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MECCANO MAGAZINE

December 1924

PRICE 3D

VOL. IX
No. 12

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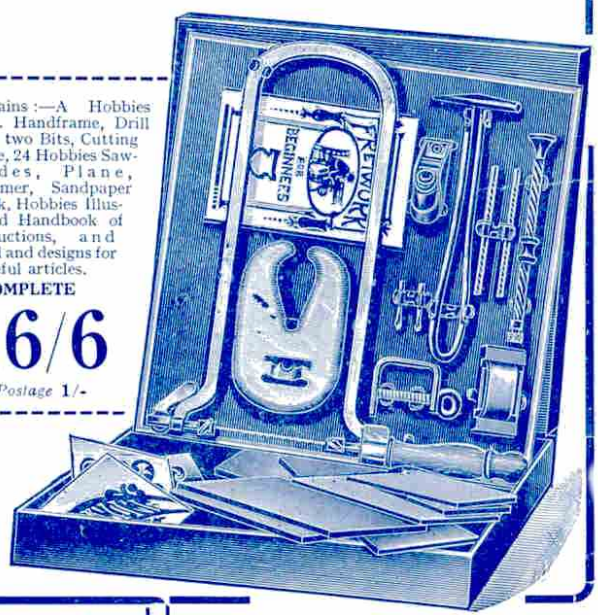

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MECCANO MAGAZINE

PUBLISHED
IN THE INTERESTS
OF BOYS

Vol. IX, No. 12.

December 1924

MY first thought this month, and my first words in this special Christmas number, must be to wish all my readers "A Very Merry Christmas." I hope that every one of you will have a good time during the coming holidays and that plenty of fun and frolic will fall to your lot. On Christmas morning I shall think of you all, and throughout the day I shall imagine the good times that you are having in all parts of the world.

Good Wishes

The brotherhood of Meccano boys receives more recruits at Christmas than at any other time of the year, for some tens—perhaps even hundreds—of thousands of boys receive Meccano Outfits and Hornby Trains as Christmas gifts. When they receive these gifts they become members of a world-wide movement—great pleasures are in store for them and there are jolly times ahead. I am sure that on Christmas Day my readers will think of these things and will welcome the recruits with a friendly smile. As we have often agreed, it would be fine to have a great gathering of all Meccano boys, but such a gathering is, of course, quite impossible. Apart altogether from the language difficulty, there is no building in the world large enough to hold us all! Instead, we must content ourselves with broadcasting by our thoughts, a Christmas message of good will and friendship to all other Meccano boys—both old and new!

It is not always pleasant to be told that an article will cost you more, but I have no doubt that the 70,000 readers of the "*M.M.*" will be unanimous in their approval of my decision to increase the price of the Magazine to 3d. At present we cannot issue the "*M.M.*" more frequently, as many thousands of our readers have suggested. Instead, I am planning to increase the number of literary pages in future issues, and in order to make this possible it is necessary to increase the price as mentioned above. There are hundreds of wonderful subjects about which I want to tell you—Locomotives, Aeroplanes, Motor Cars, the Story of Metals, Giant Cranes, the Panama Canal, Famous Bridges, and a host of other interesting subjects too numerous to mention. Then again my readers are constantly asking for special articles on different subjects of general interest, and up to now it has been impossible to satisfy many of these demands because of the limitations of our space. For example, it has been suggested by a large number of our readers that this spring we should commence a Nature Study page, and I am inclined to include this feature if many more readers ask for it. It is a good thing for boys to know something of the birds, insects, flowers, trees and the hundred and one other things that they see in their country rambles. You can help me to come to a decision on this matter by sending a postcard stating whether you would welcome short illustrated articles on these lines, or whether you would prefer they were omitted. Address your post card to "Nature Study," *Meccano Magazine*, Liverpool, and send it before 31st December.

Increase in Price

Our January issue will be published on the 1st of the month, and in accordance with the above announcement, the price will be 3d. In future, the subscription rates for the Magazine mailed direct from this office will therefore be 2/- for six and 4/- for twelve issues. These rates will include the extra postage when this is necessary owing to the postage on any particular issue exceeding the charge of 1d. that is included in the above subscription rates. The new subscription rates for copies mailed direct will come into force from to-day's date. We shall keep faith with our existing subscribers, however, and execute all orders on our books at the old rates until the subscriptions expire. This remark does not apply to the present Christmas Number, for which each subscriber will be debited 4d. including postage, a fact that should be taken into account by subscribers when renewing their subscriptions, and they should include the extra penny with their remittance. As most of my readers know, the "*M.M.*" may be ordered from all Meccano dealers, and also from any newsagent or bookstall (price 3d.). If any reader has any difficulty in obtaining supplies from one or other of these sources he should write to me giving particulars and the name and address of his dealer or newsagent, when I will take up the matter on his behalf.

Obtaining the "M.M."

It is very interesting at the end of the year to look back on the progress that the "*M.M.*" has made during the past twelve months, and also to compare this Christmas issue with the corresponding issues of a few years ago. As some of my readers remember, publication of this Magazine commenced in 1916 with a single sheet of four pages. I well remember the chorus of approval that heralded its appearance, and for many weeks thousands of letters came in day after day from enthusiastic Meccano boys. For some years the "*M.M.*" continued on these lines, for the war-time high cost of paper and printing made it impossible to enlarge it during this period, and indeed production at all was very difficult. In 1920 things became a little easier, however, and in September of that year we increased the number of pages to eight. Two years later the size was again increased, this time to 12 pages, and in July 1923 we permanently increased it to 16 pages and commenced a series of coloured covers. We thought that we had achieved something considerable when we increased the number of pages to 16, but as we intimated at the time, we did not intend to stand still. Since then there has been gradual increase in the size of the Magazine, until we reached our "high-water mark" with the November issue of 48 pages. The present special Christmas issue has exceeded even this, however, and consists of no less than 72 pages!

The Growing "M.M."

The increase in the number of our pages is largely made possible by the inclusion of advertisements, and many of our advertisers have found that the "*M.M.*" brings them more replies and orders than any other Magazine. One advertiser in many boys' papers has gone as far as to say that last month the orders he received in response to his advertisements in the "*M.M.*" exceeded the combined orders from all the other Magazines in which he advertised! This splendid result is only to be expected, and I feel sure that Meccano boys will support the "*M.M.*" and that, all things equal, if they wish to purchase any article, they will certainly purchase it from an advertiser in the "*M.M.*" rather than from outside firms, provided that price and quality are comparable. Now, in order that our advertisers may realise the value of their advertisements in the "*M.M.*" it is very desirable that all readers when replying or ordering goods, should state that they "saw the advertisement in the '*Meccano Magazine.*'" Thus they will support me and also show advertisers the value of the "*M.M.*" as a means of bringing enquiries or selling their goods. This, in time, will bring in more advertisers and additional revenue, and that will enable me to enlarge the Magazine even further. Apart from our regular features, the number of advertisements largely determines the size of each issue.

How Readers May Help

All About Pulleys

Important Labour and Energy-saving Appliances

PULLEYS play such an important part in engineering appliances and operations that a knowledge of the principles upon which they work is essential for every engineer, whether professional or amateur. The importance of pulleys lies in the fact that, when scientifically employed, they make possible a great saving of labour and energy.

A pulley consists of a circular wheel, or "sheave," of metal or wood, revolving on an axle. Its circumference is grooved to take a rope or wire, and it is supported and held in position by means of a wooden or metal framework, known as a "block." A strong hook is attached to the foot or the head of the block to enable the block to be hung up or to carry the weight to be lifted. Wooden blocks and pulleys are not in common use except on ships, where they are used for loading or unloading cargo and for various other purposes. In this case the pulleys are exposed to all kinds of weather and under these conditions wood is found to be preferable to metal.

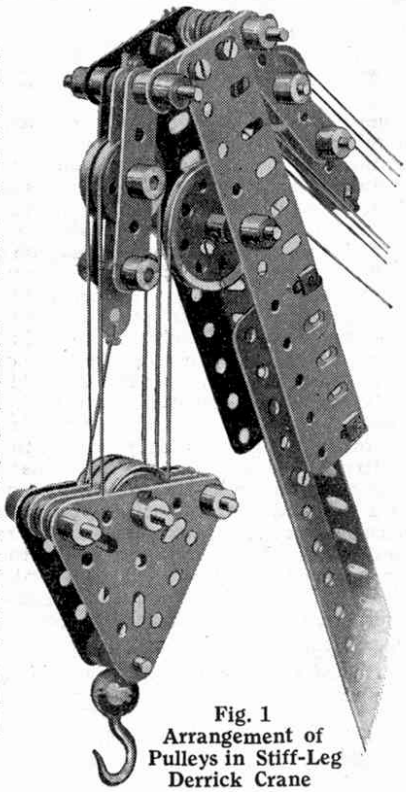


Fig. 1 Arrangement of Pulleys in Stiff-Leg Derrick Crane

Pulling Power Exceeds Lifting Power

It is a well-known fact that a man can pull with far greater strength than he can lift. Therefore if a man has to raise a 100 lb. weight to the top of a building he can pull it up more easily than he can lift and carry it up.

In actual practice a pulley must be employed in order to pull up the weight. The block containing the pulley is made fast to an overhanging portion of the roof or to a scaffolding, and a rope is passed (or "rove") through it. To one end of the rope is lashed a hook and upon this is hung the weight to be raised. The man pulls on the other end of the rope, which is called the "running" end.

If a pull of 100 lb. is now exerted by the man the weight will be exactly balanced. If he decreases his pull by even a few pounds the weight will descend, while if he increases it the weight will rise. Therefore it is clear that (ignoring friction) with one pulley the power to raise a weight must be greater than the weight itself. In fact, the pulley acts in a similar manner to a scale that balances exactly when the weights in each pan are equal. In this case the pressure on the beam carrying the pulley will be twice the weight of the load, for it has to support the pull exerted by the man as well as the weight of the load itself. Fig. 7 illustrates this single-pulley arrangement.

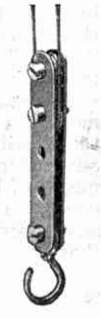


Fig. 2

Fig. 3

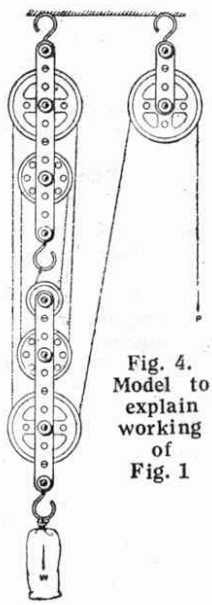


Fig. 4. Model to explain working of Fig. 1

Supposing now the weight to be moved is much larger, say 200 lb. The effort required to haul up this weight will be double that required to raise a weight of 100 lb., or, if for convenience we regard 100 lb. as the maximum pull for one man, then we shall have to engage two men to raise the 200 lb. By a little arrangement of the tackle, however, the work can still be done by one man.

200 lb. Lifted by Pull of 100 lb.

We already have our pulley fixed to a beam and our only additional requirement is another pulley as shown at B, Fig. 8. It will be seen that our second pulley, unlike the first, is moveable. The rope is made fast to the cross beam, passed under the moveable pulley B, up over the fixed pulley A, and then down to the ground. If the man now hauls on this running end he will have to exert a pull of only 100 lb. to lift the 200 lb. load. The reason for this is that the weight is now being supported by two cords, "b" and "c," and the strain on each must be the same, that is 100 lb. The result is that a man pulling on the rope "a" need only exert a pull of 100 lb. to lift a 200 lb. load.

In such a case we say that the "mechanical advantage" is two, because the pulley enables a weight of 2 lb. to be lifted by an applied force of 1 lb. It must be borne in mind, however, that the man is not lifting the weight as quickly as if the rope were passing over a fixed pulley, and as a matter of fact the load travels at only half the speed.

Effect of Three Pulleys

The arrangement we have just described is quite useful, but even better results may be obtained by a further rearrangement of our apparatus. We will now use an additional pulley and substitute separate cords for the previous continuous single cord. In Fig. 9

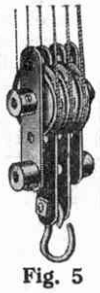


Fig. 5

Fig. 6

one end of the outermost cord is attached to D, and the cord then passes over the pulley A, which is bolted to the upper framework. The other end of this cord is fixed to the hook on the block B. The centre cord is also fastened to D and then passes over the pulley B to be secured to the hook of the block C. The remaining cord passes over the pulley C, and is led downward to serve as the running or pulling-end of the tackle.

If now we hang a weight of, say, 70 lb. on the hook attached to D, we find that a pull of only a little more than 10 lb. is necessary to balance the weight. Theoretically a force of exactly 10 lb. would be required, but in practice a little more force has to be applied on account of the friction set up in each pulley. This arrangement of cords and pulleys, though more powerful than the continuous cord system, is seldom used by engineers for the reason that the continuous cord system is much more convenient to fix and use.

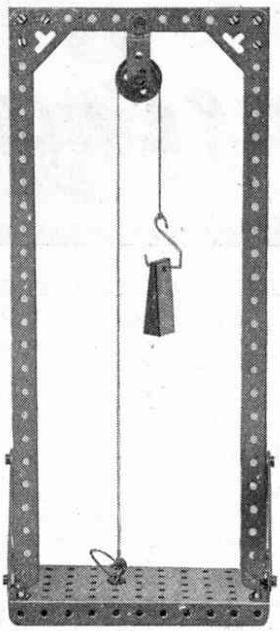


Fig. 7

Pulleys on Stiff-Leg Derrick

The most popular arrangement of pulleys is well illustrated in the Meccano Model No. 709, Stiff-Leg Derrick Crane. As shown in Fig. 1, the tackle here consists of a continuous cord and two blocks. The upper block is fixed and contains two sheaves or pulley wheels, while the lower or moveable block has three sheaves. The end of the cord that passes through the large pulley in the jib of the crane is the running-end.

In order to understand more clearly the relative arrangement of the sheaves and cords we will make use of the model shown in Fig. 4. The number of blocks and sheaves is the same in this model, but instead of all the sheaves in one block being on the same axle they are separated one from the other. The action of the pulleys in Fig. 4 is exactly the same as in the Stiff-Leg Derrick.

For instance, if we hang a 60 lb. weight on the crane-hook the tension on each of the cords will be the same throughout the entire tackle. In this case the tension will be 10 lb. on each cord. This amount is arrived at by counting the number of cords that spring from the lower or moveable pulley block to the fixed upper block. As there are six cords in our crane, then six times the strain on each rope will equal the weight, and as this weight is 60 lb., we know that the strain per rope must be 10 lb. Therefore, it is clear that only a force of 10 lb. is required to balance the 60 lb. load, or in other words the mechanical advantage in this arrangement is six.

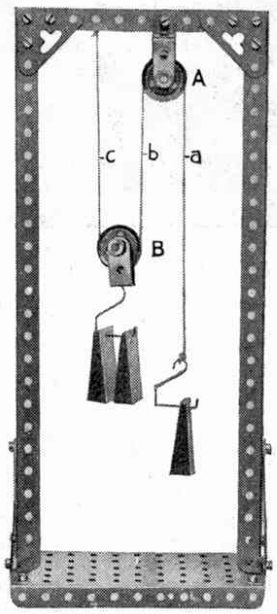


Fig. 8

Part Played by Fixed Block

The foregoing method of reducing the amount of exertion required to lift any particular weight is well illustrated in the arrangement of pulleys shown in Fig. 10. In this case a continuous cord is again used, with two blocks, one fixed and the other moveable, each containing two sheaves.

If we hang a weight of, say, 80 lb. on the hook of the moveable lower block, the force required to balance it will depend upon the number of cords from the lower block to the upper block. As there are four cords from the lower block, then the force required will be one-quarter of the weight, that is 20 lb. The examples we have given in this article should have made it clear that in order to gain any mechanical advantage more than one pulley must be used. It should be noted that a fixed pulley confers no mechanical advantage, and therefore has no effect on lessening the amount of force required to lift a load. The value of the fixed pulley lies in its ability to change the direction of the pull of the applied force so that it can be directed downward.

Types of Meccano Tackle

Figs. 2—6 show four types of tackle used in Meccano models. Figs. 2, 3 and 6 are types of single pulley tackle. One end of the cord is secured to the tail of the standing block and the other end is rove through its pulley and leads down as the running or hauling-end. In each of these three arrangements the mechanical advantage is two, that is to say a 100 lb. weight can be lifted with a force of 50 lb.

In the arrangement shown in Fig. 5 each block contains three sheaves, and the running end is led down from an end-sheave of the fixed top block. In this case the mechanical advantage is six, or in other words a weight of 60 lb. can be balanced by a force of 10 lb.

The Meccano models shown in Figs. 7–10 are very easy to construct, and an hour spent in experimenting with them will give a really practical idea of the operation of pulleys.

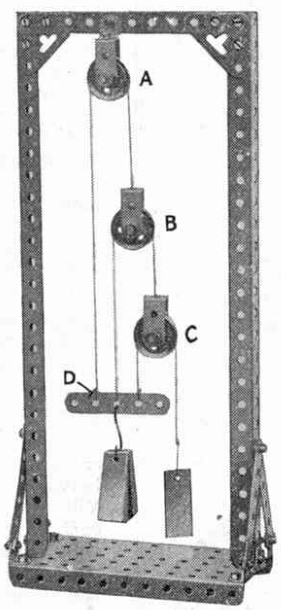


Fig. 9

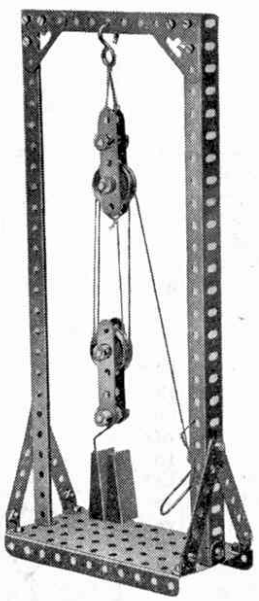


Fig. 10

Lives of Famous Engineers

TELFORD
BRIDGES, ROADS AND CANALS
XI

Last month we saw how Telford rose to a position of eminence among civil engineers by a combination of natural ability and hard work. This month we follow him further on his upward career and see something of the wonderful manner in which he overcame the great difficulties involved in the construction of the Ellesmere and Caledonian Canals.

ON his return to Shrewsbury after inspecting the fine buildings in London and the chief towns in the West of England, Telford intended to proceed with the study of architecture while carrying on his work as surveyor. Before long, however, the direction of his activities was changed by his appointment as engineer to the Ellesmere Canal Company. This new post brought him the sum of £500 per year, out of which he had to pay a clerk and a foreman in addition to his own travelling expenses.

The Ellesmere Canal

The Ellesmere Canal consisted of a series of navigations joining the River Dee to the Mersey and the Severn, the total length, including the Chester Canal, being about 112 miles. The success of the Bridgewater Canal constructed by Brindley had aroused general interest in the opening-up of inland navigations and no difficulty was experienced in obtaining financial support for this new project. The Act of Parliament authorising the construction of the canal was passed in 1793 and Telford commenced operations in October of that year. As regards masonry work he felt himself competent to deal with all difficulties, but as he had had little experience of earthwork, and none at all of canal-making, he obtained advice on these matters from Mr. William Jessop, an eminent engineer of that day.

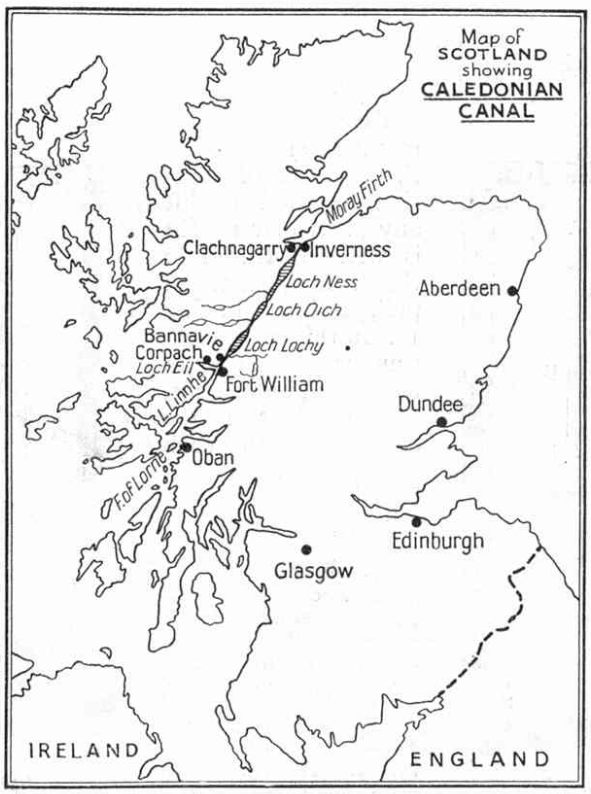
Two Great Aqueducts

The most difficult portion of the canal to construct was that through the rough hill-country between the Rivers Dee and Ceriog, in the vale of Llangollen. The only alternative to building numerous and costly locks was to carry the canal on the same level from one side of the respective valleys of the Dee and the Ceriog to the other, and this was accomplished by constructing the fine aqueducts of Chirk and Pont-Cysylltau. In these aqueducts Telford broke away entirely from the methods of Brindley in regard to carrying the water. This new construction and the reasons for its adoption are well described in Telford's own words :—

"Previously to this time such canal aqueducts had been uniformly made to retain the water necessary for navigation by means of puddled earth retained by masonry; and in order to obtain sufficient breadth for this superstructure, the masonry of the piers, abutments, and arches was of massive strength; and after all this expense, and every imaginable precaution, the frosts, by swelling the moist puddle, frequently created fissures, which burst the masonry, and suffered the water to escape—nay, sometimes actually threw down the aqueducts; instances of this kind having occurred even in the works of the justly celebrated Brindley. It was evident that the increased pressure of the puddled earth was the chief cause of such failures: I therefore had recourse to the following scheme in order to avoid using it. The spandrels of the stone arches were constructed with longitudinal walls, instead of being filled in with earth, and across these the canal bottom was formed by cast iron plates at each side, infixed in square stone masonry. These bottom plates had flanches on their edges, and were secured by nuts and screws at every juncture. The sides of the canal were made water-proof by ashlar masonry, backed with hard burnt bricks laid in Parker's cement, on the outside of which was rubble stone work, like the rest of the aqueduct. The towing path had a thin bed of clay under the gravel, and its outer edge was protected by an iron railway. The width of the water-way is 11 ft.; of the masonry on each side, 5 ft. 6 ins.; and the depth of the water in the canal 5 ft.

"By this mode of construction the quantity of masonry is much diminished, and the iron bottom plate forms a continuous tie, preventing the side-walls from separation by lateral pressure of the contained water."

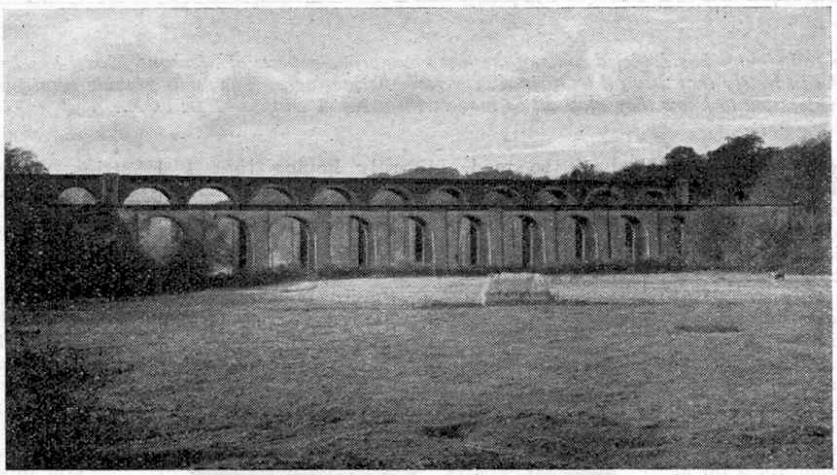
The Chirk and Pont-Cysylltau aqueducts thus consisted of masonry surmounted by a cast iron trough with towing path and side rails, in place of a puddled trough as used by Brindley in his Barton aqueduct. The Chirk aqueduct carried the canal across the valley of the Ceriog between Chirk Castle and Chirk Village. This consisted of ten arches each of 40 ft. span, the level of the water in the canal being 65 ft. above the meadow below and 70 ft. above the level of the River Ceriog. The piers were carried up solid to a certain height, and above this they were built hollow with cross walls.



Map showing the Caledonian Canal

The spandrels above the springing of the arches were constructed with longitudinal walls and left hollow. The first stone was laid in June 1796 and the work was completed in 1801.

The Pont-Cysylltau aqueduct was of even greater dimensions, and Sir Walter Scott spoke of it as the most impressive work of art he had ever seen. It was situated about four miles to the north of Chirk at the crossing of the Dee, and it was carried across the valley on piers supporting 19 arches, extending for a length of 1007 ft. The height of the piers above the low water in the river was 121 ft. The lower part of each pier was built solid for 70 ft., all above being hollow, and the outer walls of the hollow portion were only 2 ft. thick, with cross inner walls. The foundation stone of this aqueduct was laid in July 1795 and the work of construction occupied nearly eight years.



Chirk Aqueduct, with the Viaduct beyond

A Visit to Eskdale

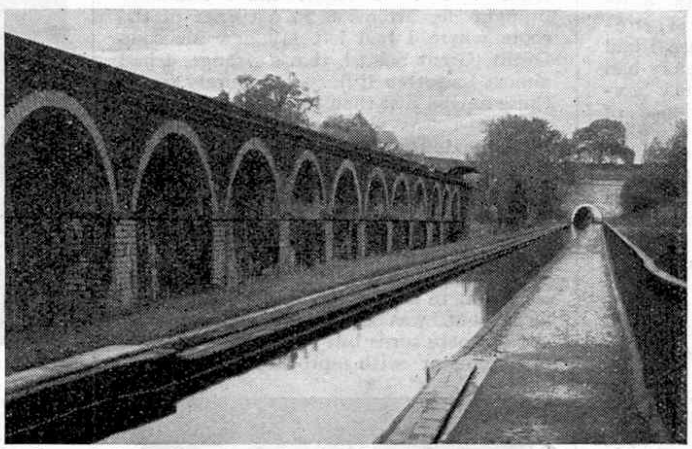
During this period of his career Telford carried out a long-planned visit to his native Eskdale to see his mother, who was now old and infirm. He had never ceased to take care that she should want for nothing, and he had regularly sent money to a friend at Langholm to be laid out in little comforts for her. On this visit he found her alive, but only just so, and all he could do was to ensure that her few remaining wants were properly supplied. He took the opportunity of calling upon some of his old friends at Langholm, among them being a former fellow-workman, now become an innkeeper. Telford asked his old friend what he had done with his mallet and chisels, and was told that they were all dispersed and perhaps lost. "I have taken better care of mine," replied Telford. "I have them all locked up in a room at Shrewsbury, as well as my old working clothes and leather apron; you know, one can never tell what may happen!"

Telford's First Iron Bridge

Telford had long been convinced of the numerous possibilities of cast iron for bridge building, and he took an early opportunity of putting his ideas into practice. The first attempt to build a cast iron bridge was made at Lyons in 1755. This attempt was abandoned, however, on the ground of expense, timber being used instead, and the honour of actually completing the first iron bridge belongs to England. Not long after the Lyons project had fallen through it was decided to build a bridge over the River Severn near Broseley, and John Wilkinson, the first of the long line of great ironmasters, strongly urged that iron should be used for its construction. After considerable discussion his suggestion was adopted and the scheme was carried out in 1777. This bridge, which consisted of a single arch of 100 ft. span, had many defects of design, but nevertheless it proved a very serviceable structure.

The second iron bridge in England was that across the River Wear at Sunderland, built in 1796. Its span was 236 ft. and its height was great enough to allow large vessels to pass beneath it without striking their masts. This bridge was in many ways a remarkable piece of work and Robert Stephenson spoke of it as "a structure which, as regards its proportions and the small quantity of material employed in its construction, will probably remain unrivalled."

Telford's first iron bridge was built in 1796 across the river Severn at Buildwas, between Shrewsbury and Bridgnorth, to replace the old bridge which had been swept away by a great flood in the previous year. It was a handsome structure consisting of a single arch of 130 ft. span, and it served successfully, until 1906, when it was pulled down and replaced by a wider structure.



On Top of Chirk Aqueduct, showing Canal and, on the left, the Viaduct

A Daring Proposition

Telford also erected several iron road bridges and he attained such confidence in the possibilities of iron that in 1801, when it was found necessary to re-build or remove Old London Bridge, he proposed the daring scheme of a cast iron bridge of a single arch of 600 ft. span, having a clear headway of 65 ft. above high water. The boldness and the originality of this design were greatly admired, but before anything was done it was decided to submit the scheme to the most eminent experts of the day, after which evidence was taken before a Select Committee. The committee seem to have agreed that the design was practicable and safe and preliminary works were actually begun, but eventually the scheme was abandoned, apparently owing to the difficulty of constructing the approaches to a bridge with such a headway.

During this stage of his career, Telford also erected a number of important stone bridges. Among these was the handsome bridge across the Severn at Bewdley in Worcestershire. This structure had three arches, one of 60 ft. span and two of 52 ft., and land arches of 9 ft. span were provided at each end for the passage of flood water. Another noteworthy bridge of this period was the Tongueland Bridge over the River Dee in the county of Kirkcudbright.

Telford's life at this time was extremely busy, involving a great amount of travelling about, and in a letter to a friend he speaks of himself as being tossed about like a tennis ball. At the same time he still managed to find time for reading and even for writing poetry, and this was undoubtedly an excellent form of relaxation for a man whose mind was full of bridges and viaducts.

Recommends Improvements in Scotland

In the year 1802 Telford was called upon by the Government to make a survey of Scotland and to report upon the measures necessary to improve the roads and bridges, and also to promote the fisheries on the East and West coasts. His report was duly presented and it formed the basis of a great scheme of development, especially in regard to the Highlands, where the absence of roads and bridges was a very serious handicap to progress of any kind. The effect of his report was such that in 1803 a Parliamentary Commission was appointed and a series of improvements was commenced. These resulted in the construction of over 900 miles of roads and bridges throughout the Highlands, half the cost being defrayed by the Govermnent and half by local assessment.

One of the most important of the new bridges constructed under Telford's supervision was that over the River Tay at Dunkeld. This occupied three years in the building and was open for traffic in 1809. It was a handsome structure of five river and two land arches. The span of the two centre arches was 90 ft. and that of the two adjoining ones 84 ft. Its cost was about £14,000, half of which was defrayed by the Duke of Atholl.

Another noteworthy bridge was built by Telford across the River Spey at Craig-Ellachie, where the river had formed a deep channel 50 yds. in width. The

(*Continued on page* 415)

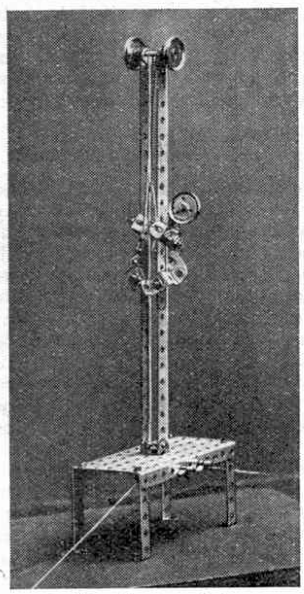
Discoveries in Meccanoland

By W. M. Manning

In this article our contributor has depicted some of the more humorous aspects of Meccano Model-building. We have built all the models illustrated, and can testify that they all work in a very realistic manner. They will provide great fun this Christmas, and our young readers will be interested to know they may all be made with a No. 1 Outfit.—EDITOR.

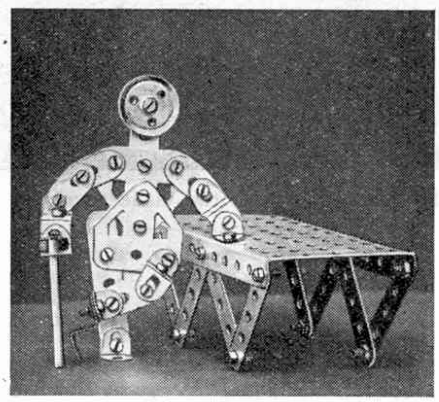
TO put it very plainly, I was feeling "fed-up." Yesterday was Christmas Day and we had had a rousing good time, but to-day, for some strange reason or other, I was decidedly off-colour. I had already explained to lots of people that I had been over-working myself at the school exams., but why my brother Jack should have chipped-in just then with something about "too much Christmas pudding or too many mince-pies, you mean!" I cannot imagine! Anyway, the rest of the family were enjoying themselves in the drawing room, but I just felt that I wanted to be left alone, for a bit at any rate!

As I wandered aimlessly about, the quietness of the house seemed most depressing after last night's noise and excitement. Dolls, books, and toys still lay about the room, although it seemed an age since yesterday when I had taken the part of Santa Claus. I had told them I could do this quite well, because I had already had some experience of acting at school. It really was unkind of Jack to remind the family of the quite unnecessary fact that my *debut* on that occasion had been in quite a minor part—as one of the sheep in the school pantomime, "*Little Bo-Peep*," in fact! As it was, things were dead against me as Santa Claus, although I admit I was to blame to a certain extent in not discovering until after I had entered the room that my "beard" was growing somewhere round my right ear! Even then I think I should have passed it off all right if that ass Bobbie had not stepped on my toe. Pauline told me later that when I asked the "silly cuckoo" to mind where he was going she knew at once I couldn't be the *real* "Father Chwissmas." But then Pauline is very young, and never had much imagination!



The Greasy Pole

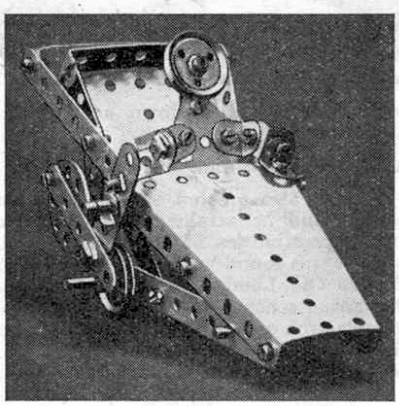
Well, all that happened yesterday, and here I was in a very different frame of mind! I sighed heavily and hunted round for a book to read, inwardly hoping that I should feel better to-morrow. Picking up a fine volume that my uncle had given me, "*Gulliver's Travels*," I drew my chair close to the fire and was soon deep in its pages.



King Meccano

I cannot say how long I had been reading, but I remember that Gulliver had returned safely home from his adventure with the Lilliputians, and I had laid the book down for some minutes to think over what I had read. . . . A slight noise suddenly brought my attention to a corner of the room where I had left my new Meccano Outfit (Great Scott! that's strange, I had almost forgotten it!) . . . Surely something moved just then? . . . I almost decided I was mistaken when the noise was repeated, and I again turned my eyes to that part of the room. Imagine my surprise to see a tiny but very quaint figure in shining armour standing in a somewhat defiant attitude by the side of an equally tiny table.

Doubting my senses I attempted to cross the room to investigate, but found to my alarm that I was bound to my chair—bound not by mere cords but in a very workmanlike manner with sprocket chains and strips. Indeed, I was literally bolted down! Glancing again at this tiny figure I observed a queer kind of smile pass over his face. He seemed to consist of a similar kind of material to that used in my bonds, for he fairly glistened in the fire-light, and as I gazed at him I saw that his armour was pierced by a pattern of equally-spaced holes. But his head fairly fascinated me; it was a beautiful golden tint and perfectly round, as were his eyes, nose, and mouth.

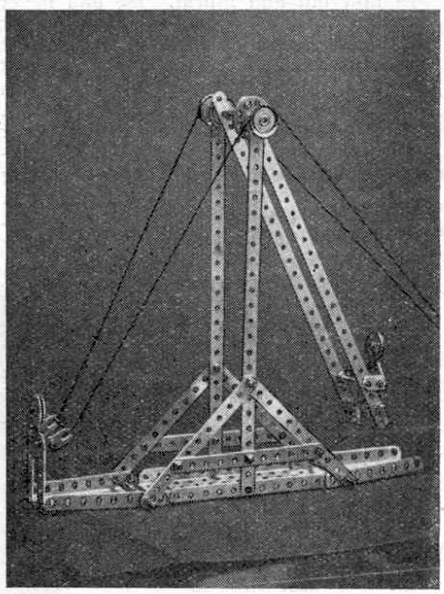


"The Oldest Inhabitant"

I had barely taken in these details, when I was startled to hear a voice, hard and metallic, addressing me:—

"You must pardon the liberty I have taken in exerting my power over you, but as you will no doubt later agree, it is in your own interests that I should do this."

Naturally, I was annoyed at being thus addressed by so diminutive a creature, and decided to kick him into a corner! But I could not move an inch, and except for my head I might as well have been paralysed. I began to think I must be dreaming, but everything was so real, and what was more I could feel the sprocket chain cutting into my wrists. Indeed, I came as near to having the "Wind up" as I have ever done! This diminutive creature certainly seemed to be "top-dog" for the moment, so I decided to humour him and to look out for a chance to get the better of him before any of the others came into the room to find me bolted to the chair.



A Happy Time on the Swings

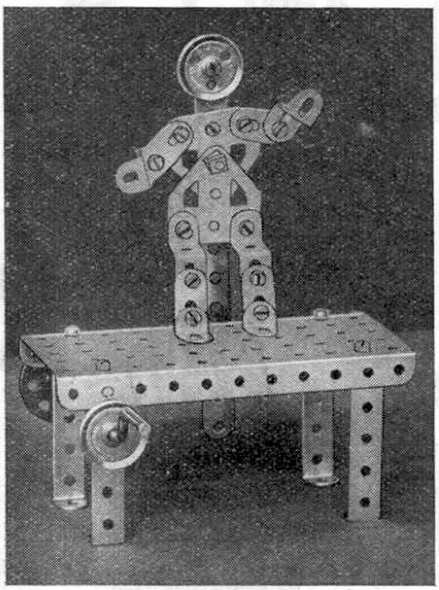
"I am the King of Meccano," he said, after a few seconds silence. "I have waited for this opportunity for a long time, but not until to-night have I been able to enter your life. I am now going

to show you some things of which I was beginning to fear you would always remain ignorant. Ho, there!" he cried, and before I could speak two tiny boys in white checked-jerseys, tumbled out from somewhere. Armed with screwdrivers and spanners, they at once commenced to loosen my shackles.

"In a few minutes I shall be free," I thought, "then I'll kick this self-styled King Meccano back into his box—and the boys too!"

But to my horror I found that, as my bonds were loosed, something was happening to me. I felt like a balloon feels when its air is slowly let out for, like Alice in Wonderland, I was rapidly diminishing in size! Smaller and smaller I became until, as my last shackle was unloosed, I had become about the same size as my strange companion, at which point my shrinking ceased, thank goodness!

[The construction of King Meccano is shown quite clearly in our photograph. In common with the other little figures on these pages he consists principally of a Flat Trunnion and 1" Pulley Wheel without set-screw. He stands upon one leg, constructed from a 2½" Strip and an Angle Bracket, while his other, which is crossed before him, consists of one Angle Bracket, one Flat Bracket and one ½" Reversed Angle Bracket].



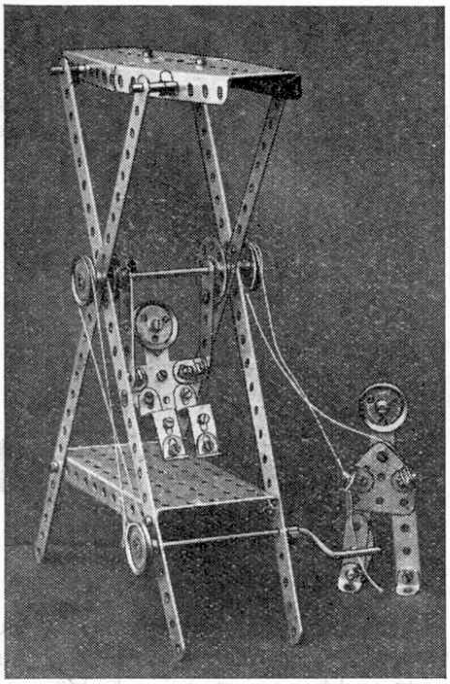
The Professor gives an Exhibition of Step-Dancing

As I drew up with a sigh of relief by his side, the King assured me of his ability to restore me to my normal size as soon as his object was accomplished. The boys, he explained, were ordinary Meccano boys who had been captured while asleep at their Outfits, for which crime they had been brought to Meccanoland to act as the King's bodyguards.

"In this capacity they are expected to learn the error of their ways, for here nobody ever sleeps. The boys seem to be enjoying themselves thoroughly. In fact," continued the King in a confidential whisper, "now they don't want to return to your world!"

Beckoning me to follow him, he threw open a tiny door in the skirting-board.

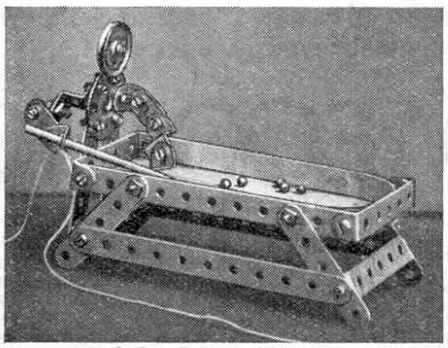
"We now enter the great realm of Meccanoland," he said, and as he spoke he seemed to glow more than ever with pride. Truly he had good cause for pride, I thought, as I stood on the frontier of the brightest and most wonderful country I have ever seen. On the plain below, prosperous-looking lands stretched away



Gymnasts on the Horizontal Bar

to the horizon, while close at hand were hundreds of Meccanitians, bustling about on their various occupations and presenting a scene of such activity and happiness that is seldom seen by the eyes of men.

"These wonderful lands of mine," my highly-placed guide was saying, "are rich



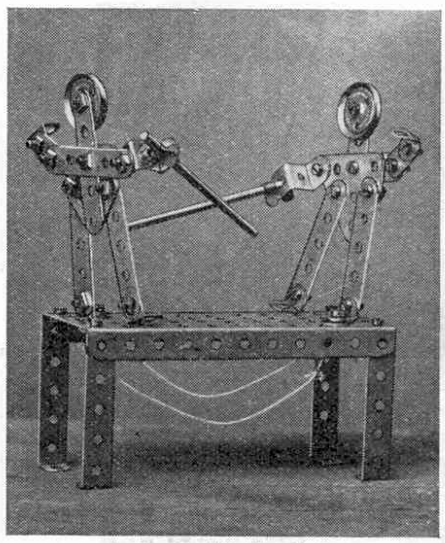
A Quiet Game of Bagatelle

with new ideas and great possibilities, hidden from sight and kept secret. There are now, however, over a million boys in all parts of your world who have sworn allegiance to me—although some do not know it—and this country is open to these boys. All that they require to enter it is a passport, and this is a Meccano Outfit. I shall welcome any and every boy, knowing that they will make this country even more prosperous than it is to-day, for I number amongst my young friends the best and brightest boys of every nation in your world.

"Those who work and seek diligently will find hidden treasures, sometimes in most unexpected places. To let you into a great secret, I may tell you that some may even discover great treasures and great possibilities *hidden in themselves!* They will be rewarded—perhaps years later—in their life in your world, for it is there that they will reap their reward!"

I was spellbound at the prospect unfolded by the King, and as we walked in Meccanoland my amazement increased even more. We were surrounded by hosts of little people, of the same type as my companion, every one of whom seemed to be intent on cramming as much fun as possible into his or her life.

"Even the Meccanitians have their holidays, as you see," remarked the King, as we entered a great fair-ground crowded with a brilliant throng. Here was every imaginable device for amusement—Swings, Roundabouts, Helter-Skelters, Joy-wheels, and Scenic Railways—all made of shining steel and polished brass.



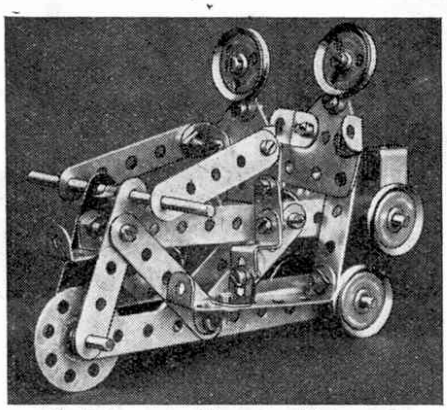
A Bout with the Foils

[SWING. In this model the cord seen in our illustration is passed twice round the 1" Pulleys at the top of the swing and then connected to the "hands" of the "Meccanitian," who has his feet (two Angle Brackets) inserted beneath the Sector Plate forming part of the base of the Swing. A slight pull on the other end of the cord will start the Swing, while our "Meccanitian" will rock to and fro as though he is doing all the work himself! The legs of the little fellow who gets the best fun in this model are specially made (by means of 1" Reversed Angle Brackets) to fit the Swing—perhaps this is the reason why he never gets out to give his friend a ride!]

His Majesty became more and more excited as we mingled with the crowd. Indeed, whilst watching the Greasy Pole he laughed so much each time the climber came tumbling down that his joints literally rattled and his bodyguard anxiously drew their screwdrivers in case they should be needed!

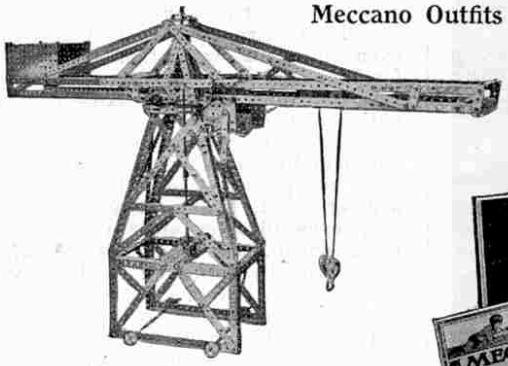
[GREASY POLE. The climber's arms and legs are loosely connected to his body, the bolts being lock-nutted. A piece of cord is connected to his hands and passed over an Axle Rod at the top of the pole, thence down through the Flanged Plate at the base. Another cord is tied to his feet and also led over the top of the pole down to the base Plate. Two 3½" Rods inserted in the latter act as guides to the cords. By operating these cords the figure

(*Continued on page* 383)

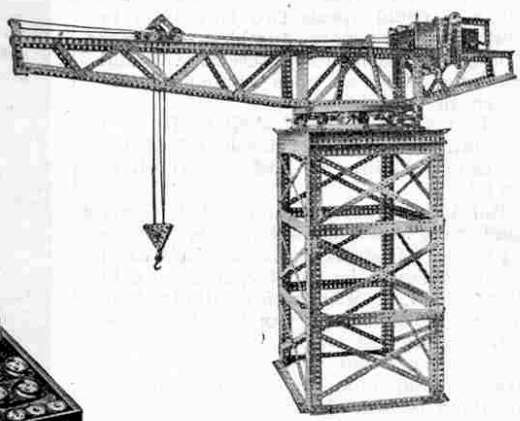


A Trip on a Meccano Motorcycle

Meccano Outfits may be obtained from all leading toy stores



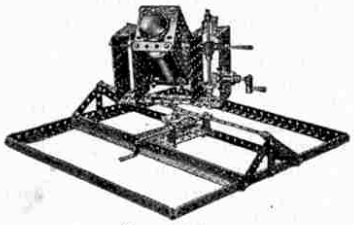
Radial Travelling Crane



Hammer-Head Crane

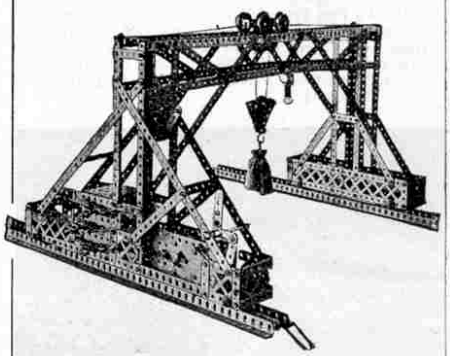
Costs 40/- *builds* 263 *models!*

Meccano Outfit No. 4.

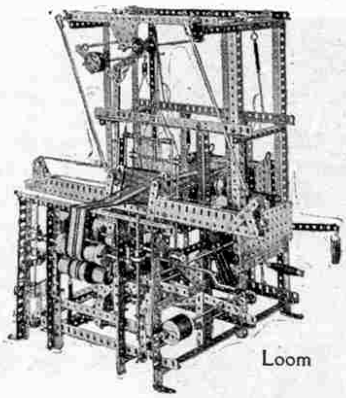


Searchlight

There is no such thing as a dull evening if you have Meccano. Hours of fun and happiness are packed in every Meccano box. The number of fascinating models any bright boy can make with even the smallest Outfits is almost endless, for when he has made those illustrated in the big Manual of Instructions he improves upon them or invents more. Meccano is indestructible—you can use the same parts for ever!



Travelling Gantry Crane



Loom

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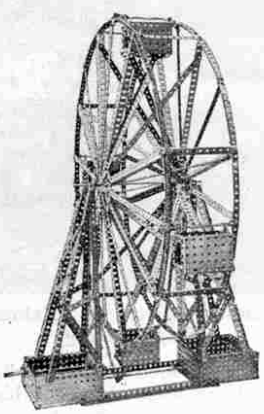
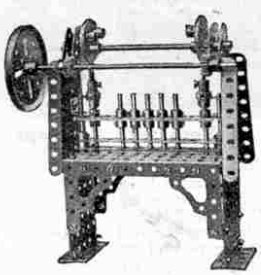
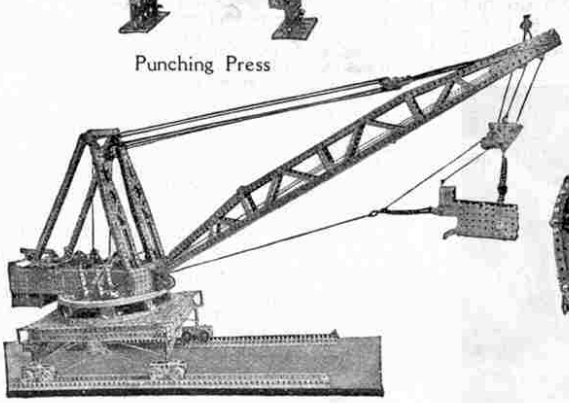


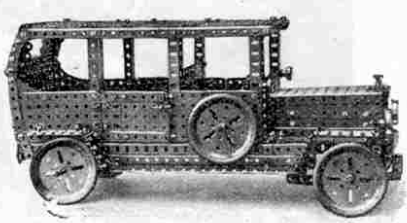
Big Wheel



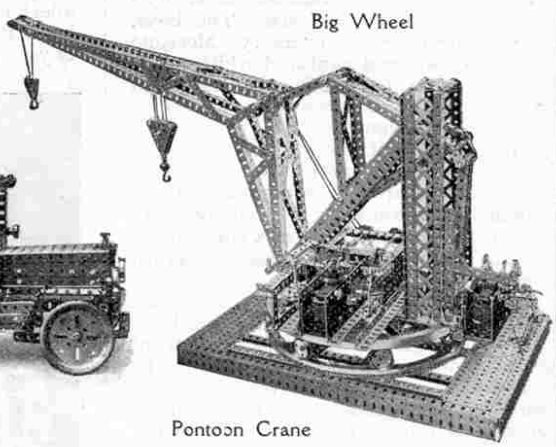
Punching Press



Dragline



Limousine



Pontoon Crane

MECCANO LTD. BINNS ROAD LIVERPOOL

Ten Minutes Slow

AN ENGINEERING STORY.

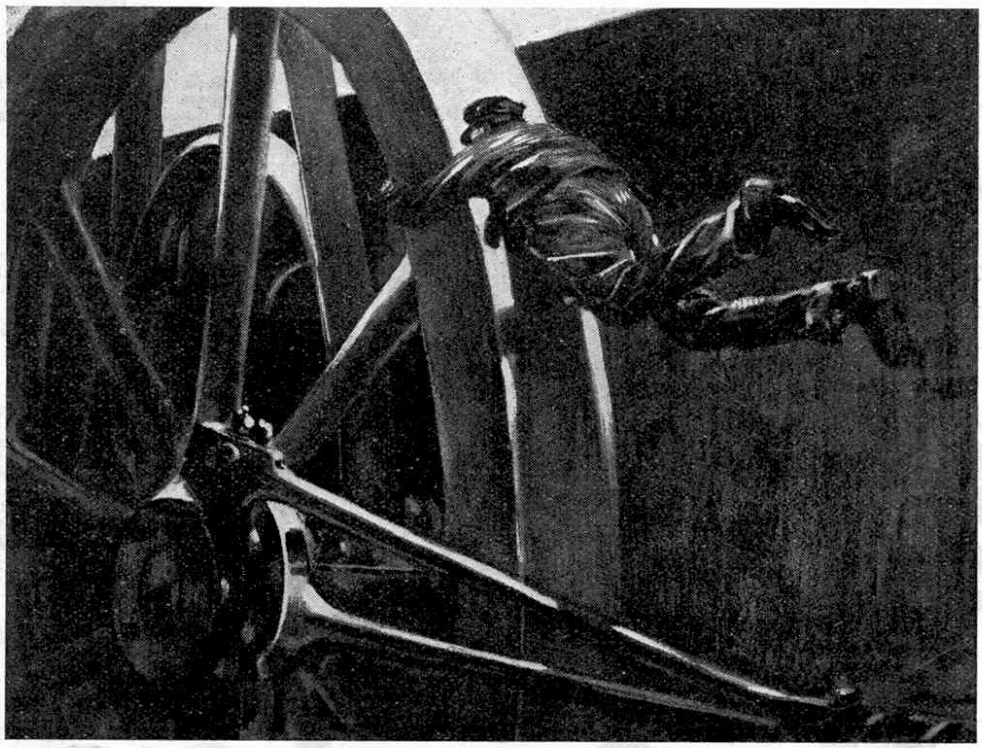
By HUGH F. GRINSTEAD*

AS Bert Kelley seated himself at the breakfast table he looked at his watch. To his surprise he found that it had run down. He wound it up, and, as he "couldn't be bothered" to go into the front room to look at the clock on the mantelpiece, he set his watch by guess at a quarter past six. Half-an-hour later, while hurrying past the Post Office on his way to work, he glanced at the big clock and found that he had set his watch ten minutes slow. "Oh, I'll just allow ten minutes when I look at it and set it right when I have more time," he said to himself as he slipped the watch back into his pocket.

Bert was employed as extra fireman and general helper in the engine room of the big smelting works where copper ore was crushed and the metal extracted and cast into bars. He arrived at the works just as the whistle blew and was kept busy until mid-day. In fact he had been so busy that he had not as much as looked at his watch all the morning. When he went out to luncheon at a neighbouring restaurant the fact that the watch was slow had passed completely from his mind.

On the way back to the works after dinner Kelley glanced at his watch and found that he had almost twenty minutes to spare before the whistle to resume work would blow. It was his duty every day, while the machinery was at rest, to oil the crank by the side of the massive flywheel, and he determined to set about it at once.

The engine furnished the power for the stamping machines and was of an old type with a flywheel sixteen feet in diameter, a rim of smaller diameter bolted to the big wheel carrying the driving belt. A cement-lined pit accommodated the lower part of the flywheel while the upper part went through an opening cut in the floor over the engine room and rose two feet above it. The opening was three feet wide and approximately seventeen feet long, and the driving belt ran up through it to the pulley on the shafting that ran along the ceiling.



Leaning forward, he caught the moving rim of the big wheel and at once he was pulled off his feet

The plant, which was situated on a steep hillside, had not been built for its present use, and because of that and of its position against the hillside many of the arrangements were not what they should have been. The engine base, for example, had been set higher than the boiler room, because it could not have been set in any other manner in the circumstances.

The crank to be oiled could only be reached from the wheel pit, and Bert, picking up the oil-can and a handful of waste, went upstairs to the floor above. Grasping the rim of the big wheel he swung himself down to the driving wheel and then stepped on to the crank bearing. The narrow space in which he was compelled to work was virtually a covered pit. On one side of him was the flywheel; on the other was the central wall of the engine-room foundation. One end of the pit was boarded up and the connecting rod from the engine came through a small passage at the other end. The roof of the pit was so low that when standing up Bert could touch the floor above.

Before he unscrewed the cap from the oil-can he looked at his watch again. It was a quarter to one, and as his task could be accomplished in a few minutes he did not hurry over it. He busied himself in polishing the brass cup with a handful of cotton waste and in wiping off surplus oil from the bearings.

As he filled the oil cup from the can and picked up the brass cap to screw it back into place he was startled by the shriek of the whistle. "Must be nearly one o'clock," he thought, "I'd better hurry!" He gave a final turn to the cap and stood up with his feet on the squared surface of the connecting rod just behind the crank bearing.

But even as he raised himself from a sitting posture he caught a sound more sinister than the whistle. It was the hiss of steam entering the idle cylinder! He felt the machinery tremble for an instant as it responded to the force of the incoming steam . . . then the crank jerked forward slowly and imparted a barely perceptible motion to the big flywheel.

Bert suddenly realised that the engine had started. In the same instant he remembered that his watch was ten minutes slow. It was already one o'clock!

Since the belt wheel was already in motion, he could not step upon it to climb up the way he had come, nor could

(Continued on page 391)

*Reprinted by arrangement with the Editor of *Youth's Companion* (Boston, U.S.A.).

Tune the Table-Talker with the "Matched Tone" Headphones

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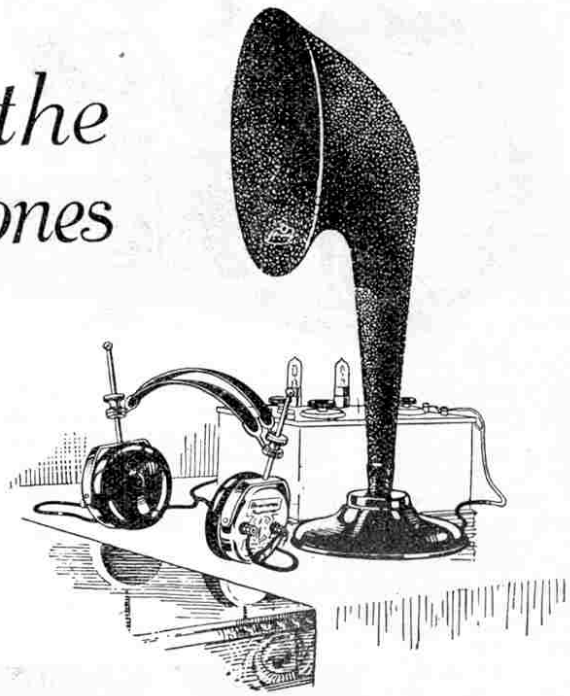

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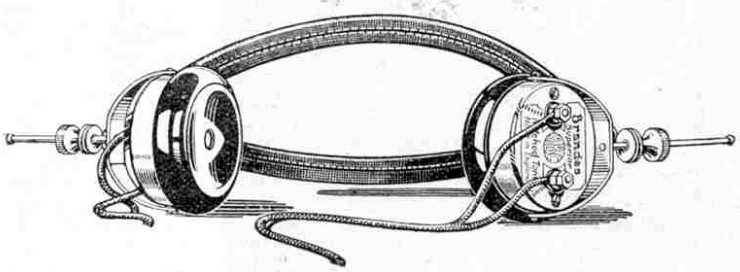

The *Table-Talker* is a Brandes quality product at a moderate price. The non-resonant, specially constructed horn is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound-balance and remarkable tone qualities. It is twenty-one inches high and has a self-adjusting diaphragm and is finished a shade of neutral brown. **42/-**

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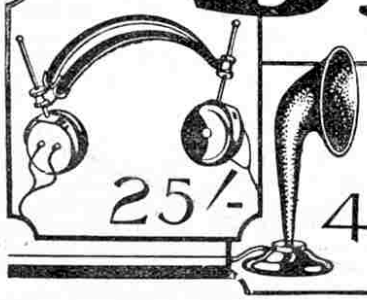
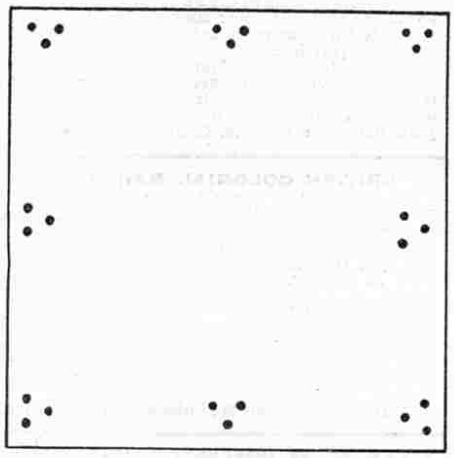
Result of 16 Years Experience

The name to know in Radio





Puzzle No. 41.

Twenty-four soldiers were billetted in a large square room and the sergeant arranged them to count nine each way, as in the diagram above. Four of these soldiers went out for a walk. How were the remainder placed so as still to count nine each way? The four who went out returned later bringing with them four friends. How were they all placed then to count nine each way? Later on it began to rain heavily and four more soldiers came in to shelter. There were then 32 men in the room. How were they arranged so as still to count nine each way?

* * * *

Puzzle No. 42.

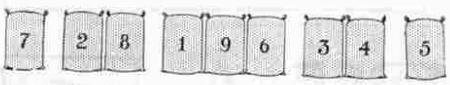
The number 45 is curious. It may be divided in such a manner that if you add two to the first figure, subtract two from the second, multiply the third by two and divide the fourth by two, all the answers are the same. What are the figures?

* * * *

Puzzle No. 43.

Arrange the figures 1 to 9 inclusive into three rows of three in a row in such a manner that each diagonal, each horizontal and each vertical total is 15.

* * * *



Puzzle No. 44.

A miller had some sacks of flour, each of which bore a number as shown in the above diagram. It will be seen that there is a set of three sacks in the middle, next to those on each side is a pair of sacks and on the far side of each pair is a single sack. There is something curious about the figures on these sacks. If the number on the left-hand pair, 28, be multiplied by the number on the adjoining sack, 7, the product is 196, which is the number on the three sacks in the middle. But if the figures on the corresponding right-hand sacks, 34 and 5, be multiplied together, the product is not 196. The problem is to place the nine sacks with as little trouble as possible so that each pair when multiplied by its single neighbour gives the number in the middle.

* * * *

Puzzle No. 45.

What man's name is this :—

Five hundred begins it,
Five hundred ends it,
Five in the middle is seen.
First of all letters,
First of all figures,
Fill in the spaces between.

* * * *

Puzzle No. 46.

I put into a pond six times more Roach than Carp, and Carp a third as many as Tench. Now Tench were less than Bream by two, and Roach twice as many as Tench. In all there were 197 fishes, how many were there of each?

Puzzle No. 47.

A cyclist after a long day's ride found that it was coming on to rain and decided to go home by train. On looking at his map he saw that he had twelve miles to go to the nearest station, and he found that he had 1½ hrs. in which to catch a convenient train. He had four miles uphill which he could walk at four miles per hour; four miles downhill which he could coast at 12 miles per hour; four miles level which he could cover at 8 miles per hour—an average of eight miles per hour. He calculated that he would be just in time for the train. Did he catch it?

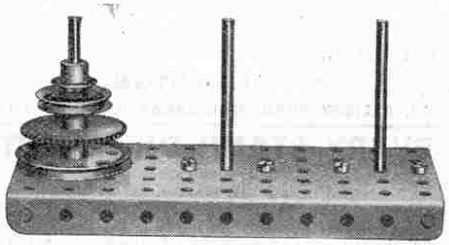
ENTER THIS PUZZLE CONTEST

First Prize : Hornby No. 2 Goods Set.
Second Prize : Hornby No. 2 Tank Loco.
Three Prizes of Meccano No. 1 Radio Receivers or Headphones.

On this page we publish 13 puzzles. Each reader who wishes to enter for this competition must select 10 of these puzzles and send in what he considers to be the correct solutions to them. The first prize will be given to the competitor who solves correctly the whole of the puzzles selected by him, and the remaining prizes will be awarded in order of merit to those sending in the next best sets of solutions. In the event of a tie neatness in writing will be taken into account.

Entries must reach this office not later than 31st December (Overseas 31st March, 1925).

The Five Discs



Puzzle No. 48.

This fascinating little puzzle may be made entirely with Meccano. Its construction is as follows :—Three 3½" Axle Rods are arranged down the centre of a 5½" × 2½" Flanged Plate and are gripped by the set-screws of Bush Wheels bolted to the underside of the Plate. On the first Rod five discs are arranged so that each disc is covered by another of smaller diameter. These discs can be conveniently provided by the following parts, placed on the Rod in the order named :—1½" Pulley Wheel, 50-tooth Gear Wheel, 1" Pulley Wheel, ½" Pulley Wheel, and Collar (without set-screw).

The problem is to transfer the discs in the least possible number of moves from the first Rod to the middle Rod, so that their final order shall be the same as that in which they commenced. Only one disc may be moved at a time, and on no occasion may a disc cover another of smaller diameter than itself.

* * * *

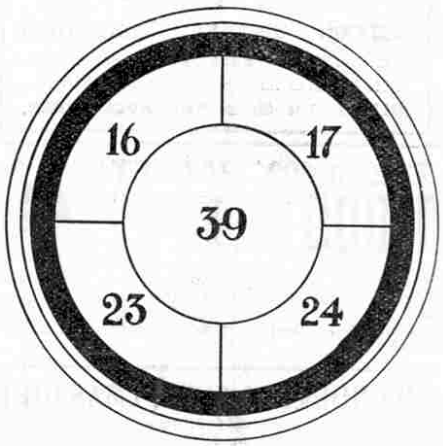
Puzzle No. 49.

When you think you have solved the previous problem in the fewest possible moves, see if you can discover the least possible number of moves it would take to achieve the same result using six discs instead of five, the rules, of course, being the same. For the sixth disc we suggest a 2" Pulley Wheel.

* * * *

Puzzle No. 50.

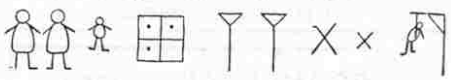
From the eight letters forming the word "starling" make seven other words, the first containing seven letters, the next six, and so on, the last word having only one letter.



Puzzle No. 51.

Practising with my revolver on the target shown above, I scored exactly 100 points. How many shots did I fire and what parts of the target did each shot hit?

* * * *



Puzzle No. 52.

A bricklayer who was unable to write was obliged to resort to all sorts of devices to make out his bills. On one occasion after carrying out a piece of work he sent in his bill in the form of the sketch shown above. What does it mean?

* * * *

Puzzle No. 53.

Three Kings, whom we will call A, B and C, arrived at the bank of a river with their three servants D, E and F. They had to cross the river, and there was only one boat available and no boatman. The boat was so small that only two could cross at one time. The servants had conspired to murder the Kings if ever they happened to outnumber them, and as the Kings had been warned about this they were anxious that there should never be more servants than Kings together. How did the Kings arrange the crossing so that the servants' plot was frustrated?

PUZZLES WANTED

Do you know any good puzzles? If so send them along to the Editor of the *Meccano Magazine*.

Each month we give a cash prize of 5/– for the best puzzle submitted, and pay 2/6 for any other puzzles used.

We specially welcome original puzzles.

Rough sketches may be sent when necessary. Our artists will re-draw these neatly for making the necessary blocks.

Sit down to-day and send in the best puzzle you know—on a post-card, if you like.

Address your letter to "Puzzles," *Meccano Magazine*, Binns Road, Liverpool.

Stamps for Sale

(See also pages 382 and 438)

(Advertisement Rates, 10/- per inch).

North, South, East and West
HILLIER'S PACKETS
VOTED BEST

ANOTHER VICTORY
for my Bargain Packets, which
TOPPED THE POLL
in the Overseas Section of the "*M.M.*"
Bargain Spotting Competition
Was also **VOTED BEST** in the Home Section.
Write for list of this month's wonderful bargains.
HILLIER, The Stamp Mart, HORSMONDEN.

THE "1,000" PACKET

1,000 500 well-mixed Foreign Stamps containing many usually sold at ½d. and 1d. each. 100 UNUSED (a complete sheet), 25 well-mixed BRITISH COLONIALS, a 12-page booklet for holding duplicates and 375 Patent "Strip" Stamp Mounts. **WATKINS (M. Dept)., Granville Road, BARNET.**

4½D.
Postage 2½d. extra. Abroad 6d. extra.

A WONDERFUL CHRISTMAS GIFT
To all bona-fide applicants for our bargain approvals, we offer
FREE 3 Unused Ceylon, 50 Unused Foreign (in 25 pairs), 1 Batum "Brit.Occ." (cat. 1/6) **FREE**
Please mention "*M.M.*," enclose 1½d. postage, and state whether a beginner or medium collector. You'll never regret getting into touch with
THE EASTERN COUNTIES STAMP CO., Withersfield, S.O., Suffolk.

BARGAIN PACKET for 1/-
including 2 Nicaragua, cat. 10/-; Salvador, cat. 6d.; Transvaal 2/6 unused; Norway, cat. 1/-; Abyssinia, cat. 1/-, postage extra. Over 200 sets of stamps free. Write for particulars.
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25 AUSTRIAN FIELDPOST 7d.
A nice all-different selection of these finely-printed, historical and hard-to-get stamps, including over-printed for occupied countries. A very attractive lot, **7d. post free.** Best stamp mounts, **4½d. 1,000**; **5,000 1/8**, post 1½d. if ordered alone. All catalogues supplied. Album list free.
W. E. WILLIAMSON, 55, Nunhead Grove, London, S.E.15.

50 High Values, etc. - - 1/-.
My Christmas Advertisement Packet contains exceptional value.
50 Colonials and Foreign, clean and off paper, including U.S. Africa, ½d.–1/-; Greece, 1 and 2 drachma; Australia, 6d. and 1/-; Southern Rhodesia, Gibraltar, etc., etc. Postage extra.
GAZE, DIDSBURY, MANCHESTER.

BEGINNER'S STAMP ALBUM
to hold 1,250 Stamps and 200 Stamps post free 1/4 P.O. We also buy Old Stamps.
T. Clement, Philatelic Market, Bell St., Wolverhampton.

Free! 25 Different Portuguese Colonials Free!
The above is a SUPERB LITTLE COLLECTION that I have specially made up as a FREE GIFT to Readers of the "MECCANO MAGAZINE" who ask to see my FAMOUS "OAK" APPROVALS. A POSTCARD will do, but Collectors who enclose postage will receive in addition a scarce EGYPTIAN WAR ENVELOPE. Mention Gift M.M.2 and write early for approvals to:
N. R. ENSOR, 2, Oak Road, BOURNEMOUTH.

GRAND CHRISTMAS OFFERS

100 British Colonials, cat. over £2	8/6
50 British Colonials, cat. over 12/- ... ... (No Transvaal).	2/6

Only Mint and fine used copies included.

Leeward Islands 3d. K.G., cat. 2/6, mint ...	10d.
Sudan 4 Mils S.G. 21, cat. 1/-, mint	4d.
Belgium 1915 1c. to 2 fr. (set 13), fine used ...	1/-
50 Fine Pictorials, all different and mint ...	2/3
14 Turkey Pictorials, all different and mint ...	1/6
250 B.C. and Foreign, all different, fine ...	9d.
500 B.C. and Foreign, all different, fine	1/9

Belgium (15), Japan (5), Roumania (10), French Col. (10), Epirus (8), Switzerland (15), Nyassa (10), Latvia (2), S. America (10), Bulgaria (6), Turkey (5), Mozambique (4) — 2/6
A Fine Collection.

Every one of the above lots a bargain. Send early to secure them, as in some cases stock is not unlimited.
Postage extra on orders under 2/6.
For further selections write or call
W. H. TAYLOR,
Dept. A., 26, Meadows Road, Sale, Ches.

A PAIR OF TURKEYS (Obsolete).
FREE and any one of the following sets to genuine applicants for approvals.
6 Mint Hayti, 1904. 15 Ruthenia & Ukraine.
14 German Provs. 14 Soviet Russia & Danzig.
8 Mexican Civil War Issues (Cat. 3/3).
Cheap Sets: 150 German, 1/-; 50 Roumania, 1/-; 25 Dutch, 6d.; 20 Venezuela, 9d.; 40 French Colonies, 10d.; Transvaal Edward, 5/-, 10/-, 20/-, 4/3 set; 500 Diff. Stamps, 2/9; 250 Diff., 1/-; 25 Bulgaria and Thrace, 8d.; 8 Cochin, 6d.
Ask for particulars of how to increase your collection Free.
ALBAN SIMMONS, Hillside, NEW BARNET.

SPECIAL XMAS OFFER.
A packet of 500 Foreign Stamps containing a good assortment. Set of 3 Irish Free State (overprinted). Fine Set of 7 unused Polish.
The whole of the above 510 stamps sent post free on receipt of 6d. to cover cost of postage and packing.
A. F. LANGTON,
37, ALLISON ROAD, HARRINGAY, LONDON, N.8.

EVERY STAMP DIFFERENT
Condition Fine.
20 Iceland, 1/-; 40 Finland, 9d.; 50 Czecho-Slovakia, 8d.; 50 Georgia and Ukraine, 1/3; 50 Russia, 9d.; 50 Roumania, 9d.; 50 Latvia and Esthonia, 2/-; 50 Austria (only Feldpost issues), 1/9; 40 Airpost, 1/6; 50 Central Lithuania, 1/6; 100 mint Germany Republic, 9d.; 25 Bosnia, 8d.; 300 Austria, 1/6; 50 Dantzig, 1/-; 50 Turkey, 1/6. **Postage Extra.**
C. FAULKNER, 90, Woodland Rd., LONDON, S.E.19.

SOME REAL BARGAINS (till 10th Jan., 1925.)
Send 1½d. stamp for my general list. The following post free; no duplicates in any of the packets. 225 German Empire only, 2/6; 400 Austria Hungary, 4/6; 60 Roumania, 1/-; 90 Poland, 1/9; 82 France, 1/-; 50 China, Japan and Siam, 10d.; 50 Holland and Colonies, 9d.; 40 Czecho-Slovakia, 8d.; 108 French Colonies, 1/9; 25 New Zealand, 6d.; 22 Austral. Commonwealth, 10d.; 50 Argentine, 11d.; 35 Brazil, 1/6; 20 Victoria, 6d.
ERNEST HARROD, 110, Pepys Road, London, S.E.14.

FREE PACKET of used and unused stamps, including 12 unused POLAND, set of 4 used UNION OF SOUTH AFRICA, MOZAMBIQUE, PERSIA, etc., to applicants for our famous approval sheets and sets.
Montpelier Stamp Co., 79, Cobourg Road, Bristol.

Special Offers to Young Collectors
and those with only a modest collection.
(1) Packet containing 60 British Colonials, all different, no stamp catalogued under sixpence, fine opportunity to secure rare stamps at bargain rates. Cash with order, 5/- post free.
(2) Pack containing 200 Foreign, all different, many rare stamps in these packets, quite different from general run, being taken from genuine collections in very old albums. Cash with order, 3/6.
John Burgess, N.R.P., 48, Green Street, Eastbourne.

BRITISH COLONIAL BARGAINS.
100 all different, 1/-; 200, 3/3; 300, 6/-; 400, 9/9; 50 different Queen's Heads, 1/6; 25 King Edward, 1/-; 50 King Edward, 3/6; 50 King George, 1/6; 50 Picturesque and Zoological, 1/3. SETS: 15 Palestine, 2/6; 20 Barbados, 2/6; 45 Indian Native States, 1/6; 25 South Africa, 1/-; 25 Australia, 1/-; 12 Cochin, 1/-; 18 Ceylon, 1/-; 4 Bermuda, 6d.; 20 Canada, 6d.; 11 Irish, 9d.; 20 Egypt, 6d.; 25 India, 6d.; 10 Newfoundland, 6d.; 6 British Guiana, 3d.; 40 Great Britain, 6d.; 4 Cyprus, 3d.; 6 Jamaica, 3d.; Add Postage. Price List Free. Peerless Mounts, 1,000 in Box, with Free Watermark Detector on bottom. Post Free 9d.
R. A. KING, 9, Seymour St., Lisburn, Northern Ireland.

FREE 25 DIFFERENT UNUSED PORTUGUESE COLONIALS including fine set AZORES with new issue pictorials. Set 4 **Guinea,** 4 **Mozambique,** 4 **Cape Verde,** 4 **St. Thomas & Prince,** set **Angola,** etc., catalogued over 2/- (usual price 6d.) In order to circulate our Latest List and old 1914 Approval Sheets which we are clearing at half price, we will send this packet **FREE** to all sending **1½d.** stamp for postage (abroad 2½d.)
SPECIAL OFFER.—Complete mint set of 39 different scarce **1923 German Provisionals** from 5,000 M. on 40 M. to 1,000,000,000 M. on 100 M. (usual price 2/-) offered for **6d.** post free.
Collections and Loose Stamps Bought. Highest Prices Paid
HORACE MILLER & CO., WHITSTABLE.

NO NEW EUROPE
FREE. 25 BRITISH COLONIALS and 10 S. American, including W. Africa, Newfoundland, Travancore, Jamaica, Queensland. To applicants for my famous approvals, enclosing 1½d. postage. 250 Unused Stamps, 1/3.
FLEMING,
St. Winifreds, Christleton Road, CHESTER.

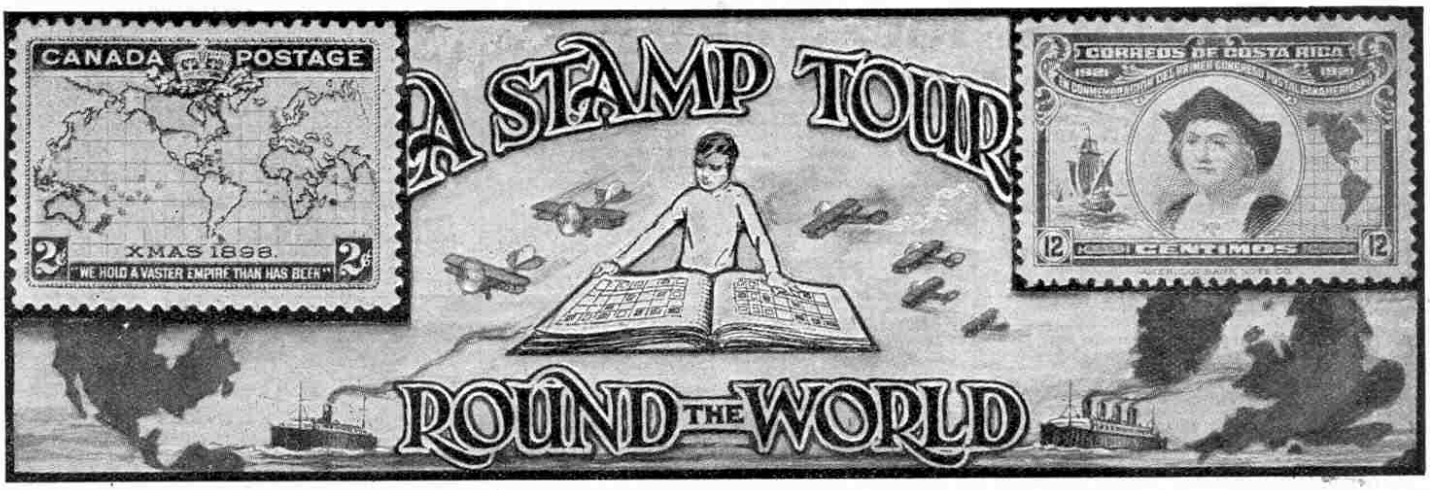
FREE and post paid to all genuine collectors asking to see our approval books.

ASK FOR 3 CORNER PACKET
Send a postcard to-day. *Only 1 lot allowed each applicant.*

This packet contains high value **Greek pictorial catalogued 3/-,** Gwalior official, Hungarian revolution (eagle), set of 3 China ships, **Bolivia** arms, Bulgaria pictorial, Norway, **Wallis and Fortuna Island,** set 5 Switzerland, Sweden, Denmark, **Venezuela high value catalogued 1/-,** Germany 50 million Marks, Pair large Ukraine pictorials, Ireland, and **an obsolete 3-cornered stamp in fine condition.**

R. Wilkinson, Provincial Bldgs., Colwyn Bay

TRIANGULAR STAMPS BRITISH COLONIAL AND WAR.
Stamp Collector's Outfit and 60 Different Stamps FREE!! **INDIAN NATIVE STATES, 25 UNUSED, ETC.**
This tremendous advertising offer contains all the following:—Czecho-Slovakia, Gwalior on India, Fiume (newspaper), Cape Verde (postage due), Prussia, Peru (San Martin), Laibach (Jugo Slavia), Schleswig Holstein, Saint Thomas, Republic of Ukraine, etc. Pkt. of finest stamp mounts and the new unique accessory, a combination pocket folder and mathematically-correct perforation measure. The whole valuable parcel absolutely free on receipt of postcard requesting approvals.
LISBURN & TOWNSEND, 201a, London Road, LIVERPOOL. **COLLECTIONS PURCHASED.**



IV. BRITISH GUIANA, JAMAICA AND PANAMA

MARTINIQUE, a French colony about 50 miles from Guadeloupe, consists of groups of volcanic mountains in the north and south, with lesser heights between. Fort de France (1908 issue, 25c. to 75c.) is the capital of the island and possesses a fine harbour guarded by forts. It is situated on Fort de France Bay, on the west coast of the island. Earthquakes are frequent, and the island for long will be remembered as the scene of the terrible eruption of Mont Pelé, one of the northern mountains, in 1902, when several towns were destroyed and 40,000 inhabitants killed.

Rivers that Dry Up

St. Lucia is 24 miles south of Martinique, and is considered to be one of the most beautiful islands of the West Indies. The chief natural feature of the island is The Pitons (1902 commemorative issue 2d.), two immense pyramids of rock rising abruptly from the sea, their slopes, inclined at an angle of 60°, being clad on three sides with dense verdure. They are 2720 ft. and 2680 ft. in height respectively.

From St. Lucia we pass by way of Barbados and Tobago to Georgetown, the capital of British Guiana—the only British possession in the South American continent. Those who have only seen it on a map often think that British Guiana is quite a small country, but, as a matter of fact, it is twice the size of Great Britain. There are 78,500 square miles of dense jungle, and this makes travelling overland impossible. The only way to get from one place to another is by the rivers, which are to be found everywhere, but even then it is not an easy matter, for many of them have the annoying habit of unexpectedly drying up!

We are exceedingly fortunate on this tour in having our fleet of aeroplanes, which take us inland to the places depicted on the beautiful pictorial stamps issued in 1898 to commemorate Queen Victoria's Jubilee. The engraving of the stamps of this set is particularly good and the colours are very tastefully chosen, with the result that the set is one of the finest issued. There are two types, the view on the 1c., 5c., and 15c. values showing Mount Roraima, and that used for the 2c. (illustrated on this page) and 10c. showing the famous Kaieteur Fall.

Mount Roraima and The Kaieteur Fall

Mount Roraima is 8,635 ft. in height and is on the boundary of the country. It is the highest mountain in the Pacaraima range, which runs across the country from west to east, and is of remarkable shape. It rises like a vertical wall of red rock to a height of 1,500 ft., and was considered to be unclimbable until two men, named Thurn and Perkins, succeeded in finding a way up in December 1884. The summit is a large tableland with an area of about 12 square miles. At the foot of the mountain are the forest-clad slopes so typical of the country.

The Kaieteur Fall is only one of many magnificent waterfalls to be found in this district. Here the river Potaro, a large tributary of the Essequibo, descends a cliff by taking one huge leap of 822 ft. The Fall was discovered in 1870 by C. Barrington Brown, who was occupied at the time upon a geological survey. The water falls in a vertical column for 741 ft., and from the foot of the fall it becomes a roaring cataract to the valley beneath. The breadth of the stream composing the fall itself varies from 400 ft. in the rainy season to only a quarter of that breadth in dry weather. The Kaieteur is normally five days' river-journey from Georgetown, although the distance between the two places measured in a straight line is only 130 miles.

The Rarest Stamp in the World

British Guiana is well-known to stamp collectors for its type-set stamps, many of which were set up and printed at the office of the "*Royal Gazette*" in Georgetown. These stamps were printed in black on coloured wove paper and each one was initialled by the postmaster or post-office clerks before being issued!

Among these type-set stamps is to be found the rarest stamp in the world, the 1c. black on paper surface-coloured magenta. This stamp, in common with a 4c. of similar design, was set up and printed at the office of the "*Official Gazette*" by Messrs. Baum and Dallas, Georgetown, and issued in February 1856. Only one copy of the 1c. black is known to exist and this was sold by auction in Paris in 1922 for £7,000.

We Call at Jamaica

If we look at a small map, a voyage from British Guiana to Jamaica appears to be almost a return on the course we have lately traversed, but in reality the two paths are over three hundred miles apart.

The Llandovery Falls, the first view of Jamaica to appear on a stamp, have been described and illustrated in the "*M.M.*" already (April 1924, p. 99). They are situated in the district of St. Ann on the northern portion of the island and form the view on one of the favourite local picture postcards. The remaining views of Jamaica form part of the pictorial set issued in 1921. In this set the 2d. shows the King's House at Spanish Town (1762–1872), the 4d. (illustrated on this page) shows the Spanish Town Cathedral, the 1/– a statue of Queen Victoria—"of Jamaica, Lady Supreme"—the 2/– the memorial to Rodney, who with Hood saved Jamaica from invasion by the French and Spanish in 1782, and the 3/– a statue of Sir Charles Metcalfe, Governor of the island from 1839 to 1862.

An Engineering Wonder: The Panama Canal

From Jamaica we continue westwards until we arrive at Colon and the beginning of the Panama Canal, one of the most striking engineering achievements of modern times. The canal is about 50 miles in length, and its construction was only made possible by first eliminating tropical diseases from the whole area so that the great army of workmen could live there

(*Continued on page 383*)

Stamps for Sale

(*See also pages* 380 *and* 438)

100 1d. RED PLATES 1/–, mixed. Beginner's packet 1/–.—Richards, 68, St. James' Road, Croydon.

200 STAMPS FREE. Ask for approvals.—Dickinson (Dept. M.), 733, High Road, Leyton.

200 MIXED UNUSED STAMPS 7d.—G. P. Cranwell, 55, Cowslip Road, London, E.18.

FOR APPROVALS you should write to John Downes, 223, Camden Street, Brookfields, Birmingham.

FREE. Six rare Persian 1 to 13 ch: complete.—Aldis, 74, Marine Parade, Yarmouth.

1/- for 6d. First 10 approval applicants may pick **half-price ! !**—Place, Woodhurst, Huntingdon.

STAMP ALBUM GRATIS. Approvals. Postage 3d. Abroad 1/–.—Neave, 25, Portnall Rd., Paddington, W.9.

LATEST. 250 Stamps. Pictorial, Asiatic, good Colonial, War Stamps, Obsolete Sets, etc., complete for 3d.—White, 6, Stourbridge Road, Lye, Stourbridge.

112 Different Stamps including Jamaica, Nicaragua, Tasmania, Travancore, Peru, 6d.—Kraus, 137, Cheapside, London.

SPACE FILLERS, ½d. to 3d. About 500 sent on approval. A useful selection.—D. Pratt, 10, Lion Gate Gardens, Richmond, Surrey.

FREE. Sheet 50 unused stamps to genuine applicants for approvals, good value, farthing upwards. Cheap sets. Send postage.—Croft, Adel, Leeds.

GRENADA 6d. tête-bêche, scarce used pair, 1/3 (select 1/8).—New Century Stamp Agency, Cornwall Rd., Bristol (Est. 1901). Postage extra. List free.

FREE. 40 different Foreign and Colonial Stamps, used and unused, including latest issues. Postage 1½d.—Howell, 20, Trilby Road, Forest Hill, London.

TURN YOUR STAMPS INTO CASH ! I buy stamp collections for cash. Let me know what you have to sell and price. Box 1202.

GOOD PRICES OFFERED for used stamps of any country of 3d., 6d., 1/- values and over, either of current or earlier issues. Box 1204.

SPECIAL CLEARANCE of old approval sheets. 7 Cochin free to applicants for a selection.—S. Huckle, 53, Birkenhead Avenue, Kingston-on-Thames.

GENUINE BARGAINS. Selling off. 100 Foreign Colonial Stamps all different, 1/2 Postal Order. 250 2/2. Worth 10/–.—Scott, 154, Wellesley Road, Ilford.

100 VARIETIES, 1/2, Foreign and Colonial, 66 to 80 per cent. under catalogue; 1d. blacks; approval.—Rev. Bell, Loughguile, Co. Antrim.

FREE. 50 STAMPS to genuine applicants for approvals.—Charlesworth & Hall, 34, Alexandra Road, Ansdell, Lytham.

SPECIAL XMAS OFFER. 50 British Colonials, Mint and used, including **high values,** 1/3.—E.C. Fisher, 13, Cumberland Road, South Norwood, S.E.25.

60 Different Stamps Free to applicants for approvals. All ½d. each. Cheaper line, 200 different 6d.—Cox, 135, Cambridge Road, Seven Kings.

385 STAMPS guaranteed all different. Clean and Perfect, 2/–. Wonderful value. Suitable Xmas Gift.—J. Baron, 8, King Edward's Gardens, Barnsley.

STAMPS. Every Meccano boy should send for our approvals and latest scheme for young collectors.—Fairweather, 64, Barker Street, Lozells, Birmingham.

FREE. 24 High-class British Colonials, 24 Foreign 1½d. Postage. Dispersing Collection. Approvals from ½d. Good British Colonials from ¼ Cat.—Hill, Romolo, Lindfield, Sussex.

STAMPS. Dispersing Collection 22,000 (also Collection entire £1 and £25). Approvals 8d. and 9d. in 1/- discount, cash or exchange Meccano or anything useful.—" Olivet," Stretton Road, Addiscombe.

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Discoveries in Meccanoland—

(*Continued from page 375*)

will climb or tumble down the pole as required in a most realistic manner.]

Just then I noticed a queer little figure propelling himself vigorously along in a bath-chair. "That is our oldest inhabitant," said the King in reply to my question. "A wonderful old man—he has a face as bold as brass, a constitution as strong as steel, yet he cannot walk for nuts!"

[OLDEST INHABITANT. The chair does not present much difficulty, its principal parts being two Sector Plates and four 5½" Strips, and it runs on three 1" Pulley Wheels—one in front and two at the back. One of these (not visible in the photograph) drives by cord another 1" Pulley Wheel, the shaft of which also carries a Bush Wheel. As will be seen, a 2½" Strip is pivoted at one end to this Bush Wheel and at the other to a second 2½" Strip which, rocking about an axle journalled through its centre hole, is again pivoted to the old man's hand. As for the occupant, he has dispensed with his legs altogether, for he doesn't require them with such a luxurious bath-chair! His neck is a Flat Bracket; his right (or propelling) arm consists of one Angle Bracket, one ½" Reversed Angle and two Flat Brackets, and his left arm—the hand of which is loosely bolted to the chair—formed by three Angle Brackets. This is a most amusing little model and has a wonderfully realistic appearance. When wheeled along the table the little fellow appears to energetically push himself along.]

Passing through several long streets of fine buildings, we presently came to some splendid recreation grounds. Here we stood gazing at a wonderful gymnast, who seemed to be attempting to dislocate his arms with horrible regularity! Next, my attention was attracted by an extraordinary step-dancer, who defied the laws of gravity, and two fencers who fought valiantly with a great amount of skill.

[THE GYMNAST is easily constructed by following the accompanying illustration. His companion demonstrates another method of working by means of a cord, which should be wound twice round the 1" Pulley Wheel.]

[THE STEP-DANCER. In this model a 5½" Strip bolted to the back of the figure is pivoted to one of the flanges of the base Plate. A 2½" Strip is then pivotally connected at one end to this 5½" Strip and at the other to the Bush Wheel carried by the Crank Handle. Each of the dancer's legs consists of one Angle Bracket, one ½" Reversed Angle Bracket, and one Flat Bracket. His arms are formed of one Flat Bracket and two Angle Brackets. He should be pivoted at his "knees" and "elbows," and on a slight movement to and fro—not rotary—of the Crank Handle—he will go through some very weird antics.]

[THE FENCERS. Cords are attached to the foot of each fencer and passed through suitable holes in the Flanged Plate so that when pulled they will cause him (the fencer) to turn on his pivot. Great fun can be had with this model if two people are playing with it, since each can take a cord and attempt to out-fence the other. The figures should be *pivotally* connected to the legs on which they stand to enable them to lift their free legs clear of the plate.]

Leaving the crowd, we gained the main road and found it thronged with traffic of all kinds. I jumped back as a motor-cyclist with pillion-rider dashed by at a terrific speed. I was reassured, however, when the King told me there were no such things as accidents in Meccanoland, for the simple reason that the Meccanitians were far too tough to be hurt, however much you knocked them about!

"In that building," said the King, directing my attention to an imposing structure, "you will find billiards and bagatelle in full swing, and indeed almost every other form of indoor recreation."

"You will soon learn that the inhabitants of Meccanoland are never idle. The few hours that they are able to snatch from their busy day are not idled away—on the other hand, they are packed full of real fun and enjoyment. Every day more and more boys in your world are learning this secret of busy happiness."

(*To be continued*)

A Stamp Tour Round the World—

(*Continued from page 381*)

until the work was completed. The canal made it necessary to construct a lake of immense size, and to remove one side of a mountain. The work was commenced by the French, abandoned, and finally completed by the United States, the Canal being opened on 15th August, 1914, just over ten years ago.

When passing from one ocean to the other, vessels are lifted to a height of 85 ft. above sea-level and at the other end of the canal they are lowered again to sea level. This is accomplished by means of locks, which we hope soon to describe in greater detail in a special article on this great engineering achievement.

When a map is consulted a most unexpected fact reveals itself, for it is then noticed that in passing from the Atlantic to the Pacific (that is, from the eastern ocean to the western) a vessel actually travels in the opposite direction, with the result that it finishes more eastward than it began! This is, of course, owing to the geographical direction of the isthmus at this point.

The Stamps of Panama

In 1915 the Republic of Panama issued a series of commemorative stamps showing views of the canal. The 1c. value, which is reproduced here, shows a map of the Canal Zone. In this map a line drawn from north to south begins approximately at the "R" of "REPUBLIC" and ends at the "M" of "CENTESIMO," from which it will be seen that the Atlantic is on the left and the Pacific on the right when the stamp is the normal way up.

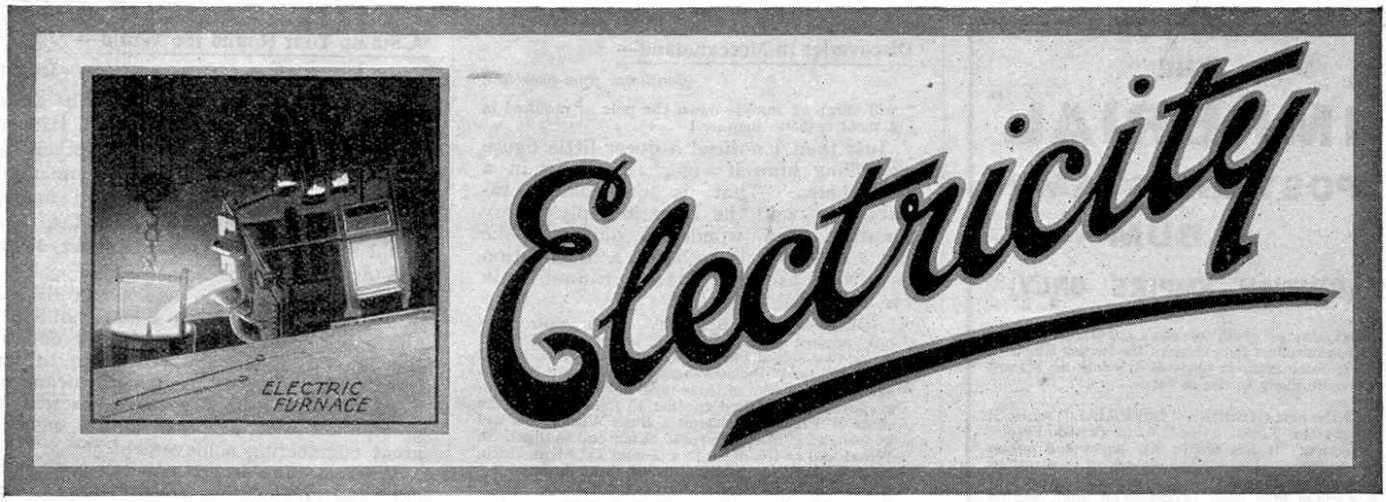
Commencing at the Atlantic seaboard, the canal is carried through Limon Bay near Colon, the coast-line of this bay being five miles from deep water where the canal really begins and from which the measurements are taken. At the seventh mile the canal enters the Gatun Lake by the three Gatun Locks. From here to the Culebra Cut is 29 miles, and four miles beyond the cut is the Pedro Miguel Lock. After passing through this lock, Lake Miraflores is entered, at the far end of which are the Miraflores Locks that bring the vessels back to sea-level. From the Miraflores locks to deep water is another eight miles, the total distance between deep water in the Atlantic and deep water in the Pacific being 50 miles.

The 5c. (also illustrated) shows the Gatun Locks, which are nearly three-quarters of a mile in length. The 10c. shows the Culebra Cut.

In 1918 a further series of pictorial stamps of high values was issued showing ships on various parts of the canal, such as at the Gatun Locks and the Culebra Cut.

Until 1903 Panama was a department of the Republic of Colombia, but in November of that year the Canal Zone, a strip of land extending for five miles on either side of the canal, was ceded to the United States. The canal is of great service to shipping, and during 1923 over 19½ million tons of cargo in 3,967 commercial vessels passed through it.

NEXT MONTH:—
CENTRAL AMERICA



X. ELECTRIC BELLS

OF all electrical instruments the electric bell is by far the most familiar. To-day nearly every house is fitted with a bell of this kind which, for ordinary domestic purposes, surpasses all other types of bell for convenience, reliability and simplicity of mechanism. Considering the valuable work electric bells perform their simplicity is really remarkable, and this is a point that Meccano boys would do well to bear in mind when they are building models of their own invention. Provided the piece of mechanism accomplishes efficiently the work for which it is intended, its value may be greatly increased by reducing to a minimum the number and complexity of its moving parts.

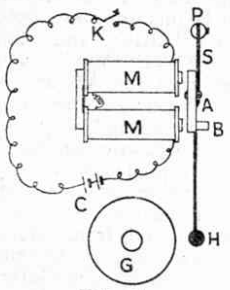


Fig. 1.
Single Stroke Bell

The Single-Stroke Bell

The type of electric bell used in our houses, shops, hotels and other buildings is that known as the "trembler bell." Before describing the work of this type of bell, however, we will consider for a moment an even simpler type known as the "single-stroke" bell. This bell consists of a horse-shoe electro-magnet, M, Fig. 1, and a pivoted soft iron armature A, to the free end of which is attached the hammer H, which strikes the gong G when the armature is pulled towards the magnet. The pivoting motion is obtained by means of a spring S, which attaches the armature to an upright brass post P. This spring is so attached that it pulls the armature away from the magnet towards the stop-block B. When the push, K, is pressed down, an electric current from the battery C passes round the magnet, the armature is attracted and the hammer strikes the gong and thus produces a single ring. The magnet remains magnetised as long as the current flows round it, and thus the armature is kept attracted until the current ceases. Therefore, in order to sound the bell a second time, the push must be first released and then pressed again.

The number of rings given by a single-stroke bell is absolutely under the control of the operator, for this is always the same as the number of times the push or switch is pressed down. For this reason this type of bell is of considerable value for signalling purposes, and it is used on all British railways for communicating from one signal-box to another.

If we can attach some kind of automatic switch to a single-stroke bell so that the current is switched off as soon as the armature is attracted towards the magnet, the armature will immediately spring back to the stop-block. When this occurs, if the current can be instantly switched on again the armature will again be attracted, and so long as the automatic arrangement continues to start and stop the current, this cycle of operations will be repeated over and over again during the whole time that the bell push is kept pressed down.

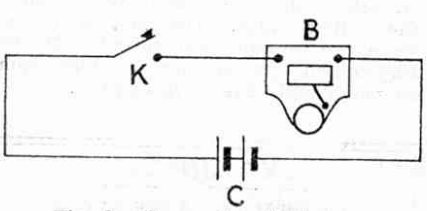


Fig. 3. Conventional Diagram

The Trembler Bell

This is exactly what takes place in the case of the ordinary household trembler bell. The construction is to a large extent the same as that of the single-stroke bell. There is the magnet, M, Fig. 2, the armature A held by the spring S fixed to the post P, and at the end of the armature is the hammer H which strikes the gong G when the armature is attracted to the magnet. Fixed to the base-board of the bell is a brass block B, through which passes a bolt called the contact screw CS. This screw is adjusted so that its point just touches the armature when this is not attracted by the magnet. When the switch is depressed current flows from the battery through the switch and round the magnet to the post P. From there it passes by way of spring and armature to the contact screw CS and the block B, from which a wire conducts it back again to the battery.

When the current flows and the armature is attracted towards the magnet it leaves the contact screw and thus immediately cuts off the current. The magnet now loses its magnetism and allows the armature to spring back and touch the contact screw again, thus switching on the current, so that the whole operation is immediately repeated. This procedure continues automatically as long as the switch is depressed, and the result is to produce a rapid succession of strokes on the gong. Considerable "sparking" takes place at the contact points of the armature and the contact screw, and therefore these points are coated with platinum or other non-oxidising metal so that the electrical contact will remain good.

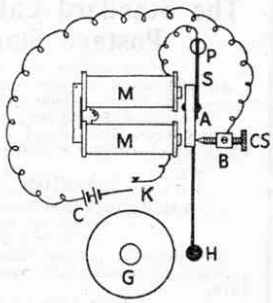


Fig. 2. Trembler Bell

Conventional Signs

It will have been noticed that in these two diagrams two conventional signs have been introduced namely, the switch or key K and the battery C. In diagrams of electrical wiring much time would be wasted if every item had to be drawn in full, and therefore a number of signs have been agreed upon to represent various parts of electrical apparatus. These signs are usually a sort of simplified drawing of the instrument or part they represent. Fig. 3 shows the same circuit as in Fig. 2, but by means of the conventional signs. The bell B is easy to recognise, K is the key, switch or push, and C is the battery. Whenever a bell appears in a diagram it is presumed to be of the trembler type unless otherwise stated. In the conventional representation of batteries a series of alternate long thin lines and short thick ones is used as in Fig. 4. One long and one short line represent a single cell of two volts, the long line standing for the positive pole and the short one for the negative pole.

Relays Used in Large Buildings

When the push or switch of an electric bell is a long way from the bell itself, as often happens in large buildings or works where a push in the basement may be required to ring a bell in the top storey, an instrument known as a "relay" is used.

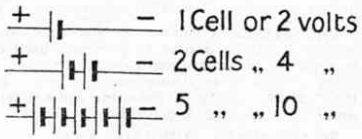


Fig. 4.
Conventional Sign for a Battery

The principle of the relay is shown in Fig. 5, from which it will be seen that the apparatus consists simply of an electro-magnet M which attracts an armature A fixed so that the contact screw CS touches CP when the armature is attracted to the magnet. It will be seen that there are two independent circuits, one containing the push K, the electro-magnet M and the battery B, and the other containing the bell, a second battery BB and the contacts CS and CP. The first circuit passes through the building to a point near the bell. When the push is depressed current flows from battery B and round the magnet, so that the armature is drawn towards the magnet and CS and CP touch. This brings the second circuit into action, so that current from battery BB rings the bell.

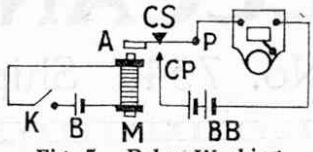


Fig. 5. Relay Working

The advantage of relay working is that smaller batteries may be used than would be possible with a simple circuit, which owing to the resistance of a great length of wire would require a comparatively large battery. In the example just considered the battery BB need only be just strong enough to work the bell, while the relay battery B also may be quite small as the relay is adjusted to work with an exceedingly small current. The result is a saving in current that more than compensates for the added cost of the relay.

Indicators for Bell Systems

Many houses have bell-pushes in practically all the rooms. These all ring one bell in the kitchen, and in order to show from which room the ring has come an indicator is fitted. Before explaining the working of a bell indicator we must first see how a number of bell-pushes can be arranged so that any one of them can ring the bell. Fig. 6 shows a bell and battery that can be controlled by any of the pushes placed in various rooms throughout the house. It is obvious that, no matter where these pushes may be placed, pressure on any one of them will complete the circuit through the bell and the battery, and consequently the bell will ring. In wiring a house for this system it is usual to take two main wires from the bell and battery to the furthest bell-push and to join branch wires to these to lead into each room where a push is to be placed.

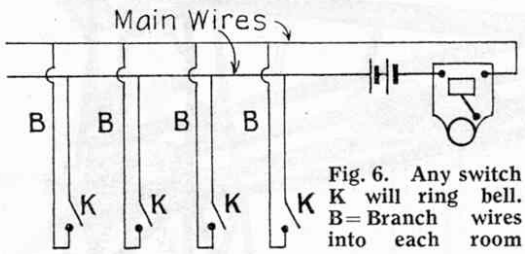


Fig. 6. Any switch K will ring bell. B = Branch wires into each room

In the indicator system, however, only one of the wires can be used as a main from which branches can be taken, the second wire from each push having to remain independent of all others until it has passed through the indicator. Each individual indicator consists of an electro-magnet with a very light armature to which is attached a brightly coloured card called a flag, which has a number printed upon it. Fig. 9 shows the wiring of such an indicator system with three bell-pushes and three corresponding indicators. When push No. 1 is pressed current will flow through the bell and round the electro-magnet of the indicator that has an armature with a No. 1 flag on it. This armature will be attracted to the magnet when the current is switched on and will remain attracted until pressure upon the bell-push ceases, when it will begin to swing to and fro like a pendulum and thus indicate which room has rung. When No. 2 push is used No. 2 indicator will swing, and so on. There is practically no limit to the number of indicators that may be used, and in large establishments such as hotels this system is invaluable.

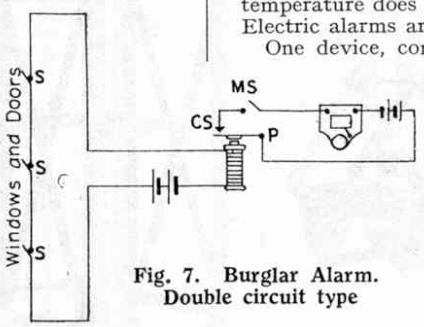


Fig. 7. Burglar Alarm. Double circuit type

Burglar Alarms

There are two standard systems for burglar alarms in regular use. The first only uses electric current when a burglar breaks in by opening a window or a door, while the second uses current continuously whether anyone is breaking in or not. It might seem that the first system would be the better in all respects, but it has the serious defect that if the burglar cuts any of the wires the bell ceases to ring, whereas in the second system the bell will ring no matter how many wires he cuts.

Fig. 8 shows the first and simpler system. On each window and door it is desired to protect a switch S is fitted, which remains " off " so long as the window or door is closed but comes " on " as soon as it is opened. The circuit is just the simple house circuit shown in Fig. 6, with special switches, and the addition of a main switch MS to cut off the current entirely when it is desired to open the windows or doors without working the alarm. As already pointed out, the great disadvantage of this system is that if any wire is cut by the burglar the whole arrangement is thrown out of action.

Fig. 7 shows the improved system. In this a number of closed switches are arranged in series, that is, connected so that the current has to pass through them all one after the other. In the same circuit is a battery and the electro-magnet of a relay. When everything is normal and all windows and doors are shut, current flows through the magnet of the relay, thus holding the armature A away from the contact screw CS. As soon as a window or door is opened the armature is released and the second circuit, consisting of a bell and battery, is completed by the armature touching the contact screw. As soon as the burglar gets inside the house he may promptly cut the wire he sees near the window he has opened, but still the bell rings, although usually it is too far away for him to hear it.

The relay, the bell and the second battery may be mounted on a small switchboard and locked up in the room where the person sleeps who is responsible for the safety of the house. In cases of extremely valuable property the second circuit may be in an entirely separate building such as a police station. This, of course, involves some loss of time in proceeding to tackle the burglar, but it gives a better chance of catching him because he cannot hear the bell and so take alarm and clear off. A main switch is enclosed in the second circuit so that windows and doors can be opened when desired without ringing the alarm bell.

Temperature Alarms

For many purposes it is necessary to maintain a room at one particular temperature, or at any rate to make certain that the temperature does not rise above or fall below certain fixed limits. Electric alarms are largely used where this is the case.

One device, commonly employed and called a " thermostat," consists of two thin strips of different metals, such as brass and steel, riveted together and suspended between two contact pieces. The two metals have different rates of expansion and contraction, so that a rise in temperature makes the compound strip bend over in one direction and a fall in temperature makes it bend in the opposite direction. When the rise or fall in temperature exceeds a certain limit the strip bends far enough to touch one or other of the contact pieces, and so closes the circuit and rings a bell in the ordinary way.

Another arrangement that serves the same purpose consists of a thermometer of the ordinary type, but having the top of the mercury tube fitted with an air-tight stopper. A wire is passed through this stopper, down into the tube as far as the mark indicating the temperature at which it is desired the alarm should sound. A second wire is connected with the mercury in the bulb of the thermometer and the free ends of both wires are taken to a battery, a bell being inserted in the circuit at some convenient point. When the temperature rises, the

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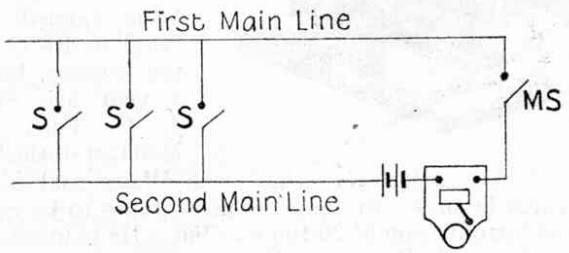


Fig. 8. Burglar Alarm. Single circuit type

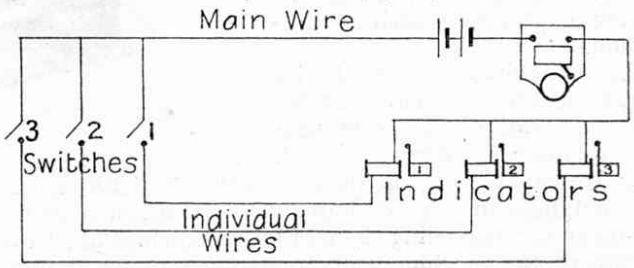


Fig. 9. Wiring for Indicator System

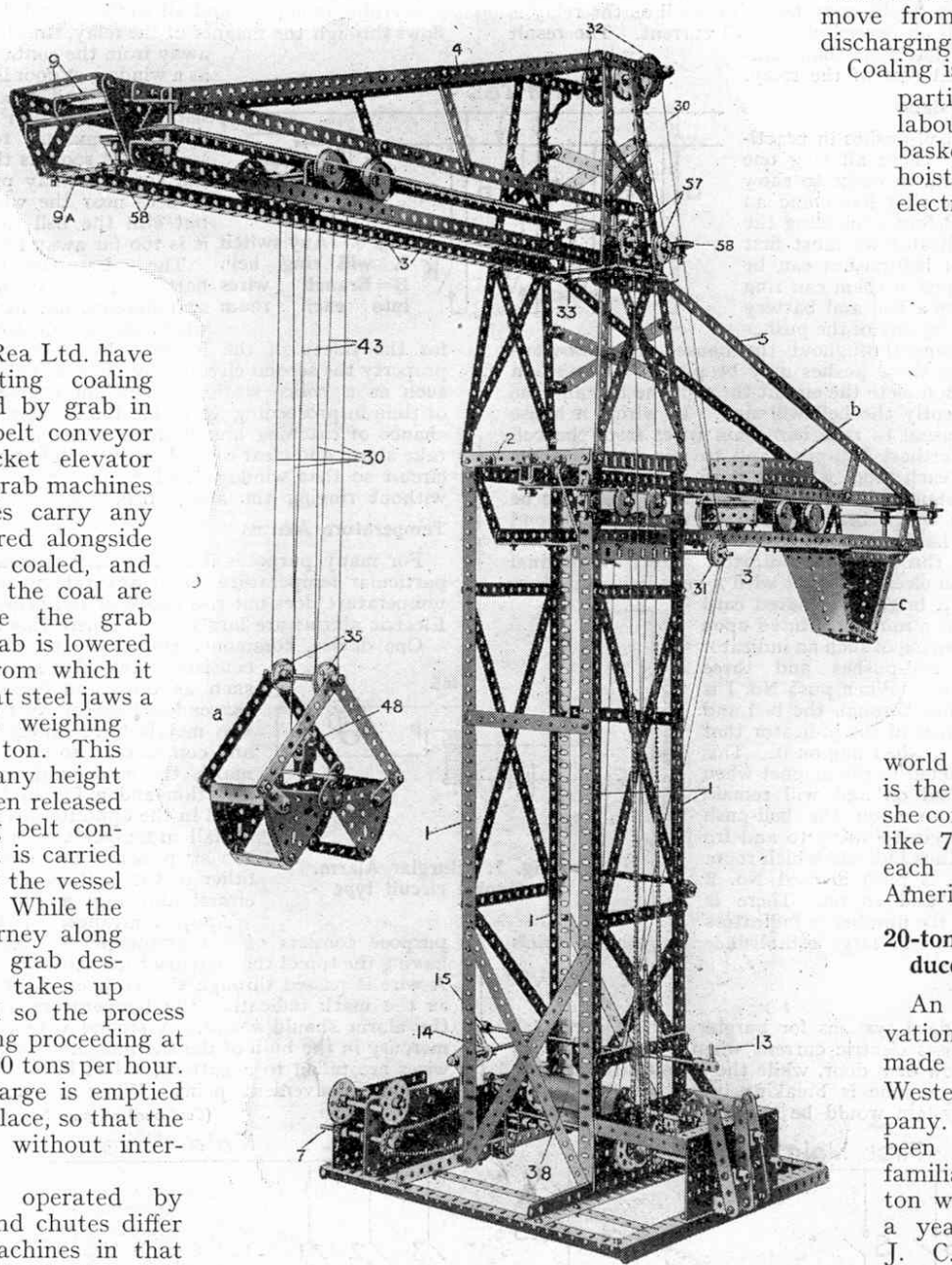
A NEW MECCANO MODEL

Model No. 734. Ship-Coaler

ONE of the most interesting features about a great port is the abundant provision made for coaling the never-ceasing stream of steamships that range in size from a small tug to a large passenger liner.

300 Tons per Hour

The method employed for transferring the coal from the quayside to the ship's bunkers varies according to local conditions and circumstances. At Liverpool, for instance, Messrs. Rea Ltd. have a fleet of floating coaling machines operated by grab in conjunction with belt conveyor and also by bucket elevator and chutes. The grab machines do not themselves carry any coal but are moored alongside the vessel to be coaled, and barges containing the coal are brought alongside the grab machines. The grab is lowered into the barge, from which it takes up in its great steel jaws a mouthful of coal weighing something over a ton. This coal is raised to any height required and is then released on to a travelling belt conveyor by which it is carried across the deck of the vessel to the hatchways. While the coal is on its journey along the conveyor the grab descends again and takes up another load, and so the process goes on, the loading proceeding at the rate of over 100 tons per hour. As soon as one barge is emptied another takes its place, so that the loading continues without interruption.



The machines operated by bucket elevator and chutes differ from the grab machines in that they themselves carry the coal. They are capable of holding from 1,000 to 1,100 tons. The coal falls in regulated quantities through a false bottom on to a travelling chain of buckets, which lift it to the top of the machine and discharge it down chutes directed either over the decks into hatchways or into side ports. By means of elevator machines coaling can be carried out at the rate of 300 tons per hour, and the coal can be delivered overall to a height of more than 50 ft., thus ensuring the speedy coaling of a large liner without the vessel having to move from her loading or discharging berth.

Coaling is also carried out partially by hand labour from barges, baskets of coal being hoisted by steam or electric winch barges alongside, or by stationary winches on the quayside.

By these various means vessels such as the White Star Liner "*Baltic*" have received 4,000 tons in one day.

To-day the largest and fastest liners burn oil fuel. The largest passenger liner in the world now burning coal is the "*Adriatic*," and she consumes something like 7,000 tons during each of her trips to America and back.

20-ton Wagons Introduced

An interesting innovation has recently been made by the Great Western Railway Company. Hitherto coal has been carried in the familiar 10-ton or 12-ton wagons, but about a year ago Sir Felix J. C. Pole, General Manager of the G.W.R., addressed a letter to the South Wales coal traders in which he urged strongly the advantages to be gained by the introduction of 20-ton wagons. He pointed out that the cost of building two 10-ton wagons was about 50 per cent. more than the cost of building one 20-ton wagon,