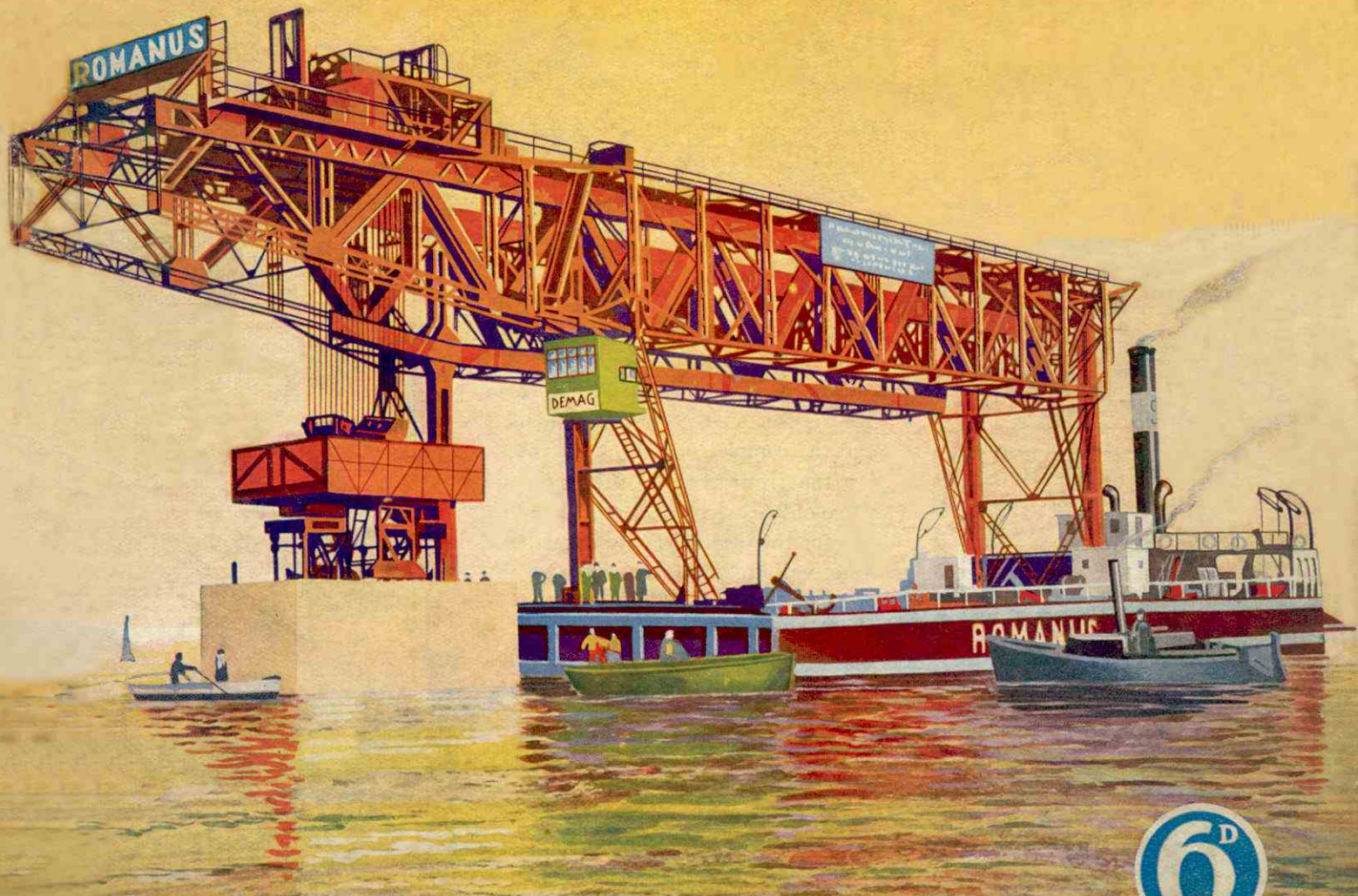
VOL. XIII. No. 9 SEPTEMBER 1928

MECCANO MAGAZINE



GIANT BLOCKSETTING CRANE

(see page 706)

6D

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A comical Calendar Picture in bright colours is given you free ready to make up into a stand Calendar.

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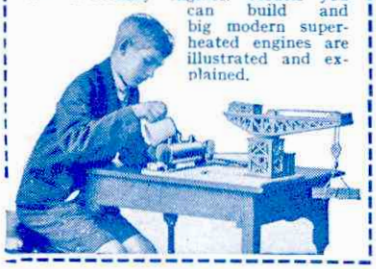

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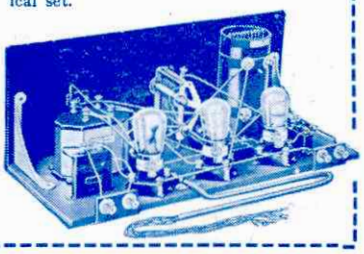

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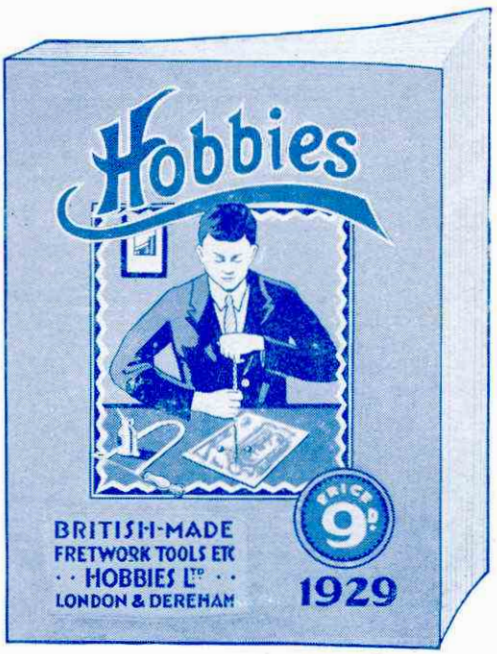

The Hobbies 1929 Catalogue is just out and is bigger and better than ever. It contains 280 pages packed with interest for any Meccano Boy. There are articles on how-to-make subjects and a complete instruction course for the fretworker. Designs to the value of 2/- are given away, including two for the beginner. No other book deals with so many pastimes at the price, and every fellow who loves handling tools, making models, or planning pastimes should possess it. The Hobbies Catalogue is obtainable at any newsagents or ironmongers and is marvellous value for 9d. Nothing to compare with it. Get your copy to-day.

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It's a splendid game cutting out Jig-saw Pictures and there is a special section telling you how to set to work, the best pictures to have, and all about it.

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Lots of fellows make money by cutting out and selling these quaint Calendars. There is an article telling you the way to start and all details of suitable calendars, etc.

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Meccano Boys will be particularly interested in the working models built from odd pieces of wood. Simple to make, and driven by a beautiful small upright engine.

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HOBBIES CATALOGUE

280 PAGES

Get one at any Hobbies Branch, newsagent or ironmonger, or send postal order for 1/- to Dept. 196, Hobbies Ltd., Dereham, Norfolk.

FREE DESIGNS

MECCANO MAGAZINE

Editorial Office:
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Vol. XIII. No. 9
September, 1928

With the Editor

World's Largest Natural Playgrounds

No doubt most of my readers have spent some part of recent months near the sea, either golfing, playing cricket or merely bathing and basking in the sun. I wonder if they have given any thought to the wonderful sands that are strewn so liberally on our shores, making them the finest playgrounds imaginable. It has been calculated that nine-tenths of the coast-line of the world is fringed with sand, and the enormous quantity that exists inevitably makes us ask where it all comes from. Those readers who are familiar with the sands at the mouth of the River Conway in North Wales, for instance, will realise why Lewis Carroll's Walrus and Carpenter " wept like anything to see such quantities of sand."

A proportion of sand, and of the shingle that almost invariably accompanies it, is the product of the weathering of the rocks torn down from the cliffs by the sea. These are broken up by the pounding that they receive from the waves, with the result that the small angular fragments that constitute sand are split off. But this only accounts for a part of it. Much more is the product of the process of the general disintegration of rocks that has been going on ever since these were formed and has been brought down by rivers. A large proportion owes its existence to the huge glaciers of the great ice age. The result is that the sand in any one district may contain rock fragments that have travelled over astonishing distances.

A Jig-saw Puzzle!

Thus, in the sands of East Anglia the most common pebble next to flint is milky quartz. This has certainly come from a far northern source, possibly Norway, and has been carried to its present resting place by an immense glacier that stretched from that country across the land that once occupied the present site of the North Sea. In the presence there of " erratics," or detached rocks of a kind that cannot be found anywhere but in Scandinavia, there is abundant evidence that this glacier extended as far as the eastern shores of Great Britain. Similarly, investigation of the sand on the beach of Felixstowe and many other east-coast resorts will reveal the existence of pieces of carnelian and agate that are rarely as large as a hazel-nut. These came originally from Scotland, where rocks containing larger nodules may be seen in position near Montrose. These also reached the position in which they are found to-day by the agency of a glacier, possibly with the assistance of the action of the sea.

History is very largely written on these sands. Besides the evidence of the glaciers of the great ice age, they also contain abundant proof that many animal types not known in Britain to-day were once strongly represented in these islands. In Suffolk there is what is known to geologists as the Suffolk bone-bed. This is a rock layer about 12 in. in thickness and at no great depth, in which occur the bones of whales of varieties now extinct, that lived in the sea in this area at some prehistoric time. The inevitable decay and wearing away of the cliffs has led to the mixture with the pebbles of the Suffolk beach of fragments of bones and teeth of whales, sharks, mastodons, rhinoceros and other animals. In addition, there may be found amber that has been washed by currents from the Baltic Sea—or perhaps has originated in the lost land that joined Britain to Holland and Denmark some 5,000 years ago—jet from Whitby, Roman coins, and pieces of ancient pottery.

The sand of every shore is not perhaps as rich and varied as that of this particular beach, but the same general description holds throughout the world. It would be difficult to find anything more interesting than these playgrounds in which the insoluble inanimate materials of which the world is made, together with fragments of extinct forms of life, seem to have been gathered together in much the same way as soluble salts are gradually being accumulated in the ocean.

Sir Harry Lauder and the Lamp-lighter

One of the most popular men in the world to-day is the Scottish comedian, Sir Harry Lauder, who is as familiar a figure on the American side of the Atlantic as he is on this. I have no doubt that many of you have laughed at his droll stories and joined with him in singing his well-known songs, as I have, with never a thought of anything but the pleasure of the moment. Possibly, however, you may also have detected the hint of serious purpose that lies behind almost everything that he says and does.

Recently, I came across a report of a speech made by Sir Harry in America, in which this side of his character was deliberately unfolded. In it he made use of a very apt illustration that is worthy of notice. He told his audience—composed of business men, by the way—of his thoughts while watching a lamp-lighter at work in the dusky streets of a Scottish city. " I was there watching that lamp-lighter as he pursued his task," he said, " and long after his form became indistinguishable I could trace his movements by the lamps he lighted and the long trail of light that he left behind him. Your business and mine, my friends, is so to live that after our personalities have become lost in the shadows we shall leave behind us a trail of light that will guide the steps of those who otherwise may walk in darkness."

Sir Harry Lauder himself has always tried to act the part of the lamp-lighter. He has given us pleasure and amusement, but in addition he has tried to live usefully and earnestly. It is because he has done this successfully, and not merely because he is a laughter-maker, that he has attained his present high position, and his example is well worthy of our serious consideration.

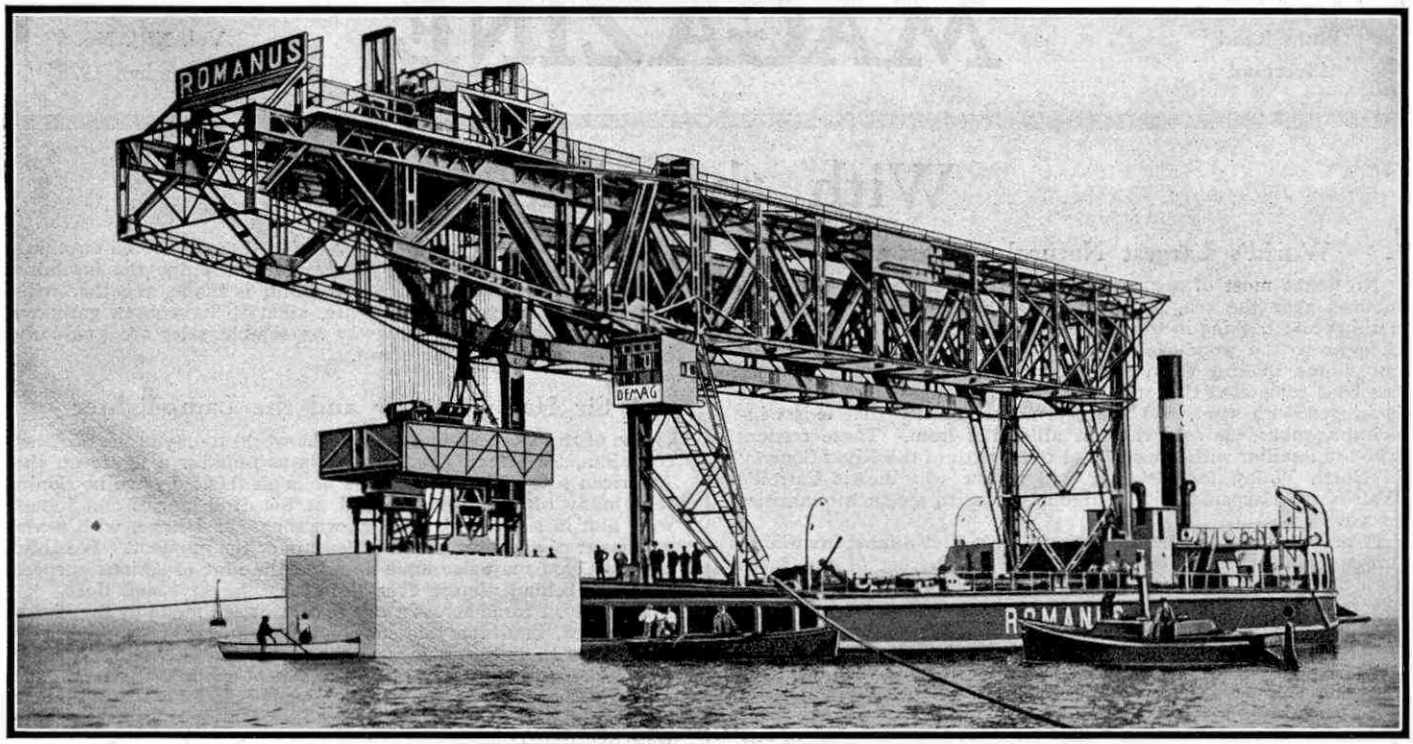
The Book of Remembrance

While reading the above extract from Sir Harry Lauder's speech, my mind went back to a scene that may be witnessed daily in the Warriors' Chapel of Canterbury Cathedral. Every morning, in the depôt of the East Kent Regiment, the smartest, cleanest and best turned-out recruit is selected by the regimental sergeant-major and sent to the orderly room. Here he receives the commanding officer's silver-mounted cane and is instructed to proceed to the Cathedral. Arriving there he is escorted by a verger to the Warrior's Chapel. On a lectern in the Chapel there rests a book containing the names of more than 6,000 men of the East Kent Regiment who lost their lives in the War. The recruit salutes, removes his hat, unlocks the glass case containing the book, and reverently turns over a page. This solemn duty having been performed, he then returns to the orderly room to report.

This custom has been carried out daily since the " Book of Life," as it is called, was placed in the Warriors' Chapel in 1924. It is a tribute to the brave men, British and Canadian, whose sacrifice is commemorated by the book. In Sir Harry Lauder's words, these men have " become lost in the shadows," but the daily turning of the pages on which their names are inscribed is a beautiful thought to keep their deeds alive in the minds of their successors.

Modern Harbour Construction

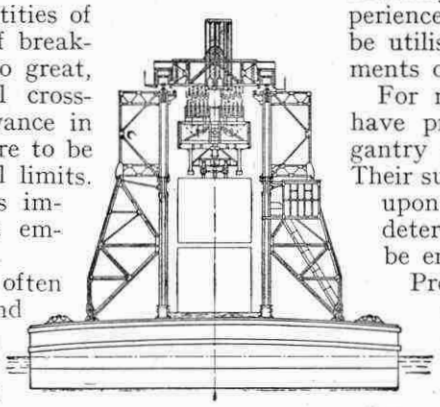
Mole-Building With 400-ton Floating Crane



400-ton "Demag" Floating Crane submerging Concrete Blocks in the Port of Bari, Italy

THE cost of constructing any extensive building to-day is so great that such operations cannot be undertaken economically unless the fullest possible use is made of mechanical means. This is particularly true of harbour construction which affords opportunities for the profitable use of mechanical appliances on a large scale. The quantities of materials needed in the construction of breakwaters, moles and quays are usually so great, owing to the length and substantial cross-section of such buildings, that conveyance in bulk must be resorted to if the costs are to be kept within reasonable and economical limits. On the other hand bulk conveying is impossible unless mechanical means are employed on a large scale.

The moles and quay walls of harbours often measure hundreds of feet in length and such distances can only be dealt with by transport appliances travelling at high speeds. In addition, the building process itself can be carried out mechanically to a very large extent for the reason that the building work consists mainly of comparatively simple processes repeated over and over again. These considerations have led to the design in modern times of suitable mechanical appliances to help the engineer to achieve victory in what otherwise would be a very unequal fight with the sea.



End Elevation of the Crane shown above

The machines and appliances of the past, however adequate they were in their day, are no longer equal to modern requirements. They were constructed chiefly of wood and this fact alone renders them incapable of performing the strenuous service demanded nowadays. In modern practice all the experience gathered in crane construction has to be utilised to the utmost to meet the requirements of harbour construction.

For mole construction two types of cranes have proved particularly useful, namely, the gantry slewing crane and the floating crane. Their suitability for any particular case depends upon the local conditions which in turn determine the method of construction to be employed.

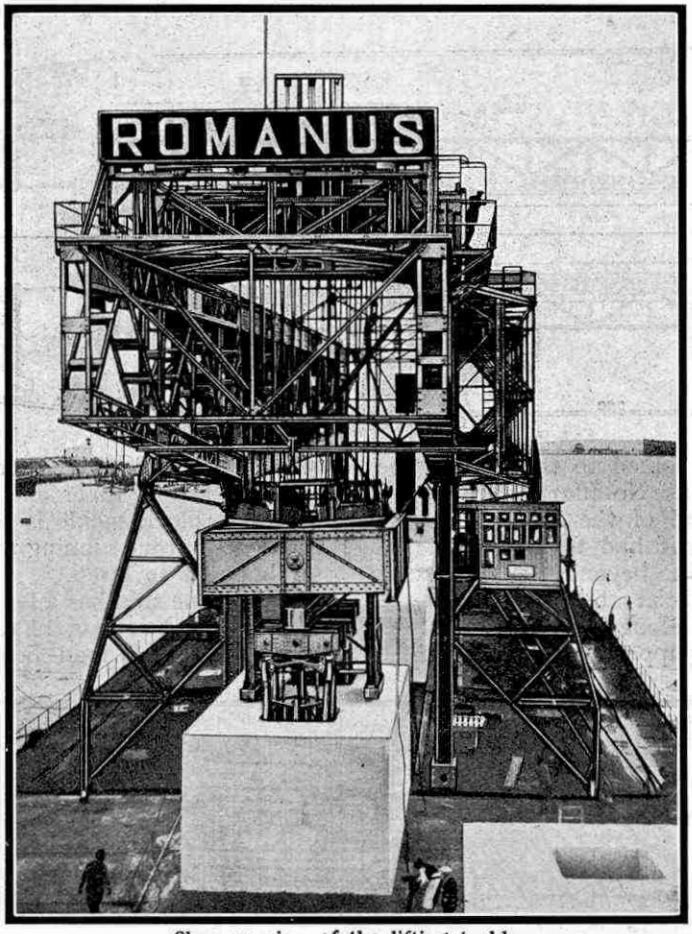
Probably the most popular method is that in which the materials are conveyed to the end of the finished portion by a railway track. At the end of the railway track a crane takes the material from the trucks and submerges it in the desired position. In this manner the crane builds up the mole ahead of it as it moves along. For such a purpose a travelling gantry slewing crane is the most suitable as it is best adapted for working in conjunction with railway trucks running underneath it.

Although such a crane requires comparatively little

room the field it serves can be made adequate by providing it with a longer jib. When equipped with an independent traversing gear of its own, the gantry slewing crane is naturally able to follow the progress made in building the mole and does not require a large number of labourers to help in shifting its position. In this method of construction all the crane has to do is to unload the trucks and deposit their load in the required place, transportation from the shore to the working site on the mole being left to fast vehicles moving on rails. A division of labour of this nature is very practical and this method of construction is destined to find ever-widening fields of application.

With a view to increasing the resistance of moles to the constant attack of the waves, stone blocks of ever-increasing dimensions are being used in their construction, the more so as carefully coursed ashlar walls with steep sides have almost completely superseded dams of stones piled up irregularly. It was found that the weights of the individual blocks of stone soon rose to such huge amounts that it became no longer possible to convey them along the mole in trucks running on rails, or to deal with them at the end of the mole with the cranes of the type just described The only means left for dealing with such blocks was the floating crane which could not only deposit them in the desired place but also bring them to the site. To make it suitable for this purpose the floating crane has had to undergo considerable modification to adapt it to the special requirements.

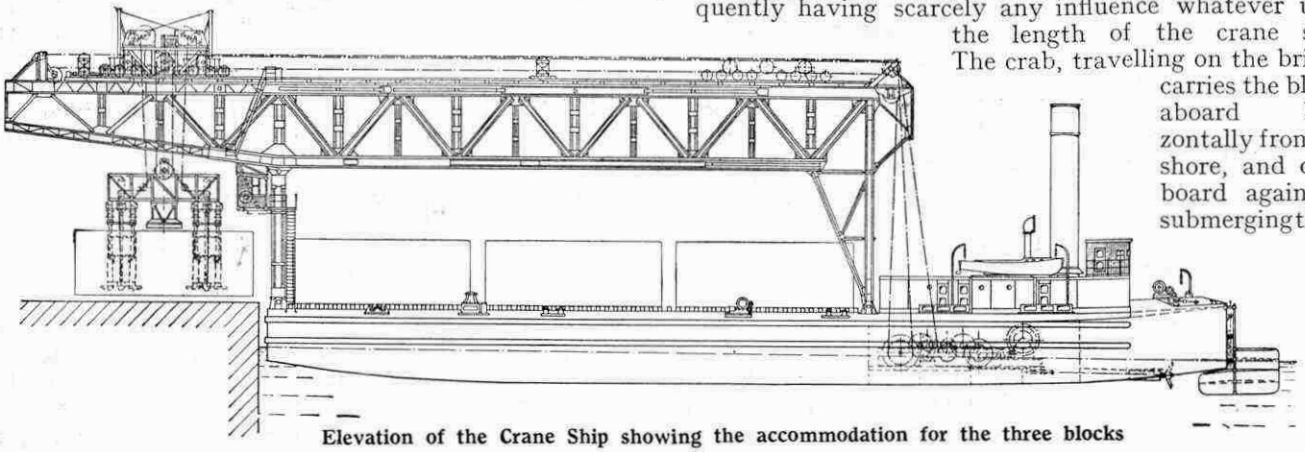
The usual floating crane with its long slewing and luffing jib answers the requirements of dockyards where large radius and extreme height are necessary because the cranes have to be able to travel long distances while carrying the loads suspended from the hook. Large clear deck areas aboard the crane ship are of minor importance and therefore are provided only to a limited extent. In the case of a floating crane for harbour construction the position is exactly the reverse. It would involve an enormous waste of time if the floating crane were to carry each block to the building site separately, especially as the travelling speed of floating cranes is only moderate. It is obvious, therefore, that the deck area must afford sufficient room for the accommodation of several blocks. This, on the other hand, means longer horizontal journeys with the loads for the crane.



Close-up view of the lifting tackle

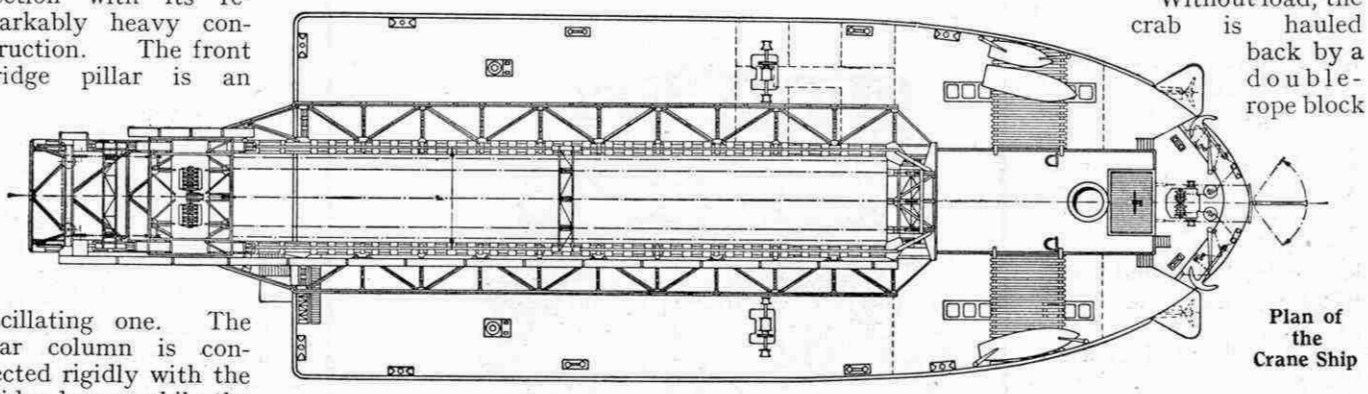
Ordinary floating cranes cannot comply with this requirement unless complicated guiding appliances are employed. Such guiding appliances have not been adapted on heavy cranes as yet because extensive horizontal motions have never been demanded of them. These considerations led eventually to the development of the peculiar bridge-like frame design employed on the 400-ton Demag floating crane which forms the subject of this month's cover. This crane is shown submerging huge concrete blocks in the port of Bari, Italy.

In this type of construction the columns supporting the bridge of the crane can easily be arranged to leave a large, continuous deck area free, and the clear area can be covered quite conveniently with the crab. As the bridge columns are short, and not exposed to bending stresses, they can be made quite light in construction, taking up very little room and consequently having scarcely any influence whatever upon the length of the crane ship. The crab, travelling on the bridge, carries the blocks aboard horizontally from the shore, and overboard again for submerging them.



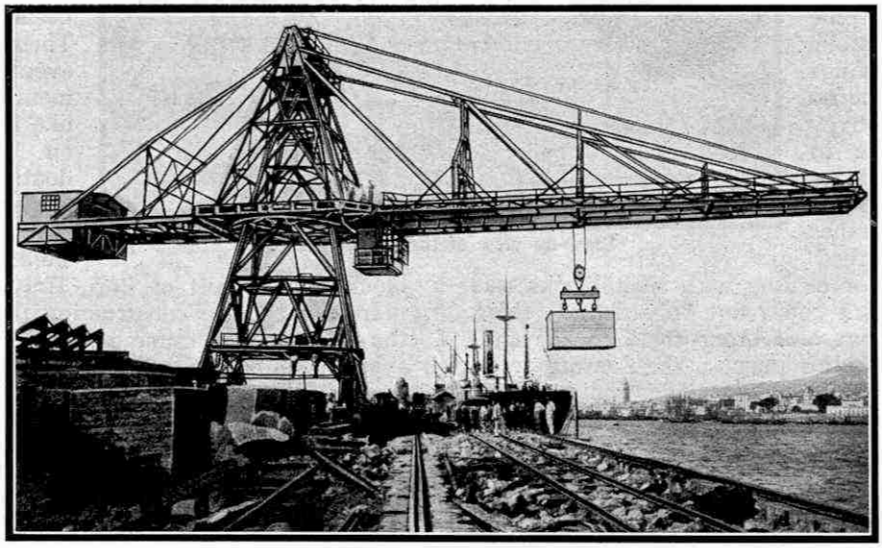
Elevation of the Crane Ship showing the accommodation for the three blocks

The bridge span of 131 ft. 4 in. is due to the necessity of having to stow three blocks on deck, one behind the other, between the bridge columns, each block measuring anything up to 39 ft. 5 in. in length. The horizontal bridge girder itself presents nothing out of the common in regard to its lattice system which is that of an ordinary lattice-work girder. Its load capacity of 400 tons only comes into evidence in connection with its remarkably heavy construction. The front bridge pillar is an oscillating one. The rear column is connected rigidly with the bridge beam, while the other end of this column is linked to the hull of the crane ship by a knuckle joint. No efforts were spared to make the cantilevered end of the bridge as short as possible, but nevertheless it had to be possible to run the crab out 25 ft. 3 in. beyond the oscillating column so as to be able to hoist the blocks from the quay wall, or to lower them alongside the ship.



Plan of the Crane Ship

The crab travels along the upper boom of the bridge and 16 rollers transmit the weight of the useful load and the crab to the track. Each pair of rollers rests in a balancing lever. The load is shared equally between two pulley blocks, each of which contains six working sheaves and six fixed sheaves. The fixed sheaves are mounted on the crab itself, whereas the two lower blocks containing the working sheaves are linked to a heavy, box-shaped balancing beam. Even distribution of the load between the two blocks is thus ensured. The gripping claws, hitched to the intermediate beam with hooks, are operated from the crab platform. One end of each of the two hoisting ropes is attached to the crab, the other loose end being taken to the winches in the stern of the crane ship over guide pulleys in the frame of the crane.



50-ton "Demag" Tower Slewing Crane in the harbour of Teneriffe (Canary Islands)

When running the crab out to the ends of the bridge the traversing motion is imparted to it by two double-rope block tackles hauling on the front end of the crab. The fixed ends of the hauling ropes are fastened to the head of the cantilevered bridge end, the loose ends pass over the rollers on the crab, return to a set of guide pulleys in the head of the cantilevered bridge end, and finally reach the outer winches over pulleys that guide them along the bridge crane. When the crab travels outward the hoisting ropes of course have to be paid out. For backing the crab away from the ends of the bridge all that is needed is to run the hoisting ropes up on the winch drums again, at the same time paying out the outer crab-traversing ropes.

Without load, the crab is hauled back by a double-rope block tackle resembling the one just described, which is hitched to the inner end of the crab. The object of this last block tackle is to lock the crab securely and prevent it from running away when the crane is tilted, or happens to lurch.

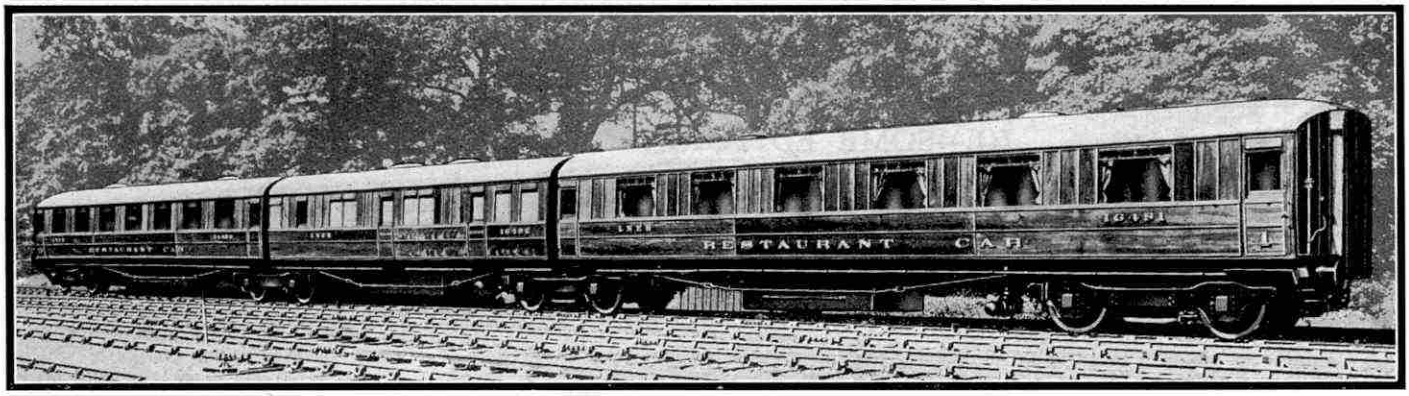
The crane ship has a length of 197 ft., a beam of 98 ft. 6 in. and a height of 14 ft. 6 in. from keel to deck, the draught at full load being 9 ft. 3 in. The hull is strengthened by longitudinal and transversal bulkheads. She is trimmed with the aid of 260 tons of solid ballast and 440 tons of water ballast, the trimming tanks containing the latter being served by a pump delivering 150 tons per hour. A steam engine of 480 h.p. propels the crane ship at a speed of up to four knots.

The hoisting and crab-traversing winches are driven by a steam engine of 103 b.h.p. common to both. The entire winch plant is located in the stern of the vessel. In lowering loads, the steam engine is not disconnected from the winch gear, but is driven by the latter as a compressor, thus acting as an effective brake. The load is supported by 24 ropes altogether, each rope having a tensile strength of 150 tons. As the total rope length to be wound on the drums is more than 984 ft. owing to the blocks having six sheaves, it was impossible to accommodate the whole length on a single drum, and therefore recourse was had to double drums. On coming from the latter, the rope—now no longer subject to tensile stresses—can be wound on

(*Continued on page* 731)

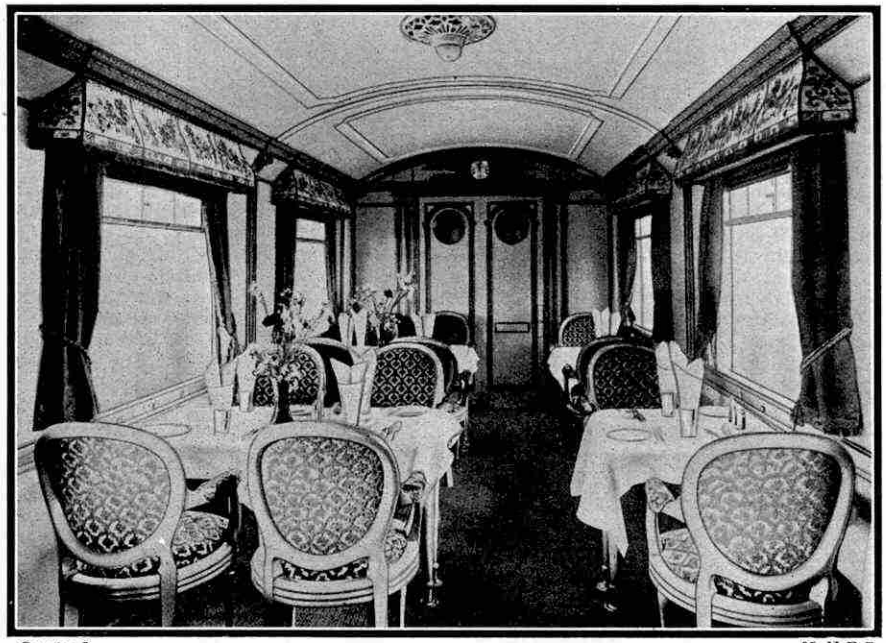
The Last Word in Restaurant Car Luxury

An Interesting L.N.E.R. Innovation



THE ambition of every railway to-day is to provide its passengers with accommodation that will give the utmost possible comfort even at the highest speeds. The latest effort in this direction has been made by the London and North Eastern Railway, with the introduction of a new type of restaurant car stock that was brought into service on the "*Flying Scotsman*" non-stop run in July last.

The cars are built in triple sets on the articulated principle, and consist of a first-class car, a coach and pantry car and a third-class car, the three together forming a single unit carried on four bogies. There is nothing particularly new in this arrangement, and it is in the interior of the cars that the changes have been made. The general effect is to make the cars appear more spacious than the ordinary type, and to resemble a first-class restaurant rather than a railway vehicle. In the first-class car the fixed seats have been done away with entirely and chairs are provided.



Courtesy [*L.N.E.R.*

The articulated construction of the new L.N.E.R. Restaurant Cars is well shown in the photograph at the top of the page

The lower illustration shows the interior of one of the first-class Cars, the accommodation and decoration of which are designed on the lines of the dining room of a luxurious hotel. Travelling in these cars is raised to the maximum of comfort

The sense of light has been obtained by raising the cornice line and arranging matters so that the roof decoration becomes a complement of the pilasters on the side walls. Delicate toned colouring produces an unusually harmonious atmosphere and there is a complete absence of French-polished timber in the panelling or furniture. The designs are exceedingly tasteful and have all the refinement of the best French work of the 18th century.

An ingenious lighting scheme has been arranged with the object of giving restful, well-diffused light without shadow. There are no electric lamp fittings in the roof, sides or ends of the first-class cars, the lights being concealed behind artistic luminous pelmets over the side windows. Another interesting innovation is the entire abolition of the familiar net racks which, though handy for small articles, certainly did not improve the appearance of a car when littered up. In place of these racks a small cloakroom is provided in the vestibule.

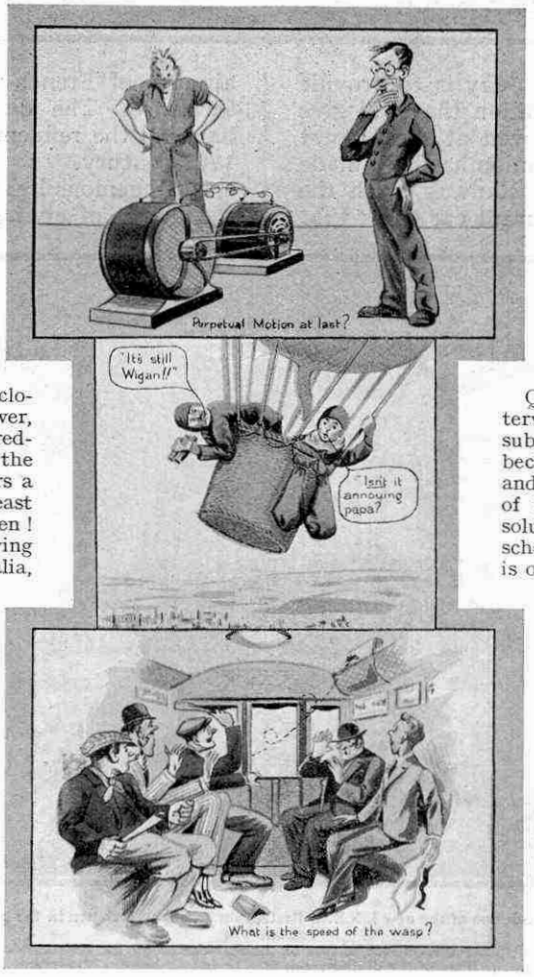
At present two sets of these cars have been constructed at the L.N.E.R. Doncaster Works. The first-class colouring of one is carried out in soft blue and stone and the other in red and stone; while the third-class cars have a colour scheme of green and stone. If the innovation proves sufficiently popular to justify the additional outlay involved it is intended to equip other long-distance express trains with similar restaurant stock. It will be interesting to observe how the public will respond to the company's effort.

III.—SOME EDITORIAL PROBLEMS

By The Editor

LAST month we gave an outline of the routine that has to be followed in preparing the "*Meccano Magazine*" for the printer. Although this in itself is a big task and one that demands a great deal of time and care, the Editor's work does not end here.

I remember in my early days how I wished I had someone to whom I could write, for there were many things on which I wanted information. I remember, too, how I used to pester a favourite uncle with long letters, some of which contained queries that must have put him to a great deal of trouble to answer. Remembering these early days when I was thirsting for information, it has been my aim to endeavour to alleviate the lot of unfortunate uncles by encouraging my readers to write to me whenever they feel they want advice or help. To this encouragement they have warmly responded, with the result that it is now my privilege to stand somewhat in the relation of a kind of "fairy-godmother-uncle" to an ever-growing army of inquiring boys and girls. My young friends believe me to have an encyclopædic knowledge, and call upon me to answer, by return of post, questions on a hundred-and-one unusual subjects. All through the year I receive, on an average, 200 letters a day, and most of them each contain at least one query—some contain a round dozen! Many of my letters come from boys living in distant parts of the Empire—Australia, New Zealand, South Africa and elsewhere—asking for information which, on account of their isolated position, they cannot obtain locally.



Of course, it is impossible for me now to deal individually with this mass of daily correspondence, which occupies the undivided attention of a separate staff. Not only are the letters replied to as quickly as possible, but they are answered in the language in which they are received—Spanish, Italian, French or even Chinese or Japanese—the reply being first dictated in English and then translated by our foreign correspondence department.

The variety of questions fired at me is astounding, and they vary from such queries as "What is the correct food for toads," to mechanical problems as "Can you please explain Walschaerts' valve gear." These queries are not always easy to answer, and often a member of the Editorial staff will spend hours searching for the necessary facts to enable a reply to be sent that will fully meet the requirements of the reader. Questions were made to be answered and difficulties to be overcome, and we do not mind how much time we spend in satisfying our readers if the questions are really genuine. We do like to feel, however, that those readers who live in towns (where a good encyclopædia can nearly always be consulted at a local reference library, or some similar institution) have themselves endeavoured to solve their difficulties before submitting them to us.

We receive many questions that do not seem to be sent altogether in the spirit of genuine inquiry, and at times we have more than a strong suspicion that someone is trying to "pull" our Editorial leg! For instance, some little time ago we published a series of articles on the building of the Forth Bridge, in the course of which it was explained very carefully why the cantilever principle is used. Imagine our feelings when, shortly after the appearance of the final article, a reader wrote: "Dear Editor, I have been very much interested in your articles on the building of the Forth Bridge. I think they are fine, but there is one thing that puzzles me. *What keeps the bridge up?*" There was a terrible silence in the Editorial sanctum for quite ten minutes after this letter was opened! Luckily for future issues of the "*M.M.*," the E.L.R. (Editor's Last Resource"—2 ozs. prussic acid!) could not be found, or the consequences might have been tragic!

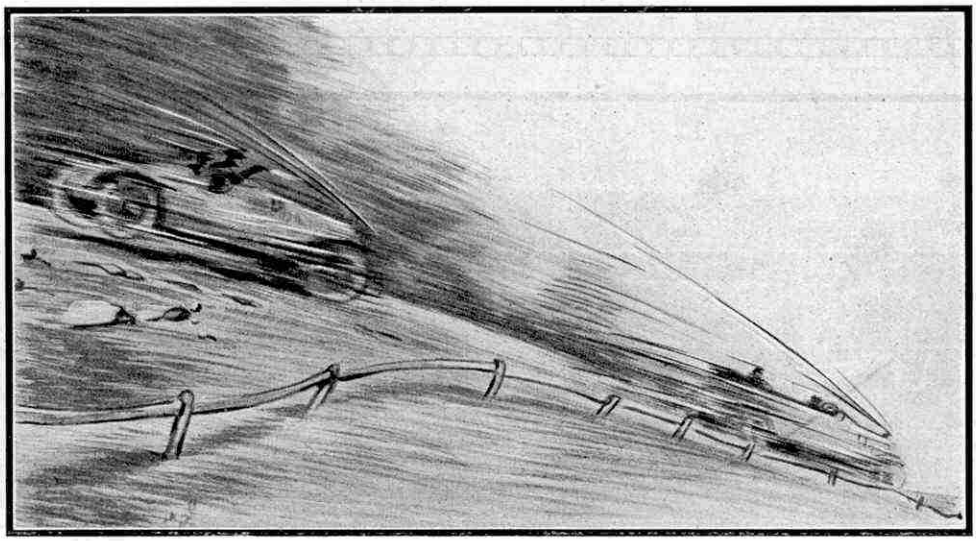
Questions reach us at fairly regular intervals in regard to perpetual motion—a subject that has a great attraction for us because Mr. Hornby, our Managing Director and the inventor of Meccano, spent many of his early years in the attempt to find a solution to the problem. One particular scheme that comes before us periodically is of special interest to me, because as a boy I thought out exactly the same scheme! The idea is that if the terminals of a dynamo, generating electric current, are connected by wires to an electric motor, and the motor in turn is coupled to the dynamo by a driving belt, the problem of perpetual motion would be solved if the dynamo were once started by some outside source of power. That is to say, the dynamo would generate current that would be used to drive the motor, and the motor in turn would drive the dynamo through the belt. The scheme is too simple to solve so great a problem, for apart altogether from technical difficulties, it would break down through friction alone.

A queer suggestion from one of our readers was directed to solving the problem of travelling considerable distances without the aid of any mechanical power of propulsion. His idea was to ascend in a balloon on a still day and remain poised in the air for a few hours. During this time—our reader claimed—as the earth beneath the balloon was rotating on its axis, the ground therefore would have moved beneath the balloon. When the balloonists descended they would find that they had travelled a distance corresponding to the period during which they had been aloft! Although I always advise my readers to try out their schemes for themselves, in order to obtain practical experience at first hand, I did not

dare to suggest that this reader should put his idea to a practical test. To go up in a balloon and remain in the air for several hours in the hope of coming down in sunny California, and at the end of the time to find that one was still in Wigan, would be a terrible disappointment!

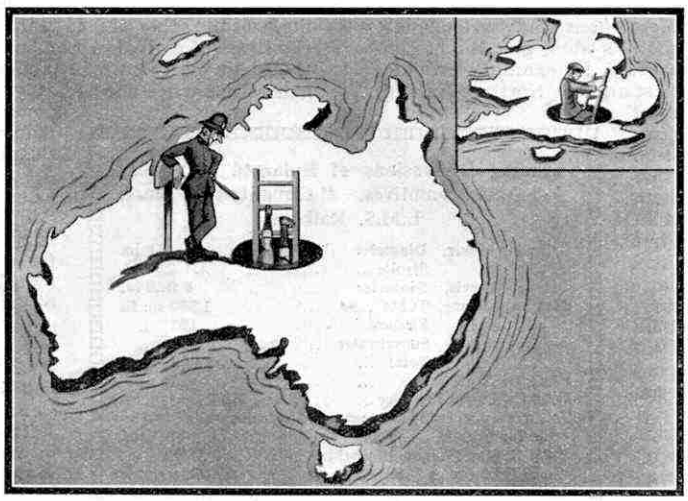
We regularly receive queries about two old problems, which come in different guises. One is regarding the effect of an irresistible force upon an immovable object; the other is the query as to whether there is any "sound" if an explosion takes place in a district where there is no one within hearing!

One reader tried his best to puzzle us with a question about a hole bored through the earth from England to Australia. Assuming that a ladder was constructed throughout the whole distance, would a boy who entered the hole in England and climbed down the ladder, emerge in Australia head first or feet first, and if the latter what action would the local police be likely to take? We were not beaten by such a simple question as that, but thought out a suitable reply. Sad to say we have not heard from our young friend since!



The problem of the police and the motor car

Then there is the intriguing series of questions based on the old query as to what is the real speed of a wasp that happens to have entered a carriage of a train travelling at 60 miles an hour, and is itself flying across the compartment in the same direction as the train. On one occasion the same problem took a more puzzling form in the question:—"Can the guard of a train shoot the engine driver, if the speed of the bullet from his revolver is the same as that of the train?" The idea seems to be that if the bullet from the guard's revolver is travelling at, say, 60 miles an hour, and the train also is travelling at that speed, the bullet will never reach the engine. But will it? If such were the fact and matters could be so arranged, the guard would have difficulty in committing suicide by blowing out his brains, if by any chance he held the revolver immediately behind his head while he was facing the engine! On another occasion we recognised the same fallacy in the form of a query as to whether, if bandits were escaping in a motor car and were followed by the police in another car, and both were travelling at the same speed as that at which a revolver bullet travels, would it be possible for the police to bring the career of the bandits to an end by shooting them?



A puzzle for the Editor—and the Australian police!

Of course, such questions as these are interesting—for they make us use our brains, and mental gymnastics is a fine exercise—but they are what I call puzzle queries. My young friends who send them along are really quite as capable as I am—many of them probably more so, since they were at school more recently than I was!—of answering them with the assistance of Mathematics—that universal aid to puzzle solvers.

Apart from these recreational questions, I receive numbers of letters of another kind, mostly from boys who either are leaving school or have recently left, and are anxious to have advice on the choice of a career. In order to deal adequately with this all-important subject, a special department has been created. Take, for instance, Engineering, in which a large proportion of my readers are naturally interested. The special department has written to, or interviewed, all the leading engineering firms in the land, and from the information gathered we have gained a thorough knowledge of the requirements of firms in all classes of the engineering industry. We have compiled a list of those firms who take apprentices and the terms under which they are taken, and obtained opinions as to the prospect of any boys who are engaged by these firms. We have followed the same plan with many other trades and professions with the result that we are in a position to reply quickly to any request for advice on a career, and able to give the enquirer accurate information. Although this has meant a great deal of work—which really is outside the scope of an Editor's duties—we have been glad to do it and to be of service in the task of selecting a career for Meccano boys—amongst whom are not only the engineers of the future, but the statesmen, soldiers, sailors, doctors and all the other important men of the next generation, whose responsibility it will be to decide the fate of civilisation and the future of the human race.

In the same way, I believe that the good work done in fostering the interest of my readers in "things that matter" will bear fruit, and that consequently in years to come the world will be a better place to live in. "If '*M.M.*' readers are interested in mechanics and in such other subjects as appear in our pages, instead of in "blood and thunder" stories and things that do not matter—if they are being taught to use their inventiveness and to construct instead of destroy, future generations will be more inclined to "turn their swords into ploughshares," to outlaw war, and to adopt a constructive rather than a destructive policy towards their countrymen in general and other nations in particular. Anything that will help towards this very desirable state of things is surely well worth an effort—at any rate that is what the members of the "*M.M.*" Editorial staff feel in pursuing their daily work.

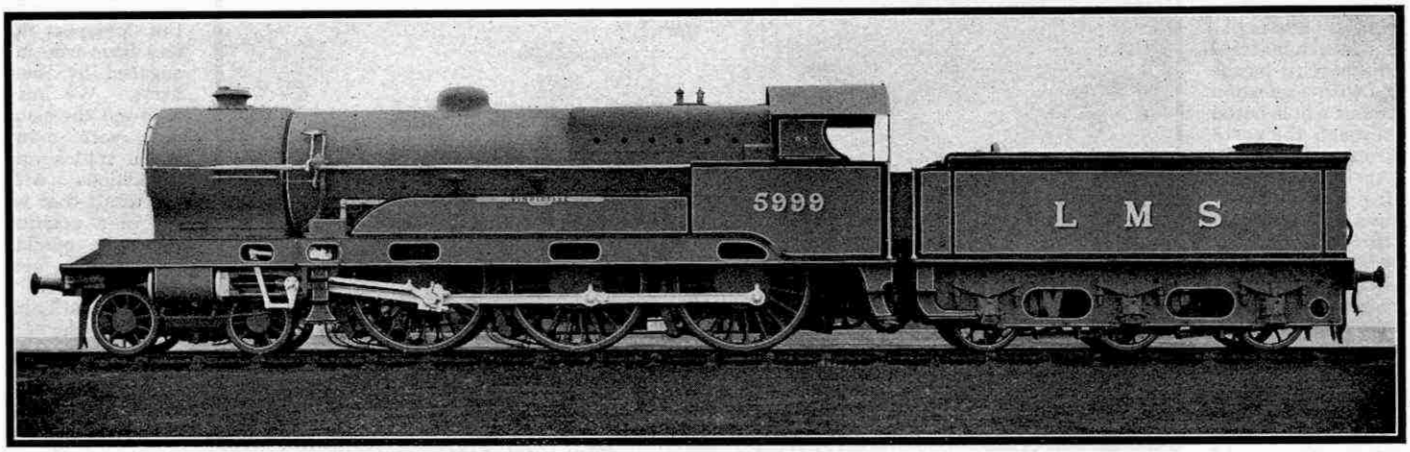
Another large section of my correspondence consists of letters which, although containing no specific queries, are written in the spirit of pure friendship. I am proud to think that the boys who write these letters regard me as a real friend, and as soon as anything unusual or of particular interest occurs in their lives they feel they must immediately sit down and tell me all about it—and they do! As may be imagined, these are the most welcome of all letters, and I enjoy nothing more than reading and answering them. Many boys, indeed, write so regularly that I am able to visualise their home life and feel that I am personally acquainted with them and their parents and friends.

Finally, we come to the large numbers of letters that may be regarded as being "on business." (*Continued on page* 784)

FAMOUS TRAINS: XXI.

The "*Irish Mail*," L.M.S.

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



The above photograph, reproduced by courtesy of the L.M.S. Railway, shows No. 5999, "Vindictive," one of the re-built Claughtons referred to in this article. A notable feature of this re-building is the manner in which a considerable increase of power has been obtained with an enhancement, rather than any loss in the symmetrical appearance of this particularly handsome engine.

IN olden days this train was called the "*Wild Irishman*," though the London and North Western authorities at Euston may never have given official recognition to so stirring a title. Not that the expresses to and from Holyhead have ever been distinguished by exceptional speed, although doubtless at the close of last century they were among the fastest trains then running. Nowadays, however, their rates of travel are surpassed by those of fast trains in other directions, and the timings along the North Wales coast, indeed, are slower by nearly 10 minutes than once they were. So the more sober title of "*Irish Mail*" doubtless suits the subject of our study well enough.

Various express services on the L.M.S. system give direct connection to Ireland. The "*Ulster Express*," for example, provides the main service from London to Belfast and the North of Ireland, and another service to Belfast is afforded through Liverpool by the 5.55 p.m. "*Merseyside Express*" out of Euston. The principal Irish mails are all carried via Holyhead, however, and from there across the sea to the port near Dublin that was once called Kingstown, but which the Irish Free State authorities now prefer to designate "*Dun Laoghaire*," in their Erse tongue. Pronounce it "*Dun Lairy*," and you will not be far off the mark.

At one time there were three independent steamer services plying between Holyhead and Ireland. The City of Dublin Steam Packet Company carried the mails from Holyhead to Kingstown; the London and North Western Railway ran their own service up the Liffey into North Wall Station in Dublin; and another service, for the North of Ireland, was run by the railway from Holyhead to Greenore. The last of the three vanished early in the war, and was never revived, in view of the ample facilities provided by other routes. Then the City of Dublin Steam Packet Company lost the mail contract, and with it the chief financial reason for its existence, so that it promptly went out of business. This left the field to the railway, and the London, Midland and Scottish, as it had now become, diverted the North Wall service to Dun Laoghaire, which has splendid facilities for dealing with the traffic, and put into commission some splendid steamers, of large passenger capacity.

Leading Dimensions of Enlarged 4-Cylinder 4–6–0 Locomotives, "Claughton" Class, L.M.S. Railway

Cylinders, Four,	Diameter	...	15¾ in.
,,	Stroke	...	26 ,,
Driving Wheels,	Diameter		6 ft. 9 in.
Heating Surface,	Tubes		1,550 sq. ft.
,, ,,	Firebox		183 ,,
,, ,,	Superheater		365 ,,
,, ,,	Total		2,098 ,,
Firegrate Area			30½ ,,
Working Steam Pressure			200 lb. per sq. in.
Tractive Effort (at 85 per cent. working pressure)			27,070 lb.
Adhesion Weight			60½ tons
Total Engine Weight (in working order) ...			79 ,,
Water Capacity of Tender			3,000 gallons
Coal ,, ,, ,, ...			6 tons
Weight of Engine and Tender (full) ...			110¾ ,,
Length ,, ,, ,, (over buffers)			63 ft. 5 in.

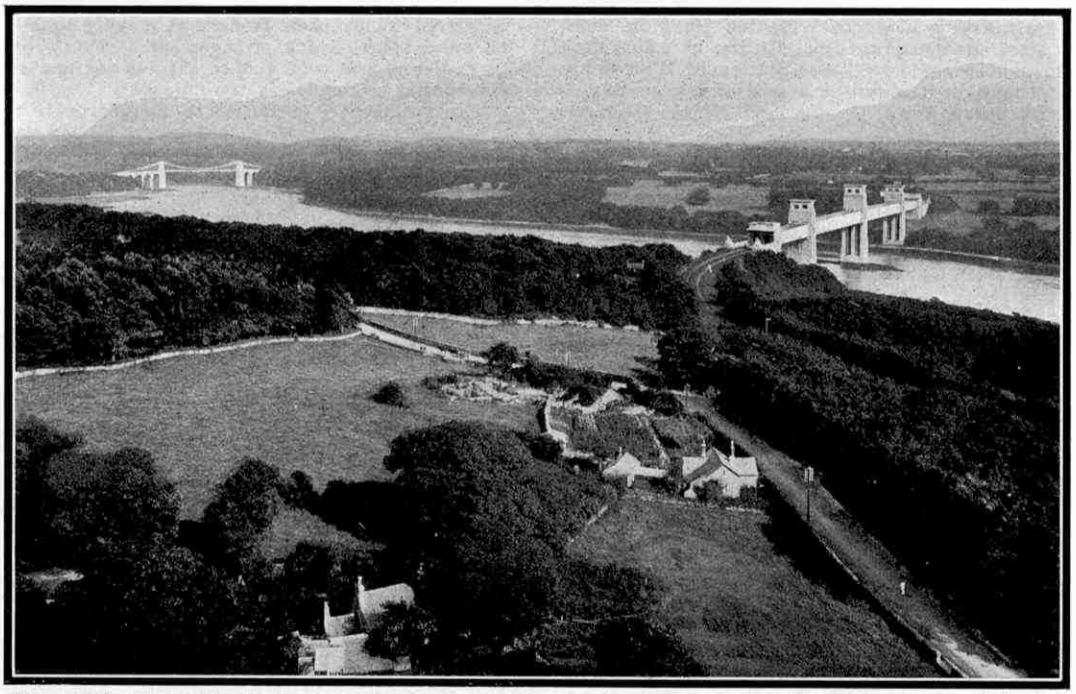
All the L.M.S. passenger steamer services between England and Ireland have now come down to three—between Holyhead and Dun Laoghaire, whence through coaches run to Cork, Galway and Belfast, serving almost the whole of Ireland; Heysham and Belfast; and Stranraer, for Scottish passengers, and Larne, just to the north of Belfast. This admirable concentration has made possible great economies in working.

Except during the summer months, it is only on the Holyhead route that both a day service and a night service are run. There are therefore two "*Irish Mails*," one leaving Euston at 8-30 in the morning, and the other at 8.45 in the evening. In the opposite direction the times of arrival in London are exactly the same, 5.50 a.m. for the night mail and 5.50 p.m. for the day mail. The night train generally carries considerably the larger number of passengers—coming Londonwards I have known as many as 17 bogie coaches, including sleeping cars, pull out of Holyhead—and so provides the bigger proposition of locomotive haulage; but as we shall doubtless want to see all that we can, the day "*Irish Mail*" is probably the better for our purpose. So we must present ourselves at Euston shortly after 8 o'clock in the morning, and if the early departure from home has deprived us of our breakfast we need not worry about it, as the restaurant car staff on the train will be happy to make good the deficiency.

The "*Irish Mail*" varies considerably in weight according to the season of the year. Next the engine are two or three vans, including the Post Office sorting tender; then follow several third-class coaches, a set of three restaurant cars—third-class, kitchen and first-class—and a first-class compartment coach and brake, or a combined first-class brake, making up ten or a dozen vehicles or more in the Holyhead portion. In all but the summer months the lighter formation of the Irish section allows of the addition, as far as Rugby, of a portion for Manchester, consisting of two or three corridor coaches; but in the height of the tourist season the Manchester train is run separately from Euston at 8-40 a.m. The main train also gives a good connection from Crewe to Liverpool, so that it is generally well filled on its journey.

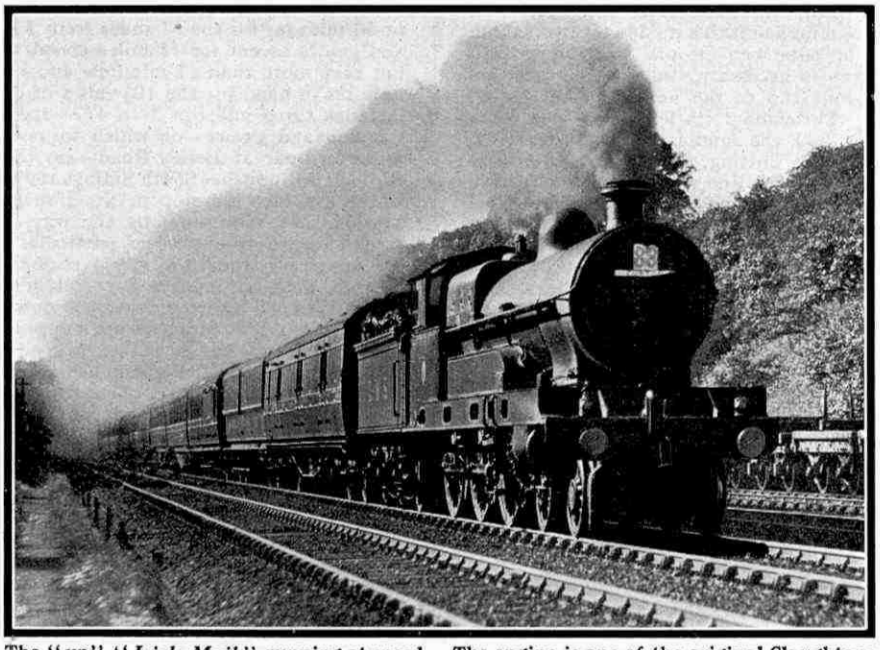
It is now frequently the custom, in these days of lengthy con-

tinuous locomotive workings, to run the engine of the "*Irish Mail*" through from Euston to Holyhead, and as the "Royal Scot" 4–6–0 engines are too heavy to work along the North Wales line, and especially over the Conway and Menai Bridges, the "Claughtons" are usually entrusted with these duties. It is for these workings in particular that a number of "Claughtons" have recently been transformed into some of the most handsome 4–6–0 locomotives in the country, by the substitution, for their original 5 ft. diameter boilers, of new 5 ft. 5 in. boilers, pressed at 200 lb. per sq. in. instead of the previous 175 lb. As compared with the clumsy external appearance of the "Royal Scots," indeed, the rebuilt "Claughtons" are a striking witness to the fact that it is still possible to develop locomotive power without an entire sacrifice of the grace of locomotive line.



View of the Menai Straits from the Anglesey side, showing the Britannia Tubular Bridge on the right and the Suspension Bridge in the distance on the left

The "Claughtons" have had a chequered history, having been notoriously variable and uncertain in the quality of their performances. Some of the early feats that I recorded behind No. 2222, "*Sir Gilbert Claughton*"—the first of the type—under the able guidance of old John Ford, one of the best-known Crewe drivers of his time, I have never surpassed with a "Royal Scot" or any other type of locomotive on L.M.S. metals. Of these the most astounding was a start one evening out of Oxenholme, in the Westmorland Fells, with a 310-ton train, which No. 2222 ran from the dead start right up to Shap Summit, 915 ft. above the sea, in 23 minutes, 11 seconds for the 18⅝ miles, attaining 48½ miles per hour up the steep ascent to Grayrigg, touching no less than 75 on the short level stretch thence to Tebay, and mounting the last four miles at 1 in 75 to Summit at a minimum rate of 38 miles an hour. This was running, indeed!



The "up" "*Irish Mail*" running at speed. The engine is one of the original Claughtons

In those early days the "Claughtons" were allowed to take trains of 440 tare tons without assistance, but in recent years it has been necessary on the faster trains to cut that figure by 80 tons. It is to be hoped, however, that the performance of the enlarged "Claughtons" will be in keeping with their magnificent appearance. In locomotive work, "handsome is as handsome does."

We have twice previously travelled over the L.M.S. main line between Euston and Crewe in these articles—once on the "*West Coast Postal*" express and again on the "*Royal Scot*"—but for the sake of new readers a brief recapitulation of the main features of the route will be forgiven, and may, indeed, stimulate our memories. The first handicap is a rise at between 1 in 70 and 1 in 105, beginning practically from the end of the platform at Euston. The engine that brought in our empty coaches will assist by giving us a friendly shove in the rear up to Camden—an incline which, in the early days of the London and Birmingham Railway, was worked with wire ropes! As we are passing on the left the capacious Camden locomotive sheds—with their lines of engines of all types—"Royal Scots," "Claughtons," "Princes," "Georges," Midland compounds, "Moguls," and others down to the villainously ugly six-coupled saddle tanks that Crewe produced long ago for shunting purposes—our "banker" will quietly drop off the rear and we shall carry on without assistance.

Between Camden locomotive sheds and the mouth of Primrose Hill tunnels there is one of the most wonderful—possibly—indeed, *the* most wonderful—layouts of railway track in the country. Unfortunately the major part of it is hidden from view underground. When the electrification scheme of the late London and North Western Railway was extended into Euston and Broad Street, the problem arose as to how the electric trains, which were to run over the northernmost of three pairs of tracks from Willesden to this point, could be got across to the centre two of four tracks for their descent into Euston terminus, without fouling all the other traffic. In fact, looking from south to north, up and down fast lines, up and down slow lines, and up and down electric lines had to resolve themselves into (in sequence) empty carriage lines, down fast line, down electric line, up electric line and

up fast line into Euston; down and up lines for Broad Street; and connections to Camden goods yard in between. A Chinese puzzle, indeed! But it was successfully solved and, by a maze of lines, many of them in tunnel, the whole of these train movements can be accomplished practically without any crossing by one train of the path of another. The reconstruction was, of course, an enormously costly business.

Meanwhile we are hurrying along to Willesden Junction, and 10 or 11 minutes after our departure from Euston at 8.30 a.m., we may expect to halt in the Low Level Station at Willesden, 5½ miles distant. The Willesden stop is a relic of bygone days. Formerly practically every down London and North Western express called at Willesden to pick up passengers from the suburbs who had been brought in by connecting trains; and every up express also stopped for the purpose of ticket collection. But nowadays, to save time, and also because the majority of suburban passengers prefer to join the train at the starting point of the journey, thereby getting a better choice of seats, the Willesden call is a rarity. On the down day "*Irish Mail*," however, it is still preserved, as well as on the following 9.0 a.m. and 9.10 a.m. down Birmingham expresses, for the benefit of suburban people wanting to join the train. Only a brief stop is necessary, and at 8.43 a.m. we are away again on our 77-mile run to the next stop at Rugby.

Photograph] [*Railway Photographs, Liverpool*

A fine photograph specially taken last month for this article, showing the up "*Irish Mail*" passing Kenton

This is an easy stretch. Throughout its length we pass over no gradient steeper than 1 in 330, the summit points being Tring, 31½ miles out of Euston; Roade Cutting, 60 miles; and Kilsby Tunnel, about 77 miles distant. The line rises at this inclination all the way from near Wembley to Tring, save for a short level stretch from Carpender's Park, just before Bushey track-troughs, to Watford Tunnels; then it falls most of the way from Tring to Bletchley, at this and easier grades. Following a level stretch from Bletchley to Castlethorpe, where are situated the second set of troughs, is a similar but shorter rise to Roade Cutting; and from there the line is fairly level through Blisworth to Weedon, whence ensues a third rise to Kilsby Tunnel, and a drop to Rugby.

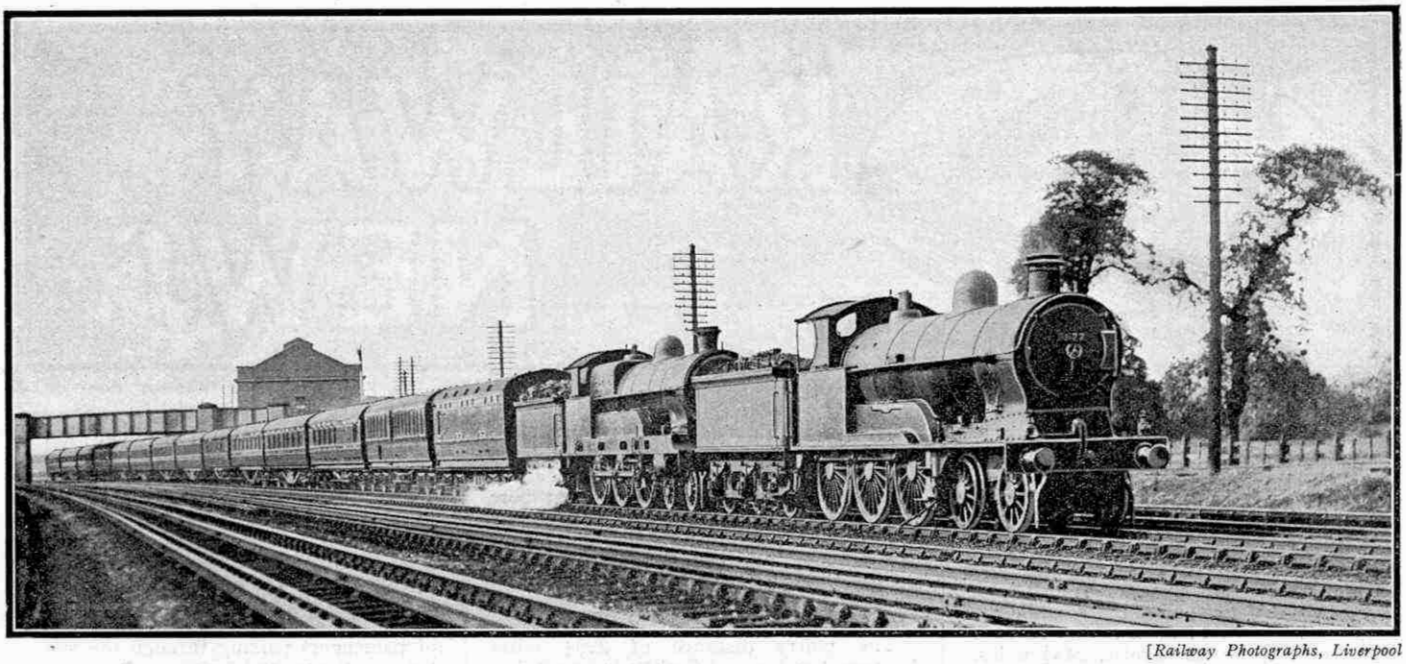
Such gradients are too flat for high speeds with heavy trains. We may touch 60 m.p.h. at Watford, 70 or a shade over between Cheddington and Leighton, and a little over 60 at Weedon; while the three summits should be breasted at round about 50 m.p.h., or possibly a little less at Tring and a little more at Kilsby. The allowance of 84 minutes from Willesden to Rugby ought to be observed with ease, in the proportion of 31 or 32 minutes for the 26 miles from Willesden to Tring, 14 minutes for the 15 miles on to Bletchley, 14 minutes for the 13 miles from Bletchley to Roade, and 24 or 25 minutes for the last 23 miles into Rugby.

We are due away from Rugby at 10.11 a.m., the next stop being at Crewe. For this distance of 75½ miles the timetable allows 85 minutes, inclusive of a long slowing round the Trent Valley curve at Stafford, and the possibility of being slowed, too, on account of subsidences caused by colliery workings under the line at Polesworth, near Tamworth. Shortly after re-starting, the engine takes a third draught of water from track-troughs just beyond Rugby. For many miles there is little worth mention in the matter of gradients. A gentle rise to Shilton is succeeded by falling grades most of the way to Tamworth, with a level intervening strip from Nuneaton to Atherstone; and we may expect to touch 70 miles an hour at both Nuneaton and Polesworth. Between the latter station and Tamworth there will probably be a slight slowing at least through the colliery area previously referred to.

At Hademore, between Tamworth and Lichfield, there lie ahead the fourth set of track-troughs, prior to a 1 in 330 ascent that extends through Lichfield to Armitage. It will be noticed that along the West Coast main line of the L.M.S. the authorities have contrived to lay their troughs at roughly equal spacings of 30 to 35 miles apart, which arrangement accounts for the limited size of tender in use with L.M.S. express engines, rendering possible substantial economies in ton-mileage.

The ornamental entrances to Shugborough Tunnel should be noted as we hurry through Shugborough Park, between Rugeley and Stafford. Brakes then go on for Trent Valley Curve, and we pass through Stafford at 40 miles per hour. From Rugby we shall have taken about 18 minutes for the first 14½ miles to Nuneaton, then 12 or 13 minutes for the 13½ miles to Tamworth, according to the severity of the Polesworth slack. The 13¾ miles from Tamworth to Rugeley may be expected to occupy 15 minutes and the 9½ miles on to Stafford 10 minutes, making 55 or 56 minutes for the 51 miles from Rugby. There is now a long and gentle ascent for 14 miles ahead to Whitmore, which should not take more than 17 minutes, and we shall then have 12 or 13 minutes in hand for the 10½ miles of downhill into Crewe. This includes three miles at 1 in 177—the steepest gradient between Camden and Crewe—on which we may get up to as much as 75 miles an hour at Betley Road—ere the long and severe slowing, through the immense South Sidings and past the South engine-sheds, which precedes the stop in No. 1 main down platform of Crewe Station. At Whitmore, by the way, we passed the fifth set of track-troughs, which are of particular interest in that they were the first track-troughs in any part of the world when John Ramsbottom, then Locomotive Superintendent of the late London and North Western Railway, laid them down as an experiment in 1859.

The platform at which we are stopping in Crewe is not the longest in the country, but it makes a good bid for supremacy, being 1,509 ft. in length. We are booked to halt here from 11.36 to 11.48 a.m., as important connections are made at Crewe, and a good deal of mail matter has to be dealt with. On leaving, we shall have to divide our attention between the fleet of engines of many different types standing outside the North engine-sheds, on the left, and the remarkable suspension bridge on the right, which clears a tremendous width of tracks at one bound, and gives access to the Crewe locomotive works. Glimpses may be caught also of some of the numerous avoiding lines which, by skilful tunnelling, keep clear of the passenger station the whole of the vast freight traffic that passes through Crewe, from no matter which direction it comes—the main line, the Shrewsbury line and the North Stafford line on the south, and the north main line, the Manchester line and the North Wales line on the north. It is through the centre of the locomotive works that we now pass—the works that have created the town of Crewe, with its 45,000 inhabitants, and at which it has been said that everything needed by a railway is made, from finished locomotives to wooden legs for such of the staff as are unfortunate enough to lose them in accidents! This does not include, of course, the carriages and wagons, for the former of which the late L. & N.W.R. established works at Wolverton, and for the latter at Earlestown.

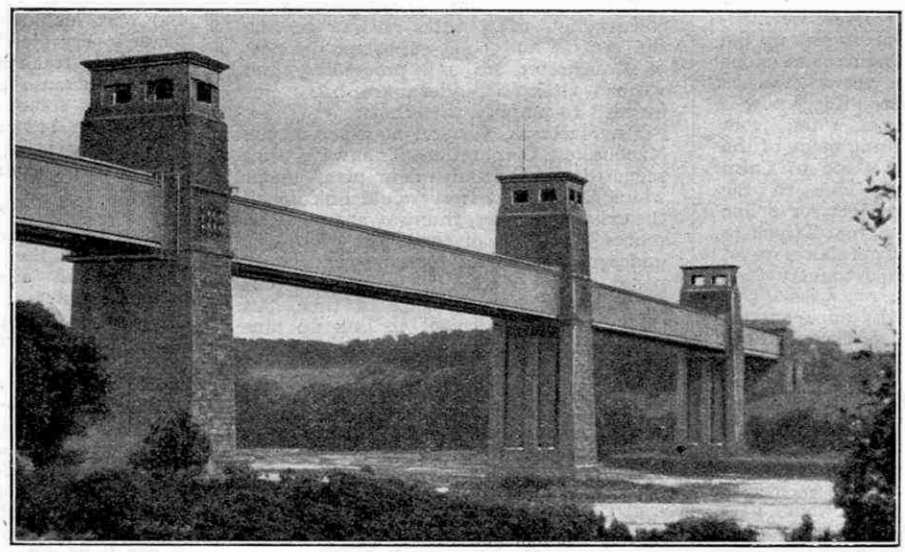


[*Railway Photographs, Liverpool*

The up "*Irish Mail*" at Kenton, double-headed, with a "Prince" piloting a "Claughton"

It is but a short level run of 21¼ miles from Crewe to Chester, and for this the timetable allows 27 minutes. When the night "*Irish Mail*" runs in duplicate, the first portion is booked to run non-stop over the 179¼ miles from Euston to Chester, and the summer "*Welshman*," leaving Euston at 11.10 a.m., goes one better by covering the 205½ miles from London to Prestatyn without a stop. But even this feat has been beaten by the first portion of our own train which, on four Saturdays during the past summer, left Euston at 8.25 a.m. and ran without any stop over the 263¾ miles to Holyhead, arriving at 1.41 p.m., at an average of 50.3 m.p.h.

Important connections from both Liverpool and Manchester are made at Chester, which bring in so much traffic that during the height of the summer a relieving train is run ahead of us from Chester to Holyhead, and we do not pick up passengers. For the Chester stop eight minutes are allowed—from 12.15 to 12.23 p.m.—ere we leave on our final run of 84½ miles to Holyhead. At one time the "*Irish Mail*" was booked to cover this distance in 93 minutes, but the time since the war has been considerably eased out, to 102 minutes.



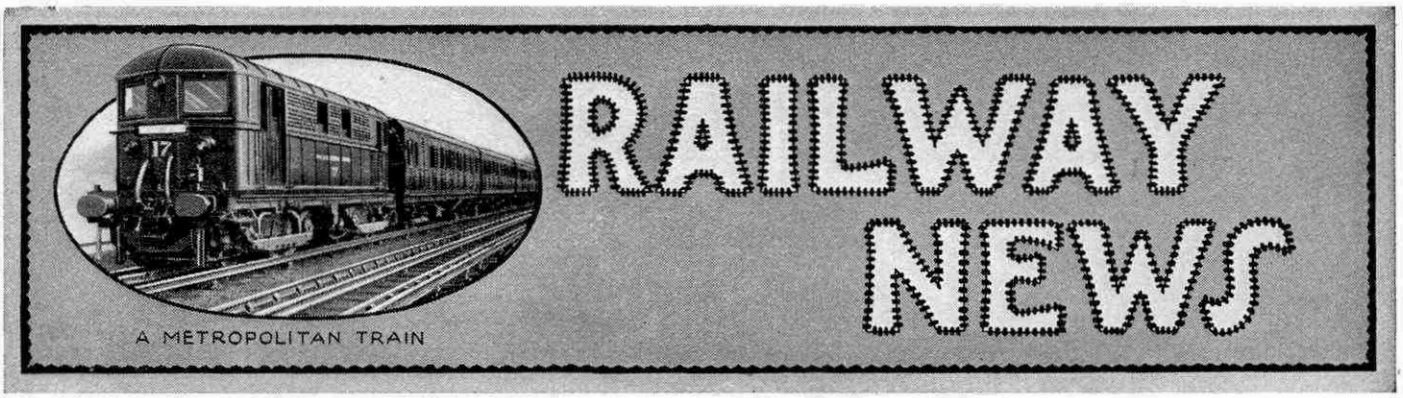
The famous Britannia Tubular Bridge, which plays an important part in the run of the "*Irish Mail*"

There is a 1 in 200-336 down-grade out of Chester, which gives us an excellent start to Sandycroft; after this the line is as near perfectly level as makes no matter for the next 31 miles. The first of the Welsh mountains begin to appear on the left-hand of the train, but we soon come out to the coastline of North Wales, which we are now to hug very closely for more than twice the distance just mentioned. The proximity of the sea, however welcome it may be from the scenic point of view, is not an unmixed blessing to the railway. After we have passed Rhyl, 30 miles from Chester, and have mounted 2½ miles at 1 in 412 and a mile at 1 in 100 from Abergele—scene of a frightful disaster to the "*Irish Mail*" in 1867, when a collision with a train carrying oil and the fire that followed caused the loss of 33 lives—we cross Llandulas Viaduct. In a later year an exceptionally high tide and a very rough sea encroached inland and swept away this viaduct completely. A temporary line with a gradient of 1 in 23 was laid down to the bottom of the valley and up the other side, to bridge the gap; and to the credit of Crewe Works be it said that a new viaduct of seven steel spans was designed, the material was rolled, the girders were assembled and conveyed to the site, and the structure was complete and in use, within a single month of the accident! Further on, too, near Penmaenmawr, the line was breached by the sea in 1899, and two lives were lost by the derailment at the spot.

For the level stretch from Chester to Rhyl, 30 miles, we shall take 34 minutes or so; then follow 14¼ miles of undulations past Abergele and Colwyn Bay to Llandudno Junction, which occupy 17 minutes more. Through Llandudno Junction there is a speed restriction. The line then swings across the Conway River by means of a tubular bridge of considerable span, which provides a foretaste of the much bigger Britannia Tubular Bridge, over which we shall pass presently. At the further end of the Conway Bridge we pass right through the walls of Conway Castle, and are soon again running high above the water round the margin of the Penmaenmawr Mountain, with its busy granite quarries, between Penmaenmawr and Llanfairfechan. Rising on a moderate grade from Aber, first at 1 in 163-220 and then at 1 in 660, we hurry through Bangor, 59¾ miles from Chester, in about 69 minutes from the start.

A mile-and-a-half beyond, at Menai Bridge, we curve sharply northward in order to leave the mainland of North Wales for the island of Anglesey. The Menai Straits at this point are 500 yards in width, and Robert Stephenson, who engineered the route, devised the Britannia Tubular Bridge in order to span the obstacle. Two continuous rectangular tubes, each 1,510 ft. in length and 4,680 tons in weight, have been set up side by side, supported both at the ends and by three intermediate towers; the down trains run through the middle of one tube and the

(*Continued on page* 768)



L.M.S. Non-Stop Runs

Among the train alterations introduced with the summer table was the inauguration of a Sunday run for the "*Royal Scot*" between London and Edinburgh and Glasgow, with a corresponding "up" train. The night express to Perth and Inverness now runs non-stop from Crewe to Perth, a distance of 292 miles, while the "up" train from Glasgow makes no stop between Glasgow and Crewe, 243½ miles. The North Wales non-stop morning express from Euston to Rhyl, 205½ miles, again appears in the timetable.

* * * *

Proposed Railways Across the Sahara Desert

Considerable impatience is being manifested by French Chambers of Commerce at the Senate's delay in instituting the promised inquiry into the proposal to construct a railway across the Sahara Desert. It will be recalled that in our note in the October, 1927, issue, we mentioned that this scheme was to link up the Mediterranean with the French possessions in the Congo. Since then the scheme has developed and the ultimate project now is the more ambitious one of a line from Algiers to the Cape, use being made of the Belgian Congo and the Cape to Cairo lines. The impatience is due to the existence of an Italian project for a line across the Sahara running from Tripoli to the Niger, which, the Italians claim, would pass through more suitable country than the proposed French line.

It is argued in France by opponents of the trans-Sahara scheme that the railway should pass through the maritime colonies of Senegal, Guinea, the Ivory Coast and Dahomey, but against this must be placed the fact that these colonies are already served by railways and the inclusion of them in the new scheme would involve a considerably longer line. The Sahara Railway, on the other hand, would pass through the French Sudan and the Upper Volta, both very rich territories. In addition, military purposes would best be served by a direct route providing branch lines to the maritime colonies.

There are immense difficulties in the way of the project, and if the French engineers succeed in carrying out the work they will have achieved one of the greatest engineering triumphs since the earliest days of railway transport.

* * * *

"Royal Scot" Nameplates

An interesting innovation is being made in connection with the nameplates of the second batch of "Royal Scot" locomotives, Nos. 6125—6149, each of which bears the name of a famous predecessor. Each "Royal Scot" is to have a small brass oval plate showing an etched-in outline drawing of the original engine that bore the name, together with a note below giving the date of the building of that engine and particulars relating to it.

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This Month's Railway Story

The paltry distance of 299¼ miles between London and Carlisle is as nothing to natives of the land of super things. Thus it came about that an American, travelling in the "*Royal Scot*," commented to a fellow passenger that in "God's Own Country one can travel all day and all night and still be in the same State." "Well," replied the Englishman, "we've got a few trains like that, but we keep quiet about them!"

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Manchester's Tube Railway

The discussions on the project for the construction of a tube railway serving the central and chief suburban districts of Manchester are still proceeding, and various alternative ideas are being put forward to amplify the scheme.

Mr. Matteson, General Manager of the Manchester Corporation Tramways, has suggested an entirely new plan, under which the tube railway would link up all the existing railway, tramway and omnibus routes by means of two short lengths of underground railway crossing at a proposed central station. The suggestion is to build only seven miles of tube, but this would be sufficient to link up nine suburban routes operating 27 separate services.

Mr. Matteson suggests also that, after constructing the two tubes, the Corporation should lease them to the railway companies, subject to an agreement that the companies should electrify their suburban lines in conjunction with the electrified tube routes. The suburban railway routes serving Manchester already carry a daily average of 200,000 persons in and out of the four main stations, and thus there is in sight sufficient traffic to provide an immediately profitable return on the outlay involved.

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Reconstructing the Gare De L'Est

During recent years French railways have been subjected to a good deal of criticism—mostly undeserved—regarding out-of-date equipment. Several extensive reconstruction schemes are now being pushed forward that will remove the various grounds of complaint. Among these schemes one of the most important is the rebuilding of the Gare de l'Est, the Paris terminus of the Chemin de Fer de l'Est.

The Gare de l'Est was originally built in 1855. It then possessed only two platform lines, but as traffic grew the accommodation was extended gradually until in 1923 the platform lines numbered 18. In approximately the same period traffic grew from one million passengers per annum to 25½ millions. In 1902 the average number of passengers passing through the station between 6 p.m. and 7 p.m., the peak hours, was only 6,200; to-day over 22,500 passengers have to be dealt with in the same time.

The station is to be completely remodelled, and by the end of 1931 an entirely new station with 30 platform lines varying in length from 900 ft. to 1,148 ft. will stand on the site of the existing station.

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The Growth of Victoria's Railways

Since Victoria's first railway was opened in 1854 between Flinders Street, Melbourne, and Port Melbourne, the system has expanded very steadily, the average yearly increase in track mileage being 80. That rate of increase probably will be maintained for some years to come, for in addition to 112 miles of new lines that are already being laid, the construction of a further 50 miles was recently authorised.

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In several previous issues we have commented on the progressive policy of electrification adopted by the French Railway systems, and it is interesting to note that it is now proposed to embark upon another five years' scheme on the Midi Railway. This scheme involves the electrification of a further 680 miles of lines, bringing the total length of electrified lines on the Midi Railway to 1,200 miles, approximately half the total length of the system. The scheme involves the expenditure of approximately £4,000,000, 40 per cent. of which will consist of materials drawn from Germany under the War Reparations scheme.

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Henry Ford orders model of "Rocket"

Mr. Henry Ford, the famous motor car manufacturer, who was so keenly interested in the G.W.R. locomotive "*North Star*" at the Baltimore Centenary Celebrations, has given an order to Robert Stephenson & Co. Ltd., for a replica of George Stephenson's great old engine "Rocket."

The original "Rocket" was employed on the Liverpool and Manchester Railway, and the replica is to be exact in every detail. Even the scratches and marks on the old locomotive are to be reproduced exactly. The order will involve months of laborious manufacture by hand.

Giant South African "Garratts"

The two largest "Garratt" locomotives yet built for the 3 ft. 6 in. gauge were recently put into service on the South African Railways. From coupling to coupling the extreme length of these engines is 85 ft., their maximum height is 12 ft. 11½ in., and the maximum width 9 ft. 11 in. The wheel arrangement is 4-6-2+2-6-4. The working steam pressure is 180 lb. to the sq. in. and the cylinders are each 19½ in. in diameter by 26 in. stroke. The coupled wheels are 5 ft. in diameter and the tractive effort on the usual basis of 85 per cent. of the boiler pressure is 44,500 lb. The weight of each engine with water tanks and coal bunkers filled, is 183 tons 17 cwt. The capacity of the tanks is 6,000 gallons, and of the bunkers 13½ tons.

One of the most interesting features of the engines, which have been built by I. A. Maffei of Munich, is the coal bunker, which is fitted with an automatic stoker that pulverises the fuel before spraying it into the firebox by means of steam jets. The coal falls down a chute on to a revolving "worm," along which it is carried on its journey to the firebox. At three stages the coal passes against grinders, each of which breaks the lumps into smaller pieces than the immediately preceding grinder. Eventually the coal, in a pulverised condition, reaches two vertical cylinders, up which it is carried by revolving "worms" to the steam jets. The engine fireman is able to place the coal wherever he desires in the firebox by means of mechanism fitted to the automatic stoker.

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The Centenary of American Railroads

The Fourth of July this year marked the 100th anniversary of the laying of the "First Stone" of American Railroads. The charter authorising the Baltimore and Ohio Railroad to construct two or more sets of rails from Baltimore, Maryland, to some point on the Ohio River, was granted by the state of Maryland on 28th February, 1827. The "First Stone" was laid on the Carroll estate just outside Baltimore a little over a year later, and marked what was then considered a gigantic task, the construction of rails from the head of the Chesapeake Bay to the Ohio River. Embedded in the stone, which still stands, is a sealed glass cylinder containing the charter of the company, newspapers of the day and a scroll.

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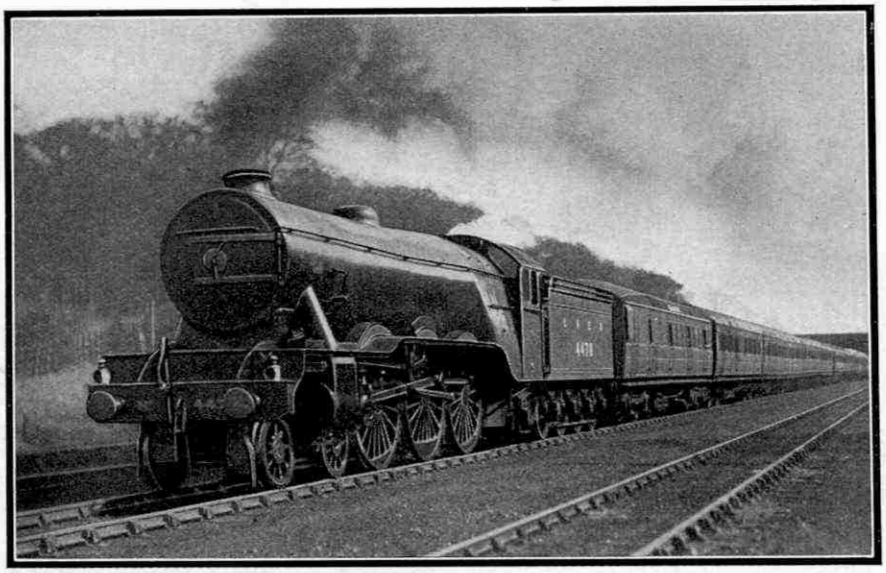
L.N.E.R. Livery

Following the lead of the L.M.S.R., the L.N.E.R. are revising the livery of their locomotives, and in future only the 340 express passenger locomotives of the following types will wear the familiar green uniform: "Pacific," large 4–6–0 (G.E. and G.C. sections), large "Atlantic" (N.E., G.N., G.C. and N.B. sections). All other passenger engines are to be painted black with a thin red lining. The style and position of lettering, names and numbers, will remain unaltered. Goods engines and tanks, formerly painted black and lined with red, will be repainted black without the lining.

The change is being made on the grounds of economy, for the beautiful finish of the livery of a "crack" locomotive is a very costly process.



Photograph] [Railway Photographs, Liverpool

L.N.E.R. Down Leeds Express, near Hadley Wood. 4–6–2 No. 4478

Already several engines have been repainted in their new livery; the first being No. 9497 *"Peter Poundtext,"* passenger, and No. 1420, J38 class 0–6–0, goods.

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Rebuilding the "Claughtons"

Further to the note under the above heading in the July Railway News, readers will be interested to know that so far 13 engines of the "Claughton" class have been rebuilt with the larger boiler, pressed to 200 lb. These are Nos. 5906, *"Ralph Brocklebank"*; 5910, *"J. A. Bright"*; 5948, *"Baltic"*; 5953, *"Buckingham"*; 5976, *"Patience"*; 5972, 5986, 5993 (unnamed); 5999, *"Vindictive"*; 6004, *"Princess Louise"*; 6017, *"Bredalbane"* and 6029 (unnamed). Each of these engines is classified as 5X.

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Bridge Strengthening on the L.N.E.R.

With a view to the operation of heavier locomotives and trains over the Hull and Stairfoot branch, the L.N.E.R. are strengthening certain of the bridges on the line. The system adopted is of special interest in that it is new to this country, although it is common practice in Australia and America. Instead of renewing the flooring of these bridges by taking up the existing floors and replacing them, supporting pieces are being inserted by electric welding. Apparently it is the intention of the L.N.E.R. to adopt the system more extensively, for three electric welding machines have been purchased to carry out the present work.

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Norway's first tube railway was officially opened recently by the King of Norway.

Engine Nicknames

The recent correspondence in the *"Railway Magazine"* on engine nicknames, to which we referred in our July issue, has been continued in subsequent issues of our contemporary, and has brought to light many other interesting facts. Mr. J. T. McKewen mentions the Highland 4-4-0 T engines originally built for South America that became known as "Yankees"; the L.N.E. 0–6–0 T's known as "Chinese Puzzles," and the Highland 0–6–0's known as the "Barneys." It would be interesting to know the origin of these names. Strangely enough the name "Barney" was recently applied by a high L.M.S. official to the new L.M.S. "Moguls," the tank type of which was illustrated on page 393 of our May issue.

Another correspondent refers to the old L.S.W.R. "Beattie" 2–4–0 T's which, because of their tall slim chimneys, were known as "Swan Necks." He continues: "A curious reminiscence about them is that Beattie was jealous of his patents, for a relative of mine, when once making a sketch of *"Firefly"* on the platform at Herne Hill, was stopped by the driver, who told him that the public were not allowed to draw pictures of these engines and that they were instructed to prevent this whenever they saw it being done." The old G.E.R. 2–4–0 express engines were rebuilt with such an ungainly appearance that they became known as the "Humpty Dumpties." It was perhaps inevitable that the small 2–4–2 tanks of the "1300" class, which had side cab windows out of all proportion to the rest of the cab, should be dubbed "Crystal Palaces"!

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A Railway Across the Pyrénées

The first railway line crossing the Pyrénées between Spain and France was recently inaugurated. On this occasion King Alfonso and the President of the French Republic took special trains from Madrid and Paris respectively and traversed the new line to meet at the little station of Confranc.

The railway crosses the mountains at a point 90 miles east of the Atlantic and in its length of 25 miles includes many interesting engineering works. The most important of these is a tunnel five miles in length. In addition there are 14 other shorter tunnels and nine bridges ranging from 40 yards to 100 yards in length.

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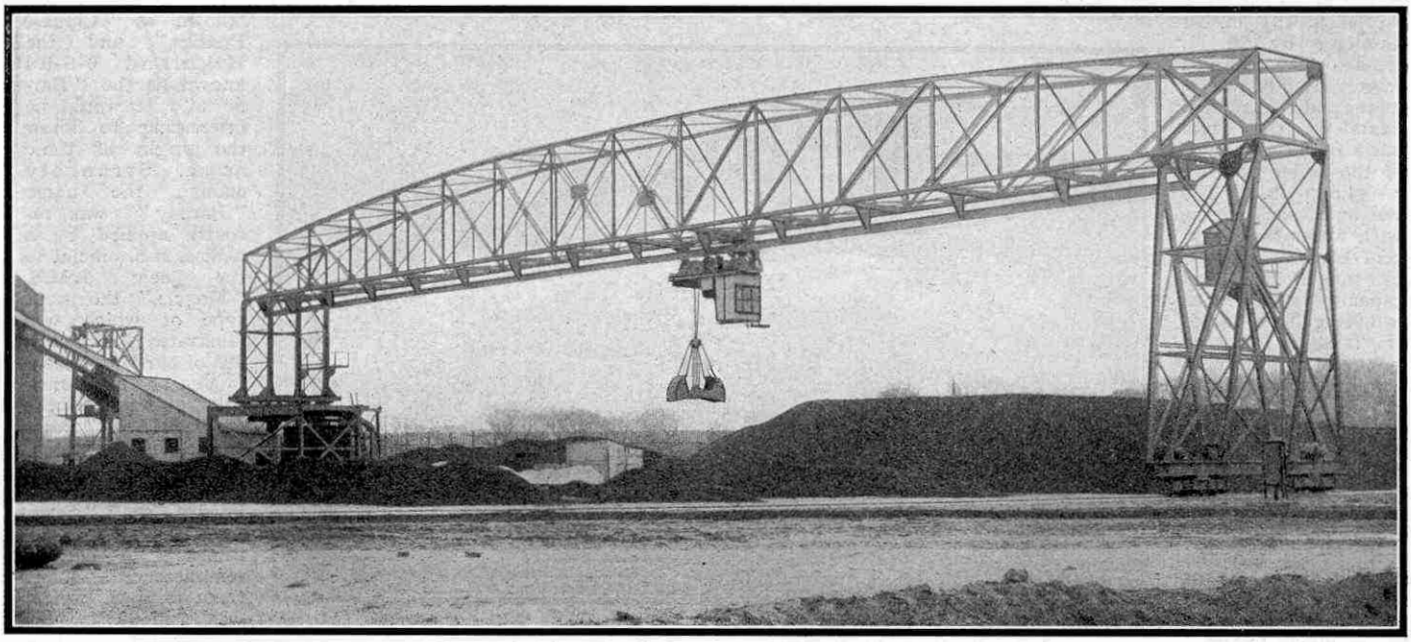
It is proposed to introduce 3,000-gallon milk tank wagons on the L.N.E.R. some time in the coming autumn. The tanks will be of exactly the same type as those that have been running for some months on the L.M.S. and G.W. lines.

Modern Coal-Handling Machinery

A Giant Radial Transporter



THE most striking feature of industrial progress during the past half century has been the tendency to replace manual labour by machinery. This has been the case more particularly in regard to work that involves strenuous and long continued muscular effort on the part of large numbers of men. Cheap power is one of the essential factors in all industries, and countries that are not abundantly supplied with water power are compelled to use coal, either of their own production or imported. The cost of coal fuel makes it absolutely necessary for economical success that it should be used to the best advantage.

Before coal can be used as a fuel it must be hewn out of mines, brought to the surface, screened, washed, stored and transported to the great industrial centres, eventually finding its way into the boiler furnaces. At one time almost all these operations were carried out very largely by manual labour, but gradually machinery has been introduced into one operation after another, with the result of an enormous speed-up in all directions. Even to-day, however, some of these processes are frequently carried on by antiquated means. For instance, men may be seen shovelling coal into a 5-ton motor lorry from a heap or dump. This operation takes four men something like half an hour to complete, and in the meantime, of course, the motive power of the lorry is standing idle. By suitable mechanical means this operation can be carried out in about one-third of the time, making use only of the power of the haulage unit and the services of the driver.

To take another instance, one may see men shovelling coal out of a railway wagon, one man taking a day to unload a 10-ton truck. By the installation of suitable and adequate mechanical means this operation can be carried out in less than three minutes.

One of the most interesting of recent developments in regard to coal handling is the radial transporter produced by Spencer (Melksham) Ltd. An excellent idea of this fine engineering structure may be obtained from the photograph at the head of this page.

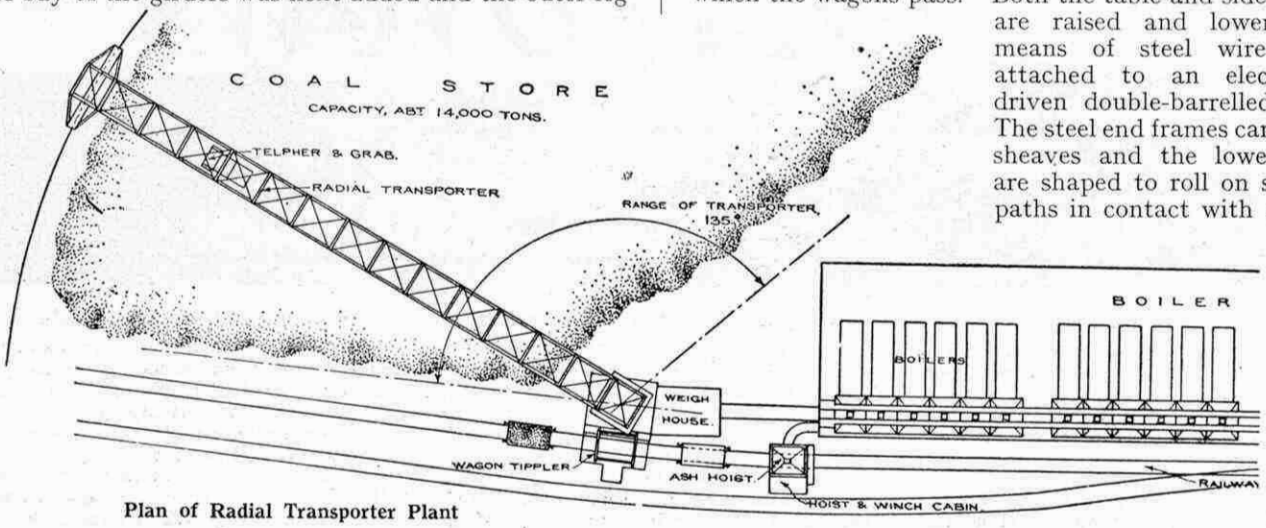
The transporter is of the bridge type, 240 ft. in length and moving radially through an angle of 135 degrees. The inner end is fitted with a turntable revolving upon rails secured to a fixed steel structure, and the outer end is carried on two bogie carriages running on the radial track. Travelling motion is imparted by a reversing electric motor connected to each end of the bogie frames by spurred gearing. The telpher runs on a track just below the main girders and is propelled by a motor through a rocker-joint chain drive.

The grab is of the treble chain type, hoisting being performed by a right and left-hand drum actuated by another motor. The grab jaws are constructed from steel plates and are linked to a pivot coupling by steel rods. The jaws have a capacity of two tons and are opened or closed by the operation of three sets of chains, two sets of which are for hoisting, while the third set controls the movements of the jaws. If all three chains are hauled in or paid out at the same speed the grab travels up or down without the jaws moving, but if the movement of the centre or control chain is checked the jaws open or close, according to the movement up or down of the hoisting chains. All controls, switches, etc., for both hoisting and traversing movements are contained in the driver's cabin, which is suspended from the telpher framing.

It will probably be of interest to mention the method by which the transporter was erected without the aid of

scaffolding. The inner fixed structure having first been completed, the outer steel frame was built up quite close to it with the bogies temporarily set at right angles to their ordinary position on completion, and running upon a set of rails from the centre to the radial track.

A bay of the girders was next added and the outer leg moved slightly away to admit the addition of another bay. This was followed by moving the outer structure bay after bay until the complete span of the bridge was accomplished without the aid of any extraneous supports, although the height to the underside of the girder is 40 ft.



Plan of Radial Transporter Plant

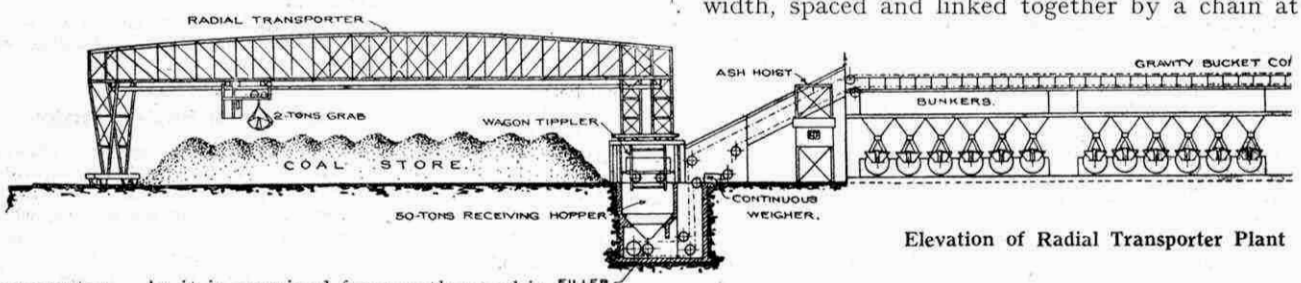
The operation of the plant is as follows. Coal is unloaded from railway wagons by a patent rotary tipper into a receiving hopper, from where it is taken and distributed on the storage area by means of the radial transporter. As it is required for use the coal is reclaimed by the transporter grab and taken to the receiving hopper. This hopper supplies a gravity bucket conveyor that distributes the coal to the bunkers over the whole range of boilers.

The patent rotary tippers of Spencer (Melksham) Ltd. are very interesting. Their various movements are all automatic, including a patent clamping gear that adapts itself to wagons of any height or width, and also is specially designed to avoid any possibility of doing damage to the sides of the wagon. Each tipper is capable of dealing with wagons of from 10 to 20 tons capacity and will discharge upwards of 20 trucks per hour.

Another interesting mechanism is an end tipper operated by hydraulic power. A tipper of this type, in use by the Great Western Railway at Port Talbot, deals with 20-ton wagons feeding a large coal handling plant, and is capable of discharging 30 wagons per hour. It is fitted with an interesting series of patent devices to minimise as much as possible any breakage of the coal, and an hourly capacity of 600 tons can be attained without difficulty.

There is also a side tipper specially designed for the rapid automatic discharge of railway wagons of all sizes and capacities. This tipper is substantially constructed so as to enable locomotives to pass through it. It consists of a table hinged to a side frame built up of steel sections, the former being equipped with steel rails upon which the wagons pass. Both the table and side frames are raised and lowered by means of steel wire ropes attached to an electrically driven double-barrelled hoist. The steel end frames carry rope sheaves and the lower arms are shaped to roll on suitable paths in contact with a series of fulcrum pins. Between the side frames are attached longitudinal cross girders, each being provided with pads against which the wagon rests and is held securely while being tipped. The apparatus is automatic in action.

Conveyors for carrying coal and distributing it to bunkers form an essential part of a power plant. The radial transporter described in this article supplies a conveyor of the gravity bucket type. This consists of a number of buckets about 2 ft. in length by 15 in. in width, spaced and linked together by a chain at each side of the line. The buckets are pivoted so that they are free to rotate on their axes and the whole line forms an endless belt or chain. This chain is mounted on bogie wheels, one pair for each bucket, running on a track erected over the points to which it is desired to carry the coal. Special gears for tipping the buckets are fitted and coal can be delivered to any bunker as desired by setting the automatic dumping levers accordingly.



Elevation of Radial Transporter Plant

For handling coal over long distances band conveyors are particularly suitable. A typical conveyor of this type is the Spencer troughed band conveyor. This band is made of indiarubber and canvas of special quality and runs on rollers slightly longer than the width of the band. It is provided with an automatic travelling throw-off which can be moved backward and forward continuously so as to discharge the load at the pre-determined points. Another type of conveyor includes short vertical steel plates attached equidistantly to a chain at each side of the line. These plates scrape, or scoop the coal into a steel trough capable of dealing with 20 tons per hour.

Trans-Pacific Flight

Two Australian aviators, Capt. Kingsford-Smith and Mr. Ulm, together with two Americans acting as navigator and wireless operator, respectively, recently made the longest oversea flight that has ever been accomplished.

The record flight was the second stage in their attempt to reach Australia from Oakland, California, by way of Honolulu and the Fiji Islands, in a Fokker FVII, equipped with three Wright " Whirlwind " engines. The machine was named the " *Southern Cross,*" and it covered the 2,400 miles between Oakland and Honolulu in 27 hours 27 minutes. Throughout practically the whole of the flight the aeroplane was in wireless communication with land stations, but two hours before the landing at Honolulu was effected the receiving apparatus unfortunately broke down.

Two days after landing at Honolulu the aviators left Barking Sands, on the island of Kauai, en route for Suva, one of the numerous Fiji Islands. After 34 hours 15 minutes the " *Southern Cross* " landed at Suva, having established a world's record with its flight of 3,200 miles over the Pacific Ocean. The last lap of 1,550 miles to Brisbane was completed in 20 hours. The total distance covered by the machine was about 7,000 miles, and on each of the three stages nearly 1,200 gallons of petrol were carried.

A fact of importance that has been demonstrated by this flight is the necessity for all machines making a trans-ocean flight to be equipped with wireless apparatus. In the first and second stages disaster would almost certainly have overcome the aviators, who twice lost their bearings, if their wireless apparatus had not enabled them to secure reports from land stations and thus pick up their bearings.

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Suggested Belgian Air Route Across the Sahara

The Belgian Government have appointed a committee to consider the practicability of establishing a regular air service between Brussels and the Belgian Congo. One of the directors of the Technical Department of Civil Aviation has just completed a tour of investigation in Africa and he considers that a route across the Sahara via Lake Chad will be safer and more practicable than any of the alternative routes that have been suggested, such as along the north-western coast of Africa. The Sahara route would be 5,400 miles in length and would require at least two years of organisation.

Completed Scottish Air Mail Services

A Glasgow aviation company, officially designated as " Aerial Taxis Ltd.," have approached the Air Ministry with a view to obtaining the contract for carrying the mails between the mainland and the West Highlands. These mails are at present carried by steamers, but Aerial Taxis offer to maintain a regular service for mails, passengers, and a limited amount of goods, between the mainland and the Western Isles. Although at present no definite plans as to the routes to be followed or the type of machine to be used have been made, the company favour the use of seaplanes for the service. If an encouraging reply is received from the Government, Aerial Taxis will immediately cause a survey to be made and routes to be mapped out. The same company also have under consideration an air service between Glasgow and Belfast.

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Opportunities in the Royal Air Force

There are 60 vacancies 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 vacancies will be filled by direct entry of suitable boys who are in possession of recognised school certificates, and the remaining apprentices will be selected by means of an open competition. 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.

The selected boys will receive two years' training in clerical duties, typewriting, shorthand, book-keeping and practical office routine. Their general education will also be continued under a staff of graduate teachers.

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

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Another Duration Record !

The duration record set up by Captain Ferrani of Italy and mentioned on this page last month, has now been surpassed by nearly 5 hours and 20 minutes. The successful attempt was made on 5th July by Herrn. Ristiez and Zimmermann, who took off from Dessau aerodrome on a Junkers monoplane. They landed in the evening of 7th July, having remained in the air for 65 hours and 26 minutes. During their flight they covered a distance of approximately 5,034 miles.

Rome-South America Flight

With their flight of approximately 5,000 miles from Rome to Touros (60 miles north of Port Natal), two Italian aviators, Captain Arturo Ferrarin and Major del Prete, established a new world's non-stop distance record. They commenced the flight from Montecelio Aerodrome, Rome, on a Savoia S64, fitted with a 550 h.p. Fiat A22 engine. On the following day they were observed passing over Gibraltar, Casablanca, Rio de Oro and the Cape Verde Islands, and later wireless messages were received by a British ship and at Pernambuco.

Two days after the flight was commenced the aviators sighted the Brazilian coast, but owing to the adverse weather conditions prevailing they were unable to make Bahia as desired, and were compelled to turn northward. Unfortunately the Latécoère aerodrome at Port Natal was missed, and while searching for a convenient landing place the supply of petrol was exhausted and a forced landing was made on the beach at Touros.

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Cross-Channel Seaplane Service

A cross-Channel air service between Calais and Dover was recently inaugurated by the Compagnie Aerienne Francaise. Seaplanes are operating the service, which is scheduled to connect with the boat trains, and the crossing takes only 15 minutes. If the service proves to be popular special " seaplane " trains may be run from Paris and London to Calais and Dover.

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London-India Air Service

Arrangements for the establishment of the long-promised weekly air service between England and India are slowly approaching completion, and it is hoped that the first trip over the complete route will commence on 1st April, 1929. Imperial Airways Ltd., are to receive the contract, and to assist in the establishment of the service, they are to receive a subsidy of £335,000 a year for each of the first two years of service. After the second year the subsidy is to decrease gradually, until it ceases with the tenth year's payment of £70,000. The total amount of the subsidy spread over the ten years will be £2,490,000.

The charges for the carriage of mail matter over the route are to be fixed at a surcharge of approximately 3d. per ounce above ordinary postal rates between England and Egypt, Egypt and Iraq, Iraq and India ; and 6d. per ounce between England and Iraq or India.

Alpine Climbers Saved by Airman

An aeroplane recently saved the lives of two Alpine climbers who were injured on one of the spurs of Mont Blanc. The pilot of an Air Union aeroplane, who was conveying passengers for flights over the highest peaks in Europe, had left Chamonix Aerodrome and was making his way towards Mont Blanc when he sighted two distressed climbers making frantic signals by means of their handkerchiefs and alpenstocks.

He immediately returned to Chamonix and on the underside of the wings of his machine he painted a message in red letters, warning the climbers to remain where they were as help was coming. After circling over the climbers to enable them to read his message, he returned once more to Chamonix and telephoned to Montenvert for a rescue party. The party immediately set out, and guided by the instructions given by the airman, succeeded in locating the two climbers, who were both seriously injured and in a grave condition.

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King's Cup Air Race

The air race for the King's Cup held in July last was won, for the second year in succession, by Captain W. L. Hope, flying a D.H. Moth. The course was a circuit of Britain 1,100 miles in length and the race was spread over two days. The route for the first day followed a zig-zag line from London to Glasgow, while that for the second was laid down the west coast to Bristol and then to Southampton and the finishing point, Brooklands. Captain Hope completed the 1,100 miles at an average speed of over 105 m.p.h., his actual flying time being 10 hours 24 minutes 4 seconds.

The fastest machine in the race was an Avro "Avenger" piloted by Mr. J. Summers, which averaged slightly more than 160 m.p.h. There was one woman competitor, Miss W. E. Spooner, who completed the course in 13 hours 9 minutes 16 seconds, an average of 83½ m.p.h.

The race was unfortunately marred by the mysterious crash in which one of the competitors, Mr. G. N. Warwick, lost his life. Mr. Warwick, who was flying his own machine, an "Anec IV," was reported missing at the end of the first day's flying, and subsequently his body and the wreck of his machine were found on the summit of a small mountain lying in lonely country between Peebles and Selkirk.

New Supermarine Flying Boat

The famous Supermarine Aviation Works, Southampton, have recently produced a new flying boat, which is to be known as the Supermarine "Solent." This machine will be fitted with three Armstrong Siddeley "Jaguar" radial engines giving a total horse power of 1,200, and will be capable of carrying two 18 in. torpedoes, one under each wing. At the rear end of the boat a gunpit is placed, and a gun is also fitted to the front cockpit. The machine has a navigating and wireless cabin, and there is sufficient room in the hull to allow for the slinging of hammocks for sleeping purposes.

The boat is 50 ft. in length, 19 ft. in height, and has a wing span of 75 ft. The area of the main planes is 1,576 sq. ft. The total weight is 16,300 lb. and weight, light, 9,840 lb., making a possible load of 6,460 lb. The maximum speed at sea level is 111 m.p.h., and the machine lands at 54 m.p.h. It possesses a service ceiling of 10,000 ft. With two 1,500 lb. torpedoes on board, carrying 210 gallons of petrol, and flying at 90 miles per hour, the "Solent" is able to fly for 3½ hours; without torpedoes, but carrying 560 gallons of petrol and flying at 85 miles per hour, it can cruise for 11 hours.

The Supermarine Aviation Works also have under construction a new three-engined monoplane flying yacht. This has been designed by Mr. R. S. Mitchell, the designer of the Southampton flying boat and of the world-famous Supermarine-Napier monoplane seaplane, and is fitted as a private yacht. It possesses a large saloon and owner's cabin, and open cockpits are provided in order to allow guests to enjoy the scenery as the boat flies along. In the fore-part of the machine there is a wireless and navigation department, a cooking gallery, and quarters for the crew.

The Latest Blackburn

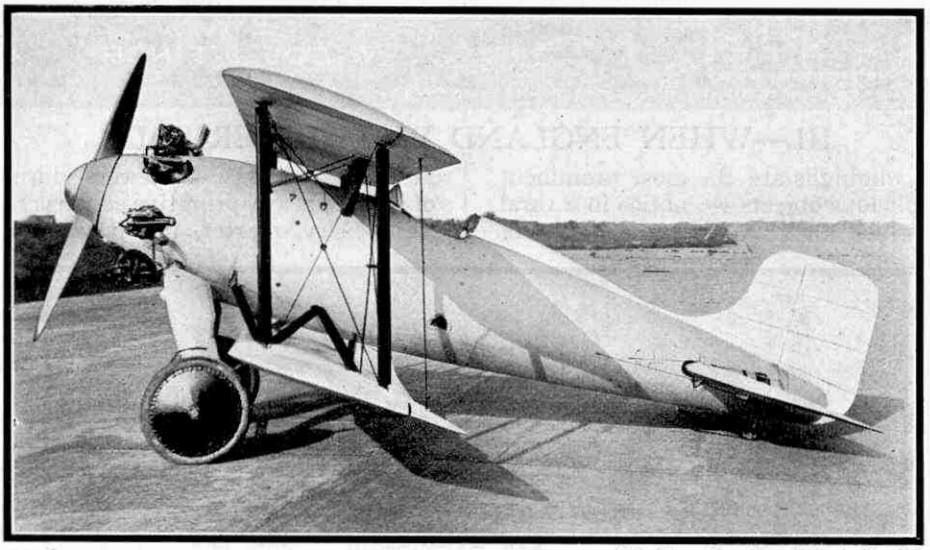

Photo [*Blackburn Aeroplane & Motor Co. Ltd.*

The Blackburn "Lincock" light single-seater fighter is the latest development in Blackburn aircraft. It is fitted with an Armstrong-Siddeley "Lynx" engine, and several of its type are being produced for the Air Ministry

The Blackburn "Lincock"

The Blackburn Aeroplane Company have introduced a new type of light single-seater fighter to be named "Lincocks." The type is designed to carry out exactly the same duties as the heavier and higher-powered type of single-seater fighter usually employed for aerial offensive action, escort duties and offensive from the air against ground forces. Being of lighter construction, the "Lincock" is a far more manœuvrable machine, and, in spite of being fitted with an engine of less power, attains in all other respects a performance very nearly equal to that of the higher-powered class.

The "Lincock" is available in either all-metal or composite construction, a simple structure of extreme lightness and durability being obtained in each case. High performance has been obtained by extreme care in eliminating interference between the various units and in producing a "clean" machine. It is the concentration of the main weight items, such as the engine, pilot and military load, as near to the centre of gravity as possible, combined with the well-proportioned control surfaces fitted, that has achieved the exceptional manœuvrability of the machine. The accessibility of all the units, and particularly the engine unit, is a very satisfactory feature, and as all spares are strictly interchangeable the replacement of detail parts or complete units may be carried out with ease and rapidity.

As the machine is now being built under contract for the British Air Ministry, further constructional details and performance records are not at present available for publication, but it is known that the machine has proved extremely satisfactory under the most rigid tests.

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Lady Heath's Seaplane Record

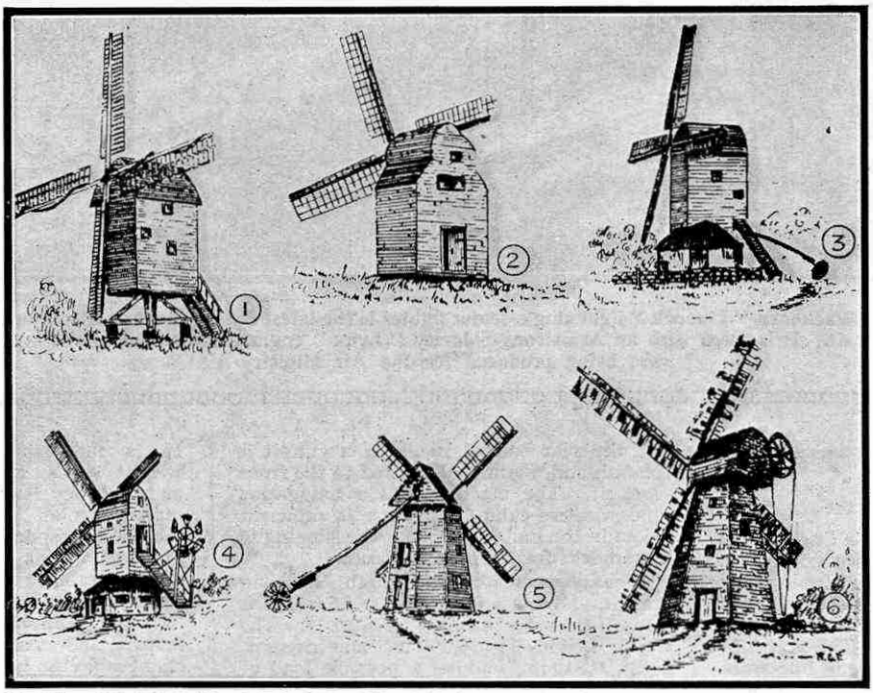
Lady Heath recently set up a new seaplane altitude record at 13,400 ft. She was flying a Short "Mussel" fitted with a 30-80 h.p. Cirrus Mark II engine, and the machine carried a total load of 1,636 lb. during the flight. The total time taken from the start of the flight until the machine reached 13,400 ft. was 1 hour 32 mins. It is Lady Heath's belief that she could easily have passed the 14,000 ft. mark, but the barograph ceased to record after reaching 13,400 ft.

THE STORY OF OUR DAILY BREAD

BY W. COLES FINCH

III.—WHEN ENGLAND WAS UNDER SAIL!

CHURCHES and windmills are the most prominent of all the conspicuous objects we notice in a rural landscape, to which they add a peculiar charm and beauty and impart an interest not readily forgotten. In the hey-day of their life it was principally English wheat that was ground in the now almost vanished mills, for they were the medium between the cornfields and the bread supply of the people. This was in the days when England was a wheat-growing country. Farming was a profitable pursuit and the millers then carried on a large and remunerative business.



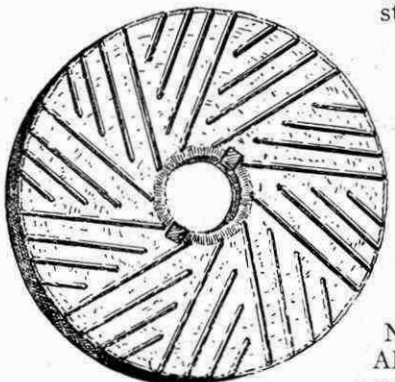
Evolution of the Windmill :—1, Tripod Post Mill ; 2, Sunk Post Mill ; 3, Turret Post Mill ; 4, The same with Fantail ; 5, Pole Windmill with revolving cap ; 6, Tower Mill

In spite of the belief that windmills came from Holland, they probably owe their origin in Europe to England. There is also a story to the effect that they were introduced by the Knights of St. John, who had seen them in use by the Saracens. They were certainly in use in England as early as 1191, however, and in the next century a windmill was erected on Coquet Island, off the coast of Northumberland.

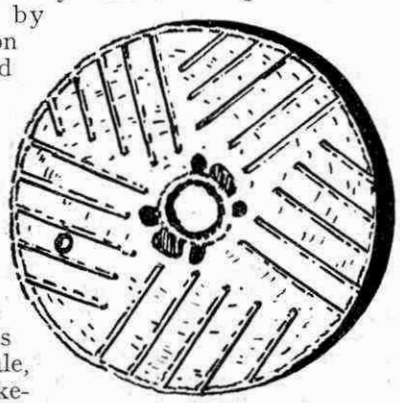
Although these machines were for centuries the most important source of mechanical energy, they were, during most of the time, of very rude and primitive construction. The wind blows from every quarter, but it was long before windmills were adapted to work with any breeze but that one towards which their sails were permanently fixed. The first advance was made when the mill was floated on a pond or canal, so that it could be turned by means of poles and ropes until the arms of the mill were facing the wind.

Later, probably in the thirteenth or the fourteenth century, was witnessed the advent of the "tripod post mill." This mill was erected upon a central post, which was usually cut from a huge oak tree and was often as much as 32 in. square. The base of the post was supported by a powerful tripod of timber securely fixed to the ground, and further supported by diagonal struts. Upon this tripod the mill could be hauled round.

These mills were often removed from place to place. On 28th March, 1797, for instance, the mill at Regency Square, Brighton, was removed about two miles by the combined efforts of 86 oxen. One at Hale, near Liverpool, was likewise removed a quarter of a mile, about 1790, by the



A large Mill Stone, showing Feathers



The upper stone of a Roman Mill, showing the similarity to the stone illustrated opposite

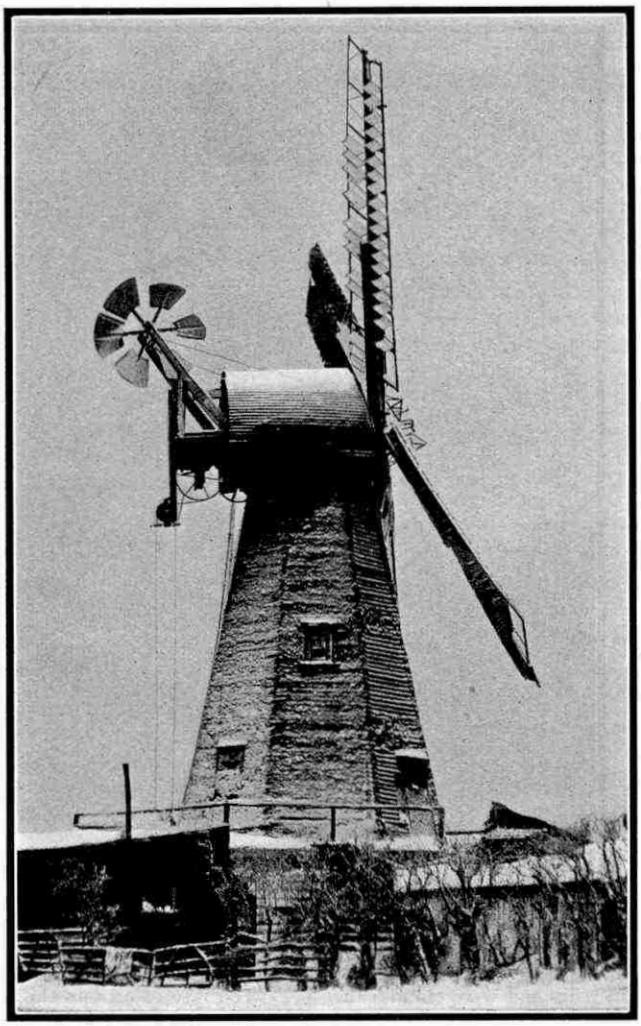
aid of 38 horses. This rhyme commemorates the event:—

"They've moved the wooden mill
To the brow of Sandy Hill,
According to contraction.
If the miller we can trust,
Now we'll have a crust
To our satisfaction."

The line "If the miller we can trust" is particularly interesting. The reputation of the miller was not very good in those days, apparently!

At a later period it became the practice to set the whole mill upon a stout upright post, and it was dragged round by means of ropes to suit the direction of the wind. This was known as the "sunk post-mill," and was an improvement in that it was not liable to "capsize," as was the tripod post mill.

The sunk post-mill was followed by the "turret post-mill," or "peg-mill," which was practically a post-mill set upon a turret-like tower. The complete mill still had to be turned by hand to keep the sweeps "in the wind's eye," however. Later, the idea was introduced of having an auxiliary wheel or "fantail" attached to the mill, by which the sweeps were brought round always to face the wind, however frequently and abruptly it might change. This was a wheel having six or eight blades, set edgewise to the wind, which revolved the mill by a train of gears, the reduction ratio being as large as 600 to 1. In this manner both the tripod post-mill and the turret post-mill were automatically turned to face the wind and take full advantage of its power.



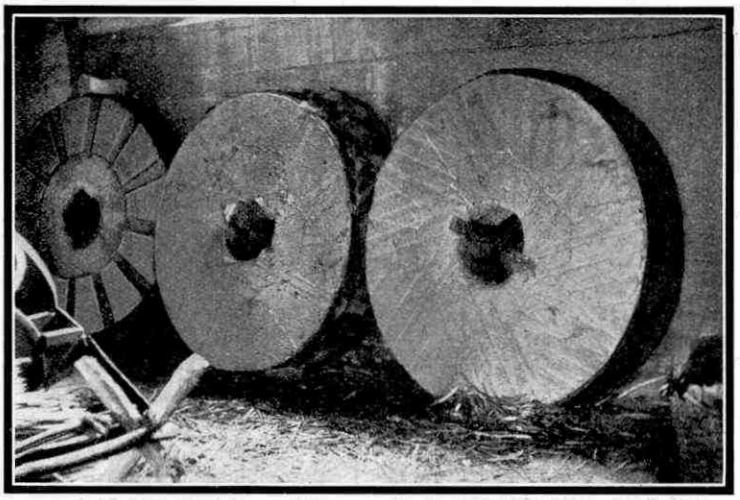
A typical Windmill, with revolving cap and fantail, under wintry conditions

In some cases a long horizontal beam was attached to the mill to give the necessary leverage for turning it. The outer end of this beam was subsequently mounted on a wheel to ease the labours of the miller. Later we find a large "fly gear" or "fantail" was erected over this wheel and geared to it, or else the fly gear was erected over a similar wheel fixed at the foot of the flight of steps that gave access to the mill. In each case, as the wind revolves the fantail it causes the large traversing wheel to travel in either direction, carrying round the beam, and thus keeping the sweeps of the mill facing the direction of the wind. This probably suggested the "tower mill," in which the mill-cap only revolves, its movement being controlled by the familiar fantail.

Even with the advent of the mill-cap the addition of the fantail was not always adopted, for in some instances a large upright wheel was fixed to the cap or dome, in the grooved rim of which was a long rope reaching to the ground. The axle of the large wheel was attached to a small spur-wheel that caused the mill-cap to revolve in any desired direction as the miller pulled the rope.

The final word in the design of windmills was spoken in the 16th century, when the "tower mill" was introduced. This mill was a development of the turret post-mill, a powerful brick or stone turret being erected upon which to construct the mill. This mill needs no further description, for the familiar windmills that once dotted almost every eminence were of this type.

The construction of the four revolving sails, or sweeps as the miller calls them, merits some consideration. They were not only the most conspicuous part of the windmill, but also the most important, for it was upon their proper construction and management that all else depended. In spite of their frail and light appearance when seen from the ground, they were of considerable weight, and were capable of piercing from roof to cellar of the miller's dwelling if by any chance they should break off. The name sails, sometimes given to the sweeps, was due to the fact that originally they were covered with sail canvas.



Three old Mill Stones

They were exposed to all kinds of weather and were therefore so constructed as to be able to resist the stiffest gale that blew. If the wind increased sufficiently to become dangerous, the mill was stopped by the application of the brake, or—as in post-mills—the top was turned round out of the wind and the hazardous operation of reefing the sails was carried out. On the

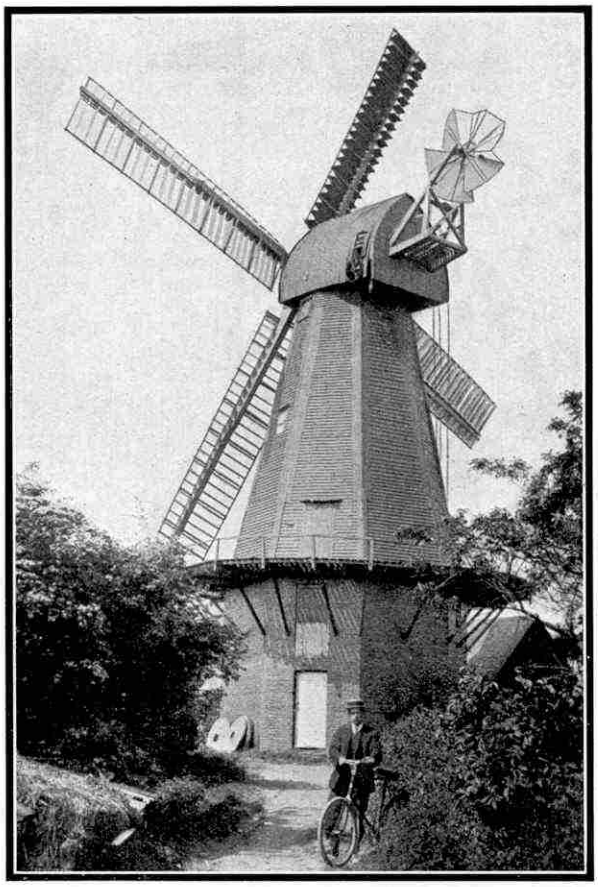
smaller mills the sails were reached from the ground, but the tower mills were provided with a balcony from which the miller could ascend the sail arm and take in canvas in the manner of a sailor out on the yard arm of a sailing vessel.

The sails of the more modern mills were constructed of wooden slats instead of cloth, and the furling was accomplished by a train of mechanism from the interior of the mill, by which the slats were placed at an angle to suit the strength of the wind. The slats were originally laid parallel to the sail length and simultaneously turned through the same angle in the manner of a Venetian blind. Later they were arranged across the sails, especially when the sail arms were very long, in order to keep them of manageable size.

Some mills carried canvas or cloth sails on two of the sweeps and shutter sails on the other two. This method secured the advantages of both contrivances—the cloth sails making use of the power of the lightest breeze, while the shutters could be adjusted to withstand the fiercest gale.

The shaft carrying the four sweeps was set at a peculiar angle to the horizontal, in order to allow the sweeps to revolve clear of the tower. Rectangular sails having a length about five times their width were customary.

The internal machinery of a windmill was of a simple character. It consisted first of the windshaft to which the sweeps are attached. This shaft was sometimes called the round beam, and it carried a large gear wheel that meshed into a small pinion, called a "wallower," on a vertical shaft. The drive was carried to the grinding stone by a large gear-wheel at the bottom of this shaft, which in turn meshed into a small pinion at the top of the stone shaft. The gear ratio at the sail-shaft was usually about 3 to 1, and at the stone-shaft 4 to 1, so that the grinding stone made 12 revolutions for every one made by the wind-shaft.



A Kentish Tower Mill. This picturesque structure was destroyed by fire in 1910

The grinding stones were arranged in pairs and were circular in shape, one being placed on top of the other. The lower stone was securely fixed to the floor of the mill and upon it the upper stone rotated, both stones being encased in a trough or pan. The rotating mill stone was driven by the stone shaft already mentioned, which was mortised into the iron bar secured in an aperture in its centre.

The grain was fed through a trough from a hopper into the aperture in the centre of the upper stone. The outlet of the trough was held close to the stone shaft by means of a spring, and as the shaft was hexagonal or octagonal in shape, it knocked the trough continuously in revolving. The constant shaking of the trough caused the grain to travel forward and fall into the aperture, to be ground between the stones, after which another trough or spout led it into a bin on the floor below.

The great days of the windmill came nearly a hundred years ago. By the middle of the 19th century the country may be said to have been "under sail," so numerous were these "land ships," especially on the Downs of Kent and Sussex. In most parts of England windmills have now almost disappeared, however. So narrow is the margin of financial success that each little catastrophe or accident as it occurs to them seals their fate, and the cost of unusual repair dare not be incurred. Thus restoration is out of the question.

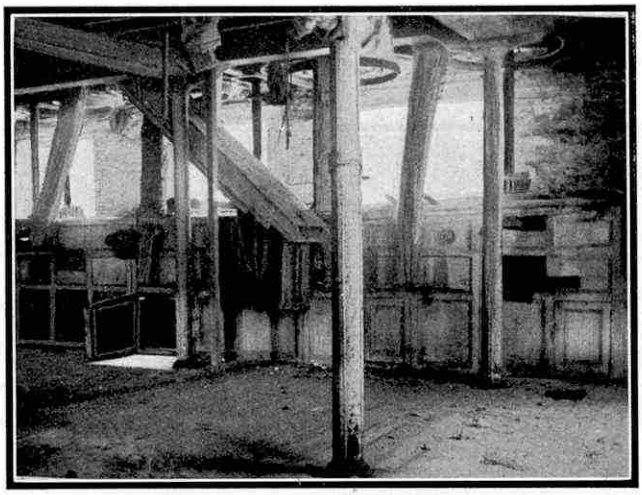
The reason for this abandonment is not far to seek. With windmills the conditions are even less favourable in the matter of reliability than with water mills, and far worse in the matter of power. A fresh breeze exerts a pressure of about ½ lb. to the sq. ft. and will run a mill slowly. The best service is given by a strong wind of 20 miles per hour, which will exert a pressure of 2 lb. to the sq. ft., while the maximum useful effect is obtained in a very strong wind five miles per hour faster. In stronger winds of the type known as gales and storms the sails must be furled or put out of action altogether.

It will thus be seen that for safe, useful working a 25 mile-per-hour wind is the limit, which gives a pressure of only 3 lb. per sq. ft. When we recall the high steam pressures now in common use it is obvious that the fate of the windmill is sealed. In the near future man's ingenuity may devise some means of utilising the swift-moving upper atmosphere, but it will not avert the fate awaiting the familiar windmill.

The once prominent windmills have thus become extinct and useless and, as if bowing to the inevitable, they now stand gaunt and idle in decay. Very many have absolutely disappeared, while others are mere wrecks. Just one here and there, however, affords an occupation and bare sustenance to the miller and his family. To attain even this modest living the miller has to carry on numerous side-lines in addition to his original business—the sale of coke, coals, faggots, eggs, poultry, patent manures, pigs—in fact anything that will supplement the meagre earnings of his mill. One case is known in which the mill survived only because the miller became a baker also.

At Rochester, in Kent, more than 40 active mills have been counted from different points of vantage within a period of 60 years. As late as 1883 there were 29 of these mills at work; to-day there is but one.

The fate of all our old mills, both water and wind-driven, was finally sealed by the demand for a whiter bread. This necessitated the substitution of chilled iron rollers for the old mill stones, and elaborate machinery to eliminate the parts of the wheat which, though nutritious, gave the dusky appearance to the old flour. This is a point to which further reference will be made in later articles dealing with modern milling.



Basement floor of a Mill, showing the Wood Casing enclosing the long shaft from the Water Wheel

The interior of an old mill always has a fascination for boys. One boy who has never lost his love for their old-time machines, and who lives now close by one of our few remaining windmills, gives the following account of some of his youthful experiences:—

"As a boy I frequently spent many happy hours in old mills, and looking back now through the vista of years, well do I remember the deep rumble, whirr and buzz of the stones, the clattering of the sails—called swifts or sweeps by the miller—swinging merrily round, and many other noises peculiar to windmills together with the vibration of the whole structure in varying intensity with the gale.

"Often as I watched the huge mill stones revolving at their work, the Biblical allusion to certain offenders would come into my mind: 'It were better for him that a mill stone were hanged about his neck, and he be cast into the sea, than that he should offend one

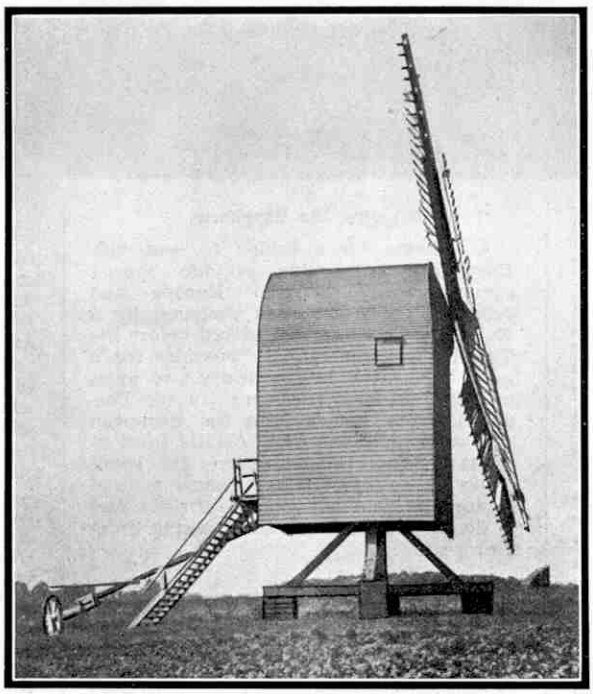
of these little ones.' I remember that I came to the conclusion that the instrument of punishment was unnecessarily cumbersome and heavy for the purpose. I did not then know that the millstone referred to was but the small ' handstone ' or ' quern.'

" All the tasks of the miller were delightful to me. Just pull one mysterious rope, up would go a sack of corn ; ' pop, pop, pop,' said each pair of flaps of the trap doors in the floors above as the sack passed to its destination at the top of the mill to be gently bumped into a cavity in the centre of the moving upper stone, the warm meal coming out of a wooden spout below. The miller would test this meal to see if the stone required adjusting.

" The brake—to slow down or stop the mill—was a positive delight, a veritable curb in the giant's jaws. The mysterious and more delicate operations such as separating the flour from the bran, pollard, etc., charmed me less than the mill itself, the grandest engineering work I knew in those distant days.

" The final ecstasy, however, was to view the surrounding country from the mill cap. Gazing down upon the distant fields under cultivation, such a grand view was presented as was not easily forgotten. In the spring it was a crazy mosaic of brightest and tenderest green shades ; as the season advanced the pattern remaining, the richer hues of the flowering crops added to its beauty, and, with the approach of harvest, the golden corn and scarlet poppy completed the beauty of the design.

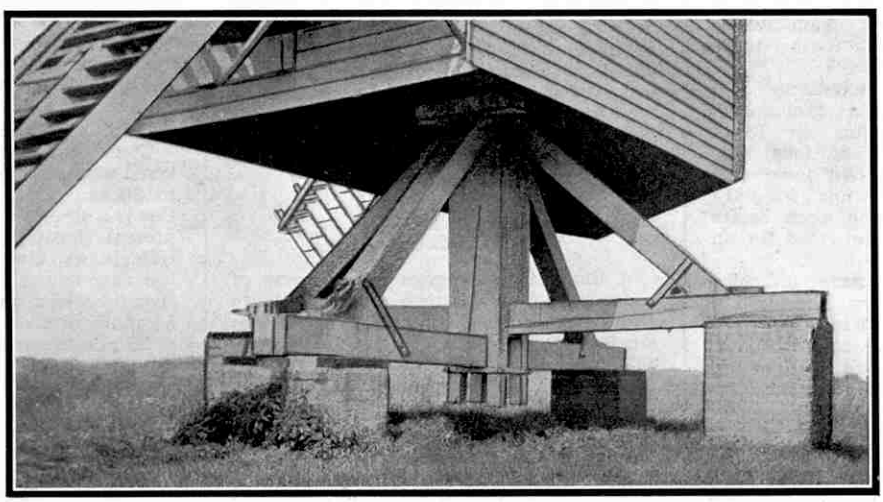
" As I stood in the old mill-cap, the large brake-wheel attached to the vertical spindle wildly revolved, emitting a deep, peculiar, yet familiar rumbling noise, which, with the chorus of quaint sounds peculiar to a windmill, impressed itself deeply and lastingly upon the mind.



A Tripod Post Mill, with beam and wheel to turn it to face the wind

" Another red-letter day was when the stones were dressed. This was the work of a specialist, who, spectacled, would recline on some sacking, and with special tools would with a mysterious air chip away ingeniously at the feathery furrows till they acquired the necessary keenness, occasionally applying the ' staff,' smeared with red ochre, to see if the stone was level."

The nature of the feathery furrows is shown in the accompanying illustration, which shows how these necessary grooves are cut to cause the grain to traverse across the face of the stone, issuing as finely-ground meal from the rim. The stone depicted weighs about 15 cwt. and came from a mill recently pulled down. It may therefore be considered as quite a modern type of mill stone. Here it will be noticed that the grooves or furrows are regularly and systematically arranged.



The foundation on which the Tripod Post Mill shown in the upper illustration revolved

It is interesting to compare the grooving of this modern stone with that of the ancient hand-stone mill or quern shown with it. The specimen is in the British Museum, and it is surprising to find such a remarkable similarity in the design after the lapse of so many centuries. The ancient miller was not so far behind us in mechanical skill and ingenuity as the lapse of years would lead us to expect.

The " old time miller " had a wonderful affection for his mill, to which he always referred as " She." A frequent expression was that " She's been a good old mill in her time," uttered with the same sincerity as he would speak of his faithful wife, or as an old sailor would speak of his beloved windjammer in which he adventured all over the world.

It is curious to note that just at the time when we are deploring the rapid disappearance of the windmill, eminent scientists are suggesting the erection around our coasts of enormous windmills. The object of these would be to raise water from the sea and to convert to our use the power developed by its return, thus harnessing the moving atmosphere and so helping to conserve our present coal supplies. The German inventor Flettner, has suggested that the principle of his rotor ship might be used for a similar purpose. The large flat sails formerly used would be replaced by several rotating cylinders that would derive their power from dynamos driven by wind propellers at their outer ends. This would cause each cylinder to move sideways, thus rotating the centre from which they rotate. The power extracted from the wind in this manner would then be employed for the production of electrical energy.

It would indeed be strange if at some future time history should repeat itself and the windmill once again become a permanent landmark !

In the days when windmills were plentiful curious questions often arose in connection with the supply of air. In earlier times the owner of milling rights was to all intents and purposes the owner of the winds, as he was in a position to prevent the erection of any building that prevented their free access to his mill. With the abolition of the monopolies referred to in the article on water-mills in the August " *M.M.*" the question of the ownership of the winds became more troublesome, and during last century law-suits were often entered upon by millers who found that their supply of this natural power was being interfered with.

Many of these legal actions proved fruitless and expensive. A Sussex mill-owner adopted a much wiser method. His mill at Lewes was shut off from the wind by the erection of a new county gaol. Instead of trying to prevent the building of the prison —an attempt that he probably suspected would end in failure— he decided to take his mill higher than the structure that threatened it with loss of power. It was necessary to raise the mill by 30 ft. in order to be effective. The tower was raised a little at a time by screw jacks and a lower story of brick was gradually built beneath it.

Apparently a miller was at liberty to rear his mill to any height he pleased in order to secure free air, just as a well sinker may bore to any depth he pleases. In this respect the miller who depended on wind was more fortunate than his colleague who worked a watermill. There were often several mills along the banks of a stream and those established on the lower reaches could only work when their rivals higher up allowed a free passage to the water. In some instances this only happened at night, and it is recorded that one ingenious miller so placed rigged up a system of floats and string that aroused him from sleep by jangling a bell when sufficient water to fill his pond came downstream unexpectedly.

L.M.S. Dock Improvements

With the completion of the transfer of the L.M.S. Belfast passenger boat service from Fleetwood to Heysham a big improvement scheme is being pushed forward to develop the Fleetwood fish traffic. New slipways are being constructed, the market space is being increased by 50 per cent. by extending the bays, and the fish dock entrance is being widened from 43 ft. to 53 ft. The shed facilities are being improved by the addition of 60 storage blocks, including a new box storage yard with concrete truckways and an overhead conveyor. In the Wyre dock two new fitting-out berths are being placed, thus freeing space in the fish dock for the discharge of fish. In addition further passenger train berths are being opened up to facilitate communication with the fish market.

Last year approximately 1,600,000 boxes, or 80,000 tons of fish were landed at Fleetwood as compared with 45,000 tons in 1913. Storage accommodation is available for 5,500 tons of fish in the largest ice storage room in the country. The completion of these extensions will justify the claim of Fleetwood to be the fourth fishing port in the United Kingdom. It is of interest to note that whereas in 1891 there was only one steam-trawler operating from Fleetwood, to-day there are over 200.

The L.M.S. are also extending and modernising the plant and accommodation at their Garston docks on the River Mersey. Twenty acres of additional timber storage area are being laid down with extra siding accommodation for 513 wagons. Elsewhere on the dock estate accommodation is being provided for an additional 170 wagons.

During recent years some difficulty has been experienced at the L.M.S. Grangemouth dock in maintaining the necessary water level and as a result it has not always been possible to make use of the available accommodation. This trouble has now been overcome by installing two 195 h.p. electrically-driven centrifugal pumps, each capable of pumping 70,000 gallons of sea-water per minute into the docks. This installation will permit the retention of the maximum depth of water in the docks at all states of the tide.

* * * *

The production of steel ingots and castings in Canada during May amounted to 117,655 tons, an increase of 22 per cent. over May, 1927, when the production was 96,711 tons. For the five months ending May, the cumulative output totalled 531,808 tons, an increase of 24 per cent. over the 427,370 tons of the corresponding months last year.

Bridging the Bosphorus

A scheme for a bridge to span the Bosphorus and thus provide speedy communication between Europe and Asiatic Turkey has been prepared by a Bulgarian Company and placed before the Turkish Government. It provides for a great suspension bridge nearly two miles in length to span the mouth of the Bosphorus from Seraglio, on the European side of Stamboul, to the Asiatic town of Scutari. The bridge is to have two levels providing roadways for tramcars and motor cars, footwalks for pedestrians, and a double track for trains passing from Europe to Asia.

* * * *

£200,000 Generating Station Extensions

A constantly increasing demand for electricity has necessitated the undertaking of considerable extensions to the Battersea generating station. A new turbo-alternator generating set, condenser plant, high-tension switchgear, a circulating water system and an overhead travelling crane have already been added at a cost of £130,000, and the capacity of the station has been increased from 12,500 Kw. to 22,500 Kw. A further sum of £70,000 is to be expended upon a 40,000 h.p. set, complete with the necessary boilers and auxiliary plant, and probably this new installation will be in commission early next year. The total cost of the contemplated extensions, together with those already carried out, is expected to be approximately £200,000.

* * * *

New Dam Construction

A dam of new design is in course of construction at Marege in the Haute Dordogne. Instead of consisting of one single and massive wall, the dam is comprised of five thin, curved, reinforced concrete shells, placed one before the other, and each one slightly higher than the one in front of it. When the reservoir is filled, the water will run between the concrete shells and, so far from pressing on the walls, will actually help to support them over four-fifths of their height. Only one-fifth of each shell will be subjected to direct pressure from the water, and that will be at the top where the pressure is least. It is stated that this system of construction secures an economy of 25 per cent. in building materials.

* * * *

Five feet of ore so rich in lead as to come close to being pure Galena, has been struck at Whitewater mine, Kelso, British Columbia. The ore assays 83 per cent. lead.

Front Wheel Drive for Cars

An entirely new departure from the recognised methods of British car construction has been made in the new 12 h.p. Alvis sports car. This car is fitted with front wheel drive and each wheel is independently sprung.

In cars fitted with front wheel drive the cardan shaft is connected to the front wheels by means of universal couplings, and power is transmitted to the wheels despite the angle at which they may be running. The clutch, gearbox and differential are all in front of the engine, and naturally the need for a rear differential disappears, as the rear axle is free, and each wheel is able to travel at its own speed when taking corners.

With front wheel drive the power is transmitted in whatever direction the car may be travelling, and when turning corners this factor proves of great use as the car has not to be steered against its inclination to travel in a straight line. Instead of the car being heavy to steer owing to the weight on the front axle as might be expected, in actual practice the car is quite as easy to steer as an orthodox rear-wheel drive machine.

Each wheel is sprung separately and thus the very minimum of shock is transmitted to the chassis, while the coach-builder is also allowed much more scope for his designs, as room for the differential and gearbox casings has not to be left.

* * * *

Motor Speed Limits

The speed limit for heavy pneumatic tyred motor vehicles will be raised from 12 to 20 m.p.h. on 1st October. Although this is a step in the right direction, for the present limit has been recognised as ridiculously low, a strict enforcement of the new law is likely to handicap motor coach services, for the schedules laid down for many of these call for an average speed of 25 m.p.h., including stops.

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Three Miles an Hour for 2,860 Hours !

The larger of the two sections of the great 50,000 ton floating dock is now well on its journey of 8,600 miles between the Tyne and Singapore. As was stated in our Engineering News in the June issue, four powerful tugs are guiding the dock during the voyage and an average speed of 3½ miles per hour is being maintained.

The total towage weight of this section is over 12,300 tons, but if rough weather is encountered two 5½ ton anchors will effectively anchor the dock, which is carrying a crew of 80. This number will include two divers, whose task is the immediate correction of any faults that may develop below the waterline during the voyage. Coal will be taken on board the dock and the tugs at Algiers, Malta and Port Said.

The Future of Charing Cross Station

The shareholders of the Southern Railway will shortly be called upon to give a decision as to the future of the famous old Charing Cross Station, for a proposal for the removal of the station to the southern side of the river is to be placed before them.

Subsequent to the presentation of the report of the Royal Commission on Thames Bridges, engineers were asked to prepare detailed plans for dealing with the Strand and Charing Cross areas. They advised the construction of a new Charing Cross Station on the north side of the river, with roads on each side and a double-deck bridge, at an estimated cost of just over £13,000,000, or alternatively a single-deck bridge for road traffic and the removal of the station to the south side of the river. The estimated cost of the alternative scheme which, in a modified form, is to be submitted to the Southern Railway shareholders, is £10,770,000.

The full scheme provides also for the building of an embankment on the south side of the river, similar to the Victoria Embankment on the north, and a new road, running from the south, to connect with the proposed new bridge. The triangular site formed by the river, the proposed new road and the road to Waterloo Bridge, affords an excellent opportunity to create a magnificent new railway terminus and hotel, with an imposing forecourt and frontage. It is stated that nine-tenths of the Southern Railway's directors are opposed to this scheme.

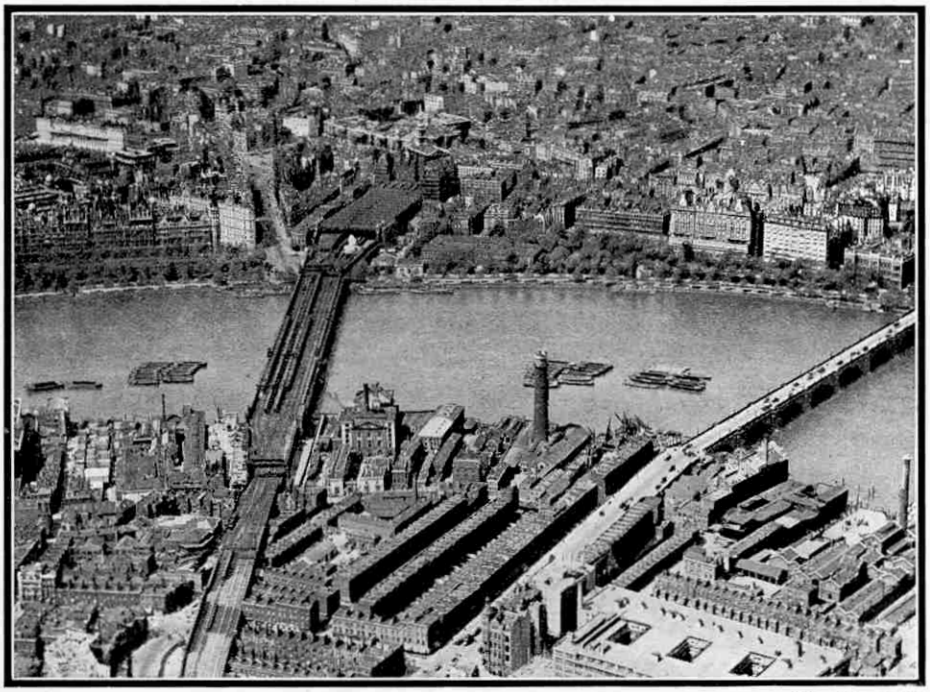


Photo [*Aerofilms Ltd.*

This aerial view of Charing Cross Station, the railway bridge, and Waterloo Bridge with the Victoria Embankment on the further side of the river, is particularly interesting in view of the discussions now going on as to the future of Charing Cross Station

* * * *

New Motor Cargo Vessel

The *"Clan Macdonald,"* a new single screw motor cargo vessel built for the Clan Line, has now completed her trials and is expected soon to be in regular commission. This vessel is of special interest as being the first cargo ship to use a single screw double-acting 4-cycle engine for propulsion. The ship is 430 ft. in length, 57 ft. in breadth and 39 ft. 6 in. in depth. The deadweight carrying capacity on a draft of 27 ft. is 9,500 tons. The eight cylinder single-screw motor is capable of developing 5,200 b.h.p., which is sufficient to secure an average speed of about 14 knots.

The Clan Line also have in course of construction a similar vessel but equipped with triple expansion steam machinery with an exhaust steam turbine. When these two vessels are in regular service an interesting and valuable comparison of the economy and efficiency of the two types of propelling machinery will be possible.

Broadcasting Programmes at Sea

The first of the Canadian National Steamships five new vessels mentioned on this page last month has been named the *"Lady Nelson."* One of the most novel features of this ship will be a wireless receiving equipment for the entertainment of passengers. Leads will be provided to all the vessel's public rooms, making it possible for loud speakers to be plugged in as desired. Passengers travelling between Canada and the West Indies will therefore be able to pick up wireless programmes from the principal broadcasting stations in Canada, United States, and Central and South America. Similar equipment is to be installed in the four sister ships now being constructed at Birkenhead.

* * * *

One Hundred and Ten Miles for a Shilling !

The London County Council Tramways Department make a great feature of their daily shilling tickets that permit a traveller to journey to any part of their system at any time throughout the day. Recently a Stratford man, as a matter of curiosity, embarked upon what one might term an endurance test. He bought a ticket at 20 minutes to nine one morning and, commencing his travels at Maryland Point, he journeyed to Abbey Wood, Catford, Wimbledon, Harlesdon, Hampstead, Highgate, Woodford, Epping Forest and Central London. He completed his journey at 7.47, after riding for 11 hours and breaking his journey only once, when he decided that he was entitled to a quarter-of-an-hour for tea. He changed trams 18 times and actually travelled 110 miles in the course of his day's outing ! The cheapness of this day's outing becomes more obvious when it is realised that a railway journey of the same length would have cost at least five shillings.

Harnessing the Wash

The Dynamic Electrical Company, of Sheffield, have a scheme on foot to establish a hydro-electric power plant on the Wash, in Lincolnshire. The proposal provides for the division of the Wash area, consisting of about 158 square miles into two basins of 100 square miles and 58 square miles respectively. The larger of the two will be the full basin and the other the empty one. Two dams will be built, one at the mouth of the Wash, fitted with inflow sluice gates to allow the water to flow into the basin at high tide and locks to allow the passage of ships, and the other to divide the full and empty basins.

The power station will be built upon the dividing dam and will be so arranged that the water will fall 15 ft. through turbines in passing from the high to the low levels. The overflow from the power station will find its way back to the sea by way of outflow sluice gates in the sea dam when the tide is at ebb, thus providing for a continuous supply of power. The sea dam will be approximately 12½ miles in length and the dividing dam about 13 miles in length. The approximate cost of the scheme is estimated to be under £7,000,000.

* * * *

Electric Marine Propulsion

One of the most interesting features of marine engineering practice in recent years has been the increased adoption of electric drive for the propulsion of ships. It is, indeed, now the accepted policy of the United States Navy that all its largest ships shall be electrically driven.

There are great economic possibilities in the installation of turbo-electric machinery, particularly where a greater power than 2,500 s.h.p. is required. The P. & O. Company are equipping their new liner, *"Viceroy of India,"* which is to be launched shortly, with turbo-electric machinery developing over 17,000 s.h.p. The steam portion of this installation is to have a working pressure of 370 lb. per square inch and a steam temperature of 650° F. The auxiliary drive of the vessel is to be duplicated to allow either turbo-electric or Diesel-electric drive to be employed, according to circumstances. The Diesel-electric system is more economical in production up to 2,500 s.h.p.

The Panama Pacific Line have now had an electric liner in commision for some time, and they are so satisfied with its performance that a sister ship is at present under construction, and a third vessel is soon to be ordered.

The Electrification of the Metropolitan Railway

(2) Permanent Way and Rolling Stock

LAST month we described how the decision to electrify the Metropolitan Railway was brought about, and the subsequent building and equipment of the power station at Neasden and the necessary sub-stations for the distribution of the current supply. We come now to the permanent way and the rolling stock.

The equipment of the permanent way for electrification was carried out by the railway company's own staff. This work was attended with considerable difficulty as it was necessary that it should be carried on without interfering with the traffic on the line. The service was a very frequent one, and the result was that the task was much more troublesome than the equipment of a new railway. Much of the running track was re-laid with new rails, chairs and sleepers, the rails being of the British Standard Section, 95 lb. per yard.

A typical Electric Coach Train in Moorgate Street Station

Two conductor rails were laid on each track. The positive conductor was placed 3 in. higher and 16 in. outside the outer track rail, while the negative conductor was laid 1½ in. higher than the track rails centrally in the four-foot way. These conductor rails were of a very strong Vignole section weighing 100 lb. per yard, with an extra broad and thick base. They had an electrical resistance only 6½ times that of pure copper. The positive conductor was protected by wooden guards where necessary, as its potential was 600 volts above earth. The negative conductor between the rails was unprotected as it is normally at earth potential. Both conductor rails were supported by vitrified porcelain insulators and for the most part were supplied in lengths of 45 ft. These lengths were bonded together by means of four copper bonds, built up of copper wire in order to give flexibility and fused into solid copper terminals at their ends. These terminals passed through holes in the bottom flange of the rail and were closed tightly on to it by means of a portable hydraulic compressor capable of exerting a pressure of 30 tons.

Details of the Re-constructed Locomotives

Weight in working order	About 56 tons
Motor equipment	Four 300 h.p. motors
Traction system	600 volts supply to positive Negative collector rail insulated
Brakes	Westinghouse and vacuum
Length over buffers	39 ft. 6 in.
Length over body	35 ft.
Width over body	8 ft.
Height from rail	12 ft. 4½ in.
Wheel base of motor bogies	9 ft. 3 in.
Total wheel base	29 ft. 6 in.
Diameter of running wheels	43½ in.

The new rolling stock for the electrification was made by the Metropolitan Railway Carriage and Wagon Company at their Birmingham and Manchester works from designs supplied by the railway company.

The cars, which were of two classes, were 52½ ft. in length and arranged with both transverse and longitudinal seats. The ends of the cars were provided with sliding doors and patent swinging gates to give access to the station platforms. The cars were brilliantly lighted and tastefully furnished and were fitted with electric heaters. In the construction every provision was made to ensure the fullest possible protection against fire. Wherever it was possible to do so, sheet steel panels, asbestos, slate and other non-combustible materials were introduced. Each car was mounted on pressed steel four-wheeled bogie trucks so that there were four axles to the car, each of which in the case of the motor cars was driven by a separate motor of 150 h.p. Thus the normal train, which had six carriages, those at each end being motor coaches, carried eight electric motors giving a total driving power of 1,200 h.p.

The motor cars weighed approximately 39 tons each and the trailer cars about 20 tons. The length of the under-frame of the motor coaches was 50 ft. 10 in. overall and the width 8 ft. Centre buffers, draw-bar, shackles and springs were fitted to each end of the car,

and also an arrangement of screw shackles for coupling to the ordinary rolling stock. The body of the car was arranged to seat 49 passengers, with a driver's compartment and a compartment for luggage at one end and a covered-in platform at the other end. The floor was of sheet steel, 6 lb. to the sq. ft., riveted to the under-frame and covered with an indestructible material $\frac{5}{8}$ in. in thickness. The bottom panels of the body and the inside lining were of sheet steel. The window-frames and pillars were of Burmah teak and the interior was finished in natural oak. The cars were thoroughly ventilated without draught, the ventilators being grouped into four sections operated by levers and quadrants at each end of the cars. The lighting was supplied by thirty 120-volt 32 candle power lamps, arranged in six circuits taken off two separate mains so that in the event of one main failing the other was still available.

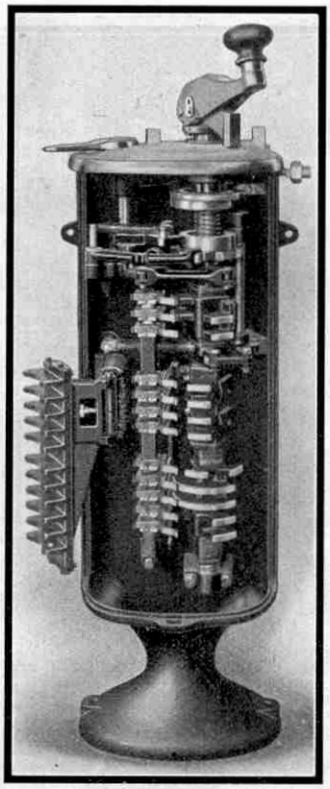
Permanent Way at Wembley Park showing the Westinghouse Signalling equipment

The four-wheeled bogie trucks on which the bodies of the cars were mounted were made by the Leeds Forge Co. Ltd., and were constructed of compressed steel frame plates. They were provided with laminated side bearing springs and elliptical bolster springs in order to secure their easy riding. The total weight of each bogie, including springs, axle boxes, wheels, axle, gear wheels, and supports for collector shoe beams but excluding any other electrical equipment was 5 tons 8 cwt. The wheels were of the open spoke type with rolled steel tyres and were 36 in. in diameter on the tread.

The brakes were of the Westinghouse automatic quick-acting compressed air type with one brake block to each wheel. They could be operated by hand from the driver's compartment or from the platform at the end of the car.

Each motor car was equipped with four motors of the Metropolitan-Vickers Electrical Company's 50 M type. They were of 150 h.p. and there were two driving motors on each truck, so that every wheel of the motor car was a driving wheel. There were thus eight motors in each train giving a total of 1,200 h.p., capable of driving the train on the reverse City and Suburban stopping service and of obtaining a balancing speed of 40 miles per hour on straight level track. The motors were suspended from the axles by bearings in the usual manner. The power cables were not run through the trains, but only multi-core control cable carrying 14-volt battery current was conveyed from coach to coach for controlling purposes. Each motor car picked up its own current from the conductor rail and the power cables ran from the collector shoes to the controlling equipment on the car, through the motors and back to the contact shoes on the negative conductor rail.

All the trains were fitted with the Metropolitan-Vickers Company's system of electro-pneumatic multiple unit control. This system allowed of the possibility of quickly building up or splitting up the trains with one or more motor cars combined with trailer cars as the density of the traffic might require; but possibly the greatest advantage of the system lay in the high rate of acceleration that could be obtained by having a number of pairs of driving wheels distributed along the length of the train. This rapid acceleration is of the first importance when dealing with a railway where stops are frequent, and it can be obtained much more easily by distributing the driving power over many wheels and thus utilising the weight of the coach itself, than by concentrating it in the locomotive, the weight of which requires power to transport it and which in itself produces no revenue.



A sectional view of the Master Controller

Each motor coach equipment included a reverser, an automatic overload current and no-volt relay, a current limit relay and one or more small master controllers. There was also a switchboard for controlling the car lighting, compressor and battery switches.

The overload and no-voltage relay was connected with the operating magnet of one of the cylinders actuating one of the electro-pneumatic contactors in the controller. This contactor acted as the main circuit breaker. The no-voltage part of this relay prevented the sudden restoration of full voltage to the motors after any unforeseen interruptions in the supply of power, and when it acted it caused the controller contactors to assume a position in which resistance was included in the motor circuit. This was then gradually and automatically notched out through the medium of the current limit relay as soon as the supply was resumed. There was a time lag in the

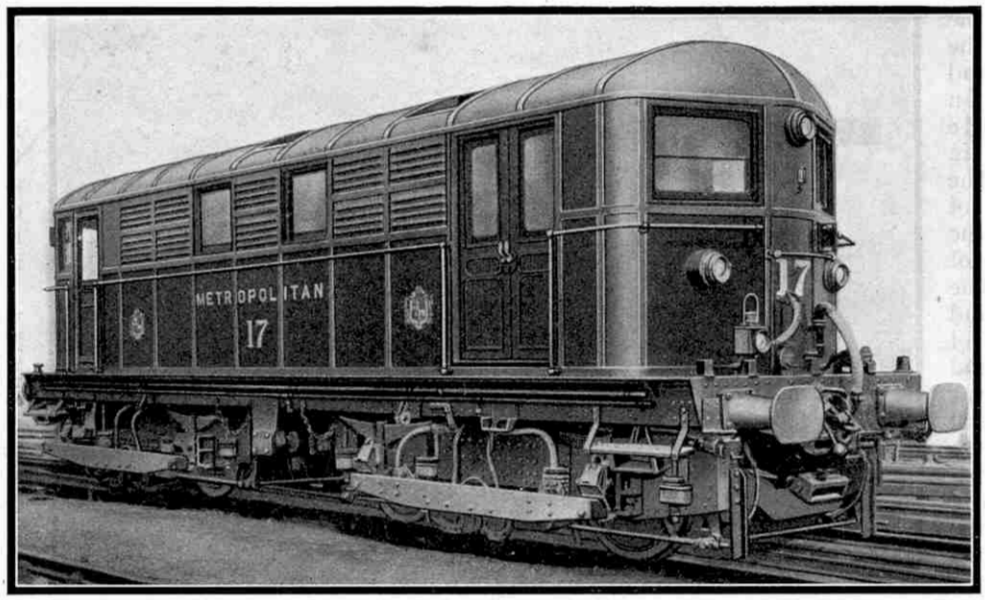
action of this relay so that it did not operate for momentary interruptions due to the car contact shoe passing over points or crossings.

The master controller, which was operated by the driver, had five notches for forward running and five for backward running. On the first forward notch the emergency brake valve was set; on the second the main supply circuit was closed and the reverse was set; on the third the motors were connected in series with all resistances in. At the fourth notch the automatic current relay device came into action and the electro-pneumatic contactors continued to close—providing they were not checked by the current limit relay—until the eight resistances were cut out, the limit switch coming into play in order to maintain a uniform accelerating current. At the last notch the contactors were operated in such a manner as to change the connections of the motors from series to parallel running, and the automatic accelerating device once more came into play and cut out the resistance step by step until the motors were running in parallel across the line. It should be noted therefore that even if the driver were to throw his handle over to the full parallel position when starting, the controller would still work automatically and gradually through all the series and parallel positions. A great advantage of this automatic acceleration, apart from the fact that it makes it impossible for careless driving to damage the motors, is that it ensures the utmost economy in power consumption.

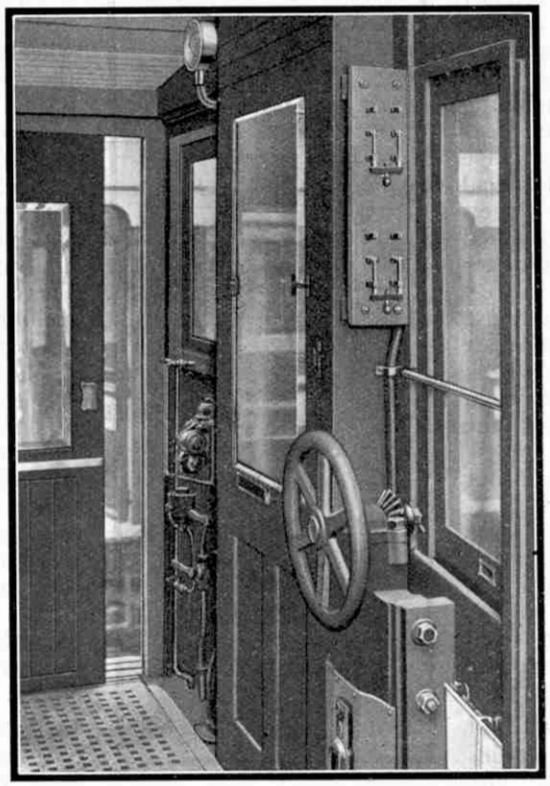
If the motorman lost hold of his controller handle through accident or sudden illness, the handle would return to its "off" position. This action immediately cuts off the current and at the same time put on the air brake throughout the train.

Since the beginning of the electrification considerable additions have been made to the rolling stock, but the electrical equipment has not varied greatly. The first delivery consisted of 102 motor coaches and 192 trailer coaches, and shortly afterward 10 locomotives equipped with 200 h.p. motors. During 1908 a further 10 locomotives were delivered and motor coaches and trailers have been added from time to time, so that the rolling stock owned by the company in 1922 consisted of 20 locomotives, 178 motor coaches and 333 trailer coaches. The 20 locomotives were entirely re-constructed between 1919 and 1922, and to all intents and purposes are new locomotives with entirely new motor and control equipment. The latest addition carried out in the years 1922–3 consisted of 20 re-constructed electric locomotives. These locomotives are of the 0–4–4–0 type and consist of two bogie trucks on which the body of the locomotive is carried in a similar manner to a motor coach body. Each truck is equipped with two 300 h.p. self-ventilated motors driving the running axles through single reduction gear. This type is thus a very simple one and is admirably suited for the class of service required by the railway company, where both non-stop express running and running with frequent stops are necessary on the same journey and where the speed does not generally exceed 60 m.p.h. on non-stop runs.

The current is collected by means of four positive and four negative shoes on the locomotives. The positive shoes are in duplicate, one set on each side, and the negative shoes are arranged along the centre line. In addition, a power bus wire connected to shoes on certain coaches is fitted on the trains to be hauled, and connected to the locomotive, as where complicated sidings and crossovers occur the gaps between the ends of the collector rails are too great to be spanned by the shoes on the locomotive alone. Arrangements are provided to enable two or more locomotives to be coupled together and driven from one driver's cab.

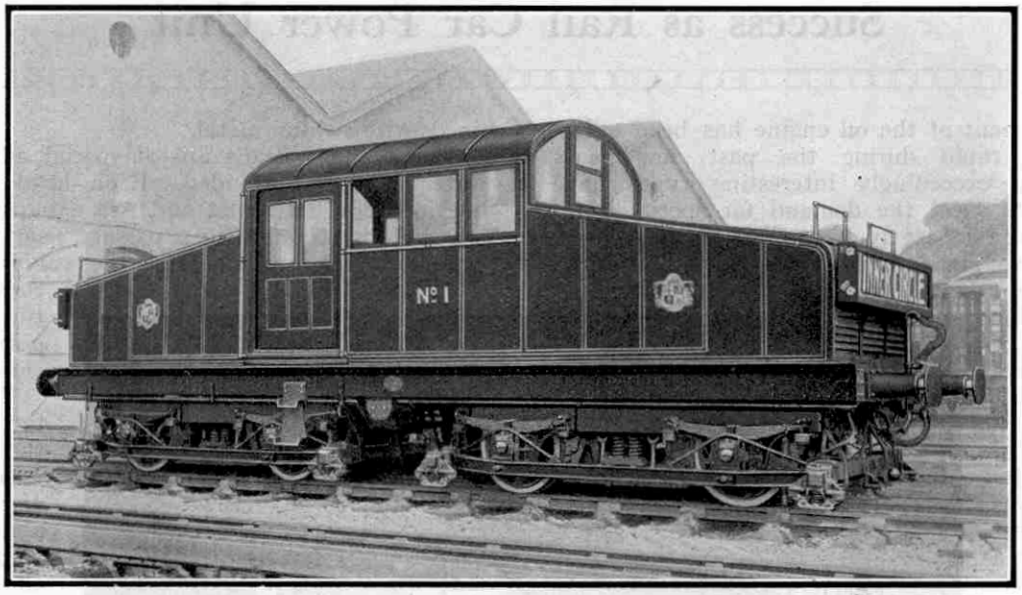


One of the reconstructed locomotives; an interesting comparison with locomotive No. 1



The Motorman's compartment

The control system is the Metropolitan-Vickers "All-Electric" control that has been in successful use for many years on the Southern Railway. Automatic acceleration is provided and ensures a constant rate of acceleration with a given weight of train, no matter how quickly the driver may throw over the controller. The driver is able to reduce the rate of acceleration and of running on certain shunting notches when marshalling trains or carrying out similar operations. Driving positions are arranged at each end of the locomotive, each position being provided with the necessary master controller, the driver's brake valves, etc.



Locomotive No. 1 as originally built. This locomotive has since been redesigned and modernised

A dual system of brakes is provided, the Westinghouse compressed air brake being generally adopted while shunting in the yards and the vacuum brake when operating the trains, which are fitted with the automatic vacuum brake system. The brake system is provided with the trip-cock arrangement in regular use on the Metropolitan Railway. This arrangement ensures that the brakes shall be automatically applied and the power cut off from the motors in the event of the driver running past certain definite positions when the signals are against him. This device effectually guards against a lapse on the part of a driver.

Modern Harbour Construction—

(*Continued from page* 708)

special storage drums, if necessary in several layers. The steam engine and drums are connected by a four-fold toothed-wheel gear. The hoisting and lowering velocity is 1 ft. 4 in. per minute.

The crab traversing motion is derived from one of the two intermediate shafts with the aid of an elastic band coupling, as the crab-traversing winches and hoisting winches must be able to work simultaneously, if crab traversing is to be possible without hoisting or lowering of the load taking place at the same time. The crab-traversing speed can be increased up to 15 ft. 9 in. per minute. In order to enable the blocks of stone to be lowered quickly to some point just above their definite position, the lowering speed can be increased to four times its normal amount—that is 5 ft. 3 in. per minute—by cutting in suitable gearing, without the steam speed of the engine having to be increased. Both motions are controlled by weighted brakes that are released automatically as soon as each change of gear is completed.

The entire winch plant is controlled from the operator's house in the front bridge column, where he has a good, short-range view of everything that happens while hoisting and submerging the concrete blocks. Wire ropes transmit all control motions to the winch house from the operator's cab. Although they are not a particularly reliable method of transmission, wire ropes were nevertheless given preference in this case because they made direct remote control of the winch plant possible from a really favourable centre of observation.

The gripping device for carrying the blocks had to be designed with the greatest care and attention, as all bending and ensuing tensile stresses had to be avoided as much as possible, concrete that is not reinforced being very sensitive to such stresses. To this end each block contains two shafts running through from top to bottom. Four claws are lowered down to the bottom of the block through each of these shafts, and grip the block from below. At the bottom of the block small guiding links and a wire-rope pull make the four claws of each group spread apart like an umbrella. The gripping claws are operated by hand or electric motor from a platform on the crab. Even distribution of the weight of the block between the eight claws is ensured by the extensive use of balancing devices. The claws are interconnected by balancing levers, and each pair of levers, with intermediate cross links on common levers, forms a group of claws. These groups are in turn connected with the main balancing beam by cross links, whence the load reaches the pulley blocks almost completely balanced.

For the details of this interesting crane and also for the illustrations we are indebted to the Demag Aktiengesellschaft of Duisburg, Germany. This firm made the whole of the preliminary plans, calculations, and final plans for the crane, with the exception of those for the pontoon; and also built the crab and gripping appliances as well as the winch plant.

In conclusion it is interesting to note that the Demag supplied a floating crane of a similar type to a shipyard in Dantzic as far back as 1903. It was found, however, that this particular type of crane was not suitable for dockyard and shipyard work.

Conquest of the Air—(*continued from page* 746)

trial flights but ultimately was wrecked in a high wind. After this the inventor appears to have lost all interest in flying machines.

During the latter half of the 19th century a great many experiments were carried out by various inventors of flying machines. It was still believed that the solution of the problem of designing an efficient machine was to be found in some sort of artificial wings and most of the contrivances that were built or proposed had wings and bird-like tails.

An interesting machine was designed and built by a Belgian shoemaker, de Groof. This machine did not take off in the usual manner but was attached beneath the balloon and hoisted into the air, subsequently being released and afterwards being manipulated by the occupant. Considerable difficulty was experienced during the trials in separating the balloon and the aeroplane at the desired moment but this was accomplished on one occasion after the machine had been carried to a height of 3,000 ft. This success, however, was quickly followed by tragedy. After leaving the balloon de Groof endeavoured to manipulate his wings but for some reason or other the apparatus failed to work. The machine fell rapidly and landed with a crash upon the pavement in Chelsea, the unfortunate inventor being killed instantly.

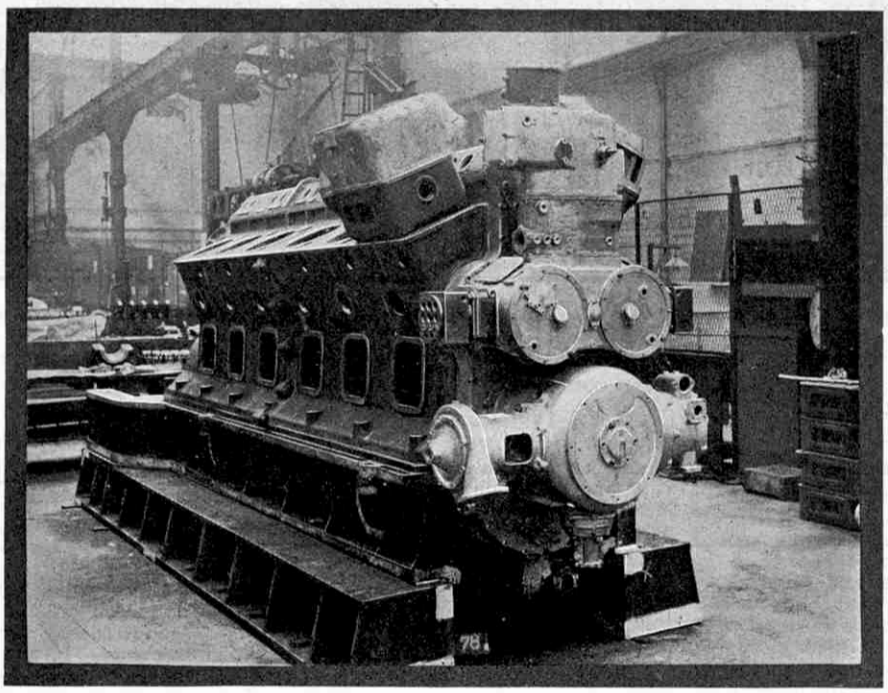
NEXT INSTALMENT:—

The Work of Maxim and the Wright Brothers

Interesting High-Speed Oil Engine

Success as Rail Car Power Unit

THE development of the oil engine has been extraordinarily rapid during the past few years and many exceedingly interesting types have been designed to meet the demand for special kinds of work. During the past five years William Beardmore & Co. Ltd. have given a great deal of attention to the development of an oil engine of a unique type which they have named the Beardmore Quick Running Oil Engine. Originally this engine was designed to meet the demand for a power unit of certain characteristics for rail car operation. The requirements called for an engine as simple, reliable and economical to run as the Diesel type, but considerably lighter in weight. Rail cars operated by this Beardmore patent unit have now been running on the Canadian National Railways for over two years and the cars in which they are fitted have completed more than 1,000,000 miles. The results obtained from the first units, both mechanically and financially, were so satisfactory that further cars of a larger type with engines of 300 B.H.P. were ordered and these have now been put to work.



A 12-cylinder Beardmore Engine of 1,500 B.H.P. partly assembled in the shops

This interesting engine operates on the four-stroke cycle and cast steel is employed wherever possible in order to give ample strength and rigidity. The crankcase is in the form of a monobloc casting, which is bored out to receive the cylinder liners and also carries the main crankshaft bearings. The crankshaft is supported between each pair of throws and the main bearings are fitted with mild steel shells lined with white metal. The pistons are of the composite type, the heads being made from "Y" alloy forgings and fitted with one scraper and four gas rings, while the skirts are of copper aluminium alloy.

The gudgeon pins are made from case-hardened nickel steel, and are of the full floating type with soft metal caps fitted at their ends to prevent contact with the cylinder bore. The connecting rods are of nickel steel, the small ends being bushed with phosphor bronze, while the large ends are fitted with steel shells lined with white metal.

The cylinder heads are of special alloy and ample water space is provided. Each head is fitted with one injection, two inlet and two exhaust valves. The camshaft is mounted in a passage near the top of the cylinder block and operates the valves by means of rods and rockers, the whole of the gear being enclosed.

The drive from the crankshaft to the camshaft is by means of a train of gears carried in a detachable case made of aluminium alloy, and the gear wheel spindles are mounted on ball bearings. A governor of the centrifugal type driven through gearing is mounted on the detachable case.

The fuel pump body is machined from a solid block of steel, and the plungers, each of which supplies two cylinders, are driven from eccentrics mounted on a shaft running at engine speed.

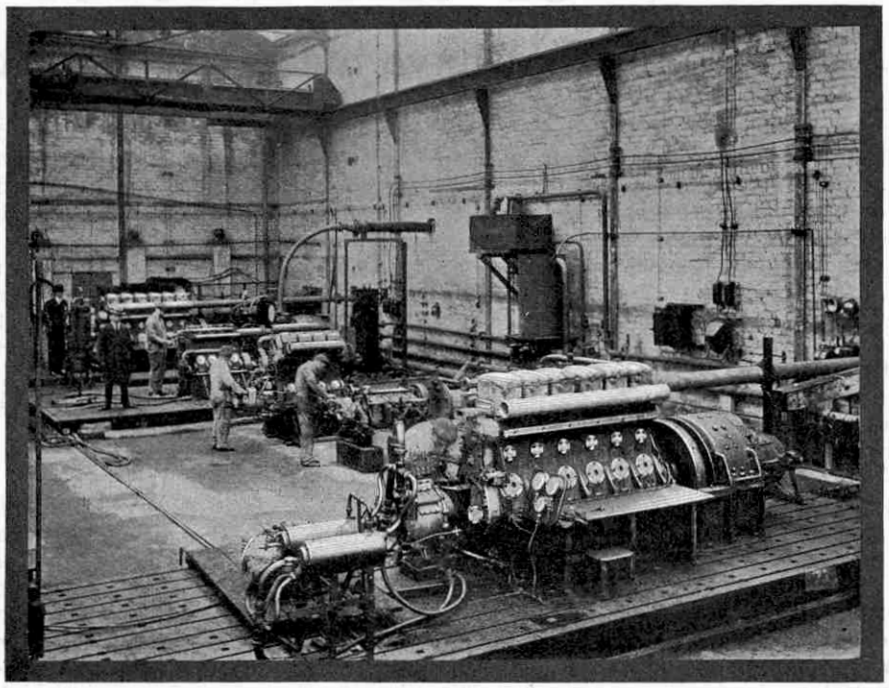
The fuel oil first passes from the storage tank to a small gear pump that raises the pressure in the supply pipe to the fuel pumps to approximately 40 lb. per square inch. It then goes through a filter and is discharged into a reservoir fitted with a relief valve. This reservoir is also in direct communication with the control and switch valves that govern the amount of fuel delivered to the cylinders, and also the time of injection.

The atomisers have spring-loaded needle valves that operate automatically as the pressure of oil in the supply main lifts the needle against the spring at the point of injection, and the spring returns the needle to its seat as soon as the injection is completed.

The fuel is projected as a very fine spray from a number of small holes in the nozzles at a pressure of approximately 8,000 lb. per square inch. Each cylinder is also fitted with a vent cock, by means of which the charge can be by-passed to a return pipe communicating with the reservoir, thus enabling any cylinder to be isolated for test purposes. There is also a pipe to each atomiser, which carries to the return pipe any oil that may leak from the fuel valve packing.

The lubricating oil and water circulating pumps are mounted in accessible positions and are driven by gearing from the crankshaft. All the main bearings and also the gudgeon pins are lubricated from the pressure feed system, the oil being drawn from the sump and passing through two filters before it enters the hollow crankshaft.

The officials of the Canadian National Railways have been so impressed with the performance of the rail cars fitted with this Beardmore engine that they have gone so far as to describe them as the most economical power units in use on any railway in the world.



Beardmore Quick Running Engines "going through" for the Canadian National Railways

Rail car operation is by no means the only use to which these engines may be put. They have been specially designed for service in which space occupied, lightness of weight and high fuel economy are factors of the first importance. They are, for instance, particularly suitable for installation on board ship, for driving lighting sets and also generators supplying current for use with electrically driven auxiliaries. For electrical installations, whether for land or marine use, the high speed of rotation allows a much lighter generator to be employed with considerable saving in weight.

One of the great advantages of the oil engine is that the stand-by losses are extremely small owing to the fact that the engine need not be started up until a few minutes before power is required; whereas with a steam installation it is necessary to keep the boilers under pressure, thus consuming a large quantity of valuable fuel from which no profitable return can be obtained.

DETECTING MERCURY VAPOUR IN THE ATMOSPHERE

The enormous development of industrial processes that has taken place in recent years has given rise in certain cases to undesirable conditions in regard to the health of the workers concerned. The same skill and patient research that has developed modern processes has, however, been successfully applied to the elimination of such conditions.

A typical case of this nature is that of the poisonous mercury vapour. On account of the greatly increased industrial use of mercury in heating operations in various chemical processes, and in the recently developed mercury turbine, it has become of great importance to devise a method whereby leaks in apparatus and traces of mercury vapour in the atmosphere can be detected quickly. Mercury poison is cumulative and it appears to make little if any difference whether the amount of vapour is inhaled in relatively large amounts during a short period of time or in very small amounts spread over a period of months.

Until quite recently the methods of determining the amount of mercury vapour in the atmosphere were tedious processes that required considerable time and the services of expert chemists. Even then the results were often very far from accurate especially when the amounts of vapour were exceedingly small. A new method has now been developed in the research laboratory of the General Electric Company of America that does not require a trained chemist to carry it out. Some idea of the efficiency of the method may be gained from the fact that as small a proportion as one part of mercury in 20,000,000 parts of the atmosphere can be measured with accuracy.

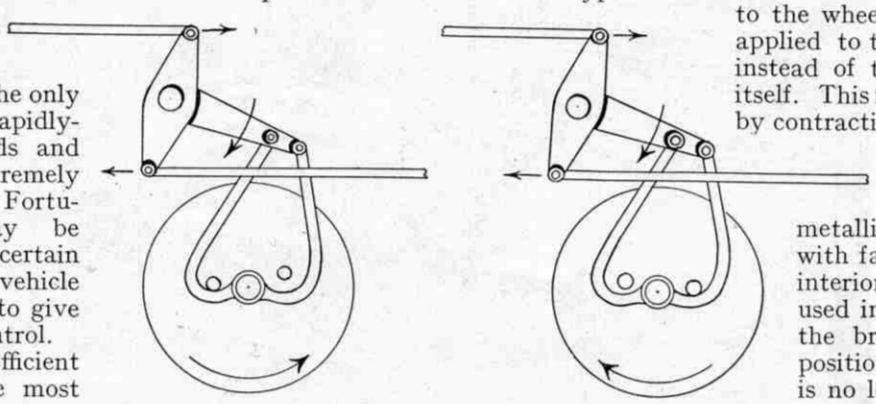
The principle upon which the new method is based is that of a reaction between a solid substance, selenium sulphide, and the mercury vapour, with the reaction product a coloured substance easily observable with the eye. The yellow selenium sulphide is applied as a coating on paper. This paper is blackened on exposure to air containing mercury vapour, the degree of blackening depending upon the concentration of the mercury, the time of exposure and various other factors that can be definitely controlled. There seems to be practically no lower limit to the concentration that can be detected by this method.

For continuous and automatic registration of the mercury vapour there has been devised a system in which a continuous strip of the coated paper is drawn slowly over an opening through which the air flows, a small clockwork motor moving the strip of paper at a uniform rate. Shortly after the exposure the coloured strip of paper is compared with a standard scale, in which the different shades from yellow to black have been calibrated in terms of mercury concentration. If an incandescent lamp is placed in front of the strip of paper and a photo-electric cell behind it, the amount of light reaching the cell will depend on the amount of blackening of the paper. The light can regulate the readings of an ammeter, so that the concentration of the mercury vapour may be determined either by observing the colour of the paper or by reading the ammeter. It is also possible to arrange the photo-electric cell circuit so that, if the mercury concentration becomes dangerously high, a warning gong will be sounded, the apparatus thus acting as an automatic chemist.

The Story of the Motor Car

VII.—Braking Systems that have made High Speeds Possible

PREVIOUS articles in this series have dealt with the manner in which the motor car is made to travel forward or backward; now it is necessary to turn our attention to the problem of effectively stopping a moving car. If the motive power were cut off, a car would soon be brought to a standstill by friction, but if this were the only means of stopping a rapidly-moving car our roads and streets would be extremely dangerous places. Fortunately friction may be applied definitely at certain selected points on a vehicle in such a manner as to give a driver complete control.



Courtesy] [Rolls-Royce Ltd.

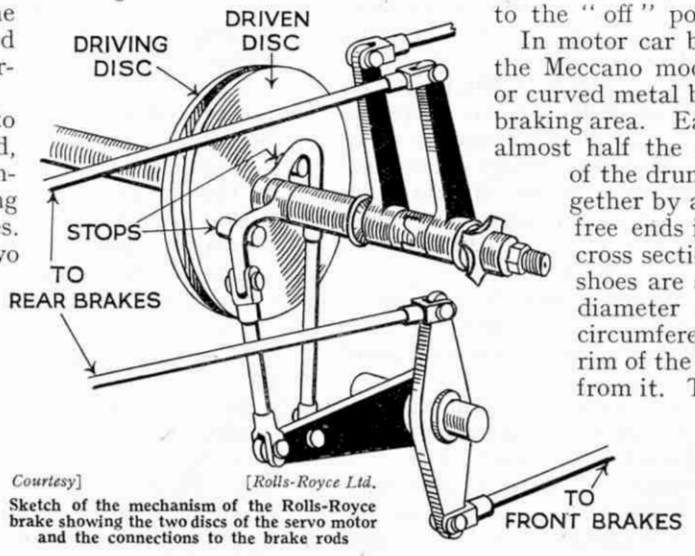
The driven disc of the servo motor of the Rolls-Royce car. Two stops are provided as shown, making the brake effective in both directions

The provision of efficient brakes is one of the most important tasks of the motor car designer. As the power and speed of engines has increased, the problem of quickly bringing a car to a standstill in any emergency has become more and more difficult. Braking power, in fact, has been one of the governing factors in determining the speed at which cars should be driven. When we remember that less than 30 years ago the police spent a considerable amount of time and energy in chasing and capturing unfortunate cyclists who were accused of travelling at excessive speeds and to the danger of the public, we can realise to some extent the alarm that was created by the appearance of motor-propelled vehicles.

The general public required to be educated in regard to speed, and in their interests great attention has been paid to the stopping powers of motor-driven vehicles. To-day every car must have two independent brakes, each of which must be capable of bringing the car to a standstill when acting alone. After every road mishap police experts examine all the vehicles concerned to try to determine the cause of the accident, and they scrutinise the brakes minutely to ascertain whether they fulfil the regulations.

In the gentler days of old, the wheels of horse-drawn vehicles were shod with iron tyres and braking was accomplished by pressing blocks of leather on the rims by means of a simple lever mechanism. The speed of rotation of the wheel was thus reduced by friction. Brakes of this kind are still in use for certain vehicles, but not for motor cars. The advent of the pneumatic tyre, together with the increased braking effort that became necessary as speeds increased, led to the universal adoption of a brake of an entirely different character.

In the typical motor car brake a steel drum is attached to the wheel hub and friction is applied to the rim of the drum instead of to that of the wheel itself. This is accomplished either by contracting a fabric-lined steel band on the outside rim, or by expanding hinged metallic shoes, also lined with fabric, to press on the interior surface. Springs are used in each case to return the brakes to the normal position when their action is no longer required. The second of these types is the one that is most generally used in Great Britain. It is described as an internal expanding brake, and the principle of its construction is easily realised from examination of the brake used in the new Meccano chassis. In this brake two collars, free to slide along slots in a face plate, are forced outward by the movement of a lever and brought into contact with the inside of the rim of the wheel. A tension spring pulls the collars towards each other and away from the rim when the brake lever is moved to the "off" position.



Courtesy] [Rolls-Royce Ltd.

Sketch of the mechanism of the Rolls-Royce brake showing the two discs of the servo motor and the connections to the brake rods

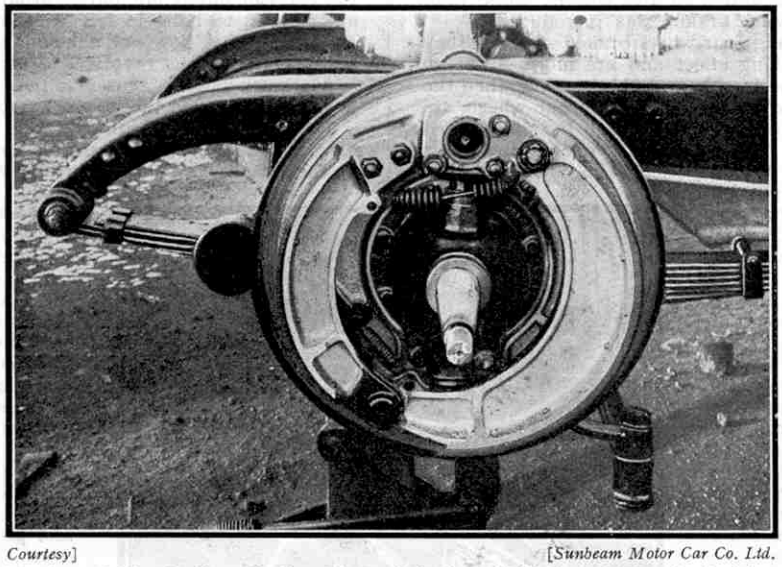
In motor car brakes the collars used on the Meccano model are replaced by shoes or curved metal blocks, which give a larger braking area. Each of the two shoes covers almost half the circumference of the rim of the drum. They are connected together by a pivot and between their free ends is a cam or wheel of oval cross section. When the ends of the shoes are separated by the smallest diameter of the cam their outer circumferences are parallel to the rim of the drum and a short distance from it. Turning the cam by means of the brake lever forces the free ends of the shoes apart and thus brings them into contact with the rim. The tension spring connects the free ends and brings them back to the normal position when the brake is released.

External brakes are more common on American than on British cars. When braking is required, the ends of the contracting steel band are drawn together by a simple lever mechanism. Such brakes are easily made and are

more powerful than internal expanding brakes of equal size, but they suffer from the drawbacks that they cannot be so well protected from rusting as the more easily enclosed internal type, and the cooling of an enclosed drum is not readily accomplished.

A form of brake that has been and is still very largely used is the propeller shaft brake. A drum is mounted on the propeller shaft immediately behind the gear box and hinged shoes are fitted to act by contraction. As a rule a brake of this kind is heavily made and is very powerful.

In order to give a sufficient braking effort drums of large diameter are required, especially with heavy cars. The power of the brakes depends on friction, and is thus proportional to the amount of surface on which the shoes press, as well as to the pressure exerted. Another factor of great importance in the design of brakes is the generation of heat, as this is liable to damage considerably the fabric used for lining the brakes.



Courtesy [*Sunbeam Motor Car Co. Ltd.*

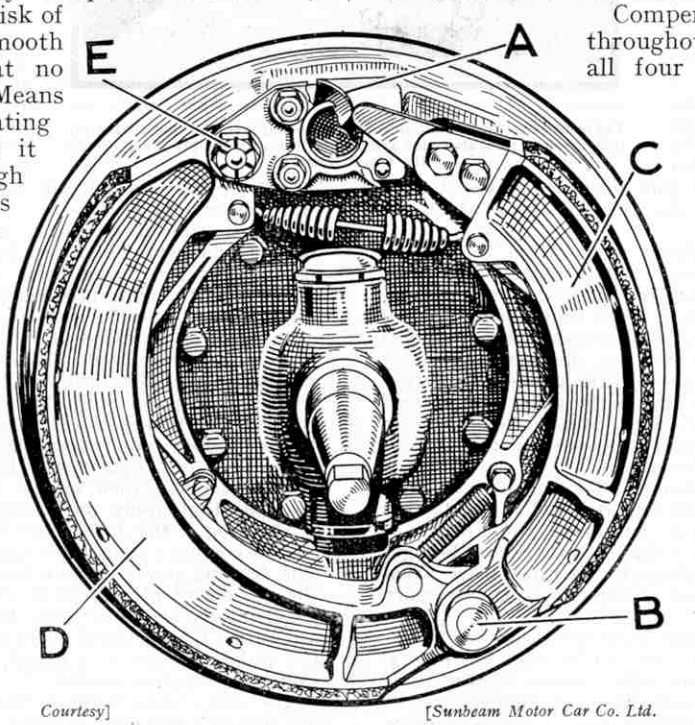
The shoes of a Perrot self-servo brake. The small shoe is applied to the brake drum by the driver and the large one then acts automatically

Modern fabrics are largely composed of asbestos, but even with them there is risk of the surface being worn so smooth by continual operation that no frictional grip is obtained. Means must be provided for dissipating this waste heat. Most of it escapes by conduction through the metal, and to assist in this process the brake drums are often cast with radiating fins in exactly the same manner as the cylinder casting of a motor cycle.

The actual application of brakes is usually carried out by means of rods or chains, preferably the former, moved by a lever operated by hand or by the depression of a pedal. In the case of an external brake the two separate ends of the band, or shoes, are merely pulled together, while the shaft on which the cam of an internal expanding brake turns is rotated by means of a short arm connected to it.

The equalisation of the braking effect on the various wheels is an important matter. In the case of a propeller shaft brake this problem does not arise, but where a hand lever or pedal controls brakes on the rear wheels it is necessary to incorporate some mechanism for ensuring that the brake on one wheel will not act more powerfully than that on the other. The result of such uneven action would be that cars would tend to turn every time the brake was applied, as one rear wheel would be retarded more than the other, and skidding would probably follow.

Unevenness of this kind can be avoided by the use of a compensator. In dealing with the two brakes on the rear wheels, for instance, the rods that turn the brake cams are pivoted at the ends of a transverse rod, while that from the brake lever is pivoted at an intermediate point. When the brakes are brought into operation the transverse rod is pulled forward. If the shoes on one side are expanded into contact with the drum ahead of those on the other, their further movement will require a greater effort. Through the compensating rods, therefore, pressure on the brake pedal will first accomplish the easier task of bringing the shoes on the second wheel up to the same stage. Thus a compensated brake adjusts itself automatically to give equal braking effects on both sides of the chassis.



Courtesy [*Sunbeam Motor Car Co. Ltd.*

In this view of the mechanism of a self-servo brake the actuating cam and the springs are clearly seen

Compensators are not always fitted throughout cars with brakes on all four wheels, as some manufacturers believe that they introduce unnecessary complications. On one well-known car two compensators are fixed, one on each side of the chassis, to provide compensation for the pair of brakes on the side where it is situated. Compensation of the front wheel brakes as a pair is not attempted, nor is that of the rear wheel brakes. On other cars the brakes on all four wheels are fully compensated.

Two interesting features of recent developments have been the greater use made of front wheel brakes and the introduction of systems of power braking. Greater braking effort is, of course, the chief advantage that these innovations have brought with them, but other important results have been obtained also.

For many years after the invention of the motor car, brakes were confined to the rear wheels or to the propeller shaft almost as a matter of course. The chief reason for this was no doubt the mechanical difficulty

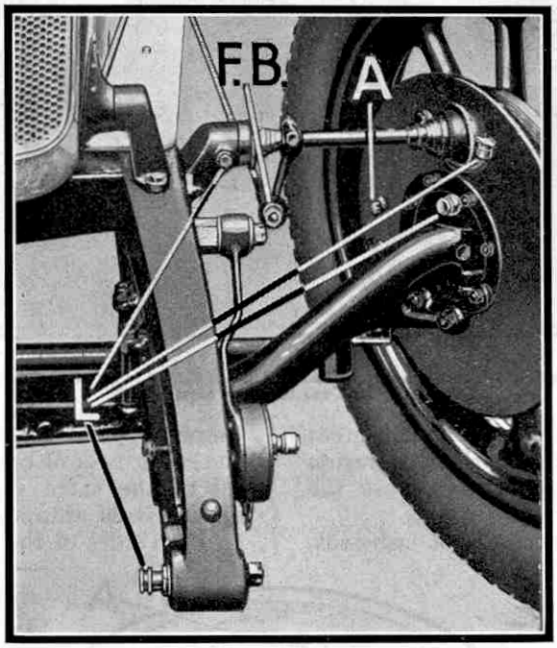
of adding brake drums and control mechanism to wheels that were continually being turned for steering purposes. An equally important requirement was that brakes used on the front wheels must not be capable of locking the wheels, as steering would then be quite impossible. But when the advantages of four-wheel braking were fully realised it was soon found possible to evolve quite satisfactory designs in which universal joints were used to allow for the turning action of the wheels, while later a hydraulic method of applying brakes was introduced.

The chief advantages of using four-wheel brakes are that they give a more symmetrical braking effect and are more powerful. A car braked on the rear wheels only is liable to skid when the back wheels are locked by the brakes while the front wheels are left perfectly free, an effect that is largely due to the unbalanced nature of the braking action. But when an even braking effort is applied by making use of all four wheels the chassis will be checked evenly and the tendency to skid reduced. The fact that the braking effort is distributed over four wheels instead of two also assists in this object, as it is less likely that any wheel will actually be locked in reducing the speed of the car to the necessary level.

Coming now to the actual design of front wheel brakes, these are always of the internal expanding type, a short shaft that turns the cam projecting on the inner side of the wheel. The shaft cannot be allowed to turn with the wheel when brake rods of fixed length are used to actuate it. It is therefore fixed in position and connected with the cam by a universal joint that is placed on the centre line of the king pin about which the wheel swivels.

In the case of the " Perrot " brake used on Sunbeam cars the shaft is connected to the side member of the chassis frame and universal joints are used at both ends. The brake cam is placed vertically above the hub of the wheel and thus the movement of the latter has no effect on the brake mechanism. The lever turning the shaft is connected to it at a point near the side member.

In another and very popular type of front wheel brake mechanism the cam shaft is secured to the underside of the front axle beam. In this case one universal joint only is used, this being placed under the pin about which the front wheel swivels.



Courtesy [*Sunbeam Motor Car Co. Ltd.*

The front wheel brake mechanism of a Sunbeam car. The cam-shaft ends in a universal joint above the axle and in line with the pin about which the wheel turns

An interesting method of applying front wheel brakes has been invented in which no mechanical action of any kind is involved. At each wheel is a cylinder containing two pistons, the movement of which controls that of the brake band or shoes through bell cranks. Heavy hose and copper tubing connect the cylinders to a central master cylinder, the piston of which is moved by rods from the brake pedal. The cylinders and connections are filled with oil. When the brake pedal is depressed the piston in the master cylinder forces oil through the connecting tubes to the wheel cylinders, where it presses the two pistons further apart, thus applying the brakes.

As the connections of such brakes are flexible, all possibility of mechanical interference with steering is avoided. A further interesting point is that completely automatic equalisation of brakes is attained, as the pressure of the oil is the same throughout the mass of liquid. Slight leakage of oil takes place when it is under pressure, but the oil lost is replaced when necessary by a small pump.

Still another method of actuating front wheel brakes makes use of cables. In this case the cam shafts turn with the wheels, but as the inner end of that on one wheel moves forward, that of the other moves backward through an equal distance. Complete allowance for the turning movement may therefore be made by connecting the two with the brake lever by one continuous cable passing round pulleys.

The second of the innovations referred to is the introduction of the use of power for applying the brakes. The effect of a brake of the ordinary variety is proportional to the pressure exerted by the driver on the foot pedal or hand lever, and although the levers always multiply the applied force, yet a considerable effort is necessary to stop a heavy car that is running at high speed. Several methods of reinforcing the muscular powers of the driver have therefore been introduced, brakes in which this is done being usually known by the general name of " servo " brakes.

The principle on which servo brakes work may be understood best by considering the way in which a steam capstan pulls a boat through the water. The whole rope is passed several times around the capstan but is not pulled around with it so long as the coils are allowed to hang loose. As soon as the seaman pulls on the end of the rope, however, the coils are tightened and immediately take a grip on the revolving drum. Thus the man's assistance is necessary but his muscular power would be quite useless if it were not reinforced by the mechanical ally that it calls into action.

The simplest application of the principle is the Perrot " self-servo " brake, used on Sunbeam cars. The brake drum on each of the front wheels contains two shoes, one of which is smaller than the other, these being connected in the usual manner by a pivot that is free to move in its housing. The upper end of the larger shoe is fixed in position by the main pin, while the free end of the smaller shoe only is in contact with the cam surface.

When the brake pedal is depressed and the cam thus rotated, the toe of the smaller shoe is pressed against the brake drum. The shoe now tends to revolve with the drum, or to be pullled down by the effect of the friction, with the result that it drags the larger shoe down with it and presses it into contact with the drum. Thus a muscular effort on the part of the driver that is merely sufficient to bring the smaller shoe into operation actually results in the production of braking effort over the whole surface of the drum.

It is important to note that if the wheel is rotated in the opposite direction, the smaller shoe is pulled upward, and a little thought will soon show that the effect of this is to pull the larger shoe away from the brake drum. This type of brake is therefore only of use when a car is proceeding in a forward direction, and in consequence it is usually fitted to front wheels only. Brakes of the ordinary kind are used on the rear wheels of the Sunbeam car, for instance, in order to check backward movement.

It is possible to design a "self-servo " brake that holds a car in both directions. This is done by using three connected brake shoes, one of the two larger being automatically applied when the smallest is brought into contact with the drum, whatever the direction of rotation.

In other applications of the servo principle what is known as a servo motor is used. This is simply a small clutch, usually situated at the side of the gear box, one member of which is driven from the propeller shaft by appropriate gearing. A lever controlling the brakes is attached to the second clutch member. When the foot pedal governing the brakes is depressed the clutch is brought into operation. The member to which the brakes are connected is then subject to a powerful drag that actuates the rods that apply the brakes.

The drag of the driven member of the clutch is only prevented from becoming a complete rotation by the resistance of the brakes. The braking power is therefore supplied through the clutch by the movement of the car mechanism, and pressure on the foot pedal merely serves to bring the system into operation. At the same time the frictional effect in the clutch will be greatest when the pedal pressure is greatest, and by varying this the driver exercises complete control.

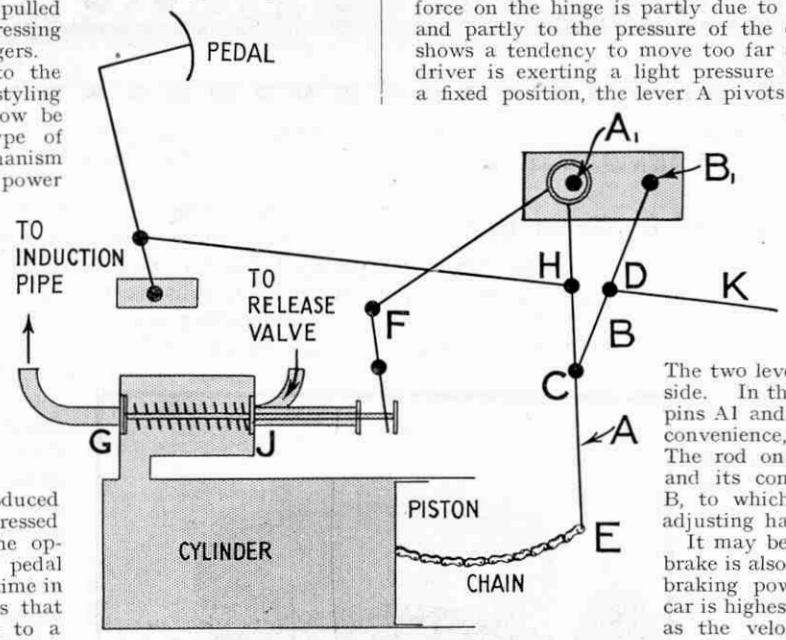
The servo brake used on the Rolls-Royce car is of this type, and has been specially designed to act irrespective of the direction of movement of the car. The driven disc has two stops upon it. As this disc commences to rotate, one or other of the stops pulls on a rod connected with the brake mechanism. An interesting feature of this brake is that the rear brake shoes are in contact with the drums before the servo motor comes into operation. When that does happen the front wheel brakes are applied and the pressure on the rear drums is increased. This arrangement ensures that the front wheels do not become locked, for if the

rear wheels, on which the pressure is greatest, are locked, the servo motor ceases to operate and the brakes on the front wheel are released.

It is claimed that the total braking effect obtained by the use of the Rolls-Royce servo system is three times greater than is given by the unassisted brakes. So light is the pedal operation required that the car may be pulled up very quickly by merely pressing the brake pedal with two fingers.

Returning for a moment to the Perrot brake, the reason for styling it the self-servo brake will now be apparent. In the second type of servo brake an additional mechanism is necessary to provide the power required for the application of the brakes, while the Perrot brake acts automatically.

Another very interesting power-braking mechanism is the Dewandre system, which has the great advantage that it can be arranged to multiply the driver's effort over the first half of the available braking range. A little consideration of the effect of the ordinary brake will show that the greatest effect is not produced until the pedal has been depressed to its greatest extent. As the operation of depressing the pedal occupies a certain amount of time in any circumstances, this means that when it is required to bring to a standstill a car travelling at high speed, the braking effort is least at the beginning of the speed reduction, although this is actually the moment when the greatest effort is required.



Courtesy [*The Daimler Co. Ltd.*

Diagram illustrating how the suction of the engine is used in the Dewandre system to apply the brakes

Similarly the greatest braking effort comes into play when the car is travelling at a greatly reduced speed and thus requires a comparatively small effort to stop it. This is often the cause of unpleasant skids, as the application of the greatest braking power when the rotational speed of the wheels is least may easily result in the wheels becoming locked.

Obviously a much more satisfactory method would be to adjust the power of the brake to the speed of the car; skidding tendencies would then be reduced and control would be more sensitive. The Dewandre system allows an approach to this to be made.

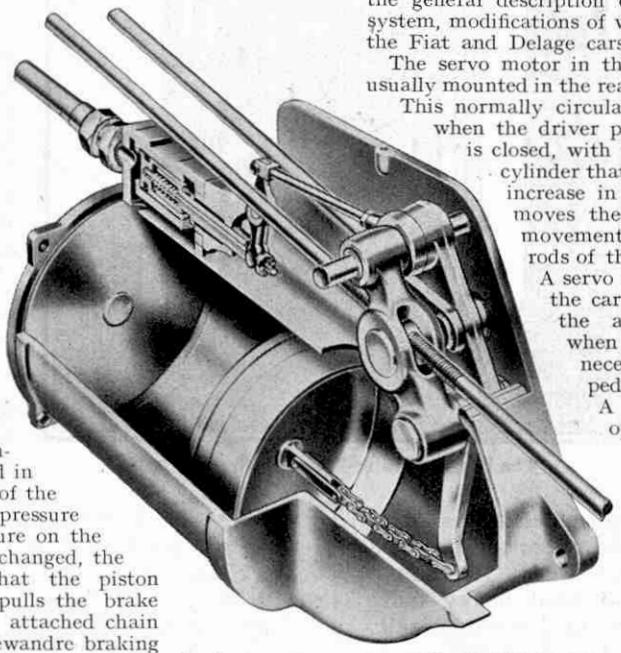
In order to understand this system its application on Daimler cars may be considered. A diagram of the mechanism used appears on this page, from which it will be seen that it consists of a system of levers in conjunction with a cylinder and piston. The interior of the cylinder may be placed in connection with the induction pipe of the engine by valve G. A reduction in pressure is thus produced, and as the pressure on the outer side of the piston remains unchanged, the result of opening the valve is that the piston is pushed down the cylinder and pulls the brake lever K after it by means of the attached chain E. The auxiliary power in the Dewandre braking system is thus the pressure of the atmosphere, and is brought into play by the suction of the engine.

The two levers A and B are hinged together at C. The lever B is pinned at its upper end, but there is a clearance space between the boss of the larger lever A and its supporting pin A1. This space is a very important and ingenious feature, as will be realised on following the action of the brake. When the pedal is depressed, the hinge C acts as a fulcrum and the upper part of the lever A moves forward as far as the clearance space allows. Through the levers F this movement opens the valve G against the pressure of a compression spring and brings the power device into operation, the brake rod K being pulled forward by the movement of the levers A and B.

The whole of the force on the brake rod K is applied through the lever B and comes to this lever through the hinge C. The force on the hinge is partly due to the movement of the piston and partly to the pressure of the driver's foot. If the piston shows a tendency to move too far along the cylinder while the driver is exerting a light pressure that keeps H practically in a fixed position, the lever A pivots about H and its boss therefore moves backward on the pin A1, an action that closes the valve G and stops further reduction of pressure in the cylinder. Thus a very sensitive control of the braking pressure is exercised by the driver.

The actual mechanism is shown in the illustration on this page, the cylinder and valve being shown in section. The two levers A and B are seen side by side. In the accompanying diagram the pins A1 and B1 are shown separately for convenience, but actually one pin suffices. The rod on the right is the brake rod and its continuation beyond the lever B, to which it is hinged, leads to the adjusting handle.

It may be noted that the Rolls Royce brake is also adapted to give the greatest braking power when the speed of the car is highest, and to reduce the pressure as the velocity of the car falls. The speed of rotation of the driving disc of the servo motor is proportional to the speed of the rear wheels, as it is driven by gearing from the propeller shaft. When the rear wheels are turning slowly, therefore, the drag on the driven disc and the pull on the brake rods are comparatively small.



Courtesy [*The Daimler Co. Ltd.*

The actual mechanism of the power brakes of a Daimler car. The cylinder and valve leading to the induction pipe of the engine are shown in section

There is still another power braking system that comes under the general description of servo brake. This is the hydraulic system, modifications of which are used on various cars, including the Fiat and Delage cars.

The servo motor in these cases consists of a small oil pump usually mounted in the rear of the gear box from which it is driven. This normally circulates oil idly through the gear box, but when the driver presses the brake pedal a by-pass valve is closed, with the result that the oil is pumped into a cylinder that is closed at each end by a piston. The increase in the pressure of the oil between them moves the pistons along the cylinder and this movement operates the brakes through levers and rods of the usual type.

A servo motor of this type is only effective when the car is moving in a forward direction, as the action of the oil pump is reversed when the car moves backward. It is necessary, therefore, to connect the brake pedal directly with the rear brakes. A safety valve is also provided. This opens when the pressure of the oil between the pistons becomes so high that the brakes are locked, and thus releases them.

The introduction of servo brakes has undoubtedly made car driving much easier and far less tiring. Brakes of this type act quickly and with great power at the mere touch of the driver's foot, and in conjunction with the symmetrical braking effort produced by modern four-wheel brakes they make high average speeds possible with safety. In spite of their cost and the weight they add to a car, it is quite certain that servo brakes of some kind will eventually be used on almost all cars.

Finality in design has by no means been reached, as servo methods have only been applied to cars for a comparatively short time. Further experience will undoubtedly lead to the evolution of simple and effective standard forms of mechanism.

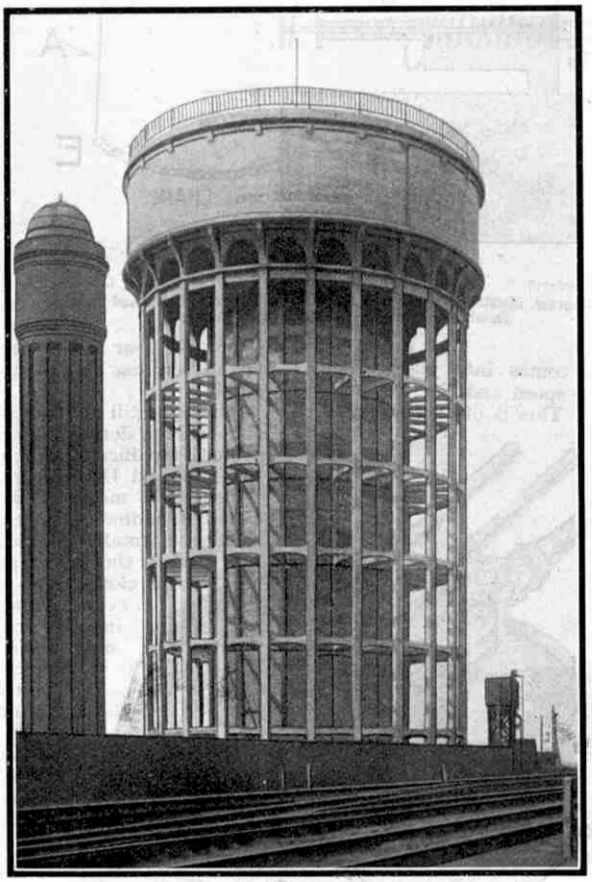
From Our Readers

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

The Largest Water Tower in Great Britain

The accompanying photograph shows the largest water tower in Great Britain, which was erected at Goole, Yorkshire, in 1927. It is a concrete structure 160 ft. in height and having a diameter at the top of 90 ft. Although it is 5 ft. less in height than the Wanganui tower illustrated on page 316 of the April "*M.M.*," its capacity is 750,000 gallons, or more than six times that of the New Zealand tower.

(H. GREENFIELD, Goole).



The Largest Water Tower in Great Britain

A Visit to the "*Victory*"

The famous battleship "*Victory*" is now harboured high and dry in dock at Portsmouth. She is balanced by means of large iron stays, which are embedded into the cement of which the dock walls are built, two on each side. The ship could best be compared with a small destroyer for displacement, but is much more bulky to look at. She has three masts, on each of which is a look-out platform supported by four ropes each side.

Counting the hold, there are six decks with about six feet clearance between each. There is only one of the original solid oak decks remaining, all the others having been replaced by new ones made of teak. They are supported by great oak rafters about one square foot in cross-section.

Around the sides of the three upper decks small trap doors are cut, which open outward to form the port-holes through which the guns were fired. These guns were made of iron and oak, and fired heavy balls. There were 112 guns altogether, arranged symmetrically around the three decks. They were fired by means of a thin track of powder laid along the top of the gun to a hole leading to the main powder charge. This powder track was ignited and the flame travelled along it and down the hole and so exploded the charge.

At the stern were two guns called "chasers," which were used to repel attacks from the rear. During a storm all guns were lashed to iron bolts in the sides of the ship by means of thick ropes that were placed through a ring at the butt end of the gun. The old iron guns have now been removed on account of their weight on the rafters and sides, and wooden models have been substituted.

The powder magazines are quite near, so that they could be conveniently reached when the guns were in action. The walls of these rooms are made of strips of thick oak, one small thick door only being provided. The store holds are on the third deck, one hold for fish and another for rum. The rum hold is the bigger!

The first name that comes to mind when speaking of the "*Victory*" is that of Nelson, who was killed on board. On the top deck the spot is shown where he fell when shot as he was parading backward and forward encouraging his men. As soon as he was shot he was carried below, where the sound of the firing was deadened, and it was on the fourth deck that he died. Nelson's cabin is at the stern of the boat looking out over the sea. The "*Victory*" is now undergoing a complete overhaul, all woodwork being restored and painted, and metal-work cleaned.

K. A. BOLT (Portland).

Grindstone Making

Grindstones are made of specially hard sandstone, quarried by drilling and shot firing. In selecting blocks for the purpose, all those showing the slightest crack are rejected, as grindstones made from them are liable to burst with disastrous results.

A circle is marked out on the flat side of a chosen block with a pair of huge compasses. The block is first roughly reduced to shape by knocking off the unwanted corners with a pick-hammer, after which the point of the pick is used to reduce to level the surfaces.

This preliminary hewing takes place below ground and the stone is then hauled to the surface by a crane. It is next taken to the lathe shop, where a square hole is cut through the exact centre. The grindstone is then placed on a mandrel, and wedged very tightly. On this it is slowly revolved, while a big chisel-like tool is used to give it a smooth surface.

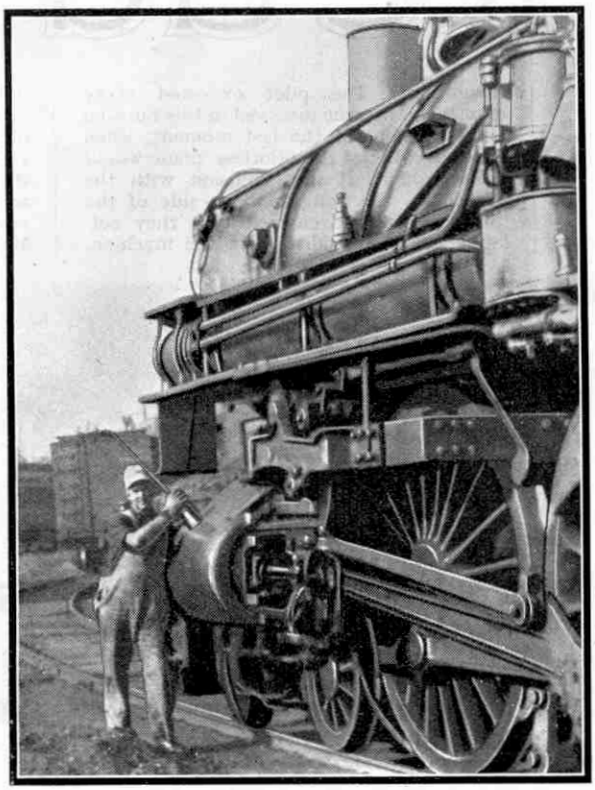
B. A. JONES (Dordon).

"401" Passes On

The accompanying photograph shows No. 401 of the Boston and Albany Railroad "Atlantics," the fastest engines that ever ran on this railway. They were originally built in 1903, with Stephenson valve gear and driving wheels 81 in. in diameter, and 16 years later they were rebuilt with Baker-Pilliod valve gear as shown in the photograph. This gear is of great interest in that it dispenses with links, and it is admitted to be the strongest gear made. At this period also the engines were superheated and the four-cylinder New York duplex air pump was applied.

After a while heavy steel equipment and the hard pulls over the Berkshires became too much for the engines and they were assigned to fast local runs. In 1923 the boilers had reached the end of their permitted period (Federal rule) and the engines "passed on."

In the photograph the driver of "401" is seen standing by her; he had run her throughout the entire period of her service. On the day after this picture was made "401" was scrapped, and on that day her driver retired, never to run an engine again. Such is the attachment that grows up between Man and Machine. (H. W. PONTIN).



No. 401, Boston and Albany "Atlantic"

How Motor Cycles are Tested

Motor cycle testing is not a mere matter of sending out finished machines for a furious half-hour on quiet roads, as I soon discovered when I was fortunate enough to be conducted round two of the biggest factories in the Midlands. Indeed road-testing is rather discountenanced, and every good-class machine is tested stringently as it is being built.

The bench test comes first, when the engines are bolted to trestles and "run in." During this process they are adjusted until they are ready for the actual power test. This consists of overcoming the air resistance of a huge fan or propeller, built up of a pair of steel plates fastened cross-ways to a bar mounted at the end of the crank-shaft. This resistance, and consequently the work done, increases enormously as the engine is "revved up," and at its maximum is far in excess of the nominal taxable horse-power. The power required to turn the propeller at various speeds is known, and thus the tester, by glancing at the speed indicator, can see at once if the engine is pulling its weight.

If satisfactory, the engine is built into the frame for the frame test. The machine is bolted into a huge jig after the style of a packing case, and cams are revolved rapidly underneath the wheels, giving an excellent imitation of the effect of a very bad pothole at each revolution. Under such severe conditions the frame is rigorously inspected, particular notice being taken of the action of the springs, or possible "wobble" in the wheel or other bearings. Naturally only thoroughbreds can endure this treatment, and that is why we read of machines standing up to rough riding trials, and desert and colonial journeys.

The final test of the finished product is usually carried out on a special track on the premises. At one of the factories I visited there is a unique circuit running from ground level to the roof of the factory. It climbs a special test hill built against one end of the building, crosses the front of the roof before descending at the other end, to finish with a flat "pure speed" stretch. Needless to say, it is by no means an easy track, but it has no terrors for the special staff of testers, each of whom sees to it that the makers' guarantee of so many miles per hour is no empty advertising phrase.

A tester's life is not without its danger, but the rewards are there too, for it may fall to any one of them to be packed off to ride the firm's machines in the T.T. Races.

AUSTIN BRENT (Walsall).

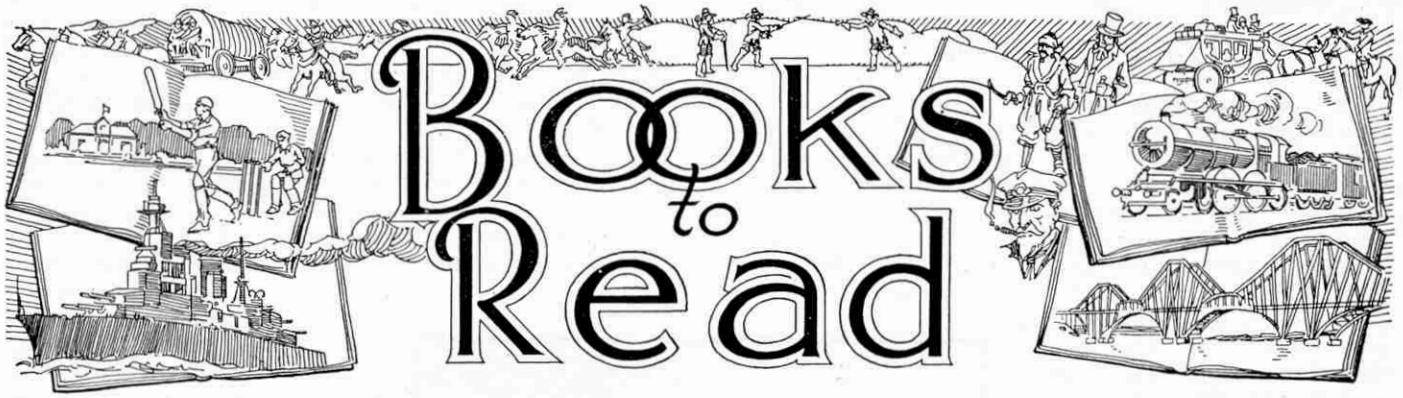
A Visit to a Tube Works

A short time ago I had the opportunity of visiting the works of one of the largest tube manufacturers in the country. I was first taken to the place where the round, solid steel bars of various diameters are broken into the required lengths. These pieces are then charged into a gas-heated furnace and when heated sufficiently are withdrawn and taken to a hydraulic press where a small hole is punched in one end for a short distance.

In the next stage the bars are pierced by being forced over a solid steel bar while rotating rapidly between rollers. They are now hollow, and perhaps about three times their original length. During the next process the red-hot, hollow pieces are first passed on to a steel bar of the required internal diameter of the tube, and then forced backward and forward between rotating rollers in order to reduce their thickness. During part of the revolution the rollers are not engaging the material and the pieces are then pulled back and partly turned round so that the rollers work on different parts of the circumference. The still red-hot tubes are then rotated rapidly between other rollers to remove scale and to make them uniform.

The tubes are then slowly cooled, after which the ragged ends are sawn off and the tubes cut to the required length. They are then straightened, closely examined internally and externally for defects, and finally tested by high water pressure to prove their soundness. It is engrossing at this stage to watch the finished tubes being lifted by large crane magnets capable of carrying five tons, and deposited in waiting railway wagons.

N. S. THOMPSON (Birmingham).



Readers frequently write asking if we can recommend books that are both of interest and of use. On these pages we review books that will specially appeal to readers of the "M.M." We do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

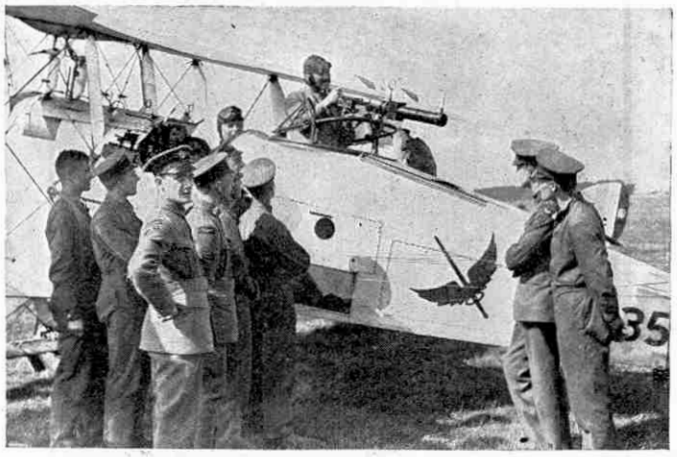
"The Wonder Book of Aircraft"

(Ward Lock & Co. Ltd. 6/–)

We picked up a copy of the recent edition of this fine volume the other day and subsequently spent an exceedingly interesting half-hour turning over its well-illustrated pages. The twelve colour plates are really magnificent and there are 250 photographs as well—photographs of aeroplanes ancient and modern, of an airman's equipment for high-altitude flying, views taken from the air, including a very striking photograph of the North Pole taken as the 'plane flew overhead.

One has only to look through this book to realise the amazing strides that have been made in aeroplane construction during the past ten or fifteen years. Progress has been made so quietly and so steadily that we who live in these days are apt to overlook the wonderful changes that have been wrought unless they are brought before us clearly and vividly as in this volume. Some of the chapters deal with such interesting and instructive phases as "A Day at the London Air Station"; "Aerobatics"; "How and Why an Aeroplane Flies"; "Wonders of Aircraft Wireless"; "Romance of the day-and-night Air Mail"; "Slip-coaches of the Air"; "Coming Wonders of the Air."

The chapter dealing with "Life-saving in the Air" is particularly interesting. This deals not with the aeroplane itself but with the value and use of parachutes. It is in this chapter that some of the most remarkable photographs appear, showing airmen descending to the ground under their fully-opened parachutes, and others who have just jumped from the aeroplane but whose parachutes have not yet opened. An unusual experience is given of a pilot whose machine caught fire in the air. He jumped from it, but as he did so the controls he had abandoned became fixed in such a way that the machine began to make a series of circles in its downward plunge. The airman had waited until he was well clear of the blazing craft before opening his parachute, but had not reckoned with this gyratory movement of the derelict 'plane, which began to make circles round and round him as he descended in his parachute, coming nearer and nearer, blazing fiercely, at each of its revolutions. The pilot expected every moment to become involved in this burning air-wreck, but at the last moment, when another swing of the pilotless 'plane would have brought it into collision with the parachute, the wings on one side of the 'plane became so charred that they collapsed and fell bodily from the machine.



London clerks belonging to the Auxiliary Air Force receiving machine-gun instruction in camp. (From "The Wonder Book of Aircraft" reviewed on this page)

The result was that the 'plane ceased to revolve and plunged down, missing the parachute and striking the ground in a shower of sparks and burning wreckage!

The chapters on "Life in the Royal Air Force" and "Apprenticeship in the Royal Air Force" will particularly interest boys who are thinking of joining the Force, whilst others, less ambitious, will be proud to possess this volume which is one of the most clearly-written and comprehensive books of the day.

A glider constructed to resemble a bird and to fly as a bird does (see above)

* * * *

"Henry Hudson"

By L. Powys (The Bodley Head. 12/6)

This book will particularly interest those readers who follow so closely our series on "The Exploration of the Arctic," for we dealt with Henry Hudson's adventures in our December 1926 issue. The purpose of the book, which is one of the volumes of the "Golden Hind" series, is to present an accurate picture of Henry Hudson's voyages over "the huge uncharted waves." Mr. Powys has endeavoured to set the great achievements of this famous sea captain in their true relation to the historical perspective that is not concerned directly with any particular country or race and in writing the book the author has had the advantage of the assistance of Mr. M. E. Hudson, who generously placed at his disposal all the available material on the Hudson family, collected through many years of patient enquiry.

An interesting item in the book is the mention of the discovery of the lost verdict passed by the High Court of Admiralty on the mutineers, this missing document being found at the Record Office, London, by a diligent and skilled investigator. Light is thrown, too, upon Hudson's ultimate fate, which is generally supposed to be a mystery. It appears that many rumours reached England from Hudson Bay that Hudson had not perished at sea as is generally supposed. Something more definite was forthcoming when the master of the "*Nonsuch*" ketch, who constructed the Hudson Bay Company's first factory at Port Charles, reported the finding of the ruins of a log house that had been built some 60 years previously. A fur hunter also came across the ruins, and in 1631 there was discovered, driven into the ground on the shore of Derby Island, a row of stakes that had obviously been cut and shaped with a European axe and which were almost certainly the work of a lusty ship's carpenter. It is now practically established that Hudson and his companions did at least manage to regain land, and that the bones of the famous navigator found a final resting place upon some honoured plot of Canadian ground.

* * * *

"Michael Strogoff"

By Jules Verne (Sampson Low. 2/6)

Since tales of Russia in the days of the Czars generally abound in incident, one is assured that in the hands of Jules Verne such a story will be doubly worth reading.

Michael Strogoff endured fatigue and hunger and unknown perils in order to carry a despatch across Russia at his Emperor's command. Telegraph wires were cut, and horses and vehicles were only available for a small part of the journey.

The fierce Tartars would show him no mercy if once he fell into their hands, for it was war-time and it was Michael's mission to cross Siberia to deliver a message to warn the Grand Duke, the Czar's brother, of impending trouble and possible treachery. At all costs Michael must reach Irkutsk before the Tartar columns, yet to do so he must travel unrecognised as a courier through land occupied by the enemy, and without attracting attention by any apparent undue haste. To make matters worse he did not know where the opposing forces were or what route they had taken. Only the fact that he was a native of Siberia and had been brought up to hunt and live in a country impossible for an ordinary person, gave him the chance of surviving the ordeal.

This is a well-printed, strongly bound edition of a great favourite and should prove very popular with our many readers.

* * * *

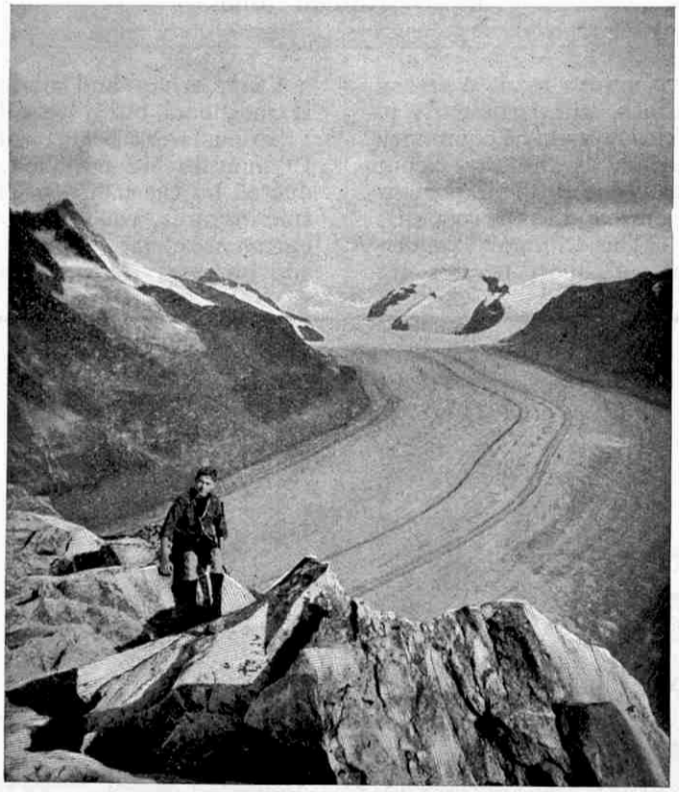
"Hike and Trek"

By G. G. MORTON, M.A., B.Sc.
(Harrap. 3/6)

This book will make a strong appeal to Scoutmasters and also to outdoor boys, and will doubtless convert many readers to the healthy ranks of trekkers and hikers. In his foreword, Sir Alan Cobham says: "It is not necessary for a man to sleep with a roof above his head. From my own experience I think that sleeping in the open, living night and day in the open for three years, has fortified my physical constitution far more than anything else in my life." This suggestion of adventure, from one who has so admirably proved his powers of endurance, is surely sufficient in itself to rouse one's interest in the open-air pleasures with which the author of this book deals.

Dr. Morton points out that hiking and trekking bring out the virtues of courage and self-reliance, which, he says, are not ready-made in any boy but can be developed by experiencing and mastering dangerous situations. He tells of his adventures with his boy-pioneers in this country and abroad—crossing avalanches or marching through scorching heat—and he gives the reader the benefit of his varied and wide experiences and several very useful hints. The Chief Scout says: "I agree fully with all that Dr. Morton says regarding the value of the hike and trek for making boys into manly men. But I see yet a further good in it which I know will appeal to every red-blooded British boy; and that is that it offers you a means of doing service for your country."

The book gives valuable practical hints on the 'how' of camping, particularly on the moving of camp by road or water. It appeals to the parent, the scoutmaster, the schoolmaster, and the youth, and has a unique interest for the lover of Stevenson by reason of its romantic story of travels with a donkey in the Cevennes and along the Sambre and Oise in canoes. There are many interesting photographs.



On the summit of the Eggishorn (from "Hike & Trek" reviewed on this page)

The Brotherhood of the Sea

By E. KEBLE CHATTERTON
(Longmans Green & Co. Ltd. 12/6 net)

Mr. Chatterton has written many books of the sea, but probably not one of them exceeds the present volume in thrilling interest. The theme of the book is the great human brotherhood that exists among seafarers of every nationality and which, although at times it may be hidden, invariably comes to the surface in the hour of danger.

Commencing with some exciting stories of the early navigators of the days of sail, the author leads us gradually to the Great War, and takes us in imagination into the heart of many desperate sea combats. Perhaps the finest thing in the whole book is the description of the work of the destroyers at Jutland, and certainly no British boy could read this without feeling a thrill of pride in his nationality. Full of interest also is the description of the coastal motor boat service, and the achievements of these tiny craft during the War were certainly astonishing.

Other chapters give vivid descriptions of rescues from sinking vessels in mid-ocean and make one realise that man has not yet won the age-long fight against the sea.

A trial flight of a model monoplane (From "The Wonder Book of Aircraft"—see previous page)

* * * *

"Deep Sea Days"

By T. M. HENRY (Witherby. 12/6)

The chronicles of a sailor and sea-painter, giving a truthful description of life at sea in the days of the sailing ship, must be of interest to everyone for whom the sea holds any fascination. Such is the case with this book, which is based largely on the author's own experiences between the years 1866-70. There has been no attempt at embroidery or exaggeration—none indeed is needed, for here, as in every other sphere, truth is stranger than fiction.

The author was born on the Atlantic on a ship bound for Australia. He tells us that his advent caused some little excitement among the other passengers, but no resentment was shown by the genial Captain at his attempt to avoid paying the fare! As there was no clergyman on board, so—as with funerals, marriages, trials and the award of punishments—christenings were amongst the Captain's unpaid duties. His father was a member of the Church of Rome, however, and he thought himself justified in taking the matter into his own hands:—"The results showed what amateurs can be capable of when they butt in. I, the unfortunate victim, was first deluged with water . . . . and then the cruel parent, taking advantage of the helplessness of his child, tacked the name of the ship on to the others with which he had adorned him . . . . only the remonstrances of my mother prevented him from adding the name of the Captain also! Worse was to follow, for one of the passengers . . . . wrote a poem on the event which . . . . was recited at a concert given by my father a few years later. It seemed to me then as though it might have been sawn out of wood . . . . made up out of the author's own head in fact!"

Mr. Henry has given us a racy yarn in this strain, dealing with his experiences in many seas and including many adventures, not the least of which was a shipwreck off St. Bees Head. The book makes interesting reading and is illustrated with 12 sketches by the author.

Interesting New Books

We hope to deal with the undermentioned books in an early issue.

"POLICING THE TOP OF THE WORLD" *by* H. P. Lee (Bodley Head), 8/6
"HUNTING UNDER THE MICROSCOPE" *by* Sir A. Shipley (Ernest Benn Ltd.), 8/6
"STARS AND ATOMS" *by* A. S. Eddington (Humphrey Milford), 7/6

Life at an O.T.C. Camp

Work and Fun of a Holiday Under Canvas

By G. Ronald Jones

THE joys of camp life have always made a strong appeal to boys of all nations, and particularly to those of the English-speaking races. The popularity of such a world-wide organisation as the Boy Scout movement, for instance, is largely due to the important part played in it by organised camps and to the romantic associations of the camp fire. The Officers' Training Corps is in a similar position. As most readers are aware, contingents of the O.T.C. are maintained at practically all Universities and Public Schools. Boys are attracted in the first place by the opportunity afforded them of mixing on equal terms with their fellows, and when they have become members they find that they are not treated as parts of a machine, but as thinking human beings. This is particularly noticeable at the annual camps, where serious work and holiday pleasures are combined in a very satisfactory manner.

After the day's work: Polishing up for next morning's parade

With the exception of the Boy Scout Association, no movement in the world brings a larger number of boys and young men together in annual camps than the O.T.C. The camps they occupy are situated at Tidworth Pennings, Tidworth Park, Strensall, Aldershot, Blair Athol and Gailes. Each is attended by four battalions, or nearly 5,000 cadets.

The work is varied in character and not too heavy. It includes rifle drill, guard-mounting and band practice, together with field operations that round off the course of training received during the school or university term.

The day in camp starts early. Reveille is sounded at 6.30 a.m. and a tremendous rush ensues. The hurry is not entirely dictated by zeal, however, but is very largely due to a desire to secure water for washing in the large shelters. This precious liquid is supplied through ordinary 2½ in. pipes, 30 ft. in length, tapped on both sides at intervals of a yard. When the taps nearest the source are running, no water reaches those at the further end and competition for the first six taps is very keen. After washing the bedding is folded up and placed outside the tents. Everything must be cleaned up and the tents emptied before time for parade.

Breakfast is at 7.30 and consists of porridge, sausages, tomatoes, bacon, bread and butter—the real thing, not margarine—and marmalade. Criticism of the food is traditional, but it is really good and quite well cooked.

Serious work begins with parade at 8.30. The first 10 minutes are occupied with battalion prayers conducted by the padres. Then follows the march to the training area, which is not always the same, since the battalions change ground from day to day in order to add interest. The work itself may consist of demonstrations, followed by an hour or two spent in practice, or of field training. The latter often takes the form of a mock battle between companies or even battalions. The demonstrations may include aeroplane work—in which a pilot picks up with a hook messages that are attached to a rope—or machine-gun practice by a squad of regular soldiers, who show how, after the aim has been laid, the modern machine-gun pumps lead into a target at the rate of 600 bullets per minute without supervision. Regular cavalry, infantry and tank formations also carry out manœuvres that are instructive and at the same time entertaining.

The mock battles are not always successful. The inexperience of the cadets may lead to vagueness and loss of position at later stages of the fight, when nobody seems to know where the enemy is, or even sometimes *who* he is! But as long as it is a fine day nobody cares, and if it is wet—then again, nobody cares. In one of the pauses for breath the field ration, consisting of an apple, a pork-pie and a bar of chocolate, is consumed, after which comes further excitement and false alarms brought about by suggestions that somebody knows where the enemy is! Finally the cadets return to the camp and are dismissed for the day at about 2.30.

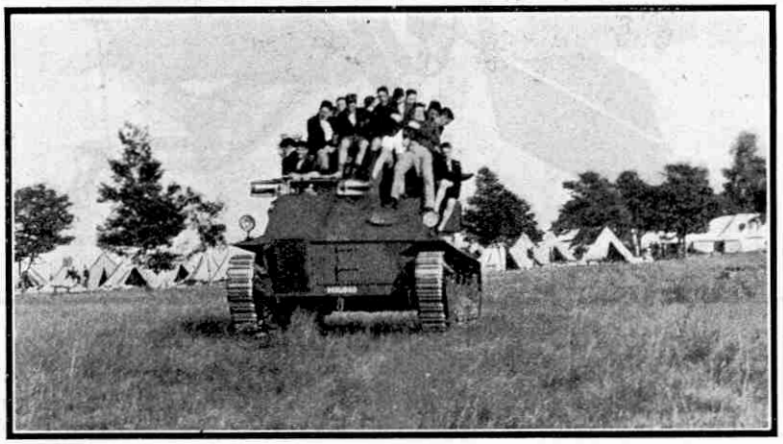
After changing into comfortable "greys" or khaki shorts, they break up into groups. Those who prefer to buy their own dinner instead of taking the regular meal dash off to the canteen. Some sit about and rest after the arduous labours of the morning. Others—more enthusiastic—go to examine the field guns and question the regular soldiers in attendance regarding their range and other points of interest. A few of the keener cadets even go to the length of dismantling machine-guns of various kinds under the guidance of a

regular soldier. Free rides are available on the tanks and armoured cars, and it is a remarkable sight to watch a tank negotiating a narrow trench at 25 miles per hour without pitching off one of the 20 or more joy-riders perched precariously on top. If a cavalry troop is attached to the brigade in camp, horses may be hired and provide the cadets with many enjoyable and thrilling rides.

It is even possible to enjoy the experience of turning out at 2 a.m. to re-pitch a tent that has been blown down during a violent rainstorm! The sight of five or six pyjama-clad figures hopping about in the wet grass while trying to master the violently-flapping canvas is so funny that more often than not, the victims themselves are compelled to laugh at each other.

The O.T.C. Camp at Tidworth Pennings

No description of life at an O.T.C. camp would be complete without reference to the "regulars." They play a very important part for it is they who pitch the camp, keep it supplied with provisions and cook the meals. They also set the pace for the cadets at demonstrations, while their bands attract a great deal of attention. The sight of a brilliantly-uniformed military band on the march is very impressive. They keep perfect formation and are led by a drum-major with swinging baton, while the drummers whirl their sticks in the air and the sun glints on the polished bugles.



Cadets joy-riding on one of the Tanks

The greatest of all occasions in camp is undoubtedly the field day, when the cadets are usually called upon to spend the whole day out on the training ground. They take with them the necessary supplies of food in their haversacks and water in their water bottles, and do not return to camp until late afternoon or evening. Arrangements are made with the R.A.F. and the Royal Tank Corps, as well as with any other branches of the forces that happen to be stationed locally, such as the Royal Artillery and sometimes the Royal Engineers, to combine in one huge mimic war. In such cases, in order to prevent the confusion that arises between friend and foe in the shorter mimic battles, either the attacking or the defending army is ordered to wear white cap bands.

Everything has to be extremely well organised from Headquarters and it is really amazing to see how well controlled are all the movements of the attack and the defence. Information relating to the disposition of the troops is carried to H.Q. by cavalry and also by runners, but by far the greatest part in "contact" work is played by the R.A.F. The large machines of the Air Force add a great amount of realism to the operations and it is really quite trying when two or three enemy scouts or bombers pass close overhead. Then everyone has to keep perfectly still, as the slightest movement down below can be detected from the air, with the result that the whole position would be fatally exposed. Sometimes, indeed, as the drone of the enemy machines gradually grows into a roar, one feels convinced that the whole position must have been seen, and there is a sigh of relief when the hum of the machines becomes fainter and fainter in the distance, showing that their objective has not been noticed. There are many such tense moments during a field day and invariably cadets return to camp thoroughly tired.

One night of every camp is spent in performing what are known as night operations, commonly referred to by the cadets as "night ops." These are very similar to the operations that take place on the field day, the main difference being that silence is absolutely essential. One important thing that cadets are taught to remember is that whenever a Verey light shoots up they must either stand perfectly still or drop to the ground instantly, in order to avoid being seen. Verey lights are very similar in appearance to Roman candles. They illuminate the ground for miles around and they certainly contribute considerably to the erie atmosphere of a silent advance. Occasionally, in order to add a little picturesque realism to the operations, the attacking force will dress up in Indian or Arab costume. The necessary garments are easily fabricated from pyjamas and towels, and faces are blackened by any of the time-honoured methods.

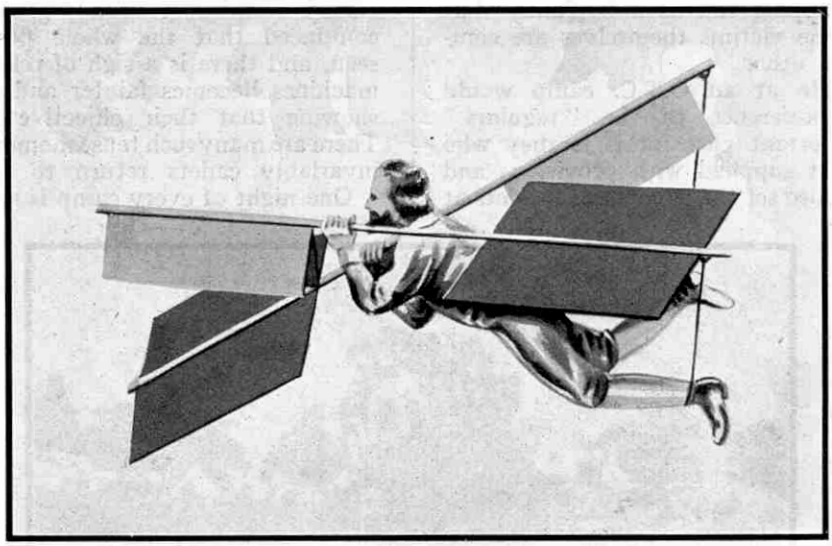
Boxing contests, band competitions, concerts, sports and other varied attractions combine to make life in camp interesting and enjoyable. It is never dull and the end of the eight or ten days spent in this manner brings with it a feeling of regret and a conviction that the time has been far too short for a full appreciation of an O.T.C. camp.

The Conquest of the Air

DEVELOPMENT OF THE AEROPLANE

IN this series of articles we have related the history of ballooning and the development of the dirigible. This month we commence the story of man's efforts to fly by means of heavier-than-air machines.

The earliest experimenters in this direction made use of artificial wings which they attempted to manipulate in imitation of the motions of a bird in flight. One of these pioneers was a French acrobat named Allard who, after a number of successful short flights, decided in 1660 to endeavour to fly from the terrace of St. Germain towards the woods of Vesinet. The attempt was made in the presence of King Louis XIV and a large crowd of people. Shortly after taking-off Allard's strength failed him and he fell to earth, receiving severe injuries.



Besnier manipulating his crude oscillating wings

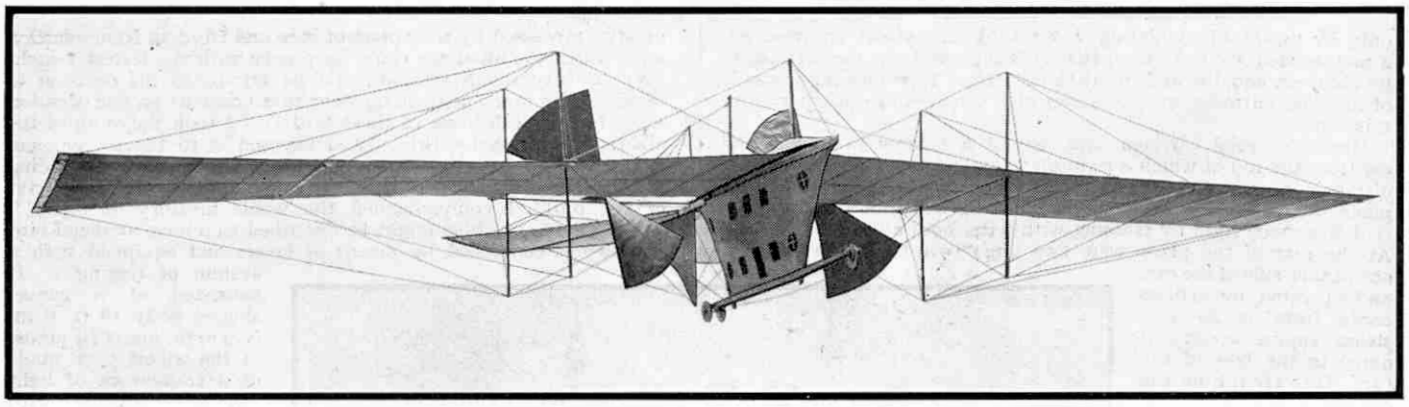
Eighteen years later a French locksmith named Besnier constructed an apparatus that consisted of two long wooden poles at the end of which were wings made from muslin and hinged from the poles so that they could be flapped up and down. In operating this crude flying device Besnier carried a pole across each shoulder and from the rear extremity of each pole a cord passed down to a corresponding foot. When the left pole was pulled downward at the front by the left hand the right pole was jerked downward at the rear by the right foot. The wings at the ends of the poles that were canted downward then opened out flat, while the wings at the upraised ends of the poles folded up. Thus a crude representation of the motion of the wings of a bird was obtained.

Besnier contented himself with short-distance efforts until he had gained confidence. His first experiments consisted of jumping from chairs and tables to the floor, seeking to delay his downward progress by actuating his wings. Later, jumps were made from the sills of first and second storey windows, and eventually he jumped from an attic window and sailed over the roof of a neighbouring cottage before coming safely to earth. Besnier eventually sold his apparatus to a touring acrobat and constructed a second pair with which he intended to carry out flights across wide rivers and other places impossible or difficult to traverse on foot. History does not record any accomplishments on his part in this respect, however, and it is probable that he lost interest in the subject.

In 1709 a friar named Bartholomew de Guzman claimed to have invented a passenger-carrying flying machine, capable of travelling at a high speed. He petitioned the King of Portugal to prohibit anyone from copying his invention, and on 17th April, 1709, a Royal decree was issued stating that any transgressor of Guzman's rights would be put to death. In order to encourage the inventor to further experiment the King granted him " the first Professorship of mathematics in my University of Coimbra, and the first vacancy in my College of Barcelona, with the annual pension of 600,000 reis during his life."

Guzman's inventiveness was regarded with acute disfavour in Rome and efforts were made to persuade him to confine himself to tasks considered more seemly for a monk. His enthusiasm for his invention could not be restrained, however. Eventually he was reported to the Inquisition as a heretic and was arrested and placed in gaol. Nothing is known of his later life, and it is thought likely that he died while in prison.

The next notable experimenter was another Frenchman, the Marquis de Bacqueville, who constructed a pair of artificial wings which he attached to his hands and feet. After a number of successful practice flights he announced, in 1742, that he intended to take-off from his mansion, fly across the River Seine and land in the Tuileries, a distance of 600 ft. from his house. His



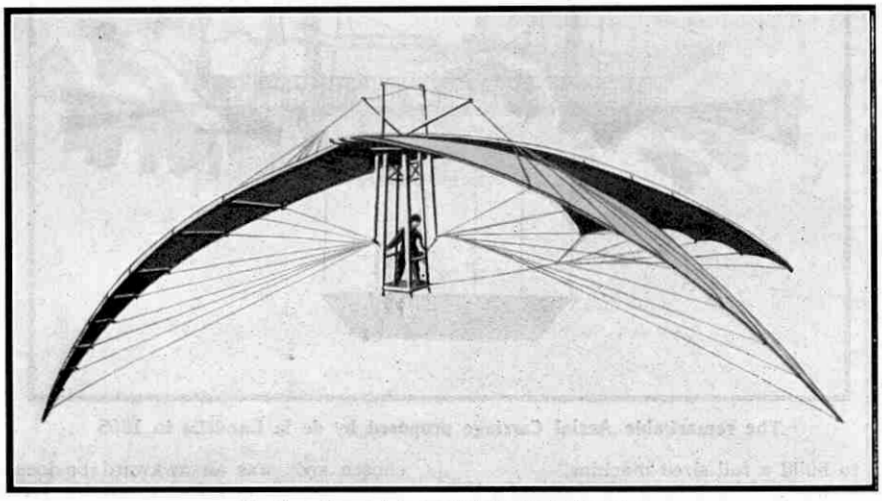
Courtesy] [*Board of Education*

Model of Flying Machine invented by Henson in 1845

novel proposal attracted great attention and on the appointed day a huge crowd assembled to witness the event. After equipping himself with his wings the Marquis made a successful take-off and travelled successfully through the air for some distance. Then he appeared to become tired and shortly afterwards he crashed down upon the deck of a barge anchored in the river. This experiment cost him a broken leg and he made no further attempts. It is stated that the wings he used on this occasion had a total area of only 24 square feet and it is evident that they were much too weak for the task.

The example of De Bacqueville was emulated in 1772 by Abbé Desforges, a priest of Etampes. Desforges designed a "flying chariot" having a wing on each side and a small horizontal sail attached. He believed that by rapidly beating or flapping the wings he would be able to travel through the air, but when a trial was made he found himself unequal to the great strain of manipulating the wings with the result that he crashed to the earth, fortunately without serious injury. During the subsequent 35 years or so inventors confined their attention mainly to the development of balloons, which achieved great popularity. The idea of bird-like flight was not forgotten, however, and in 1809 a Viennese watchmaker named Degen produced an apparatus consisting of two parachutes between which a flyer was accommodated. These parachutes thus served the purpose of wings and by manipulation they could be folded up or extended as desired. The strange apparatus worked fairly well and with it Degen accomplished several public flights. On one occasion he attained an altitude of 54 ft. and after flying in different directions to demonstrate the ease with which the wings could be manœuvred he glided safely to earth again. His enterprise aroused considerable public interest and at Vienna a fund was organised to provide him with the capital necessary to further his experiments.

Degen's achievements gained him the attention of many aeronauts and scientists, among whom was an English aeronaut, named Sir George Cayley. Cayley later published an essay on the subject in the course of which he remarked that:—". . . the idea of attaching wings to the arms of a man is ridiculous enough, as the pectoral muscles of a bird occupy more than two-thirds of its whole muscular strength, whereas in man the muscles that could operate upon wings thus attached would probably not exceed one-tenth of his whole mass. There is no proof that, weight for weight, a man is comparatively weaker than a bird; it is therefore probable if he can be made to exert his whole strength advantageously upon a light surface similarly proportioned to his weight as that of the wing to the bird, that he would fly like the bird, and the ascent of Mr. Degen is a sufficient proof to the truth of this statement."



De Groof and his quaint Flying Machine

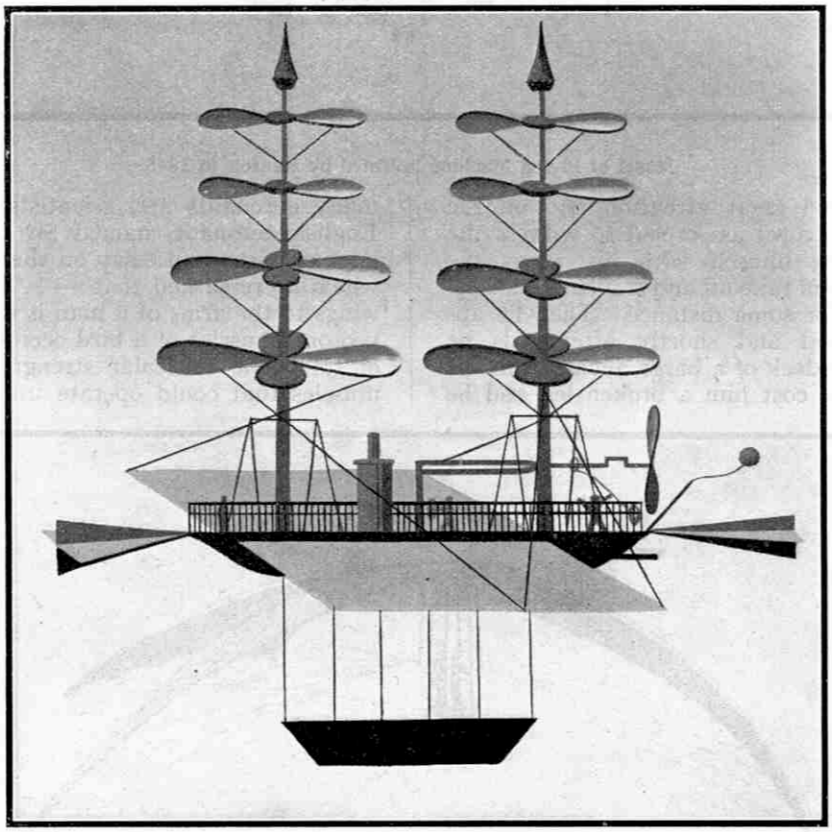
Cayley expressed the opinion that a steam engine offered a satisfactory means of obtaining the necessary motive power for a flying machine. Such a scheme called for a much lighter steam engine than the Boulton and Watt engines of that time, however.

A flying machine somewhat similar to Degen's was proposed later by Thomas Walker of Hull. In a booklet that Walker published under the title of "*The Art of Flying*," he related that during his youth he had dissected numerous birds and, in later life, had studied closely the structure and working of the various parts such birds use when in flight. As a result of his research, he stated, he had evolved a method for "making a flying car with wings, in which a man may sit and by working a small lever cause himself to ascend and soar through the air with the facility of a bird." The device that he suggested consisted of a sail, shaped like an equilateral triangle, and extended horizontally over the head of the flyer.

Most of these early attempts to evolve a satisfactory man-carrying flying machine were based upon the idea that the requisite buoyancy in the air could be obtained

only by means of oscillating wings. About 1845 it occurred to a man named W. S. Henson that this support from the air might be obtained equally well by utilising a rigid type of wing instead of movable surfaces, and he designed a contrivance incorporating this idea.

Henson's aerial carriage consisted of a narrow three-wheeled car from the top of which a rigid plane extended for a considerable distance on each side, like the outstretched wings of a bird. The plane was of oiled silk or canvas covering a bamboo framework that was made rigid by trussing with wire, both above and below. At the rear of the plane were two large twin-bladed propellers, one at each side of the car, and operated by endless cords from a 30 h.p. steam engine accommodated in the bow of the car. Directly behind the car was a fan-shaped tail, extended upon a horizontal triangular framework, that could be moved upward or downward and opened out or closed by means of an arrangement of cords and pulleys, workable from the car. Beneath the tail was a vertical rudder for steering the machine to right or left, while a sail, stretched between two masts rising from the car, provided an aid to maintaining the desired course.



The remarkable Aerial Carriage proposed by de la Landelle in 1865

Henson never built the imposing machine that he had planned, but subsequently he and another experimenter, J. Stringfellow, made a model of it and carried out various tests. These tests were not very successful, however, on account of the model being too light to withstand even gentle puffs of wind. Subsequently Stringfellow achieved some success with indoor experiments with model aeroplanes but so far as is known he did not make any attempt to build a full sized machine.

In 1856 a flying machine was invented by Lord Carlingford. This had two slightly concaved wings one on each side of the car, and to ensure their rigidity laths as sustaining leaves or ailerons were extended over the top of the car from one wing to the other. A tail and rudder were provided for steering. This machine embodied an original scheme of propulsion that included a screw propeller worked by a hand wheel fitted in the forepart of the car. "I have proved by experiment," declared the inventor, "that an aerial screw of only five inches long can give a pull greater than a ten-pound weight suspended to a cord and drawing through a pulley; and as it will only take such a small force to maintain the flight of the aerial chariot, that what we look upon as fabulous may hereafter come to pass, and that, like the chariot of Jupiter, we may yet behold two eagles trained to draw the aerial chariot."

One of the problems that troubled early inventors of aeroplanes was that of starting-up their machines, and Carlingford proposed to overcome the difficulty by an unconventional method. The aeroplane was to be suspended by ropes between three lofty poles, one rope passing from the rear of the car to the top of one of the poles, while two lines were to extend from the bow of the car to the other two poles, passing over pulleys on the top. A weight was to be attached to the "free" end of each of the two front lines, while the stern rope carried a trigger which, on being released, caused the weights to descend, thus exerting a substantial forward pull on the machine. As the machine moved forward the ropes were to be cast off and the flight sustained by energetically turning the hand-wheel of the propeller. There is no record of Carlingford's machine ever having been constructed.

A remarkable flying machine was built by a French sailor named Le Bris. While at sea during his youth he had been greatly impressed by the apparent ease and freedom from exertion with which the albatross could keep pace with the fastest vessels, even in very rough weather, and he attributed his decision to build a flying machine to an incident that occurred on one occasion when he had killed one of these birds. "I took the wing of the albatross," states Le Bris, "and exposed it to the breeze, and lo! in spite of me it drew forward into the wind; notwithstanding my resistance it tended to rise. Thus I had discovered the secret of the bird. I comprehended the whole mystery of flight!"

The sailor's machine might be described as a huge artificial bird with wings controlled by means of levers and equipped with a system of rigging. It consisted of a canoe-shaped body 13 ft. 6 in. in length, and 4 ft. across at the widest part, made of a framework of light ash ribs covered with waterproof cloth to enable it to float, in the event of the machine descending upon the water. The two flexible wings and the tail were shaped like those of an albatross. The wings were each 23 ft. in length, with the front edges constructed of a flexible piece of wood to which transverse stays were fitted, the whole being covered with Canton flannel. Rotary motion was imparted to the flexible fringe of the wings by means of two strong levers situated in the car, where also was a foot pedal to operate the tail. A short inclined mast projected from the prow of the car and carried the pulleys over which passed the cords from the levers to the wings.

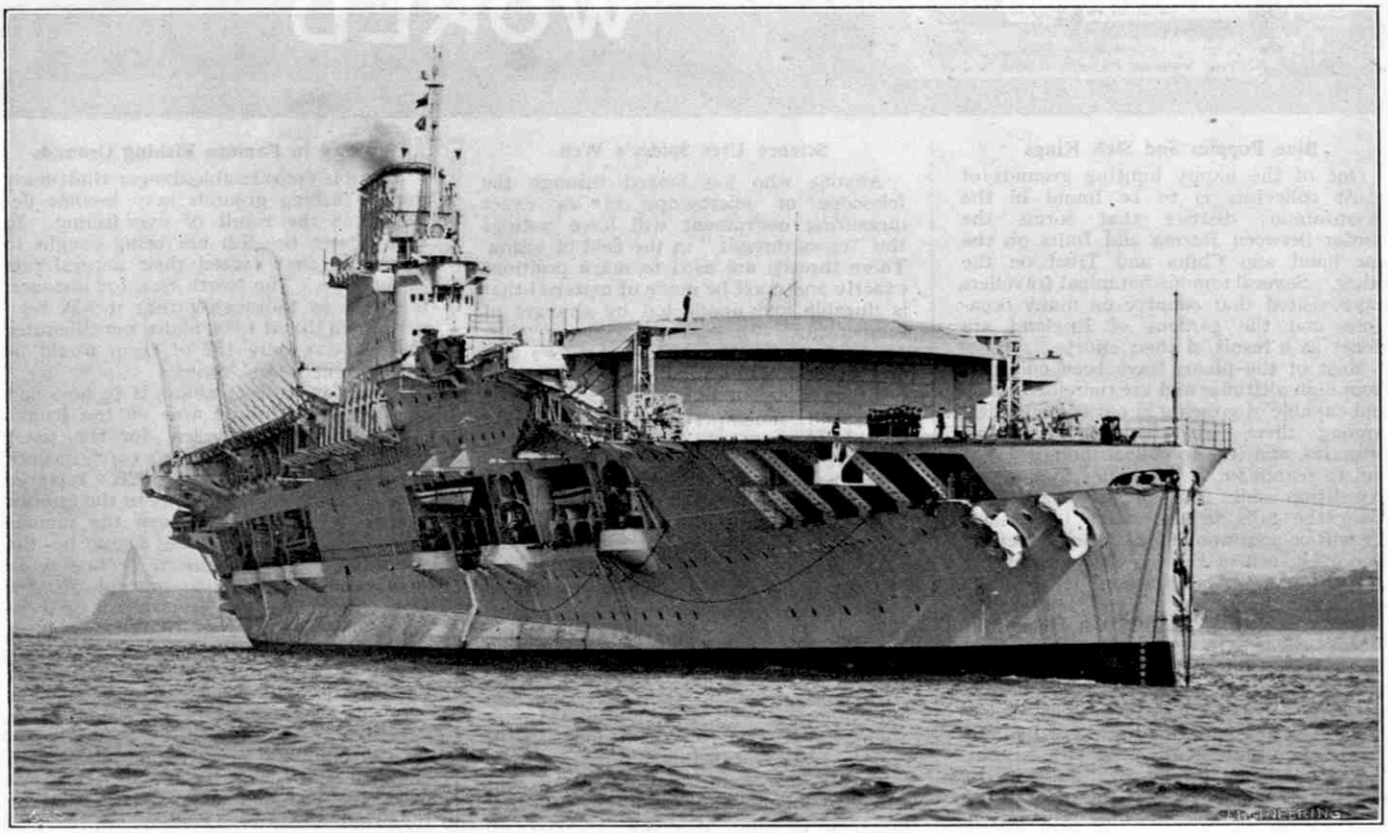
The trial took place one Sunday on a public road at Trefeuntec. The machine measured 50 ft. in length from tip to tip of the extended wings and conveyance to the chosen spot was an awkward business. It was loaded on to a peasant's cart and tied down by a rope that passed under the cart rails and terminated in a slip-knot on the wrist of Le Bris, who stood in the car of the machine. The cart, driven by the peasant, set off down the road, Le Bris keeping his hands on the machine levers and pressing down the flexible front edge of the wings to prevent the wind from getting underneath and lifting the machine. Further stability was given to the craft by assistants on each side of the conveyance, who maintained a hold upon the wing tips. The cart moved along against a stiff breeze until the place chosen for the experiment was approached when, at a given signal from Le Bris, the driver put the horse to a trot. At the same time the inventor loosened the slip-knot and, depressing the levers, caused the front edges of the wings to elevate gradually. They responded almost immediately to the wind pressure on the under side and the machine rose steadily into the air, ascending to a height of almost 300 ft.

The take-off of the machine was accompanied by alarming cries from below, however, and looking down Le Bris perceived that the rope he had detached from his wrist had wound itself around the body of the driver of the cart, with the result that when the machine rose it lifted him from his seat! The terrified man was clinging to the rope and it was fortunate that he was so placed in respect of the machine as not to unbalance it. Le Bris promptly manipulated his levers and caused the machine to glide to earth so quickly that the suspended driver was not hurt. On this occasion the machine had flown a distance of about 200 yards. During a later trial the machine plunged into a quarry and was smashed up, the inventor escaping with nothing worse than a broken leg. In 1869 Le Bris constructed a second machine the funds for which were provided by public subscriptions. This machine made some successful

(*Continued on page 731*)

Britain's Latest Aircraft Carrier

H.M.S. "*Courageous*" has Cost Over £4,000,000



THE fifth aircraft carrier to be added to the British Navy has recently undergone her steam trials. This is H.M. Aircraft Carrier "*Courageous*," which was laid down in May, 1915, at the Walker-on-Tyne yard of Armstrong, Whitworth & Co. Ltd.

The "*Courageous*" was originally designed as one of three battle cruisers, the other two being H.M.S. "*Glorious*," laid down at the Belfast yard of Harland & Wolff Ltd. about the time when the construction of the "*Courageous*" was commenced, and H.M.S. "*Furious*," the keel of which was laid down by Armstrong, Whitworth & Co. Ltd. in June, 1915. The design of these three vessels embodied recommendations made by Lord Fisher in April, 1915, and the close secrecy maintained regarding them led to the cruisers being nicknamed "Lord Fisher's 'hush-hush' ships." The vessels were intended for operations in the Baltic.

The "*Courageous*" was completed in January, 1917, but during her subsequent trials in heavy weather she strained her hull forward and was returned to dock, where her hull was reinforced. The hull of the sister ship "*Glorious*" was similarly strengthened. When these two light battle cruisers subsequently became engaged in action their 3 in. belt of protecting armour plate amidships proved insufficient to defend them from the gunfire of hostile light cruisers, while their limited armament was found to be inadequate for effective attack. The cruisers did not take part in any further actions during the war and it was ultimately decided to convert them into aircraft carriers. For this purpose the "*Courageous*" was sent to the naval dockyard at Devonport.

The "*Courageous*" has an overall length of 786 ft. 3 in. and a beam of 81 ft. Her displacement when fully loaded is 22,700 tons and her maximum draught 26 ft. Her 18 Yarrow small tube boilers burn oil fuel only and supply steam to Parsons geared turbines, which are capable of developing 90,000 s.h.p., and drive four propellers. The results of the recent trials have not been made known, but during her cruiser trials in 1917 the "*Courageous*" developed an average speed of 31½ knots.

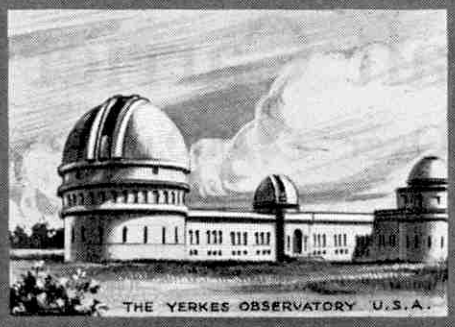
The protecting belt amidships of 3 in. armour plate, included in the cruiser design, has been retained and modified bulges have been provided to protect the vessel against torpedo attacks. Her armament consists of 16 guns of 4.7 in. calibre and 18 smaller guns.

In the case of this aircraft carrier the smokestack has been re-introduced and this is incorporated in the high, narrow superstructure built up at the extreme starboard edge of the deck. The superstructure also carries a small mast forward of the funnel. The flat flying deck extends the full width and about two-thirds the length of the vessel and, with the exception of the funnel casing at the starboard edge, is entirely free from obstructions. The peculiar situation of the smokestack is calculated to reduce to a minimum the eddying air-currents that it sets up when the ship is in motion, and which are troublesome to the aeroplanes.

Extensive hangers are situated below the flying deck and provide accommodation for five "flights" of aeroplanes, while electric lifts are provided for hoisting the machines up to the flying deck. These machines are of the varied types necessary to the evolutions of a fleet at sea.

The construction of the "*Courageous*" as a light battle cruiser cost about £2,000,000 and her conversion to an aircraft carrier is estimated to have cost approximately £2,025,000, so that altogether she has cost over £4,000,000,

The four aircraft carriers that have already been commissioned are the "*Eagle*," "*Argus*," "*Hermes*" and "*Furious*," the last-named being a sister ship to the "*Courageous*." The "*Argus*" is of special interest. It was laid down in 1914 as the Italian liner "*Conte Rosso*," and was subsequently purchased for the British Navy and re-designed as an aircraft carrier, being completed in 1918. A feature of this vessel is the absence of any smokestack or superstructure, and in consequence the flying deck is entirely unobstructed, giving the ship a very grotesque appearance. The furnace smoke and gases are ejected through specially designed horizontal ducts aft.



OUR WONDERFUL WORLD

Blue Poppies and Sick Kings

One of the happy hunting grounds of plant collectors is to be found in the mountainous district that forms the border between Burma and India on the one hand and China and Tibet on the other. Several famous botanical travellers have visited that country on many occasions and the gardens of England are richer as a result of their efforts.

Most of the plants have been collected from high altitudes and are therefore hardy and capable of growing in our own climate. Among them are rhododendrons and primulas, and it is to collect more of these and to search for blue poppies that a new expedition under Mr. Kingdon-Ward is to roam the hills to the north of Assam. He will be accompanied by Colonel Kermit Roosevelt, son of the famous president of the United States, who is an explorer with great experience.

Besides collecting plants, Mr. Kingdon-Ward, warned by past experience, will be prepared for other emergencies. On one occasion in Tibet he had the pleasure of curing a petty king of a serious illness, greatly to his own surprise. He had no idea of the nature of the king's illness, but it was necessary for his own sake to do something and hope for the best. Accordingly he entered into a long explanation of his patient's state of health, which nobody understood, and gave the king a few harmless looking headache pills. A few days later he was summoned back to the monastery where the king lived. He went with a feeling that disaster was imminent, but to his surprise he found the monarch dressed in his most gorgeous robes and in riotously good health and spirits! On the strength of this wonderful cure Mr. Kingdon-Ward immediately became the most popular individual in the king's realms, and had no difficulty in procuring the guides and porters necessary for his work.

* * * *

Shooting Round the Moon

The long range gun with which the Germans bombarded Paris had a range of 75 miles. Such a gun transported to the Moon would make conquest by invaders from the Earth quite simple, as it would be possible to drop a shell on any point of the Moon's surface without altering position. The difference between the pull of the Earth and that of the Moon on the projectile would increase the range from 75 miles to 2,250 miles, a distance that is more than a quarter of the Moon's circumference. A still more remarkable feat could be accomplished by the gunner, for if he gave the gun an elevation of four degrees, the shell would pass right round the Moon and hit him in the back.

Science Uses Spider's Web

Anyone who has looked through the telescope or microscope of an exact measuring instrument will have noticed the "cross threads" in the field of vision. These threads are used to mark positions exactly and must be made of material that is durable and unaffected by changes of temperature. In some instruments they are actually the threads of a spider's web and often have a thickness of less than one thousandth of an inch.

An American expert finds that the finest thread is spun in the latter part of September, as it is then of uniform strength. Evening is the time for collecting spiders, when they are attracted by strong lights and an abundance of flies and mosquitoes.

In order to obtain the strands for scientific purposes the spider is placed on a four-sided loom and left to establish himself. Presently he begins spinning and so does the loom, an attendant turning it gently as the spider lowers himself on his silken thread, thus deceiving him into thinking that he is travelling quite a long way! Strands up to 15 ft. in length may be reeled off in this manner. A tiny cable thus obtained is steamed and stretched for use in scientific instruments. It is elastic and of great strength, an ordinary strand being capable of supporting a good-sized pebble. It is also very durable and many spider's web cross-hairs installed in instruments 40 years ago are still in good condition.

* * * *

A Blind Fish with Three Hearts

Probably the strangest fish in the world is one found in great numbers in Monterey Bay on the coast of California, and known locally as the "hagfish." This creature is of great interest because, so far as is known, it is the only fish that is a complete parasite. It lives on larger fishes, making its way into their bodies through the skin at the throat and devouring the muscles, leaving the skin and organs untouched. A fish so attacked soon dies for it is impossible to live with such a ferocious uninvited guest.

Although the hagfish is blind it is extremely sensitive in other ways. When touched, however lightly, it draws back its head with lightning speed and swims away. Its sense of smell is also highly developed, and a piece of food dropped into a tank of hagfish causes an instant commotion.

This strange fish has three hearts. Two of them are of a normal type but the third, situated in the tail, is unable to contract by itself and is controlled by nerves.

Scarcity in Famous Fishing Grounds

There is considerable danger that many famous fishing grounds may become depleted as the result of over-fishing. In many cases the fish are being caught in quantities that exceed their natural rate of increase. The North Sea, for instance, is fished so thoroughly that it has been calculated that if 1,000 plaice were liberated there to-day only 157 of them would be left in four years' time!

A similar state of affairs is to be found in the salmon-fishing area on the Pacific coast of North America, for the latest report shows that this year's catch has not been more than half that of 1926. It is true that the deficiency is chiefly in the inferior grades of salmon, but even the famous "Sockeye" variety, the finest in the world, also shows signs of decreasing in numbers. In order to prevent disaster from overtaking the industry it will be necessary to impose drastic restrictions on fishing operations, particularly at the mouth of the Fraser River, through which pass enormous numbers of fish on their way to the spawning grounds. This necessity has been realised for some years by the Canadian Government but before effective steps can be taken it will be necessary to secure the co-operation of the United States Government, as the Fraser River enters the Pacific Ocean very near the boundary between the two countries.

It is a curious feature of new fishing grounds that they are actually improved by judicious fishing. Plaice taken from new grounds always include a large proportion of old and thin fish. The removal of some of these makes life easier for the remainder and thus, as fishing proceeds, larger and better specimens are caught. If fishing is continued on too large a scale, however, the young fish do not grow up in sufficient numbers to replace those captured, and in consequence there comes a time of scarcity such as is now threatening the North Sea and the salmon grounds of Alaska and British Columbia.

* * * *

Breathing Rocks in Coal Mines

A curious explanation has been given of the surprising length of time during which a fire in a coal mine will continue to burn after the gallery in which it is raging has been sealed off by a concrete wall. The reason is said to be that air is breathed out by porous rocks, thus enabling combustion to continue long after the air normally present in the colliery has been exhausted. Such porous rocks are to be found in many mines, notably in those of Montana in the United States, and it is believed that they absorb the air when the barometric pressure is high.

Egypt Without the Nile

The importance of the River Nile to Egypt has been common knowledge for centuries, and an account of the manner in which the first principles of agriculture were revealed on its banks was given in the first article of the series on "*Our Daily Bread.*" An inquiry into the origin of the enormous quantity of water that the great river carries down at flood times has led to the surprising conclusion that the cause of the existence of the Nile is the comparatively high temperature in Central Asia, 2,000 miles away!

The Nile and its tributaries rise in Uganda and Abyssinia, where their sources are fed by the rains brought by the winds of the south-west monsoon, which appears with great consistency in summer. At other periods the prevailing winds are those of the dry north-east monsoon. The existence of these two winds depends upon the existence of the large mass of land constituting Asia, in conjunction with the wide expanse of the Indian Ocean to the south. The land warms up more quickly than the sea, but it also loses more rapidly the heat thus acquired. It is this fact that gives rise to the monsoons. When October comes, for instance, the land in Central Asia cools quickly and becomes a centre of high atmospheric pressure, with the result that at this time the winds of the north-east monsoon begin to flow out over India and Arabia. The reverse conditions in spring and at the beginning of summer produce the moisture-laden south-west monsoon.

At present the two monsoons are well balanced, but if the average temperature of Central Asia became lower from any cause, the north-east monsoon would begin to play the greater part and the climates of the countries that are swept by the monsoons would become drier. This would apply to the regions in which the Nile rises, and it is therefore quite clear that if the temperature of the country surrounding the Himalayan mountains became so low that huge glaciers pushed their way down the mountain slopes into the Indian plains, the rainfall of Uganda and Abyssinia would be very greatly reduced and the Nile probably would disappear. The astonishing thing is that these conditions did once actually prevail. There is ample evidence that the glaciers of the Himalayas formerly extended far beyond their present limits, which in its turn proves that the temperature of Central Asia was very low indeed. The dry north-east monsoon then completely over-shadowed the rainy south-west monsoon, and the rainfall in South Africa was so slight that the Nile disappeared in the desert, owing to lack of water, long before it reached Egypt.

The period when this state of affairs altered, and the growing Nile began to push its way down its present course through Egypt, may very easily be found from an examination of the fertile mud brought down by it. This is at most 30 ft. to 35 ft. in depth, and 10 ft. have been deposited in the last 4,000 years, as is known from actual records. Assuming that the rate of deposition has been the same throughout, this indicates that the process has been in operation for 14,000 years. Thus old Father Nile is really quite a youngster in comparison with many other natural features of the world.

* * * *

From an Indian Reader

A train of bullock wagons splashing through a ford across an Indian highway. This primitive mode of transport has been in use in India for ages and is still very much in evidence

Hailstone Havoc

Hail can be a very serious menace indeed, not only in countries subject to tropical storms, but also in Great Britain. One day in 1893 England and Wales were devastated by successive downfalls of hailstones that were big enough to earn the name of young icebergs. Many were as large as tennis balls and for weeks afterwards glaziers were as busy as plumbers after a prolonged frost! Thousands of panes of glass were broken in Harrogate alone.

More recently London was visited by a hailstorm in which the glass roof of the workshops of Woolwich Arsenal was bombarded by jagged hailstones three inches in diameter. Abroad, hailstones that weigh half-a-pound, and even more, are by no means uncommon, some stones that fell in Natal in 1878 weighing as much as a pound and a half. The record weight appears to be four and a half pounds. This is given as the weight of stones that fell in Spain almost a hundred years ago, but there is some doubt whether the weighing was correctly made. Birds and animals have often been killed by hailstorms, and an authenticated case is reported from Siberia in which some women met their death in the same manner.

Electric Dust Storms

When motor cars were first introduced into Western Kansas, temporary breakdowns often occurred for which no obvious explanation could be found. Eventually the cause was traced to clouds of electrified dust that settled on the car and imparted to it a charge that it retained on account of the tyres acting as insulators. When the cause was discovered a remedy was soon found in the shape of a trailing chain attached to the back axle. This effectively earthed the charge collected on the car and enabled the ignition apparatus to work properly once more.

Dust storms of this kind are fairly frequent in the great plains east of the Rocky Mountains during dry seasons, and in similar areas in other parts of the world, notably in South Africa. Wire fences are charged by them to a high voltage and their effect on wireless reception is, of course, disastrous. It is often possible to light a small electric lamp by placing it in series with an aerial and an earth wire! Even the tips of horns of cattle have been seen to glow in dust-storms. The animals become charged with electricity, as they are effectually insulated from the earth by their hoofs, and the charge leaks away from the points of the horns in the same manner as it leaks from the tops of the masts of a ship in a severe thunderstorm.

These electrical storms have been studied by allowing the sand to be blown into a large tin vessel, one end of which is covered with fine wire gauze. In this way it has been discovered that the charge is positive, but it is not by any means certain how the charge has been produced. Possibly friction between the particles of dust or between them and the earth is responsible, a suggestion that is to some extent confirmed by the fact that large voltages have been measured, although the actual amount of electricity is very small.

* * * *

Cleaning Up a Town

The authorities of Ord, a town in the United States, have hit upon a novel method of getting rid of insanitary accumulations of tin-cans that were an eyesore to them. A "tin-can matinee" was held at a local picture theatre, the price of admission being 12 cans!

The receipts were no fewer than 10,000 tin cans, paid at the doors by 300 children. A competition for can collecting was won by a boy who acccumulated 2,200 cans and beat his nearest competitor by 100 cans only, thus earning a prize of six free tickets. A grand procession of lorries laden with the booty followed the collection. To-day it is very difficult to find a stray can in Ord, and the town has become a serious contender for the "spotless town" championship.

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 Suggestions published showing special merit. Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(132)—Centrifugal Governor for Electric Motor

(K. S. Roberts, London, S.E.)

MANY Meccano boys must have felt the need of an automatic regulating device for controlling the speed of the Meccano 4-volt Electric Motor. In the ordinary way the speed of the Motor may be regulated with the Meccano Resistance Controller by cutting resistance in when the speed increases and cutting it out when it falls. This means, of course, that the operator constantly has to manipulate the controller. With the device described below the required results are obtained in an entirely automatic manner, while it is impossible for the speed to rise beyond a certain limit.

The Meccano 4-volt Electric Motor is mounted at one end of the base, which is composed of Angle Girders bolted together. The governor spindle is a 3½" Rod that is journalled in a reinforced bearing consisting of a Double-arm Crank and a Double Bent Strip bolted to one of the cross girders in the base.

Construction of the Governor

The governor consists essentially of two Simple Bell Cranks that are pivoted by ⅜" lock-nutted Bolts (see Standard Mechanism No. 263) to the ends of two horizontal 3½" Strips. The latter are secured to the head of the governor spindle by a Collar (new style). Ordinary bolts are passed through the centre holes of the 3½" Strips and are inserted in the set-screw holes of the Collar, two Washers on each bolt being used for spacing purposes. These Bolts must be tightened up very securely.

The upper extremities of the Bell Cranks 4 are each weighted with two ¾" Pinions that are secured to 1½" Rods passed through the end holes of the Bell Cranks. Links composed of 1½" Strips are attached pivotally by means of lock-nutted bolts (S.M. 262) to the other ends of the Bell Cranks, and the lower ends of the links are attached in a similar manner to two ½" × ½" Angle Brackets bolted to the top Pulley 2. The 2" Pulleys 2 are connected rigidly together by means of ½" Bolts. The latter are first secured to the upper 2" Pulley, and the lower Pulley is then secured to the shanks of the bolts by means of further nuts. The distance separating the two Pulleys should be such that the Threaded Pin on the Strip 6 may easily pass between them. A Compression Spring is inserted between the Pulleys 2 and the Collar carrying the 3½" Strips forming the head of the governor.

The 5½" Strip 6 is attached pivotally by a lock-nutted bolt to a 1½" Angle Girder that is bolted to the Motor side plate. The other end of the Strip 6 is provided with a contact stud consisting of a Spring Buffer.

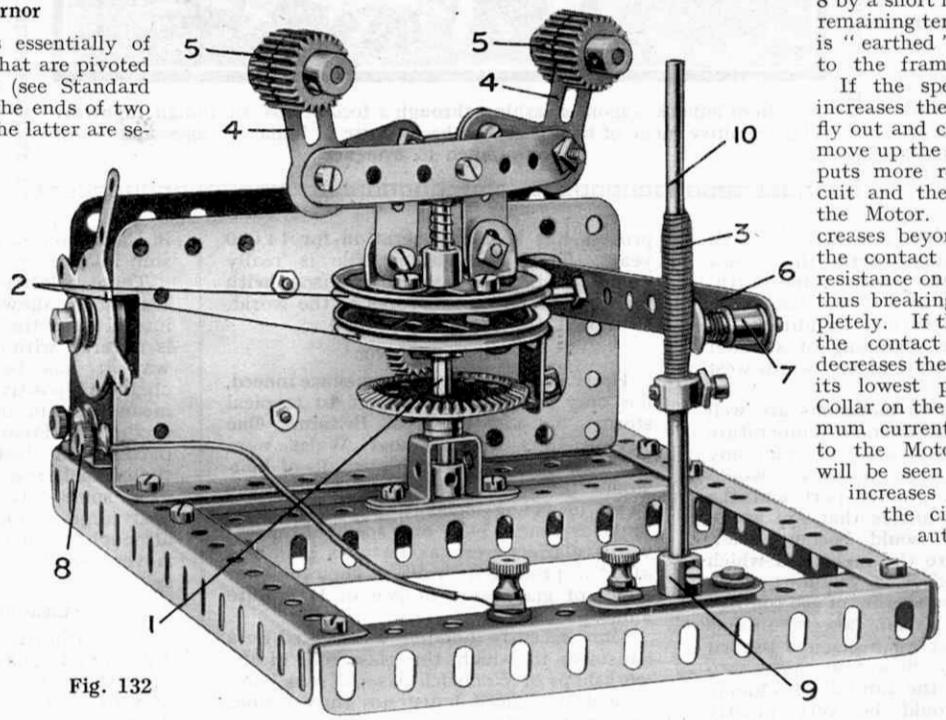


Fig. 132

The 4½" Rod 10 is covered carefully for a portion of its length with brown paper, which is stuck to the Rod with gum. One end of a length of 27 B.I. Resistance Wire (Part No. 312) is secured to the bolt shown inserted in the Collar on the Rod 10, and is retained in position by a nut. The wire is laid on in a smooth spiral over the brown paper, and finished off a short distance from the top end of the paper, for reasons that will become apparent later.

Arrangement of the Electrical Connections

The Double-arm Crank 9 is attached to, and insulated from the Angle Girder on which it is mounted by two 6 B.A. Bolts and Insulating Bushes and Washers. One of the 6 B.A. Bolts is provided with a terminal. Another insulated terminal is secured to the same girder and is connected to the Motor terminal 8 by a short length of wire. The remaining terminal of the Motor is "earthed" by connecting it to the frame of the model.

If the speed of the Motor increases the governor weights fly out and cause the Strip 6 to move up the resistance 3. This puts more resistance into circuit and therefore slows down the Motor. If the speed increases beyond a certain limit the contact 7 moves off the resistance on to the plain paper, thus breaking the circuit completely. If the speed decreases, the contact 7 descends and decreases the resistance, and at its lowest point touches the Collar on the Rod 10. A maximum current is then supplied to the Motor. From this it will be seen that as the load increases the resistance in the circuit is decreased automatically, and vice versa. Hence the speed of the Motor is maintained at a fairly constant level, notwithstanding fluctuations in the load. An easy way of demonstrating the action of the centrifugal governor would be to incorporate it in a model crane. Weights of different values could be hung from the crane hook and a note made of the speed at which they were hoisted.

The parts required to build the governor mechanism are:—

1 of No. 2	1 of No. 16	14 of No. 37A	1 of No. 120B
2 „ „ 3	2 „ „ 18B	1 „ „ 45	2 „ „ 127
2 „ „ 6A	2 „ „ 21	2 „ „ 59	3 „ „ 302
2 „ „ 8B	4 „ „ 25	2 „ „ 62B	3 „ „ 303
4 „ „ 9	1 „ „ 30A	2 „ „ 111A	3 „ „ 304
1 „ „ 9F	1 „ „ 30C	2 „ „ 111C	3 „ „ 305
2 „ „ 12	1 „ „ 30C	2 „ „ 111C	2 „ „ 306
1 „ „ 15A	17 „ „ 37	1 „ „ 120A	1 „ „ 312

(133)—Spring Letter Balance

(D. T. Howard, Margate)

Models that may be put to actual use are always sure of a welcome. This one, if constructed carefully, may be used to weigh small objects. Fig. 133 is a general view of the Spring Balance, and Fig. 133a is a rear view, showing the mechanism.

A 5½″×2½″ Flanged Plate is bolted in a vertical position to a 3½″×2½″ Flanged Plate. A 6½″ Rod 1 is journalled in the centre hole of the top flange of the vertical Plate, and its lower end is journalled in a ½″×½″ Angle Bracket bolted to the Plate. The Rod carries a Face Plate on its upper end, on which the objects to be weighed are placed, and a Rack Strip is secured to it by means of two Collars (new style), ordinary bolts being passed through the holes in the Rack Strip and inserted in the set-screw holes of the Collars. Nuts on the bolts hold the Rack Strip rigidly in position.

The spring consists of three Compression Springs (Part No. 120B) placed on the Rod 1 and separated from each other by Washers. (The Rack Strip has been partially cut away in the illustration, Fig. 133a, so that the spring may be seen more clearly). The end of the spring rests against the lower Collar holding the Rack Strip to the Rod 1.

A 2½″×½″ Double Angle Strip is bolted between the flanges of the upright 5½″×2½″ Flanged Plate in such a position that it prevents the Rack Strip twisting round and so becoming disengaged with the ½″ Pinion on the Rod 2. The latter Rod is journalled in a reinforced bearing consisting of a Double-arm Crank bolted to the Flanged Plate. It carries a Pointer (Fig. 133) at its outer end.

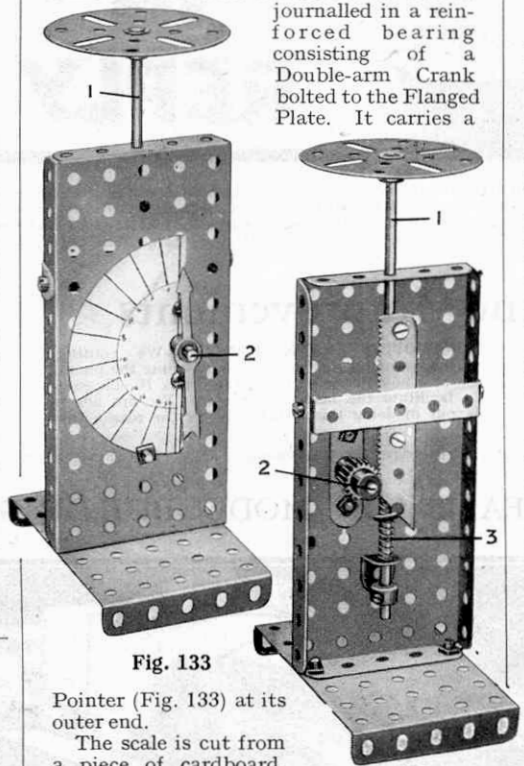


Fig. 133 Fig. 133a

The scale is cut from a piece of cardboard. It may be calibrated by placing weights of different known values on the Face Plate and marking the position the Pointer takes up on the scale for each weight. Care should be taken to see that the Pointer is exactly at zero when no weight is on the Face Plate.

(134)—Meccano Puzzle

(D. A. Turner, London, E.17)

An ingenious puzzle always provides much good fun, and one made entirely from Meccano Parts should be particularly popular. The design of the Meccano puzzle shown in Fig. 134 is extremely simple, but the problem, which is to remove the Strip 2 from the frame, is by no means an easy one to solve! Cutting the string or undoing the knot is *not* allowed.

The loop of string 1 attached to the end of the 5½″ Strip 2 should be of such a length as to reach half way along the Strip 2. To assemble the puzzle first pass the loop over the points 3, 4, and 5 and then slip it down to the Trunnion 6. Next pass the 5½″ Strip 2 through the space 7 and again take the loop over 3, 4 and 5. The loop 1 and Strip 2 are now attached to the frame as shown in the illustration.

A friend should be asked to remove the Strip 2 from the frame. He will undoubtedly find the task difficult; indeed, we fully expect him to fail dismally!

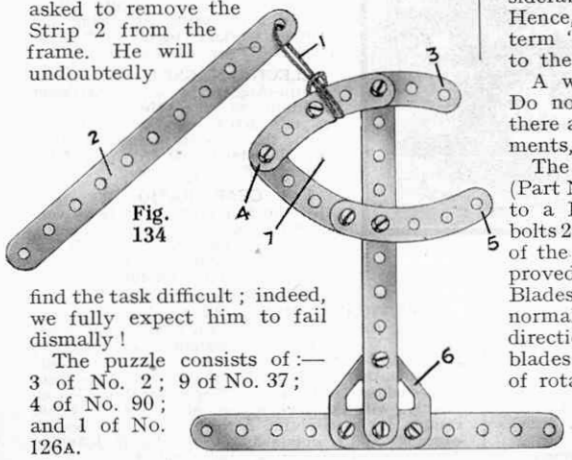


Fig. 134

The puzzle consists of:—3 of No. 2; 9 of No. 37; 4 of No. 90; and 1 of No. 126A.

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.23). Bicycle Indicating Lamp.—Details of an interesting "stop" indicating lamp for use on a bicycle have been received from F. Clayton (Yeadon, near Leeds). The lamp is placed at the rear of the bicycle and when the brakes are applied it is caused to shine through a screen on which is stencilled the word "stop." The act of applying the brake causes the crank on the end of the brake lever to make contact with a Strip attached to the handlebar stem and insulated therefrom. This completes the electric circuit connecting the lamp to the accumulator or battery which is carried in any convenient position on the cycle. The idea should appeal to many readers who are enthusiastic cyclists or motor cyclists.

(M.24). Infinitely-variable Speed Gear.—An infinitely-variable speed gear submitted by G. Roberts (Ealing, W.13) consists essentially of two wooden rollers of conical shape mounted on parallel axles and arranged so that the thin end, or neck, of one is opposite the base, or widest part, of the other. A driving belt is passed round the two cones and the relative speed of their axles may be varied by sliding the belt to and fro along their lengths. This, of course, is a well known method of varying the speed of a driven shaft, but a drawback to its reproduction in Meccano is the necessity for two specially-shaped wooden cones.

(M.25). Sandpaper Block.—A sandpaper block is a useful addition to any tool kit. L. Williams (Ramsgate) has fashioned one from a Meccano Flanged Plate and two 5½″ Strips. The sandpaper is placed over the face of the Plate, turned over the flanges at the ends, and held in place by the Strips, which are sprung between the flanges.

(135)—The Meccano Helicopter

(G. W. Cole, Hereford)

The model illustrated in Fig. 135 is extremely simple to build and will provide a great deal of entertainment, especially for one's younger brothers or sisters. Merely by pulling a cord sharply, the pair of Propeller Blades may be made to fly off vertically in the air to a considerable height and then glide to earth. Hence, there is some justification for the term "helicopter" that has been applied to the model!

A word of warning is necessary here. Do not fly the model in a room where there are fragile china ornaments, for obvious reasons!

The two Propeller Blades (Part No. 41) are secured to a Bush Wheel 1 by bolts 2. The performance of the model will be improved if the Propeller Blades are given a greater "pitch" than normal by twisting them in opposite directions, so that the surfaces of the blades make a greater angle to the direction of rotation.

The Bush Wheel 3 and the two Flanged Wheels 5, which act as a flywheel, are all secured to the 4½″ Rod 4, and the latter is journalled in a 2½″×1½″ Double Angle Strip, in which it is retained by a Collar 6. The Double Angle Strip forms a convenient handle.

A piece of cord about 24″ long is wound on the Rod 4. The propeller should be placed on the Bush Wheel 3 so that the shanks of the bolts 2 project freely through the holes of the Bush Wheel. If now the free end of the cord wound on the Rod 4 is given a smart pull, the propeller will immediately leap off into the air.

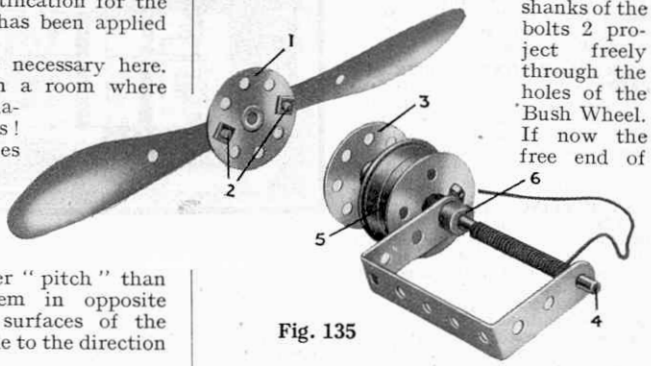
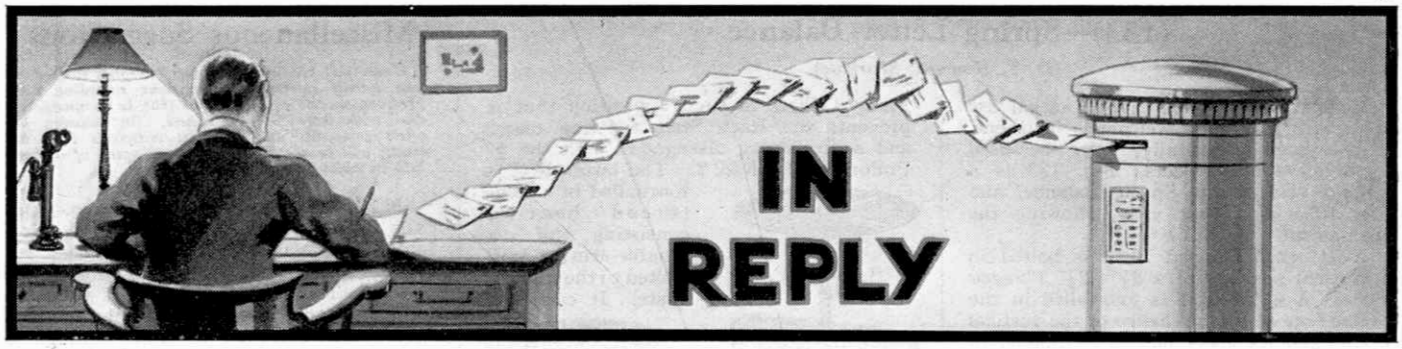


Fig. 135



In these columns we reply to suggestions regarding improvements or additions to the Meccano and Hornby Train systems. We receive many hundreds of such 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 separate sheets 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, Liverpool.

Suggested Meccano Improvements

COLOURED MECCANO.—While we do not agree with your suggestion that Meccano should be coloured in blues and yellows, we are experimenting with a steel blue colour for certain parts, as we find this gives the article a most realistic appearance. (*Reply to C. Derek Legge, Bradford, Yorks.*).

NEW PLATE.—A plate having holes only around its edges would have a neat appearance, but its adaptability would be greatly impaired. (*Reply to Arthur J. Risk, Adelaide, S. Australia*).

ELECTRIC BOAT MOTORS.—We are afraid that few uses could be found for an electric motor of the boat type. A motor of this type would certainly be smaller but we are afraid that power would be sacrificed. (*Reply to F. R. Liddall, Plymouth*).

KEYED RODS.—We are unable to consider the introduction of rods having a key-way cut in them, as the standard Rods are of too small a diameter to allow this to be done. (*Reply to O. Charlton, Cheam, Surrey*).

TINS OF ENAMEL.—Small tins of red and green enamel are now available, so that boys who possess nickel parts may bring them up-to-date. Watch the "*M.M.*" for a further announcement on this subject. (*Reply to L. M. Noguera, Argentine, and others*).

LARGER ELECTRIC LAMPS.—We do not think it advisable to introduce more powerful lamps to work off a 12-volt supply as the existing Lamps fulfil most purposes, and in most cases their size is more in keeping with Meccano Models. (*Reply to S. Dundas, Ilkley, Yorks.*)

THE NEW FLANGED PLATE.—We have received several complaints that the new Flanged Plate (part No. 52) cannot be used in certain models. In every case, however, slight modifications have made the use of the new Plate possible. Of course, in building many of the smaller models the new-type Plate will be found infinitely superior to the old pattern. (*Reply to R. G. Stansfield, Southampton, and P. Brailsford, Yarmouth, I. of Wight*).

GRAMOPHONE 'PICK-UP' PARTS.—We cannot consider the introduction of special parts for the construction of a gramophone 'pick-up,' as a great number of new parts, such as permanent magnets, special wire, etc., would have to be added. (*Reply to R. F. Medforth, Rochdale*).

ENAMELLING OF MECCANO PARTS.—Your suggestion that all Meccano Plates, Strips, etc., should be enamelled on one side only, is both novel and interesting. We agree that parts so enamelled would be much more convenient to use in electrical models than the existing enamelled parts, as continuous electrical connection could be made without removing the enamel. Parts so enamelled would find favour with model-builders who possess coloured parts, and also those boys who still use the nickelled articles, although for many purposes they would prove awkward. We will further consider this suggestion and comment on it later in the "*M.M.*" (*Reply to W. Harbord, Normandy, Nr. Guildford*).

IMPROVED CRANK HANDLE.—We continue to receive numerous suggestions regarding the punching of a hole in the centre of the Crank Handle so as to facilitate the fastening of cord. We are not in favour of doing this, principally for the reason that the strength of the Crank Handle would be materially impaired, but we are filing all suggestions received for further consideration. It is quite a simple matter, however, to attach cord to a Crank Handle by means of a Spring Clip, and this method of connection will be found quite secure in nearly every case. (*Reply to S. Graham, Belfast; J. Nash, Quebec, Canada; D. Clayton, Moseley, Birmingham; D. E. Grant, Acton, W.3; H. F. Wilmot, Port Elizabeth, S. Africa; K. J. Smith, St. Albans; and E. Barker, Surbiton, Surrey*).

CHEVRON-TEETH GEAR WHEELS.—As previously stated in these pages we are unable to consider the manufacture of these parts, as they would be very costly to produce and would show little, if any advantage over the existing Gear Wheels. (*Reply to J. Herrial, Lochgilphead*).

NEW RACK SEGMENT.—A 7" diam. rack segment would find few uses if introduced and we cannot therefore consider its manufacture. (*Reply to Coln Gallen, Dublin*).

INTEGRAL RATCHET GEAR WHEEL.—A gear wheel incorporating a ratchet mechanism is meeting with our consideration and we hope to be able to give a definite announcement on the subject in the near future. A part of this type would be very compact and would offer several advantages over the existing Ratchet Wheel and Gear Wheels in certain models. (*Reply to H. F. Lane and S. F. Watkinson, Hampstead*).

2½"×2½" FLANGED PLATES.—It is not our intention to introduce a plate of this type as a similar article can be built up from a 2½"×2½" Flat Plate and two 2½" Angle Girders, quite easily. There would be very little difference in strength and appearance between the built up article and your suggested part. (*Reply to A. Coldham, Peachland, B.C., Canada*).

SWITCH ARMS.—We were interested in your suggestion regarding a brass strip having a standard hole punched in one end. This would be useful in constructing switches, etc., but as the standard Strips can be made to function quite well as switch arms we do not consider your suggested part necessary. (*Reply to A. M. Johnston, Dunstable*).

SPRINGY PLATES.—We are going into the question of manufacturing plates of very thin pliable metal. We agree that an article of this type would be most useful in the construction of certain models. (*Reply to J. Ellechim, Brighton*).

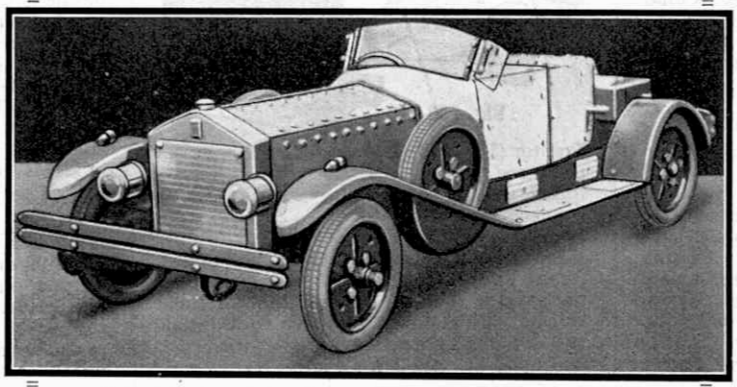
CHEAPER OIL CANS.—We are pleased to say that we will shortly introduce an oil-can that will be priced much lower than the "K" pattern. The new oil-can will be found most useful in oiling the various working parts of Meccano models. (*Reply to B. Edwards, Hythe*).

ELECTRO-MAGNET.—A special electro-magnet is an unnecessary addition to the Meccano range, as this article can be constructed from the existing electrical parts (see the March "*M.M.*" page 245). (*Reply to E. Gray, Southall*).

5:1 GEAR RATIO.—We agree that the 5:1 gear would be of considerable use in certain models, such as clocks, etc. We will endeavour to introduce gear wheels giving this ratio in the future. (*Reply to E. E. Jones, Northwich*).

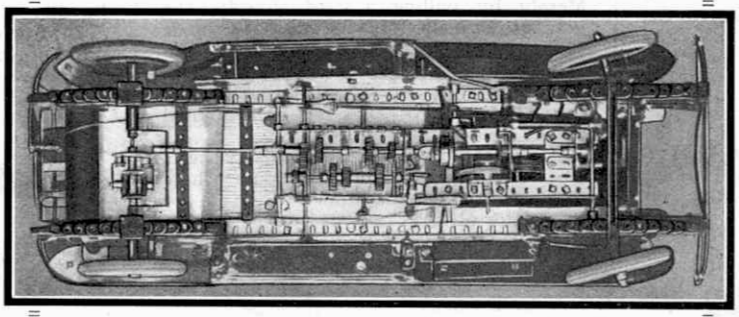
NEW WORM WHEEL.—We consider your suggestions, that a special worm wheel to gear with the Sprocket Wheels should be manufactured, distinctly good. As you remark a gear reduction of 14 to 1 could be obtained by using a ¾" Sprocket Wheel and your suggested part, or by using a 2" Sprocket Wheel in conjunction with the worm a gear ratio of 36 to 1 would result. It is doubtful however, whether smooth working could be obtained. (*Reply to A. M. Johnston Dunstable and S.J. Orford, London, S.E. 4*).

REALISM IN MODEL-BUILDING



On first glancing at the photograph reproduced above, one might think that it has been taken from the catalogue of a well known motor firm! In reality it depicts a wonderful example of miniature automobile engineering.

The builder of the model, Mr. F. Hancock of Sale, Manchester, has not utilised Meccano in the construction of the body-work, but on referring to the lower illustration, it will be seen that the framework of the car and all mechanical features, such as clutch, 3-speed and reverse gear box, differential, four-wheel brakes, etc., have all been built up from parts standard to the System. The working portions of the chassis are in many respects similar to those fitted to the new Meccano Chassis. Mr. Hancock is to be congratulated on this excellent piece of model-building.



Suggested Hornby Train Improvements

CHIMNEY OF No. 3 LOCOMOTIVE.—We agree that the present type of chimney fitted to our No. 3 locomotive leaves something to be desired in regard to appearance and the design will be altered as soon as possible. (*Reply to M. D. Wilson and A. P. Walker, Alloway, Ayr*).

PARALLEL POINTS FOR CONTROL.—Many important developments in regard to the Hornby Control System are now under consideration and it is possible that parallel points will be incorporated. At present there are certain difficulties in the way. (*Reply to O. Macnamara, Oxford*).

DUMMY WHISTLE FOR LOCOMOTIVES.—This is a good idea. We shall probably fit a dummy whistle to certain of our locomotives before long but we cannot make a change at present. (*Reply to J. Garner, Eastbourne*).

No. 0 LOCOMOTIVES.—If we were to adopt your suggestion and fit our No. 0 locomotives with reversing gear they would then be the same as our No. 1 locomotives and would, of course, be the same price. We think you will see that for this reason the idea is not practicable. (*Reply to E. Eggington, Bristol*).

BOGIES FOR METROPOLITAN LOCOMOTIVES.—Your suggestion regarding the introduction of bogies to these engines is interesting and we agree that they would be improved in general appearance and be more in accordance with actual practice if this alteration were made. Nevertheless, judging from our correspondence, the Hornby Metropolitan locomotives are giving extremely satisfactory performances as they are, and at present, at any rate, we cannot adopt your idea which, of course, would entail a considerable increase in cost. (*Reply to P. Yates, Manchester*).

EXTENSION OF WINDING SPINDLE.—We do not consider that the advantage of a winding spindle extending from side to side of the locomotive would be sufficient to warrant the expensive alterations that would have to be made to all the locomotives in the Hornby series, if the idea were adopted. (*Reply to M. Summers, Exmouth*).

"RIVER" CLASS TANKS.—We do not consider that the introduction of models of the "River" class tank engines of the Southern Railway would prove very popular. In any case, as we do not intend to introduce a 6-coupled mechanism at present, we think that our No. 2 Tank Engines, which are of the 4-4-4 type, should meet your requirements. These locomotives are very steady workers and their hauling capability is above that of the average 4-coupled models on account of the greater weight they have available for adhesion. (*Reply to D. Heaps, Hastings*).

DOUBLE TRACK.—We are sure that model railway enthusiasts will welcome the new double track that we are now designing. This track will solve all the problems of double curves and will be very realistic in appearance. Other double track accessories such as crossovers, level crossings and parallel points will be introduced from time to time to fit the double track. (*Reply to D. Carmichael, Blackpool*).

LARGER LEVER FRAME.—We realise that it is not possible to control a very large shunting yard with our standard control lever frame. We will consider the introduction of a larger frame and also of detachable bell cranks, similar to those you suggest, to enable the rodding of the Control System to be taken from one side of the track to the other. (*Reply to R. Fox, Earlsfield, S.W.18*).

'FLYING SCOTSMAN' INDICATOR BOARDS.—We will consider attaching boards bearing the legend 'Flying Scotsman' to our No. 3 L.N.E.R. locomotives, as in actual practice. (*Reply to H. Watson, Newcastle-on-Tyne*).

LOCOMOTIVE WORKS.—We are afraid that you do not realise the immensity of the proportions of a locomotive works, when you suggest that we should supply a model of one of them in two or three sections, for assembling at home. If you particularly desire to possess one of your own, it should be possible for you to make quite an imposing model from Meccano, though you would require an extremely large number of parts if the result is to approach scale proportions. (*Reply to R. Mills, Carlisle*).

CATCH POINTS.—Catch points are no doubt very necessary on real railways, but we cannot see that they would serve any useful purpose on a model railway. (*Reply to L. Dobbie, Birmingham*).

"MOUNTAIN" TYPE LOCOMOTIVES.—Locomotives of the "Mountain" and similar types are, of course, very fine models and attractive in appearance, but they are not suitable for the small curves of gauge 0 railways. (*Reply to L. Williams, Windsor*).

STEAM LOCOMOTIVES.—We have received many inquiries regarding the possibility of introducing steam locomotives to the Hornby system. For the time being at any rate we do not propose to manufacture such locomotives. For general model railway use, and in particular for timetable working, clockwork locomotives have many advantages over the steam type. (*Reply to G. H. Reid, Londonderry*).

NAMES ON STATION LAMPS.—You are quite right in stating that most station lamps bear the station name on them. At present it would be rather difficult to apply this idea to our models for various reasons, including the shape of the lamps, but when the time arrives for re-designing our lamps we will give the idea consideration. (*Reply to F. Jacobs, Leicester*).

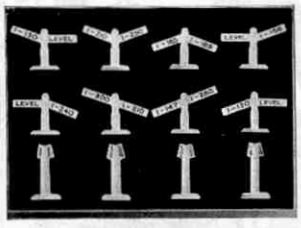
COLLECTING SHOES FOR METROPOLITAN COACHES.—Your idea in regard to fitting our Metropolitan coaches with separate collecting shoes is interesting and we agree that the lights in these coaches could by this means be kept on without there being any need for connecting the coaches together electrically. The drawback to adopting this scheme, however, is the additional cost that would be involved, which would be so great as to counterbalance the advantage to be gained. (*Reply to J. Perry, London, N.19*).

ATLANTIC COAST EXPRESS.—We thank you for suggesting this name for our No. 3 Southern Railway Set but we have already decided to name this outfit the "*Dover Pullman.*" The locomotive is to be called "*Lord Nelson.*" (*Reply to O. S. Hare, Etwall, Derbyshire*).

NEW ROLLING STOCK AND ACCESSORIES

The new accessories that are illustrated below are now available. They will be found to add greatly to the realistic appearance of any Hornby Railway layout. The Watchman's Hut, the Gradient Posts and the Mile Posts, in particular, look extremely effective when placed by the side of the line. The new Redline Petrol Tank Wagon is a very interesting addition to Hornby rolling stock. It is finished in standard "Redline" colours and presents a most attractive appearance. The Mansell die-cast Wheels are strongly recommended to Hornby enthusiasts who desire to improve the running of their coaches. They are correctly designed to represent actual railway practice, and there is not the slightest difficulty in fitting them. The Shunter's Pole is a small but extremely useful accessory. By means of it the clumsy and unrealistic coupling and uncoupling by hand is entirely done away with, and all these operations may be performed quickly and with suitable delicacy. The "K" Oil Can is an item of exceptional interest. It has been specially introduced for oiling Hornby Trains, Meccano Models, and other small mechanisms, and its long tapering spout enables the most awkward corners to be reached without difficulty. The oil is ejected drop by drop by depressing the valve, just in the same manner as in a full-sized model. For use with this oil can there is the Meccano Lubricating Oil. This oil is of exceptionally fine quality and is the correct grade for Hornby Trains. The regular use of this oil will greatly improve the running of trains and Meccano models of every description.

RAILWAY ACCESSORIES No. 7. Watchman's Hut, Brazier, Shovel and Poker. Price **1/6.**



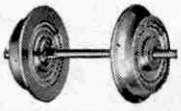
RAILWAY ACCESSORIES No. 5. Gradient Posts and Mile Posts. Price **2/-** per set.

MECCANO LUBRICATING OIL. Price **6d.** per bottle.

PETROL TANK WAGON "REDLINE." Price **2/6.**

SHUNTER'S POLE. Price **4d.**

OIL CAN No. 2 ("K" TYPE). Price **3/6.**



MANSELL WHEELS. Price per pair **4d.**

TUBE RAILWAY.—Your designs for an underground railway are certainly interesting but we are afraid that the difficulties that would be entailed in running the system realistically would prove prohibitive. (*Reply to J. Fisher, Guernsey*).

KITCHEN CAR.—We do not think there would be much demand for a kitchen car. There are several more popular additions to be made to the Hornby Rolling Stock before we consider this idea. (*Reply to J. R. Moss, Southsea*).

FURNITURE FOR COACHES.—This is quite a novel idea but we are afraid that the great expense incurred in manufacturing details of this kind would prove prohibitive. It should not be difficult for enthusiasts who desire to furnish the interiors of their rolling stock, to do so by means of cardboard models. (*Reply to B. Whittaker, Southampton*).

MAIL VANS.—We are now carrying out experiments with Mail vans with a view to introducing them into the system and we will announce any further developments as soon as they occur. (*Reply to D. H. Wakely, Cheam, Surrey*).

SADDLE TANK ENGINES.—At present we do not intend to manufacture a small locomotive of this kind, as we think the No. 1 Tank engines are ideal for the light shunting work that you mention. (*Reply to J. Dowlands, Hastings*).

POP SAFETY VALVES.—There would be no advantage to be gained by making the alteration you suggest to our "Royal Scot" Locomotives. We are afraid that this idea is unsuitable. (*Reply to J. Dowlands, Hastings*).

HORNBY TRANSFERS.—We are unable to supply any of the transfers used in the Hornby Series. (*Reply to W. Bennett, Bishopton, Renfrewshire, and many others*).

MIXED TRAIN SET.—It is not usual to see a locomotive at the head of a train consisting of one Pullman car, an open wagon, petrol tank, and a guard's van, in actual railway practice, and we do not think that a train set consisting of these accessories would be popular among Hornby enthusiasts for this reason. (*Reply to N. Simpson, Whitchurch*).

ENGINE CAB LEVERS.—We fully appreciate your suggestion for the fitting of a scale model regulator and a brake handle in place of the present levers. This no doubt would improve the general appearance and we will give it consideration, although we are inclined to doubt its practicability. Your suggestion for shortening the control rods is much more feasible and we are filing this for reference later. (*Reply to D. L. Nicholson, Weybridge*).

GOODS SHED.—We hope to place a goods shed and crane on the market shortly. (*Reply to S. Ellam, Hythe*).

NAMEPLATES.—This is certainly a novel idea, but as all the large Hornby locomotives already bear a name before they leave the Hornby Locomotive Works in Liverpool, we do not consider that separate nameplates such as you suggest, would be in very great demand. (*Reply to R. A. Lang, Haywards Heath*).

SLEEPING CARS.—We do not propose to introduce English sleeping cars. We manufacture the "Voitures Lits" for the Blue Train, and possibly these will satisfy your requirements. (*Reply to B. Madely, Manchester*).

WHEEL FLANGES.—We quite realise that the flanges on the pressed metal wheels fitted to Hornby Rolling Stock are rather large, but we do not propose to alter these for various reasons. The Mansell Wheels, illustrated on this page, considerably improve coach running and have much smaller flanges than those on the ordinary tinplate wheels. We suggest that you use these cast wheels where tinplate wheel flanges catch on the scale model track chairs. (*Reply to R. Johnson, Birmingham*).

Electricity Applied to Meccano

XI—Electric Beam and Horizontal Engines

These articles are intended to draw every Meccano boy's attention to the numerous fascinating uses to which the Meccano Electrical parts may be put. The first two articles of the series dealt with the elementary principles of electricity, and subsequent articles described various Meccano switches, a coil winding machine, a Meccano electric telegraph system, electro magnets, a galvanometer, motors, an electric locomotive, bells, lamps, an ammeter, an electric sign, and an electrically-controlled Hornby Railway. This month we describe two novel electric engines. Although developing no great power, they are extremely interesting to build and set in motion.

THIS month we describe the construction of two electrically-operated engines. One is of the horizontal type and the other is of the overhead beam type. Both depend for their operation upon the action of solenoids. It was explained in the article on the Electrically-operated Signal (described in the "*M.M.*" for March, 1928) that the solenoid is an electro-magnet with a hollow core, and when a current flows through the wires of the coil, magnetisable objects, such as iron rods, etc., are drawn into the core of the solenoid.

In the model beam engine (Fig. 1) two solenoids are mounted one above the other. They are energised alternately, and draw the steel "piston rod" first in an upward direction into the core of the upper solenoid and then downward into the lower one. The reciprocating movement so produced is converted into a rotary one by the crank and beam mechanism that is the characteristic feature of the prototype.

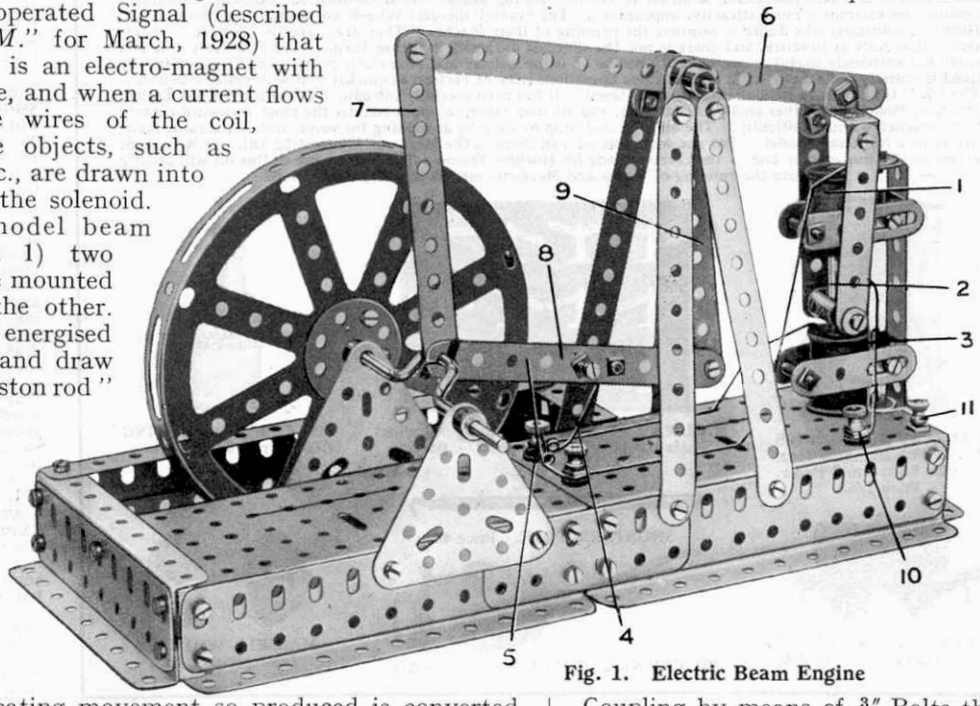


Fig. 1. Electric Beam Engine

Construction of the Beam Engine

The erection of the model should be commenced by building the base. This consists of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates bolted end to end. At one end of the base so formed a $4\frac{1}{2}''$ Angle Girder is bolted, and secured at right angles to this is a $7\frac{1}{2}''$ Girder. The other end of the $7\frac{1}{2}''$ Girder is attached to the side flange of one of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates forming the base by a 2" Angle Girder and an Angle Bracket.

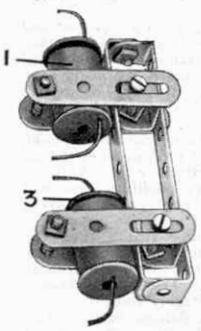


Fig. 2 Electro-magnets of Beam Engine

Flat Girders are bolted to all sides of the base and Angle Girders are secured to the bottom edges of these Flat Girders to strengthen the construction and also enhance the appearance of the finished model. Two $2\frac{1}{2}''$ Triangular Plates are bolted to the base as shown to form bearings for the Crankshaft. The flywheel consists of a Hub Disc bolted to a Bush Wheel that, in turn, is secured to the end of the Crankshaft.

Two Bobbins 1 and 3 (Figs. 1 and 2) are wound with seven layers of No. 26 S.C.C. wire on each. A layer of brown paper should be placed round each finished coil to protect the insulation of the windings.

Four 2" Slotted Strips are attached to two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips by means of Double Brackets, and each solenoid is placed between a pair of Slotted Strips and clamped in position by a 1" Screwed Rod passed through the end holes of the Slotted Strips and secured by nuts at each end. It is important that both solenoids are in line so that the "piston rod" may work with perfect freedom.

The "piston rod" 2, which consists of a 2" Rod, has a Coupling secured to its centre and two 3" Strips are attached pivotally to the Coupling by means of $\frac{3}{8}''$ Bolts that are inserted in the ends of the Coupling and gripped by the set-screws. Two $\frac{1}{2}''$ Reversed Angle Brackets are bolted to the upper ends of the 3" Strips to form means of attachment to the beam 6.

The beam 6 is mounted together with a $4\frac{1}{2}''$ Strip 9 on a $1\frac{1}{2}''$ Rod that is carried by two 1" Triangular Plates secured to the tops of four vertical $5\frac{1}{2}''$ Strips, the other ends of which are bolted to the base of the model. Two $4\frac{1}{2}''$ Strips 7 and 8 are placed together on the

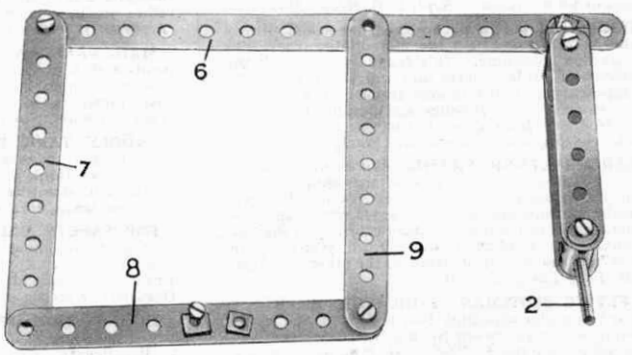


Fig. 3. Reciprocating Parts of Beam Engine

crankshaft and retained in position by means of Spring Clips. The Strip 7 is attached pivotally to the end of the beam 6 by a lock-nutted bolt and the Strip 9 is attached in a similar manner to Strip 8. Two $\frac{3}{8}$" bolts are secured to the Strip 8 by double nuts, so that they protrude from opposite sides of the Strip 8. (Fig. 3). The various lock-nutted joints should be quite free yet have no appreciable side play.

All that now remains to be accomplished is the wiring of the model. The brushes 4 and 5 are merely short lengths of bare 23 S.W.G. Copper Wire. A loop is formed in each brush (by twisting it round a Rod) to increase its springiness. The brushes are attached to two terminals that are insulated from the base plate by Insulating Bushes and Washers.

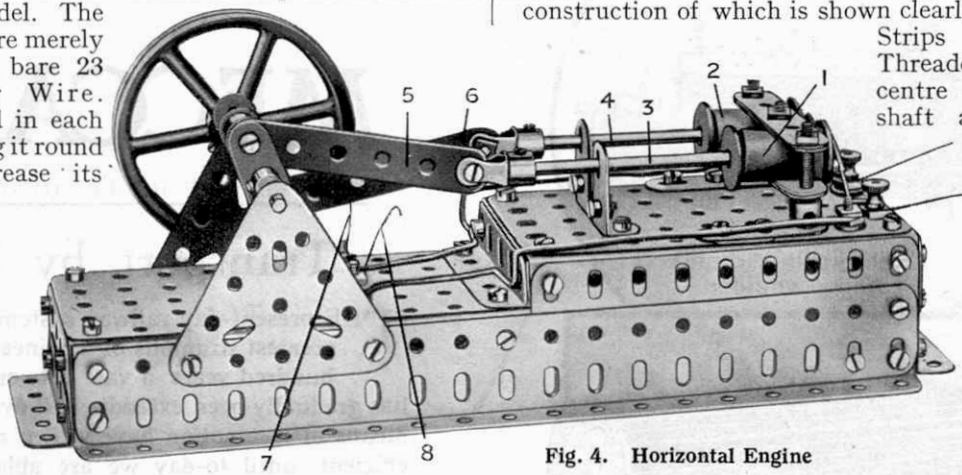


Fig. 4. Horizontal Engine

One wire from each solenoid is taken to a brush terminal, the remaining wires of the solenoids being attached to the insulated terminal 10, the terminal 11 being in metallic contact with the base plate. The brushes may be regarded as a type of switch, operated by the model itself, that complete the circuits of the solenoids alternately.

In Fig. 1 the piston rod 2 is shown in the act of completing its downward stroke. The flywheel is rotating in an anticlockwise direction, a fact which causes the Strip 8 to move to the left and one of the $\frac{3}{8}$" Bolts on it to make contact with the brush 5. This completes the circuit of the solenoid, energising it and causing it to draw the piston rod up into its core.

As the crank nears its lowest position — or bottom dead centre as it is termed — the Strip 8 commences to move to the right, eventually causing the brush 5 and its bolt to part. Thus the solenoid 1 is de-energised. The Strip 8 continues moving to the right and the second $\frac{3}{8}$" Bolt secured to it presently makes contact with the brush 4, which energises solenoid 3. The latter pulls the Rod 2 downward until the brush 4 breaks contact with its bolt. The cycle of operations is then repeated.

The brushes 4 and 5 must be so adjusted that they commence to make contact with the respective bolts on the Strip 8 when the crank is just past its dead centre, otherwise the model will not work properly.

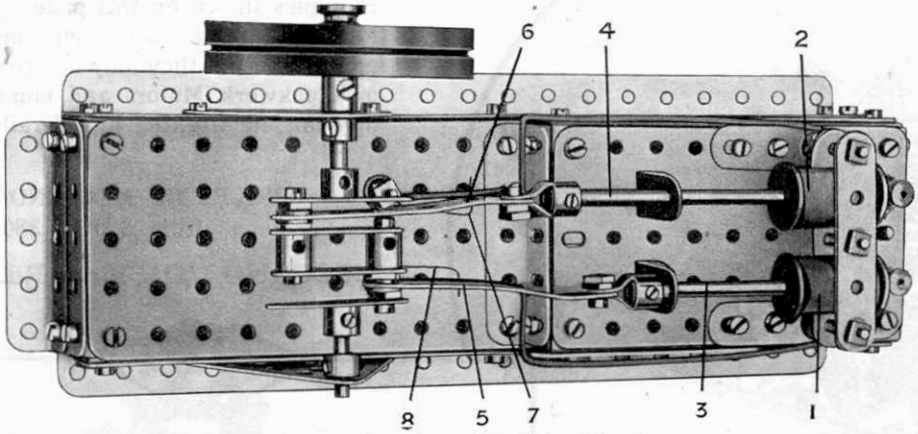


Fig. 5. Plan view of Horizontal Engine

Electric Horizontal Engine

The interesting little horizontal engine shown in Fig. 4 may be run off a 4-volt Accumulator or from a transformer connected to the house supply, provided that the latter is alternating current. It works exceedingly well and may be used to drive small models.

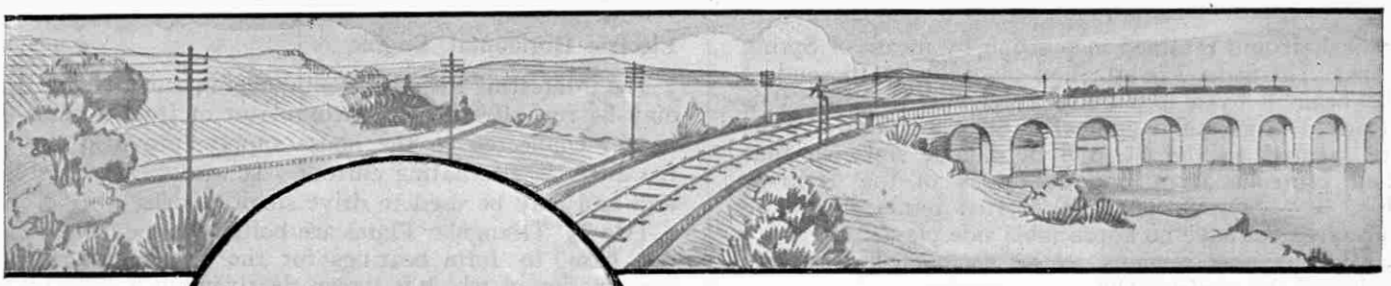
Two $2\frac{1}{2}$" Triangular Plates are bolted to the sides of the base to form bearings for the crankshaft, the construction of which is shown clearly in Fig. 5. Two $1\frac{1}{2}$" Strips spaced apart by Threaded Bosses form the centre web of the crankshaft and Double Arm Cranks are secured on each side by means of $\frac{1}{2}$" Bolts. The 3" Strips 5 and 6 forming the connecting rods are journalled on these Bolts and are spaced thereon by means of Washers. The bolts and nuts used in the construction of the crankshaft must be secured very tightly.

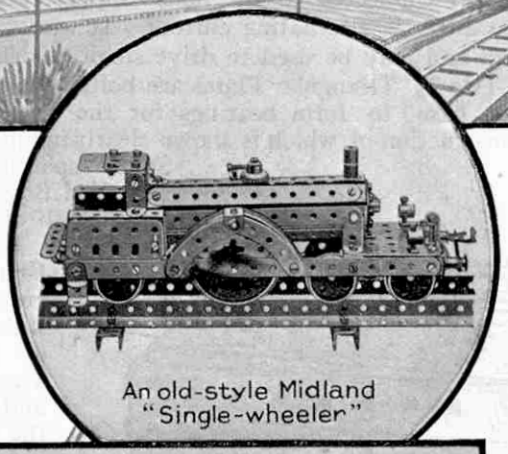
Two Bobbins are each wound with seven layers of No. 26 S.C.C. wire and when finished a strip of brown paper is gummed round each coil. The finished coils 1 and 2 are held in position by means of $2\frac{1}{2}$" Strips secured by means of 1" Threaded Rods and nuts to Threaded Cranks bolted to the base.

Two terminals are secured at the end of the model, one being insulated and the other in metallic contact with the Plate. One wire from each coil is secured to the terminal insulated from the Plate, each of the other coil wires being secured to a 6 B.A. Nut and Bolt secured to the base Plate near the terminals and insulated from it by Insulating Bushes and Washers. Each of these 6 B.A. Bolts is connected by means of wire to similar nuts and bolts which carry pieces of bare copper wire 7 and 8. These bolts must also be insulated from the Plate, of course.

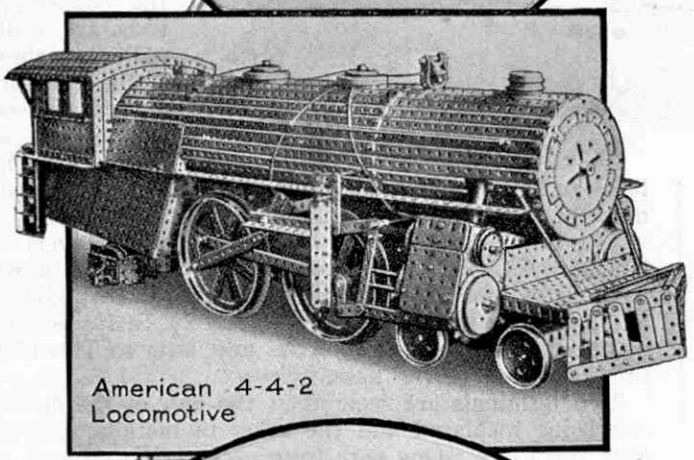
These wires or "brushes" are adjusted so that when the connecting rods 5 and 6 are on their respective dead centres the wires are just below them. As the connecting rods fall in following the rotation of the crankshaft, the brushes make contact with them and so cause the coils 1 and 2 to become energised alternately.

Before using the model care should be taken to ensure that all movable parts move freely and that the points of contact between the connecting rods and the brushes are thoroughly clean.

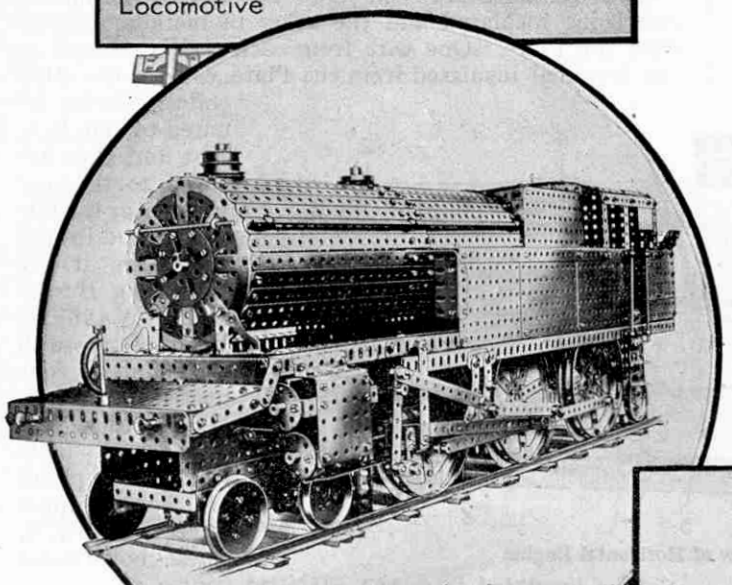




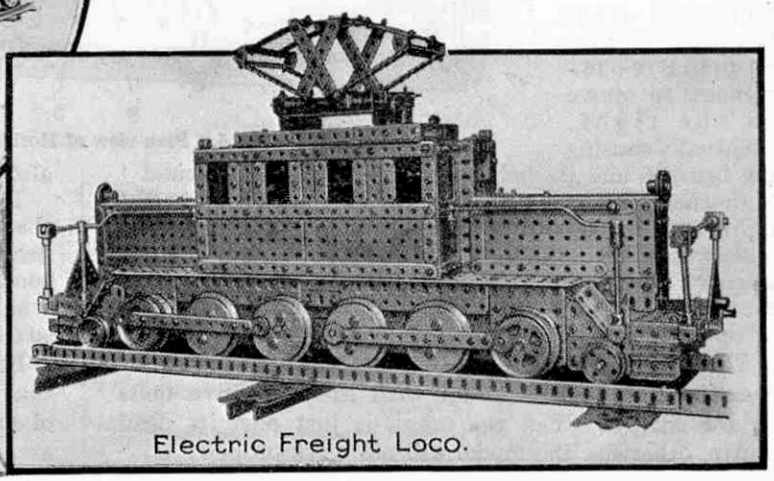
An old-style Midland "Single-wheeler"



American 4-4-2 Locomotive



A typical Meccano Tank Loco.



Electric Freight Loco.

MECCANO

EXAMPLES OF MODEL CONSTRUCTION:

Transport by Rail

THE present-day railway system is one of the greatest triumphs of engineering. For one hundred years a vast network of steel rails has gradually been extending all over the country. Means of locomotion have grown more and more efficient, until to-day we are able to travel for almost any distance at a great speed and with every comfort. It is almost impossible to imagine the everyday life of the public before the introduction of railways. Because of the difficulties of travel the ordinary individual a century ago seldom travelled far from his native town or village, with the result that the countryside beyond a certain radius was as remote to him as a foreign land.

Railway Transport is represented by a number of fine Meccano models, as will be seen from the examples shown on this page. Locos made with Meccano parts are not only realistic in appearance but they may be driven by the Electric or Clockwork Motors and employed in building up complete working model railways.

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How to Photograph Your Meccano Model

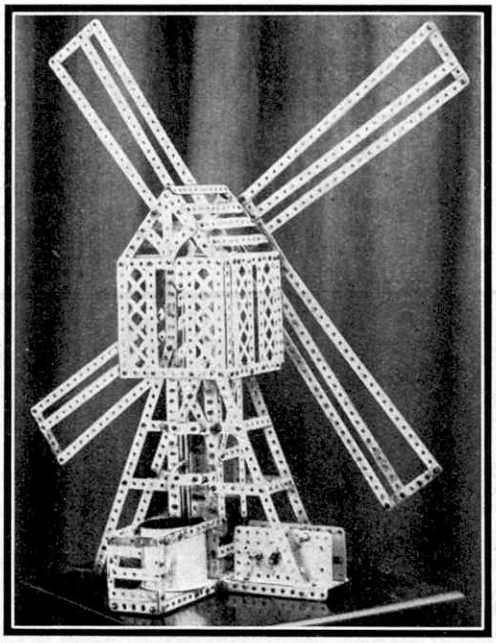
Some Practical Hints for Competitors and Others

By Arthur N. Gaunt

A MECCANO boy who owns a camera of any kind possesses an instrument that may be made to serve many useful purposes in connection with his model-building activities. In order to take part in the Model-building Competitions that are announced month by month in the "*M.M.*," it is necessary to send in either a photograph or a drawing of the model that is to be entered. For this purpose the camera's capacity for recording minute details with perfect accuracy is far ahead of a drawing unless this is made by an expert.

The photographing of Meccano models does not demand an elaborate or expensive instrument and indeed almost any camera will give good results. If the camera has adjustments for photographing objects at close quarters this is an advantage, but owners of box-form and other non-focussing cameras can obtain "close-ups" of their models by fitting over the lens a second or supplementary lens, commonly known as a "portrait attachment," which may be purchased cheaply from any photographic dealer.

Before commencing to photograph a model a few simple preparations are necessary. If the work is to be done out-of-doors in the garden or elsewhere, the model must be placed in such a position that, although it is in a good light, it is not actually exposed to direct sunlight. Indoors it is usually necessary to place the model close to a window in order to secure sufficient light, but here again the Sun should not be shining full on the window.

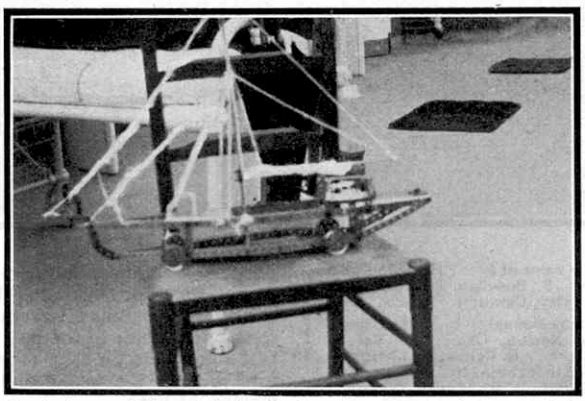


A good example of model photography, nickelled parts shown up well by dark background

Wherever the photograph is to be taken, a suitable background of some kind must be provided. The importance of this cannot be over-emphasised, for many of the photographs submitted in "*M.M.*" competitions are quite hopeless on account of neglect of this precaution. Sometimes when a model is photographed out-of-doors the absence of background results in utter confusion, the model and foliage, trellis-work, or brickwork behind it being all mixed up.

In all cases a plain sheet of some material entirely without pattern should be hung behind the model. The exact colour of this sheet is not important and may range from light brown to grey, but a white sheet should be avoided. If the model is constructed entirely of nickelled parts a fairly dark background is effective, while on the other hand a rather lighter tint is often more suitable for models built of the new red and green enamelled parts.

Readers will have noticed that the illustrations of models in the "*M.M.*" show the subject standing alone without either background or foreground to distract attention. It is not difficult to obtain photographs of this nature provided a little care is taken. A long sheet of suitable background material is required and this is attached to the wall behind the table on which the model is to be placed. The material is then allowed to hang down and over the table in one sweep, thus forming a combined background and foreground without a break. The model is then placed on the table and is thus isolated from all unwanted details.



An instance of the confusion that results when no background is provided

Dark shadows at the back of the model should be avoided and often this may be done quite easily by arranging sheets of white paper in such a manner as to reflect light on to the dark portions. These sheets, of course, must not be placed so near the model as to appear in the photograph.

The model should be photographed from two or three different viewpoints in order to make clear the various details of its construction.

It is of the greatest importance that every part of the model should appear equally "sharp" in the photograph, and in order to secure this result the lens should be "stopped down"—that is the movable diaphragm attached to the lens should be closed up to its smallest aperture. This stopping down unfortunately has the effect of greatly decreasing the amount of light that passes through the lens, and consequently a proportionately longer exposure is required. Conditions vary so greatly that it is almost impossible to give definite advice regarding exposure, and readers are strongly recommended to make use of an exposure meter, or an exposure calculator such as that published by Burroughs Wellcome and Co. Ltd. The small sum required to purchase one of these useful guides is quickly repaid by the great reduction in waste plates or films. Guesswork will often succeed in ordinary snapshot photography, but for indoor work of this kind even an expert may go far astray if he relies entirely upon his own judgment to estimate the light value and other conditions.

A word of advice may be given here in regard to prints that are to be submitted in a Model-building Competition. Do not make pencil or ink marks on the prints to draw attention to certain parts, unless you can submit at the same time a second print without such marks. The best plan is to gum to the top back edge of the print a piece of tracing paper of such size that when it is pulled over it will completely cover the front of the print. Any figures or letters that may be required may then be marked upon this tracing paper and thus will serve the necessary purpose without the print being marked in any way.

If it is found necessary to draw special attention to certain details in the interior of a more or less complicated model, it is often the best course to remove such portions of the model as are in the way and take a separate photograph of the particular section.

Readers who carry out their own developing may be reminded that the type of negative to be aimed at is one which, while being full of detail, is rather on the "thin" side. A negative of this type gives a far brighter print than one that has been over-developed and is dull and lifeless, and possibly slightly fogged in addition. As regards the prints, these may be on any kind of paper, contrasty gaslight paper being perhaps the most suitable. Self-toning paper is also excellent and has the advantage of being simpler to manipulate. Whatever type of paper be decided upon, a grade with glossy surface should be selected as this tends to show up fine details better than a matt surface.

Results of Meccano Model-Building Contests

By Frank Hornby

"March" Competition, "Home" Sections

THE names of the prize-winners in the Home Sections of the "March" Model-building Competition are as follows:—

Section A

FIRST PRIZE (cheque to value £3-3-0): Leslie Hope, Weston-super-Mare, Som. SECOND PRIZE (cheque to value £2-2-0): W. H. Trenholm, Eaglescliff, S.O. THIRD PRIZE (cheque to value £1-1-0): Alfred Brunner, Upminster, Essex.

SIX PRIZES, each consisting of Meccano products to the value of 10/6: E. L. Hutchings, Southend-on-Sea; Robert Marshall, Belfast; R. Allum, Chard; T. W. Morris, Eccles; E. Whalley, Blackburn; L. Hollyoak, Coventry.

TWELVE PRIZES, each consisting of Meccano Products to the value of 5/-: A. D. Drysdale, Manningside, Edinburgh; A. Wright, Bow, E.3; E. Ratter, South Shields; H. D. Hosegood, South Norwood; E. Whatley, New Moston, Manchester; R. Kirkham, Elworth, Nr. Sandbach; J. Chorley, Pollokshaws, Glasgow; J. T. Jones, Castle Bromwich, Nr. Birmingham; W. Hawkes, Eckington, Nr. Sheffield; S. T. Wills, Stoke, Devonport; Dennis Toms, West Bridgford, Nottingham; G. Nicholl, Farnham.

SPECIAL COMMENDATION (Certificate of Merit and Standard Mechanisms Manual): A. C. Towner, St. Leonards-on-Sea; S. Hislop, Dalmuir, Dumbartonshire; R. B. G. Fletcher, Walthamstow, E.17; J. D. Charteris, Quadrant, Glasgow.

Section B

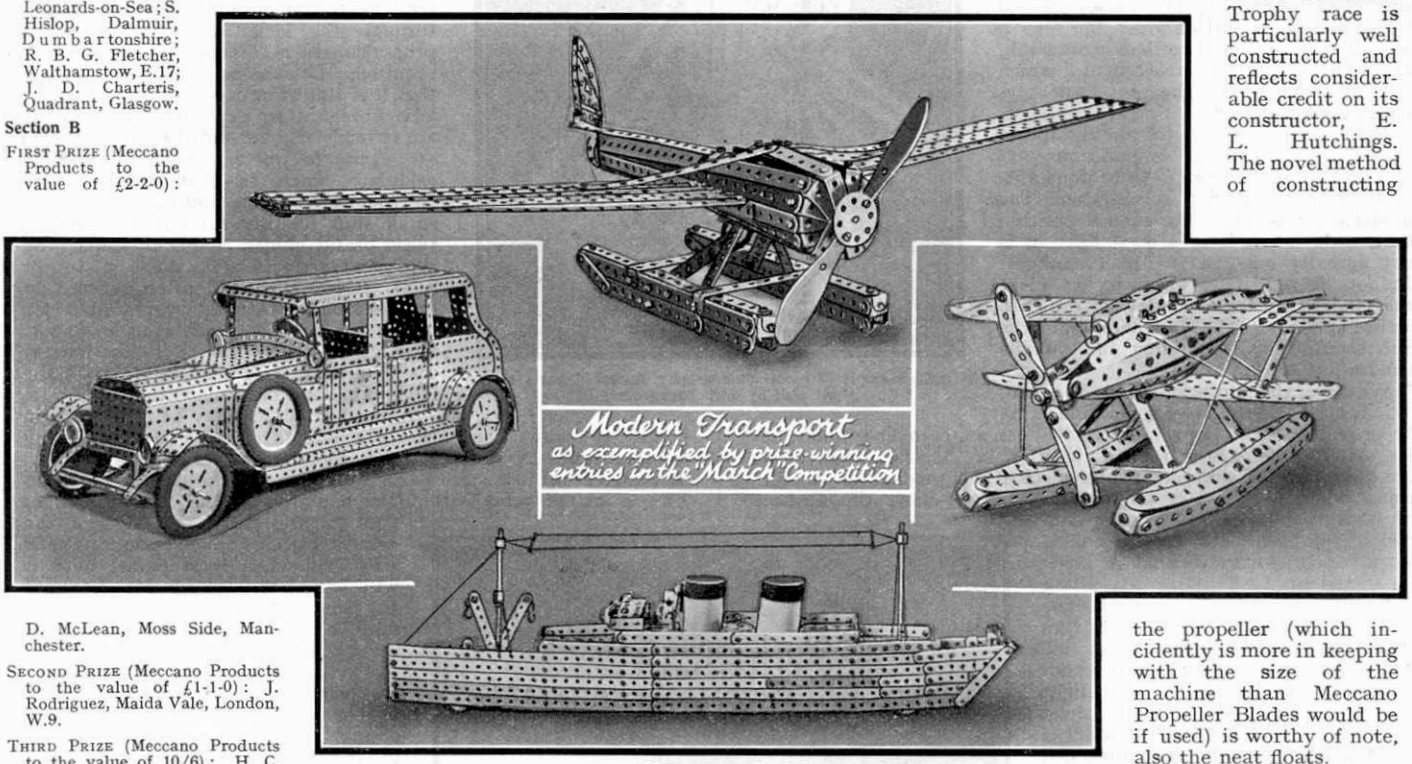
FIRST PRIZE (Meccano Products to the value of £2-2-0): D. McLean, Moss Side, Manchester.

SECOND PRIZE (Meccano Products to the value of £1-1-0): J. Rodriguez, Maida Vale, London, W.9.

THIRD PRIZE (Meccano Products to the value of 10/6): H. C. Stevens, Bolton.

SIX PRIZES, each consisting of Meccano Products to the value of 5/-: H. Thomson, Edinburgh; M. Ross, Perth; C. Wadsley, Crewe; F. Bowman, Darfield, Nr. Barnsley; J. Redmond, Woolwich, S.E. 18; L. Tyley, Oswestry.

TWELVE PRIZES, each consisting of Complete Instructions Manual: L. V. Harrison, Forest Fields, Nottingham; P. Scott, Chipping Norton, Oxon; R. Yate, Glasgow; R. O. Ballard, Erith; A. Metcalf, Wisbech; R. Cairns, Edinburgh; L. D. Smart, Kingston-on-Thames; S. Beeton, Westhoughton, Nr. Bolton; C. Goss, Markyate, Nr. Dunstable; A. N. Stenning, Ilford; R. W. Wasley, Glinton, Nr. Peterborough; R. P. Thellis, Brockley, S.E.4. A number of Certificates of Merit have also been awarded to competitors.



The composite illustration on this page shows four interesting models submitted by competitors in Sections A and B. The illustration has been called quite aptly "Modern Transport" for, as will be seen, it depicts models of machines used for carrying passengers and goods in the air, on the land, and over the sea. At the top of the illustration will be seen a very fine model of the Supermarine S5 Seaplane, winner of the Schneider Trophy. The model is the work of Robert Marshall and is an excellent example of neat and accurate model-building. The fusilage of the plane is devoid of the "scrappiness" often present in models of this type.

On the left of the illustration will be seen an example of land transport—a very neat model of a touring saloon car. This car is the work of R. Allum. In addition to having designed the bodywork of the car on very neat lines, its builder has incorporated a 3-speed gear box, differential, clutch and Jeantend steering gear in the chassis, the mechanisms being particularly neat and well designed. The external appearance of the car is distinctly "sporty," and although it could not be expected to vie with the seaplane previously described in matters of speed, it certainly gives one the impression that it would be capable of "getting one there" in very short time!

To the right in the illustration a Gloster IV biplane can be seen. This clever little reproduction of one of the machines that took part in the Schneider Trophy race is particularly well constructed and reflects considerable credit on its constructor, E. L. Hutchings. The novel method of constructing the propeller (which incidently is more in keeping with the size of the machine than Meccano Propeller Blades would be if used) is worthy of note, also the neat floats.

The model liner was built by D. McLean and includes several quite novel features. The model is well proportioned throughout and its construction appears to be quite sound. It is equipped with four Flanged Wheels fitted to the under side of the hull; hence it may be run along the floor or table and this greatly adds to its interest. The derricks in the fore part of the vessel and the radio equipment are also points worthy of note.

In recent contests we have received a number of interesting models of old-time sailing ships. The model of an old-time sailing ship submitted by Leslie Hope is particularly interesting. While the construction of the hull is in itself well carried out, Hope has further added to the realism of his model by attaching sails made from white card to the various booms. The sails have been slightly curved thus giving an appearance as though a stiff breeze is propelling the ship. I have on previous occasions commented upon the artistic value of models of this type. Hope's model would form a splendid ornament for any boy's "den."

"February" Competition, "Overseas" Section

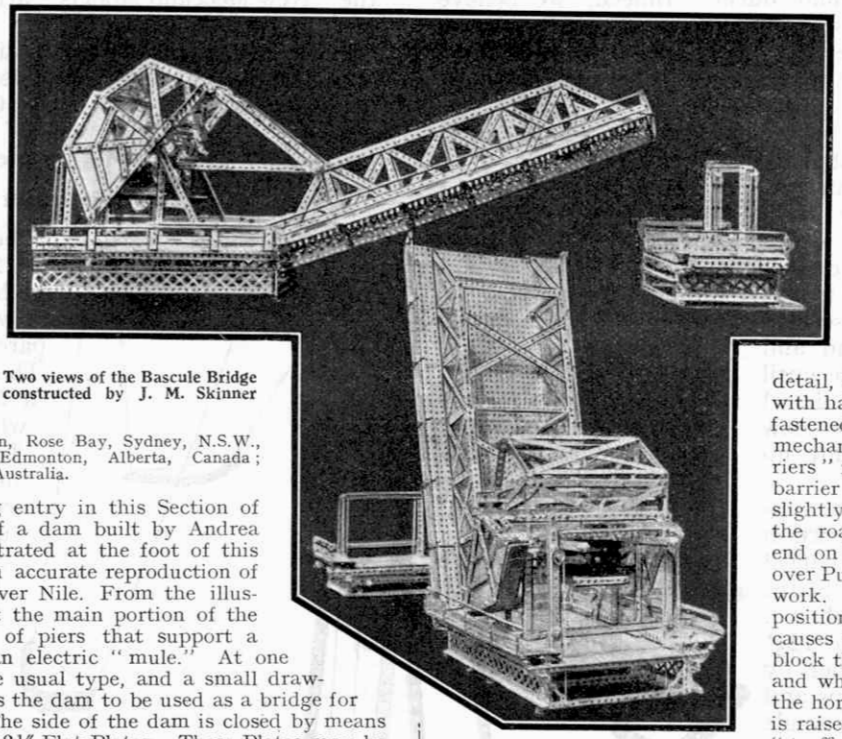
THE February competition proved extremely popular with Overseas Meccano boys, and many fine entries were received. The names of the prize-winners in this Section are as follows:—

FIRST PRIZE (cheque value £3-3-0): Andrea Huszar, Shareh Cheisfein, Cairo.
SECOND PRIZE (cheque value £2-2-0): J. M. Skinner, Toronto, Ontario, Canada.
THIRD PRIZE (cheque value £1-1-0): R. O. Jukes, Timaru, New Zealand.

SIX PRIZES, each consisting of Meccano Products to value 10/6: A. S. Ross, Dartmoor, New Plymouth, New Zealand; S. G. Budge, St. Sampsons, Guernsey, Channel Islands; E. Smith, Rosemount, Montreal, Quebec, Canada; W. Welsh, Ottawa, Ontario; Kirpah Singh, Lahore, Punjab, India; W. D. Pippy, Springhill, Nova Scotia, Canada.

TWELVE PRIZES, each consisting of Meccano Products to the value of 5/-: Alan R. B. Nash, Old Naval Hospital Gibraltar; Leslie Potter, Mosam, Sydney, S. Australia; J. Barron, Mosam, Sydney, S. Australia; E. Worthington, South Vancouver, B.C., Canada; Graham R. Nisbet, Mount Albert, Melbourne, Australia; W. L. Holcroft, East London, S. Africa; J. D. Lowe, Lindfield, N.S.W., Australia; Jack McLeod, Ngaio, Wellington, New Zealand; Ronald P. Argent, Mount Barker, Adelaide, S. Australia; F. Linker, Pau, France; T. Cook, Melbourne, Australia; F. Isambara, Karachi, Sind, India.

SPECIAL COMMENDATION (Certificate of Merit and Standard Mechanisms Manual): P. Grant, Parktown, Johannesburg, South Africa; C. McAllister, Pt.aux Trembles, Montreal, Canada; B. Osbourn, Rose Bay, Sydney, N.S.W., Australia; Aubrey Blower, Edmonton, Alberta, Canada; Nelson Eustis, Alberton, South Australia.



Two views of the Bascule Bridge constructed by J. M. Skinner

An unusually interesting entry in this Section of the Contest is the model of a dam built by Andrea Huszar of Cairo, and illustrated at the foot of this page. The model is quite an accurate reproduction of the Delta Dam on the River Nile. From the illustration it will be seen that the main portion of the dam consists of a series of piers that support a platform on which runs an electric "mule." At one end is placed a lock of the usual type, and a small drawbridge over the lock enables the dam to be used as a bridge for various forms of traffic. The side of the dam is closed by means of gates consisting of $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates. These Plates may be raised by means of a windlass fitted to the "mule" and driven by means of the Meccano Clockwork Motor. This arrangement of "sluices" is identical with actual practice, for when the head of water held up by the dam becomes too great a certain number of the gates can be lifted and the water thus allowed to escape.

The design and construction of the model is most workmanlike and reflects great credit on the builder. The only criticism that might be made is that Meccano Cord has in certain parts been used a little too freely, the result being that these portions lose their appearance of strength and rigidity.

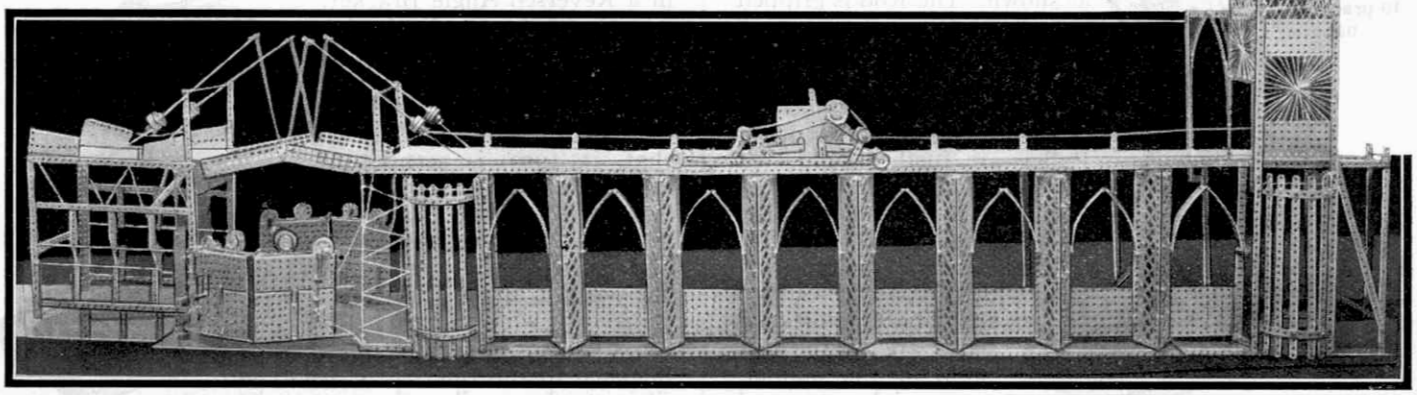
One could not fail to be attracted by the model of a bascule bridge shown in the other illustration on this page. It was built by J. M. Skinner.

The bascule type of bridge is used extensively in the United States and Canada, and it is from one of these bridges situated in Toronto that the design for the model was taken. In practice the bridge spans a canal upon which steamers of various sizes and heights pass, and frequently it is imperative that the roadway should be swung entirely clear of the canal to permit the free passage of a vessel.

This is done in the bascule form of bridge by erecting a base on one bank and pivoting to this the roadway of the bridge. A heavy weight consisting of concrete blocks held in a steel framework, is balanced against the weight of the roadway of the bridge and acts as a counterpoise. The roadway is slightly heavier than the counterpoise and the bridge therefore tends to remain closed. To open the bridge so as to allow shipping to pass, an electric motor, or some other form of power is set in motion and pulls the roadway into a vertical position.

The prize-winning model accurately reproduces the functions of a typical bascule bridge and will work in a most realistic manner. The motive power for lifting the roadway is taken from a high-voltage Motor. The model includes a wealth of detail, such as sidewalks complete with handrails and safety barriers fastened to each end. The mechanism of the "safety barriers" is worthy of mention. The barrier itself consists of a Strip slightly longer than the width of the roadways suspended at each end on lengths of cord, which pass over Pulleys fastened to the framework. In rising into the vertical position, the roadway automatically causes the Strip to fall and thus block the approach to the bridge, and when the roadway returns to the horizontal position the barrier is raised, of course, thus allowing "traffic" to pass. Slowly rising or falling in response to the starting and stopping of the Motor, the model must indeed make an impressive sight.

R. O. Jukes, who is well known in Meccano circles as a builder of considerable skill and ingenuity, entered a very fine model of a battleship, H.M.S. "Meccano." The model is not representative of any particular warship, but its design certainly follows the latest practice for the ship incorporates an aeroplane landing platform. Jukes has added further to the interest of his model by building a number of very small monoplanes and placing them on the landing platform. The warship includes all the usual fittings to be found on a vessel of this type and the large turret guns, built up from Axle Rods on which are placed Couplings, look very formidable.



An interesting model of a dam. The work of Andrea Huszar, it secured First Prize in the Overseas "February" Competition

New Meccano Models

Fly-boats—Searchlight—Tractor—Letter Balance—Coal Cutter—Coco-nut Shy

WE are again describing a number of models that should provide plenty of fun for the owner of a small Meccano outfit. Indeed, we believe many readers who possess quite large outfits will welcome these models, for they are extremely simple to build and at the same time very realistic when completed.

Simple Fly-boats

The model illustrated in Fig. 1 should be an old favourite with many Meccano boys. Almost every fair ground contains one of these contrivances, by means of which pleasure-seekers may be whirled round and round at a terrific rate until they are thoroughly dizzy! The model uses very few parts and can be built up in quite a short time.

The vertical tower supporting the revolving portion consists of a 5½" × 2½" Flanged Plate having four 12½" Strips attached to it as shown. The upper ends of the 12½" Strips are held together by means of two 2½" Strips and two 2½" × ½" Double Angle Strips. A 3" Pulley Wheel forming the lower half of the bearing for the swivelling portion is bolted by means of Angle Brackets to these Strips. The swivelling portion consists of a second 3" Pulley Wheel that rotates on the Wheel attached to the top of the vertical tower. It carries four arms, each consisting of two 5½" Strips overlapped and bolted together.

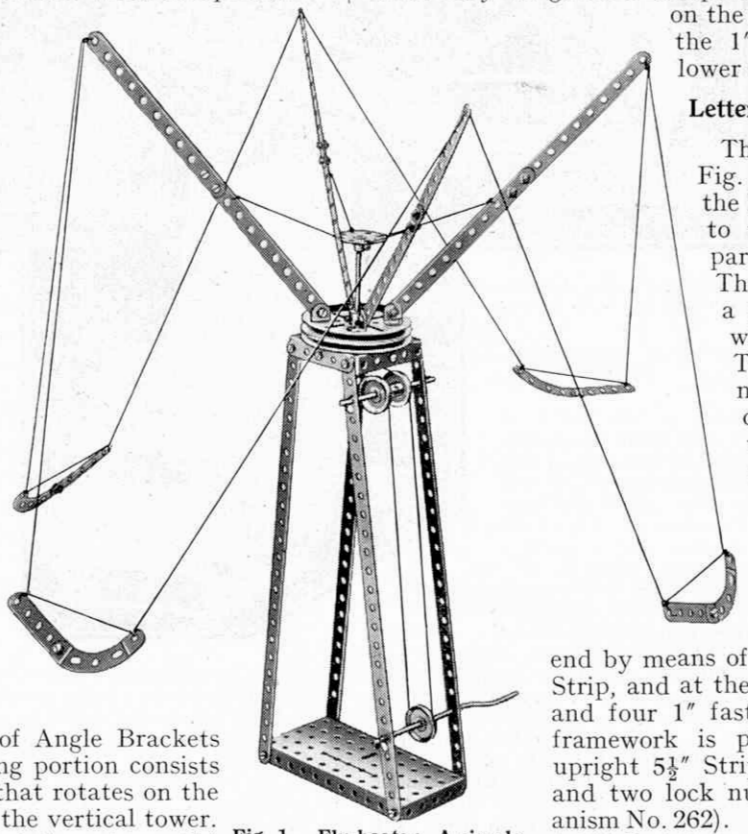


Fig. 1. Fly-boats; A simple working model

The swivelling pin consists of a 3" Rod carrying a 1" fast Pulley Wheel at its lower end and a Bush Wheel at its top, as shown. The Rod is gripped by the set-screw of the upper 3" Pulley Wheel, and is free to turn in the boss of the lower Pulley. The four arms radiating from the upper Pulley are further supported by means of short pieces of Cord tied to the holes in the Bush Wheel.

The "boats" each consist of a 2½" Strip and a 2½" Curved Strip, but if additional parts are at the disposal of the builder, more elaborate and more realistic boats can be devised, of course. Those used in the "Flying Machine" that was illustrated in the "New Meccano Models" article in the May "*M.M.*" are excellent examples.

In order to obtain a more positive drive, the operating cord may be given a complete turn round the Pulley on the Crank Handle and round the 1" Pulley secured to the lower end of the swivelling pin.

Letter Balance

The model illustrated in Fig. 2 should prove useful in the home, for it can be made to weigh letters and small parcels fairly accurately. The model is built up from a 5½" × 2½" Flanged Plate, which acts as a stand. To this Plate two Trunnions are bolted, each carrying a 5½" Strip. The upper ends of the 5½" Strips are held together by means of a 2½" × ½" Double Angle Strip.

The movable portion of the balance consists of two 5½" Strips connected together at one end by means of a 2½" × ½" Double Angle Strip, and at the other end by a 3½" Rod and four 1" fast Pulley Wheels. This framework is pivoted to each of the upright 5½" Strips by means of a bolt and two lock nuts (see Standard Mechanism No. 262). A 3½" Rod that carries a Bush Wheel slides in the centre hole of the Double Angle Strip that connects the vertical 5½" Strips and also in a Reversed Angle Bracket. To the lower end of this Rod an Angle Bracket is attached by means of Spring Clips, the Angle Bracket being bolted to a 2½" Strip that, in turn, is secured to the pivoting framework.

Two 2½" Curved Strips are connected end to end and bolted rigidly in the position shown. A strip of white card should be cut and fastened to the Curved Strips and a cardboard

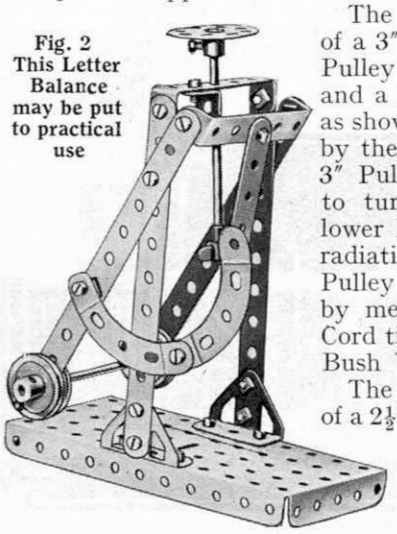


Fig. 2 This Letter Balance may be put to practical use

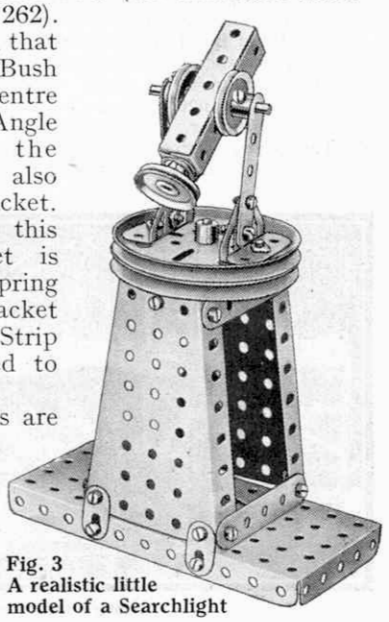


Fig. 3 A realistic little model of a Searchlight

pointer attached to the upright 5½″ Strip. By placing different known weights on the Bush Wheel and noting the position of the curved strip of card with respect to the pointer, the balance may be graduated.

Searchlight

Our next illustration (Fig. 3) is of a simple little model searchlight. The base of the model consists of a 5½″×2½″ Flanged Plate to which are attached two Sector Plates that are held together by means of four 2½″ Strips. A 3″ diam. Pulley Wheel is mounted by means of Angle Brackets on the top of the Sector Plates.

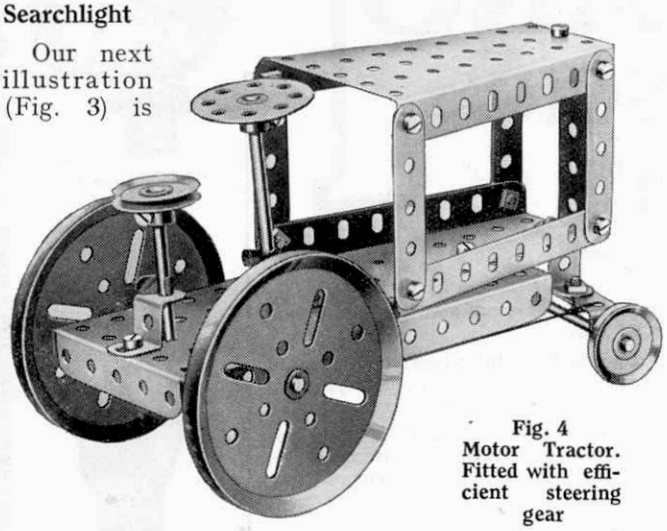


Fig. 4
Motor Tractor. Fitted with efficient steering gear

The swivelling portion of the model consists of a second 3″ Pulley Wheel to which are attached two Trunnions carrying 2½″ Strips. The upper ends of these Strips form bearings for the 2″ Rod that carries the searchlight "barrel." The latter consists of four 2½″×½″ Double Angle Strips bolted together at one end by means of a nut and bolt in the usual way and held at the other end by means of a ⅜″ Bolt and a 1″ fast Pulley Wheel, the set-screw of the Pulley Wheel gripping the shank of the bolt. The barrel is clamped to the 2″ Axle Rod by means of two Pulley Wheels.

The swivelling portion of the searchlight is attached to the base by means of a 2″ Rod that is gripped in the boss of the upper 3″ Pulley Wheel but is free to turn in the lower one. By rotating the upper Pulley and moving the barrel of the searchlight up and down, the "light" can be directed to any position.

With the aid of a few Meccano electrical parts it is quite a simple matter to make this model actually work. All that is required is a Meccano Lamp Holder and Lamp, a short length of insulated wire and a battery. The Lamp Holder should be mounted on the end of the searchlight barrel by means of a 6 B.A. Bolt and Nut, insulated from the barrel by means of an Insulating Bush and Washer. A length of wire should then be taken from the 6 B.A. Bolt to one terminal of the battery, the other terminal being connected to the framework of the model.

A Simple Motor Tractor

The tractor illustrated in Fig. 4 is of a type that often is seen nowadays on farms or building sites, where it is used to haul loads or to operate machinery. The front road wheels consist of two 1″ fast Pulley Wheels mounted on a 3½″ Axle Rod that is journalled in a 2½″×½″ Double Angle Strip. To the centre of the Double Angle Strip two Reversed Angle Brackets are bolted and these in turn are connected pivotally to the end hole of the lower Sector Plate. The steering wheel and column consist of a Bush Wheel and a 3½″ Rod respectively. The Rod is journalled in a hole in the base Flanged Plate and in a Reversed Angle Bracket bolted to the plate. Its lower end carries a 1″ fast Pulley Wheel. A length of cord is passed once round this Pulley and its ends are attached to each end of the Double Angle Strip that carries the front wheels. By rotating the Bush Wheel the wheels may be deflected to either side, as desired.

Coco-nut Shy ; A New Game

The model shown in Fig. 5 should appeal to the model builder who is of a rather "sporty" temperament. It somewhat resembles the game of skittles, but the title of "coco-nut shy" is, we think, most apt.

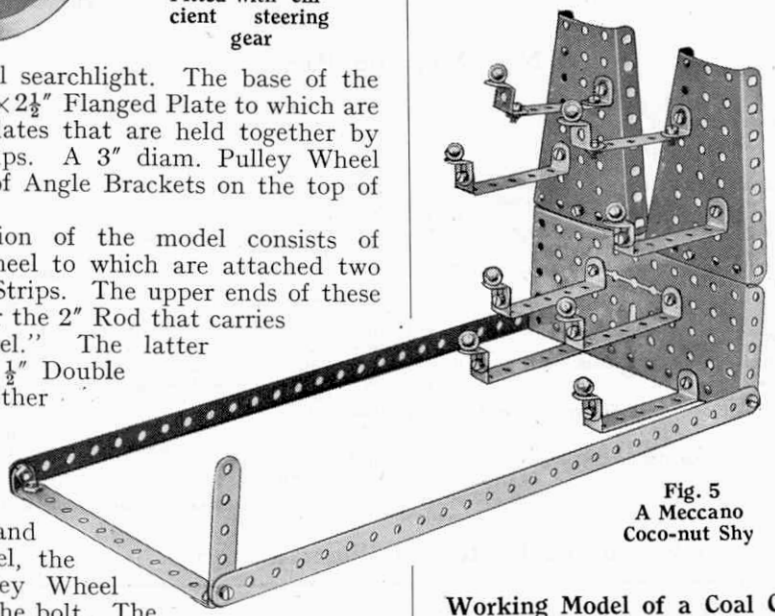


Fig. 5
A Meccano Coco-nut Shy

The construction of the model is quite simple. The "coco-nuts" shown resting upon the Angle Brackets may consist of Meccano steel Balls or ordinary marbles. The missiles with which the balls are displaced may consist of darts, marbles, etc. Incidentally, a Meccano catapult or the Spring Gun that was described in the "Suggestions Section" some time ago, would provide an excellent means with which to remove the coco-nuts!

Working Model of a Coal Cutting Machine

Fig. 6 represents a most interesting machine—a coal cutter. As many of our readers will know, machines of this type, driven by an electric motor, are much used in coal and other mines, as bycutting

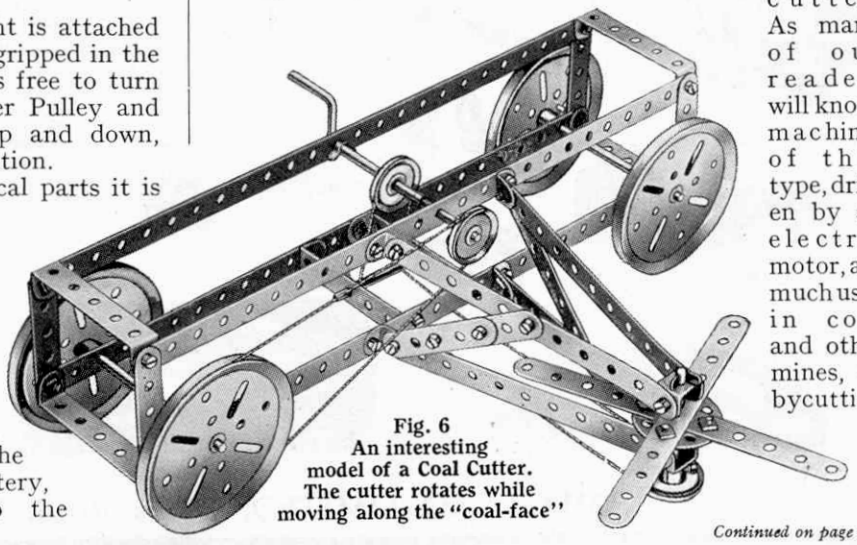
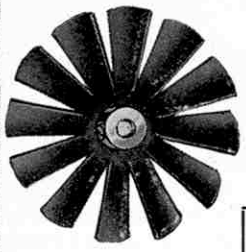


Fig. 6
An interesting model of a Coal Cutter. The cutter rotates while moving along the "coal-face"

Continued on page 768



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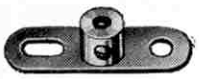

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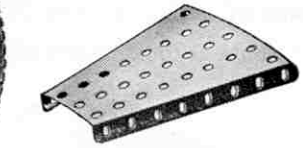
No. 142A

No. 20B



No. 54

Nos. 154A and 154B

No. 25A

No. 165

No. 89A

MECCANO ACCESSORY PARTS

New parts are constantly being added to the Meccano system and it is interesting to note that the range now consists of a total of 252.

A selection of the splendid parts that have recently been introduced is illustrated on this page. Every Meccano boy should make a point of adding these parts to his equipment, for they make possible a wide range of interesting movements.

The attention of Meccano users is drawn to the new style Flanged Plate, Part No. 52 (with flanges at the ends as well as the sides) and to the improved Sector Plate, Part No. 54 (with two additional rows of holes). The revision in the designs of these plates makes them more adaptable and gives them wider scope.

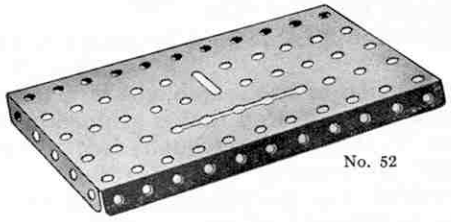
New Meccano Parts

No.		s.	d.
20b.	Flanged Wheels, ¾" diam. ... ... each	0	4
25a.	Pinion Wheels, ¾" diam., double width face ... „	0	8
26a.	„ „ ½" diam., double width face ... „	0	6
30a.	Bevel Gears, ½", 16 teeth } *Can only be* „	0	6
30c.	„ „ 1½", 48 „ } *used together* „	1	6
50a.	Eye Pieces, with boss ... ... „	0	4
52.	Perforated Flanged Plates, 5½" × 2½" „	0	5
54.	Perforated Flanged Sector Plates „	0	3
62b.	Double Arm Cranks ... ... „	0	3
89a.	3" Curved Strips, cranked, 1¼" radius, 4 to circle ... ... „	0	2
*116a.	Fork Pieces, Small ... ... „	0	3
138a.	Ship's Funnels, Cunard type ... „	0	9
142.	Rubber Rings, 3" rim ... ... „	0	3
142a.	Dunlop Tyre to fit 2" diam. rim... „	0	4
142b.	„ „ „ 3" „ ... „	0	6
150.	Crane Grabs ... ... „	0	7
151.	Pulley Blocks, Single Sheave ... each	0	8
152.	„ „ Two „ ... „	0	9
153.	„ „ Three „ ... „	1	0
*154a.	Corner Angle Brackets, ½", right hand ... ... ½ doz.	0	6
*154b.	Corner Angle Brackets, ½", left hand ½ doz.	0	6
155.	Rubber Rings, ½" ... ... each	0	1
*156.	Pointers, 2½" over all, with boss... „	0	4
157.	Fans, 2" diam. ... ... „	0	4
158a.	Signal Arms, Home ... ... „	0	5
158b.	„ „ Distant ... ... „	0	5
*159.	Circular Saws ... ... „	1	0
161.	Girder Bracket, 2" × 1" × ½" ... 2 for	0	3
162.	Boiler, complete with ends ... ... each	1	0
162a.	Boiler ends ... ... „	0	3
163.	Sleeve Pieces ... ... pair	0	6
164.	Chimney Adaptors ... ... each	0	2
*165.	Swivel Bearings ... ... „	0	6
*166.	End „ ... ... „	0	3
167.	Geared Roller Bearings ... ... „	20	0
167a.	Roller Races, geared, 192 teeth ... „	4	6
167b.	Ring Frames for Rollers ... ... „	3	0
167c.	Pinions for Roller Bearings, 16 teeth „	1	0
168.	Ball Bearings, 4" diam. ... ... „	3	0
168a.	Ball Races, flanged ... ... „	0	6
168b.	„ „ geared ... ... „	0	9
168c.	Ball Casings, complete with balls „	1	9
169.	Digger Buckets ... ... „	2	0
170.	Eccentrics, ½" throw ... ... „	0	9

IMPORTANT.—Meccano Accessory Parts will be supplied in colours unless nickelled parts are specially ordered.
**These parts are available with nickel finish only.*

Ask your dealer for an illustrated price list

No. 164



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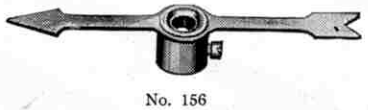

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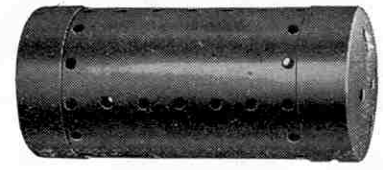

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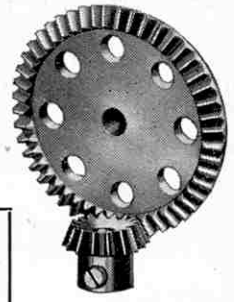
No. 166

No. 116A

No. 159

No. 158A



Nos. 30A and 30c

No. 163

No. 151

No. 152

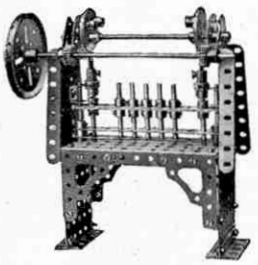
No. 153

Grand New Model-Building Competition

SIXTY-THREE VALUABLE PRIZES TO BE WON

DURING September the majority of Meccano boys recommence model-building with increased enthusiasm. The holidays are over for most of them and they have all kinds of ideas concerning new Meccano models that they wish to try out at the first opportunity. There is always a record number of entries in the model-building competitions at this time of the year; that is one of the reasons why we are offering in connection with this month's Contest no less than sixty-three splendid prizes, as well as a number of Meccano Certificates of Merit.

The contest is designed to encourage "*M.M.*" readers to exercise their imaginations, and to test their inventive ability in designing and building new models or movements or in improving the models that are shown in the Meccano Manuals. Many of the best models submitted will be illustrated in future issues of the Magazine and, if suitable, some of them will be included in forthcoming Instruction Manuals and other publications. The Contest offers unlimited scope for the keen Meccano boy. We hope the excellent prizes offered will induce every "*M.M.*" reader to enter.



Hints to Competitors

Do not refrain from entering the contest because you are unable to think of a novel idea for a model. Many of the highest awards in previous contests have been carried off by competitors who have taken the simplest subjects for their models, the awards having been given for excellence of construction alone. On the other hand, models that were really novel in principle, but poorly constructed, failed to obtain a prize.

Many Meccano boys are restrained from entering Model-building Contests by the myth that the more parts one puts into the model that is being submitted, the bigger the chance one has of carrying off a prize. This is quite untrue. Each entrant, no matter whether he owns a No. 0 or No. 7 Outfit, stands just as good a chance of winning a prize. In fact, the owner of a small Outfit has an advantage over the No. 7 owner, in that if any really ingenious ideas are contained in his model they will stand out prominently, while in a large and cumbersome model the good points are often dwarfed by poor construction in the other portions.

Again, the question of age sometimes deters model-builders from entering. There is no reason for this, however, for in addition to the entries being divided into separate Sections (see below) each individual entrant's age will be brought into consideration when awarding the prizes. Thus, if Brown's model is equal to Smith's and Brown is 9 years of age while Smith is 7, then the prize will be awarded to Smith.

As will be seen by reading the instructions given later there are no entrance fees or forms, etc. All you have to do is to obtain an illustration (either photograph or drawing) and send it to this office. The judges will do the rest.

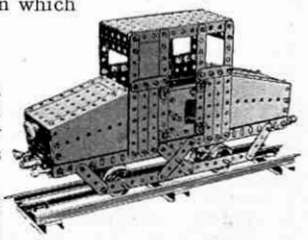
What to Enter

Before building your model you should first think out exactly what type of apparatus you are going to construct and make a mental note of any particular features that you intend to incorporate in it.

If you cannot think of a good subject on which to base your entry, take a walk or a cycle ride with the express purpose of finding a suitable subject from which to build a model. It is remarkable how productive of new ideas an expedition of this kind is! A visit to a factory, or a train or motor journey should all give the Meccano boy new ideas on which to base his model.

A Word to Overseas Readers

If you live outside the British Isles you should make a special effort to enter this contest. Remember that every competitor has just as good a chance to carry off a prize no matter whether he lives ten miles or ten thousand miles from Liverpool. The Overseas closing date is extended over three months after the Home Sections close, so that you will have plenty of time in which to construct your model. Although all Overseas competitors are grouped into one Section, the age of each model-builder will be considered when awarding the prizes. We want a record number of entries for this Contest, so start building your model now!



THE PRIZES

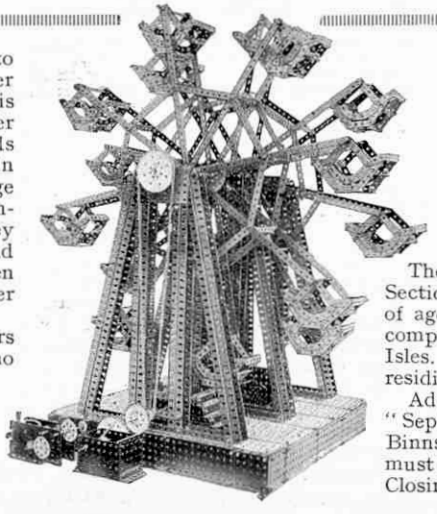
The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Cheque for three guineas.
Second Prize: Cheque for two guineas.
Third Prize: Cheque for one guinea.
Six prizes, each consisting of Meccano Double Headphones, or Meccano Crystal Receiving Set.
Twelve prizes, each consisting of a Meccano Single Telephone Receiver.

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 a Meccano Single Telephone Receiver.
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.

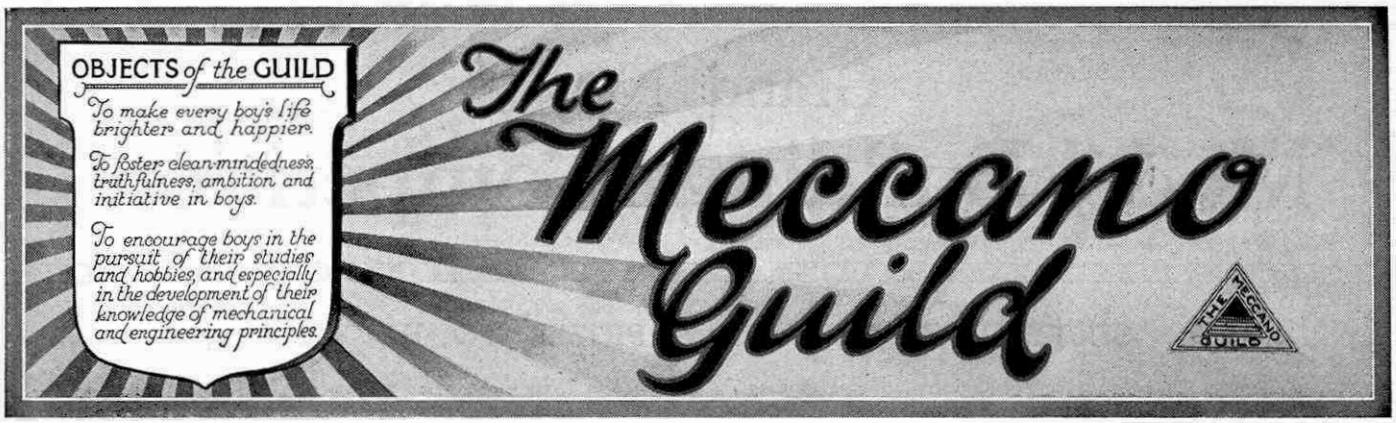


Important Instructions

When you have built your model, have it photographed or, if you do not wish to do this, a clear drawing will do quite as well. When forwarding either photos. or drawings take care to see that your name, age and address, and the Section in which you are eligible, appears on the back of each sheet of paper.

The entries will be divided into the following Sections: Section A, for competitors over 14 years of age residing in the British Isles. Section B, for competitors under 14 years residing in the British Isles. Section C, for competitors of all ages residing Overseas.

Address the envelope containing your entry "September" Model-building Contest, Meccano Ltd., Binns Road, Liverpool. Entries in Sections A and B must reach Liverpool not later than 31st October, 1928. Closing date for Section C; 31st January, 1929.



With the Secretary

Models from Headquarters

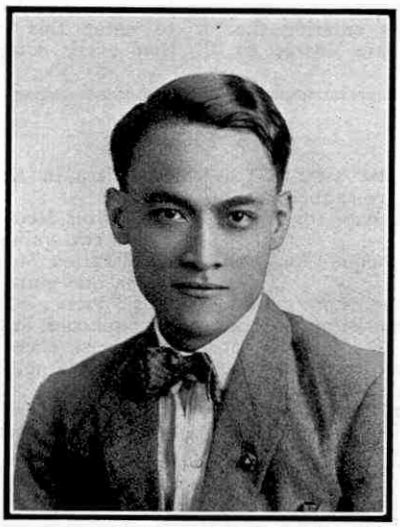
A notable feature of recent months has been the great popularity of the special models that may be obtained on loan from Headquarters by clubs affiliated to the Guild. The primary object of this scheme is to enable members of clubs to study the larger working models that either illustrate important principles or are specially good examples of the Meccano system of construction. This purpose has been fulfilled admirably, and in addition the models have proved exceedingly useful in connection with the exhibitions that now form such an important part of the programme of practically every club.

The large models especially invariably arouse great interest at exhibitions. The Meccanograph, for instance, proves a great attraction to visitors, who are surprised to find that such intricate movements are possible in a Meccano structure, and are fascinated by the astonishing variety of the designs that it produces. Not the least of its virtues is that it may be made a source of revenue, as visitors are generally easily persuaded to pay a small fee to make a design of their own, and having made one they usually find it difficult to tear themselves away!

Another model that has attracted special attention since its introduction is the new Motor Chassis. This faithful reproduction of the chief working parts of a motor car is an ideal subject for study at club meetings as well as for display at exhibitions. As at present sent out, it is fitted with a 4-volt motor to be worked from an accumulator carried at the rear. It is thus self-contained and will travel well along the floor. At times lack of room and the presence of a crowd make it impossible to provide a suitable track, but the model may still be shown in action by placing it on a table with the rear wheels jacked up, a position that is also well adapted for studying the motion of the various parts of the Chassis. If this method is adopted, current from the mains may be used and I have therefore arranged that, when desired, the model may be obtained with a 220-volt motor instead of the 4-volt type.

Meccano Club Leaders

No. 36. Mr. Choo Teck Hong



Mr. Choo Teck Hong took the Leadership of the Singapore Chinese M.C. when it was formed, and in conjunction with Mr. Hoe, whose photograph was reproduced last month, he has developed the club splendidly. He is kindly allowing meetings to be held at his home until a more suitable room is secured

New Models Available

So far seven models have been available for lending to clubs. These do not by any means exhaust possibilities, however, and the great demand has induced me to arrange for an extension of the list. The number of models that might with advantage have been included is very large, but unfortunately the delicate mechanism of the more intricate of them may be disarranged by the shaking to which they are liable during transit, in spite of careful packing. Needless to say, models are in perfect condition when despatched from Headquarters. It is impossible to guarantee careful handling on the journey, however, and as nothing is more disappointing than to receive a model that will not work, models such as the Loom and the Clock are not sent out on loan.

The list of models that may be had on loan is now as follows:—(1) Workshop; (2) Motor Chassis; (3) Horizontal Engine; (4) Derricking Crane; (5) Meccanograph; (6) Big Wheel; (7) Aeroscope; (8) Roundabout; (9) Tank Locomotive; (10) Warehouse; (11) Horizontal Steam Engine, two-cylinder; (12) Stiff Leg Derrick; (13) Ship Coaler; (14) Transporter Bridge; (15) Log Saw.

Models sent out are usually fitted with a 220-volt motor, with the exception of the Motor Chassis, which is sent out with a 4-volt motor unless the higher voltage is specified. In one or two cases recently the 4-volt Chassis motor has been connected with high voltage mains, with the result that it was immediately burnt out and ruined. In applying for the Chassis Model secretaries should indicate clearly which voltage motor is required, and should take care that the 4-volt motor is always used with an accumulator. The Meccanograph, of course, does not require a motor.

I am often consulted by Club secretaries with regard to models for use in a room not fitted with electric light, and I take this opportunity of stating that the models in the foregoing list numbered respectively 3, 6, 7, 8, 9, 12, 13, 14 and 15 will work also with a 4-volt motor, although the results are nothing like so satisfactory with the smaller power.

Notice Necessary

Attention to the conditions under which models are sent out will save a considerable amount of trouble. Carriage is paid on the outward journey only, the return carriage being paid by the club. This is, of course, the only expense that will be incurred. It is most important too that sufficient notice be given. Large models of this kind are not kept in stock but are built up in the Model Department as required, and as this Department is always very busy designing new models and in experimental work of all kinds, five weeks' notice at least must be given in order to ensure delivery by any specified date.

Proposed Clubs

Attempts are being made to form Meccano clubs in the following places and boys interested in becoming members should communicate with the promoters, whose names and addresses are given:—

DERBY.—Cyril Taylor, Ockbrook Moravian School, Nr. Derby.
LANGLEY.—R. Nightingale, "The Elms," Joinings Bank, Langley, Nr. Birmingham.
MALAY.—Y. Yoon Choi, St. Paul's Institution, Seremban, Malay.
NEWARK.—A. F. Faulkner, 69, Harcourt Street, Newark, Notts.
WOLVERHAMPTON.—A. E. Haskew, 15, Retreat Street, Wolverhampton.

Woolwich and Plumstead M.C.—The club has now introduced its colours, which are to be white and black. Two splendid Lectures have recently been given, the first on '*Camping*,' by the Rev. Father Hutchinson, and the second on '*Postage Stamps*,' by Mr. Dingle, who is President of the Woolwich Philatelic Society. Throughout the summer Saturday afternoons have been devoted to Cricket. A small but highly successful Exhibition of Models has been held. The Mayor of Woolwich has kindly accepted the Presidency of the club. Club roll: 57. *Secretary*: Stanley. E. Weller, 22, Woodhurst Road, Plumstead, S.E.18.

Wolverley School M.C.—The Leader recently addressed the club on "*The Motor Car*" and his talk was followed with keen interest by all present. The Meccano Motor Chassis model was demonstrated at a later meeting and the opportunity of inspecting it was greatly appreciated. An Exhibition of members' models proved very successful, the winning models representing an Ambulance and the Eiffel Tower. Club roll: 36. *Secretary*: W. F. G. Gadsby, Bury Hall, Wolverley School, Nr. Kidderminster.

Wimbledon M.C.—Outings on the Common are very popular, while two Debates and a Mock Trial proved most interesting. A Table Tennis and Draughts challenge from another club in the district has been taken up and a keen contest is anticipated. The club magazine continues to make good headway. Any boy wishing to join this club may have his name added to the waiting list and become a member when a larger club-room has been secured. Present accommodation is very severely taxed. Club roll: 14. *Secretary*: M. O'Carroll, "Dairin," Drax Avenue, Wimbledon, S.W.20.

Merelands M.C.—Stamp Collecting is a strong feature and is pursued enthusiastically. A camera has been loaned by the Leader and members are using it to obtain a photographic record of the Summer Session. Club members who attend Merelands Private School are now allowed a period for Model-building every Friday afternoon. Club Roll: 10. *Secretary*: Eric Stroud, Lindsey Vicarage, Nr. Ipswich.

Queen Elizabeth's School M.C.—The Cycling Section is proving very popular and is to have its own badge. The most exciting of the many enjoyable runs took the form of a paper chase on bicycles, and other runs of this nature are to be arranged. The possibilities of cycle football are now being discussed. *Secretary*: J. Sprague, 96, High Street, Crediton.

Parkstone M.C.—Attendance at meetings continues excellent. Model railways are popular and the members look forward to Hornby Train Nights with keen interest. Many splendid models have been constructed, including a Captive Flying Machine, Stone Crusher, and Delivery Chute. The club is fortunate in having an electrician among its members and several electrical nights of great interest have been held. Club roll: 14. *Secretary*: Eric Bath, 165, Ashley Road, Parkstone, Dorset.

Dudley M.C.—A picnic to Baggeridge Woods was very successful. It is hoped to arrange other outings in the future, and a camping holiday has been arranged. The club assisted at a local bazaar, their exhibit raising a sum of £3. *Secretary*: W. E. Darby, 93, Queens Cross, Dudley.

Westbury M.C.—A Model-building Competition organised at the beginning of the session proved very successful. Several prizes were awarded, including two given by local Meccano dealers. Cycling is a popular feature, and a long cycle run to the Pexton Hills was very much enjoyed. Club roll: 31. *Secretary*: Eric D. Moye, 24, Burnell Rise, Letchworth, Herts.

Norbury M.C.—A Whist Drive proved a huge success. Several models were on view and the visitors greatly enjoyed an inspection of them. During the interval one of the members gave a demonstration of conjuring and another member made a collection from those present, realising £4 14s. 6d. The club is now established in the Church Hall, which makes an admirable club-room. Several games have been introduced, including Draughts and Chess, and the secretary is endeavouring to secure an army tent for the use of the members. Boys between the ages of 12 and 15 who would like to become members should write to the secretary for full particulars. Club roll: 27. *Secretary*: A. F. B. Young, 21, Stanford Road, Norbury, S.W.16.

Ludlow M.C.—The outdoor session has proved most attractive. Picnics in the woods and by the aqueduct from the reservoirs of the Birmingham Waterworks were greatly enjoyed. Members paid early visits to the ground of their summer camp, pitched in a very pleasant situation at Overton, and later spent a very enjoyable holiday under canvas. Club roll: 13. *Secretary*: A. T. Chester, 8, Castle View Terrace, Ludlow, Salop.

The striking display organised jointly by Chelmsford Meccano Club and F. Spalding & Sons Ltd. for the Chelmsford Annual Carnival

Earlsfield M.C.—Three sections have been formed for Swimming, Cricket and Cycling, and they are proving very popular. The Cricket section has played several matches and been very successful. Club roll: 38. Leader: Mr. E. M. Dye, 15, The Drive, Earlsfield, Grantham.

Sittingbourne Pioneer M.C.—A debate "*Steam v. Electricity*" proved very interesting and produced excellent speeches. Electricity was judged most advantageous by seven votes to five. The challenging system referred to in the Guild Pages of the August "*M.M.*" is a novel feature that continues to provide enjoyable evenings. Club roll: 10. Secretary: R. Hampshire, 2, Charlotte Street, Milton Regis.

Atherstone Grammar School M.C.—A visit paid to the "*Atherstone News*" works was greatly enjoyed, the process of producing a newspaper fascinating the members. This was followed by an illustrated account of the production of one of the great London dailies. Model-building is the main activity, a recent evening being devoted to a comparison of various types of Cranes. Air Gun Shooting is a prominent feature of the syllabus. Members made a good show in the school prize lists and at the Annual Sports. Club roll: 21. *Secretary*: W. Clarence Stokes, 11, Stafford Street, Atherstone, Warwickshire.

Weymouth Central School M.C.—Is making splendid headway and the Headmaster has very kindly allowed the use of one of the form rooms and of the hall. A Ping-pong Tournament held some time ago was greatly enjoyed. An interesting paper on "*The First American Railway*" was given by E. Brampton, while A. Brake discussed "*Levers*." The club has been divided into two sections, Nuts and Bolts, which are competing in games and model-building. Club roll: 21. *Secretary*: R. Mogg, 26, Chelmsford Street, Weymouth.

Derby M.C.—The first meeting in the new club-room was a great success and the new Leader, Rev. A. Crudgington, has been given a very cordial welcome. Seven of the members gave Five-minute Lectures, which proved rather amusing. Games Evenings are popular and Table Tennis Tournaments are frequently arranged. The Meccano lecture "*Some of the World's Famous Bridges*" was read by the Secretary. A Cycle Paper Chase was held recently and after the "Hares" had been caught they joined the "Hounds" in a fishing excursion. A Magazine is to be published in the near future. Club roll: 20. *Secretary*: Wm. P. Smith, 435, Uttoxeter Road, Derby.

Bridport Grammar School M.C.—Meetings are held weekly for Model-building and many enjoyable nights have been spent. The Exhibition was a great success. The models included two Motor Chassis, one loaned from Headquarters and the other made by a member, Wire Rope-making Machine, Motor Breakdown Van, Swing Bridge, Racing Car, Gantry Crane and many others. Every model that worked was kept going the whole evening. Club roll: 27. *Secretary*: E. E. C. Marsh, Uploders, Bridport, Dorset.

Sedgley Park M.C.—Affiliation with the Guild has been secured and excellent progress is being made. Meetings are held weekly and the programme includes Model-building Contests and Games. *Secretary*: W. A. Robinson, 9, Queen's Drive, Sedgley Park, Prestwich.

(*Continued on page* 768)

Competition Page

DOUBLET PUZZLES (IV.)

At the request of many readers we are repeating this month another of the doublet puzzles that have proved so popular in the past two years. Doubtless the majority of our readers are already familiar with the rules governing these fascinating word puzzles, but for the benefit of our many new readers we are repeating them here.

Two words, each containing the same number of letters, are given, and are termed the Doublet. It is required to change the first word into the second by placing connecting words between the two, each new word differing from its predecessor by the alteration of one letter only, and without any shuffling of the letters. These connecting words are called "links," and the object of the contest is to effect the necessary change from one word of the doublet to the other with the smallest possible number of links. As an illustration we give the following examples.

Change COLD to HEAT
COLD—hold-held-head—HEAT
Make LION ROAR
LION—loon-loan-roan—ROAR

Competitors should note that in making the links only English words appearing in a standard dictionary may be employed. Proper nouns—names of persons, places, etc.—are not permitted.

The doublets that are to be solved are as follows :—

Identify	BIRD	as	DOVE
Save	LIFE	with	BELT
Fix	GAZE	on	STAR
Fill	SPACE	with	CROWD
Rule	LAND	with	LAWS
Make	PRINT	on	PAPER
Publish	PAPER	as	DAILY
Write	BOOK	for	BOYS
Move	GEAR	into	MESH
Hunt with	DOG	and	GUN
Dye	BLUE	to	GREY

Cause 'PLANE to STUNT then CRASH

Meccano or Hornby Train goods to the value of £1/1/-, 15/- and 10/6 respectively will be awarded to the senders of the three solutions showing the lowest total of links used. In addition there will be a number of consolation prizes.

Entries should be addressed to "Doublets No. 4, Meccano Magazine, Binns Road, Liverpool," and sent to reach this office not later than 29th September. Overseas closing date, 31st December.

37th Photographic Contest

With the arrival of the end of this month the last of our readers will have returned to school or business from his summer holiday ; the holiday photographs will have been developed and prints will be available to record for ever those happy moments of the 1928 holiday. Nothing therefore could be more appropriate than a competition for "THE BEST HOLIDAY SNAPSHOT."

Prizes of Meccano or Photographic goods, to be selected by the winners, to the value of 10/6 and 5/- respectively, are offered to the senders of the best and the second best holiday photograph in each of the two sections into which the competition is divided : A for those aged 16 and over, B for those under 16.

In judging the entries the first consideration will be the story the photograph tells. Professionally finished prints are eligible, the only condition being that the competitor must have exposed the original film or plate. Everything else being equal, preference will be given to prints that are the work of the competitor throughout, and readers who claim to have done this should make a note of this fact on the back of each print submitted.

Entries must be addressed to "37th Photographic Contest, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than 29th September. Overseas closing date, 31st December.

The Most Interesting Experience of My Holidays

This is not an essay competition ! It is an opportunity for each of our readers to tell us the story of the most interesting incident of his or her holidays. Many readers, of course, will not have experienced anything really exciting, and we want to make it clear that the prizes will be awarded to the readers who give us the best story of what they consider the outstanding episode of their holidays, whether this was thrilling or not.

Prizes of Meccano or Hornby Train goods, to be chosen by the winners, to the value of 10/6 and 5/- respectively, will be awarded to the senders of the best and second best narratives in each of the usual two sections : A for those aged 16 and over, B for those under 16. Every competitor must see that his name, age, and address, is given on the back of each sheet of paper submitted with his entry. The actual stories should be written on one side of the paper only.

Entries must be addressed to "Holiday Stories, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than 29th September. Overseas closing date, 31st December.

COMPETITION RESULTS

Sketchograms.—This drawing competition proved easily the most popular that ever we have held in the "*M.M.*" and our hope that it would appeal to readers with no special claim to artistic ability was amply fulfilled. Many readers who had not previously taken part in a drawing competition competed.

The winner in Section A, JACK JENNINGS, of Dublin, required only 7 lines and a dot, apart from the sketchogram, to achieve a most cheery picture of a British soldier complete with tin hat. His entry probably was the most simple in conception in the whole of the competition, and undoubtedly was the most effective in construction. Similarly the entry submitted by R. BOWDEN, of Richmond, Surrey, which gained the premier award in Section B, depicting a portion of a Monday's washing on the garden line, required a dozen lines, in addition to the sketchogram. The sketch entitled "Sailors don't care" by S. HARRY, of Leeds, and "The End," by J. W. PERCIVALL, Birmingham, showing the sad fate of a bicycle that endeavoured to ram an omnibus, are gems of construction and demonstrate strikingly that subtle suggestion is more effective than elaborate explanation.

In view of the really high quality of the entries it was decided to give more consolation prizes than was originally intended, and these were awarded to :—C. C. COX (North Wembley) ; T. O. DAWSON (Tyldesley, Manchester) ; J. B. FROST (Newton-le-Willows) ; F. I. GILLSON (Plaistow, E.13) ; Miss B. Gow (Dumbarton) ; L. HOLMAN (Camborne) ; R. KIRKHAM (Birmingham) ; M. RAWLINS (Shanklin, I.O.W.) ; F. J. ROBINSON (Shiplake-on-Thames) ; R. SEWELL (St. Ives, Hunts.) ; E. T. SMITH (Bideford).

35th Photographic Contest.—The subject of this competition was "An Engineering Photograph," and so popular was the appeal, that few branches of engineering work were unrepresented among the entries.

The first prize in the A Section went to JACK FINLEY, of Miles Platting, Manchester, for a street scene showing a concrete mixer at work. The scene was taken against the light on a bright, sunny day, and a very striking effect has been secured. In the B Section the first prize goes to E. DYER, of Mottingham, S.E.9, whose winning entry shows the s.s. "*Cardiganshire*" passing through a lock entrance on its way into dock. The second prizes go to W. F. STRICKLAND, St. Leonards-on-Sea (A Section), for a splendid snap of "*Southern Maid*," one of the Romney, Hythe & Dymchurch Railway's "Pacific" type locomotives, and to A. M. JOHNSTON, Dunstable (B Section), for a photograph showing the starting gun at work at Halton Camp Aerodrome.

Consolation prizes for really excellent efforts were awarded to :—A. DOWN (Maidstone) ; I. KINLOCH (Sudbury) ; G. LANE (Wakefield) ; G. S. MARSH (Blackpool) ; G. E. OWEN (Bristol) ; G. S. PARKER (Southampton).

OVERSEAS RESULT

2nd Stomachion Competition.—Like the competitors in the Home Section of this competition, the Overseas competitors have produced a considerably higher level of merit than was the case in the first contest.

The first prize was awarded to F. W. BEER, of Toronto, for a very striking design of a Japanese Juggler. His picture is full of life, and is particularly meritorious. A very touching picture of a singularly active old pedlar briskly stepping out along the road with his pack on his back secured the second prize for L. WATERHOUSE, of Albert Park, South Australia. The third prize goes to R. WALLACE, of Durban, South Africa, who shows a mysteriously cloaked reader of the "*M.M.*" with his head almost buried in the pages of his favourite publication. S. GALDIES, of Valletta, Malta, takes the fourth prize with an "Egyptian Musician," while a consolation prize goes to M. C. PATEL, of Baroda, India, for an "Old lady with an umbrella."

Club Notes—(*continued from page 765*)

New Zealand

Wiseman's (Auckland) M.C.—A huge Model-building Contest has been arranged and many valuable prizes are to be awarded. A record entry is anticipated and the models will be on exhibition after judging. A most interesting address on "*Internal Combustion Engines*" was given by Mr. A. Moren of Takapuna. Every detail was carefully demonstrated, a complete model engine, on view, built entirely by Mr. Moren, presenting a very high standard of engineering. This gentleman has very kindly offered to give another address on "*The Engine and the Ship.*" Mr. N. Kerr, Physical Culture Expert, gave a most interesting and instructive demonstration of the use of muscles. *Secretary*: Mr. W. Shearer, 170-172, Queen Street, Auckland, New Zealand.

South Africa

Clifton (Johannesburg) M.C.—The club has now been divided into Junior and Senior Sections, to meet on separate evenings. A most interesting lecture on "*The Motor Car*" was recently delivered by Mr. Pope, this being illustrated in various ways. A debate entitled "*Which is most popular—the Hornby Train or the Meccano Outfit*" led to a keen contest that ended by the majority voting in favour of Meccano. Club roll: 34. *Secretary*: H. Jacobsen, 169, Loveday Street, Clifton, Johannesburg, Transvaal.

Denmark

Odin M.C.—An interesting syllabus has been followed and the members are all very enthusiastic. Model-building competitions have been held and the models submitted are always of a very high standard. A visit was paid some time ago to a shipbuilding yard, when the members had the pleasure of seeing a ship launched. The workshops of the yard will be inspected on a later visit. *Secretary*: Aksel E. Oswald, Kronprinsensgade 56, Odense, Denmark.

Clubs Not Yet Affiliated

Darwen M.C.—Good progress is reported. In a Model-building Competition recently organised a Crane secured the first prize and a Bridge the second. During last session a fine model of the Pit-Head Gear driven by a Wormar steam engine was constructed. An interesting syllabus has been drawn up for the summer session and among other activities it is hoped to publish a club Magazine. *Secretary*: J. Eatough, 16, Bridge Street, Darwen.

Hornsea M.C.—This new club has secured a suitable club-room and an interesting programme is being arranged. Members have been very fortunate in meeting with an enthusiastic Leader, and they hope very soon to become affiliated. *Secretary*: Robert Coverdale, 4, Pioneer Terrace, Cliff Road, Hornsea.

St. Leonards, Harrow and Kenton M.C.—The opening meeting was a great success and a very enjoyable evening was passed. Model-building is popular and members take specially keen interest in Model Railways and in Stamp Collecting. *Secretary*: A. Joyce, The Manor House Lodge, Bonnersfield Lane, Harrow, Middlesex.

Taunton M.C.—A Club has been started in Taunton, and meetings are held on Wednesday evenings. A good room is available and the summer programme includes cycle runs and tours. Those desiring to join should write to the Secretary for full details. *Secretary*: R. Ball, "Ferndale," South Road, Taunton, Somerset.

Swadlincote M.C.—An interesting visit was paid to the famous Bass Brewery at Burton. It is hoped to follow this with a visit to the Rolls-Royce Works very soon. The club is in a splendid position and it is hoped that affiliation will be granted in the near future. *Secretary*: R. W. S. Moore, "Summerfield," Wilmot Road, Swadlincote.

West Norwood Meccano and Hobbies Club.—This club already has a Leader and an excellent club-room. More members are required and the secretary will be pleased to hear from those wishing to join. It is hoped that the club will soon be affiliated with the Meccano Guild. *Secretary*: C. D. Treganowan, 20, Broxholm Road, West Norwood, London, S.E.7.

Cowlersley M.C.—An interesting programme has been arranged for this new club, including picnics, outings to places of interest, and Meccano and Hornby Train evenings, while an Exhibition has been planned. A Leader has not been secured up to the present time, and the secretary will be grateful for any assistance in this connection. *Secretary*: Harold Wilson, 40, Western Road, Cowlersley, Huddersfield.

Harehills (Leeds) M.C.—This club is making splendid headway but is handicapped owing to the fact that a Leader has not yet been secured. Any gentleman in the district who is willing to assist in this capacity should communicate with the secretary. Many keen cricket matches have been played and a Paper Chase was very much enjoyed. The club is in a splendid financial position and new members will be given a hearty welcome. *Secretary*: Robert K. Fourness, 12, Berkeley Street, Leeds.

Clonmel M.C.—The secretary reports that headway is being made, new members having been enrolled at each meeting. A typical summer programme has been followed and the club possesses a small cinema outfit of which it hopes to make good use. There is still room for more members and anyone wishing to join should write to the secretary, who will be glad to give all particulars. *Secretary*: J. F. Griffin, 110, Irishtown, Clonmel, Co. Tipperary, Ireland.

Back Numbers of "*Meccano Magazine*"

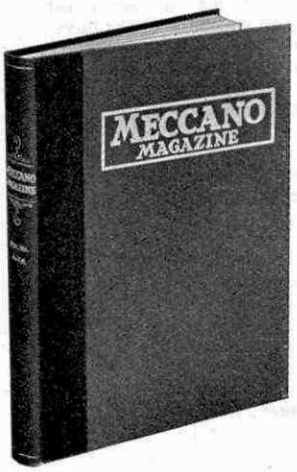
Will readers please note that all "*Meccano Magazines*" prior to December 1923 are out of print. Each of the 1924 issues is available, but only the May, June, July, September and December issues of 1925 are in stock. All of the 1926 and 1927 issues are available with the exception of January and February 1926.

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, 8d. The number of copies is very limited and early application should be made.

We can supply a limited number of bound volumes of the "*M.M.*" at the following prices (carriage paid). January-December 1924, in one volume, 10/–. July-December 1926, price 8/3. January-June 1927, 9/6. July-December 1927, 9/6.

Binding the "*M.M.*"

Binding cases for back numbers of the Magazine may be obtained from Messrs. O. H. Bateman and Co., 13, North John 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.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., 13, North John Street, Liverpool, carriage paid.

Famous Trains—(*continued from page 715*)

up trains through the other. It is a singular experience to plunge into the darkness of the tube just when one might be expecting to have the most extensive of views.

Immediately on the other side of the bridge lies the famous Welsh village that rejoices in the name of "Llanfairpwllgwyngyllgogerychwyrndrobwll–llandisilio–gogogoch!" It has a station, but the authorities, despairing of obtaining a station name-board that would not overlap the platforms at both ends, have wisely cut the name down to Llanfair, and left it at that! Thence we hurry across the island, past Gaerwen, junction for Red Wharf Bay and other delectable resorts on the north side of Anglesey; down a dip of three miles steepening from 1 in 264 to 1 in 100, which may carry us well into the "seventies" by way of maximum speed; up the other side, and finally down falling gradients until we can sight the port of Holyhead dead ahead.

Into the commodious harbour station we run at 2.5 p.m., 263¾ miles from London, and 5 hours, 35 minutes after leaving. Across the quay lies the steamer for Ireland, and the transfer of passengers, mails and baggage is quickly effected. Later on we, too, must pay a visit to the "Emerald Isle" and see how its railways conduct themselves—wonderfully well, let me say in advance, with excellent trains and remarkably high speeds. But that is a subject we must leave for next month.

New Meccano Models—(*continued from page 761*)

a deep slot into the face of the coal, ore, etc., they greatly facilitate the removal of the material.

The cutting wheel, which consists of a Bush Wheel having two 5½" Strips bolted to it, is carried on a 2" Rod journalled in Double Brackets at the end of the extended support. The 2" Rod also carries a 1" fast Pulley Wheel.

Cord is passed around this Pulley Wheel, then guided round the 2" Axle Rod journalled in the main framework, and is looped around the Pulley on the Crank Handle. The latter also is connected by Cord to one of the four 3" Pulley Wheels on which the model travels. Hence, on turning the Crank Handle, the cutter rotates and, at the same time, the entire model moves along in a most realistic manner.

Pictorial Perfection in Photography

The photographic booklets issued from time to time by Messrs. Burroughs, Wellcome & Company are always exceedingly attractive in appearance as well as of real practical value. The booklet recently to hand, entitled "*Pictorial Perfection in Photography*," is even more striking than usual. It contains in small space a really astonishing amount of useful photographic information ranging from exposure to development, printing and enlarging. A section explaining the colour effects obtainable by toning opens up new and fascinating possibilities for the production of coloured photographs.

The booklet is fully illustrated and the examples of effects produced by staining and toning are very striking.

A copy of this booklet will be sent post free to any "*M.M.*" reader applying to Burroughs, Wellcome & Co., Snow Buildings, London, E.C.1.

A PORTRAIT GALLERY OF GREAT MUSICIANS

A GLANCE through the pages of any stamp album will reveal numbers of portraits of kings, princes, statesmen, soldiers, sailors and men of distinction in other spheres of life. There is wonderful scope here for collectors interested in stamps because of the stories told by stamp designs. They might well consider the possibility of arranging these collections of portraits in groups, rather than allowing them to remain scattered under the headings of the countries of issue.

We have selected a portrait gallery of great musicians to illustrate our suggestion. Our illustrations are drawn mainly from the Austrian 1922 charity series depicting Haydn, Mozart, Beethoven, Schubert, Bruckner, Johann Strauss, and Wolf. The interesting history of the selection of these portraits for stamp purposes was related in our Charity Stamp article last month, and does not require retelling. We have included also portraits of Bach, Chopin, and the great Polish pianist Paderewski, who is probably the only musician of international repute who has occupied the position of President of his own country.

Johann Sebastian Bach, whose portrait appears upon the 50 pf. value of the German "Art" issue of 1926, in many respects was one of the greatest composers the world has ever known. He was born at Eisenach, about 20 miles from Hamburg, on 21st March, 1685, and at the age of 14 was left to provide for himself. Throughout his life he was entirely wrapped up in music, and his enthusiasm for his art was so great that at times it led him into trouble. On one occasion, for instance, he obtained a month's leave of absence from the church at which he was organist, to go to Lübeck to listen to the famous organist Buxtehude. He was so excited by this man's playing that he completely forgot to return at the end of the month and stayed on for another three! Naturally there was trouble when he returned, but he does not appear to have been greatly upset by the furious reception he received from the elders of the church. On the contrary, he seems to have made it quite clear that he thought very little of either them or their opinions! In his later years Bach became quite blind and he died at Leipzig on 28th July, 1750.

Joseph Haydn, affectionately known as "Papa" Haydn, was born near Vienna in 1732. His portrait appears on the 2½ Kr. value of the Austrian 1922 issue. As a small boy he joined the choir of St. Stephen's Cathedral, Vienna, where he remained until he was 17. By that time his voice had broken and he was no longer wanted, and his departure was hastened considerably when it was discovered that, in a sudden fit of boyish mischief, he had cut lumps of hair off a fellow-chorister! It was many years before Haydn made more than a bare living, but financial matters never seemed to worry him and it was not very long before he decided to get married. The girl he fell in love with was the younger daughter of a barber, but for some unknown reason she suddenly decided to become a nun. "Never mind," said the barber, "you shall have the other girl"; and he did! The great characteristic of Haydn's music is its imperturbable cheerfulness and friendliness, and in this it reflects the character of the man. Haydn died in Vienna in 1809.

The 5 Kr. Austrian stamp depicts one of the greatest among the world's musical prodigies, Wolfgang Amadeus Mozart, born on 27th January, 1756, at Salzburg. Music came so naturally and so easily to him that in his fifth year he was actually composing little pieces. By the time he was six he was known all over Europe as an infant prodigy, and his father took him on long tours with brilliant success. One of the most remarkable features about the boy was his amazing memory. On one occasion, at the Sistine Chapel in Rome, he heard a certain composition that was jealously guarded, the singers being forbidden to copy the score on pain of all sorts of terrible penalties. Mozart listened intently to the performance, went straight away back to his lodging, and immediately wrote out the entire work. The accuracy of his writing was afterwards tested by a skilled musician, who found scarcely a wrong note anywhere.

These early successes came to an end in due course and subsequently Mozart, although composing incessantly, lived in comparative poverty. He died in Vienna at the age of 35. He was buried among paupers, and to this day no one knows the exact site of his grave. Mozart's music to some extent resembles that of Haydn, but it surpasses it in emotional power, delicacy and technical perfection.

One of the most tragic among the great figures of history is the mighty genius Ludwig van Beethoven, whose likeness appears not only on the 7½ Kr. Austrian stamp, but also on the 20 pf. value of the German 1926 issue. He was born in 1770 at Bonn, and his childhood was spent in miserable surroundings. His father intended that the boy should become a prodigy like Mozart and made him practise incessantly at the piano and the violin. In spite of this drudgery Beethoven's passion for music grew steadily until it absorbed his whole life. As he grew older he became more and more unconventional, and we hear of him throwing the soup at his housekeeper when it did not please him, and pouring water over his hands until the people in the room below were flooded out! He was very fond of taking long country walks, and sometimes when musical ideas were seething in his brain he would scare the villagers by shouting and waving his arms about as he passed.

The great tragedy of Beethoven's life was his deafness. For years he refused to admit to his friends that he could not hear, but at length things became so bad that he could not disguise the fact that he would never again hear a note of music. To a musician no misfortune could be greater, and it is all the more remarkable that Beethoven's greatest compositions were written during his years of utter silence. He died in Vienna in 1827 during a particularly

(Continued on page 771)

Stamp Collecting—(*continued from page* 769)

violent thunderstorm.

As a composer Beethoven began where Mozart and Haydn left off and, building upon the foundations they had laid, he produced a series of symphonies, sonatas, quartets, and other works that will never be surpassed.

Franz Schubert occupies the 10 Kr. value. He was one of the greatest of all song writers, and seems to have composed simply because he could not help it. He just bubbled over with melodies, which he jotted down on any odd scrap of paper wherever he might be. To him came easily things that other composers had to labour years to acquire, and he produced one work after another at a rate that was truly extraordinary. He was born in 1797 in a suburb of Vienna, his father being the parish schoolmaster. Throughout his life he was poor and he never achieved fame, but so long as music paper and a pencil were available he was happy. He died in 1828 at the early age of 31. Many readers will have seen the musical play "*Lilac Time*," which makes extensive use of Schubert's music and also lays violent hands on the composer to form the hero.

By way of contrast with the simple-hearted Schubert, who was most at home in the cafés of his beloved Vienna, we come to Frederick Chopin, the aristocratic Pole, whose life was spent mostly in the drawing rooms of fashionable Paris. As a composer for the pianoforte Chopin stands alone. He devoted his whole life to this instrument, and was probably the greatest pianist of his day with the exception of Liszt. Chopin was a prodigy, and we are told that, as a small child, he used to collect around the piano his father's pupils and improvise little musical stories, the meaning of which was so plain that his youthful audience used to guess correctly nearly every time. Throughout his life Chopin was extremely delicate and he died of consumption, after a long period of suffering, in 1849. Our illustration of Chopin is taken from the 40 gr. stamp issued by Poland on 1st March, 1927.

We have little space left to deal with the other musicians illustrated here.

The 25 Kr. shows Anton Bruckner (1824-96), an Austrian composer born at Ansfelden, Upper Austria. He was organist of the imperial chapel at Vienna, and subsequently professor at the conservatorium and lecturer on music at the university. Bruckner, like Beethoven, wrote nine symphonies; but unlike Beethoven failed to fill them with genius.

Johann Strauss (1804-49), familiarly known as the "Waltz King," appears on the 50 Kr. Conducting his own band, Strauss made several extraordinarily successful tours throughout Europe, during which his waltzes—of which he wrote more than 150—leaped into fame. These waltzes are characterised by attractive melody and brilliant instrumentation and the popularity of many of them does not show any sign of waning.

The 100 Kr. depicts Hugo Wolf (1860-1903), whose life story is one of the saddest among composers. He was born at Windischgraz, South Styria, and received his first musical instruction from his father. Subsequently he entered the Vienna Conservatorium, but was expelled as the result of a breach of some regulation. He was now thrown on his own resources and in turn he tried teaching, conducting and musical criticism, but with small success. Finally, the help of a few friends enabled him to devote himself entirely to composition. For a while his prospects seemed brighter, but gradually he became more and more subject to fits of terrible depression, during which he thought that his musical inspiration had left him for ever. In spite of all sympathy and care his condition became worse; his brain gave way entirely, and ultimately he died in an asylum in Vienna. As a composer Wolf is greatest in his songs, and it is a strange coincidence that another and even greater song writer, Robert Schumann, should also have fallen a victim to insanity.

Finally we have Ignace Jan Paderewski (1860) who, as President of Poland, was the subject of the 15c. value of the Polish 1919 issue commemorating the first Polish National Assembly. Paderewski was born at Podolia, and after a period of teaching at the conservatoires of Warsaw and Strassburg he devoted himself entirely to solo playing. His success has been phenomenal. During his world tours he has played in the largest available halls to enormous audiences and he has created an enthusiasm unequalled by any other pianist of his day.

We are indebted to Stanley Gibbons Ltd., for the loan of the stamps from which the illustrations accompanying this article were prepared.

Fireside Fun

NO WISH TO STAY

The proceedings of a police-court case had been rather noisy, and the magistrate determined to restore order.

"The next person who interrupts," he said sternly, "will be put outside."

"Hurray!" shouted the prisoner.

* * * *

A girl with a voice like a corncrake sang "My Zummerset Hoame."

Even the hostess realised how awful the whole business was, and she was staggered to see an elderly gentleman in a corner of the room crying quietly. "Are you a Somerset man?" she asked gently.

"No," said he, "I'm a musician!"

* * * *

Mr. Bones: "The other day I hung a ham in front of my shop and a big Alsation dog came along and ran off with it. What shall I do?"

Lawyer: "Make the man who owns the dog pay for the ham."

Mr. Bones: "Well, Mr. Lawyer, it was your dog and you owe me 7/6!

Lawyer: "That so? Well my charge for legal advice is half a guinea, so you owe me three shillings!

* * * *

THAT CHEEKY NEPHEW

Tommy (when riddles were being asked): "Do you know the difference between an apple and an elephant, Uncle?"

Uncle: "I'm afraid I don't, Tommy."

Tommy (triumphantly): "Then it wouldn't do for Mother to send you out to buy apples, would it?"

* * * *

Detective (after the burglary): "You say there are twenty watches and ten diamond rings gone? Is there anything else missing?"

Victim: "Yes, the chap that stole 'em."

* * * *

Motorist: "I was in a bad jam last night."

Friend: "Tell me about it, but don't spread it on too thick."

* * * *

Little Girl (who has had a pair of woollen gloves for her birthday): "Oh, mummy, I wish you had bought kid gloves."

Mother: "Why, darling?"

Small Girl: "This kind makes my toffee so hairy."

* * * *

"What is your husband's daily pursuit?" asked the census taker. "The 8.25 train," replied the wife promptly.

* * * *

ON THE GOLF LINKS

The Colonel (waiting to drive): "Now then, hurry on, please, with that baby."

Nursemaid: "Baby yerself, playing at ball there in yer knickerbockers and all!"

QUITE A GOOD REASON

Tiresome Old Gentleman (who seems to think he owns the line): "I say, guard, what are we waiting for?"

Guard (snappily): "Waiting for the train to go on, sir!"

* * * *

"That's a nice dog. What do you call him?"

"Fish."

"Why?"

"'Cos he won't bite."

* * * *

Customer: "Oh, you're back! Is the strike settled?"

Waiter: "What strike, sir?"

Customer: "Well, what have you been doing since I ordered my lunch?"

* * * *

RIGHT THERE

"Where shall I catch the London express?"

"You'll catch it all over you if you don't come off that level-crossing this very moment!"

* * * *

THE PUDDEN

In the pantry was a pudden;
Johnny thought it was a good'un.
In the pantry, though forbidden,
Naughty Johnny is now hidden,
And in Johnny is the pudden
Johnny thought was such a good 'un.

Down comes daddy in a minute,
Sees the pantry and John in it,
But he cannot see the pudden
Which is making John look wooden.
"Where's the pudden John?" says daddy,
Gazing sternly at his laddie.

Johnny stammered, Johnny stuttered,
Then these wicked words he uttered:
"*In the pantry is the pudden!*"
"John," said dad, "you really shouldn'
Tell such stories to your pater;
You will much regret it later."

"But it's true" replied his laddie.
"I am in the pantry, daddy,
And the pudden is in me, dad,
So" said Johnny, "you must see, dad,
In the pantry is the pudden!"

WALLOP!
Daddy gave him such a good 'un!

Daily Mirror.

* * * *

A STUDENT OF ECONOMY

Baker: "I shall want another penny for that loaf, please. Bread's gone up to-day."

Mother's Little Messenger: "Then give me one of yesterday's."

* * * *

PROTECTED

Insurance Agent: "Don't you want your office furniture insured against theft?"

Editor: "Yes, all except the clock. Everybody watches that."

DIPLOMACY

Enterprising Vendor: "I say, mum, 'ave you got such a thing as a match you could give me?"

Kind Lady: "I haven't one in the place."

"Well, will you buy a few boxes? I sells 'em, mum!'

* * * *

Burglar (to clumsy mate who has fallen over a chair): "That's the idea, Bill—deafen 'em so as they can't hear us!"

* * * *

Jack: "Father, I saw a deaf and dumb beggar in the street this afternoon and he had an impediment in his speech."

Father: "Don't talk nonsense, Jack."

Jack: "But he had, father, one of his middle fingers was missing.

* * * *

Indignant Father: "Hadn't you done anything but laugh?"

Boy: "No, nothing at all."

Indignant Father: "And the master caned you for that? The scoundrel! I'll teach him!"

Boy: "Yes, and he hit me hard, too! He's a great big man."

Father (not so indignantly): "H'm, is he? You mustn't laugh in school, Tommy, it's against the rules."

* * * *

SHOWN ROUND

A stationmaster after enrolling a new recruit called a porter off a platform to show him "round." Four hours afterwards they were seen returning towards the station having visited the Free Library, Art Gallery and other places of interest!—(*Model Railway News*).

* * * *

Teacher: "Jones, this is the third time I've seen you look on Smith's paper."

Jones: "Yes, sir, he doesn't write very plainly sir!"

* * * *

Stage Manager: "Now then, we're all ready. Run up the curtain!"

New Stage Hand: "Wot yer talkin' abaht?" Run up the curtain! Think I'm a bloomin squirrel, do yer?"

* * * *

THEIR PUNISHMENT

"Johnny," said the minister, reprovingly, as he met an urchin carrying a jar of fish one Sunday afternoon, "did you catch those to-day?"

"Ye-es, sir" answered Johnny. "That's what they get for chasin' worms on Sunday."

* * * *

Father: "What are you drawing, Jimmy?"

Jimmy: "You, daddy."

"But that isn't much like me."

"Ah, then, I'll put a tail on it and call it a monkey."

* * * *

Binks: "Run upstairs and get my watch."

Jinks: "Wait awhile, and it will run down."

"No it won't: our's is a winding staircase."

* * * *

Angry Neighbour: "Your boy has just thrown a stone at me!"

Father: "Did he hit you?"

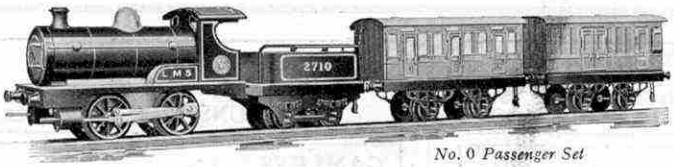
"No, but—

"Then it wasn't my boy!"

HORNBY TRAIN SETS

With More Coaches and Wagons

We are able to announce that (as from 1st September) alterations have been made to the contents of several Hornby Train Sets, as indicated below. In some cases new rolling stock has been added, while in others replacements of rolling stock have been effected in order to give a more realistic appearance to the sets. These additions do not make any difference in the prices of the train sets concerned. In fact, No. 0 Passenger Set is now reduced from 22/6 to 20/–. Ask your dealer to tell you all about the new sets.



No. 0 Passenger Set

No. 0 Goods Set

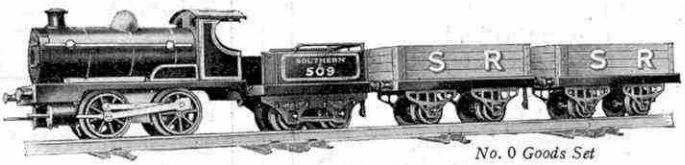
This set is improved by the addition of an extra wagon. It now consists of Locomotive (non-reversible) Tender, two Wagons and set of Rails. One of the rails is fitted with a braking device by means of which the train may be stopped from the track. The Locomotive is fitted with brake mechanism. Gauge 0.

Hornby No. 0 Goods Set, complete, packed in strong cardboard box ... ... Price **17/6**

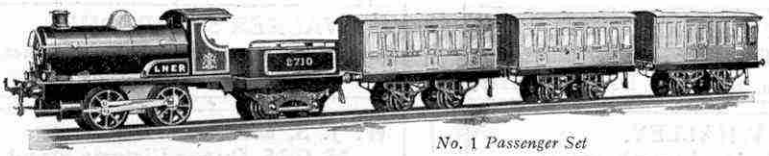
No. 0 Passenger Set

This set now contains Locomotive (non-reversible), Tender, Passenger Coach, Guard's Van and set of Rails. One of the rails is fitted with a braking device by means of which the train may be braked from the track. The Locomotive is fitted with brake mechanism, and the doors of the Coach and Guard's Van open. Gauge 0.

Hornby No. 0 Passenger Set, complete, packed in strong cardboard box ... ... Price **20/–**



No. 0 Goods Set



No. 1 Passenger Set

No. 1 Goods Set

The revised contents of this set are Locomotive, Tender, Wagon, Brake Van and set of Rails. One of the rails is fitted with a braking device by means of which the train may be stopped from the track. The Locomotive is equipped with reversing gear and brake mechanism. Gauge 0.

Hornby No. 1 Goods Set, complete, well boxed ... Price **20/–**

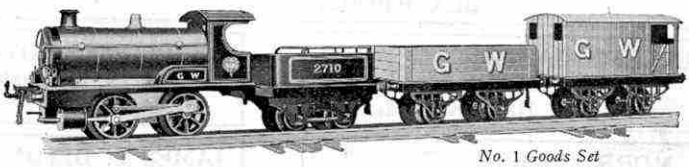
Hornby No. 1 Goods Set, complete, well boxed, fitted for Hornby Control... ... ... Price **23/6**

No. 1 Passenger Set

This set now consists of Locomotive, Tender, two Passenger Coaches, Guard's Van and set of Rails. One of the Rails is fitted with a braking device by means of which the train may be stopped from the track. The Locomotive is fitted with reversing gear and brake mechanism, and the doors of the Coaches and Guard's Van open. Gauge 0.

Hornby No. 1 Passenger Set, complete, well boxed. Price **25/–**

Hornby No. 1 Passenger Set, complete, well boxed, fitted for Hornby Control ... ... Price **28/6**



No. 1 Goods Set

No. 2 Goods Set

No. 2 Goods Set

This set is much improved by the addition of a Brake Van. It now contains Locomotive, Tender, two Wagons, Brake Van and set of Rails. The Rails include one Brake Rail by means of which the train may be both braked and reversed from the track. Gauge 0.

Hornby No. 2 Goods Set, complete, well boxed. Price **32/6**

Hornby No. 2 Goods Set, complete, well boxed, fitted for Hornby Control ... ... Price **37/6**

No. 2 Tank Passenger Set

This set now contains a No. 2 Hornby Tank Locomotive, three No. 1 Pullman Coaches (in place of the three Passenger Coaches previously included), one No. 1 Pullman Composite (in place of the Guard's Van previously included), and set of Rails. One of the rails is fitted with braking device, by means of which the train may be both braked and reversed from the track. The Locomotive is fitted with brake mechanism and reversing gear. Gauge 0.

Hornby No. 2 Tank Passenger Set, complete, well boxed. Price **40/–**

Hornby No. 2 Tank Passenger Set, complete, well boxed, fitted for Hornby Control ... ... Price **45/–**

No. 2 Tank Passenger Set

1928 HORNBY TRAIN PRICE LIST

Clockwork Train Sets

No. M 1 Passenger Set	7/6
„ M 2 „ „	9/–
„ M 3 Goods Set	15/–
Hornby No. 0 Goods Set	17/6
„ „ 0 Passenger Set	20/–
„ „ 1 Goods Set	20/–
„ „ 1 „ „ fitted for Hornby Control	23/6
„ „ 1 Passenger Set	25/–
„ „ 1 „ „ fitted for Hornby Control	28/6
„ „ 2 Goods Set	32/6
„ „ 2 „ „ fitted for Hornby Control	37/6
„ „ 2 Pullman Set	50/–
„ „ 2 „ „ fitted for Hornby Control	55/–
Hornby No. 1 Tank Goods Set	22/6
„ „ 1 „ „ „ fitted for Hornby Control ...	26/–
„ „ 2 „ „ „	37/6
„ „ 2 „ „ „ fitted for Hornby Control ...	42/6
„ „ 2 Tank Passenger Set	40/–
„ „ 2 „ „ „ fitted for Hornby Control	45/–
„ „ 3c G.W.R. "Cornish Riviera"	60/–
„ „ 3c L.N.E.R. "Flying Scotsman"	60/–
„ „ 3c L.M.S.R. "Royal Scot"	60/–
„ „ 3c S.R. "Dover Pullman"	60/–
„ „ 3c Riviera "Blue" Train	62/6
„ Metropolitan Train Set C	55/–

Rolling Stock and Accessories

The prices of the undermentioned Rolling Stock and Accessories have been revised and are now as follows:—

	New Price		New Price		New Price
Hornby Passenger Coach No. 0-1 ...	2/6	Seccotine Van	3/6	Pullman Coach No. 2-3 (Improved Design)	11/6
Riviera "Blue" Train Coach	12/6	Guard's Van	2/6	Goods Platform (Improved Design) ...	10/6

The prices of the remaining Hornby Rolling Stock and Accessories remain the same as previously

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this 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.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

J. BELL,
10, Lower Garfield St.,
Royal Avenue, BELFAST.

J. WOODHALL,
256, Grange Road,
'Phone : B'head 621 BIRKENHEAD.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
BLACKPOOL.

SELLEN'S BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

J. MORRIS, F.C.O.,
70, Knowsley Street,
Tel. 1074 BOLTON.

BROWN, MUFF & CO. LTD.,
BRADFORD.

JOHN TAYLOR,
28, Preston Street,
Tel. : Brighton 957 BRIGHTON.

BRISTOL TOY EXCHANGE,
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Clifton, 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.

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Silver Street,
Tel. 320 BURY.

HAROLD HUNT,
38, Spring Gardens,
Tel. 202 BUXTON.

PANTOYS LTD.,
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The Promenade, CHELTENHAM SPA.
37, Westgate Street, GLOUCESTER.

THOMAS JAMES & SON,
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R. H. JEPSON,
1, Cross Cheaping,
COVENTRY.

PURSEY & MOCKRIDGE,
The Sports Outfitters,
Tel. Dartford 173 DARTFORD.

HENRY WHALLEY,
195, Duckworth Street,
DARWEN.

RATCLIFFES TOYERIES,
19, Osmaston Road,
DERBY.

JAMES L. DIXON,
14, Suffolk Street,
Tel. Dublin 1528 (off Grafton St.), DUBLIN.

DIXON'S
41, High Street,
Telephone No. 5810 DUNDEE.

BASSETT-LOWKE LTD.,
5, Frederick Street,
EDINBURGH.

ROBERT BALLANTINE,
103½, St. Vincent Street,
GLASGOW.

CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, the Railway Coys., etc.

LUMLEY'S,
Lumley House, Sauchiehall Street,
'Phone: Douglas 2701. GLASGOW.

The MARVEL MART (Wm. Ross & Co.)
110, West Nile Street,
GLASGOW.

POLLOCK & CO.,
36, Bridge Street, 222, Argyle Street,
(Under Railway Bridge) GLASGOW.

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.

HAMMOND'S LTD.,
Paragon Square,
HULL.

WALKER'S EMPORIUM,
25-9, Inglis St., and 11-13, New Market,
INVERNESS.

W. J. S. CARPENTER,
13 & 15, Queen Victoria Street,
LEEDS.

PEARSON & DENHAM (PHOTO) LTD., 6, Bond Street,
LEEDS.

A. WRIGHT, The Garage,
200/2, Dewsbury Road,
Tel. 22719 LEEDS.

ROBOTHAM'S LIMITED,
"Baby's Kingdom,"
Tel. 4809 Belvoir St., LEICESTER.

LLOYD & SONS LTD.,
2, Station Street,
LEWES.

BYCROFTS EMPORIUM,
366, High Street,
LINCOLN.

C. LUCAS, Hobbies Depôt,
35, Manchester Street,
LIVERPOOL.

Reliance Cycle & Motor Co.,
29/31, Manchester St., Liverpool.
Argyle & Conway Sts., Birkenhead.

The ARUNDEL CYCLE & SPORTS STORE, 52, Church Road,
Upper Norwood, LONDON, S.E.19.

DEMPSEY & CO.,
69, South Side, CLAPHAM,
'Phone : Brixton 3022 LONDON, S.W.4.

LEDWITH BROS.,
42 & 44, Walworth Road,
Nr. ELEPHANT AND CASTLE, LONDON, S.E.17.

Meccano & Hornby Train Supplies

The twenty-three dealers whose advertisements appear on this 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.

PERCIVAL & CO.,
140, High Street,
Tel. Wstw. 0120 **WALTHAMSTOW, E.17.**

F. R. POTTER & SON,
43, Market Place,
LOUGHBOROUGH.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 **LUTON.**

BARRS, Children's Paradise,
49, Deansgate,
Telephone 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.

JOHN NESBITT LTD.,
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MANCHESTER.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

R. SCUPHAM & SONS,
35, Linthorpe Road,
MIDDLESBROUGH.

WILLIAM OLLIFF,
13, Grainger Street West,
NEWCASTLE-ON-TYNE.

BEECROFT & SONS,
16, Pelham Street,
NOTTINGHAM.

J. R. NORRIS,
Photographic Dealer,
9, Pelham Street, NOTTINGHAM.

C. HORSBURGH,
12, High Street,
PAISLEY.

DEAN & HOLT,
78, Yorkshire Street,
ROCHDALE.

A. E. HAIG,
16, Northenden Road,
SALE, CHESHIRE.

THE REDGATE CO.
(SHEFFIELD) LTD.,
Tel. 22806 **Moorhead, SHEFFIELD.**

SHEFFIELD PHOTO CO. LTD.,
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'Phone 23891 **SHEFFIELD.**

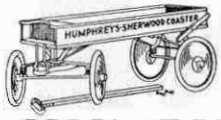
WILSON, GUMPERT & CO. LTD.,
57, Fargate,
Tel. 20489 **SHEFFIELD.**

BIRMINGHAM & COVENTRY CYCLE CO., 140 & 151, Above Bar, SOUTHAMPTON.

S. T. SIMPSON & SON,
589-595, Lord Street,
Tel. 4998 **SOUTHPORT.**

H. W. GINN,
The London Motor, Cycle & Sports Co.,
Tel. 252 Staines **106, High St., STAINES.**

E. M. COLLINS,
12, Lower Castle Street,
TRALEE.



42'6
CARRIAGE PAID

HUMPHREYS
Sherwood Coaster

WILL CARRY A TON

Disc Wheels. Roller Bearings. Solid Rubber Tyres. Coil Spring Shock Absorbers.

Write for illustrated list.

HUMPHREYS,
Meccano and Hornby Train Depot,
Next Grove Arcade,
WALLASEY VILLAGE CHESHIRE

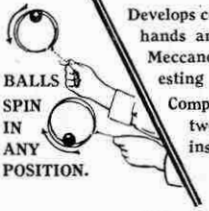
POCKET MICROSCOPES

Magnify lineally about 50 times, squares about 2,500 times. Disclose wonders of Nature invisible to naked eye. Indispensable for study of Chemistry, Botany, etc. Superior Microscope, complete with tweezers, 3 objects and 3 glass slides in case, post free 5/6, Microscope, with 3 slides in box, post free, 2/6.—R. DILNOT (Dept. M), 125, Chiswick High Road, London, W.4.

SPIN-BALL

Rd. No. 735510

The most Fascinating Game since Diabolo.



Develops complete control of both hands and can be used with Meccano parts for many interesting experiments.

Complete Spin-Ball outfit : two frames, six balls : full instructions. 1/2 post free.

THE SPIN-BALL CO.,
WROXALL, I.W., ENGLAND.

GREAT RECORD BARGAIN!!

THE NEW 1928 IMPROVED MODEL OF THE FAMOUS

"MONARCH" *(Regd).* DE-LUXE LARGE **CAMERA**

Fitted with Genuine **Guaranteed Meniscus Lens, Reflex Viewfinder,** Nickel-plated Spring Lever Shutter, Lever Guard, Flexible Leatherette Handle, and absolutely GUARANTEED to TAKE PERFECT LARGE Size PHOTOS 3½ x 2½ BRITISH MADE, supplied complete with all accessories !—Best Quality Plate, Developing & Printing OUTFIT, with easy instructions. Send P.O. 2/- for complete Outfit! Testimonials Galore! W. J. Thomas, Esq., writes: 'Developed and printed photo, think it as good as if taken with a Camera costing £3" *Sale Catalogue 1,000 Big Bargains Post Free*

SALE PRICE **1/9** ONLY! Post 3d.

The LEEDS BARGAIN Co. (M), 31, Kendal Lane, LEEDS.

SAFETY PISTOLS AND REVOLVERS

Can be bought, sold, and carried without permit of any kind (except India).

PISTOLS.

No. 54. Small Nickel Pistol with extractor and cartridge cover, solid barrel and top vent holes 1/11
No. 85. Medium size, heavier model, nickel as above 2/6
No. 21. Long barrel, 8" over all, nickel finish, etc. 3/-

REVOLVERS.

No. 286. 6 Chamber, Blue or Nickel solid barrel, top vent holes, perfectly sound and fool proof 6/11
No. 055. 8 Chamber Blue or Nickel, heavier pattern, solid frame 9/11
No. 685. New Model as illustrated, with safety catch, heavy constabulary pattern with trigger guard, 10 chamber, nickel or blue 17/6
No. 287. Safety Automatic Pistol, 6 shot magazine, blue finish, latest model ... 12/6
No. 123. Dolla Air Pistol 5/-

BLANK CARTRIDGES.

50 ... ... 9d. or 100 ... 1/3

Postage on each 6d. extra Inland. Abroad ex. No Cartridges sent Abroad.

H. H. Parson (Pistol Dept.), 55, Northcote Rd., S.W.11

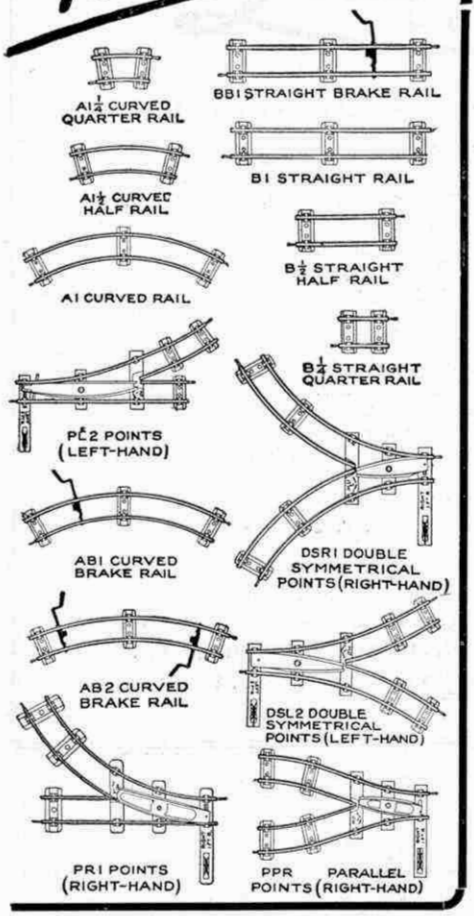
MAKE OR BUY A GRAMOPHONE 100% cheaper than others. Mechanical Parts of a 1st-class **RIFANCO-Phone :** Double Spring Motor, 12-in. Turntable, Swan or "S" Tone-arm, Superior Sound Box, Internal Horn or Cast Throat. Needle Cups as fitted by other firms in £10, £20 Gramophones. All bar the wood. **Nett Cash £1 :18 :6**

This set supplied with polished Oak or Mahogany 40 in. high Cabinet as shown, or Jacobean Pedestal. **Nett Cash £4:10:0**

Carriage paid in U.K. Other sets from 18/-. Machines 30 models, Sideboards, Pedestals, Portables, etc., from **19/6.** Motors **9/-**. New M216, 64-page Catalogue of Accessories with Instructions *How to make Gramophones, 3d.* Established 24 years.

Regent Fittings Co., 78D, 120, Old St., London, E.C.1

HORNBY SERIES
Rails Points and Crossings



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. For 2-ft. diameter circle.

A1	Curved rails (1-ft. radius)	... per doz.	4/6
A1½	Curved half rails	„ ... ... „	3/6
A1¼	Curved quarter rails	„ ... ... „	3/–
AB1	Curved brake rails	„ ... ... each	6d.

CURVED RAILS. For 4-ft. diameter circle.

A2	Curved rails (2-ft. radius)	... per doz.	4/6
A2½	Curved half rails	„ ... ... „	3/6
A2¼	Curved quarter rails	„ ... ... „	3/–
AB2	Curved brake rails	„ ... ... each	6d.

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

CROSSINGS.

CA1	Acute angle crossings (1-ft.)	... each	1/6
CA2	Acute angle crossings (2-ft.)	... „	1/6
CR1	Right-angle crossings (1-ft.)	...	1/6
CR2	Right-angle crossings (2-ft.)	... „	1/6

CROSSOVER.

CO2	Crossovers	... ... each	7/6

POINTS. For 1-ft. radius curves.

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

POINTS. For 2-ft. radius curves.

PR2	Right-hand points	... } per pair	4/–
PL2	Left-hand points	... }	

DOUBLE SYMMETRICAL POINTS. For 1-ft. radius curves.

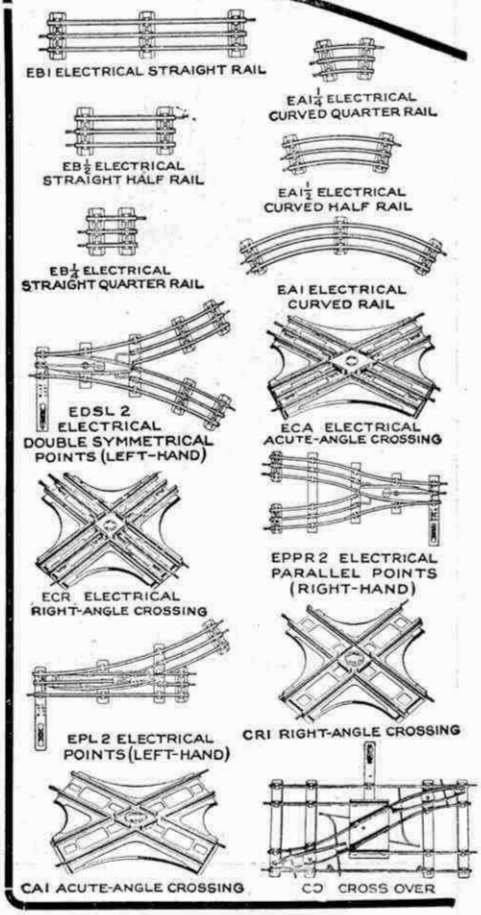
DSR1	Double symmetrical points, right	} per pair	5/–
DSL1	Double symmetrical points, left	}	

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 ...	}	
RCP	Rail Connecting Plates...	... ½ doz.	4d.



Rails for Electric Trains

CURVED RAILS.

For 2-ft. diameter circle.

EA1	Curved rails (1-ft. radius)	... per doz.	8/–
EA1½	Curved half rails	„ ... ... „	5/–
EA1¼	Curved quarter rails	„ ... ... „	4/6

For 4-ft. diameter circle.

EA2	Curved rails (2-ft. radius)	... 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/–

DOUBLE SYMMETRICAL POINTS.

For 2-ft. radius curves.

EDSR2	Double symmetrical points, right	} per pair	12/–
EDSL2	Double symmetrical points, left	}	

STRAIGHT RAILS.

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

POINTS.

For 2-ft. radius curves.

EPR2	Right-hand points	... } per pair	10/–
EPL2	Left-hand points	... }	

PARALLEL POINTS.

For 2-ft. radius curves.

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

Electrical Points and Parallel 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 new booklet entitled "How to get more fun out of Hornby Trains." This booklet is obtainable from your dealer price 3d. or from Meccano Ltd., Binns Road, Liverpool, price 3d. post free.

Manufactured by MECCANO LTD., Binns Road, LIVERPOOL

READERS' SALES

Sale. 97 Hobbies, 85 Designs, 11 9d. 2 1/6. Offers—A. Blyth, Huggate, York.

Sale. 130 "Boy's Magazines," 6/-.—D. Currie, 30, Amherst Road, Withington, Manchester.

Sale. "Meccano Magazines," Sept. 1924—Sept. 1928. 200 assorted sporting photographs. Offers.—Box 901.

Sale. 52 copies, "Story of the British Nation." including 12 bound in Red Morocco Leather, £2/5/-. E. Holmes, 9, Chatsworth Road, Rowsley, Derbyshire.

Sale. 54 Fretwork Designs, worth £1. 12/-. Derbyshire, 3, Austins Road, Hayes, Middlesex.

For Sale. 2,500 Stamps (all genuine) and Album. Catalogued £23. £12 or nearest.—Rush, 11, Kings Road, Accrington.

Sale. Stamp Album, Various Books, Magazines. Cheap. Stamp for list.—Allen, 15, High St., Daventry.

Sale. First numbers unsoiled "Mechanical Boy," 19 Nos. 2/6, "Wireless Review," 26 Nos. 3/3, "Wireless Weekly," 14 Nos. 3/6, also "Junior Mechanics," 1922-24, 3/-, Meccano Magazine, 1923, 1/-.—B. Robinson, 17, Crosscliffe Street, Manchester.

Wanted. Meccano Magazines, January and February, 1926. Good condition, 1/6 offered.—Beattie, 33, Regent Street, Greenock, Scotland.

Sale. Model Railway. Cost over £10, good condition, will accept £6. Stamp for particulars.—R. S. Bagley, "Fairfield," Knottingley, Yorks.

Bowman Steam Engine. Cost 32/6, used 3 times.—Winfield, "Springbank," South Brent, Devon.

Wanted. "M.M." Nos. February, May and April 1926, and all of 1925. Send offers to H. A. Rodrigo, Randenhockerweg, Amersfoort, Holland.

For Sale. Collection 550 British Colonials mounted in album. £1 or offer. J. Gare, 24, The Avenue, Coulsdon.

Old "Meccano Magazines" for sale. Half price. Write for list. Rhodes, Chestergate, Macclesfield.

S.T. Steam Plant, 10/-. Kiddyphone, 20 Records and Needles, 10/- or nearest.—Timmis, Windmill, Hankelow, Nantwich.

Sale. Bing Miniature Railway, many accessories. Cost 45/-. Sale for 35/-.—Whittington, 12, High Street, Ventnor.

2,500 Miscellaneous Clean Cigarette Cards for sale, at 6d. hundred.—Radcliffe, Alderbury, Salisbury.

A big Yacht, 5 ft. high, 5 ft. 4 in. long, for sale. £5 or offers.—C. King, Edzell, Berrow Road, Burnham-on-Sea, Somerset.

Model 3 ft. clockwork Turbine Steamer "Queen Alexandra." Runs 3½ mins. £2/10/-. Photo on application.—Balfour, 13, Broadstone Avenue, Port Glasgow.

18 in. Cutter Yacht, 12/6. "Meccano Magazines," Jan. 1925–Nov. 1927. Fair condition. Offers.—C. Bunn, Chalk Pit Road, Wool, Dorset.

Sale. Cigarette Cards. Stamp for list.—Shrimpling, 69, Palace Gardens, Buckhurst Hill, Essex.

Sale. 100 Horse and Foot Soldiers, Guns, Gun Carriage, Fort, etc. List Free.—BM/ZHXT, London, W.C.1.

Sale. 2,000 Cigarette Cards, good condition, plenty of sets, list free.—R. Laven, Main Street, Bailieborough.

Wanted. "Chums," September 1927, good condition.—Clark, 62, Eglinton Hill, Plumstead, S.E.18.

Marklin Clockwork 4-4-0 Locomotive for sale. Gauge 0. Passenger Coaches and other Accessories. Send for particulars. S. Hodson, 55, Daventry Road, Chorlton-cum-Hardy, Manchester.

This Month's Special Articles

Producing the "*M.M.*"—

(*Continued from page* 711)

These are the letters from the critics, both friendly and otherwise, and they are of the greatest possible value because by means of them I have been able to develop the "*Meccano Mag.*" on lines that are popular with all keen, ambitious and healthy-minded boys. When a reader sends in a suggestion for articles of a certain type, that suggestion is carefully noted. Possibly this suggestion is not supported to any extent by letters from other readers, and in that case, although it is not lost sight of, no action is taken. On the other hand many other letters may be received containing the same or a similar suggestion, and as soon as it becomes evident that articles of the type in question would be popular, they are found a place in the Magazine.

Then comes the real test. Whenever any new feature is introduced to the "*M.M.*," shoals of letters come in either expressing approval or denouncing the innovation right and left. From these letters I am able to decide whether the new feature is popular with the majority of readers or not, and to act accordingly. Many of our most interesting regular features have been introduced in this manner and, on the other hand, many other features that were experimented with have been abandoned on account of their unpopularity.

It is, of course, impossible to please everybody. One reader writes to complain that railway subjects monopolise nearly the whole Magazine, while another says there is not enough railway matter. Stamp collectors complain of the small space allotted to their hobby, while model-building enthusiasts demand that the stamp pages shall be swept away and filled with descriptions of new models! But almost all these letters have a bright lining tucked away somewhere. As a rule, however fierce the "grouse," the letter ends by saying that, after all, the writer would not be without his "*M.M.*" for worlds!

MECCANO MAGAZINE

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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 (see important notice below).

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

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Display. Quotations for space bookings, and latest circulation 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 10th 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 two inches 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 8/- for six months and 16/- 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.

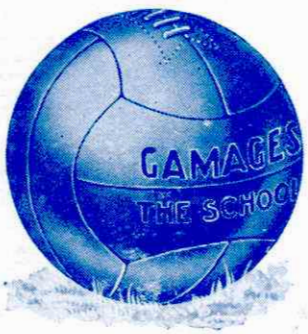
GAMAGES

Supply Everything for Boys !

For over 50 years we have specialized in supplying Boys of all ages with what they need. Games, Sports' Kit, Hobbies, Clothes, nothing comes amiss to us. We have endeavoured in this Page to convey an idea of Gamages Variety, Stocks, Value and Service !

WELCOME KING SOCCER !

The return of the great game thrills every British Boy—and Gamages Famous FOOTER KIT enables you to play at TOP FORM always.



A FAMOUS GAMAGE FOOTBALL and a FINE GOAL-GETTER !

This Ball was specially made to meet the demand for a Strong Ball for Junior Clubs, Schools, etc. It is hand-sewn and satisfactory in every detail. Match size. A wonderful ball at the price.

9/6

Club Secretaries :

Write for GAMAGES FAMOUS FOOTBALL CATALOGUE.

Beautifully illustrated, well compiled, containing a special coloured JERSEY SUPPLEMENT, sent post free.

We give Special Terms to Clubs !

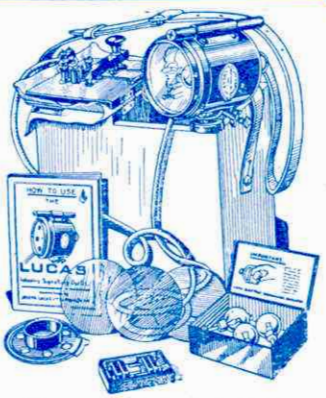
Don't Miss This !

An important offer to Campers, Scouts, etc.

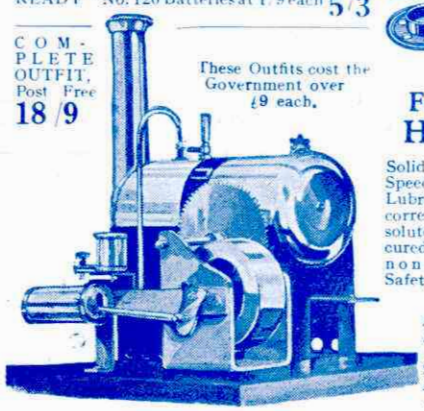
LUCAS DAYLIGHT SIGNALLING LAMPS

As used by Army Signallers. Every one is complete with three spare bulbs, coloured discs, ground peg, Morse key, and sundry other spares, and fitted in a strong waterproof case with Strap, and we are offering them at the Special Price of **13/6** Post free.

Suitable Battery consisting of three "EVER-READY" No. 126 Batteries at 1/9 each **5/3**



COMPLETE OUTFIT, Post Free **18/9**



These Outfits cost the Government over £9 each.

For the Model Man Horizontal Engine

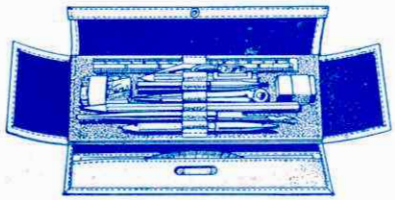
Solid Brass and Steel throughout, Two-Speed Gear, Automatic Drip Feed Lubrication, Overflow Tap for filling to correct level, absolute safety secured by the new non-sticking Safety Valve.

32/6

IT DRIVES

Any Meccano model with ease.
A small 4-volt dynamo.
A large number of small models.
Several Hobbies fretwork models.
A crane lifting 8 lbs. direct weight.
A Sewing Machine.

HERE'S A USEFUL OUTFIT FOR SCHOOL AND CHEAP TOO !



Containing Pens, Pencils, Compasses, Ruler, Drawing Instruments, etc., also Map of Great Britain under celluloid cover at back of instrument board. Price complete **3/6**

FOR THE "SPORTY" BOY !

Strongly Built, Accurate, Powerful Breech Loader. Will last years. Slugs 1/- per 1,000. Darts 6d. per Dozen. The Finest Gun in the World for the money ! Carriage 1/-

The DIANA AIR GUN

10/9

A. W. Gamage Ltd., Holborn, London, E.C. 1

Good News!

No. OO Outfit

The special Manual included with this Outfit shows how 116 splendid models can be constructed.

No. O Outfit

The Manual of Instructions included gives examples of 184 models that may be built with the Outfit.

No. 1 Outfit

This popular Outfit will be a greater favourite than ever as a result of the increased contents. Instructions for building 348 models are included.

1928

MECCANO

Double Value Outfits

Boys! we have some goods news for you! The contents of every Meccano Outfit have been greatly increased and a number of new and very valuable parts have been added, making it possible to build a large number of new models. As a result of these improvements it has been necessary to increase the prices of some of the Outfits, but we should like to emphasise that there is no comparison between the small increases in prices and the tremendously increased value of the Outfits, *e.g.*, the new No. 1 Outfit, which formerly made 136 models, now makes 348.

Particulars of the new prices are given below, and in addition we have given a table showing the number of models that each new Outfit will build as compared with the old corresponding Outfit. The number of models refer to the examples illustrated in the Manuals of Instructions only. Every Meccano boy knows that these do not exhaust the capabilities of the Outfit, however, for the number of models which may be built with each Outfit is almost incalculable.

Ask your dealer to tell you all about the latest developments.

No. 2 Outfit

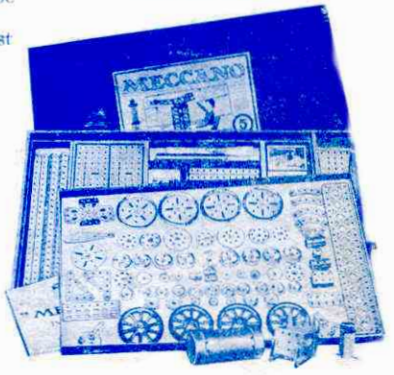
This splendid Outfit builds bigger and better models than ever before. Full instructions for building 396 models are included.

No. 3 Outfit

This excellent Outfit contains many Meccano parts of an advanced engineering type and a Manual showing how to build 447 models.

No. 4 Outfit

Examples of 504 models that may be constructed are illustrated in the Manuals that are included in this Outfit.



No. 5 Outfit

Model-building possibilities are now very greatly increased with this Outfit. Examples of 547 fine engineering models are illustrated in the Manuals.

Prices of Complete Outfits

OUTFIT	NUMBER OF MODELS Old Style	New Style	PRICE
No. 00	42	116	3/6
„ 0	67	184	5/-
„ 1	102	348	10/-
„ 2	158	396	16/-
„ 3	202	447	27/6
„ 4	255	504	50/-
„ 5 Carton	298	547	65/-
„ 5 Wood	298	547	95/-
„ 6 Carton	343	594	115/-
„ 6 Wood	345	594	150/-
„ 7	384	636	380/-

Prices of Accessory Outfits

No. 00A	1/6
„ 0A	5/6
„ 1A	7/-
„ 2A	12/6
„ 3A	23/6
„ 4A	15/-
„ 5A Carton	50/-
„ 5A Wood	80/-
„ 6A	215/-
Special Inventor's Outfit	17/6

MECCANO LIMITED Binns Road LIVERPOOL

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