VOL. XIV. No. 3

MARCH 1929

MECCANO MAGAZINE

LOADING A TON OF COAL A SECOND

(See page 186)

6D.

NEXT MONTH: WORLD'S LARGEST OIL-ELECTRIC LOCOMOTIVE. PUBLISHED: 30th MARCH

MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool

Vol. XIV. No. 3.
March, 1929

With the Editor

February Mystery Photograph

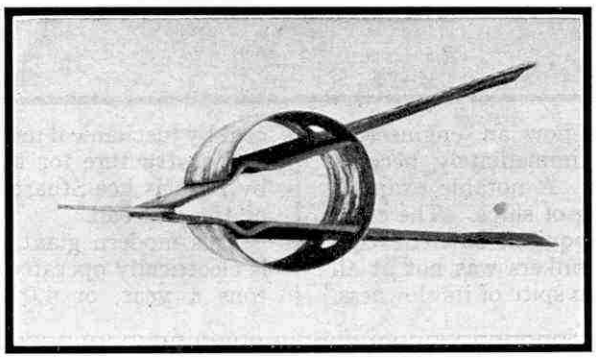
Since examining the stack of entries in the Third Mystery Photographic Competition I have taken several long looks at the illustration itself, and must confess to a feeling of sympathy with the boys who plumped for the tread of a tyre! Had I not known that actually it was a section of the edge of a half-crown as seen through a low power microscope, I also would have been inclined to suggest the worn tread of a motor tyre. The first correct solution was from Ichiro Takohashi, London, S.W.17, to whom an autographed copy of my book "*Engineering for Boys*" has been sent.

This photograph has provided an even bigger puzzle than its two curious predecessors, and very ingenious were some of the "solutions." Probably the brightest idea was the suggestion that it is "the ridge of knobs on the wing-case of a cricket, with the aid of which it produces its song." Centipedes crept into several entries, while there was quite a plague of caterpillars. Bridges were suggested very freely, four boys being firmly of opinion that it was a distorted aerial view of the Tay Bridge. Other ideas included sprocket chain, teeth of gear wheel, connecting fish plate on a curved rail, part of the circumference of a riveted tank, the typing plate of a toy typewriter, part of a ball-race, a worm's eye view of an airship, a scale on a crocodile's back, the battlements of an ancient castle seen from beneath, and a section jawbone. Among the curiosities that we have not already mentioned we must refer to a corn harvest with the sheaves in the foreground, the roots and beginning of a baby's tooth, the rear view of a salute of guns as at Cowes, and an aerial view of the discharge over a river barrage. If each puzzle brings forth as great a variety of replies as the first three have done, there will be very few things in the world left unmentioned!

We are able to announce the result of the Overseas section of the December Contest this month. The first entry was from Frederick G. Glass, Garanhuns, Pernambuco, Brazil, to whom the prize book has been sent. As announced last month, the illustration showed the view from the bottom of the spiral staircase in the lighthouse at the Point of Ayre, in the Isle of Man.

These contests have proved so popular that it is my intention now to continue them throughout the year. At the end of the year consolation prizes will be awarded to every competitor who has succeeded in giving ten correct results without gaining a major award. It is quite possible that many competitors may enter month after month and succeed in giving a correct solution in each occasion without having the luck to be the first correct entry to be received. The consolation prizes will provide a reward for this sustained effort.

No. 4. WHAT EVER IS IT?



Here is the fourth little puzzle in the series that is proving so very popular, judging from the number of postcard "solutions" I receive. Can you identify this mysterious-looking object? To the first reader to send an exact answer or to the reader who gets nearest, I will send an autographed copy of my book "Engineering for Boys." Solutions should be written on postcards only and addressed "Editorial Competition, No. 4, Meccano Limited, Old Swan, Liverpool." Closing date 30th March next.

Will New German Vessels beat the "Mauretania"?

Throughout 1928 there was an undercurrent of liveliness in the shipbuilding world. Early in the year rumours began to be heard of ships that were to be far speedier than any yet built, or were to outclass the "*Majestic*" in point of size. Presently these rumours took definite shape, and we learned that the Germans had begun a determined effort to take a greater share in the passenger traffic across the Atlantic. The keels of two vessels of 46,000 tons each were laid down, and work on them was hurried along so quickly that the vessels actually have been booked to sail next month.

Although the Germans confidently expect to capture the "blue riband" of the Atlantic with these vessels, the British companies will certainly accept the challenge, and we may look forward to exciting races across the "herring pond" next summer. Apart from any new vessels, there remains the incomparable "*Mauretania*" to uphold British prestige at sea. This sprightly vessel has held the Atlantic record for 21 years, and as recently as last September knocked off three hours from her own previous record by making the voyage from New York to Plymouth in six minutes over five days. Even so, her admirers assert that she has not yet been called upon to show her best paces. That this actually is so seems very likely, and probably her greatest speed is known only to those who time her on her trials. Recent alterations in her machinery are expected to enable her to pull out a few extra knots, and we may yet find that this wonderful vessel will hold her own, not only with the German liners, but with the White Star ship now under construction.

Mystery Vessels of 1929

The new White Star liner still remains more or less of a mystery, little being known about her beyond the fact that she is to be 1,000 ft. in length. It has been announced also that she will be provided with an electrical system of propulsion, but the nature of this system has not yet been divulged. The "*California*" and her sister ships, the largest electrically propelled vessels in the world, are fitted with turbo-generators, and it will be interesting to see if the White Star Company follow this example.

Still greater mystery surrounds the giant Cunarder of which so many rumours have been heard. In most quarters it is believed that the Cunard Company will not be content to be left behind in the race, and it has been said that they intend to build a vessel that will be not only the largest, but also the fastest in the world. So far, this report has not been confirmed, and at the moment we can only "wait and see."

Loading A Ton of Coal Per Second

Remarkable Plant in Baltimore Harbour

IT is always interesting to note how an engineering development in one direction immediately necessitates developments in others. A notable example of this is to be found in the coaling of ships. The early steamships were so simple and required so little coal that the problem of filling their bunkers was not at all serious. Coaling by hand labour, in spite of its slowness, fulfilled all requirements and the need for mechanical appliances was not felt. As the size of steamships and the length of their voyages increased, however, the old coaling methods became inadequate, and it became necessary to speed up the process by the use of machinery. This process has continued up to the present day. Side by side with the growth of ships there has been developed a series of remarkable mechanical appliances for coaling; and to-day the machinery for this purpose is specialised to an extraordinary degree.

The illustration above shows a general view of the Baltimore and Ohio Railroad Company's Coal Pier at Curtis Bay, Baltimore. The Plant is one of the largest of its type in the World and has a working capacity of 4,000 tons per working hour, or 10,000,000 tons a year, under normal working conditions.

For this and the other photographs illustrating this article we are indebted to the Baltimore and Ohio Railroad, U.S.A.

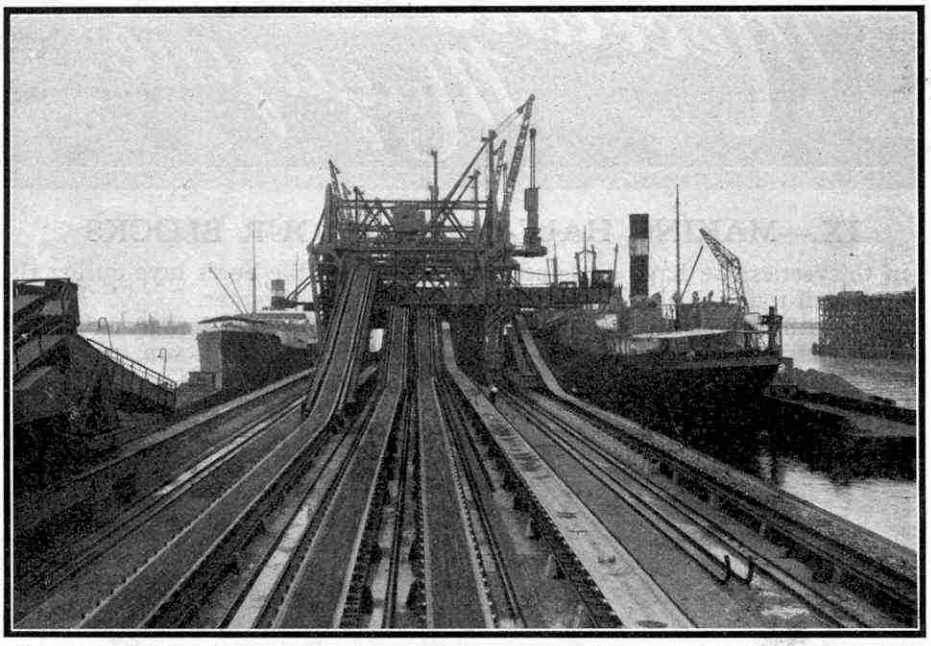
One of the most interesting modern coaling plants is the Curtis Bay Coal Pier of the Baltimore and Ohio Railroad in Baltimore Harbour. This plant, which periodically breaks all records for the fast loading of coal into vessels, is one of the largest in the world. It was formally opened for use in 1917, and it marked a new departure in the construction of facilities to attain a greater speed in loading and at the same time to overcome breakage of coal. The pier was the first of its type to be built and it replaced a wooden pier that had been in operation at the Curtis Bay terminal of the railroad for a number of years. Careful study of the different types of piers in operation along the Atlantic seaboard resulted in the decision to handle the coal by mechanical means rather than by gravity loading, and a structure for the purpose was specially designed by Francis Lee Stuart, who was formerly Chief Engineer of the railroad.

This modern giant is built of concrete and steel and is electrically operated. It has a capacity of 10,000,000 tons a year, or 4,000 tons per working hour, under normal working conditions. On the land end of the pier are two car dumpers. A concrete deck 8 ft. above mean tide level extends out into the stream. On this deck are four main loading towers and two side machines to which coal is delivered by belt conveyors, 60 in. and 48 in. in width respectively, from receiving hoppers at the car dumpers or from a balancing bin interposed between the dumpers and the pier.

The pier is in two units—a car dumper, two loading towers and a side machine comprising a unit. Sixty 50-ton cars or forty 100-ton cars can be handled per hour by each dumper and the pier can accommodate a car 54 ft. in length. Leading to the dumpers are the yard tracks, which are on a descending grade, and the cars run to the "barney" pit by gravity. The "barney," which is a mechanical arm, pushes the cars up a 10 per cent. gradient to the cradle of the car dumper. After the car is placed on the cradle it is clamped and turned upside down, and thus delivers its contents to a counter-weighted apron. This apron is raised when a car is being dumped in order to minimise breakage and after the car has been dumped the apron is lowered again to permit the coal to slide freely to the belts that convey it to the vessel.

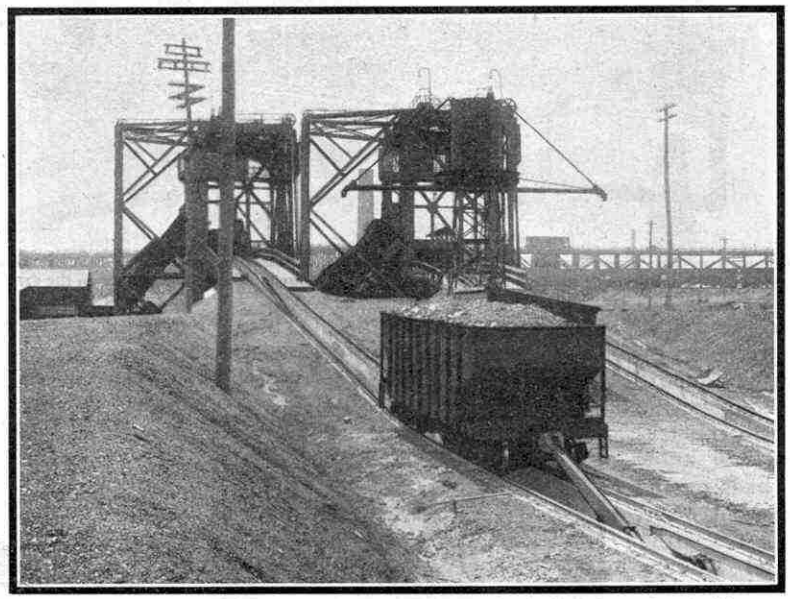
There are three belts to each car dumper, each belt being 60 in. in width, running 500 ft. per minute, with a capacity of 1,500 tons per hour. Two belts in each group run out on to the pier to loading towers while the third runs to the balancing bin.

The loading towers are equipped with a cage supporting a shuttle ram. The cage is raised or lowered to suit the height of the vessel that is being loaded, thus providing a further precaution against breakage of the coal. The cage has a variation in height of 27 ft., the minimum height above the water being 15 ft. The shuttle ram, which can be run out on either side of the pier, has a maximum reach of 45 ft. There is no drop from the hopper where the cars are unloaded to the belt that conveys the coal to the tunnel or telescopic chute. The cars are placed on a dumper, raised, and then tipped over, the coal then sliding down the chute directly to a feeder belt along which it moves to the conveyor belt that carries it out on the pier and up the incline to the shuttle belt.



View looking toward the end of the pier, showing the 60-in. rubber belts conveying coal to the movable coal loading towers

The shuttle from which the coal is fed to the telescopic chute at the base of which is the Lane-Galloway mechanical trimmer, can be lowered to a point 20 ft. 8 in. above mean low water. This shuttle has also a vertical raising possibility of 27 ft. In other words, it is possible to drop coal from a point 47 ft. 8 in. above mean low water to as low as 20 ft. 8 in. above that level. This spread of 27 ft. is for the purpose of meeting the lowering of the ship as it becomes loaded and gradually sinks lower in the water. No serious consideration is given to the tide as the variation of level amounts only to about 19 inches.



The "Barney" or Mechanical Arm pushing a loaded car up the incline to the dumper

As the coal or coke leaves the shuttle belt it drops down the telescopic chute at the base of which is the mechanical trimmer which can be lowered to a position directly on the bottom of a hold or to any position between that and the deck. The coal, in passing down the chute, first falls on the belt in the mechanical trimmer which forms a cushion for it and thus minimises breakage. It is then thrown by means of the trimmer to such portions of the hold as may be desired. The trimmers have been so equipped as to give five speeds on the motor, namely, 410, 575, 660, 710, and 735 revolutions per minute, respectively.

With the towers travelling along the pier in a horizontal direction and the shuttle working in and out at right angles to the direction of the towers, the apparatus will load a hatch uniformly and reduce trimming to a minimum.

The two side machines, placed on each side of the pier, have belts 48 in. in width with a capacity of 5,000 tons per hour each when travelling at a speed of 500 ft. per minute. Coal for these belts is taken from the balancing bins. These bins are supplied by machines that have swinging booms 45 ft. in length. They are attached at their base to turntables and can be moved in a circle or on a horizontal plane. They have a vertical variation of 35 degrees each way from the horizontal. While the loading towers are working on the cargo the side machines may load scows or assist in loading the vessel.

The operations of the pier are interlocked and controlled electrically by push buttons located every 20 ft. on each belt conveyor runway. When one of these buttons is pushed all movable parts of the belts, towers and feeders are stopped.

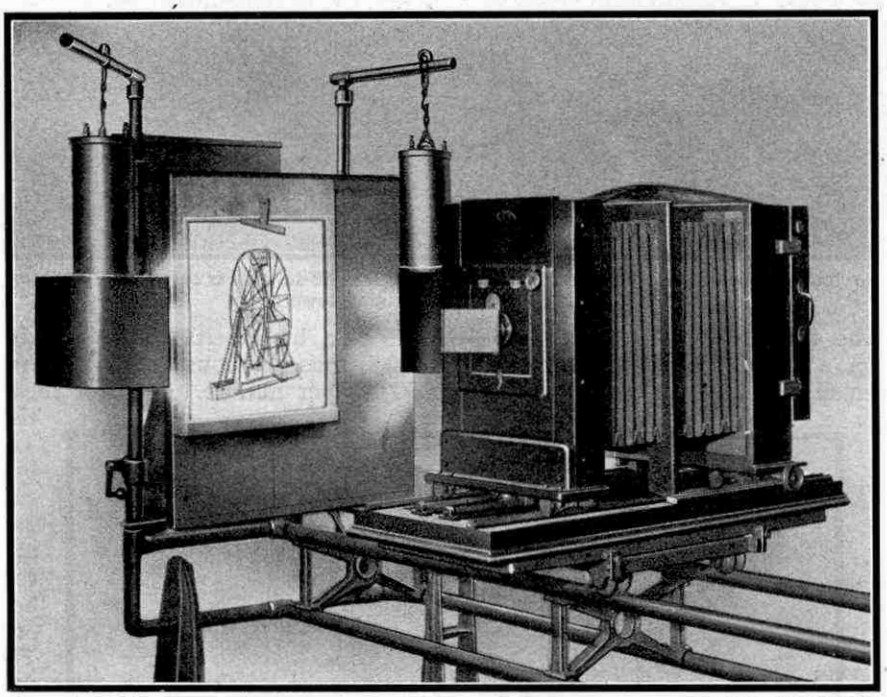
The operators are situated in little houses on the shuttles. They first start the shuttle belt, and when this is running at full speed the main belt and then the feeders start automatically. The shuttle belt runs at a greater speed than the main

(Continued on page 261)

IX.—MAKING HALF-TONE COLOUR BLOCKS

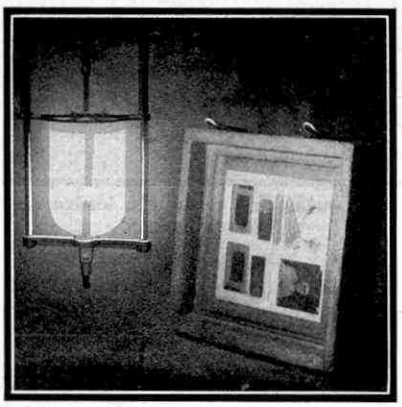
IN previous articles in this series, we have explained how line blocks and half-tone blocks are made and used, and last month we pointed out that colour was the one thing necessary in order to make a half-tone illustration a faithful rendering of its original. Fortunately it is possible to produce magnificent illustrations in colour by the use of blocks prepared in the ordinary manner.

Half-tone colour printing is usually described as three-colour work, but it must not be supposed that only three colours appear in illustrations reproduced by this process. A glance at the cover of the "*Meccano Magazine*," which is printed in this manner, will show that a much greater range of colour is present. The name simply means that the three primary colours are used in printing, and that the remaining colours are produced by combinations of two, or even all three, of them.



Front view of photo-engraver's camera. In front of the lens is the prism that reflects light from the drawing on the board into the camera

A little knowledge of the composition of light will help to explain this remarkable process. Most readers will know that, when a beam of sunlight is passed through a glass prism, it is spread out into a band of seven colours. The order in which these occur is red, orange, yellow, green, blue, indigo and violet. They are separated because differently coloured rays are bent, or refracted, through different angles on passing from air into glass. Violet rays are bent most, and red ones least. The coloured band thus formed is called a "spectrum," and the colours in it are exactly those seen in the rainbow. The latter is, in fact, a spectrum formed by the bending of the Sun's rays during their passage through tiny drops of water.



Printing from half-tone negatives. On the right is a vacuum printing frame

It is possible to re-form white light by bringing together again the seven colours of the spectrum. In order to accomplish this, the rays formed by a prism must be bent through equal angles in the reverse direction. Sir Isaac Newton discovered how to do this many years ago. He decomposed white light by means of a prism, and in the path of the coloured rays he placed an inverted prism of exactly the same size. In this manner, white light was first split up into colours; these colours were re-combined and white light was once more produced.

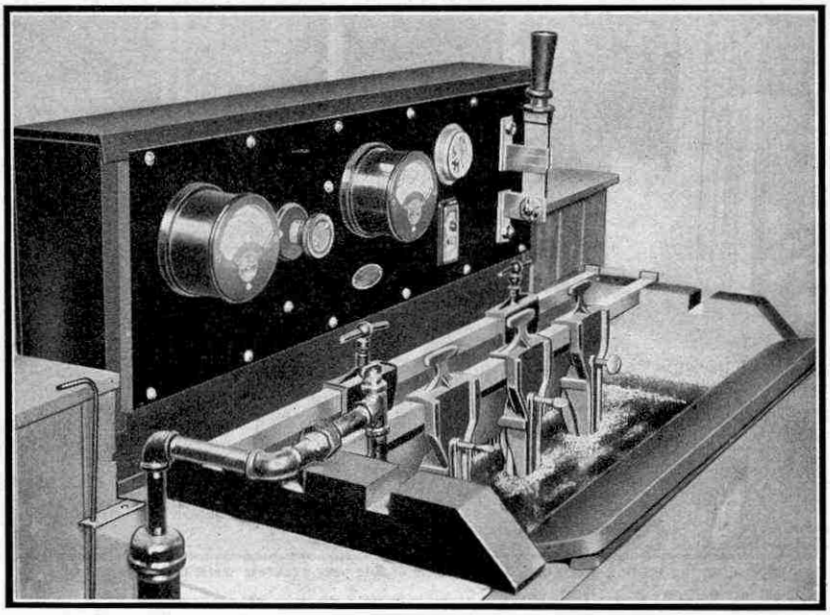
The same effect may be produced also with the well-known Newton's disc. This consists of a circle of cardboard divided into seven sectors each painted with one of the colours of a spectrum. When the card is whirled round at a high speed, the colours lose their separate individuality and appear to blend into white. In this case, the eye receives the impressions of the colours in very rapid succession, and it retains each so long that they appear to be simultaneous and are automatically combined.

An interesting new Meccano model of Newton's disc has been constructed, and a photograph of it will appear next month. It is quite simple to build and acts perfectly.

Different objects reflect light in different degrees. If they reflect all the component colours of white light they appear white, the mixture producing

this effect taking place in our eyes. In order to see any particular colour, other colours must be eliminated, and this elimination is caused by absorption. For example, when viewed in white light an object that appears black is absorbing all the light and reflecting none; whereas an object that appears white is reflecting all the light and absorbing none. In between these extremes come objects that appear grey as the result of absorbing approximately half the light and reflecting half. A substance that appears red is absorbing all colours except red, which it reflects.

It has been found that three out of seven colours are sufficient to produce a complete colour range. These are red, blue and yellow, and they are usually called primary colours. It is because the colours in half-tone reproductions are produced by the combination of the three primary colours that the printer describes this remarkable process as three-colour work.



The electrical etching machine used in preparing half-tone blocks for use in printing the "M.M." The plates to be etched are held by the clamps on the bus-bar nearer the instrument board

It will be remembered from last month's article that half-tone illustrations are composed of dots of varying sizes. Close examination of a three-colour impression, such as the illustration on the cover of the "*Meccano Magazine*," for instance, will show the presence of similar dots, but these are coloured. Any area containing only red dots will of course appear red to the eye, but if yellow dots are mingled with the red ones an orange effect is produced. The exact shade depends on the proportions of the dots of the two colours present, and their size determines the tone.

If the cover of the present number of the "*M.M.*" is examined with the aid of a powerful magnifying glass it will be seen that other colours, such as green and purple, are produced by a similar mingling of dots of the primary colours. This can be seen very clearly in the enlarged coloured reproduction of a portion of a three-colour print that appears in a panel on the back cover of the present number of the "*M.M.*" The dots shown on this enlargement are too small to be detected separately by the naked eye, which automatically combines them into various shades.

Half-tone etcher covering portions of a plate with acid-resisting pigment before it is returned to the etching machine

Three blocks are necessary for the production of any coloured picture, and these are made in exactly the same manner as ordinary half-tone blocks. Photographs of the coloured picture to be reproduced are taken through screens, and from each negative a positive print is made on a copper plate. This is followed by etching in one of the machines described last month, and the plates are finally trimmed and mounted on blocks of wood.

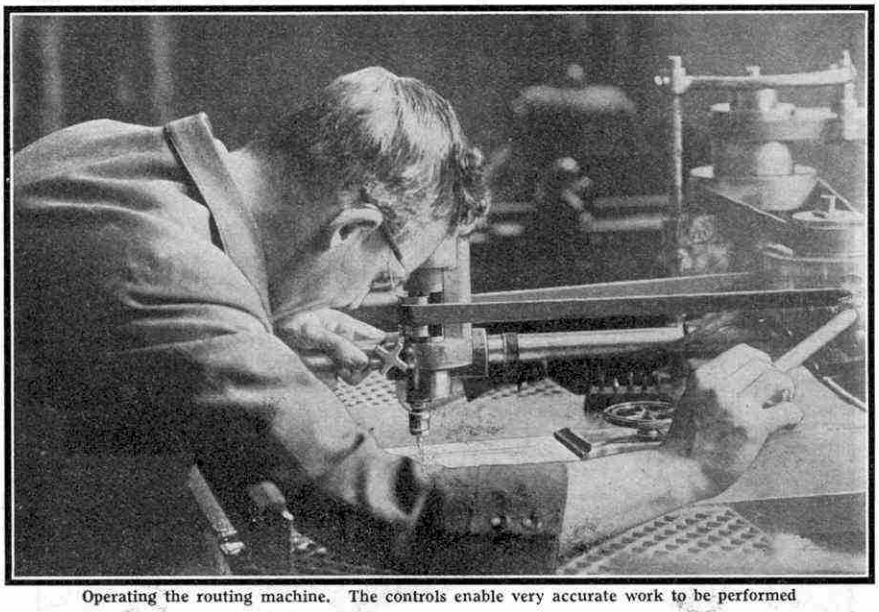
The first point is the provision of three negatives and it is at this stage that the colours in the picture are separated.

In making the negative from which the yellow printing plate has to be prepared, a light filter is placed between the copy prepared and the camera. The colour of this filter is such that it cuts out red and blue but allows light from the purely yellow portions of the picture to pass through unhindered in order to produce an effect on the photographic plate. In addition, any colour of which primary yellow forms a part must penetrate the filter. For instance, green in the copy must affect the photographic plate sufficiently to supply the yellow tones that help to give shades of that colour in the finished picture. In a similar manner, two other negatives are prepared by the use of filters that respectively allow red rays and blue rays to pass through them.

Photography of this kind is by no means simple. Ordinary sensitive photographic films do not respond equally to all colours and therefore the plates must be treated specially, in order to make them sufficiently sensitive to the colours of which they are to make the record. A further important point is that the colours of the filters must be very correctly adjusted, in accordance with the colour sensitiveness of the plates.

Another interesting point concerns the screen through which the photographs are taken. If the same screen were used in exactly the same position in each of the

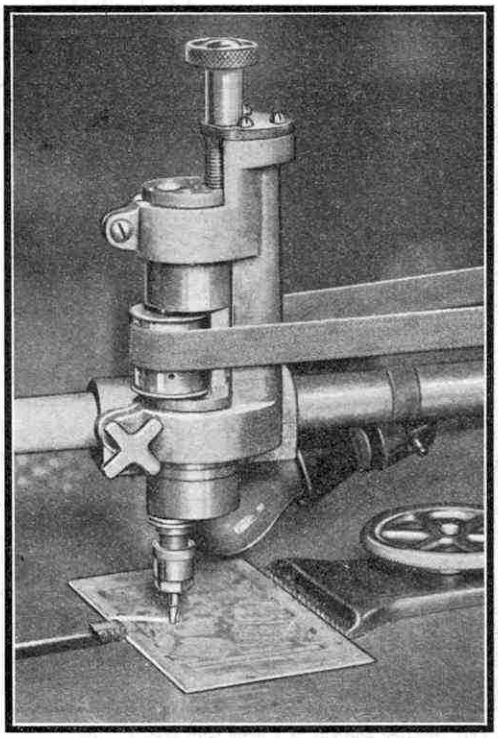
three cases, the dots on prints from the three blocks would fall exactly on top of each other. This would give a mere blur, and it is necessary to take steps to separate them. For this purpose the screen must be moved in some manner, and the most practical method is to turn it round. As a rule the lines of the screen are at an angle of 45° to the horizontal when the blue negative is being prepared, and the screen is turned through successive angles of 30° in the preparation of the red and the yellow plates.



Operating the routing machine. The controls enable very accurate work to be performed

Examination of the pattern of an ordinary half-tone illustration with the aid of a powerful magnifying glass will show that during the preparation of the negative the lines of the screen have been at an angle of 45° to the horizontal. By careful examination of a colour illustration it is often possible to find portions in which may be seen traces of the dot pattern formed when the screen is turned round. This reveals itself most plainly in the case of areas that are pure yellow in colour, for it is during the preparation of the block from which that colour is printed that the screen is turned through the greatest angle.

From the negatives prepared in this manner prints are made on copper plates that have been sensitised by coating them with the usual film of fish glue containing ammonium bichromate and albumen, as explained last month. After exposure the outline of the picture is fixed on the plates by washing with water, and the film is transformed into enamel by heating over gas flames. The plates are then etched, and as in the case of ordinary half-tone blocks, this process is carried on in stages. The plates are removed from the machine when the darker portions have been etched sufficiently, and these are covered with an acid-resisting pigment before etching is continued. This ensures that a sufficient contrast is obtained between the various tones of the pulls taken from the blocks.



The head of a routing machine. The photograph shows how a plate is held in position while the rotating drill cuts out unwanted metal

The blocks are now ready for a trial printing, or proofing. The yellow plate is fixed on the bed of a platen printing machine, rolled with ink of the desired colour, and an impression taken. The same operation is carried out successively with the red and the blue plates, in the order named. Great care must of course be taken that each block makes its impression in the correct position on the paper. When this is not the case a confused blur results, but if the plates are in perfect register, the result of printing from the three in succession is a reproduction of the original coloured drawing.

In order to make quite clear the manner in which these blocks are used, a series of coloured illustrations has been specially prepared by Gilchrist Bros. Ltd., Leeds, who make the blocks used in printing the coloured covers of the "*M.M.*" They show the three stages in the printing of one of these splendid pictures. There are five of them, and they will be found at the foot of the back cover of this number. The first two show the impressions made separately by the blocks used in printing the yellow and the red portions of the picture respectively. The central illustration has been obtained by printing the red over the yellow, and it will be seen that areas in which both red and yellow dots are present appear to have an orange shade.

At this stage the impression is distinctly vague, and has a flat appearance. The effect of combining it with that produced by the blue plate—which is shown next—is almost startling. The addition of blue completes the colour range, and causes every detail of the complete picture to stand out quite clearly. In combination with yellow it gives green; purple is produced by its intermingling with red; and many other shades are present in the last illustration in which a proportion of all three primary colours are concerned.

The proofs thus obtained are compared with the original in order to discover if any improvement can be made. Only very rarely is the preliminary etching completely satisfactory. It may be found that one colour is too prominent; or the tone of a second is too heavy or too light in certain sections; or the picture as a whole does not show sufficient contrast. The services of the fine etcher are then called in. It is his task to prepare the plates for further etchings that will (*Continued on page 265*)

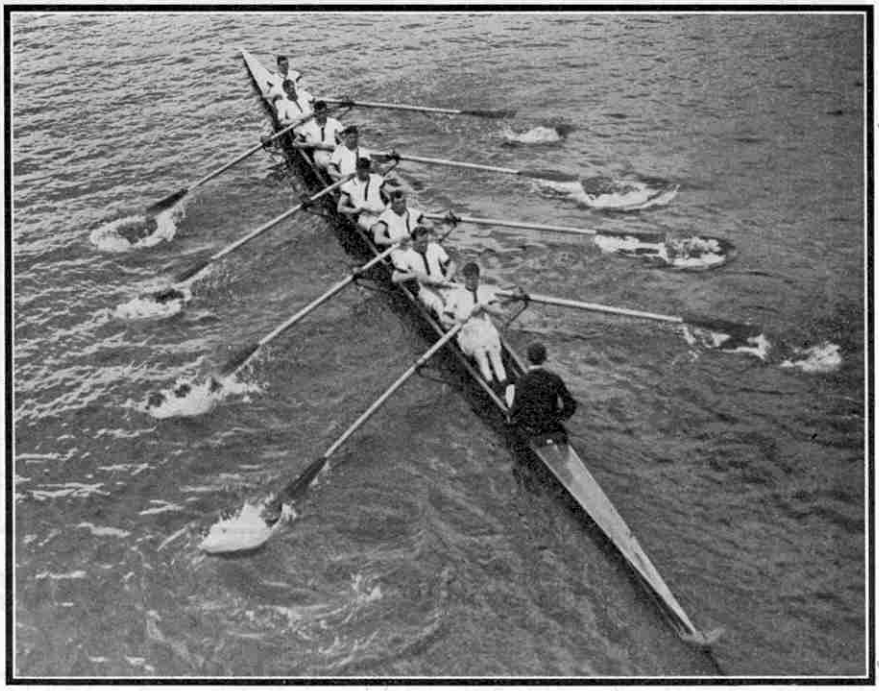
Oxford and Cambridge Boat Race Centenary

Rowing "Blues" in the Making

ON the 23rd of this month half a million people will assemble between Putney and Mortlake on the banks of the Thames in order to witness the annual University Boat Race. It is 100 years since the date of the first contest and in the interval the race has become a national affair, and one in which a world-wide interest is taken.

The first eight-oared University Boat Race was rowed on 10th June, 1829, over a distance of 2¼ miles. The event aroused considerable excitement and ended in victory for Oxford, who won by five or six lengths. It is interesting to find that "*The Times*' report of this consisted of a mere seven-line paragraph in small type, and was not published until three days after the race! This contrasts strangely with the amount of space now given in practically every British newspaper, not only to the race itself, but also to reports of the progress of the crews during training.

The next contest did not take place until seven years later. In this second race the Cambridge men obtained their revenge, and won by four lengths. A "rubber" contest thus became necessary. This was rowed in 1839, and after a keen struggle Cambridge won by the narrow margin of seven seconds.



The Oxford crew shooting Barnes Bridge in the 1928 race, which Cambridge won by 10 lengths. This is one of the many interesting illustrations in the official Boat Race Centenary Souvenir, "*One Hundred Years' of Boat Racing*"

It may be said that this Cambridge victory led to the establishment of the race as an annual event. The Oxford men smarted under their defeat, and immediately afterwards the Oxford University Boat Club was founded. One of the purposes of the club was to enable crews to be got up "for the defence of the University," in order to avoid a repetition of the defeats it had suffered. A challenge was issued in 1840, and in the following year the Oxford secretary proposed to Cambridge that the "annual race" between the Universities should take place. This established the race as a regular event, but in occasional years there was no contest. The chief interruption in the sequence was during the five years from 1915 to 1919, when the members who would ordinarily have made up the crews were engaged in sterner work on the battlefields of the Great War.

Scarcely a race has passed without some exciting or remarkable incident. In 1859, the Universities met in a tremendous gale accompanied by gusts of hail and snow. Both boats were water-laden before they could reach the starting point. The "Light Blues" rowed until their craft sank beneath them, but not a man in the crew abandoned his oar until the Thames covered the rowlocks. The Oxford boat just managed to struggle home in an almost water-logged condition.

Sliding seats were first used by each crew in 1873, when Cambridge won a runaway race by nearly four lengths. A curious explanation has been given of the origin of the sliding seat, and is referred to in "*One Hundred Years of Boat Racing*," the interesting official centenary handbook to which we are indebted for valuable information. It is said that one of the Varsity strokes "buttered" his seat in order to be able to move more freely! The advantage of being able to slide about soon impressed itself upon him, and next year sliding seats became common. Rumour has it that the boys at one famous rowing school were forbidden to use them, but managed to secure the same effect by well soaping both the seats and their trousers!

Perhaps the most remarkable races on record were the dead heat of 1877, and the astonishing contest of 1912. The former aroused keen controversy. The Oxford men were sure that they had won by several feet, but the judge—a Thames waterman—was equally convinced that neither crew had the advantage. Strange as it may seem, at that time there was no definite winning post to assist the judge in deciding the winner of a close race. It has since become the custom to invite an old "Blue" to act as judge.

The second of these two remarkable races was rowed over a storm-swept course that resembled a miniature sea. Additional buoyancy was given to the boats by fitting inflated bladders beneath the seats, but the boats were partly swamped before the start of the race. The coxswains were blinded by spray, and the boats almost collided after proceeding three or four hundred yards. At Harrods the Cambridge boat sank and the crew swam ashore. Oxford carried on, but survived only as far as Chiswick, where their boat also foundered. They emptied the boat and completed the course, but the umpire decided that the race should be re-rowed on the following Monday.

At the close of the War the series of races were resumed, and since 1920 Cambridge have won every race with one exception. They have now won altogether 39 to Oxford's 40, and will thus have a double incentive this year, for a win will enable them to draw level.

No other athletic event is preceded by such intensive training as the Boat Race. The oarsman who aims at a "Blue" must make up his mind to sacrifice almost everything else to this ambition. He must lead the "simple life" in a very real sense and, rain or shine, he must be on the river every workaday afternoon during term time.

Only those undergraduates who have distinguished themselves in inter-college races have their names submitted to the President of the University Rowing Club as candidates worthy of consideration for a seat in the trial eight, and two or even three years of ceaseless effort may be necessary before this happens.

In January the President passes in careful review his men for the race. Old "Blues" have claims to inclusion, and probably there are only four, or perhaps five vacant seats. The strictest possible training is now commenced, and a weeding-out process begins which practically ends only on the day of the race. The coaches ring the changes on the candidates during the long weeks of practice and spartan training that precede the great day, and each oarsman who has gained a place in either of the boats wears an honour that he has won by sheer hard work, self-denial and merit.

FAMOUS TRAINS: XXVI.

"The Thirties," Southern Railway

By Cecil J. Allen, M.Inst.T., etc.

IT has been a great puzzle to decide upon the most suitable title for this article. To speak of the fine service of expresses that will form the subject of our study this month merely as "The Bournemouths"—quite apart from the lack of euphony in any such nickname—is to overlook entirely the other important places that they serve, and especially the great and increasingly prosperous port of Southampton. So why not follow the excellent example set by the L.M.S. Company in dubbing their Midland Manchester expresses "*The Twenty-fives*," as we saw in December last? By so doing, and with equal appropriateness, we shall arrive at "*The Thirties*" as the nickname of the much more extensive series of express trains, all leaving Waterloo, without exception, at thirty minutes past the hour, that connect London with Southampton and Bournemouth. The title is the more fitting in that the Southern was the first British railway to adopt on an extensive scale this valuable principle of systematic departure times from its London terminal stations to all parts of its large system.

Photograph] [*Railway Photographs, Liverpool*

Down Bournemouth Express passing Clapham Cutting. Southern Railway "King Arthur" class Locomotive No. E.792, "Sir Hervis de Revel." The train is running over a section of track fitted for both steam and electric working

Of all the systematic long-distance train services in Great Britain, the Bournemouth service of the Southern is probably the most complete. During the summer months the first Bournemouth express leaves at 8.30 in the morning, and the series goes on without a break at each "thirty" round to 7.30 in the evening—12 expresses in all. Beginning with the 10.30 a.m. down, each of the even hour "*Thirties*"—the 10.30, 12.30, 2.30, 4.30 and 6.30—calls only at Southampton West between Waterloo and Bournemouth Central, making the journey to Bournemouth in 2¼ hours. The even hour "*Thirties*" carry through portions for Weymouth, in addition to the main section of the train, which proceeds on through the Central to the West Station at Bournemouth. During the winter months there is not sufficient traffic to warrant the running of the 10.30 a.m. from Waterloo, and the 2.30 p.m. is run on Mondays, Fridays and Saturdays only. Otherwise the service remains virtually unaltered throughout the year.

The odd hour "*Thirties*" make various additional calls, chiefly at Basingstoke, where important connections are made; the Cathedral City of Winchester; and Brockenhurst, the heart of the New Forest and junction for Lymington, whence a steamer service plies to Yarmouth, at the west end of the Isle of Wight. In certain cases further stops are made, such as Surbiton and Woking, at the London end; Christchurch and Boscombe; at the Bournemouth end; and Eastleigh; the journeys by these slower "*Thirties*" for the most part taking round about 2 hrs. 50 min. to Bournemouth Central.

It is typical of the comfort of present-day travel conditions on the enterprising Southern that every one of "*The Thirties*" carries a restaurant car. In the formation of the trains that travel at hours when there is no great demand for meals, the restaurant accommodation consists of an ordinary compartment coach into one end of which there has been built a kitchen and pantry. From there light refreshments and *à la carte* meals are served wherever in the train they are desired, portable tables being set up in the compartments as necessary. In the earlier days of Southern restaurant car enterprise the same procedure was followed in the busy trains also, and I well remember, on one occasion in particular, counting no less than 24 compartments in the popular mid-day Bournemouth express, in addition to the restaurant car proper, furnished with tables and laid ready for lunch! Something like 150 lunches must have been served simultaneously on that day between London and Southampton—a nice problem for a restaurant car staff serving up and down the corridors from the exiguous confines of a restaurant car kitchen!

To-day, on the busier of "*The Thirties*," very fine 58-ft. restaurant cars of the latest type are used in pairs. The first-class car, which also contains the kitchen and pantry, seats 24 diners, and is flanked by a third-class open car with seats for 64, so that 88 passengers can be fed in the cars at one sitting.

The people of Bournemouth profess to have a grievance in that their best trains from London are not so fast as the best of pre-war days. Before the war the 4.10 p.m. out of Waterloo covered the 108 miles to Bournemouth Central without a stop in the even two hours, and there were two trains making the same run in the reverse direction. The 2 p.m. down also made one stop only—at Christchurch—and required six minutes more on the journey. To-day the best time is 2 hrs. 14 min., except on summer Saturdays, when pressure of traffic makes it necessary to run certain trains in division, and the first part of the 12.30 p.m. runs down non-stop to Bournemouth Central in eight minutes over the two hours. Why, then, this slowing down? The answer is the ever-growing importance of Southampton which, with its maritime connections, bids fair ere long to be, if it has not already become, the most important town on the Southern system outside London. The Southampton traffic demands an hourly train service to and from London with just as much insistence as that to and from Bournemouth, so that it is not reasonable to let the Bournemouth trains pass through Southampton without stopping.

But what the Bournemouth people "lose on the swings" they most certainly "gain on the roundabouts." Apart from their four pre-war two-hour trains, the remainder of the service was slow, irregularly spaced and infrequent. To-day they have their hourly service from London, with trains each two hours averaging 2¼ hours on their journeys, and every train made up of vestibuled coaches and provided with restaurant car accommodation, as we have already seen. Even the two-hour trains of pre-war days were not so equipped, though certain other trains carried restaurant cars. It is singular to recollect, too, that one of the earliest Pullman services in Great Britain—of first-class cars only, one of which was included in certain trains—was run between Waterloo and Bournemouth, though now long since abandoned.

To revert to the lengthened journey time between Waterloo and Bournemouth, this is due partly to the time required for the stop at Southampton West, and partly to the much increased weight of the trains. The pre-war two-hour trains weighed from

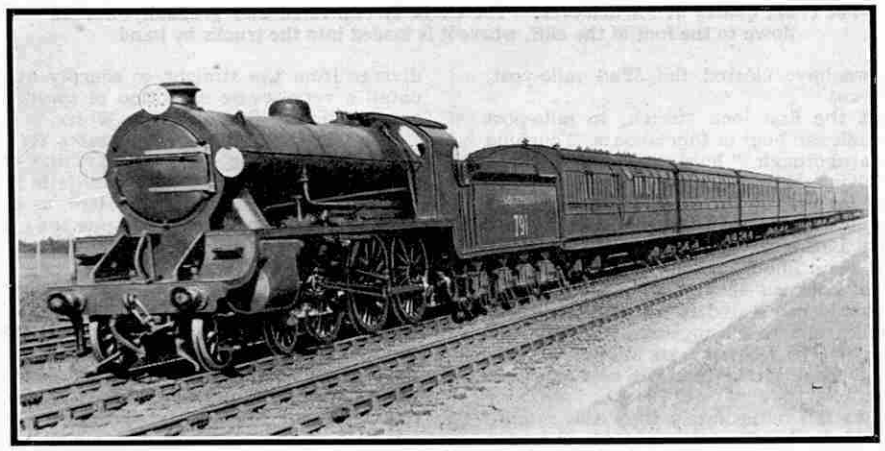
200 to 250 tons all told ; to-day from 350 to 400 tons are common figures on the Bournemouth service.

We now have to choose one of *"The Thirties"* for our journey. We cannot do better, I think, than the 12.30 p.m. luncheon car express from Waterloo, as it is easily the most historic train on the service. As far back as 1845 there was a 12.30 p.m. express from Nine Elms—the first terminus of the London and Southampton Railway—and, striking to relate, even in those early days it made the journey to Southampton with two stops in 120 minutes, as compared with the present 92 minutes from Waterloo. Taken all the year round, too, the 12.30 p.m. is the most popular and best-patronised *"Thirty"* of the day, and is therefore the heaviest and the hardest to work. Further, it has the merit of allowing us to see the whole of the route traversed in daylight, even in mid-winter. Soon after mid-day, therefore, we must find ourselves at Waterloo Station, as neither time, tide nor the Southern Railway is likely to wait for us should we be late.

Southern Railway "King Arthur" class Locomotive No. E.787, "Sir Menadeuke" leaving Southampton West Station. This Locomotive was one of the first of the type to be fitted with Smoke Deflectors

On our journey by the *"Atlantic Coast Express"* we inspected Waterloo at some length, so that we need not stop now for another detailed survey. It is easily Britain's finest railway terminus, and this chiefly because it has been carried out as one complete scheme, rather than as a succession of additional platforms tacked on to an original station of small dimensions. The Waterloo of to-day appeals even more to those of us whose memories are long enough to recall the chaotic and labyrinthine collection of buildings that it replaced. To-day we move freely across the roomy *concourse*, planned with its beautiful curve from one side of the station to the other. We admire the singular spaciousness and airiness of the great structure—the roof, by the way, has swallowed up no less than 1,000 tons of glass and 60 miles of metal glazing bars!—and find our train without the slightest difficulty at No. 6 platform.

The attractive green livery of the coaches immediately invites attention. Present-day Southern stock, indeed, has a particularly handsome and workmanlike appearance, the steel-plated coach exteriors having little in the way of projections to disturb the even contours of the coach sides. The vehicles are heavy, for the most part weighing 32 or 33 tons apiece, but no aggregation of them—within reasonable limits, of course—appears to occasion the slightest difficulty to the "King Arthur" 4–6–0 engines used exclusively on this service. The trouble to-day appears to be, indeed, that the "King Arthurs," not to mention the later "Lord Nelsons," can handle without difficulty longer trains than were ever foreseen by those who planned and laid out the 21 platforms of the new Waterloo!



Photograph [*Railway Photographs, Liverpool*

Down Bournemouth Express passing Barton Mill, drawn by Southern Railway "King Arthur" type 4–6–0 Locomotive No. E.791, "Sir Uwaine"

At times the 12.30 p.m. may load up to 13 or even 14 coaches, but at this time of the year the load is not likely to exceed 12—six in the main portion of the train, for Bournemouth West; two for Swanage, and four for Weymouth, making a total tare or empty weight of 380 or 390 tons. With passengers and luggage the gross weight behind the engine tender will be 400 tons, or slightly over.

The praises of the "King Arthurs" have been sung in these pages before. It was Mr. R. W. Urie who laid the foundation of the design, first in the series of engines numbered from 482 to 491, and then in the far more successful 736–755 engines, in which the driving wheels grew from 6 ft. to 6 ft. 7 in. Mr. Maunsell capped the work of his predecessor by introducing modifications of the valve-motion, which enable the "King Arthurs" to be worked with the full regulator and short cut-off methods so popular on the Great Western Railway. It is safe to say that, for efficient and economical working, the Southern "King Arthurs," as a class, have no superiors for their weight—with the possible exception of the Great Western "Saints"—among British express locomotive types. We cannot help noting by the way, the "wings" with which our steed has been provided, on both sides of the smoke-box. They have no connection with flying however, other than that when the engine is running at speed, they are designed to cause a strong up-draught of air, and so to lift the exhaust steam clear of the front windows of the cab.

Out of the platform, as at St. Pancras and Euston, it is the practice for the engine bringing the empty coaches into Waterloo to give a helpful "shove" in the rear, in order that a smart start may be made up the short initial gradient. It is quite likely that between Waterloo and Vauxhall an impertinent electric train that has started after us may overhaul our proud "King Arthur" while he is getting his heavy load into speed, but he will get his own back with interest presently. Not too soon, though, for the Southern "electrics" are easily capable of speeds up to and slightly over 60 miles an hour, and 55 an hour or so is a common rate of electric travel between Vauxhall and Clapham Junction.

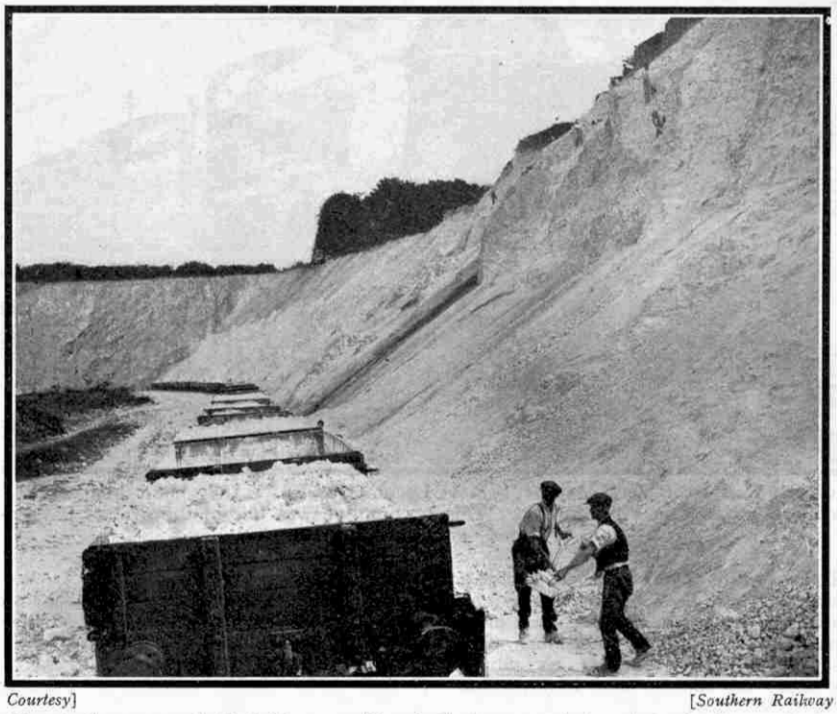
The tremendous width of electrically-equipped tracks, as we approach Clapham Junction and are joined by the Brighton section lines from Victoria, is a reminder of the enormous progress made by Southern electrification in the past few years. The total of single miles on the Southern system now electrified is no less than 875, and of "route miles," ranging from ordinary double lines to the vast expanse we see here, the aggregate is now 256—enough to stretch nearly from London to Newcastle-on-Tyne,

and by far the biggest electrified railway system in the world.

It takes us about seven minutes to clear the four miles through Clapham Junction. With its 17 platforms, this is Britain's busiest junction, handling a total of 1,730 train movements daily. Our speed has mounted into the "fifties" by now, but it falls slightly as we ascend through Clapham cutting, and then, ere we dash through the fine new station at Wimbledon, begins once again to rise. From here on to Surbiton cutting the track is practically level, followed by a gentle fall through Surbiton to Esher, where we reach and probably just cross the "sixty" line for the first time.

Speed remains at or slightly above the mile-a-minute rate on through Weybridge to the bottom of the dip near Byfleet, adjacent to the Brooklands racing track. Here once again the speed potentialities of our "King Arthur" may be challenged, either by a racing car on the track or an aeroplane above, neither of which, however, is hauling behind it 400 tons of load with several hundreds of passengers. Our maximum speed here is likely to be round about 65 miles an hour.

Now our "King Arthur" has some "collar-work" ahead. For the next 30 miles the gradients, though not steep, are almost continuously against the engine. First we have 10½ miles from mile-post 20½ to mile-post 31, steepening gradually from 1 in 368 to 1 in 298; then a level six-mile stretch through Farnborough and Fleet to three miles up at 1 in 337 to Winchfield. Next come six more undulating miles ere we strike the six miles up at 1 in 249, past Basingstoke, which marks the conclusion of the climbing. To maintain a high average speed, therefore, the engine must be worked very hard without respite practically all the way from Waterloo until we have cleared the 52nd mile-post, four miles beyond Basingstoke.



Courtesy] [Southern Railway

The chalk quarry at Micheldever. The chalk is excavated and gradually worked down to the foot of the cliff, where it is loaded into the trucks by hand

We shall probably breast the first long stretch, to mile-post 31, at a minimum rate of 50 miles an hour or thereabouts. Touching 60 and over along the Farnborough "level," the next slight ascent to Winchfield our "King Arthur" will take in his stride, so to speak; and once again reaching or slightly exceeding 60 beyond Hook, we shall forge up the final 1 in 249, with speed falling gradually to 50 past Basingstoke and Worting Junction, where the West of England main line leaves us on the right, and ultimately to a minimum of between 45 and 48 miles an hour. The 24½ miles to Woking should be cleared in an even half-hour from Waterloo; the 48 miles out to Basingstoke will not take more than 55 minutes or so. "*The Thirties*" are allowed slightly more in their timings through Basingstoke than the best expresses on the West of England route.

The line does not begin to fall immediately after the summit at mile-post 52. We run along level track until we thread a short tunnel just before passing, on the right-hand side of the train, a signal-box called Litchfield. This marks the beginning of a gradient that stretches without a break from the 55¾ to the 76¾ mile-post. For 16½ miles down the gradient is almost perfectly even, averaging just 1 in 250. The engineering of the line here is really rather remarkable. Despite the sharply undulating character of the downland country, the line pursues its even course by means of deep chalk cuttings and tunnels here and there, interspersed with high embankments, across the county of Hampshire in its slantwise direction from north-east to south-west, with scarcely a deviation from the straight line.

Any speed within reason might easily be run down so tempting a declivity as this; I have indeed, from the footplate, timed a maximum of 83½ miles an hour past Winchester. If we are on time, however, our driver will probably be content to stick to a maximum not much over 60 miles an hour, but possibly reaching 70 or a shade over. We shall dash through the wide cutting, terminated by tunnels at both ends and used as a chalk quarry by the Southern Railway, in which stands Micheldever station. Possibly we shall note that we have come 10¼ miles through this sparsely-populated country from Basingstoke without passing a single station; in the 18¾ miles from Basingstoke to Winchester, indeed, there is only the one intermediate station, at Micheldever.

At Winchester Junction the line that has come from Waterloo by Alton—actually shorter than our main line but considerably more difficult from the traffic point of view—joins us on the left; while at the same time we pass over the single line of the old Didcot, Newbury and Southampton Railway, which is later to join us below Winchester, and has given the Great Western, by absorption, direct access to Southampton. Over this course, by the way, there will run this evening the through Glasgow to Southampton coach that accompanied us last month as far as York when we were coming down from Glasgow to join the L.N.E.R. North-Country boat express.

In 75 or 76 minutes after leaving Waterloo we clear Winchester, and a little under seven minutes later we hurry through Eastleigh, at whose extensive locomotive works of the late London and South Western Railway our "King Arthur" first saw the light. Shortly afterwards we enter the suburbs of Southampton. The main station of the original line—Southampton Terminus—which has recently been rebuilt and modernised, lies dead ahead of us; in the earlier days Bournemouth and Weymouth trains entered it and reversed for the remainder of their journey. A later station was built at Southampton West, and by means of a short spur line known as Northam Curve we diverge from the straight so sharply at Northam Junction as to entail a very severe reduction of speed. Three minutes later we are standing at Southampton West.

The timetable allows 92 minutes for this 79½-mile journey in both directions—it seems a pity that the figure cannot be cut to the even hour-and-a-half—and quite likely our "King Arthur" has a minute or so in hand. Here, as there are no water-troughs along the route, our driver, despite the use of a large eight-wheeled tender, will probably draw slowly up to the water-column in order to replenish his tank.

The public timetable shows an allowance of five minutes for the Southampton stop, but actually the working time is seven minutes, so that we are due away at 2.9 p.m. At first the line runs along the margin of Southampton Water, and if we look back towards that part of the town that stretches as a kind of peninsula into the water, where the docks are located, we may have a striking reminder, not merely of the marine activities of Southampton, but also of the vast size of some of the vessels using the port. There is a church at that end of the town, with a tower of quite a reasonable height. But if there happens to be in the docks any one of that great trio of ocean mammoths—the "*Majestic*," the "*Berengaria*" or the "*Leviathan*"—you will see that church and its tower positively wilting into nothingness by reason of the comparison!

Presently we pass Redbridge, where the Southern Railway have now established their chief permanent way depot, for casting chairs, creosoting and chairing sleepers, making switches and crossings, and so on. Then we bear sharply to the left over the River Test, and enter the New Forest country.

The line rises gently through Lyndhurst Road and then drops sharply towards Beaulieu Road and Brockenhurst, which we pass at over 60 miles an hour. After that come another sharp ascent to higher ground at Sway, undulating line to New

Milton, and a further swinging drop to the valley of the Avon at Christchurch, where a curve through the station demands some reduction of speed. Lastly we rise at 1 in 99 for a short distance, and then at easier grades into Pokesdown, an outlying suburb of Bournemouth; Boscombe; and finally Bournemouth Central. The 28½ miles from Southampton have been covered easily in the 36 minutes allotted.

Bournemouth Central is yet another of the stations on which a good deal of money has been spent recently by the enterprising Southern Railway with a view to modernisation. The chief improvement is an extension to 1,750 ft. of the main down platform, so that two trains may be dealt with at the same time. The stay of the principal portion of our train here, however, is brief. A separation is made at the centre, and at 2.48 p.m. the "King Arthur" draws out with the six front coaches for Bournemouth West. As the crow flies the latter station is only just over a mile distant, but the circuitous course of the railway round the outskirts of the town, through Meyrick Park, makes a 3¼-mile journey of it, concluding with an exceedingly steep fall down to the terminal. Meanwhile our rear portion of the train has attached, probably, a Drummond 4–4–0 locomotive for the 35-mile run to Weymouth.

Courtesy [*Southern Railway*

The main entrance of Southampton West station, which deals with a large volume of passenger traffic. The present station was opened on 5th November, 1892, and was built on the site of the old "Blechynden" station. Since 1892 many additions and alterations have been made. The up platform is 600 ft. in length and the down platform 800 ft. in length. The entire station is supported on a foundation made of concrete 30 ft. deep. The height of the clock tower is 100 ft.

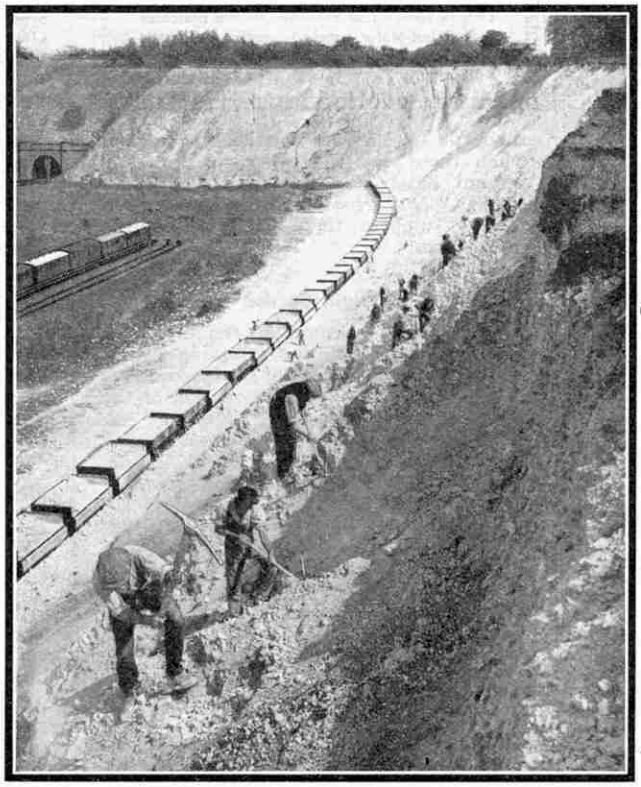
We re-start at 2.51 p.m. Various stops have to be made. After negotiating some very sharp curves, and descending a gradient that is for 1½ miles as steep as 1 in 69, we find ourselves skirting Poole Harbour, and presently stop at Poole, 5¾ miles from Central, at 3.2 p.m., leaving at 3.5 p.m. From Bournemouth West also this route is used, as far as Holes Bay Junction, beyond Poole, by the trains of the Somerset and Dorset Joint Railway which is the way by which the Midland Division of the L.M.S., extending its most southerly tentacle to Bath, obtains direct access to Bournemouth.

From Poole we have a short run of seven miles to Wareham, an important Dorset town where connection is made with the popular resort of Swanage, allowed 12 minutes. The next break is one of 15 miles, from Wareham to Dorchester, over which the gradients are chiefly against the engine, rising as steeply in one part as 1 in 100, for 1¾ miles in all, and elsewhere at 1 in 200 and 1 in 240. The uphill time allowance is only 19 minutes, however. At one period the late London and South Western worked over this section the fastest run in their timetable, the 15 miles from Dorchester to Wareham being allowed 16 minutes, start-to-stop.

Only seven miles remain between Dorchester and Weymouth, but they are mountainously steep. We mount at 1 in 88 to the tunnel above Upwey, and then descend precipitately a gradient of two miles ranging in steepness from 1 in 54 to a short strip at 1 in 48, to Upwey. Then we have a mile at 1 in 71 to 74, and a final mile at 1 in 170 into Weymouth—a nice start for up trains! But it is the Great Western Company, which uses this line from Dorchester into Weymouth, that suffers the worse of the two in this respect, as the Great Western trains, including those of the boat service between Weymouth and the Channel Islands, are usually the heavier.

So, at four minutes before four o'clock in the afternoon, we alight at Weymouth. It is singular to reflect, at the conclusion of the journey, that three more of "*The Thirties*" have already left Waterloo in pursuit of us!

The first railway communication between London and Southampton was brought about as the result of the success of the Liverpool and Manchester Railway. The shipowners of Southampton felt uneasy in regard to the development of Liverpool that was likely to result from the railway, and they determined to have a railway of their own. Money was raised and in 1832 a Bill was introduced into Parliament for the construction of the London and Southampton Railway. The Bill was thrown out on this occasion and also again in the following year, but in 1834 it was successful.



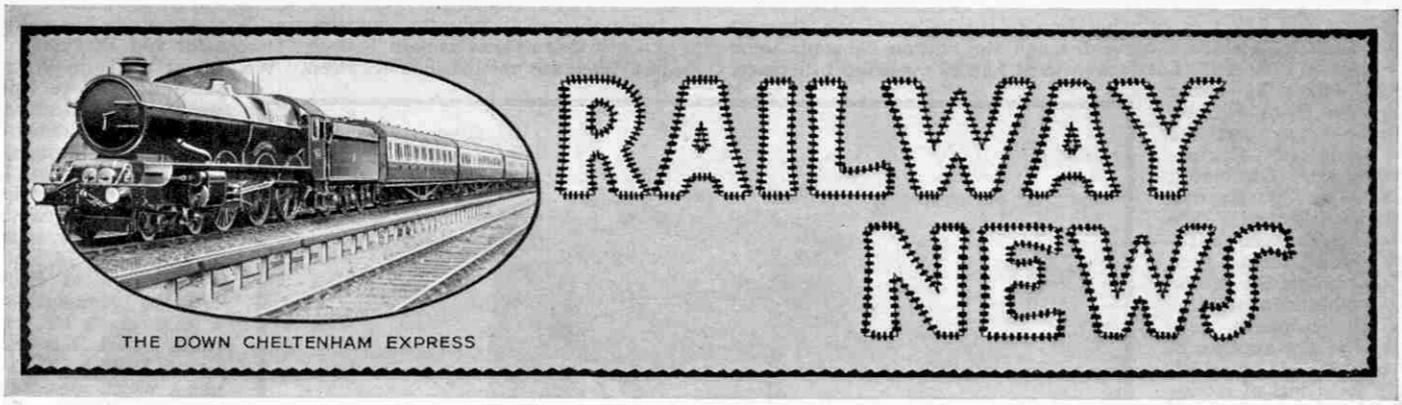
Courtesy [*Southern Railway*

Another view of the chalk quarry at Micheldever. The extensive scale of the operations may be realised from the length of the train of wagons. Main line tunnel on extreme left

Work commenced in due course, but one difficulty after another was encountered and progress was extremely slow. In the meantime, the available money came to an end. Fortunately, there were men at hand capable of handling the situation, and after some changes among the leading engineers, work proceeded steadily. There were still difficulties to be encountered, however, including many cuttings and embankments and also the crossing of Fleet Pond, beyond Farnborough.

Gradually the work proceeded, and by June, 1839, it was possible to make the journey from London to Southampton by a combination of train and coach. The trains ran from London to Basingstoke, and then came a coach ride to Winchester, followed by another train trip to Southampton. This state of affairs continued until May of the following year, when the first train ran through from London to Southampton.

After this line was opened, the people of Portsmouth decided that they would like a branch from it, but they insisted that the name should be altered to "London and South Western," to avoid using the name of the rival port!



L.M.S. Locomotive News

Delivery of thirty 0–6–0 standard shunting tank engines, numbered from 17,000 to 17,029, is now being effected by Wm. Beardmore & Co. Ltd. The whole batch is to be employed on the Midland division, and will be followed later by 20 other engines of the same type, numbered from 17,030 to 17,049, for service on the Western division.

Ten more "Barneys" 2–6–0 mixed traffic engines are to be put in hand at Crewe. These are intended for service on the Northern division and will bear numbers 13,100 to 13,109.

"Claughtons" that have been adapted to work over the Northern division lines include numbers 5912, "*Lord Faber*"; 5917, "*Charles J. Cropper*"; 5933; 5976; and 5979, "*Frobisher.*" Probably two or more of these engines will be employed on the G. & S.W. main line.

Nine of the re-boilered "Claughton" class locomotives are fitted with "Caprotti" valve gear. These locomotives are Nos. 5927, "*Sir Francis Dent*"; 5946, "*Duke of Connaught*"; 5948, "*Baltic*"; 5957; 5962; 5975, "*Talisman,*" 6013; 6023, "*Sir Charles Cust,*" and 6029.

The other 11 re-boilered "Claughtons" are fitted with the original Walschaerts' gear. These include 5906, "*Ralph Brocklebank*"; 5910, "*J. A. Bright*"; 5953, "*Buckingham*"; 5970, "*Patience*"; 5972; 5986; 5993; 5999, "*Vindictive*"; 6004, "*Princess Louise*"; 6017, "*Breadalbane,*" and 6027.

Recent withdrawals on the L.M.S. are 6 ft. 6 in. and 6 ft. 2–4–0 "Jumbos"—5009, "*Princess Helena*"; 5035, "*Hector*" (old numbers 1517 and 866); 5036, "*Novelty*"; 5057, "*Courier*"; 5091, "*Ellesmere.*" Also, D.X. 0–6–0 goods engine No. 8000. This engine, which was the third of its class, was built at Crewe in November, 1858, and named "*Falstaff,*" No. 358. Later the name was removed and in 1900 it became No. 3331, to be re-numbered 8000 in the new L.M.S. re-numbering scheme. The last seven D.X.'s to remain in service are Nos. 8014, 8029, 8051, 8058, 8060, 8064 and 3517. Other recent withdrawals are North Stafford class "G" 4–4–0 No. 5412, and "Experiment" Class Nos. 5453, "*Belgic*"; 5463, "*City of Paris*"; 5533, "*Boniface*"; 5550, "*Yorkshire.*"

Latest 0–6–0 standard superheater goods engines turned out from Crewe include Nos. 4542-4550. The first five of these are to be put into service on the Central division, and the last four are for work on the Midland division.

* * * *

"Lord Nelson" Locomotives. S.R.

At present there are eight of these locomotives in service, the last two to be completed at Eastleigh being Nos. E.856, "*Lord St. Vincent,*" and E.857, "*Lord Howe.*" With the exception of the first two engines, the "Lord Nelson" class locomotives are fitted with the smaller six-wheeled tenders. It is not considered necessary to use the large eight-wheeled tenders supplied with the first two engines on the comparatively short "Continental" runs between Victoria and Folkestone and Dover. The six-wheeled tenders provided for the remainder of the class have a water capacity of 4,500 gallons and carry five tons of coal. We understand that five more "Lord Nelson" locomotives are to be put in hand at Eastleigh soon, and when these and the other three of the present batch (E.858, "*Lord Duncan*"; E.859, "*Lord Hood,*" and E.860, "*Lord Hawke*") appear, there will be 16 engines in the class.

DIFFICULTIES EXPLAINED

7.—"H.W." on G.W.R. Coaches

The lettering "H.W." appearing at the ends of some Great Western coaches indicates that a hot-water supply is available for the convenience of passengers in these carriages.

* * * *

Isle-of-Wight Section—S.R.

In response to numerous requests from readers, we publish the following list of the names and numbers of the locomotives in use on the Isle-of-Wight section of the Southern Railway:—1, "*Medina*"; 2, "*Freshwater*"; 3, "*Carisbrooke*"; 8, "*Bembridge*"; 10, "*Cowes*"; 11, "*Newport*"; 12, "*Ventnor*"; 13, "*Ryde*"; 16, "*Wroxall*"; 19, "*Osborne*"; 20, "*Shanklin*"; 21, "*Sandown*"; 22, "*Brading*"; 23, "*Totland*"; 24, "*Calbourne*"; 25, "*Godshill*"; 26, "*Whitwell*"; 27, "*Merstone*"; 28, "*Ashey*"; 29, "*Alverstone*"; 30, "*Shorwell*"; 31, "*Chale.*"

* * * *

The "*Mid-Day Scot*" L.M.S.

The "*Mid-day Scot,*" which leaves Euston, London, every week-day at 1.30 p.m. for Glasgow and Edinburgh, is successor to the famous "*Corridor,*" run for many years over the West Coast route by London and North Western and Caledonian companies. The "*Corridor*" so-called because it was the first train run by either company to be regularly formed of corridor stock was, in the years immediately preceding the Great War, composed of specially built end-door corridor vehicles similar in type to those used on the "*Royal Scot*" to-day, and then represented the very last word in luxury and comfort. The "*Corridor,*" which was originally timed out at 2.0 p.m., was, in consequence of the drastic war-time restrictions and decelerations, re-timed to depart at 1.15 p.m., as from Monday, January 1st, 1917. On and after April 1st, 1918, it left at 1 p.m.; on May 3rd, 1920, it reverted to 1.15 p.m., and on Monday, July 11th, 1921, the present departure time—1.30 p.m.—was instituted. (*L.M.S. Magazine*).

* * * *

Steam Rail Cars on the L.N.E.R.

Steam rail cars are extensively employed in the North-Eastern area of the L.N.E.R. There are now 30 of these in service, including both the "Sentinel Cammell" and the "Clayton" types. In certain instances units work over distances of 200 miles per day. The average coal consumption per car is 13·1 lbs. per mile, the boiler pressure being 275 lbs. per square inch.

Comparing the power of the small engine fitted to these rail cars with one of the monster "Pacifics," it will be found that the rail coach boiler pressure is approximately 100 lbs. per square inch higher. The speed of the crankshaft when the engine is travelling at 30 m.p.h. is 486 revolutions per minute, while the crankshaft of the "Pacific" revolves 126 times a minute when the locomotive is travelling at that speed.

In order to ensure proper lubrication of the high-speed Sentinel Cammell engine, the working parts are entirely enclosed in a case very similar to a petrol motor crank case, and are thus continuously running in an oil bath.

* * * *

More Glass-Lined Milk Tank Wagons

In co-operation with the United Dairies (Wholesale) Ltd., the L.N.E.R. are now using glass-lined container wagons for the transport of milk to the receiving and distributing depot at East Finchley. The success of this method of transporting milk in large quantities has been proved by the experience of the L.M.S. and the G.W.R.

* * * *

More L.N.E.R. Speed

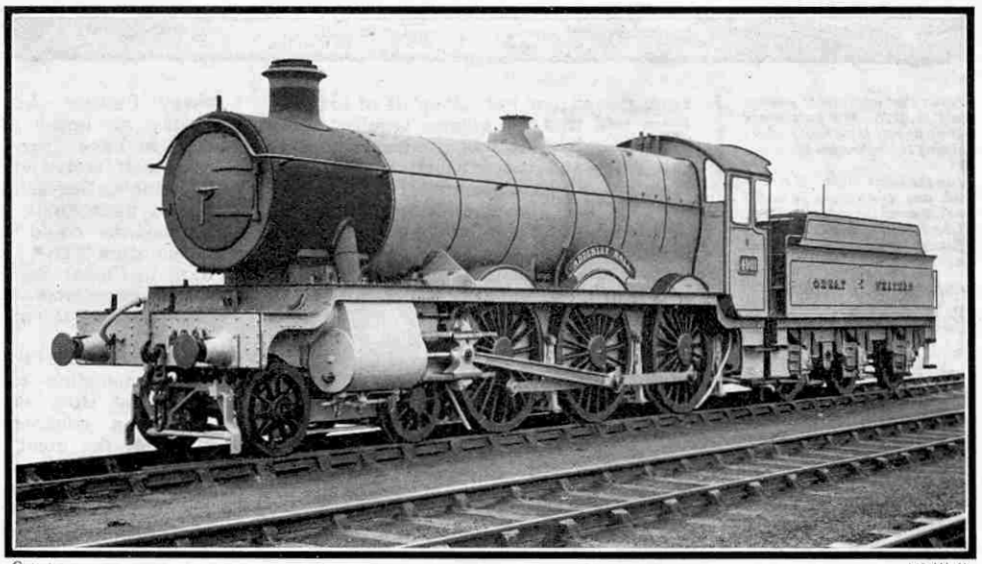
The 8.5 p.m. Newcastle to York express left Darlington three minutes late and arrived at York one minute ahead of scheduled time, in charge of N.E. "Atlantic" No. 737. The weight of the train was 267 tons. The total running time was 38 minutes (one minute having been lost through a signal check en route), and the average speed for the run was no less than 69.6 miles per hour.

New " Hall " Class Locomotives—G.W.R.

By courtesy of the G.W.R. we are able to illustrate engine No. 4901, "Adderley Hall," the first of the 80 locomotives of this type that are under construction at the Swindon Works. These engines are two-cylinder 4–6–0's and will be known collectively as the " Hall " class.

All locomotives of the " Hall " class will have outside cylinders 18½ in. in diameter by 30 in. stroke, and piston valves. The coupled wheels will be 6 ft. diameter and the bogie wheels 3 ft. diameter.

Standard No. 1 boilers with conical barrels and Belpaire fire-boxes are to be fitted and the working pressure will be 225 lbs. per square inch. At 85 per cent. of the boiler pressure the tractive effort will be 27,275 lb. as compared to the 24,395 lbs. of the "Saint" class. As will be seen, the cab is similar in pattern to those fitted to the " King " and " Castle " classes, being provided with side windows and extended roof. The tender is of the standard G.W. six-wheel pattern, equipped with water pick-up apparatus, the water capacity being 3,500 gallons and the coal capacity six tons.



Courtesy [G.W.R.

Our illustration shows the new Great Western " Hall " class locomotive, No. 4901, "Adderley Hall." The " Hall " class engines are practically identical with those of the " Saint " class, except that the driving wheels of the former are smaller. " Saint Martin," now No. 4900, was originally a " Saint " class locomotive, numbered 2925, but was rebuilt with smaller driving wheels and is now first in the " Hall " list

The engines will be named as follows :—4900, *"Saint Martin"*; 4901, *"Adderley Hall"*; 4902, *"Aldenham Hall"*; 4903, *"Astley Hall"*; 4904, *"Binnegar Hall"*; 4905, *"Barton Hall"*; 4906, *"Bradfield Hall"*; 4907, *"Broughton Hall"*; 4908, *"Broome Hall"*; 4909, *"Blakesley Hall"*; 4910, *"Blaisdon Hall"*; 4911, *"Bowden Hall"*; 4912, *"Berrington Hall"*; 4913, *"Baglan Hall"*; 4914, *"Cranmore Hall"*; 4915, *"Condover Hall"*; 4916, *"Crumlin Hall"*; 4917, *"Crosswood Hall"*; 4918, *"Dartington Hall"*; 4919, *"Donnington Hall"*; 4920, *"Dumbleton Hall."*

* * * *

New High Pressure Engine

We understand that an order has been placed with Henschel & Sohn of Cassel, by the P.L.M. Railway of France, for a high-pressure locomotive, the boiler of which is to be designed to carry a working pressure of 1,000 lb. per square inch. It is estimated that the new engine will weigh 109 tons empty.

* * * *

The L.N.E.R. successfully conveyed a ship's rudder loaded out of gauge from the Darlington Forge Company's Works, Darlington, to Messrs. Furness' Shipbuilding Yard, Haverton Hill. The load was 10 ft. 2½ in. from the centre to the 6 ft. side of the track and 5 ft. 11½ in. from the centre to the platform side. The special was restricted to a speed of 10 miles per hour and the opposite and adjacent lines were required throughout. The rudder was for the steamship *"Berengaria."*

G.W.R. Safety Precautions

With the object of facilitating the working of trains through the area between Old Oak Common and Paddington during periods of fog, electrically-illuminated fog-repeaters have been provided for the main and relief line signals. The electric lights on the fog-repeating signals are controlled by switches from the signal boxes and are brought into use when the fog renders the sighting of ordinary signals difficult. A further innovation, at Old Oak Common and Ladbroke Grove boxes, takes the form of " marker lights," showing a single white light 100 yards to the rear of existent signals, as a further help to enginemen in locating signals in dense fog.

* * * *

School-Boy " Howlers "

The following amusing school-boy " howlers " were mentioned recently in the *" Railway Gazette "* :—

A conjunction is a place where two railway lines meet.

Plato is the god of the Underground Railways.

Robert Louis Stevenson first invented railways.

Britain is divided into three parts—London, Midland and Scottish.

* * * *

The L.N.E.R. dealt with a very extraordinary load towards the close of last year. The special train, that travelled from Leeds to Glasgow, weighed 515 tons, and consisted of 17 Owners' Vans of wild animals (including camels, elephants, Polar bears, monkeys, zebras, snakes, birds, etc.), five caravans and stores, and a motor tractor. This was quite a modern Noah's Ark !

* * * *

The new locomotives of the "Sandringham" class are named as follows :—2800, *"Sandringham"*; 2801, *"Holkham"*; 2802, *" Walsingham "*; 2803, *"Framlingham"*; 2804, *"Elveden"*; 2805, *"Burnham Thorpe"*; 2806, *"Audley End"*; 2807, *"Blickling"*; 2808, *"Gunton"*; 2809, *" Quidenham."*

G.W.R. Locomotive News

According to the *G.W.R. Magazine*, 92 locomotives were built at Swindon Works during 1928, including 14 of the " King " class, which makes a total of 20 of these engines now in service. Forty of the 55XX class (2–6–2 Tank type) for mixed traffic and branch services, and 33 of the 66XX class (0–6–2 Tank type) for mineral services in South Wales have been constructed ; five engines of the new 4–6–0 type two-cylinder " Hall " class, have also been completed ready for service, and others are due to appear in the near future.

In addition, 50 locomotives of the 66XX class, built by Messrs. Armstrong, Whitworth & Co. at Newcastle, have been put into service, and some of the 50 engines of the 57XX class (0–6–0 Tank type), at present being built by the North British Locomotive Company at Glasgow, have also been delivered.

Out of a total of 216 engines condemned by the G.W.R. last year, 71 were from the " absorbed lines " and 145 were original G.W. stock. Of these, the most interesting were (1) *"Alliance,"* No. 104—which was the last of the three French "Atlantics," (2) two of the " Brunel " engines (one broad gauge), and (3) five of the famous " City " class engines.

* * * *

L.N.E.R. Locomotive News

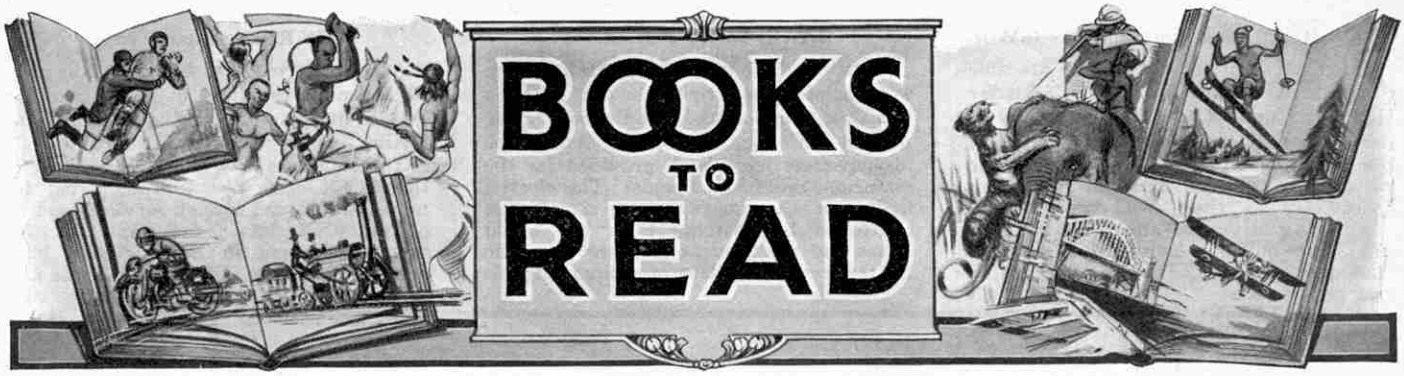
The latest 0–6–2 Tank engines delivered by Messrs. R. Hawthorn, Leslie & Co., are Nos. 2670 and 2671, while the North Road Works have completed Nos. 2718, 2719 and 2720 of the 0–6–0 J.39 class. We understand that work is to be commenced upon 48 new J.39 class locomotives this year, and also nine 2–6–0 tender engines. This forms part of the L.N.E.R's 1929 locomotive-building programme, which includes the construction of eight new " Pacific " type engines of the latest design, with a working pressure of 220 lb. per square inch. According to reports, the construction of 110 new locomotives has been authorised altogether.

* * * *

A Memorable G.W.R. Trip

A party of passenger agents representing 65 different railroad companies of America visited this country recently, many of them landing at Plymouth from the Cunard liner *"Mauretania."*

A trip to the Shakespeare country occasioned much favourable comment from the visitors on the excellent run from Leamington to Paddington, when the famous engine *"King George V"* covered the 87¼ miles, start to stop, in 83 minutes, at an average speed of 63.14 miles per hour.



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Aeroplanes, Seaplanes, and Aero-Engines"

By CAPTAIN P. H. SUMNER
(Published by Crosby Lockwood & Son. 25/-)

This volume, by a late staff-officer of the Air Ministry, is one of the "Science of Flight" series and it is uniform with the volume on "Airships and Kite Balloons" that was reviewed in our issue of October 1926. In this book, abstruse formula is avoided as far as possible in the text, and it has been the author's endeavour to combine the scientific aspect with that of practical flight. As the author points out, the mastery of the air places another aspect on the life and being of a nation. There arises now the necessity of an air sense behind the nation, in the same way as the sea and seamanship called the youth of this country in former days. There are to-day many opportunities for learning to fly and obtaining that air sense and mental alertness so necessary to control stability in flight.

Captain Sumner tells us in his Preface that one of the earliest records of attempted flight is that of an English monk, Oliver of Malmesbury who, in 1065, equipped himself with imitation wings and jumping from a high tower was severely injured. The development of flight was slow, and little progress was made until the 19th century, but the advance during the last 25 years has been extraordinarily rapid.

The historical side of the subject, however, is not dealt with in this volume, which is devoted solely to the practical application of science of flight. It includes chapters on such fundamental subjects as :—aerodynamics; the air-screw; the engine; types of aero-engines; general design and construction of aircraft; rigging and truing up of aircraft; types and performances of aeroplanes and seaplanes; and finally aeronautical instruments.

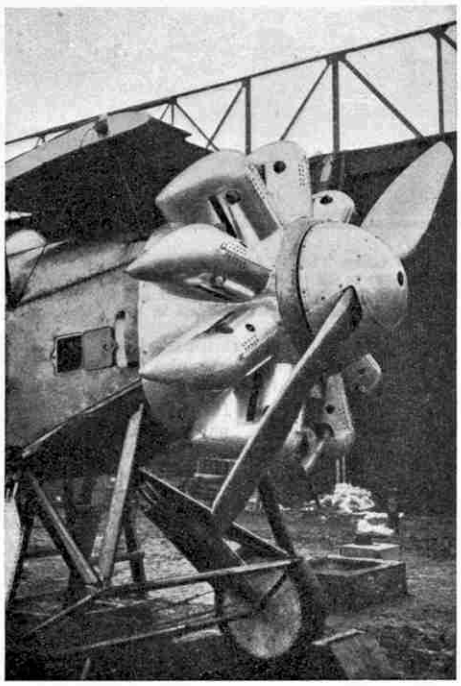
To those contemplating entering the Flying Services, the book will be of the greatest technical value.

* * * *

"Pioneers of Plant Study"

By ELLISON HAWKS. (Published by Sheldon Press. 12/6)

The beginning of things is always interesting but often difficult to trace. The course of a river may be accurately charted if we will but travel its length, but the way of the stream of knowledge in many commonly accepted things is not so easy. Therefore a patient, painstaking and accurate book on the history of plant study is a difficult task, and in this new book the author has given us of his best. I am told that the volume required seven years to write—it was commenced before the War—and the exhaustive index alone took six weeks to compile! Readers of the "*M.M.*" have wide interests and many among them will appreciate this book, in which the author has consummated the patient work of the late Professor G. S. Boulger, who as a botanist



Special helmet-cowling, covering the cylinders of a radial air-cooled engine

(This and the two illustrations on the next page are from "The Science of Flight—Aeroplanes, Seaplanes and Aero-Engines" reviewed on this page)

was well known to all students.

We are told of the plants of Ancient Egypt and learn that the plants of "there and then" are much the same as these "here and now," and fruits, flowers and seeds delighted taste and sight at the beginning of history as at the present day. The men who built the Pyramids possibly had salads at meal times just as do many wise engineers to-day! Weeds, too, worried gardeners in Egypt as they do now in England, and even the dodder flourished!

It is wonderful to think that the Chaldeans probably introduced to the Egyptians such plants as wheat, barley, and flax. The chapter on the plants of Assyria and China takes us back with ever-growing interest to days in the dim past. In every Chinese chemist's shop there is to-day an image of Chin-nung, who is said to have discovered seventy poisons and their seventy antidotes in one day. This interesting gentleman is said to have had a glass front fitted to his stomach so that he could observe the processes of digestion! His pharmacopœia (a standard in China) was not published until 4,300 years later—surely a record delay and enough to make any author impatient!

The plants of the Old Testament are very interesting to all Bible students, as is the story of Botany revealed in Phœnician commerce and Greek myth. Many of the great writers of the world successively show their knowledge of plant life and their interest in gardens. The father of Medicine was Hippocrates, of whose work there is here a fascinating summary, while Aristotle, whose studies in plant life are remarkable, is here spoken of as the father of Natural History. The names and records of great students of Nature follow in rapid succession—Pliny, Dioscorides, and Arab physicians mingle with a Frankish emperor, Marco Polo and Christopher Columbus, as scene after scene in the drama of plant study is shown

From the New World men brought maize, cotton, cacao, tomatoes, haricots, bananas, potatoes and tobacco, and showed for the first time the passion flower with all its symbolism. History tells of larger knowledge and workers everywhere welcoming new facts when Turner issued in London his famous "*Herball.*"

So the story is told, as history must always be told, in terms of its great men. They were all pioneers in this great field, and the pageant of these worthies becomes the history of plant study. We commend the book—a mine of information and learning—to all thoughtful readers.

REV. J. H. MARTIN.

* * * *

"The 'King' of Railway Locomotives"

By W. G. CHAPMAN (G.W.R. 1/-)

This book is a welcome addition to the excellent series of railway handbooks "for boys of all ages," published by the Great Western Railway. It resembles its predecessors in being of a size convenient for the pocket, and will be found an ideal companion for a long railway journey.

The book commemorates the introduction of the "King" class of G.W.R. engine, with special reference to "*King George V,*" the first of this class. Four chapters are devoted to a detailed account of the ancestry of the "Kings," and contain some very interesting references to the early G.W.R. engines. Subsequent chapters deal in a fascinating manner

with the building of the " Kings " and the outstanding features of this new class of locomotives. The historic visit of " *King George V* " to the Baltimore and Ohio Railroad Centenary Exhibition in 1926 is described, and the book concludes with an excellent description of a trip on the footplate of this famous engine.

The illustrations are very numerous and, especially those showing " Kings " in the making, are of unusual interest. Another valuable feature is the coloured frontispiece which shows " *King George V* " in his handsome livery.

This splendid little book may be obtained at any G.W.R. station bookstall, or direct from the Great Western Railway, General Manager's Office, Paddington Station, London.

* * *

" Stamp Collecting and How to Enjoy It "

By Stanley Phillips
(Published by Stanley Gibbons Ltd. 2/6)

This little book is written not only to interest those who are already collectors, but to interest also those who do not collect stamps.

As the author points out in his Foreword, present-day collectors have a tendency to run in narrow grooves. Each collector maps out his own path and keeps closely to it, with little knowledge of the other sides of the fascinating hobby. Often he has too little sympathy with those who are following other paths from which they derive equal pleasure. Such narrowness cannot be good for the individual and so Mr. Phillips has written this book in the hope that it may offer a wider vision of the hobby, or help in the choice of other paths if interest in a selected field is waning.

There are many illustrations throughout the book and the chapters include Postage Stamps as National Symbols; Stamps as connected with History, Religion and Charity. Postage Stamps and the Arts, Science, Invention and Engineering, Heraldry in the Stamp Album, etc.

In the chapter " Yarns from the Stamp Album " are many interesting facts, including the statement that Queen Victoria was very wrath about the portrait of Baden-Powell being shown on the Mafeking Seige Stamps. We are told also that there are many stamps that for one reason or another have never been on sale. A sixpenny stamp issued in Jamaica, showed the historic scene of the granting of freedom of the slaves in the island. Owing to political conditions in the island it was considered inadvisable to issue the stamp, and the whole stock was destroyed. In the same way, stocks of twopenny stamps bearing a portrait of King Edward, which was in preparation for issue in Great Britain at the time of his death, were destroyed.

Mr. Phillips' treatment of his subject and our own policy in the selection of our stamp articles are so closely in sympathy that we recommend this book to every reader, and particularly to those who have yet to sample the fascination of stamp collecting.

" Gilbert White "

By W. Johnson. (Published by John Murray. 15/-)

" White's Selborne for Boys and Girls "

Edited by Marcus Woodward
(Published by Blackwell, Oxford. 7/6)

Gilbert White, who was born at Selborne, Hants., on the 18th July, 1720, and died there 73 years later, was an explorer of note in the great realm of Nature. He passed through Oxford, where he was a fellow of Oriel College, and then obtained the curacy of Swarraton at a salary of £20 a year. Later, he became curate at Selborne, his birthplace, and he settled here in 1751.

In the surrounding district he had plenty of opportunities of studying Nature. Birds, flowers and rocks were his chief delight, and his patient and persistent search for first-hand knowledge of the mysteries of Nature brought him world-wide fame. " It is, I find," he wrote, " in Zoology as in Botany—all Nature is so full that that district produces the greatest variety which is the most examined."

Perhaps his most famous work was the " Natural History and Antiquities of Selborne," which is one of the most charming books in English literature.

White's life was placid and happy, and although he was a bachelor he had many family ties. He was delightfully modest, as is evidenced on one occasion when he mentions in his " Natural History " that two authorities—one of them the great Linnaeus himself—had described the water-rat as being web-footed on its hind feet. White asserted that if Linnaeus was right then he (White) had discovered a new water-rat, for these creatures in the district around Selborne were certainly not web-footed.

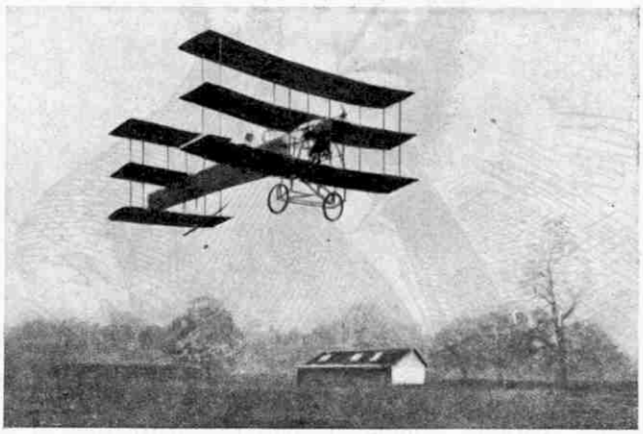
Although the study of birds and flowers were perhaps White's chief delight, he was interested in a multitude of other subjects. He was probably the first man to discover and describe the harvest mouse, and he spent much time in studying bats, one of which he tamed so that it would take flies out of his hand. He studied the little creature for hours on end and was rewarded by discovering many peculiarities previously unrecorded. One of the things he found was the fact that contrary to the general belief of the day, the bat can rise from a flat surface.

In his book Mr. Johnson not only shows us the extent of White's discoveries but, what is equally interesting, he tells us how near he came to discovering many things that since his day have been revealed by other workers in the same field. It is a remarkable fact that the observations recorded by Gilbert White, and the conclusions he arrived at, have emerged triumphant from the thorough tests and close scrutiny that they have been called upon to bear from those who lived after him. The book is a valuable addition to the library of all Nature students in general, and to those who hold in reverence the work of Gilbert White in particular.

It is interesting to note that a new edition of White's " Selborne," specially edited for boys and girls, has recently been published. This book, which is full of first-hand information concerning the wild life of England, has justly been numbered among the " hundred best books." First published in 1789, it has passed through more than 150 editions.

In the present edition the original text has been closely followed, but has been simplified and modern names—both popular and scientific—have been supplied in place of the ancient ones used in the original work. Many notes have been added to explain every difficult point and extra details are given about nearly all the observations. With these notes the book becomes a comprehensive natural history, not only of Selborne but of the whole English countryside. There are eight fine colour plates and numbers of figures in the text, and at the end of the book is a naturalist's calendar. A fine present for any nature student to whose library shelf it will be a treasured addition.

Orville Wright soaring and balancing a glider in an up-current (see previous page)

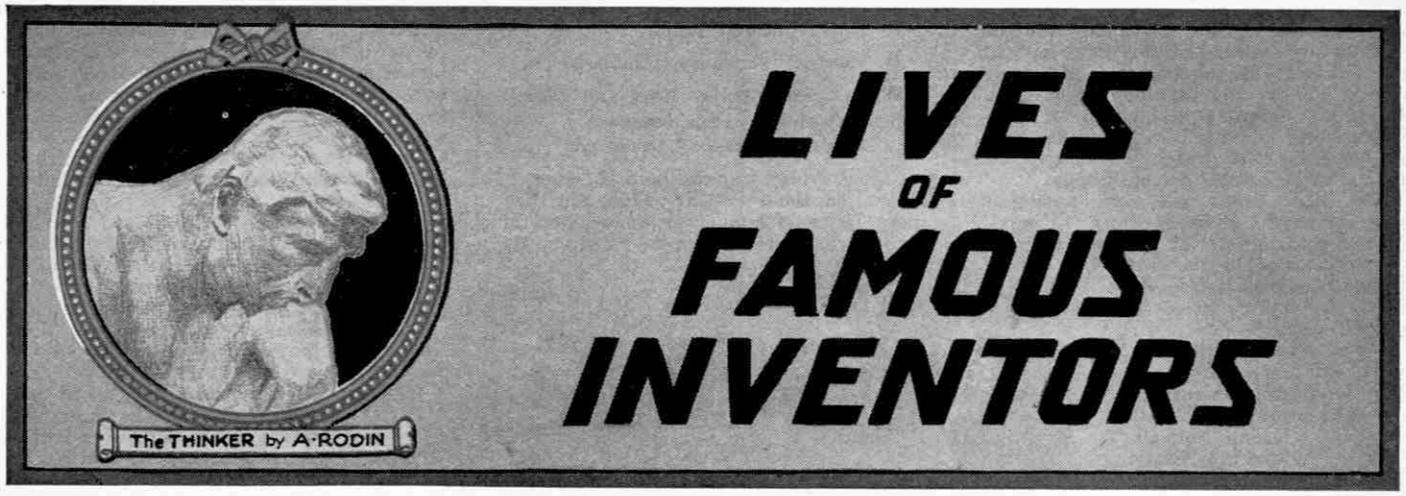


A. V. Roe on his first machine, constructed and flown in England (see previous page)

Two Interesting New Books

" Telegraphy and Telephony "
by Archibald Williams.
(Thos. Nelson & Sons Ltd. 10/6)

"The Golden Age"
by K. Grahame.
(John Lane, The Bodley Head Ltd. 7/6)



XII—RICHARD ROBERTS, WHO "INVENTED TO ORDER

SOME inventors have achieved fame through devoting their life to a single purpose and in perfecting a particular work, while others could apply their inventive genius to almost any subject and achieve equal success. One of the most successful of these versatile and brilliant inventors was a Welshman named Richard Roberts.

Richard Roberts was born on 22nd April, 1789, at Carreghofa, in the parish of Llanymynech, situated partly in Shropshire and partly in Montgomeryshire. It is said that the house in which he was born stood upon the border line that then divided the two counties, the front entrance being in one county and the rear entrance in the other!

His father was a shoemaker, but occasionally he supplemented his small income by toll-keeping. The boy was not sent to school, and the little education that he acquired was given to him by his father. As soon as he was old enough he was put to work as a labourer in a limestone quarry situated not far from his home.

Richard Roberts

During his leisure hours Roberts busied himself in making various simple mechanisms, and soon became skilful in handling tools. A fortunate circumstance that undoubtedly helped to develop his mechanical genius was the permission to use a pole lathe possessed by a gentleman who employed him on odd jobs. In woodworking also Roberts showed a natural ability, and one of his first achievements in this direction was the completion of an excellent spinning wheel, which he presented to his mother. Mrs. Roberts made no secret of her new possession, and such was the admiration of her neighbours that some of them raised a subscription and with the funds presented the lad with a chest of tools. With the aid of these implements young Roberts then constructed a second wheel, more elaborate than the first. This wheel, which was made of inlaid woods, was still in existence 40 or 50 years ago, and remained the cherished possession of a family in the neighbourhood.

Some of Roberts' happiest moments about this time were spent in visiting certain local lead mines where steam engines by the famous Soho firm of Boulton and Watt had recently been erected. Thus a combination of circumstances awakened in him an ambition to become a mechanic, and one day he relinquished his job at the quarry and went in search of employment at one of the ironworks in the district.

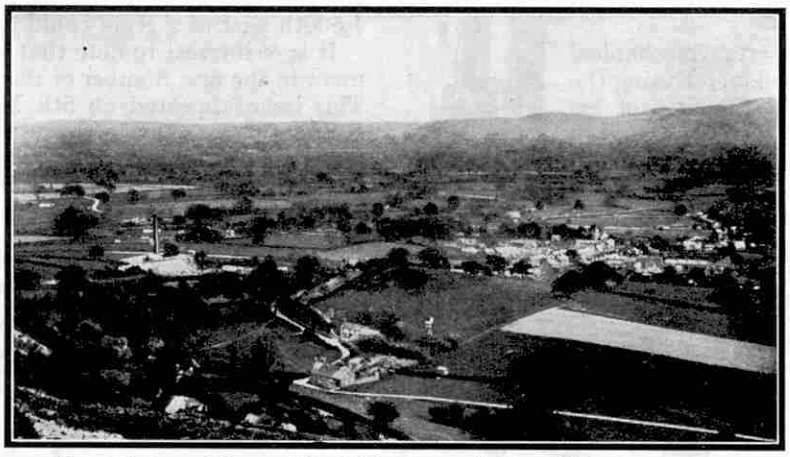
Roberts was fortunate enough to obtain work at the Bradley Ironworks near Bilston, under John Wilkinson, the famous ironmaster. Wilkinson was a man of considerable mechanical skill and enterprise. He was the first man in this country to bore an engine cylinder with any degree of accuracy, and readers of the articles on James Watt, "The Father of the Steam Engine," that appeared in the "*M.M.*" during 1927, will recall how invaluable to Watt was Wilkinson's skill in this respect. Wilkinson had the distinction of erecting the first steam engine in France, while he was responsible also for the building of the first iron boat in England.

At the Bradley Ironworks Roberts was employed as a pattern maker, and he gained much practical knowledge of wood and metal working. From Bilston he removed to Birmingham, where he served for varying periods in different workshops, gaining at each place valuable experience in some branch of mechanics. By varying his employment in this manner Roberts became, in the words of Samuel Smiles, the biographer: "A good turner, a tolerable wheel-wright, and could repair mill-work at a pinch."

From Birmingham Roberts migrated to the Horsley Ironworks at Tipton, Staffordshire, where he secured

an engagement in the pattern making shop. While at Tipton, he received word that he had been drawn for the militia. He was determined not to be a militiaman, however, and leaving his work he returned to his home on the Welsh frontier. He found that he was too easy a mark there for the recruiting officers, so after bidding a hasty farewell to his father he again left home, this time as a fugitive.

Travelling on foot he made his way northward to Liverpool, where he obtained work as a cabinet maker. Apparently the job was not to his liking, however, for he was soon on the road again, this time for Manchester. The journey proved long and wearying, for the road was little more than a series of mud-filled ruts. Tired, hungry and with only a few coppers in his pocket, he reached Manchester at dusk.



General view of the parish of Llanymynech where Roberts was born

According to Samuel Smiles, the young engineer, not knowing a person in the town, went up to an apple-stall, ostensibly to buy a pennyworth of apples but really to ask the stall-keeper if he knew of any person in want of a hand; and from him obtained information that led to his employment as a turner. A more likely version of the adventure is given by one of the inventor's personal friends, who states that Roberts made his way to the Old White Lion Inn, Deansgate, the headquarters of the engineers of Manchester and Salford. There he enquired of the landlord what prospects of work there were for a youth who was ready to undertake any kind of job. The landlord was impressed by the young fellow's earnestness and bade him wait until a certain customer of his arrived. In due course there entered a short-sighted old man who was a master turner of some local repute, and upon being told that the youth wanted work, he engaged him on the spot. The kindly landlord then offered the young engineer board and lodging on trust until he could earn enough to pay for them, and his offer was readily accepted.

Nos. 1 to 11, Water Street, Manchester. The house in which Roberts established his first business is in the centre

On the following morning Roberts presented himself at the old man's workshop, a small place in Blackfriars Street, Salford, where he found a number of journeymen fitters at work. The various lathes were operated by manual power, for the use of steam engines had not then extended to small workshops. Roberts, already a master hand at the lathe, found to his disappointment that his new duties were very simple—all that he had to do was to turn the flywheel of a lathe for one of the journeymen!

The outlook for the young engineer did not seem at all promising, but in less than a week a new turn of events altered his position completely. One journeyman for whom he supplied the motive power failed to put in an appearance. The work in hand was very urgently required and the employer endeavoured to take the journeyman's place. His eyesight proved to be unequal to the task, however, and he had to abandon it. This was Roberts' great chance and he promptly seized it. He asked to be allowed to try his hand at the lathe, and on permission being given he carried out the work so well that shortly afterwards he was promoted to the position of head turner.

Everything now seemed to be going well for Roberts, but before long he received an intimation that the militia warrant officers were again on his track. Becoming uneasy he determined to leave the north and take refuge in London, and with two companions he walked all the way there. A bargain was struck between the three that the first one to obtain employment in London should help to maintain the other two, until all were obtaining sufficient money to be independent. Roberts was the luckiest, both in being the first to obtain work, and in the high quality of his new employer, who was no other than Henry Maudslay, the inventor of the slide rest.

Roberts remained with Maudslay for about a year, during which time he acquired very valuable practical knowledge of the use of tools, and learned a good deal by contact with first class workmen among whom prevailed a spirit of friendly rivalry in regard to the quality of their work and the ingenuity of their various contrivances. In due course, Roberts began to think of returning to Manchester, for at that time this city presented even better opportunities than London for men of real mechanical ability.

The Treaty of Ghent, signed in 1814, left England in peace with America, and in the following year the Napoleonic Wars came to a close, thus removing the menace of compulsory military service that was so repugnant to Roberts. This danger being over, he left London and returned to Manchester, interestingly enough along with his two original companions.

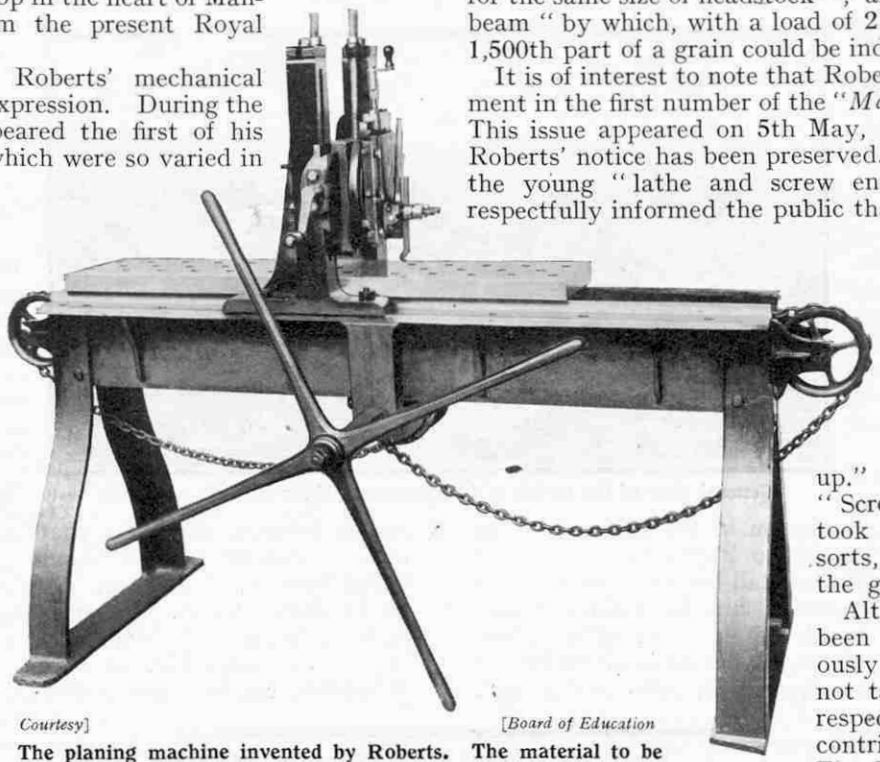
In 1815 or 1816 Roberts established himself as a lathe and tool maker at No. 5, Water Street. It is interesting to note that this long straggling thoroughfare, which follows the course of the River Irwell in a south-westerly direction, has undergone very slight changes since that time, and the present trustees are of opinion that No. 5 has remained practically untouched.

Roberts' accommodation was decidedly limited. He

erected a lathe in one of the bedrooms of the house and the fly-wheel in the cellar so that the driving belt that connected wheel and lathe passed through the living room. At this time he must have been married as it is recorded that his wife turned the fly-wheel for him. It is satisfactory to note that this domestic arrangement continued for only a very short period. He soon began to obtain such an abundance of work that he found it necessary to rent a shop in the heart of Manchester, not far from the present Royal Exchange.

It was now that Roberts' mechanical genius began to find expression. During the year 1816, there appeared the first of his series of inventions, which were so varied in character and so numerous that their originator has been spoken of as "the man who invented to order." In this year, Roberts constructed an improved type of screw lathe and produced "an improved sector for correctly sizing wheels in blank previously to their being cut."

In the following year, at the request of the City Commissioners, he devised an oscillating and rotating wet gas meter that enabled them to sell gas by measure, and solved the problem of preventing escapes of gas—a matter that had caused great annoyance to users. The patentees of the only other gas meter then in existence paid Roberts the compliment of copying the improved features of his device!



Courtesy [*Board of Education*

The planing machine invented by Roberts. The material to be planed was secured to the movable table that passed to and fro between the two vertical standards carrying the cross-slide. This slide held the planing tool firmly in position

One of the most important of his early inventions was a machine for planing metal. The invention of the planing machine has been claimed for several others besides Roberts, and it has been asserted that Fox of Derby had such a machine in use for planing the textile machinery that he constructed for Sir Richard Arkwright and Messrs. Need and Strutt, long before Roberts' planer made its appearance. Although there is some doubt as to whether Roberts was the originator of planing machines, it is known that the planer he produced in 1817 was constructed to an original plan of his own.

This machine, which is now in the Science Museum, South Kensington, is regarded as the earliest example in existence of a machine for planing metal, and it is a very interesting fact that the marks on the foot of the machine show that no such appliance was used in its making. The work is secured to a table that moves to and fro along a straight path beneath a fixed tool. The table has bolt holes for securing the work which is moved by chains wound by the drum rotated by hand. The cross slide is supported on two standards, bolted to the bed, screws being provided to adjust its height. It has an internal screw for traversing the tool rest which is capable of angular adjustment and has a handfeed motion.

Roberts' planer proved to be an efficient and correct machine and was used in many mechanical workshops until it was superseded by a superior machine invented by Whitworth that was operated by means of a screw.

The planer was quickly followed by other inventions, most of them being improvements of existing types of machines. These included an improved slide lathe "giving a large range of speeds with increased diameters for the same size of headstock"; and an improved scale beam "by which, with a load of 2 oz. on each end, the 1,500th part of a grain could be indicated."

It is of interest to note that Roberts had an advertisement in the first number of the "*Manchester Guardian.*" This issue appeared on 5th May, 1821, and a copy of Roberts' notice has been preserved. In the course of it the young "lathe and screw engine manufacturer" respectfully informed the public that he had a new and improved engine to cut "Bevil, Spur, and Worm Geer in Wood, Brass, Cast Iron, Wrought Iron and Steel," and that the teeth cut by his process would not require "fileing up." On his improved "Screw Engine" he undertook to cut screws of all sorts, pitches or sizes, with the greatest accuracy.

Although Roberts had been inventing continuously since 1816, he did not take out a patent in respect to any of his contrivances until 1822. The first patent related to improvements that he devised in power looms for weaving plain and fancy cloths. The loom as revised by Roberts was, according to the patent specification, "adapted to weave twill cloths or fustians, and such other fabrics as have the threads crossed in weaving, and in that peculiar manner called twill." His second patent related to machinery for raising or depressing certain parts of the warp in the weaving of figured goods.

During 1823 Roberts met Mr. Sharp, the managing director of Sharp, Hill and Company, manufacturers of a patent machine for making weavers' reeds. The patent had been acquired by Sharp from an American, but had not so far proved a success. He invited Roberts to call and inspect the invention and endeavour to locate the fault. The enterprising engineer accepted the invitation and, after carefully going over the details of the machine, he decided that it could not be made to operate satisfactorily. He then offered to devise a machine that would perform the same work efficiently, and his efforts in this direction were so successful that Sharp offered him a partnership in the business. The offer was accepted, and the title of the company was altered to "Sharp, Roberts and Company."

The new firm made rapid progress. Roberts was always thinking out fresh schemes, and by his untiring inventiveness the firm were soon manufacturing many other things in addition to reed-making machinery. The planing machine that he had invented was put to good use in making billiard

(*Continued on page 265*)

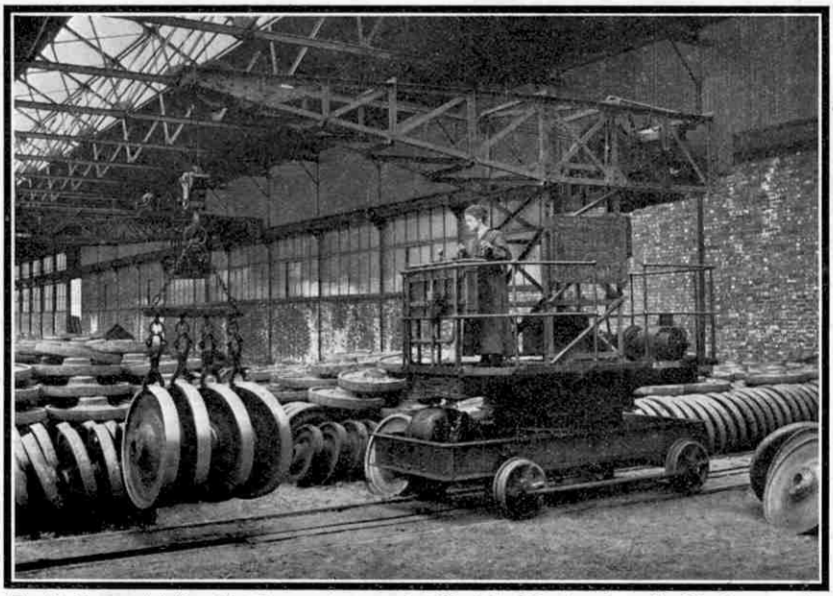
How Things are Made

Rolled Steel Disc Railway Wheels

By E. Watson Smyth

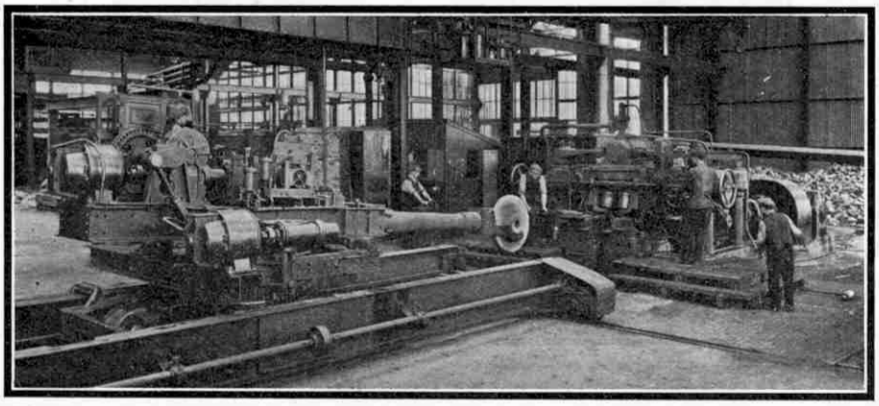
ONE of the most notable recent developments in railway rolling stock has been the gradual displacement of the spoke type of wheel by the rolled steel disc wheel. Railway engineers all over the world have given their approval to the steel disc wheel, and as this undoubtedly has a great future it will be of interest to give an outline of the interesting processes through which it passes in the course of manufacture.

It may be asked what advantages the rolled steel disc wheel has over the old type spoke wheel. First of all, the spoke wheel is made of iron, and the demands made upon rolling stock to-day as the result of the ever-increasing speeds and non-stop runs have caused iron to be discarded wherever possible in favour of the stronger steel. Further, the spoke wheel during its manufacture has no less than 40 welds to join its spokes to the boss and rim.



Electrically operated Travelling Transporter conveying Disc Wheel Forgings from the Warehouse to the Machine Shop. For this and the other Photographs illustrating this Article we are indebted to Taylor Bros. & Co. Ltd., Manchester

A further advantage is that a solid disc wheel does not create so much dust when running at high speeds as a spoke wheel, which is very much like a fan, the spokes acting in a similar manner to the blades of the impeller of the fan. Then again the disc wheel has perfect balance both dynamically and statically—that is balance when running at high speed and balance when the axle is placed on knife edges and free to revolve with the minimum amount of friction. Balance is of vast importance these days when the comfort of passengers is looked after so keenly by the railway companies. If a pair of wheels were seriously out of balance and you happened to be riding in a carriage over them, you would find that you were being rocked about so badly that you would not be able to sit quietly and read your "*Meccano Magazine*" as you naturally expect to do when you are travelling on a long journey.



The Electric Manipulator delivering a blank Disc Wheel Forging to the Rolling Mill

Before commencing to describe the various processes through which the steel has to pass before it becomes a railway wheel, it should be explained that a pair of wheels, as fitted to a railway carriage or wagon, consists of three main parts. These are the Wheel, known in railway language as the "centre"; the Tyre, which is the hard steel hoop that actually runs on the lines and takes the breaking strains; and the Axle, which is a forged steel round bar turned on the bearings, or "journals" as they are known, and also turned for the wheel centre to fit closely upon, providing what is known as the "wheel seat." I do not propose to describe the methods employed in the manufacture of either tyres or axle, but to confine myself to the making of wheels and the final fitting up of the three components to make a complete pair of wheels, tyres and axles.

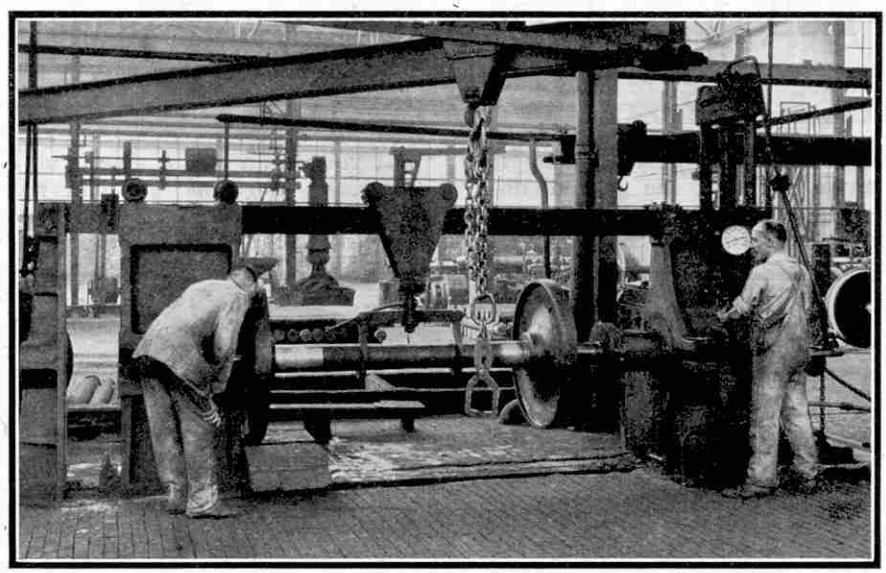
In order to do this I cannot do better than give you a description of the methods adopted at a very modern and up-to-date works in the north of England. These works are entirely self-contained in that here is made the steel from which the wheels are ultimately rolled and also the steel for the tyres with which they are fitted and the axles to which they are fitted.

The works are sub-divided into four main departments, namely, the Steel Melting Department; the Wheel Department; the Tyre Department and the Axle Forge Department.

The Steel Melting Department is situated in the centre of the works, where are installed seven 40-ton Siemens open hearth steel furnaces. These are equipped with the most modern machinery for quickly and efficiently handling the raw material as it is delivered into the stockyards, and for transporting the steel ingots and wheel blanks to both Tyre and Wheel Departments.

The layout of the shops has been carefully planned in order that all material delivered into the works shall pass over a central weigh-bridge. Every truck is automatically weighed and checked before being shunted to its destination, and these remarks apply equally to the finished products as they are shipped from the warehouse.

The arrangements for the handling of the large quantities of coal used in the works are also worthy of note. All the furnaces, both steel melting and reheating, are of the gas-fired type, gas being obtained from batteries of gas producers situated near the furnaces in each department. The coal is delivered in wagons and automatically emptied into bunkers from which it is conveyed to overhead bunkers. The latter in turn serve the mechanically-fed gas producers, the whole process requiring the services of only two men for each battery.



The Wheel Forcing Press which, by means of hydraulic pressure, forces the Wheel on to the Axle. The average pressure required for a Standard Wagon Wheel is between 55 and 65 tons

Coming now to the Wheel Department, this receives specially cast steel blanks from the Steel Melting Department, which are transported upon wagons of special design and delivered direct into the several stockyards. The design of these special wagons enables time and space to be saved by allowing the blanks to be sent in a hot state from the Steel Melting Department. The blanks are immediately dealt with in the stockyards by powerful overhead electric cranes, to which are attached electric lifting magnets that quickly empty a cast of blanks and stack them in readiness for delivery on to the charging platform for the succeeding operations.

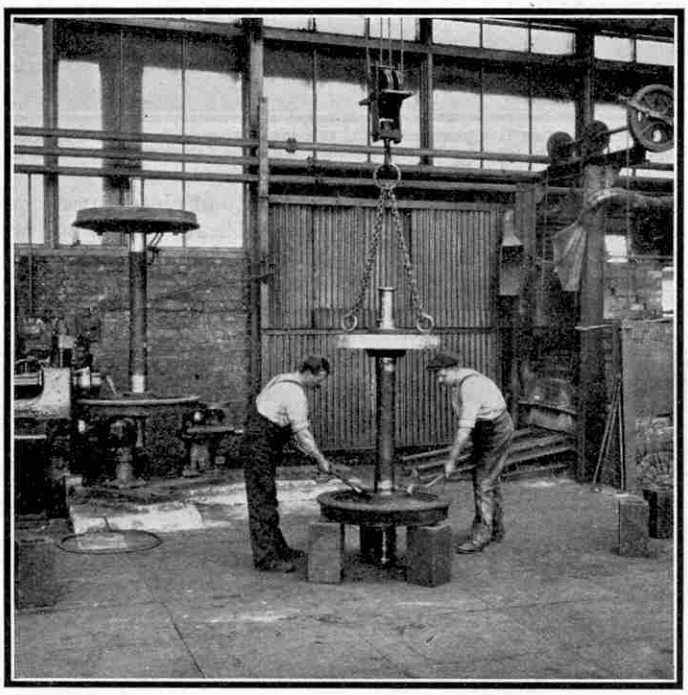
The blanks are dealt with by an electrically operated charging machine of special design, which picks them off the platform and places them on the hearth of the furnaces in the desired positions. When the necessary heat has been attained the machine transfers the blanks from the respective furnaces to the 2,000-ton wheel forging press. This press is also of a definite and special design and is extremely quick in operation, having a steam intensifier that ensures not only quick manipulation but also ease of working.

The blanks are forged in such a manner that all portions of the steel are thoroughly worked, thus ensuring homogeneous metal throughout the wheel. After pressing the blanks are punched and transferred from the back of the press by means of an electric manipulator to the re-heating furnaces, where they remain for a short period to bring them to the requisite heat for rolling.

In order to enable continuous operations to be maintained in this plant, a further manipulator operating upon the same track next transfers the forged blanks from the re-heating furnaces to the rolling mill. This mill is of very massive construction and is driven by an electric motor of 500 b.h.p., the adjustment of the rolls being carried out hydraulically.

The electric manipulator delivers the blanks direct into the rolling mill without the employment of any manual labour, and the operation of rolling is carried out most expeditiously, the actual time occupied varying with the size of wheel required. After rolling the manipulator transfers the wheels to the dishing press, which exerts a pressure of 800 tons and gives the wheel the necessary "dish." From the dishing press the wheels are placed on a hot bed where they are allowed to cool, and afterwards are transferred to a warehouse preparatory to being delivered into the machine shops.

Before passing on to the machining operations it may be advisable to make a few remarks upon the wheel forge. Visitors to this plant are immediately impressed with the absence of manual labour in the various operations, and indeed the remarkable handiness of the electric manipulators must be seen to be believed. The whole process works so smoothly and rapidly that it is impossible to watch it without being impressed with the wonderful organisation that enables a steel blank to be converted into a rolled steel disc wheel in such a ready manner.



Fastening a heated Tyre to a Disc Wheel. The man on the left is inserting the "Gibson" Ring referred to in the Article

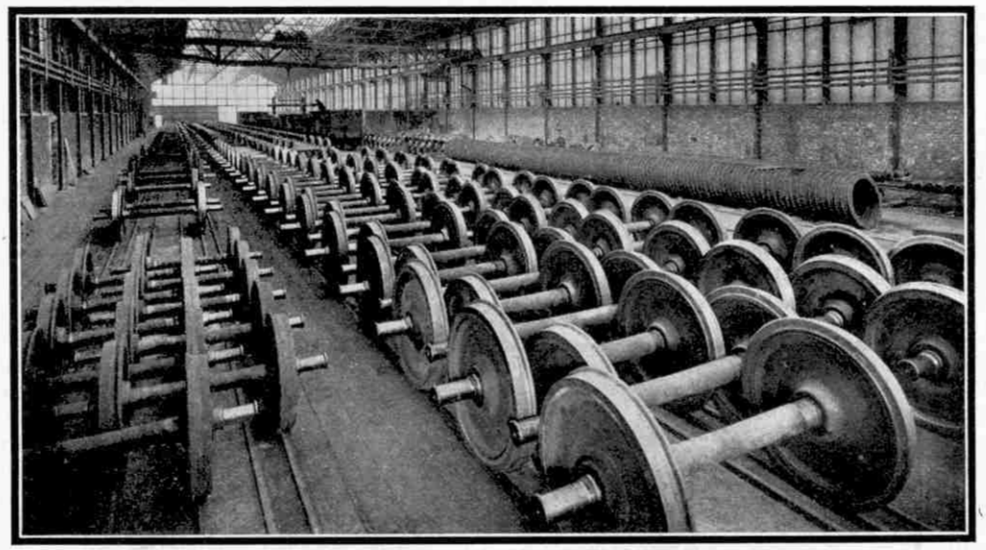
Passing on now to the machining section, the electrically operated transporter, lifting and transferring to the machine shops four wheels at a time, demonstrates the fact that speed in this department has by no means been neglected. The arrangement of overhead electric cranes to deal with the large number of wheels necessary for feeding the many machines at work upon the processes in the completion of a pair of wheels indicates close attention to detail, and it may safely be stated that nothing is too small to receive the attention of the staff in order to maintain and increase output and efficiency.

The machine shops comprise several bays all well apportioned and the number of machines installed and in operation is remarkable. At the same time, when it is realised that this plant at present has an average output of 800 complete pairs of wheels and 800 machined disc centres per week, even the great volume of plant contained in this department does not seem too adequate for such a task.

The first process of machining the wheels after they are received in their rough forged state from the forge warehouse takes place in motor-driven turning mills. The cutting speed employed in these tools is realised more fully when the quantity of turnings removed from each machine per day is actually seen. Each machine is provided with an automatic self-centring attachment

and a pillar type jib crane. The time occupied in setting up a wheel for machining is reduced to a minimum, and the jib cranes ensure rapid handling of the wheels and save any delay that might be caused by waiting for an overhead crane to change the wheel at the end of the cutting operation.

From these machines the wheels in their rough machined condition are transferred in large batches by overhead cranes to the boring mills. These machines are similar to the turning mills, with the exception that they are fitted with a massive boring head in place of the cross slides of the latter. After boring the wheels are transferred for trepanning. This operation is continuous, being performed upon specially designed machines having two trepanning tools working simultaneously, and a special duplex table by means of which one wheel is always set ready while the second is being trepanned. On completion of this process the wheel is a completely machined disc wheel centre, and is then transferred to the wheel forcing presses, where the necessary axles, having been machined, are sent forward to be assembled.



Completed pairs of Wheels in the Finishing Warehouse, where they are carefully Gauged and Checked before being passed for delivery to Customers

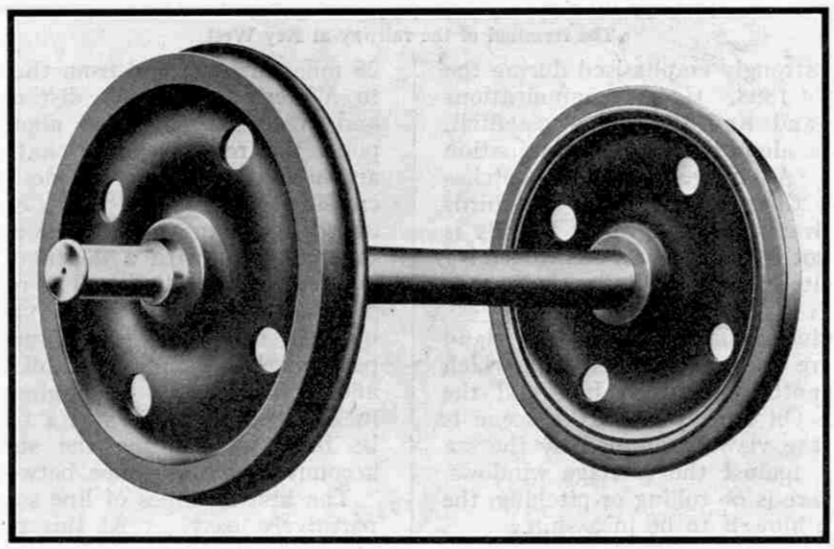
The wheel forcing presses are of the horizontal type and are actuated by hydraulic power. They take their supply from the main at 700 lb. per square inch, and very fine manipulation can be obtained by means of specially designed valves working in conjunction with hydraulic intensifiers. The average pressure required for a standard wagon wheel while being forced on to the wheel seat is between 55 and 65 tons, depending upon the size of the axle, the usual tonnage specified being 10-12 tons per inch diameter of wheel seating. The greatest care is exercised in the boring of the wheels and the turning of the wheel seats to standard gauges in order that the requisite pressure required in this operation may be obtained.

All wheels pressed on are numbered and recorded by means of a special graphic recorder attached to each press. This apparatus records on scaled paper the exact pressure exerted during the forcing operation, and these records are carefully preserved. After a pair of wheels have been pressed on to an axle the set is conveyed to the topping lathes, where they receive the finishing cut which, while machining to the requisite diameter for receiving the tyres, also ensures their being concentric with the axle journals. They are then sent forward to the tyre shrinking furnaces. The tyres are also assembled here after having been machined to the necessary dimensions, this operation being performed in very massive machines of the duplex type.

The furnaces installed for heating the tyres in readiness for shrinking on to the wheels are of special construction. The design is such that the tyres receive only enough heat for the necessary expansion, and the greatest care is exercised to prevent them from being scaled by coming into direct contact with an oxidising flame. This treatment ensures the tyre becoming as one with the wheels after shrinking, there being no possibility of any foreign matter becoming introduced between the two surfaces. This point is considered of paramount importance in the successful manufacture of all rolled steel disc wheels.

Passing on to the next process, attention may be drawn to the method of fastening the tyres to the wheels. This is accomplished by means of the Gibson ring, constructed so that once it has been fixed it forms a key which, in conjunction with the tyre lipping under the disc on the opposite side, makes a solid support against lateral shocks. If properly fitted it is impossible for the tyre to become loose, regardless of subsequent heat generated by braking, for as the tyre and wheel are as one any heat so generated is quickly dissipated throughout the wheel, which acts as an efficient radiator. This has been definitely proved on many foreign railways where long and steep gradients are frequently encountered.

The Gibson ring is a specially rolled section of mild steel cut off to the exact length required. These lengths are passed through a small rolling machine, which forms them into rings of the requisite diameter. The ring is placed into the groove of the wheel and under the lip of the tyre. The whole product is then transferred to a rolling-down machine which gradually bevels the lip of the tyre, thus completing this very efficient fastening.



A " close-up " view of one pair of Standard Disc Wheels, complete with Tyres and Axle

The pairs of wheels are then sent forward to the treading machine where the tyres are turned to the form required, special measures being taken to ensure accurate gauging for both diameter and section. This operation completes the manufacturing processes, and the completed pairs of wheels are sent to the finishing warehouses where they are finally gauged, checked and balanced, preparatory to painting and lagging, after which they are ready for delivery to customers.

The gauging and checking of the wheels before final despatch is most carefully looked after. One of the most important tests carried out on each wheel is that of ringing to ascertain that each tyre is sound and has been properly fixed on to the wheel centre. This test is carried out with a hand hammer, each tyre being given a sharp blow on the tread or part that is in contact with the rail. If the tyre is sound and is as one with the wheel, it will give a distinct ring, but if it is not it will give a dead sound.

So we come to the end of the manufacture of rolled steel disc wheels, which form such an important item in present-day railway equipment in all parts of the world.

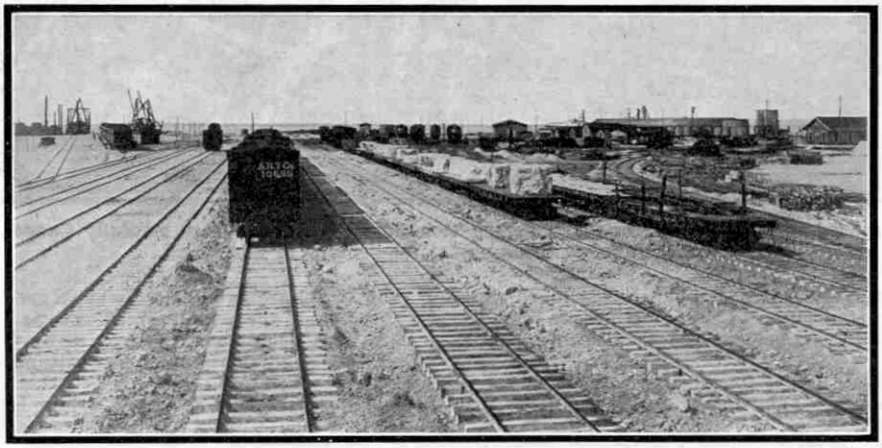
A Railway that Goes Out to Sea

From New York to Havana Without Change of Coach

By H. J. Shepstone, F.R.G.S.

THE greatest engineering feats of the world may be said to be the result of imagination coupled with determination. First of all into some man's mind there flashes a great idea—how splendid it would be if this river could be bridged, that mountain tunnelled or that city supplied with electric power from a far-distant waterfall. If the man who evolves this idea is himself an engineer, he may possibly proceed to take an active part in turning it into reality. It is more probable, however, that he will pass on the idea to others who have the necessary practical skill.

To judge from the map, the suggestion of a railway to connect Florida with Key West would appear wildly absurd; yet such a railway actually exists. The importance of Key West to the United States was very strongly emphasised during the Spanish-American War of 1898. Good communications between the mainland and Key West were essential, and presently there came along the man of imagination who said to himself: "A string of islands stretches out across the Florida Channel for some two-thirds of the distance. The water between these islands is shallow. Why should not these intervals be bridged?" From that idea has resulted a railway that actually goes out to sea.



The terminal of the railway at Key West

In crossing the viaducts that link up the island sections of this line there are many places upon which the traveller can see nothing between him and the horizon but open sea. On stormy days the scene is wild and desolate and the view is dimmed by the sea spray flung incessantly against the carriage windows. But for the fact that there is no rolling or pitching, the traveller might imagine himself to be in a ship.

Key West is the most southern of the curved chain of islands that stretch out into the Florida Channel and which are known as the Florida Keys. The word "Key" is a corruption of the Spanish word "Kayo" which means a small island. The distance from Miami in Florida to Key West is 156 miles, but if the traveller wishes to go forward to Havana he need not leave his coach, for great steam ferries take the trains on board and carry them bodily across the remaining 90 miles.

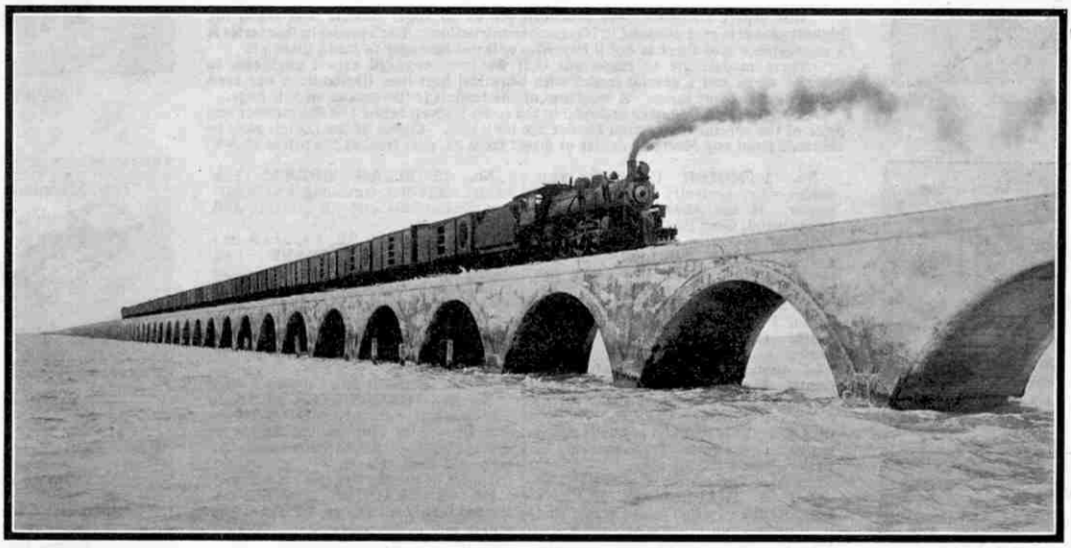
The scheme for connecting this outpost of the United States with the mainland by rail was instigated by Mr. Henry M. Flaglar, a Florida millionaire, and it offered problems that the railway builder had never before been called upon to solve. The first question the engineers had to decide was how far down from Miami the track could be laid on the mainland before jumping off on to the Keys. In order to settle this point engineering parties spent months at a time in the region known as the Everglades, carrying out surveys under appalling conditions. The Everglades may be likened to a very large shallow lake enclosing thousands of islets covered with dense thickets and containing vast numbers of alligators. The engineers suffered terrible hardships in this inhospitable region, and one party had to be rescued by a special relief expedition, which found them on the verge of starvation.

In the end it was decided to run the line to Homestead, 28 miles distant, and from there across the Everglades to Water's Edge, the distance between Homestead and Water's Edge being about 17 miles. From this point the road became what one might describe as amphibious, reaching its destination, Key West, by crossing 47 islands. The channels between these islands vary in width from a few hundred yards to several miles, with a depth of water ranging from a few feet to over 40 ft. The road is carried over these gaps on embankments and viaducts of concrete built up from the ocean floor. Surveying in the Keys was particularly difficult. Most of the work had to be done afloat and at times the engineers were lost among the maze of islets for days at a time. Tall towers had to be built for sighting the surveying instruments on account of the distance between the islands.

The first 28 miles of line south of Miami were comparatively easy. At this point the Everglades are entered and the next 17 miles down to Water's Edge pass virtually through a heavy mangrove swamp. It was here that the first serious difficulties were encountered. An embankment was thrown up for the track with the help of specially constructed dredges, but before these could be set to work it was necessary for the engineers to dig out a channel on each side of the route. Down these channels the dredges, navigable in 2½ ft. of water, made their way, using the material excavated for building up the railway embankment. The work was continually hampered and delayed by rock which came so near the surface as to necessitate the construction of locks to float the machines over.

Next there had to be filled two arms of a bay, Jewfish Creek, and the filling of these arms made it necessary for the engineers to form an artificial outlet to the creek.

So the line continues down to the shore and reaches by means of a handsome steel drawbridge the first and largest of the islands, Key Largo. From here the track continues for some 16 miles, its embankment being built up entirely of coralline limestone, as is also every one of the railway embankments crossing the various Keys. At the south-western end of Key Largo, Tavernier Creek, which separates it from Plantation Key, is crossed by a steel bridge with concrete piers and abutments. On Key Largo was found an inland lake not encountered in preliminary surveys. This lake completely obstructed the line of grade and was half a mile wide and 6 ft. in depth, the bottom being composed entirely of peat. In order to displace this peat and sink a stable foundation for the embankment two dredges had to be operated continuously for 15 months.

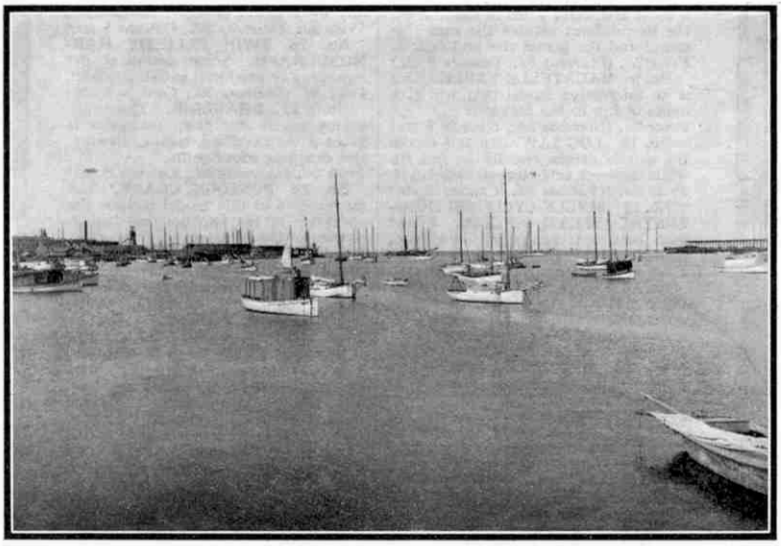


Cuban Special Pineapple Train crossing the Long Key viaduct

By this time an army of 2,800 men had been collected and distributed over the route in 30 construction camps. The line was built from boats and this necessitated the services of a fleet of very miscellaneous and costly craft. For use along the coast alone there were requisitioned three tugs; eight stern-wheeled steamers of the Mississippi type; 30 petrol launches; 14 houseboats each with accommodation for 144 men; eight work boats fitted with derricks and concrete mixers; three floating pile drivers; one floating machine shop and over 100 barges and lighters.

Progress was greatly hampered by the difficulty of obtaining good workmen, the majority of whom were engaged on the vast workings of the Panama Canal. Very many of the men who were induced to commence work on the Florida scheme resigned after a few days, and thus the engineers were constantly up against the trouble of finding new men. The surroundings were so depressing that the best class of men refused to sign on and the work had to be carried through with an inferior grade of labour, including large numbers of men of a rough type who were extremely difficult to manage. Another difficulty arose from the fact that, although there was an abundant supply of water on the Keys, it was quite unfit for drinking purposes, and water had to be transported in tanks from Miami which was a costly proceeding.

From Key Largo, the first of the islands tapped by the railway, to Long Key, the line is carried over the sea gaps between the Keys by embankments built up from the ocean bottom. Then we come to the first of the four arched viaducts. If the engineers had had their way they would have connected, by massive ramparts, the whole of the 47 islands over which the line passes; but the Government at Washington became uneasy at the prospect of a solid wall stretching from the mainland to Key West. They feared that this, by shutting off the tidal flow, might disturb the aquatic equilibrium of the Bay of Florida. The builders therefore were respectfully but firmly told that they must include a certain number of bridges by way of openings in their embankments, in order that the immemorial habits of the tide in that part of the world should not be upset.



Key West Harbour, showing the Sponge Fleet at anchor

These viaducts are the most picturesque part of the whole undertaking. There are four of them, totalling about six miles in length. They extend from Long Key to Grassy Key, 10,500 ft.; across Knight's Key Channel, 7,300 ft.; across Moser Key Channel, 7,800 ft.; and across Bihia Honda Channel, 4,950 ft.

We may obtain some idea of what it meant to erect these viaducts in the open sea, when we learn that the

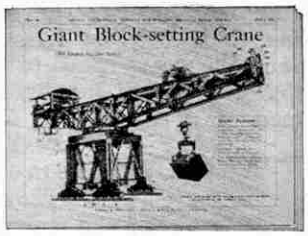
MECCANO

SUPER MODELS

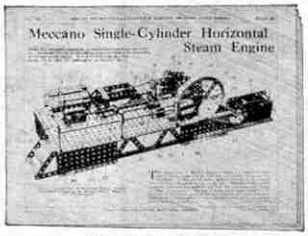
Our expert designers have produced for us 35 super models that reach the highest pinnacle ever attained in Meccano construction. Each model in this series is a masterpiece and there is not a boy who will not be eager to build them all.

These models are so important that we have engaged expert engineers to describe them and a special leaflet with beautiful half-tone illustrations has been written for each of them. A selection of the leaflets is illustrated on this page.

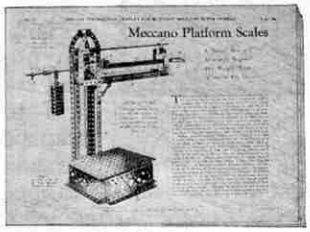
A brief description of each model in the series is given below and the number and price of the special Instruction Leaflet are indicated. Copies of the leaflets may be obtained from any Meccano dealer or direct from us, post free, at the prices shown.



No. 4 Leaflet.



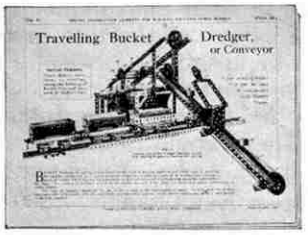
No. 11 Leaflet.



No. 7 Leaflet.

No. 1 Leaflet.

No. 25 Leaflet.



No. 5 Leaflet.

No. 1 MOTOR CHASSIS. This model runs perfectly under its own power. It has Ackermann Steering, Differential, Gear Box and Clutch, etc. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 2 SHIP COALER. All the movements of a real ship-coaler are reproduced in this model. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 3 MOTORCYCLE AND SIDE-CAR. The sidecar is of stream-line design and is mounted on springs. The motorcycle is complete with lamps, horn, exhaust pipes, etc. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 4 GIANT BLOCK-SETTING CRANE. This realistic model is fitted with an accurate reproduction of Fidler's block-setting gear. *Price 6d. (Overseas 8d., Canada 15 cts.)*

No. 5 TRAVELLING BUCKET DREDGER. In this model trucks and wagons can run underneath the chute through which falls the material raised by the dredger buckets. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 6 STIFF-LEG DERRICK. This model has many interesting movements, including hoisting, luffing and swivelling, which are controlled by suitable levers. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 7 PLATFORM SCALES. This model will weigh articles up to 4½ lbs. with remarkable accuracy. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 8 ROUNDABOUT. This model is most attractive when in motion. As the roundabout rotates the cars spin round and the horses rise and fall. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 9 BAGATELLE TABLE. This is an interesting model that will give hours of fun to the players. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 10 LOG SAW. In this model the saw is driven rapidly to and fro while the work table travels beneath it. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 11 SINGLE-CYLINDER HORIZONTAL STEAM ENGINE. Fitted with balanced crankshaft, crosshead, and centrifugal governor. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 12 STONE SAWING MACHINE. The model is equipped with adjustable work table and overhead trolley with self-sustaining chain hoist. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 13 MECCANOGRAPH. This wonderful model will draw hundreds of beautiful designs. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 14 GRANDFATHER CLOCK. A practical example of Meccano model-building. The model keeps accurate time. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 15 BALTIC TANK LOCOMOTIVE. The driving wheels are operated by an Electric Motor. An accurate reproduction of Walschaerts' Valve Gear is fitted. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 16 LOOM. This is perhaps the greatest Meccano success. The model weaves beautiful material. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 17 PLANING MACHINE. Fitted with quick-return motion. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 18 REVOLVING CRANE. This model is fitted with screw-operated luffing gear. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 19 STEAM SHOVEL. This model embodies travelling and rotating mechanisms and jib hoisting and lowering gear. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 20 MOBILE CRANE. This model has hoisting, luffing, travelling and slewing movements. It is fitted with an automatic brake on the hoisting shaft, an internal expanding brake on the front axle, and a limit switch to prevent over-winding of the jib in either direction. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 21 TRANSPORTER BRIDGE. The carriage automatically travels to and fro for as long as the motor is driven, pausing for a few seconds at each end of its travel. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 22 TRACTION ENGINE. A remarkably realistic model that will pull a boy of average weight. Fitted with two speeds. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 23 VERTICAL LOG SAW. While the saws are in motion, the logs are fed slowly to them. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 24 TRAVELLING GANTRY CRANE. The movements of this model comprise the traversing of the entire gantry, hoisting and lowering, and the traversing of the crane trolley. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 25 HYDRAULIC CRANE. The hydraulic ram is represented realistically by a powerful screw mechanism. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 26 TWIN ELLIPTIC HARMONOGRAPH. Some beautiful designs may be produced with this model. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 27 DRAGLINE. This imposing model of a giant excavator is fitted with travelling, luffing, slewing, and dragging movements. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 28 PONTOON CRANE. The movements of this model include the operation of the two hoisting blocks, slewing of the entire crane, and luffing. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 29 HAMMERHEAD CRANE. This is a very realistic and powerful model, comprising traversing, hoisting and slewing motions. *Price 2d. (Overseas 3d., Canada 5 cts.)*

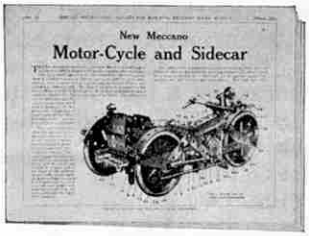
No. 30 BREAKDOWN CRANE. This model is equipped with travelling, slewing, luffing, and hoisting motions, and also is fitted with laminated springs, brakes, out-riggers, etc. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 31 WAREHOUSE WITH ELEVATORS. The two cages are driven automatically and work alternately, pausing at top and bottom positions. *Price 3d. (Overseas 4d., Canada 8 cts.)*

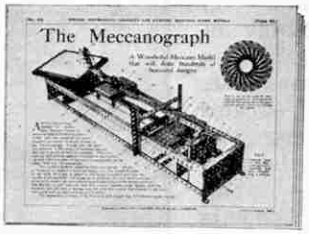
No. 32 TWO-CYLINDER STEAM ENGINE AND BOILER. This is a realistic working model of a complete steam plant, equipped with valve gear, governor, balanced cranks, etc. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 33 SINGLE AND DOUBLE FLYBOATS. These two models represent popular pleasure-fair attractions. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 34 THREE-ENGINE BIPLANE. This is a realistic model of an "Argosy" machine, and is fitted with ailerons, elevators and rudders. *Price 3d. (Overseas 4d., Canada 8 cts.)*



No. 3 Leaflet.



No. 13 Leaflet.

No. 10 Leaflet.

No. 17 Leaflet.

No. 6 Leaflet.

No. 19 Leaflet.

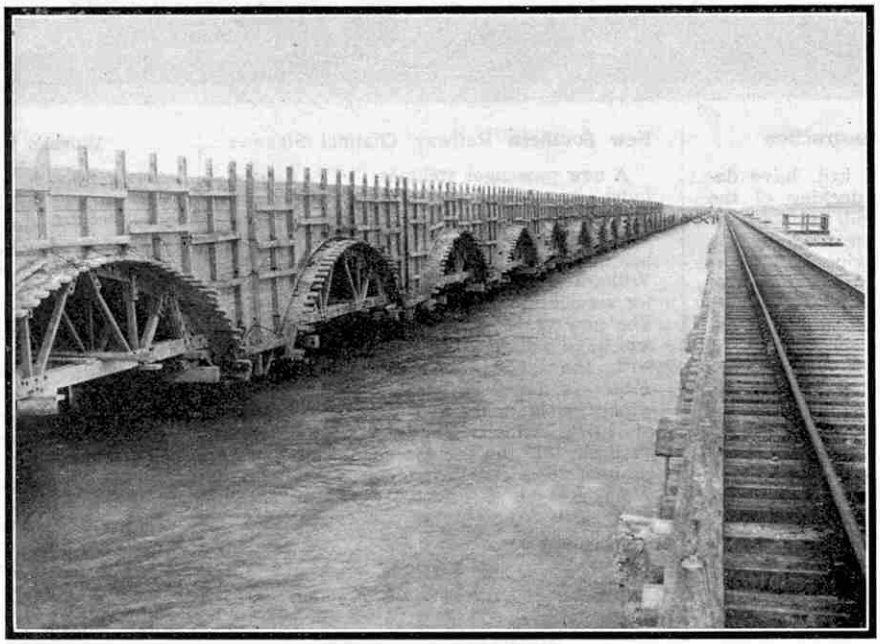
Meccano Limited

OLD SWAN, LIVERPOOL

one at Long Key consists of 186 arches and is two miles in length. In the erection of this particular viaduct there were used 286,000 barrels of cement; 177,000 cubic yards of crushed rock; 106,000 cubic yards of sand; 612,000 lineal ft. of piling; 5,700 tons of re-inforcing rods and 2,600,000 ft. of dressed timber. A large fleet of boats had to be chartered to convey this immense quantity of material to the scene of operations; the crushed rock alone filled 80 steamers! In places where the water was very shallow, special rafts had to be constructed to carry the necessary plant, the ordinary vessels being used in deeper water.

In the construction of the concrete arches the generally adopted method of railway bridge-building was employed. Pier piles and arch-bent piles were first sunk and cofferdams were then lowered and pumped out. A seat of concrete was then placed at the bottom of the cofferdam and upon this the concrete construction of the pier was raised. Twisted re-inforcing rods were then placed in position, their upper ends protruding from the top of the concrete pier. The arch-bent piles were then ready to receive the arch forms.

When the erection of the spandrel wall forms was completed on each side of the arch the re-inforcing rods were joined by means of heavy wire to those protruding from the pier, and the re-inforcing continued inside the spandrel wall in the ring of the arch. The next step was to fill the forms and spandrel walls with concrete and tamp it into position, after which the whole was allowed 28 days to set. The construction of the spandrel wall was followed by the dislodgment of the arch forms from the arch-bent piles. These were then floated away on barges and used over again as often as the condition of their timbers warranted.



Spanish Harbour Bridge. This illustration gives an excellent idea of the method of construction adopted

When some 90 of the arches of the Long Key viaduct had been completed, a hurricane swooped down upon the Keys and not only tested the work of the engineers to the utmost but also made havoc in the ranks of the men. The finished arches stood the test well, but hundreds of pier forms and costly wooden frameworks were washed out to sea and lost. The camps on the islands were blown down, vessel after vessel was torn from her moorings and swept out to sea, and much valuable equipment of all kinds was lost. One houseboat with 145 men on board was swept on to Florida Reef, and smashed up completely. The floating wreckage was fringed with men hanging on for dear life and of these only 87 were rescued.

As soon as the line was finished to Knight's Key, 109 miles from Miama, it was decided to erect a station there, and to build a dock and make it a place of call. A trestle embankment, 2,000 ft. in length, was carried to the dock, which was connected with the open sea by a deep channel that permitted of vessels of 20 ft. draught to come alongside the dock themselves.

Between Knight's Key and Pidgeon Key there is an opening of 10,250 ft., of which distance 7,300 ft. are crossed by a viaduct. Next comes another gap of some 22,900 ft. which is bridged by a 7,800 ft. viaduct and some very long embankments.

Many of the islands are mere swamps densely covered with mangrove. The throwing of an embankment across them was largely a matter of dredging, and for this work the engineers devised a new type of machine. It was impossible to feed any of the usual types of dredge with the necessary coal and fresh water because supplies could not be transported over the shallow lagoons and landed within reach. The dredges used here therefore were operated by petrol engines, and six of them were constructed on barges. Where there was enough water to float them they waddled across the bay, indefatigably heaping up embankments. When they came to dry going they were hauled ashore, mounted on wheels and slid on to a steel truck. The dredges then moved ahead as effectively as they had done before.

Upon these embankments miles of trestle work were built and white coral and sand dumped in to form in time solid limestone rock. When this part of the work was finished the graders came along, followed in turn by the track layers; and in this manner island after island was connected up and prepared for the iron road.

On the viaducts and embankments in the open sea the track is kept at a level of more than 30 ft. above high water. It had been determined after prolonged observation that the maximum height of waves throughout these waters was 25 ft. so that the highest waves, even in the rough months of September and October, could not break over the top of the viaducts or embankments.

It should be made clear perhaps that, although the viaducts are of tremendous length they do not by any means complete the connections. For instance, the viaduct across Long Key Channel is 10,500 ft. in length, but the embankment at each end brings its total length up to 19,100 ft. Many of these ramparts were thrown up by suction dredges which trailed their long lines of pipe across the channel like huge serpents. These crossings were then faced with rock in order to protect them against the wash of the sea.

At certain points special bridges had to be erected and these had to comply with the requirements of the officials at Washington. One of them has 100 ft. clearances on each side of a central pier, while there are two others with 40 ft. clearances and seven with fixed openings of 25 ft. The arches have openings of from 50 ft. to 60 ft.

The timber used in the construction of the railway was brought from Florida; the gravel came from Mobile; the cement was shipped from Germany and the hundreds of boat loads of crushed gravel used in making the concrete were brought from the Hudson River. The work occupied two years and cost £3,000,000, or over £20,000 per mile.

On 2nd January, 1907, the line was opened from Miami to Knight's Key, a distance of 109 miles. The first passenger train to travel over this stretch of line was a private one consisting of two coaches containing Mr. Flaglar, his family and a few privileged friends, and a number of railway officials.

Work proceeded slowly on the 46-mile section from Knight's Key to Key West. In some respects this was the most difficult length of the whole route to construct. The farther out to sea the line was carried the more the operations were exposed to the fury of the waves, and there was also the increasing difficulty of maintaining uninterrupted and adequate supplies of the materials required. The islands that were linked up were wild and inhospitable, their few isolated residents living like hermits. It is recorded that one man had lived on one of the smaller islands for over 30 years and during the whole of that period he had seldom seen a fellow man. He maintained himself on fish and sea birds that he caught, and on various wild fruits.

In spite of all obstacles and without any serious mishap the railway was completed to Key West in 1911.

In addition to being a financial success this railway naturally makes a great appeal to the tourist, as it is the only railway in the world that runs for many miles over the sea. After leaving the mainland the traveller's only means of locating his bearings is afforded by the numerous lighthouses that rise from the sea on their skeleton legs and are visible from the carriage windows. The journey is rendered more interesting by the fact that almost all the time there may be seen from the train the ships that ply regularly between the ports on the Atlantic coast of America, Cuba, the West Indies, and the Central and Southern States of South America.

Zambesi Bridge Reconstruction

The Rhodesia Railways Ltd. have decided to reconstruct the decking of the famous Zambesi Bridge, and the contract for the work has been awarded to the Cleveland Bridge and Engineering Company of Darlington. The bridge spans the gorge cut by the River Zambesi, about 700 yds. below the Victoria Falls, where the gorge is approximately 400 ft. in height, and 650 ft. in width at the top. The main span of the bridge is 500 ft. in length, and a lattice girder approximately 87 ft. in length is attached to the southern end of the main span, while a similar girder 62 ft. in length is situated at the northern end.

Although the bridge is 30 ft. in total width, there is at present only a single 3 ft. 6 in. gauge railway line across it, and included in the contract for the reconstruction work is the provision of a road for ordinary traffic in addition to the railway line. The work is estimated to cost approximately £35,000, and according to contract terms must be completed within 16 months, the whole of the work being carried out without any interference to ordinary traffic crossing the bridge.

* * * *

Growth of the Canadian Motor Car Industry

The rapid development during 1928 of the Canadian motor car industry is clearly shown by the published figures of production for the eleven months ending November last. During this period, 232,957 cars were built, with a sales value of approximately £36,625,600. This represents an increase of 33 per cent. in number, and 27 per cent. in value over the corresponding totals for 1927, for which year the figures were 175,948 cars, valued at £28,818,400.

The dominion Bureau of Statistics gives the number of cars produced in Canada in November last as 11,769, as compared with 6,617 cars reported for November 1927. The value of the cars manufactured last November was approximately £1,648,000.

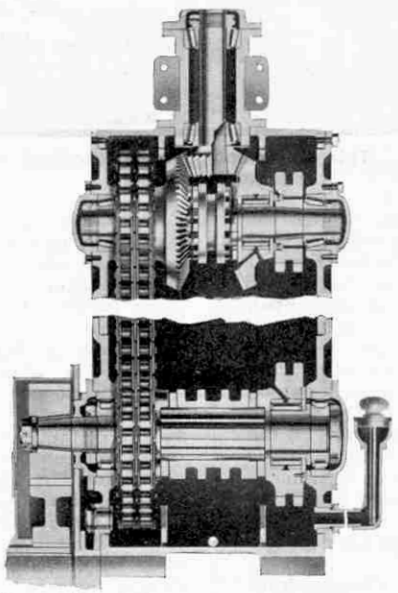
* * * *

Swing Bridge for Birkenhead Docks

A new hydraulic swing bridge weighing 870 tons is the latest development in the improvements proceeding on the Birkenhead Docks, of which mention was made in our October 1928 issue. The bridge spans a passage 80 ft. in width and 40 ft. in depth, between the Alfred Dock and the East Float, and has been built to accommodate foot, road and rail traffic. The cost of the bridge has been approximately £300,000.

New Southern Railway Channel Steamer

A new passenger steamer, "*The Canterbury*," specially designed for the Southern Railway's London-Paris services, in conjunction with the "*Golden Arrow*" express, has been launched at Dumbarton by William Denny Bros., and will be ready for service in time for the summer traffic. The new vessel, which will cost £220,000, will have a tonnage of 2,800, as compared with the 2,656 tons of the "*Maid of Kent*" launched in 1925. "*The Riviera*," which was launched in 1911, has a tonnage of 1,676, which affords an interesting example of the development of cross-channel steamers during recent years.



The gear-box of the Kerr Stuart locomotive (described in our January issue), showing Duplex Chain Transmission and the reversing arrangements

The Latest French Submarine

What is probably the largest and fastest submarine in the world was launched recently for the French Navy. The vessel has been named the "*Surcouf*," and is approximately 400 ft. in length—almost the length of a light cruiser—and has a surface displacement of 3,250 tons, and a displacement when submerged of 4,000 tons. The vessel's Diesel engines give her a surface speed of from 22 to 23 knots.

A notable feature of this submarine is that complete armour protection has been provided for all vital parts that are exposed when on the surface. The hull is of exceptional strength and is divided into a series of watertight compartments, while escape hatches are fitted at various points.

World's Longest Bridge Span

The longest bridge span in the world will be incorporated in the "Ambassador" bridge over the Detroit River, which is rapidly approaching completion. The span will be 1,850 ft. in length, thus exceeding by about 100 ft. the length of the main span on the Philadelphia-Camden bridge, which is approximately 1,750 ft. The "Ambassador" bridge joins Detroit, in the United States, and Sandwich, in Canada, and is approximately 9,000 ft., or over 1¼ miles, in total length. It is 47 ft. in width, and will be able to take five separate streams of road traffic. There will also be a footway 8 ft. in width.

In addition to the new bridge, another means of communication between the two countries will be available shortly, when a huge tunnel joining Detroit and Windsor is to be opened in September or October next. The tunnel will have a total length of approximately 5,600 ft. and it will be capable of dealing with a yearly traffic of over 1,750,000 motor vehicles and 23,000,000 passengers. In the November 1928 issue of the "*M.M.*" it was stated that the estimated cost of the two schemes was approximately £9,800,000, but a more recent and more accurate estimate reduces this figure to £9,000,000, the tunnel itself costing approximately £4,000,000.

* * * *

Objects of the Shannon Power Scheme

In the course of a paper on the Shannon hydro-electric power scheme, read recently before the Royal Society of Arts, Mr. George Fletcher (late member of the Water Power Resources, Ireland, Committee) said the exploitation of our water power resources had been delayed too long, especially in Ireland, which had suffered greatly from its lack of fuel. The primary need of the Irish Free State was cheap electric energy for lighting and power, and that it would be the function of the Shannon scheme to provide. The first effect would be to improve greatly the conditions of the country towns. There were approximately 130 towns and villages, with a minimum population of 500, in which at present no electric supply existed. As many of these places as possible would be given the benefit of the current when it became available, and already contracts had been given for the erection of distribution networks in more than 30 of them.

* * * *

During 1928 a total number of 203,209 passengers crossed the North Atlantic in Cunard ships. This is the fifth successive year that the Company have carried more passengers than any other line.

Captain Campbell's New Speed Attempt

Captain Malcolm Campbell and his powerful racing car, the Napier-Arrol-Aster "*Bluebird*," are now in South Africa, where Captain Campbell hopes to wrest the world's land speed record from America. His wife and two children, together with two Royal Automobile Club official timekeepers and a number of mechanics, have accompanied him from England. The attempt will most probably be made in the very near future at Verneuk Pan. This is a vast expanse of extremely flat sun-baked clay, about 3,000 ft. above sea-level, and some 450 miles from Cape Town. Banks of pebbles are found scattered over the area, which is said to be the bed of a dried-up lake, and a course extending far enough for the attempt to be made with safety will be cleared by gangs of natives.

One of the disadvantages of making the attempt at Verneuk Pan is the extreme difficulty of reaching the place. In addition to the voyage from England to Cape Town, a rail journey of over 600 miles has to be undertaken, followed by a 75-mile overland trek. Some idea of the transport difficulties to be overcome may be gathered from the fact that fares alone are costing £1,500. The total cost of the attempt probably will be somewhere about £30,000.

Captain Campbell has taken his D.H. "Moth X," numbered G-AAAJ, with him, so that in the event of a visit to Cape Town becoming necessary for any urgent reason, he will be able to carry this out in the shortest possible time.

The "*Bluebird*" has been modified considerably since it broke the world's record a year ago at Daytona Beach, Florida. The most noticeable alterations are the removal of the radiators over the rear wheels, and the substitution of a more orthodox type in the nose of the car, and the improved streamlining at the back of the car.

* * * *

Large Boilers for Battersea Power Station

Messrs. Babcock and Wilcox now have under construction at their works the complete steam-raising plant for the London Power Company's new power station at Battersea. The plant will consist of six water-tube units, the largest in Great Britain, and each capable of evaporating a maximum of 312,000 lb. of water per hour. The average hourly evaporation will be about 250,000 lb. The plant will operate at the extremely high pressure of 600 lb. per sq. in. and will be equipped with mechanical stokers.

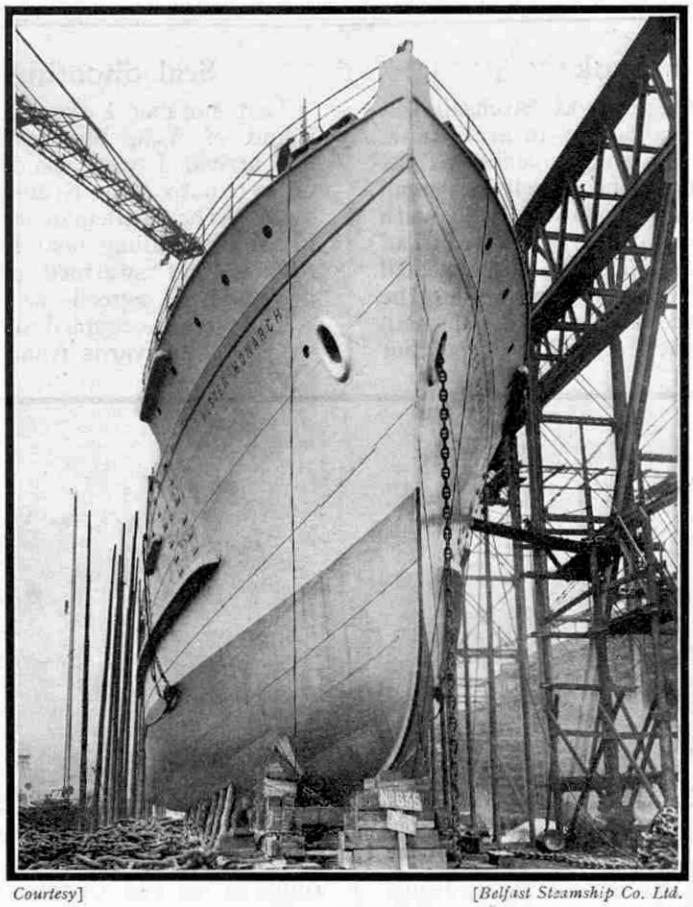
* * * *

World's Largest Furnace

What is claimed to be the largest electric steel-melting furnace ever made, has recently been constructed by a Sheffield firm. The furnace has a capacity of 30 tons and has been constructed for a steel works in Spain, where it will replace an open-hearth furnace.

Mid-East-England Electrical Development

A sum of more than £4,500,000 will most probably be expended in connection with the mid-east England electricity scheme of the Central Electricity Board. The area covered by the scheme is approximately 7,550 sq. miles and includes the whole of Lincolnshire and Rutland, and the East and West, and part of the North Ridings of Yorkshire, and part of Nottinghamshire and Derbyshire, the population of which area is approximately 4,665,000. The estimated expenditure is for the period extending up to 1935-6 and the minimum saving that is expected will be afforded by the scheme has been estimated to be in the region of £1,400,000.



Courtesy [*Belfast Steamship Co. Ltd.*

The "*Ulster Monarch*," a fine motor ship built by Harland and Wolff Ltd., for the Belfast Steamship Company Ltd. Our photograph shows the vessel on the stocks immediately before being launched

* * * *

Oil Versus Steam

Although at first thought there has appeared to be a glut of motor vessels recently, it is obvious from a perusal of Lloyd's Register that the internal combustion engine has sustained a definite check in its progress and popularity for marine work. This is borne out by the fact that in December last, there were under construction 257 motor vessels giving an aggregate of 1,395,868 tons, as compared with 254 ships, of 1,419,602 tons, in September—a decrease in tonnage of 23,734 tons. During this period the number and tonnage of steam vessels under construction increased from 300 vessels aggregating 1,084,958 tons, to 342 vessels, of 1,211,553 tons—a clear gain of 42 vessels and 126,595 tons.

A Fine New Motor Vessel

The "*Ulster Monarch*," the first of three twin-screw passenger motor vessels for the Belfast-Liverpool service of the Belfast Steamship Company Ltd. (Ulster Imperial Line), was launched recently from the yard of Harland and Wolff Ltd. The other two vessels are to be named "*Ulster Queen*" and "*Ulster Prince*." These vessels will be the first motor ships to be employed in British cross-channel services.

The "*Ulster Monarch*" is a fine handsome vessel with a cruiser stern and two funnels of the type that is now becoming formal for motor ships. Her principal dimensions are length between perpendiculars, 345 ft.; breadth, moulded, 46 ft.; depth, moulded, 19 ft.; gross tonnage, 3,760. The double bottom extends the whole length of the ship and the hull is subdivided into eight watertight compartments. The berthing arrangements provide for 419 first-class and 86 third-class passengers.

The public rooms on the ship have been designed with great taste and with the fullest regard to the maximum comfort. Oak panelling is employed effectively for the main entrance on "B" deck. The dining saloon is decorated in Louis XVI style with cherry-coloured mahogany panelling. On "A" deck the lounge is panelled in polished greywood and amply provided with luxurious settees, while the smoking room and verandah cafe on the boat deck are in Old English Tudor style, after the manner of a country inn.

The propelling units of the vessel consist of two ten-cylinder airless injection Diesel engines of the Harland-Burmeister and Wain type. The whole of the auxiliary machinery is electrically operated, and the equipment is remarkably complete, especially in regard to safety devices.

* * * *

Dock Improvements at Sunderland

Several improvements at the Port of Sunderland have been necessitated by the increased number of vessels using the port for the importation of various goods, resulting from the deepening of a gateway connecting the Hudson and Hendon Docks.

In connection with these improvements five new Babcock and Wilcox 5-ton electric cranes have been installed for the discharge of iron ore. The cranes are of the level luffing type and have a radius of action of 47 ft. Three smaller cranes each capable of hoisting a load of three tons have also been installed, and these additions, together with a supply of electric power with which the East Dock has been equipped, bring the cargo-handling facilities to a high standard of perfection.

The River Weir Commissioners are also contemplating the construction of a new gravity staith at one of the docks. The new quay upon which the staith will be erected will be 500 ft. in length while four gravity spouts and at least one belt conveyor are to be fitted on the staith itself.

FROM OUR READERS

Contributions not exceeding 500 words are invited, with or without photographs or sketches for use as illustrations, and payment will be made for all articles published. The Editor takes no responsibility for the accuracy of statements contained in such articles, nor for the opinions of contributors.

A Ride in a Tank

While attending the O.T.C. camp at Strensall last year, I had an opportunity of a ride in an army tank. I scrambled eagerly through the small opening at the back that served for entry, and found myself in a small square compartment that seemed to be lined with hard and unpleasant protuberances. When I had become accustomed to the dim light, I distinguished two machine guns, and the gear for swivelling the three-pounder with which the tank was also armed. All projecting angles were padded with leather, but even that was too hard for my liking.

When I had settled down, the engines were started and the tank shot forward with a violent jerk. The ungainly vehicle made light of all obstacles. It demolished hedges and gorse bushes, and took ditches and banks in its stride. I was becoming accustomed to the unfamiliar motion when suddenly I was thrown violently to one side. The driver had brought the caterpillar track on one side to a standstill, with the result that the tank had made a sudden turn at right angles!

Group of O.T.C. Cadets examining an army tank. The difference between the caterpillar tracks of the two vehicles is clearly noticeable

At the end of the ride I squirmed very willingly through the doorway into the fresh air. I was distinctly the worse for wear, for my head was bruised where it had come into violent contact with the butt end of a machine gun! I had greatly enjoyed the experience, however, and should have had no hesitation in accepting a second invitation.

J. E. C. RICKMAN (Cobham, Surrey).

Engraving on Metal

Readers of the articles on the preparation of blocks for illustrating the "*M.M.*" will be interested to know that they can engrave names on medals or coins in a similar manner. For instance, I succeeded in making a very good label for a rose tree by coating both sides of a small sheet of metal with paint, and scratching on it the name of the tree. I then placed the sheet in weak hydrochloric acid. This attacked the metal where it had been exposed by removal of the paint. When a sufficient depth of metal had been removed I washed the label, and finally removed the paint with turpentine.

I then tried to make labels with raised letters. This I did successfully by painting the letters and allowing the acid to eat away the surrounding metal thus left exposed.

HARRY RUMBOLD (Reading).

Seal Shooting in the Shetlands

Last summer I spent an interesting holiday in the island of Yell, Shetland. About three weeks after my arrival I was asked to accompany several boys on a trip to Haaf Grüney, an island about five miles away. The gentleman who invited us was going there in his own sailing boat in order to shoot some of the rabbits that swarmed on the island. As may be imagined, I agreed willingly!

The voyage occupied about an hour and a half. When we were 200 yards from Haaf Grüney the sails were lowered and we rowed the boat into a small fiord. We were still more than a yard from the shore when I was rather alarmed at being told to leap across with the heavy rope, for the so-called shore was only a strip of rock two yards in width! I made a great effort, however, and soon we were all on the island. The gentleman went off searching for rabbits, while I and the other boys wandered about and explored the ruins of an old Celtic "broch," or castle.

The time to go home came all too soon, but the return trip was enlivened by the sight of a seal. This was spotted soon after we left the island, and after an excited discussion it was decided to try to shoot the animal and tow it home. One of the boys barked like a seal and the creature appeared on the surface, but it dived again before aim could be taken. It is said that a seal will not appear twice in succession, but we waited patiently for ours to come up once more, and this, at length, it did.

This time our host succeeded in hitting it, but he failed to kill it outright. We rowed up as close as we dare and tried to throw a noose round it, but this was not easy, for the animal was writhing and plunging furiously. At the fifth attempt we were successful, however, for by then the seal was almost dead. Sail was then hoisted and we set off for Yell, where we arrived an hour behind our time on account of the extra weight of the seal that we were towing.

While waiting for the seal to reappear I was reminded of the patience displayed by Eskimos. When they discover the breathing hole of a seal in the sea ice they sit motionless for hours waiting for the animal to come up. As each seal usually has several breathing holes this is a slow business, but possibly if my life depended on seal-hunting I should become as patient as an Eskimo.

HECTOR THOMSON (Edinburgh).

My Visit to the Victoria Falls

Last year I spent a very enjoyable holiday visiting the world-famous Victoria Falls. The train in which I left Johannesburg was drawn by a 2-8-2 : 2-8-2 Garratt locomotive, but on reaching Mafeking a Rhodesian engine took charge and remained at the head of the train during the whole of the 24-hour run to Buluwayo. Several stoppages were made, and at every station the train was met by crowds of natives selling skins and other curios.

After a wait of several hours at Buluwayo, I left for the Falls in Rhodesian coaches drawn by a Canadian-built engine. It was 6.30 on the morning of next day when I arrived at my destination, but after a bath and breakfast I was quite ready to begin my exploration of the interesting surroundings of the wonderful Falls.

The main cataract of the Victoria Falls. Our reader, F. Inglis, is standing on the right of the photograph

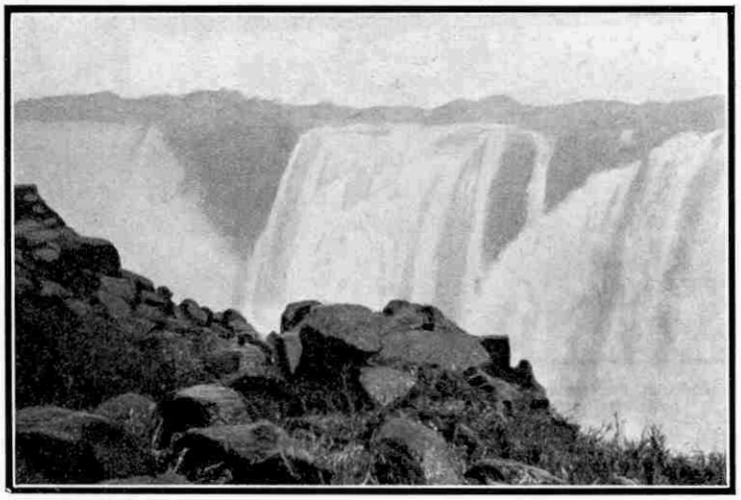
My first visit was paid to the Gorge, a zig-zag chasm nearly 40 miles in length, through which the foaming waters rush after plunging over the brink of the Falls. Later in the day I crossed the famous Bridge that spans the Zambesi River at this point, and saw the cataracts into which the Falls are divided by rocks and islands. At the period of my visit the river was low and I was able to wade in it. To my surprise I found a number of old bayonets in the water. These were triangular in cross-section, and probably were thrown in at the time of the Matabele War more than 30 years ago. I took one of them home with me as a curio.

The level of the water in the Gorge shows remarkable variations. During the rainy season it may be as much as 56 ft. higher than in the dry period. It was a little unfortunate for me that I saw the Falls when very little water was passing over, but it was sufficient to enable me to appreciate their native name. This is " Sounding Smoke," a description that aroused the curiosity of Dr. Livingstone, who was the first European to visit the cataract. He heard of the Falls from a native chief, who asked him if there were any " sounding smokes " in Great Britain ; and it was the sight of immense columns of mist ascending to the sky that revealed their presence to him as his canoe descended the Zambesi River. I saw a considerable amount of mist, but could only imagine the wonderful spectacle that the Falls present when there is an abundance of water.

The Rainy Forest and the Boiling Pot also were not at their best at the time of my visit. The former is a forest on the southern bank of the river, below the Falls, which in the rainy season is bathed in spray, but I passed through it without getting very wet. The Boiling Pot was more impressive. In order to reach it I followed a path leading into the gorge, and after rounding a huge stone suddenly found before me a bubbling pool of water 300 ft. in breadth. The river is very tumultuous at this point, and roars and sizzles like water boiling in a gigantic kettle.

I stayed several days at the Falls, and thoroughly enjoyed every moment of my experience. I saw troops of baboons on several occasions, and one afternoon I was thrilled by the sight of a crocodile calmly floating down the stream. The whole district was full of interest, and I was very sorry indeed when the time came to return home. I shall visit the Falls again, and then I hope to see them at their best.

F. INGLIS (Johannesburg).



Another view of the Victoria Falls. The islands on the brink are partly hidden by clouds of spray

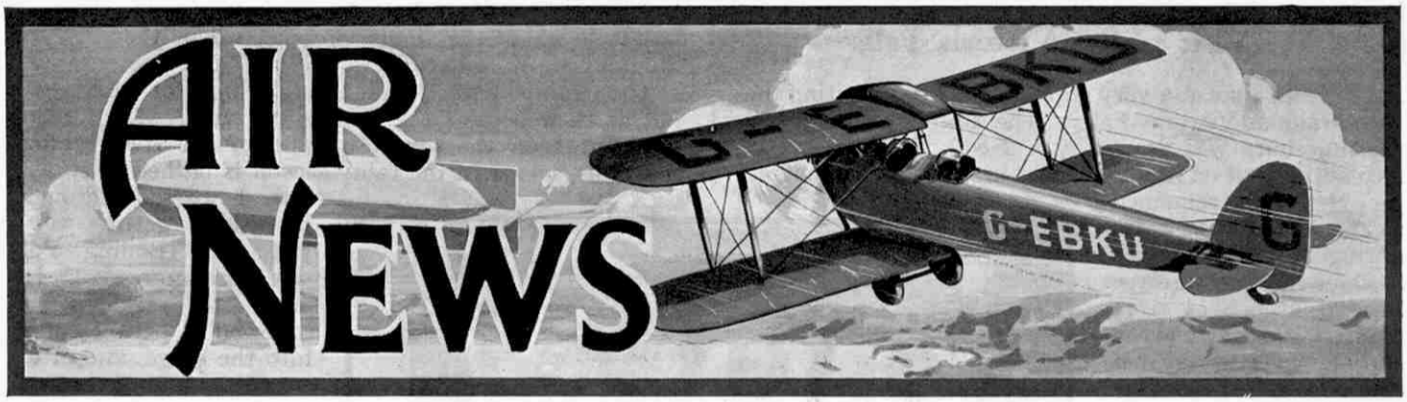
Life in Malta

To an English boy life in Malta is very strange. The Maltese are a curious people who speak a language that is partly Italian and partly Arabic, but practically all the townspeople are able to converse in broken English. They seem to live in a state of poverty. The usual meal of the country people consists of a loaf of bread out of which a hole has been scooped, which is filled with small fish soaked in olive oil. The inhabitants of Valetta, the capital of the island, are always eager to buy pennyworths of scraps from the warships !

The streets of Valetta are very steep and many of them actually are composed entirely of steps ! In one of them, in which Sir Walter Scott lived during his stay in Malta, is St. John's Church. This is the largest church on the island, and on its tower is a remarkable clock that records not only minutes and hours, but also weeks and months.

For travelling about Valetta, " carrozzins " or cabs are used, but the " dghaisas " in which one moves about in the harbours are far more interesting. They are like Venetian gondolas, except that their ends are straight instead of curved.

R. PARNELL (Malta).



Pick-up Apparatus for Air Mails

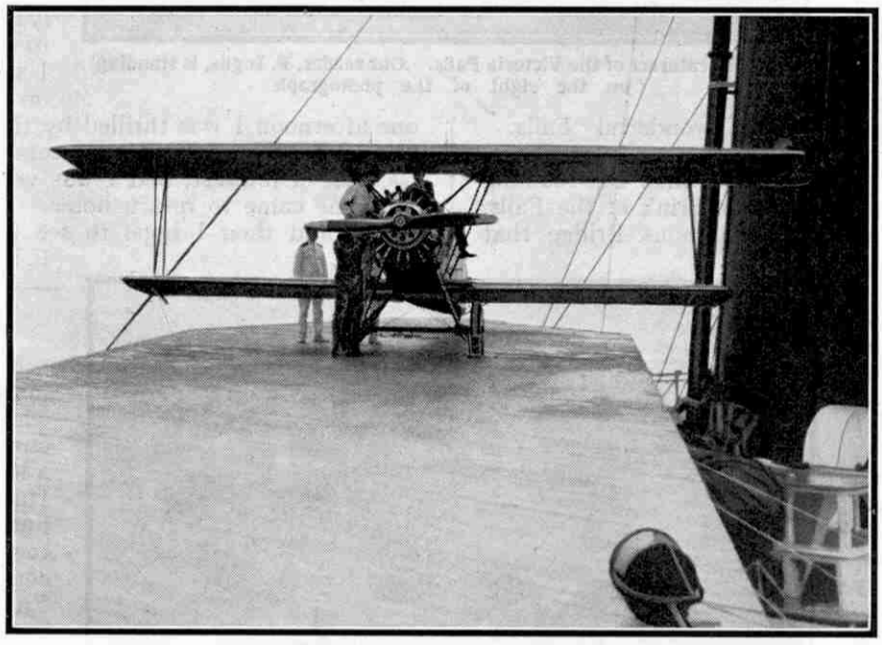
An apparatus by means of which an aeroplane may either pick up or deliver mail bags and articles of a similar nature has been subjected to a series of experiments in America. The tests have proved remarkably successful, for the device never once failed to operate perfectly.

The apparatus consists of a trap that resembles the bow section of a boat, the wide end of which has been left open. The deck is made in two sections which slope downward toward the centre line and are separated by a narrow slot. A pilot who wishes to pick up a mail bag lowers a steel cable, to the end of which a heavy ball of the same metal is attached, and flies low over the chute in such a manner that the steel ball enters the open end. The cable automatically finds its way into the slot between the two halves of the deck and the further flight of the machine drags the ball to the apex of the trap. There it engages a coupling arrangement, which is lifted out of the slot by the cable as the aeroplane continues on its course.

Attached to the coupling is a mail bag. A sudden jerk when the cable took the weight of this would make the aeroplane difficult to control, and therefore a catapult is incorporated in the device. This shoots the mail bag forward into the air at the moment when the coupling is lifted, with the result that the strain is applied gradually. The pick-up is built on a turntable in order that the aeroplane may fly into the wind while approaching the device.

The cable is raised and lowered by means of an electrically-operated reel that hauls up a heavy mail bag with great speed. If the steel ball were to become jammed while the device was in action, the result would be disastrous to the aeroplane. In order to avoid this an automatic release is fixed, the use of which ensures that the cable is pulled loose from the machine before it is possible for any damage to be done.

The chute is ingeniously arranged so that one lot of mails may be delivered and another lot picked up in the same operation. When this is to be done the mail bag for delivery is carried into the chute at the end of the cable, along with the steel ball. The coupling unit then releases the bag as the ball enters it. Provided this pick-up apparatus proves sufficiently reliable for every-day use, it should play a prominent part in the development of air mail services. Many more trials will be necessary, however, before a final decision can be made.



Clarence Chamberlin, the famous Trans-atlantic pilot, entering his machine on the deck of the U.S. liner "Leviathan" prior to a successful pioneer effort in ship-to-shore mail-carrying

* * * *

Aerial Tour of 3,000 Miles in Seven Days

The Queensland and Northern Territories Aerial Service have completed the longest and most important tour yet organised by them, in conveying Air-Marshal Sir John Salmond, on a seven days' aerial tour of over 3,000 miles. Special arrangements were made for petrol and oil supplies in Central Australia, and some idea of the isolation of certain points at which petrol had to be provided, may be gained from the fact that at one point the price charged for petrol was 7/4 per gallon!

The machine used for the tour was a Bristol "Jupiter" D.H. 50, capable of a cruising speed of 105 m.p.h. This type of aeroplane forms an ideal taxi machine, its cabin seating four passengers comfortably.

The Karachi Airship Shed

The new airship shed at Cardington, an illustration of which was published in these pages in January last, is the largest airship shed in England, and is wide and high enough to house either the London Olympia, the main building of the Crystal Palace or the Nelson Monument. In spite of its vast size, however, this shed is eclipsed by one that has recently been constructed at Karachi. This is claimed to be the largest single building in the world, and it would be capable, with very little modification, of housing the whole of St. Pancras Station, which is the largest station in the United Kingdom, under a single span.

The shed, which was built by the Armstrong Construction Company Limited of London, is situated about 13 miles east of Karachi. It measures 890 ft. in length, 230 ft. in breadth and 200 ft. in height. It is constructed entirely of steel, and in such a manner that, if the necessity ever arises, it may be dismantled and re-erected at some other place in a very short time. It lies in an approximately due east-to-west position. The east end has two sliding doors each 171 ft. in height and 91 ft. in width, and the west end is faced with a blank wall.

* * * *

Lady Bailey's 18,000-Mile Solo Flight

Lady Bailey recently completed a remarkable 18,000-mile solo flight from London to Cape Town and back. The trip was made in her own de Havilland "Moth," fitted with a Cirrus engine developing a maximum of only 30 h.p. Lady Bailey is thus not only the first woman to accomplish this journey by air from London to Cape Town and back, but has the distinction of having made the longest solo flight on record.

* * * *

The International Aeronautical Federation have awarded the Gold Medal for the finest air exploit in 1928 to Sqdn.-Ldr. Hinkler, for his England–Australia flight in an Avro "Avian."

The Blackburn "Bluebird" Mark IV

The Blackburn "Bluebird" Mark IV, which is the latest product of the Blackburn Aeroplane and Motor Company Ltd., promises to prove an extremely useful and popular machine. It is of the all-metal construction type, fitted with side-by-side seating arrangements to accommodate two people, and it is confidently expected that its maximum speed will considerably exceed 100 m.p.h. It will be available either as a land machine or as a seaplane, and a choice of three engines will be available—the de Havilland "Gipsy," the A.D.C. "Cirrus III" and the Armstrong-Siddeley "Genet." The design follows in general that of the earlier wooden construction type. According to a description of the machine that appeared in "*Flight*," "forms of metal construction have been evolved which are so amazingly simple as to remind one irresistibly of the well-known Meccano!"

The "Bluebird" has a wing span of 30 ft. and a total wing surface area of 246 sq. ft. The total length of the machine from end-to-end is 23 ft.

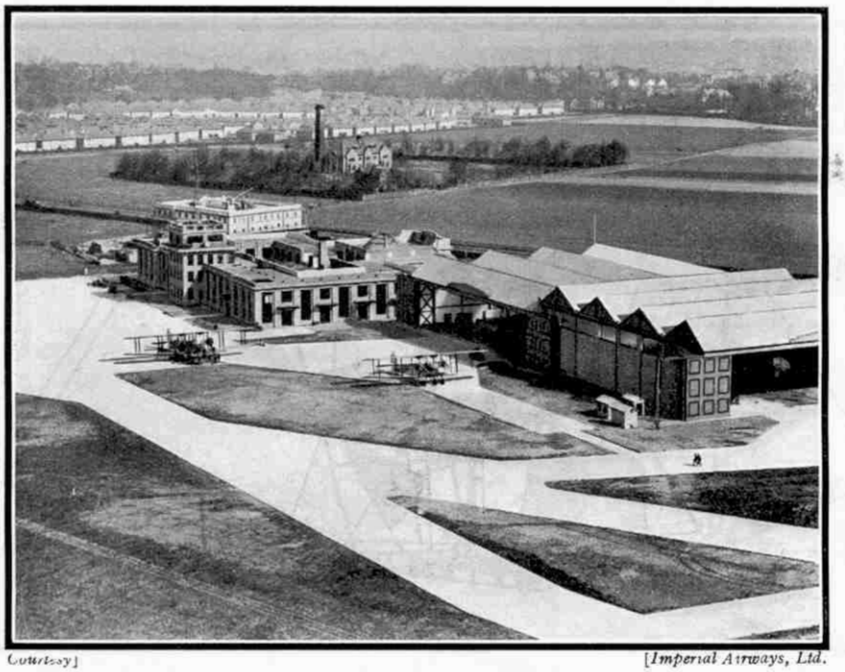
Performance details of this interesting machine are not yet available but we shall publish photographs and further particulars at the earliest possible moment.

* * * *

Interesting Features of New British Air Liners

The three new Armstrong Siddeley Argosy air liners now being built at Coventry for Imperial Airways Limited, will be equipped with an interesting type of servo lateral control which when combined with the anti-stalling automatic slots will make the machines still safer and easier to fly. The new liners will be fitted with more powerful Jaguar engines of the geared type and as the propellers turn slower in consequence and are situated farther away from the cabin their noise will be less noticeable. An improved arrangement of exhaust pipe will also decrease the noise, while the comfort of passengers has been further studied by the perfection of a new type of ventilating system and a very attractive interior colour scheme designed by a well-known artist.

The effect of various improvements in design has been to increase the cruising speed from 90 to nearly 100 m.p.h. The radius of action has also been increased from 350 to 500 miles owing to the larger supply of petrol carried. If more attention was paid to streamlining on these large machines it is very probable that an extra 60 m.p.h. could be achieved with a similar engine to the one being used at present.



Courtesy] [*Imperial Airways, Ltd.*

The Air Port of London, after its extensive reconstruction, is the most efficiently equipped and most up-to-date aerodrome in the world. Our illustration shows a section of the new buildings photographed from the air, and in the foreground will be seen two of the giant air liners used on the London-Paris air service

R.A.F. Apprentice Clerks

The Air Ministry announce that 60 vacancies exist in the Royal Air Force for well-educated boys between the ages of 15½ and 17 to enter as apprentice clerks. Approximately 30 of the positions will be filled by means of an open competition that will be held by the Civil Service Commissioners in April at various centres, and the remaining 30 by direct entry of boys who have obtained an approved school certificate. Successful candidates will be required to complete a period of 12 years' regular Air Force service after reaching the age of 18, in addition to the training period. At the age of 30 they may return to civil life or may be permitted to re-engage to complete time for pension.

Boys entered under this scheme undergo a two years' course of training in clerical duties, during which time their general education is continued under graduate teachers.

The apprentice clerks are paid 1/– a day for the first year, and 1/6 a day afterwards until they have both attained the age of 18 and been posted for duty after passing their final examination. The subsequent commencing rates of pay, varying from 3/– to 4/6 a day, depend upon the degree of success achieved at this examination. In addition they receive free board and lodging.

Detailed information regarding this scheme may be obtained from the Royal Air Force, Gwydyr House, Whitehall, London, S.W. 1.

Short Service Officers for R.A.F.

The Air Ministry announce that about 100 officers will be required by the Royal Air Force for flying duties during the next few months under the short service commissions scheme. Applications are invited from well-educated young men of sound physique and between the ages of 18 and 25. From these applicants candidates will be selected to appear for interview at the Air Ministry in London, and if accepted they will be granted short service commissions for five years on the active list and four years on the reserve. During their period of service, short service officers are afforded facilities for study with a view to preparing themselves for civil life, and assistance is given them in finding employment when they pass to the reserve.

Accepted candidates enter as pilot officers on probation with pay of about £273 per year, increased on promotion to flying officer, normally after 18 months' service, to about £343. Officers receive also free quarters, rations, fuel and light, etc., or where these are not available, cash allowances instead amounting at present to about £141 per year. On joining for duty officers with no previous service in H.M. Forces receive an outfit allowance of £50. Gratuities of amounts varying according to length of service are payable on termination of such service.

Application forms and full details may be obtained from the Secretary, Air Ministry, Kingsway, London, W.C.2.

* * * *

Proposed Seaplane Service to Norway

A scheme to establish a regular seaplane service between Harwich and Oslo is under consideration, and if this materialises Harwich will become the first English air-seaport. The scheme provides also for a motor coach service between London and Harwich. The total length of the journey to be covered by seaplanes is approximately 950 miles, and the machines will fly direct from Harwich across the North Sea to Rotterdam, from where they will proceed to Oslo by way of Amsterdam, Hamburg and Copenhagen. It is estimated that the service would enable a passenger to travel from London to Norway in the remarkable time of 9 hours.

* * * *

The United States Army contemplate carrying out a number of improvements, costing approximately £400,000, at their Military Air Port at Wheeler Field, Honolulu. The improvements will mainly consist of the construction of new living quarters for the officers and men stationed there, providing accommodation for an extra 82 officers and 1,082 men.

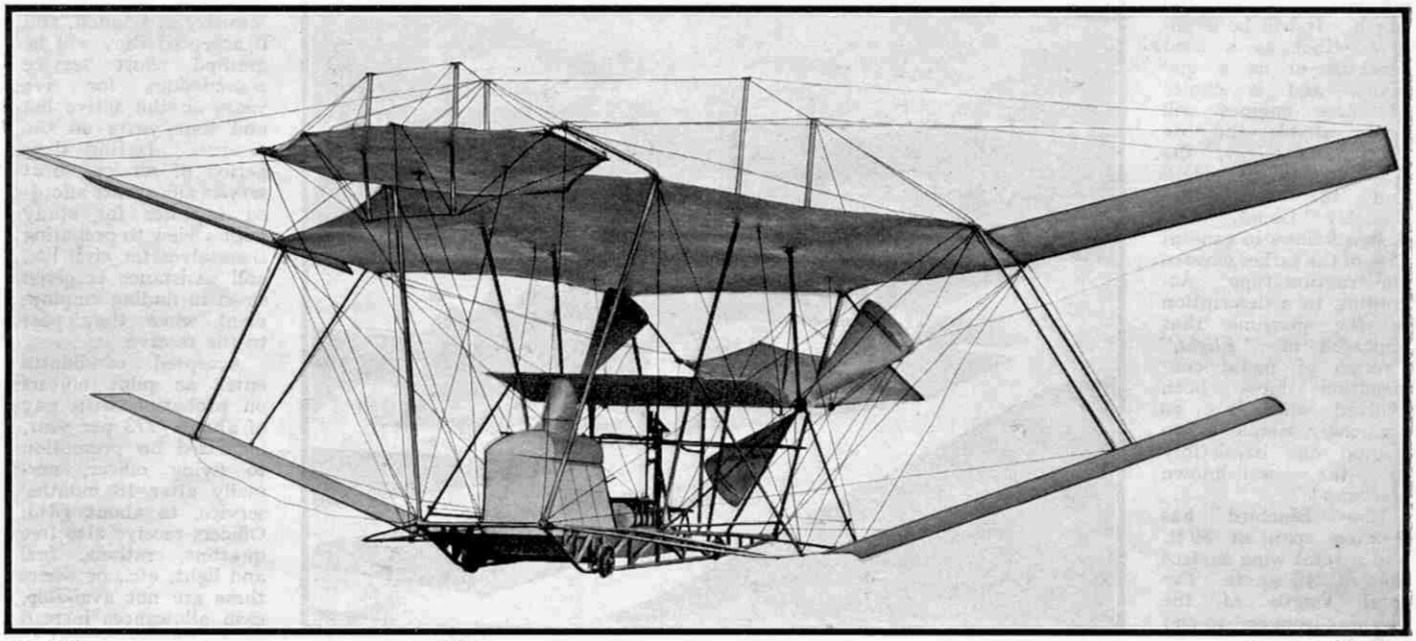
THIS MONTH'S AIR STORY

Lady (inspecting Service machine): "What do you do if your parachute fails to open when you have jumped from the aeroplane?"

Flying Officer (very bored): "Oh! We just go back and get another one."

The Conquest of the Air

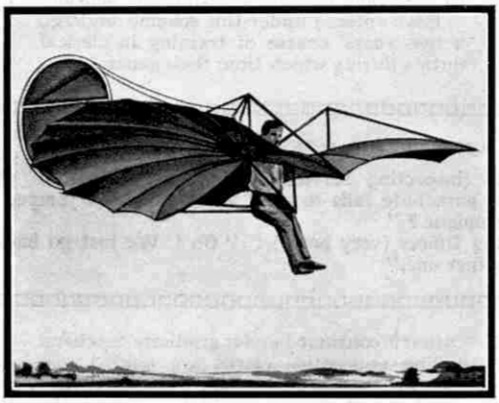
Development of the Aeroplane



Courtesy] [*Board of Education*

The flying machine built by Sir Hiram Maxim in 1894. It is of great historical importance as being the first machine to lift itself, with engine, boiler, fuel and passengers, completely off the ground. It is of interest to compare the massive construction of this monster with that of a light modern machine such as the de Havilland "Moth"

DURING the 19th century it was commonly believed that the problem of flight by means of heavier-than-air machines could only be solved by the creation of some type of huge artificial wings. Inventors studied the movements of large birds in flight and endeavoured to imitate them by means of gliding machines. One of the most thorough investigators of bird flight was Otto Lilienthal of Berlin. After a prolonged study of the subject he constructed a flying machine in 1895. This had a span of 22 ft. and embodied two concave wings arranged horizontally with an aperture between them to accommodate the pilot. Their degree of curvature had been carefully calculated so that they should bear the same relation to the body of the pilot as the wings of a bird do to its body. The wings were made of linen stretched over a willow framework, and had an area of approximately fourteen square yards.



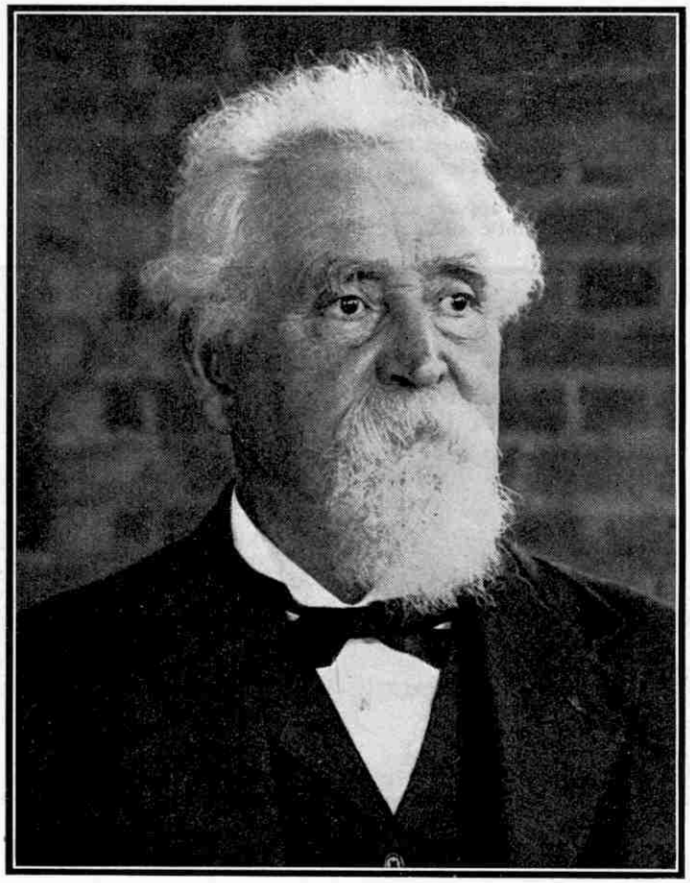
Lilienthal making a flight in his glider

The body of the machine consisted of a circular horizontal hoop of willow, to the left and right of which were the wings, and of two long willow rods one on each side of the hoop. These rods extended in a fore and aft direction and converged to a point some distance to the rear of the wings. The main frame terminated in a tail portion consisting of a small horizontal wing hinged separately to a vertical plane that was attached rigidly to the body of the machine. A main beam or strengthening bar, of X shape, extended from wing to wing across the front of the hoop, while immediately behind the beam was the aperture that accommodated the upper part of the pilot's body. To ease his position two small bolsters were attached one on each side of the hoop to serve as shoulder rests, while rests for his arms were provided in the corners of the main beam.

Lilienthal's machine was of the glider type, and as he was unable to discover a suitable elevated area of land from which to carry out his attempts at flight he built up, near Berlin, a large earthen mound almost 100 ft. in height and conical in shape. In practice, the machine was hauled to the summit of the mound, Lilienthal assumed the pilot's position, and having made himself secure ran downhill against the wind. As he gained speed the upward pressure of the wind on the under side of the wings increased until it overcame the weight of man and machine and Lilienthal was lifted off his feet and carried through the air until the machine lost speed and descended to earth again.

In this manner the glider attained an altitude of 75 ft. and sailed more than 100 yds. in one minute. Lilienthal depended upon his instinct to maintain his equilibrium, and controlled the machine by shifting the position of his body to counteract any deviation from the level position.

Experimental flights were made in the direction of the wind as well as against it, and when backed by the wind the machine travelled much farther before descending to earth. On one of these occasions Lilienthal accomplished an aerial voyage of 400 yd. When flying with the wind he regulated his descent by means of some braking arrangement by which an increased surface of wing could be offered to the air, and the velocity of the machine reduced. Later he fitted a series of feather sails to the extremities of the wings. These sails were connected to a small machine driven by carbonic acid gas and situated adjacent to the pilot's accommodation. The engine, and with it the sails, could be set in motion by the pressure of a finger. He found that the engine greatly increased the weight of the machine, however, and rendered it considerably more difficult to handle.



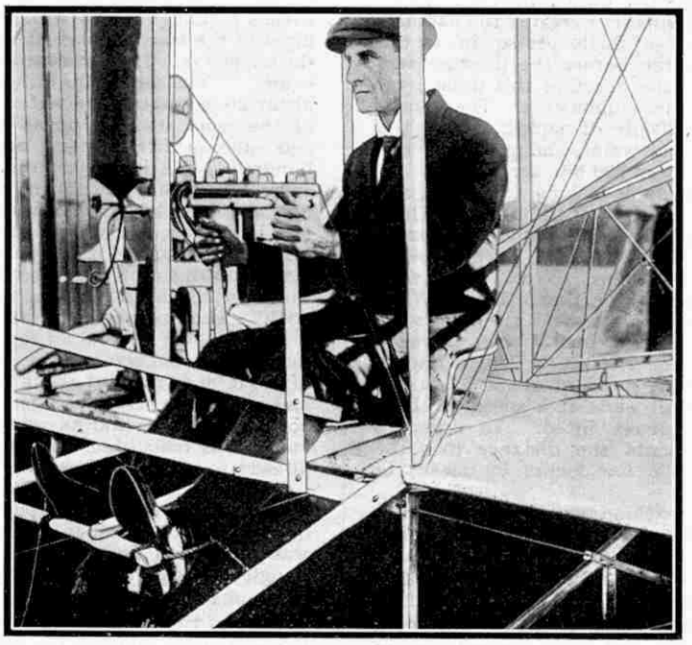
Sir Hiram Maxim

The success that Lilienthal attained with his experiments attracted considerable attention and won him praise and admiration from scientists and aeronauts both in Europe and America, where experimenters soon began to emulate him.

Lilienthal now became desirous of carrying out experiments in winds of such strength as to carry him long distances. For this purpose he constructed a second machine, consisting of two smaller wings placed one above the other, instead of two large wings side by side as in his first machine. He found that with the new glider he could take off from the hilltop in a wind with a velocity of 18 ft. per second without having to make a preliminary run downhill as before.

Sometimes during these flights the machine would remain poised in the air at a higher altitude than that at which it had taken off from the mound. Speaking of these occasions Lilienthal once declared: "I feel very certain if I leaned a little to one side, and so described a circle, and further partook of the motion of the lifting air around me, I should sustain my position. The wind itself tends to direct this motion; but then it must be remembered that my chief object in the air is to overcome this tendency of turning to the left or right, because I know that behind or under me lies the hill from which I have started, and with which I would come in rough contact if I allowed myself to attempt this circle sailing. I have, however, made up my mind, by means of either a stronger wind or by flapping the wings, to get higher up and further away from the hills, so that sailing round in circles, I can follow the strong up-lifting currents and have sufficient airspace under and around me to complete with safety a circle, and lastly, to come up against the wind again to land."

After further experiments Lilienthal considered that he had learnt all that gliding machines could teach him and he turned his attention to perfecting a self-propelled or power-driven flying machine. The internal combustion engine as adapted to motor cycles was at that time just becoming popular, and Lilienthal decided to instal a petrol-driven motor in his next machine. This was completed by August 1896, and on the morning of 9th August that year he indulged in a last flight in his glider before venturing aloft with the power-driven aeroplane. He commenced his flight in the glider from the village of Rhinow, in the province of Bradenburg, and had sailed through the air for a distance of approximately 200 yds. when a sudden gust of wind caught the machine and carried it swiftly upward. Lilienthal failed to maintain control of the wings and the machine crashed to earth from a height of 50 ft. His spine

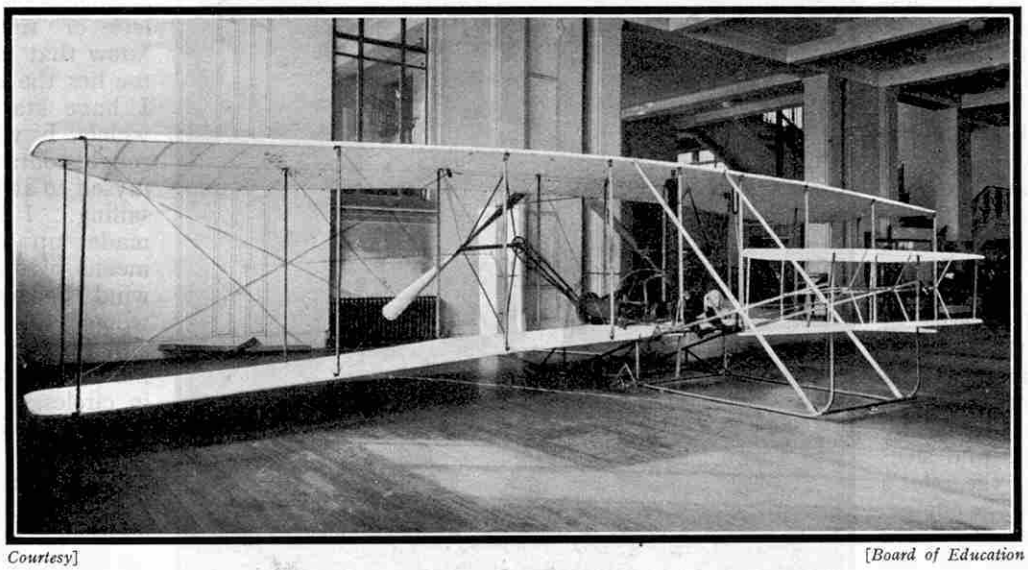


Wilbur Wright in his power-driven aeroplane. The rough-and-ready nature of the fittings and controls is very noticeable

was broken and he lived only for a very short time.

At the period of Lilienthal's early experiments in Germany, Mr. (afterwards Sir) Hiram Maxim was busily engaged in England designing and constructing a mechanically-propelled heavier-than-air machine. Maxim had achieved fame by his invention of a machine gun, as related in the "*M.M.*" of December, 1927, but for many years he had been interested in the problems of aviation. When he had practically retired from active business and had settled at Baldwyn's Park he devoted himself seriously to experiments with lifting surfaces and propellers, and to ascertaining the air resistance of struts of various section. When he had solved these problems to his satisfaction he commenced the construction of a heavier-than-air machine designed according to his theories, and completed the work in 1894.

Maxim's flying machine presented a very striking appearance, bearing considerable resemblance to a kite of gigantic size. It consisted of a braced structure of steel tubes and wires connected to extensive horizontal wings, or planes, having a total surface area of 5,400 sq. ft. The huge central plane had a surface area of 1,400 sq. ft. and a spread of 120 ft., and in addition there were one fore and one aft steering or elevating planes, and at each end of the central wing two extensive side planes inclined upward at an angle of 7.25 degrees. The far-reaching side wings were strongly suggestive of half-raised arms.



Courtesy] [*Board of Education*

The original Wright Biplane, now in the South Kensington Museum

The machinery was carried on a platform suspended in a central position from the principal plane. The 350 h.p. compound steam engine weighed about 600 lb., and by its situation on the platform was roughly 8 ft. above ground. The "Thornycroft" boiler included a multitude of small copper tubes having a total heating surface of 800 sq. ft., and had a capacity of approximately 40 lb. of water. It was heated by a naphtha burner having a flame surface of 30 ft. A naphtha-heated vaporiser created the naphtha gas, which was passed at a pressure of 50 lb. per sq. in. to the burner jets, numbering 7,650. At the burner the pressure was brought down to 1 lb. per sq. in., one effect of this drastic reduction being to draw in air to assist combustion. The plant's capacity was 600 lb. of water and 200 lb. of naphtha, while the total weight of the engine, boiler and water, and generator was 1,200 lb., almost the weight of a modern 700 h.p. aero engine.

The machine possessed two formidable-looking propellers, the blades of which were 5 ft. 2 in. in width and of 16 ft. pitch. These propellers were driven by compound engines with cylinders of 5 in. and 8 in. dia. respectively, by 12 in. stroke. Each propeller had a diameter of 17 ft. 10 in. and weighed 135 lb. They were capable of 375 revs. per min. and exerted together 360 h.p. When started up the propellers were allowed to develop a thrust of some 1,500 lb. before the machine was released and it then travelled along a specially prepared steel track 1,800 ft. in length and of 9 ft. gauge. It was found that at a speed of about 30 m.p.h. the load on the track was very small while at a speed of about 35 m.p.h. the machine was completely lifted. In order to ensure safety during the experiments the distance that the machine could rise was limited to a few inches by means of inverted rails.

On 31st July, 1894, the flying machine was started up for a trip with three people on board, and on being released sped forward somewhat faster than usual. In his account of the subsequent happenings Sir Hiram says: "The machine was lifted clear of the lower rails and all of the top rails were fully engaged on the upper track when about 600 feet had been covered. The speed rapidly increased and when 900 feet had been covered, one of the rear axeltrees, which were of 2-inch steel tubing, doubled up and set the rear end of the machine completely free. . .

"The rear end of the machine, being set free, rose considerably above the track and swayed. At about 1,000 feet the left forward wheel also got clear of the upper track, and shortly afterwards the right forward wheel tore up about 100 ft. of the upper track. Steam was at once shut off, and the machine sank directly to the earth, embedding the wheels in the soft turf without leaving any other marks; showing most conclusively that the machine was completely suspended in the air before it settled to the earth . . ."

This was the first time in history that a flying machine, carrying passengers, engine, boiler, water and fuel, had risen entirely unfettered into the air.

Two years after Maxim's notable experiment, Professor Samuel Pierpoint Langley, of the Smithsonian Institute, Washington, U.S.A., announced that he had constructed a machine that would prove the practicability of mechanical flight. The "Aerodrome," as he called his machine, differed in construction from any previous machine and it might be described as resembling a double monoplane. There were two pairs of wings, one a short distance behind the other, the front wings being slightly larger than the rear ones. A tail portion consisting of an arrangement of vertical and horizontal plane was attached to the rear of the second pair of wings. The machine measured approximately 14 ft. from wing tip to wing tip and had a total weight of about 30 lb. A steam engine of between one and two horse-power was accommodated in the machine body beneath the framework. The body was boat-shaped in order to enable the machine to alight upon or rise from water.

The "Aerodrome" was launched from the roof of a house-boat on the River Potomac on the 6th May, 1896. Among the many friends of Langley who witnessed the launch and the subsequent flight of the machine was Alexander Graham Bell, the inventor of the telephone. Bell afterwards described the event in the following words: "The aerodrome at a given signal started from a platform about 20 feet above the water and rose at first directly in the face of the wind, moving at all times with remarkable steadiness, and subsequently swinging around in large curves of perhaps a hundred yards in diameter and continually ascending until its steam was exhausted. When at the lapse of about a minute and a half and at a height which I judged to be between 80 and 100 feet in the air, the wheels ceased turning, and the machine, deprived of the aid of its propeller, to my surprise did not fall, but settled down so softly and gently that it touched the water without the least shock and was in fact immediately ready for another trial." Langley was very gratified at the success of the experiment.

After a short interval for re-fuelling, the machine again ascended, following a circular course as before. It attained an altitude of 100 ft. and travelled about 1,000 yd. before steam was exhausted and it again gently descended. Of this flight Bell said: "I had occasion to notice that its course took it over a wooded promontory, and I was relieved of some apprehension in seeing that it was already so high as to pass the tree tops by 20 or 30 feet."

The aeroplane accomplished these brief but successful flights without any pilot or other person on board, and the all-important question as to whether a man-carrying power-driven aeroplane was capable of flight still remained unanswered. At this time Langley appears to have felt inclined to leave the solution of the problem to others, for he said: "I have brought to a close the portion of the work which seemed to be peculiarly mine, and for the next stage, which is the commercial and practical development of the idea, it is probable that the world may look to others. The

world, indeed, will be supine if it does not realise that a new possibility has come to it and that the great universal highway overhead is now soon to be opened."

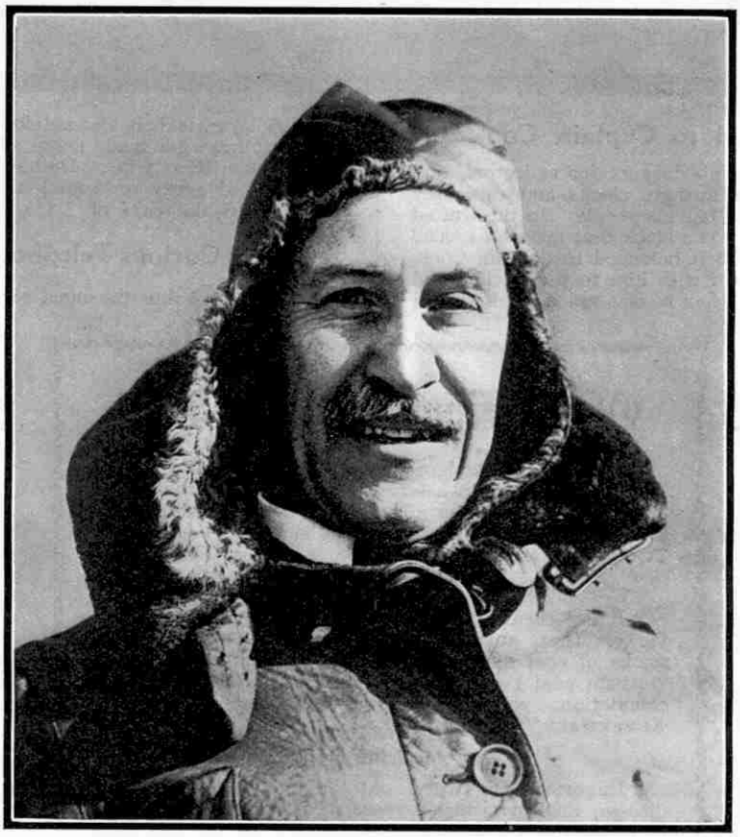
Subsequently, at the request of the American military authorities, Langley continued his experiments, and eventually constructed a full-sized aeroplane similar to the one launched in 1896, but considered capable of carrying a passenger. The launching ceremony was fixed for 8th December, 1903, and on the appointed day a vast crowd of spectators lined the banks of the Potomac River. The machine was hauled to the roof of a house-boat and when all was ready an assistant climbed into it. The starting signal was then given and as the engine began to roar the aeroplane lurched forward. By some means it fouled the launching gear, however, and with a crash fell backward off the roof of the house-boat and into the water. The machine was fished out of the river and again hauled up to the platform. The launching ceremony was then repeated but with precisely the same results as before, and as the aeroplane plunged backward into the river the great crowd jeered loudly. The newspapers reported these mishaps in most contemptuous terms and referred to the machine as "Langley's Folly."

By this time Langley had exhausted his funds and, bitterly disappointed, he was obliged to abandon further experiments. Three years later he was taken seriously ill and died. During his illness he received a copy of a resolution passed by the Aero Club of America expressing "appreciation of his labours as a pioneer in the important and complex science of aerial locomotion." The dying man smiled feebly as the message was read to him, and he requested that it should be made public as a reply to the press that had scorned his experiments.

How near this unfortunate inventor had been to achieving success was demonstrated in 1914 when one of his old pupils took Langley's machine from the United States National Museum at Washington and conveyed it to the River Potomac. After fitting the machine with floats the pilot took his seat and started up the engine. The machine sped across the water for a short distance and then rose into the air. A short flight was made and afterwards a successful descent on to the water was effected. The success of this trip proved that if it had not been for some fault in the launching gear on that fateful day in 1903, the machine would have flown then equally as well as in 1914. Langley would then have been honoured as the inventor of the first man-carrying machine capable of flight, instead of being scorned as a crank.

The first experimenters to achieve a successful flight in a power-driven machine were Wilbur and Orville Wright of Dayton, Ohio, U.S.A. At the time when they became interested in aeronautics, in 1896, they were joint proprietors of a small cycle store in the city. Their interest was aroused by reading of the tragic death of Lilienthal, and they were soon perusing all the books they could obtain dealing with the science of flight, including the works of Lilienthal and Professor Langley. When the brothers considered that they had acquired sufficient knowledge they commenced building and experimenting with model gliders that resembled giant box kites.

Their first small glider was a failure, and it convinced them that much of the information they had studied was incorrect. "It seemed to us," said Wilbur Wright at a later date, "that . . . no-one had been able to obtain any adequate practice. We figured that Lilienthal in five years of time had spent only about five hours in actual gliding. If some method could be found by which it would be possible to practise by the hour instead of by the second there would be hope."



Orville Wright

The Wright brothers then entered upon a thorough investigation of the technical side of the problem. By 1900 they had evolved a satisfactory gliding machine and a full-sized example was constructed. The machine was of the biplane type adopted by Lilienthal in his later experiments and had a total wing surface of 165 sq. ft. It embodied several original features, one of which was that the pilot had to lie flat in order that the minimum of body surface might be exposed to the air. In this position it was difficult for him to move his body about in order to maintain the equilibrium of the machine, and stability was obtained by means of a horizontal rudder in front of the main planes. The most important innovation was the "warping" of the wings in order to maintain the equilibrium of the machine and to prevent side-slipping during turning movements. The warping took place along the rear edge of the wings and was effected by the pilot by means of cords.

The brothers carried out their experiments and tests at Kitty Hawk, an isolated locality on the sandy coast of North Carolina, where they were able to work without exciting curiosity. More than a hundred successful flights, or glides, varying in duration from a few seconds to a minute, were made with their machine during 1900-1. The numerous defects in the first glider were carefully noted and a bigger and better machine having a total wing surface of 308 sq. ft. was built during 1901. For this machine the inventors built a wooden shed, or hangar, at an elevated place known as Kill Devil Hill, about eight miles from Kitty Hawk. Numerous experimental flights were carried out from this hill during 1901-2.

Month after month the Wright brothers experimented with their machines. They were harassed by lack of capital and sometimes funds were very low. Their father was as enthusiastic as themselves in the development of the glider and he readily gave all that he could spare of his limited earnings to help to defray their expenses. Their sister also gave generously of the meagre salary she obtained as a school teacher.

When they had learned all they could of the behaviour and control of gliding machines, the brothers turned their attention to constructing a mechanically-propelled flying machine. By that time the petrol motor had become very popular for automobile use because it combined high power with comparatively low weight, and inventors realised that it was the ideal type of engine for flying machines. The Wright brothers failed to find a suitable petrol motor, however, and they set to work to construct their own, basing its design upon the most approved type of engine then in vogue for motor cycles.

Their first power-driven aeroplane was built in 1903 and in appearance resembled the gliders with which they had experimented. The horizontal front elevator, the vertical steering rudder at the rear of the machine and the warping of the wings were controlled by the movement of levers situated on each side of a seat provided for the pilot centrally in the front of the machine. There was no wheeled under-carriage, but two skids, or runners, were fitted beneath the machine to enable it to make safe landings. There were two large propellers driven at a speed of approximately 500 r.p.m. by a 25 h.p. motor weighing about 250 lb. The propellers were fitted in the rear of the machine and revolved in opposite directions. The absence of an under-carriage necessitated the use of a launching device to start the aeroplane off on a flight. An initial push was all that was needed, however, for the propellers soon took effect.

The machine was tried out on 17th December, 1903. The inventors issued many invitations to witness the flight, but owing to the coldness of the day only five people,

(*Continued on page 261*

Of General Interest

A Clock that Belonged to Captain Cook

Clock-hunting has always been good sport for collectors, and high prices have been given for antique clocks and especially those that were formerly owned by famous people. In the United Services Institution, London, there is a clock that makes a special appeal to British boys, for in 1776 it belonged to Captain Cook. The famous explorer took the clock with him to the Pacific, and it was on board the "*Discovery*" when he was killed in the tragic struggle with the natives of the Sandwich Islands.

Thirteen years later this clock was associated with another tragedy of the Pacific Ocean. It passed into the possession of Lieutenant Bligh, who was in command of H.M.S. "*Bounty*" during a cruise in the South Seas. The sailors under his command were goaded into mutiny by his severity, and turned him adrift in a small boat along with the few sailors who remained loyal. The mutineers then went to Tahiti, where a few of them settled, but the remainder sailed away, and were not heard of again until 1808. In that year an American vessel visited the lonely Pitcairn Island, and there found John Adams, the sole survivor of the nine British seamen who had fled from Tahiti. On the island he had organised a prosperous colony with the aid of the natives who had accompanied the fugitive mutineers.

Captain Cook's clock was still in Adams' possession and he sold it to one of the Americans. Afterwards it passed through various hands until the sixties of last century, when it was purchased by Sir Thomas Herbert and presented to the Institution.

The original cost of the clock was £460, and its strange history must have increased its value enormously. Fortunately it is not likely to be sold again, and it will remain in the United Services Institution as a perpetual memento of Captain Cook.

Over a Hundred Years Ago!

"The grounds assigned to the Zoological Society in Regent's Park are in a forward state. The gardens, laid out in promenades, shrubberies, aviaries, enclosures, etc., are expected to open early in the summer."—"SUNDAY TIMES," 25th Mar., 1827.

Before the Strike!

"It has been estimated by geological writers and coal-viewers that, at the present rate of consumption, the seams of coal now worked in the Northumberland and Durham coal basin will not be expended, at the lowest calculation, within five hundred years."—"HANTS. ADVERTISER," 31st May, 1828.

A "Medicine Man"!

"Important Discovery. At the present season, when disease, and particularly measles, is so very prevalent, it is worthy of remark that London porter has been discovered to possess the wonderful power of inducing leeches to bite with astonishing rapidity."—"LIVERPOOL MERCURY," 19th January, 1827.

Would Make Modern Authors Think!

"Sir Walter Scott is to receive £11,000 for 8,000 copies of his 'Life of Napoleon,' the Baronet himself paying for the paper and print. The copyright is to revert to the author after the sale of the first edition of 8,000 copies."—"HANTS. ADVERTISER," 22nd January, 1827.

"Mr. Margat, who has ascended 32 times in a balloon, has been rewarded by the appointment of *aeronaut* to the King!"—"LIVERPOOL MERCURY," 29th January, 1827.

The World's Record in Lion Hunting

If a world's championship cup were to be awarded to the man who had killed the most lions, it probably would be won by Captain Coetser, a South African hunter, whose bag in the past nine years totals 435. He once shot 54 in a month, and on various occasions he has accounted for no less than five in one day.

Captain Coetser is a ranger in the wonderful National Park in the Eastern Transvaal. This great tract of bushland is famous for the number and diversity of the animals that roam unhindered through it, and it affords exceptional opportunities for hunting lions and other game. Captain Coetser's home is in the Park, and one of his amusements is motoring at night through the dark and silent alleys of the forests. A spot light carried on the car often discloses lions, jackals and antelopes crossing avenues in the bush, and the hunter has made many additions to his bag of lions while out on these short trips. He has had many narrow escapes from the claws of angry or wounded lions, but he hopes to increase still further his score of "435 not out!"

The Most Curious Telephone Exchange in the World

What is probably the most remarkable telephone exchange in existence is to be found in the north-western area of Nebraska. The possible number of subscribers in this sparsely populated prairie country was far too small to make it worth the attention of any telephone company and therefore some 15 years ago a local resident named Elias Clark, determined to set up one himself and, to-day, this is quite a flourishing concern.

The system possesses about 100 miles of telephone line and 52 subscribers, this number being fixed as the limit on account of the necessity of enlarging the system at prohibitive cost that would arise if more subscribers were admitted. Mr. Clark commenced operations by the purchase of a dozen second-hand telephones, a thousand pounds of telephone wire and a quantity of other indispensable equipment. After a great deal of difficulty twelve ranchers were persuaded by the offer of a month's free service to allow the telephones to be installed in their homes. At first none of the ranchers thought the scheme would succeed but when it was found that the service operated perfectly there arose a great demand for telephones to be installed at a charge of £3 per annum. Although Mr. Clark is now over 70 years of age, all repairs are carried out by him personally and his wife and daughters act as telephone operators.

Some of the financial arrangements of this system are certainly unique. For instance, whenever anyone living in a subscriber's house dies, Mr. Clark presents the household with a year's service, free of charge. He also reduces his bill when a subscriber is known to have had bad crops or to have suffered a run of bad luck in some other way. A more curious feature still and one that will appeal to the British telephone user is that when a subscription is overdue, a note is sent stating that the service will be discontinued if the money is not paid within two years!

Mr. Clark fills in the greater part of his spare time by running an extensive farm. He is also an expert in the art of digging wells, and is very proud of the fact that for some miles around his home every resident has installed one of his telephones and draws water from a well that he has dug.

How Old is the Earth?

By measuring the proportion of lead present in certain minerals it is possible to determine their age. One good example of this is the pitchblende found at Morogoro in the portion of East Africa that passed from German into British hands at the close of the Great War. The reason for this is that, as far as can be ascertained, the lead in the mineral is entirely of the type of the metal that is the final product of the radio-active changes undergone by uranium, and contains no common lead at all. The rate at which the change takes place has been carefully determined by laboratory experiments, and it has been calculated that 700 million years would be required to produce in uranium the proportion of lead that is present in the Morogoro ore. If therefore, the latter were originally purely a uranium ore—a quite reasonable assumption to make—its age is thus fixed at 700 million years.

In a similar manner a Norwegian mineral named brögerite works out to be 950 million years old. Of the minerals so far examined in this way, the youngest proves to be 320 million years old, while the oldest is one found in Madagascar, the age of which appears to be 1,500 million years!

The transformation of uranium into radium G, as the particular type of lead produced is known, is accompanied by a loss of helium. Practically the whole of this gas remains within the mineral, from which it may be separated by crushing and fusing. This gives a second method of estimating the age of a mineral, for the rate at which helium is produced from uranium is also known from laboratory work. Unfortunately, the results are not absolutely certain, as it is quite possible that a proportion of the helium may have escaped in the millions of years that the minerals concerned have been known to exist, while a further proportion is certainly lost during the exposure of the mineral after removal from the earth, and also when it is crushed. The ages that have been found by this method vary from eight million to 700 millions of years, and the possibility of loss of helium makes it certain that they must really be even older than this.

The figures thus obtained give some idea of the age of the Earth, for the minerals could not come into existence until the temperature of the outer layers of the glowing mass, separated in some way from the Sun, had fallen sufficiently to bring about solidification of the crust. The only deduction we can make from the figures is that the crust of the Earth is at least 1,500 million years old, and that the Earth as a whole must be considerably older.

Shan beauties in their native costumes. The Shans are a race of people who have inhabited the borderlands between Burma, Siam and China for centuries. They are light-yellowish in complexion and have a somewhat Chinese appearance.

The women of the race are very clever at needlework and embroidery and, as our photograph suggests, are fond of gaily-coloured garments and silver ornaments of all kinds

Travelling 175,000 Miles in One Second

Interesting experiments have been made on the effect of the cathode rays from the giant vacuum tube constructed by Dr. Coolidge and described in the article on the "*Story of Electricity*" series in the "*M.M.*" for March last year. Readers will no doubt remember that in this tube a stream of electrons with a speed of 150,000 miles per second is produced by applying a voltage of 350,000.

The experiments referred to were made with rats. The animals were wrapped in coats of copper foil to protect them from the action of the rays except at one place about an inch in diameter on the abdomen, and were left in the path of the rays for varying periods. Some received daily doses lasting from one-tenth of a second to six seconds, while others were only treated once. The colour of the hair on the exposed portions changed from white to yellow. On further exposure the skin became tender and finally developed sores that proved, on microscopic examination, to be similar to X-ray burns. It has been thought for a long time that X-ray burns are really due to electrons produced by the impact of the rays on the skin, and the experiments now reported seem to confirm this.

Interest in these experiments is increased by the announcement that Dr. Coolidge has now excelled his previous effort and constructed a tube to which he can apply current at 900,000 volts. The speed of the electron stream from the new tube is 175,000 miles per second, or 350,000 times faster than a bullet fired from a standard army rifle!

The importance of Dr. Coolidge's studies in the use of high voltages lies in the fact that the only other source of electrons possessing these high speeds is radium. Unfortunately this substance exists only in very small quantities, and its use for curative work is therefore severely restricted. If Coolidge tubes producing electrons with similar speeds do not remain scientific curiosities, but become practical, then an alternative to radium will have been secured, which will be available to a far greater extent.

Quite apart from these considerations, the new Coolidge tube will add greatly to scientific knowledge of atoms and of electricity. One interesting feature is that the speed of the electrons produced in it is very nearly that of light. According to modern ideas the speed of light is unattainable by any material object, and it remains to be seen how near we can approach to this speed by the application of still greater voltages to vacuum tubes.

Caterpillars as Farmers' Allies

In New Zealand the method of destroying unwanted plants by the introduction of insects partial to them is being systematically pursued, and it has now been announced that an insect has been found capable of checking the spread of ragwort, a weed that worries thousands of farmers in that country.

This plant is a familiar sight in Great Britain, its branched heads of yellow flowers appearing in autumn. In New Zealand it flourishes greatly and spreads at an astonishing rate, causing much loss. After a long search the biologists of the Cawthron Institute in New Zealand have discovered that a particular type of caterpillar feeds on ragwort in preference to any other plant, even when placed in a room literally crammed with plants of all kinds, including other members of the ragwort family. This preference is an important point, for more harm than good would be done by liberating on a large scale caterpillars that feed on useful plants in addition to the one that they are intended to destroy. The caterpillar referred to has so far resisted all temptation to feed on other plants, and little doubt remains that when it commences its attack ragwort will be effectively checked.

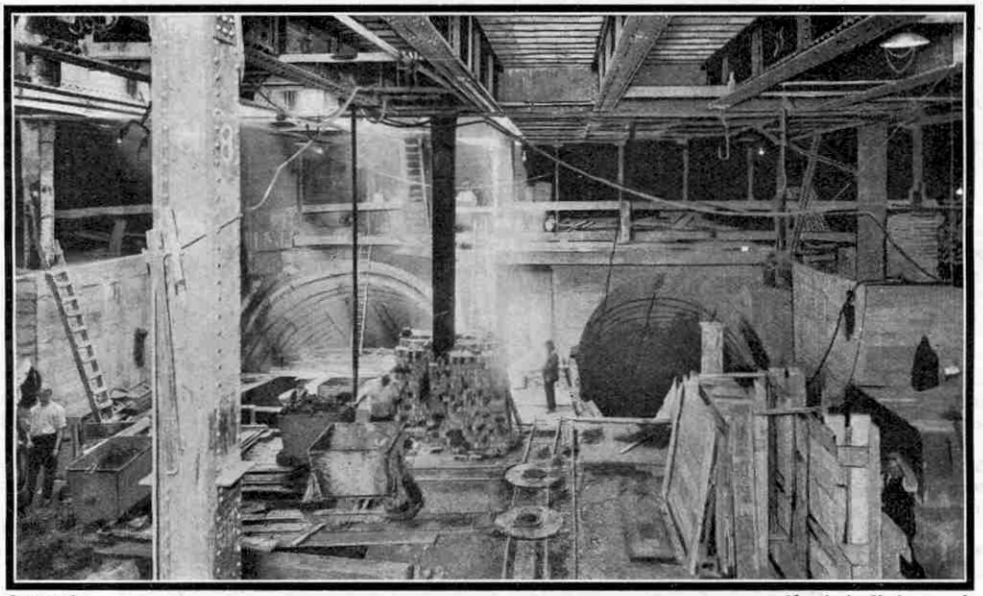
Other plants presenting serious problems in New Zealand are blackberry and gorse. Insects in plenty have been found that feed on blackberry, but unfortunately they either cannot tell the difference between a blackberry-bush and a rose-bush—or they do not wish to do so! It may take 20 years to find a satisfactory insect, but as nearly 100,000 acres of land have been wasted by the spread of the plant, success will abundantly repay the time and the money spent on the search.

Largest Underground Tube Railway Station

Engineering Triumph Beneath Piccadilly Circus

THE opening of the reconstructed Piccadilly Circus Tube Railway Station, London, on 10th December last, made accessible to the public the largest and most remarkable underground station in the world. The new station has taken four years to complete, and combines the old separate tube stations at this point of the Bakerloo and Piccadilly lines. These two underground railways lie at different levels, the former passing under Regent Street and the Haymarket at 86 ft. below the surface, and the Piccadilly line passing under Coventry Street and Piccadilly at 122 ft. below the street level.

The new combined station is capable of handling 50,000,000 passengers a year and includes a spacious elliptical-shaped booking hall, only a few feet below the surface of the Circus, from which five escalators connect with a lower chamber 42 ft. beneath the booking hall. From this chamber six escalators lead downward and terminate close to the platforms of the railways that they serve.

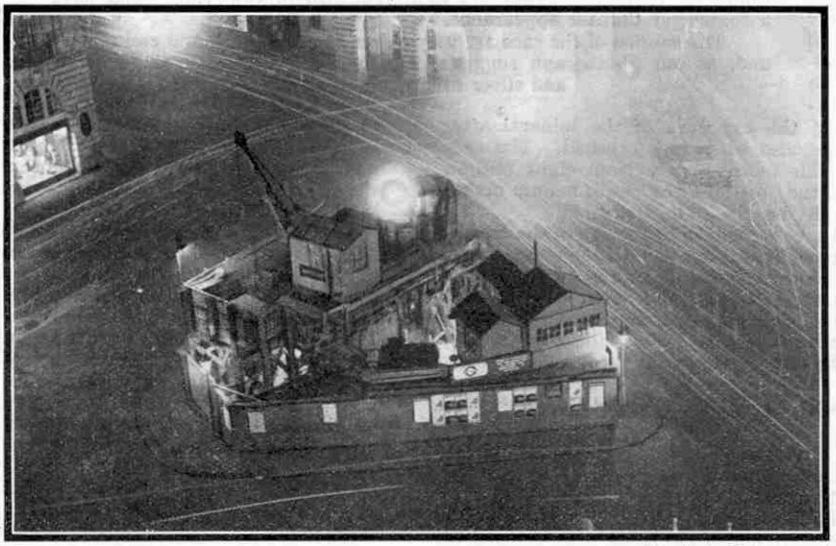


Courtesy] [*London's Underground*

A view of the twin escalator tunnels leading from the booking hall to the common landing at Piccadilly New Station

The only site where the contractors could sink their "service" shaft without interfering with the road traffic was a small island in the centre of Piccadilly Circus, occupied by the Shaftesbury memorial. This monument was therefore removed, the area screened by hoardings, and excavation commenced.

A preliminary task of great importance was that of strengthening the roadway around the island to prevent subsidence when the ground underneath should be cut away to make room for the great booking hall. The wood paving around the island was removed and series of steel rails, each 22 ft. 6 in. in length, were inserted and connected together in the underlying concrete. Cement was then poured into the spaces between the rails and over them to a depth of ½ in., after which a surface covering of asphalt 1½ in. in depth was spread. The work was carried out in 13 sections so as to reduce to a minimum interference with the great traffic at that point.



Courtesy] [*London's Underground*

Night view of the new works at Piccadilly Circus

Excavation on the site of the memorial was commenced in February, 1925, and a shaft 18 ft. in diameter was sunk to a depth of 92 ft. Headings, or small tunnels, were then driven off from the lower part of the shaft, and from these was put in hand the construction of the stairways, passages, etc., to connect the lower flights of escalators with the respective platforms of the two railways. Higher up the shaft, headings were driven for the tunnel-shaped chamber that connects the upper and lower flights of escalators. The inclined tunnels that accommodate the lower escalators were also driven from this level.

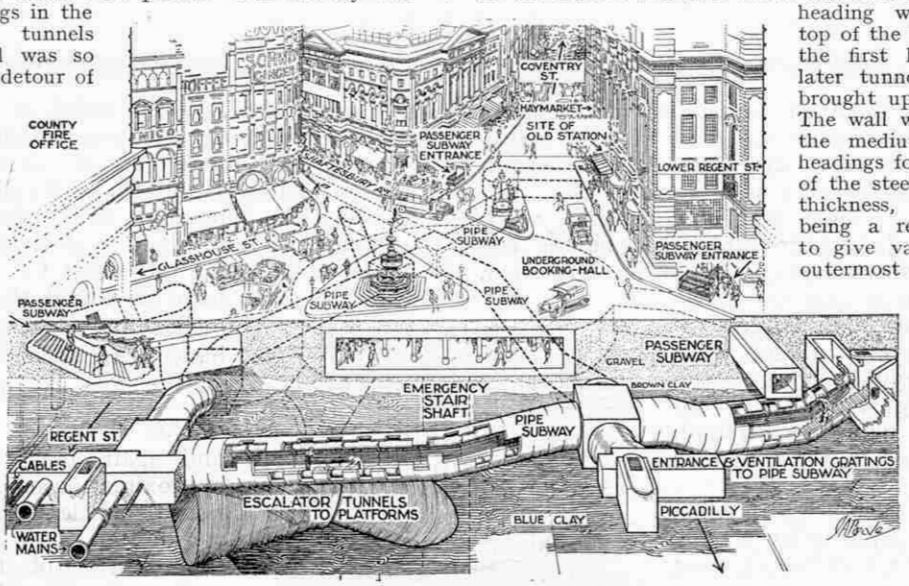
The escalator tunnels and subways were lined with cast-iron rings that were fitted into place as excavation progressed. Each ring consisted of radial flanged segments bolted together to form a continuous cylinder; a "key piece" with inclined flanges; and two segments of special construction, one of which was designed to receive the key piece. The number of segments incorporated depended upon the diameter of the ring. In each segment was a ½ in. hole through which cement was injected when the complete ring had been placed in position.

Where the tunnels were driven through moisture-bearing strata the longitudinal joints both of the segments and of the rings themselves were filled with red and white lead, but in the case of rings set in dry earth the joints were "metal to metal." Hard wood packing pieces ½ in. in thickness were used for the circumferential joints. The pieces were of sufficient width to insure a cavity between the packings and the edges of the flanges forming the interior diameter of the tunnel. These cavities were about ¾ in. in depth, and were filled with liquid cement that was forced home by means of a grouting machine operating at a pressure of 60 lb. per sq. in. Each ring was grouted immediately it was secured in position, and the grout hole in the ring was then stopped with lead pipe

forcibly inserted by means of tapering iron plugs.

Before the construction of the booking hall and the public subways in the upper levels could be commenced, a maze of water, electric light and other mains that lay beneath the surface of the Circus had to be cleared away. These could not be disturbed until alternative accommodation was provided, and the problem was solved by constructing a special subway 12 ft. in dia., in which all the pipes and cables were placed. This subway was built up of cast-iron rings in the same manner as the tunnels already mentioned, and was so planned that it made a detour of the area to be excavated for the great booking hall.

When all the mains that encroached upon the booking hall site had been diverted, the great task of excavating the hall was commenced. This part of the undertaking has been described as " a series of methodical burrowings delved out with mathematical exactitude until the ground beneath the Piccadilly Circus became a labyrinth of steel-roofed and steel-supported tunnels that eventually, through the removal of the intervening walls of earth, became merged into an elliptical chamber 155 ft. by 144 ft. in area and 9 ft. in height."



The Pipe Subway at Piccadilly Circus

The excavation of this large chamber, situated only a few feet below the street level, was carried out to a carefully devised plan. Near the service shaft two circular cavities were made in the ground, and from these headings 8 ft. in width and 6 ft. in height were driven for a distance of approximately 40 ft. As this tunnelling proceeded, the ground above was supported by rolled-steel joists that later were incorporated in the permanent roof of the chamber.

A hole was excavated at each end of the headings, and concrete foundations were provided for the main columns that were to support the central portion of the booking hall. When these columns had been erected, the main girders of the roof were brought into the headings and mounted upon the columns. The weight of the ground overhead, hitherto supported by temporary timbers placed in position as the headings were driven forward, was then transferred to the main girders by the insertion of steel packings between the latter and the roof joists. Numerous other headings were then driven for the introduction of the columns and the main and secondary girders to sustain the weight of the ground above the other parts of the hall.

By this process of driving narrow headings close up to the underside of the roadway foundations, and immediately placing in position the permanent steelwork, the enormous weight of the roadways and their burden of moving traffic was sustained without even the indication of a disturbance of any sort. The whole of this work was carried out at night to a schedule that allocated some particular detail to each night.

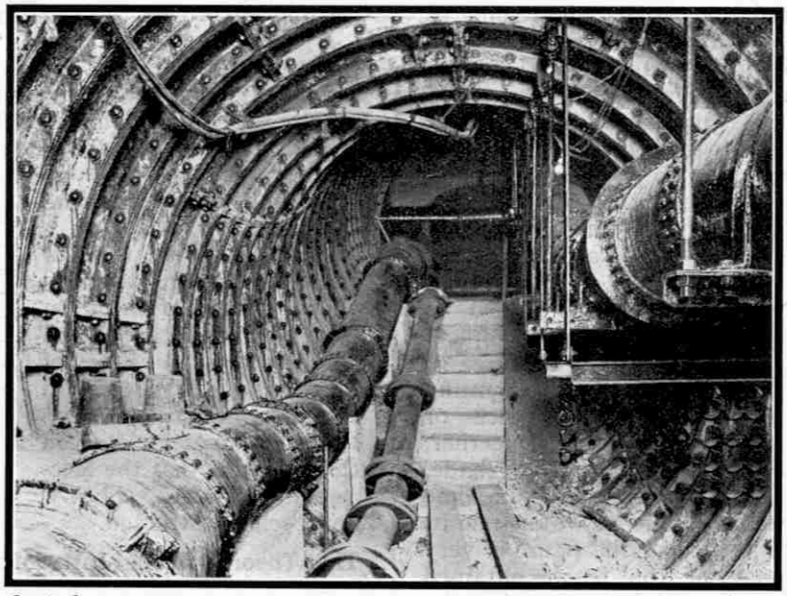
Each of the four columns erected in the central portion of the hall is capable of supporting a weight of 309 tons, while the 50 columns erected in a double row around the perimeter of the hall are capable of supporting individual loads ranging from 78 to 150 tons.

While the headings for the insertion of the steelwork were being excavated, another heading was driven round the boundary of the site, and in this was built the concrete and brick foundation for the massive wall that was to enclose the hall. Next, a second heading was driven along the top of the brickwork built within the first heading, and in this later tunnel the brickwork was brought up to the second stage. The wall was completed through the medium of certain of the headings formed for the insertion of the steelwork. It is 4½ ft. in thickness, and in addition to being a retaining wall it serves to give valuable support to the outermost girders of the roof.

These extensive operations were carried out without any interruption to the dense traffic of Piccadilly Circus. This is remarkable in view of the fact that the only tackle that could be used for the removal of debris and the reception of materials consisted of rollers and levers, blocks and tackle. A further handicap was that the only means of access to the underground workings was the 18 ft. diameter service shaft.

Access to the booking hall can be gained by any one of six subways, the entrances to which are at various points around Piccadilly Circus. Two of the subways have their entrances one on each side of Lower Regent Street, and a separate subway beneath that thoroughfare connects the two entrances and also provides pedestrians with a welcome means of crossing beneath this very busy " one way " street. The various subways were excavated by methods similar to those adopted in constructing the booking hall. Headings were driven from the latter along the sites of the subway sidewalls, and in these the foundations were laid and the subways constructed in successive short sections, the permanent steelwork being installed as work progressed.

There are 11 escalators at the new station—the greatest number installed at any London Underground station. As already stated, they are arranged in two flights. The upper flights connect the booking hall with the intermediate escalator chamber, or lower hall, from which the lower flights of escalators lead off in a reverse direction and terminate close to the respective railway platforms. The five upper escalators are in two groups of two and three respectively, while the six lower escalators are in two equal groups, one leading to the Bakerloo platforms and the other to the Piccadilly platforms. The superiority of the ever-open escalators, in close proximity to the railway platforms, over the inconvenient lifts of the old stations, is emphasised by the fact that at the new station a passenger can pass from street to platform in 2½ minutes less time than was possible under the old conditions.



Courtesy [*London's Underground*

View of part of pipe subway showing 24 in. water mains and pipe alongside for hydraulic power. At the top of the steps a junction chamber is shown

No particular decorative scheme

(*Continued on page 261*)

A Meccano Planimeter

Determining Areas of Drawings by Mechanical Means

By H. F. Lane

A PLANIMETER is an instrument for determining by mechanical means the area of any figure, whether regular or irregular. Given certain principal dimensions, the area of a regular figure, such as a square, circle, triangle, etc., may readily be calculated from formulæ. There are other figures less regular than these for the graph, or outline, of which, an algebraic equation can be determined, and the area obtained by integration. But beyond these again are completely irregular figures, such as those shown in Figs. 1 and 2. Should the area of such a figure be required, it can be determined in the following three ways :—

(1) Graphical. Either by drawing the lines in on the paper or by placing on top of the paper a transparent sheet so ruled, we cover the figure with a multitude of tiny equal squares, the area of each square being some definite fraction of the scale in which the result is required, and then count up the squares (see Fig. 1). No error need result so long as we are dealing in whole squares, but when we come to the outer edges of the figure we shall find some of the squares incomplete, because cut off by the boundary line of the area (Fig. 3). Here each partial square must be considered on its own merits, and a search made round the edge of the figure for a second partial square of such a shape that the portion inside the area of the second square, added to the portion inside the area of the first square, will together equal a complete square, and so be included in our computation of the area. For example, the small portion B added to A makes a complete square.

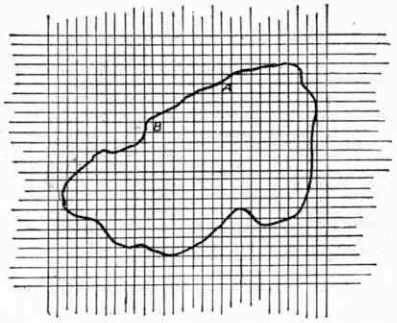


Fig. 1. Graphical method of measuring areas

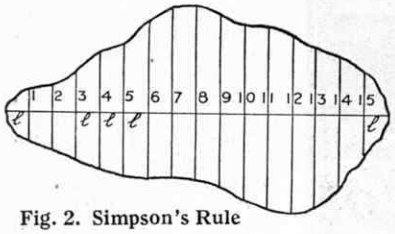


Fig. 2. Simpson's Rule

To avoid counting a square twice or omitting it altogether, it is usual to shade, dot, or mark in some fashion, each square or partial square as we include it. This method of obtaining the area of the figure is very laborious, and the accuracy of the result obtained depends, obviously, on our "eye" for estimating the various pairs of complementary portions to complete the broken squares.

(2) By Calculation. In this method we find the length of the figure by drawing inside the area, and bounded by the edges of the area, the longest straight line possible (Fig. 2). We then divide this line into an even number of small equal parts, and draw through each division a line at right angles to the length of the figure. The additional lines so obtained are called "ordinates" and again are bounded by the edges of the area. Let l be the width of each small division, i.e., the distance separating each pair of ordinates. Add together the lengths of the two extreme, or outside, ordinates (1 and 15), and call the result A. Add together the remaining odd ordinates (3, 5, 7, etc.) and call the result B, and then the even ordinates (2, 4, 6, etc.), calling the result C. Then, supposing we have measured the various lengths in inches and decimals of an inch, we have :—Area of figure in square inches =

$$(A+2b+4c)\frac{l}{3}$$

This is known as Simpson's Rule, and again must be regarded as an approximation only, because if we have not a sufficient number of ordinates, we do not allow sufficiently for the irregularities of the figure, because each ordinate will have too large a relative value. On the other hand, although theoretically the equation only ceases to be an approximation and becomes perfectly true when the number is infinite, the more we increase the number of ordinates and decrease l, the more do we introduce personal error due to faulty measurement.

(3) By Mechanical Means. By the aid of an instrument termed the planimeter, the result can be arrived at with more accuracy and very much more rapidly, since all we have to do is to guide the pointer of the instrument carefully round the boundary line of the area, and read off the result on the recording apparatus.

There are several types of instrument designed for this purpose, some of them extremely complicated and able to perform a variety of functions, but the one in common use is Amsler's Polar Planimeter. It is on this principle that the Meccano model described below has been constructed.

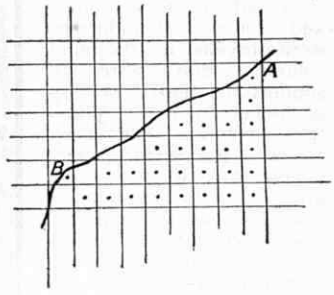


Fig. 3. Enlargement of AB in Fig. 1

The Theory of the Instrument

The instrument consists in its essential features of two bars PX, XT, (Fig. 5) hinged together at the point X. One end of the arm PX pivots about the fixed point P in the paper, and the end T of the bar XT has a tracing point secured to it. This tracer T is traversed round the entire outside edge or perimeter of the figure, the area of which it is desired to find.

The bar XT carries a wheel W that is sometimes rotated by the motion of T (when motion is perpendicular to XT), sometimes slid sideways without revolving (when motion is parallel to XT), and at other

times undergoing a combination of both movements (at any other angle). As the wheel undergoes these various movements, it is always turning first in one direction and then in the other. When it has completed the whole perimeter of the figure, however, and returned to the point at which it started, it will be found that the wheel has rolled more in one direction than the other, and it is this difference in travel that measures the area of the figure, according to some predetermined scale.

It is not proposed to go too deeply into the mathematical considerations of the planimeter, but in the simple figure MNOQ (Fig. 5) it may readily be seen that the wheel records a definite sector MNX whilst rolling from M to N with X remaining stationary. The area of MNX is dependent entirely on the arc MN—since XM and XN are fixed lengths—and may therefore be recorded by the wheel. In this broad and approximate demonstration of the principle of the planimeter, we will disregard the slight roll of the wheel in moving from N to O. This roll of the wheel is very much less than the distance NN_2 (obtained by drawing ON_2 parallel to QM), because the point X takes up a new position X_2 as the bar XT moves from N to O, which counteracts the effect of the distance NN_2.

In moving from O to Q, we roll back again a certain amount of the roll of the wheel already recorded, but as in this figure the arc OQ is shorter than the arc MN, a diminished reading still remains. Also disregarding the second slight roll as the tracer moves from Q to M and still speaking approximately, we have recorded the area MNX less the area OQX_2, and the difference between the two is the required area MNOQ.

It must again be insisted that the above explanation is a non-mathematical approximation; the small rolls occurring while moving from N to O and from Q to M do affect the result and it is because they do so and further entail a movement of X, that the instrument is accurate for any figure, however irregular.

It will be noted that the point P lies outside the area. It is not proposed to mention the added complications entailed when the figure is so large that P must be placed inside the area.

The Construction of the Model

As will be seen from Fig. 4 the construction of the model is very simple. The point P in Fig. 5 is represented by a $3\frac{1}{2}$" Rod 1 that is held in a Bush Wheel screwed to a Designing Machine Table (part No. 107). The bar 2 is retained in position on the Rod 1 by means of Collars. The bar 3 consists of four $18\frac{1}{2}$" Angle Girders bolted at one end to a Channel Bearing. The tracer, which consists of a $3\frac{1}{2}$" Rod filed to a sharp point, is held in the boss of a Fork Piece secured to the upper pair of Angle Girders, and its lower end is passed through the centre hole of a Double Bracket that is secured to the lower pair of Girders. The two pairs of Angle Girders are spaced the correct distance apart at this end by $1\frac{1}{2}$" Strips.

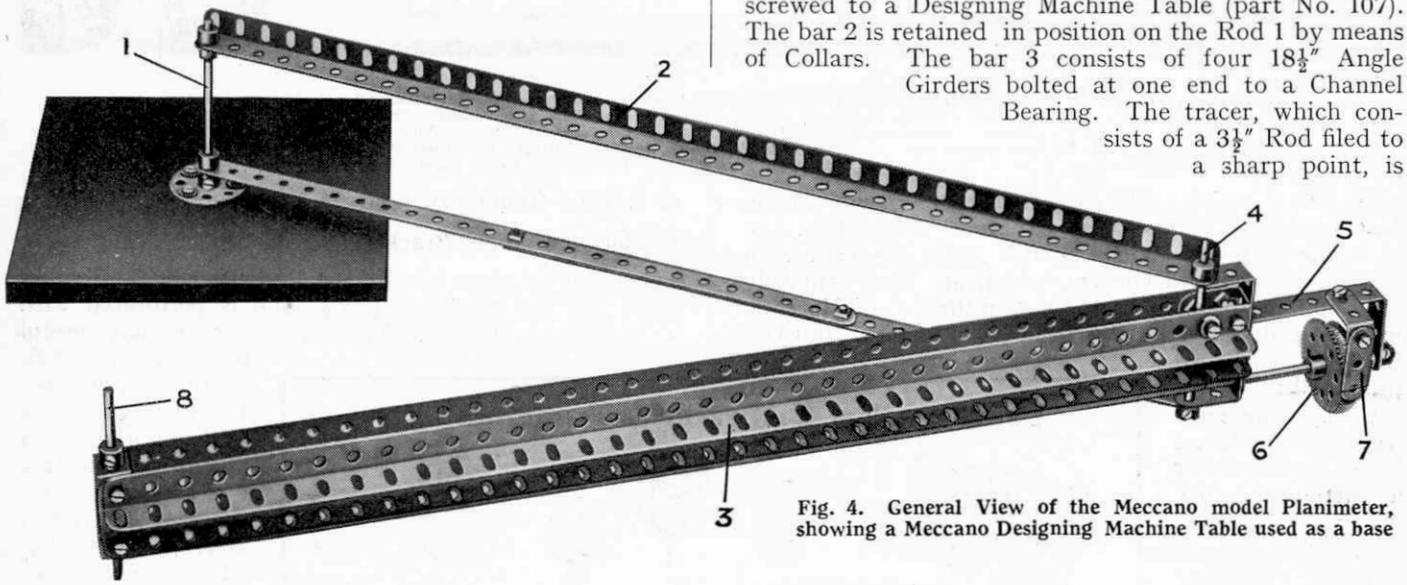


Fig. 4. General View of the Meccano model Planimeter, showing a Meccano Designing Machine Table used as a base

On the $\frac{1}{2}$" side of the Channel Bearing, $2\frac{1}{2}" \times 1"$ and $2\frac{1}{2}" \times 1\frac{1}{2}"$ Double Angle Strips are bolted as indicated in the illustration, the former being used to connect the bar 2 to the tracing arm 3.

The wheel 6 consists of a 57-teeth Gear and a Flanged Wheel secured together on a 3" Rod that is journalled freely in the bottom hole of the Channel Bearing and in the end of the $2\frac{1}{2}" \times 1\frac{1}{2}"$ Double Angle Strip. A strip of paper is stuck round the circumference of the Flanged Wheel, and this Strip is marked off into 10 equal main divisions, each of which is further divided into ten subdivisions, making in all 100 divisions of the circumference of the Flanged Wheel. The main divisions should be numbered 0 to 9. The $1\frac{1}{2}$" Strip 7 serves as a sighting piece with which to read the graduations on the Flanged Wheel, the graduations being viewed through the bottom hole of the Strip. In order to lessen the possibility of error a fine silk thread, termed a "spider line," should be glued across the hole in the Strip 7 so as to indicate the exact

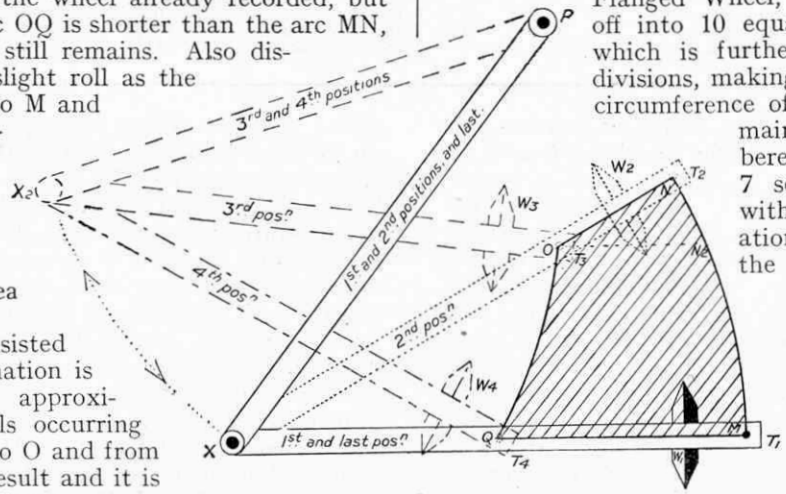
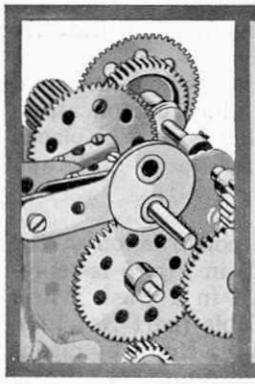


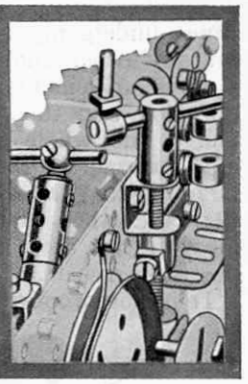
Fig. 5. Drawing illustrating the theory of the instrument

(Continued on page 261)



HOW TO USE Meccano Parts

III.—BRACKETS, etc. (CLASS C)



For the purpose of this series of articles we have grouped all the Meccano parts into two main sections, termed the Structural and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping is as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools and Literature. Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical Parts; Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

CLASS C, which is the subject of this month's article, comprises the smaller structural accessories. In the first two articles of this series we dealt with Meccano Strips and Girders, which are used primarily for building the framework or "outlines" of Meccano models, and the majority of the parts included in Class C are intended principally to form the connecting links between these larger parts. After a little practice, however, Meccano boys will find many other important uses for them.

The Flat Bracket (part No. 10) is of the standard $\frac{1}{2}$" width and measures $\frac{7}{8}$" in overall length. It is perforated by one round hole and one elongated hole, and the latter enables the part to be used in many cases where it is necessary to make slight adjustments that are not possible with the ordinary equidistant holes. The Flat Bracket is, of course, invaluable for connecting parallel Strips or Girders, as was shown in last month's article (see Figs. 6 and 11 in that issue). The part may also be used as a short Strip for ordinary connecting purposes. For example, in Fig. 10 on the next page two Flat Brackets are shown in use as shackle couplings attached to the end of a Meccano leaf spring of a type frequently used in model motor cars, etc.

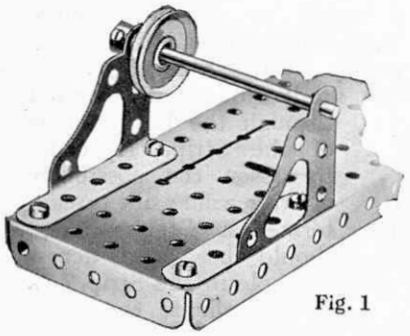
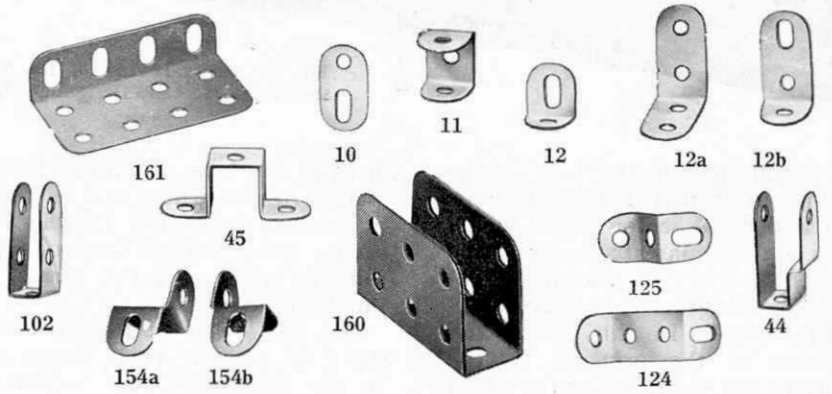


Fig. 1

Parts in Class C: Brackets, Trunnions, etc.



The following is a complete list of parts in Class C. Most of them are illustrated.

Part No.		Price s.	d.
10	Flat Brackets	½ doz. 0	2
11	Double Brackets	each 0	1
12	Angle Brackets, ½" × ½" ...	doz. 0	3
12a	" " 1" × 1" ...	½ doz. 0	4
12b	" " 1" × ½" ...	" 0	3
44	Cranked Bent Strips ...	each 0	1
45	Double Bent Strips ...	" 0	1
102	Single Bent Strips ...	" 0	1
108	Architraves	" 0	2
124	Reversed Angle Brackets, 1"	½ doz. 0	4
125	Reversed Angle Brackets, ½"	½ doz. 0	3
126	Trunnions	each 0	2
126a	Flat Trunnions	" 0	1
133	Corner Brackets ...	" 0	1
139	Flanged Bracket (right) ...	" 0	2
139a	" (left) ...	" 0	2
154a	Corner Angle Brackets (right) ...	½ doz. 0	6
154b	" " " (left) ...	" 0	6
160	Channel Bearings, 1½" × 1" × ½"	each 0	2
161	Girder Brackets, 2" × 1" × ½" ...	2 for 0	3

Double and Angle Brackets

Each of the three sides of the Meccano Double Bracket (part No. 11) measures $\frac{1}{2}$" × $\frac{1}{2}$" and is perforated with a single round hole. The part is extremely useful for various connecting purposes. In Fig. 10 it is seen employed as a means of connecting together the shackles mentioned above, while Fig. 12 shows three Double Brackets bolted between two 1½" Pulleys to form a cam. In operation a rocking lever is placed between the Pulleys of this mechanism so that as the cam rotates it is forced up by the Double Brackets and allowed to fall only after all three Double Brackets have passed beneath the lever.

In Fig. 5 a Double Bracket is employed as a means of connecting a piston rod to a connecting rod, the Bracket being mounted on the former and attached pivotally to the latter by means of a bolt and two nuts. In Fig. 6 this part forms a sliding connecting piece that operates a rocking lever in a quick-return motion. The Double Bracket is pivoted to the Bush Wheel and the rocking lever slides freely between its up-turned flanges.

Of Meccano Angle Brackets there are three different types, namely, the ordinary Angle Bracket, Reversed Angle Bracket, and Corner Angle Bracket. The ordinary kind is available in three different sizes, $\frac{1}{2}$" × $\frac{1}{2}$", 1" × 1", and

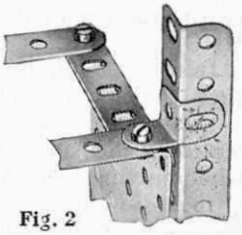


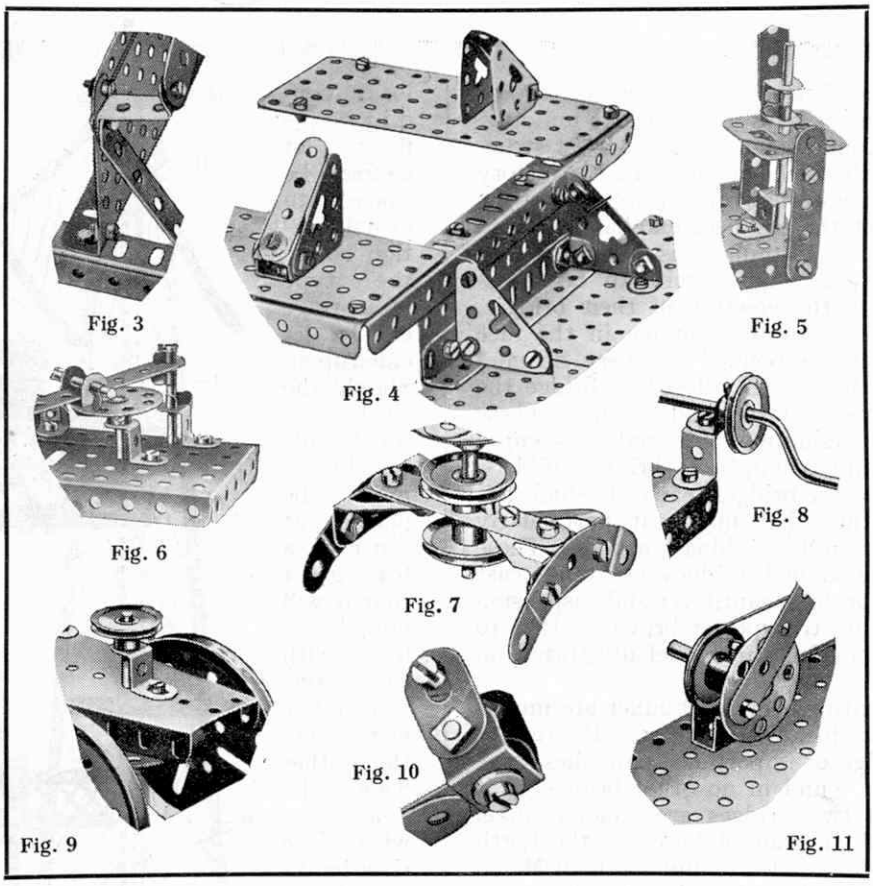
Fig. 2

1″×½″ (Nos. 12, 12a, and 12b respectively). They are designed for connecting any two Meccano parts at right angles to each other, the extra holes provided in Nos. 12a and 12b merely adding to the rigidity of the connection. On occasions they also prove useful as journal bearings for shafting.

The Reversed Angle Brackets (Nos. 124 and 125) are in two sizes, ½″ and 1″. These dimensions refer to the centre portions of the parts only, and in each case the ends are turned at right angles to form a flange that is about ½″ long and perforated with a round or elongated hole. The Corner Angle Brackets (Nos. 154a and 154b) are similar to part No. 12 but have an additional flange. There are two types, right and left-hand.

Various examples of the use of the different Meccano Brackets are illustrated. Fig. 2 shows a Corner Angle Bracket used as a guide for a lift cage. As will be seen, the Bracket is secured by one of its flanges to the top of the cage, thus leaving the other two flanges free to slide against the vertical Angle Girder which forms one of the guides for the lift.

Fig. 3 shows the 1″ Reversed Angle Bracket used as a support for one end of the dashboard in a Meccano motor chassis. Both types of Reversed Angle Brackets form excellent reinforced bearings for Axle Rods, and typical examples of the use of the ½″ size for this purpose will be found in Figs. 5, 6, and 9. Fig. 8 is another illustration of the adaptability of this part.



Single and Cranked Bent Strips

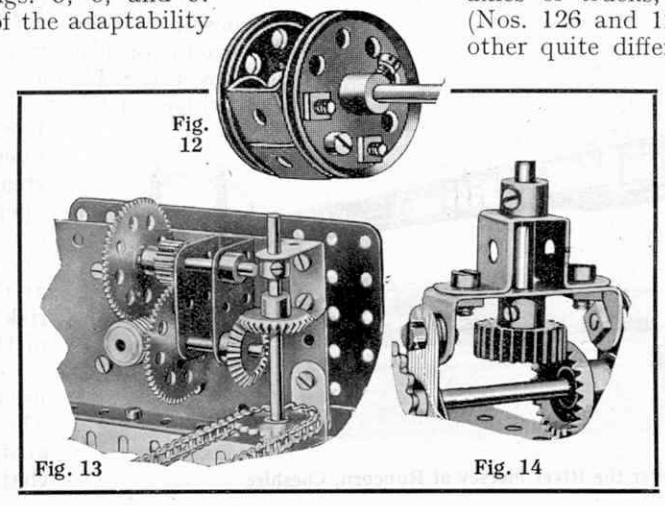
Parts Nos. 44 (Cranked Bent Strip) and 102 (Single Bent Strip) are similar in appearance except that the latter has two holes in each side instead of one and one side of the former is cranked so as to allow more space between the ends. The principal function of both parts is to form a simple and compact bearing for short Axle Rods (see Fig. 11). They are also used in the construction of innumerable small mechanisms, such as pulley blocks, castors, guides, etc., or as "claws" for gear-shifting levers, etc.

The Double Bent Strip (No. 45) is designed to form reinforced, "footstep," or extended bearings for Axle Rods, etc. (see Fig. 14). It is invaluable where space is restricted, for when bolted to a Strip or Plate ample journal bearings are provided for a short Axle Rod, the Rod passing through the Strip, of course, and through the centre hole of the Double Bent Strip.

Part No. 108, Architrave, is intended for strengthening corners of frames, as will be fairly obvious from its design. It resembles 2½″ and 2″ Strips meeting together at right angles and strengthened by a narrow diagonal piece. It is not only extremely useful but also ornamental, as is shown in the Meccano Eiffel Tower (model No. 7.15 in the 4-7 Instruction Manual), the top of which consists principally of four Architraves!

The right and left-hand Flanged Brackets resemble the Architraves except that in each of the former one side is bent over to form a flange. These parts are illustrated in Fig. 1, where they appear as bearings for a horizontal shaft. They are also extremely useful for strengthening various structures.

In addition to their obvious use as bearings for axles of trucks, etc., the Meccano Trunnions (Nos. 126 and 126a) lend themselves to many other quite different adaptations. In Fig. 5, for example, two Flat Trunnions are shown bolted together in such a way that they form a small plate 1½″ square. In Fig. 7 two ordinary Trunnions, which differ from the Flat Trunnions only by the fact that one end is bent over to form a flange, are used to form a very rigid base or pedestal for a small swivelling structure. There are, of course, many hundreds of similar applications for the Meccano Trunnions. (Continued on page 265)



Now Build this one!

Auto-Reversing Transpor

THERE are few branches of engineering that appeal more to imaginative boys than bridge-building. In it are to be found some of the greatest structures and most creditable achievements in the history of engineering, while in no other branch do we find the amazing adaptability of the engineer emphasized in so many remarkable ways. In numerous cases the engineers have had to face what seemed to be insurmountable difficulties in the erection of their bridges, and they have shown undaunted courage in the face of obstacles. They have responded to every demand made upon them, and have even offered to bridge the English Channel between Dover and Calais! These facts appeal to our imagination and make us enjoy reading of the trials and triumphs of bridge builders.

There are many types of bridges, each of which has some outstanding feature that makes it particularly suitable for some special and individual purpose. These different types include arched bridges of stone, cast or wrought iron girder bridges, cantilever and suspension bridges, drawbridges, and transporter bridges. It is to the latter class that the Meccano model illustrated on this page belongs.

The problems confronting a bridge builder are indeed many and vary with each individual case. Because of this, nearly every bridge of importance embodies some original feature that is found in no other bridge, so it may be said that no two bridges are exactly alike. The Tower Bridge with its pair of bascules, the Forth Bridge with its mile-long roadway, and the high Menai Suspension Bridge, are all "bridges" but each differs from the other in almost every particular owing to the peculiarities of the local conditions.

Local conditions to be observed

When it is desired to bridge a river the local conditions must of course be taken into consideration before the type of bridge can be decided upon. Should the river be navigable the bridge must be placed at such a height that it will not interfere with the traffic on the water. On the other hand, in cases where the river banks are almost on the same level as the river the construction of a high bridge many feet above the water line is not always practicable, for the cost and inconvenience of building the necessary inclined approaches would be very great.

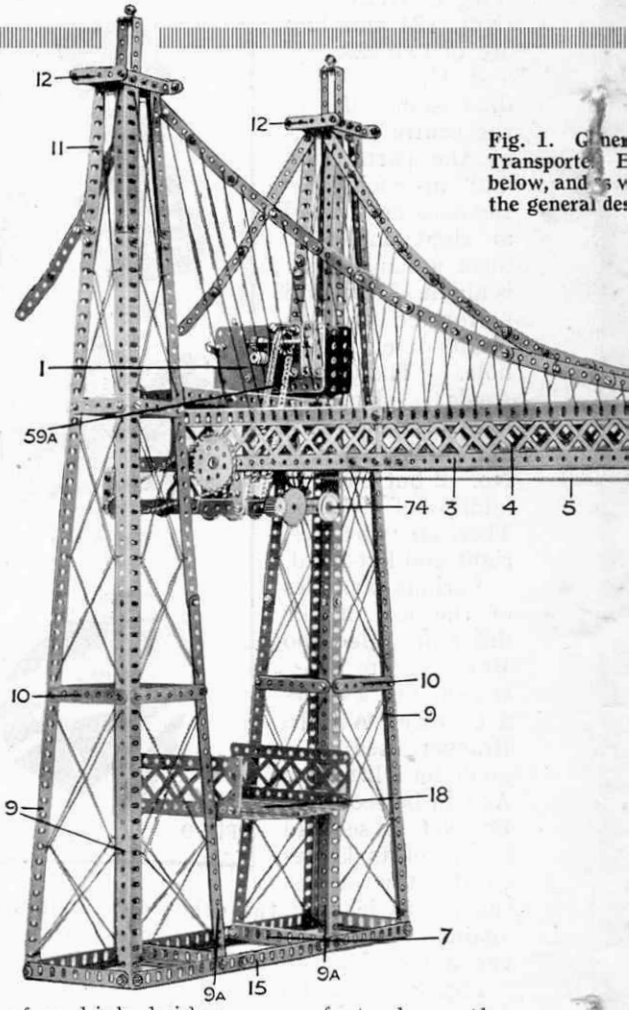
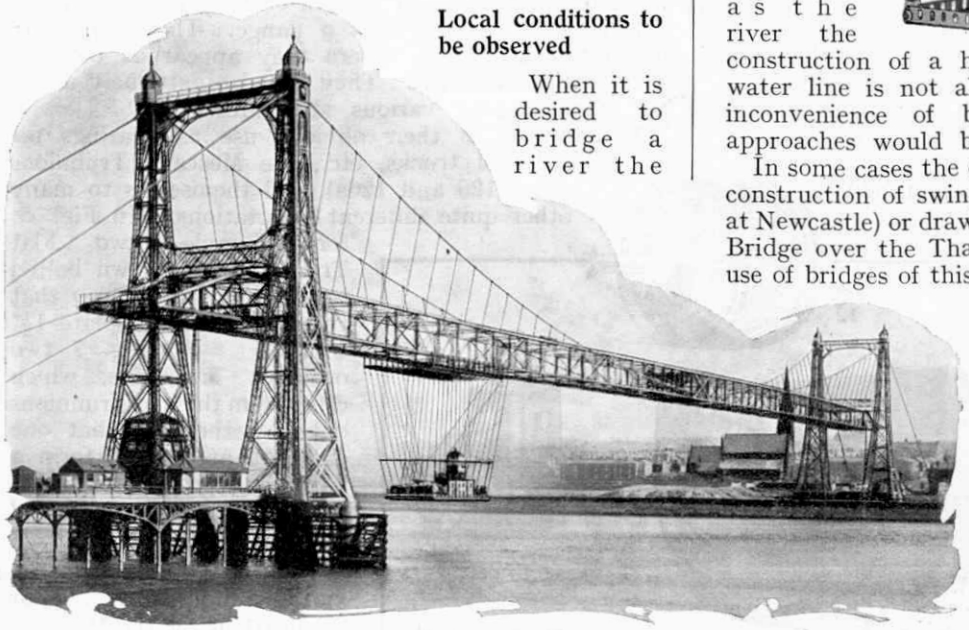


Fig. 1. G[illegible]ner Transporte[illegible] E below, and [illegible]s v the general des

In some cases the difficulty has been overcome by the construction of swing bridges (as over the River Tyne at Newcastle) or drawbridges (as in the case of the Tower Bridge over the Thames) but it may be said that the use of bridges of this type is confined generally to comparatively narrow rivers. Moreover, the steering of large steamers through the narrow opening of a swing bridge calls for considerable navigating skill, and if a strong tide is running at the time, there is considerable risk of the ship fouling the piers of the bridge.

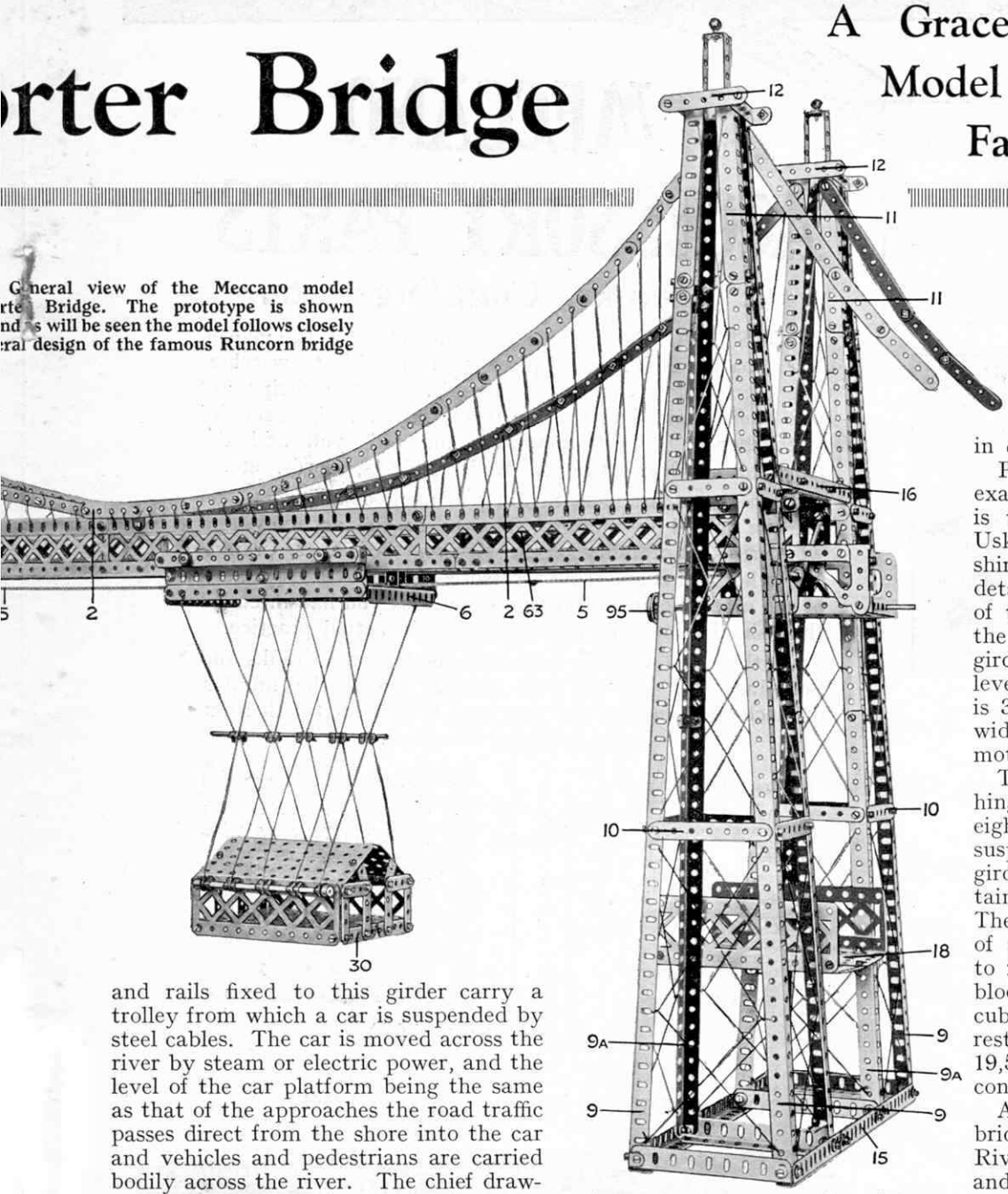
Consequently in certain places, use is made of transporter bridges. These consist essentially of a girder suspended at such a height that it clears the tallest masts,



The Transporter Bridge over the River Mersey at Runcorn, Cheshire

...rter Bridge

A Graceful Meccano Model of a World-Famous Bridge



General view of the Meccano model ...rter Bridge. The prototype is shown ...nd as will be seen the model follows closely ...eral design of the famous Runcorn bridge

and rails fixed to this girder carry a trolley from which a car is suspended by steel cables. The car is moved across the river by steam or electric power, and the level of the car platform being the same as that of the approaches the road traffic passes direct from the shore into the car and vehicles and pedestrians are carried bodily across the river. The chief drawback to bridges of this type is, of course, the time taken in loading and unloading the car. Also whilst the car is taking one load across other road traffic may be held up until the car has completed the double journey. Hence it is improbable that transporter bridges will be made use of in the future except in places where the amount of road traffic is small.

The first transporter bridge was designed in 1872 to cross the River Tees at Middlesbrough, but owing to financial reasons the bridge was never built. For some years thereafter the transporter type of bridge remained more or less a novelty until Palacis, an architect of Bilbao, and Arnodin, a French engineer, took out a patent for this system of bridge design. In 1893 they designed and erected a transporter bridge at Portugalte, near Bilbao, the main span of the bridge being 148 feet above high water level and built in the form of a suspension bridge with "stiffening" girders. In 1897 a transporter bridge was erected across the River Seine at Rouen. It has a span of 472 feet and is operated by electric motors fixed to the top of the car. The towers are 280 feet in overall height.

Perhaps the most notable example of a transporter bridge is that which crosses the River Usk at Newport in Monmouthshire. The following are a few details of the principal features of the bridge: the span between the towers is 645 feet and the girders are clear of high water level by 177 feet. The car itself is 33 feet in length by 40 feet in width and is driven by two electric motors each of which is of 35 h.p.

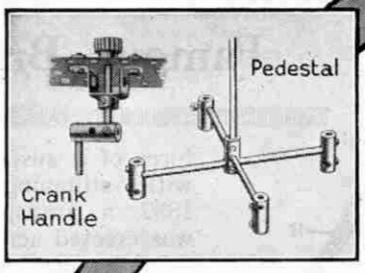
The legs of each end tower are hinged and sixteen steel cables, eight inside and eight outside, suspend each of the two stiffening girders. Each of these cables contains 127 wires and weighs 4 tons! There is also a similar number of anchor cables which are fixed to foundations consisting of large blocks of masonry totalling 35,000 cubic feet. Each of the end towers rests on piers containing some 19,500 cubic feet of masonry and concrete.

Another famous transporter bridge is that which crosses the River Mersey between Runcorn and Widnes. This bridge is of the suspended girder type and is of very massive construction. The structural details of the Meccano model follow the lines of the Runcorn Bridge very closely—most of the principal features of the actual bridge being reproduced in the model.

A special automatic mechanism by means of which the travelling carriage will traverse slowly from one end to the other of the bridge and then reverse and travel back again is also included in the model. Each time the carriage reaches the landing platforms at either end of the bridge it pauses for a brief period before moving away again to the opposite end. This process is repeated automatically so long as the electric current is supplied.

The constructional details of the towers and the main bridge are dealt with fully in this issue. The automatic reversing gear and the construction of the

MECCANO — ENGINEERING IN MINIATURE



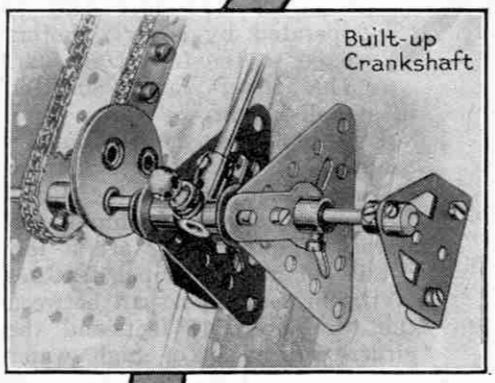
MECCANO ACCESSORY PARTS

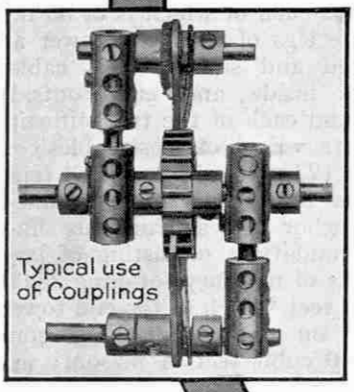
1. *Cranks, Couplings, etc.*

CONSTRUCTING a Meccano model is a fascinating pastime. Piece by piece, you are able to watch it growing beneath your hands. As the Strips fall into their allotted places the whole structure is gradually strengthened. The framework completed, you add the mechanism—Gears, Cranks, Rods, Pulleys, Cords, etc.

Then comes the most thrilling moment of all, when you set the model in motion. Thanks to the accuracy and wonderful adaptability of the Meccano Couplings, Cranks, and other real engineering accessories, the movable portions of the model begin to function exactly as you had intended they should, and exactly as they do in actual practice.

On this page we show a few uses of Meccano Cranks and Couplings, but—as *"M.M."* readers know—the number of mechanical movements that may be obtained with these parts is almost unlimited.





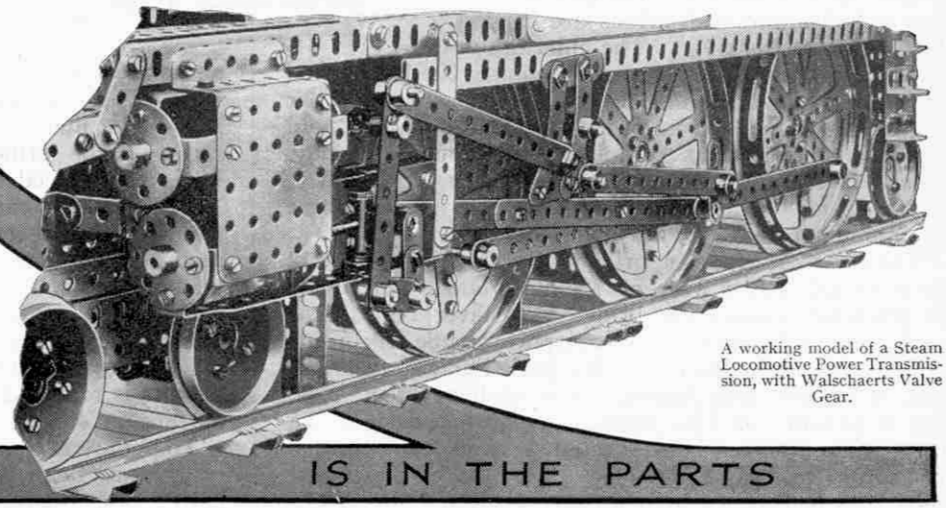
No.		s.	d.
19.	Crank Handles (large) each	0	2
19s.	„ „ (small) „	0	2
*38.	Washers ... ... doz.	0	1
43.	Springs ... ... each	0	2
50a.	Eye Pieces with boss... „	0	4
†57.	Hooks ... ... 2 for	0	1
57a.	„ (scientific) ... each	0	1
†57b.	„ (loaded) ... ... „	0	3
58.	Spring Cord .....per length	0	9
59.	Collars with set screws 2 for	0	3
62.	Cranks... ... ... each	0	3
62a.	Threaded Cranks ... „	0	4
63.	Couplings ... ... „	0	6
63a.	Octagonal Couplings „	0	8
63b.	Strip Couplings ... ... „	0	8
63c.	Threaded Couplings ... „	0	6
64.	„ Bosses ... „	0	2

No.		s.	d.
65.	Centre Forks ... ... each	0	1
115.	Threaded Pins ... „	0	2
*116.	Fork Pieces, large ... „	0	3
*116a.	„ „ small ... „	0	3
120.	Buffers, for locos, etc. „	0	2
120a.	Spring Buffers ... per pair	0	8
120b.	Compression Springs each	0	1
*121.	Train Couplings ... „	0	2
127.	Simple Bell Cranks „	0	1
128.	Boss Bell Cranks ... „	0	3
†130.	Triple Throw Eccentrics „	1	0
*134.	Crank Shafts, 1" stroke „	0	2
136.	Handrail Supports ... „	0	3
140.	Universal Couplings „	0	10
144.	Dog Clutches ... ... „	0	6
*165.	Swivel Bearings ... „	0	6
*166.	End „ ... „	0	3

** These parts are available with nickel finish only.*
† These parts are available in enamel finish only.

Your dealer will be pleased to show you all the Meccano Parts; ask him for a complete Price List.

MECCANO LTD. OLD SWAN LIVERPOOL



A working model of a Steam Locomotive Power Transmission, with Walschaerts Valve Gear.

THE GENIUS IS IN THE PARTS

travelling carriage will be described and fully illustrated in next month's "*M.M.*"

Building the Meccano Model

The base of each tower is formed by bolting together two pairs of 9½" Angle Girders 15 (Fig. 2) overlapped nine holes. These are laid parallel to each other and connected crosswise by four 4½" Angle Girders 7. The outer vertical members of each tower are constructed with 24½" Angle Girders 9 butt-jointed to 5½" Angle Girders 11. The joins are bridged by 2½" Strips. Each inner vertical member consists of two 12½" Angle Girders 9a bolted together and extended by 5½" Angle Girders 11 in a similar manner to the outer members. The 3½" Strips 10 and 2½" Strips 14 connect the four girders of each tower while the top is braced by 2½" Strips 12 bolted to 2½" Double Angle Strips 12a.

The finials of the towers are formed by two 2½" × ½" Double Angle Strips 13 bolted to a 1½" × ½" Double Angle Strip that, in turn, is bolted to the inside faces of the Double Angle Strips 12a. Handrail Supports secured to the top of the Double Angle Strips 13 complete the structure.

Having constructed the end towers, they should be bolted to the base as indicated in Fig. 2 and the landing stages 18 placed in position. These are each composed of a 5½" × 2½" and a 5½" × 3½" Flat Plate overlapped one hole and bolted together. Two 5½" Angle Girders 19 bolted to these Plates carry two 5½" Braced Girders 17. The platforms are attached to the vertical members of the towers by Angle Brackets as shown. The 7½" Angle Girders 16 may now be attached to the inner sides of the towers by means of 2½" Angle Girders.

When each tower unit has been completely assembled Meccano Cord may be laced through holes in the Girders as shown. This will give the towers a very realistic appearance especially if care is taken to draw the cord quite tight. A 4-volt Meccano Electric Motor is secured in position by bolting the flanges of the Motor to the Angle Girders 16 (Fig. 2).

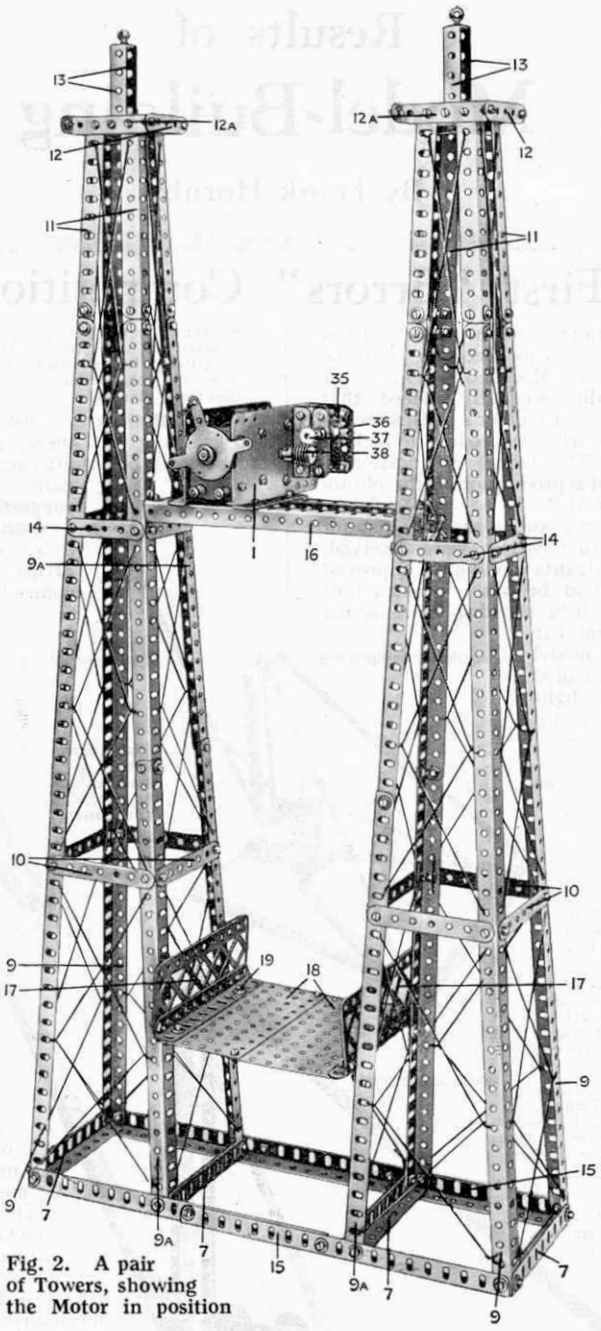


Fig. 2. A pair of Towers, showing the Motor in position

The Main Span

Each of the upper Girders of the main span or gantry (see Fig. 1) is formed by bolting three 12½" and one 9½" Angle Girders end to end. Each of the lower Girders **3**, on which the carriage 30 (Fig. 1) travels, consists of one 24½", one 12½", and one 9½" Angle Girders bolted to Braced Girders 4. The wheels of the carriage travel on the outturned flanges of the Angle Girders 3.

The two similar sides of the main span should now be joined together at each end of the bridge by bolting two 3½" Angle Girders across the upper Girders. In addition to these 3½" Angle Girders, a 3½" × 2½" Flanged Plate is secured by the same bolts across each end of the upper Girders and one is also secured across the centre of the main span, in order to hold the girders rigid.

To secure the main span to the towers proceed as follows. At the Motor end bolt the 3½" Angle Girders to the transverse Angle Girders 16 (Fig. 2) of the towers. The non-Motor end is secured by bolting the Flanged Plate at that end to the Angle Girders 16 of its respective towers.

The suspension "cables" 2 (Fig. 1) are each constructed from twenty-four 2½" Strips bolted end to end. Both cables are attached to the centre of the main span by Flat Brackets, and Meccano cord threaded as shown through the holes of the 2½" Strips and the top Angle Girders of the main span represents the suspension bars of the actual bridge.

Although the model will be quite rigid without the use of "back-stays" or anchorages for the suspension cables, greater realism will be obtained by adding these. If the model is mounted on a baseboard and the cables are brought down and secured at each end to suitable anchorages, a very graceful and realistic model will be obtained.

(To be continued)

Parts required to build the Meccano Transporter Bridge:

4	of No.	1B	4	of No.	8B	1	of No.	12A	2	of No.	17	1	of No.	29	17	of No.	48A	4	of No. 70	2	of No. 103G
8	„ „	2	22	„ „	9	8	„ „	12B	4	„ „	18A	1	„ „	32	3	„ „	48B	10	ft. „ 94	2	„ „ 103K
18	„ „	3	8	„ „	9A	3	„ „	13	1	„ „	19	26	„ „	35	3	„ „	48C	1	„ „ 95	4	„ „ 108
112	„ „	5	4	„ „	9B	3	„ „	13A	4	„ „	20B	507	„ „	37	2	„ „	52	2	„ „ 96	2	„ „ 115
14	„ „	6	4	„ „	9D	2	„ „	14	4	„ „	22	162	„ „	38	2	„ „	52A	3	„ „ 96A	4	„ „ 126A
6	„ „	6A	2	„ „	9E	4	„ „	15	4	„ „	23A	8	„ „	40	4	„ „	53	6	„ „ 99	4	„ „ 136
10	„ „	7	6	„ „	10	2	„ „	15A	1	„ „	25A	1	„ „	43	28	„ „	59	2	„ „ 99A	2	„ „ 165
26	„ „	8	6	„ „	11	3	„ „	16A	3	„ „	26	2	„ „	45	2	„ „	62	6	„ „ 100	1	Electric Motor
10	„ „	8A	22	„ „	12	1	„ „	16B	1	„ „	27	4	„ „	48	7	„ „	63	20	„ „ 101		

Results of Meccano Model-Building Contests

By Frank Hornby

First "Errors" Competition

THIS competition, which was first announced in the July, 1928, *"M.M.,"* struck an entirely new note in Meccano contests.

In the announcement we illustrated a Meccano Derrick Crane which had been constructed very badly—so badly, indeed, that many competitors described it as a " model-builder's nightmare"—and prizes were offered for the boys who succeeded in picking out the greatest number of errors. The model in question is illustrated below, together with a small reproduction of the photograph that appeared in the July *"M.M."*

The competition provided an amusing and searching test for Meccano boys, and some very interesting entries were received. I am glad to say that every one of the entrants would have improved upon the model very greatly if he had been the constructor!

A number of competitors sent in lists showing more errors than we had included in the original list drawn up at these offices when the model was built, although many of the so-called " corrections " were really only slight modifications on the design and did not correct actual mistakes in engineering or model-building principles.

The names of the prizewinners are as follows :—

Section A (for competitors over 14 years of age).

FIRST PRIZE (Meccano products to the value of £3-3s.): James Wilson, Aberdeen, Scotland. SECOND PRIZE (Meccano products to the value of £2-2s.): Stuart D. Taylor, Crouch End, Hornsey, N.8. THIRD PRIZE (Meccano products to the value of £1-1s.): James F. Huson, Upper Norwood, London, S.E. 19.

SIX PRIZES, each consisting of Meccano Products to the value of 10/6: James Healy, Mitchelstown, Co. Cork; R. S. Burch, Westcliff-on-Sea; L. Wentworth S. James, Glasgow; E. Day, Barnsley; Kenneth Blackshaw, Ferrybridge S.O.; W. Raybould, Bloxwich, Nr. Walsall.

SPECIALLY COMMENDED (Certificates of Merit): James Boag, Netherlee, Glasgow; John V. McGann, Fermoy, Co. Cork; Bertram Unné, Harrogate; James J. Brookes, St. Albans; William Burke, Cork; G. Kenneth Hooper, Wallasey; George C. Hayman, Manchester; Cyril Jenkins, Fulham, London, S.W. 6.

Section B (for competitors under 14 years of age).

FIRST PRIZE (Meccano Products to the value of £2-2s.): W. G. Roberts, Hove, Brighton; SECOND PRIZE (Meccano products to the value of £1-1s.): John Rodriguez, Maida Vale, London, W.9. THIRD PRIZE (Meccano products to the value of 10/6): C. W. I. Arnold, Ballacolla, Leith, Ireland.

SIX PRIZES, each consisting of Meccano products to the value of 5/-: F. S. Simpson, Wolverhampton; Jack Morton, Edinburgh; Joseph Bell, Ascot; James Sims, Alderbury, Nr. Salisbury; D. J. Davis, Bedford; Donald Cann, London, N.19.

SPECIALLY COMMENDED (Certificates of Merit): Harold Rothwell, Cheltenham, Glos.; C. R. Hunter, Knutsford, Cheshire; B. Lacey, Preston; Ronald F. Low, Manchester; E. F. Wright, Kensington, W.8.

Section C (Overseas competitors).

FIRST PRIZE (Meccano products to the value of £3-3s.): D. R. Heeramaneck, Bombay, India; SECOND PRIZE (Meccano products to the value of £2-2s.); C. Sweet, Alberta, Canada. THIRD PRIZE (Meccano products to the value of £1-1s.): E. Smith, Montreal, Quebec, Canada.

SIX PRIZES, each consisting of Meccano products to the value of 10/6: P. O. Kirkwood, Cape Province, S. Africa; Y. M. Bhave, Kolaba, Bombay, India; E. Myers, Pontiac, Illinois, U.S.A.; J. G. Guanaderai, Trichinopoly, S. India; D. Mckerchar, Johannesburg, S. Africa; P. L. Bargellini, Florence, Italy.

SPECIALLY COMMENDED (Certificate of Merit): A. Keith, Mt. Eden, Auckland, New Zealand; Charles Galdes, Valletta, Malta; A Shepherd, Bloemfontein, O.F.S., S. Africa; Robert Oswald Jukes, Christchurch, New Zealand; E. Morris, Parktown W., Johannesburg; N. G. Jackson, Johannesburg, Africa; W. F. Mann, Montreal, Canada.

The following is a list of the outstanding errors. In addition to pointing out these, several of the principal prize-winners mentioned other alterations which, they considered, should be carried out in the revised model, and these suggestions were taken into consideration when awarding the prizes.

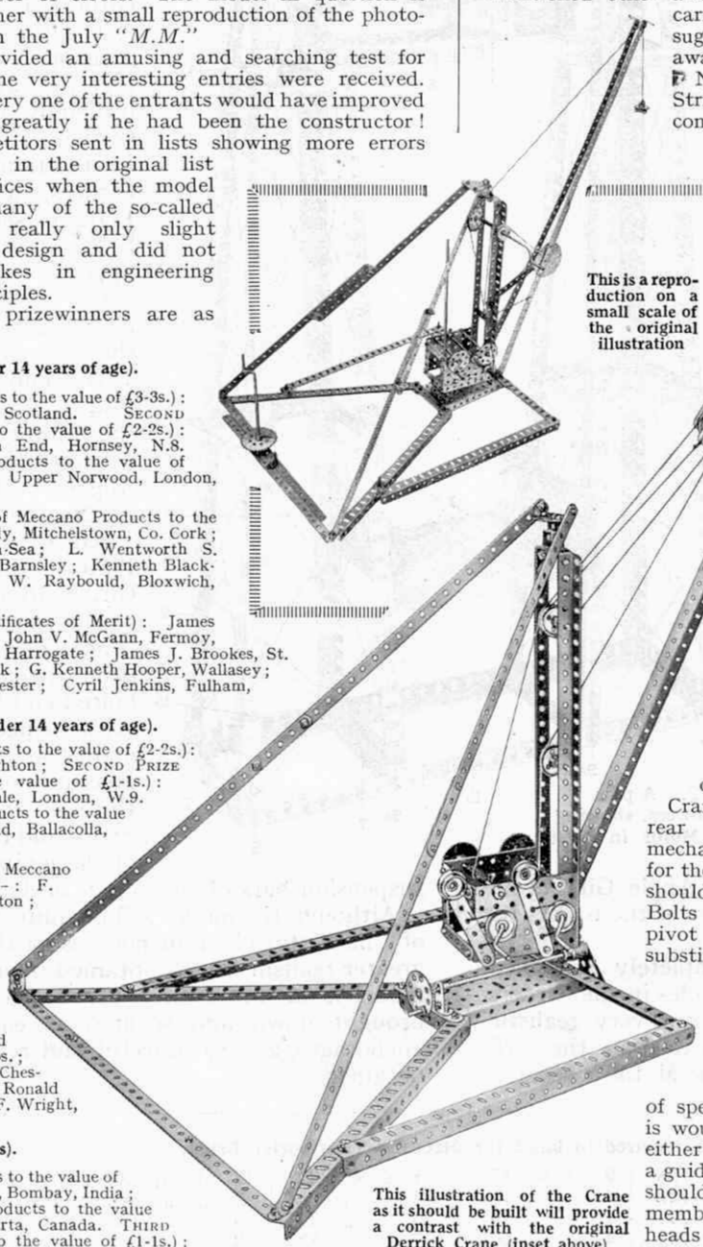
No pulley on jib; No hook on hoist cord; Strips comprising jib not overlapped, but connected by single bolts; No bracing on jib; Base of jib secured to fixed base and cannot therefore slew; Pivot at top of upright insecure.

Pulley over which hoist cord passes should be placed on upright and not on tension member; Crank Handle at top of upright should be in gear box; Luffing cord incorrectly placed; Brake on Crank Handle incorrectly designed and in wrong position; Strips comprising tension members should be overlapped and not bolted side by side by Flat Brackets; Luffing cord should be attached near the top of the jib and not near the base; Some system of Pulleys should be introduced in luffing mechanism in order to give increased mechanical advantage.

The Strips comprising the rear base members should be overlapped and not connected together by Flat Brackets; Crank Handle and 2" Sprocket Wheel at rear badly situated and unconnected to mechanism; A Set-screw should be substituted for the ¾" Bolt in the 2" Sprocket; Standard bolts should be used in several cases where ½" and ¾" Bolts are used; The 11½" Rod forming the main pivot should be removed and a shorter Rod substituted; The 57-teeth Gear Wheel mounted on this Rod should be removed, as it serves no useful purpose.

No swivelling gear included; Hoist cord should be placed on inside of the gear box; Gearing, which should give a reduction to driven shaft, gives increase of speed; The drum on which the luffing cord is wound should be in gear box; No brakes on either shaft; The hoist cord should be passed over a guide pulley at top of jib; A reinforced bearing should be provided at top of vertical upright member. Bolts are placed with both shanks and heads protruding, instead of being consistent; Collars on shafts in gear box are incorrectly placed.

The luffing cord should not pass over the 2½" Strip secured between the upright as friction will be caused; No necessity for a Face Plate as weight on brake lever—a Flanged Wheel or smaller part could be used here.



This is a reproduction on a small scale of the original illustration

This illustration of the Crane as it should be built will provide a contrast with the original Derrick Crane (inset above)

An Interesting New Zealand Competition

The model-building competitions that are organised from time to time in the "*Meccano Magazine*" give Meccano boys living in all parts of the world an excellent opportunity of competing with each other. These competitions, however, are not the only means whereby constructors may enter into friendly rivalry with other Meccano boys. Model-building contests are continually being organised in almost every civilised country by Meccano Clubs or by Meccano dealers, and the large number of excellent entries that are invariably received show that they are extremely popular.

Meccano boys will naturally be interested in the models submitted in such contests, and I am therefore pleased to be able to include this month a few particulars of a highly successful contest that was organised some time ago by Wiseman's Meccano Club, at Auckland, New Zealand. This is one of the largest Meccano Clubs in the world; hence it is not surprising that a very large number of really excellent models were submitted.

A full report of the contest was forwarded to me by the Club Secretary, Mr. W. Shearer, together with several photographs of the more interesting of the models submitted. Some of these are illustrated on this page and it will be seen that the standard of workmanship was very high indeed. The competitors were divided into three sections, Section 1 being for the very young members of the Club; Section 2 for older boys, and Section 3 was devoted to the entries of the still older members.

In Section 1 the chief entry of note was a travelling crane constructed by Alan Wylie. The crane was most cleverly designed and its constructor fully deserved the First Prize that was awarded to him.

Amongst entries in Section 2, the models submitted by Felix Mulligan and Geoffrey Polland were particularly outstanding. Mulligan's model represented a lighthouse whilst a gangsaw comprised Polland's entry. One of the most interesting of all the entries was Leslie Crayo's model aeroplane. This excellent model had a wing span of 39½" and included a wealth of detail, the way in which the engine was represented being particularly noteworthy. A joystick and rudder bar were of course fitted and the model in addition contained very neat representations of those vitally important accessories—the petrol tanks. An exhaust pipe leading from the cylinder engine was also included.

Readers could not fail to notice the excellent model tank illustrated on this page. Although the tank is fitted with caterpillar track consisting of double lengths of Sprocket Chain passing over Sprocket Wheels, it was found impossible to propel the model by this means alone, as the Sprocket Chain did not give sufficient adhesion. Four 3" Pulley Wheels fitted with rubber tyres were therefore used to supplement the track and these have been concealed so ingeniously that it is impossible to discover them in the photograph. A high-voltage motor drives both the caterpillar track and the axles carrying the four 3" Pulleys through reduction gearing, and thus a very powerful drive is obtained.

The caterpillar track proves very useful when the tank has to negotiate an obstacle, and it can well be understood that there were few obstacles that the tank was not able to overcome!

Doubtless "*M.M.*" readers will be wondering what animal or reptile the model shown in the centre of the illustration is intended to represent. As a matter of fact I am quite as much in the dark as any one, for its name was unfortunately omitted from the photograph. Hazarding a guess, however, I should say that the model was either of a prehistoric crocodile, a brontosaurus, or an armadillo. Nevertheless this peculiar creature has been very cleverly built up and presents a somewhat sinister appearance.

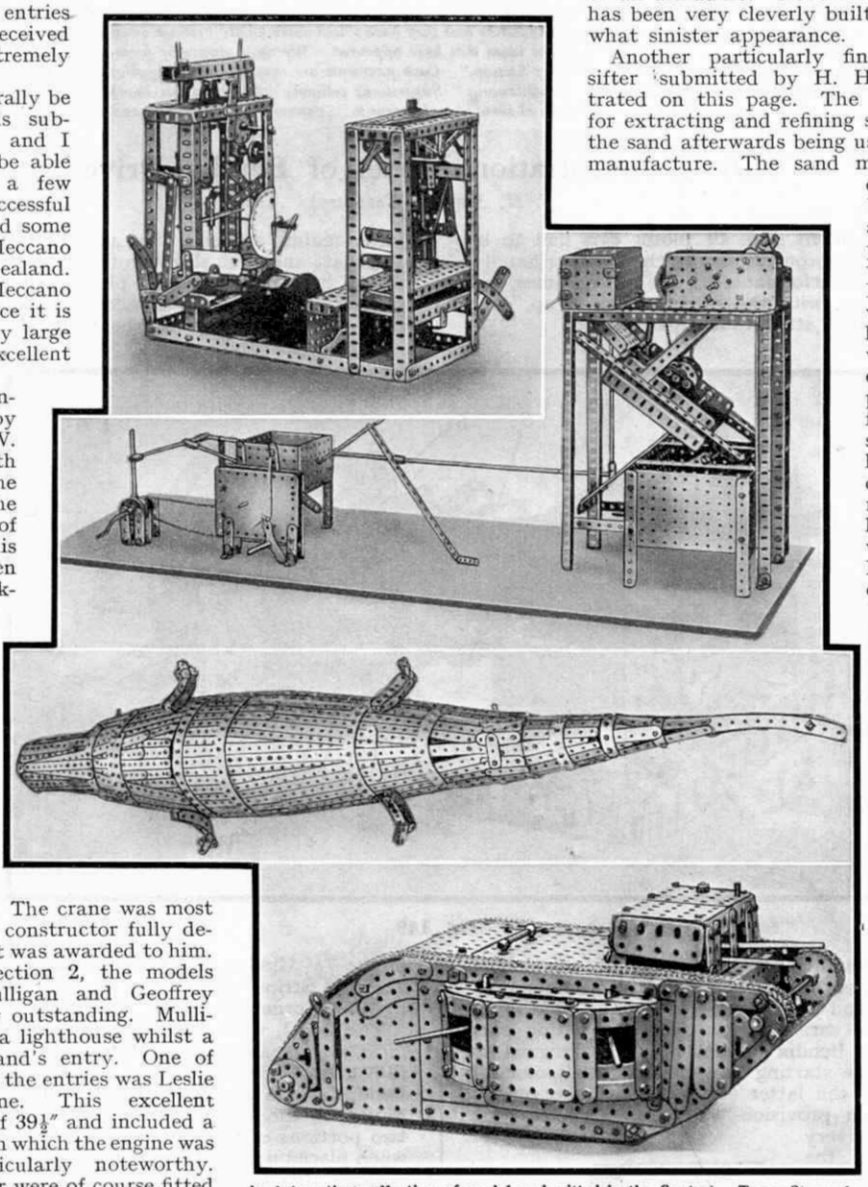
Another particularly fine model was the sand-sifter submitted by H. H. Walker and also illustrated on this page. The model represents a plant for extracting and refining sand from the river bed—the sand afterwards being used for concrete or cement manufacture. The sand mixed with water is first drawn up from the river bed and is deposited into a small tank, a suction pump being used to draw the sand into the tank. In the model the tank will be seen on the left-hand side and a Clockwork Motor has been employed to operate the pump. A pipe leads from this tank up to a second tank on the right-hand side and is situated directly over a sifting mechanism that is oscillated backwards and forward by means of the Electric Motor, mounted on the top of the framework of the model.

As the sand falls through the opening in the top tank it strikes the oscillating plates of the sifting mechanism and any stones, etc., are thrown out into a separate receptacle at the bottom, whilst the sifted sand itself is collected in a separate bin ready to be transported.

Alan Lusk must be a most prolific model-builder, for in addition to the tank and "Meccanodillo," both of which are illustrated on this page, he also submitted an exceedingly well-proportioned model of a car. This was of the two-seater coupé type and its external lines were very fine indeed. The complete model was rather marred, however, by its builder using 3" Rubber Rings on the 3" Pulleys that comprised the road wheels; 3" Dunlop Tyres should of course have been used here and would have made the car look even better.

In building his model Lusk paid particular attention to many of the characteristic fittings of a car, and such details as a "dickey" seat that actually folded up, a luggage grille, and spare tyres secured to the rear of the car, were particularly noteworthy. It is remarkable what careful attention to detail will do to even the simplest model, and constructors who aspire to honours in the model-building world should pay particular attention to this point.

This account would be incomplete without making mention of three further entries—a stiff leg derrick built by Jack Low, a printing machine by D. Wilcox, and a naval gun constructed by George Henwood. Although these competitors failed to gain prizes they were highly commended by the judges.



An interesting collection of models submitted in the Contest. Top: Strength Testing Machine, built by Jack Wray. Second from top: Sand Sifting Tank, constructed by H. H. Walker. Centre: The "Meccanodillo," the work of Alan Lusk. Bottom: A realistic tank also built by Alan Lusk

Suggestions Section

Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(149)—Demonstration Model of Bendix Drive

(J. H. Smythe, Coventry)

UP to a comparatively recent date all motor cars had to be started by hand by vigorously turning the starting handle. This was a very tiring performance at the best of times, but on a cold winter's morning, with the engine "frozen up," one required a great reserve of both strength and patience!

It had long been realised by those interested in the motor car's development that before it could become generally popular some reliable mechanical device would have to take the place of the handle. Nowadays all modern cars of the powerful "luxury" type are equipped with self-starters, and happily there is little fear of a recurrence of that notorious but probably mythical incident when the deaf old lady, after watching a pioneer motorist struggle for some time with the starting handle, offered him a penny and commended him upon the hearty manner in which he was grinding his organ!

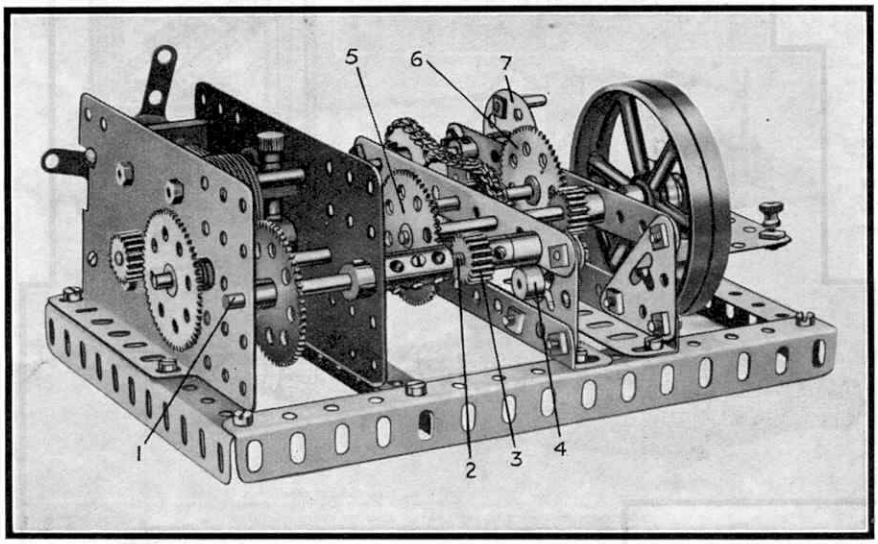


Fig. 149

Modern self-starters generally take the form of an electric motor that obtains its supply of current from the accumulators that also supply the front and rear lights, electric horn, and other electrical accessories of the car. Not the least interesting part of the starting gear is the Bendix pinion, which is designed to disconnect automatically the starting motor from the crankshaft of the engine immediately the latter starts. It will be readily understood that if no such provision were made, the starting motor would be driven at a very high rate of speed when the engine started, with disastrous results to the former.

The illustration at the foot of this page shows the actual Bendix pinion as fitted to a car. The armature spindle of the starting motor is cut with a thread of very coarse pitch and the pinion works in this thread. When the shaft revolves in the direction of the curved arrow, the pinion moves toward the left and enters into engagement with a toothed segment cut on the periphery of the engine flywheel. The pinion is weighted on one side to prevent it rotating when travelling along the thread. As the pinion reaches the end of its travel it butts against a fixed collar, and commences to turn "solid" with the shaft and thus slowly rotates the flywheel. When the engine starts, it turns the Bendix pinion faster than the armature speed of the motor and as a consequence causes it to travel backwards out of engagement with the flywheel. The shock of taking up the drive is lessened by the spring shown on the motor shaft.

The action of this highly interesting device is completely demonstrated in the Meccano model shown in Fig. 149. Several other important motor car mechanisms have been demonstrated in Meccano and *"M.M."* readers who are interested in this branch of engineering should find this model a valuable addition to the series.

The 4-volt Motor is bolted rigidly to one end of the frame, which is composed of two 7½" Angle Girders spaced apart by five 5½" Angle Girders. Two of the latter Girders are placed on top of the upper flanges of the 7½" Girders and Corner Brackets are bolted to their ends. Two 5½" Strips, which form bearings for the gearing, are secured to the Corner Brackets.

The Rod 1, which is driven through a gear train of 9:1 reduction ratio, is journalled in the Motor side plates and carries a Coupling that has a 2" Threaded Rod secured rigidly in its other end. The Bendix pinion unit 3 is placed on this Rod; it consists of a ½" Pinion to the boss of which a Threaded Boss is soldered. The two portions of the unit must be fixed together carefully so that when placed on the Threaded Rod, the latter is capable of turning perfectly freely and smoothly within them.

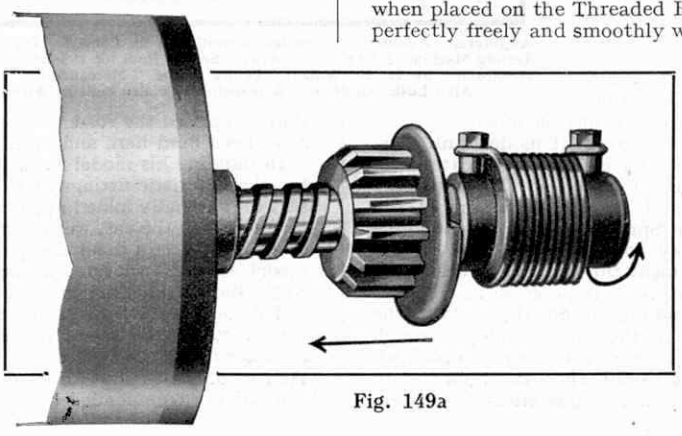


Fig. 149a

A Collar 4 is secured in the position indicated by a bolt passed completely through its set-screw holes and inserted in the Threaded Boss. The object of this is to add weight to the unit so that normally it may be screwed along the Rod without turning round, as in the actual gear. When the Motor is set in motion in the correct direction, the unit will travel along the Rod toward the 57-teeth Gear 5 and eventually come into mesh with it. At this instant the Pinion butts up against the face of the Coupling and turns with the shaft, *(Continued on page 258)*

(150)—Patent Window Device

(E. Edwards, Hoylake, Cheshire)

One of the many practical uses to which Meccano may be put is the demonstration of new inventions of all descriptions. The essential features of many patent specifications can only be brought out in a working model, and there are many cases in which this may be done very easily by means of Meccano. Fig. 150 is another example bearing out the truth of this statement.

The illustration shows a special form of window-frame that, it is claimed, possesses important advantages over the ordinary kind. If used for house or factory window, for example, it has the advantage that, when opened, the entire window can be cleaned from inside the room. It is also expected that the frame will be applicable to motor car windscreens. It is the invention (patent applied for) of Mr. Eric Edwards, of Hoylake, Cheshire, who perfected his idea with the aid of Meccano parts.

The fixed portion of the window frame is represented in the model by 12½″ Angle Girders, which are spaced apart at top and bottom by 9½″ Angle Girders and secured rigidly to the base. The window proper is also built up from Angle Girders and is retained in the guides 1 by means of the ½″ Pulleys 2. The latter are secured to a rod 9″ in length (obtained by joining an 8″ and a 1″ Rod by a Coupling) and they should be arranged to slide freely in the flanges of the vertical side girders.

Cranks 4 are attached pivotally to the sides 3 of the window frame and are also secured rigidly to a transverse 11½″ Rod which is journalled in the lower portions of the Angle Girders 1. A 57-teeth Gear on the end of the 11½″ Rod meshes with a Worm that is secured on the Rod carrying the 57-teeth Gear 5, and this latter Gear meshes with a ½″ Pinion on the Rod to which the manipulating handle 6 is secured.

On operation of the handle the Cranks 4 slowly describe arcs, and their movement causes the top of the window to slide up or down the guides 1 while the bottom moves toward or away from the guides. When in the fully open position the window is practically horizontal.

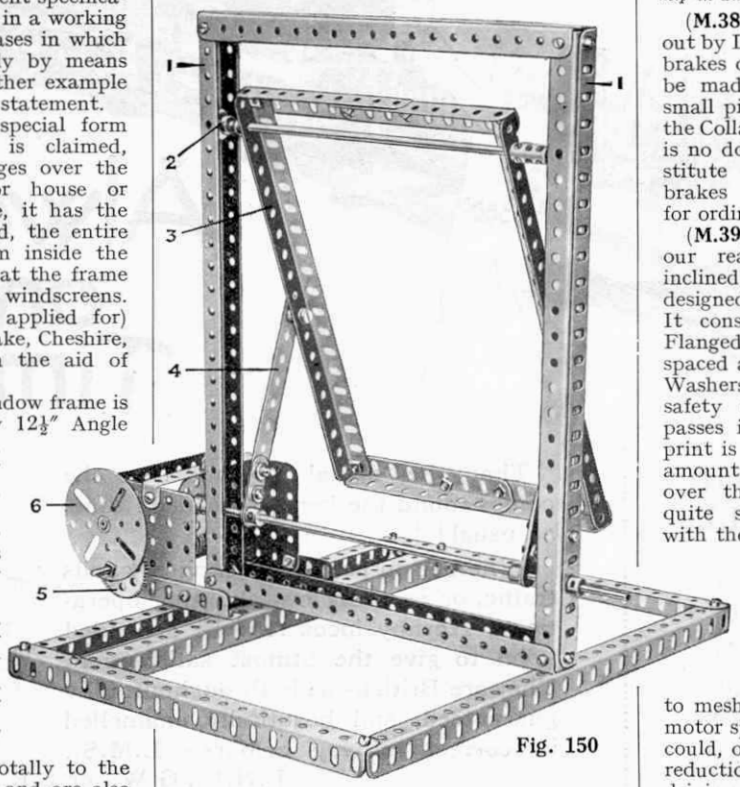


Fig. 150

(151)—Flywheel-Propelled Truck

(S. A. Bell, Southport)

S. A. Bell has adopted a novel means of propulsion for the model truck shown in Fig. 151. His idea consists essentially of a Rod 1 that carries at its extremities two Flywheels 2 and presses lightly against the peripheries of the Dunlop Tyres fitted to the 2″ Pulleys that form the road wheels. By setting the Rod carrying the Flywheels in rapid motion, a remarkably powerful drive may be applied to the road wheels. The model will proceed along the ground at a fair pace and will climb steep gradients or surmount obstacles, such as thin books, etc., placed in its path.

The body of the truck consists of a 5½″ × 2½″ Flanged Plate, in the side flanges of which the Rods carrying the road wheels are journalled, the Rods being placed in the third holes from the ends.

The Rod 1 is journalled in two Flat Brackets bolted to the Flanged Plate by their slotted holes. Its position should be adjusted by moving the bolts in the slotted holes, until it makes contact with all four wheels equally. This is an important point, for the proper working of the model is dependent upon the Rod making efficient contact with the rubber tyres.

To operate the model, one end of a piece of string about 36″ in length should be wrapped round the bolt 4. This bolt is secured in a Collar that is attached rigidly to the Rod 1. The cord should be wound evenly on the Rod and then given a smart pull, thus setting the Flywheels in rapid motion, when the model will immediately commence to travel forward.

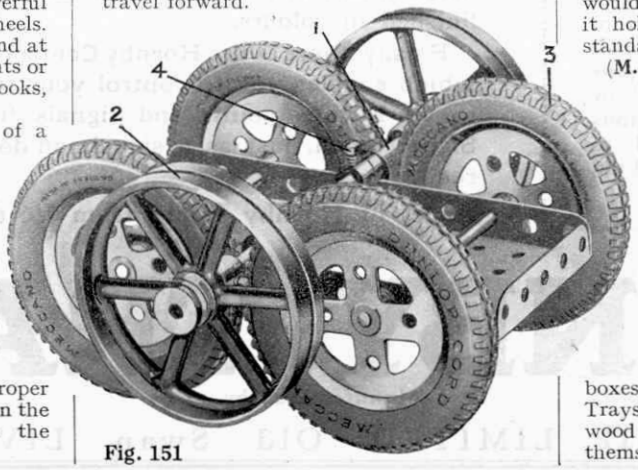


Fig. 151

Miscellaneous Suggestions

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

(M.38). Improved Brakes.—It is pointed out by L. Boreham (London, N.20) that the brakes of the Meccano Motor Chassis may be made more effective by attaching a small piece of cloth or similar material to the Collars forming the brake shoes. There is no doubt that this addition would constitute an improvement, although the brakes are already sufficiently powerful for ordinary purposes.

(M.39). Print Trimmer.—For those of our readers who are photographically inclined, A. Lightfoot (Newton Abbot) has designed a very efficient print trimmer. It consists essentially of two 5½″×2½″ Flanged Plates bolted side by side but spaced a short distance apart by means of Washers. The knife, which consists of safety razor blades fastened to Strips, passes into the slot so formed, and the print is laid on top of the Plates with the amount requiring trimming projecting over the slot. The print may be cut quite square by comparing its edges with those of the Plates.

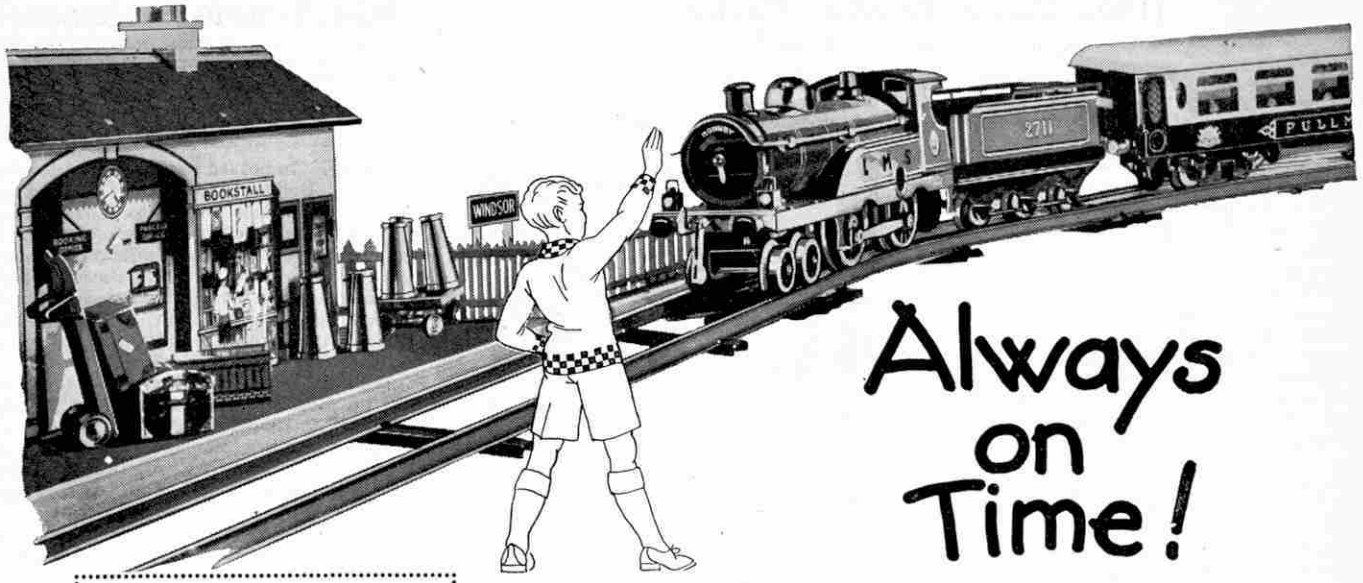
(M.40). Slow Drive from Clockwork Motor.—A slow drive that may easily be obtained from the Meccano Clockwork Motor is suggested by L. C. Hart, of Portsmouth. It consists of a 1″ Gear Wheel arranged to mesh with the large gear to which the motor spring is attached. The same result could, of course, be obtained from suitable reduction gearing applied to the ordinary driving spindle, but Hart's method effects a considerable economy in parts.

(M.41). Gearing for Clockwork Motor.—A similar suggestion to the above has been received from G. Trobridge, of Johannesburg, who points out that a 2 : 1 reduction gear may be obtained from the driving spindle of the Clockwork Motor merely by meshing a ¾″ Pinion with the special Pinion already fitted to the spindle. This hint may prove useful in many models.

(M.42). Fibre Universal Coupling.—A simple fibre Universal Coupling has been devised by R. W. Barnett of Norbury. It consists of two Double Arm Cranks bolted one to each side of a circular disc of soft leather. The centre of the cranks coincide, but their arms are at 90 degrees to each other. Although this device would certainly prove very efficient, it holds no special advantage over the standard Meccano Universal Coupling.

(M.43). Safety Catch for Brakes.—In many cases it is necessary to arrange matters so that the brakes of a model may be kept on without holding the levers by hand. M. Monarty (Christchurch, New Zealand) provides a neat catch for a brake lever in the shape of a Hinge that is fastened in such a position that, when required, it may be pressed over the end of a Threaded Pin secured to the brake lever.

(M.44). Meccano Storage Boxes.—Neat storage boxes for Meccano parts may be made from cigar boxes, according to W. Burnet (Luton). Trays and partitions made from fretwood are refinements that will suggest themselves to every Meccano boy.



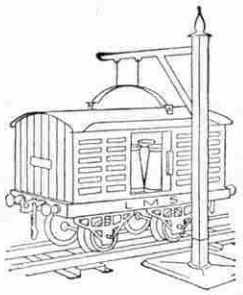
Always on Time!

SEND FOR THIS NEW BOOKLET

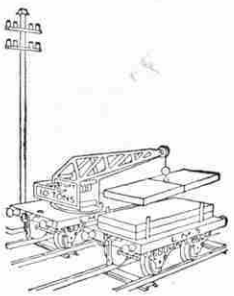
Every owner of a Hornby Train should have a copy of this splendid booklet entitled "How to get more fun out of Hornby Trains" for it contains much useful information concerning miniature railways. All enthusiasts will find it of great assistance in enabling them to obtain the utmost pleasure and satisfaction from their hobby.

The price of the booklet is 3d. and if you cannot obtain it at your dealers it will be sent direct, post free, on receipt of 3d. in stamps. All applications should be addressed to Dept. AM, Meccano Ltd., Old Swan, Liverpool.

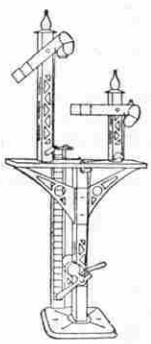
"That's her signal . . . . and here she comes round the bend. Dead on time, as usual!"



Whether on passenger service, goods traffic, or carrying out shunting operations, Hornby locos may be depended upon to give the utmost satisfaction. They are British-made throughout, fully guaranteed, and beautifully enamelled in correct railway colours — L.M.S., L.N.E., G.W., or S.R. You can't help being thrilled when you see a Hornby Loco dashing along the track—smoothly over the points, steadily round the curves, full speed ahead on the straight.



Your miniature railway is exact in every detail when it is constructed with Hornby Rolling Stock and Accessories. The Rolling Stock includes Passenger Coaches, Pullman Cars, Trucks, Wagons and Vans of the same types as you see on the big railways, while amongst the Accessories there are Stations, Tunnels, Bridges, Signals and Level Crossings, all made in perfect proportion and all beautifully finished in colours.



Finally, there is the Hornby Control System, which enables you to control your train and to work your points and signals from the Signal Cabin, just as a signalman does on a real railway.

Prices of Hornby Trains from 7/6 to 110/-

HORNBY TRAINS

Manufactured by

MECCANO LIMITED Old Swan LIVERPOOL

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

Notes by the Secretary

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

The Hornby Railway Company is now well past the experimental stage, and has settled down as a vigorous organisation working on definite lines. Although the scheme was announced only as recently as October last, there are now 18 Branches incorporated with the parent Company, and another dozen practically ready for incorporation. In addition, many other Branches are in process of formation, with every prospect of success.

Owing, no doubt, to the newness of their work, the secretaries of some incorporated Branches have been rather erratic in forwarding their monthly reports. These reports are of the greatest possible importance, as it is only through them that I can keep in touch with the work of the Branches. In this connection I will give secretaries one tip upon which I hope they will act—that is, not to leave the writing of their reports to the last minute. Notes should be made after each meeting, or any other event of interest during the month, so that when the time comes for preparing the report, all that is necessary is to collect these notes together. I shall be particularly glad if secretaries will make it a rule to let me have their reports by the first of each month, so that I have plenty of time to deal with them in the following month's "*M.M.*"

One other point that I wish to emphasise is the importance of each Branch sending me photographs from time to time, with a view to their publication in the Hornby Railway section of the "*M.M.*" Possibly some Branches may consider that their layouts are not sufficiently elaborate to be worth photographing. This is a great mistake. There is something of interest about all well-produced photographs of anything connected with model railways. In addition to photographs of layouts, I am anxious to receive photographs of the members of every Hornby Railway Branch, whether it is already incorporated or not.

Recent reports to hand show that most of the Branches have decided upon a definite layout and are now proceeding to develop all its possibilities, with special attention to timetable working. The H.R.C. pads of forms for this purpose—which are fully described in the H.R.C. booklet—are rapidly increasing in popularity as their value becomes better known.

One Branch has adopted a feature of particular interest, and one that I should like to see adopted generally. This is "*Overhaul Night.*" This night comes once in two months and it is the occasion for a thorough overhaul of Branch material. Locomotives are cleaned, adjusted and oiled, and all rolling stock is examined carefully for any slight defects that may have developed. The track rails, and especially the points, are tested, to make certain that they have not become bent out of shape or damaged in any other way, and similar attention is given to signals and all other items. Branches that adopt this idea will find that their railway is always kept in first-class condition.

I receive every day letters from H.R.C. members enquiring as to whether a Branch of the Company already exists in their neighbourhood, or is likely to be formed. For the benefit of H.R.C. members generally, therefore, I publish this month a list of the incorporated Branches and of the Branches that are in process of formation.

Miss Ethel Marcia Hirst of Harrogate has the honour of being the first girl to join the Hornby Railway Company. Her membership number is 34. She is an enthusiastic Meccano model builder and has been a member of the Meccano Guild for some time. More recently she has turned her attention to model railway working, and is rapidly becoming an expert.

H.R.C. Incorporated Branches

ELLESMERE—T. S. Moore, 13, Hillsboro' Road, East Dulwich, London, S.E.22.
LENTON SANDS—F. W. Byron, 125, Harrington Drive, Lenton Sands, Nottingham.
WHERWELL—P. Trodd, Wherwell, Andover, Hants.
NEW EARSWICK—S. Bruce, 67, Rowan Avenue, New Earswick, York.
SITTINGBOURNE & MILTON—H. F. W. Rivett, 44, Ridham Avenue, Kemsley, Sittingbourne.
SOUTHCHURCH—K. Harrod, Worpits, Rochford Road, Prittlewell, Essex.
NEATH—G. C. L. Alexander, 76, Gnoll Park Road, Neath, S. Wales.
ILFRACOMBE—W. A. Hatchley, 47, St. Brannocks Park, Ilfracombe.
KILMAURS—R. McClintock, 52, Fenwick Road, Kilmaurs, Ayrshire.
THE PARK (SELLY OAK)—J. L. Twittey, 148, Raddlebarn Road, Selly Oak, Birmingham.
MONTPELIER—R. W. Blackmore, 6, Picton Street, Montpelier, Bristol.
EXHALL—M. Melville, Exhall Vicarage, Nr. Coventry, Warwickshire.
ST. JOHN'S (EXETER)—A. Passmore, 42, Northernhay Street, Exeter.
BELFAST—C. Andrews, 52, Rugby Road, Belfast.
1ST CROYDON (ADDISCOMBE) WOLF CUBS—Mr. K. W. Nottle, Beverley Hall, Grant Road, Addiscombe, Croydon.
POLSLOE (EXETER)—Mr. M. C. Hodder, 60, Elmside, Exeter.
FARNHAM (SURREY)—H. S. North, "Karind," Boundstone, Nr. Farnham, Surrey.
WILMONT—L. Woods, 72, Up. George's Street, Dun Laoghaire, Dublin.

Branches in Course of Formation

Branches of the Hornby Railway Company are in process of formation at the following places, and those interested should communicate with the promoters whose names and addresses are given below :—

BLACKPOOL—Mr. Charles Band, "Baslow," Mossom Lane, Norbreck.
LETCHWORTH (HERTS.)—G. Thomas, "Homestead," 131, Baldock Road, Letchworth.
GRAHAMSBY—W. M. Marr, 16, Wood Houses, Grahamsby, Nr. Crook, Co. Durham.
SHREWSBURY—L. G. Wright, 5, Nelson Place, Havelock Road, Belle Vue, Shrewsbury.
BECKENHAM (KENT)—Mr. W. C. H. Post, 190, Mackenzie Road, Beckenham, Kent.
GLOUCESTER—G. F. Clark, 66, Falkner Street, Gloucester.
DONCASTER—C. E. Aston, 43, King's Road, Doncaster, Yorks.
NORBURY, S.W.16—C. Mills, 15, Tylecroft Road, Norbury.
GUILDFORD—Mr. G. Watson, Guildford Dolls' Hospital, Swan Lane, Guildford.
PAISLEY—J. P. Kerr, 23, Donaldswood, Corsebar Road, Paisley.
DUBLIN—P. Troddyn, 2, Brighton Square, Rathgar, Dublin.
NEW ZEALAND—T. MacLachlan, Art Studio, 66, Albany Street, Dunedin, N.Z.
NEWCASTLE-ON-TYNE—Mr. B. Gilbey, 91, Norfolk Road, Newcastle-on-Tyne.
CHISWICK—C. P. Griggs, 25, Elliott Road, Chiswick, W.4.
MANCHESTER—F. Gee, 40, Queens Road, Urmston, Manchester.
ST. ANNES-ON-SEA—E. Thompson, 28, Glen Eldon Road, St. Annes-on-Sea.
HORNSEY—E. T. Bryan, 23, Glebe Road, Hornsey, N.8.
GLASGOW—G. Watson, 188, King's Park Avenue, King's Park, Glasgow.
HENDON—A. Needell, 1, Sunningfields Crescent, Hendon, London, N.W.4.
NOTTINGHAM—G. Brown, "Mayoniss," Dale View Road, Sneinton Hill, Nottingham.

Hornby Railway Company

JUNIOR SECTION

III.—How to Make a Simple Timetable

IT is rather a curious fact that the mere mention of timetable working seems to cause alarm to large numbers of model railway enthusiasts, not only beginners, but also those who have had considerable experience. The only reasonable explanation of this state of affairs is that the word timetable carries with it a suggestion of elaborate complications, which involve severe mental struggles. It is very unfortunate that such an impression exists, because the adoption of timetable working adds enormously to the interest of operating even the smallest miniature railway.

Timetable working means simply that, instead of trains being dispatched in haphazard fashion from one point to another, they are sent off according to a pre-arranged plan. There is not the slightest difficulty in making such a plan or in carrying it out provided that there is available the minimum equipment—two locomotives and sufficient rolling stock to make two trains.

The drawing up of a timetable is, in itself, a most interesting process. Roughly described, it consists of making a sketch of the layout with all stations and branches marked, and then arranging a certain number of train movements to be carried out in regular succession. In order to prevent matters developing into a wild scramble it is necessary to allow plenty of time for each movement, and therefore, before the starting times for the trains are definitely decided upon, experimental trips should be run and a note made of the time occupied by each one.

The actual number of trains that can be run in, say, half an hour, must obviously depend upon the number of operators available, because miniature railway working is an outstanding instance of many hands making light work. In every case, no matter how many operators are available, there should be no need for any of them to rush hurriedly from one point to another. If such rushing is found to exist, the time allowance for some or all the train movements should be slightly increased.

The simplest way of explaining the principle on which all timetables are developed is to take an actual example.

Let us suppose that our plan consists of station "A" and station "B," illustrated here, connected by a plain stretch of track with no intervening halts or interruptions of any kind. We will suppose also that we have only two engines and sufficient rolling stock for two trains. Let us imagine further that there is a train at platform No. 2 in "B" station with a locomotive at the head, and that in "A" station there is a train in the siding and a locomotive in the sheds. The positions of these trains should be marked down clearly on a sheet of paper. This forms the commencement of our timetable, and from these trains in their present positions we have to work out the whole thing.

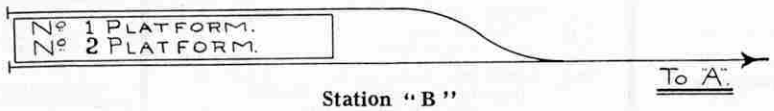
We now come to the movements of the trains, and it will be quite clear that these must be noted down

1. C. A. Harrison-Jones (60), Horsham, Sussex.
2. F. Latimer-Jones (86), Whixall, Shropshire.
3. K. J. Cornick (78), New Malden, Surrey.
4. G. Spriggs (37), Bridport, Dorset.
5. K. R. Emmett (39), Upper Armley, Leeds.
6. S. Groves (81), Great Horton, Bradford.
7. D. B. Barnard (83), Harbledown, Nr. Canterbury.
8. D. W. McGowan (8), Weaste, Salford.
9. R. S. Heath (64), Swindon, Wilts.
10. Frank Heppenstall (82), Linthwaite, Nr. Hudds.
11. A. J. Sudborough (85), Northampton.

Another Group of H.R.C. Members. All Smiles!

on paper, one by one. In this manner our timetable will, as it were, grow up automatically.

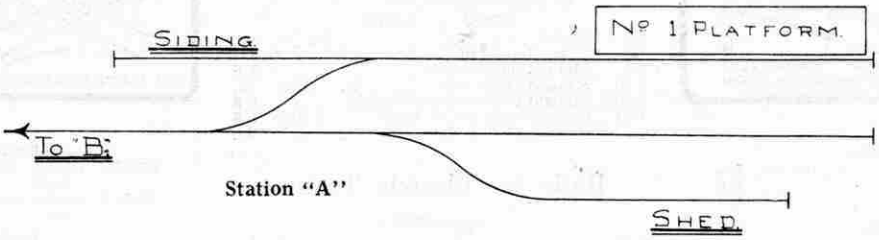
Now let us take the first move. The train from No. 2 platform in "B" station is running through to No. 1 platform in "A" station. It is more than likely that the actual time taken for this movement is only about half a minute, but, remembering the advice we have already given, we will make this half minute into a minute, and by so doing we shall allow sufficient time, not only to carry out the movement without the slightest fuss or hurry, but also to deal with any little unexpected hitch that may occur. This movement or any other movement may be carried out repeatedly in a certain time, and then suddenly some little unexpected thing happens and the time is exceeded. If no allowance has been made for such a state of affairs, the result is inevitably to cause rush and confusion, and possibly to upset the whole of the timetable. It is quite a good plan to fix one minute as the minimum time for any operation, no matter how simple it may be.



Station "B"

Having made our first move, we must enter it on our draft timetable. Supposing that our timetable is to commence at 1 p.m. and that we are using a Tank engine and a Pullman train, we might enter up the movement as follows:—1–0 p.m.; platform "B" 2. No. 1 Tank; Pullman train. Arrives 1–1 p.m.; platform "A" 1.

It is obviously necessary that shunting operations should be included in the timetable. As the locomotive that will now be required to handle the train that has just arrived at platform No. 1 in "A" station has to travel from the sheds to the train by way of the main line, this separate move should be booked in the timetable. This might be done as follows:—1–2 p.m. "A" sheds. No. 2 locomotive; light. Arrives 1–3 p.m.; platform 1 "A."



Station "A"

The locomotive is now attached to the train, which should be scheduled to leave the station a minute or so later.

In the foregoing description of two simple movements is shown the whole principle of timetable working. The process simply consists of placing our locomotives and coaches in certain positions at a terminal station, arranging movements for them as we feel inclined, and writing down on a sheet of paper the nature of these movements and their timings. A little experience is, of course, required to avoid running the trains into impossible positions. If, for instance, it is found that a certain movement results in an engine being "trapped" in a siding or elsewhere, so that it cannot be got clear without a large number of movements, then the move that leads to this position should be revised and altered so as to avoid the trouble. This revising of movements so as to secure smooth and simple working, is full of interest, and any model railway enthusiast will soon realise its fascination.

Sufficient train movements should be worked out as already described to occupy a definite period, such as half an hour, and then the timetable should be written out neatly ready for actual work. Then comes the excitement of running through the whole of the operations without a break and in strict accordance with the pre-arranged timings. No one who has ever experienced the fun to be obtained in this manner will ever think of going back to haphazard working with no plan or system in view.

In order to simplify timetable working, special forms have been prepared for the benefit of members of the Hornby Railway Company. These are as follows:—General Working Timetable; Stationmaster's Arrivals and Departures; Engineman's Job Card; Signalbox Instructions; and Stationmaster's Report Form. These forms are so arranged as to make it a very simple matter to fill in the various details and they are sold in pads each containing 50 forms, price 5d. each post free, or 2/– post free for a complete set of five pads.

The interest in the operation of a miniature timetable will be increased to a very great extent if there is some underlying object for the working of the trains. For instance, there is bound to be a great deal more fun in transporting various consignments of goods from one station to another to timetable than by merely running trains about to a certain specified time.

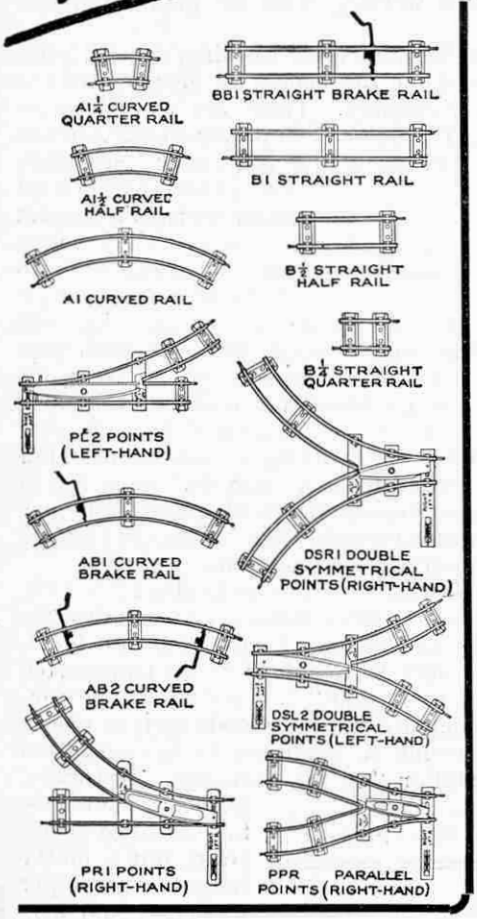
Suitable goods, such as Meccano sacks (Part No. 122), miniature milk cans (Hornby Railway Accessories No. 2), or small trunks and boxes (Hornby Railway Accessories Set No. 1), may be arranged to be transported from station "A" to station "B" and should be consigned by certain definite trains. Goods such as rice or dried peas, etc., could be arranged to be sent from station "B" to station "A" in exchange. Naturally, all goods should be forwarded by goods train, but a pretty frequent passenger service should also be a feature of every miniature timetable, although the trains only convey imaginary people.

In regard to the operation of goods trains to timetable, a point that should be watched is the length of the trains. If these are made too long it will be found very awkward to unload the wagons at a goods platform and the numerous shunting operations that will result will take up a great deal of valuable time and perhaps put the train concerned very much behind time on its return journey. It is most important to avoid delays of this kind, as the delay caused not only concerns the train itself, but usually all the trains running in the scheme!

If possible, avoid the use of a separate shunting engine. Shunting engines are apt to get in the way and are usually more trouble than they are worth. This is particularly the case in small termini where there is not much room for them to move about freely.

Almost every timetable caters for goods and passenger services, and it is of the utmost importance, if realism is to be the keynote of the model railway concerned, that goods trains should be run into goods yards or sidings, and passenger trains should be destined for the passenger platforms in the stations. It is very unusual to see a goods train being unloaded at a passenger platform in actual railway practice, although this is sometimes done.

HORNBY Rails Points and Crossings SERIES



Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. They make possible an almost endless number of realistic and railway-like layouts. Only the finest materials obtainable are used in their manufacture.

For Clockwork & Steam Trains

CURVED RAILS—1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/–
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/–
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	5/–

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right	per pair	5/–
DSL1	Double symmetrical points, left		

For 2-ft. radius curves

DSR2	Double symmetrical points, right	per pair	5/–
DSL2	Double symmetrical points, left		

PARALLEL POINTS—For 2-ft. radius curves

PPR2	Parallel points, right	... per pair	5/–
PPL2	Parallel points, left		

CROSSINGS AND CROSSOVERS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	1/6
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/6
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	1/6
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/6
COR2	Crossovers, right hand ...	per pair	12/–
COL2	Crossovers, left hand ...		

POINTS—For 1-ft. radius curves

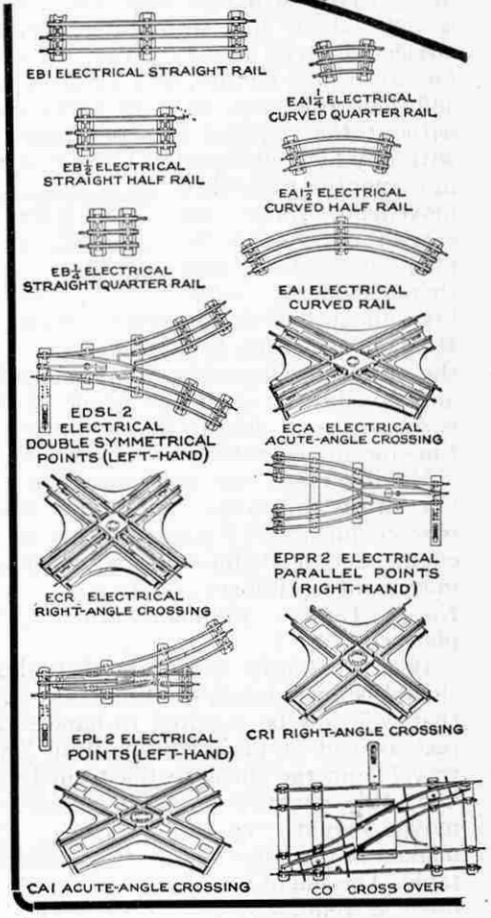
PR1	Right-hand points	... per pair	4/–
PL1	Left-hand points		

For 2-ft. radius curves

PR2	Right-hand points	... per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, right ...	per pair	7/6
PSL2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, left ...		

STRAIGHT RAILS

B1	Straight rails	per doz.	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track ...	½ doz.	4/6
RCP	Rail connecting plates	„	4d.



Rails for Electric Trains

STRAIGHT RAILS

EB1	Straight rails	per doz.	7/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	8/–
EA1½	Curved half rails	„	5/–
EA1¼	Curved quarter rails	„	4/6

2-ft. radius

EA2	Curved rails	per doz.	8/–
EA2½	Curved half rails	„	5/–
EA2¼	Curved quarter rails	„	4/6

CROSSINGS

ECA	Acute-angle crossings	each	4/–
ECR	Right-angle crossings	„	4/–

POINTS

For 2-ft. radius curves

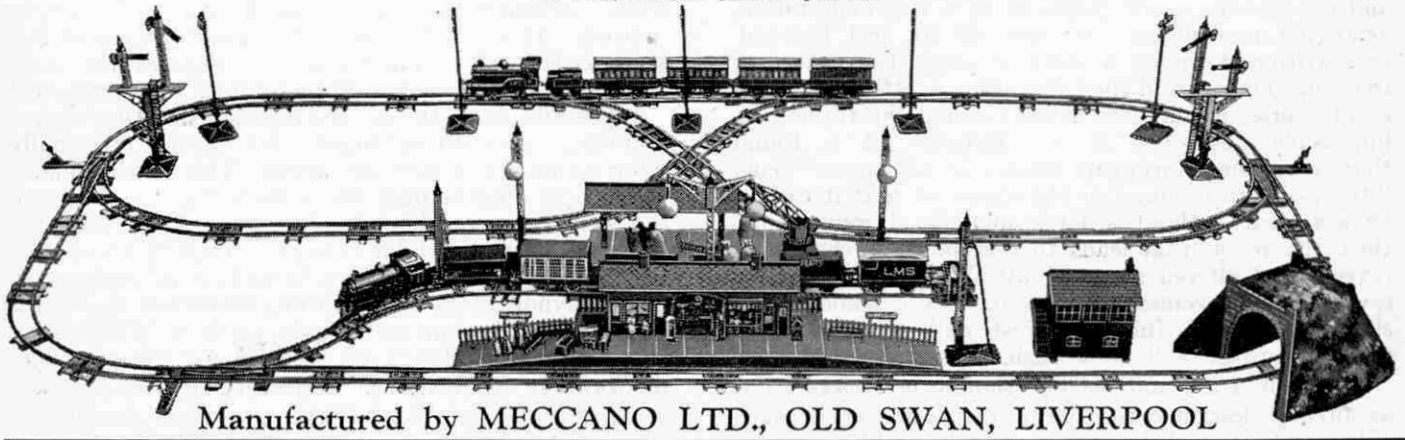
EPR2	Right-hand points	... per pair	10/–
EPL2	Left-hand points		
EDSR2	Double symmetrical points, right	per pair	12/–
EDSL2	Double symmetrical points, left		

For 2-ft. radius curves

EPPR2	Parallel points, right	per pair	12/–
EPPL2	Parallel points, left		
TCPL	Terminal connecting plates (low voltage)	each	1/6
TCPH	Terminal connecting plates (high voltage)	„	1/6

Electrical Points for 1-ft. radius curves are not supplied

The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many similar illustrations and much useful information is given in a booklet entitled "How to get more fun out of Hornby Trains." This booklet is obtainable from your dealer price 3d. or from Meccano Ltd., Old Swan, Liverpool, price 3d. post free.



Manufactured by MECCANO LTD., OLD SWAN, LIVERPOOL

Suggested Hornby Train Improvements

SLIP CROSSINGS.—Crossings of this kind would be far too complicated to produce in standard 2 ft. radius Gauge '0' tinplate track. In any case, they are rarely required in the average gauge '0' layout. (*Reply to I. Difford, Capetown*).

REVISED No. 1 LOCOMOTIVE.—You will be interested to hear that we hope to revise our present type No. 1 engine shortly. (*Reply to N. P. Simpson, Wrexham*).

STEAM RAIL COACH.—This appears to be an extremely popular suggestion. We are keeping a record of the names of readers who would welcome a model of a "Sentinel-Cammel" Steam Coach. (*Reply to P. Warner, Rhyl*).

PULLMAN CAR BOGIES.—It was with the greatest of surprise that we read your remarks regarding the bogies we have fitted to our new type of No. 2-3 Pullman cars. We do not agree that these are incorrect, as our designs for the new cars were based on particulars furnished to us by the Pullman Car Co. Ltd. (*Reply to B. J. Akroyd, P. A. D. Boden, and J. S. Spencer Smith, Eton College, Bucks.*).

MINIATURE BRAKES.—From time to time we receive letters suggesting that we should fit our model rolling stock with miniature brakes. As a matter of fact, an addition of this kind would be a very costly item and there would really be no definite advantage to be gained. In model railway practice the braking of the train engine is quite sufficient to stop the whole of the train. (*Reply to R. Brotherton, Huddersfield*).

DETACHABLE NAME PLATES FOR LOCOMOTIVES.—Your proposal that we should supply name plates bearing various locomotive names, to be fitted to Hornby models as desired, is interesting, but we are afraid, not practicable. One objection is that the scheme would not be in accordance with actual railway practice. (*Reply to J. Robertson, Plymouth*).

MINIATURE GUARD.—We are already considering a similar idea to your own. We agree with you that the introduction of miniature guards, porters, etc., would prove very popular among Hornby Train owners. (*Reply to W. Breton, Guernsey*).

REVISED CAB FOR HORNBY LOCOMOTIVE.—We thank you for your sketch showing the outline of your proposed new cab for Hornby locomotives. As far as we can make out, however, this is no improvement on our present type, and for this reason we do not propose to effect any alteration in this direction until we re-design the locomotives entirely. (*Reply to S. C. Short, London, W.2*).

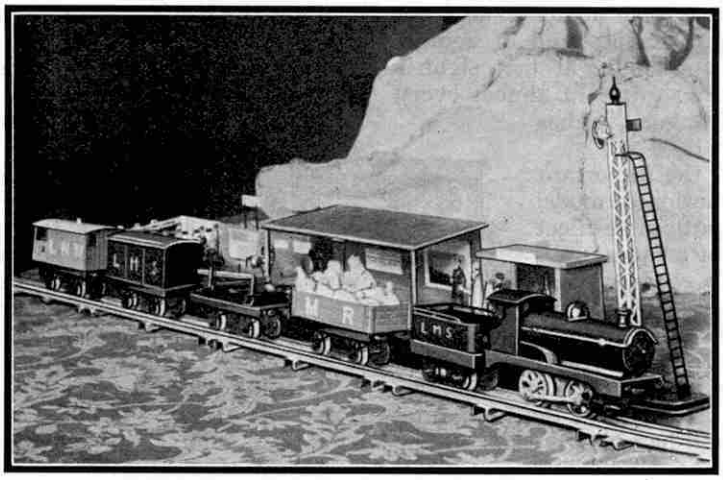
CLOCKWORK CRANE.—We are interested in this suggestion. The idea is certainly a good one. We are unable to consider the introduction of this type of crane at the moment, however, and we would suggest you use the ordinary type of Hornby Crane. This is an attractive hand-operated model. (*Reply to George Griffin, Walton, Liverpool*).

No. 2 GUARD'S VAN.—We have had the question of introducing a No. 2 Passenger Coach and Guard's Van under consideration for some time now and an announcement will be made when developments occur. (*Reply to Billy Richmond, New Zealand, and H. R. Hewlett, Sussex*).

MODEL CATTLE DOCK.—At present we do not manufacture a miniature cattle dock, but it is possible that we shall consider introducing one later. (*Reply to H. C. Boutcher, Ascot, Berks.*).

DOUBLE CROSSOVER.—This is a complicated arrangement of points and, for the time being, at any rate, we cannot consider introducing it into the Hornby Series. The same result may be obtained by arranging two separate crossovers (one facing and one trailing) next one another. (*Reply to O. P. Dinnick, London, S.W.2*).

LONGER CHIMNEY FOR No. 1 LOCOMOTIVE.—See our remarks regarding "Revised No. 1 Locomotive" on this page. (*Reply to R. Bayes, Rushton, Northants.*).



Our photograph shows a section of a layout used by the "Ellesmere" Branch of the H.R.C. Interesting timetables are arranged for Branch Nights, and consignments of goods are despatched to the various stations in real railway-like fashion. The goods train in the illustration is about to leave the first through station on the line

STATION NAME BOARDS.—It is quite possible that we may consider the introduction of a station with detachable Name Boards, so that the present series of Name Boards (Railway Accessories No. 6) may be used. (*Reply to L. Snook, Reading*).

SALT WAGON.—This type of wagon is certainly not very common on actual railways, and for this reason we prefer not to introduce a model of one at present. (*Reply to B. Cutler, Chiswick, W.4*).

AEROPLANE TRUCK.—As in the case of many other suggested new types of rolling stock, the Aeroplane Truck is at present very uncommon on the actual railways of this country. As a result, we feel that there would be only a very limited demand for an accessory of this kind. (*Reply to A. Langrish, Southampton*).

CLOCKWORK MECHANISMS.—Where specially required, any kind of Hornby clockwork mechanism may be obtained from this office. Prices and particulars may be had on application. (*Reply to R. G. Harris, Cradley Heath*).

"FAIRLIE" LOCOMOTIVES.—We regret that we are unable to consider the introduction of this idea. We very much doubt whether the model of a "Fairlie" engine would prove as popular as you anticipate. (*Reply to H. M. Darlow, Bedford*).

GLASS-LINED MILK TANK.—As stated previously in these pages, we have definitely decided to produce a model of a glass-lined milk tank. This will be coloured in correct accordance with the standard practice of the "United Dairies." (*Reply to D. G. G. Higgins, London, W.2., and R. Clews, Birmingham*).

LIGHTING SIGNAL LAMPS.—We thank you for your interesting suggested improvements to the Hornby series. The objection to that dealing with the lighting of miniature signals is that it would be practically impossible to produce a bulb small enough to be fitted into a scale model Gauge 0 signal lamp casing. It will, however, be quite possible for you to light the interior of your Metropolitan clockwork coaches with bulbs and a battery. (*Reply to R. F. W. Redman, Tonbridge, Kent*).

GANGWAY FOR CATTLE TRUCK.—We quite agree with your statement that almost all cattle trucks owned by the actual railway companies are fitted with doors that drop to form gangways. There are one or two objections to our producing wagons fitted with doors of this kind, but the idea will be given serious consideration when next we re-design this particular line of rolling stock. (*Reply to S. G. Burley, Reading*).

No. 2 TANK LOCOMOTIVE.—You are mistaken when you state that only the Metropolitan Railway have tank locomotives with the same wheel arrangement as our No. 2 Tank engine. As a matter of fact, the Metropolitan Railway have eight of this type of locomotive, the L.N.E.R. have 45, and the G.W.R. have one. We consider that our No. 2 Tank Engine is quite a handsome standard tank design. (*Reply to R. Dowley, South Croydon*).

DOORS IN OPEN WAGONS.—Our open wagon would no doubt be improved if it were re-designed with a door on each side. Your idea is being filed for further consideration. (*Reply to P. W. Cross, Birmingham*).

ARTICULATED BREAK-DOWN VAN AND CRANE.—We regret to say that this idea is not suitable. We doubt whether such a piece of rolling stock exists in actual railway practice. (*Reply to F. Stallworthy, E. Dulwich, S.E.22*).

LONG STRAIGHT RAILS.—Your proposal that we should introduce longer straight rails into the Hornby Series is an interesting one, and although at present there is no prospect of our designing a new type of rail, we will file your idea for future reference. (*Reply to F. A. Beane, Halstead, Essex*).

CORRIDOR CONNECTIONS.—We note that you suggest the addition of corridor connections to the Metropolitan coaches. As a matter of fact, we doubt whether any of the coaches owned by the Metropolitan Railway Company are actually fitted with corridor connections. In any case, at present we cannot adopt your idea. (*Reply to J. P. Hughes, Middlesbrough*).

SIX-WHEELED COACHES.—We do not consider that it would be advisable to introduce model six-wheeled passenger coaches, as these are rapidly being replaced by bogie coaches on the actual railways. (*Reply to H. Smith, Blackpool*).

EIGHT-WHEELED WINE WAGON.—We cannot possibly consider the introduction of model eight-wheeled wine wagons. We doubt whether such wagons actually exist. (*Reply to D. Edwards, Richmond Hill, Surrey*).

Rolling Stock of the Hornby Series

By 'Tommy Dodd'

RECENTLY an old friend wrote to me enclosing a number of very good photographs showing various views of his new model railway. He asked me for my criticism on his layout, and his closing sentences were: "I should like to hear your candid opinion on my railway system in general. I might add that I do not aim at getting perfect scenic effects, but I am particularly anxious to have a layout technically correct as far as reasonably possible. In addition, I like to run all the trains to a definite system."

MILK TRAFFIC VAN

As regards the layout of the track, the system was unquestionably good, as everything had obviously been carefully planned with a view to considerable enlargement later. What struck me as spoiling the whole batch of photographs, however, was the fact that in each case no attention had been paid to the realistic formation of the trains that were shown running on the lines.

For instance, the first photograph showed a really interesting section of my friend's railway, taken at the exit of an extensive goods yard. A huge model goods locomotive was leaving the depot at the head of a most curious collection of wagons. Really, at first sight I thought I could pick out an example of almost every conceivable gauge '0' model wagon that has ever appeared on the market!

My friend had overlooked the important fact that the thoughtful formation of model trains of all kinds has a most noticeable effect on the realistic appearance of a model railway system. Who ever saw a goods train in actual railway practice consisting of one gunpowder van, one petrol wagon, one open wagon, a cement wagon and a biscuit van, with a guard's van trailing? Still, my friend had not noticed these details. I pointed out to him what I considered the faults and then asked for his opinion, and he wrote later deploring his sad mistake! "In any case," he added, "I feel sure that articles on the correct formation of model trains would be appreciated by many other H.R.C. members beside myself."

LUGGAGE VAN No. 2

For the next month or two, therefore, I propose to survey the various types of rolling stock of the Hornby System, and to say a few words about the use of each.

HORNBY WAGON No. 0-1-2

Perhaps the most popular piece of Hornby Rolling Stock is the Milk Traffic Van. Possibly this is favoured by many enthusiasts owing to the fact that, in addition to being neat in appearance, it is sold complete with a supply of realistic milk cans that rattle in the van in a most realistic manner, when the trains are going! In actual railway practice one usually sees milk vans in separate milk trains by themselves, or attached to the end of passenger trains. It is a very rare occurrence to see milk conveyed by a mineral train! A point that requires attention when marshalling a model milk train is that an ordinary goods guard's van should not be placed at the end if a passenger van is available. A passenger guard's van looks far more realistic at the end of half a dozen milk vans, and is certainly more in accordance with actual railway practice. In addition, passenger locomotives should be employed for milk train services whenever possible.

Luggage Vans Nos. 1 and 2 are also very popular, and I think this is explained by the fact that their prototypes are perhaps the most common wagons (with the exception of the open type) to be seen in any goods yard. A very realistic model goods train may be made up simply by marshalling a number of luggage vans, or closed wagons as they are more commonly called, belonging to various railway companies. A train of this kind, with a goods guard's van in the rear, will certainly be far more realistic in appearance than one consisting in a variety of different types of brightly coloured rolling stock.

LUGGAGE VAN No. 1

For miniature mineral traffic the correct thing to use is the Hornby Wagon No. 0–1–2. The No. 2 Hornby Goods Engine can manage a very long train of these wagons with ease. The engine may be made to appear to be doing twice as much work if Hornby Tarpaulins are spread over the wagons to make them appear to be heavily loaded. A very fine goods train effect is easily obtained by including one or two of the No. 1 Luggage Vans in a long train of open wagons, and finishing the train off with a guard's van.

Another point in favour of open wagons is that they are particularly suitable for the carriage of miniature goods to timetable, as they are easily loaded and unloaded. Where a timetable is being worked out and goods are being conveyed by the trains, however, I find that it is best not to attach miniature tarpaulins. To spread tarpaulins neatly requires rather more care and time than can be spared in timetable working.

The Refrigerator Van is also most useful, and helps to brighten up a train realistically. Actually one often sees long trains of refrigerators "on their own," as in the case of milk vans. A very handsome "perishables" express can be made up from refrigerator vans and milk vans alone.

REFRIGERATOR VAN

In actual railway practice refrigerator vans are cooled by means of special ice-filled boxes, so arranged that the air in the van is cooled and at the same time is continually in circulation.

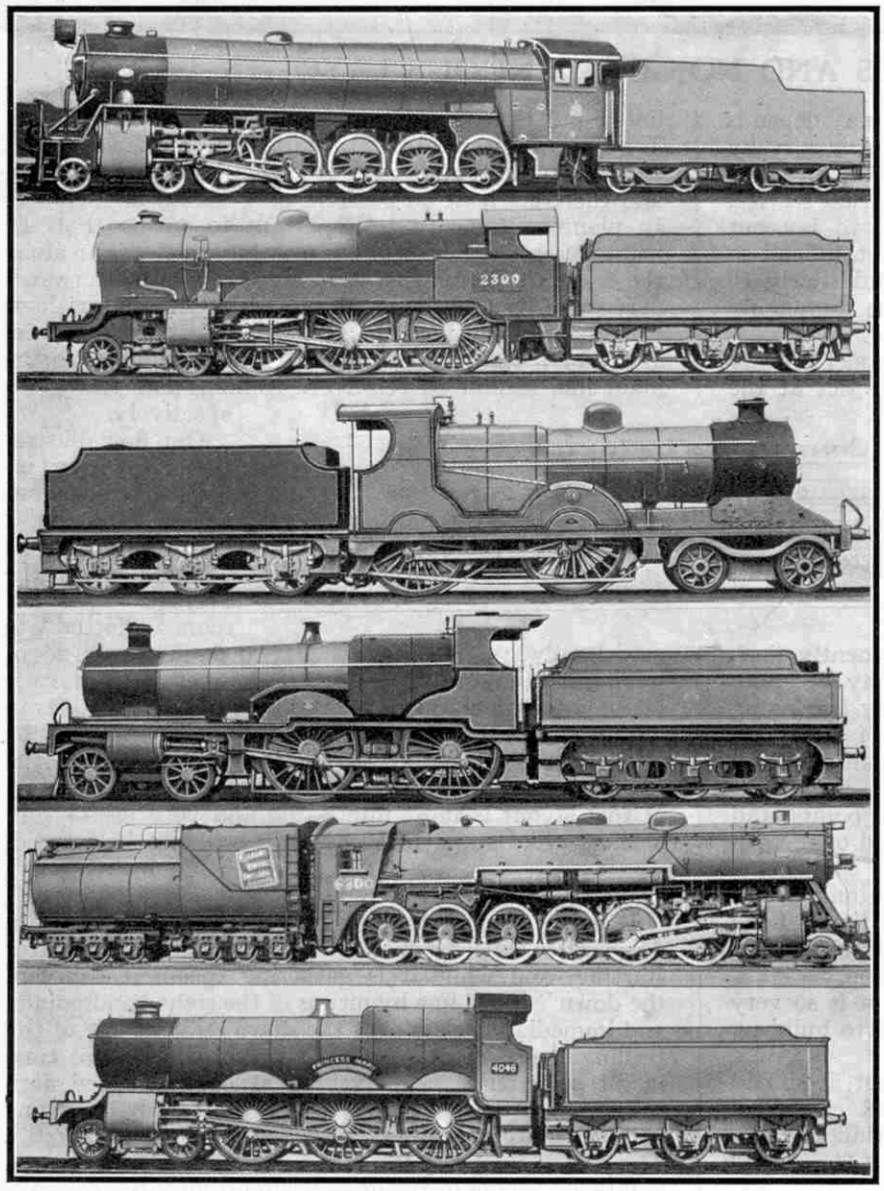
These vans are painted with a light colour, usually white, but sometimes pink, as in the case of those of the Southern Railway. This is an additional precaution towards keeping the goods cool in hot weather.

As refrigerator vans are very frequently run in express "perishable" trains, most of them are "fitted" vans, that is, they are fitted with continuous braking apparatus.

H.R.C. COMPETITION PAGE

Locomixtures!

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



The "Birmingcastle" Branch of the H.R.C. held a very interesting debate the other evening on a most popular railway subject. Thomas Smithkins was called upon to propose the motion that "Generally speaking, the locomotives of the L.M.S. are more handsome in appearance than those of any other Railway Company."

Smithkins opened out by giving a cursory glance at the handsome designs of the old locomotives of the various constituent companies of the L.M.S., and explained how these designs had been improved from time to time, both from the economical as well as from the artistic viewpoint. This improvement, he claimed, had been more noticeable since the amalgamation in 1923 than during any other period. In closing, Smithkins claimed that the "*Scot*" design of the L.M.S. is the absolute acme of perfection in modern locomotive design.

At his closing sentence the audience was evidently disturbed. There was a distinct murmer of disapproval from one corner of the room and equally distinct signs of satisfaction from another. The rest of the meeting merely glanced about, preserving their silence, but evidently thinking deeply.

James Silver seconded the motion and merely added that although he agreed with the statement about the "*Royal Scots*" he was inclined to favour the *Midland Compound* as a good second.

The opposition were eager, and James Johnston, a keen G.W.R. enthusiast, opened out by bitterly disapproving of the remarks made by both the preceding speakers. He considered the "*Scot*" did not even compare with one of the re-built "*Claughtons*," and as neither of these came anywhere near one of the "*Kings*" or the "*Castles*" of the G.W.R., he thought that it was pretty evident that the motion was defeated without any more ado. In seconding the opposition, Peter Partington tried his utmost to convince the meeting that the "*Kings*," the L.N.E. "*Pacifics*" and the S.R. "*Lord Nelson*" would make short work of any L.M.S. locomotive. He was entirely in agreement with all Johnston had said.

The meeting was then thrown open to discussion.

Immediately 15 or 20 members jumped to their feet, and the lucky one who was chosen by the Chairman to speak had plenty to say. In his opinion there was much to be said on both sides, but one thing was certain, that the boiler and chimney fitted to the "*King*" locomotives were all that were required to make the "*Royal Scot*" design perfect. Thereupon another member rose and claimed that the cylinders would have to be placed further back on such a locomotive as that suggested by the previous speaker, also the tender would have to be suitably modified.

And so the discussion proceeded. Almost every locomotive that was brought up for consideration as being the most handsome in existence was immediately improved in the imagination of almost everyone by being re-built into something totally different.

On this page are illustrated six of the re-built "Birmingcastle" locomotives. Prizes of Hornby goods, or Meccano if preferred, to the value of £1/1/0, 15/–, 10/6 and 5/– will be awarded to the four Hornby Railway Company members who send in to Headquarters the most neatly prepared correct lists of all the *locomotives represented in each of the "rebuilds."*

In sending in entries, the engines must be referred to by numbers, from one to six, starting from the top. As an example of the correct method of sending in entries, let us imagine that there is a seventh illustration showing a "*Royal Scot*" engine fitted with a "*King George V*" (G.W.R.) boiler and a Canadian Pacific tender attached. The correct way of sending in the solution to this illustration would be as follows :—*Illustration No. 7—"Royal Scot" frame and wheels : G.W.R. boiler ("King" class) : C.P.R. tender.*

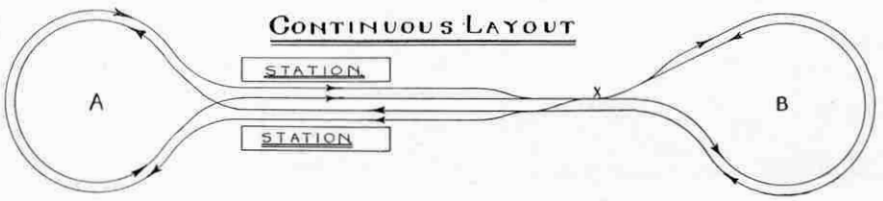
It should be remembered that each part used in re-building the engines is not only taken from an actual existing locomotive but also from one that has at some time or other been illustrated in the "*Meccano Magazine.*"

The competition will be divided into two sections—Home and Overseas. Closing dates, Home Section—2nd April, Overseas—29th June.

V.—CONTINUOUS AND NON-CONTINUOUS LAYOUTS

THE success or failure of any model railway depends upon the ability of the owner to plan a really interesting and railwaylike track layout over which eventually he will run his miniature train service. No beginner can reasonably be expected to lay out straight away an efficient track, but it is not difficult to work out a simple plan at the outset, and slowly to add rails, points and crossings until finally a thoroughly effective and railwaylike layout is produced.

It is unfortunate that many young model railway engineers make a great mistake in this respect at the very beginning. Instead of adding to their original outfit by degrees and according to some plan, they buy all kinds of material without any thought of the use to which it will be put. The result is frequently that, whereas the total quantity of material may be quite large, it is so ill-assorted as to be useless for the laying out of a workmanlike track. The result of this state of affairs is often to fill the beginner with disgust and to damp all his enthusiasm.



If, on the other hand, sufficient rails, points and crossings are purchased to form a good sized oval, with perhaps right hand and left hand points to complete a loop, the layout is railwaylike from the beginning, and its operation is correspondingly interesting. Long distance runs can be made and simple shunting operations can be carried out by means of the loop.

This point has been emphasized because it is so very important to have a plan of campaign, and to build up one's model railway according to it.

In considering the type of layout to adopt, it should be remembered that there are two distinct classes of model railway layouts. The first is the continuous type, similar to the oval we have just mentioned. The second is the non-continuous type.

Continuous Layouts

A continuous layout is one over which a train may be allowed to run indefinitely, and the simplest example is a circle of rails. A layout of this type is usually essential where there is only one operator. The advantage of a continuous layout is that it allows of the longest possible locomotive runs, and is therefore ideal for running-in and testing purposes.

The operation of a simple continuous layout may be varied by the introduction of sidings and branch lines, and also a terminus or if possible two termini. Termini are essential if interesting timetable working is to form an important part of the operation of the system, and therefore if at all possible they should be included. In planning them, it is important to ensure that the trains leaving either terminus may have a clear run along the track for as many times as required, and afterwards may run directly into the other terminus without backing or shunting. In other words, if two termini are to be placed inside an oval, their junctions with the main line should be relatively trailing and facing respectively.

Our first illustration shows an interesting continuous layout built on a plan that may be adapted to the average type of room allotted to model railways. It consists of two double track loops joining four main lines in such a manner as to make it possible to run a service of trains on the correct lines in both directions. Naturally, the four main lines may be shortened or lengthened according to the size of the room in which the system is to be laid. The principle of this layout is most interesting and very useful, and a short time spent in studying it will not be wasted.

Operating the Continuous Layout

Imagine a train standing in the station on the main down slow line from "A" to "B." Shortly after starting, and while it is gathering speed, it will join the down "fast" line by means of the right-hand points, and immediately pass over the down straight line of the trailing crossover at "X." The train will by this time in all probability be travelling at express speed and, since it is a down express, will take the left-hand line and negotiate the outer "fast" line of the loop "B." The direction of the train will now be reversed, and it will be travelling in the up direction from "B" to "A," and will run straight through the station on the up "fast" line.

Once the station is passed, the express will negotiate the "fast" inner circle at "A," returning on the down "fast" main line through the station again to "X." Here this time it should be switched over to the right after passing the crossover, and should travel by means of "B" loop back to "X," and run via the crossover at "X" and the following left-hand points into the station.

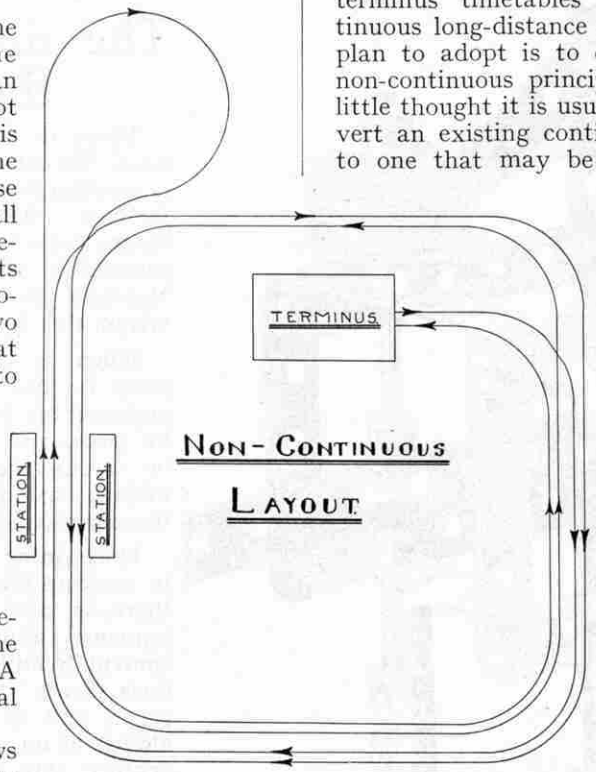
It will be noticed that each time the train has passed through the station it has been on the correct running

line. The arrangement of a signalling scheme for a system such as this would be a very interesting problem, and could be correctly effected without much difficulty. Readers will agree that the whole scheme is a very ingenious one.

An additional advantage of this particular continuous layout is that it may be applied to a long narrow room or, if desired, the four main lines may be made to run all the way round a large square room.

Non-Continuous Layouts

The other type of layout is the non-continuous layout, the simplest example of which is an ordinary straight line. It is not possible to run trains on this type of layout indefinitely in the same direction, as in the case of the continuous type, but all the services have to be run between a number of definite points or termini. Most terminus-to-terminus layouts require two operators, though a few that are cleverly designed, similar to that illustrated on this page, may be operated by one person only. In the majority of cases, however, the non-continuous type is the one used by two or more operators. Interest in the working may often be increased if the termini are in separate rooms, an arrangement usually only possible in the case of temporary layouts. A non-continuous layout is the ideal one for timetable working.



Our second illustration shows the plan of a very interesting non-continuous line. In spite of the fact that only one terminal station is made use of, terminus to terminus services may be operated. As will be seen, the plan allows of the entire running of the trains on their correct lines. In order to appreciate the advantages of this track scheme, let us follow the lines round and notice our relative running position with the other tracks.

Realistic Terminus to Terminus Working

On leaving the terminus in the centre of the room, the line crosses over the up "fast" line and resolves itself into the down "fast" line. To commence with trains pass the through station as expresses on the correct "fast" line. After crossing over the up "fast" line on the level, trains then have a clear run as far as the through station at which they should stop. It will be noticed that they now occupy the down "slow" platform.

A run round the loop reverses the direction of all "down" traffic, and trains find themselves once again on the "fast" line, speeding through the station in the homeward direction. A little further on a crossing is negotiated, and before long the trains stop again in the station on the up "slow" line. The ensuing short run completes the circuit of the track and brings all trains back to the terminus. Thus, throughout the whole length of its run, each train is on the correct regulation running line as in actual practice.

The operation of either of the layouts explained in this article will be found to be very instructive and, provided some simple operating system is worked to, it is hardly possible for any accidents to occur due to mismanagement.

Combination of Both Principles

Many model railway enthusiasts like to vary their schemes of operation, by sometimes running terminus-to-terminus timetables and sometimes arranging continuous long-distance services. In such cases the best plan to adopt is to combine the continuous and the non-continuous principles in the one layout. With a little thought it is usually quite a simple matter to convert an existing continuous or non-continuous scheme to one that may be made suitable for the optional working of either.

Supposing, for instance, that it is required to convert the continuous layout described in this article into one that may be used for either continuous or non-continuous train services.

The simplest way of effecting the change would be to run one line off the down "slow" line, at the exit of the through station (the junction being effected by means of trailing points on the main line) and to run a similar branch line off the up "slow" line at the entrance of the through station. The junction in the latter case should, of course, be facing. Both of these lines should be led to separate termini.

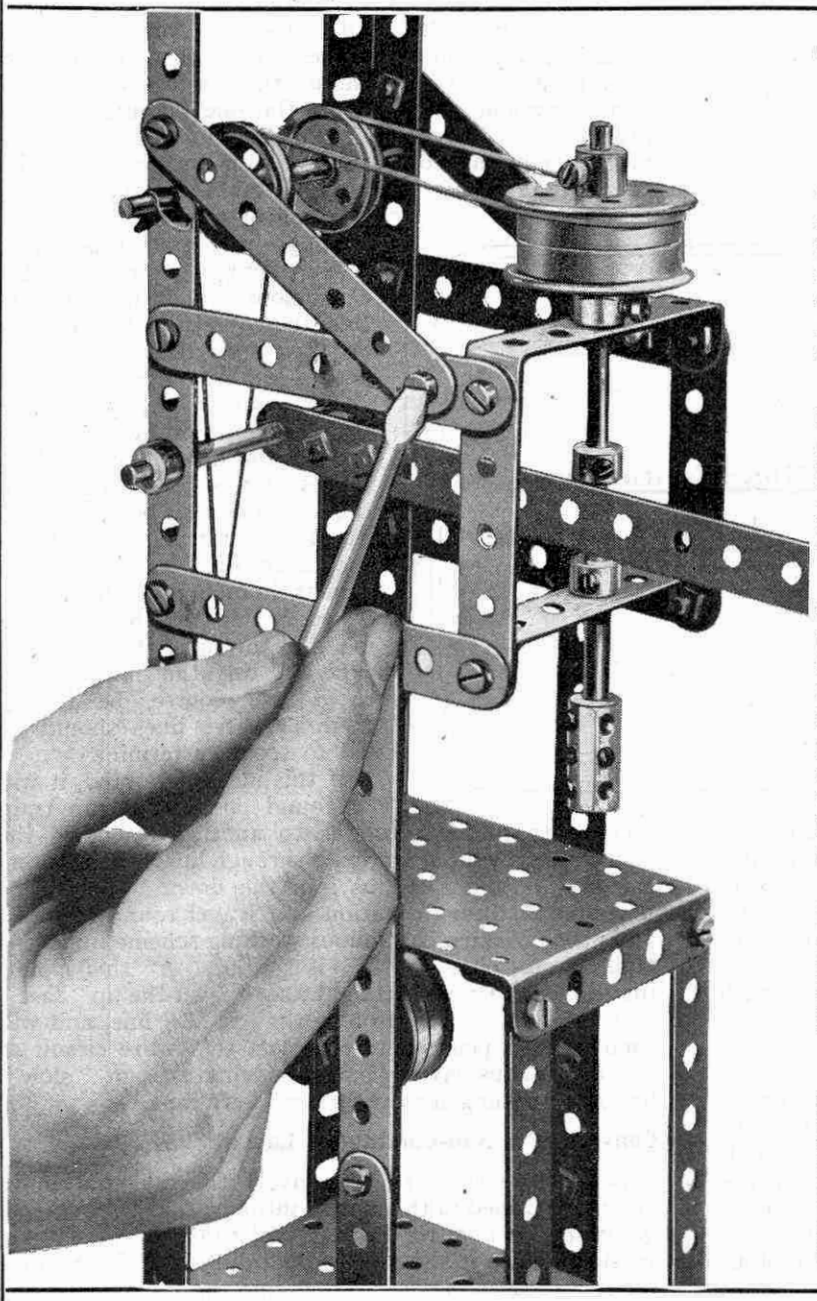
If this idea is adopted, it will be found possible to run train services from one terminus to another by using the continuous layout as the main through lines. On leaving the first terminus, trains join the down "slow" line beyond the through station and travel round the loop as in the ordinary continuous working scheme, until the trailing crossover at 'X' is passed. At this point, instead of continuing straight ahead, over the up "fast" line, they are switched on to the "slow" line, and will then be in a position to complete the entire circuit of the continuous layout before leaving the up "slow" line and running into the second terminus.

Converting a Non-Continuous Layout

It may be required to convert the non-continuous layout described in this article into one that incorporates a continuous oval for testing, and running-in purposes. In such a case it should not be a difficult matter to arrange a facing crossover connecting the up "slow" line with the up "fast" line. A crossover of this kind will enable trains to make use of the up "slow" line for continuous running purposes.

Another possible method of converting the layout is by running a loop round the terminus from the up "slow" line to the down "fast" line. There would be little advantage to be gained by bringing this scheme into operation, however, as no clockwork locomotive would be able to make practical use of the arrangement.

MECCANO



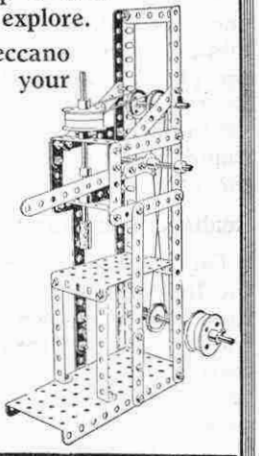
The finest hobby in the world!

There is no hobby in the world to equal Meccano model-building and there is no other hobby that is so full of interest for boys. Only Meccano is good enough for the boy who prides himself on knowing something about machinery, because Meccano is the only constructional system that is based on exact principles.

When a boy builds with Meccano parts he has all the thrills of a real engineer for he builds his models, piece by piece, and when they are completed he works them in exactly the same manner as an engineer would work the corresponding machines in real life.

The training of the eye, brain and hand in erecting Meccano is considerable, but there is also developed a faculty of immense value to every boy. No boy is content to build the models exactly as he finds them ; it is always possible to improve, and he sets to work to do this almost at once. It is a boy's nature to venture into unknown fields, and the Meccano hobby opens up a new and wide world for him to explore.

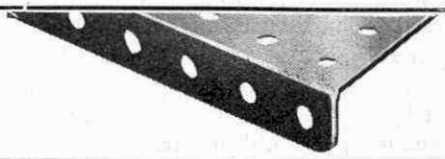
Send to-day for the Meccano 16-page booklet, or ask your dealer for a copy. This splendid little book tells you all about the wonderful Meccano hobby.



MECCANO PRICES

No. 00 Outfit	...	...	3/6
No. 0	,, ...	...	5/-
No. 1	,, ...	...	10/-
No. 2	,, ...	...	16/-
No. 3	,, ...	...	27/6
No. 4	,, ...	...	50/-
No. 5	,, (carton)	...	65/-
No. 5	,, (oak cabinet)	...	95/-
No. 6	,, (carton)	...	115/-
No. 6	,, (oak cabinet)	...	150/-
No. 7	,, (oak cabinet)	...	380/-

The Toy that made Engineering famous



MECCANO LIMITED
Binns Road, Old Swan, LIVERPOOL

THE "SIMPLICITY" MODEL-BUILDING CONTEST

A FASCINATING CONTEST FOR EVERY MODEL-BUILDER

FULL particulars of the "Simplicity" Contest were published last month but we are again including them so that any readers who did not see the previous announcement may have an equal chance of competing.

The "Simplicity" Contest, as its name implies, is primarily intended for small and simple models but the competitor is not restricted to any specified list of parts. He can build his model with just those parts that he finds necessary. The prizes will be given to those models that combine the most ingenuity in design with simplicity in construction. Although the contest affords splendid opportunities to the owner of a small Outfit, there is also plenty of scope for the constructor who possesses a quantity of the more advanced parts, such as Cranks, Gear Wheels, and Couplings, etc., which are often invaluable in the construction of simple models.

Rules Governing Entry

When you have completed your model, the question arises as to what particulars and illustrations should be submitted. Whilst a good photograph is preferable to a drawing it is far better to forward a clear drawing if the photos turn out indistinct or are too small to enable the essential features of the model to be discerned.

No entry forms are needed but you must take special care to see that your name, age, and address appear on the back of each sheet of paper or photograph that you submit, and also the Section in which your model is to be entered. Address the envelope containing your entry "Simplicity" Contest, Meccano Ltd., Old Swan, Liverpool.

Photographs or drawings need not be your own work, but the model itself must be entirely the result of your own unaided efforts.

More than one model may be entered in the Competition, but all entries from any single competitor must be sent under the same cover. No single competitor can win more than one prize; if he sends two or more models they will be considered jointly.

Your photographs or drawings, if unsuccessful, will be returned provided that a stamped address envelope of the necessary size is enclosed. It should be noted, however, that photographs of prize-winning models become the property of Meccano Ltd.

Entries will be divided into three Sections: Section A, for competitors over 14 years of age residing in Great Britain; Section B, for those under 14 years residing in Great Britain; Section C, for readers of all ages residing Overseas.

THE PRIZES

The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Meccano products to value three guineas.
Second Prize: Meccano products to value two guineas.
Third Prize: Meccano products to value one guinea.
Six prizes, each consisting of Meccano Double Headphones, or Meccano Crystal Receiving Set.
Twelve prizes, each consisting of Meccano products to the vaue of 5/-.

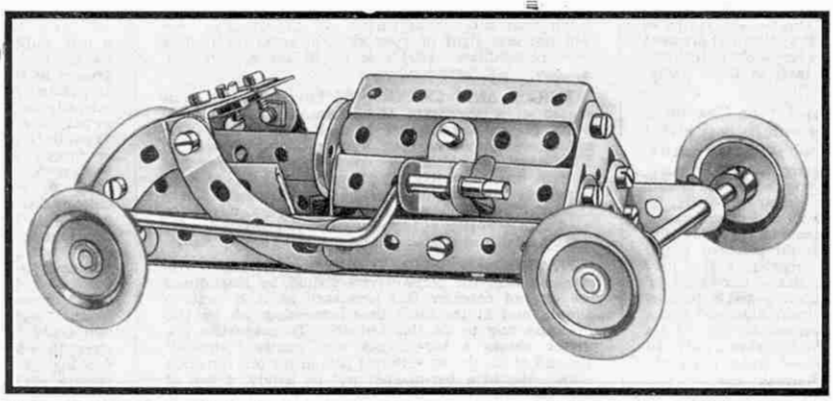
The Prizes in Section B are as follows:—

First Prize, Meccano products to value two guineas.
Second Prize: Meccano products to value one guinea.
Third Prize: Meccano Double Headphones, or Crystal Receiver.
Six Prizes, each consisting of Meccano products to the value of 5/-.
Twelve Prizes, each consisting of a Complete Instructions Manual.

A limited number of Certificates of Merit and complimentary copies of "Meccano Standard Mechanisms" Manuals will be awarded in each Section.

Still Plenty of Time to Enter

Meccano boys who decide to enter the Contest (and no one who reads this announcement should fail to do so!) will have plenty of time in which to construct their models, for the closing dates for both the Home and Overseas Sections have been specially extended. April 30th, 1929, is the last day on which entries can be received from competitors entering in the Home Sections (A and B). Overseas readers entering in Section C must forward their entries so that they reach Liverpool not later than 31st July, 1929.



This model of a Racing Motor Car secured a prize in a recent competition for a young Italian Meccano boy, Carlo Marini. It is just the type of model that will carry off the prizes in this Contest, but, of course, the more original the subject the greater chance of success the model has.

In this and the following page we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

"RATCHET" CLUTCH.—A clutch having a number of ratchet teeth in place of the tongue and groove in the existing Dog Clutch (part No. 144) would

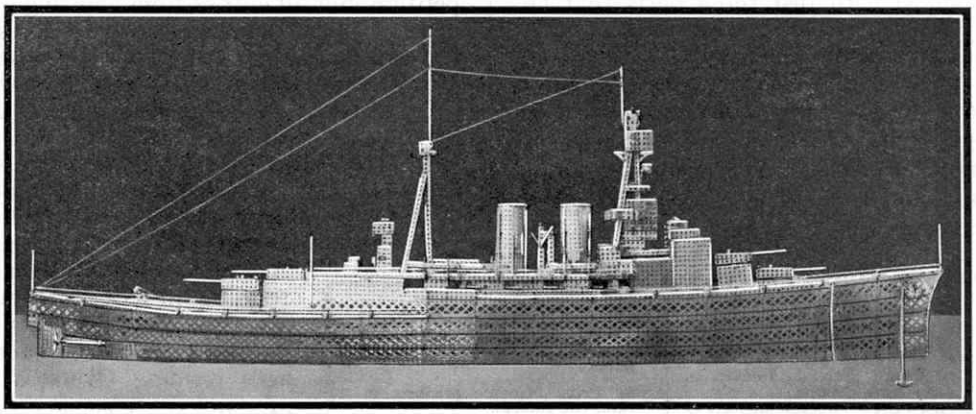
form an interesting addition to the Meccano system. The idea will be clear from the illustration, and it will be seen that each half of the clutch would be identical and therefore would follow somewhat the design of a dog clutch that was shown in the February issue. The principal features of this type of clutch would be that it would only operate in one direction–when travelling backwards the two halves would simply slide over each other and no motion would be transmitted. This movement would doubtless be of use in certain cases, but we do not think that the few models in which the clutch could be used would in any way compensate for its high cost of manufacture. We cannot therefore give any further attention to the idea. (*Reply to W. Cooper, Bowcombe*).

IMPROVED LAMP.—Your proposal that the screwed portion of the Lamps should be shortened is interesting. You mention that a considerable portion of the existing Lamps project after they have been screwed into the Lamp Holders and that a clumsy and unrealistic fitting results. Although we consider that this is a good idea and would offer a distinct improvement, we doubt whether it would be possible to shorten the lamps in this way without interfering with the globe and filament of the Lamp itself. We are, however, looking into the idea and will comment upon it later in these pages. (*Reply to R. Uskdale, Bradford*).

CAM WHEEL.—We have noted your idea for a cam resembling a Flanged Wheel with its boss placed towards the circumference instead of in the centre. A cam, readers will note has been suggested previously, but the flange in your suggested type cam would enable "tappets" consisting of either Strips or Rods, to rest on the cam and thus moved up and down, and it would offer a distinct advantage over the flat disc type cam. A cam would no doubt prove a useful addition and we are therefore considering this idea closely. We would, however, draw our readers' attention to the fact that it is quite possible to construct one of these mechanisms from Standard parts. For example a Bush Wheel mounted by one of its radial holes on a Threaded Rod makes quite an efficient cam, or the type described under Standard Mechanism No. 266 (see S.M. Manual, page 39) can be used with excellent results. There are doubtless other methods of improvising a cam from standard parts and any suggestions regarding this will be welcomed. (*Reply to P. L. Skerratt, Bournemouth*).

DOUBLE ARCHITRAVE.—Your suggested bracket resembling two Architraves secured back to back would form quite a useful part. We suggest, however, that a more suitable title for such a part would be "Reinforced T-piece." It should be possible to find a number of uses for your part in Meccano constructional work where two platforms have to be rigidly secured at a fixed distance by means of Strips, etc. The framework of the Roundabout (Super-Model No. 8) is a case in point, while there are no doubt, several other large models in which your suggested T-piece might be employed. We are giving careful attention to your idea, as we consider it quite good. (*Reply to M. Johnstone, Hastings, New Zealand*).

"The Navy's Mightiest" in Meccano



The prototype of this remarkable model constructed by Clarence Robinson of Milton, Otago, New Zealand, is the famous battleship H.M.S. "Hood" which has the distinction of being by far the largest warship in the world. Some idea of the size of the model will be obtained by noting the number of Braced Girders that comprise one side of its hull, but when it is mentioned that the builder, in completing the battleship used no less than 1,300 nuts and bolts, the immensity of the task will be better understood. When working to so large a scale, Robinson was, of course, able to include a considerable amount of detail in the deck fittings, gun-turrets, etc. These portions, it will be noticed, have been constructed with remarkable care and accuracy, and are devoid of all "scrappiness." Careful comparison will show that the essential features of the actual warship have been most accurately reproduced in the model, and that it is a very creditable achievement in every respect.

CURVED FLANGED PLATE.—As a cab roof for locomotives or steam cranes, etc., a curved plate such as you suggest might prove useful, but we do not think that this would justify its introduction. We will not lose sight of your idea, however, as it may offer possibilities. (*Reply to G. Robinson, Alfriston, Sussex*).

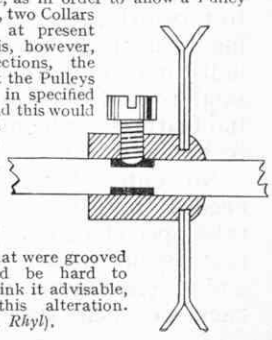
THREE ARM CRANK.—We have inspected your sketch of a suggested three arm crank, the arms being set at 120 degrees to each other. We fail to see, however, where such a part could be used to advantage, for although holes might be punched in each arm so that a ½", ¾", and 1" throw could be obtained, the composite crank would be extremely clumsy. Your suggestion that the part might be used as a propellor is ingenious but this would hardly justify its introduction. (*Reply to A. Tucker, Bude*).

MAGNETISED SCREWDRIVER.—Although you suggest that the Screwdrivers should be magnetised we do not consider this necessary as it is quite a simple, and at the same time interesting job for the Meccano boy to do this himself. To magnetise the driver obtain a bar-magnet and gently "stroke" the end of the driver with one pole in the one direction only. Should a bar-magnet not be handy, a coil of wire wrapped round the screwdriver, and the ends connected to an accumulator will have the same effect. (*Reply to R. W. Hassall, Kaiapoi, Canterbury, New Zealand*).

LARGE CIRCULAR SAW.—We do not think that a large Circular Saw (about twice or three times the size of the existing Saw, Part No. 159) would be popular. The existing Saw conforms quite accurately to scale, when included in models of power driven saw benches, workshops, etc., and a large saw would appear out of place . The existing Saw can moreover, be made to cut very thin wood and cardboard if suitably coupled to an Electric Motor, but if a large saw were introduced a much greater amount of power would be needed to drive it. (*Reply to D. Banks, Alanbury Hill*).

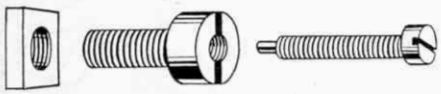
CYLINDERS FOR MOTOR CYCLES.—Cylinders for model Motor Cycles can quite easily be devised in Meccano. For the smaller models for instance, a Worm Wheel can be used (if you wish to represent a twin engine, two Worms fastened at an angle will be suitable). In large models of motor cycles the Worm Wheels are too small, and a number of loose 1" Pulleys slipped on to an Axle Rod will give a very realistic effect. Following on these lines we do not think model-builders will ever require special cylinders for their models. (*Reply to E. Macherness, Old Stratford; J. R. Christie, Leeds; Alan Grainger, Eastbourne, and others*).

GROOVING OF AXLE RODS.—Your suggestion for using fast Pulley Wheels as loose ones is of considerable interest. The idea will be clear from the sketch, which shows a section through a 1" fast Pulley mounted upon an Axle Rod. A number of grooves would first be cut in the Axle Rods, and when it was required to use a fast Pulley as a loose one the set screw would be screwed through the boss and partly into the groove in the Rod. This would enable the Pulley to rotate freely but would prevent it from moving laterally on the Rod. By this means, a great saving in parts would be made, as in order to allow a Pulley to rotate in this manner, two Collars or Spring Clips have at present to be used. The idea is, however, open to several objections, the chief of these being that the Pulleys could only be mounted in specified positions on the Rod, and this would prove a considerable hindrance to the model-builder. In addition cutting grooves in a Rod in this manner would materially affect their strength while smooth running of gears and pinions, etc., on Rods that were grooved in this manner would be hard to obtain. We do not think it advisable, therefore, to make this alteration. (*Reply to J. C. L. Cole, Rhyl*).



Suggested Meccano Improvements—(*Continued*)

THREADED BUSH.—Adjusting the contact breaker in the Meccano bell (see June 1928 "*M.M.*," page 515)



is certainly a somewhat difficult job, as it necessitates disconnecting the 6 B.A. Nuts that are fastened on either side of the Flat Bracket forming the contact post, and your suggested bush would therefore be very useful. The bush is illustrated herewith, and it will be seen that it would resemble externally a standard bolt with a thread tapped through it. When used in the Meccano Bell the bush would be pushed into the round hole of the Flat Bracket, and secured by a standard nut. The contact screw could then be screwed into the tapped hole and very fine adjustment of the contact point obtained. A part of this type would have a very limited demand however, and for this reason we do not think it advisable to introduce it. If further uses for the bush could be found, however, further steps might be taken. We shall be pleased to receive suggestions from readers regarding this. (*Reply to O. F. Hargreaves, Burnley*).

SPRING CLIP.—Your improved pattern of spring clip is, we consider, very ingenious. The clip would resemble a thin collar having on its inside face a groove into which a small piece of spring may be introduced. The collar would be pushed on to the rod and the spring would hold it in place. In questions of neatness your suggested article would certainly score over the existing pattern of Spring Clip, but we are afraid that the cost of manufacture would be great. However, we are giving careful attention to your idea and will comment upon it further in the near future. (*Reply to B. Green, Salford, Manchester*).

MECCANO "IN MINIATURE."—A complete system of Meccano parts one half the size of the present accessories, would have very little to commend it. The present standard of sizes of parts in the Meccano system was only settled upon after much experiment, and it is an acknowledged fact that the half inch spacing of the holes is the best for all round uses. Accessories that were manufactured to half-size would moreover have nothing like the strength of the present parts and the possessor of such an outfit would therefore be prevented from performing many of the experiments and building many of the models that the present system makes possible. (*Reply to M. Platt, Dundee*).

RIGHT-ANGLE BRACKET.—A bracket resembling two Flat Brackets secured at right angles to each other might prove a useful and popular addition to the Meccano range, for numerous uses for such a part immediately suggest themselves. In particular, the part could be employed to strengthen corners in Meccano structures, but the existing Corner Brackets (Part No. 133) could be used here, although it would not be so neat. The part might also be employed in constructing small switch arms and many other mechanisms where neatness is an essential factor. We will certainly give careful attention to your idea. (*Reply to A. R. Renton, Stafford*).

SPECIAL WIRE.—We do not think that it would be advisable for us to introduce special coils of steel wire for making wire ties, as tie rods are very rarely required in models, the necessary rigidity being achieved with the standard Strips, etc. When a tie member is specially required we would remind you that one or more Healds (part No. 101) can often be used most effectively. (*Reply to E. R. Ball, Newcastle*).

WATER MOTOR.—We have noted your idea that a small water motor should be introduced. This is an interesting idea as a miniature turbine would be capable of providing sufficient power to drive many of the smaller models. The chief disadvantage, however, would be the mess that is always attendant when water is used. (*Reply to C. J. G. Stobie, Talyport*).

LOCK AND KEY.—A special lock and key would be quite unsuitable for inclusion in the system, and we suggest that you try devising a lock and key from standard parts. A combination lock for a safe door, etc., was described in the "Suggestions Section" for August, 1928. (*Reply to D. J. Howard, Exmouth*).

NEW COUPLING.—Your suggested method of altering the effective length of a rotating shaft is interesting. The coupling would consist of a tube having a slot cut for part of its length and secured at each end to a Collar, while in the tube a third collar would be placed so that it could slide up and down at will. In operation one shaft would be secured to one end of the tube, while a second shaft would be gripped in the sliding collar. The compound shaft thus formed would be capable of transferring motion and at the same time could be extended or contracted. The movement is quite useful in certain models, but we do not think we would be justified in introducing your suggested part as standard Meccano parts can be employed to duplicate the movement. (See Standard Mechanisms Manual, page 40, S.M. 270). (*Reply to J. Foley, King Williamstown, South Africa.*)

IMPROVED DOUBLE BENT STRIP.—We do not consider that the addition of a boss to the Double Bent Strip would increase its usefulness in any way. (*Reply to R. Collins, Victoria, Australia*).

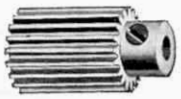
RADIATOR.—A specially manufactured radiator is an unnecessary addition to the system. Two fine examples of radiators built from standard parts were shown last month. (*Reply to N. Collinson, Tamworth*).

NEW MECCANO PARTS

Part No. 171, Socket Coupling, price 9d. This part is designed to couple two wheels or gears together rigidly so that they can turn as a unit upon a shaft. Its advantages will be apparent to all Meccano boys who have any experience with the design of gear boxes, and we have no doubt that it will prove an extremely popular addition to the Meccano system. By securing a section of a Dog Clutch in one end of the new part and a Gear Wheel in the other, it is possible to assemble a very efficient and realistic drive-changing gear almost exactly similar to the "sliding dogs" gear box employed in most motor cars and motor cycles. Two excellent examples of the use of the Socket Coupling will be found in the new Meccano Super Model Dragline (see Instruction Leaflet, No. 27).

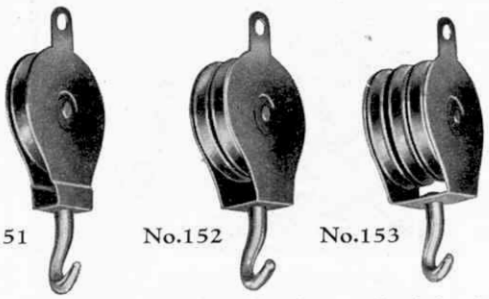
New Pinions

No. 25b. Pinion, $\frac{3}{4}$" diam., $\frac{3}{4}$" wide ... Price 10d.
No. 26b. Pinion, $\frac{1}{2}$" diam., $\frac{3}{4}$" wide ... ,, 8d.



These parts are similar to the Double-width Pinions (parts Nos. 25a and 26a), except that the width of the tooth face is $\frac{3}{4}$" instead of $\frac{1}{2}$", and like the latter parts they engage with the 50- and 57-teeth Gear Wheels respectively. When one of these Pinions is used in connection with a Gear Wheel, either part may be moved longitudinally through a distance of nearly $\frac{3}{4}$" before the teeth become disengaged. The value of this longitudinal movement in regard to all kinds of gear-change mechanisms will be obvious.

IMPROVED MECCANO PARTS



The above illustrations show how each of the three Pulley Blocks (Parts Nos. 151, 152 and 153) have been improved. The small lug that has been added enables cord to be tied to the Blocks, this being impossible with the old style part. There is no alteration in the prices. The price of the single sheave Pulley Block is 8d. whilst the two sheave and three sheave Pulley Blocks cost 9d. and 1/- respectively.

SPRING STRIPS.—There appear to be distinct possibilities in your proposal that spring strips of various lengths should be introduced. We will look into your idea with care. (*Reply to F. Waugh, Rochdale*).

RAIL CONNECTOR.—We have noted your suggestion that a special connector for joining Meccano to Hornby Rails should be introduced. Similar ideas, we may mention, have received our attention in the past, but as a part of the type is but rarely required we do not consider it advisable to proceed with its manufacture. However, we are making a note of your idea for future use. (*Reply to A. E. Haskew, Wolverhampton*).

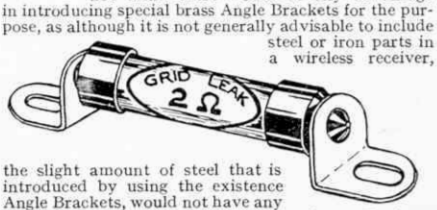
IMPROVED RACK STRIP.—No advantage would result from sharpening the teeth of the Rack Strip (part No. 110). Of course, it would have the outward appearance of a saw but the steel of which the Strip is prepared is not intended for this kind of use and it would be blunted rapidly. By sharpening the teeth the main functions of the Strip would moreover be more or less destroyed as the working of the Strip in a rack and pinion mechanism would be greatly impaired. We consider it much better, when a saw that will actually cut wood is required, to use a hack saw blade and to retain the Rack Strip for its original function. (*Reply to G. W. Crew, Newcastle*).

MOTOR HORN.—Your suggested design for a motor horn is quite good but we fear that it would not be suitable for inclusion in the system. A horn would certainly look effective if fitted to a Meccano motor car or cycle but the merits of a part of this type lie purely in its external appearance, and we consider it a much better plan to concentrate on the introduction of new parts that fulfil some definite want. A very realistic "Klaxon" horn, we may mention, is fitted to the Motor Cycle and Sidecar (Super Model No. 3) the horn being constructed entirely from standard parts. (*Reply to G. Wilkins, Redditch*).

SPECIAL AUTOMOBILE PART.—We cannot consider introducing a special Outfit including an automobile body, steering wheel, number plates, mudguards, wind-screen, etc., as this would be contrary to the principles of Meccano. A motor built up with such a set would have, of course, a very realistic outward appearance, but it is the internal mechanism that counts with the true model-builder. With existing parts he is able to build a motor that contains a wealth of mechanism conforming accurately with that of a real car, while at the same time it is possible to build up very realistic body-work for the chassis from standard parts. (*Reply to D. B. Egerton, Buckingham*).

1½" DUNLOP TYRES.—It would be difficult to find any uses for 1½" tyres if introduced, as the existing 2" tyres fulfil nearly every need. We would point out that the ⅝" Rubber Rings form excellent "pneumatic tyres" for the 1" Pulleys and with a little persuasion it is possible to fit these to the 1¼" Pulleys as well. (*Reply to F. Howard, Thornton Heath*).

BRASS ANGLE BRACKETS.—To use Meccano Angle Brackets as clips for holding various grid leaks and anode resistances in radio receivers is, we consider, a most ingenious idea. The way in which the resistance is mounted will be clear from the sketch. The Angle Brackets should be screwed down to the base board of the radio set by means of wood screws, and if the base is of hard wood there will be no need to insulate the Brackets. Connection to the two Brackets may be made by slipping solding tags on to the shanks of the wood screws that hold the Brackets, and soldering the wires to these. While we consider this idea excellent we do not think there would be any advantage in introducing special brass Angle Brackets for the purpose, as although it is not generally advisable to include steel or iron parts in a wireless receiver,



the slight amount of steel that is introduced by using the existence Angle Brackets, would not have any disadvantageous effect upon reception. (*Reply to R. S. Lawson, Middlesbrough*).

With the Secretary

Special Merit Medallions

I wish to remind Leaders that recommendations for Special Merit Medallions for the winter sessions should be sent in at the earliest possible opportunity. The list of these awards is not as large as I should like, and I am afraid that in many clubs insufficient use is made of the medallions. They should be regarded as the chief prizes of the year. Two of them are allotted every session to each club, to be awarded to the two members who, in the opinion of the Leader, have done the most valuable work for the club. There are no restrictions as to the nature of the services for which awards may be made.

The best time to present medallions is undoubtedly at the exhibition that usually marks the close of the winter sessions, and Leaders should send their recommendations to me without delay, in order that medallions may be prepared and forwarded in time for such occasions.

Looking Ahead

Although it is so early in the year, it is interesting to note that many clubs have already begun to make arrangements for outdoor activities during the summer. This is very sound policy. A great deal of the falling-off in attendance of which Leaders complain during the summer is due to failure to prepare a plan of campaign sufficiently far in advance. If members get the feeling that there is nothing very definite ahead they immediately lose interest, and this, of course, is fatal to the success of the club.

It is unwise to attempt to carry out a summer programme of too elaborate a nature. A better plan is to decide upon a few really attractive events, and to concentrate attention on making these successful. By so doing, interest is maintained, and there is little fear of members drifting away.

If it is intended to run a cricket team, it is particularly important that fixtures should be arranged at the earliest possible moment. Nothing is more disheartening to a club than to find that it cannot obtain even a moderately full programme of fixtures, because application has been left until almost the beginning of the season.

There is also the question of a summer camp. Although it seems a little premature to begin thinking about camps so early, it is surprising how quickly time flies. The choosing of the site of the camp and the working out of the various details in connection with it require a considerable amount of time if the results are to be satisfactory. It is impossible to arrange a successful camp in a last-minute rush and, generally speaking, the more time taken over the preliminaries the better. I shall be very glad if secretaries will notify me as soon as possible of the place and time chosen for their club camp, and also whether they would be willing to co-operate with one or more clubs in the same district with the object of arranging a combined camp, a plan that usually ensures a merry and successful holiday.

Meccano Club Secretaries

No. 15, T. H. Evans

T. H. Evans acted as Secretary of the Bristol Grammar School Meccano Club from its affiliation in January, 1928, until the beginning of this year. The formation and progress of the club have been due very largely to his initiative and enthusiasm, and it is satisfactory to know that, although he is no longer Secretary, he is still a member of the Club Committee.

The Proposed Annual Conference

In the January "*M.M.*" I invited Leaders and secretaries to give me the benefit of their ideas on the proposal to hold an annual conference of Meccano clubs. I have received many interesting replies, and it is evident that the suggestion has met with considerable support, mainly on the ground that direct interchange of ideas between the officials of different clubs would be very helpful. It has also been pointed out that such a conference would strengthen in every club member the feeling that he belongs to a "live" organisation.

Critics of the scheme mostly base their objections on the ground that it would be extremely difficult to secure a representative gathering, and that in particular the interest of the smaller clubs in remote districts would be in danger of being overlooked. As an alternative, one of my correspondents has made the very interesting suggestion that an annual "*Questionnaire*" should be sent out from Headquarters to every affiliated club. This questionnaire would put forward the most important ideas and suggestions that had been brought forward during the year. Each Leader would be asked to arrange a meeting for full discussion of the various points, and subsequently to convey the opinions of his members to Headquarters. These reports would be carefully analysed and steps would be taken to put into operation as far as possible, all the items on the questionnaire that had received the approval of the majority of the clubs.

Such a scheme would have the advantage of providing each club with a means of expressing its opinions at practically no cost. I shall be very glad if Leaders will think over the idea, and let me know their views.

* * * *

The Harehills (Leeds) Meccano Club will hold their first exhibition on Tuesday, 26th March, in the club room, Spencer Hall, 46, Frankland Place, Roundhay Road, Leeds, when an extensive display of models will be on view. Proceedings will commence at 6.30 p.m., and the moderate charge of 4d. will be made for admission. A cordial invitation is extended to Meccano enthusiasts.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters whose names and addresses are given below :—

BRIGHTON—R. Waddell, 123, Ditchling Road, Brighton, Sussex.

ST. LEONARDS-ON-SEA—William Laver, 9, St. Paul's Road, Bohemia, St. Leonards-on-Sea, Sussex.

SLIEMA—E. Barbara, 9, S.S. Trofimo, Sliema, Malta.

STOURBRIDGE—T. T. Virr, "The Limes," Pedmore, Stourbridge.

KINGHORN—William Mackie, 69, Pettycur Road, Kinghorn, Fife.

CLUB NOTES

Albert Village M.C.—Exhibitions on local dealers' premises of models made by members attracted crowds of visitors. The models displayed included a Meccanograph, Eiffel Tower, Big Wheel, Beam Engine and Revolving Crane. A Hornby layout, on which ran both electric and clockwork trains, also was a prominent feature. The club is at present without a club-room, and the secretary would be grateful to anyone who can help to secure accommodation of a suitable character. Club roll: 16. *Secretary*: L. C. Adey, 239, Occupation Road, Woodville, Burton-on-Trent.

Annan M.C.—Has set up a record for attendance, every member being present at all meetings for more than two months. On Contractors' Night a model of a large Crane was completed in a satisfactory manner by the successful group, and other excellent models have been constructed on regular Model-building nights. Physical Training continues to be popular, and Boxing Tournaments have been arranged. Club roll: 35. *Secretary*: W. F. Duff, 10, Hecklegirth, Annan.

Elm Road (Beckenham) M.C.—The Magazine is making splendid headway and has now achieved the dignity of a printed cover. In addition to interesting articles and stories, it contains notes contributed by Leaders of sections, whose exhortations are very much to the point; in a recent number one Leader told his team that their models of ships looked like bakers' vans! A Lantern Lecture on "*Omnibuses*" was greatly enjoyed, about fifty slides being shown. Club roll: 20. *Secretary*: C. W. Price, 52, Queen's Road, Beckenham.

Dudley M.C.—Meetings are well attended and several excellent models have been built. One of the members read a paper on "*Portsmouth Docks*." Rehearsals for a play entitled "*Robin Hood*" are now in progress. The club funds have been satisfactorily increased by the selling of scent satchets. Club roll: 15. *Secretary*: W. E. Darby, 93, Queen's Cross, Dudley.

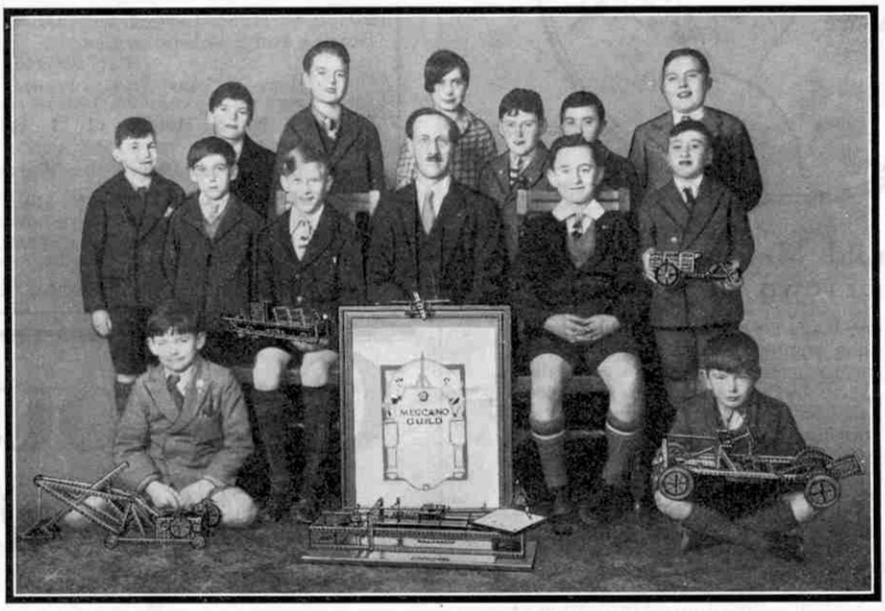
Galashiels M.C.—Surprise Night was very successful. Members were delighted to find the club-room gaily decorated and entered with spirit into the programme of Games and Competitions. Visitors' Night attracted a large attendance. Open Nights are now a regular institution and the club has derived much benefit from them. Members are busily engaged on the construction of a Funicular Railway. The organisation has been changed, the Senior Section now including all members of two years' standing. Club roll: 27. *Secretary*: D. Richmond, 58, St. John Street, Galashiels.

Merelands M.C.—Model-building is the chief feature of the programme. A Meccanograph has been constructed, and members have been astonished at the inexhaustible variety of patterns that may be produced. Photography is the favourite hobby of members, whose work is of a very high quality. Club roll: 11. *Secretary*: Eric Stroud, The Vicarage, Lindsey, Hadleigh, Suffolk.

Larne M.C.—Steady progress is reported. The club's exhibition attracted many visitors, who were both surprised and interested by the display of models. A small entrance fee was charged, and the proceeds, amounting to £2 17s. 6d., were given to the local branch of the R.S.P.C.A. Club roll: 16. *Secretary*: H. Rutherford, Main Street, Larne.

Stansted M.C.—Dartboard and Air-gun Shooting are the chief recreations and matches are keen and enjoyable. Model-building is the supreme interest, and members who build good models are eager to demonstrate their construction and use with the aid of plans and sketches. Lively scenes have been witnessed at Football Matches. A surprise Christmas entertainment was arranged by a member for the special benefit of new comers to the club. Club roll: 11. *Secretary*: G. Haselden, Bank Cottages, Stansted, Nr. Sevenoaks.

Parkstone Meccano Club



A group of members of the Parkstone M.C., an enterprising club that was affiliated in March 1928. It owes its present position to the hard work of the Leader, Mr. E. P. Bath, who is seen in the centre of our photograph. On his right is Eric Bath, his son, the energetic secretary. The members of this club specialise in the construction of large models, and also are interested in painting and electrical work.

Preston Embee M.C.—Excellent progress is reported. An interesting demonstration of "*Moulding*," and a Lecture on "*Aeroplanes*" have been given by gentlemen interested in the work of the club. Model-building is the chief pursuit. Members' activities have been stimulated by the promise of Mr. J. Clayton to present gold and silver medals, to be awarded for the best models displayed at the forthcoming exhibition. Efforts are being made to arrange a visit to the works of the Leyland Motor Company. New members will be made welcome, and boys wishing to join should apply to the secretary for full details. Club roll: 28. *Secretary*: J. R. Drysdale, Greeba, Meath Road, Broadgate, Preston.

Herne Bay M.C.—Games Tournaments continued throughout the session are being played and arouse great interest. Members bade "Farewell to 1928" at a highly successful Social Supper and Jollity Evening. Attendance is now recovering from a slight set back, and it is hoped that the interesting and varied programme will attract new members. Club roll: 43. *Secretary*: C. W. Russell, 4, Clifton Villas, Herne Bay, Kent.

Holy Trinity (Barnsbury) M.C.—An interesting Lantern Lecture on "*London's Underground Railways*" was given by the Assistant Leader. The club took charge of a stall at the Annual Church Sale of Work, and raised a sum of more than £2. An excellent programme is now being followed and the present session is proving very successful. Club roll: 50. *Secretary*: Mr. F. W. Johnson, 23, Market Street, Edgware Road, Paddington, London, W.2.

Edinburgh M.C.—Now has a splendidly equipped club-room. The sub-Leader, Mr. D. Gellatly, has presented a substantial number of books to the club library, which is growing rapidly. Model-building Nights figure prominently on the syllabus, particularly fine models made including a Fire Engine and a Two-Seater Motor Car. These won prizes in the Monthly Competitions. A Stamp Section has been started, and brief lectures are being given to help beginners in this hobby. Club roll: 19. *Secretary*: B. McClumpha, 83, Bellevue Road, Edinburgh.

Pershore M.C.—A Hobbies Section has been formed for members interested in Woodwork and similar pursuits. Games Nights are devoted to Table Tennis Tournaments and Bagatelle. Readings from the "*M.M.*" are popular features of the syllabus, and a visit to the local Power Station has been arranged. Most members received additions to their Meccano sets at Christmas, and are now building more ambitious models. Club roll: 10. *Secretary*: D. Cross, Church Street, Pershore.

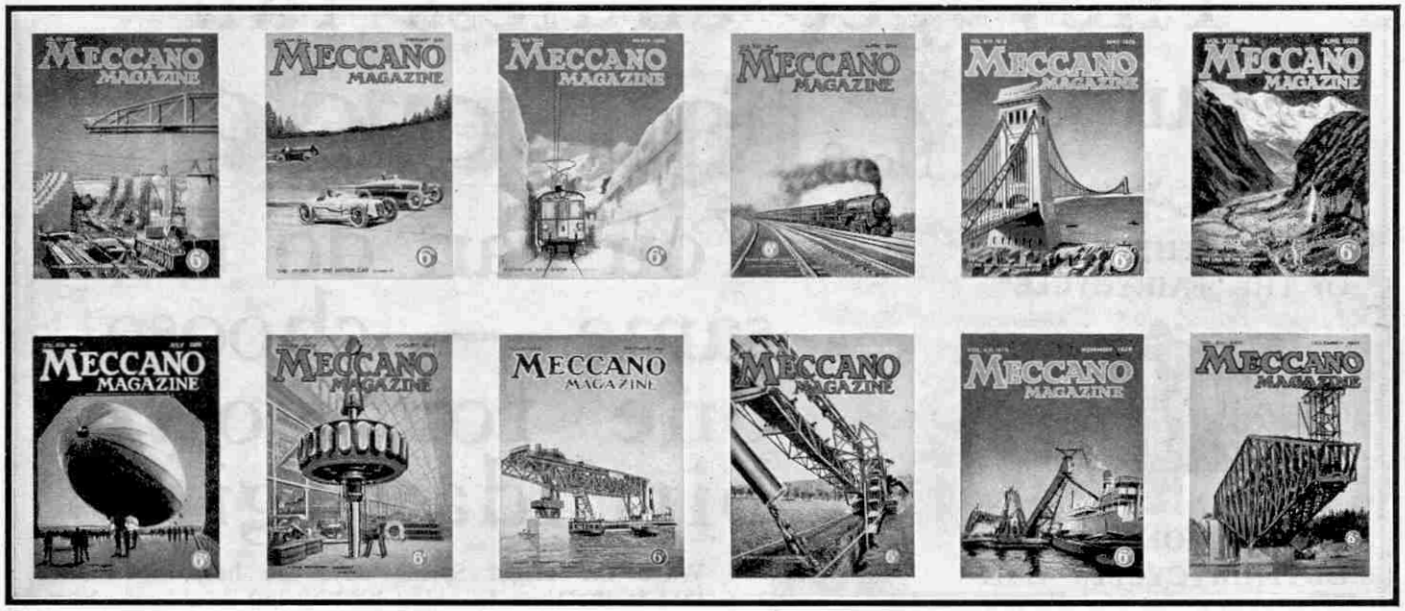
Stockton-on-Tees M.C.—A varied and interesting programme is being followed. It includes Hornby Train Evenings, Games and Puzzles Nights and Model-building Competitions, in one of which members were required to build a model of the new Tyne Bridge. The fourth Annual Exhibition attracted a large number of visitors and was the best yet held. Models exhibited were exceptionally good, and the side shows cleared a profit of £2. Club roll: 30. *Secretary*: N. Middleton, 14, Victoria Avenue, Norton Road, Stockton-on-Tees.

The Leas (Hoylake) M.C.—The Meccanograph loaned from Headquarters was explained by the Leader and members then made many attractive patterns. A Lecture on "*Cable-laying by Machinery*" was given by the President with the aid of the secretary. A very interesting explanation of the effect of stream-lining on the speed of ships and racing cars was given by the Leader, who also showed how the same principles were used in designing the shape of certain tools. A "Meccano Part Naming Contest" aroused great interest. Club roll: 47. *Secretary*: G. S. W. Ollerenshaw, The Leas, Hoylake.

Hampstead and Cricklewood M.C.—A club Magazine is to be published and an Editor has already been appointed. A very successful Lecture on "*Railways and Locomotives*" was given by Major Myers, whose kindness is greatly appreciated. Other interesting items on the programme have been Hornby Train Evenings and Ten-minute Lectures by members. Club roll: 12. *Secretary*: R. Zizolfo, 2, Minster Road, Cricklewood, N.W.2.

St. Paul's (Birmingham) M.C.—The Exhibition and Sale of Work was a great success. Many excellent models were displayed, a Lorry, Tower and several Cranes attracting attention. A splendid Hornby Train layout also was on view. The Exhibition has aroused widespread interest in the club and the Vicar, Rev. A. W. Waugh, has very kindly accepted the office of President. A Mock Trial and a Debate have been held, while at Christmas a play was presented. Members are now busy constructing scenery for an elaborate and realistic club railway. Club roll: 16. *Secretary*: E. Cunningham, 93, William Street, Lozells, Birmingham.

Competition Page



Which were the Most Popular Covers in 1928?

In the above illustrations the beautiful coloured covers that appeared on the various issues of the "*M.M.*" during 1928 are displayed in reduced form in their published order—January to June in the upper row, July to December in the lower.

The "*M.M.*" covers are among the most striking that are published to-day, and therefore it is not surprising that opinions should differ as to which are the most effective ones. Many readers will recall the interesting voting contest held to judge the best covers in our 1925, 1926 and 1927 volumes, and we are sure that the opportunity of expressing the opinion on the 1928 covers will be welcomed by everyone.

The reproductions above are intended for reference purposes only, but new readers will find them of great assistance in forming their judgment, although, of course, the brilliancy of the colour of the originals is lost. Those readers who possess copies of the 1928 issues will be well advised to compare the originals.

Referring to each cover by its month of issue, each competitor is asked to write the following two things on a postcard :—

(A) The 1928 cover he likes best of all.

(B) His idea of the order of popularity of the covers as decided by the massed vote of all the competitors. This list must cover the whole year, every month being included.

The entrant's name and address must be added to the card, which should be addressed " Cover Voting Competition, Meccano Magazine, Binns Road, Old Swan, Liverpool." No competitor may submit more than one entry.

Prizes of Meccano goods (to be chosen by the winners) to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors whose lists most accurately forecast the final result. In the event of a tie for any of the prizes preference will be given to the entry displaying the neatest or most novel presentation. In addition there will be a number of consolation prizes. Closing date, 2nd April. Overseas, 30th June.

Why is the "Boat Race" so Popular?

On Saturday, the 23rd of this month, will be decided one of the greatest sporting events of the year—the Oxford and Cambridge Boat Race on the River Thames.

Perhaps the most remarkable feature of the Boat Race is its widespread popularity. Hundreds of thousands of men, women and children, who have never been perhaps within 100 miles of the University cities, choose either the Light Blue or the Dark Blue crew as their favourite, and are keenly interested in reports of its progress throughout the strenuous period of training. This interest grows steadily, and on the day of the race reaches a very high pitch of excitement. The vast majority of those who discuss prospects so earnestly, and who read so eagerly the account of the struggle, have never seen the race and probably never will see it; yet year after year the interest revives as fresh as ever.

There must be some explanation of this state of affairs, and we should like to know our readers' opinions on the matter. This month, therefore, we offer prizes for the best answer to the question : " WHY IS THE BOAT RACE SO POPULAR " ? In judging this contest the literary style of the replies will not be taken into consideration, only the merit of the idea put forward.

Prizes of Meccano products (winner's own choice) to the value of £1/1/– and 10/6 respectively, will be awarded to the senders of the best and second best answers to the question, in each of the two sections into which the entries will be divided—A for those aged 16 and over ; B for those under 16. In addition, there will be a number of consolation prizes.

The competitor's name, age and address, must appear on the back of each sheet of paper used.

Entries must be addressed to " Boat Race," Meccano Magazine, Binns Road, Old Swan, Liverpool. Closing date, 2nd April. Overseas, 30th June.

HOME RESULTS

Bottled Parts No. 2.—1. A. M. JOHNSTON (Dunstable) ; 2. G. E. PEPPER (Dublin, S.E.5) ; 3. J. SHEPHERD (Eastbourne). Consolation Prizes : F. BREWIN (Chesterfield) ; J. DEMPSTER (Leith) ; A. NICHOLS (Darlington) ; C. PLAYFORD (Uxbridge, Middx.) ; H. WILKINSON (Sheffield) ; C. E. WRAYFORD (Teignmouth, S. Devon).

Christmas Card Design Competition.—First Prizes : Section A, A. Murray (Birmingham) ; Section B, R. C. Randall (St. Albans). Second Prizes : Section A, S. HOWSON (Workington) ; Section B, Miss M. WALKER (Stoke-on-Trent). Consolation Prizes : R. BOUSTRED (Bowes Park, N.22) ; R. D. REID (E. Dulwich, S.E.22) ; F. G. STAPLEY (Etchingham) ; H. LANE (Stokesley) ; J. T. BENT (Harrow-on-Hill) ; R. D. CLARK (Highbury, N.5) ; B. WYNNE (Anfield) ; L. HEAD (Writtle) ; H. EVERITT (London, S.W.16) ; R. M. BRUCE (Shipley) ; J. HALLIDAY (Farnworth).

OVERSEAS

37th Photographic Contest.—First Prizes : Section A, R. M. ANDERSON (Melbourne) ; Section B, T. D. A. WILSON (Paris). Second Prizes : Section A, I. MACLAREN (Vancouver Island) ; Section B, F. COLLINS (Cape Town).

Doublets No. 4.—1. R. RUSSELL (Whangarei, N.Z.) ; 2. M. H. WHITLOCK (Lahore, India) ; 3. W. RUSSELL (Whangarei, N.Z.) ; Consolation Prize : E. WORTHINGTON (South Vancouver, B.C.).

Just watch your friends. They get endless fun out of The No. 8 Fairycycle

REGD TRADE MARK

You can do the same——choose one for your birthday gift.

THIS IS THE BADGE OF THE "FAIRYCYCLE"

ASSOCIATION. OWNERS OF "FAIRYCYCLES" CAN BECOME MEMBERS FREE.

This Association is open free to all owners of genuine "Fairycycles." The badge is attached to every "Fairycycle." All you have to do is to fill up the form which is given at the time of purchase and post it to Lines Bros. Ltd. You will then become a registered member of the "Fairycycle" Association.

When the bright Spring days are here, that is the time to enjoy healthy out-door exercise with a Fairycycle. Races, rides, and a hundred-and-one games are easily planned with its aid.

The "Fairycycle" is on sale at the Stores and all first-class Toy Dealers.

This illustration shows the No. 8 model which is fitted with REAL DUNLOP BALLOON TYRES.

Models and Prices

No. 1, with tangent spoke wheels, $\frac{3}{8}$" ribbed tyres, stand and carrier.	39/6
No. 2, with stand and carrier, $\frac{3}{8}$" ribbed tyres, rim brake, upturned handlebars, tangent spoke wheels.	49/6
No. 3, De Luxe Model, with ball bearing wheels, 1" ribbed tyres, plated rims, etc.	59/6
No. 4, Super "Fairycycle" with ball bearings throughout and spring saddle, 1" cushion tyres.	65/-
No. 6, Senior Model with 16" wheels, 1" ribbed tyres, ball bearings throughout.	70/-
No. 7, as Model 6, but with 16" × 1$\frac{3}{8}$" pneumatic tyres.	75/-
No. 8, with Dunlop pneumatic tyres (2$\frac{1}{4}$" buttressed treads, special tubular forks, large domed mudguards, chain guard, stand and carrier, ball bearings throughout, plated rims and rim brake, finished black, orange or blue.	87/6

L. BROS. LTD. LONDON BROS. ENGLAND

Regd. Trade Mark.

"Fairycycles" are made by
LINES BROS. LTD.
114, Morden Road, Merton, S.W. 19

NOT HIS JOB

An old woman who had called in the doctor to give her treatment for a cold was somewhat grumpy when she found that her own doctor had been unable to come and had sent a young deputy. After questioning and examining the patient, the young doctor nodded wisely and said: "Ah, I know what's the matter with you. You are suffering from nasal catarrh."

The old woman looked disgustedly at the doctor. "Hoots, mon," she said, "I sent for you to cure ma cauld, no' to christen it."

* * * *

A Belgian student was relating his experience in studying English. "When I discovered that if I was quick I was fast, that if I was tied I was fast; that if I spent my money too freely I was fast, and that not to eat was to fast, I was discouraged. But when I came across the sentence, 'The first one won one one-pound prize,' I gave up trying to learn the English language at all!"

* * * *

Lady: "Nothing to do in the summer months? What is your work?"

The Wanderer: "Lidy, I'm a football mascot!"

* * * *

THE REAL THING

As the old lady strolled slowly through the park two very small urchins ran up and stopped her.

"Please, lady," began the taller of the two, "the little brother 'ere does luverly imitations. For a penny, lady, 'e'll give you the imitation of a 'en."

"Dear, dear!" smiled the old lady kindly, groping in her knitted bag. "And what will he do—sit up and cackle?"

She was treated to a look of intense contempt.

"Naw," replied the lad scornfully, "'E doesn't do cheap imitations of them sort. 'E'll eat a worm!"

* * * *

Pat: "I want to see some mirrors, please."

Salesman: "Hand mirrors, sir?"

Pat: "Begorra, no! Some that Oi can see me face in, to be sure."

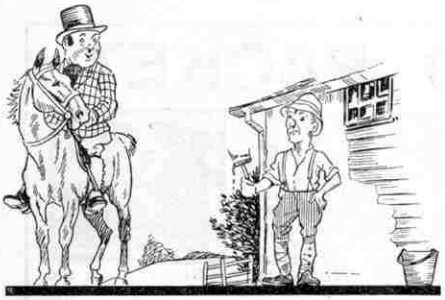
* * * *

Talkative Old Gentleman (to fellow passenger): "How fast we travel! But, young man, have you ever thought of the flight of time? Think of the fleeting hours of youth, the golden days that swiftly pass away. Have you ever counted the minutes—"

Young Man (suspiciously): "What are you trying to do? Sell me a watch?"

* * * *

NOT ENOUGH WORK



Old Jarge was busy whitewashing his barn with a brush that had seen better days.

"If you used a brush with more bristles on it you would do twice as much work," good-humouredly suggested the squire, who was passing.

"Oh, be that so sur?" replied old Jarge. "Well, ye see, I beant got twice as much to do

Mrs. Sambo: "Darkie, you'se remind me of one of dose flyin' machines."

Darkie: "'Cause I'se a high-flyer Mrs. Sambo?"

Mrs. Sambo: "No, 'cause you'se ain't no good on earth."

* * * *

A GOVERNMENT OFFICIAL

First Sailor: "Why is that nigger lookin' at us like that?"

Second Sailor: "Dunno, unless 'e 'appens to be the food inspector."

* * * *

"When I was once in danger from a lion," said the explorer, "I tried sitting down and staring at him, as I had no weapons."

"How did it work?" asked his companion.

"Perfectly. The lion didn't even offer to touch me."

"Strange! How do you account for it?"

"Well, I sat on the top branch of a tree."

* * * *

"You can't swindle me, my man," declared the indignant spinster. "I haven't ridden in taxis for the last ten years for nothing."

"Bet you've 'ad a good try, all the same," came the bitter response.

* * * *

Lily, aged six, to little John, who is eight: "I say, Johnny, do you know what wind is?"

Johnny, pondering for a little while: "Yes, I know; it is air that has made itself late, and is running to catch up."

* * * *

"I wish you to know," said the angry one, "that I am not so stupid as you think I am."

"Quite so," rejoined his companion, "that would be impossible."

* * * *

ARMY TERMS

An old General was walking down the street when he was stopped by a beggar.

"Don't refuse a trifle, sir. I'm an old soldier."

"An old soldier, eh?" replied the General. "Then I'll give you a test. 'Shun! Eyes right! Eyes front! Stand at ease! Now what comes next!"

"Present alms!" retorted the beggar.

* * * *

The efficiency expert was enthusiastic. "Sir," said he, "our system will show you how to earn more money than you are getting."

"I do that now," exclaimed his long-suffering listener, moving on.

* * * *

"I hear that you can swim," said Uncle to his young nephew.

"Yes, Uncle," replied Peter.

"Good. And where did you learn?"

"In the water, Uncle," replied the boy innocently.

* * * *

The bumptious young man was trying to create an impression at a party.

"Oh, yes," he said to a lady guest, "I am something of a thought reader. I can tell just what a person is thinking."

"Really?" queried the lady. "Then I beg your pardon. I had no intention of hurting your feelings."

* * * *

Navvy (to pal who has just picked up a two-shilling piece): "'Ere, that's my 'arf-crown!"

Finder: "Just my bloomin' luck, but I'll have to owe you the tanner." *(Humorist).*

THE OTHER WON

Two boys were one day discussing the merits of their respective Mayors.

"We've a real Mayor," said one.

"So've we," retorted the other.

"But ours wears a collar and chain," said the first, "Does yours?"

"No fear," answered the other, "We can trust our fellow; he runs about loose!"

* * * *

It was Christmas Eve and the sentry heard the sounds of approaching footsteps. Instantly he levelled his rifle, and challenged "Halt! Who goes there?"

"Cook, with the plum-pudding," was the reply.

"Pass, Cook—Halt, plum-pudding."

* * * *

Smith: "Did I return that lawn-mower I borrowed last autumn?"

Brown: "No, you didn't."

Smith: "That's awkward. I've just come to borrow it again."

* * * *

The assembled company was discussing the sagacity of animals.

"I firmly believe," said an elderly man, "that a horse understands more than a dog."

"I don't," said an interfering young fellow rudely.

"Probably not, but I was referring to a horse," was the quiet reply.

* * * *

Jimmy was in despair, having lost his handkerchief.

"It is not a very grave loss," they told him.

"Oh, it isn't for the handkerchief!" sighed Jimmy. "It is because I made a knot in it to remind me about something!"

* * * *

Master: "Name six animals found in India."

Smith Minor: "Five lions and a tiger."

* * * *

Teacher: "Now tell me the names of some pieces of clothing."

Children: "Coat, hat, shoes, blouse ——."

Teacher: "Yes, now a piece of clothing for the hands."

Smith: "Trouser's pocket."

* * * *

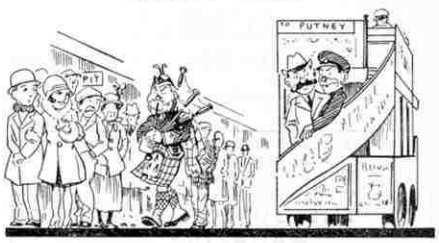
Student: "Have you ever heard of the footprints of time?"

Professor: "Of course, I have."

Student: "Then where do they come from if time flies?"

* * * *

SAFETY FIRST



A kilted Highlander, playing the bagpipes, paraded up and down the street alongside a theatre queue.

"Why do they always walk up and down when they're playing?" asked a man in a passing bus.

"'Cos it's harder to 'it 'em that way!" said the conductor.

* * * *

The pilot had taken charge of the vessel on coming into the harbour. The night was dark, and driving rain obscured vision still further. Suddenly the ship struck a rock and began to fill with water.

The captain raved and turned to the pilot. "I thought you said you knew every rock in this harbour," he exclaimed wrathfully.

"I do," replied the pilot. "That was one of them."

* * * *

New Boarder: "But you told me in your letter that there was a beautiful view for miles."

Landlady: "Well, there is. Just put your head out of the window and look up."

POPE ON POSTAGE STAMPS

SPAIN, 1928. Big Stamps with portraits of Pope and King Alfonso. 12 un., 1/6; 24 un., 8/-; 32 un., 40/-. **EGYPT, 1927.** Statistical Congress. 3 un., 1/6. **1928.** Medical Congress, 2 un., 6d. **MONACO.** 25 diff., 2/9. **N. BORNEO.** Current Zoological. 8 un., 1/3. **JAPAN, 1928.** Coronation. 4 un., 1/-.

NOTE.—Add 2d. for Postage when remitting.
FREE.—Big illustrated lists and specimen Magazine.

STANLEY GIBBONS LTD.
DEPT. S.15, 391 STRAND, LONDON, W.C.2.

THE QUALITY "SET AND ACCESSORY" PACKET

A splendid offer of good quality stamps, mainly in Sets, such as: Set 3 Siamese, 4 Indian Native States, 6 stamp-, Surcharged with new value, Set 3 French Republic (Sower), Set 3 Cochin Rajahs, Set 4 I.F.S., including Sword of Light and Map, Set of 30 brilliant unused, every one different, Sets of British Colonials and War stamps, Set of Straits Settlements, also a very useful Metal Watermark Detector and List of 43 other fine gifts. All absolutely free! Send 2d. only for postage and request our famous Approval Sheets.

FREE!!

LISBURN & TOWNSEND (DEPT. M.M.), LONDON ROAD, LIVERPOOL

FREE! 50 DIFFERENT BRITISH COLONIALS

This wonderful gift packet contains 2 Jamaica (pictorial), 5 Australia, 1 Malay (tiger), 10 Canada, 1 Cochin (rajah), 1 Deccan, 4 Ceylon, 1 Gold Coast, 1 Nigeria, 1 Travancore, 4 New Zealand, 1 Queensland, 1 Straits, 5 Union South Africa (including new issue), 9 Irish (set with high values). ABSOLUTELY FREE TO GENUINE COLLECTORS REQUESTING APPROVALS.
SPECIAL OFFERS.—50 diff. French Colonials, 7d.; 100 diff. 1/6; 50 diff. Portuguese Colonials, 7d.

J. BURTON, 31, Onslow Road, Fairfield, LIVERPOOL

200 ALL DIFF. FROM PORTUGUESE COLONIES ONLY

3/6
Postage 1½d. extra

Those who have previously taken advantage of my offers will have no hesitation in sending for **My Latest Bargain.**

PHILIP J. DYKE, 122, Gladstone Road, WIMBLEDON, S.W.19

YOU CANNOT GET A BETTER BARGAIN THAN

"DIAMONDS"

Thousands of "M.M." Readers have proved this; why not you?

MANY RARE STAMPS have been found by purchasers of **THE "DIAMOND" PACKET,** which contains **1,000 Unsorted Stamps** from convents abroad. 1 packet, 1/3; 2 packets, 2/5; 3 packets, 3/6; 4 packets, 4/6; 5 packets, 5/6. All post free (abroad 3d. per packet extra). Stationers supplied at wholesale prices.

O. NERUSH, Importer (Dept. E), 68, TURNPIKE LANE, HORNSEY, LONDON, N.8.

500 STAMPS FREE

This **Fine Packet** contains **500** Stamps including unused. Superior items such as **Jamaica 2/-** Queen Victoria, **Ceylon, Guatemala, Southern Rhodesia, Seychelles,** &c., &c., are included. In order to circulate latest **Bargain List,** this packet is offered **Free** to all genuine applicants asking for approvals, and enclosing **1½d.** stamp towards cost of postage. (Abroad 7½d.). Mention 500 Pkt.

HORACE MILLER & CO., WHITSTABLE, KENT.

1,000 PACKET A WONDERFUL OFFER

of stamp bargains. Price **4½d.,** postage **2½d.** extra, abroad collecting friends. *Ask for my famous approvals.*

The "**1,000** Packet" contains **500** excellently assorted Stamps, a COMPLETE SHEET of **100** UNUSED (very useful for exchange purposes); a neat **12**-page booklet for holding duplicates; **25** British Colonials, usually sold at ½d. to 1d. each, including new and obsolete issues; **375** Magic "Strip" Mounts, and my price list 6d. extra. In addition, free sets will be sent to those who send name of stamp

H. C. WATKINS, M. Dept., Granville Road, BARNET.

SETS (POSTAGE EXTRA)

10	Australia	3d.	20	French Cols. ...	2d.
15	,, ...	8d.	30	,, ,, ...	4d.
18	,, ...	1/-	40	,, ,, ...	7d.
10	Canada	2d.	50	,, ,, ...	10d.
15	,, ...	4d.	60	,, ,, ...	1/2
20	,, ...	6d.	6	Nigeria	4d.
25	,, ...	9d.	20	Roumania ...	2d.
30	,, ...	1/-	25	,, ...	3d.
35	,, ...	1/6	30	,, ...	4d.
20	France	2d.	35	,, ...	5d.
30	,, ...	3d.	40	,, ...	6d.
40	,, ...	5d.	45	,, ...	7d.
50	,, ...	8d.	50	,, ...	8d.
5	Bolivia	3d.	55	,, ...	10d.
8	,, ...	6d.	60	,, ...	1/-
25	Czecho	4d.	65	,, ...	1/6

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

FREE Six Mint Colonials FREE

I send FREE SIX MINT BRITISH COLONIALS, one each from KEDAH, ZANZIBAR, Kenya, TURKS & CAICOS Is., SOUDAN and CAYMAN ISLANDS—and ALL MINT, to any collector at Home or Abroad sending a postcard for my fine 42-page Illustrated Price List (No. 7) containing over 1,200 items: Stamps, Albums, Sets, Packets, Accessories—in fact EVERYTHING FOR THE STAMP COLLECTOR. Prices from 1d. (over 200 sets at 1d. each) to 40/-. Send a postcard only—no cash—and ask for No. 200.

EDWARD SANDELL, 10-11, FETTER LANE, LONDON, E.C.4

If in nineteen-twenty-nine
You'd like to read something fine
Monthly—just drop a line
For that philatelic gold mine:

"THE JUNIOR STAMP MAGAZINE"

Send only 2/6 for 12 issues and 12 happy months. 2d. a copy from your newsagent, or 2½d. post free from: **J.S.M. Offices (Dept. 2), 112, Strand, London, W.C.2.**

BRITISH & COLONIAL HIGH VALUES
Superb postally-used copies

Hong Kong, K.G., $2 Script 2/-
India K.G., 5R Nasil Printing 1/-
Orange River Colony V.R.1., 5/- ... 2/6
South Africa K.G. 2/6, 6d.; K.G. 5/-, 1/-; K.G. 10/-, 1/6
Transvaal K.E. 5/-, 1/-; K.E. £1, 3/6
Cash with order. Postage extra.
Latest Price List of Packets, Sets and Albums.
THE MIDLAND STAMP CO. LTD.,
Warwickshire **LEAMINGTON** England

Anglo-Persian Packet Free

You will know you have "struck oil" when you receive this fine assortment of **Superior** Stamps, including N. Borneo (Br. Protectorate), Queensland, India, K.G., Rhodesia, K.G., Old Transvaal, unused, etc.—including **high values.** Also a superb **PERSIA (Coronation issue, Mint).** This stamp alone is catalogued at 1/6 **ALL FREE** to bonafide applicants for my extra-value Approvals enclosing two 1d. stamps for postage

L. STUART, 15, The Crescent, Highbury, BATH.

FREE Pictorials FREE

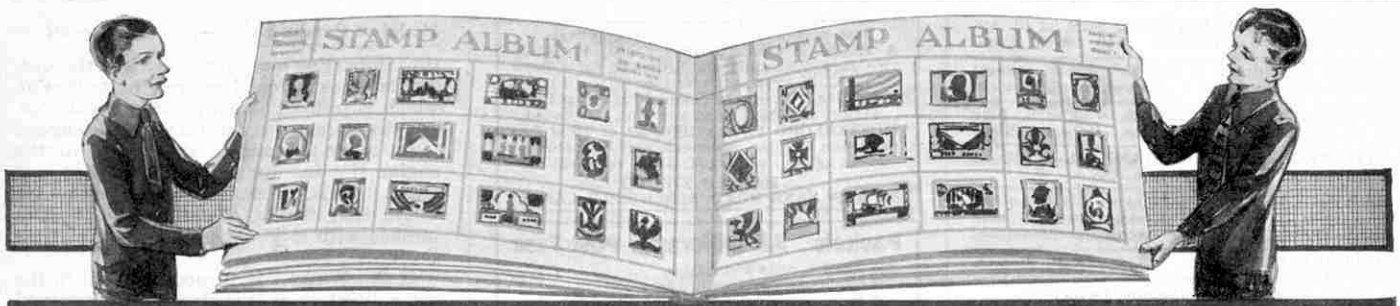
Packet of Grand Pictorial Issues, including Mozambique, French Cols., Cuba, and many other interesting varieties sent absolutely FREE to all requesting approvals. Send P.C. to-day.

L. C. JONES, 61, West Street, Bourne, Lincs.

THE CONGO PACKET

The Belgians are honouring England's great Explorer, H. M. STANLEY (to whom they owed so much for his work on the Congo) with a special issue of stamps bearing his head. I am therefore offering a packet of *African Stamps only,* representing most of the countries he explored and the adjoining States. ALL are GOOD CLASS Stamps. NO COMMON Continentals. GOLD COAST, NIGERIA, PORTUGUESE CONGO, a fine set of KENYA & UGANDA, MIDDLE CONGO, EQUATORIAL AFRICA, QUILEMANE (ZAMBESIA), IVORY COAST, RUANDA-URUNDI, RHODESIA, NIGER ANGOLA and many others. Price 4½d., postage 1½d. extra. In addition to this I am presenting all who ask to see my approval sheets a SPLENDID set of **10 CONGO** (including the Stanley Stamps) usually sold at **1/-.** Senders of addresses of stamp collecting friends will receive a free set in addition.

H. C. WATKINS (M Dept.), GRANVILLE RD., BARNET



STAMP COLLECTING

THE LEGEND OF THE NIBELUNGS

THIS month we are going to deal with an interesting series of Austrian Charity Stamps, designed to illustrate one of the oldest of all Teutonic legends, the story of the Nibelungs. These stamps were first issued on 8th March, 1926, but their life was very short, as they were withdrawn at the end of the following month. On account of their great beauty and popularity, together with the extensive revenue obtained from stamp collectors, the Austrian Postal Authorities re-issued the series in December last. Each of the stamps of this series is inscribed with two values—3 gr. +2 gr., 8 gr. +2 gr., and so on. Their value is the sum of the two figures, and the second figure represents the amount that goes to the Child Welfare Authorities. The perforation in each case is 12½.

The *"Nibelungenlied"* or story of the Nibelungs, is an attempt to piece together the early Teutonic legends. The incidents of the story originally formed the principal themes of many of the old Norse sagas. Many of the versions differ widely from one another. This is not remarkable, but it certainly is a striking fact that the principal incidents and characters in each version can be identified clearly with those of the others.

The story is long and complicated, and we can only give here a very brief outline of it. Two points should be mentioned here, in order to make matters clear from the outset. One is that the Teutonic gods, although they had enormous power, were not immortal. The second is that the Nibelung treasure of gold was originally the property of a dwarf, Andwari, who in the form of a pike was captured in a net. Loki, his captor, compelled him to deliver up the treasure as a ransom, and finally to give up the magic ring that was reputed to breed gold. Andwari, in his wrath at his loss, cursed the treasure, and the evil spell attended it to the last, as we shall see as the story proceeds.

The first illustration shows the 3 gr. sepia value. Here the young Netherland prince Siegfried, the hero of the early part of the story, is depicted after he has conquered a dragon which, in certain accounts, is the guardian of the Nibelung treasure around which the whole story revolves. Siegfried, by slaying two Nibelung princes, who had quarrelled over the division of the treasure, has become possessed not only of the treasure itself, but also of the magic sword *"Balmung"* and the cloak *"Tarnkappe,"* which made its wearer invisible. After slaying the dragon he bathes in its blood, thus rendering himself invulnerable to ordinary weapons. Unfortunately a leaf fell on one spot between his shoulders, before the blood was dry, and therefore he was not protected at that point.

Siegfried goes to the Court of Burgundy and wins as his bride the beautiful princess Kreimhild, sister of King Gunther. The King takes a liking to Siegfried and asks for his assistance in winning the hand of Brunhild, the Queen of Iceland. Brunhild was a decidedly unique personage. She was very beautiful and very clever, and in addition she had enormous physical strength that far surpassed that of the average man. She was very proud of her strength, and declared that she would only marry a man who could overcome her in three events in single combat.

The 8+2 gr. indigo value shows Gunther and Siegfried setting sail for Iceland. This stamp is the most beautiful of the series. The people of Vienna were asked to take part in a voting competition to decide which of the set was the most popular, and the 8 gr. value easily headed the poll.

Strenuous trials of strength followed Gunther's arrival. Siegfried, wearing his cloak *"Tarnkappe,"* aided Gunther to overcome Brunhild, who then accepted his offer of marriage. On the wedding night Brunhild apparently changed her mind, for she attacked Gunther, overcame him, and strung him up on the wall of the bridal chamber, where he had to stay all night! On the next night Siegfried, in his cloak of invisibility, fought Brunhild for his friend, and took away a girdle and a ring as tokens of his victory. The final result of all this furious display of energy was that Gunther won Brunhild for his queen, and took her to Burgundy.

From this time events proceeded smoothly until Siegfried and Kreimhild, living happily together at the capital of the Netherlands, received an invitation to visit Gunther and his queen in Burgundy. The visit was duly paid, but with disastrous results. Acute jealousy sprang up between the two wives, and this came to a climax in a heated scene before the Cathedral at Worms, shown on the 15+5 gr. lake stamp. Kreimhild asserted her right to enter the Cathedral before Brunhild. An argument followed, which grew more and more bitter, until at length Kreimhild insulted Brunhild by wild and dishonourable accusations. Siegfried did his best to restore harmony, but in vain. Brunhild was too deeply hurt to be pacified, and she planned a terrible revenge. She induced Hagen, one of Gunther's warriors, to find out the exact position of the vulnerable spot on Siegfried's back. Hagen did this, and seizing his opportunity when Siegfried

(*Continued on page 259*)

Stamp Gossip—*(continued from page 259)*

"Stamp Collecting"

By RAYMOND RAIFE
(Warne's Recreation Books No. 14. 6d. net)

An interesting addition to the list of popular stamp books has made its appearance, under the title "Stamp Collecting," in the handy Warne's Recreation Series.

Mr. Raymond Raife, the author, has set out on the exact mission that we undertook ourselves, in a less detailed form, in the articles in our issues for October and November last—to smooth the path of the beginner.

The pages are fully illustrated and the beginner in stamp collecting will find the book a very useful guide.

* * * *

A Stamp Fable

The legends of ancient Greece provide a fruitful source of inspiration for stamp designs, but it is a pity that greater use has not been made of Roman mythology, which is represented by but a single specimen appearing in the Fiume charity issue of 18th May, 1919, to commemorate the 200th day of peace. The stamp is illustrated here and shows the statue commemorating the legend of Romulus, Remus and the wolf.

Romulus was the mythical founder and first king of Rome, and the legendary son of Mars. His mother was Vestal Silvia, daughter of Numitor, who had been dispossessed of his throne of Alba by his younger brother Amelius. Silvia's twin sons, Romulus and Remus, so the legend tells, were placed in a trough and cast into the River Tiber by their cruel grand-uncle. The trough grounded in the marshes at a spot on which a portion of Rome afterwards was built, under a wild fig tree, that remained a hallowed spot in later years. Here the two babies were found by a she wolf, who suckled them and fed them with the aid of a woodpecker. Later they were discovered by the wife of a shepherd, who adopted them as her own children.

As they reached manhood they became the leaders of a warlike band of shepherds, and in course of time were recognised by their grandfather, whom they restored to his throne, slaying the usurper Amelius. The brothers now proposed to found a city on the site where they had been brought up, but a quarrel broke out between them and Remus was slain. The story goes on to tell how Romulus eventually became King of the Sabines, until one day he suddenly disappeared from earth in darkness and storm, and was thereafter worshipped as a god under the name of Quirias, a Sabine form of Mars.

This charity issue consisted of 12 stamps, each of which was sold at a premium of 5 korone over their face value, in aid of students of Fiume pursuing their studies in Italy. Each of the stamps is very faintly overprinted on its back with the wording "Posta di Fiume" three times in black.

Model of Bendix Drive—*(cont. from page 234)*

thus imparting motion to the 57-teeth Gear. The latter is fastened securely to its Rod on which is secured also a Flywheel (part No. 132) to represent the flywheel of the engine.

In order to imitate the action of the engine starting-up, a hand wheel 7 is provided. This is connected by Sprocket Chain drive to a 57-teeth Gear 6 that meshes with a ½" Pinion on the flywheel-shaft.

If the Wheel 7 is turned by hand in the same direction as it is already being turned by the starting Motor, but at a faster rate, the Bendix pinion is caused to travel backwards along the Screwed Rod, and thus disengage itself from the 57-teeth Gear Wheel 5. This, of course, disconnects the starting Motor. The rotation of the hand wheel corresponds to the starting-up of the engine in the actual device.

The model will be made more realistic and still easier to manipulate, if a simple push-button switch is incorporated. A suitable switch for this purpose was described in the article "Electricity Applied to Meccano" in the January, 1928, "*M.M.*"

Stamp Collecting—(*continued from page 257*)

was returning from hunting stabbed him between the shoulders.

Brunhild realised immediately the awfulness of the crime, but it was too late. Hagen lived on, and with Gunther secured possession of Siegfried's treasure. Kreimhild naturally was overwhelmed with grief and rage, and the remainder of the story is concerned mainly with her plans for revenge, and the manner in which she achieved her object. For several years she remained quietly at Gunther's Court, until Rüdiger, a knight at the court of the King of Hungary, arrived with an offer of marriage from his King. Kreimhild consented, but only after Rüdiger had promised to assist her to avenge all her previous wrongs. The meeting of Rüdiger and Kreimhild is shown on the 24+6 gr. stamp, the colour of which is violet.

In due course Kreimhild became Queen of Hungary, but she never ceased to plan her revenge. She invited her brother and his followers to visit her court, and although Hagen was deeply suspicious of the invitation, it was accepted. Before leaving for Hungary, however, Hagen took the precaution of sinking the treasure in the Rhine for safety. On their journey to Hungary the cavalcade arrived upon the banks of the River Danube, where three Danube maidens—wise women—were bathing. With the idea of forcing them to disclose what the future held for the party Hagen stole their clothes. The eldest of the maidens forecast long happiness and peace for the Court of Burgundy, but after the clothing had been returned the youngest told Hagen that only one of the party, the chaplain, would ever return home. The meeting of Hagen and the Danube maidens is shown on the 20+5 gr. stamp.

Events moved rapidly when the Burgundians reached Kreimhild's court. Kreimhild cleverly brought about a quarrel between guests and hosts, and a general conflict ensued and lasted until only the Burgundian King and Hagen of the visiting party were left alive. They fought valiantly, although they were greatly exhausted, and eventually it was left to Dietrich, one of the greatest of the Hungarian knights, to overcome and disarm them. The closing scenes of the fight between Dietrich and Hagen are shown on the last stamp of the set, but, although the design would seem to suggest it, the end of Hagen had not yet come.

Hagen and Gunther were delivered into the hands of Kreimhild, who commanded them to reveal where they had hidden the treasure of the Nibelungs. Hagen answered that he had sworn not to reveal the secret so long as the King lived. Kreimhild then ordered the execution of her brother and exhibited his head to Hagen, but the latter still refused to disclose the secret. Exasperated beyond endurance, Kreimhild snatched up Hagen's sword and with her own hands cut off his head! The closing scene followed immediately. Hildebrand, the young squire of Dietrich, horrified by the awfulness of the disaster that Kreimhild had brought about, drew his sword and killed his queen!

This story of the Nibelungs was utilised by Richard Wagner in his famous sequence of four operas, known collectively as "The Ring of the Nibelungs." Wagner's version of the story, however, differs very considerably from the one we have just given. Perhaps some day a series of stamps will be issued to illustrate this great work.

Stamp Gossip

U.S. Commemorative

Within recent years there has been a remarkable flood of commemorative issues from the United States, but almost without exception these have been really splendid efforts. Controversy raged round one of the most recent which is illustrated here. This is the Valley Forge stamp, and shows General Washington on his knees in prayer prior to the battle that took place at Valley Forge in 1778. The stamp has had to face a considerable amount of hostile criticism on the grounds that it is not a proven historical fact that Washington prayed in the open air on this occasion. Fortunately, however, stamp designers are not compelled to draw their inspiration from facts, and the commemoration of the incident probably is best achieved by this design than by something else that might have been historically perfect.

A curious feature of the design is the little man in the bowler hat who can be seen peeping from behind one of the trees in the background. This figure, we understand, represents Isaac Potts, a farmer of Valley Forge, at whose home Washington made his headquarters.

* * * *

New Gold Coast Issue

The Gold Coast, which for so long has confined its stamp designs to simple portraits of the reigning monarch, has broken away from tradition in its new issue which recently made its appearance. Our illustration shows the new stamp, the principal features of which are the Residency in a big centre panel, surmounted by a portrait of His Majesty, King George V, and flanked by native trees.

* * * *

Stanley Gibbons Ltd. send us a copy of their new booklet of titles of countries. Neatly printed on good quality gummed paper, in uniform type throughout, the book contains no less than 864 names, and will be found suitable for heading the pages of any blank album.

The cost is 1/-, postage 2d. extra.

(*Continued on page 258*)

"MECCANO MAGAZINE" SPRING BACK BINDER

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines — price 4/6 post free. The small binder holds 6 Magazines — price 3/- post free. Meccano Ltd., Old Swan, Liverpool.

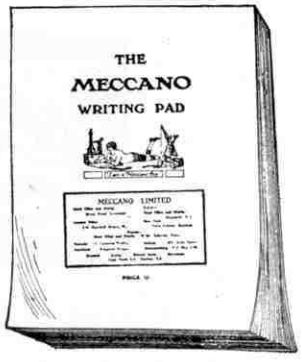
BINDING THE "*M.M.*"

Binding cases for back numbers of the Magazine may be obtained from Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These are supplied in two sizes (1) for six copies price 3/6 and (2) for twelve copies price 5/3 post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown here. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding 6 or 12 copies. These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

WRITING PADS FOR MECCANO BOYS



These Writing Pads are becoming increasingly popular and most of the letters we receive from Meccano boys are written on the familiar tinted paper. The pads are supplied in two sizes, each consisting of 50 sheets of tinted bank paper, with cover. They are just the thing to use when writing to your friends, for the special notepaper shows that you are a Meccano boy.

Prices—Large, 1/- each (post free); Small, 6d. each (post free).

Meccano Ltd., Binns Road, Old Swan, Liverpool

COMPLETE YOUR FILES

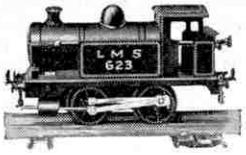
All "Meccano Magazines" prior to December, 1923, are out of print. Each of the 1924 issues, with the exception of January, February and September is in stock. Only the May, June, July, October and November, 1925, issues are available. All the 1926, 1927 and 1928 issues are in stock, with the exception of January, February and September, 1926, January and March, 1927, and February, 1928.

Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues, 1925 and 1926, and all the issues of 1927 and 1928 are 8d. each.

Quotations for complete bound volumes may be obtained from the publishers—

"Meccano Magazine," Binns Road, Old Swan, Liverpool

HORNBY TANK LOCOMOTIVES



Hornby No. 1 Tank Locomotive

Strong and durable Locomotive capable of any amount of hard work; richly enamelled and highly finished; fitted with reversing gear, brake and governor.

Gauge O, in colours to represent L.M.S., L.N.E., G.W. or Southern Railway Companies' Locomotives ... ... Price 12/6

Hornby No. 1 Tank Locomotive, fitted for Hornby Control... ... ... Price 15/-

Hornby No. 2 Tank Locomotive

Powerful model embodying all the splendid Hornby characteristics. It is 10½ ins. in length and is fitted at both ends with a four-wheeled bogie. Beautifully finished in colours to represent L.M.S., L.N.E., G.W. or Southern Railway Companies' Locomotives, and suitably lettered. Fitted with reversing gear, brake and governor. Suitable for 2 ft. radius rails only. Price 22/6

Hornby No. 2 Tank Locomotive, fitted for Hornby Control... ... ... Price 25/-

Meccano Ltd., Binns Road, Old Swan, Liverpool

How to obtain the "*M.M.*"

The "*M.M.*" may be ordered from all Meccano dealers, or from any newsagent or bookstall, price 6d. per copy. If desired it will be sent direct, post free, for 4/- for six, or 8/- for twelve issues. As a rule back numbers cannot be supplied, because only sufficient copies are printed to fill standing orders. To prevent disappointment, therefore, place a regular order with your dealer, newsagent, or the publishers—

"Meccano Magazine," Binns Road, Old Swan, Liverpool

Adventures in Meccanoland

Every Meccano boy who has read the story of "Dick's Visit to Meccanoland" will be interested to know that we have now published a new edition of the booklet "Adventures in Meccanoland" telling of Dick's further adventures.

The booklet is profusely illustrated with humorous sketches, and Meccano boys will find great enjoyment in building up and operating the many different models that are the principal feature of the illustrations.

The price of the book is 2d. post free. All applications should be accompanied by stamps for this amount and addressed to Meccano Ltd., Binns Road, Old Swan, Liverpool.

OIL CAN No. 1 (Ordinary Type)

This miniature Oil Can will give every satisfaction. It may be used for general purposes but it is particularly suitable for oiling Meccano Models and Hornby Trains. Price 6d.

Meccano Ltd., Binns Road, Old Swan, Liverpool

OIL CAN No. 2 ("K" Type)

Every Meccano and Hornby Tra n enthu iast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect.

One of the oil cans was recently sent to H.R.H. the Prince of Wales, and a gracious letter of acknowledgment was received expressing H.R.H.'s admiration of the beautiful lines and perfect finish of this model. Price 3/6.

Meccano Ltd., Binns Road, Old Swan, Liverpool

MECCANO LUBRICATING OIL

Before commencing to operate a Meccano model, or to run a Hornby Train, all gears and bearings should be oiled thoroughly with Meccano Lubricating Oil. This oil is specially prepared and is of the right consistency for the purpose. Price per bottle 6d.

Meccano Ltd., Binns Road, Old Swan, Liverpool

MECCANO ENAMEL

Meccano enamel has been introduced to enable model-builders to convert nickel parts to colour or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red, grey and green, each colour being identical in shade with the enamels used in the Meccano Factory for spraying Meccano parts. Price per tin 8d.

Meccano Ltd., Binns Road, Old Swan, Liverpool

Loading a Ton of Coal per Second

(*Continued from page 187*)

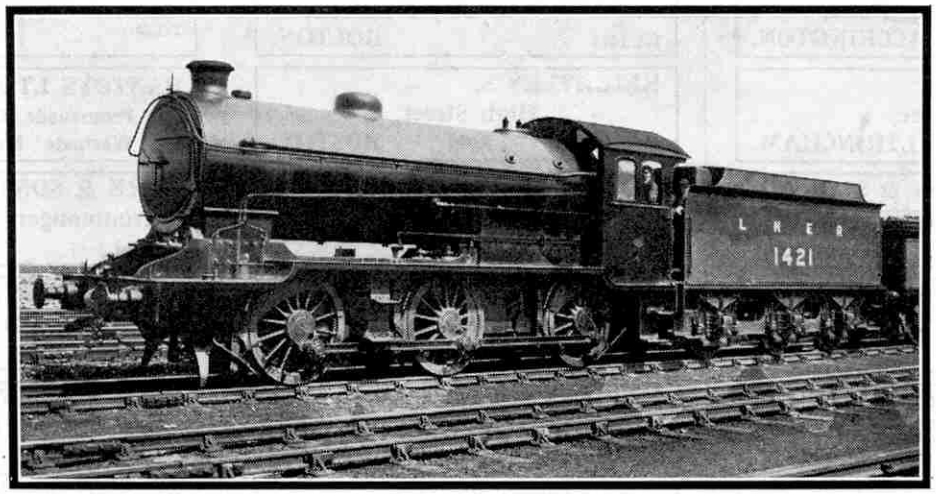
belt while the main belt runs faster than the feeders so that there is never any danger of flooding either the main or the shuttle belts. The master control of the whole pier is located in the Superintendent's office.

Each of the four loading piers is equipped with a Lane-Galloway mechanical trimming machine. This machine eliminates completely the necessity for manual labour in connection with the loading of coal into vessels and has very considerably increased the operating efficiency of the pier.

In order to maintain the pier's operation in wintry weather, thawing sheds were built to cover the tracks leading to the car dumpers. These sheds have a capacity of 22 cars and a temperature of 180 degrees applied for 30 minutes thaws the coal sufficiently to allow it to free itself.

As stated in the second paragraph, the Curtis Bay Coal Pier periodically sets up a new record for the fast loading of coal into vessels. The present record in this respect was achieved on 13th April, 1926, when, by means of the plant, the S.S. "*Lemuel Burrows*," was loaded with 11,353 tons of coal in 3 hrs. 1 min.—an average of 3,763 tons per hour, or just over one ton per second! The record for volume of traffic handled at the pier during one week was set up in 1920 when the total of 182,000 tons of coal was attained by the close of the first week in November. These figures convey some idea of the immense capabilities of the plant.

The machines have been in constant use since they were erected 12 years ago and to-day they are as efficient as when first operated. Their great strength is further demonstrated by the way in which they successfully cope with any foreign material that accidentally enters the chute with the coal. Sometimes these undesirable objects are of such size and shape as to test severely the power of the plant. On one occasion a piece of iron, 3 ft. in length by 2 ft. in width, and about 500 lb. in weight, passed through the machines without causing any damage. In two other instances, large pieces of stone weighing 500 lb. and 600 lb. respectively, passed in with the coal and were delivered without any injury to the plant.



This photograph, by our reader R. D. Stephen, shows a L.N.E.R. 0-6-0 locomotive of the J.38 class. It is No. 1421 and was built in 1926, to the design of Mr. H. N. Gresley, Chief Mechanical Engineer of the L.N.E.R.

Meccano Planimeter

—(*continued from page 225*)

centre line.

As already explained, the tracer 8 must be run round the perimeter of the figure and the number of divisions noted on the Flanged Wheel. The latter should be at zero to start with, of course.

It is impossible in this article to give the correct calibrations of the dial so that areas may be read off from it direct, for any particular machine will have a different scale as the result of slight variations in the exact relative position of the wheel. Each constructor therefore should calibrate his own instrument. The best way to do this is to draw squares or other simple figures, the areas of which have been calculated previously, so that by comparing the reading on the wheel 6 with each calculated area a table may be prepared, which should be somewhat as follows :—

Area of figure	Reading on Wheel
36 square ins.	4.2
16 square ins.	1.8
9 square ins.	1.
—	—
61	7.0
—	—

Dividing 61 by 7 we get approximately 8.7, which is the value in square inches of one main division. Each of the subdivisions will have 1/10th of this value, of course, namely .87 square inches. Knowing the values of the scale, it is now a perfectly simple matter to find the area of any figure, however irregular.

To obtain the best results from the instrument, it should be placed on a good smooth surface drawing paper, so that the wheel 6 may roll quite smoothly and easily.

Conquest of the Air

—(*continued from page 219*)

including three coastguards from the Kill Devil life-saving station, turned up to witness the event. Both of the brothers were eager to win the distinction of piloting the power-driven machine on its first flight and they settled the matter by tossing a coin. Orville won the toss, and climbing into the pilot's seat he started the engine. With a roar the aeroplane moved slowly forward, Wilbur keeping pace with it until it ascended into the air. The machine rose to an altitude of 120 ft. and remained aloft for only 12 seconds, but it proved that heavier-than-air machines capable of carrying a person on board could be successfully flown.

Three further trips were carried out that day, the last being of 59 seconds duration and covering a distance of 852 ft. All the four flights on 17th December were carried out against a 20 m.p.h. wind, but in every case a safe landing was effected. Shortly after the last flight, and before the aeroplane could be returned to its hangar, a sudden gust of wind overturned it and damaged it seriously.

From 1904 until 1908 the Wright brothers continued to experiment with power-driven machines, continually effecting minor improvements as the need of these became realised. In 1908 they visited France, and this visit and the work of the French airmen with whom they then came in contact will be dealt with in the next article in this series.

Largest Underground Tube Railway Station

(*Cont. from page 223*)

has been adopted at the new station, but the general effect is none the less pleasing and harmonious. The floor of the booking hall is paved with large white tiles, while the ceiling, of white fibrous plaster, is divided into rectangular coffers. Showcases with bronze framework, and frieze and skirting of Travertine marble, are ranged along the boundary walls on the east, west and north, while the telephone cabinets on the south are of polished teak. The booking office, on the west side of the hall, is also of Travertine marble and bronze, while the patent ticket machines that are to be installed later will be encased in similar marble, so that the harmony of the design and colour scheme may be preserved. The walls of the lower hall are faced with silver-gray tiles, while the lighting is by means of concealed lamps. The arches of the escalator tunnels have been decorated in matt white distemper to assist illumination, which is by means of lamps mounted on bronze pedestals, set at intervals along the balustrades.

Automatic ticket machines are an important feature of the new station. For the time being, the standard electric type, delivering pre-printed tickets are being used, but these will be replaced at an early date by a group of A.E.G. special ticket printing and delivering machines. The first batch of machines to be installed will number 26, and will be arranged so that they form portals to the passenger circulating area of the booking hall. They will include two machines for issuing 1d. tickets, two for 1½d., eight each for 2d. and 3d., four for 4d., one for 5d., and one for 6d. Tickets of greater value or of a special character will be obtained at an auxilary booking office, equipped with three A.E.G. ticket printing and issuing machines.

An interesting feature of the booking hall is a set of six train recording clocks. Each of these clocks automatically records the working of the service of one of the London Underground Railways.

Sets of similar clocks are installed at the Company's head office, in the traffic controllers' offices, at Westminster Station on the District Railway, and in the various signal boxes. We hope to publish a description and illustration of these remarkable clocks in an early issue.

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on the following four pages carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

E. J. RILEY LTD.,
28, Blackburn Road,
ACCRINGTON.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

A. E. WILKINSON & SON,
Bank Street, ASHFORD, KENT.
57, High Street, MAIDSTONE.

BENNETT WATTS,
10, Silver Street,
Tel. 229 AYLESBURY.

BUTTERFIELDS & MASSIES Ltd.
Church Street,
Tel 141. BARNSLEY.

J. BELL,
10, Lower Garfield St.,
Royal Avenue, BELFAST.

SPORTS DEPOT,
57, Victoria Street,
Tel. 4554 (Nr. Albert Memorial) BELFAST.

J. WOODHALL,
256, Grange Road,
Tel. : B'head 621 BIRKENHEAD.

H. A. CLEWS & SON,
404/5, Monument Road,
BIRMINGHAM.

A. STOCKWIN & CO.,
16, Worcester Street,
Tel. : Mid. 869 BIRMINGHAM.

GEO. W. TAYLOR,
221, Lichfield Road,
Aston, BIRMINGHAM.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
BLACKPOOL.

SELLEN'S BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

BURGESS' BAZAAR,
Opposite The Pier,
BOGNOR.

J. MORRIS, F.C.O.,
70, Knowsley Street,
Tel. 1074 BOLTON.

KEIGHTLEY'S,
High Street,
BOSTON.

BROWN, MUFF & CO. LTD.,
BRADFORD.

W. CARTER,
British Sports Depot, 15, Bridge Street,
Opposite Mechanics' Institute BRADFORD.

MAURICE COHEN & SON,
11, Darley Street,
BRADFORD.

RUSHWORTHS LIMITED,
Kirkgate,
BRADFORD.

CHARLES E. READ,
64, High Street,
BRIERLEY HILL, Staffs.

JOHN TAYLOR,
28, Preston Street,
Tel. : Brighton 957 BRIGHTON.

S. H. ARTHUR,
15 & 16, Narrow Wine Street,
Tel. 511 BRISTOL.

ECONOMIC LIMITED,
288, 290, 292, Lodge Causeway,
Fishponds, BRISTOL.

GYLES BROS. LTD.,
Tel. 2888 24, Bridge Street, BRISTOL.
188, Whiteladies Road, Clifton, BRISTOL.
Tel. 143

JOHN HALL (TOOLS) LTD.,
BRISTOL. NEWPORT.
CARDIFF. SWANSEA.

SALANSON LTD.,
20, High Street, BRISTOL.
4, High Street, CARDIFF.

T. ARNOLD BENNETT,
2, Aberdeen Buildings,
High Street, BROMLEY.

HAROLD HUNT,
38, Spring Gardens,
Tel. 202 BUXTON.

FRED SPALDING & SONS LTD.,
Tel. 25 CHELMSFORD.

PANTOYS LTD., Tel. 3561
The Promenade, CHELTENHAM SPA.
37, Westgate Street, GLOUCESTER.

EYRE & SONS LTD.,
Ironmongery Dept., Arcade,
Tel. 2181 CHESTERFIELD.

R. H. JEPSON,
1, Cross Cheaping,
Tel. 4968 COVENTRY.

E. A. ANELAY,
Parkgate,
Tel. 2925 DARLINGTON.

PURSEY & MOCKRIDGE,
The Sports Outfitters,
Tel. : Dartford 173 DARTFORD.

HENRY WHALLEY,
195, Duckworth Street,
DARWEN.

SWADDLING,
60, South Street,
Tel. 295 DORKING.

JAMES L. DIXON,
14, Suffolk Street,
Tel. : Dublin 1528 (off Grafton St.), DUBLIN.

A. CURRIE,
The Emporium, 92, High Street,
DUMBARTON.

DIXON'S
41, High Street,
Tel. 5810 DUNDEE.

MARTINS',
232, Hilltown,
DUNDEE.

PHINS LIMITED,
45, Murraygate,
Tel. 3897 DUNDEE.

ALFRED GOODWIN,
140, Church Street,
Tel. 344 ECCLES.

ALDERTON'S,
8, Bank Parade,
Tel. 0303 EDGWARE.

BASSETT-LOWKE LTD.,
5, Frederick Street,
EDINBURGH.

HOWARDS,
72/74, Chase Side, ENFIELD,
& 246, Lordship Lane, N.22.

Devon & Somerset Stores Ltd.,
Toy & Sports Dealers,
Tel. 2638
Telegrams : Stores, Exeter EXETER.

CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, the Railway Coys., etc.

COPLAND & LYE LTD.,
Caledonian House,
Tel. 780 Douglas GLASGOW.

LUMLEY'S,
Lumley House, Sauchiehall Street,
Tel. : Douglas 2701 GLASGOW.

LYON LTD.,
389, Sauchiehall Street,
GLASGOW.

Pettigrew & Stephens Ltd.,
Sauchiehall Street,
GLASGOW.

POLLOCK & CO., 36, Bridge Street,
222, Argyle Street
(Under Railway Bridge), GLASGOW.

ROWANS LIMITED,
70, Buchanan Street,
GLASGOW.

R. WYLIE HILL & CO. LTD.,
20, Buchanan St. & Argyll Arcade,
GLASGOW, C.1.

FLETCHER'S TOYLAND,
77, Deardengate, HASLINGDEN.
Grand Building, RAWTENSTALL.

H. POULTON, Toyland,
75 & 77, High Street,
HOUNSLOW, Middlesex.

GAMLEYS,
The Hove Hornby Train Store,
78, Church Road, HOVE.

C. BOOTH & SON,
13, Cross Church Street,
Tel. 457 HUDDERSFIELD.

RUSHWORTHS LIMITED,
Westgate,
HUDDERSFIELD.

PRIESTLEY'S,
62, Prince's Avenue,
Tel. 6040 Cent. HULL.

YE OLDE TOY SHOPPE,
Chariot Street,
Tel. : Central 1031 HULL.

CRANBROOK SPORTS DEPOT,
Complete Sports Outfitters,
Tel. 0932 91, Cranbrook Rd., ILFORD.

WALKER'S EMPORIUM,
25-9, Inglis St., and 11-13, New Market,
INVERNESS.

W. J. S. CARPENTER,
13 & 15, Queen Victoria Street,
LEEDS.

HAMILTONS PYGMALION,
Trinity Street,
Tel. 26651 LEEDS.

RONALD B. MOSES,
Newsagent, 254, Tong Road,
WORTLEY, LEEDS.

PEARSON & DENHAM (PHOTO)
LTD., 6, Bond Street,
LEEDS.

THORNTON'S,
Sports House, Briggate,
LEEDS.

A. WRIGHT, The Garage,
200/2, Dewsbury Road,
Tel. 22719 LEEDS.

ROBOTHAM'S LIMITED,
"Baby's Kingdom,"
Tel. 4809 Belvoir St., LEICESTER.

J. T. WEIGHTMAN,
198, Charnwood Street,
Tel. 58804 LEICESTER.

R. & H. ROBBINS LTD.,
33, Dale Street,
Tel. : Central 3301 LIVERPOOL.

BUNNEY'S LTD.,
Church Street, LIVERPOOL.
Mostyn Street, LLANDUDNO.

C. LUCAS, Hobbies Depot,
35, Manchester Street,
LIVERPOOL.

Reliance Cycle & Motor Co.,
29/31, Manchester St., Liverpool.
Argyle & Conway Sts., Birkenhead.

ACACIA STORES,
168, 229 & 231, Upper Tooting Rd.,
Tel. : Streatham 2441 S.W.17.

The ARUNDEL CYCLE & SPORTS
STORE, 52, Church Road,
Upper Norwood, LONDON, S.E.19.

DEMPSEY & CO.,
69, South Side, CLAPHAM,
Tel. : Brixton 3022 LONDON, S.W.4.

R. E. BARNES,
88, Park Road,
Tel.
Sydenham 2404 W. DULWICH, S.E.21.

FREDERICK BECK,
22, 24 & 26, Camden Passage,
Tel. : Clerkenwell 8403 LONDON, N.1.

F. C. CABELDU,
371, High Street, Lewisham,
Tel. : Lee Green 1342 LONDON, S.E.13.

W. F. CHAPMAN, Streatham 1736-0759
225, High Road, Balham, S.W.17
1410, London Rd., Norbury, S.W.16

THE CITY RUBBER & MOTOR Co.
(next Liverpool St. Station) 141, Bishopsgate,
Tel. : Bish. 2284 LONDON, E.C.2.

DAVIES & CO.,
157, Leytonstone Road,
Stratford, LONDON, E.

W. HUMPHRYS & SON,
269/271/273 & 275, Rye Lane,
Estab. in 1840 PECKHAM, S.E.15.

JUCHAU,
32, East Road, City Road,
LONDON, N.1.

LAFFEATY,
308, King's Road, Chelsea,
Tel. : Kensington 2705 LONDON, S.W.3.

WILLIAM W. LANK,
Near Boleyn, East Ham,
LONDON.

LEDWITH BROS.,
42 & 44, Walworth Road,
Nr. ELEPHANT AND CASTLE LONDON, S.E.17.

H. V. PALIN,
120, Station Road,
Tel. : Chingford 104 CHINGFORD, E.4.

PIGGOTT BROS. & CO. LTD.,
220/226, Bishopsgate,
Tel. : Bis. 4351 LONDON, E.C.2.

PERCIVAL & CO.,
140, High Street,
Tel.
Wstw. 0120 WALTHAMSTOW, E.17.

F. J. WAIN & SON,
478, Kingsland Road,
Tel. : Clissold 9269 LONDON, E.8.

F. R. POTTER & SON,
43, Market Place,
LOUGHBOROUGH.

Meccano & Hornby Train Supplies

All the dealers whose names appear on this page, on the preceding two pages, and in the eighteen announcements on the opposite page, carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

AITCHES',
41-43, The Valley,
LOWER BEBINGTON, Cheshire.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

The BERKSHIRE RUBBER Co.,
51, Queen Street,
MAIDENHEAD.

BARRS, Children's Paradise,
49, Deansgate,
Tel. 165 City MANCHESTER.

A. FRANKS LTD.,
95 & 97, Deansgate, MANCHESTER
90, Bradshawgate, BOLTON.

HENRY'S Toy & Game Stores,
22, King Street,
Tel. 3004 Central MANCHESTER.

A. INMAN, MANCHESTER.
105, Lapwing Lane, Didsbury. Tel. 1518.
179, Dickenson Rd., Rusholme. Tel. 2241.

EDWARD LLOYD & SON,
268, Upper Chorlton Road,
Tel. 613 Chorlton MANCHESTER, S.W.

JOHN NESBITT LTD.,
42, Market Street,
City 2284 MANCHESTER.

H. J. ROFE,
93, Piccadilly,
Tel. : Centra 2945 MANCHESTER.

ALEC. WATSON LIMITED,
39, Piccadilly & 35, Oxford Street,
MANCHESTER.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

THE MANSFIELD & SUTTON CO-OP. SOC. LTD., Stockwell Gate,
Tel. 583 MANSFIELD.

JACKSON'S CYCLE STORES,
158, Parliament Road,
MIDDLESBROUGH.

R. SCUPHAM & SONS,
35, Linthorpe Road,
MIDDLESBROUGH.

A. WHEELE,
61, Longbridge Road,
Tel.: Grangewood 0857 NEW BARKING.

KENDRICK'S DOLLS' HOSPITAL
82, George Street,
NEWCASTLE-UNDER-LYME.

W. MARK & CO. LTD.,
27, The Drapery,
Tel. 461 NORTHAMPTON.

BEECROFT & SONS,
16, Pelham Street,
NOTTINGHAM.

J. R. NORRIS,
Photographic Dealer,
9, Pelham Street, NOTTINGHAM.

PEARSON & PEARSON,
12, Angel Row,
NOTTINGHAM.

REDMAYNE & TODD LTD.,
Carrington Street,
Tel. 41604 NOTTINGHAM.

THE ATHLETIC STORES,
Opposite Town Hall,
Tel. 1238 OLDHAM.

BUTTERFIELD BROS.,
Meccano & Chemistry Outfits,
48, Yorkshire St., OLDHAM.

J. STYLES,
6, Church Street,
Tel. 276 ORMSKIRK.

E. DE LA MARE,
9/13, George Street,
Tel. 3456 OXFORD.

C. HORSBURGH,
12, High Street,
PAISLEY.

GWYN M. JONES,
The Rexall Pharmacy,
PENYCRAIG, Glam.

D. J. WARREN,
6, Hyde Park Place, Mutley,
Tel. 1482 PLYMOUTH.

JOHN TAYLOR, Chemist,
Ropergate,
Tel. 67 PONTEFRACT.

E. A. HODGES,
Stationer & Bookseller,
Evesham Street, REDDITCH.

REDRUTH DRAPERY STORES LTD., West End,
Tel. 102 REDRUTH.

JAMES ORR,
120, Paisley Road,
RENFREW.

F. SHEPPARD,
58, Kew Road,
Tel. 1970 RICHMOND, SURREY.

DEAN & HOLT,
78, Yorkshire Street,
ROCHDALE.

GERALD MORRIS,
24 & 26, High Street,
ROCHESTER.

WM. COOPER,
6, Doncaster Gate,
Tel. 13 ROTHERHAM.

Wm. McIntosh (Rotherham) Ltd.,
Imperial Buildings, High Street,
ROTHERHAM.

A. V. WORDEN,
"Toyland," Park Road,
ST. ANNES ON SEA.

J. F. BARNES,
1a & 3, Cross Street,
SALE.

A. E. HAIG,
16, Northenden Road,
SALE, CHESHIRE.

THE NOAH'S ARK,
15, The Broadway,
SHEERNESS.

Wm. McIntosh (Sheffield) Ltd.,
Change Alley,
SHEFFIELD.

THE REDGATE CO. (SHEFFIELD) LTD.,
Tel. 22806 Moorhead, SHEFFIELD.

SHEFFIELD PHOTO CO. LTD.,
6, Norfolk Row (Fargate),
Tel. 23891 SHEFFIELD.

Lives of Famous Inventors—

(*Continued from page 202*)

table tops, and so near to perfection were these that a great demand for them arose.

At the time when Roberts first met Sharp he was greatly interested in locomotive developments, and before the close of the year he had taken out a patent respecting a new arrangement of the working valve of locomotives. He did not originate the idea of working steam expansively, but he claimed to be the first to perform it successfully by making "one arm of the intervening lever in the working gear of the induction valve changeable at any moment."

When the Liverpool and Manchester Railway was opened, Roberts realised that a new branch of engineering was beginning and, as Smiles put it, he "adroitly seized the opportunity presented by this new field of invention, and devoted himself for a time to the careful study of the locomotive and its powers."

During 1830 he patented "an arrangement for communicating power to both driving wheels of the locomotive, at all times in the exact proportions required when turning to the right or left." In the same patent he included his invention of the steam-brake—an idea to which George Stephenson also devoted much thought.

As the business grew, the premises in Faulkner Street proved inadequate, and a second works was established at Great Bridgewater Street. At these premises, in 1834, the firm began the manufacture of locomotives on a large scale, and had the distinction of turning out the first Manchester-built locomotive. This engine was produced for the Dublin and Kingstown Railway, and was of the "Hibernia" class—a type that did not prove successful. The engine had two vertical cylinders, one on each side, connected by crossheads and side links to bell crank levers that transmitted the power to the driving wheels.

This was followed by the "Atlas" type, the features of which—dome, side cylinders, frame and shape—were copied by nearly all other makers. It has been stated that the firm constructed nearly 1,500 engines during the period of the locomotive's most effective development.

How to Use Meccano Parts—

(*Continued from page 227*)

The Corner Angle Bracket, like the Architrave, is designed primarily for use as a corner strengthening piece. It is in the form of a triangle having a base $1\frac{7}{8}$" in overall length and sides $1\frac{1}{2}$" long, and owing to its smaller size it can be used in many places where the Architrave would prove unsuitable. Fig. 4 indicates other uses for the Corner Bracket. The illustration is of the front footplating of the Meccano Tank Locomotive, and it will be noticed that two Corner Brackets are used as strengthening pieces between the footplating and the front buffer beam.

Four other Corner Brackets are shown assembled to represent the steam pipes leading from the cylinders to the smoke box; the proper effect of these can only be obtained by referring to the general view of the model locomotive (see Special Instruction Leaflet No. 15). Two Corner Brackets bolted together along their base, with their apexes turned in opposite directions, form a plate $1\frac{1}{2}$" square.

The Channel Bearing (part No. 160) is used principally to form bearings for Rods. Each side of the channel measures $1\frac{1}{2}$" × 1" and is perforated with six holes, while the connecting piece is $\frac{1}{2}$" wide and is pierced with three holes. The part is small but rigid and therefore very valuable where space is limited. In Fig. 13 it is seen attached to the side of an Electric Motor, where it provides bearings for two Rods carrying a part of the Motor reduction gearing. To build up similar bearings from other Meccano accessories would require a good deal of time and a number of small parts, and the result would not be nearly so neat or rigid.

The Girder Bracket (No. 161) is also primarily intended for forming bearings for shafting. It resembles a 2" Flat Girder with the addition along one side of a flange $\frac{1}{2}$" wide. Two of these accessories bolted together would form a part similar to No. 160 but larger, and would provide excellent bearings for two, three, or more Axle Rods. A valuable feature of the part is the fact that the four holes in the flange are elongated, thus enabling certain adjustments to be made that would be impossible with the ordinary round holes.

Producing the "*M.M.*"

(*Continued from page 190*)

remove these defects. If, for instance, blue appears to be unduly prominent in one corner of the proof, the retoucher covers the rest of the plate from which blue is printed with the usual acid-resisting pigment. The plate is returned to the etching machine, where metal is removed until the dots in the unsatisfactory corner of the plate have been sufficiently reduced in size to give the required tone on printing.

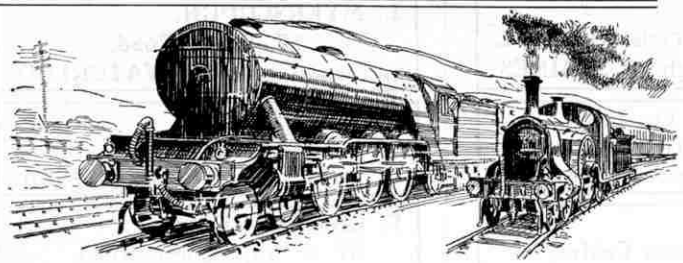
By delicate and painstaking retouching in this manner it is possible to produce amazingly faithful reproductions of coloured pictures. When it is judged that shades and tones are quite satisfactory, the blocks are cut out, bevelled and mounted in the usual manner before despatch to the printer.

What is the Longest Word?

When asked to name the longest word in the English language, we are apt to suspect that the question is a catch. We expect to be told, for example, that "smiles" is longer than any other word because there is an indefinite distance to go after passing the initial letter!

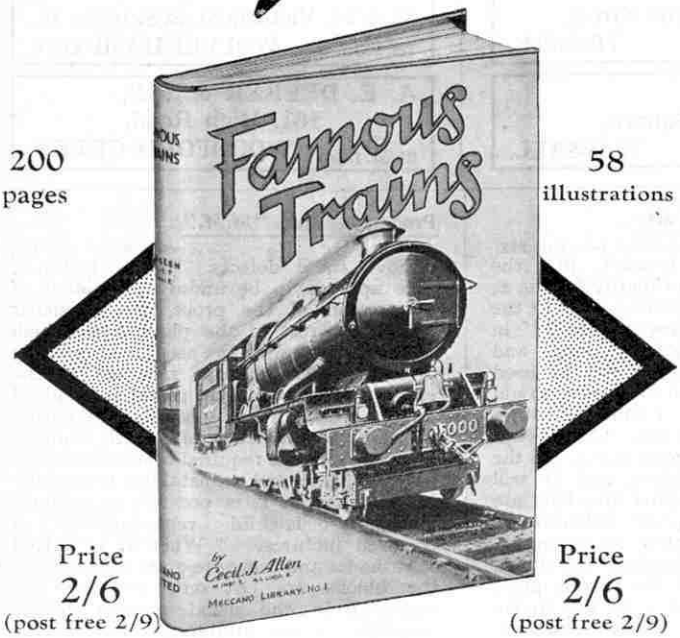
Joking apart, the question is very interesting, and quite good fun may be obtained in trying to find the answer. Anyone acquainted with organic chemistry will immediately think of a word such as "phenylmethyltriazolecarboxylic," which has 30 letters; but strict fairness demands that it should be ruled out, for it is a special word built up by placing others end to end in the German manner.

A word that was formerly regarded as the longest in the English language is "honorificabilitudinitatibus," but this is a faked word that appeared in an eighteenth century play. A genuine word that actually has two more letters is "antiundenominationalistically." Even this has now been displaced by the magnificent combination "antiinterdenominationalistically," which first appeared in print in 1927. This has 32 letters and is a genuine word that expresses an idea for which no other word or even phrase is sufficient. Its author claims that it is probably the longest simple word in any language.



A Book for Every Railway Enthusiast

200 pages



58 illustrations

Price 2/6 (post free 2/9)

Price 2/6 (post free 2/9)

This fine book tells the story of thirteen of the most famous expresses of Great Britain. The author, Mr. Cecil J. Allen, is easily the most popular writer on railway subjects and his lectures and B.B.C. talks are always looked forward to with keen interest by thousands of railway enthusiasts, both young and old.

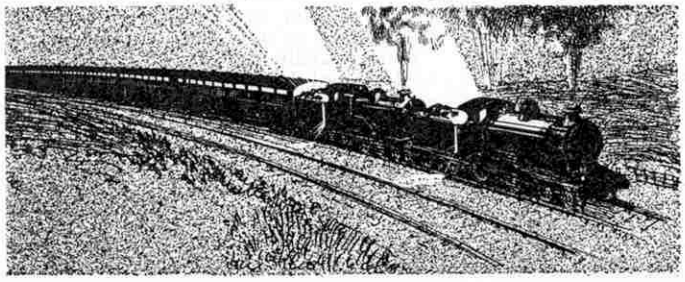
The book tells of the routes over which the expresses run, the speeds attained, the times of departure and arrival; and also includes many interesting details about the Engines, Tenders and Coaches.

Every boy who is keen on railways should add this book to his library. It is a splendid production, beautifully printed and profusely illustrated throughout.

The "Famous Trains" book may be obtained from any Meccano dealer or newsagent, price 2/6. If preferred, we can send it direct, price 2/9, post free.

MECCANO LTD.

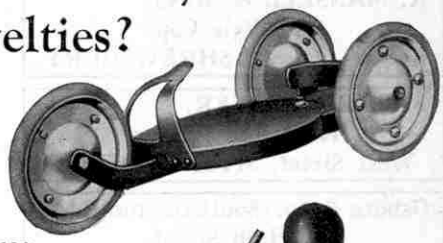
OLD SWAN ——— LIVERPOOL



BOYS! have you seen these novelties?

Safer than a Skate!

Better than a Scooter!

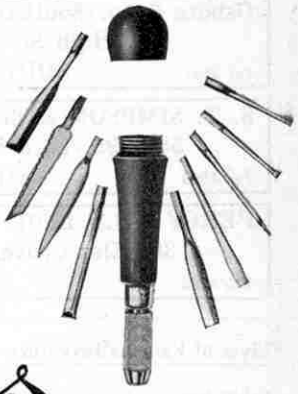


THE "E-ZEE-ON" SCOOTER SKATE

This skate is fastened to the boot, and used exactly as an ordinary scooter. No straps needed for fixing, and one skate only required. Try "Scoota-skating" and see how exciting it is! Price **6/6** (postage 9d.).

HOLLOW HANDLE TOOL OUTFIT

Containing nine oil-tempered tools of the finest quality. A really useful gift for amateur woodworkers—always handy and ready for use. Price **8/6** (postage 9d.) and **12/6** (post free).



Hamleys

Estd. 1760.

HAMLEY BROS. LTD.

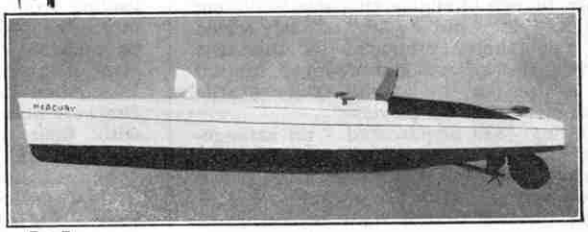
Mail Order Department (M):

200/2, REGENT ST., LONDON, W.1.

And Branches London, Croydon and Eastbourne

The last word in Motor Boats

BRITISH MADE THROUGHOUT



Clockwork Model

30/-

Electric Model

35/-

(including Battery)

The Clockwork Model will run six minutes at one wind and the Electric Drive Boat **three hours** with one pocket battery.

They have a wooden hull as tough as an old wooden battleship! Three real bulkheads for strength to these spanking craft! Decks curved like the "Shamrock" and absolutely watertight! and you can "port your helm" from the cockpit.

Don't buy a motor boat until you have seen these new Bassett-Lowke masterpieces. Fullest details on receipt of postcard.

Other Sailing Yachts and Power Boats, Ships' Fittings and everything for the model ship builder are described in our new catalogue section S/17 now ready, post free 6d.

Section A/17. MODEL RAILWAYS and ACCESSORIES, over 170 pp. and Coloured Inset, post free **6d.**

Bassett-Lowke Ltd., Northampton

LONDON: 112, High Holborn, W.C. 1

MANCHESTER: 28, Corporation Street

EDINBURGH: 5, Frederick Street

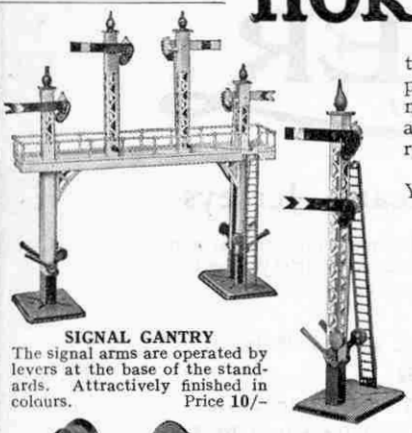
HORNBY SERIES

HORNBY ACCESSORIES

GAUGE 0

There is a splendid range of Hornby Accessories in the Hornby Series, all built in exact proportion and all perfectly designed. With these realistic Accessories the most elaborate railway system may be constructed and operated in exactly the same manner as a real railway in actual practice.

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



SIGNAL GANTRY
The signal arms are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

DOUBLE ARM SIGNAL No. 1
Price **3/9** per pair

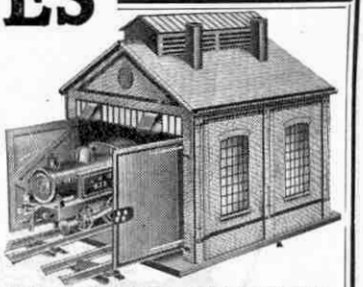
DOUBLE ARM SIGNAL No. 2
(as illustrated)
Price **3/-** each

MANSELL WHEELS
These wheels are die cast.
Price per pair **4d.**

RAILWAY STATION No. 1 (as illustrated). A well-made model, richly finished in bright colours. Dimensions: Length 16¾ in., width 6 in., height 6 in. Price **5/-**
RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Dimensions: Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/-**

SIGNAL No. 1
Price **3/-** per pair
One "Home" and One "Distant."

SIGNAL No. 2
(as illustrated)
Price **2/6** each
"Home" or "Distant"



ENGINE SHED No. 1 (as illustrated)
This Shed will accommodate Locomotives and Tenders of the M Series, No. 0 and No. 1 types. Price **11/-**

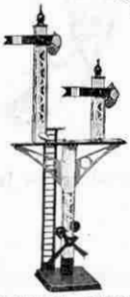
ENGINE SHED No. 2
This Shed will accommodate two of any type of Hornby Locomotive and Tender.
Price **17/6**

TUNNEL
Realistic and finished in colours. Price **7/6**

LOADING GAUGE
Price **1/9**

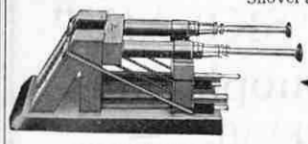
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker. Price **1/6**

GOODS PLATFORM
Length 16¾ in., height 6½ in., width 6 in. The crane at the end of the platform revolves on its base
Price **10/6**

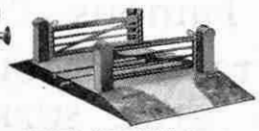


JUNCTION SIGNAL
"Home" or "Distant" Signal arms operated by levers at base.
Price **5/6**

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



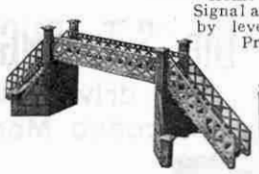
BUFFER STOPS No. 2 (HYDRAULIC)
Price **5/-**



LEVEL CROSSING No. 1
(as illustrated)
This model is suitable for a single track only and has gauge 0 rails in position. Price **3/6**

LEVEL CROSSING No. 2
Measures 11½ × 7½ in. with two tracks of gauge 0 rails in position.
Price **5/-**

TARPAULIN SHEETS
Strongly made. Lettered L.M.S., N.E., G.W. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon.
Price **6d.**

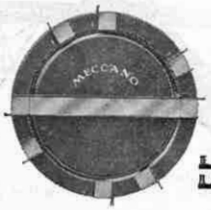


LATTICE GIRDER BRIDGE
Constructional type. Strong and well proportioned. Price **9/6**

RAILWAY ACCESSORIES
No. 1 Miniature Luggage and Truck. Price **1/6**
No. 2 Milk Cans & Truck. Price **1/6**
No. 3 (as illustrated) Platform Machines, etc. Price **1/6**
No. 4 Composite of Nos. 1, 2 & 3
Price **3/9**

SIGNAL CABIN No. 1
(as illustrated)
Finished in colours.
Price **2/9**

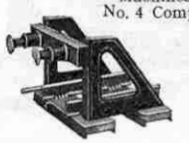
SIGNAL CABIN No. 2
Roof and back open to allow signal levers to be fitted inside cabin, if desired. Price **6/6**



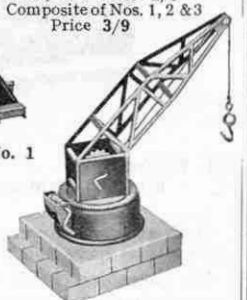
TURNTABLE No. 2
(as illustrated)
Price **4/-**

TURNTABLE No. 1
Price **2/6**

VIADUCT No. 1. Price **7/-** **Centre Section only,** Price **4/6**
ELECTRICAL VIADUCT, Price **8/-**
Centre Section for Electrical Viaduct.
Price **5/-**



BUFFER STOPS No. 1 (SPRING)
Price **1/-**

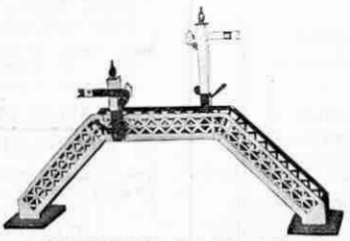


PLATFORM CRANE
The Crane revolves on its base and is fitted with a crank and ratchet mechanism for controlling the load. Price **4/-**

SHUNTER'S POLE. Price **4d.**

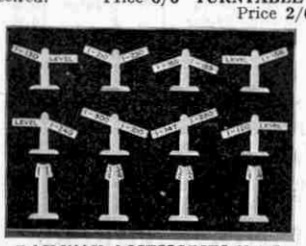
LAMP STANDARD No. 2 (DOUBLE)
(as illustrated)
Four-volt bulbs may be fitted into the globes. Price **4/-**

LAMP STANDARD No. 1 (SINGLE)
A 4-volt bulb may be fitted into the globe. Price **3/-**

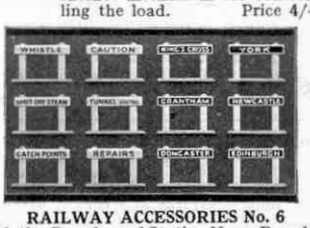


FOOTBRIDGE No. 1 (without Signals) Price **3/6**
FOOTBRIDGE No. 2 (as illustrated), complete with detachable Signals. Price **6/-**
Signals only, per pair **2/9**

TELEGRAPH POLES
Price per pair **3/6**



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



RAILWAY ACCESSORIES No. 6
Notice Boards, and Station Name Boards
Price **4/-**

READERS' SALES

Sale. "M.M.'s," Jan. 1924–Sept. 1927. Condition New.—43, Thorncliffe Road, Oxford.

Cinematograph, Film, Slides, Re-winder. Cost 79/6. Sell 30/-.—Young, Oakmount, Lasswade, Midlothian.

4 ft. Model Yacht without Sails. Cheap offers.—Agar, 22, Goldney Road, Clifton, Bristol.

Bassett-Lowke Model Tank Engine, Atlantic Type, Gauge 1, 3 Coaches, Dining Car, 6 Coal Trucks, Brake Van, Station Water Bridge, Foot Bridge, 50 Lines on Wood, Sleepers, including Curves and Straights. Cost £40. Accept £10. For quick sale.—K. Wood, 34, Mountjoy Road, Huddersfield.

For Sale. 1,500 Cigarette Cards, 100 assorted, 6d. Postage 2d.—Peter Atkinson, 37, Haslam Street, Clarkes Lane, Rochdale.

For Sale. Three Valve Wireless Set complete with Loud Speaker, Valves, Batteries, etc., in a Mahogany Cabinet. Has not been in use a fortnight. Cost £15. Accept £7/10/- or highest offer.—D. Latimer, High Street, Langholm.

Wanted. January 1928 "M.M." Will give 1/-.—H. Curry, Box 25, Windsor, Nova Scotia, Canada.

"M.M.'s," May 1923—December 1925. Perfect. First Card gets them. 5/6 and carriage.—Delaney, 37, Merton Hall Gardens, Wimbledon.

Collectors Abroad. Send me Colonials, Dutch, Scandinavian, Roumanian, Turkish, Mexican, Guatemalan, Argentine or Syrian Stamps. Good exchange given.—Grimble, 22, Osterley Park Road, Southall, Middlesex.

Complete Set "Meccano Magazines" from September-October 1920, to December 1928. 90 copies in all. Some soiled, mainly good condition. Will separate. Correspondence only. Offers to—Morton, 2, Endsleigh Terrace, Euston, London.

Sale. Wireless and Electrical Parts. All in good condition. Switches, Buzzer, Tapping Key, 'Phones, Variable and Fixed Condensers, 1,000 ft. Strong Insulated Wire, Accumulators, Shock Coils, Bulbs and Holders. Write—J. F. Ford, 1, Old Winton Road, Andover.

Excellent Cinema Films, Cheap. Yacht, 8/6.—A. Higgins, 11, Scolton Villas, Haverfordwest.

Sale. Simplex Typewriter, cost £1. Sell 15/-. or nearest.—Allen, Ashurst, Himley Road, Dudley.

Wanted. Clark's Creamed Barley Section "Break." Yellow preferred. Three Sections in exchange.—B50, Colonels Walk, Goole.

For Sale. Wireless Electrical Apparatus, Motors, etc. Card for List. Millidge, Four Seasons, High Salvington, Worthing, Sussex.

Sale. "Meccano Magazines," September 1922 to December 1928, complete, 16/-; 17 odd issues from August 1924, 3d. each; Nelson Lee's, new series, No. 1 to present date, perfect, 14/-; Magnets, 997 to 1029, 3/-; Champions, 151 to 224, 4/-. Wanted, Nelson Lees before No. 112 old series.—Rhodes, 18, Jackson Street, Ashton-under-Lyne, Lancashire.

Wanted. Small Bivouac Tent, 5-6 ft. high.--Roberts, 8, Gledhow Wood Grove, Roundhay, Leeds.

Sale. Populars and Nelson Lees, 1/- dozen; Gauge "0" Rails: 24 Straight, 2/- dozen; 9 Curved, 1/-; Crossing, 1/3; 2 Open Wagons, 1/6 each: 4-volt Electric Motor, 1/9: Chemistry Outfit, 2/-.—Hobbs, Manse, Windygates, Fifeshire.

Sale. "Meccano Magazines," 1923-1926. Stamp for list.—Gegg, Nower Road, Dorking.

900 Different Foreign Stamps in two Albums, 17/6 or nearest.—Pattison, 7, Carnarvon Road, West Bridgford, Notts.

Sale. "Meccano Magazines," July-August, 1921—November, 1928. Five Binders. Offers?—Davies, Wellington Road, Ashton-u-Lyne.

Sale. No. 2 "Brownie" Camera. Perfect. Portrait Attachment and Case. 12/-. Also No. 2 "Hawk-Eye," never used. 7/6.—Cooper, 17, Preston Gardens, Ilford.

12 "Meccano Magazines" Sale, 1927. 6d. each. Excellent condition.—Simpson, 133, Fernhead Road, Paddington.

For Sale. Rolling Stock, Rails, Engines, Accessories, etc. Gauge 0. Apply—W. Young, Ittington, Beech Avenue, Glasgow, S.1.

Bing Train, Gauge 0, and Accessories, 14/-. Eight good 6/- Annuals, Tiger Tims, etc., 26/-. Box lovely Anchor Blocks, 14/-. Kick Game, 3/6. Boy's Chemistry Apparatus, 3/6. The lot £3. Too cheap for approval. No rubbish.—Knight, The Yews, Yaxham, Norfolk.

"Meccano Magazines," complete, 1921, 3/6. 1922, minus November, 3/-.—Wilfrid Gauntlett, Berwick-on-Tweed.

Fine specimens Birds' Eggs. Sale. Cheap.—Fellows, The Rocks, Hurst Hill, Bilston.

Sale. Brownie Crystal Set with 5XX Coil, 10/6. Simplex Typewriter, Model D, 15/-. Invisible Ink, Black, 9d. Pink, 6d. Post Free.—Box 301.

Stamps Exchanged, also 700 Cigarette Cards, Sets, loose, for sale or exchange. B. Stenson, 114, Notts Road, Belper, Derby.

Sale. 1928 No. 2 Brownie Camera. Excellent condition. What offers?—Gilbert, 1, Leopold Road, Wimbledon.

"M.M.'s" 1923. Offers? Quite good condition.—J. E. Shapley, 7, Bystock Villas, Withycombe, Exmouth.

This Month's Special Articles

Sale. Steamboat in excellent condition. Geared. Exhaust Pipe. Cost 30/-. Sale 14/-. Also 1,900 Cigarette Cards and 356 Stamps, and Albums. What offers?—P. Williams, 11, Linden Road, Levenshulme, Manchester.

Adana Printing Machine, complete, extra type, etc. Cost £3/5/-. Only used once. £1/10/- or offers.—Box No. 302.

For Sale. Two Loose-Leaf Stamp Albums, also Cigarette Cards and Album. Lists.—G. Johnson, 6, Norfolk Square, Great Yarmouth, Norfolk.

Cigarette Cards, Sets, Odds, Lots. Lists.—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Wanted. Gibbon's "Imperial" Album. Good condition. Price and Particulars to—Hilditch, Wirksworth, Derby.

Air Gun, accurate at 25 yards. 25/- or offer.—Rowntree, 15, Thornton Way, N.W.11.

Wanted! Cigarette Cards. Offer sixpence per hundred in sets.—Wardlaw Anderson, South Guildry Street, Elgin.

Sale. "Meccano Magazines," November 1925–December 1928, 10/-. Cigarette Cards, Sets 50, 4d. Albums, Stamps. Lists.—BM/ZXGM, London, W.C.1.

Sale. 24 in. Speed Launch, 6 m.p.h., six minutes on one wind. 36 in. Yacht, fast, steady. Offers?—Goligher, 8, Ebrington Terrace, Londonderry.

For Sale. Miniature Table Railway. Cost 30/-. Perfect condition. 15/-, or offers. Apply—Kenneth Cook, "Inveresk," Salisbury Road, Andover, Hants.

MECCANO MAGAZINE

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

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office. 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Advertisements

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/- per inch (average 12 lines to the inch). Cash with order.

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

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

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

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the case of Australia, where the price is 1/- per copy (postage extra), and the subscription rates 7/- for six months and 14/- for 12 months (post free).

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

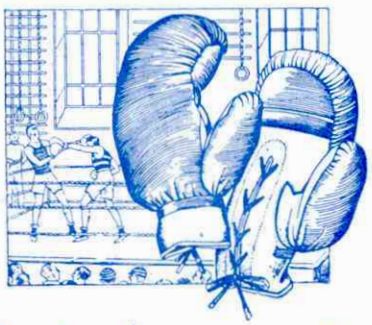
CANADA: Meccano Ltd., 45, Colborne Street, Toronto.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street.
Bombay: Bombay Sports Depot, Dhobi Talao.
Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

Cases have been reported recently, in which readers in various parts of the world have been charged more than the published price for their copy of the magazine—that is to say, more than 1/- in Australia, and more than 6d. in other parts of the world.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the correct figure. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor. The name of the nearest Meccano dealer who is willing to supply at the correct figure will then be given.

There's something to please every boy at

GAMAGES



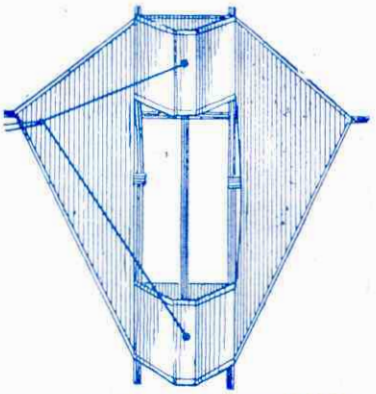
Boxing keeps you Fit

A "few rounds" with the gloves every day will keep you fit and strong. These Boxing Gloves are most suitable for the hard wear you will give them. They have laced palms, correctly placed bar grip, and are stuffed evenly with pure horse-hair.

Youths' **14/6** the set. Boys' **13/6** the set.

Pocket Sundial and Compass

A novel and useful little instrument which will appeal to every boy. It enables you to tell the correct time by the Sun, and is a practical compass as well. Very light and is easily carried. Only **1/-** Post 2d.



Gamage Professional Kite

Folds up into a small space. This kite is well known for its remarkable lifting power and steadiness in flight.

No. 1 Height 29in. Price **1/9**

No.	2	3	4	5	6
Height	31 in.	33 in.	40 in.	46 in.	52 in.
Price	**3/6**	**4/6**	**4/11**	**6/6**	**8/6**

Post and Packing 6d. extra.

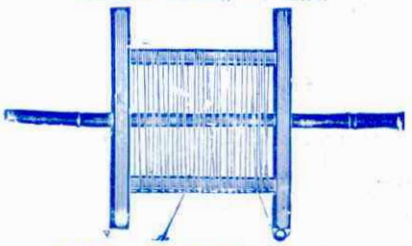
THE WARNEFORD FEATHER AIRPLANE

This fine feather Airplane will give you plenty of thrills. The Airplane, when assembled as shown, will fly smoothly for a considerable time. This type of model holds the British Spa Tractor Record with a flight of 108 seconds. Price **3/6**

THE MINIATURE MICROSCOPE

The Latest Scientific Optical Novelty

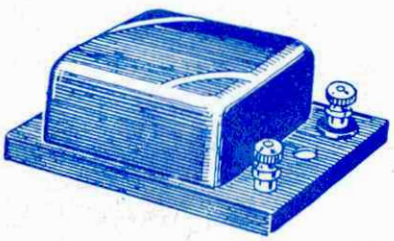
In this small instrument are introduced the principles of the Standard Microscope in such a form that a boy can, without any technical knowledge, observe the wonders of nature. Objects which are practically invisible with the naked eye, can by the aid of this wonderful instrument be seen extensively magnified, and you can carefully study the formation and peculiarities of objects. This will give hours of joy and is an Education, as well as interesting. Price, Post Free, **2/6**



THE PROFESSIONAL KITE WINDER

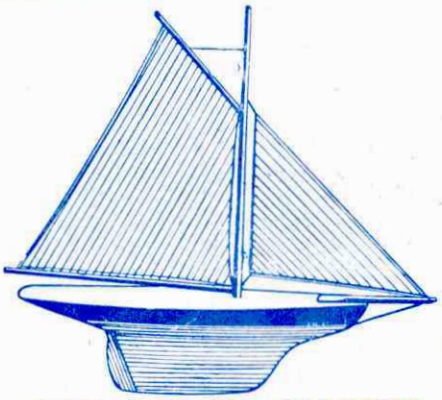
Supersedes the old style, and cord can be wound up very quickly.

No.	1	2	3
Price	**1/-**	**1/9**	**2/9**
Post	2d.	4d.	5d.



HANDY PRACTICE BUZZER

Every learner should have one of these handy Practice Buzzers. Black enamelled finish. Price **1/6** Post 4d.



A FINE MODEL CUTTER

Built to scale and solidly constructed. Similar to sketch. Hollow. 12 in. Price **4/11**

14 in.	16 in.	18 in.
7/3	**10/6**	**14/-**

21 in.	23 in.
18/6	**23/6**

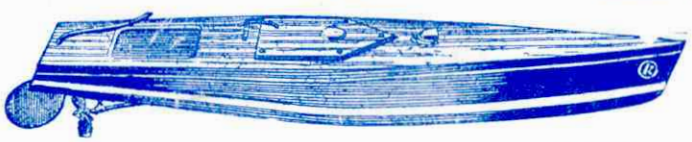
Post 6d.

TAPPING KEY

Well finished and accurate working. Mounted on polished wooden base. Size o tapping key base 3½×2½in. Post 6d. Price **2/6**

Larger key, similar type to illustration, mounted on polished walnut base 4¾×2¾×⅞in. with two terminals. Price **4/6** Post 6d.

We stock all Hornby Train and Meccano Parts and send them Carriage Paid to any Station U.K.



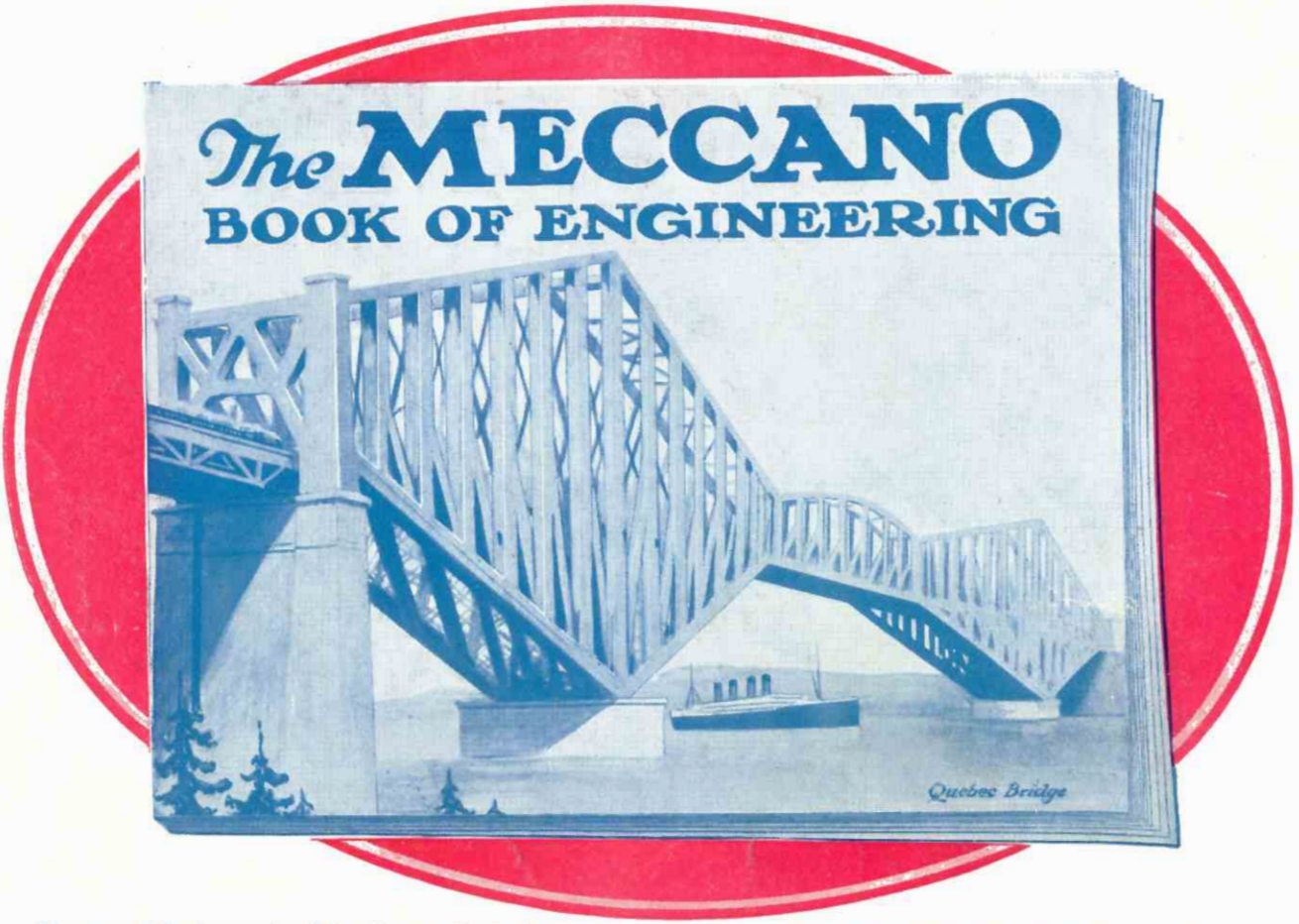
CLOCKWORK MOTOR BOAT

Built of African Mahogany and fitted with long-running c. w. motor, finished with finest marine varnish. Length 18 ins. Natural mahogany colour, Green lines. Price **16/6** Post 9d.

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

City Branch:
107, Cheapside, E.C.2

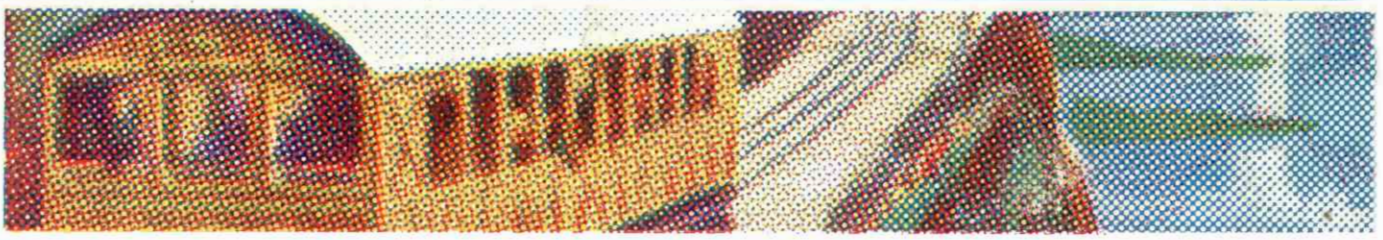
Boys! Order your copy of this fine book today



There are still a few copies of the Meccano Book of Engineering left, and all boys who have not yet read this book should obtain a copy immediately before supplies are exhausted.

The Meccano Book of Engineering is splendid reading. It tells how the advance of civilisation has depended mainly on the engineer, who has built bridges, constructed harbours and breakwaters, and reclaimed deserts in the face of overwhelming odds. It also tells the story of the famous Quebec Bridge and describes many other engineering masterpieces. The whole of the 48 pages in the book are beautifully illustrated in half-tone.

You can obtain a copy of the Meccano Book of Engineering from your dealer, price 3d. If you prefer it, send us three penny stamps and we will send you a copy, post free, providing you send us the names and addresses of three of your chums. Write clearly and be sure to put No. 70 after your own name for reference.



First stage — impression from yellow block. **Using red printing block alone.** **Second stage—the combination of red and yellow.** **Using blue printing block alone.** **Completion by final overprinting from blue plate.**

The above illustrations show the three stages in the printing of a coloured cover of the "*Meccano Magazine*." Above them is an enlarged reproduction of a strip from the cover, showing how dots printed in the three primary colours are intermingled. A full explanation of the wonderful three-colour process used is given in the article on page 188 of the present number.

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