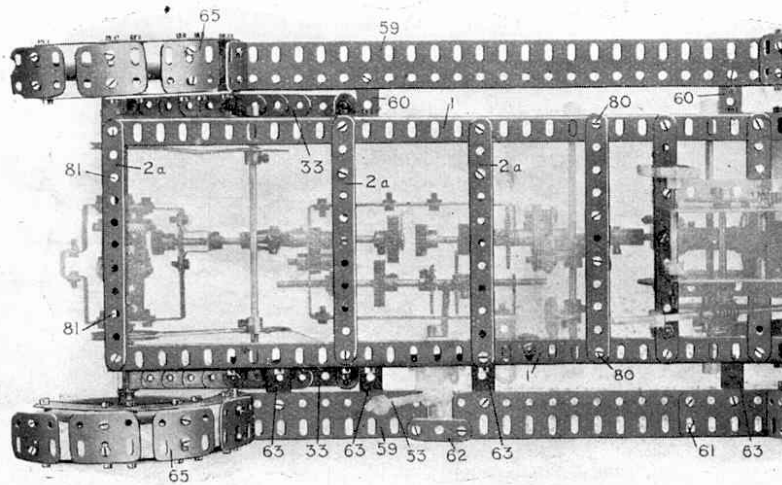


Fig. J. Method of Attachment to Chassis

No.	Parts Required for the Meccano Limousine Body		
2	$5\frac{1}{2}$ " Perf. Strips	...	1
2a	$4\frac{1}{2}$ " " "	...	4
3	$3\frac{1}{2}$ " " "	...	6
4	$3\frac{1}{2}$ " " "	...	1
5	$2\frac{1}{2}$ " " "	...	2
6a	$1\frac{1}{2}$ " " "	...	7
8	$12\frac{1}{2}$ " Angle Girders	...	2
9	$5\frac{1}{2}$ " " "	...	6
9a	$4\frac{1}{2}$ " " "	...	3
9b	$3\frac{1}{2}$ " " "	...	2
10	Flat Brackets	...	2
12	Angle " "	...	52
12a	1" Angle Brackets	...	2
12b	$1 \times \frac{1}{2}$ " Angle Brackets	...	7
14	6" Axle Rods	...	1

No.			
59	Collars	...	4
70	$5\frac{1}{2} \times 2\frac{1}{2}$ " Flat Plates	...	4
72	$2\frac{1}{2} \times 2\frac{1}{2}$ " " "	...	5
89	$5\frac{1}{2}$ " Curved Strips	...	3
90	$2\frac{1}{2}$ " " "	...	29
103	$5\frac{1}{2}$ " Flat Girders	...	2
103b	$12\frac{1}{2}$ " " "	...	1
103c	$4\frac{1}{2}$ " " "	...	1
103f	$2\frac{1}{2}$ " " "	...	5
103h	$1\frac{1}{2}$ " " "	...	16
108	Architraves	...	2
109	Face Plates	...	2
111b	$7/32$ " Bolts	...	150
114	Hinges	...	6
120	Buffer	...	1
136	Handrail Supports	...	3

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.

P. Short (Derby).—Your poem commencing "Yes! we have no Meccanos" is very good, but we seem to have heard something of the kind before in connection with the fruit business! We read your cheery letter with much pleasure.

Sidney Miles (Woodford Green).—You are quite right in surmising that this is the happiest and best time of the year for us. Hundreds of bright cheery letters arrive every day from boys living in all corners of the earth. We work early and late, Sydney, but we enjoy every minute of it.

A. Ferruccio (Turin).—We think you write English very well, and it was a pleasure to read your letter. We wish you success in your engineering career, and we thank you for your kind expressions towards Meccano and the Editor of the "M.M."

F. E. R. Nunn (Colchester).—You get extraordinarily good results on your Crystal Set, and we congratulate you on possessing such an efficient piece of apparatus. Telephonic reception at 350 miles is most unusual. We note you prefer Guild Badges in the form of pendants or tie pins.

L. K. Thompson (Bath).—Publishing the "M.M." once a month keeps us very busy, but it looks as though we might have to go to press more frequently. There are many articles of the greatest interest for boys now being prepared for our future numbers. We much appreciate your good wishes.

A. G. Johnson (Northwich).—All Meccano Clubs actively take up sports and games of all kinds, both Winter and Summer, but it is difficult to find room in the "M.M." to deal with their exploits and prowess in this direction.

J. Spiegelhalter (Malton).—We were interested to see the photographs of the three-valve set you have made, and we congratulate you on a very efficient and workmanlike job. We were also interested to know that you get Bournemouth clearly on the loud speaker, and this is our experience here. We hope you will spend many pleasant evenings "listening in."

W. Penman (Partick, N.B.).—We were pleased to hear of the wide interest being shown in your club, and we hope this will result in more Meccano clubs being established in Glasgow.

E. Drafern (Southampton).—At present we fear that there are too many difficulties in the way to enable us to publish the "M.M." weekly. The suggestion will not be lost sight of, however, and you may be sure that if we are able to see our way to do so, we shall certainly publish more frequently.

F. Padgett (Newark).—We quite agree with you, Frank, when you say that Meccano is "something more than a toy." We are sorry not to be able to print your verses, but these are scarcely up to our usual standard.

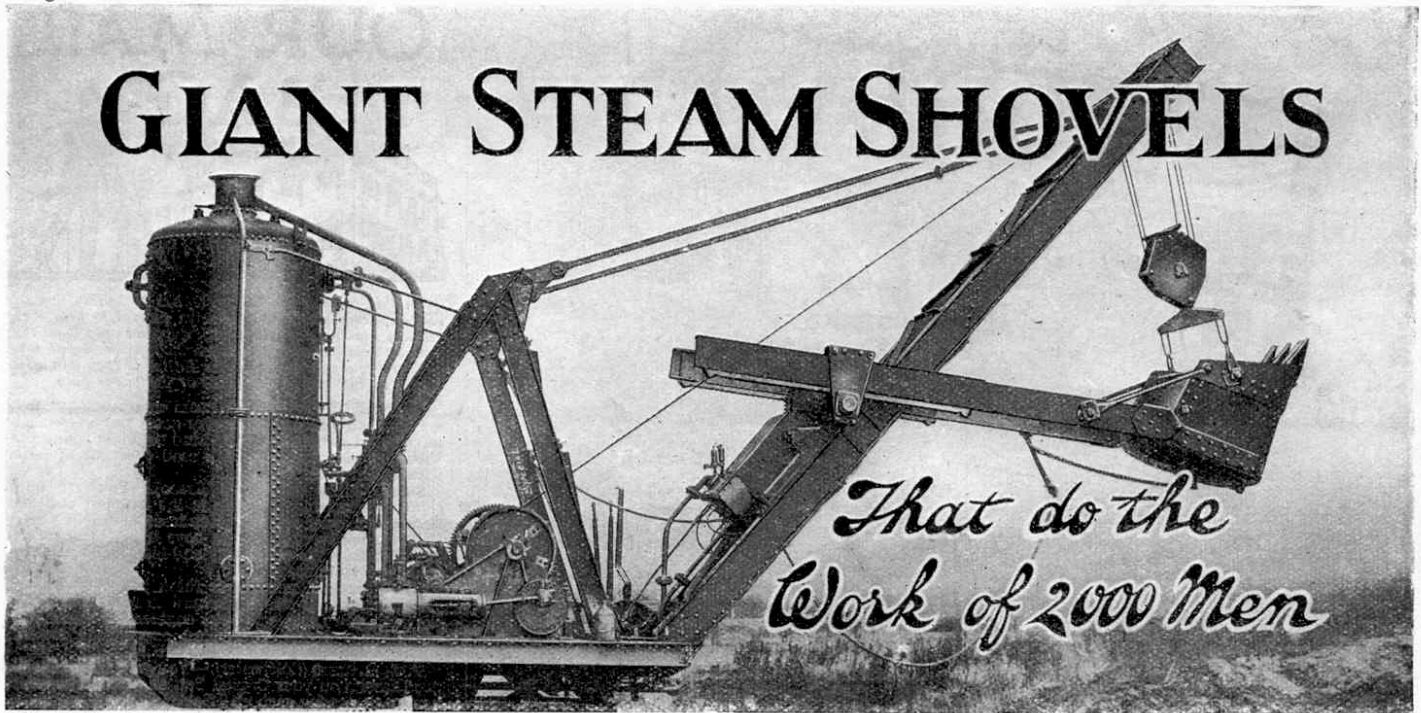
R. L. Uphill (Ryde, I.O.W.).—The subscription rates in Australia are the same as in England. Most Australian dealers stock the "M.M." We wish you all good fortune in your new home.

A. E. Bebb (Redditch).—Now that we know that you will be confined to your room during the whole of the winter through sickness, we are more pleased than ever that you carried off the prize in our Tom Sawyer competition. We trust that you will derive much pleasure from your wireless outfit. Under the circumstances you could not take up a finer hobby.

B. Mitchell (Stockton).—Send us a copy of your Magazine by all means, Bernard. Nothing pleases us so much as to see boys with literary tastes taking a keen interest in amateur journalism.

G. Winward (Burnley).—You will be more than delighted with the heavy Hornby Tank Loco. It is a beauty! We are sorry to hear of your trouble with your eyes, but if the doctor says that wearing the bandage for some days will cure you, you should be thankful it is no worse.

GIANT STEAM SHOVELS



*That do the
Work of 2000 Men*

(Continued from last month)

IN our last issue we described the general principles on which steam shovels are constructed and the purposes for which they are used. We saw that the size of the machine employed on any particular contract is governed by the output required and the nature of the material to be worked. In addition we saw that the size of the machine also depends on the size of the bucket it is to carry, a fact which itself depends again on the amount of material to be handled.

Considerations Affecting Construction

Another consideration that affects both the size and constructive details of these machines is the distance from the machine that it is required to discharge the excavated material. For instance, steam shovels of the standard type (weighing 55 tons) discharge the excavated material at distances of up to 32 ft. from the machine centres. This standard type of shovel may be modified by adding a longer jib, however, and this makes possible the discharge of the material at distances of up to 60 ft. Such machines are used for quarrying mineral buried beneath a top covering of earth, and will excavate ordinary soil or clay at the rate of 25 to 50 cubic yards an hour. The steam shovel stands on the uncovered deposit and works at the face of the material covering the remainder of the mineral to be quarried.

Machines with Long Jibs

The lengthening of the jib in this manner makes it necessary to considerably decrease the cutting effort on the teeth, as compared with that on the standard machine. Were this not done the machine would be unstable. The bucket is therefore made smaller and handles only $1\frac{1}{4}$ cubic yards, or roughly about a quarter the quantity handled by the standard bucket.

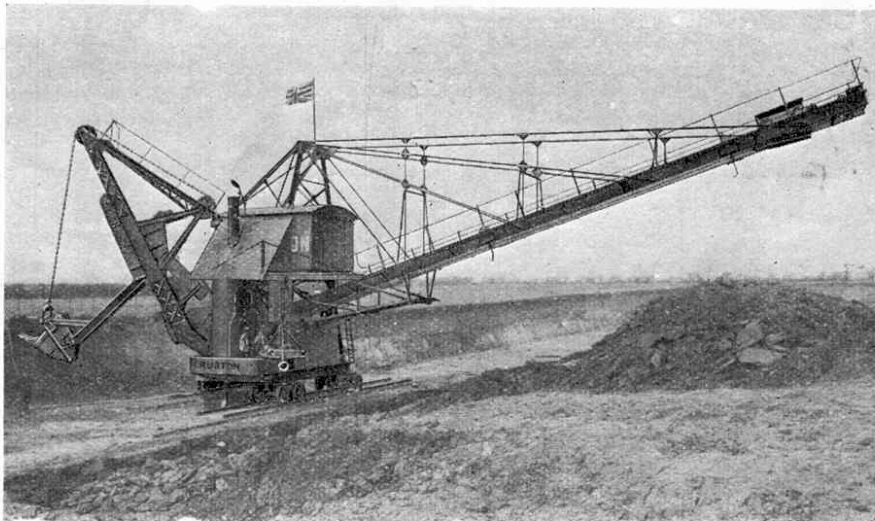
On the radius over which the machine effectively operates depends also the

machines with larger buckets must be used. Some very large machines of this type are now in use, and we illustrated one of these giants on page 3 of our last month's issue. Some of these machines are equipped with rock-loading buckets having capacities of $3\frac{1}{2}$ cubic yards. Although naturally slower in operation than the lighter types, they are able to complete a cycle of operations in about a minute! They eat their way through 300 cubic yards of material in an hour and discharge their loads at any given point over a radius of 100 ft.

Combined Excavators and Transporters

It is not always economical, nor always possible, to employ an excavator with a long jib, where dumping at a distance is necessary. Sometimes, for instance, it may be required to remove earth from one side of a narrow cutting and deposit it on the top of the opposite bank. The slewing motion of a machine working on the lower level would not be able to accomplish this.

In such circumstances, or in the case where it is desired to build up a high banking with the excavated material, a transporter may be installed to work in conjunction with the excavator. A transporter may also be used, in conjunction with a standard shovel, for taking away the excavated material to a greater distance than would be possible with a jib of ordinary length.



Photo]

[Messrs. Ruston & Hornsby Ltd.

A Ruston Combined Steam Shovel and Transporter

depth to which it is able to cut. Modified machines, such as are referred to above, will excavate soil, etc., to a depth of 15 to 20 ft. and deposit it up to 60 ft. distances. If it is desired to excavate to a greater depth than this, machines with even longer reaches must be constructed.

If the material to be excavated is heavier than soil or clay, more powerful

The transporter is sometimes a separate unit, and distinct altogether from the excavator. In this form it generally consists of an under-frame and tower, supporting a double cantilever track for the wagon or skip. The under-frame is fitted with the necessary wheels and travelling gear to enable it to be moved about the quarry under its own power. The boiler and winding engines for actuating the transporting gear and the transmission system are supported on the under-frame.

In another type of machine the transporter consists of a framework attached to the excavator, and worked by the main engines. Such a machine is illustrated on the previous page. With both types the earth to be dumped is run up the inclined track of the transporter in a skip, which is slightly larger than the excavator bucket to allow for spillage. The skip is fitted with a hinged door, similar to that on the bucket of the excavator. It is so arranged, however, that the door may be opened at any desired point on the transporter track by means of a moveable trip placed at the required position by the driver, who is thus able to regulate the building-up of the dump.

Controlling the Machinery

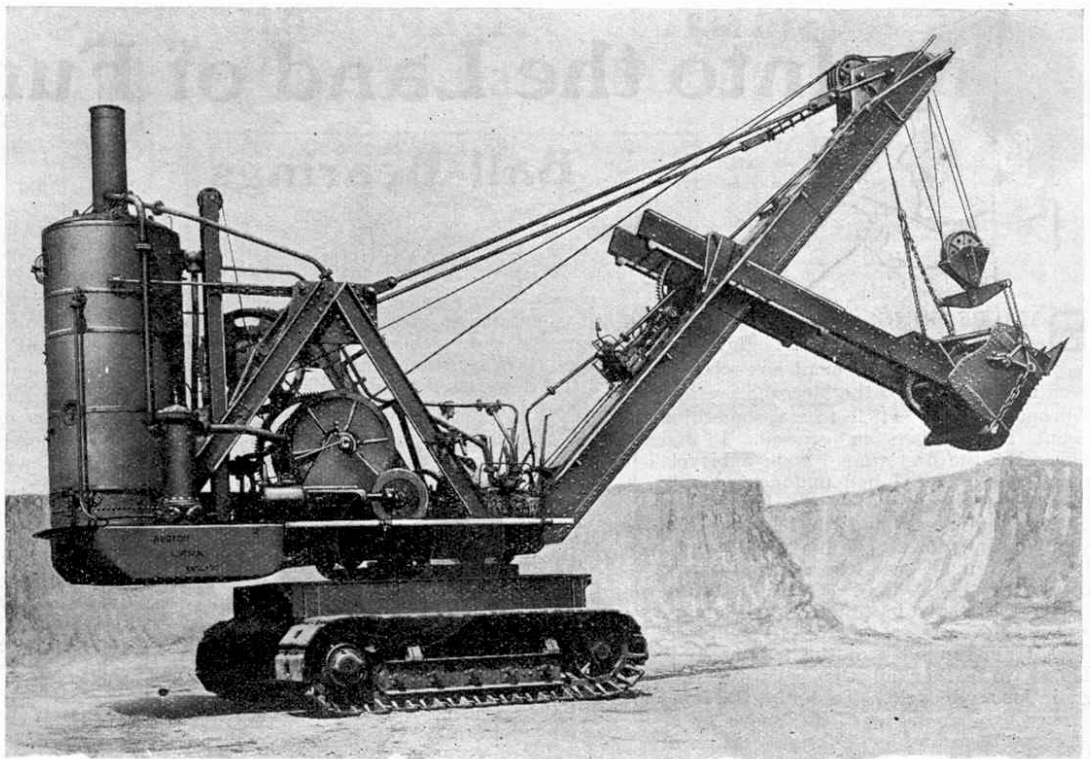
Having now seen something of the construction of these giant shovels we may consider for a moment how a machine of the standard type is operated.

When commencing operations, the bucket hangs in a vertical position, with the teeth resting on the ground opposite the face of the material that is to be removed. The driver starts up the engines and throws in the hoisting clutch. This action drags the bucket forward and upward, to the face. At the same time it is thrust outwards by means of the racks along the bucket arm until it is cutting away the material to the required depth.

With one hand on the control-lever of the main engines, and the other on the control-lever of the racking engines, the driver is able to control the depth of cut so that an equal thickness is taken throughout the whole length of the stroke. He thus ensures that the bucket is completely filled when the top of the stroke is reached. At this stage, the hoisting clutch is thrown out and the racking motion draws in the bucket until clear of the working face, being held in the meantime on the free drum by means of the brake.

Working at High Speed

The slewing motion is then started up, and the bucket is swung over the wagon, or over the point where the material is to be dumped. When the correct position is reached, the driver pulls a cord by his side, and his action withdraws a catch on the bucket door, allowing the contents of the bucket to be discharged.



Photo]

[Messrs. Ruston & Hornsby Ltd.

A Splendid Steam Shovel, mounted on Caterpillar Travelling Gear

The slewing motion is then reversed and the bucket is swung back into position to take the next cut from the working face. The bucket is allowed to return to the bottom of the stroke by releasing the drum, which is loose upon its shaft. When free of the clutch it is under the driver's control by means of a foot-brake.

All these operations take place almost as quickly as they are described, and the whole series, or "cycle" as it is called, is performed in from 20 to 60 seconds, the actual time depending on the size of the machine and the length of the jib. As an illustration may be mentioned a special test of a steam shovel capable of dealing with about 150 cubic yards of soil or clay per hour, or from 60 to 100 yards of iron-ore per hour. In the tests referred to it regularly completed the cycle of operations in from 25 to 35 seconds.

Working with a Transporter

The operations when a separate transporter is employed are not difficult to follow. The excavator takes a cut and discharges the material into the skip, which stands ready at the foot of the transporter track. When the skip is thus filled the transporter driver starts his engines and the loaded skip is hauled up its track to the tipping point. Here the catch holding the door of the skip is knocked out automatically by a trip gear, as already described, and the skip is emptied. The driver then throws out the hoisting clutch and the skip is lowered by gravity to the foot of the track, the drum to which its hauling rope is attached being allowed to run free, but controlled by the driver with a brake.

In designing a transporter it is necessary to arrange for the bucket to complete its trip from start to finish at a speed that is slightly faster than is required for a

complete cycle of operations by the excavator with which it is working. In the case under review the transporter makes a round trip in about 25 seconds and is several seconds quicker than the excavator, which is not therefore called upon to wait for the return of the skip. Exactly the same foresight must be exercised when an ordinary excavator is used, where the excavated material is loaded into wagons. In this case a good contractor will always arrange that his steam shovels are never left idle, waiting for empty wagons.

An excavator working with a separate transporter is capable of a larger output than a long-jib shovel of equal bucket capacity. This is largely because the machine has a shorter jib and therefore is able to slew round more quickly than a shovel with a long jib. Really, therefore, the work of the long jib is carried out by a separate machine, the transporter, which works at top speed and has a longer reach than a shovel with a long jib. Also in practice it is found that the coal consumption of the two separate machines is rather less than that of a single long-jib machine, because the latter is very much heavier and requires more power to work.

Of course, there are disadvantages as well as economies. These are chiefly that an extra man is required to work the transporter and also that tracks must be laid for two machines instead of one.

A good deal more might be written about these interesting machines, and in next month's "M.M." we shall have something to say about another type of excavator, called the Drag-Line. We shall give illustrations of the heaviest Drag-Line in the world, and announce an interesting competition in connection with this model, for which a special prize of £5 cash will be awarded.



Into the Land of Fun:

Ball-Bearings

by
"SPANNER."



BALL-BEARINGS are one of the greatest inventions in engineering, and as this movement has recently been introduced into the Meccano system, I propose in this article to say something about ball-bearings in general. I well remember the first time I took a bicycle to pieces. When I had undone the nuts that held the front wheel in its fork, taken off the hub caps and pushed out the spindle, some dozens of tiny balls dropped out and ran all over the floor into any corner they could find! It was one of my first experiments in practical mechanics, and whenever I see a ball-bearing nowadays I am reminded of the tedious hunt I had to gather all the balls together again for my bicycle. No doubt, the same experience has occurred to many other Meccano boys, and no doubt, too, they will have learned that the best way to put the balls back into position when re-assembling a wheel, is to fill the hub with thick grease, which holds the balls in position and serves as a lubricant after the wheel has been re-assembled.

The Cause of Friction

One of the greatest troubles that occurs in connection with every engine or, indeed, with any form of movement where things rub, is due to friction. Friction is caused by the microscopic projections on the surface of one body interlocking with those on another body, upon which it may be moving. This causes a machine to run more slowly than if friction were entirely absent.

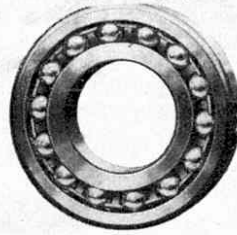
The reduction and elimination of friction has been the subject of considerable thought and experiment by engineers. The very first attempts to eliminate friction were those made by pre-historic man, when he placed rollers beneath the load he was dragging, finding it easier in this way to drag heavy stones or trunks of trees from one place to another. Even then, however, there was friction between the rollers and the ground, but later this was reduced to a certain extent by the introduction of large narrow rollers placed at the centre of the load. This ultimately led to the invention of the wheel.

Advantages of Oil

A certain amount of friction is eliminated by lubrication. Generally, oil is regarded as a sort of magic fluid that makes things run more easily. I wonder how many Meccano boys know exactly what happens when a bearing is oiled. What occurs is that a layer of animal or vegetable fat forms a film on the surfaces in contact, and so keeps them apart. The oil forces itself between the two surfaces, even though the pressure be as much as a ton

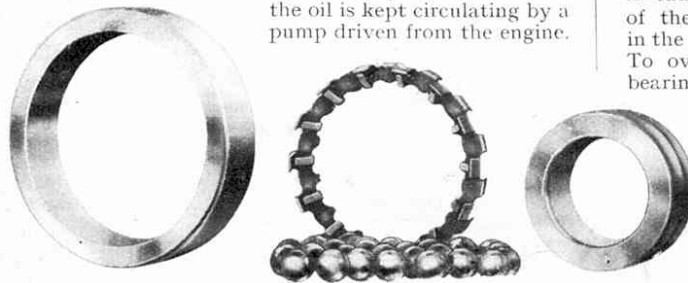
to the square inch. It refuses to be squeezed out, although in the course of time it is consumed unless replaced.

It is now easy to see why it is so necessary to maintain an ample supply of lubrication



A Radial-Journal Ball-Bearing

to all parts of an engine or machine, where friction is likely to occur. In bicycles, special oil-holes are provided in the hubs of the wheels and in the free wheel. In motor cycles the crank-case contains a certain amount of oil in which the fly wheels revolve, splashing the oil to all parts of the engine in the form of a fine spray. In motor cars a similar principle is adopted and in some the oil is kept circulating by a pump driven from the engine.



Courtesy of]

[Messrs. SKF Ball Bearing Co. Ltd.]

The Four Parts of the Radial-Journal Ball-Bearing

Friction may be considerably reduced by using ball-bearings, which have the effect of reducing the area of the surfaces in contact. Instead of the whole of the two surfaces rubbing one another, the only surfaces in contact when ball-bearings are used are points.

The advantages of ball-bearings may be well illustrated in the following manner. Take three or four balls—billiard balls,

tennis balls, or even marbles will do quite well—and placing them on the table, rest a heavy book on them. It is quite easy to move the book from one side to the other when resting on the balls, but if the balls be removed and the book be pushed about on the flat table the difference will be appreciated. Notice how very much greater is the amount of power required to overcome the friction between the two large surfaces when the book is lying on the table, than is the case when it is resting on the balls, when the only points of contact are the very small surface areas where the balls touch the book and the table.

Types of Ball-Bearings

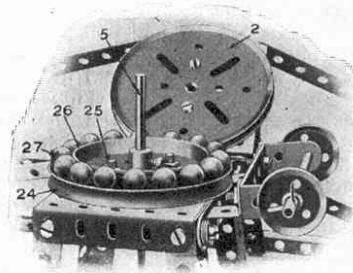
The earliest form of ball-bearing to be used was known as the "cup and cone" type, such as is used in bicycle wheels. This type is not altogether satisfactory, however, for there is a great deal of what may almost be called "side-slip" as well as the normal rolling action. This slipping is caused through the points of contact of the balls and their tracks not being in the same plane as the plane of revolution. To overcome this defect a new type of bearing called the "radial-journal" was introduced. In this bearing, which is illustrated on this page, the points of contact lie in a plane that is at right-angles to the axis of rotation. This results in a pure rolling motion on the part of the ball.

The radial-journal type of bearing consists of four principal parts, (1) the outer and (2) inner rings or "races," (3) the balls, and (4) the supporting device, usually called the "cage." The rings are grooved for the ball tracks, as shown on the smaller ring at the right-hand side of our illustration. The grooves are of a slightly larger curvature than the balls in order that the principle of contact of points shall be preserved.

Remarkable Accuracy

One of the most important points about the balls is that they should be of exactly uniform size. One of the leading manufacturers guarantees the balls used in their bearings to be true to within one ten-thousandth part of an inch! Some idea of the minuteness of such a measurement may be obtained by comparing it with the thickness of a sheet of fine tissue paper, which is approximately one-thousandth of an inch in thickness. Thus the balls are guaranteed true to about one-tenth the thickness of such a sheet.

When we understand how necessary it is to manufacture the balls with such accuracy, we are able to see that it is bad policy to renew one or two balls in a bearing.



The New Meccano Ball-Bearing

Ball-Bearings—(cont.)

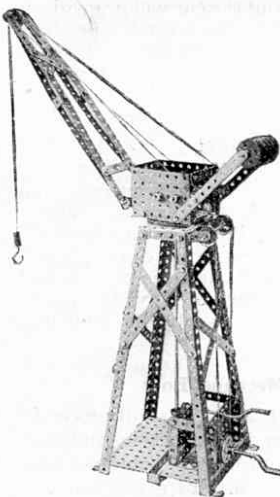
The new balls may be a fraction of an inch larger than the old balls, which have become worn, and the new balls will take the whole of the thrust or weight. The bearing will not therefore work correctly, and may probably break down under the strain. Therefore, if one of the bearings of your bicycle requires a few new balls you should change all the balls in that particular bearing.

The supporting cage of a radial-journal bearing is necessary to support the balls and ensure that they take up their load smoothly. It is made of an anti-friction metal, for it is the only part of the bearing where friction may possibly develop. For very light loads and comparatively low speeds, cages are not absolutely necessary and small bearings are generally made without cages.

Ball-bearings are made from a special carbon-chrome steel of such exceptional hardness that it is impossible to mark it with a file! The balls are highly polished and thus present the minimum of microscopic projections to the surfaces with which they come into contact.

Use of Ball-Bearings

The use of ball-bearings is to substitute a rolling action for a sliding action, and by doing this they considerably reduce friction. Ball-bearings are also used for taking-up end-thrusts, for taking the weight of vertical shafts, for "locating" horizontal shafts, for taking-up the thrust of worm and bevel gear drives, and for many other purposes.



Model No. 401.

Crane in which the Meccano Ball-Bearing is used to advantage

Bearings to take-up the thrust are of a different pattern to those illustrated. They resemble more closely two washers with a cage of balls between, the washers being grooved to take the balls. Many other patterns of bearings are also made, each designed for its own particular purpose.

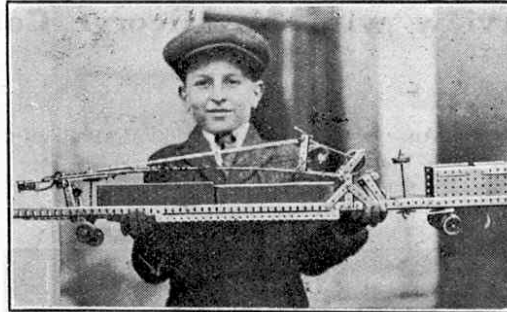
It is, of course, essential that ball-bearings should be mounted with great accuracy. They must also be fully protected, because, owing to their highly-finished surfaces, they are peculiarly liable to rust. The slightest particle of dirt or grit that enters the bearing will quickly wear it slack. The best way to protect bearings from wet or damp is to fill the bearing with some grease about as thick as vaseline. Further protection is desirable by using dust-proof housings, and end covers that have a very fine clearance of the shaft.

The Meccano Ball-Bearing

The new Meccano ball-bearing movement is useful for cranes or any similar models in which one part of the model

(Continued in next column)

How Master Mortimer J. Fox Rose to Fame through Meccano



Mortimer J. Fox, Jr., and his model Fire Truck, which won him a pass into all the Fire Brigade Stations of New York

We all delight in watching a fire-engine turn out. Our imaginations are stirred as we hear it go clanging down the street. It is even more exciting to watch than an ambulance or a procession with a brass band at its head! We seem to see the smoke and smell the burning materials; to hear the hoarse shouts of the firemen and the cheers of the crowd as a rescue is effected, or a particularly smart piece of work carried out.

Every boy appreciates the opportunity of visiting a fire station to inspect the engines. Regulations do not often allow of this, however, and we think our readers will be interested to hear how fortunate is an American boy in this respect. Of course, this bright boy, Mortimer J. Fox, is a Meccano boy! He is 11 years of age, and the point of the story is that he recently received a pass from Captain John Kenlon, head of New York City's famous fire brigade. It all happened as a result of Mortimer showing Captain Kenlon a working Meccano model of a tractor-propelled fire truck. This model, which weighs 9 lbs., is operated by a Meccano Electric Motor, supplied by two dry batteries carried on the truck.

Mortimer's pass gives him the freedom of all the fire stations in the city, so that he may inspect the various fire engines in each town.

"Of course, I won't be able to visit all the fire-stations," Mortimer explained to our representative. "There are about 200, I think. I want to visit as

many as I can, however, to get ideas for a Meccano model of a fire engine on which I soon hope to start work.

"I don't know that there is anything very unusual in my truck," he continued modestly, as he placed it on the floor and proceeded, with several interruptions from his big dog Renard, to show the principles of its construction. "I have made models of bridges and many other things from the Meccano Manuals, but that is the first time I have made anything out of my own head.

"Ever since I was two years old," he continued, as he lovingly fingered his truck, "I have been making something or other. I just want to go on working and working, making bigger and better things. When I grow up, I want to be a mechanical engineer. For my birthday I received a new Meccano Outfit, and not long after Christmas I began work on my truck. I've worked on it about an hour a day, after school, and a lot on Saturdays!

"This is the way my extension ladder works," he said, as he ran the ladder up and down. Then followed an interesting description of the features of the model, and also an accurate and comprehensive explanation of the principles of modern fire-fighting apparatus.

Our representative was astonished at Mortimer's knowledge of his subject, and it is no wonder that our young friend's father, who, by the way, is Vice-President of the Columbia Bank, is proud of his son!

Storage Boxes



We have in stock a limited number of boxes, suitable for holding Meccano parts. These boxes are in polished oak, fitted with partitions, and hinged lids. They fasten with lock and key, and are provided with two drawers, also with locks and keys.

The dimensions of the boxes are 17" x 15" depth 9½", and the price is each 70/-, carriage forward.

As our stock is only small we advise those of our readers who are interested to take immediate advantage of this opportunity of securing a strong and serviceable box for storage of their Accessory Parts.

MECCANO LTD.

LIVERPOOL

Lives of Famous Engineers

Next month we hope to print Part II of the story of George Stephenson's life. The second instalment of this popular article has been "crowded out" of this issue.

NEXT MONTH

Some More No. 4 Models

Motor Cars Without Gears

An Interview with Mr. George Constantinesco

A SHORT time ago we received information that a new device for motor cars had been invented by Mr. George Constantinesco. It was claimed that as a result of this invention it would be possible to construct motor cars without clutches or gears; that hills would be climbed with little—if any—loss of speed, and that the engine would always run at the correct speed, according to its particular load and gradient.

The news of so wonderful a device so impressed us that we wrote to the inventor telling him that we felt certain Meccano boys would be delighted to hear full details of his new mechanism. For this purpose we placed the columns of the *Meccano Magazine* at his disposal. Mr. Constantinesco's reply was brief and to the point. "Come and see me!" he wrote, and our readers may be sure that we lost no time in responding to this kind invitation.

A Mathematical Idea Successfully Applied

"You want me to tell Meccano boys about my new invention?" said Mr. Constantinesco kindly, when I called upon him. "I shall be very glad to do so, for I am particularly interested in the Meccano hobby. You see I have to be, because my small son owns a Meccano Outfit and is already an enthusiastic Meccano boy!"

"This new device is called the Torque Converter. It is a mathematical idea applied to practical problems. I am afraid I cannot explain exactly how I obtain my results without falling back on advanced mathematics and highly technical engineering knowledge. What I am able to tell you, however, is that with this invention a motor car will run without gear-box or clutch, and will require an engine of only one cylinder to drive it."

"Some of my friends told me such a thing was impossible and would not work, so I built an experimental model, using a model that had been built for bench tests only, into an old 45 h.p. Sheffield-Simplex chassis. Instead of using the big engine I substituted a 10 h.p. Singer engine. The car went splendidly. It was driven about the outskirts of London, and later towed a lorry up a steep incline. When 6 inch wooden blocks were placed in front of the wheels and the engine started, the car climbed over the blocks without hesitation, to the great astonishment of the people who happened to be present."

An Invention that will Revolutionise Transport

"I believe that my invention will revolutionise all forms of transport, for



Mr. George Constantinesco, Inventor of the Torque Converter

it is not confined to the motor car alone. For instance, my first idea during the war was to apply such a Converter to the improvement of tanks used in warfare. It may also be applied to locomotives, aeroplanes, ploughs, tractors and all similar vehicles. At least a quarter of the cost of these vehicles will be saved by using this gear. Their engines will require to be only about half the size of engines used to-day, so that petrol and oil con-

sumption will be considerably lower. By using an engine with a single cylinder—and very probably a cheap two-cycle engine—the four, six or eight-cylindere engine will be abolished and all the complicated mechanism in the working of such an engine will be eliminated. What is more important, we shall do away with the costly material and machinery entailed in the manufacture of multi-cylindere four-cycle engines.

"Then again, the control of all vehicles will be considerably simplified. A three-way switch will give the forward, neutral, and reverse positions. In the case of a motor car the engine is started, the throttle opened, and the car will immediately glide forward. Increased speed is obtained simply by opening the throttle and there is no trouble with gears or clutches."

"In actual practice the Converter will be built into the engine-casing, and for an average small four-seater car it will fit comfortably into a box of about one cubic foot dimension. No matter what type of an engine is used, its drive is converted into a smooth even-turning movement, without jerk even though the engine may be racing. The engine may be placed either horizontally or vertically, and may be air or water-cooled."

A Paradise for Meccano Boys

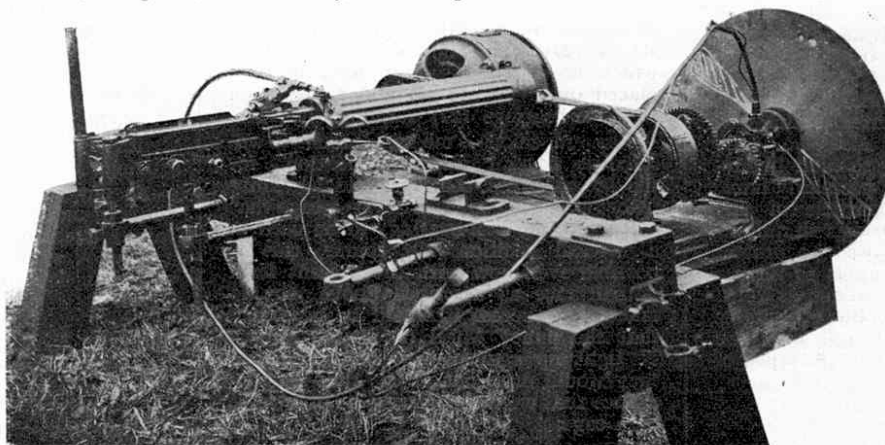
When I asked Mr. Constantinesco for a list of his other inventions he smilingly took down a couple of volumes filled with details of patents of every kind.

"There you are," he said, "you may make a list of them if you wish!"

Needless to say I did not "wish," for several hours would have been necessary to list them all. Turning over the leaves of the volumes, however, I had the opportunity of peeping into what would be a veritable paradise for Meccano boys.

There were descriptions of patents covering every kind of mechanism:—Internal Combustion Engines, Reinforced Concrete Buildings, Carburettors, Depth-Charge Projectors, Bridge-Construction Plants, Motors, Firing Gears, Trench Mortars, Rock Drills and many other inventions of absorbing interest to Meccano boys.

"When I was 11 years of age," said Mr. Constantinesco in reply to my enquiry as to how he came to devote his attention to science and engineering, "I was greatly attracted



The world-famous "C.C." aeroplane gun, one of the most remarkable inventions of the war

by the mysteries of electricity. It seemed to me such a wonderful power, offering such a wide field for investigation, and yet nobody seemed to know exactly what it is. That alone was enough to arouse the liveliest curiosity in a small boy! My first experiments were made with the household bell, but as all the bells in the house went out of order as soon as I started my investigations, my experiments were not exactly popular! But I had learned something, and setting to work I was eventually able to invent an electrical apparatus used in the treatment of paralysis. After several minor improvements had been made on this invention, it was found to be superior to any apparatus used for the purpose at that time. I think I was forgiven for the bell experiments after that!

Musical Harmony and Transmission of Energy by Sound

"When I was 17 years of age I used to play the piano, and so I became interested in musical harmony and therefore in the theory of sound. I read and studied everything bearing on sound, and the more I learned the more interested I became. I found with surprise that there was no scientific theory for musical harmony and I determined to study this subject. Three years later I had my reward, for I was able to discover the correct mathematical laws of musical harmony. This led me to study the theory of sound on an entirely new basis and by new methods. Finally I was led to the discovery of my method of transmitting energy through water by enclosing the sound waves in a pipe full of water—hitherto an unheard-of feat! It is to those years of study and to the knowledge that I then acquired, that I undoubtedly owe my successes, for at least one of my most successful inventions is based on the theory of vibrations and of sound waves.

"But now," continued Mr. Constantinesco, "Meccano boys are not interested in the theory of sound. I'm sure they would much rather hear about that part of my work that concerns my inventions." Saying which he opened a drawer in his desk and took out several photographs of his inventions.

A Famous Invention

"Perhaps the best-known of my inventions," he continued, "was this timing apparatus for machine guns. In 1915-16 the German airmen with their Fokker 'planes were far in advance of those of the Allies so far as their method of shooting was concerned, and I determined to 'turn the tables' on the Germans at the earliest opportunity.

"I therefore undertook several experiments, the result of which was a high-speed timing apparatus that enabled two machine guns to fire at the same time over 2,000 rounds per minute. They fired in this way through the aeroplane propeller, even though this was revolving at the rate of 1,500 revolutions per minute. My invention made any aeroplane to which it was fitted immensely superior to the German aeroplanes, and over 40,000 of these 'C.C.' firing gears were made for the British Air Service and about 10,000 for the American Forces."

Our illustration shows Mr. Constantinesco's invention fitted to a Vickers Machine Gun. An outline resembling a propeller is marked on a disc, which is rotated in front of the machine gun, through gearing

from an electric motor. Between the two propeller blades are to be seen two holes. The larger one was made by firing 140



A hitherto unpublished photograph of the Constantinesco Trench Mortar

A Message to Meccano Boys

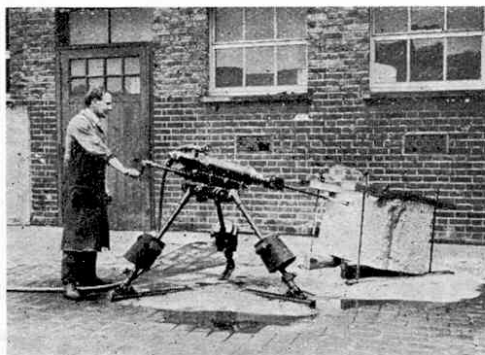
7 Grosvenor Gardens.

London W.1.

All boys are curious, and my advice is - go on being curious. Find out the reason for everything, no matter if it appears silly or simple. Find out from men and books the why and wherefore of everything. Study mathematics and engineering books, but particularly mathematics.

G. Constantinesco

rounds at the rate of 600 rounds per minute. The smaller hole near it was caused by a round having been discharged



A Rock Drill driven by a 2 h.p. engine, and invented in 1914

one two-thousandth part of a second slower than the other rounds. The wonderful accuracy of the invention is shown by the fact that all the bullets fired (with the exception of the "slow" one already mentioned) passed through the same hole, with the disc revolving 1,500 times per minute.

Pianos to Aeroplanes

In answer to my enquiry as to how this result is obtained, Mr. Constantinesco said:—"I am afraid I could not tell you without falling back on a highly technical explanation that would occupy many pages of your Magazine. Broadly speaking, however, the firing mechanism of the gun is controlled by an ingenious method employing sound waves, the energy of which is transmitted through a pipe containing paraffin oil. The idea of using sound waves occurred to me as a matter of course. As I have told you already, while I was a boy I was interested in music and later on, having mastered the theory of sound waves, it was not difficult to invent—when the need arose—this firing mechanism which uses waves passed through liquid contained in a pipe."

I could not help remarking how interesting this was, for there seems to be not the slightest connection between piano-playing and firing a machine gun from an aeroplane!

Machines for Throwing Explosives

Another of Mr. Constantinesco's war-time inventions was a trench mortar, which fires a 200 lb. bomb without any noise or flash. In its original form this trench mortar was submitted to the War Office, but as it fired a bomb weighing only 2 lbs. and was limited to a range of 150 yards it was not considered serviceable, because the trenches were in many places over 150 yards apart. Improvements were made, however, and a new mortar, with an increased range of over 1,500 yards and capable of firing such gigantic bombs, was completed and successfully tried just before the Armistice.

Mr. Constantinesco also invented and made a very successful device capable of throwing two depth charges, each containing 400 lbs. of high explosive, to the left and right simultaneously to be used against submarines. This machine was also noiseless and flashless.

Peace-time Inventions

"And now," said Mr. Constantinesco, "we have seen enough of my 'frightful' machines. Let us turn to something of a more useful nature. Here is an interesting photograph of an invention that I brought out in 1911. It is a paraffin vaporiser, which was fitted to a four-seater car that was tested on a trip from London to Brighton and back. The journey required four gallons of crude paraffin-oil which at that time cost only 3d. a gallon. Just think of it—from London to Brighton and back for 1/-!"

"This photo is of a rock-drill that I brought out in 1914. This drill requires only a 5 h.p. motor to work it through a length of over 500 ft. of pipe line. Under test it was found that the drill itself absorbed only about 2 h.p. Here again energy is transmitted through water by sound waves, and the drill is easily made to pierce even so hard a rock as granite."

(Continued on page 56).

New Accessories for HORNBY CLOCK WORK TRAINS

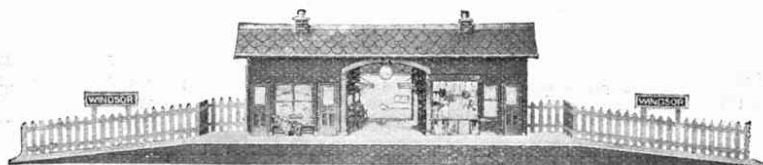
THESE wagons, signals, lamps, stations and turntables are all built in correct proportion as regards size, gauge, method of coupling, etc., to the Hornby Trains. Most important of all they have the uniformly beautiful finish that is the great feature of the Hornby system. To use cheap-looking rolling stock or a foreign-looking station with a Hornby Train completely spoils the effect.

The Windsor Station, illustrated below, is a thing of beauty and its bright colouring and realistic appearance will bring joy to the heart of every boy who sees it.

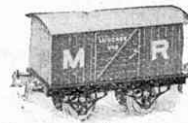
Write for illustrated leaflet of Hornby Clockwork Trains and complete range of accessories.



BRAKE VANS
Finished in colour.
Each 4/6



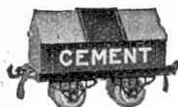
WINDSOR STATIONS
Excellent models, beautifully designed and finished.
Dimensions: Length 2 ft. 9 in., breadth 6 in., height 7 in. Each 12/6



No. 1 LUGGAGE VANS
Lettered M.R. Representative colours. Each 4/6



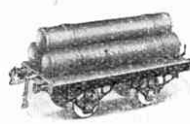
SIDE TIPPING WAGONS
Excellent design and finish.
Each 3/6



CEMENT WAGONS
Finished in colour.
Each 4/6



TURNTABLES. Each 4/6



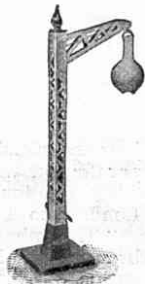
GAS CYLINDER WAGONS
Finished in colour.
Each 4/6



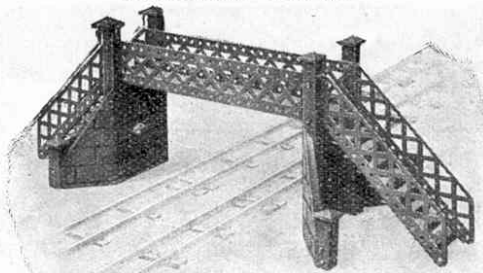
HOPPER WAGONS
Mechanically unloaded.
Finished in colour. Each 4/6



DOUBLE LAMP STANDARDS
Four-volt bulbs may be fitted into the globes. Each 4/6



SINGLE LAMP STANDARDS
A four-volt bulb may be fitted into the globe. Each 3/6



LATTICE GIRDER BRIDGES
Constructional type. Strong and well proportioned.
Each 10/6



TELEGRAPH POLES
Each 3/6



SIGNALS
Each 2/6

MECCANO LIMITED

BINNS ROAD

LIVERPOOL

New Railway Colours.

EVERY Meccano boy who is interested in railways knows that new colours have been adopted by the various companies, since the recent re-grouping. At present there are many variations in the colours of the rolling-stock used on each of the different lines, but in future there will be only four colour schemes, one for each of the amalgamated Companies. It is interesting to note that, in view of these changes in colouring, the Hornby locos of the future will be finished with the distinctive colours of the Company they represent, and lettered to suit.

Our illustration shows a 4-6-0 passenger locomotive and tender of the London, Midland & Scottish group, neatly painted in the old "Midland" crimson-lake. The tender carries large numerals, and the letters "L.M.S." of comparatively small size appear on the sides of the cab. The goods locos on this line will be painted all black with the lettering "L.M.S." in the same place as in passenger locos.

On the London & North Eastern Railway the carriages are to be red-brown in

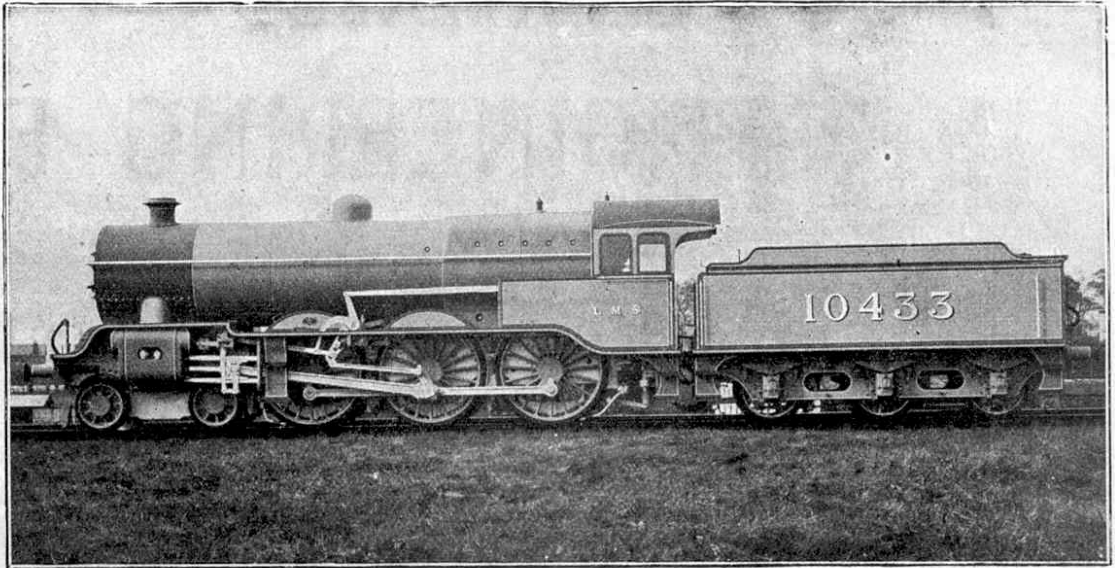


Photo by]

[London, Midland & Scottish Rly. Co.

A 4-6-0 L.M.S. Passenger Loco painted in the new colours

colour and the passenger locos green, while the goods locos will also be black.

Although the colour of the locomotives of the Southern Railway has not, so far, been definitely decided, the carriages will be finished in sage green.

The colours adopted by the Great Western Company for their carriages are Windsor brown, with cream upper panels.

The locos on this line will be green and black.

These changes, of course, cannot be made all at once. They will come into use only as the coaches and locos pass through the repair shops for overhauling purposes. It will, therefore, be some time before a complete change is finally effected, and our readers will find it interesting to watch for locos of the new colours.



A real boys' food

When you have "FORCE" for breakfast, you won't think anything more of a cold morning than the boy in the picture does. "FORCE" is the bone and muscle-building food that makes you feel fit for work, fine for play and ready for anything.

"FORCE" is the big fellow's food—it's whole wheat, all the wheat, bran and everything, made so good to eat that you'll wonder why wheat was ever prepared in any other way.

You must get into the habit of eating "FORCE" every day—it won't be difficult to persuade mother to get "FORCE" regularly for you because she'll appreciate the fact that it NEEDS NO COOKING. Just add hot milk.

**SEND FOR
FREE SAMPLE**

Decide now to try
"FORCE." Post
coupon below to
"Sunny Jim," Dept.
A.Y.7, 197, Great Port-
land St., London, W.1.

NAME.....
ADDRESS.....

FORCE
WHOLE WHEAT FLAKES
MALTED AND TOASTED



A NOTABLE ENGINEERING FEAT

*American Engineers Build New Bridge
without Disturbing Traffic*

A Quick Change-over

At 8 p.m. on the 2nd December, 1921, all traffic crossing the river was suspended, and the old swing bridge was moved into the open position for the last time. In this position, as is shown in our illustration on the next page, the old bridge rested upon the piles and false-work that had been erected for it in mid-stream. The centre portion of the bridge was then cut away, by burning through the girders with oxy-acetylene torches, and a gap was thus made so that the new bridge might be lowered into position.

In the meantime the missing portions of the leaves of the new bridge were built in. The leaves were then lowered until horizontal, and after they had been adjusted, the track for the elevated railway was laid on the upper deck.

The New Bridge in Position

At 7 a.m. on the 5th December, only 58 hours after the work commenced, overhead railway traffic was resumed over the bridge, the trains running as usual.

The illustration at the head of this article shows an elevated train passing over the bridge

on the upper deck, and a street car, road traffic, and pedestrians crossing the bridge on the lower deck. It shows the bridge in its finished form, and it is

With this article we conclude the account of the Chicago Bascule Bridge. Last month we showed how the Bridge was built in position, without interruption to traffic. Future articles of this series will include a description of Transporter Bridges, such as those at Runcorn and Newport, and Cantilever Bridges, including the Forth and Quebec Bridges.

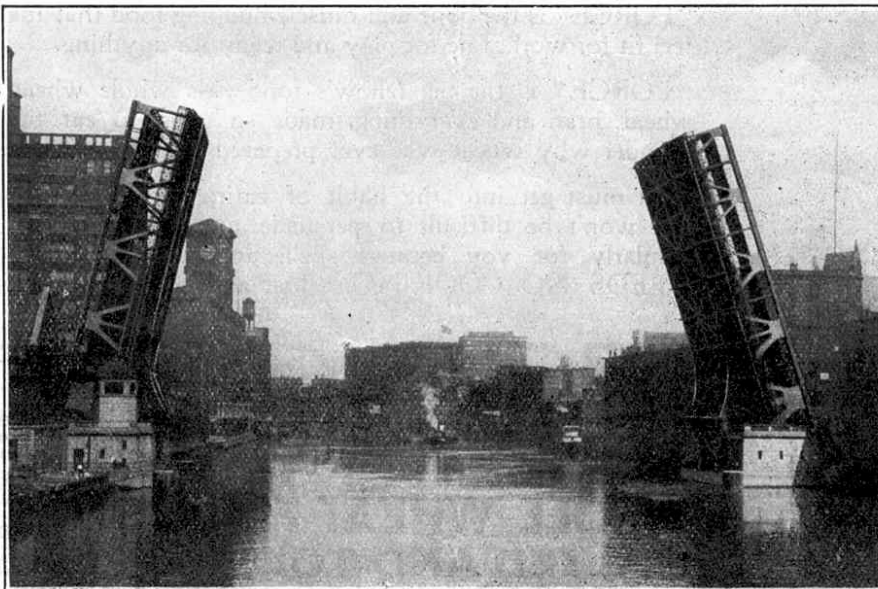
interesting to note that every trace of the swing bridge shown in the other illustrations has been removed.

After the bridge had been lowered into position, work was commenced on the roadway and footpaths of the lower deck, and the trackways for the electric cars were laid. This work necessitated the closing of the bridge to street traffic for about four months. During this time the remaining portions of the old swing bridge, that had not been cut by oxy-acetylene, along with the centre pier, were removed.

Details of the Bridge

The piers upon which the new bridge rests are from 5 to 11 ft. in diameter. They are so placed as to allow the construction of sub-ways or railway tunnels beneath the river, should it be decided to introduce such "tubes" in the future. The sub-structure of the bridge contains 8,000 cubic yards of concrete and 236 tons of re-inforced steel. The total weight of steel in the bridge is over 2,800 tons.

The leaves are mounted on trunnions 27½ ins. in diameter and these leaves, with their massive counter-weights, weigh some 5,000 tons. The counter-weights are brought into use to give mechanical advantage to the elevating mechanism, which includes two 100 h.p. electric motors.



Photograph by courtesy of]

[Bureau of Engineering, Chicago

The new bridge opens to allow a boat to pass up the river

A Notable Engineering Feat—(cont.)**The Two Decks**

The over-all length of steel-work is 385 ft. and the distance from centre to centre of the trunnions 268 ft. The bridge is 72 ft. in width and its height above the piers 231 ft., with a channel clearance of 220 ft.

The roadway on the lower deck is 38 ft. in width, paved with wood blocks, and is available for electric cars and road vehicles. There are two footpaths, each 13½ ft. in width.

The upper deck carries the lines of the North Western Elevated Railway.

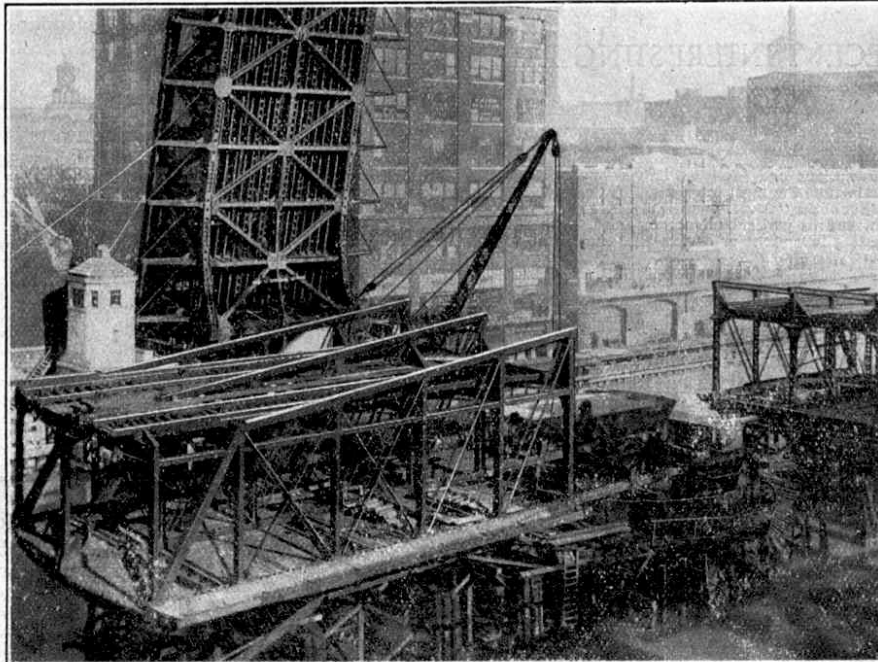
Bells and Danger Lights ensure Safety

The bridge is equipped with safety devices of the latest types. When it is about to open, gates close across the footpaths and roads, and stop-signals are exhibited. Warning bells ring, and at night red danger lights flash out.

These safety devices are inter-locked with the opening mechanism

of the bridge, and with the signal system of the overhead railway. It is impossible for the bridge to be opened unless all

safety devices are in operation and the overhead railway signals set at danger.



Photograph by courtesy of

[Bureau of Engineering, Chicago]

When this photograph was taken, the steel-work of one half of the structure was practically completed. A slot had been cut away in the old bridge to allow the new structure to fall into place, the old bridge being subsequently demolished as it stood inoperative on the piles in the centre of the river.

Advantage of Bascules

Where a narrow river is to be bridged, a bascule bridge is generally the type selected, because the central pier, which is necessary to pivot a swing bridge, obstructs the fairway of the river to a certain extent.

In the illustration at the foot of the previous page we are able to observe the advantages that the bascule possesses over the older type of bridge. The river is shown unobstructed by the open bascule bridge, whilst in the distance a swing bridge of the old type is to be seen. It will be noticed that the centre pier of this swing bridge takes up a considerable portion of the river.

THE END.



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.

A. P. Mitra (Delhi, India).—Straight-toothed gear wheels cannot impart rotary action to a worm wheel. The only type of gear that is able to effect this is the skew or helical gear.

D. Lane (Kanturk, Co. Cork).—(1) We do not stock rubber "tyres" on account of their perishable nature. (2) The difficulty of extra long rods would be their boxing.

H. Eunson (Sparkhill, Birmingham).—We have found that nimble fingers are capable of dealing with isolated instances of awkwardly-placed nuts.

Geo. Burgess (North Kensington, Adelaide).—The existing type of coupling lends itself to a right-angle fastening.

L. Briggs (Birstall, nr. Leeds).—We shall go into the matter of the elimination of the flanges on the sector plate, as an addition to the range of flat plates.

James H. Field (Blackpool).—Your suggested spoke wheels for Hornby wagons would add unnecessary weight without increasing efficiency.

Walter H. Crawford (Dublin).—Your suggested crossover point is only applicable to a double track system, but we do not propose as yet introducing another radius to form this. We have in mind the question of a siding point.

D. H. N. Caley (E. Budleigh, Devon).—We should have to have some definite applications of the cam before introducing it. Perhaps you could suggest some.

T. Kernahan (Ilford).—We have been engaged in the complete revision of our models, and the operation of all the movements of the crane has been effected by the new construction, thereby obviating any departure from standard on the lines of your suggestion.

(Golcar, nr. Huddersfield).—(1) We shall consider your idea for a curved braced girder. (2) A circular saw has only an ornamental use. A 3" sprocket wheel gives a good representation of a circular saw.

Charles F. D. Hall (Cambridge).—We think you will find that an architrave acts admirably as a corner brace. This piece is similar in principle to the right-angled triangle you suggest.

B. Cook (Cottingham, nr. Hull).—Your suggested sliding action screw seems good, and we shall keep it before us.

John C. Potts (Catton, Queensland).—Why not bolt two existing cranks together to give the reversed formation? Set-screws could be used to prevent fouling.

V. Stenison (Sheridan, Ontario).—(1) A ¼" pinion has no scope in the Meccano system on account of its departure from the ½" standard. (2) What diameter do you suggest for the curved double angle strips you mention? (3) We fear that your suggested pointed rods and bearings to match would not be practicable.

Geo. Hillargan (Dunfermline).—Many thanks for your print of curved plate sections. We shall explore carefully their possibilities.

Edwin Cox (Rochester, Kent).—The flanged disc attached to the face plate will give you a flanged wheel of nearly 3" diameter.

O. Howes (Ilford).—We are considering the question of coupling the wheels of the Hornby loco.

N. Tilsley (Eccleston-on-Sea, Yarmouth).—We are considering the advisability of squaring the collar of the threaded pin to fit the spanner in order to obtain a firmer fastening. This will obviate lengthening the threaded portion.

E. A. Robbins (Kidderminster).—We contemplate revising the electrical Manual shortly, when several new examples of electrical experiments will be illustrated.

R. J. Peace (Ovenden, Halifax).—We note your idea for a greater lead angle worm wheel.

P. Nash (Abertillery, Mon.).—(1) There is not sufficient space on the 1" loose pulley for the bolting of double angle strips to form small cylinders. (2) There would be no object in manufacturing a variety of eccentrics. Our present design fulfils all the requirements of an eccentric movement.

Robt. A. Miller (Lincoln).—We have in mind the introduction of channel sections.

Stanley Wilkinson (Skegness).—A firm fastening is obtained by lapping the cord two or three times round the crank handle and knotting with two ordinary half hitches.

Cyril H. Shepherd (Bedford Park, W.).—We do not think that there is any advantage in the type of tooth you suggest. We have found the present type of toothed wheel quite efficient for every degree of Meccano practice.

Jack Jennings (Dublin).—(1) Your suggestion for the issue of the "cigarette card" illustrating items of engineering interest in conjunction with the "M.M." coincides more or less with our future intentions. (2) The matter of the perforation of the sector plate is already under consideration.

V. J. Kitson (Ingeniero Blanco, Argentina).—We realise that a Meccano boat would be attractive, but the caulking of the joints would present difficulties.

W. G. F. Thorley (Wellingboro').—We would not care to undertake the manufacture of the types of rail you suggest as they come into the scale-model category. It would not be worth while going to the expense of tools to make larger size buffers for the limited number of Hornby trains in circulation fitted with the old style chain coupling. This type is now obsolete.

Harold Javer (Wolverhampton).—We have a flanged architrave already, R. and L. (No. 139 and 139a).

Leslie K. Thompson (S. Petherton).—Various types of combination points and crossings will be added to our list in due course.

Stanley and Philip Love (Bristol).—We shall go into the matter of the method of securing the signal to the track.

How to Obtain the "M.M."

The "Meccano Magazine" may be ordered from your Meccano dealer, or from any newsagent or bookseller, price 2d. If you are not able to obtain the "M.M." from these sources it may be obtained direct from this office, post free, six issues 1/6, 12 issues 3/.

The next number of the "M.M." will be ready on 1st March. As we print only sufficient copies to supply orders received, you should place a regular order with your dealer or newsagent, or direct with this office, to avoid disappointment.

"Meccano Magazine"

Binns Road,

Liverpool

OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

Every day new inventions and ingenious labour-saving devices are being brought into existence. From time to time the most interesting of these will be described and illustrated in these columns. The Editor of the "M.M." will be pleased to hear your opinion of this new feature. Readers are invited to send us particulars (accompanied, if possible, with photos, sketches or cuttings) of any interesting inventions or devices that may come to their notice.

TAKING out a patent is a long, intricate business, as we shall endeavour to explain in some future article on this page. Not every patent lives up to the claims of its owner. Very few arrive at the dignity of a commercial success, or bring real profit to the inventor. When a patentee does design something really new and useful, however, his reward is a generous one.

It is not always the largest mechanisms that bring the greatest return. Little inventions, such as the crimped hair-pin, the metal bottle-cap, or the rubber tip on a pencil, have all brought their inventors considerable sums. Gillette, it is reported, received £500,000 a year for his invention of the Gillette Safety Razor.

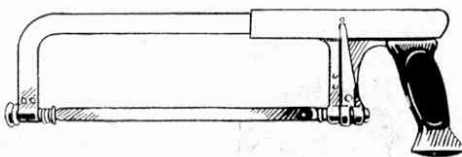
Among the more interesting patents this month we notice the following:—

Vest Pocket Gramophone

Particulars of a gramophone no larger than a watch come from Austria. It is wound in a similar manner to a watch and produces music from small records, ten of which are contained in an inside compartment. Some time ago an English inventor designed and marketed a midget machine that was only 6 inches in height and weighed 4 lbs. It had a collapsible horn, took full size records, and folded together like a camera.

Pistol Hack-Saw

This novel form of hack-saw has a handle shaped after the manner of a pistol grip. It is claimed that in this form the



tool is not so tiring to use. Different sizes of blades may be fitted by sliding the frame backwards or forwards. The bolts that lock the saw in place are so arranged that if necessary it may be used sideways for horizontal cutting.

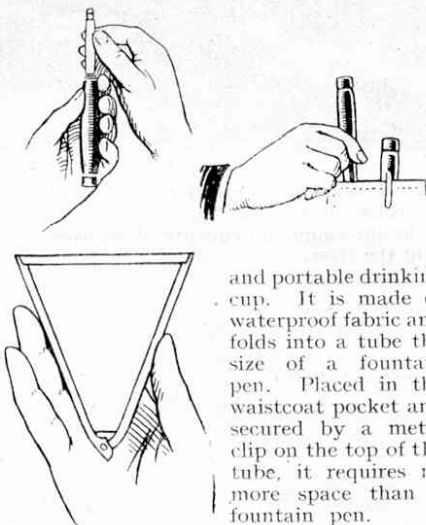
New "Movie" Invention

An American inventor has perfected a method of showing cinema films in which the films have so natural an appearance that the figures seem to stand out, as in a stereoscope. The camera with which the film is photographed has two lenses and takes two pictures, one on top of the other. The screen on which the new

pictures are shown is about four times the size of the screen used at present. The first of these new films, which is to be shown in England shortly, is already being widely discussed.

A Collapsible Cup

An invention that will appeal to all boys fond of camping out is this compact



and portable drinking cup. It is made of waterproof fabric and folds into a tube the size of a fountain pen. Placed in the waistcoat pocket and secured by a metal clip on the top of the tube, it requires no more space than a fountain pen.

Gas-Mask For Engine Drivers

A gas-mask has been designed to protect engine drivers and others against the gases encountered in tunnels. It may also be used for many other purposes. In appearance the mask resembles to a certain extent the mask used for gas protection during the war, although there are several improvements. The mask also provides protection to the ears against loud noises, such as the engine exhaust when rushing through the tunnel.

An Old Secret Discovered

Another interesting invention this month is unbreakable glass. This is being made by a factory in Bohemia, from an old formula that has long been hidden away. This new glass resists heat, enabling it to be used in the manufacture of cooking utensils. As it will withstand high temperatures and destructive acids, it may also be used in the construction of laboratory vessels.

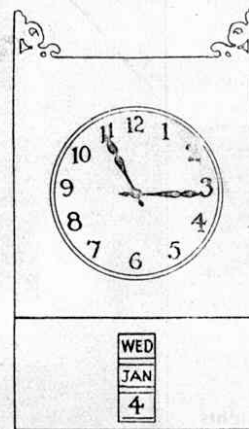
A Folding Tooth Brush

A new type of tooth brush folds into a metal case, and may be carried in the vest-pocket. This should prove very popular indeed, for though everyone knows

how important it is to keep the teeth clean, it is no unusual thing to forget to take a tooth brush when leaving home.

Calendar Clock

A calendar-clock is a useful ornament, but none has been made to overcome the difficulty that all the months of the year do not contain the same number of days. A clock has recently been patented, however, that shows not only the date but also the week and the month. So simple and ingenious is the device that it may be attached to any existing clock.



Helping the Motorist

The automobile industry seems to offer a wide field for the inventor, and many of the latest patents are designed for the comfort and convenience of the motorist. Among the more recent inventions of this character is a new tyre which may be safely ridden under low air pressure. Rough roads and "pot-holes" will be shorn of their terrors, and the strain on the chassis will be considerably lessened. Several manufacturers are already introducing this new tyre to the market and it will be interesting to watch its progress.

Another device is one that enables the driver of a motor car to protect himself from the glare of the headlights of an approaching car. It consists of a small enamel plate of sheet metal attached to the wind-screen by a universal holder. In the daytime the metal shield is swung out of the way, and when in use at night it is brought down. The driver is thus able to look out under its lower edge and see several yards ahead, whilst protected by the enamel plate from the dazzling rays of the lights of the approaching car.

Stainless Metal

Stainless or rustless steel has been very much in evidence during the last few years. It has numerous advantages in pier construction, ship-building, bridge-building, and for a thousand and one domestic purposes. Now comes news of a new stainless alloy that has been developed by Sheffield manufacturers and which, it is claimed, more than equals stainless steel in utility. Spoons and forks made of this metal have been found absolutely stainless in domestic use. Vinegar, lemon juice, sauces, etc., appear to have no action on it whatever. This will indeed be a saving in housework! Tell mother about it!

Reversible Heels

A new type of rubber heel has been invented, and people who quickly wear out one side of their heels will find the new article both useful and economical. When the heels become worn they may be pulled off the shoe and used again without any injury to the ankle. They are held in place by means of nails with large heads driven into the heel so as to fit into holes in the rubber.

Books of Joy!

From the few books detailed below you will be able to get a tremendous amount of pleasure. For 13 years the Wireless Press has devoted its energies to publishing books on wireless, and in our catalogue we have no less than 75 wireless publications. We shall be glad to send you a catalogue upon receipt of a postcard.

THE HOME CONSTRUCTOR'S WIRELESS GUIDE. Price 3/6, by Post 3/9

This is the most complete book yet issued for the home constructor. If you want to make wireless apparatus, get this book. You cannot beat it.

THE WIRELESS ANNUAL, 1924. Price 2/6, by Post 2/11

Full to overflowing with valuable information, the Annual includes amongst its contributors Senators G. Marconi, Dr. W. H. Eccles, Sir William Noble, Phillip R. Coursey, Major H. C. Parker, Captain P. P. Eckersley, W. G. W. Mitchell, etc. In addition the Annual provides you with a full, up-to-date list of Amateur Call Signs, including French Stations, Regular Transmissions of European Wireless Stations, Call Signs of all Land and Aircraft Stations, Directories of Wireless Societies, Manufacturers and Retailers of Sets and Accessories, Definitions of Technical Terms in five languages, a host of useful tables and other general information. GET YOUR COPY TO-DAY.

MAST AND AERIAL CONSTRUCTION FOR AMATEURS. 1/6 net, by Post 1/7

Complete information is given here on the erection of masts and of indoor, outdoor, and frame aeriels. With a copy of this book at hand you will have no difficulty in these matters.

THE AMATEUR'S BOOK OF WIRELESS CIRCUITS.

Price 2/6 net, by Post 2/10

The most up-to-date book of circuits yet published. This contains 111 practical circuits showing full values of condensers, etc.

CONSTRUCTION OF AMATEUR VALVE STATIONS.

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Those interested in valve apparatus will find full particulars for making the various parts of receiving sets.

CRYSTAL RECEIVERS FOR BROADCAST RECEPTION.

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Descriptions of the various types on the market and full directions for building a first-class crystal receiver, with many useful hints, are presented to the reader.

HOW TO BUILD AMATEUR VALVE STATIONS. Price 1/6, by Post 1/7

Amongst other matter, several different arrangements of receiving "units" are described in detail, together with description of component parts of valve apparatus.

PRACTICAL WIRELESS SETS FOR ALL-HOME CONSTRUCTION MADE EASY. Price 1/6, by Post 1/8

For inexpensive and wonderfully effective sets, you should get this book.

THE WIRELESS WORLD AND RADIO REVIEW. Every Wednesday, 4d.

First published in 1913, this is universally recognised as the premier wireless journal. There is something for everybody interested in wireless in every issue. Send for free specimen copy.

The Wireless Press Ltd. Dept. M.M.
12/13, Henrietta Street, Strand, W.C.2.



Readers frequently write to me asking if I can recommend books that are both of interest and of use. In this column I hope to review books that I consider specially appeal to Meccano boys. I do not actually supply these books, which may be obtained either through any book-seller or direct from the publishers.

The Pigeon's Cave

by J. S. Fletcher

(Pub. by Partridge. Price 2/- net).

A story dealing with hidden treasure and sea fights is always welcome, for it may generally be counted on to provide something really exciting. This story deals with buried treasure on the rocky coast of Wales, and certainly comes up to our expectations. We learn how Hugh Pritchard helps his father and the mysterious Doctor Lorette in their search to discover the treasure buried in a cave near the Great Ormes' Head; how a French raider, with the bloodthirsty Monsieur Chabot aboard, arrives on the scene and takes a hand in the dangerous game. Of course, we are pleased when Hugh finally outwits the Frenchman and his ruffians by a clever ruse. Altogether a thrilling story well told.

Lost on Du-Corrig

by Standish O'Grady

(Pub. by The Talbot Press. Price 5/- net).

This is a book of thrilling interest, being the narratives of three brothers living on a wild portion of the sea-coast of Ireland. Two of them mysteriously disappear and, as may be imagined, we are held spellbound and mystified with a dozen different solutions to the problem. Finally the brothers relate their strange adventures—a tale of wonderful resourcefulness and strength of nerve. A fine spirit of adventure runs through the book. We feel ourselves clambering over rocks and clinging to dangerous ledges, as we follow the brothers through their hazardous experiences. As a simply-written tale of adventure and mystery this book is quite out of the ordinary.

The Practical Electrician's Pocket Book, 1924

(Pub. by S. Rentell & Co. Price 3/- net).

Though somewhat advanced for the very young model-builder, the new edition of "The Practical Electrician's Pocket Book" is a mine of information for anyone interested in either the theory or practice of electricity. It is packed from cover to cover with interesting facts and details, illustrated with figures. For anyone intending to take up Electrical Engineering as a profession, there are few books likely to prove of more value and assistance than this admirably compiled Pocket-Book. The book is well bound and of a handy pocket size. It contains over 570 pages, and is indispensable to those engaged in practical electrical work.

BOOKS RECEIVED

We have received copies of the undermentioned books during the past month, and these will be reviewed in this column in a future issue.

"THE WONDER BOOK OF NATURE"
(Ward Lock & Co. Ltd.), 6/-

"300 THINGS THAT A BRIGHT BOY CAN DO"

"301 THINGS THAT A BRIGHT GIRL CAN DO"

(Sampson, Low, Marston Co. Ltd.), 6/-

"INTRODUCTION TO WIRELESS TELEGRAPHY AND TELEPHONY"
(Sir Isaac Pitman & Sons Ltd.), 3/6

PUBLICATIONS RECEIVED

We have received from Messrs. The Wireless Press (12 & 13, Henrietta St., London, W.C.2), copies of the "Wireless World" for January (price 4d.), containing interesting articles on an Inductance Calculator, a New Clock for Wireless Operators, Microphones for Divers, and other interesting articles. The January issue of "Conquest" (price 1/-), contains articles on Prehistoric Animals (of which the Diplodocus will be particularly interesting to Meccano boys as this creature is the subject of Meccano Model No. 403), Telescopes, Silk Worms, Hippopotami, Time-saving Devices, Atoms and many other interesting subjects are dealt with in this monthly magazine of popular science.

CATALOGUES RECEIVED

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

A new price list, which comes to us from the Midland Stamp Company Ltd. (78, Warwick Street, Leamington Spa), contains 40 pages of interest to stamp collectors. This firm make a speciality of cheap sets of stamps, and the list contains some choice lots. A copy of the list will be sent free on application to any reader mentioning the "M.M."

A very useful little paper model showing the coils necessary to receive various stations will be sent free on application to the Igranic Electric Co. (149, Queen Victoria Street, London). This firm also publish a fine catalogue of radio accessories. Both will be mailed free on request to readers mentioning the "M.M."

Messrs. Norris & Co. (Leabrooks, Alfreton, Derbyshire), send us their new season's catalogue, containing many excellent offers. Some remarkably cheap sets are featured, and the catalogue also devotes several pages to stamp collectors' accessories. Messrs. Norris will be pleased to mail a copy post free on application.

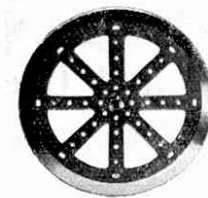
The "Boy's Own Paper" Publishers (4, Bouverie Street, London, E.C.4), have recently published many splendid new books, also new editions of old favourites. They will be pleased to forward to "M.M." readers catalogues of adventure stories, historical stories, nature books, travel stories, and the hundred and one volumes that appeal to boys.

New Meccano Part

No. 19c.

Pulley Wheels,
6 in. diameter.

Price,
2/6 each.



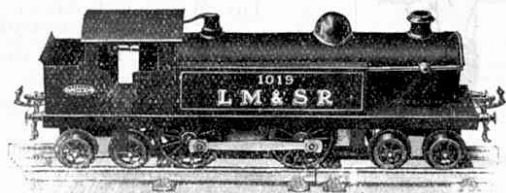
Dealer's Model-Building Competitions

Details of local model-building competitions have appeared in the last two issues of the "M.M.," together with the names and addresses of the dealers arranging them. This month we publish the names of further dealers arranging competitions, from whom all information may be obtained.

BLACKBURN—Mercer's, 68, Darwen Street.

BRISTOL—J. Williams & Son, 17, Church Road, Redfield.

Hornby Tank Locos.



This magnificent Tank Loco is a splendid addition to any train system. A glance at the above illustration shows how beautifully this Loco is designed. It is thoroughly representative of the latest type of its class. Measuring $11\frac{1}{2}$ in. in length, it embodies all the characteristics of the Hornby Trains. Suitable for 2 ft. radius rails only.

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

Price each ... 32/6

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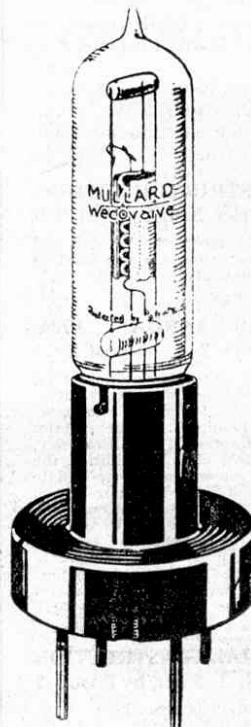
Send for Illustrated List and Quotations to:

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Cycle, Tricycle and Sidecar Chassis Manufacturers,

389/397, FARM STREET, BIRMINGHAM.

WIRELESS VALVES.



Mullard Weco valves.

The Mullard Weco valve, fitted with a standard 4-pin base, is the last word in Wireless Valves. It takes but a single dry cell to operate the filament, and a cell of normal size will last for months.

The cost of the valve is 30/- and its life is therefore of great importance compared with that of inexpensive dry cells.

In normal use, the Mullard Weco valve filament will last for 4,000 hours, whilst mechanically it is unbreakable.

It is short and robust in construction and has in no way been attenuated in order to reduce current consumption.

The life of the valve is no longer than that of its filament.

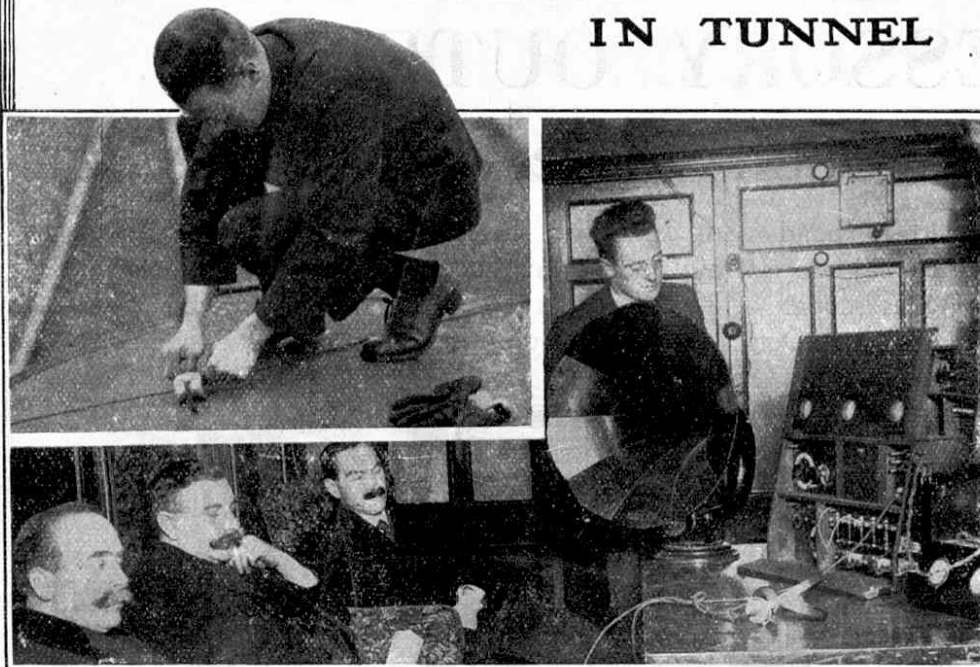
*Turn these points over and then order
Mullard Weco valves for your set.*

MULLARD

Advt.: The Mullard Radio Valve Co. Ltd., Balham, S.W. 12
(E.P.S. 85)

CONCERTS WHILE TRAVELLING

BROADCAST HEARD CLEARLY EVEN IN TUNNEL



Passengers seated in Euston to Liverpool express listening-in to broadcast from Marconi House. Inset shows operator fixing aerial on the roof of the coach.

THE value to a business man of instant communication with his office or works, wherever he may be, has long been realised. Experiments are now being made with a view to installing wireless apparatus on long-distance trains in order that passengers may keep in touch with their offices whilst travelling on high-speed trains. Already the Hamburg-Berlin express is equipped with wireless telephony, which it is claimed gives excellent results. Passengers are able to converse with greater ease and clearness than if they were speaking over the ordinary land-line telephone, and may be "put through" to any telephone subscriber on the land lines.

Radio on Train Maintains Service

A recent instance of wireless being used on a railway was in November 1913, when the Lackawanna and Western Company (U.S.A.) fitted one of their trains with a wireless telegraph installation. This enabled communication to be maintained between the train and the Ringhampton Radio Station, and with other radio stations along the line.

Shortly after the introduction of this novelty the telegraph wires between Hoboken and Scranton were broken by a storm, and the train's wireless installation enabled traffic to be dealt with in the usual way. Had this installation not existed the line would have been completely blocked, resulting in a stoppage for three days, until the wires could have been repaired.

Recent Experiments

All experiments with wireless on trains were suspended when America entered the war, and it was not until March 1922, that the Lackawanna and Western Company re-commenced their trials. In these later experiments the train was equipped with a telephonic installation consisting of a 15-watt valve-transmitter, a valve-receiver and a cage type aerial. Experiments, both in transmission and reception, were successfully carried out over distances up to 25 miles.

Recently two more American railways have adopted wireless on their trains, namely the Chicago Elevated Railroad and the Southern Pacific Railroad. Loudspeakers have been installed in order that passengers may enjoy the broadcast concerts whilst on long journeys.

Experiments in England

Prior to 1919 no attempt was made in this country to experiment with wireless on trains, but in the autumn of that year, during the railway strike, the Government decided to link up all important railway centres by wireless telephony. It was also decided to make trials of wireless installations on trains, in view of the fact that it was possible that the ordinary telephone and telegraphic systems might be interfered with. Communication was successfully established between St. Pancras, London, and important railway centres such as Birmingham, Leicester, Leeds and Durham. The instruments used were Marconi $\frac{1}{2}$ k.w. Portable Sets.

A special coach fitted with a loop aerial was then attached to the Paddington to

Bristol train, and throughout the journey, signals from the Woolwich Experimental Station were satisfactorily received on a wave length of 150 metres.

In 1920 the Marconi Wireless Company carried out tests with wireless telephony on trains running between Euston and Crewe—a distance of 158 miles. The results were quite beyond expectation, and in fact it was said at the time that the speech was even clearer than over ordinary telephone lines.

Broadcasting on Trains

Recently a further experiment in this connection has been carried out on a train running from London to Liverpool, and the results obtained were very encouraging. A special saloon was fitted with two aerials, one an indoor and the other an outside aerial. The latter was composed of a length of wire stretched along the top of the carriage, a few inches above the roof.

As the train ran out of London a "bed-time story" was being broadcast from Marconi House, and was received perfectly on the out-door aerial, despite the fact that for a portion of the time the train was travelling through a tunnel. One small detail had, however, been overlooked, and this was the interference caused by the dynamo used for the electric lighting on the train. This interference was a source of great trouble, but it would be an easy matter to overcome the difficulty by screening the dynamo, thus preventing its influence reaching the receiver.

Speech received at 60 m.p.h.

Later in the journey, and whilst the train was travelling at over 60 miles an hour, the voice of an amateur, transmitting speech, was picked up by means of the frame aerial.

Broadcast from London was audible on the same aerial at 50 miles distant. Later the Birmingham Station was heard very clearly, one of the most interesting features being the reception of the news bulletin at 7.30 p.m. Another item of interest was a duet that was received quite well just before the train left Stafford.

In view of the success of this initial experiment further tests are to be carried out. It is hoped that, by effecting several slight improvements, it will very soon be possible for passengers journeying between London and Liverpool to enjoy all the latest news whilst dining on board the train. Thus another step will have been made in the forward progress of the wonderful science of Radio.

MECCANO

ACCESSORY OUTFITS

Make Your Outfit Bigger and Better

Once a boy has commenced to build with Meccano, he desires to build larger and more ambitious models. He may do so by adding an Accessory Outfit to his existing set, thereby greatly increasing its scope. The particulars below show how a boy who commences with one of the earlier Outfits may build up his equipment by easy stages, until he is the proud owner of a No. 7 Outfit.

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/-



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/-

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

No. 00a OUTFIT

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

No. 0a OUTFIT

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

No. 1a OUTFIT

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

No. 2a OUTFIT

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

No. 3a OUTFIT

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

No. 4a OUTFIT

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

No. 5a OUTFIT (Carton)

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

No. 5a OUTFIT (Wood)

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

No. 6a OUTFIT

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

FROM ALL MECCANO DEALERS