VOL. XV. No. 11. NOVEMBER 1930.

MECCANO MAGAZINE

CANADIAN NATIONAL ENGINES IN THE MAKING
(see page 842)

6D.

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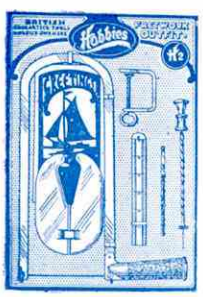

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MECCANO MAGAZINE

Editorial Office:
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Vol. XV. No. 11
November, 1930

With the Editor

"R 101"

I am sure my readers would not wish me to pass over in silence the tragic end of "*R 101.*" I do not propose to enter into any of the details of this terrible disaster, for these are now familiar to everybody. The two outstanding features of the tragedy are its utter unexpectedness, and the fact that at one blow it removed so many prominent men connected with the development of air transport. Such men as Lord Thomson, Air Minister; Sir Sefton Brancker, Director of Civil Aviation; and Major G. H. Scott, Assistant Director of Airship Development, will be hard to replace.

One of the results of the disaster has been the raising in some quarters of a demand that experimental work in connection with airships should be abandoned. This demand is natural, but it is one that will have no effect. When the "*Titanic*" went down the same kind of people said that there must be no more giant liners; yet steamship development has gone on, and bigger and faster liners are now crossing the Atlantic. Progress cannot be stayed by disasters, however great. Airship development must go steadily forward, and the sacrifice of those who perished in "*R 101*" will not have been in vain.

A British Steamship Pioneer

The recent celebration of the centenary of the Liverpool and Manchester Railway has had the effect of taking our minds back to the earliest days of the railway, and of making us realise the importance of the work of the pioneers, insignificant as their efforts must have appeared at the time. The giving of a definite order for the construction of a new Cunarder, to be larger and faster than any previous liner, makes it difficult to realise that the steamship is not much more than a century old. The earliest successes in the propulsion of a boat by steam were obtained by American inventors, notably by Robert Fulton, who had a steamboat travelling up and down the Hudson River in 1807. In this country the main pioneers were two Scotsmen, William Symington and Henry Bell, the latter of whom died on 14th November, 1830. Symington's tiny vessels were designed for inland waterways only, but Bell's vessel, the "*Comet*," boldly made her way down the tidal waters of the Clyde.

In common with the other early steamboats, the "*Comet*" created a great sensation when she appeared on the Clyde in 1812. She was advertised "to sail by the power of wind, air and steam," and she made three trips weekly each way between Glasgow and Helensburgh, where Bell had a boarding house. As might be expected, the owners of the local sailing boats were greatly worried about this innovation. They feared the competition of a vessel that could travel at six miles per hour and was independent of the wind. Some of them regarded the "*Comet*" as an invention of the Evil One, and it is on record that one old Clyde skipper, whenever she passed his boat, ordered his crew, consisting of a man and a boy, to kneel down and thank God that they were sailing by the wind and not with the devil's fire and brimstone!

The "*Comet*" was wrecked at Crinan in 1830. She was not a great success, but as a pioneer vessel she occupies an important place in the history of British steam navigation.

No. 24. WHAT EVER IS IT?

Here is the twenty-fourth puzzle in the popular series of mystery photographs. Can you identify this mysterious object?

To the first reader to send an exact answer or, if nobody is successful in this, to the one who gets nearest, I will send an autographed copy of my new book "The Railway Book for Boys."

Solutions should be written on postcards only and addressed "Editorial Competition No. 24," "Meccano Magazine," Old Swan, Liverpool. Closing date, 29th November.

Our Special Christmas Number

Next month will see the appearance of the special Christmas number of the "*Meccano Magazine*," which will be greatly enlarged and will consist of more than 100 pages. Many special articles will be included, in addition to the regular features; and I believe that this will be the best issue of the "*M.M.*" that has yet appeared. It will be published at the usual price of 6d.

During the past few months the demand for the "*M.M.*" has been enormous. In spite of steady increases in the number of copies of each successive issue printed, the magazine has been completely sold out, month by month, within a few days of publication. The unfortunate result has been that many readers who did not place a regular order were unable to obtain copies. There will be an even greater demand for the Christmas number, and I strongly urge those who wish to make sure of obtaining this splendid issue to place a definite order with their Meccano dealer or newsagent. We print only as many magazines as are ordered by our dealers at the time of going to press, so to avoid disappointment readers should order their December copy *now*.

October Mystery Photograph

The October Mystery Photograph has broken all previous records. At the time of going to press only two readers had succeeded in arriving at the correct answer—a view of the top of a gasometer. Actually the gasometer was under construction at the time that the photograph was taken, but neither of these readers realised this fact. The first postcard received was from A. H. James, Gilling East, York, to whom an autographed copy of my book "*Engineering for Boys*" has been sent.

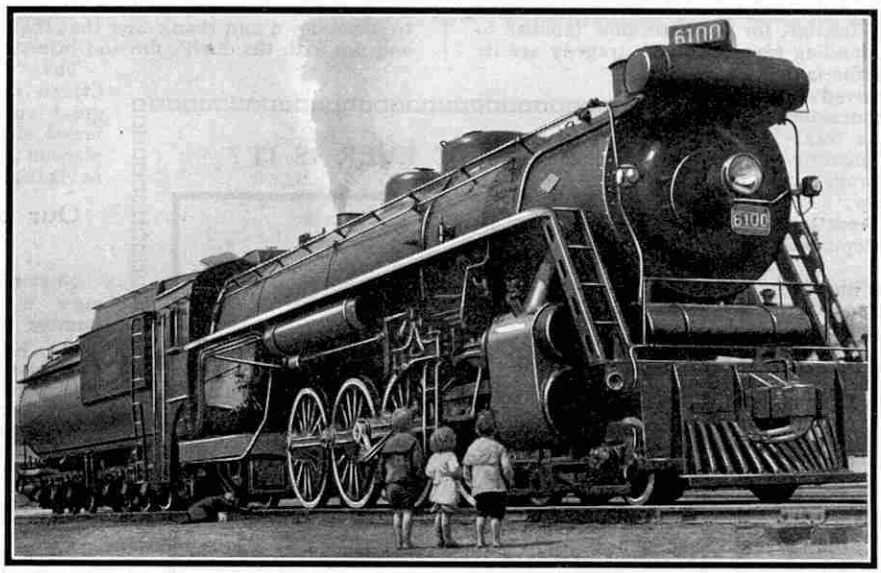
The great majority of competitors were firmly convinced that the photograph represented the nose end of an airship Other solutions suggested included a bird's eye view of a roundabout, a rifle range target, a photograph of a Hudson Tunnel fan and the interior of an open parasol. The regularity of the design deceived one reader into the belief that it portrayed a view through a kaleidoscope.

Locomotive Progress in Canada

Canadian National Railways' Shops at Montreal

OUR cover design this month shows the ease with which monster locomotives are dealt with in the shops of the Canadian National Railways at Montreal. The locomotive shown in the picture, one of the "Northern" type that bear the numbers of the "6100" series, weighs, when complete and equipped for service, 319 tons. Even when the tender is removed the locomotive proper represents a tremendous weight, and in order to move it from point to point in the repair shops powerful travelling cranes are installed to pick it up and transfer it as required.

The new shops of the Canadian National Railways at Montreal were referred to briefly in the "*M.M.*" for March last, but these shops are of such outstanding interest that we propose to give here a more detailed description. They are situated on a projecting area of land known as Point St. Charles, where over 70 years ago was erected the first locomotive shop of any importance in Canada. These early shops were built by English workmen, and that they were well built is proved by the fact that the original buildings were still in use up to a few months ago. The first structures had been added to, but as they were intended for the comparatively small wood-burning locomotives in use in those days, no amount of structural addition would make them serviceable for the tremendous locomotives of the present day. This will be realised when it is stated that the locomotives of the "6100" series measure overall 93 ft. $10\frac{3}{4}$ in. and are 15 ft. 3 in. in height. The tenders of these locomotives carry 20 tons of coal, and those equipped with cylindrical tanks carry nearly 14,000 gallons of water.



A striking view of No. "6100," giving a good idea of its enormous size. For this and the other illustrations to this article we are indebted to the Canadian National Railways.

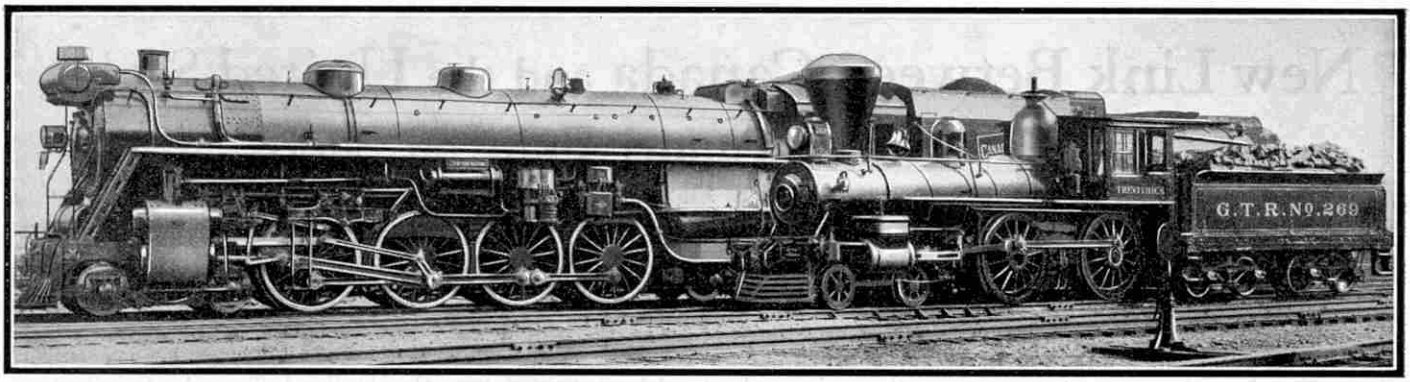
The main building at Point St. Charles in which locomotives are given service occupies a space 265 ft. 4 in. in width by 1,056 ft. in length, and provides a gross floor area of 277,100 sq. ft. or 6.36 acres. The building is divided longitudinally into four bays with an 85-ft. transverse bay across the west end for the forge shop. The first bay contains the following sub-departments—spring shop, brake and spring gear, tube shop, air brake, feed-water equipment, jacket and tin shop, pipe shop, woodworking shop, light plate shop and riveting tower. The second bay contains a 31-pit erecting shop and main boiler shop; while the third bay, known as the heavy machinery bay, contains the tender, tank and frame shop. The fourth bay is used for tender and engine truck repairs.

The entire superstructure stands on concrete piles, the outside concrete walls being carried up 5 ft. above floor level to the first windows. From that point the walls are of red brick with reinforced concrete bands above each row of steel window sashes.

The new shops are noteworthy for the scientific manner in which the lighting has been arranged. Adequate natural lighting is ensured by means of the large area of glass that has been utilised, amounting to more than 119,000 sq. ft. Windows actually represent 39.5 per cent. of the entire side walls. To assist in the diffusion of the light the interior of the building is coated with aluminium paint to within 5 ft. of the floor, the remaining distance being finished in black. The artificial lighting is all overhead, with Holophane reflectors suspended on flexible brackets.

Both alternating and direct current is fed throughout the shops in lead-covered cables and underground ducts, and current is tapped off at suitable points from the manholes through galvanised conduit embedded in the concrete. Electric welding circuits are also provided through sub-floor conduits to plug stations placed at convenient points, the current being supplied by a generating set situated in the centre of distribution. Provision has been made also at the rear of the locomotive pits for portable electric welders and electric rivet heaters.

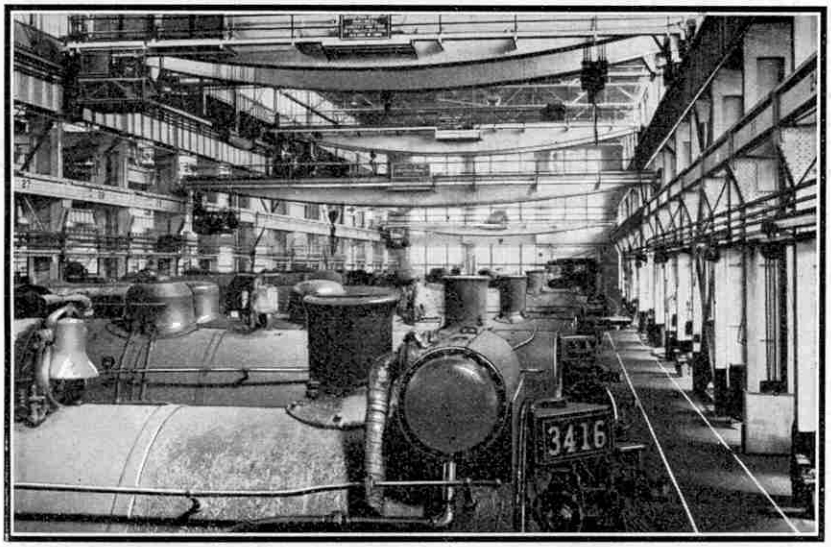
The shops are well equipped with suitable cranes ranging from the mammoth traveller capable of picking up over 200 tons to a number of small one-ton cranes used in the light machinery bay. Altogether 14 electric travelling cranes are in operation, all of which incorporate the most modern features and, with the exception of the wall bracket cranes, have central lubricating systems. The design of the 200-ton locomotive-lifting crane is unique in that it has a third or 10-ton auxiliary hoisting trolley operating on the main bridge between the two main trolleys. This is the first of its kind to be used on any locomotive crane, and it has proved to be a



A contrast in motive power. "*Trevithick*," one of the early wood-burning locomotives of the old Grand Trunk Railway, shown alongside "*Confederation*," one of the latest giants of the Canadian National Railways.

decided improvement upon the old system in which auxiliary hoists were used. By this means main and side rods on either side of the locomotive may be removed or replaced while the locomotive is suspended on the main hooks. This is a great advantage in a modern shop and results in convenience and economy in operation.

One feature that strikes every visitor to these shops, whether he is technical or non-technical, is the piping. All piping in the shops, with the exception of the drinking-water lines, has been welded in, and the complete piping installations present an appearance which, in regard to neatness and accessibility, would be difficult to improve upon. None of the piping is buried below the floor, but all is carried throughout the bays on the columns, so that in case of emergency the point of trouble may be ascertained immediately. Different colours have been adopted for each type of pipe and by this means the different pipe lines are recognised quickly and with certainty.



The erection shop bay of the new Canadian National Railways motive power shops at Montreal. The overhead travelling cranes are a prominent feature.

While the shops themselves possess great interest, the chief feature in regard to them will always be the locomotives with which they deal. Locomotives used in Canada differ considerably from those used in the British Isles; and this is not the result of any desire to have things different, but of wide variations in operating conditions. The passenger coaches used in Canada are larger and heavier than those used here, and the goods wagons also are heavier and of much greater capacity. The manner in which Canadian locomotives have increased in size will be realised best by comparing them with the locomotives first used on what is now the Montreal-Toronto section of the Canadian National Railways.

The locomotive used in 1857 was of the wood-burning type. It was built at Birkenhead, England, and was always referred to as the "Birkenhead engine." If placed beside one of the modern giants the engine of Canada's pioneer railroad would be completely dwarfed, for the boiler alone of the new modern "6100" type is almost equal in size to the complete locomotive of 1857. The modern locomotive with its tender measures 93 ft. $10\frac{3}{4}$ in. from end to end, while the total overall length of the Birkenhead engine was 50 ft. 7 in. In comparing the weights also one can obtain an excellent idea of the great difference in size. The Birkenhead locomotive with tender loaded weighed 95,160 lb.; the "6100" of to-day with tender loaded weighs 648,000 lb., equal to the weight of six of the early type. The Birkenhead had a boiler pressure of 125 lb., whereas the working pressure of the modern locomotive is 250 lb. and upward.

The differences between the old and the new may be measured also in different terms. For instance, the Birkenhead locomotive was capable of hauling four passenger cars weighing approximately 90 tons at a speed of 45 m.p.h. The present-day locomotive can haul 16 all-steel passenger cars totalling approximately 900 tons in weight, and with this tremendous load will rise to speeds of between 70 and 80 m.p.h. It is in freight service, however, that the great value of these new locomotives becomes most evident. The old locomotives could haul a freight load of from 10 to 15 cars, while the new ones are capable of handling 150 loaded freight cars. It is, of course, not always practicable to make up trains of such great length, but trains of 100 cars laden with wheat are not uncommon in railway operations in Western Canada. It must be remembered also that such freight cars range in capacity from 40 tons to 60 tons each.

The new locomotives are fitted with many interesting mechanical devices, prominent among which is the mechanical stoker. By the use of such a stoker the fireman is saved the back-breaking labour of shovelling coal from tender to fire-box, the pressure of his foot on a lever being sufficient to transfer

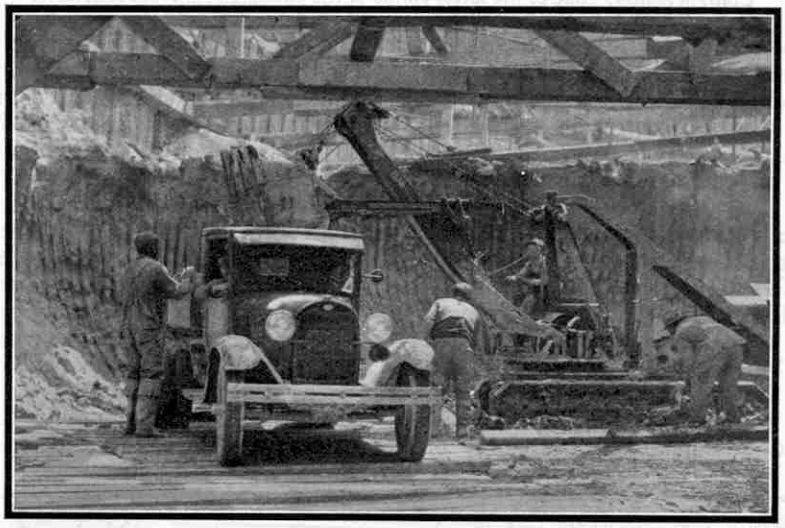
Continued on page 854

New Link Between Canada and the United States

An Underwater Tunnel Built on Shore

By E. Flaxman

A REMARKABLE vehicular tunnel now under construction to join Windsor, Ontario, with Detroit, Michigan, makes a departure in many ways from established practice in subaqueous tunnelling. The fact that the under-river portion was sunk in a trench is, of course, not a novelty because, as mentioned in the "*M.M.*" for December 1929, the tunnel connecting Oakland and Alameda, in California, was placed in this manner. But the Oakland tube was built up of reinforced concrete in a dry dock, while the Detroit-Canada tunnel was built on the shore with structural steel, and was lined and surrounded with concrete after it had been floated.

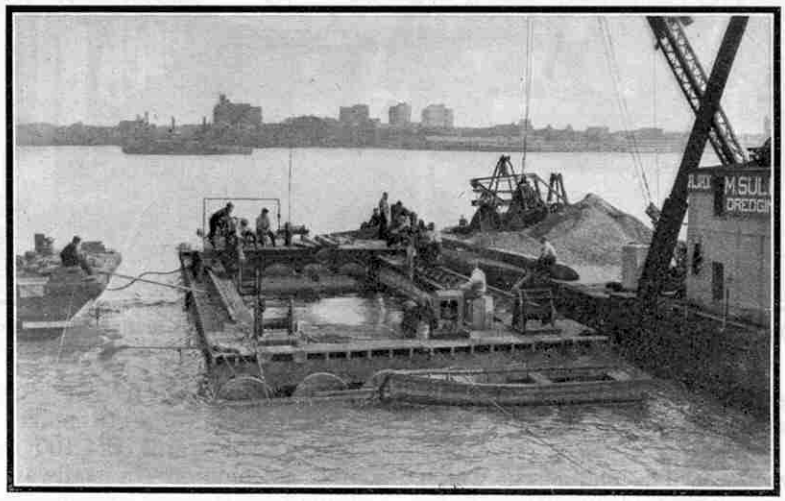


Photograph showing the stiff nature of the clay encountered in driving the Detroit-Canada Tunnel. Note the timber-strutting overhead.

The line of the tunnel runs from a portal about 400 yds. from the river edge on the United States side to one 600 yds. back on the Canadian side. The underwater portion is 2,204 ft. in length, and the total length of the tunnel from street levels is 5,745 ft., or a little over a mile. For construction purposes the work was divided in seven sections. These consist of two portions of open cutting, 350 ft. in length on the Detroit side and 360 ft. on the Windsor side; two "cut-and-cover" sections, respectively 627 ft. and 602 ft. in length; two lengths of shield-driven tunnel, 466 ft. and 1,136 ft. respectively; and the subaqueous portion, 2,204 ft. in length. The cut-and-cover sections are box-shaped, and on the United States side there are separate compartments for inward and outward vehicles. These sections were carried forward about 350 ft. until the tunnel reached a depth of some 60 ft. below ground-level. After this it was considered more economical to use the shield, and for this purpose there was constructed the largest tunnelling shield that has ever been brought into employment.

The shield-driven section is 31 ft. 8 in. in diameter, and the shield used was 32 ft. 3½ in. in diameter and 15 ft. 3½ in. in length. The previous largest shield-driven tunnel was the Holland Tunnel, described in the "*M.M.*" for February and March last, which has a maximum diameter of 30 ft. 4 in. Thirty 250-ton jacks were used for driving the shield forward, and these exerted a working pressure of 4,000 lb. per sq. in. on the rams. Owing to the great size of the shield, four working platforms were provided on it, and on account of the stiff nature of the clay all material in front had to be excavated by cutting knives.

When the shield had been driven forward about 100 ft., a steel bulkhead, fitted with airlocks for men and materials, was erected across the tunnel. Compressed air at about 18 lb. was then used to ensure that no water would enter the workings as the shield proceeded.



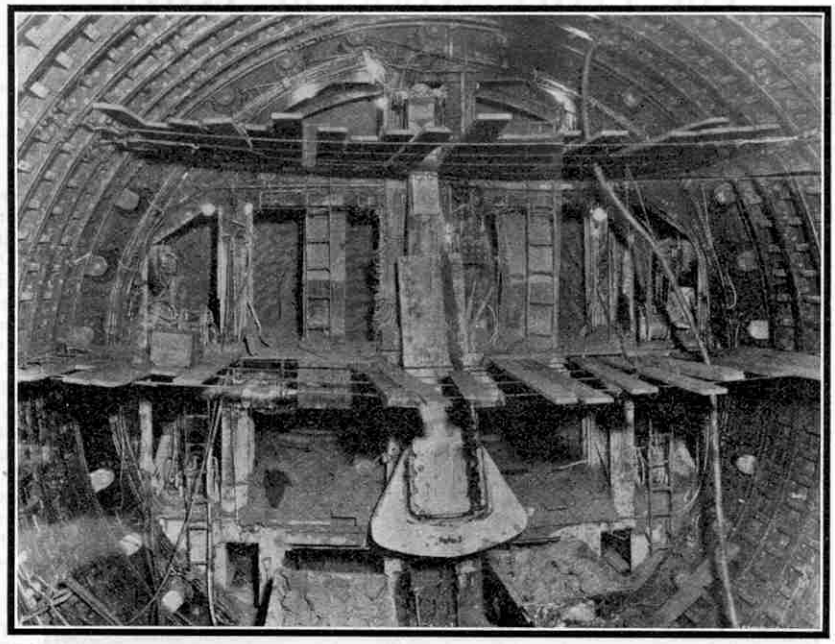
The grill for smoothing the sand bed. The sand and the lowering buckets are shown on the right.

During the progress of the work sand pockets were encountered, and some difficulty arose owing to the settlement of building foundations above. When the shield reached the river it might have been necessary to sink a special river shaft, but this was avoided in a very ingenious manner. The first underwater section was made with a bell-shaped mouth, sunk into position and covered over with filling. The shield was then driven into the bell mouth, and the outside "skin plate" of the shield was left in position. The steel lining was placed in segments in the same manner as in the well-known London "tubes."

Segments each weighing nearly half-a-ton, and a key piece were required for each ring of lining 2 ft.

6 in. in width, and these needed 475 bolts for fastening them. After work with the shield had been completed on the United States side, the shield was dismantled and taken across for use on the Canadian side.

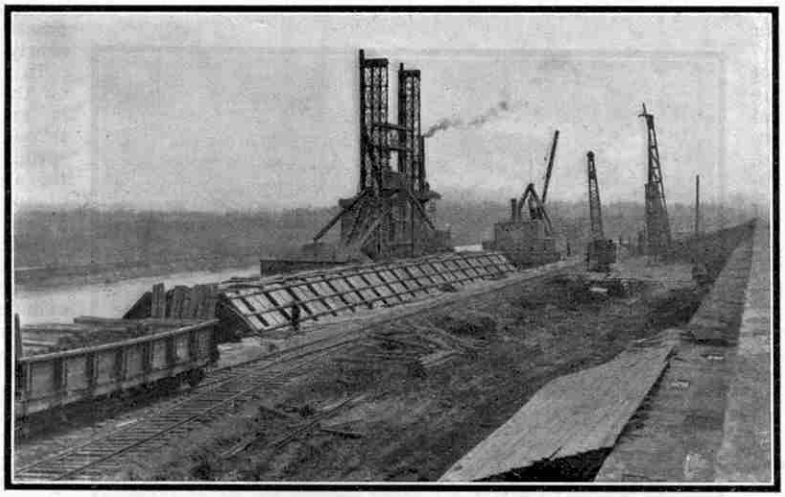
The most interesting portion of the tunnel is the part under the river. This was divided into nine sections, each of which was built and sunk separately. The first section was 220 ft. in length and the others were each 248 ft. In cross-section the subaqueous portion of the tunnel is an octagon enclosing a double circle. The double circle is the tunnel itself with its lining, the space between being filled with concrete. The octagon was placed outside to provide for the ballasting concrete necessary to sink the completed cylinders into position.



The largest tunnelling shield ever brought into use. The jacks for moving the shield are seen around the rim.

The works at which the cylinders were built are a few miles down the river, where special slipways were erected. Here the sections were made up of steel plates to a finished diameter of 28 ft. inside and 31 ft. outside. A special track carried a steam crane and this, together with a traveller crane, placed the steel in position. All joints were riveted and afterwards welded, to ensure that the tunnel should be absolutely watertight.

At intervals of 12 ft. octagonal plates were fastened to the outside of the shell by riveted angles, and the three lower sides were enclosed by wooden formwork. When this was complete, the ends of the cylinder were sealed by timber bulkheads and the cylinder was then slid down the launching way into the water. Each cylinder when launched had a draught of about 7 ft., and it was towed to a concreting site near by. Light rails were laid along the top of the cylinder, and on these ran a concreting skip that placed the concrete for the interior lining through holes left when the section was made up. A special concrete mixer, operating with a chute, discharged concrete into the space between the wooden forms around the three lower sides and the shell, to form a keel. The remaining five sides were then encased with wooden forms.



Placing the concrete for encasement. The wooden formwork should be noted.

When this work had been completed the cylinder had a draught of 23 ft., and had to be towed to a spot near the tunnel site, where a greater depth of water was available, before the final concreting could be carried out. At this point the cylinder was moored to piles so that it lay up-and-down stream, in order that it should present the least resistance to the current. Here a double-tower floating concrete plant was used owing to the necessity for pouring evenly on both sides in order to maintain the balance. High steel masts were secured at each end of the cylinder to serve as a guide to alignment and level during final sinking.

As the exterior concrete was poured, the section sank gradually and special pontoons were moored above it, one at each end. The pontoons, with the section slung underneath, were then towed by tugs to the site of the trench. Here large grab dredgers had moved 250,000 cu. yds. of clay to form a trench 20 ft. in width at the bottom. Divers went down at intervals to see that the trench was being made in its true line.

It was not considered desirable to place the cylinders directly on to the clay, and therefore a bed of sand about 3 ft. in depth was provided. As may be imagined, it was not an easy matter to ensure that this sand bed, situated over 70 ft. below the water, was level, without employing a host of divers or some means such as a pneumatic caisson. This problem was solved by the invention of an ingenious levelling device, which consisted of pontoons formed in the shape of a hollow oblong. On the two longer sides a rail was fixed, and this carried a grill stretching from side to side, which could be moved to and fro and lowered into the water by means of winches. Heavy concrete blocks were suspended from the four corners of the apparatus, and the ropes on these were pulled tight until the pontoons lay at the required angle. The sand was then lowered by buckets into the trench, and as the grill moved backward and forward the bed was smoothed off to the desired level. (*Continued on page 854*)

HOW THINGS ARE MADE

Two-Stroke Oil Engines

The Petter Works at Yeovil

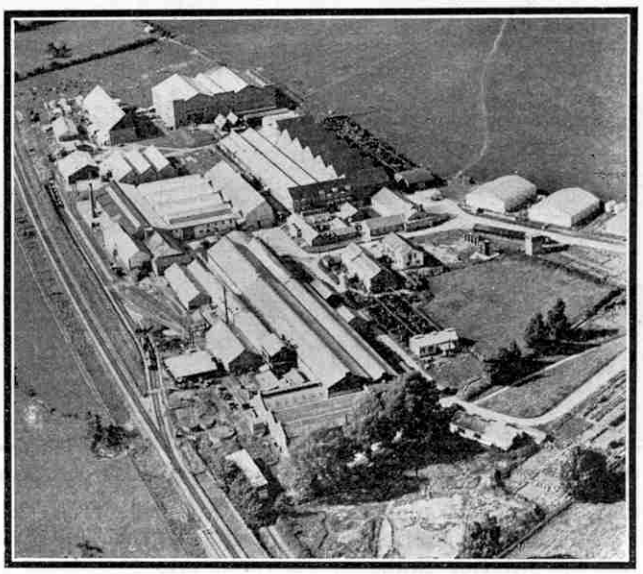
WHEN anyone speaks of a large engineering works we are apt to picture a huge assembly of machinery in a grimy building in the grimiest part of some big industrial centre; and this picture is, in many cases, correct. The works of Petters Limited, however, present a striking contrast to the majority of engineering establishments so far as surroundings are concerned, for they are situated in a beautiful agricultural district in Somerset on the outskirts of Yeovil.

During the past few years oil engines have developed along two distinct principles of design, employing respectively the two-stroke and four-stroke cycles of operation. In a four-stroke engine a power impulse is given to the piston once in every four strokes, that is to say, in every two revolutions of the crankshaft. In a two-stroke engine the power impulse is given at every second stroke of the piston, that is at every single revolution of the crankshaft. Petters Limited manufacture engines of the two-stroke type, for which is claimed a regularity of motion that cannot be obtained with a four-stroke engine. Two-stroke engines are consequently very suitable for driving electric generators and other similar machines that require great regularity of motion. Another point of importance in their favour is the absence of mechanically-operated mushroom or poppet inlet and exhaust valves working under the high temperatures and pressures of the combustion chamber, as in four-stroke engines. The periodical valve grinding necessary with four-stroke engines is eliminated in the two-stroke type, and the small number of working parts tends towards long life and freedom from breakdown. The smaller number of apertures required in the cylinder head of a two-stroke engine makes the casting a comparatively simple one, and obviates the tendency for the cylinder head to crack that exists in four-stroke engines

Capstan lathes in the machine shop at Westland works, Yeovil. For this and the other illustrations to this article we are indebted to Petters Limited.

Petter engines provide suitable motive power for driving all kinds of machinery, and they range in size from 1½ to 400 b.h.p. These engines may be divided into three types—small magneto-ignition engines running on petrol or paraffin; somewhat larger crude oil surface ignition engines; and heavy oil Diesel type engines capable of starting from cold by means of compressed air, and developing considerable power at the lowest fuel cost. Before passing on to deal with the making of these engines a few words on their working cycles will be of interest.

We will deal first with the more familiar magneto-ignition petrol-paraffin engine. As paraffin does not vaporise at a low temperature, the necessary heat for starting is obtained by using a small quantity of petrol placed in the fuel chamber. After the engine has run for two or three minutes it automatically changes over to paraffin, which is contained in the base tank, and pumped by a patent fuel pump to the fuel inlet. During the upstroke of the piston air is drawn into the crankcase through the air inlet plate, and during the downstroke of the piston it is slightly compressed in the crankcase. This air, with a small quantity of atomised fuel, forms an inflammable mixture, which is passed into the engine cylinder when the piston uncovers the air inlet port. On the upstroke of the piston this air-gas mixture is compressed, and finally it is ignited by an electric spark generated by the magneto. The piston then descends on the power stroke until the exhaust port is uncovered, when the burnt gases are discharged into the exhaust silencer and the cycle of operations is complete. The engine thus receives an impulse at every revolution. The method of taking in the "live" charge and passing the exhaust out through ports in the cylinder is very similar to that which has been common practice in the steam engine for nearly 100 years.



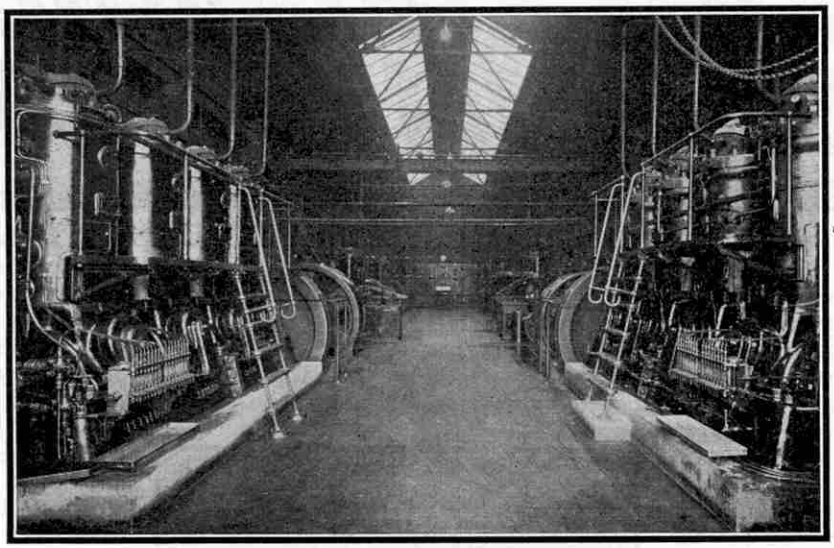
Aerial view of the Westland works giving a good idea of the amount of ground they cover.

In the surface ignition engine, on the upstroke of the piston air is sucked into the crankcase through air plates made of thin spring steel and on the downstroke this air is compressed to a pressure of approximately 4 lb. per sq. in. When the downstroke is nearly completed the piston uncovers the inlet ports, and the lightly compressed air rushes into the cylinder through the passage-way that is cored in the casting. The air is deflected toward the top of the cylinder by the specially-shaped top of the piston, and on reaching the cylinder head is then diverted downward, thus effecting a very complete scavenge of the cylinder. On the upstroke of the piston the ports are closed, and the air is compressed to a pressure of 180 lb. per sq. in.

The injection of fuel oil takes place near the top of the stroke, and intimate mixture of fuel and compressed air occurs. The explosive charge is ignited by the hot surface of the vaporiser, and the piston then descends on the power stroke. The exhaust ports are uncovered near the end of the downstroke, and the expanding hot gases find relief by escaping to the silencer, their pressure falling sufficiently to permit the admission of fresh air. It will thus be

seen that, while a complete cycle of operations occurs on the upper side of the piston, the lower side also is doing its share by compressing air on the down-stroke and sucking in a fresh charge on the upstroke.

A notable feature of the surface ignition engines is their ability to start from cold on the same fuel as used for running, by means of the Petter Patent Cold Starter, a simple invention that places the oil engine on a par with the petrol engine for ease of starting. Engines of this type are sometimes started by directing the flame of a blow-lamp on to the uncooled portion of the cylinder head until sufficient heat is generated for preliminary charges. With the cold starter, however, the engine is started instantly from cold without any of the delays inseparable from the blow-lamp method. The starter consists of a combustible cartridge placed in a special holder, and screwed into the vaporiser portion of the cylinder head. The cartridge contains a preparation which, when ignited, burns slowly entirely away, and in so doing generates sufficient heat to ignite the preliminary charges until the uncooled portion of the cylinder head becomes hot enough to carry on combustion in the usual manner.



The power house where ten Petter engines generate current for light and power for the whole of the Westland works.

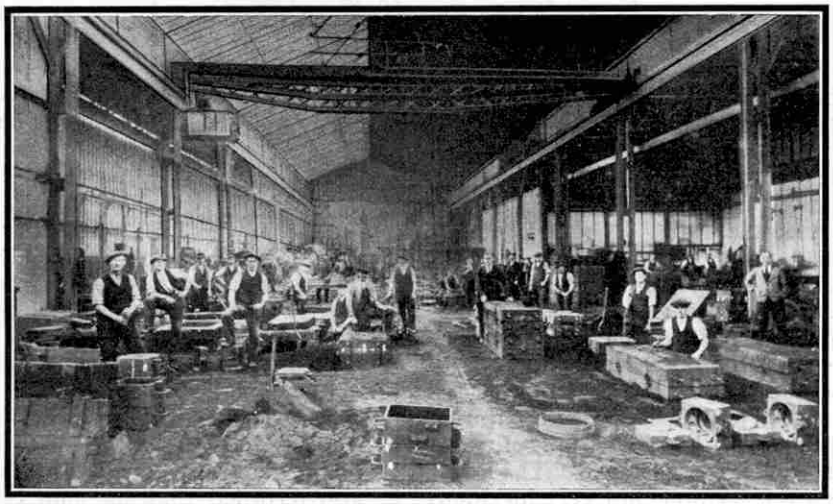
The third type of engine to which we have referred is the Atomic Diesel engine, which possesses the Diesel qualities of low fuel consumption with crude oil, without the usual accompanying Diesel appliances and mechanism. The engines, which are manufactured in sizes with from one to six cylinders, up to 400 b.h.p., are, like other Petter products, of the vertical type. The engine works on the perfected two-stroke cycle, and requires only a small amount of attention of a semi-skilled nature. At the finish of the upstroke of the piston, pressure is raised to about 400 lb. per sq. in. At this point the piston crown almost touches the lower base of the cylinder head, which is provided with a central cavity of special shape into which all the air is made to pass in such a manner that there takes place a strong swirling action, known as turbulence. The injection of atomised liquid fuel into this turbulent mass takes place a few degrees of crank angle before the top dead centre. Intimate mixture occurs, followed immediately by rapid ignition and rise of both temperature and pressure.

The outstanding difference between the surface ignition engine and the atomic Diesel engine consists in the fact that in the former the compression pressure of 180 lb. per sq. in. assists, but does not cause, the ignition of the injected charge. This is dependent upon its contact with the hot surface of the vaporiser, and when combustion is completed the maximum pressure generated does not exceed 350 lb. per sq. in. In the atomic Diesel engine the compression is raised to 400 lb. per sq. in., with a resulting state of incandescence sufficient to ignite the charge as it is injected; and when combustion is completed the maximum pressure rises to about 640 lb. per sq. in. This, therefore, is not a hot surface-ignition, but a hot volume ignition engine.

The Petter engine works cover many acres, being one of the largest devoted to the manufacture of oil engines in the British Empire. The long, lofty and well-ventilated shops are fitted with the most modern facilities and machinery. In one shop, which covers nearly 50,000 sq. ft. of ground space, there has been installed the largest turret lathe in this country. The power-house provides electric light and power for the whole works, and there 10 Petter engines demonstrate effectively the value of the smooth-running two-stroke in the generation of electricity. One of them, a three-cylinder 150 b.h.p. engine installed when the present works were built in 1913, is still running as well as ever, in spite of the fact that it has often worked day and night for long periods.

To follow the process of manufacture of the engines through the works is an interesting experience. First of all we visit the foundry, which is one of the largest in the South of England, and consists of large bays with three cupolas from which the molten metal is tapped into huge ladles and then poured into the moulds. Overhead cranes are employed for lifting the heavy ladles and the finished castings. From patterns of wood or metal, the moulds are made in halves of specially-prepared sand. Parts that have to be hollowed—cylinders, for example—have to be cast with cores in the moulds, and these cores are made in soft sand and baked hard in huge ovens in an adjacent shop. After casting, the rough sand is chipped off in the fettling shop, and the castings are then conveyed to the machine shops.

Here, as far as is practicable, arrangements are made for "line" production. For instance, when the rough cylinder or crank-case casting for one size of engine arrives from the foundry, it proceeds through the various stages until it is completely machined down to the last bolt hole. The same process is followed with the various other parts of the engine, the machines in line being fitted with special tools so that the particular operation for which each is responsible is performed with speed and accuracy. Modern automatics, multiple drilling machines, grinding machines, crank-pin lathes, gear cutting machines, and turret lathes, are used wherever possible. It is interesting to note that in connection with the two larger engine sizes the cylinders are reamed out half-a-thousandth of an inch under size, after which, in the same machine, a special honing device is passed through the cylinder head, increasing the bore by the necessary half-a-thousandth of an inch, and at the same time giving the surface a burnish of excellent wearing quality.



A view in the foundry, which is one of the largest in the south of England.

As the parts approach their final stage they arrive at the assembling end of the shops. The line system is in operation here also, and each series of benches deals with one particular size of engine. Trolleys on wheels at a convenient height are arranged alongside the benches, and on each bench is a framed notice that states clearly the parts and tools required and the work to be done at that stage. When the engine is so fitted it is pushed up to the next bench or stand where it goes a step further, and so on until it is completely assembled. At the end of the line the completed engine, still on the trolley, is pushed along to the testing bed, the trolley being at the same height as this bed for

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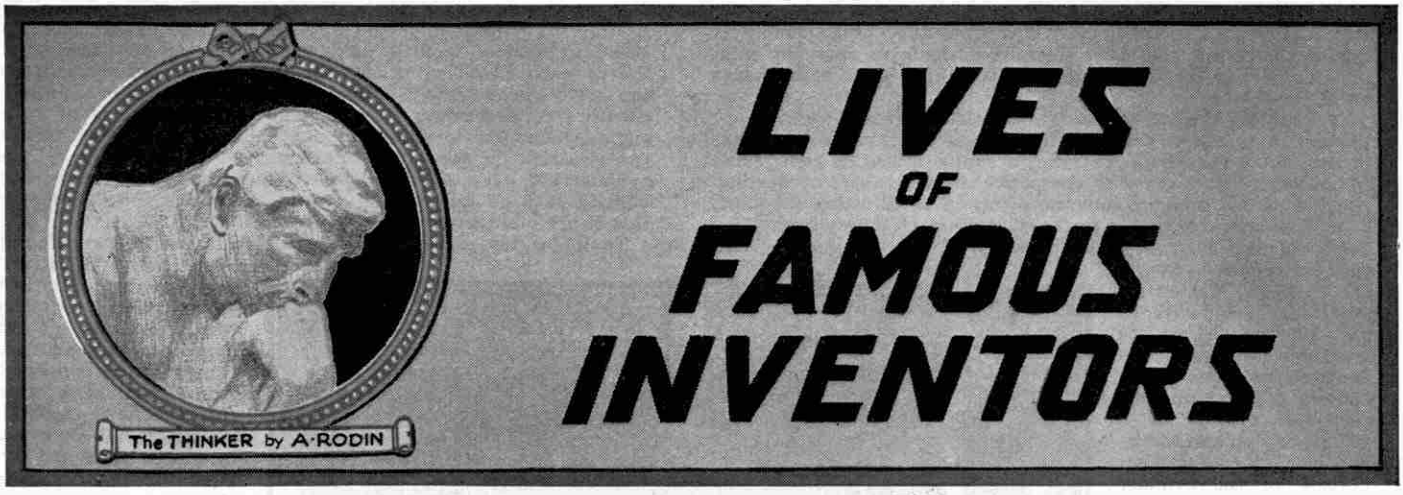


XIV.—JOHN KAY AND THE FLY SHUTTLE.

By W. F. Harrison

FROM the earliest days woven fabrics have been produced by means of the loom, which may be described roughly as a machine for interweaving longitudinal threads called the "warp" by transverse threads called the "weft." This interweaving, which is called the "picking motion," is effected by passing a weft thread from a shuttle between some of the threads of the warp. The shuttle moves from one side of the loom to the other, and each time it passes between the threads of the warp it leaves behind a thread of weft.

Three distinct operations are necessary to enable the shuttle to accomplish this movement. The first is the opening of the warp and the raising of some of the threads ready for the second operation of picking. The third operation, which is called "beating up" the weft, consists of pressing the weft into position by what is known as a "rib." These three primary operations must be carried out on every loom, no matter whether it be the hand loom of a cottager or the largest and most complicated power loom in a modern factory.

John Kay, the inventor of the fly shuttle.

Up to the early part of the 18th century the shuttle had to be thrown backward and forward by hand, and on broad looms, that is looms for fabrics over 36 inches in width, this was accomplished by two persons who stood one on each side of the loom. As the shuttle was heavy the task of throwing it was laborious, and in consequence the process was slow. In 1733, John Kay of Bury, brought out a great improvement by his invention of what came to be known as the "fly" shuttle. The great feature of this invention was a simple but very ingenious "picking" arrangement for driving the shuttle backward and forward and thereby relieving the weavers of the task of throwing it from hand to hand. Not only did this invention greatly decrease the labour involved, but at the same time it increased considerably the output of material from the looms.

Owing to various circumstances a good deal of misunderstanding appears to have arisen in regard to the life of Kay. At one time it was asserted that he was the grandson of Sir John Kay, Bt., of Woodsome in Yorkshire, and that his father, Robert Kay, was a merchant. It was also insisted that Kay had some close connection with Colchester. Many writers state that Kay's father owned a woollen mill in that town, and that after the boy had completed his education abroad he took charge of this mill. There is no doubt about the importance of Colchester as a manufacturing centre in the early years of the 18th century, and therefore it is highly probable that John Kay frequently visited the town on business in connection with his reeds and shuttles. But no evidence of the residence there of either John or his father is afforded by the city registers, which have been searched diligently.

All authorities are now agreed that John Kay was born on 16th July, 1704, at the Park, Walmersley, near Bury. The district is appropriately named Shuttleworth. It is situated at the foot of a hill, now dominated by Grant's Tower, an erection commemorating the first visit to the Irwell Valley of William Grant, the father of the two manufacturers immortalised by Dickens as the Cheeryble Brothers.

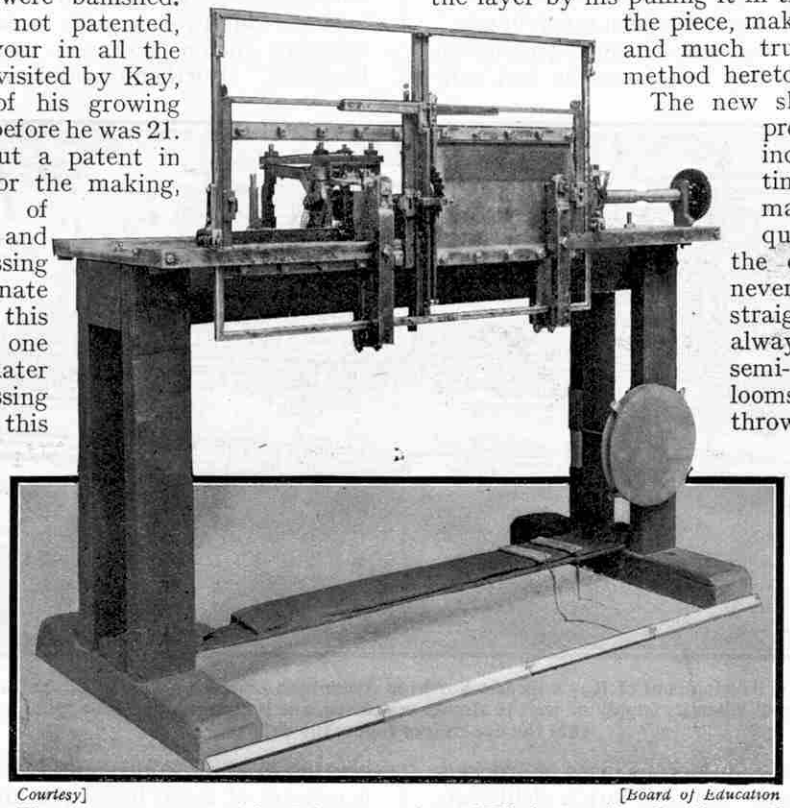
Robert Kay, the inventor's father, was a small farmer in moderate circumstances. He died some months before John was born, and it has been pointed out that the inventory of his goods at the time of his death contains no mention of Colchester nor of anything connected with manufacture of any kind. His bequest consisted of his modest property at the Park and was made to his eldest son Robert, who had to pay out of it £30 each to the younger members of the family when they attained the age of 21. It is also recorded that the sum of ten shillings per annum was earmarked by another relative for John's education, a fact that practically disposes of the story of an education abroad, which in any case is unlikely.

As soon as John Kay was old enough to work he became apprenticed to a reedmaker. He appears to have made rapid progress, and certainly he was not lacking in self-confidence, for on returning home at the end of the first month of his apprenticeship he announced that he already knew the business as well as his master!

For many centuries reeds had been made of cane, as the name implies, and during Kay's apprenticeship they were still so made. Kay's first improvement to the loom was to make the reed dents of polished metal, thus adapting them to the weaving of fine fabrics. In this manner for the first time perfect alignment was given to the warp threads when passed through the interstices of the reeds in regular lines, and the unsightly places caused by the irregularities always present in cane reeds were banished. This improvement was not patented, but it found ready favour in all the manufacturing districts visited by Kay, and on the strength of his growing business he married just before he was 21.

In 1730 Kay took out a patent in respect of a machine for the making, twisting and carding of mohairs and worsted and for the twisting and dressing of thread. It is unfortunate that the details of this machine, and also of one invented three years later for the opening and dressing of wool, are missing. In this connection it may be noted that in Kay's time patents were often issued without the proviso that the patentee should file a full description of his invention.

The year 1733—not 1738, as stated in most accounts—saw the production of the "wheel" shuttle or "fly" shuttle as it afterwards came to be called. This invention marked an epoch in textile history, gave John Kay an undisputed place among the benefactors of the human race, and drew down upon him the ungovernable wrath of an ignorant mob.



Courtesy [*Board of Education*

The machine invented by John Kay about 1750 for cutting, bending and inserting the wire in the cards used in the preparation of cotton.

The following description of this invention is taken from a short life of John Kay by Woodcroft, who was perhaps the greatest patent authority of his day. "He (Kay) invented the race board fixed to the layer under the warp with a shuttle box at each end, a spindle and a picker (a dummy hand) in each box, and a cord passing from each picker to a short lever held in the weaver's right hand. He also improved the shuttle and adapted it to the improved layer. Although these inventions did not dispense with the use of the weaver's hands and feet they enabled one hand to be used exclusively for throwing the shuttle (i.e., by giving a sharp jerk to the lever), while the other was used solely to drive the weft home. From the speed at which the shuttle could now be thrown this world-famed invention obtained the name of the 'fly shuttle.'"

There is no mention in Woodcroft's account of the brass wheels on which the shuttle ran, but this will be found in the following description of Kay's shuttle as applied to broad goods. It was invented "for the better and more exact weaving of broad-cloths, broad bays (baize), sail-cloths, or any other broad goods, woollen or linnen, which shuttle is much lighter than the former, and by running on four wheels moves over the lower side of the webb or spring, on a board about nine feet long, put under the same and fastened to the layer; and which new contrived shuttle, by the two wooden tenders, invented for that purpose and hung to the layer, and a small cord commanded by the hand of the weaver, the weaver sitting in the middle of the loom, with great ease and expedition by a small pull at the cord casts or moves the said new invented shuttle from side to side at pleasure, and also strikes the layer by his pulling it in the middle uniformly over the piece, makeing it unavoidably even and much truer and better than any method heretofore used."

The new shuttle not only enabled production to be greatly increased, but at the same time brought about a marked improvement in the quality of the fabric. By the old method the shuttle never could be propelled in a straight line. Its path was always nearer to that of a semi-circle, and on broad looms where the shuttle was thrown a longer distance there was a constant danger of the warp being broken by a faulty cast.

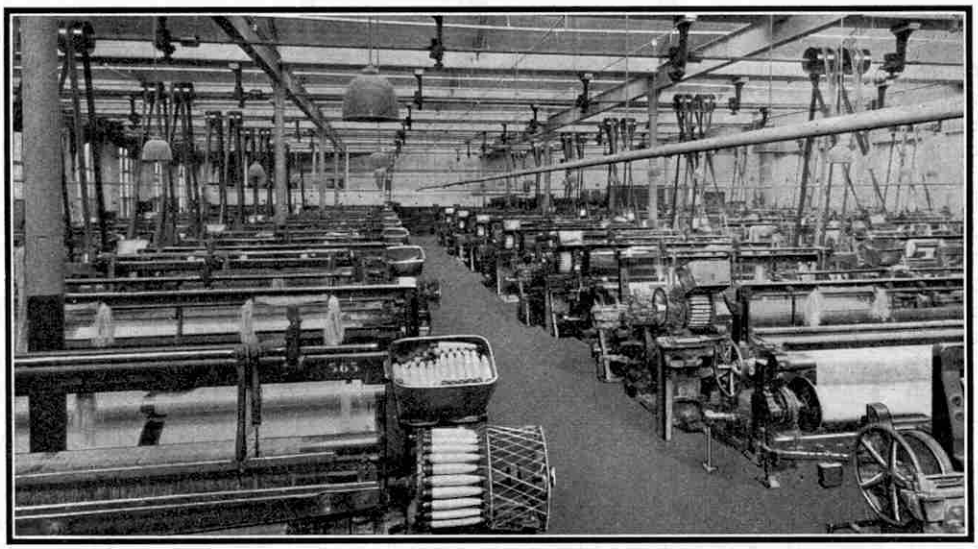
The invention made its way slowly. Among the cotton workers of the North it was impossible to find men willing either to buy or hire it; while in the South, notably at Colchester and in Spitalfields, it was resisted by the weavers of vastly different classes of goods. In fact the only people who saw the value of it were the woollen manufacturers, and they banded themselves together in order to defraud the inventor of his patent rights. Kay supplied the workers with his shuttle at a cost of fifteen shillings per annum; but the "Shuttle Club," an abominable institution composed of members pledged to fight the question of payment on every occasion, forced the inventor into the Courts so often that, although successful on the issues he contested, he was almost ruined in the process.

Kay subsequently became interested in many other inventions. There was his wire-woven kiln floor, his windmill pump patented in 1738, and a two-handed wheel for spinning wool. He was also concerned in the improvement of drill ploughs and ploughs to cut "drean's in marshe land and in makeing canals or sluses for navigation as Duke of Bridwater's cut near Manchester." But of all Kay's patents the most advanced was that taken out in 1745 in conjunction with Joseph Stell of Keighley, for improvements on the Dutch engine loom which, the patent said, "may go or be worked by hands, water or any other force." There is not in existence even a rough sketch of this machine, but from the details specified it may be regarded as the first English power loom, although it was applied only to narrow goods. This was undoubtedly the greatest of Kay's undeveloped patents,

for the entrance of the power loom under different auspices two generations later opened out another chapter in the history of the textile industry.

Later in life this illiterate genius, in a communication to the Society of Arts, referred to an invention of his for the "spining of cotton by water, but as the Engines was so expencif to make and keep in repair so that the profit by this invention is very little; now I have contrived to lay by most of the great expence of making and repairing the Engine and to perform with more ease and in a simpler manner and the yarn much better." Then followed a pathetic and now famous passage in which he referred to the other inventions he had concealed owing to the infamous treatment he had received from the "woolling and cotton factres in different parts of England."

The great catastrophe of Kay's life occurred in 1753. For 20 years he had seen his shuttle used by others in defiance of his rights and without receiving any recompense for his invention; and during that period he had been an object of hatred to a numerous class of workers who saw in the new shuttle nothing but a deliberate attempt to deprive them of their livelihood.



Present day development of Kay's ideas. Northrop Automatic Looms in which the shuttle shoots out the spool when its supply of weft is almost exhausted, and is charged by a new spool so rapidly that the eye cannot follow the change.

It was easily seen by those in the cotton trade that the new shuttle would accentuate still further the yarn shortage that had been prevalent for many years. In his "*History of the Cotton Manufactures*" Guest pointed out that it was no uncommon thing for a weaver to have to walk three or four miles in a morning and call upon five or six spinners before he could collect weft enough to keep him going for the remainder of the day. In a pamphlet entitled "*Some Considerations on the Art of Weaving Chequer'd and Strip'd Goods,*" it is related how the weavers argued that "as one Man could by the use of the Wheel Shuttle do as much work as two Men with the Hand Shuttle, one half the Weavers then employed in the broad Woollen Way must starve for want of employment. The Weavers therefore assembled in a Mob, determining to hinder the Wheel Shuttles Progress, by the killing of Mr. John Kay, the Inventor, who very narrowly escaped by flight."

This fateful episode is the subject of the tenth fresco painted by Ford Madox Brown for the Manchester Town Hall. The painting reproduces the interior of Kay's house at the time of the attack. On the left, through the windows whose bars are already bent out of shape, may be seen the mob armed with a variety of weapons, preparing to wreak vengeance on the life and property of the inventor. The centre is occupied by Kay's loom, over which one of the inventor's sons is anxiously watching the movements of the crowd outside. To the right, John Kay is being swathed in a woollen sheet previous to being smuggled away, and is kissing his wife farewell; while his two young daughters are weeping by his side. On the floor in the foreground lies the inanimate cause of the attack—the hated and feared wheel shuttle.

In a statement believed to have been written or dictated about 1764, Kay said he had applied to Parliament for assistance and, receiving none, had gone abroad. According to Woodcroft he commenced business in France with machines for carding and spinning cotton that were smuggled to him out of England. Further research, however, has shown that Kay went first to Paris and afterwards settled down in some place in Normandy, where his wheel shuttle was introduced. As a result the French Ministry granted him a sum of 15,000 livres, to which the Province of Languedoc added 7,000 livres. The inventor was also granted a patent for the sole making and selling of the wheel shuttle in France, excepting in Languedoc; and furthermore he was promised a pension of 2,500 livres per annum for himself and his son. All this suggests prosperity, but it is very doubtful whether Kay actually received any of the grants, and as for the pension, the Seven Years' War put a stop to all payments of that kind.

In 1764, in consequence of a letter written to the Society of Arts by Robert Kay, the inventor's eldest son, the wheel shuttle, or rather Robert Kay's improvement upon it, came up for consideration before the committee of the Society. From this it is apparent that Kay's sons at Bury had continued to make the shuttles and machines for the invention of which their father had been exiled. For a long time it was thought that John Kay's original shuttle was the one referred to, but further correspondence unearthed by Sir Henry Trueman Wood makes it appear that something more complicated was meant. In all probability it was Robert Kay's drop box for bringing up different colours of weft in succession without stopping the machine. A good deal of correspondence followed, but in the end nothing seems to have been done.

The last invention of John Kay that has borne fruit was the wire card-making machine. This machine, which is believed to have been made about 1750, carried out the operations of cutting, bending, and inserting the wire in the cards used in the preparation of cotton. These operations previously had all been done laboriously by hand. Kay's own words on the subject are interesting. "Now I have invented and made two engines which I have for a long time

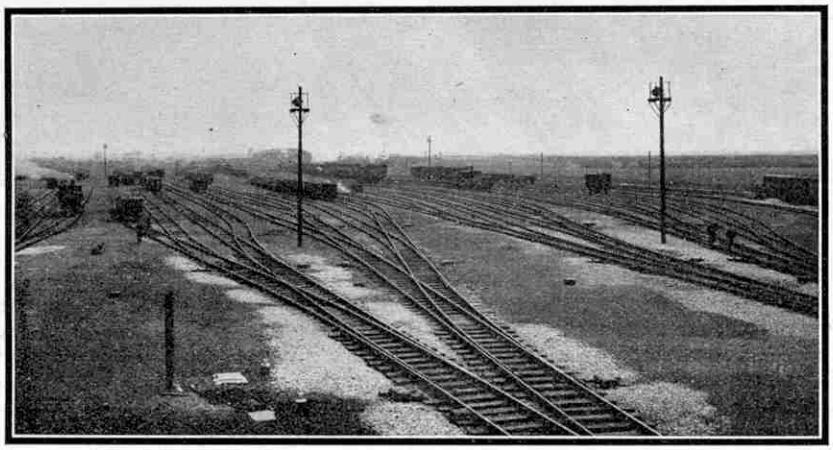
(*Continued on page 854*)

L.N.E.R. Marshalling Yard at Whitemoor

Shunting Three Thousand Wagons a Day

OF late years railway authorities in this country have given careful attention to the requirements of modern traffic. This has been shown in the improved design of coaches and goods wagons, and in the building by each of the four British railway groups of powerful express passenger locomotives. The desire for greater efficiency also is responsible for the interesting experiments now being made on the L.N.E.R. and the L.M.S. with the high pressure locomotives described in the article that appeared on page 102 of the *"M.M."* for February last.

Giants such as the L.N.E.R. locomotive "No. 10000," or the L. M. S. "*Fury*" appeal very strongly to the imagination; but other developments are taking place that are no less important and interesting, although they may not attract so much attention because they are less spectacular. Among these may be mentioned the creation by the London and North Eastern Railway Company at Whitemoor, a quarter of a mile north of March Junction, of a shunting yard for goods traffic that may fairly be described as one of the most modern and efficient in existence.



The enormous extent of the Whitemoor marshalling yard is clearly shown in the above photograph. For this and the other illustrations to this article we are indebted to the courtesy of the L.N.E.R.

March is a concentration point for a very large volume of traffic to London and the eastern counties. An immense number of trucks from northern coalfields and industrial centres arrive there daily, and these must be sorted out and remarshalled before being despatched southward. Until recently this traffic was dealt with in four separate yards. One of these was at Peterborough East, the second was at March itself, and the remaining two were at Whitemoor. These yards were laid out many years ago, and eventually the traffic so largely outgrew the accommodation they provided, that trains arrived at them more quickly than they could be divided and reformed. Very serious delays occurred and the necessity for modernising the yards became very urgent.

In planning new means of handling the immense traffic that passes through March, two factors had to be taken into consideration. To begin with, more accommodation for wagons had to be provided, and this was done by choosing a site on which a large number of shunting tracks could be laid down. It was also necessary to speed up the actual sorting of wagons. For this purpose it was decided to follow a practice introduced abroad of using mechanical rail brakes, or Froelich "retarders," as they are called, together with automatic points.

The Whitemoor marshalling yard is the result of this determination to provide modern plant, and it is regarded as the most up-to-date wagon sorting installation in the world. It is modelled on a Continental marshalling yard, but contains so many improvements and entirely new features that representatives of railway companies in Europe, and also in Canada and the United States, have taken early opportunities of inspecting the layout and studying its working.

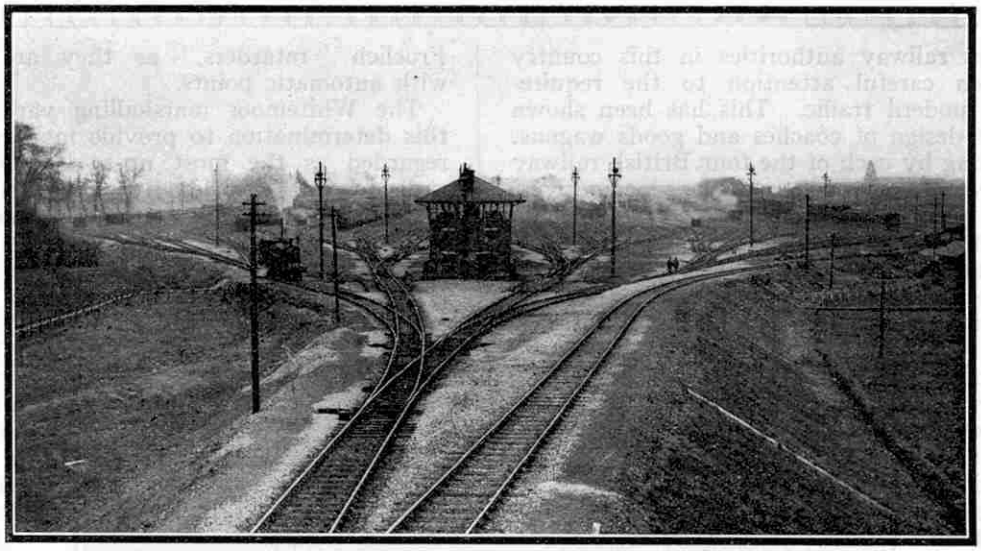
The yard itself is slightly over a mile in length and is 210 yards in width. At its northern end are ten reception roads, where incoming trains are halted for examination before sorting begins. To the south of these are no fewer than 40 sidings, in which the wagons are marshalled into new trains to be sent to various destinations further south. The multitudinous tracks at Whitemoor also include engine and transfer roads, and two extra sidings, one of which is used for brake vans and the other for crippled wagons, and in them there is room for 4,000 wagons.

Shunting is carried out on the "hump" or gravity system. The ten reception roads converge to a single line that mounts a slight eminence, called the "hump," and over this the wagons of each train are slowly pushed by a powerful locomotive. These wagons are not coupled and as each passes over the summit of the hump it gathers speed and opens up a considerable gap between itself and the following wagons. In ordinary gravity yards this gives shunters an opportunity of setting points to divert each wagon in turn into any one of the sorting sidings beyond the hump, and when the wagon has entered the proper road, a man running alongside applies the hand brake and checks its career as required.

The hump at the new Whitemoor yard is constructed with an ascending gradient of 1 in 80. The wagons pushed over the top first descend a track, 50 yards in length, that has a gradient of 1 in 18, and then pass over a section with a fall of 1 in 70. The gradients are steeper than those in an ordinary gravity shunting yard and wagons running down the hump attain a speed higher than that at which a shunter can run alongside and apply the hand brake. In this yard the work is done by Froelich rail brakes or retarders,

however, and it is these that give special interest to the layout.

The retarders installed at Whitemoor are of the most up-to-date type. Each consists of a table, supported on hydraulic cylinders by means of which it may be raised 4¾in. The table itself is about 50 ft. in length. It carries two pairs of longitudinal brake rails, that normally are level with the top of the running rails bridged over the table, and enclose these rails between them.



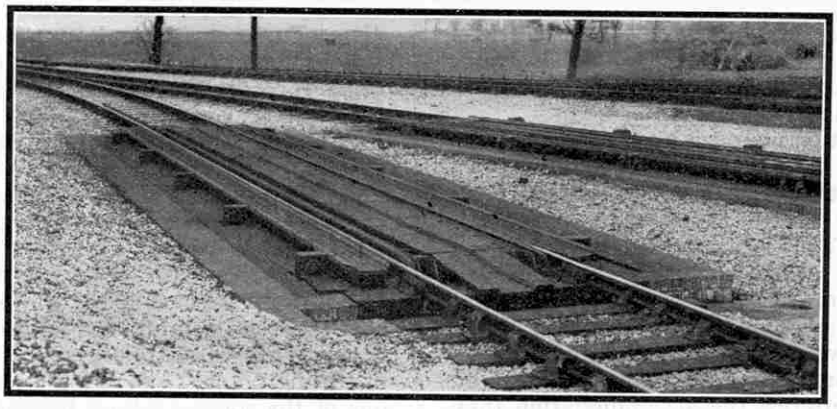
General view from the hump of the 40 sorting sidings at Whitemoor marshalling yard. The control tower may be seen in the centre, and on each side of it are two of the four Froelich retarders installed at the yard.

When the table is raised the brake rails are moved toward the running rails by means of a toggle mechanism. This causes them to press on the tyres of the wheels of a wagon passing over the retarder. The braking effect produced in this manner may be regulated by varying the pressure, and the operator in the control cabin at Whitemoor may slow down a wagon running at 15 miles per hour to any desired extent. If a truck has to travel almost the full length of the siding into which it is diverted, he gives it a slight check. But if this siding is nearly full, the wagon may be brought to a standstill within the length of the retarder itself.

In order to follow the astonishingly rapid sorting out of wagons that is possible with the aid of retarders and automatic points we may suppose that we are watching operations from the top of the hump. Approaching us from the reception sidings at the north end of the yard are the wagons of one of the trains. These are being pushed by a powerful locomotive. The engines usually employed for this work are the three-cylinder 4–8–0 tanks of the "T.1." class built by the North Eastern Railway Company before its absorption into the L.N.E.R. group. Even under bad weather conditions these locomotives are capable of dealing efficiently with trains composed of 70 wagons, each of 10 tons capacity, and in normal circumstances they handle with ease even greater loads than this.

The rate at which the wagons are being pushed up the incline leading to the summit of the hump is only about three miles per hour. It has been found that when they travel over the top at this speed they are separated during their descent by the most suitable distance. In order to help the drivers of the shunting engines to keep the wagons on the move at this speed special low register speedometers are fitted in the cabs.

As each wagon passes over the hump it commences to run down the further slope towards the marshalling sidings, 40 in number, into which the single line over the rise spreads out. The first branching is into four lines, on each of which is a retarding platform. Each wagon in turn runs down the incline and is switched on to one of the four branch lines. As it passes over the retarding table, its speed is so far reduced by the application of the brake rails that it travels the required distance along the one of the 40 parallel sidings into which it is directed. The wagons follow each other very quickly and so rapidly are the points changed that to the onlooker it almost appears as if each vehicle knows exactly which of the many sidings it is intended for and chooses its own route.



A close-up view of one of the Froelich retarders at Whitemoor. The brake rails are on each side of the running rails and nip the wheels of passing wagons when the table carrying them is raised.

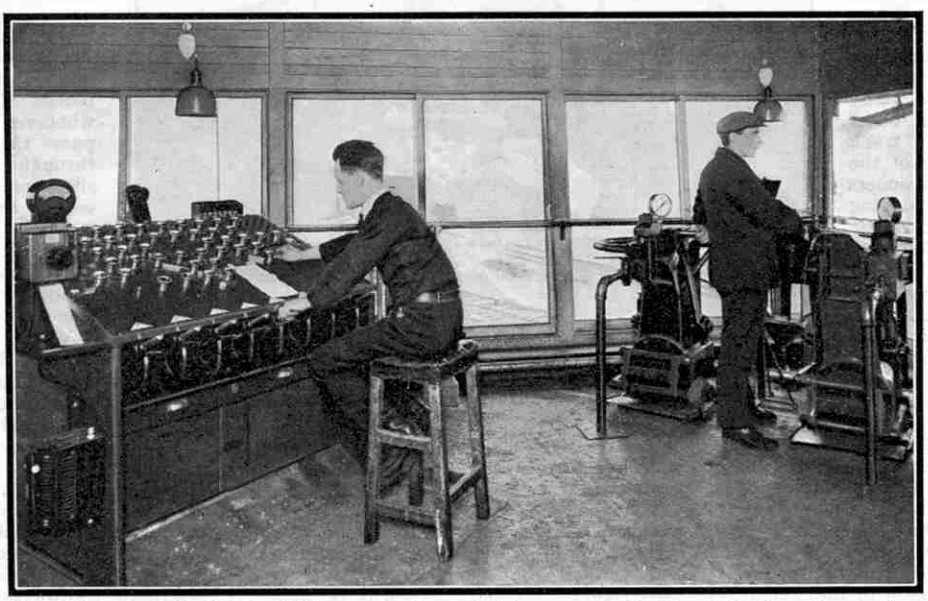
A train of from 60 to 70 trucks may be disposed of in the very short time of six to seven minutes. The yard deals with about 60 trains every day, and the largest number of wagons yet sorted in that period is 2,982. It is expected that when operations are in full swing this will represent the work of an ordinary day.

If we wish to see how the rapid disposal into the proper sidings of the wagons pushed over the hump is brought about a visit must be paid to the control tower. This is a tall building near the retarders and beyond it stretch the many sidings of the marshalling yard itself. In the usual kind of gravity shunting yard the sidings are arranged on what is described as the "ladder" principle, but the tracks at Whitemoor are laid out on the "balloon" plan, and spread out on each side of the line over the hump.

In the control tower are installed the machinery used to apply the rail brakes and the switches that operate the points by means of which the wagons are distributed into the various sidings. It is airy and well

lighted and a visitor is immediately struck by the excellence of the view of the yard that its occupants have. The windows are not vertical, but slope outward in such a manner that their surfaces are at right angles to the line of vision of the operators when they are looking down upon the tracks near their tower. The roof is made to project to a considerable distance in order to protect the windows, for if rain or snow were allowed to drive against the glass this would be obscured and operations hampered by difficulty in seeing the wagons.

The controllers by means of which the retarders are brought into action are four in number, one for each table. They are mounted in pairs and are placed in such positions that the operator sees clearly the braking effect produced by the "nip" that he gives each wagon. On the same floor of the tower is the switchboard by means of which the automatic electric points, as well as those manually operated, are set. The face of the switchboard is a replica of the yard itself, for on it are 40 metal bars or switches laid out in the same manner as are the entrances to the sorting sidings.



At work in the control cabin of the Whitemoor shunting yard. The man on the right is operating two of the retarders, and on the left is the switch table, by means of which the points are set in accordance with instructions on the "cut" card. Successive movements of certain points may be arranged in advance, and these are automatic in action.

In order to understand the work of the man in the control tower we must go back to the arrival of a train of wagons in one of the ten reception sidings at the north end of the yard. A shunter immediately passes down the train and uncouples the wagons, making at the same time a note of the destination of each. He marks every vehicle according to the sorting siding into which it is to be run, and, of course, if several wagons coupled together are intended for the same destination he refrains from uncoupling them.

In this manner the shunter divides the train into a number of "cuts," as they are usually called. Several copies of the shunting list, or "cut" card, are made, and these are delivered to the foreman of the yard, who is stationed at the top of the hump. He retains one copy, despatching the rest through a pneumatic tube to various points. Three copies come to the control cabin and others are sent to the shunter's hut at the side of the hump.

As each wagon rolls down the incline the operator sets the points to divert it into its proper siding. In doing so he follows the directions on the "cut" card, a copy of which is before him. His task is rendered easier by the use of the automatic points. At Whitemoor there are seven of these, each of which controls the entry of wagons into one of eight groups of sidings, each consisting of four tracks. The successive movements of these points may be arranged in advance by means of a wonderful invention that "stores" the point movements, as the railwaymen say. As soon as he receives the shunting list the operator moves the levers in turn in accordance with the information it gives, and when the wagons begin to run down from the hump the points thus set operate automatically. They change after the passage of each wagon and the movement of the tongue as the rear wheel of a vehicle clears a point may easily be seen. Even a last minute alteration in the destination of one of the wagons may be allowed for without disturbing the remaining changes in the series of point movements set out.

The automatic points divert the wagons into one of the groups of sidings, and in order to switch each in turn into the individual sorting siding for which it is marked, points operated by hand must be moved. This may be done quickly and accurately, for the switches are grouped together within easy reach of the operator, and since they are electrical, their movement requires little effort. The position of each point at any moment is shown by an indicating lamp and when a wagon passes through it a small lamp in the centre of the switch lights up.

As each wagon passes the control tower, it is ticked off on one copy of the "cut" card, and at the end of the sorting the whole number of wagons from any one train have been distributed over the 40 sorting sidings. Other shunters then couple them up in readiness for being pulled out when the goods train of which they form part has been completed.

The work of a shunter in a yard fitted with Froelich retarders is much less risky than in ordinary hump shunting, for practically all the work is done on stationary wagons. Occasionally it may happen that a wagon is insufficiently braked on passing over the retarders and runs along the siding at too high a speed. This is immediately observed from the control tower and the attention of the shunters is aroused by an audible signal. The shunters themselves have worked out a code, by means of which the man in charge of the siding on which this wagon is running is warned of its approach.

Work may be carried on by night as well as by day, for when necessary the yard is brilliantly illuminated by 23 "Blaizolite" flood lighting units and also by a number of special lights placed at important points, such as the entrances to sidings and in the neighbourhood of the retarders. The specially designed lanterns used in the flood lighting units have concentration lenses and direction mirrors, and they are fixed on poles at a height of 25 ft. above rail level.

Trouble has been experienced because of the varying sizes of tyres and wheels fitted (*Continued on page 863*)

Locomotive Progress in Canada—

(*Continued from page 843*)

the required quantity of coal to the combustion chamber.

A noticeable feature of the locomotives is the position of the whistle. This is known as the "Canadian National Standard Four Chime," and it is situated on the left-hand side of the smoke-box near the chimney. It is placed in this position because in ordinary practice, where the whistle is near the engine cab, the shriek of the whistle when the train is travelling at high speed is sufficient to affect the hearing of the driver. These whistles are very powerful and are in frequent use. Canada is a new country and not thickly populated, and therefore many of the highways and other roads cross the railway track on the level. By order of the Board of Railway Commissioners of Canada all trains approaching such level crossings must whistle at a certain specified distance.

In designing these "6100" type locomotives the engineers of the Canadian National Railways have kept in mind the peculiar requirements of railway operations in Canada. The climatic conditions, ranging from intense summer heat to severe winter cold, were given special consideration, with the result that the new engines work to a high degree of efficiency even in blizzards and heavy snowstorms. Special steel has been used in the construction of the boiler in order to permit of increased boiler pressure without a material increase in the weight of the engine. In addition to being designed by Canadian engineers the locomotives have been built entirely in Canadian shops, and they form an interesting and important contribution towards the solution of the problem of Empire transportation.

Linking Canada and the United States—

(*Continued from page 845*)

The next stage was the lowering of the cylinder. The barges carrying the section were moored over the completed trench, and the cylinder was let down to its bed under the direction of divers. At the ends of each cylinder provision had to be made for effecting a junction with those on each side; and this was done by means of projecting lugs that engaged with similar lugs on the adjoining section. The divers directing sinking operations inserted great pins into these joints to secure them, and finally the cylinder was covered over with about 4 ft. of filling.

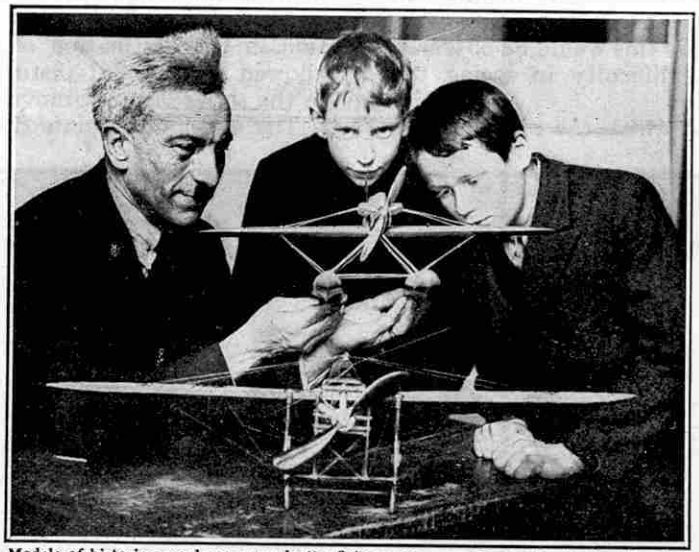
The ventilating arrangements for the tunnel were designed by Ole Singstad who, as "*M.M.*" readers will remember, was the chief engineer of the Holland Tunnel between New York and New Jersey. Ventilating plants are provided on both sides of the river, and each of these contains six fresh air fans and six exhaust fans. These two stations have to provide a complete change of air in the tunnel at intervals of 1½ minutes, and in order to do this they must supply no less than 60,000,000 cu. ft. per minute!

The tunnel is designed for a capacity of 1,000 vehicles per hour along a roadway 22ft. in width. Work is still in progress, and it is expected that the tunnel will be opened for traffic by November next.

Famous Inventors—John Kay

(*Continued from page 850*)

experimented for makeing of woolling and cotton cards, the one for pricking the leather's and the other to cut and bend the wires that is to be put into the leather's, now pricking the leather's and makeing the wires is all the difficulty and teadous work in card making; the rest is children's work or may be done by any hand."



Models of historic aeroplanes, now in the Science Museum, South Kensington, London. The upper model is of the British Supermarine seaplane that won the Schneider Trophy at Venice in 1927, and the lower one is of the monoplane in which Bleriot made the first crossing of the Channel on 25th July, 1909.

These machines were examined by members of the Society of Arts on two occasions in 1766, when John Kay attended and worked the machines. It was resolved that "six pairs of cards be made from wires and leaves pricked by Mr. Kay's machines to ascertain the merits of these engines, and that two guineas be advanced to Mr. Kay towards his furnishing the wire and leaves." Whether John Kay ever made the six pairs of cards is a matter of conjecture, as is the whole of his subsequent history. Many writers believe that he returned to France and died there in obscurity about 1770.

What is certain, however, thanks to the researches of Sir Henry Trueman Wood, is that in 1774 the wire card machine came up again for consideration by the Society of Arts, owing to a claim having been made for its bounty on behalf of an American inventor named Pope. The applicant was informed that his machine was not new, and that a much better one had been offered to the society 10 years previously. It is pleasant to note that tardy justice was then done to the Kay family, for after a Mr. Cook, rug maker, of "Whitechapple," had testified to the superiority of the wire card machine made in Lancashire, the sum of fifty guineas was paid to William Kay of Bury, the inventor's youngest son, the matter being handled as though John Kay had been dead some time.

Little more is known of the career of the "father and founder of the British textile trade." His inventions form the basis of every power loom and wire card making machine in the world, and yet he ended his days without recognition. In common with Hargreaves, Crompton and other great pioneers of textile machinery, Kay suffered from the violent opposition of the workers, who were convinced that the introduction of machinery meant the rapid disappearance of their means of livelihood.

Two Stroke Oil Engines—

(*Continued from page 847*)

convenience of handling A telescopic exhaust pipe is brought down and slipped over the exhaust outlet to save time in building up flanged connections. Cooling water pipes are connected up, and a fuel supply pipe is attached.

The engine is then started and run light for a period to run-in the bearings. It is then subjected to tests for power, and for fuel and lubricating oil consumption. Every engine is guaranteed to give its full rated power, so that the tests are exceedingly thorough. A special shop is used for testing the larger sized engines. Along one side runs a series of sliding panels that can be opened wherever desired in order to pass the exhaust pipe out through the wall. Exhaust silencers are mounted on wheels and run alongside the outside wall on a railway track, so that they can be moved easily up and down to connect in a few seconds with the various exhaust pipes.

When the testing is completed the engines are dismantled, inspected, cleaned and then taken to the paint shop. After painting they are given another short test and then packed. Here, as in the shops, large overhead cranes are employed for moving the engines which, when ready for transport, are lifted straight on to the special siding that runs alongside the shop and connects with the Great Western and the Southern Railways. Great care is taken in the packing, especially of the large number of engines that go abroad. Strong crates lined with tarred felt are used, and the engines are fixed in a rigid position by internal ribbing, so that no parts can be damaged in transport.

Another interesting part of the works is the spares department, where is kept a complete stock of parts for all kinds of Petter engines; while a little apart from the main engine works is a factory for making the patent cold starters used with the surface ignition engines.

Meccano Leaflets in Six Languages

Many readers no doubt will be interested to know that the Special Instruction Leaflets describing the well-known Meccano Super Models are printed in several languages. These include French, German, Spanish, Dutch and Danish. The French leaflets are printed and issued in exactly the same manner as those in English, but in the four remaining languages special editions without illustrations have been prepared. These are intended for use in conjunction with the English edition.

As an illustration we may take the Motor Chassis leaflet. A Meccano enthusiast living in Germany, Spain, Holland, Norway, or Denmark, who wishes to build this wonderful model may obtain the four-language leaflet describing this model by writing to Meccano Ltd., Liverpool. With it is sent the English leaflet, which contains the illustrations, and to these he may refer while reading the instructions in his own language.

Meccano boys in this country who are learning one or more of the languages referred to will find the leaflets of great assistance. They may read the versions in English and in the foreign language side by side, or may follow the more interesting and useful plan of reading the instructions in the foreign language and referring to the English leaflet only for confirmation, or for assistance when unknown words are encountered.

The appropriate four-language leaflet will be sent free of charge to every purchaser of a special Instruction Leaflet who expresses the desire to have it. The leaflets are published at various prices. From time to time complete lists appear in the pages of the "*M.M.*," and full information regarding the leaflets published in all six languages will be forwarded to any reader who applies to Meccano Limited, Binns Road, Liverpool.

Automatic Control of Steam Trains

Safety System on New York Central Lines

THE elaborate systems of signalling that are in operation to-day on lines operated by steam trains have as their primary object the securing of safety for passengers. These systems have been brought to a remarkable pitch of perfection, but they have one weak point—they are more or less dependent upon the human element, namely, the driver. So long as a driver obeys the signal indications provided for him all is well, but if he fails to respond to even one indication he may bring about a serious disaster. Many schemes have been devised to guard against this danger by means of mechanism that will automatically stop a train in case a driver disobeys a signal indication. Perhaps the most interesting of these mechanisms is that introduced in 1928 on the steam-operated section of the New York Central Lines.

This device is controlled through the same medium as the automatic block signal system. The track rails are arranged in blocks or sections of track by the use of insulated joints, which are placed at prearranged points as required in order to produce a space or time interval in the continuous train movements, and form what is commonly termed a block. Each block or section of track is protected by a signal and is controlled through a relay connected to the track. The track relay is constantly charged with an electric current supplied through the track rails that form each block, and any interruption of the continuity of the rail or the current supplied is instantly recorded by the dropping of the armature of the relay. Such a condition is produced, for example, by a broken rail, an open switch, or the presence of a train or vehicle in the section. When the relay opens then, through the medium of circuits designed to give information to the driver, signals are displayed so that he may be governed in the operation of his train as against a train occupying the section immediately ahead or the second section ahead.

The track circuit covers the whole of the main line, and in addition any branch lines or crossovers leading to the main line. By means of the track circuit and the secondary or control circuits, it can be arranged to inform the driver as to whether the line is occupied or clear for as many blocks in advance of his train as may be desired.

Automatic block signals are usually placed one mile apart, but the spacing is definitely fixed in relation to the speed of the trains, the density of the traffic, the nature of the line as regards gradients, and other matters.

By adapting to the control circuits of the automatic block signal system an inductor located alongside the running rail, there is made available at all times a reliable means of controlling the engine when its receiver passes over the inductor. No electric current is supplied to the inductor. The control circuits of the automatic block signal system set up a choking effect in the inductor circuit, which is broken when the signal displays any indication other than "clear."

Courtesy [*New York Central Lines*

The automatic control equipment on a New York Central "Pacific." This allows the driver to retain control of the train so long as he observes the signal indications, but takes the control away from him on the side of safety if he disregards them.

The condition set up on the lineside is transmitted to the train by means of a receiver on the locomotive. The accompanying illustration shows the general arrangement of the train-stop equipment on the locomotive. The turbo-generator situated in front of the engine cab supplies the electric current to operate the train-stop device, the headlight and the engine lights. The mechanism case, which is at the rear of the tender, contains the automatic train-stop relays. When the locomotive receiver passes over an inductor at a signal displaying an indication other than "clear," the relay armatures drop away, and cannot be restored until after the train has come to a complete stop. The electrical circuits are restored by pressing a button on the re-set contactor placed at the rear side of the tender frame.

When the locomotive relays are opened, the electro-pneumatic valve is opened also and permits the flow of air from the train-stop actuator, which automatically brings about a full service brake application to the train.

If the driver is alert when he passes a signal displaying an indication at which the automatic device is operative to stop the train, he acknowledges that he has seen the signal and has complied with the rules, by operating an acknowledger handle to avoid an automatic application of the brakes. The sounding of the acknowledging whistle informs the driver that the inductor has been passed, when he may release the acknowledger handle which, if held longer than 15 seconds, automatically applies the brakes.

Europe's Largest Dam

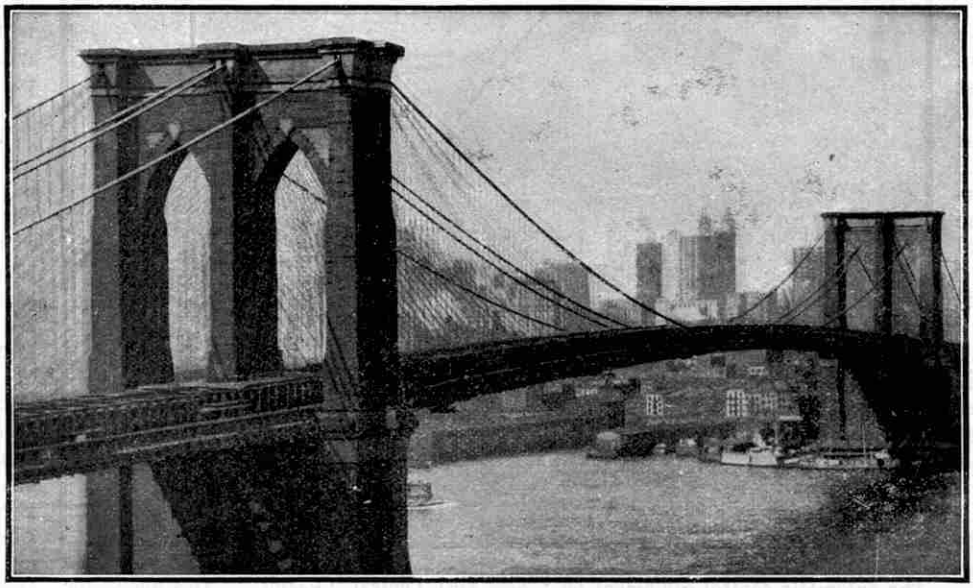
Work on a dam that when completed will be the largest in Europe is now nearing completion. Its erection is part of a scheme for increasing the water supply of Bradford and several neighbouring towns. This is derived from the upper reaches of the valley of the Nidd, and the dam is being built across the river at Scar House, which is a short distance above Pateley Bridge. It has been under construction for nine years and it is expected that the work will be completed during 1931, at a total cost of about £2,500,000.

The dam will impound the water of the Nidd to form a lake with a surface area of 170 acres. In addition, a chain of lakes is to be constructed between Angram and Gowthwaite. The reservoirs thus formed will have a capacity of 2,200,000,000 gallons of water and it is expected that this supply will be sufficient to meet the demands of Bradford and the associated towns for at least 50 years.

Many hundreds of workmen are engaged in the operations, and in order to accommodate them it has been found necessary to build a small town. This is lighted by electricity generated on the spot and is remarkably complete, possessing shops, a school and a cinema. When the dam is complete the town will be abandoned.

The Brooklyn Suspension Bridge

The famous bridge shown in the illustration on this page was designed by J. A. Roebling. It was the first structure to connect New York and Brooklyn, and when completed was by far the longest suspension bridge in the world. Roebling was severely injured shortly after the erection of the bridge was commenced, but he continued to superintend the work of construction, watching the progress of operations from a room overlooking the river. He died from his injuries before the bridge was completed.



The Brooklyn Bridge over the East River at New York. This bridge is 5,989 ft. in length, and has a central span of 1,595 ft. (From the Editor's book "Engineering for Boys," by permission of the publishers, T. C. & E. C. Jack Ltd.).

Concrete Skyscraper Built in Rio de Janeiro

A skyscraper 410 ft. in height has been constructed in Rio de Janeiro, the largest city in Brazil. It is known as the "*A Noite*" building and has 25 storeys. Concrete only has been used in its construction and it is claimed to be the tallest building in the world made entirely of this material.

One of the most interesting features of the skyscraper is the elevator system that has been installed. The cars have a speed of 700 ft. per minute and are capable of carrying loads of 2,500 lb. A special inductor control system developed by the Westinghouse Electric International Company is employed in order to reduce to a minimum the attention required from the operator. When a passenger inside a car wishes to alight at any floor, the appropriately-numbered button inside the car is pressed. The effect of this is to ring a bell and switch on a light signal on approaching the landing at which the stop is to be made, thus warning the operator to centre his switch. The gear then comes under the control of the Westinghouse automatic mechanism, which slows it down and finally brings it to rest at the exact level required.

The attendant is warned by similar means when he is required to stop at any floor in order to pick up a passenger.

Wrecked Liner Found

After numerous unsuccessful attempts, the wreck of the P. & O. liner "*Egypt*" has been found. This vessel was sunk in the Bay of Biscay in 1922. She was carrying a valuable cargo, including a consignment of gold ingots, and several efforts have therefore been made to locate her. These were fruitless until early in September of this year, when divers from the Italian salvage steamer "*Artiglio*" succeeded in reaching her.

The "*Egypt*" is lying on an even keel in 66 fathoms of water. Salvage operations were commenced immediately the wreck was found and within 72 hours one of the hydraulic cranes with which she was equipped had been raised to the surface.

Naturally special attention is being paid to the gold carried by the vessel. This is believed to be inside the strong room, which is situated in front of the forward funnel on the orlop, or lowest, deck, and it will be necessary to cut through four decks in order to recover it. Heavy seas may make it necessary to suspend operations during the winter, and in that case the position of the wreck will be marked by means of buoys, in order that there will be no possibility of her being lost again.

A quantity of mail that has been at the bottom of the sea for eight years has already been brought to the surface. Included in this is a despatch from the British Foreign Office that has twice failed to reach Tangier, its destination. On the first occasion it was overlooked and allowed to remain in the bottom of the mail bag in which it was placed. On its return to London it was again forwarded, but this time it suffered the more disastrous fate of being sunk in the Bay of Biscay. When recovered it was discoloured by the action of sea-water, but the address was still readable.

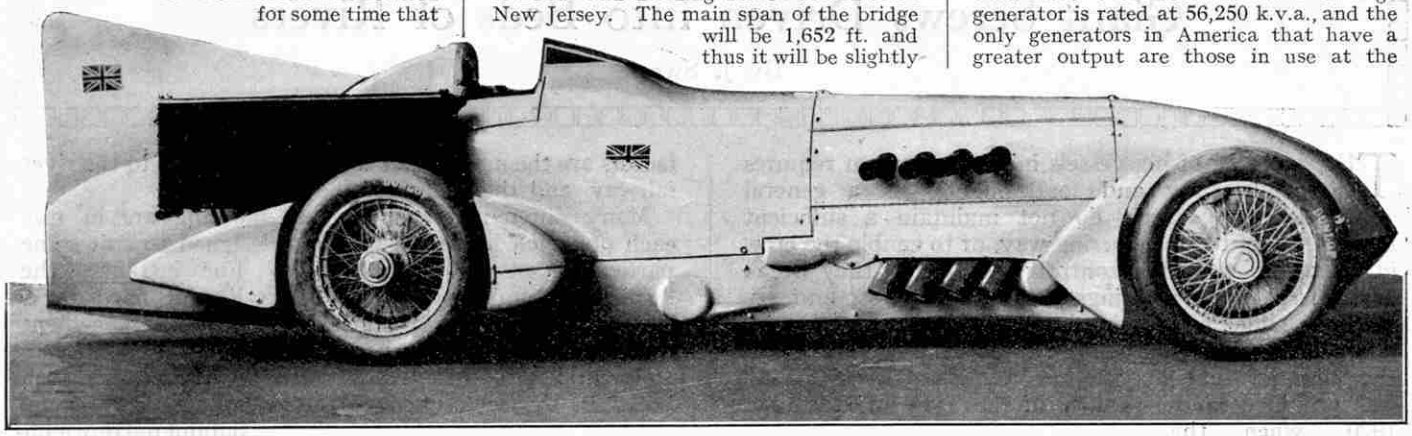
Motor Car Built on Aeroplane Lines

Sir Dennistoun Burney, the designer of "*R100*," the famous British airship that recently visited Canada, has now built a scientifically streamlined motor car. Sir Dennistoun has realised for some time that an excessive amount of the power of an ordinary car is wasted in overcoming the resistance of the air. Although this is not so great a factor as in the case of a giant airship it has more effect than is usually realised. For instance, to push the headlamps of a large motor car through the air at a speed of 60 m.p.h. requires no less than 7 h.p. In the "Burney Streamline" as the new type of car is called, effects of this kind are practically eliminated, for the lamps are let into the bodywork and the wheel is carried inside the specially constructed rear door.

The chassis of the car consists essentially of two girders, one running along each side. These are wide apart between the wheels, but the frame tapers to points in front and at the rear. Two other girders curve upwards from the rear end to a point just in front of the driving seat, where the front of the car is brought down fairly bluntly. The underside of the car is perfectly flat, being covered in with sheet metal, and thus the side elevation of the motor car closely resembles a section taken through an aerofoil, or aeroplane wing.

An interesting feature is the position of the 2,956 c.c. straight-eight Beverley-Barnes engine installed. This is fitted in the rear, and between it and the rear seats is a roomy luggage compartment, entry to which may be obtained either through doors at the sides, or by lifting out a portion of the roof.

The makers of the new car claim that with it speeds of over 80 m.p.h. may be obtained. It has a four-speed gear box designed for high-speed work. The third gear is the direct drive, and it is said that with this engaged, the car may be driven at speeds varying from walking pace to over 60 m.p.h. without "snatch."



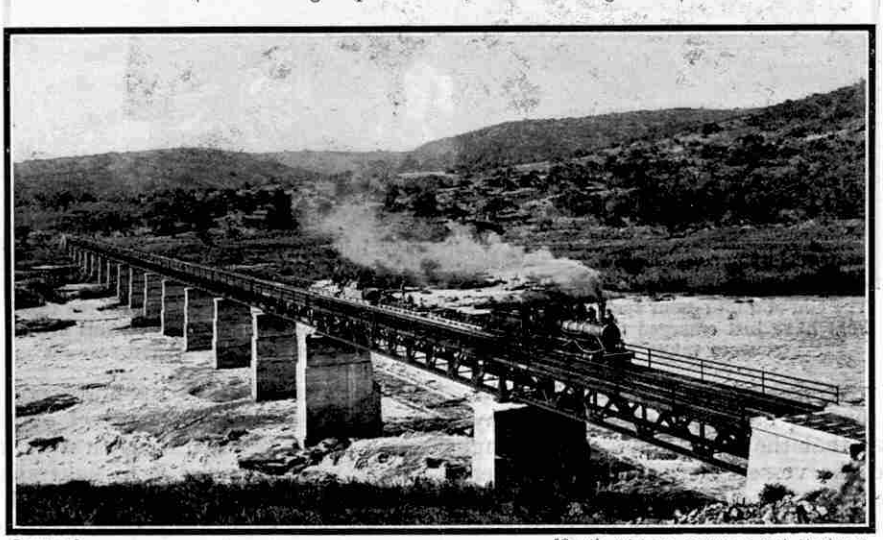
The Napier-Arrol-Aster "Bluebird" motor car on which Captain Malcolm Campbell endeavoured to set up a new world's land speed record at Verneuk Pan in South Africa, some time ago. Although he failed to accomplish this, he set up new figures of 216 and 211·5 m.p.h. over distances of five kilometres and five miles respectively.

Giant American Arch Bridge

A rival to the Sydney Harbour Bridge is now being constructed in America. This is an arch bridge to span the Kill van Kull, a waterway opening into New York Harbour and dividing Staten Island from New Jersey. The main span of the bridge will be 1,652 ft. and thus it will be slightly longer than that of the bridge at Sydney, which at present is the largest arch bridge in the world.

The new bridge is of the two-hinged type and the distance between the centres of bearings of the arched shoes is 1,675 ft. The crown of the top arch is 327 ft. above the water line and the deck, which is suspended by means of the cables, will be 140 ft. above high water level. This will be 40 ft. in width and will accommodate four lines of traffic, while a footwalk also will be provided. Future developments are being kept in view, for the bridge is being constructed in such a manner that it may readily be widened in order to make room for three more lines of traffic or for a double track electric railway.

Work on the bridge is well advanced, for the heavy concrete abutments were completed in 1929. These are founded on solid rock and faced with granite. Long viaduct approaches are to be built at each end of the bridge. These will be 3,000 and 4,000 ft. in length respectively, and will consist of plain girder spans supported on concrete piers. The total cost of the bridge is estimated at £3,200,000.



Courtesy [*South African Railways and Harbours*

The Railway Bridge that carries the South African Railways' track across the Tugela River, Natal. The piers of this and other bridges in these regions must be strongly built in order to withstand the strains imposed on them when the rivers rise rapidly after heavy rains in the neighbouring mountain ranges.

Hydro-Electric Generators of Record Size

The General Electric Company of New York are now constructing at the same time the largest and the smallest hydro-electric generators of the overhung type that have ever been built. The large generator is rated at 56,250 k.v.a., and the only generators in America that have a greater output are those in use at the Niagara Falls Power Station. These are rated at 65,000 k.v.a., and are not of the overhung type. Four of the smaller units are being constructed. Each of these has an output of 3,300 k.v.a. They are to be employed at McIndoes Falls on the Connecticut River, while the world's largest overhung generator is intended for service on the Lewis River, a mountain-fed stream in the State of Washington, on the Pacific Coast, that flows into the Columbia River.

Both generators possess interesting features. Those to be employed at McIndoes Falls are to be driven by Kaplan adjustable waterwheels. These are of the screw propeller type, and the pitch of the blades is automatically adjusted to give the best results under varying conditions. When other types of waterwheels are employed it is necessary to stop the machine and adjust the blades manually in order to compensate for lower waterhead, increased tail race, or a change in the demand for power. With the Kaplan waterwheel this is unnecessary.

The generator that is to be installed in Washington is of gigantic size. It will weigh nearly 450 tons, and a little more than half the total weight will be in the rotor itself. The unit will have an overall diameter of more than 37 ft. It will be too heavy to be transported in its finished form and it is to be shipped in four sections.

The turbine that is to drive this huge generator is guaranteed to supply 61,600 h.p. with a head of water of 158 ft. The generator and turbine are to be mounted on a single shaft 28 ft. in length. It is interesting to note that a fish trap is to be installed in the sub-structure of the power house. This is intended to catch the salmon that at certain seasons are abundant in the Lewis River.

Mooring Big Ships in Tidal Waters

Giant Screws Driven into Beds of Rivers

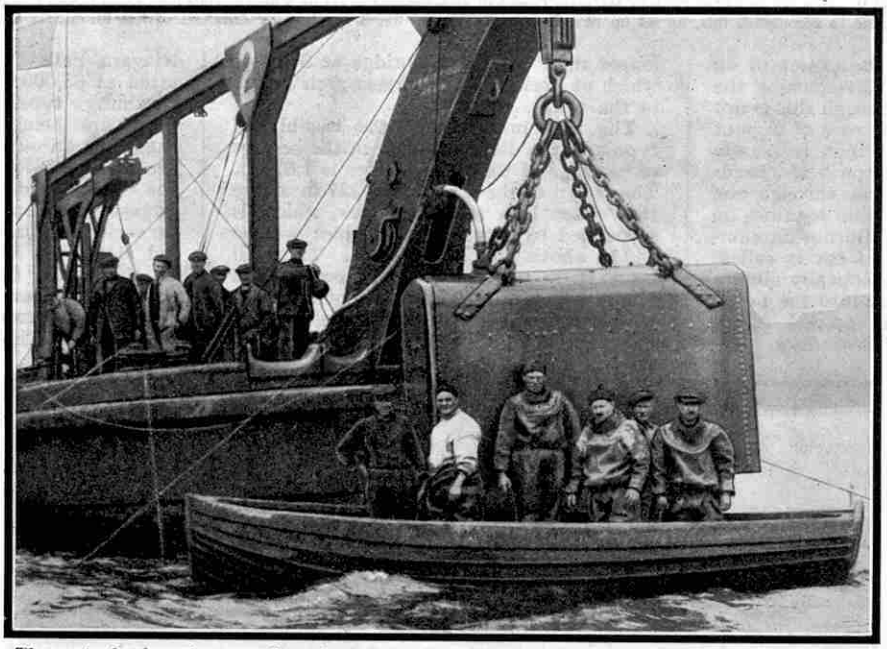
By J. Sweet

THE mooring of big vessels in a tidal stream requires careful study and forethought. As a general rule such vessels do not maintain a sufficient head of steam to give steering way, or to enable the crew in charge to maintain control; so that if they break adrift from their moorings they are helpless, and are liable to suffer serious injury themselves and to cause damage to other vessels. An interesting illustration of the mischief that may follow a mishap of this kind was provided in the estuary of the Tyne in December 1920, when the "*Adolph Woermann*," a 6,000-ton German liner, snapped her cable during a violent westerly gale.

The ship had not an ounce of steam raised, and the only man on board was the watchman. Driving downstream with the wind and the tide, she broke into a tier of ships lying off a graving dock. Eventually at Harton Buoys, South Shields, she collided with a string of vessels consisting of several large cargo boats, a number of concrete lighters, and two ferry boats. For a few moments there was no movement, but then the pressure of the wind on the broadside of the runaway vessel became so great that the whole mass of shipping was carried away, and the vessels were in great danger of crashing into the ferry landing at South Shields. A ketch actually was crushed against one of the pontoons of the landing, and only the promptitude of the master and crew of a tug in getting a hawser aboard the "*Adolph Woermann*" prevented a more serious disaster. This episode in the Tyne is of course unusual, but there is always risk of such an occurrence, and for this reason a large margin of safety must be allowed in designing moorings for large ships.

Before deciding where a mooring is to be laid, and what type shall be employed, the size of the ship for which it is intended must be taken into consideration. Full allowance must be made for the strength of the tidal currents and of the prevailing winds, and care must be taken to ensure that there is a sufficient depth of water at all states of the tide. Other important factors are the nearness of the chosen position to the river fairway, and the nature of the river bed.

Many different types of river mooring are in use, each of which has been specially designed to suit some particular set of circumstances. For instance, the "spike" mooring is used principally on hard rock. This mooring is really quite a primitive arrangement made by driving a number of iron spikes, from 8 ft. to 10 ft. in length, into holes that previously have been bored in the rocky bed of the river. The spikes are hammered down until the shackle at the head of each one is level with the surface of the rock. The mooring cable is then attached to the shackles by men who descend in a diving bell, and its upper end is connected to the underside of a pear-shaped buoy. This buoy rides the water and serves the two-fold purpose of marking the position of the mooring and providing a tying-up place for vessels.



The end of a four-hour spell at the bottom of the River Tyne. The workmen in the small boat have just emerged from the diving bell. The photographs illustrating this article were taken by courtesy of the Tyne Improvement Commission.

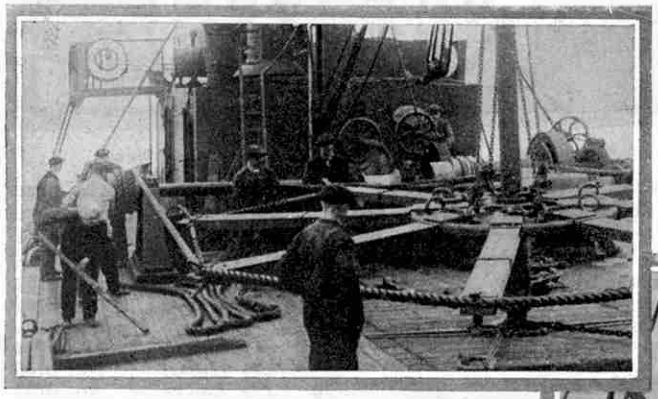
The pear-shaped mooring buoy has been specially developed for use in busy tidal waters, and so far all attempts to improve upon its general design have been unsuccessful. It has swivel eyes at top and bottom, and therefore when in use it may spin freely on its own axis, which enables it to neutralise to a certain extent the action of the tide and wind. This type of buoy offers very slight resistance to chance blows from passing vessels, and only spins merrily as it curvets away after such an impact.

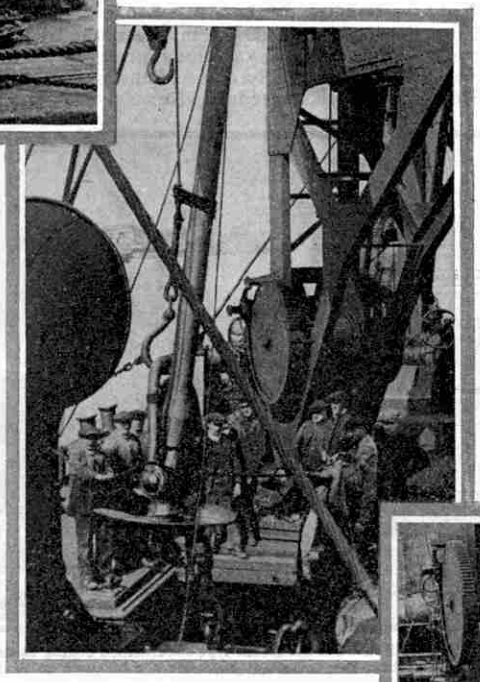
The "spike" mooring would be quite ineffective in loose shale or in sandy ground, and in such conditions the heavy "concrete dump" mooring is most usually employed. This is formed by lowering a big block of concrete into a hole that has been specially dredged in the bed of the river. A horizontal iron spindle with a short length of chain attached is embedded in the heart of this block. The big stud-link mooring cable is then shackled to the end link of the chain and carried up in the usual manner to be shackled to the underside of the buoy.

For general purposes the "screw" mooring is the best

and the most reliable of all those employed to-day. It is extensively used on the rivers of Great Britain, notably on the Thames and the Tyne, for it is cheap, efficient and adaptable, and may be used almost anywhere except on very hard rock.

Laying down a " screw " mooring is a very interesting task, and the manner in which it is done may be explained best by making an imaginary trip in a screw keel. We go aboard at the home jetty to find that the loading up process has just been completed. The lengths of heavy stud-link cable chain required have been taken aboard; these measure anything from $2\frac{1}{2}$ in. to $3\frac{1}{2}$ in. in diameter, and are stowed in the hold amidships, together with the large flat iron mooring screws. Our old friend the pear-shaped buoy rolls easily on the current alongside. We cast off and proceed down the river to the point where the screw mooring is to be fixed. On the short trip we examine our vessel with some curiosity, for the screw keel is a craft of peculiar and varied interest. Away aft are the engines, the boiler, and accommodation for the crew; while amidships a square watertight well, open top and bottom, is sunk through the vessel. The screwing capstan is mounted above this, with winches fore and aft. Chain lockers occupy most of the remaining space, and at the prow, jutting out in the manner of the figurehead of a sailing vessel, is a 100-ton jib that has a very business-like appearance.





(Top) Screwing operations in progress. The giant capstan being turned by means of steam winches. (Centre) Lowering the first length of shafting, with the mooring screw chain attached, through the well of the keel. (Right) Shipping the capstan head. This is fitted on to the uppermost length of shafting, and the capstan bars are inserted in the square sockets.

On reaching the mooring site the first task is to find the exact position in which the screw is to be placed. This is not a difficult matter, for the river surveyor has been here before us, and has marked the position by erecting two flags on the foreshore. Our skipper simply manœuvres the craft until the flags are in line with the screwing capstan in the centre of the well.

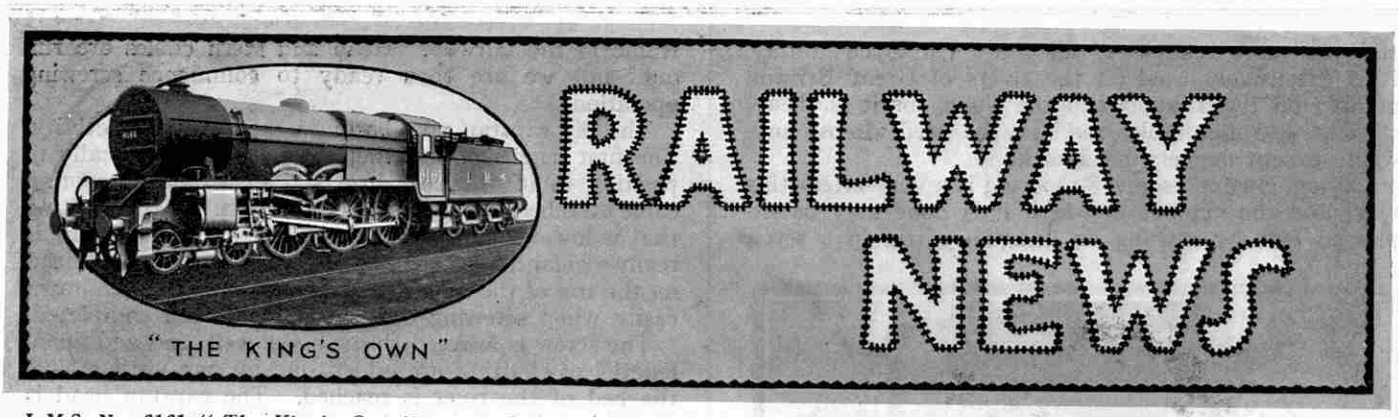
When the vessel is in the correct position all hands turn out to assist in mooring her. This is rather a ticklish business, for it must be carried out in such a manner that the ship remains perfectly rigid while screwing operations are being carried on. Two light thwart chains, sometimes known as the " messenger chains," are run out on the port and the starboard sides, and these are made fast to piles, or anchors, on to the foreshore on each side of the river. The chains hang low in the water, and do not in any way obstruct the traffic in the fairway. Head and stern cables are run out, and we are then ready to commence screwing operations.

The big capstan now becomes the centre of activity. The first length of screwing shaft is fixed vertically in position in it, the cast iron screw, with the mooring cable attached, being made fast to the end of the shafting that is lowered down the watertight well. The shaft is really a gigantic box spanner that fits on to a square head on the top of the mooring screw and may be withdrawn easily when screwing operations have been completed.

The screw is lowered through the well, and additional lengths of shafting are added one by one until at last the bed of the river is reached. The capstan head is now shipped, and the real work begins. The twin steam winches that are conveniently situated fore and aft of the capstan are brought into play, ropes hitched on to the spokes of the capstan wheel being hauled in by each in turn. This process, slow but very sure, is repeated, each pull by the winches giving a quarter turn to the capstan, until the screw has been embedded to the required depth below ground level. A depth of 12 ft. is usually considered adequate, but it depends to a very large extent upon the nature of the ground. Good honest clay may be said to give the best hold, although it is not easy to work with. In any case it may be supposed that, having due regard to the responsibilities connected with his job, the mooring superintendent will take the minimum of risk.

The laying of one screw provides a good day's work for the screw keel. Since three or four screws are attached to one buoy, and two buoys are required for one berth, one buoy for'ard and one aft, the laying of a complete mooring keeps the craft employed for a full week. The average life of a mooring is 15 years, however, so that the hours spent in fixing it securely are not wasted.

When screwing is finished, the end link of the long mooring cable is shackled to the buoy (Continued on page 863)



L.M.S. No. 6161 "*The King's Own*"

The L.M.S. locomotive No. 6161 "*The King's Own*" shown in the heading on this page, is one of the latest additions to the "Royal Scot" class. It was shown at the Exhibition of locomotives and rolling stock recently held at Liverpool in connection with the Centenary of the Liverpool and Manchester Railway. No. 6161 belongs to a batch of twenty new engines all of which are identical in design with the original fifty. The earlier engines were built by the North British Locomotive Company of Glasgow, but the new ones are being built in the L.M.S. shops at Derby. A minor point in the tenders of the new engines is the provision of coal rails in addition to the high coping already fitted. This addition increases the coal capacity from five to approximately seven tons.

At the Centenary Exhibition at Liverpool "*The King's Own*" was beautifully clean, not only as regards the paintwork but the steel parts of the motion and the various cab fittings were so polished as almost to resemble silver. The interior of the smoke box was painted white and since the door was open many took the opportunity of standing inside and examining the chimney, "petticoat pipe," blast pipe, steam pipes, fire tubes and superheater. The blastpipe was temporarily closed with a plug of wood as a protection against anything being dropped down it.

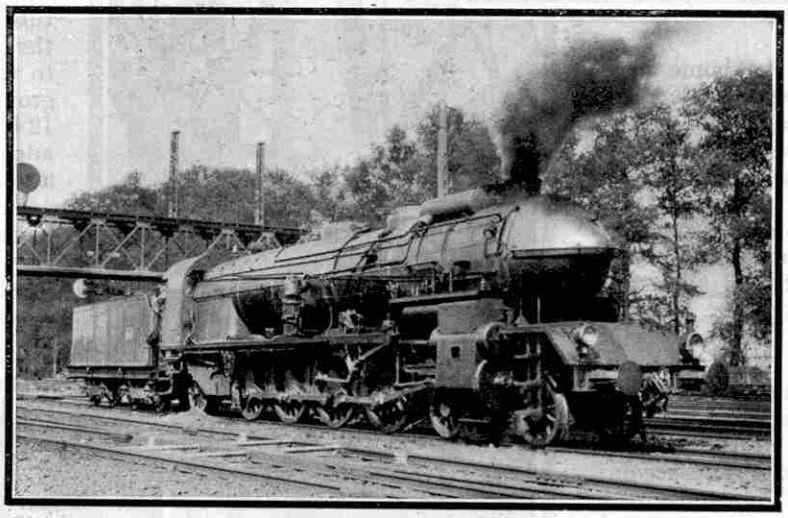
The "Royal Scot" locomotives have three cylinders, 18 in. × 26 in. driving on to six-coupled wheels 6 ft. 9 in. in diameter. The boiler has a total heating surface of 2,526 sq. ft. and is pressed at 250 lbs. per sq. in. The fire-grate area is 31.2 sq. ft.; the tractive effort at 85 per cent. working pressure is 33,150 lbs., and the total weight of the engine is 85 tons, of which 62½ rest on the coupled wheels.

B.T.H. Equipment for Underground Railways

The British Thomson-Houston Company Ltd. are to supply 160 control equipments for new motor and trailer cars of the London Electric Railways. These embody a number of improvements and include circuit breakers, reversers, master controllers, cut-out switches, switch boards, relay and contactor control gear. The Company supplied 561 similar equipments for coaches constructed in 1928 under a scheme for speeding up traffic on the London Underground Railways.

L.N.E.R. Sleeping Cars of New Type

Two new sleeping cars of an entirely new type have been built at the L.N.E.R. works at Doncaster and are now in service on the East Coast route to Scotland. Each car is 63½ ft. in length, the body being of solid teak, and mounted on two 4-wheeled bogies. Special methods have been adopted to reduce vibration to a minimum.



P.L.M. No. 241-A-45, a 4-8-2 mountain type superheated engine as used on the "Blue Train" at Laroche. For this photograph we are indebted to W. H. C. Kelland.

In each car there are ten separate bedrooms. Walnut bedsteads of full size are provided, with box-spring mattresses, and blue blankets that match the general colour scheme. Each bedroom is fitted with a corner wash-basin of white porcelain, on which hot and cold water are laid. An ingenious system of ventilation regulates the supply of hot or cold cleansed air to each room as may be desired. In every conceivable way the comfort of the passenger has been catered for in these new cars and a degree of luxury in night travel has been attained that surpasses anything previously known in this country.

Illuminated Nameboards on the S.R.

At the stations on the new Wimbledon and Sutton line of the Southern Railway illuminated nameboards have been introduced. The end pieces and top capping are of concrete, and the posts carry two sheets of plate-glass inscribed with the name of the station. Between the sheets of glass is a space of about 9 inches in width, in which several electrical lamps are inserted. This internal illumination gives an effective nameboard that can be read as easily by night as by day. The consumption of current is low.

L.M.S. Locomotive News

New Derby-built "Royal Scots" are now in service up to No. 6163. Several have received names representing familiar types in the British Army. No. 6150 is called "*The Life Guardsman*"; No. 6151 "*The Royal Horse Guardsman*"; No. 6152 "*The King's Dragoon Guardsman*"; No. 6153 "*The Royal Dragoon*"; No. 6154 "*The Hussar*"; No. 6155 "*The Lancer*"; No. 6157 "*The Royal Artilleryman*"; and No. 6161, "*The King's Own*." A number of the new engines are located in Glasgow and it is reported that others are to be sent to work in the Midland division.

The latest 2–6–0 mixed-traffic engines turned out from Crewe works are numbered 13205-6.

Beyer, Peacock & Co. Ltd. are now delivering the "Beyer-Garratt" articulated locomotives that were ordered by the L.M.S.R. early in this year, and Nos. 4967 to 4976 are already in traffic. These engines are fitted with a special device to prevent coal dust blowing into the cab when they are running with the coal-bunker in front.

A beginning has been made with the breaking up of the old North London 0–6–0 goods tank engines. Nos. 7504, 7518 and 7519 have already been broken up at Bow Works and others are to follow soon. This class comprised 30 engines, to which the L.M.S. numbers 7503 to 7532 were given. Although comparatively small, they are smart at their work and have dealt very efficiently with the heavy goods traffic on the former North London line. Some of the class have been in service for over 50 years, the earliest having been built in 1879. They have outside cylinders of 17 in. diameter and 24 in. stroke, and the diameter of their coupled wheels is 4 ft. 4 in. As the total wheel-base is only 11 ft. 4 in., they are able to take even sharp curves easily.

The 4–6–0 engine No. 5942, of the "Claughton" class, that had been adapted to the Northern loading gauge, has been transferred to the Midland division.

Another engine of the 4–6–0 "Experiment" class—No. 5485, "*Harlequin*"—has been withdrawn for scrapping.

Two mineral 0–8–0's of Class "D" have been converted to superheated engines of Class "G1." Ordinary round-topped boilers are fitted as previously but the steam brake formerly fitted has been replaced by the vacuum brake.

Automatic Cab Signalling Gear fitted to 500 G.W.R. Engines

Further 2–8–0 goods tank engines have been completed at Swindon and are numbered 5276 to 5285. Some additional 2–6–2 tank engines of the "5100" class are now in hand, and work has also been commenced on the new batch of 4–6–0 express engines of the "Hall" class.

Goods 0–6–0 tank engines Nos. 6715 to 6720 have been received from W. G. Bagnall Ltd.; No. 7724 from Kerr Stuart Ltd.; and Nos. 6735 to 6739 from The Yorkshire Engine Co. Ltd.

Two 0–4–2 passenger tank engines numbered 3 and 4 have been taken over from the Corris Railway, and Great Western numbers 3 and 4 allocated to them.

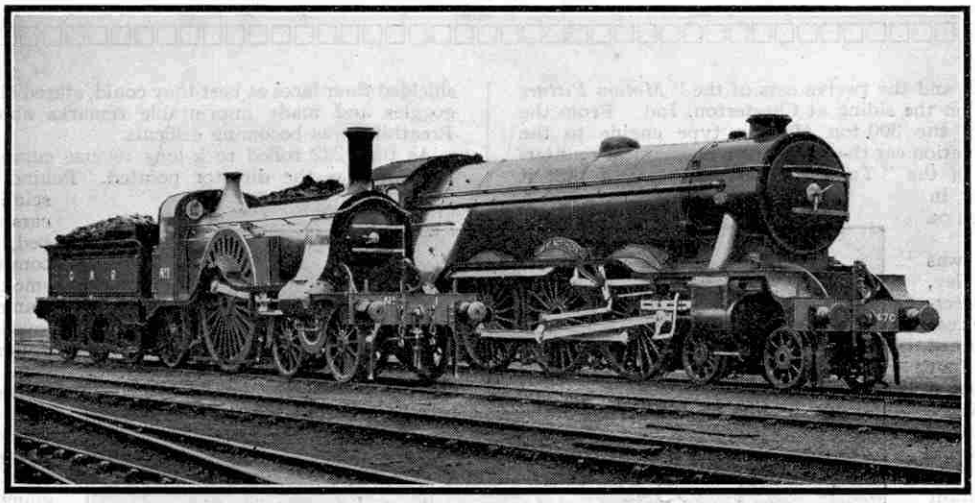
The work of making and fitting electric automatic cab signalling gear is being pushed forward rapidly and is causing great activity at Swindon. During the last few months this equipment has been installed on more than 500 engines, and it is intended that, in all, about 2,000 G.W.R. locomotives shall be fitted with it. This gear affords valuable assistance to the enginemen, especially in foggy weather. If a signal should be passed at danger, the vacuum brake is automatically applied and the ringing of a bell in the cab of the engine gives the driver immediate warning.

New Giant Locomotive for C.N.R.

A locomotive capable of hauling an all-steel train weighing 1,000 tons at a speed of 80 m.p.h. has been placed in service by the Canadian National Railways. It is the fastest locomotive in the Dominion, for it is capable of attaining a speed of 80 m.p.h., and is the first of five that will be employed in hauling *"The International Limited,"* the famous train between Montreal and Chicago that holds the world's record for speed for a run of more than 300 miles.

The new engine is of the "Hudson 5700" type. From the tip of the cow-catcher to the end of the tender it measures 92 ft., and its driving wheels are 6 ft. 8 in. The engine develops a tractive effort of 43,300 lb., and the "booster" increases this to 53,300 lb.

In order to attain a simplicity of outline similar to that of British locomotives practically all piping has been concealed and a sand chamber inside the smoke box has been substituted for the sand dome usually carried on top of the boiler of Canadian locomotives. The handsome appearance of the new locomotive is enhanced by the fitting of a polished steel jacket.



G.N.R. Locomotive No. 1, the first of the 8 ft. Single Drivers designed by Patrick Stirling and built in 1870, alongside L.N.E.R. No. 4470, "Great Northern," the first of the Gresley "Pacifics" built at Doncaster in 1922. No. 1 ceased active work in 1907 and is now in the Railway Museum at York. (Photograph by Railway Photographs, Liverpool).

"The Cheltenham Flier"

A correspondent has sent the log of a run made by the *"Cheltenham Flier"* on the G.W.R., when the sharp schedule time of 70 mins. for the 77¼ miles from Swindon to Paddington was well kept in spite of three checks. The load was 210 tons and the engine was No. 4090, *"Dorchester Castle,"* in charge of Driver Bailey of Old Oak Common, who got some excellent work out of his engine.

Swindon was left punctually at 3.45 p.m. and rapid acceleration was made. Signals were "on" at Steventon and brought down the speed to 30 m.p.h., but Didcot, 24.2 miles from Swindon, was passed in 23 min. 45 sec. from the start. The 17.1 miles from Didcot to Reading were covered in 14 min. 15 sec. Permanent way repairs reduced the speed through Reading station to 25 m.p.h. and "signals" at Twyford necessitated a slack to 35 m.p.h. From these checks *"Dorchester Castle"* recovered with lightning rapidity and the 36 miles from Reading to Paddington were accomplished in 31 min. 50 sec. Notwithstanding the three checks, which it is calculated cost fully six minutes, the train finally came to a stand 10 sec. before the due time of 4.55 p.m. The maximum speed noted was 82 m.p.h., which, although high, is not unusual with this train.

Locomotive No. 6101 of the Canadian National Railway's new "6100 Northern" type, hauling the "Ocean Limited Express." This photograph was taken by our reader, W. Pippy, Springhill, N.S.

New Tank Locomotives on L.N.E.R.

The first of a new class of 2–6–2 tank locomotives has been put into traffic, and is working on local passenger services in the Southern Scottish area of the L.N.E.R. It has been built at Doncaster to the designs of Mr. H. N. Gresley. It is numbered 2900, and has three cylinders of 16 in. diameter and 26 in. stroke. The coupled wheels are 5 ft. 8 in. in diameter. The total heating surface is 1,324.93 sq. ft. and the boiler pressure is 180 lb. per sq. in. The grate area is 22.08 sq. ft. The engine carries 4 tons of coal and 2,000 gallons of water, and its total weight in working order is 84 tons. It has a tractive effort of 22,464 lb.

Another three-cylinder 4–6–0 express engine of the "Sandringham" class has been turned out from the works at Darlington. It is No. 2811, *"Raynham Hall."* Three more 2–6–0 engines of the "K3" class have also been completed. They bear the numbers 2767, 2768 and 2769.

Five 100 h.p. Sentinel engines have been delivered by the makers and are now working at Grimsby Docks, New England, Immingham, Wrexham and Bidston. Thirteen more are on order and will be completed shortly.

When working the Royal train recently, "Pacific" No. 4472, *"Flying Scotsman,"* made the run from Peterborough to Newcastle, a distance of 192 miles, without a stop.

L.M.S. Officers in America

A number of L.M.S. officers recently visited the United States in order to study American Railroads and their methods. This visit had been planned by Sir Josiah Stamp, President of the L.M.S. Company, who was himself in America last June. While in Baltimore the visitors were the guests of Daniel Willard, President of the Baltimore and Ohio Railroad and arrangements were made for them to inspect the shops, yards, terminal stations and marine facilities of this railroad. Similar visits to America have previously been paid by British Railway officers in order to investigate the operating conditions there.

Amongst those forming the party were Sir Harold Hartley, vice-president in charge of technical departments and scientific research; Sir Henry Fowler, chief mechanical engineer; A. Newlands, chief civil engineer; E. J. H. Lemon, carriage and wagon superintendent; F. A. Cortez-Leigh, electrical engineer; and A. F. Bound, signal and telegraph engineer.

Exciting Moments on an Express:

Making Motion Pictures of the "*Twentieth Century*"

By T. G. Price

LOCOMOTIVE 5222 and the twelve cars of the "*Motion Picture Limited*" stood on the siding at Chesterton, Ind. From the front coupler of the 300-ton Hudson type engine to the markers on the observation car the train was a mechanical counterpart of one section of the "*Twentieth Century*," except that it carried no dining car in the middle and no sign on the rear end.

The passenger list was unusual. John Smiley, Assistant General Superintendent, sat on the rear platform and consumed cigars. The other four passengers were holding a pow-wow with Mr. Vaniman, Road Foreman of Engines, in the cab of 5222. There was George Bainbridge, Assistant Director; the brothers, Oscar and Bill Ahbe, than whom there are no better motion picture cameramen in the city of Chicago, and the director of the piece.

"How do you want the engine run, Mr. Price?" asked Vaniman.

"Well," suggested the director, "you might run her to Englewood Station as fast as she'll go." The engine crew grinned expectantly.

"The speed limit is seventy miles an hour," stated Vaniman.

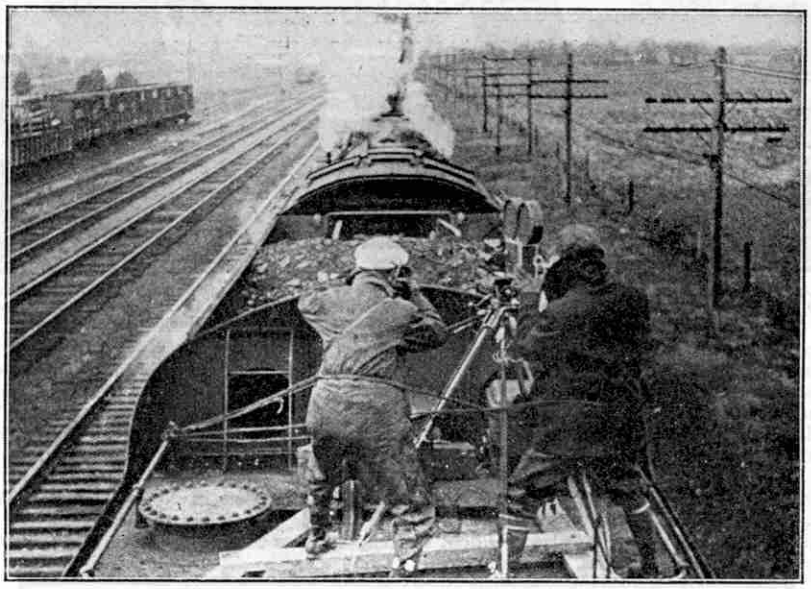
"All right, go the limit, as soon as you feel like it."

George Bainbridge squeezed his rotund bulk in behind the fireman on the left side of the cab. Oscar Ahbe crouched between the coal gates and adjusted the hand camera for the cab shots. Bill Ahbe and the director scrambled back over the coal to the flat deck of the tender. There stood the camera on its tripod, lashed down with steel cables to a complicated rigging of wood, rubber and springs to cushion the inevitable jarring.

There followed the rapid tolling of the bell. The world moved slowly backward. On their eerie perch Bill and the director pulled down their caps, leaned back on the safety ropes and prayed for sunshine.

The fake "*Century*" swung majestically on to the main line and headed for Chicago. The speed increased. The sound of the bell was drowned in the roar of the exhaust. The crossing at Porter swept by in a mad clatter. At forty miles an hour the director pointed ahead.

"Hit it!" he bawled, and the cameraman began to grind film. The speed mounted. Forty, forty-five, fifty—Bill and the director shielded their faces as best they could, stared ahead through clouded goggles and made unprintable remarks about red hot cinders. Breathing was becoming difficult.



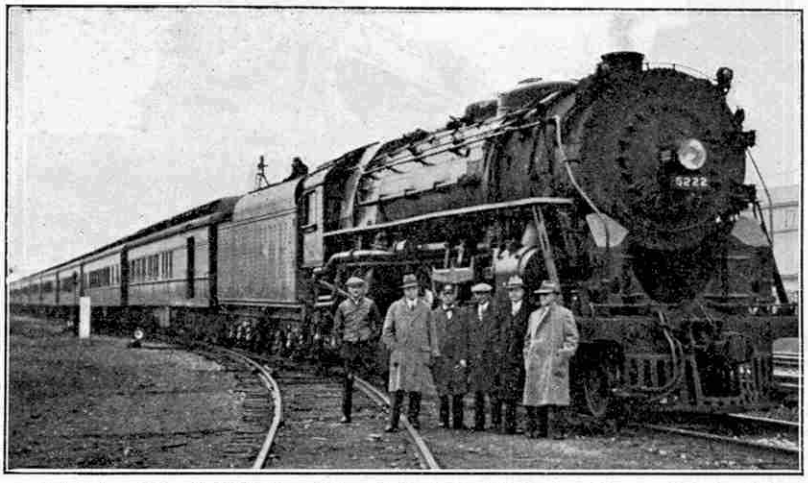
As the train headed for Chicago, cameraman and director leaned back on the safety ropes and prayed for sunshine.

As the 5222 rolled to a long reverse curve Bill swung his lens backward as the director pointed. Behind them stretched the scimitar of twelve steel cars and the rushing roadbed, balanced for artistic composition by the flying smoke and the whole framed in the autumnal loveliness of the sand dunes along Lake Michigan.

The whistle was blaring continuously now for the Dunes Highway crossings. Evidently Vaniman and the engineman weren't going to be cheap about doing the limit. Fifty, fifty-five, sixty. Wind shrouded the men on the tender in a buffeting, smothering tumult. Dumbly the director thumped the cameraman on the back and pointed to where steel mills loomed ahead. Speech was impossible, but Bill understood the signals and cranked his camera.

Then speed mounted steadily. Sixty, sixty-five, seventy, seventy-five. The 5222 was stepping out. They descended on Gary like a falling planet. The station platform streaked by in a blurr of whirring lampposts and white, upturned faces of waiting passengers.

Dull foreground, towering black stacks, framed by streaking clouds of steam flew to meet them. "Here comes Buffington," thought the director, gulping lungfuls of coal gas and cinders. Again he thumped his companion and pointed. Indiana Harbour whirled by, kaleidoscopic with shifting switch engines and the abrupt thunder of the bridge with its whizzing beams and girders.



A brief rest for "5222" and the staff of the "*Motion Picture Limited*."

Heads down against the wind and smoke, Bill and the director strove to keep the camera on its legs and working. Fine grit sifted under the padding of their goggles. Whiting flew by, a ghostly line of white oil tanks. Then came the flat yards to the east across which they could see Lake Michigan rolling to the first November gale. State Line and Calumet Generating Stations moved by majestically, remote on far horizons.

The special bellowed through the Grand Calumet Bridge and tore pell-mell along the embankment paralleling South Chicago Avenue. Houses sprang up as if by magic. Then the speed slackened. Bill

and the director were lowering the cameras as the 5222 rolled past Englewood Station and started down town at a respectable forty miles an hour.

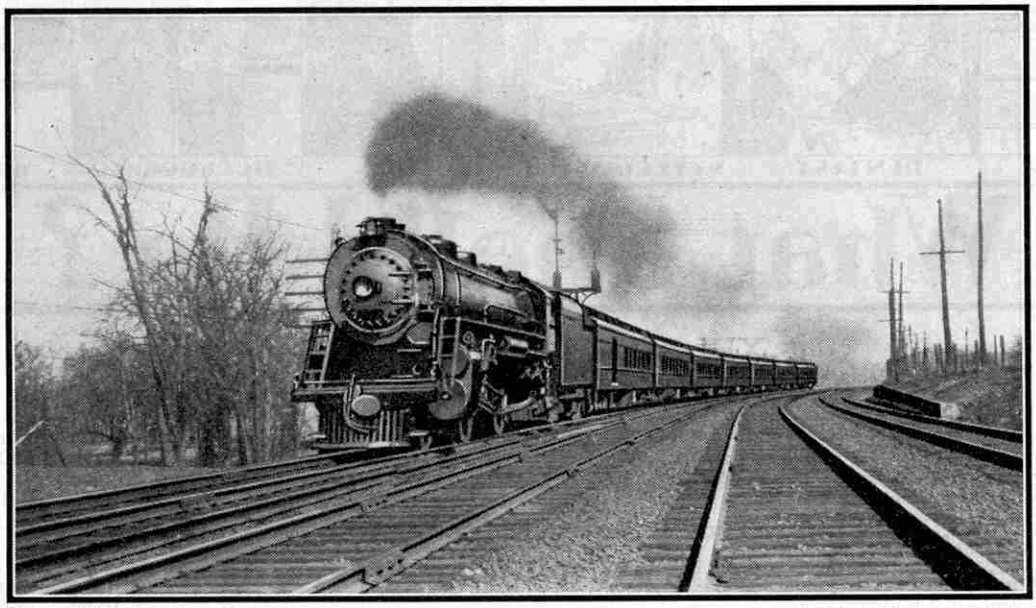
They ducked the low bridge at Fortieth Street—only 17 ft. 2 in. from top of rail to bottom of lowest girders—raised the camera again and repeated the whole performance at Roosevelt Road. The camera was still going as the big Hudson slid under the train shed at La Salle Street.

"Everything all right, Mr. Price ? " asked Vaniman when the director and the cameraman had finally tumbled their equipment and themselves back to earth. Both admitted that the engine had been run satisfactorily. Then up came Alan Rogers and John Smiley and made pointed remarks about black-faced comedians who wore dungarees and rode on the tops of engines.

But the all-important question was " Did you get the pictures ? " and both Bill and Oscar stated that they had got them.

A few days later the New York Central men saw the opening episode of the Commonwealth Edison Company's new film, " Your Chicago." That part of the picture follows the subtitle, " Through Chicagoland on the Famous Twentieth Century Limited." And just before you get to Gary, in the picture, the director inserted a title that wasn't called for in the original script. It reads, " The first successful motion pictures to be made from a locomotive travelling seventy - five miles an hour."

Ever since that first showing the cameramen and the director have been shaking hands with themselves, for the pictures are sharp, bright and steady and there is enough footage to satisfy the most ardent railroad enthusiast.



Photograph] [*Railway Photographs, Liverpool*

The " *Twentieth Century Limited*," hauled by locomotive No. 596.

But what is even more dear to the heart of the motion picture men is that the pictures are not faked or tricked in any respect, save only that they were not taken from the true "*Twentieth Century.*" (*For this interesting article and photographs we are indebted to the courtesy of the Editor of the New York Central Lines Magazine*).

L.N.E.R. Marshalling Yard

(*Continued from page 853*)

to wagons on British railways. This has now been overcome, however, and the retarders in use at Whitemoor deal with practically all types, except those in which the tyres are secured to the wheel centres by means of bolts. The pressure exerted by the rails would break the bolts, and wagons with wheels constructed in this manner are diverted to a special siding where fixed retarders check their progress.

In order to warn shunters of the presence of a wagon with projecting tyre bolts, a detector has been installed at the entrance to the reception sidings. The passage of a truck of this kind causes a bell to ring and the wagon responsible for this is then plainly marked with chalk.

The final result of shunting over the hump and sorting out by means of the automatic and manual points operated from the control tower is that wagons arriving from the north are distributed over the 40 sorting sidings. Each of the new trains thus formed has a special destination. For instance, that on one track is ready for despatch to Norwich ; the train on another is composed of wagons for Spitalfields ; and so on.

The total number of destinations for which trains are prepared at Whitemoor is no less than 350, and the organisation of such an immense number of services is a tremendous task. In order to enable the staff to deal quickly and accurately with the thousands of wagons that must be sorted and marshalled daily, a pamphlet of instructions was printed and distributed to them. This gives the numbers of the sorting sidings into which wagons for any given destination are shunted, and also shows for each siding the range of stations to which the vehicles in it may be despatched. The two lists are printed in alphabetical order of stations, and are so long that in the pamphlet they occupy no less than 58 pages. The careful arrangements ensure smooth working, and remarkable records in the speed with which trains are shunted have been made.

Mooring Big Ships

—(*Continued from page 859*)

and the task is completed.

Drawing a mooring screw that has served its allotted span of 15 years in the bed of a river is an nteresting task. The screw is buried too deeply in the ground to be extracted by merely unscrewing it, and it is heaved out of the river bed by sheer brute force. The 100-ton jib of the screw keel is employed for this purpose, a stout steel purchase wire being hitched to the ground chain. The direct pull on the screw usually is sufficient to drag it to the surface without any particular difficulty. Sometimes a full load is applied without effect, however, and a process known as " pinning down the keel " then becomes necessary. This means that the keel is pinned down to the screw at low water by means of a purchase wire from the jib, and allowed to stand-to until the rising tide lifts her gradually and so drags the screw from the ground.

If the screw continues to be obstinate and refuses to budge, it is abandoned and left to corrode in the mud. In that case it does not see daylight again until the bucket dredger comes along and ignominiously scoops it out.

What Shall I Be ?

XIII.—CIVIL ENGINEERING

THE term civil engineering is applied to an extremely wide field of activity. Strictly speaking it includes all branches of engineering that do not come under the heading of military; but nowadays we use the term mainly to include such operations as the erection of huge buildings, the bridging of rivers, the cutting of canals, the construction of dams and reservoirs, and the making of roads and railways.

Civil engineering has an amazingly long history. Indeed it may be said that civil engineering and civilisation have grown up together, for it is the civil engineer who has been responsible chiefly for the improvements in the conditions of life that have made advancing civilisation possible. In order to realise this it is only necessary to think how different the world would have been without the roads and bridges provided by the engineer; and these are only two of his great historical activities.

Many of the works carried out by civil engineers in the dawn of history exist to this day, and their enormous proportions, artistic design and skilful workmanship compel our admiration, even when we consider them in relation to the greatest engineering works of modern times. We know little of the methods adopted by the men who built the Great Pyramid, for instance; but even a brief examination of this stupendous structure tells us that these men were worthy of comparison with any of the great engineers of our time. Similarly the engineers who, thousands of years ago, cut the first canal to connect the Mediterranean with the Red Sea, deserve to rank with de Lesseps and Goethals, who carried out the greatest modern undertakings of the same kind.

Everywhere in the ancient world skill in engineering went side by side with power and wealth, but it was in Roman times that the connection between the two was first fully recognised. The Romans not only conquered country after country, but held their conquests securely for centuries; and they did so largely because their armies were followed by engineers who built the magnificent cities, roads, reservoirs and aqueducts of which the ruins may be seen throughout the extent of the old Roman Empire. Even these ruins are sufficient to show the excellence and durability of the workmanship of the Roman engineers, and indeed certain waterworks constructed by them 2,000 years ago are still in use.

Coming to our own times, it is impossible to overestimate the part played by civil engineers in the industrial development of Great Britain. Their work has been one of the great romances of modern civilisation, and many of their names are familiar to all readers of the *"M.M."* There is Myddelton, London's first great waterworks engineer; Brindley, who constructed the Bridgewater Canal and the Grand Trunk Canal, and in connection with the former astounded his generation by carrying the canal by means of an aqueduct over the River Irwell; and Telford, road-maker, builder of the first iron bridge, and of the Menai and Conway suspension bridges. Other names that readily occur are those of Brunel, railway builder, and in between times pioneer of steamship construction; Smeaton, builder of the Eddystone Lighthouse; Rennie, constructor of bridges, harbours and canals; and Metcalf, the blind roadmaker. These men were pioneers. With supreme confidence in their own ability they dared to attempt things that had not been tried before, and their work has made possible the great achievements of modern civil engineering.

In considering the prospects of this important and widespread branch of engineering it must be pointed out that it differs from the branches already dealt with in that it is not usual for a large permanent staff of employees of all grades to be attached to any firm of constructional engineers. The reason for this is that the work cannot be localised in the manner that is possible and customary in the manufacture of, for instance, steam engines, motor cars or electrical machinery. A large firm of contractors may at one time be erecting a huge steel bridge in a remote part of Africa; and this may be followed by the driving of a tunnel through a range of mountains in South America, or the building of a breakwater to protect a harbour in the Far East. In connection with such works it is clearly impossible to carry round a large staff, and the usual plan is to recruit unskilled and semi-skilled labour on the spot. The permanent staff usually consists of the engineers in charge, together with a number of men who, by education, training and experience, have become capable of assuming responsibility in directing the efforts of the unskilled workers.

It will be obvious that under conditions of this kind definite schemes of apprenticeship and training are practically impossible. There are a few cases in which boys are engaged on terms similar to those that apply to trade apprentices in other branches of

FAMOUS ENGINEERS—13

Sir Ernest W. Moir, Bart., was President of the Engineering Section of the British Association at its hundredth annual meeting held at Bristol from 3rd to 10th September. When still a young man he was given charge of the erection of the southern cantilevers of the Forth Bridge. Later he became resident engineer on the Hudson River Tunnel Works, New York, and while engaged on this work he invented the medical air lock used for the protection of men suffering from the effects of working in compressed air.

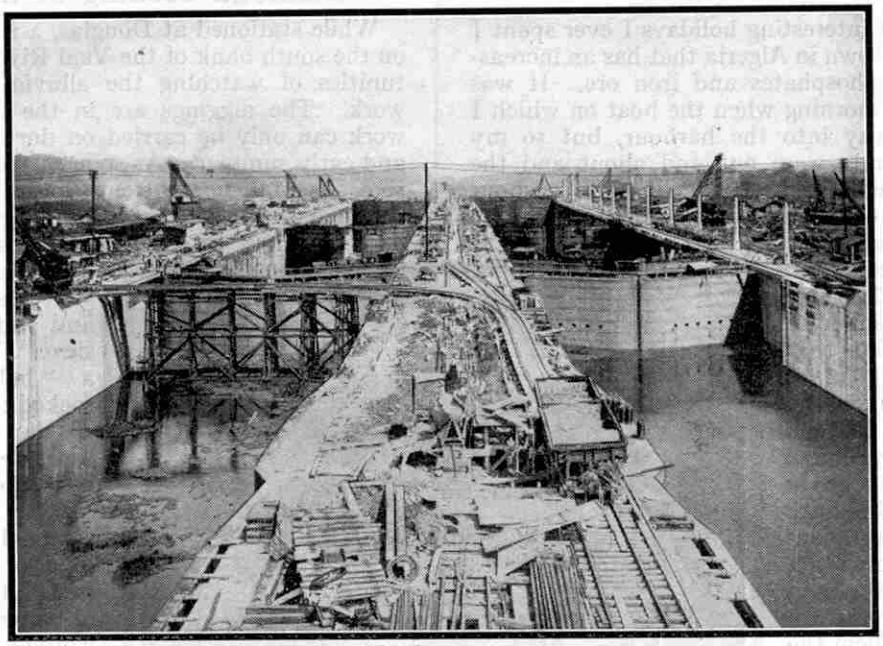
Since that time Sir Ernest has directed many important operations, including dock extensions and the boring of railway tunnels in London, and harbour works in this country and abroad. During the War he was appointed Comptroller of the Munitions Inventions Department of the Ministry of Munitions, and later he became the representative of the Ministry in the United States.

engineering. In addition, certain firms that have no regular apprenticeship schemes take on boys as rivet heaters or hammer boys and allow them to work their way upward until they become fitters and erectors. In such cases the sons and relatives of men already in the employ of these firms are usually given preference. Those who find employment in engineering work in this manner can scarcely be described as civil engineers, however. That term is properly applied to the men who plan the work, and to those who carry out these plans.

Generally speaking, it may be said that there are two chief classes of civil engineers. On the one hand there are the designer of structures of all kinds, and the consulting engineer who places his specialised knowledge and experience at the disposal of those responsible for outstanding engineering works. On the other hand there is the practical engineer, who must be capable of understanding the ideas and intentions of the men who have planned the work that he superintends.

The distinction between the two classes of engineers is one for practical convenience only. In regard to training and qualifications there is no difference between them and, in fact, the ranks of consulting engineers are largely recruited from those who have been engaged in superintendingconstructional work, for that is by far the best means of gaining practical experience.

The responsibilities of a civil engineer are very great, and in order to qualify for posts of the highest class it is essential to take a degree course at a University. Practically all British Universities have an engineering department, in which special courses in civil engineering are usually arranged. On the average these occupy three years, but it is advisable to give four years where possible, and to take an honours degree in civil engineering. The courses include the necessary training in mathematics and scientific subjects to enable the future engineer to understand the materials with which he will work, and to make the intricate calculations of strains, stresses and pressures that play so great a part in the design of large engineering structures. In the earlier years of his course a good foundation of general engineering knowledge is laid, and this is followed by a study of the special aspects in which he is generally interested. Needless to say, the training of a civil engineer does not come to an end when a degree has been obtained, and opportunities for more advanced study are afforded by most Universities, in which post-graduate courses in municipal engineering, engineering geology and similar subjects are arranged.



A scene during the cutting of the Panama Canal, one of the world's greatest engineering projects, showing the Gatun Locks in course of construction.

After completing a University course in civil engineering the chief need is experience, for unless supplemented by extensive practical knowledge, no engineering degree is sufficient to qualify for a responsible position. Experience may be gained in a variety of ways, and the choice of the course to follow depends very largely upon the particular branch of his profession favoured by the young engineer.

If general engineering work is to be followed, the best plan is to seek a position on the staff of a large firm engaged in carrying out engineering contracts either at home or abroad. Such a position may be only temporary, and on the completion of any particular piece of work it may become necessary to seek a new post. But occasionally vacancies arise on the permanent staffs. These may be filled by the appointment of men who, while engaged in a temporary capacity, have proved themselves to be capable engineers, and in any case further positions probably will be offered to those who have shown themselves worthy of encouragement.

The prospects open to a young engineer who has made good in practical work of this kind are excellent. With increasing experience he may rise to responsible and well-paid posts, and eventually be given complete charge of the execution of important works. In a sense there is no limit of salary, particularly if an engineer shows such outstanding ability that he becomes one of the principals of the firm with which he is engaged.

An engineer who has gained practical experience in different parts of the world may become a consulting engineer. This is a particularly remunerative occupation for the man who has acquired a detailed expert knowledge of one or more special aspects of his profession, for those engaged in undertakings of the type that he has specially studied are glad to avail themselves of his advice and general assistance.

Many civil engineers enter the profession in direct association with special branches, of which municipal engineering, waterworks, railway, dock and harbour engineering are examples. In such cases the custom of serving articles with an engineer already well established is largely followed. For instance, a young man who is specially interested in waterworks engineering may serve for a limited period as a pupil under the engineer-in-charge of the water supply of a large town or district. This does not replace ordinary training as a civil engineer, of course, but is an excellent means of obtaining the necessary practical experience. It has the added advantage that the pupil is constantly in direct contact with a fully qualified engineer of high standing, from whom he may receive valuable advice and guidance.

The terms on which a civil engineer takes a pupil are a matter for arrangement. In most cases a premium is required, and the amount asked depends partly on the position occupied by the engineer with whom the articles are served, and partly also on the prospects of the branch or profession concerned.

There is a great variety of posts open to the young engineer who follows this course. Thus he may enter the engineering department of a large borough, where he will be chiefly concerned with the planning of roads and the supervision of their construction and repair. In some boroughs the work of the Municipal Engineer includes also the care of the water supply, and sometimes of the sewerage, gas and tramway undertakings; but in the larger cities, where the best experience is to be gained, these usually are separate departments, each under a responsible head specially qualified to be in charge. In addition there are many posts in connection with docks and harbours in all parts of the world, while the construction and maintenance of the permanent way of railways is another outlet for the special knowledge of the civil engineer. The Admiralty and the Ministries of Transport and Health offer many important posts in this country, and India and the great Dominions offer prospects for those who are willing to travel overseas. These posts are usually filled directly by the Departments concerned, but in certain instances the recommendations of eminent consulting engineers are accepted. The work in most cases is attractive and the pay is quite good, commencing at about £450 a year and rising to £1,000 a year, and in many cases even more.

Civil engineers who are of an adventurous character will find good opportunities in the British Dominions, in many of which there is still a call for pioneer civil engineering. There are many good openings of this kind, and those who wish to take advantage of them will find it advisable to receive part of their training at Universities in the Dominions chosen.

As in the case of other branches of engineering, a society exists to look after the interests of civil engineers, and to give them opportunities for discussing problems that arise in connection with their profession. This is the Institution of Civil Engineers, the headquarters of which are in Great George Street, London, S.W. Full details of the various grades of membership may be obtained from the Secretary.

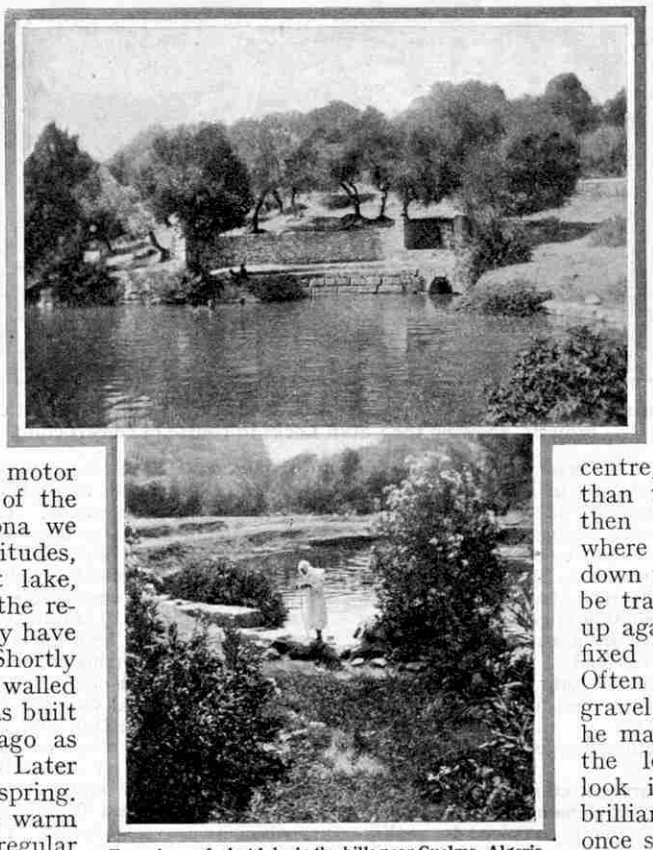
From Our Readers

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.

My Holiday in Algeria

On one of the most interesting holidays I ever spent I visited Bona, a small town in Algeria that has an increasing export trade in phosphates and iron ore. It was only 4 o'clock in the morning when the boat on which I travelled made its way into the harbour, but to my surprise the inhabitants were out and about and the quayside workers were busily engaged. The harbour is rather pretty. It consists of three sections. In two of these cargo boats are loaded and discharged, and in the innermost of the three I noticed a large number of small boats and yachts that at week-ends and on holidays are used for pleasure sailing.

Part of the interest of Bona is due to its antiquity. Near it the ruins of Hippone, a Roman city, may still be seen and the waterworks constructed by the Romans are still in use. The reservoirs in which the water is stored are underground and in them the liquid is kept very cool and fresh.



Two views of a hot lake in the hills near Guelma, Algeria. Ruins of ancient buildings erected on its shores may be seen in the upper illustration.

I joined in an interesting motor run to the mountains south of the town. Soon after leaving Bona we began to climb to greater altitudes, and presently reached a hot lake, on the shores of which were the remains of old buildings that may have been baths or temples. Shortly afterward we passed through a walled town called Guelma, which was built by the French many years ago as protection from the Bedouins. Later we encountered a hot sulphur spring. The ground near it was quite warm and the liquid poured out in a regular cascade.

On making my may into the town one evening during my stay I was surprised to see that the trees on the boulevards were festooned with gaily coloured lights. The band and orchestra were playing; the cafes, which during the day were sparsely attended, were now crowded with customers; and the booths in the native bazaar or market were lit by glaring flares and surrounded by women buying sweets, apples, peaches and other fruits. It was a fête day, and the purchases were being made in preparation for the festive suppers that were to follow. Everybody was happy and I watched the scene with pleasure almost equal to that of the people themselves.

J. L. NORWELL (Whitecraigs.)

Diamond Seeking in the Vaal River

While stationed at Douglas, a small town or "dorp" on the south bank of the Vaal River, I had many opportunities of watching the alluvial diamond diggers at work. The diggings are in the bed of the river and work can only be carried on during the winter months and early summer. As soon as the level of water in the river has fallen sufficiently, the diamond seekers set native labourers to work digging for the gravel that contains the precious stones. When a layer is struck, the gravel is lifted out in buckets and dumped on a coarse sieve. The diggers call this a "baby" because it is rocked to and fro, the purpose of the movement being to separate the coarse gravel from the fine.

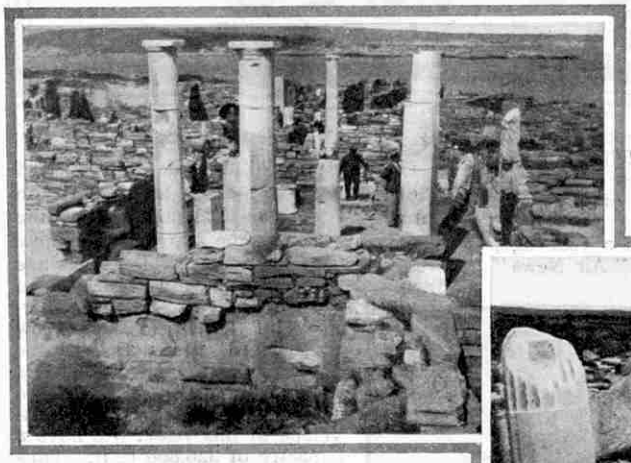
Only the fine gravel is retained. This is placed in a sieve of narrow mesh, which is then transferred to a barrel of water and the gravel in it whirled rapidly round. If there is a diamond in the mass it gravitates to the centre, its density being much higher than that of gravel. The sieve is then taken to the sorting table, where it is sharply turned upside down in order that its contents may be transferred without being mixed up again. All eyes are immediately fixed on the centre of the wash. Often nothing is to be seen but gravel, but if the digger is fortunate he may see a diamond lying among the loose silt. He cannot overlook it, for it is wet and glitters brilliantly, making a spectacle that once seen is never forgotten.

A diamond unearthed in this manner is carefully treasured by its finder until a diamond buyer visits the town. The fortunate owner then reaps the reward of his luck and patience. Instead of diamonds, garnets and rubies are more often found in the wash, however. But the digger never loses hope and continues to wash the gravel time after time in the expectation of at length finding a diamond that will make his fortune. In spite of the fact that finds of this kind are rare, the occupation is fascinating. In South Africa it has become proverbial that "once a Digger, always a Digger," and rumours of discoveries attract many new-comers.

J. A. N. BEYERS (Pietermaritzburg).

The Ruins of Delos

Delos is a rocky island washed by the bright blue waters of the Ægean Sea. It is one of a group known as the Cyclades, and was regarded as a sacred island for centuries after the mythical times when it was believed to have floated about the ocean. According to early Greek legend, it was driven by the waves into the centre of the Cyclades and there brought to anchor in its present position by Jove himself.



(Left) The amazing expanse of ruins of ancient Greek buildings on the island of Delos. (Centre) A wonderfully-preserved mosaic on the floor of a Delian temple. (Bottom) Statues of lions on Delos. These were carved more than 2,000 years ago, and their surfaces have been worn remarkably smooth.

In classical times many wonderful temples were built on Delos, most of them of marble imported for the purpose, and at one period in its history the island was remarkable for its flourishing commerce. It was laid waste in one of the numerous wars between the Romans and the Greek kings of the East, and in spite of many attempts to revive it the island never regained its former prosperity.

To-day Delos is almost deserted, the only inhabitants in addition to the keepers of the ruins and of the museum being a few fishermen. It attracts many visitors, however, all of whom are interested in the wonderfully-preserved ruins of the ancient buildings. A number of these are on the slopes of Mt. Cynthus, a steep and rugged peak 350 ft. in height, and an Ionic temple is actually on the summit of the hill. Other reminders of the wonderful skill of Greek architects of classical times include the ruins of a colossal statue of Apollo, a portico erected by Philip of Macedon and the so-called "treasury of Delos." An interesting relic of the days when Delos was of great religious importance is a circular tank or lake that supplied water for the rites performed in the temples. Perhaps the most imposing ruins on the island are the remains of a magnificent Temple of Apollo, among the chief attractions of which are beautifully coloured mosaic floorings. These have been covered by glass in order to preserve them from injury. But the glass is removed when visitors wish to examine the mosaics and the guides then brighten up the colours by wetting them with a sponge.

It is interesting to note that in ancient times a festival celebrated on the island every five years included games and competitions. Although these were not as famous as the celebrated Olympic Games they attracted multitudes of visitors.

B. G. PAPACONSTANTINO (Athens).

A Saw-Mill in British Columbia

Recently I visited one of the largest and most modern sawmills on the Pacific Coast. This is situated at Port Hammond on the banks of the Fraser River in British Columbia. I began my tour at the riverside, for the logs arrive by water. As they float in the pool they are seized by hooks and dragged on to an incline, up which they are pulled by means of a winch. When they reach the top the hooks are automatically released and the logs roll over on to a conveyor that carries them into the mill itself.

From the conveyor each log is quickly taken to the "log carriage." This is a long platform on rails that is pulled to and fro by means of a cable. On it the log is carried against a large bandsaw that trims off the bark, and it is then automatically set forward to the saw, where the sides are squared. This operation fascinated me, for as soon as one side has been treated a mechanical arm called the "nigger" shoots up from the floor and with almost uncanny accuracy tosses the log over in order to bring the next to the saw. The logs are sawn into planks of any required thickness, and finally eight saws mounted in a gang on a frame that moves up and down at great speed reduce these to scantlings.

The logs themselves and the planks and scantlings into which they are cut up are moved about the mill by means of conveyors, the timber not being touched by hand from its entry into the mill until the time when it reaches the storage piles. Even examination is not left to human agency, for a special machine unerringly picks out scantlings of wrong size and diverts them to a conveyer that returns them to be re-sawn. Those that are correct in size continue along the conveyer to the storage pile, where they are put in position by means of a large gantry crane.

The immense forests of British Columbia now yield enormous supplies of timber yearly. When the trees growing on the mountain slopes have been felled, the logs are trimmed in readiness for their journey by water to the sawmill. In many instances they are sent down flumes or channels into which water has been diverted from a convenient stream. As this rushes down with great speed it carries the logs with it.

J. CLARKE (Vancouver).

Aviation in Canada

A remarkable demonstration of the safety of flying is provided by the fact that in the course of three years the organised Canadian air mail services have not lost a pound of freight, nor has a single life been lost in maintaining them. The record is particularly noteworthy, for the distances covered by the air lines are very considerable and in many cases penetrate into the regions where the ground organisation necessarily is of a very primitive kind.

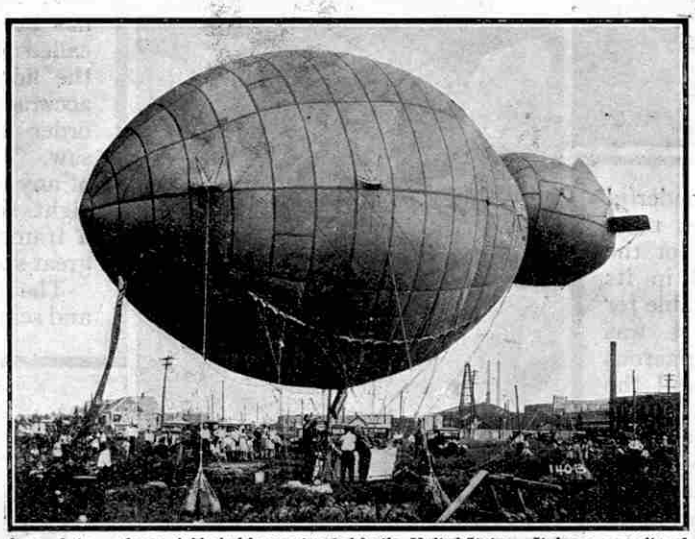
The recently published Report on the Progress of Civil Aviation in Canada during 1929 shows that flying in that country is making great progress. According to the Report aerial work in connection with the conservation of forests was continued on a larger scale than ever before, and the lines to the far North have established themselves as an essential part of the Dominion's general transport systems. In addition air mail services now span half the Continent, and night flying across the prairie regions is undertaken regularly. Municipal authorities have recognised the value of aircraft in improving communication between different sections of the country, and are contributing considerable sums for the building of aerodromes, the laying out of landing grounds and the establishment of efficient ground equipment for both night and day flying.

Advertising by Airship

Novel use recently was made of a small blimp airship owned by the Airship Development Co. Ltd., of Cramlington. Large banners were fixed on each side of the envelope. On these was an announcement in bold lettering to the effect that space on the vessel was "to let" for advertising purposes. The airship was then flown over London. The originality of the scheme announced in this striking manner appealed to many firms, and it is believed that several "space bookings" have been made.

From the advertiser's point of view the medium has much to commend it, for a notice displayed on an airship is brought to the attention of practically every inhabitant of the district over which it is flown, and, unlike sky-writing, an advertisement thus displayed is not blown away by the wind.

While some may object to the appearance of advertisements in the sky, it is scarcely probable that as much antagonism will be aroused as probably would follow the use of huge loud speakers carried in aircraft. A proposal to make use of these for advertising purposes was made in Australia a little more than a year ago, and was referred to in the "Air News" pages of the "*M.M.*" for August, 1929. Since the invention of this unwelcome method of advertising little use has been made of it, however, and it is to be hoped that in this country, at least, it will never be employed as a regular advertising medium.



A novel type of non-rigid airship constructed in the United States. It has a capacity of 22,000 cu. ft. and when in the air is steered by means of the small auxiliary lobe in the rear During test flights a speed of 20 m.p.h. was attained.

Across America in 12 Hours

A new record for the flight across the United States from the Pacific to the Atlantic coast has been set up by Mr. F. Hawks, an American pilot. The flight was made from Los Angeles to Long Island and stops were made at Albuquerque, Wichita, and Indianapolis en route. The approximate distance flown was 2,500 miles, and this was covered in 11 hr. 40 min. flying time, giving an average speed of 214 m.p.h. The machine in which the flight was made was a Travel-Air monoplane. The previous record for the flight was held by Colonel Lindbergh with a flying time of 14 hr. 10 min.

It is interesting to note that Mr. Hawks also holds the record for the transcontinental flight in the opposite direction, having flown, also in a Travel-Air monoplane, from New York to San Francisco in 13 hr. 38 min. This gives an average speed of over 200 m.p.h. for the journey.

World's Largest Non-Rigid Airship

On page 781 of last month's issue of the "*M.M.*" appeared an article on "blimps," or non-rigid airships, of the Goodyear fleet. The largest of these vessels is the "*Defender*," the envelope of which has a capacity of 178,000 c. ft. The Goodyear-Zeppelin Corporation have now commenced construction of the envelope and control surfaces of another "blimp" for the United States Navy. The envelope of this vessel will have a capacity of 320,800 c. ft. Thus it will be nearly twice as much as the "*Defender*," and when completed will be the largest non-rigid airship in the world.

The new vessel will be 220 ft. in length and 54 ft. in diameter, and the car will be large enough to accommodate a crew of six men. It will be fitted with two 200 h.p. engines that will give it a maximum speed of nearly 58 m.p.h.

The engines will be interesting features of the airship, for they are to run on gas instead of petrol as the vessel is to be employed in experimental work on the use of gaseous fuel. This scheme has already been adopted in the case of the German airship "*Graf Zeppelin*." The advantage is that the gas used has approximately the same density as air, and the change in buoyancy following its combustion therefore may be compensated by allowing air to replace it.

In the American airship the gas will be carried in a bag placed within the envelope itself. The engines will also run on petrol, and a supply of this will be carried in tanks situated outside the car for use when the supply of gas is exhausted.

London-Le Touquet Service Resumed

It has now been found possible to resume the popular London-Le Touquet services, which, as mentioned in our April issue, were suspended on account of the bad state of the aerodrome at Berck. On the outward route there are now two services every Friday and Saturday, and one on Sunday. The return services from Le Touquet are on Sunday, when one journey is made, and on Monday and Tuesday, two flights being made on each of these days. The outward journey from London to Le Touquet is scheduled to take on the average about 2 hr. 35 min., and the return journey in 2 hr. 30 min. As on the London-Paris services of Imperial Airways Ltd. multi-engined air-liners are employed.

Interesting American Helicopter

Helicopters, or aircraft fitted with horizontal screws, have always exerted a great fascination on inventors, and from time to time reports of successful aircraft of this kind have been circulated. An ideal helicopter should be capable of ascending and descending vertically but although startling claims have been made for various machines none has yet been produced that fulfils this condition. The nearest approach to the ideal that has so far appeared is the Cierva "Autogiro." This machine is very efficient and gives onlookers the impression that it crawls through the air. Its landing speed is so low that when the wind is favourable the machine is capable of alighting on a predetermined spot without running along the ground.

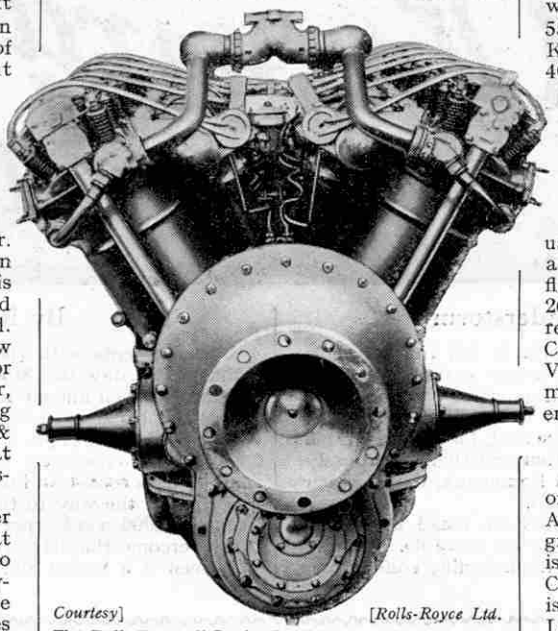
A rival to the "Autogiro" has now been produced in America. The inventor of the new machine is Mr. M. B. Bleecker, a young engineer. His machine is being developed by the Curtiss Aeroplane & Motor Corporation, and it is claimed that trials have shown it to be quite satisfactory in action.

The fuselage of the Curtiss-Bleecker helicopter is similar in design to that of an ordinary aeroplane, but it has no engine and airscrew in front, thus allowing more efficient streamlining. Above its centre are the four horizontal blades of the airscrew. These are driven by an engine placed in a nacelle situated midway between the two cockpits provided. The rotation of these blades provides the lift and horizontal motion of the aeroplane. They are of aerofoil section, and are much wider than those of the "Autogiro." They differ from those of the older machine also in the manner in which they are caused to rotate. On the "Autogiro" it is the passage of the machine through the air that causes the movement of the blades, but on the Curtiss-Bleecker machine they are driven by means of four-bladed airscrews, one of which is fitted to each vane. A complicated system of shafts and universal joints transmit the drives through reduction gearing from the Pratt & Whitney "Wasp" engine employed.

A curious feature of the machine is that the nacelle in which the engine is mounted is free to rotate. If this were not the case the whole machine would revolve in the opposite direction to that of the blades.

When the vanes are moving into the wind their speed relative to the airstream is greater than when they are moving against it. The result of this would be to cause the machine to bank over when in flight, and a novel scheme has been evolved in order to prevent this. A little behind each vane a small blade, 12½ sq. ft. in area is mounted on struts. These blades are of aerofoil section and are termed "stabovaters." When turning into the wind each stabovater tends to rise and this raises the trailing edge of the vane on which it is mounted, the vanes being left free to turn in this manner. This causes the blade to lose a certain amount of its lift and so to drop the machine on that side in order to maintain a level position. When the vane turns with the wind the stabovater falls back to its normal position.

Another interesting feature of the machine is that the rudder is hinged longitudinally instead of about a vertical axis. The reason for this is that the slipstream from the rotating blade is forced downwards. Consequently it would have no effect upon a rudder hinged in the ordinary manner. We hope to publish photographs and further details of this interesting machine in an early issue of the "*Meccano Magazine*."

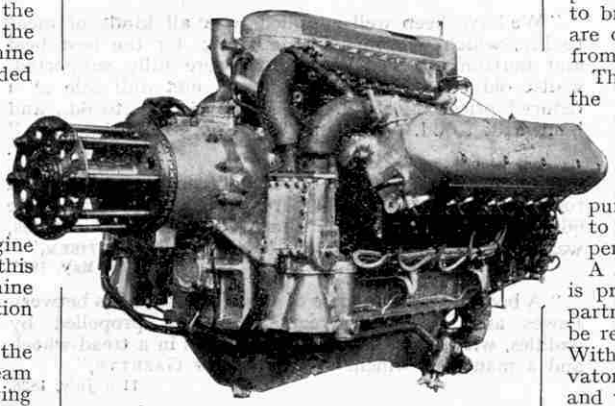


Courtesy] [*Rolls-Royce Ltd.*

The Rolls-Royce "Condor III" aero engine seen from the airscrew end. This engine is of the type that was used in the Fairey "Atalanta" flying boats, which are no longer in service.

Life-Saving Vest for Airmen

All members of the flying branch of the Ontario Forestry Department are now required to wear a special life-saving vest.



Courtesy] [*D. Napier & Son Ltd.*

A three-quarter front view of a 450 h.p. Napier "Lion" engine. The "Lion," both in this and in improved and more powerful designs, is extensively used in the R.A.F.

This is made of rubber and at the lower right-hand edge a small clip is fitted to it. If the wearer has to make a forced landing on water, he unfastens the clip, which then allows compressed air to pass from a small cartridge into the vest, which is thus inflated with sufficient air to keep a load of 300 lb. afloat indefinitely.

New British Anti-Aircraft Gun

A new type of anti-aircraft gun recently produced in England has been subjected to numerous trials by the Admiralty. Details of the gun naturally are not available for publication, but it is reported to be of unusual size, and to have more than one barrel.

New Light Aeroplane Records

A world's single-seater light aeroplane endurance record has been set up by Mlle. Maryse Bastié, a French airwoman, who made a flight that lasted for 37 hr. 55 min. The record was set up on a Klemm monoplane equipped with a 40-50 h.p. Salmson engine, and exceeded the previous record, which was held by Mlle. Lena Bernstein, by approximately 1 hr. 40 min.

A world's single-seater light aeroplane record for distance flown in a closed circuit also has been created by M. Laulhe, a French airman, who used an Albert monoplane fitted with a 40 h.p. Salmson engine. This pilot flew a distance of about 1,690 miles in 26 hours, thus easily beating the previous record of about 1,550 miles held by the Czechoslovakian pilot, Commandant Vicherik, who made his flight in an Avia II monoplane, equipped with a 60 h.p. Walter engine.

Canada's Airship Mooring Tower

On the arrival of "*R100*" at Montreal on the conclusion of her flight across the Atlantic Ocean she was moored at the great mast at St. Hubert Airport. This is one of the largest landing fields in Canada. It has an area of 615 acres, and is located on the south side of the St. Lawrence River, only seven miles from Montreal.

The St. Hubert airship mooring tower is an octagonal structure 171 ft. in height, surmounted by a steel plate turret 25 ft. in diameter. From the top of this turret projects a telescopic mooring arm to which the nose of the airship is attached, and which can be extended 7½ ft. The total height of the tower, measured to the top of the mooring arm, is 205 ft. The powerful electric winches that were used to bring "*R100*" safely to her moorings are operated by means of remote control from the towerhead.

The tower is well equipped to meet the needs of airships moored to it. It contains a series of pumps capable of raising 2,000 gallons of fuel per hour to a height of 400 ft., and there are also two pumps for delivering water ballast to an airship at the rate of 5,000 gallons per hour against a head of 250 ft.

A 12-inch gas main up the tower also is provided, in order that the gas compartments of airships moored there may be re-filled with the minimum of trouble. Within the tower there is also an elevator that has a capacity of 3,000 lb. and travels at a speed of 150 ft. per min. This is used for lifting passengers, mails, provisions and other cargo to the level from which entrance is gained to the ship along the small gangway lowered from its nose. Searchlights are provided on a special platform 143 ft. 6 in. above the ground, and they are used to light up the anchorages at night.

It is of interest to note that the mooring head, which contains 87 tons of steel and equipment, was manufactured in England, but was erected by Canadian Vickers Ltd., of Montreal, who also manufactured and erected the tower on which it is mounted. The amount of structural steel used in the construction of the tower was nearly 290 tons. The Airport also is fully equipped with underground storage tanks for fuel and water, and has a hydrogen generating plant and gas holder in addition to a great variety of machinery and other equipment.

Of General Interest

Safest Place in a Thunderstorm

The safest place during a thunderstorm is the interior of a steel building. There the discharge is safely carried away to earth through the steel framework, and points in the interior remain unharmed. In the most modern steel buildings erected in America lightning cannot even injure the roof, for a considerable quantity of metal is used in its construction and this is purposely brought into good contact with the steel framework, down which the lightning may pass harmlessly to earth.

In houses to which lightning conductors are fitted the safest place is as far away from the conductor as possible. To-day very few houses are deliberately fitted with lightning conductors, except in the country, but nevertheless every house possesses one that is not usually visible. This is the plumbing system, for in practically every case an air vent or overflow pipe runs up to the roof or very near it. Another good rule for safety in an ordinary house, therefore, is to keep clear of water pipes, an especially dangerous place to avoid being the space between two of them, or between pipes and the radiators of a central heating system.

Any precautions that are taken are almost superfluous, however, for the chance of being struck by lightning when at home is only one in many millions. It has been calculated that on the average, a city house in the United States would be struck only once in every thousand years, and such a building appears to be in greater danger of falling to pieces than of being destroyed or even damaged by lightning!

Even a house in the most dangerous position—on a hill-top unsurrounded by trees—is only liable to be struck once in every 100 years, and the chance of the inhabitants of such a house being injured is only one in several millions.

Ober a Hundred Years Ago!

"In the town of Birmingham there are seventy-three founderies, and but twenty milliners and dressmakers, and there are in the town, which contains nearly 100,000 inhabitants, only five music dealers, while there are seven coffin furniture makers, and three manufacturers of felons' irons."—"HAMPSHIRE ADVERTISER,"
29th March, 1827.

"We have been well supplied with all kinds of meat to-day, which was in good demand; for the best beef and mutton our last quotations were fully supported, whilst old ewes and inferior beasts met dull sale at a reduced price. Beef 5d. to 6d., mutton 5d. to 6d., and lamb 5½d. to 6d. per pound."—"LIVERPOOL MERCURY,"
28th September, 1827.

"The estimates of the Liverpool and Manchester rail road are taken at £12,000 per mile! The road is to be 66 feet wide. This estimate includes the cost of engines, wagons, and warehouses."—"HANTS ADVERTISER,"
9th May, 1825.

"A boat, on the principle of steam-vessels, plies between Lewes and Newhaven regularly, being propelled by paddles, with the assistance of two dogs in a tread-wheel, and a man at a winch."—"BRIGHTON GAZETTE,"
11th July, 1828.

Remarkable Ocean Drifts of Bottles

Two instances of long drifts made by bottles thrown into the ocean recently have been reported. One of these was thrown overboard by an officer of a Norwegian steamer and drifted 6,000 miles before being picked up among the Marshall Islands in the Pacific Ocean. In the second case the length of drift was 7,000 miles greater.

The longest drift that is recorded in the Hydrographical Offices at Washington was made between May, 1909 and May, 1912. In the three years the bottle travelled eastward from the south Indian Ocean to the tip of Cape Horn, covering a distance of about 11,820 miles. Even longer voyages of this kind have been made, however, and one bottle is said to have travelled almost round the world in the southern hemisphere. In this case the distance covered was 15,000 miles, and the drift occupied **32 years!**

By Rocket to the Moon

Experiments with rockets are still being pursued in the hope that some day the Moon may be reached by that means. In France a well-known inventor has stated that if the necessary financial backing could be obtained, a journey to the Moon and back will be feasible within the next ten years. He bases his belief on the discovery by Professor Oberth, of Germany, of means of giving a rocket an initial speed of 4,000 yards per second. This is well on the way to the speed of 11,000 metres, or a little more than 10,000 yards, per second, required from a rocket that is to overcome the attraction of the earth.

Even if a rocket that could escape from the earth were constructed several other difficulties would remain to be overcome. One of these would be how to protect travellers from the shock of being suddenly shot off at this tremendous speed. A greater difficulty is to ensure the return from the Moon! Even if such a rocket did not hit the surface of our satellite with sufficient violence to be smashed to pieces, it is by no means easy to see how the necessary machinery for starting it on its return journey could be constructed there.

Considerations of this kind are not preventing experiments from being made, and Professor Oberth hopes shortly to fire a rocket of the type that will be used for Moon journeys. In this instance the rocket will only reach an altitude of 30 miles above the earth's surface, but the professor expects that the trial will give information that will enable him to make a second missile capable of travelling the 240,000 miles that separate the Moon from the earth.

Professor Oberth's rocket is made of steel. It is about seven feet in length and 12 in. in circumference. A special gas mixture will be exploded in order to give the necessary power. An interesting feature of the scheme is that the rocket is provided with a parachute that will open automatically when the greatest height has been reached. The return of the rocket therefore will be gradual and its descent upon the earth will do no damage. The inventor is thoughtfully attaching a red light to the parachute, partly in order that its course may be followed by observers and partly also to enable people on earth to get out of its way when it threatens to descend upon them! Naturally the results of Professor Oberth's experiment will be awaited with great interest and if his rocket reaches the height aimed at there will be much speculation on the possibility of reaching the Moon.

In the meantime preparations also are being made for journeys across the Channel by rocket and, as already mentioned in the "*M.M.*," it is seriously proposed to transmit mails by a rocket air service capable of spanning the Atlantic in 30 minutes. This may not yet be feasible, but the proposal suggests that practical schemes may follow from experiments with rockets.

How the Grid-Glow Tube Works

A neon tube that may be made to glow by approaching it or even merely waving a hand over it has been developed in America in the Westinghouse Research Laboratories. In size and appearance this resembles an ordinary wireless valve, but instead of having a vacuum in its interior it contains a small proportion of the rare gas neon. It is equipped with an anode, a grid and a cathode, the latter replacing the filament installed in a wireless valve.

The anode and the cathode are connected to the positive and negative terminals of a battery, or other source of current, and thus a certain voltage is maintained between them. The grid is connected to a silvered globe placed near the valve, or to a disc of tinfoil placed at any convenient spot. When the hand is waved over the globe, or the disc is touched, current flows across the valve and this is made evident by the bright orange glow characteristic of neon lamps.

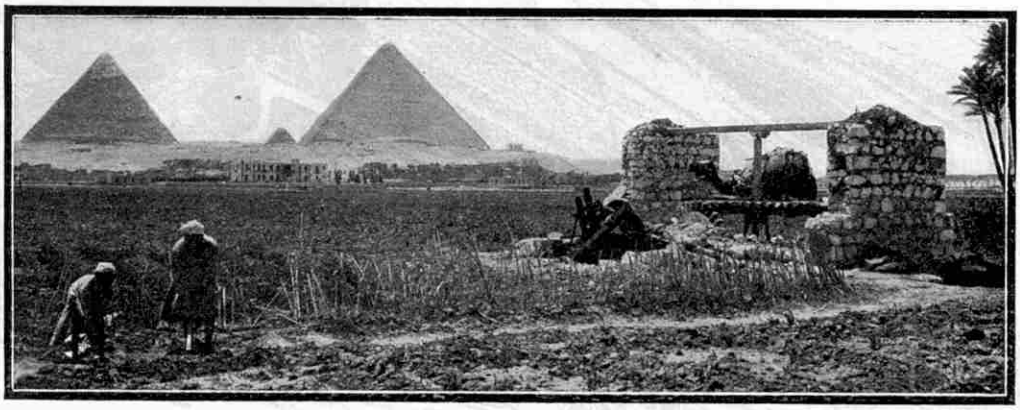
The explanation of the working of the "Grid-glow" tube, as it is called, is quite simple. The high positive charge of the anode causes the negative electrons within the tube to be attracted toward it. On the way they must pass the grid. Many of them fail to get through the meshes and thus give the grid a strong negative charge. The result is that the flow of electrons to the anode is checked, for being themselves negative in charge they are repelled by the grid.

The only way in which a current may be made to flow across the glow tube is by removing the negative charge on the grid. This happens when the tinfoil disc is touched or the hand is placed near the metallic coating of the silvered globe.

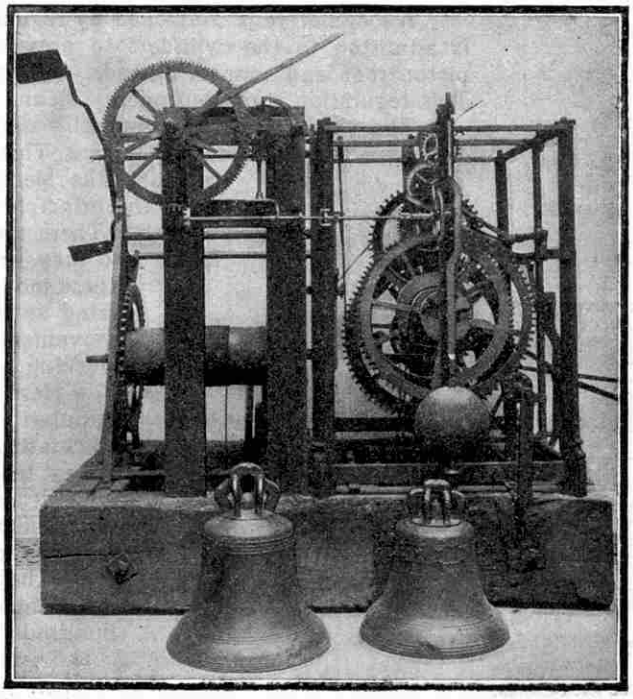
By arranging that the current giving the glow in the neon tube also should pass through a relay that operates the necessary switches, the tube may be made to ring alarm bells, start motors and control mechanism of almost any kind. One interesting use is that of lighting up shop windows at night. On the plate glass fronts of many establishments is a small silver disc, alongside which is mounted a notice asking passers-by to touch it. Immediately this is done the lights in the window are turned on. In this manner shop-keepers give those interested the opportunity of seeing the goods on show without incurring the expense of keeping their windows continuously illuminated. When the fingers of the passer-by are removed from the disc, the grid again acquires a negative charge.

Electricity on Canadian Farm

A model electric farm in Ontario has a huge electric hen or incubator that will hatch 20,000 chicks at a time. The current required to operate this comes from the hydro-electric plant at Niagara Falls. Many uses for electricity are demonstrated on this wonderful farm, for there it not only hatches the chickens, but also milks the cows and operates vacuum sweepers, electrical washers, fans and an automatic heating furnace.



Under the shadow of the Pyramids irrigation is carried on as crudely as it was thousands of years ago. Camels or bullocks turn large wooden wheels that raise water in earthenware pots.



Mechanism of the old clock presented to Glastonbury Abbey early in the 14th century. This was the first recorded example of a clock that struck the hours automatically and is now preserved in Wells Cathedral. This illustration is reproduced from the Editor's book, "The Triumph of Man in Science and Invention," by permission of the publishers, T. C. & E. C. Jack Ltd.

Photographing a Mountain 270 Miles Away

A new record for long distance photography on earth recently was established by Capt. A. W. Stevens of the U.S. Army Corps. Flying over Crater Lake, Oregon, at an altitude of 20,000 ft., Captain Stevens obtained a photograph of Mt. Rainier, a peak 14,363 ft. in height, about 270 miles away. Previous attempts by the same airman had given photographs of the same mountain from a distance of 227 miles.

Captain Stevens could not see Mt. Rainier on the first occasion when he photographed it, and probably it was invisible when he made the second exposure, for even on clear days there usually is sufficient haze in the atmosphere to limit vision to much less than 270 miles. He made use of film sensitive to invisible infra-red rays of light for, as explained on page 126 of the "*M.M.*" for February, 1929, these are able to penetrate through fog and smoke. When at a sufficient height he simply pointed his camera in the direction of Mt. Rainier, made the exposure, and then waited for development in order to learn if the trial had been successful. On the prints the mountain clearly could be distinguished.

Some time ago Captain Stevens used the same camera to take a photograph from an altitude of nearly 38,000 ft., a height greater than any at which a camera previously had been used. Further experiments are being made in the endeavour to produce a camera with an even greater range.

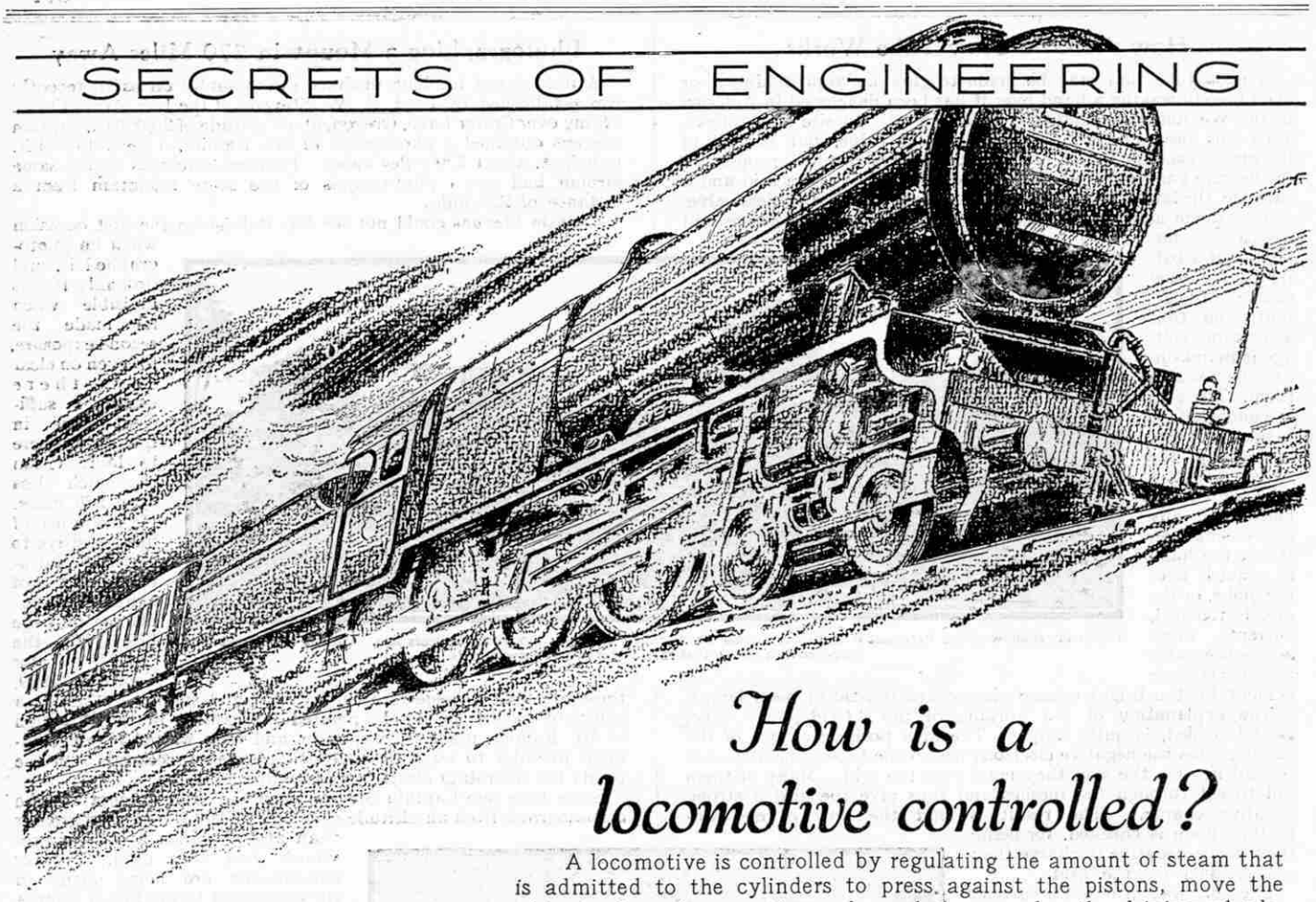
Defeating the Moth

In order to prevent damage to clothing by the larvæ of moths, the only certain plan is to incorporate something in the material that is injurious to them. It is the larvæ themselves, and not the moths, that cause damage. When very tiny they eat into the fibres, and it is very difficult to detect their ravages before immense harm is done, for they work in the dark and inhabit only the corners of pockets, cuffs and other folds.

A new treatment that promises to be far more satisfactory than the use in the ordinary manner of camphor or naphthalene follows this plan, chemicals being incorporated in the actual fibre. The material may be sprayed with a solution of these or immersed in it.

The chemicals used as moth-proofing agents do not repel the larvæ, but they are uneatable and the larvæ that try to feed on them starve to death. Organic compounds containing fluorine have been found to be most successful in preventing the ravages of the insects, and a number of them have been used commercially. Work is still being undertaken in order to discover other chemicals that have a similar effect. Several other fluorine compounds are undergoing tests. These promise to be even more effective than those already tried, and it is claimed that in future no difficulty will be experienced in making woollen fabrics absolutely mothproof before they leave the factory.

SECRETS OF ENGINEERING



How is a locomotive controlled?

A locomotive is controlled by regulating the amount of steam that is admitted to the cylinders to press against the pistons, move the piston rods and connecting rods, and thus revolve the driving wheels. This regulation is carried out by means of Valve Gear.

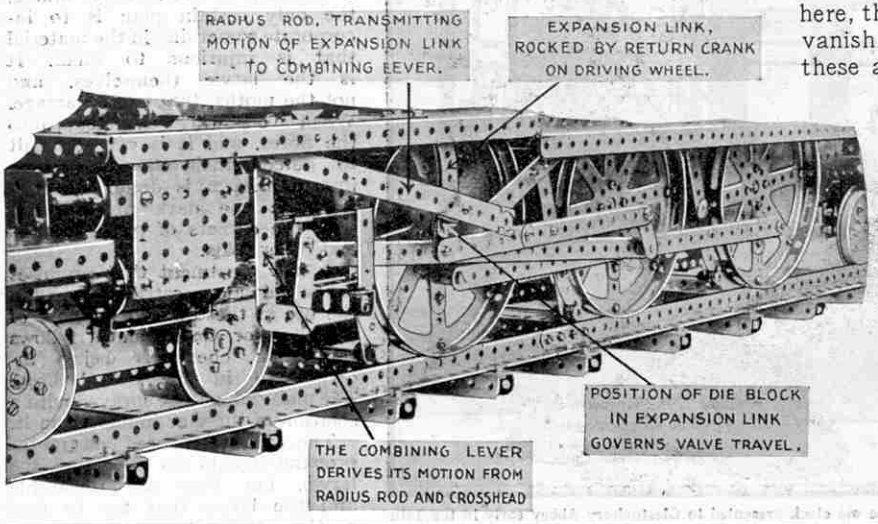
The valve gear most generally used in recent locomotives is the Walschaerts. How does it work? This is not easy to explain, but by building the Meccano model of this gear shown here, the principle is made clear, and all difficulties vanish. There are other valve gears in use, and these also may be reproduced in Meccano. All these models work—they can be manipulated so as to show the different valve movements for different conditions of working.

Here is the reason for the world-wide popularity of Meccano. It is not only fascinating to play with, but at the same time it teaches real engineering principles.

Meccano is real engineering in miniature—all the parts are miniatures of the corresponding parts in engineering practice. They are all standardised and interchangeable and can be used to make hundreds of different working models.

There is endless fun, endless variety—when you have Meccano!

There are Meccano Outfits at all prices from 2/- to 450/-



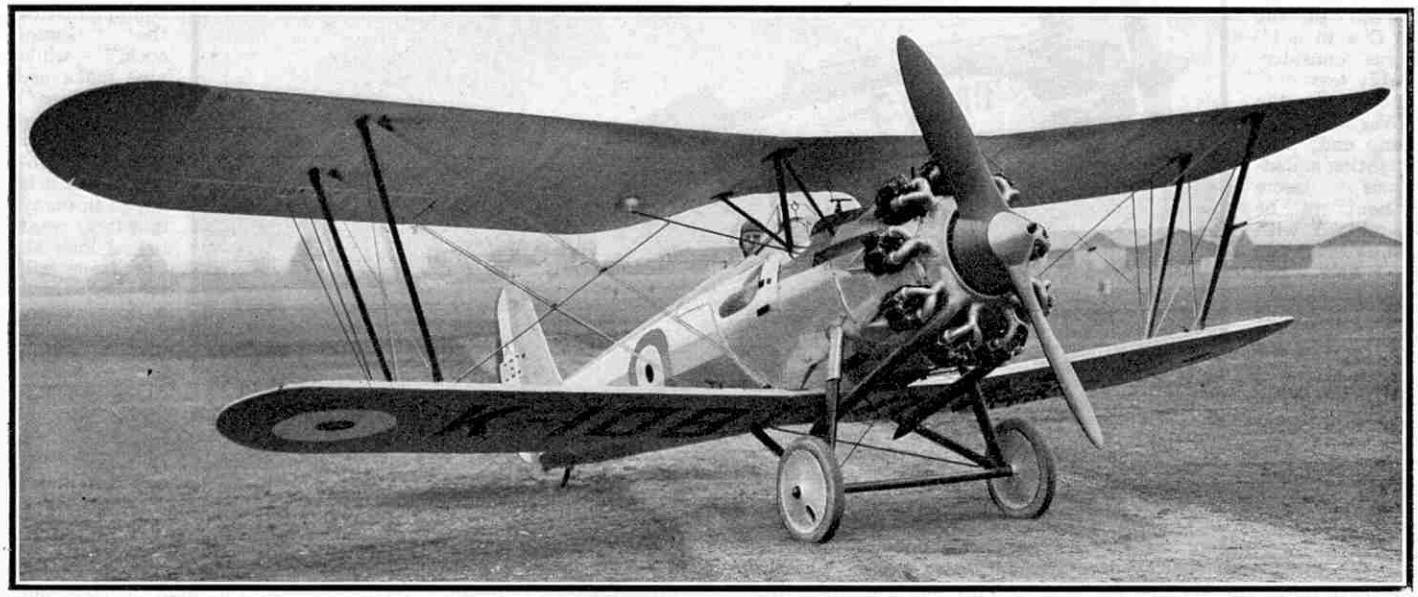
MECCANO

The Toy that made Engineering Famous

MECCANO LIMITED — OLD SWAN — LIVERPOOL

World's Fastest Military Aircraft

Single-Seater Fighters capable of 203 m.p.h.

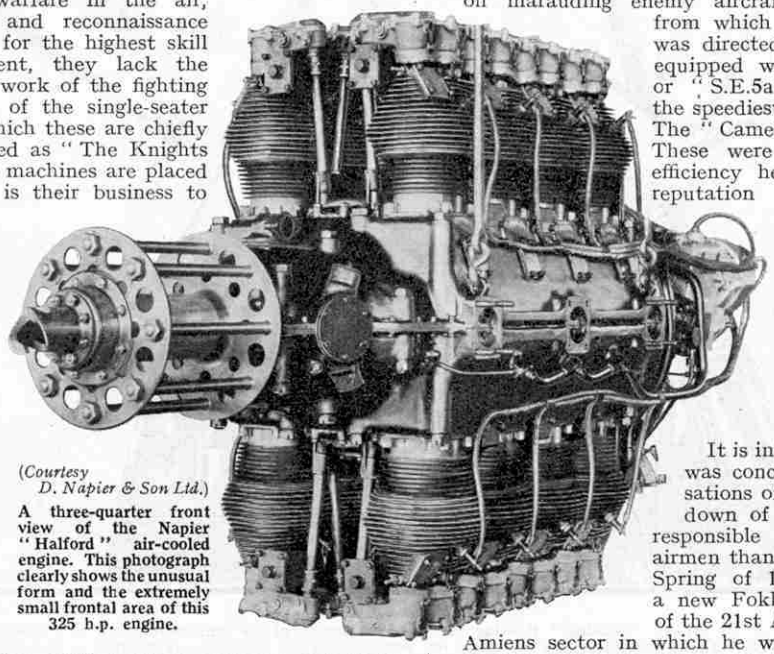


Courtesy [*Bristol Aeroplane Co. Ltd.*

The Bristol "Bulldog" all-metal single-seater fighter. The machine is equipped with wireless and may be used for either day or night work. It is generally regarded as the world's most efficient all-round fighting machine. Three squadrons of the R.A.F. are equipped with the "Bulldog," and it is also used by the Royal Australian Air Force.

OF the many types of aeroplanes that have been developed since man first conquered the air, none is more interesting or possesses more glamour than the single-seater fighter. Neither commercial flying nor the creation of long distance records are calculated to give a pilot the feeling of excitement that he derives from warfare in the air, and although bombing and reconnaissance work are risky, and call for the highest skill and the coolest judgment, they lack the romantic features of the work of the fighting squadrons. The pilots of the single-seater fighting machines with which these are chiefly equipped may be described as "The Knights of the Air." The fastest machines are placed at their disposal and it is their business to seek combat and to fight for the protection of slower and more vulnerable machines engaged on other duties. This has been realised by the authors of air stories, and it is only on rare occasions that the heroes of these are regular pilots of other types of aeroplanes.

It is a maxim of warfare that the best method of defence is attack. This is doubly true of war in the air, and the fighting squadrons of the R.A.F., and indeed of any Air Force in the world, invariably adopt aggressive tactics when carrying out their duties. In struggles between pilots of skill and experience success goes to the men who control the machines that have the highest speed and can be manœuvred with the greatest ease. In many respects therefore the single-seater machines with which fighting squadrons are equipped represent the highest achievement of the designers of aircraft and of the high-powered engines with which these are invariably fitted.



(Courtesy D. Napier & Son Ltd.)

A three-quarter front view of the Napier "Halford" air-cooled engine. This photograph clearly shows the unusual form and the extremely small frontal area of this 325 h.p. engine.

When the Royal Air Force came into being in April, 1918, the fighting squadrons were chiefly employed in the protection of machines engaged in bombing and reconnaissance work, but an equally important part of their duties was to keep off marauding enemy aircraft and to attack the machines from which the fire of the enemy's artillery was directed. Most of the squadrons were equipped with Sopwith "Camels," "Spads," or "S.E.5a's," all biplanes that were then the speediest and handiest machines available. The "Camels" had 130 h.p. Clerget engines. These were of the rotary type and their efficiency helped greatly in establishing the reputation of the "Camels" as fighting aeroplanes. Two different types of engine were installed in the "S.E. 5 a's." One of these was the 180 h.p. Wolseley "Viper," and the other the 150 h.p. Hispano-Suiza. A slightly more powerful engine was installed in the "Spads." This also was a Hispano-Suiza, that developed a normal output of 220 h.p.

It is interesting to know that a "Camel" was concerned in one of the greatest sensations of the War. This was the bringing down of Baron von Richthofen, who was responsible for the deaths of more Allied airmen than any other German pilot. In the Spring of 1918, von Richthofen was flying a new Fokker triplane and on the morning of the 21st April, he was given orders that the Amiens sector in which he was engaged was to be cleared of British aeroplanes at all costs. In the effort to carry out these instructions the German pilot became involved in a fight in which several machines took part, and he was shot down by Capt. Roy Brown, the pilot of a "Camel."

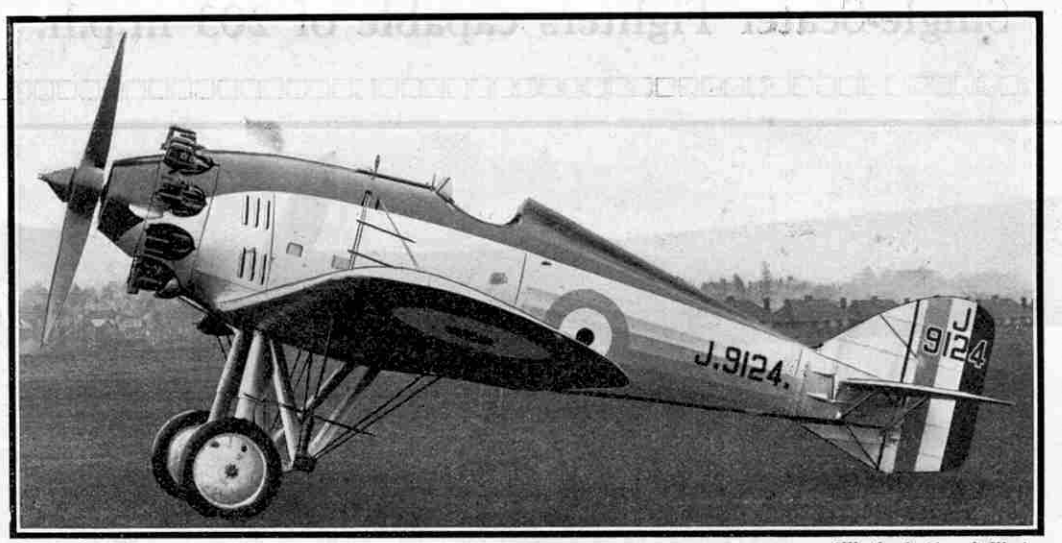
The "S.E.5 a's" and "Camels" were still in use at the end of the War, but the "Spads" had been replaced by Sopwith "Dolphins" and "Snipe." The "Dolphin" was equipped with

a 200 h.p. Hispano-Suiza engine or with the Sunbeam "Arab," which also developed 200 h.p., while a 230 h.p. "B.R.II" rotary engine was installed in the Sopwith "Snipe." Both machines were great improvements upon the older type of fighters. The speed of the "Dolphin" at a height of 10,000 ft. was 123 m.p.h., or 10 m.p.h. more than that of the "Camel" at the same altitude. This advantage was well maintained at greater heights, the "Dolphin" being capable of 111 m.p.h. at an altitude of 18,000 ft., at which the speed of the "Camel" was considerably less.

When the War came to an end, the fighting squadrons were about to be equipped with Martinsyde "F.4's," Bat "Bantams," and Nieuport "Nighthawks." A number of these machines were completed and ready for service, but the coming of peace deprived them of the opportunity of demonstrating their powers in actual warfare. Of the three it is probable that the Martinsyde "F.4" possessed the best performance. It was fitted with the 300 h.p. Hispano-Suiza engine, and was a variation of the Martinsyde "F.3." This was a machine that had a speed of 130 m.p.h. at a height of 10,000 ft., which was only reduced to 127.5 m.p.h. at 5,000 ft. higher. It was equipped with the 190 h.p. Rolls-Royce "Falcon" and the only reason that prevented it from being largely used was a shortage of this type of engine, all available "Falcon's" being then required for service in Bristol Fighters. The "F.3's" were remarkable machines and some idea of their efficiency may be gained from the fact that if fitted with modern engines their performance would almost rival that of the single-seater fighters now in use.

The end of the fighting did not put a stop to the further development of fighting aeroplanes. The tendency in the design of these has been to keep to practically the same overall measurement, but to increase the amount of military equipment carried and to fit larger fuel tanks in order that the machines should be capable of remaining in the air for longer periods. The additional weight that this extra equipment involves has made it necessary to use more powerful engines, and remarkable strides have been made in the efficiency of power units of all types.

Ten years after the War the machines being used by the fighting squadrons of the R.A.F. were the Armstrong Whitworth "Siskin" IIIA, and the Gloster "Gamecock," the first being equipped with the "Jaguar" engine and the second with the 420 h.p. Bristol "Jupiter." The Gloster "Gamecock" was described and illustrated on page 628 of the "*M.M.*" for October, 1926. It is of wooden construction and it is interesting to note that it was evolved from the Nieuport "Nighthawk" already mentioned.

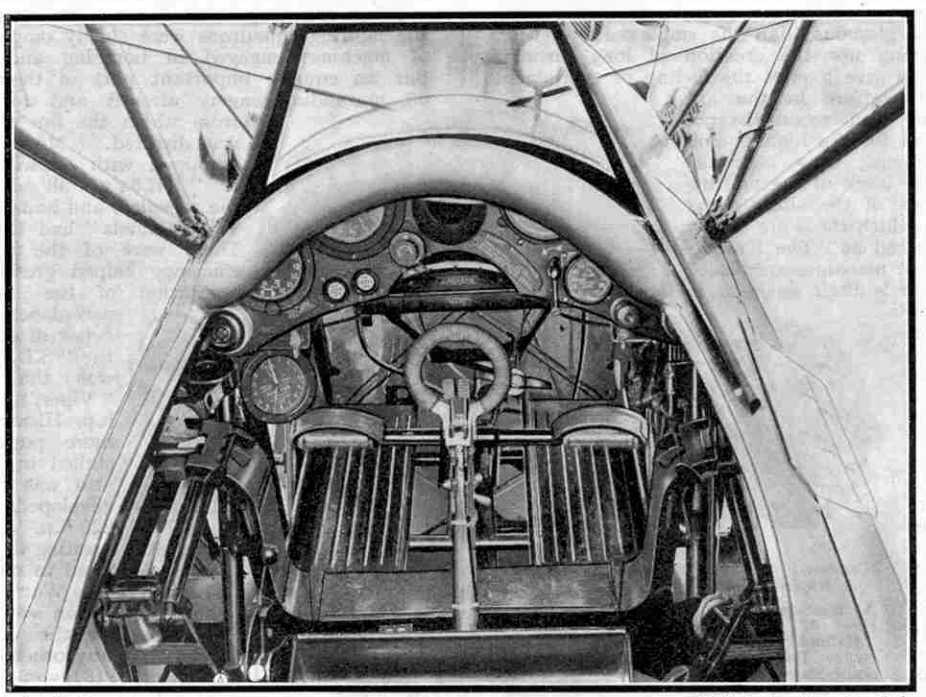


Courtesy] [*Westland Aircraft Works*

The Westland single-seater interceptor fighter. This is of all-metal construction, and is fitted with a Bristol "Mercury IIA" engine. Although the machine lands at high speed, its run is shortened by the use of wheel brakes.

To-day only one fighter squadron of the R.A.F. — No. 23, stationed at Kenley — is equipped with the "Gamecock," while nine make use of "Siskins." Both machines are rapidly becoming obsolete and it is hoped in many quarters that before long all squadrons will be equipped with Bristol "Bulldogs" or with machines of similar performance. Three squadrons—No. 54 at Hornchurch and Nos. 3 and 17 at Upavon—already make use of the "Bulldog," which is of all-metal construction and is regarded as the most modern and efficient of day and night fighters. At a height of 19,700 ft. it has a speed of 175 m.p.h. This is no less than 25 m.p.h. greater than the speed of the "Gamecock" at the same height, and the superiority of the "Bulldog" is further shown by the fact that it is capable of climbing to a height of nearly 20,000 ft. in 11½ mins., during which time the "Gamecock" could only reach an altitude of 15,000 ft.

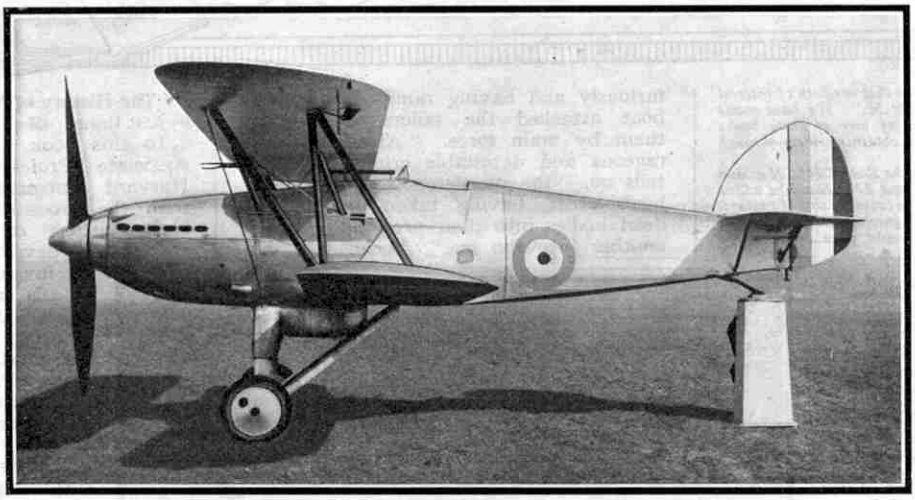
Another interesting single-seater fighter aeroplane, which was on view at the R.A.F. Display on 28th July of this year, is the Armstrong Whitworth "Siskin" IIIB, a photograph of which appeared on page 599 of the "*M.M.*" for August last. When fitted with a "Jaguar Major" supercharged and geared engine, this is capable of 186.5 m.p.h. at a height of 15,000 ft., and the speed is only reduced by 6 m.p.h. when the machine is flown 10,000 ft. higher. The time required to reach a height of 25,000 ft. is only 17.75 mins., and the absolute ceiling of the machine is 32,800 ft. A comparison of the performance of this machine with that of the single-seater fighters of 1918 shows how great have been the advances in design and construction during the intervening period. The fastest of the machines of 12 years ago had a speed of only 130 m.p.h. at an altitude of 10,000 ft., and this is 56 m.p.h. less than that of the "Siskin" IIIB, at a much greater height.



Courtesy] [*Bristol Aeroplane Co. Ltd.*

The cockpit of the Bristol "Bulldog," showing the complex nature of the instrument board of a modern fighting machine. The two machine guns that form the armament of the aeroplane are mounted at the sides, and the pilot fires them by means of the small thumb levers visible in the ring at the top of the "joy stick."

A fight between two single-seater machines of the latest type will be a revelation of the mastery that has been acquired over the air. The machines are capable of rising to great heights in remarkably short times, and may be put through amazing evolutions in the efforts of pilots to secure points of vantage. All military machines of the single-seater type are fitted with machine guns that fire forward through the airscrew, the bullets being prevented from actually striking the blades of the propeller by the employment of synchronising gear. Consequently the guns are trained upon their target by simply directing the machine toward it. The airman is unable to shoot rearward and for this reason each pilot engaged in an aerial fight manœuvres to obtain a position from which he may directly approach the tail of his adversary's machine. He takes advantage of fog or cloud, or tries to effect a surprise by getting between his enemy and the sun, in order to get into a good firing position a short distance below and behind the opposing aircraft. When attacked in this manner the pilot of a single-seater is helpless and is compelled to dive or adopt some other desperate means of escaping the rain of bullets that will be poured upon him.

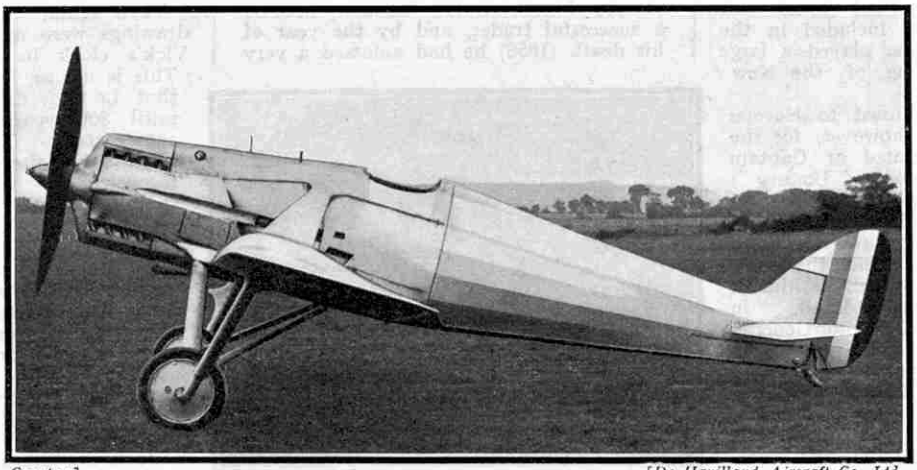


Courtesy [*H. G. Hawker Engineering Co. Ltd.*

The Hawker "Hornet" single-seater interceptor fighter. This type of machine has been definitely adopted by the Air Ministry as the R.A.F. standard interceptor fighter. The telescopic sighting apparatus with which the "Hornet" is fitted may be seen immediately in front of the cockpit.

The same means may be adopted in attacking a larger machine in which an observer is stationed in the rear. The assailant runs comparatively little risk, for his own engine, particularly if this be of the radial type, acts as a very effective shield to protect him from machine gun fire.

A pilot who has once secured a position in the rear of his enemy only finds himself in a position of real danger when he has overtaken the machine he is attacking and is turning with the object of regaining his former position. The necessity for protection under these circumstances has led to the introduction of formation flying. The nine machines of a squadron are divided into three flights of three aeroplanes. Each of these flies in the formation of an inverted "V," while the three flights themselves adopt similar positions with respect to each other. It will be seen that each Flight Leader is protected from attack in the rear by two machines, one on each side of him, while the Squadron Leader may be protected by all if necessary. An alternative formation is that called "squadron V," in which the nine machines of the squadron form one large "V," headed by the Squadron Leader.



Courtesy [*De Havilland Aircraft Co. Ltd.*

The de Havilland interceptor fighter is fitted with the new Napier "Halford" engine, a photograph of which appears on page 873. The gun port and groove on the near side of the fuselage should be compared with those shown on our photographs of the Bristol "Bulldog" and the new Westland machine.

The Fighter Squadrons of the Fighting Area of the Air Defence System of Great Britain are each allotted one sector for the defence of which they are responsible. On being warned of the approach of enemy craft, nine machines of the squadron concerned, the full complement of which is 12 aeroplanes, take off and patrol their sector, flying either in "squadron" or in "squadron V" formation. The average time taken for the nine machines of a really good squadron to get into the air after receiving the warning signal is three minutes! On no account must a squadron leave its sector unless the enemy are in an adjacent sector and are within easy range. It will be realised that for work of this kind machines must be capable of remaining in the air for long periods, and it is chiefly for this reason that fighting craft are now being fitted with larger fuel tanks.

There is very little doubt that future warfare between two countries will commence with fast raids by bombing machines, and in order to cope with threats of this character an interesting new type of single-seater fighter has been developed by the British Air Ministry. Machines of this type are known as "single-seater interceptor fighters," and they are really single-seater fighting machines with a light load and very high performance.

The task of the interceptors begins when news of raiding aircraft is reported. At a moment's notice their pilots take them into the air with the purpose of intercepting, and if possible, of destroying the raiders, who would probably be equipped with day bombers capable of a speed of about 150 m.p.h. at a height of 20,000 ft. In many instances such machines can travel from the frontier to important centres in an incredibly short time. For instance, a flight of day bombers could reach London about 20 minutes after crossing the coast at Dover. They would fly high and any machines sent to engage them must be able to climb up to an equal altitude in the short time available. Clearly, interceptor fighters must not only be speedier machines, but must be possessed of a very high rate of climb. They are specially chosen for this purpose. Their fuel capacity is low and they do not carry out the regular patrol duties undertaken by the machines of the ordinary fighter squadrons.

Several firms have produced interceptor fighters for the Air Ministry, the best-known being the Bristol "Bullpup," the de Havilland interceptor fighter, the Fairey "Firefly II," the Hawker "Hornet" and the Westland interceptor fighter. Of these machines the Hawker "Hornet" has been officially adopted and a squadron is shortly to be equipped with machines of this type. Naturally details of the "Hornet" may not yet be published, and for the present full particulars of other types of interceptor fighters are also withheld.

Two of the machines of this class that are full of interest are those produced by the Westland and de Havilland firms. These are unique in being low wing monoplanes, and if one of them had been chosen by the Air Ministry they would have been the only monoplanes to be used in the R.A.F., except for the huge Beardmore "Inflexible," and the Fairey long range machine. The Westland machine is described as being an all-metal, fast-climbing, single-seater, low wing monoplane, fitted with a Bristol "Mercury IIA" engine. The machine has been designed to provide the pilot with a complete view forward and upward, and for high performance at altitude. Its armament consists of two fixed enclosed guns firing forward through the airscrew, and as it is expected to work at high altitudes, oxygen apparatus is provided (*Continued on page 900*)

Books to Read

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

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

"Great Navigators and Discoverers"

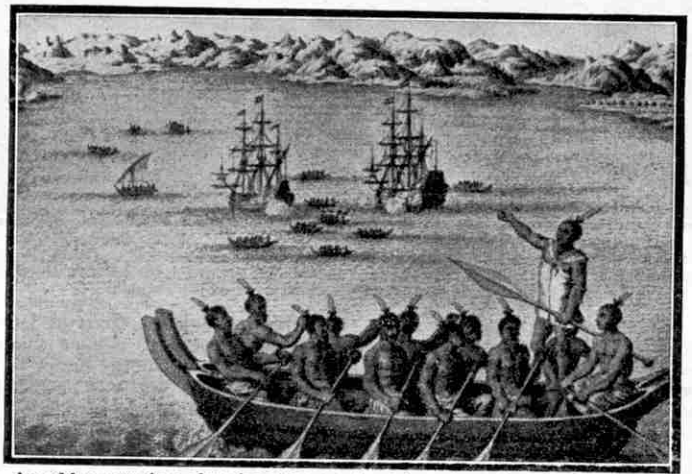
By J. A. Brendon, B.A.
(Harrap. 7/6)

These stories deal with navigators who blazed the trail of exploration and discovery before the time of steam, and commence with Hanno the Carthaginian and end with Sir John Franklin.

From the great number of seamen and the vast variety of exploits available the author has chosen wisely. As we read through these entrancing pages we realise how well Mr. Brendon has succeeded in his object of setting out the stories of twenty-four representative sailors, and at the same time showing how the peoples of Europe made themselves masters of the seven seas. Although most of the stories deal with men who won fame as navigators and explorers rather than as fighters, the stories of a few fighting adventurers—such as Paul Jones and Admiral Cochrane—are included in the book because these men played a large part in the establishing of the New World.

The story is not confined to Europe and the New World, however, for the adventures are recounted of Captain Cook, Bligh (of the famous "Bounty") and others in the South Seas. One of the lesser known sailors is Tasman, who, of course, discovered (on the 24th November, 1642) the island that now bears his name, but which he himself named Van Diemen's Land, "in honour of the Hon. Governor-General, our illustrious master who sent us to make the discovery," as he tells us in his journal. The island was appropriately re-named Tasmania in 1853.

In December 1642, Tasman sighted South Island, New Zealand, and coasting northward rounded Promontory Point (now known as Cape Farewell) and entered the bay that bears his name. While the ships were anchoring, natives came out in their boats and thinking they wished to be friendly the sailors tried to entice them on board their ships by displaying merchandise. The natives refused to be drawn, however, and the captain of one of the ships then manned the cock-boat, which was pulled towards the natives. The crew of one of the native prows immediately began to paddle furiously and having rammed the cock-boat attacked the sailors, overcoming them by main force. "After this outrageous and detestable crime," Tasman tells us, "the murderers sent the cock-boat adrift, having taken one of the dead bodies into their prow and thrown another into the sea." Because of this incident, Tasman weighed anchor and crossing Cook Strait coasted northward without even setting foot on the land of the Maori. Later Tasman became a successful trader, and by the year of his death (1659) he had amassed a very considerable fortune from his enterprises.



An old engraving showing Tasman's ships at anchor in Murderer's Bay (See below).

Sir Walter Raleigh at Trinidad, 1594. (The two illustrations on this page are from the book "Great Navigators and Discoverers.")

The book, which is well illustrated both with line and half-tone, will be read with great pleasure by all those who have a liking for the sea or for adventure—and what "*M.M.*" reader has not? It should also prove of considerable use to the student, apart from its interest to the general reader.

"The History of Mechanical Invention"

By A. P. Usher. (McGraw-Hill Book Company. 25/–)

In this book, the author (who is an Associate Professor of Economics at Harvard University) deals interestingly with the process of invention and the early history of mechanics. He also traces the development of a number of inventions, such as water-wheels and windmills, water clocks and mechanical clocks, printing, machine tools, and the production and application of power.

Unfortunately the value of the volume as a book of reference is spoiled by a number of errors. Apart from several surprising spelling mistakes (as for instance, "acqueducts" on page 89 and "coccoons" on page 221) there are also numerous technical errors. Many of these latter seem to have occurred because the author has taken various statements from other books without confirming their accuracy. For instance, in dealing with the famous Dover Castle Clock, Professor Usher tells us that it bears the date 1348. As a matter of fact, this date was removed from the clock some time ago because it was decided by competent authorities that its accuracy was doubtful.

Then again, we are told that careful drawings were made by Le Roy of de Vick's clock in its original condition. This is not so, however, for it is known that Le Roy did not make his drawings until 300 years *after* the clock was constructed. The drawings show that at that time the clock must have been reconstructed very considerably and that but little of the original work remained.

It is stated (on page 221) that in the early days of silk manufacture the "coccoons" were gathered *after* the larvæ had emerged, but this statement is not in accordance with the writings of either Aristotle or Pliny, both of whom suggest that the cocoons were gathered before the moths emerged, as of course they must be if the thread is to be continuous.

It is not impossible to find mistakes in most books, but we do feel that in an important book of this kind, which is likely to be much used for references, greater care should have been taken, and we hope that the Professor will revise carefully the text for a subsequent edition.

Although many of the statements obviously should be accepted with caution, there is a great amount of interesting matter that will be useful to Meccano boys. All the illustrations are interesting and some are very quaint.

"Nature Rambles—Spring to Summer"

By EDWARD STEP. (Fredk. Warne. 2/6)

This is the second volume in the "Come with Me" books, the first of which we reviewed last month. The present volume continues the story on the same lines as the first, taking the reader through the early summer months and giving an account of Nature in summer on the heathlands, behind the sand-dunes, among the oaks, over the sand hills, and at the pond. Plants, trees, insects and flowers, as well as birds and animals, receive attention from Mr. Step's facile pen. Much that is ordinarily hidden to the casual observer is laid bare—for instance, a whole wealth of wonder often lies hidden on the underside of a leaf in the shape of eggs or galls. The book is considerably enhanced by the inclusion of 16 plates in colour, 15 half-tone plates and 81 line drawings in the text.

This little book will be invaluable to the Nature student and, as is the case with other volumes in this series, it is of handy size, and will therefore find a place in many a walker's pocket.

Sweet Chestnut—flowers and young fruit. The prickly coverings of the sweet nuts look like tiny hedgehogs. (See below).

"The Motorist's Electrical Guide"

By A. H. AVERY. (Sir I. Pitman & Sons Ltd. 3/6 net)

So many electrical fittings are used on the modern motor car that the owner or driver who wishes to get the best out of his vehicle, or to be able to deal correctly with most of the emergencies that may arise during running, should have some acquaintance with the manner in which they work. This book has been written to supply his special requirements.

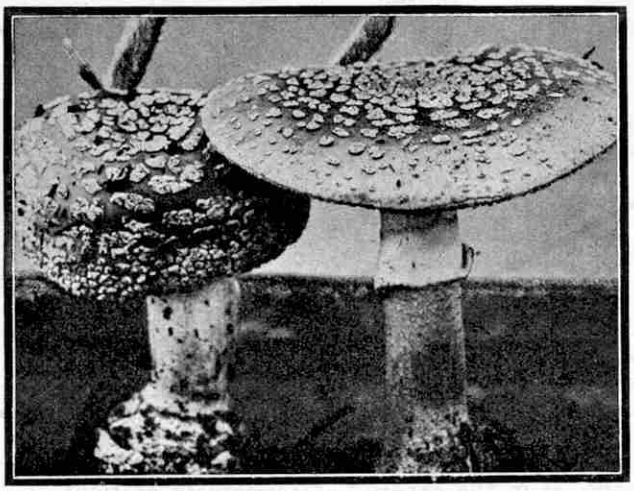
It may appear surprising that a book running to 146 closely printed pages should be necessary for non-technical readers. Possibly much of the information given may seldom be required by owners or drivers, but the book is of such interest that it is quite certain that its readers will study it from end to end. As a result they will get a clearer understanding of the electric mechanisms on which they depend for ignition, starting and lighting, and also for operating luxuries such as cigarette lighters and foot warmers.

In the earlier chapters the author gives a condensed account of the principles of electricity and magnetism, and in the remaining sections of the book he uses these principles in explaining how accumulators, magnetos, ignition coils, dynamos and starting motors work. Hints for adjustment and repair of most of these are given, and there is no doubt that the explanations given by the author will enable tests and repairs to be carried out in an intelligent manner.

The book is well illustrated with photographs of electrical apparatus, many of these showing the separate parts of the devices explained, and there are also a number of useful circuit diagrams.

"*Railway Magazine*" 400th Number

With its October issue the "*Railway Magazine*" made its 400th monthly appearance since its inauguration in July 1897, and this interesting event is marked by the inclusion of several special features. Mr. J. F. Gairns, who has edited the magazine since 1910, contributes an introductory article, and Mr. G. A. Sekon, who was editor from 1897 to 1910, deals with "Railway Progress and Development, 1922-1930." Mr. C. S. Lake and Mr. C. J. Allen write respectively on locomotive development and British locomotive performance during the period 1897-1930, and Mr. J. Francis gives a useful survey of the progress of electric traction in the British Isles. There is also a practical article on railway photography contributed jointly by the three well-known experts, H. Gordon Tidey, F. R. Hebron, and C. J. L. Romanes. In addition, a special folding plate is presented containing views of the "*Flying Scotsman*," "*Royal Scot*," "*Cornish Riviera*" and "*Golden Arrow*" expresses. The "*Railway Magazine*" may be obtained from all booksellers, or direct from The Railway Publishing Co. Ltd., 33, Tothill Street, Westminster, S.W.1.



Blusher Mushrooms, the illustration of which (together with that above) are taken from the book "Nature Rambles" reviewed on this page.

"My Book of Trains"

By ELLISON HAWKS

(Thomas Nelson & Sons Ltd. 2/- net)

The writing of a book for children on a severely practical topic such as railways or motor cars is a task of peculiar difficulty. On the one hand the author must avoid being too technical and complicated, and on the other must not on any account underestimate the knowledge and intelligence of the average child, and become condescending. Mr. Ellison Hawks, the Editor of the "*M.M.*," has avoided both these dangers, and has produced a book that is accurate, interesting, and packed with information. It is printed in clear, easily read type, and is splendidly illustrated by colour plates and black-and-white illustrations. These will satisfy the eye of the keenest young critic, and they add very greatly to the value of the book.

In his commencing chapter the author shows how railways began, and makes it clear that they grew out of the urgent needs of the time. The rutted roads and the slow travel by canal made some new and speedier form of transport necessary. The hour found the man—George Stephenson—and under his guidance there came into existence the pioneer railways from Darlington to Stockton and Liverpool to Manchester.

The next two chapters deal with the story of the steam locomotive and lead us by easy stages from the "*Rocket*" to the "*Royal Scot.*" This is one of the most interesting sections of the book, and will make a special appeal to all young model railway enthusiasts. Having explained the different types of tender engines and tank engines, the author shows us how the modern railway carriage has been developed from the comfortless, van-like structures of the early railways. The story of the automatic brake and of the lighting of trains makes a good section, which is completed by an account of the Royal Train and the travelling Post Office. Signals receive adequate treatment, and we are shown how the splendid system of to-day, which makes railway travelling so safe, has grown out of the crude ideas of the early days. We note particularly an accurate description of fog signalling apparatus and working, about which most people have only vague ideas.

A welcome chapter deals in the most interesting manner with four famous British expresses, the "*Flying Scotsman*," the "*Royal Scot*," the "*Cornish Riviera*" and the "*Southern Belle.*" The final chapter comes as a pleasant surprise, for it deals with animal workers on the railways. It shows how the locomotive may be assisted by the draught horse, and it introduces us to the famous station collecting dogs.

"*My Book of Trains*" is in short a really worth-while production, and at its price represents extraordinary value.

(REV.) J. HENRY MARTIN.

The Swashplate

A Meccano Demonstration of a Novel Mechanical Movement

By H. F. Lane

Last month Mr. Lane explained the principles involved in the mechanism known as the "swashplate," and described certain of its practical uses. In the following article he deals with the Meccano demonstration model, which not only illustrates the operation of the swashplate very clearly but also forms an extremely interesting working model.

AS was pointed out in last month's article, the swashplate is used extensively in hydraulic installations on shipboard. It is also put to a novel use in the transmission system of a certain make of motor car, but in this case the movement of the swashplate is transmitted by purely mechanical means instead of hydraulic power.

A device of this character holds several distinct advantages over the usual form of motor car gearbox and clutch unit, for it is simple in operation and robust in construction, and will stand up to considerably greater ill-treatment in the hands of an unskilful driver than the more familiar type. Added to these advantages is the fact that it is infinitely variable as regards the range of gear ratios obtainable. With the ordinary type of gear box only three or four fixed ratios may be obtained. On these grounds it is calculated that the swashplate transmission should appeal particularly to those motorists who experience difficulties in mastering the art of changing gear.

The system by which the movement of the swashplate is transmitted by mechanical means, as in the experimental car gear box, is reproduced in the Meccano model described in this article. Incidentally, the model should form an interesting contrast to another novel variable-speed mechanism—the Constantinesco Torque Converter—which formed the subject of a Meccano model that appeared on page 426 of the May 1927 "*M.M.*" In the case of the torque converter the speed ratio varies automatically to suit the load, whereas in the swashplate model it is necessary to alter the tilt of the swashplate by means of a suitable lever or handwheel in order to vary the speed of the driven shaft.

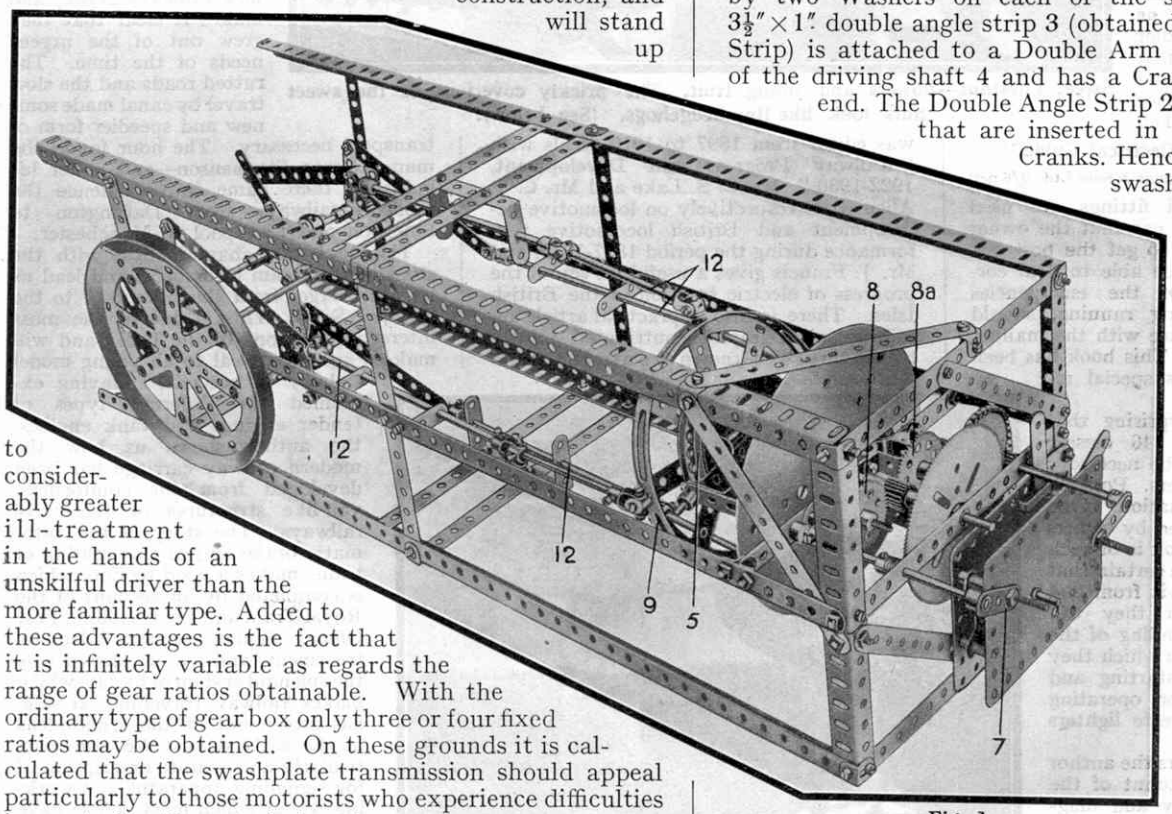


Fig. 1

Construction of the Meccano Model

The starting point of the construction of the model should be the containing framework and after this is completed attention may be paid to the swashplate unit. This is shown in detail in Fig. 2, from which it may be gathered that the swashplate itself comprises a 3" Pulley 1 to which a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 2 is bolted. The latter is spaced away from the face of the Pulley by two Washers on each of the securing bolts. A $3\frac{1}{2}" \times 1"$ double angle strip 3 (obtained by bending a $5\frac{1}{2}"$ Strip) is attached to a Double Arm Crank on the end of the driving shaft 4 and has a Crank bolted to each end. The Double Angle Strip 2 pivots on 1" Rods that are inserted in the bosses of the Cranks. Hence the Pulley 1 (the swashplate) rotates with the driving shaft and at the same time is free to turn about the axis formed by the 1" Rods.

A 3" Pulley 5 is mounted freely on the shaft 4 and is connected to the swashplate by a pair of $1\frac{1}{2}"$ Strips, which are mounted on 1" Rods that are held in Handrail Supports secured to both Pulleys. A Compression Spring, placed on the shaft 4 between the Pulley 5 and the boss of the Double Arm Crank, serves normally to retain the swashplate at right angles to the shaft. In order to take the twisting strain off the $1\frac{1}{2}"$ Strips when the swashplate is turning, a 1" Rod 6, attached by a Double Arm Crank to the double angle strip 3, enters one of the holes of the Pulley 5, thus allowing the latter to slide longitudinally on the shaft, and at the same time to rotate bodily with the swashplate.

A Circular Plate and a 3" Pulley are now bolted together, and the unit so formed is threaded on the shaft 4, on which it is free to rotate, its purpose being to transmit the thrust of the screw tilting gear to the Pulley 5.

The Screw Tilting Gear

The operating handle 7 (Fig. 1) is secured to a Rod that is journalled in suitable bearings in the frame and carries a ½" diam. ½" wide Pinion, which is in mesh with a 57-teeth Gear Wheel 8. The latter is in mesh with a second ½" diam. ½" wide Pinion, which is loose on the shaft 4 and also engages with a second 57-teeth Gear 8a. The Gears 8 and 8a are secured by nuts on 2" Screwed Rods that work in the tapped bores of Strip Couplings (the slot of each Strip Coupling is passed over the edge of the transverse Strip on which it is mounted so that the tapped hole in the jaw of the Coupling coincides with one of the holes in the Strip). The inner ends of the Screwed Rods just enter the appropriate holes in the Circular Plate and are maintained in that position by two nuts locked together on each Rod about ⅛" from the end. By turning the handle 7, both Screwed Rods are advanced in their bearings by an equal amount, thus pushing the Pulley 5 along the Rod and tilting the swashplate.

The Hub Disc 9 has secured to it a 3" Pulley 10, which forms one member of a built-up ball bearing (see Standard Mechanism No. 134), a Wheel Flange being bolted to the centre of the 3" Pulley to form the "race" in which the Meccano Steel Balls are placed. The other portion of the bearing is formed by the back of the swashplate, the two portions being held on the Balls by a short Rod that passes through the bosses of the Pulleys and is retained by a Collar on each end.

When the shaft 4 revolves, the swashplate revolves also, but the Hub Disc 9 does not rotate but performs a sort of wobbling motion, so that a point on its circumference will move backwards and forwards in a straight line. This motion may be varied by altering the tilt of the swashplate through the medium of the handle 7, a large tilt giving a large but weak "wobble," and a small tilt (with the swashplate nearly at right-angles to its axis) a small, powerful one. This reciprocating movement is converted into rotary motion in the following manner.

Arrangement of the Final Drive

Four Swivel Bearings are attached loosely by Pivot Bolts to equidistant points on the circumference of the Hub Disc, and are connected by jointed Rods and Strips 12 to the levers 11a, 11b, 11c, 11d (Fig. 3). Each of these levers, with the exception of 11c, consists of a Boss Bell Crank, to one arm of which is bolted a 2" Strip that is connected pivotally by lock-nutted bolts to the ends of the connecting links 12. The other arm of each Bell Crank carries a Pawl that is mounted freely on a Pivot Bolt.

The lever 11c is composed of a Crank, and the motion of one of the links is transmitted to it via the medium of the bell crank lever 13, which is secured on a Rod journalled in a Channel Bearing. The four levers are mounted freely on a Rod and the Pawls engage with Ratchet Wheels that are secured thereto. The Rod carries also a 3½" Gear Wheel that is in mesh with a ½" Pinion on the final driven shaft, to which is attached the 6" Pulley forming the flywheel.

It will be seen that the driven shaft is rotated by means of a series of impulses received through the Pawl and Ratchet mechanisms, which receive their motion in turn from the wobble of the swashplate. A large tilt of the latter will impart a high speed to the driven shaft, while a small degree of tilt will result in the shaft rotating at a considerably slower rate with a correspondingly greater increase in power. Owing to the manner in which the swashplate is tilted, the degree of variation is infinite between the limits of maximum and minimum angles of tilt. When the swashplate is exactly at right angles to the shaft 4, no movement is imparted to the driven shaft.

The drive from the Clockwork Motor to the shaft 4 is conveyed by a Sprocket Chain drive to a Rod on which is a ½" Pinion that is in mesh with the 3½" Gear Wheel on the shaft 4.

The effectiveness of the device may be illustrated by setting the swashplate at the maximum angle and starting the Clockwork Motor. The Motor soon commences to slow down and eventually stops, but on diminishing the angle of the swashplate it recommences to work. This shows that, although the Motor may be too weak to drive the model with the swashplate at its maximum angle, it can be made to do so by diminishing the angle.

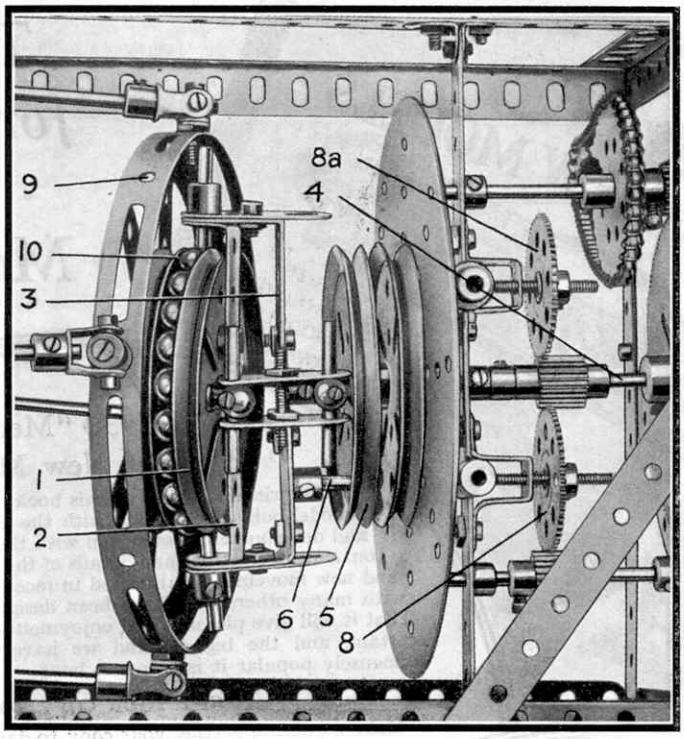


Fig. 2

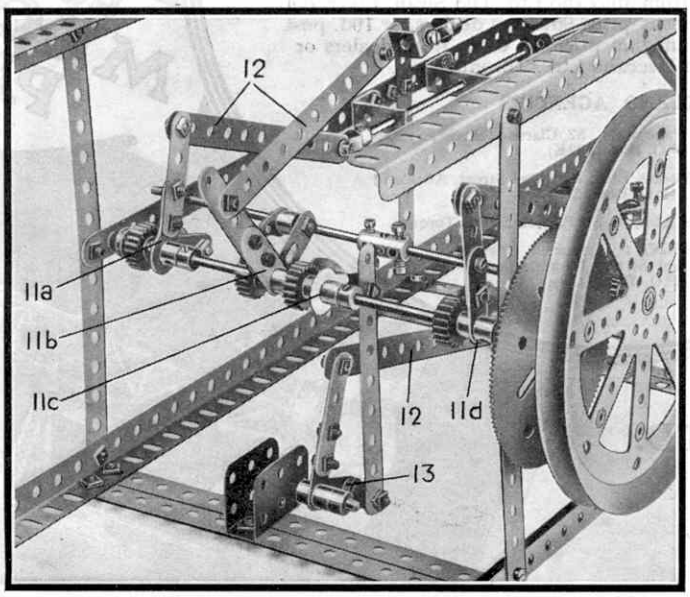
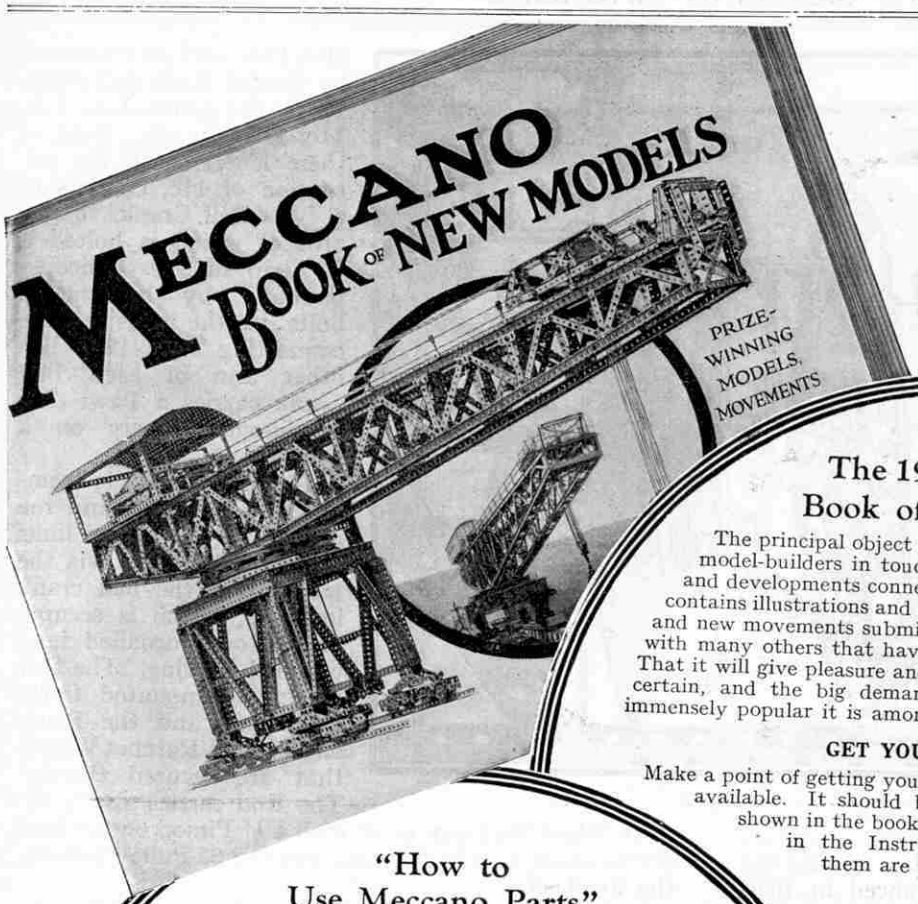


Fig. 3



Two Books for every keen Meccano Model-builder

The 1930 "Meccano Book of New Models"

The principal object of this book is to keep Meccano model-builders in touch with the latest improvements and developments connected with their hobby. The book contains illustrations and details of the best of the new models and new movements submitted in recent competitions, together with many others that have been designed by our own experts. That it will give pleasure and enjoyment to every model-builder is certain, and the big demand we have already had shows how immensely popular it is amongst boys.

GET YOUR COPY TO-DAY

Make a point of getting your copy to-day while a plentiful supply is available. It should be mentioned specially that the models shown in the book are supplementary to the models shown in the Instruction Manuals, and the majority of them are published for the first time.

HOW TO OBTAIN THE BOOK

The 1930 Book of New Models may be obtained from any Meccano dealer, price 6d., or direct from Meccano Ltd., Old Swan, Liverpool, price 7d. post free. (Overseas price 9d. from dealers, or 10d. post free from our agents. Canadian price, 15 cents from dealers or 20 cents, post paid, from Meccano Ltd., Toronto).

"How to Use Meccano Parts"

Here is a new Manual that every Meccano model-builder who wants to build better models should have. Its main purpose is to outline the principal uses of the standard parts that together constitute the Meccano System. Detailing every function of every part would be almost impossible, but we believe that by pointing out the special purposes for which the various parts have been designed, together with a few of the other uses that have been suggested from time to time by Meccano boys themselves, we shall help Meccano enthusiasts to build more interesting models, and also to construct them on scientific and practical lines.

HOW TO OBTAIN THE BOOK

We advise every keen Meccano boy to obtain his copy of this new Manual as early as possible. It may be obtained from any Meccano dealer, price 6d., or direct from Meccano Ltd., Old Swan, Liverpool, price 7d. post free. (Overseas price 9d. from dealers, or 10d. post free from our agents. Canadian price, 15 cents from dealers or 20 cents, post paid, from Meccano Ltd., Toronto.

MECCANO AGENCIES

AUSTRALIA: E. G. Page & Co., 52, Clarence Street, Sydney (P.O. Box 1832K).

NEW ZEALAND: Models Ltd., Kingston Street, Auckland (P.O. Box 129).

CANADA: Meccano Ltd., 34, St. Patrick Street, Toronto.

SOUTH AFRICA: Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).

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

SPECIAL STRIP.—We were interested in your suggestion regarding a special perforated strip, and for the benefit of other readers we are illustrating this novel idea herewith. The strip would be used for coupling a Strip to a Rod, and for this purpose a length of "rod" would be formed on one end of the strip. A standard Coupling would be secured on the "rod" portion and the Axle Rod secured in its bore, while the Strip, etc., would be bolted in the usual manner to the perforated part. This assembly would certainly enable a Rod and a Strip to be joined together, but it would be very clumsy. In addition to this the suggested part would be expensive to produce, as the "rod" portion would have to be "forged," or alternatively the complete strip cut from solid and machined to shape. When it is required to join a Rod to a Strip a standard Coupling can be used, the Strip being secured to the side of the Coupling by two bolts. The Strip Coupling, of course, provides a pivotal connection between a Rod and a Strip. (*Reply to R. Walker, Leeds*).

SPECIAL GEAR WHEEL.—A 57-teeth gear wheel fitted with a boss in which is machined a square section hole so that it may fit over the winding shaft of the Clockwork Motor, is an ingenious idea. The special gear could be fitted to the Motor when the latter was secured in an awkward position in a complicated model, and a ½" Pinion meshed with the gear. The shaft carrying the Pinion could be fitted with a handle, and the Motor could then be wound up with comparatively little effort, through the 3 : 1 reduction gear so formed. There are very few instances where such an arrangement is really necessary, however, as normally a model in which the Motor is "ungetatable" is poorly designed. However, your idea is ingenious, and we may be able to consider it. (*Reply to E. C. Taylor, Manchester*).

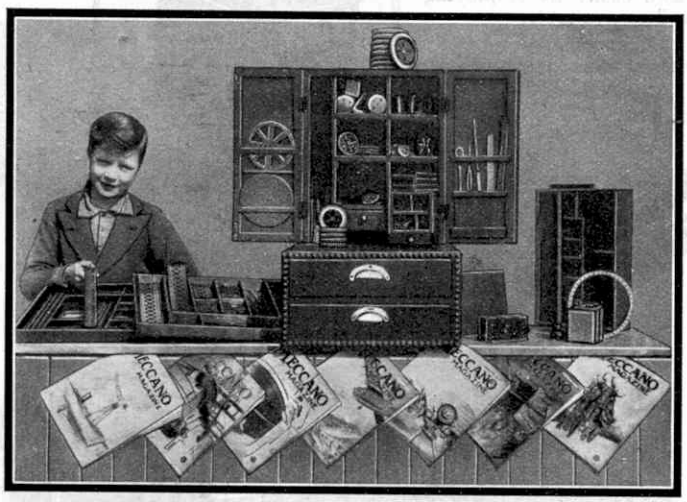
BALL AND SOCKET.—Your suggested ball and socket joint is an interesting idea. As will be seen in the sketch (Fig. 1), the joint would consist of two distinct units, a brass sphere drilled and fitted with a boss, and a cup-shaped portion also fitted with boss and set-screw, in which the sphere could rotate. Fig. 2 shows the completed joint, from which it will be seen that two "cup" portions would be used, the sphere being mounted between the two cups so that it could rotate freely. The ball and socket mechanism is not often employed in engineering, however, and the application of your proposed unit in the Meccano system would be very limited. In addition, it is possible to improvise an efficient substitute for a ball and socket from standard parts (see the Chronometric Governor described in the "Suggestions Section" for May, 1928). The Meccano Universal Joint also will be found to fulfil the function of a special ball and socket in a number of models. (*Reply to T. R. Cooke, Langley*).

Fig. 1

SELECTOR LEVER.—A selector lever for use in gear boxes, etc., is an unnecessary addition to the Meccano system, as this part can easily be formed from a Strip or a Rod fitted in a Coupling as, for example, in the Constant Mesh Gear Box described in the "Suggestions Section" for July 1929. (*Reply to R. Rose, Leigh-on-Sea*).

LENS.—A small convex lens mounted in a metal frame fitted with perforated lugs might be of some use in the Meccano system. We agree that there are several models, such as searchlights, lanterns, cinematographs, etc., that would benefit from the addition of a lens, and we hope to consider your idea in the near future. In the meantime we suggest that you use the lens from a pocket flash lamp, and this should serve your purpose quite well. (*Reply to R. Taylor, Brixton Hill, S.W.2*).

A Well-designed Storage Cabinet



This illustration shows a large storage cabinet constructed by Mr. F. N. Ablewhite, of Henley-on-Thames, to enable his son, who is shown in the photograph, to store his entire collection of Meccano parts. Two small drawers fitted in the base of the cupboard portion house nuts and bolts and other small accessories, while 24½" Angle Girders may be placed in the narrow upright section at the left-hand side. Even the doors of the cupboard have been utilised as storage space, the left-hand door holding Hub Discs and Face Plates, and the right-hand one forming a rack for a selection of model-building tools, which includes several types of screwdrivers, spanners and a metal rule.

Altogether this young engineer's "stores department" is very complete indeed, and will undoubtedly be of considerable assistance to him in model-building. Readers who are thinking of building storage cabinets for themselves should study this design carefully, as it is both ingenious and practical.

IMPROVED PULLEYS.—We do not consider that there would be any advantage in providing the 1" diam. Pulley Wheels with deeper grooves. If the special Meccano Cord is used and suitable "jockey" or guide pulleys are employed there will be little likelihood of the cord slipping from the groove. (*Reply to F. T. Hughes, Bristol*).

MODEL AEROPLANE PARTS.—We have noted your idea that we should manufacture special parts for assembling model power-driven aeroplanes and gliders. This is an interesting suggestion, but we cannot consider producing parts of this type at present. Several excellent aeroplane constructional sets are advertised in the Magazine and we suggest that you obtain one of these. (*Reply to R. Cartwright, Bolton*).

ANCHOR.—An anchor would certainly form an interesting part, but it would be difficult to find any use for it except as an ornament on model ships. When used for this purpose it would certainly add a finishing touch to a Meccano super-dreadnought, for instance! We have in mind the introduction of several miniature ship fittings, and we may be able to consider your idea. (*Reply to D. Hesketh, Blackburn*)

TIP BUCKET.—Your design for a tip bucket for use in models of cranes is quite well thought out. The bucket would be manufactured from thin sheet metal, and would be fitted with a metal yoke about which it could pivot. The yoke would be provided with a centre lug for attachment of the lifting cord, and a catch would be fitted that could be controlled by a cord so that the bucket could be tipped when required. This is certainly an interesting idea, and it will receive careful consideration. In the meantime why not try to build a "tip bucket" from Meccano parts? Be sure to let us know if you are successful. (*Reply to R. Griffiths, Wrexham*).

MULTIPLE CRANKSHAFT.—A double or triple throw crankshaft would not be a suitable addition to the Meccano system as a shaft of this type can be built quite easily from standard parts. One way of doing this is to use Cranks as the "webs" of the shaft, and to mount these in pairs on the ends of short rods that form the compound shaft. Alternatively, where only a small "throw" is required, Meccano Couplings can be used as the webs; or where the throw required is very small indeed Collars can be used mounted in the way described in the "Suggestions Section" for July, 1930. (*Reply to R. S. Edwards, Taunton*).

"000" ACCESSORY SET.—We note your suggestion that we should introduce a "No. 000a" accessory outfit so that the new No. 000 Outfit can be converted into a No. 00 set. This is a very good idea, and you will be pleased to hear that we have decided to introduce a special packet of parts that will enable the owner of a No. 000 Outfit to convert it to a No. 00, so that a much larger number of models can be built. The price of the special packet of parts is 2/9, and it may be obtained from your dealer or direct from Head Office at Liverpool. (*Reply to R. Appleby, Lincoln*).

MECCANO TRANSFORMERS.—We note that your 6-volt Motor does not run satisfactorily when supplied with current from your mains transformer. Provided the Motor itself is functioning correctly—you can test this with an Accumulator or 6-volt dry cell—the probable cause of the trouble is that you are using an old-style Meccano Transformer. The old type Transformers were introduced for driving the old 4-volt Motor, and they do not supply sufficient voltage for operating the new 6-volt Motor at full power. The new type Meccano Transformers are specially wound for operating the 6-volt Motors, and will be found very satisfactory in use. The Transformer can also be used for supplying current for lighting Meccano 6-volt Electric Lamps. (*Reply to R. Bergen, Eastbourne*).

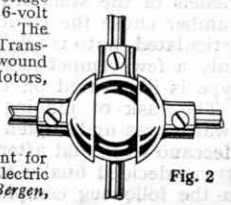


Fig. 2

Results of the "Lister Commercial Truck" Contest

By Frank Hornby

Full Lists of Prize-winners (Home and Overseas)

THIS month we publish the full lists of prize-winners in all sections of the "Lister Commercial Truck" Model-building Competition. In this contest the well-known firm of R. A. Lister & Co. Ltd., Dursley, Glos., offered many big cash prizes for the best Meccano models of a popular and ingenious type of commercial truck that they manufacture for use in engineering works, warehouses, etc., for the rapid transport of goods.

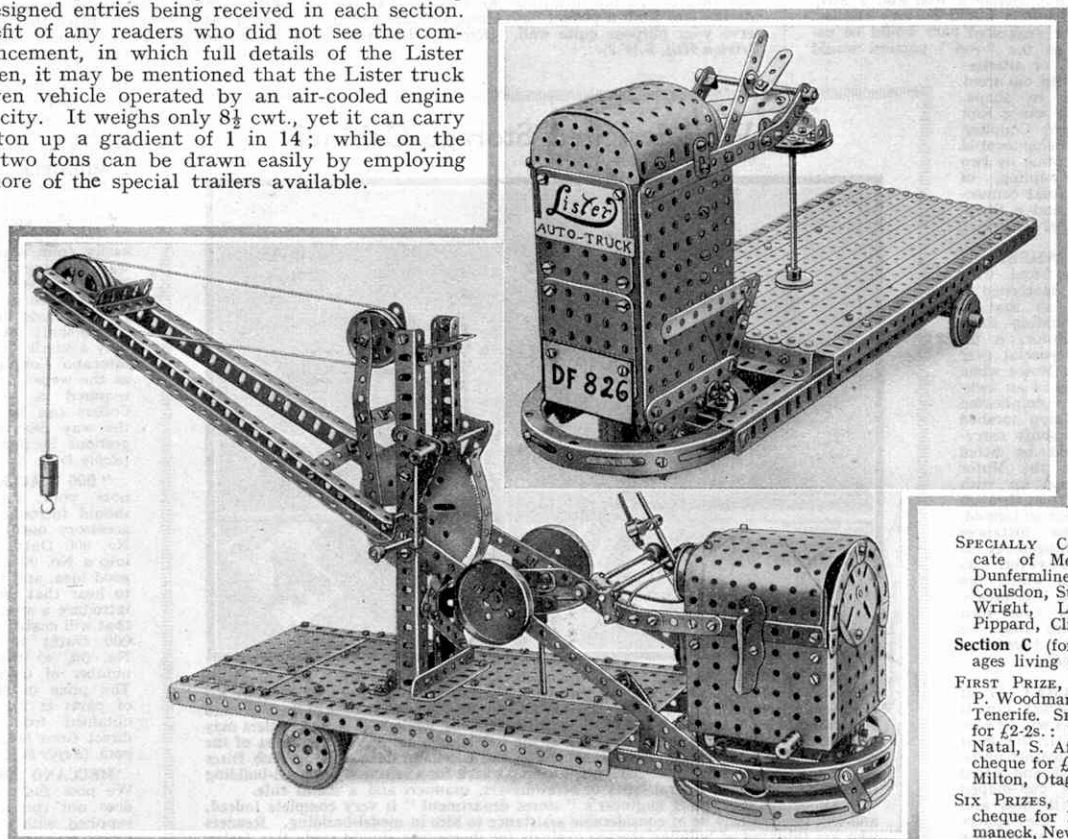
Competitors were invited to reproduce in Meccano any of the various models in which the Lister truck is available, and in building their models they were free to use any size of Outfit or number of parts they chose.

Full details of the competition were announced in the *"M.M."* for March last, and the response of Meccano enthusiasts all over the world has been splendid, large numbers of interesting and cleverly designed entries being received in each section.

For the benefit of any readers who did not see the competition announcement, in which full details of the Lister trucks were given, it may be mentioned that the Lister truck is a petrol-driven vehicle operated by an air-cooled engine of 600 c.c. capacity. It weighs only 8½ cwt., yet it can carry a load of one ton up a gradient of 1 in 14; while on the level an extra two tons can be drawn easily by employing one, two, or more of the special trailers available.

The truck is available in several different models, each designed for some particular class of work, but alike in fundamental principles. The chief models, however, are the standard fixed-platform truck, a combined truck and 10 cwt. hand-luffing crane, and an ingenious articulated auto-truck and trailer. The mechanical features of each of the models are similar. Each of these three types was illustrated in the *"M.M."* for March last, and competitors were left entirely free to model the type they preferred. The majority of competitors submitted models of the standard fixed-platform truck, and quite a large number chose the combined truck and hand-luffing crane. The articulated auto-truck, on the other hand, found favour with only a few competitors. One of the best models of the latter type is illustrated on the opposite page.

The task of judging the entries and allocating the various awards was undertaken jointly by R. A. Lister & Co. Ltd., and Meccano Ltd., and after very careful consideration of each model it was decided finally to make awards to the competitors named in the following complete lists.



(Top) H. R. Powell's model of the standard Lister Truck, which secured a prize in Section B. (Bottom) A prize-winning model from Section A, constructed by E. Whalley.

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

FIRST PRIZE, cheque for £3-3s.: C. J. Keates, Dulwich, London, S.E.21. SECOND PRIZE, cheque for £2-2s.: Alan D. Horton, Birchfield, Birmingham. THIRD PRIZE, cheque for £1-1s.: E. L. M. Shipway, Southsea, Portsmouth.

SIX PRIZES, each consisting of a cheque for 10/6: L. M. Simonds, Bromley, Kent; A. Mackenzie, Taunton, Somerset; Philip J. Wright, Cotham, Bristol; Eric Whalley, Blackburn; J. Birkbeck, Lincoln; P. R. Fairbairn, Acton, London, W.3.

TWELVE PRIZES, each consisting of a Meccano Engineer's Pocket Book: T. T. Ronald, Milnathort, Kinross-shire; G. K. Hooper, Wallasey; J. A. Willman, Dumfries; N. Hulbert, Trowbridge; William Leslie Collis, Wallasey; L. Williams, Willesden Green, N.W.10; J. Burdon, Whitby; V. C. Kaile, Mayford; R. Tipton, Bicton, Nr. Shrewsbury; G. H. Gurney, Goodmayes; F. R. Higgs, Leicester; R. Whitney, Birmingham.

SPECIALLY COMMENDED (Certificates of Merit): W. Wilkinson, Mosborough; F. Bearne, Grantham; F. A. Burgess, Birmingham; F. W. Jenner, Margate; A. Coventry, Chalford; F. Mills, Kearsley, near Bolton.

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

FIRST PRIZE, cheque for £3-3s.: H. R. Powell, Dursley. SECOND PRIZE, cheque for £2-2s.: Alan Le Claire, Worksop, Notts. THIRD PRIZE, cheque for £1-1s.: Sandy Hutton, Dunfermline.

SIX PRIZES, each consisting of a cheque for 10/6: Brian O. Way, Colchester; Ronald Edwards, Bath; Alex B. Thomson, Faversham; A. P. Birdsall, Northampton; R. A. Bayetts, Epsom; N. Gorman, Coventry.

SPECIALLY COMMENDED (Certificate of Merit): F. Kirkhope, Dunfermline; G. Faggetter, Coulsdon, Surrey; S. W. Mclan Wright, Leyton, E.10; B. Pippard, Clifton, Bristol.

Section C (for Competitors of all ages living Overseas).

FIRST PRIZE, cheque for £3-3s.: P. Woodman, Puerto de la Cruz, Tenerife. SECOND PRIZE, cheque for £2-2s.: R. Wallace, Durban, Natal, S. Africa. THIRD PRIZE, cheque for £1-1s.: Walter Fagg, Milton, Otago, New Zealand.

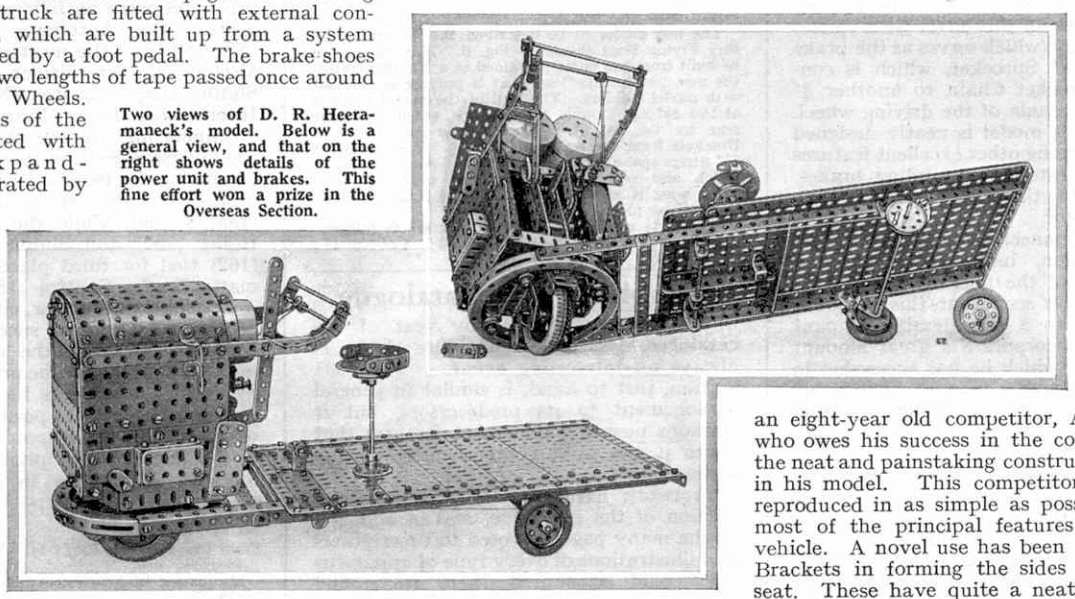
SIX PRIZES, each consisting of a cheque for 10/6: D. R. Heeramaneck, New Gamdevi, Bombay, India; Brian Warner, Grahamstown, Cape Province, S. Africa; M. Rankin, Toorak, Melbourne, Australia; Neil D. Smyth, Lindfield, N.S.W., Australia; R. Stokes, Private Bay, Auckland, New Zealand; C. A. Laskaris, Athens, Greece.

EIGHT PRIZES, each consisting of a Meccano Engineer's Pocket Book: C. E. Tremblay, Chicoutimi, P.Q., Canada; C. W. Sharpe, Nelson, New Zealand; Ken Orams, Blenheim, New Zealand; E. N. Boldero, Morningside, Auckland, New Zealand; Aubrey Shepherd, Bloemfontein, O.F.S., S. Africa; Alwyn McKellar, Johannesburg, S. Africa; E. Levin, Johannesburg, S. Africa; J. J. Pienaar, Johannesburg, S. Africa.

The features of outstanding interest in C. J. Keates' model, which won the First Prize in Section A, are the starting mechanism and external contracting brakes on all wheels. The former uses an ingenious system of levers, which work in such a way that when the driver releases the handlebar, a spring immediately pulls the Motor switch into the "off" position. The brakes on the

rear wheels are operated by a hand wheel mounted on a Screwed Rod which, when rotated, draws the brake bands taut round the grooves of Pulley Wheels secured on the axle. To apply the brake on the driven front wheel, a lever is employed. The Motor is prevented from reversing by means of a device that limits the movement of the Motor switch. The model can be manœuvred with great ease, and it displays sound and workmanlike construction throughout.

A. D. Horton, winner of the Second Prize in this Section, submitted a model of the articulated auto-truck. An illustration of the model will be found on this page. The trailing wheels of the truck are fitted with external contracting brakes, which are built up from a system of levers actuated by a foot pedal. The brake shoes are formed by two lengths of tape passed once around large Flanged Wheels. The rear wheels of the tractor are fitted with internal expanding brakes operated by the same pedal as the trailing pair of wheels. The brake drums on the rear wheels of the tractor are of very massive build, and are made from Wheel Flanges bolted to 2″ Wheels. The latter are fitted with Dunlop Tyres.



Two views of D. R. Heeramaneck's model. Below is a general view, and that on the right shows details of the power unit and brakes. This fine effort won a prize in the Overseas Section.

E. L. M. Shipway's entry features the standard fixed-platform truck. This model is most interesting, for an accelerator and clutch are included among other good features. The clutch is controlled by "Bowden" wire, made from Meccano copper wire with the insulation removed, and passed through Spring Cord. When the wire is operated by means of the lever provided, it lifts the dual-plate clutch out of engagement. The accelerator is a built-up resistance controller, and consists of an insulated Curved Strip on which are wound several turns of high resistance wire, over which the control lever slides when operated by a second lever on the steering bar. The principle of the device is similar to that of the standard Meccano Resistance Controller. Shipway's mechanism is very small, however, and can be used with advantage where space is restricted. The rear wheels are fitted with internal expanding brakes, the drums being represented by ¾″ Flanged Wheels. When the foot pedal is depressed, the ends of short Strips are caused to press outward against the inside of the ¾″ Flanges, thereby retarding the movement of the wheels. The engine rotates through a complete circle and is supported on roller bearings.

One of the best models of the combined truck and crane was that entered by Eric Whalley (Section A) and illustrated in one of the accompanying composites. The value of this type of vehicle for handling all kinds of goods will be obvious. The chassis of the model is constructed from a Circular Girder, with Strips and Angle Girders forming the side members. A particularly interesting feature is the handlebar. This is fitted with a loose rail which, when pulled towards the driver, brings the clutch into engagement. When the bar is released, the clutch springs automatically out of engagement owing to the action of a compression Spring fitted between the clutch members on the clutch spindle.

The Electric Motor is started and stopped by a control formed from a short length of Spring Cord, with a piece of flexible steel wire pushed through its centre and so arranged that when the control lever is released the switch arm of the Motor is pulled over to the "off" position by means of a Spring.

As in the prototype, no reversing gear is provided, for the "engine" unit is capable of swinging through an angle of 180 degrees, thus making reversing absolutely unnecessary.

A very praiseworthy effort was that of H. R. Powell. This entry took the First Prize for boys under 14 years of age and is illustrated here. The engine unit is a Meccano Electric Motor, the drive from which is transmitted by Sprocket Chain to the front wheel. The entire mechanism is pivotally mounted and is free to swing through 180 degrees. The rear shaft is fitted with a brake drum, the brake being operated from a foot pedal.

Somewhat similar models to Powell's secured the Second and Third Prizes in this Section, the former prize being won by an eight-year old competitor, Alan Le Claire, who owes his success in the contest chiefly to the neat and painstaking construction displayed in his model. This competitor has carefully reproduced in as simple as possible a manner most of the principal features of the actual vehicle. A novel use has been made of Angle Brackets in forming the sides of the driver's seat. These have quite a neat effect.

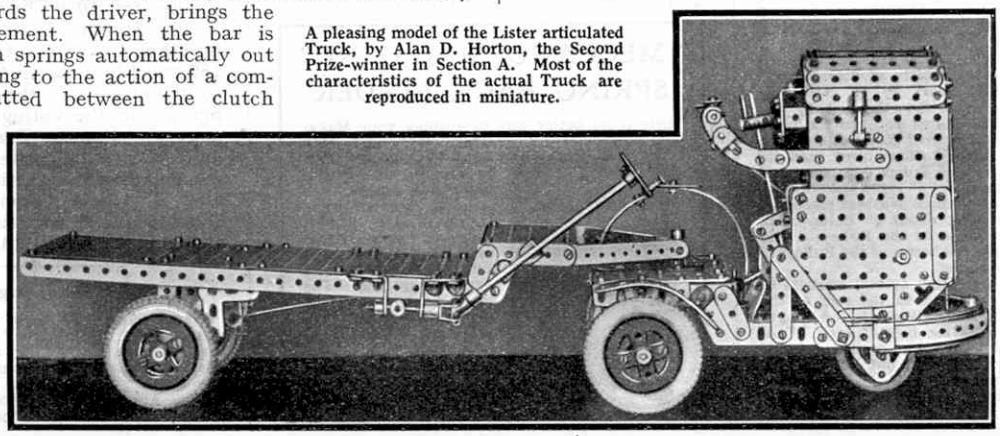
Sandy Hutton, the Third Prize winner, has every reason to be proud of his success, for his model is a very realistic reproduction of the standard truck. So far as constructional details are concerned the model follows closely that submitted by Alan Le Claire.

The biggest prize in the Overseas Section was won by P. Woodman with a model of the fixed-platform truck. This entry is built to a very generous scale, for it measures 22 inches in overall length and has a breadth of 9 inches.

The engine is represented by a six-volt Meccano Motor, the drive from which is transmitted to the front wheel through a reduction gear of 121½ : 1 ratio. This ratio is obtained by using ½″ Pinions and 57-teeth Gear Wheels, with a 1″ Sprocket on the axle of the last gear driving a 1½″ Sprocket on the front wheel axle. External contracting brakes are fitted on each wheel, the rear wheel brakes being applied by a pedal and the front wheel brake from a hand lever.

R. Wallace, another Overseas competitor, uses a 4-volt Motor as the driving agent in his model of a standard truck. The Motor stands on end in a framework composed of 2½″ Angle Girders, built round the lower end of the Motor. ½″ loose Pulley Wheels are mounted round the sides of this frame, and the grooves of the Pulleys fit the inner rim of a Circular Girder. The Motor unit can thus rotate through 180 degrees.

The Motor drive is transmitted via a clutch. A ½″ Pinion bolted to the armature spindle engages a 57-teeth Gear, on the axle of which is another ½″ Pinion engaging a second 57-teeth Gear. On the axle of the latter is the clutch, which is made up as follows. A 1″ Pulley is bolted to the axle, and is kept away from the inner surface of the Motor side plate by a Compression Spring. A circle of sandpaper is Seccotined to this Pulley Wheel, and another circle of sandpaper is Seccotined to a ¾″ Pinion (which is free to revolve



A pleasing model of the Lister articulated Truck, by Alan D. Horton, the Second Prize-winner in Section A. Most of the characteristics of the actual Truck are reproduced in miniature.

on its Rod), which is spaced from the other side plate by a Collar also free to rotate on its Rod. In between the Pulley and the Pinion is a circle of rubber. The Spring keeps the Pulley and the Pinion close together, thus compressing the rubber, and transmitting the drive from the Pulley to the ¾" Pinion. To declutch, the Pulley is withdrawn from the Pinion. The ¾" Pinion drives a 50-teeth Gear, the axle of which carries a ½" Pinion that drives a 57-teeth Gear directly above the driving wheel. The axle of this latter Gear carries a ½" fixed Pulley (which serves as the brake drum) and a ¾" Sprocket, which is connected by Sprocket Chain to another ¾" Sprocket on the axle of the driving wheel.

Walter Fagg's model is neatly designed and includes among other excellent features a clutch, and internal expanding brakes. The power unit in this instance is a Meccano Clockwork Motor.

D. R. Heeramaneck, a competitor in the Overseas Section, built the fine model shown in one of the illustrations on page 883. It will be seen that this competitor has gone to a considerable amount of trouble to incorporate a great amount of detail work, which he has succeeded in reproducing in such a manner as to avoid the scrappy appearance usually resulting from the presence of a number of minor items.

The number of really noteworthy entries that were submitted is sufficient evidence of the popularity of the contest, and while I should like to have mentioned all of the prize-winning entries, space has permitted me to deal only with those models of particular merit.

R. A. Lister & Co. Ltd., wish to take this opportunity to express their appreciation of the excellent work done by competitors, for collectively they have made the "Lister Truck" Contest one of the most interesting that have yet been organised.

New Meccano Models—(*Continued from page 889*)

The model double-decked tram car shown in Figs. 5 and 7 incorporates several novel features. The tram body is mounted on two four-wheeled bogies placed at each end, a spring-controlled trolley pole is mounted on the roof, while the interior is furnished with dummy motor controllers for the driver and a "bell" system is provided for the conductor!

The base frame of the model consists of two 12½" Angle Girders spaced apart by means of a 5½"×3½" Flat Plate and four 3½" Strips 7. Two 2½" Curved Strips are bolted to each end, as can be seen in Fig. 5, to complete the frame. Braced Girders and Strips are attached as shown in Figs. 5 and 7 to the sides and ends of the base frame to form the body and the whole is surmounted by seven 12½" Strips which form the roof. The floor of the "upper deck" consists of two 5½"×3½" Flat Plates held to the sides by means of 12½" Angle Girders.

The seats fitted to the upper deck consist of two sets of 5½" Strips 2 connected together at the ends by means of 2" Strips, which are secured to the floor of the upper deck by means of two 9½" Angle Girders 3 (see Fig. 7). The seats proper are 5½" Strips similar to 2 but are joined together by Flat Brackets and secured to the backs by Angle Brackets.

The construction of the bogies can be followed from Fig. 5. Each bogie consists of two 3½"×½" Double Angle Strips held apart by 1½" Strips at one end and by a Trunnion at the other. A 1½"×½" Double Angle Strip is also bolted between the bogie frame, and a 2" Pulley 5 is secured to this and to the Trunnion by ⅜" Bolts, three Washers being used for spacing purposes. The second Pulley 4 is connected to two 1½" Strips 6 by means of ⅜" Bolts spaced away from the Strips by means of three Washers placed on each bolt. The bogies pivot about ¾" Bolts which are passed through the bosses of the Pulleys 4 and nipped by the set-screws in the bosses of the Pulleys 5 which are secured to the bogies.

The conductor's bell signalling system consists of 1½" Flanged Wheels 1, attached to the roof of the lower deck by means of Angle Brackets. A length of cord is threaded through the boss of each Wheel and a Collar is attached to each end of the cord. If the cord is drawn down at any point between the two Flanged Wheels, one or other of the Collars will be drawn up, thus striking the wheel forming the bell or gong!

The following parts will be required in the construction of the model Tram Car:

9 of No. 1; 2 of No. 1b; 12 of No. 2; 2 of No. 2a; 7 of No. 3; 2 of No. 4; 18 of No. 5; 4 of No. 6; 6 of No. 6a; 4 of No. 8; 4 of No. 8a; 12 of No. 10; 4 of No. 11; 20 of No. 12; 1 of No. 13; 3 of No. 16a; 4 of No. 17; 2 of No. 18a; 4 of No. 20; 4 of No. 20a; 2 of No. 20b; 4 of No. 22; 1 of No. 23; 169 of No. 37; 6 of No. 37a; 24 of No. 38; 1 of No. 40; 1 of No. 43; 2 of No. 45; 2 of No. 48; 2 of No. 48a; 4 of No. 48b; 3 of No. 52a; 13 of No. 59; 4 of No. 63; 2 of No. 77; 4 of No. 90a; 8" of No. 94; 4 of No. 99; 4 of No. 100; 4 of No. 103f; 3 of No. 111; 6 of No. 111c; 2 of No. 115; 1 of No. 116; 1 of No. 116a; 2 of No. 126; 1 of No. 147b.

Flying Boat

The last model to be described this month is the tiny Flying Boat shown in Fig. 6. This model can be built from the parts contained in a No. 000 Outfit, the new "simplicity" set that is proving so popular with model-builders. The hull of the model consists of two 2½"×½" Double Angle Strips, extended at the rear by two 2½" Strips to form the tail (two Flat Brackets form the tail plane itself!). The wings are 5½" Strips spaced apart by two ½"×½" Angle Brackets, which also represent the "engine nacelles." The lower wing is attached to the upper Angle Strip of the hull by means of a bolt.

The parts used in the Flying Boat are as follows: 2 of No. 2; 2 of No. 5; 2 of No. 10; 4 of No. 12; 12 of No. 37; 2 of No. 48a.

Hobbies 1931 Catalogue

The appearance year by year of the catalogue issued by Hobbies Ltd. is always an interesting event. The 1931 edition, just to hand, is similar in general arrangement to its predecessors, but it contains new and important features that make it the most comprehensive of the series.

Fretwork naturally occupies the main portion of the catalogue, and in addition to the many pages devoted to descriptions and illustrations of every type of apparatus that could be desired, there are special articles giving really practical advice on how to start this fascinating hobby. There is also a splendid collection of more than 400 illustrated designs, including a great variety of ornamental and useful articles, ranging from photo frames and letter racks to artistic clock cases and cabinets for china. The general woodworker also is well catered for, and there are articles on polishing woodwork, the making of useful trays, the fixing of hinges, and many other thoroughly interesting topics. The lathe worker will find much to interest him, and the tools listed and illustrated cover the requirements of even the most advanced woodworker. Among many other attractive items are model sailing boats and steam launches.

The catalogue, with free designs, may be obtained for 9d. from any Hobbies dealer, or direct from Hobbies Ltd., Dereham, Norfolk, for 1/- post free. From the same address may be obtained, post free, an interesting 16-page booklet entitled *"For Makers of Things in Wood."* All that is necessary is to send a postcard asking for the booklet, giving your name and address and mentioning the *"M.M."*

"Suggestions" Contest Results

In the "Suggestions Section" for January of this year we announced a Voting Contest with the object of discovering the most popular Suggestions published from January 1929 to January 1930. Competitors were asked to write down in order of merit the four suggestions they considered the most interesting.

The best suggestions as determined by the votes were as follows. In the Home Section the Automatic Traffic Control (No. 159) was the most popular, with the Mechanical Screwdriver (No. 155), the Sliding Dog Gear Box (No. 162) and the Interlocking Lever Frame (No. 145) as "runners up," in the order named. In the Overseas Section there was a different result, for the Bendix Drive (No. 149) was first, with the Mechanical Screwdriver (155) second, while the Resistance Controller (152) and Sliding Dog Gear Box (162) tied for third place, and the Automatic Traffic Control (159) was fourth.

No single competitor, either in the Home or Overseas Sections, succeeded in placing the suggestions in the correct order of merit, and therefore the prizes were allotted by giving four points for each suggestion placed in the correct position, three points when it was one place out, and so on. The names of the prize-winners are as follows (the figures in brackets denote the individual scores):—

Section A (Home)

FIRST PRIZE, cheque for £1-1s.: William T. Chambers, Pleasley, near Mansfield, (11). SECOND PRIZE, cheque for 10/6: William R. Lang, Glasgow, W.4 (10).

NINE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: L. B. Sholl, London, S.E.6 (9); F. Smith, Lenton, Nottingham (8); E. A. Steele, London, N.7 (8); G. Wild, Orrell; L. Leeson, Brigg; H. G. Kidd, March; F. Margerison, Blackburn; R. Laws, Ely; A. W. Gadd, Deal (7 each).

EIGHT PRIZES, each consisting of a Meccano Engineer's Pocket Book: K. G. Budden, Southsea; J. T. Tingley, London, S.E.2; C. E. Wrayford, Teignmouth; K. Costain, Bolton; J. Cottam, Pontefract; B. Unné, Harrogate; W. L. Maclean, Stornoway; V. Clement, Willington (6 each).

Section B (Overseas)

FIRST PRIZE, cheque for £1-1s.: J. Jessen, Dargaville, New Zealand (12). SECOND PRIZE, cheque for 10/6: Miss C. Consalves, Bombay, India (11).

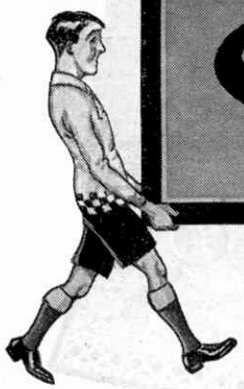
FIVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: Hervert Curry, Windsor, Nova Scotia (10); Colyn Rolston, Levin, New Zealand (9); W. Flanderka, Colombo, Ceylon (7); D. Atkinson, Nowra, N.S.W., Australia (6); D. Thompson, Blenheim, New Zealand (6).

NINE PRIZES, each consisting of a Meccano Engineer's Pocket Book: R. Baker, Bathurst, Australia; J. A. Gomes, Bandra, Bombay, India; and J. A. Rodriguez, Montreal, Canada (5 each); R. Russell, Whangarei, New Zealand; C. J. McCain, Leichhardt, Sydney; J. Buckell, Montreal; B. Willis, Stratford, Canada; Miss J. A. Arcus, Masterton, New Zealand, and Gordon L. Arcus, Masterton, New Zealand (4 each).

Special Prizes, each consisting of a cheque for 10/6, have been awarded to J. R. Sprent, Portsmouth, and J. H. Smythe, Coventry, for suggestions Nos. 159 and 149 respectively, and the following contributors of the other suggestions figuring in the voting will each receive a copy of "Famous Trains" by C. J. Allen and a Certificate of Merit:—F. K. Lochart, Birmingham (Suggestion No. 155); J. M. and A. M. Johnston, Dunstable (162); R. M. Bleas, Newcastle (152); W. Pantin, Blackheath, S.E.2 (145).

A Welding Contest

Commencing with their November issue the Proprietors of "The Welder" have decided to offer a monthly prize of £5-5s. for the best illustrated article describing interesting jobs undertaken by the Electric Arc Welding Process. For further particulars apply to the Alloy Welding Processes Ltd., Ferry Lane Works, Forest Road, Walthamstow, London, E.17.



Suggestions Section

Edited by "Spanner"

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

(208)—Four-Cylinder Electric Engine

(L. Hoydon, York)

In the "Suggestions Section" for June, 1930, we described the construction of a novel electric engine that resembled closely both in operation and appearance a single-cylinder steam engine of the inverted vertical type. Fig. 208 shows a general view, and Fig. 208a a sectional view of an interesting development of this model, in the shape of a four-cylinder engine. The basic principle of both models is the same, but in the case of the one about to be described the employment of four cylinders in line necessitates the use of a four-throw crankshaft and a more complicated form of switchgear. The latter is necessary on account of the fact that each solenoid must be energised at the correct moment when the respective plungers are on the upstroke. The crankshaft, connecting rods, and cylinders are contained in a common casing, which lends to the model an exceptionally neat and business-like appearance.

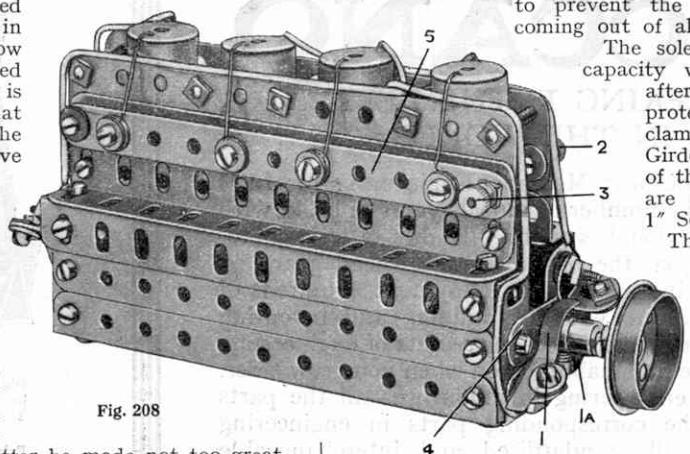


Fig. 208

The engine should prove very handy as a power unit for large Meccano models of single and multi-engine aeroplanes on account of its compact nature. It develops sufficient power to drive a propeller composed of Meccano Propeller Blades, provided that the pitch angle of the latter be made not too great.

The base of the crankcase consists of a 5½" Flat Girder to the sides of which are bolted 5½" Angle Girders; and to its ends 1½" Angle Girders are secured. Four 1½" Angle Girders are then secured in a vertical position to the four corners of the crankcase base. Each side portion of the crankcase (one of which is shown detached in Fig. 208a) is composed of two 5½" Flat Girders and two 5½" Angle Girders, the latter being bolted together so that their flanges form a Z. Both sides may be completed, but only one should be secured in place, so that the assembly of the internal mechanism may be accomplished with greater ease.

The crankshaft, as mentioned above, is of the four-throw type, each crank consisting of two Couplings that are secured by their centre holes to the ends of short Rods 9 that form the straight portions of the crankshaft. The crankpins, on which the lower ends of the connecting rods 8 are mounted, each consist of a 1" Screwed Rod that is secured by lock-nuts 10 in the transverse end tapped holes of each pair of Couplings, the upper extremities of the connecting rods being carried on Setscrews inserted in Collars on the ends of the piston rods. The complete crankshaft is journalled in 1½" Strips 4, and care should be taken to see that all Grub Screws and lock-nuts are tightened very securely in order to prevent the possibility of the crankshaft coming out of alignment.

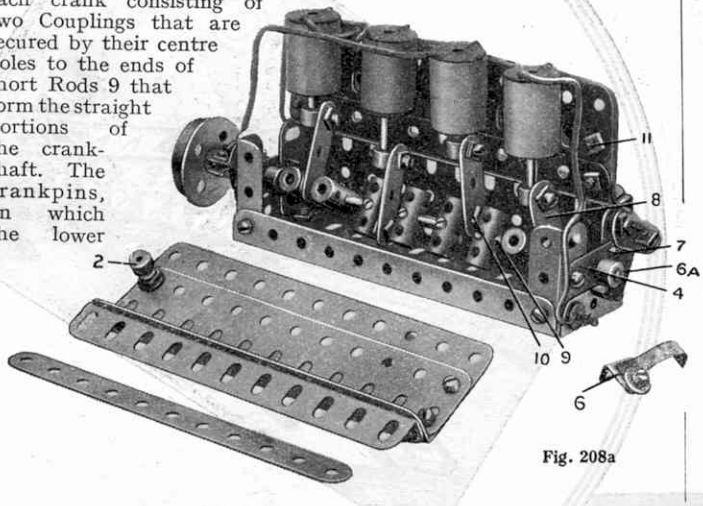


Fig. 208a

The solenoids are wound to their full capacity with No. 26 gauge wire, and after being covered with paper to protect their windings, they are clamped in position between the Flat Girders that form the top portion of the crankcase. The Flat Girders are drawn together by means of 1" Screwed Rods.

The next item to claim our attention is the rotary switchgear. Two similar switches are required, one on each end of the crankshaft; and each takes the form of two brushes (Pendulum Connections, part No. 172) 1, 1a, which are bent carefully to the shapes shown so that they make contact alternately with a Setscrew inserted in a Collar on the crankshaft, as the latter rotates. The brushes are attached rigidly to ½" × ½" Angle Brackets that are secured by 6 B.A. Bolts to the end of the crankcase, and are insulated from it by Insulating Bushes and Washers.

A similar arrangement is followed at the other end of the crankshaft, and from Fig. 208a it will be seen that the brush 6 has been removed in order to show the Setscrew 7.

Electrical Connections of the Model

The brush 1 is connected by rubber-covered wire to the second solenoid, and the brush 1a to the third solenoid (counting from the right-hand end of the model in Fig. 208); and the remaining two solenoids are connected to the brushes 6 and 6a. The other ends of the windings of the solenoids are all connected to a common "busbar" 5, which is composed of a 5½" Strip that is attached to, and insulated from, the Flat Girders by means of 6 B.A. Bolts and Insulated Bushes and Washers. A Terminal 3 is mounted on the shank of one of the 6 B.A. Bolts that serve to secure the busbar in place, and a second terminal 2 is secured in metallic contact with the frame of the model.

The path of the current may be assumed to be from the accumulator to the terminal 3 on the busbar, and from there through the particular solenoid, the switch of which happens to be making contact. The closing of the switch allows the current to pass through the frame of the model to the terminal 2 and to the other pole of the accumulator, thus completing the circuit.

A careful examination of Fig. 208a will reveal the fact that Nuts are used instead of Washers on the shanks of the Set-screws that attach the connecting rods to the piston rods. This is due to the nuts being slightly thicker, thereby taking up the play that would be present were Washers used.

It will readily be realised that as the power of the solenoids is strictly limited, it is of the greatest importance to ensure satisfactory working of the model, that friction be reduced to the lowest by careful adjustments to the moving parts and by judicious lubrication.

No. 00 OUTFIT
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This Outfit is specially suitable for young boys. The Manual of Instructions included shows how 190 interesting models may be constructed.
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No. 3 „ ...	27/6	No. 7 „ „	450/–

MECCANO LIMITED
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More Prizes for Meccano Model-Builders!

Cash Awards for Meccano Model Aircraft

IN several recent model-building contests aircraft models have been very popular subjects with competitors, probably owing to the fact that they lend themselves to a wide diversity in design, and may be reproduced with remarkable accuracy, even with small Outfits.

With a view to encouraging enterprise and exploiting to the full this field of Meccano engineering, we are announcing a splendid aircraft-building competition, in which many cash prizes are offered for the best models of any type of aircraft built by Meccano model-builders. Competitors may build their models from any Outfit or number of parts, and on the lines of any existing machine that comes under the general classification of "aircraft"—monoplanes, biplanes, triplanes, gliders, helicopters, airships, seaplanes, flying boats, etc. We wish to emphasise that it is not necessarily the largest and most complicated models that will win the prizes, for very often simple and straight-forward models are the best and most realistic.

The contest is open to Meccano model-builders of all ages, no matter whether they live in the British Isles or Overseas; and there are no fees to pay or forms to fill in.

List of 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 products to the value of 10/6.
Twelve Prizes, each consisting of Meccano products to the value of 5/–.

The Prizes in Section B are as follows:—

First Prize: Meccano products to value two guineas.
Second Prize: Meccano products to value one guinea.
Third Prize: Meccano products to value 10/6.
Six Prizes, each consisting of Meccano products to the value of 5/–.

A limited number of Certificates of Merit and Consolation Prizes will be awarded in each Section.

Intending competitors should note that reproductions of models described in any of the Meccano publications are not eligible for entry in this contest, and any such models received will be disqualified.

Entries will be divided into the following sections: Section A, for competitors living in the British Isles and over 14 years of age; Section B, for competitors living in the British Isles and under 14 years of age; Section C, for Overseas competitors of all ages. The age of each competitor will be taken into consideration when judging the entries.

Competitors should send in either a photograph or a good drawing of their models, together with a brief explanation of any interesting feature that may be present, although the latter should be made as short as possible. The competitor's age, name and address should be written clearly on the back of each sheet of paper or photograph sent, together with the letter A, B, or C indicating the Section in which the model is entered. Envelopes should be addressed to "Aircraft" Competition, Meccano Ltd., Old Swan, Liverpool. Closing date for Sections A and B, 31st December, 1930. Section C, 28th February, 1931.

It is absolutely essential that the model should be the result of the competitor's own unaided efforts.

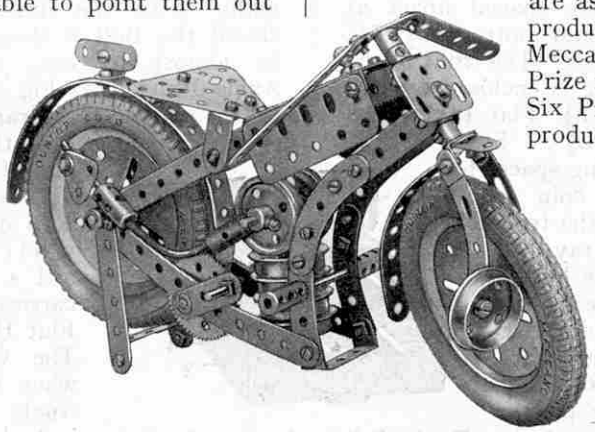
How Many Errors in this Meccano Motor Cycle?

A glance at the Meccano Motor Cycle illustrated on this page will show that a number of mistakes have been made both in designing and constructing the model. Most of the mistakes are obvious, and any Meccano enthusiast should be able to point them out without difficulty.

We are offering a number of splendid prizes to the competitors who make the lists containing the largest number of mistakes and state clearly and briefly the best way in which the faults may be rectified. A good plan is to tabulate all the errors in column form, and then, against each item on the list, write a short explanation of a way in which the error may be remedied.

Entries will be divided into two sections as follows:—Section A, for competitors of all ages living in Great Britain; Section B, for competitors of all ages living Overseas.

The prizes to be awarded in each Section of the Contest are as follows: First Prize: Meccano products to value £2-2s. Second Prize: Meccano products to value £1-1s. Third Prize: Meccano products to value 10/6. Six Prizes, each consisting of Meccano products to value 5/–. Six Prizes, each consisting of a copy of "*Famous Trains*" by C. J. Allen.



Competitors should write their name and address clearly on the back of the entry. Envelopes should be addressed to "Errors" Contest, Meccano Ltd., Old Swan, Liverpool. Closing dates: Section A, 29th November, 1930. Section B, 31st January, 1931.

New Meccano Models

Penny-in-the-Slot Machine—Model Flying Boat—Electric Tram Car

ONE of the great benefits of the Meccano hobby is that in addition to giving the model-builder hours of fun and amusement it also enables him to understand the working of all kinds of machines and mechanisms that he sees about him. There are without doubt many thousands of boys who owe their knowledge of the intricacies of motor cars, clocks, looms, etc., to a study of accurate Meccano models of these machines; and many other instances could be found where a complicated mechanism or movement can be demonstrated clearly by means of a Meccano model.

This month we are including details of a Meccano model of a "penny-in-the-slot" machine, which should be of particular interest to model-builders as the mechanism incorporated in these "robot salesmen" is remarkably ingenious. A model tramcar and a flying boat complete this month's collection of new examples.

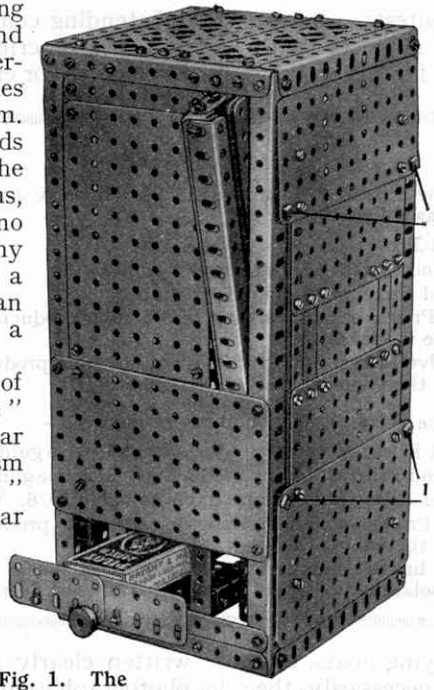


Fig. 1. The Meccano Penny-in-the-slot Machine.

Penny-in-the-Slot Machine

Many Meccano boys, when extracting a bar of chocolate from an automatic machine, will have wondered how the mechanism was arranged. Those who have been unable to solve this problem should study the mechanism of the model shown in Fig. 1, as it resembles closely that incorporated in a standard machine. The casing of the model should be built first and the mechanism fitted into position after it has been assembled.

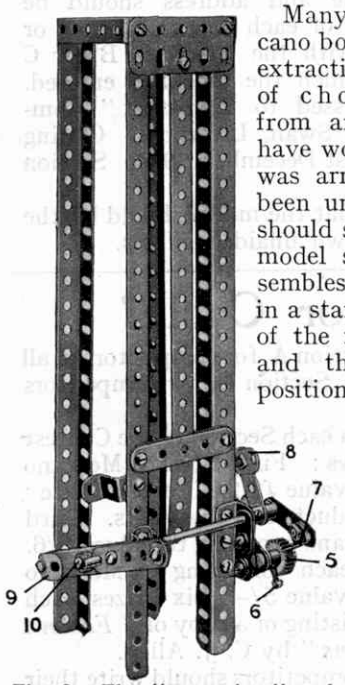


Fig. 2. The "magazine" and trip gear removed from the casing of the machine.

The frame of the casing consists of four 12½" Angle Girders spaced apart at top and bottom by 5½" Girders. The front of the casing is enclosed by two 5½"×3½" Flat Plates and a 3½" Strip, leaving spaces for the coin chute and the front of the tray.

The back is filled in with four 5½"×3½" Flat Plates and three 5½" Strips, while the sides are built up from Flat Plates and Strips, as can be seen in Fig. 1. The built-up side plates can be removed by unscrewing four nuts 1 from bolts that are secured firmly by additional nuts to the 12½" Angle Girders. The machine can thus be reloaded and attention can be given to the mechanism if necessary.

The operating mechanism is shown in Fig. 3 removed. Four 12½" Angle Girders are spaced apart by 2½"×½" Double Angle Strips and 2½" Strips to form a receptacle for the match boxes. It will be seen that the bolts are arranged so that they do not interfere in any way with the downward movement of the boxes. The 9½" Strip bolted between the rear pair of Girders is clamped between two 2½" Strips (see Fig. 2) near its lower end.

The drawer and guides on which it slides are shown in Fig. 4. The bolts 2, which hold the 2½" Strips to the 1½"×½" Double Angle Strips of the slide, should be passed through the vertical 12½" Angle Girders, one hole above their lower extremities. The Angle Brackets 3 form guides for the 5½"×½" Double Angle Strips of the drawer. The Rack Strip 4 is secured to a 1"×1" Angle Bracket and to a 3½" Strip that is fixed by an Angle Bracket to the Flat Girders that form the front of the drawer.

A ¾" Pinion 5 (Figs. 2 and 3) is mounted on a Pivot Bolt and gripped in place by a ½" Bolt 6. When the drawer is moved in or out, the Rack Strip engaging with the Pinion causes the latter to rotate. Normally, with the drawer closed the Bolt 6 should be almost touching an Angle Bracket 7 (Fig. 2) that is secured to a Crank on the end of a 4½" Axle Rod, which also carries a second Crank to which the Flat Bracket 8 is fixed by a ¾" Bolt. The Cranks are arranged so that when the ¾" Bolt strikes the vertical Angle Girder, the Angle Bracket 7 just clears the teeth of the Pinion 5.

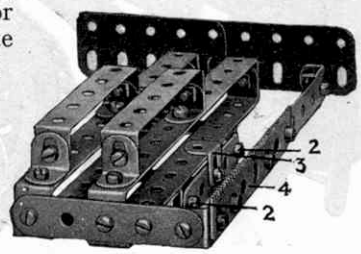


Fig. 4. Delivery drawer and guides.

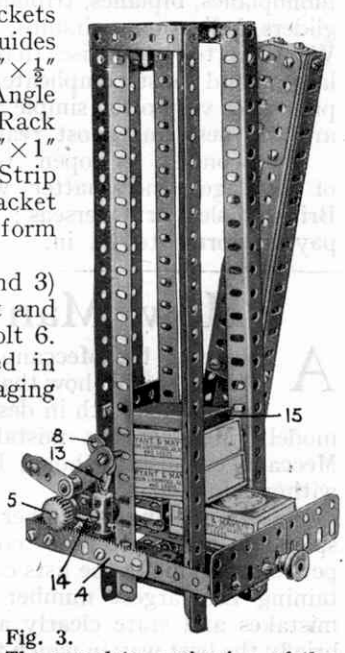


Fig. 3. The complete mechanism of the Slot Machine with delivering drawer and match-boxes in position.

A 4½" Strip is bolted to a Double Arm Crank fixed on the other extremity of the 4½" Rod, and carries two 2½" Strips which act as a balance weight. The weight is adjusted correctly by means of a bolt and Washers. The Flat Bracket 9 is spaced from the 4½" Strip by two Washers and a ⅜" Bolt 10 carrying four Washers is bolted in the fourth hole from the end of the Strip so that the falling coin may rest on the Strip.

The coin chute should next be built up. This consists of two pairs of 9½" Angle Girders bolted, one inside the other, so that a space rather thicker than a penny is left between them (see Fig. 1). A 7½" Angle Girder is attached to each of the compound Girders and the latter are held at the correct distance apart by means of two 2½" Flat Girders. The top end of the chute is partly filled in with a Flat Bracket secured in position by means of two ½" × ½" Angle Brackets. This form of construction provides a slot down which a penny can slide freely and so reach the actuating mechanism.

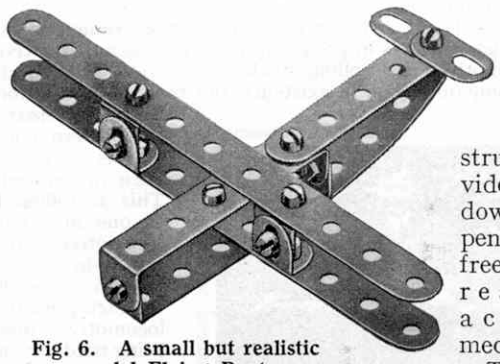


Fig. 6. A small but realistic model Flying Boat.

The chute is secured in place by a 1" Triangular Plate bolted to the upper transverse 5½" Angle Girder at the front of the outer casing of the model and also by the ½" Reversed Angle Bracket shown in Fig. 2.

The cycle of operation of the mechanism after a coin has been inserted is as follows. The penny is placed in the chute and falls between the Flat Bracket 9 (Fig. 2) and the 4½" Strip. The Washers on the Bolt 10 serve as a "stop," for a penny, but if anyone should attempt to "defraud" by inserting a half-penny it will not be retained between the Bracket and Bolt, and will merely fall into the machine without actuating the mechanism. Which after all is but a just reward for such dastardly conduct!

The weight of the penny raises the Crank carrying the Angle Bracket 7, but only sufficiently to allow the Bolt 6 to pass unimpeded, for the Centre Fork 13 engages the Flat Bracket 8 and prevents further movement of the Crank. The Centre Fork is held in a Coupling which is loosely attached to the model by a ¾" Bolt passed through its centre transverse hole, and secured by two nuts to an Angle Bracket. The Rod 14 held in the lower transverse hole of the Coupling is forced upward by the Bolt 6 when the drawer is pulled out, and thus forces the Centre Fork 13 out of engagement with the Flat Bracket. The penny is then free to drop off the end of the lever. The weight of the Rod 14 then returns the Centre Fork to its normal position, and as the drawer is pushed back the Bolt 6 raises the Angle Bracket 7, which should be arranged obliquely. When the drawer is pushed right in, the next box of matches should fall into position in the drawer, and the weight 15 (See Fig. 3)—consisting of a piece of lead—is provided to assist the downward movement of the boxes in the vertical guides.

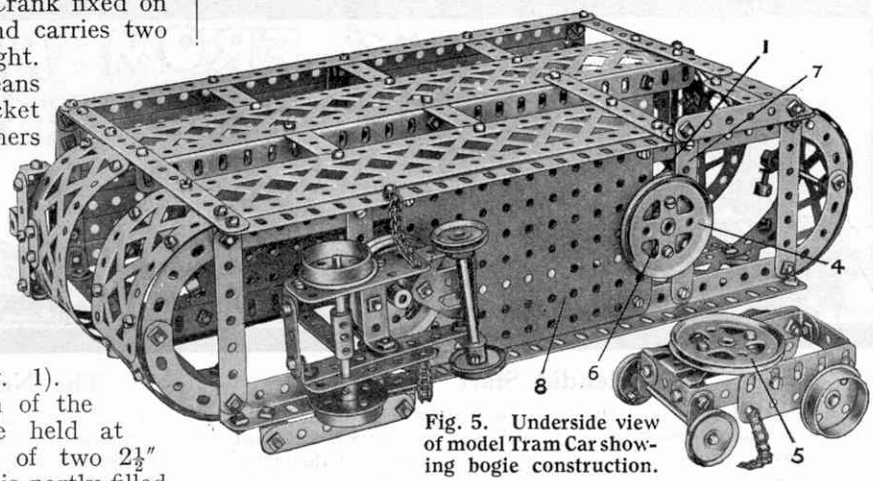


Fig. 5. Underside view of model Tram Car showing bogie construction.

After the mechanism has been completed, ten small-size match boxes should be inserted in the "magazine," and the right-hand side plate secured in position by means of four nuts 1 (see Fig. 1). The model is then ready for operation.

It will be noted that the model does not incorporate a container for the coins after they have fallen off the weighted arm. We do not think this omission will present much difficulty, however, as model-builders should find it quite a simple matter to devise a "strong box" in which their wealth may rest in perfect safety!

In order to build the Meccano Penny-in-the-slot Machine the following parts will be required:

1 of No. 1; 1 of No. 1a; 5 of No. 2; 1 of No. 2a; 2 of No. 3; 11 of No. 5; 8 of No. 8; 8 of No. 8a; 2 of No. 8b; 8 of No. 9; 1 of No. 9f; 4 of No. 10; 12 of No. 12; 1 of No. 12a; 1 of No. 15a; 1 of No. 18b; 1 of No. 23a; 1 of No. 26; 170 of No. 37; 13 of No. 37a; 16 of No. 38; 2 of No. 48; 4 of No. 48a; 4 of No. 48d; 4 of No. 52a; 4 of No. 53a; 1 of No. 59; 2 of No. 62; 1 of No. 62b; 1 of No. 63; 1 of No. 65; 6 of No. 70; 2 of No. 72; 2 of No. 77; 2 of No. 100; 5 of No. 103f; 1 of No. 110; 1 of No. 111; 2 of No. 111a; 2 of No. 111c; 1 of No. 125; 1 of No. 147b. (*Continued on page 884*)

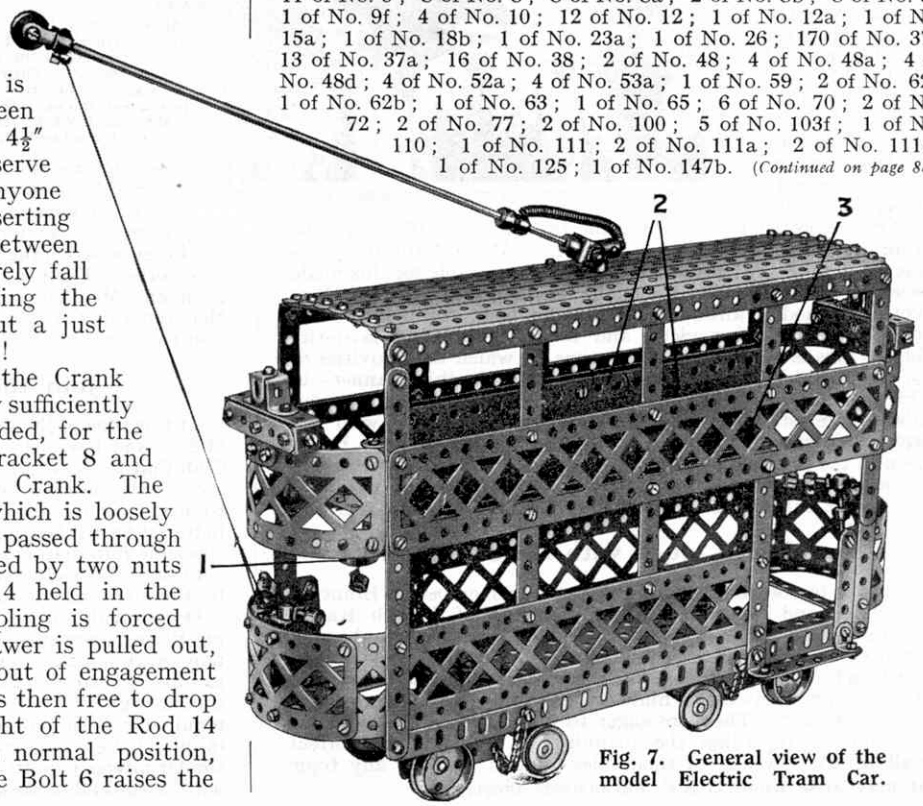
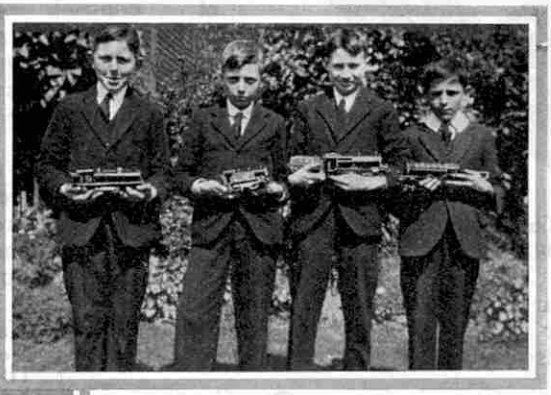


Fig. 7. General view of the model Electric Tram Car.

A Splendid Start

Last month I remarked that members of local Branches were returning to indoor meetings with increased enthusiasm and that there was every prospect of wonderful advances being made during the coming winter. Since writing to that effect more reports of the first meetings of local Branches have reached me and in them there is every promise of a record year for the H.R.C. Ingenious ideas for extending the scope of Branch tracks, and also for varying the programme by the introduction of Lectures and Debates and of various hobbies, games and recreations are being ardently pursued, and it is quite clear that for every miniature railway enthusiast who has followed my advice to identify himself with a local Branch of the H.R.C., a really good time is in store.

The reports that I have received mention many interesting events and incidents. Among these perhaps the most noteworthy is the extraordinary success that has attended the members of one Branch at a local Flower Show and Carnival. Included in the programme were a number of competitions, among which were two for the best model railways laid down in a certain amount of space, and for the construction of models of locomotives and other features of railway interest respectively. Naturally the members of the local Branch entered eagerly into the competitions and between them they succeeded in carrying off all the prizes in these sections. This was a remarkable feat and a proof of the interest and efficiency of the Branch.



(Above) C. S. J. Evans (H.R.C. No. 15210), Bedford, and his friends exhibit their favourite locomotives. (Left) Members of the Blackpool (Northern Section) Branch, No. 29 : Chairman, Mr. Charles B. Band ; Secretary, A. Ian Howarth. This Branch has two permanent tracks. These represent sections of the L.M.S. and L.N.E.R. respectively, and there is keen rivalry between the two operating staffs.

An event of a somewhat different character but one that is in many respects equally noteworthy is reported from the Cardiff Branch, No. 107. At the Cardiff Broadcasting Station a talk on "*Model Railways*" was being given, and the gentleman who was responsible for this made special reference to the Branch as an association of members devoted to model railway matters, who meet together for the purpose of exchanging views and indulging in their favourite hobby. This is not quite the first time on which the activities of such an organisation have been referred to in this manner—in Sydney, Australia, there is a Meccano Club, with strong Hornby Railway interests, that is actually run in connection with the broadcasting station known as 2UW and regular Meccano Hours appear in the programme—but the event is sufficiently noteworthy to arouse comment. It is gratifying to find that the publicity given to the Cardiff club immediately attracted several recruits.

Keeping in touch with Headquarters

It may be opportune to remind officials and members of Branches that advice and assistance in the planning of Branch tracks, or in extending them in order to enable increased numbers of members to be provided with interesting working, may be obtained on writing to Headquarters. The members of the staff are experts and from them many useful hints on the running of model railways may be obtained. They are eager to be of service and welcome any enquiries regarding the planning of tracks, their correct signalling, the devising of timetables, and in fact, on any topic that may arise when H.R.C. enthusiasts meet.

The New "*Hornby Book of Trains*"

I feel sure that all H.R.C. members will be greatly interested in the new issue of the "*Hornby Book of Trains*." Its predecessors have all been remarkable for the wealth of information on railway matters that they have contained. The new edition maintains the high standard set in previous years and its contents are of exactly the type to appeal to H.R.C. members and, indeed, to all railway enthusiasts.

One article that is of particular interest describes some typical features of British railways in pre-grouping days, when distinctive designs of locomotives and rolling stock were developed by each of the many companies then in existence and the standardisation made necessary by modern conditions had not been introduced. This is followed by one on recent locomotive progress, in which the principles of the high-pressure locomotives now being tried out on British railways are dealt with, and the future tendencies of locomotive design are referred to. Other articles describe a tour of the British Isles by means of famous expresses of the four railway groups—topics of ever-present interest to all railway enthusiasts—and tell the story of "Named" locomotives that have made history.

As in previous issues of the "*Hornby Book of Trains*," a very attractive section illustrated in colours gives complete details of the extensive range of Hornby locomotives, rolling stock and accessories. The price of the book is 3d., and it may be obtained from any Meccano dealer. It may also be ordered direct from Meccano Limited, Binns Road, Old Swan, Liverpool, price 4½d., post free, and it will be available on the 3rd of this month.

Join the Correspondence Club

At this time of the year many new members join the ranks of the H.R.C. and I wish to draw their attention to the Correspondence Club that is organised in association with it. All H.R.C. members are keenly desirous of learning something of railways in other countries, or in distant parts of their own, and they cannot do better than by keeping in touch with other enthusiasts, and exchanging information and views with them. I urge every member who has not already done so to fill in an application form immediately, therefore, and to forward it to me as soon as possible.

Occasionally a little difficulty is experienced in immediately fulfilling the requirements of a new member. This is usually due to a temporary shortage of members in the country where he most desires to have a correspondent and for this reason alternative countries should be given. At the present moment new members are urgently required in France, Canada, and Germany, and any H.R.C. member in one of these countries who wishes to correspond with a boy of similar interests in other parts of the world would be put in touch with a suitable correspondent almost immediately.

Branch Notes

PORTSMOUTH (NORTH END).—A new track has been designed and put into operation, and this is to be fixed at a convenient height for working. Some interesting tests for speed and length have been made upon it. At a recent meeting a signal was ignored and a locomotive at the head of a long train crashed into level crossing gates. No damage occurred, but an official enquiry into the cause of the disaster was held. A Branch magazine, called "*The Shunter*," has been started and a visit paid to Fratton Engine Sheds. Secretary: Denis Cole, 90, Emsworth Road, North End, Portsmouth.

IPSWICH.—During the summer many visits have been paid to the local station in order to see the holiday traffic, one member recording 41 such visits. Articulated sets of coaches and locomotives of the 4–6–0 "Sandringham" type have been seen and interesting features for reproduction in track work noted. The Branch celebrated its first birthday by awarding special prizes to four members for good work. Secretary: P. E. Buck, 10, Dial Lane, Ipswich.

FIRST YORK.—An interesting feature of a visit to the local Engine Sheds was an inspection of a breakdown train. Members were allowed on the footplate of the crane itself, and the breakdown apparatus, including the use of detonators, was fully explained and demonstrated where possible. A collection of railway photographs is being assembled. It has been decided to change the layout periodically, in order to give scope for trying new ideas. Secretary: K. Shannon, 38, Severus Avenue, Acomb, York.

FIRST CARDIFF.—Interesting rambles and visits have included one to Porthcawl, a seaside resort about 45 miles from Cardiff. The train which carried the members is called the "*City to Sea Express*," and was hauled by a 2–6–0 "Mogul." Very useful publicity was obtained through a broadcast talk on Model Railways, the gentleman who gave this reading a report on the Branch's activities that had been prepared by the Secretary. Three new members joined the Branch after hearing the talk. Secretary: A. V. Strong, 47, The Parade, Cardiff.

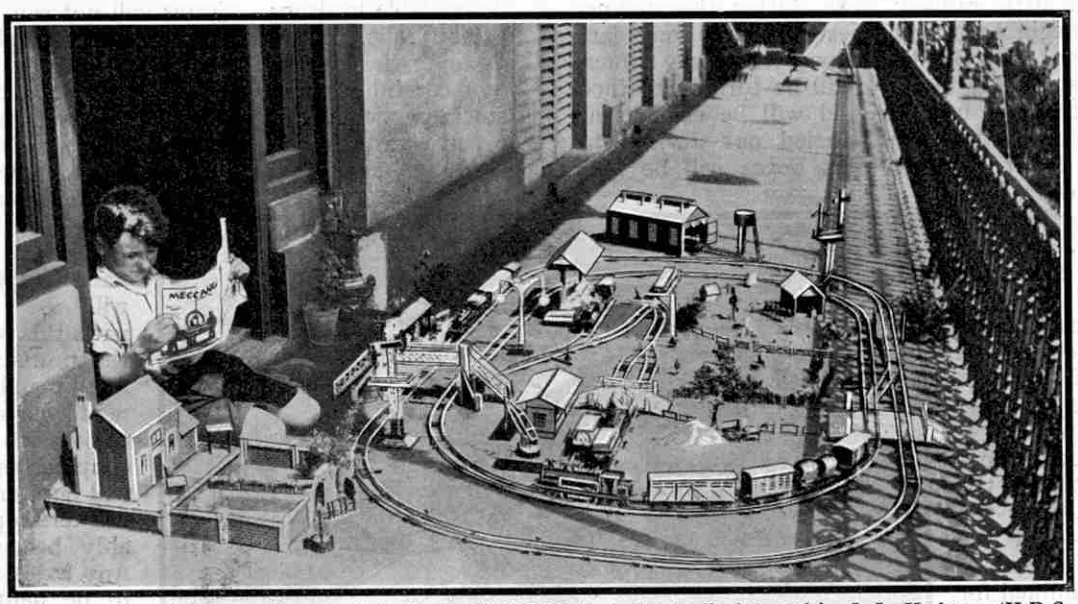
SLIGO.—Drastic relaying operations have been necessary on the permanent track in order to accommodate a new Control Cabin. Members were fully repaid for their trouble when they found how realistically the points could be changed. Owing to the influx of new Hornby locomotives and rolling stock it will shortly be necessary to lay down a second track. The Branch will then be divided and the friendly rivalry between the two sections will add interest to the meetings. Preparations are being made for a special H.R.C. week. Secretary: Kevin McMenamin, 78, John Street, Sligo, Ireland.

KENSINGTON.—The roomy school dining hall is used as a Branch room. Adequate sidings have been laid down in the large space available and the handling of trains has been found to be much easier. At one meeting experiments were made with heavy train working, double-heading being used. For one train of 36 trucks, two L.M.S. 4–4–0 goods engines were employed. A Mock Trial was held at the end of one meeting. The prisoner was charged with interfering with points in a section controlled by another member. He was found guilty, and violence on his part during the trial led to an exemplary sentence! Secretary: D. J. Higgins, 28, Hillersdon Avenue, London, S.W.13.

SAINT NICHOLAS (BIRMINGHAM).—A visit has been paid to New Street (L.M.S.) Station where the new 2–6–4T engines were seen. The members were allowed on the footplate of one of these. Another visit was paid to Bromsgrove to see the famous "Decapod" and the members' train was pushed up the incline by it. At the next track meeting interesting banking experiments were carried out with a 4–4–4T. At a recent Flower Show Branch members carried off all the five prizes offered in two sections for boys, these including one for the best model railway laid down in a space of 6 ft. × 4 ft., and another for the best model constructed from any material. Secretary: J. E. Wilson, 23, Meadow Hill Road, King's Norton, Birmingham.

OVERSEAS

ALEXANDRIA (EGYPT).—A novel plan has been adopted in order to settle the layout of the Branch permanent track. Each member is submitting a plan and the best will be chosen. Trestles and wood for shelves have been obtained and the work is to be started on immediately. Secretary: W. D. Draycott, 16, Avenue Sidi Gaber, Alexandria, Egypt.



Enjoying the miniature railway articles in the "*M.M.*" during a traffic interval! J. L. Hodgson (H.R.C. No. 2143) Torquay, adds greatly to the attractions of his well-planned Hornby Railway by the use of suitable lineside accessories, all of which are employed in a very realistic manner.

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

ALDERSHOT—M. Charles, "Bandon," Church Hill, Aldershot.

BIRMINGHAM—R. T. Coxon, 101, Somerset Road, Handsworth Wood, Birmingham.

BRIDGWATER—G. D. Hews, Oban, Northfield, Bridgwater.

BRISTOL—R. Salter, 92, Cotham Brow, Bristol.

COVENTRY—Eric J. Smith, 5, White Street, Coventry.

FARNBOROUGH—R. Fairbairn, "Woodthorpe," Tribbenden Lane, Farnborough.

HUCKNALL—W. Bailey, 10, Watnall Road, Hucknall, Notts.

KIDDERMINSTER—Mr. C. P. Harris, 76, Dudley Street, Kidderminster.

KINGSTON-ON-THAMES—F. J. Browne, 31, Staunton Road, Kingston-on-Thames.

LONDON, S.E.23—C. M. Flood Page, 4, Manor Mount, Forest Hill, London, S.E.23.

PAIGNTON—G. Pack, "St. Monica," Littlegate Road, Paignton, Devon.

ROMFORD—Edwin W. Amos, 48, Rainham Road, Romford, Essex.

SHORTLANDS—H. Starling, 110, Farnaby Road, Shortlands, Kent.

WIGAN—I. McKinlay, 37, Parsons Walk, Wigan.

OVERSEAS

SOUTH AFRICA—James Wilks, 67, Brand Street, Kroonstad, Orange Free State.

Further H.R.C. Incorporated Branches

137. NORTH BIRMINGHAM—C. E. C. Walker, St. Mary's Vicarage, Aston Brook, Birmingham.
138. LARCHFIELD (ABERGAVENNY)—C. S. Griffiths, Ty-Llwyd, Abergavenny.
139. FIRST BEDFORD—H. N. Darlow, 1, Burnaby Road, Bedford.
140. SWANSEA MODEL RAILWAY CLUB—Leslie T. Levitt, "Alpha House," Townhill Road, Sketty, Swansea.

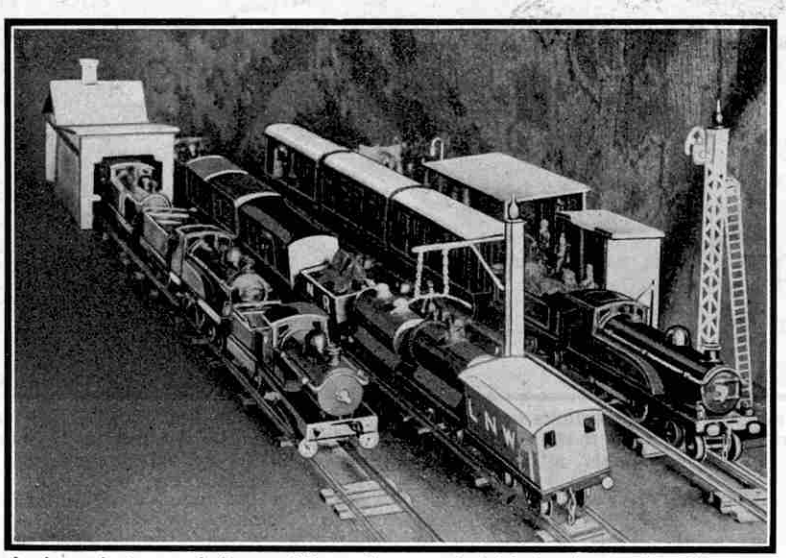
Hornby Railway Company

JUNIOR SECTION

XXIII.—Overhauling a Hornby Railway

ALTHOUGH many model railway enthusiasts continue their railway operations throughout the year, there is no doubt that the majority do comparatively little railway work during the summer months and begin again in earnest when the long dark evenings arrive. By this time Hornby Railway owners who have not already done so will be turning to their trains with renewed interest, and will be considering possible developments to be carried out during the winter. No doubt in most cases hopes will be high that later on a new locomotive, additional rolling stock, or fresh rails or points will be forthcoming!

Before ideas for new layouts are considered it is advisable to overhaul the existing material and put everything into good condition. First of all the rails—especially the curved ones—and the points and crossings should be examined for defects. Some of the rails may have become bent out of shape, or otherwise slightly damaged, and these should be put right immediately otherwise they may give rise to derailments. The points should be tested carefully to see that they operate smoothly. It is probable that some of the projecting pins, by means of which the rails are fastened together end to end, have come out of their sockets. If the pins can be found it is quite easy to insert them again, and if any are missing new supplies may be obtained at the price of 3d. per dozen.



An imposing array! Some of the railway material belonging to the Ellesmere H.R.C. Branch, lined up ready for inspection.

It is important that a sufficient number of connecting plates should be available to grip together the end sleepers of each adjoining pair of rails, so that there is no fear of the rails springing apart as the result of the passage of the trains or of knocks or jerks that may be accidentally given to the track.

If the track has been laid away for some time it is likely that it will have become dirty and perhaps rusty. If this is the case each piece should be cleaned by rubbing it with a rag dipped in paraffin or petrol. If paraffin is used, sufficient time should have elapsed to allow the rails to dry thoroughly before trains are run, otherwise the locomotives will slip badly. As regards petrol, only a small quantity should be in use, and this should be kept well away from the fire or any light. Perhaps the safest method is to pour a small quantity of petrol into an ordinary oil can, so that it is available in drops. Trains will not run well on dirty greasy rails, and a little time and trouble spent in cleaning the track will be well repaid.

A careful examination should be made of the rolling stock, particular care being taken to see that the wheels revolve quite freely. The couplings also should swivel freely, though excessive looseness is a nuisance and is to be avoided. If the coupling hook of a vehicle is loose and hangs down, trouble will be experienced with this vehicle when the train is being backed. The coupling of the next wagon will tend to override the hanging coupling, and either they will jam, or the wagons will telescope and probably become derailed. Any axles that happen to be bent should be straightened. It frequently occurs that a certain amount of dust and fluff collects round about the wheels and axles. This should be cleaned off with a paraffin rag.

The locomotives should, of course, receive special attention. The mechanism of each probably will require cleaning, as a certain amount of dirt is bound to have collected inside. Petrol is preferable to paraffin for this purpose, and it may be introduced to the mechanism by means of an oil can. The advantage of petrol is that it evaporates quickly, leaving the mechanism perfectly clean and dry. The various spindles and gear wheels, the axles, and the coupling and connecting rod pins should be lightly oiled, while a few drops between the plates of the spring will assist matters. Too much oil should be avoided, as it attracts dust, and results in the mechanism becoming clogged.

If the locomotives are electric, the pick-up shoes probably will require cleaning; and here again the paraffin or petrol rag should be used. The brush holder caps should be removed—care being taken that the spring does not shoot out and get lost—and the brushes should be examined. If the engine has had a good deal of use they may require renewal. The axles and coupling rod pins should be lightly oiled, but

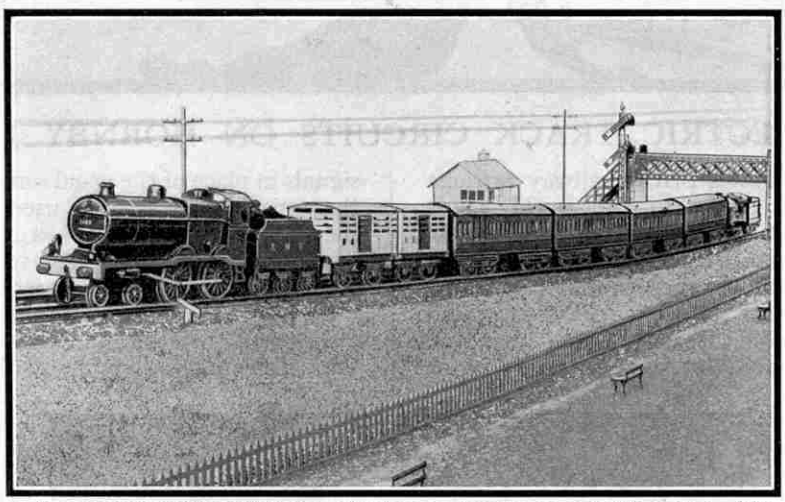
on no account should oil be applied to the brushes and the commutator. If the slots of the commutator have become filled up with dirt they may be cleaned by the gentle use of a pin or a sharpened match-stick.

When these overhauling operations have been completed and the railway is in perfectly good running order, it is time to consider how the existing layout can be improved so as to make it more realistic and more interesting to operate. Many suggestions for the development of layouts have been made in these pages in past issues of the "*M.M.*," and we strongly recommend that the advice given should be considered before changes are decided upon. Then there is the question of locomotives and rolling stock. It is undoubtedly a great advantage to have two or three locomotives of different types, so that a variety of trains may be run according to the rolling stock available.

The further question arises as to whether the railway shall be devoted mainly to passenger or to goods traffic. It is best to avoid running trains made up of a miscellaneous collection of passenger coaches and goods wagons. It is true that such trains are occasionally to be seen on certain country branch lines, but they never look well, and when reproduced in miniature their appearance is even worse. As far as possible it is best to devote each train entirely to passenger traffic or to goods traffic. The running of goods trains is apt to be neglected by the average miniature railway enthusiast. This is a pity, because there is a vast amount of fun and interest to be obtained from goods train working. In the first place there is a much more varied selection of goods wagons than of passenger coaches to be obtained, and in addition goods vehicles of all kinds may be provided with suitable loads, which is scarcely practicable in the case of passenger trains.

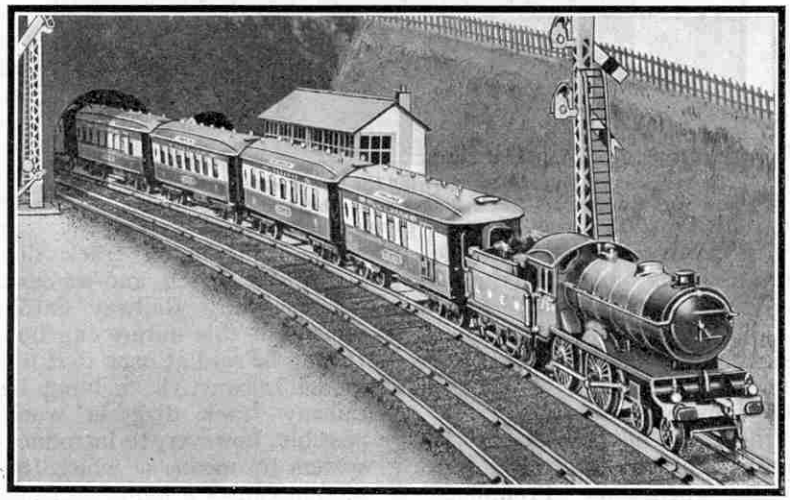
All kinds of household materials may be used for loads, from rice or dried peas to tiny pieces of real coal; and most interesting effects may be produced with a little ingenuity. The Meccano miniature Sacks are also useful. If Hornby Milk Vans are used, these are already provided with churns. The Hornby Goods Platform makes a particularly interesting addition to a goods line, and the crane with which it is provided may be used very realistically for loading and unloading wagons. The appearance of a miniature goods yard where actual traffic is handled is very attractive, and there is almost no limit to the operations that can be carried out.

Probably some additions and improvements to the accessories of the railway will be considered. It may be that the model railway owner desires to provide more realistic surroundings. For this purpose the accessories of the Hornby Series are extremely effective, and if used with judgment will greatly improve the appearance of any layout. The upper photograph on this page, for instance, shows how effective the Lattice Girder Footbridge and the Hornby Fencing appear when placed in suitable positions. It will be noted, too, how realistic the Signal Cabin and Signals and the Telegraph Poles and connecting wires appear. As the train is ascending a bank, the slope is indicated by a Gradient Post, thus adding another touch of realism.



A heavy Hornby Train being assisted up an incline by a bank engine. The train engine is a Hornby L.M.S. No. 2 Special.

A great deal can be done in the way of making railway accessories at home. In the lower photograph on this page a Hornby Pullman Express is shown passing through a cutting. It appears to be emerging from a tunnel, but actually this is a road overbridge constructed of cardboard. The making of such a bridge is very easy. The sides are first carefully marked out to allow sufficient space in the centre arch for trains to pass beneath safely. It is a good plan to use wood to connect the two sides to form the roadway. The sides should be attached to the wood by glue and pins, and if the work is done with reasonable care the finished bridge will be extremely strong. The final touch is given by painting the bridge with some dark grey paint to give a weather-beaten appearance to the structure.



A Hornby Pullman Express hauled by the well-known 4-4-0 "*Yorkshire*."

Cuttings such as the one illustrated may be made quite easily. The first step is to prepare a rough framework of wood, over which is glued in position stout brown paper, first crumpled up and then unrolled, to give the necessary rough surface. The wooden framework may be fixed to a base formed of a piece of wood of suitable length. The whole cutting should be covered with thin glue, and while this is wet, sawdust should be sprinkled over all. When everything has set hard, a realistic appearance may be given by painting the cutting a suitable shade of green.

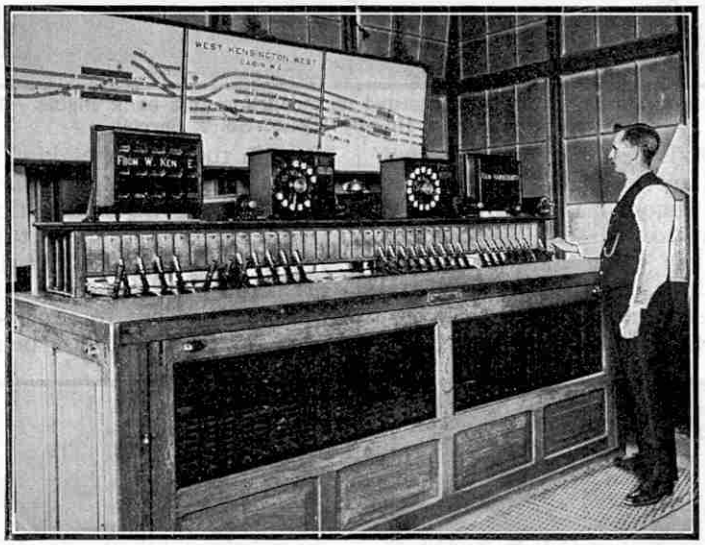
XXV.—ELECTRIC TRACK CIRCUITS ON HORNBY LAYOUTS

IT has often been stated that a British railway carriage is one of the safest places in the world. This statement is fully justified by the remarkably few fatal accidents that occur on British railways when one takes into consideration the enormous number of trains running night and day, and the high speeds at which they travel. This splendid freedom from accident is the result of a wonderfully perfect system of train control that has been developed little by little by railway engineers as the result of experience and experiment.

In the earliest days of railways, traffic control as we know it to-day did not exist, and indeed the trains were so few and so slow that it was unnecessary. Subsequently, when traffic increased, safety was secured by a "time-interval" system, in which one train was not allowed to follow another until after a certain interval had elapsed. Still later this was superseded by a system of trains running with a "space-interval" separating them. The line was divided into a number of sections, and only one train was allowed to be on any section at one time. These sections were known as "block sections," and the system was called the "block system." The use of the block system, combined with telegraphic communication between signalmen and the mechanical interlocking of signals and points so that conflicting settings could not be made, provides an almost perfect method of working from the point of view of safety.

During recent years refinements have been introduced into various signalling operations. Prominent among these is the power operation of signals and points as a substitute for manual operation by the signalman. In a manual box the signalman has to move the points and signals by the manipulation of large levers, which involves the exertion of a considerable amount of physical strength. In a power box the signalman has only to manipulate small levers that move with the greatest ease, and the electric or pneumatic power then comes into operation and does the hard work. Another important introduction is that of colour-light signals in place of the usual semaphore signal. At present these signals are mainly used on electric railways, but they are already used to a small extent on local and main lines, and are likely to gradually supersede the semaphore as re-signalling is carried out.

In each signal box there is displayed a large scale diagram of the section of line controlled from that box. This diagram shows in detail the whole of the track and all the points and signals. Each signal has a number, and the lever that controls it is clearly marked with the same number. On electric railways, such as the London Underground, where large numbers of trains succeed one another at very short intervals, a more elaborate form of signal box diagram is in use. This diagram is electrically connected in such a manner that the passage of a train through one section causes a series of lamps to light up in turn on the portion of the diagram indicating that section. In this manner the signalman is able to ascertain the position of any train at any moment.



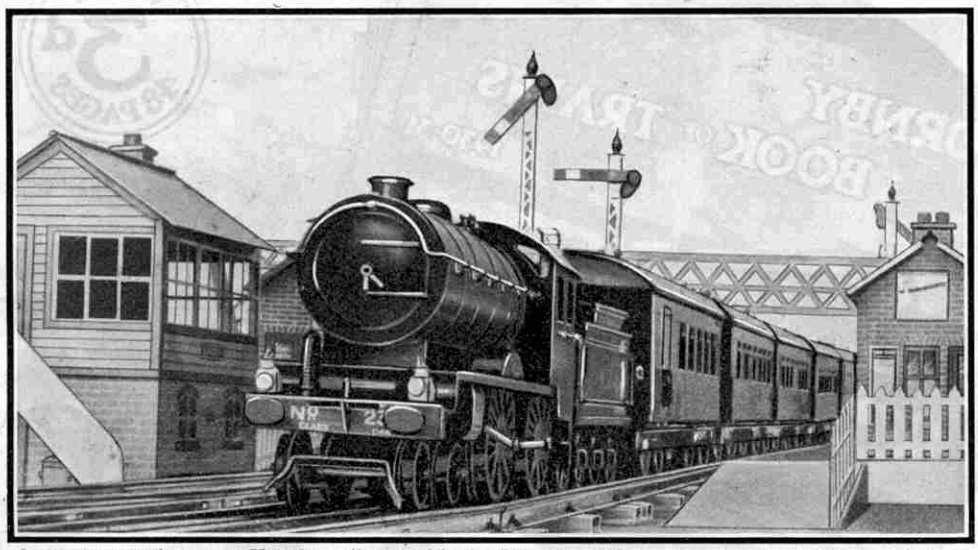
The interior of a Signal Box, showing the electro-pneumatic lever frame and the illuminated track diagram of the section controlled from the box. The small levers for power operation are clearly shown.

The illuminated track diagram is extremely fascinating to watch, and we continually receive enquiries from Hornby Railway enthusiasts as to whether a scheme of this nature can be carried out in miniature. It may be said at once that to reproduce on an ordinary model railway the moving light indications of a real railway track diagram would be impossible. It is possible, however, to introduce an extremely interesting system by means of which the presence of a train in a section causes a lamp, corresponding to that section, to light up. There is not much difficulty about making the necessary arrangements, and the small amount of trouble involved is well repaid by the fun and excitement obtained when the system is working.

The accompanying diagram shows the scheme of wiring most suitable for the purpose. It should be understood that this is purely a diagram to explain the idea, and does not represent an actual layout. It is assumed that the layout is divided up into four sections, each to be provided with its own light indication. These

sections, which we may call A, B, C and D, are shown in the diagram for convenience as adjoining sections of a length of straight track; but, of course, the actual arrangement will vary with each layout.

The first point to notice is that in one of the running rails a small gap is left between each section and the next. From each of these isolated lengths of rail a wire is led to a lamp, the lamps being lettered in accordance with the sections. The lamps are also connected to one terminal of a dry battery or accumulator as shown in the diagram — the battery being represented by the conventional alternate short and long strokes — and the circuit is completed by way of the continuous running rail as shown. The rails in which the gaps occur are insulated from the continuous running rail, so that the bridging of the two rails by a train completes the electric circuit and thus causes the lamp corresponding to that particular section to light up.



A country station on a Hornby railway with the Signal Box from which the section is controlled. The Hornby Pullman express thunders past hauled by No. 2 Special Locomotive "*Yorkshire.*"

The insulation of the rails may appear to be a difficult process, but actually it is quite easy. A ready means of insulation is found in the special insulators that are now available in connection with the conversion for electric traction of the latest Hornby clockwork trains. These insulators cost 3d. per dozen, and may be obtained through any Hornby Train dealer. The clips at each side of the running rail in which the gaps occur, which hold the rail down to the sleepers, should be gently lifted so that the rail may be removed from the sleepers. One of the insulators is then placed under the rail at each point where the clips come, and the rail is then restored to its original position, the clips being pressed down gently but firmly to secure it in place.

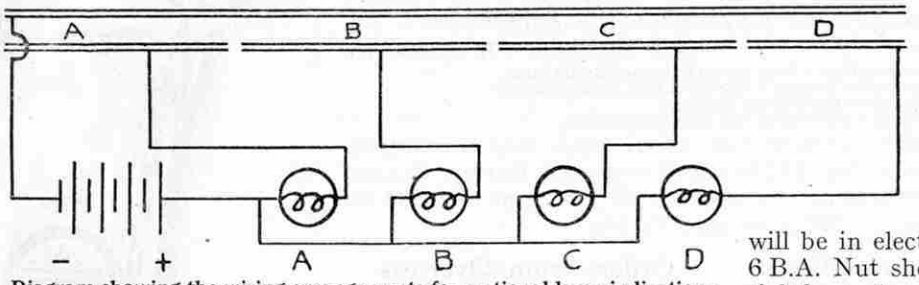


Diagram showing the wiring arrangements for sectional lamp indications on a model railway.

We have already said that a gap is left in one of the running rails between each section and the next. The best method of doing this is to withdraw the connecting spikes in the insulated rails at these points, and to fix the rails in such a manner that the gap cannot be closed up. The most satisfactory method is, of course, to screw down the rails to a baseboard, and this should be done if possible. The spike in the uninsulated rail will assist in keeping the track in alignment, and match sticks might be used to replace the withdrawn spikes.

It should be remembered that all that is necessary is to make an electrical break between each section, and it is not at all necessary to have a gap so large as to give the wheels of the train a severe bump as they pass over.

We have now to consider the arrangement of the lamps. For the sake of convenience these should be grouped at the point where most of the controlling is carried out. This will be the chief signal box on the line, and therefore the lamps should be placed near it. The actual manner in which the lamps are fixed and connected up by wires to the insulated sections and to the battery may be varied according to the ideas and the materials at the disposal of the owner of the railway. We suggest the following scheme, however, as being simple and at the same time thoroughly practical.

Each lamp should be mounted in a Meccano Lamp Holder (No. 310) that has previously been secured to a Meccano Double Bent Strip (No. 45) in the following manner. A Meccano 6 B.A. Screw (No. 304) should be passed through the hole in the base of the Lamp Holder and through the centre perforation of the Double Bent Strip. A Meccano Insulated Bush (No. 302) and a 6 B.A. Nut (No. 305) should be placed on the shank of the 6 B.A. Screw, but before securing the latter the enamel should be removed from the Double Bent Strip where the Lamp Holder touches it, so that the two parts will be in electrical contact. The 6 B.A. Nut should be screwed up tightly and a Meccano Terminal (No. 306) placed on the projecting portion of the 6 B.A. Screw. Each built-up Lamp Holder may then be mounted in position on a strip of wood by means of wood screws passed through the perforations in the Double Bent Strip. One lug of each Strip should be scraped clean of enamel and a washer placed under the head of the wood screw securing it in place. This enables a length of wire to be held firmly in contact with the Double Bent Strip when connecting up.

In order to connect up, the wires from the insulated sections are led to the terminals secured on the 6 B.A. Screws. The other wires, which come from the unbroken rail through the battery, should be clamped under the washers placed on the shanks of the wood screws previously mentioned, the insulation being removed from the wire at each point where contact is to be made.

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Is now ready

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Direct orders are not acknowledged. They are dealt with as soon as they are received, and every endeavour is made to send the book to the purchaser by return of post. It is desirable that a remittance in stamps should be sent and also that the name and address of the sender should be clearly written. There is no reduction if more than one copy is ordered.

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SOUTH AFRICA.—Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

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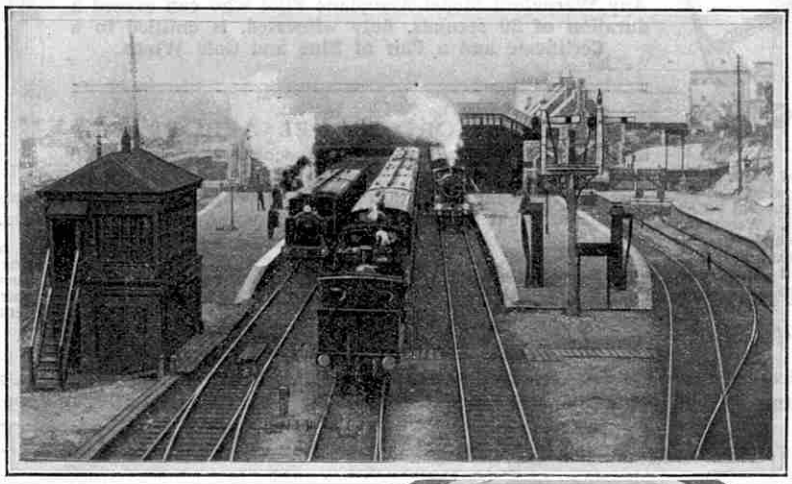
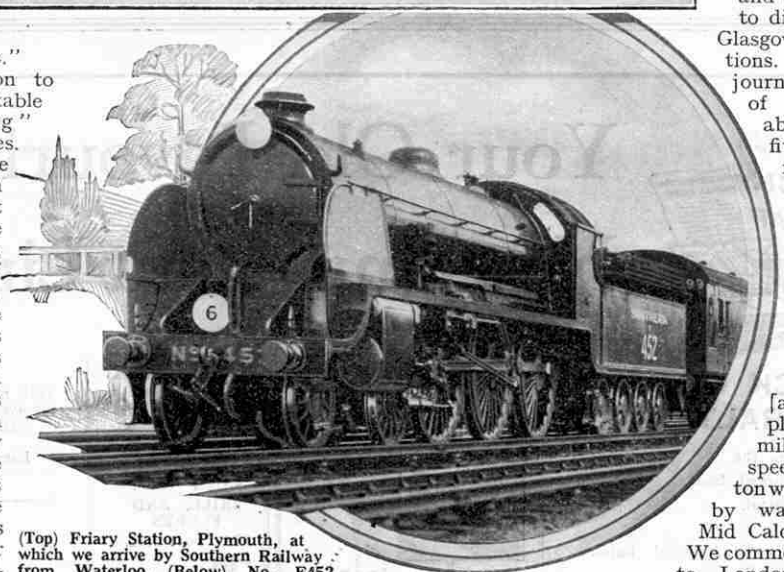
Touring By Railway

Round Britain By Four Famous Expresses

EVERY summer large numbers of people make tours by road, either in their own cars or by one of the multitude of motor coach services that cover the country. Nobody ever seems to think of touring by railway trains; yet for those who are really interested in railways there are countless things to be seen and enjoyed from the window of a railway carriage, and these things cannot be seen in any other way. Let us make in imagination a railway tour specially for the purpose of seeing some of the engineering features of our great main lines. We will commence our tour from London, and we will finish there. We will travel from Waterloo to Plymouth by the S.R. "*Atlantic Coast Express*"; from Plymouth to Paddington by the G.W.R. "*Cornish Riviera Express*"; from Euston to Edinburgh by the L.M.S.R. "*Royal Scot*," and finally from Edinburgh to King's Cross by the L.N.E.R. "*Flying Scotsman.*"





(Top) Friary Station, Plymouth, at which we arrive by Southern Railway from Waterloo. (Below) No. E452, "Sir Meliagrance," one of the 4-6-0 locomotives that haul the "Atlantic Coast Express."

On the S.R. route from London to Plymouth we find the most remarkable series of "flying" and "burrowing" junctions existing in the British Isles. By a "flying" junction is meant the arrangement by which the branch line bridges over those main lines that otherwise would be crossed on the level, dropping down again to form the necessary connection with one of the main lines, usually an outside one. The term is used also to describe the layout when one of the branch lines dives under the main lines; but this is more accurately described as a "burrowing" junction. On this journey it is interesting to pass through Clapham Junction, which is probably the busiest main line junction in the world. We also pass the Brooklands motor racing track, and at Basingstoke we may catch a glimpse of the famous Thornycroft Motor Works. Our "*Atlantic Coast Express*" will probably be hauled as far as Exeter by one of the handsome "Lord Nelson" class; but from Exeter onwards an engine of a lighter type will be substituted.

Our return journey from Plymouth to London by the Great Western route passes Dartmoor on its south side, and the scenery all along this part of the journey is very fine and typical of Devon. From Newton Abbot, recently rebuilt and now a fine example of a junction station, our course lies in picturesque fashion along the estuary of the Teign to Teignmouth. The engineering of the line onward to Dawlish is most interesting, the rails hugging the coast line and being carried through spurs of rock by a series of tunnels. It is not an unusual occurrence for a tunnel to be completely opened out and transformed into a cutting, or to be shortened by some such process; but at this point on the G.W.R. there is a tunnel that has actually been lengthened. This is the Parsons Tunnel, and it was lengthened with the object of shielding the track from falling rock and debris.

In the course of our run to Paddington we descend the Wellington Bank, down which the fastest railway speed ever reliably recorded in these islands was registered—102.3 m.p.h. We shall also see the Westbury White Horse clearly cut on the chalk hillside, and from Pewsey through Hungerford to Newbury we are alongside the Kennet and Avon Canal, a picturesque but little used waterway that the G.W.R. would be very glad to dispose of. Later we must look out for the ramps in the four foot ways situated near the distant signals and used in connection with the company's system of cab signalling, by which the indications of the distant signals are repeated on the engine.

Our northward journey from London is one of approximately 400 miles and, assuming that the summer service is available, we shall have only two stops—Kingmoor, north of Carlisle, to change engines, and Symington or Carstairs to divide the train into its Glasgow and Edinburgh portions. The latter half of our journey includes the climbing of Shap Summit, 914 ft. above sea level, but the five miles at 1 in 75 will not trouble our "Royal Scot" engine greatly. Still further on we have to tackle the famous Beattock Bank, the top of which is 100 ft. higher than Shap Summit. Here banking engines are kept, but the "Royal Scot" needs no assistance and accomplishes unaided the 10 miles of 1 in 75. After a speedy descent to Symington we continue to Edinburgh by way of Carstairs and Mid Calder.

We commence our return journey to London from the famous Waverley Station, Edinburgh. This journey is full of interest to the railway enthusiast. Our route takes us over the Royal Border Bridge, 2,160 ft. in length, and the King Edward VII Bridge at Newcastle, 82 ft. above sea level. Having admired the fine station at York we pass cautiously over the swing bridge at Selby, and so on to Doncaster, the locomotive headquarters of the old Great Northern Railway, and where our locomotive was built. Over the water troughs at Scrooby we come presently to Retford, where there is one of the few examples to be found in this country of the crossing of two main lines over one another at the same level. All too soon we reach King's Cross and the end of our tour.

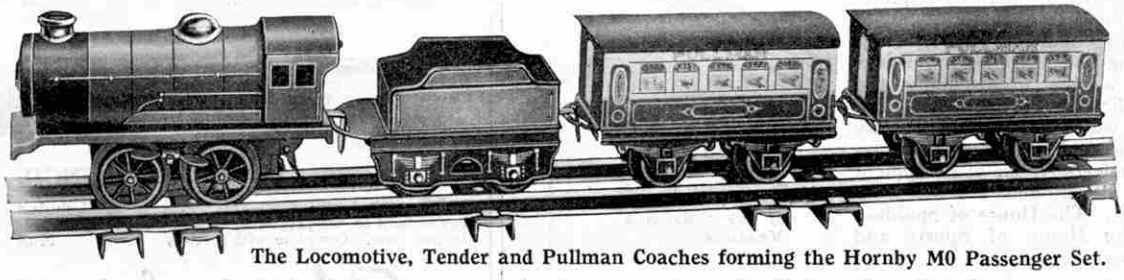
This interesting tour is described in greater detail in the 1930–31 edition of the "*Hornby Book of Trains.*" In addition this book contains a fascinating account of many typical features on British railways in pre-grouping days, a description of the latest high-pressure locomotives, and of some of the "named" locomotives that have made history.

Improvements in the Hornby "M" Series

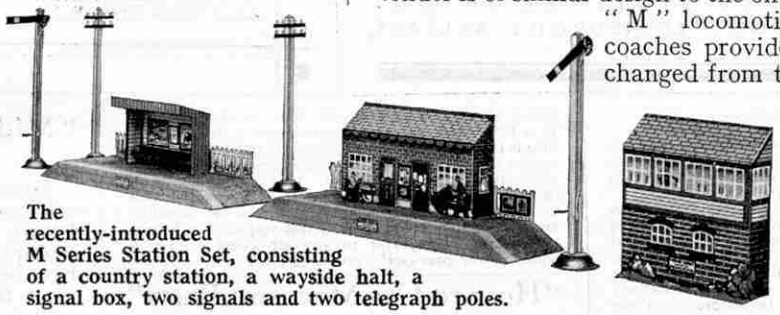
By "Tommy Dodd"

LAST month I dealt with a number of additions to the Hornby Series and with improvements to various existing items. This month I want to draw special attention to the important changes that have been brought about in regard to the popular locomotives and rolling stock of the "M" type.

The M0 Sets have been redesigned, and the locomotives, tenders, coaches and wagons of which they are composed are entirely new. Taking the locomotive first, a considerable improvement in appearance has resulted from the adoption of a raised footplate, which drops down in front of the smoke-box as in many modern locomotives. An improved pattern of cab has been fitted. This is provided with double windows in the sides, so that the locomotive is given an up-to-date appearance. The tender is of pleasing outline, following for the most part the general contour of the standard L.M.S. tenders. The sides therefore are flat, and are developed upward to form a raised coping round the coal space. The wheel frames are slotted out in the correct manner, and their appearance is very realistic, for they have embossed upon them representations of the axle boxes, springs, and hangers seen on actual tenders.



The Locomotive, Tender and Pullman Coaches forming the Hornby M0 Passenger Set.



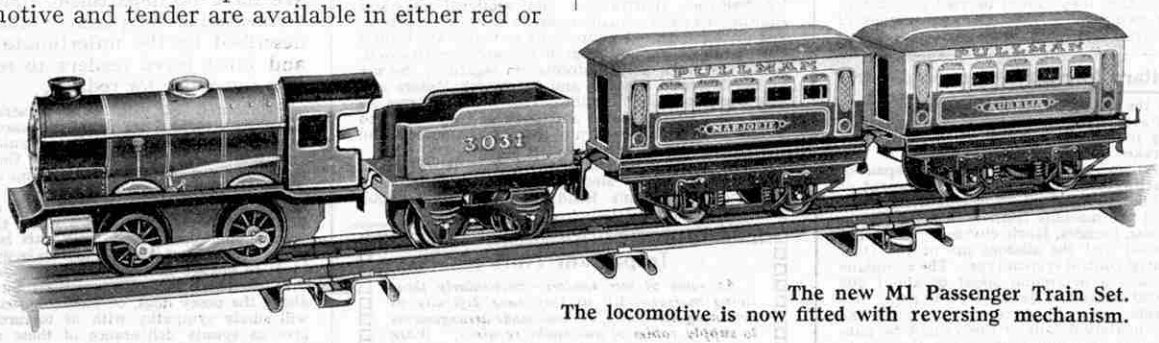
The recently-introduced M Series Station Set, consisting of a country station, a wayside halt, a signal box, two signals and two telegraph poles.

The mechanism fitted to the locomotive is of improved design and will be found capable of the hardest work. The locomotive and tender are available in either red or green colouring, the quality of finish in both cases being excellent. The M0 Pullman coaches are well-designed vehicles, and are finished in the standard Pullman colours. Together with the locomotive and tender they make up a smart little train, from which a vast amount of fun may be obtained.

The new M1 locomotive is certain to be extremely popular. Its general design, with outside cylinders, is thoroughly modern, and a raised footplate is provided. The cab is of up-to-date shape, and closely follows the style of cab fitted to the L.M.S. "Royal Scots," the S.R. "Lord Nelsons" and other famous British locomotives. This M1 locomotive is fitted with an entirely new clockwork motor, which for its size is remarkably powerful and is capable of a great length of run. A particularly attractive feature, and one that is the result of a widespread demand, is that the mechanism may be reversed by means of a lever in the cab. This feature, which is rarely met with in so small a mechanism, greatly increases the usefulness of the locomotive. The tender is of similar design to the one provided on previous "M" locomotives, and the Pullman coaches provided are practically unchanged from those previously available.

Both the M0 and the M1 locomotives are available also in Goods Train Sets. In the M0 sets wagons of a new design are provided having a large amount of detail that gives them an extremely realistic appearance. The M1 wagons are similar in design and construction to the well-known Hornby No. 1 Wagon.

In order to enable the chief features of a real railway to be satisfactorily reproduced, specially-designed accessories have been introduced for use with the "M" series locomotives and rolling stock. The various items may be obtained separately or as a complete set. The set consists of seven items—a Station, a Wayside Station, a Signal Box, Two Signals and Two Telegraph Poles. The platforms of the two stations are similar, but whereas the Wayside Station is composed of a platform with a small shelter erected upon it, the other model is fitted with a complete station building finished to



The new M1 Passenger Train Set. The locomotive is now fitted with reversing mechanism.

(Continued on page 900)

Hornby M Series—(*Continued from page 899*)

represent a brick structure and complete with an awning over the front. The Signal Box is a reproduction of the familiar type that has the lower portion built of brick and the upper part of timber.

The signals are of simple but effective design, the semaphores representing the pattern that is in use on the majority of British railways. A wire is led from the semaphore to the foot of the signal post, by means of which the signal is operated. The Telegraph Poles are each fitted with two crossbars, upon which are mounted four insulators. These neatly-designed poles look very effective when placed alongside the track, and particularly if they are connected by cotton threads to represent wires.

With the object of assisting model railway enthusiasts who have very little space at their disposal for railway operations, special rails have been introduced for use with the M0 trains. The curves in this series of rails have a radius of only 9 in., so that a circle of them has a diameter of 1 ft. 6 in. measured from centre to centre of the track, or 1 ft. 8½ in. measured to the outer extremity of the sleepers. It is very important to note that these rails are for M0 trains only, and that they cannot be used successfully for the other locomotives, carriages and wagons of the Hornby System.

Fastest Military Aircraft—(*Cont. from page 875*)

in order that the efficiency of the pilot may not be impaired by having to breathe the thin atmosphere. An interesting feature is that the machine is fitted with wheel brakes.

The de Havilland machine has a wing span of 32 ft. 2 in., a length of 24 ft. 6 in. and a height of 7 ft. 6 in., while the total all-up weight is 2,300 lb. The fuselage of the machine consists of a duralumin tube with wooden formers, fabric covered. The wing structure is wood and the ailerons are of the D.H. patent differential control system type. The aeroplane is said to possess a maximum speed of about 203 m.p.h. at 20,000 ft. and to land at 60 m.p.h. Its most remarkable feature, however, is its rocket-like climb. Unfortunately details of this cannot be published, but when the machine took part in the R.A.F. Display this year, it was notable for the speed with which it reached high altitudes.

Naturally the engine fitted to such a remarkable machine is of great interest. It is an entirely new type—the air-cooled Napier "Halford." This engine has 16 cylinders, disposed in four blocks, each consisting of four cylinders, that are vertically opposed in pairs, giving the entire engine the shape of an "H" when viewed from the end. The engine is rated at approximately 325 h.p. at 3,500 r.p.m. It is fitted with reduction gearing and a supercharger also is installed. The overall length and height of the engine are 54 inches and 35 inches respectively, while the overall width is 21 inches. One of the chief aims of the designers has been to reduce the frontal area in order to keep air resistance as low as possible, and the makers claim that in this respect the Napier "Halford" is superior to any air-cooled engine of equal power previously produced.

"How to Use Meccano Parts"
A New Manual

Every keen Meccano enthusiast wishes to carry out his model-building operations in accordance with correct engineering principles. In order to do this he must know the special functions of each of the parts that comprise the Meccano System, and to assist him in acquiring this knowledge there is published a special manual entitled "*How to Use Meccano Parts.*" In this manual all the parts in the system are listed and classified, and the uses of each individual part are described in detail. The descriptions are assisted by half-tone illustrations and sectional diagrams showing the parts actually in use in Meccano structures and mechanisms. An important section of the book is devoted to the various forms of Meccano motive power, and gives much useful information regarding the use of the Meccano Electric and Clockwork Motors and the Meccano Steam Engine. This manual forms an ideal constructor's guide and book of reference, and should be in the possession of every Meccano boy who wishes to build more and better models.

"*How to Use Meccano Parts*" may be obtained, price 6d., from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Old Swan, Liverpool, price 7d. post free.

Important Notice

As some of our readers—particularly those living overseas—tell us they have difficulty in obtaining new books, we have made arrangements to supply copies of any books required. When ordering please give full title, author, and (if possible) publisher.

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

"Midnite Walings" at Pasir Panjang

Editors of newspapers and other periodicals occasionally receive very curious letters from their readers, and many examples of amusing efforts of this kind have been published. The following letter is of this character. We feel sure that readers will agree that it is very effectively, if quaintly written. We imagine that the Editor to whom it was addressed could scarcely fail to do something to enable his correspondent to "rest in pieces." But we hope that readers of the "*M.M.*" will not take the letter as an example of the kind of topic on which they should write to the Editor of their favourite Magazine! We have no department that deals with "lamentable complaints" similar to those described by the unfortunate Sum Moor, and must leave readers to rely on their own ingenuity for redress.

"Honoured Sir,—In your venerable paper of yesterday's night I see a Sufferer ears noises of dogs barkings at past midnite at Pasir Panjang. I also ear the same noises but no European Gentlemans bring stones to my door to stay the barkins of the dogs who make the past midnite hidious.

"When I am on my bed sleep does not come to me but the noses of barkins comes all the times and I pray you in your goodness to stop this lamentable complaint so I can rest in pieces and wake with the morning birds to engage in my pursuits for daily rice. Now that his excellency the honorable Sir Gullimot ears about the nosey dogs, of Pasir Panjang two times he will surely sympathy with us tortured inmates and give us speedy deliverance of these midnite noises. I pray that he can come and sit in our lane and hear them for his honourable self and thus get stone wall proof that I do not talk with my hat.

"Your venerable paper has a big cirkulation an if it is red by the dog shooter I pray he will answer our pray and come here quick with some ammunitions and releve us of this midnite howlings and walings and fightings of the dogs.

Your humble servant,
SUM MOOR."

H.R.C. COMPETITION PAGE

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

HIDDEN EXPRESSES

From the earliest days of railways there have been certain trains familiarly known by individual names. In many cases these names were not officially recognised, but were given to the trains by the staff engaged in working them, or by the public who travelled by them. Thus many years ago there were the famous "*Flying Dutchman*" and the "*Zulu*" running on the Great Western Railway; while the well-known Irish Mail trains of the former London and North Western Railway were commonly known as the "*Wild Irishmen.*" This last title, which is suggestive of high speed, is rather misleading, for these particular trains were not renowned for their rate of progress. However, popular imagination invariably associates mail trains with high speed, and so the title caught on.

In 1904 the G.W.R. began to run a train non-stop from Paddington to Plymouth. The distance was then 246 miles, and the inauguration of the service created quite a sensation. It was therefore decided that the train should be distinguished by a suitably dignified name. The title "*Cornish Riviera Limited*" was chosen, and since that day this express has become famous all over the world for its comfort and speed.

Another luxurious express, the "*Southern Belle,*" commenced to run under this name in 1908, but generally speaking British railways did not then favour the practice of giving official names to their trains. Since grouping took effect in 1923, however, railway publicity has advanced considerably, and the companies have developed the practice of naming most of their principal trains. It is much more interesting to travel by a named train than by a nameless one, and there is no doubt that suitable names for trains have a definite advertising value.

Members of the H.R.C. will all be familiar with the names of most of the famous expresses now running. Those who happen to live on or near the route of any of these trains will no doubt make a practice of watching them pass daily, in order to see which locomotive is in charge and what load is being taken.

To test our readers' knowledge of the names of famous expresses we announce a special contest this month. In the panel on the centre of this page there are twelve words that appear to be a hopelessly confused mixture of letters. These words disguise the names of twelve famous British expresses, and we set H.R.C. members the task of sorting these out from the existing confusion.

1. EDHERMITIONSILVERATCHIRI
2. ERNESTHELLEBEAT
3. SHOUTHUNSPERTEXSYNES
4. CATESHAVINDINAN
5. CANMINAHUNTE
6. BERETINOHANDA
7. PATNUMOQUOTESCHELNSELF
8. DIMHOTSCAYTED
9. MAYROTHEDILTEBIT
10. HOLTOWARDERGEN
11. MASHMEWLETH
12. HERTOHYALLERGHINDA

When competitors are satisfied that they have discovered the trains represented, they should prepare a list in the same order as that of the jumbled names. This list should be enclosed in an envelope marked "Hidden Expresses" and posted to reach H.R.C. headquarters at Binns Road, Old Swan, Liverpool, not later than 29th November, 1930. As usual, there will be a section for Overseas competitors, and in this the closing date is 28th February, 1931.

In each of the two sections of the competition, Home and Overseas, prizes of Hornby Railway material (or Meccano products if preferred), to the value of £1/1/–, 15/–, 10/6, and 5/– respectively will be awarded to the four most correct entries. A number of consolation prizes also will be awarded. In the event of a tie occurring between two or more entries, general style and neatness will be taken into consideration as the deciding factor. It should be noted that all entries must bear the competitors' H.R.C. number; otherwise they will be immediately disqualified.

Railway Drawing Contest

There must be very few members of the H.R.C. who have not been impelled to make drawings of famous locomotives, or have not made use of sketches in order to fix in their minds the characteristic features of remarkable engines or of interesting rolling stock that they have seen. Ability to draw is a very valuable asset to a railway enthusiast, and in order to encourage members to further efforts in this direction we are this month giving them an opportunity of entering a drawing competition.

In this Contest we wish entrants to submit a view of their favourite locomotive about to commence a long run at the head of a famous train. For their subjects they have a choice of many interesting scenes. For instance, they may show "*King George V*" standing in Paddington Station at the head of a "*Cornish Riviera Express*" waiting for the signal to start, or their drawing may depict one of the "Lord Nelson's," or an engine of the "Schools" class, backing on to one of the expresses of the Southern Railway at Victoria. Other suggestions will readily occur to competitors. Drawings may be in ink or pencil, and colours may be used if thought desirable.

The contest is divided into the usual two sections—Home and Overseas—and Hornby railway material, or Meccano products, to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the competitors who submit the best drawings in each of these. Envelopes containing entries should be clearly marked "H.R.C. November Drawing Contest," and must be posted to reach Headquarters on or before 29th November, 1930. Overseas closing date 28th February, 1931.

A Standard British Locomotive?

In correspondence with H.R.C. members we have had many lengthy discussions on the lessons to be learned from the exchanges of locomotives that have occasionally taken place between different lines. A similar subject in which members are greatly interested is the transference of engines to new lines that took place on the grouping of British railways in 1922. It occurred to us that this interest would form a suitable subject for an interesting competition. In this we wish members to assume that grouping has gone much further than was the case in 1922 and that British railways have been brought under single control. Remembering that each group is developing distinct locomotive types, the task we set before competitors is to suggest how an engine to be standardised for the heaviest express passenger traffic over the whole British railway system could be developed from these. Possibly a "*King George V,*" a "*Royal Scot,*" or another of the types already in existence may be suitable, but on the other hand modifications may be necessary in order to meet the requirements of the different sections. We shall look forward with great interest to receiving readers' opinions on this problem in the form of an essay illustrated by neat sketches if necessary.

Members of the H.R.C. at Home and Overseas are eligible to compete and prizes of Hornby railway material, or Meccano products, to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded for the best entries in each section. Envelopes containing these should be marked "H.R.C. Standard Locomotive Contest." The closing date in the Home section is 29th November, 1930, and for Overseas readers is 28th February, 1931.

H.R.C. Competition Results

HOME

August "Locomotive Voting" Contest.—First: G. L. NICHOLSON (9622), Ryde, I.O.W. Second: D. H. GOWERS (10083), Barnehurst. Third: J. ALLEN (3308), Buxton. Fourth: M. COULTER (12786), Newport, Mon. Consolation Prizes: P. J. COATES (6143), Dorking; C. E. WRAYFORD (6039), Moretonhampstead; P. W. FEESEY (14744), London, S.W.11; H. GORDON (7031), Dinnet, Aberdeenshire; R. G. JENNINGS (17345), Birmingham.

September "Errors" Contest No. 1.—First: J. A. SAUNT (2264), Stoke, Coventry. Second: H. C. KELYNACK (17548), London, N.W.3. Third: R. MCLELLAN (2383), Glasgow, C.4. Fourth: S. LUCAS 2942), London, N.18. Consolation Prizes: R. F. LADD (17390), Reading; W. H. WATTS (618), New Barnet, Herts.; E. LONGMAN (3838), West Croydon; W. K. BUTLER (7013), Poynton, Cheshire; W. J. RICHARDSON (17483), Bristol; R. MARTIN (4283), Cheltenham Spa; R. BARBARY (5580), St. Ewe, Mevagissey; D. S. BOWIS (15288), Brighton; K. Costain (5108), Bolton; A. SAULT (15446), Ilkeston, Derbyshire.

September "Holiday Essay."—First: W. J. Young (9656), Salford. Second: A. DOBBS (17551), Boston. Third: D. A. MILLER (107), Birkenhead. Fourth: R. G. DIXON (13161), Berkhamsted. Consolation Prizes: R. WOOD (179), Manchester; E. W. ROBINSON (2349), Hereford; D. H. PAYNE (11399), Woking; L. GRUGEON (4023), Chiseldon; D. LEWER (6892), London, E.9; E. G. BRADLEY (15648), London, S.E.22; H. MCDONALD (10832), Edinburgh; T. E. LAWSON 15265), York.

OVERSEAS

April "1950 Locomotive Drawing" Contest.—First: F. E. MILLS (9375), Nilgiri Hills, South India. Second: A. H. BENNETT (10615), Auckland, N.Z. Third: A. G. SAUNDERS (9822), Hamilton, N.Z.

May "Mystery Locomotive" Contest.—First: B. CHILES (9191), Port Elizabeth, S. Africa. Second: W. FAGG (8557), Milton, Otago, New Zealand.

June "How would you plan a Hornby Railway?" Contest.—First: J. A. RODRIGUEZ (3647), Montreal, P.Q., Canada. Second: F. VAN BULCK (1875), Brussels, Belgium. THIRD: A. JOHNSTON (16298), New South Wales, Australia. Fourth: D. MATHEWS (16420), Cape Town, S. Africa.

June "Railway Photographic" Contest.—First: F. D. ARIA (12362), Bombay, India. Second: E. C. STONYER (10306), South Canterbury, New Zealand. Third: P. GALDES (14183), Valletta, Malta.

With the Secretary

Models from Headquarters

Several interesting additions have been made to the list of models available for lending to clubs for special study or for use at Exhibitions and on Visitors' Nights. The list is now very extensive and provides excellent variety. The total number available is 22 and for the convenience of Leaders I give the complete list, including models that have previously been available and those now added :—Workshop ; Motor Chassis ; Horizontal Engine ; Derricking Crane ; Meccanograph ; Big Wheel ; Aeroscope ; Roundabout ; Tank Locomotive ; Warehouse ; Stiff-leg Derrick ; Ship Coaler ; Transporter Bridge ; Log Saw ; Horizontal Steam Engine (Two Cylinder) ; Power Press ; Watt's Beam Engine ; Vertical Lift Bridge ; Cable Ploughing Engine ; Traction Engine ; Vertical Marine Engine ; Steam Wagon.

These models will be sent out fitted with high voltage motors unless I am specially asked to equip them with 6-volt motors. The high-voltage motor is not employed for the Traction Engine, the Steam Wagon and the Motor Chassis. These models are fitted with 6-volt motors to be supplied with current from accumulators carried on them. The Meccanograph, of course, requires no motor. I shall be glad if officials will give full details of the current available when ordering models. I may also remind them that at least six weeks' notice should be given. Otherwise there may be some difficulty in having the models complete in time, for during recent months the demands made on our Model-building Department have greatly increased.

Lantern Lectures

Secretaries who wish to arrange interesting lectures should not overlook the list I have compiled of those that may be obtained on loan from various firms and railway companies. These are illustrated by an excellent selection of lantern slides, and in certain cases by films of standard size. Many Leaders have written to tell me how interesting these lectures are, and I strongly advise every club to endeavour to include at least one in their programme.

The list of lectures available has now been revised and extended, and I shall be very pleased to send a copy to Leaders and secretaries who do not already possess one. It not only indicates the nature of each lecture, but gives full information of the steps to be taken in order to obtain the slides, and the accompanying descriptive matter. The demand for these is very great, and I advise those wishing to make use of them to make application well in advance of the date when they are required.

A lantern is required in order to exhibit the slides illustrating these lectures. Many clubs already possess one of these useful instruments, and in most cases there should be little difficulty in hiring one. The small outlay necessary may be recovered by exhibiting the slides or films on Visitors' Nights, and making a small charge for admission. This course may also be followed when a lantern for club use is purchased. One enterprising club that adopted the plan a year ago made sufficient profit from a series of lectures to pay the greater part of the cost of a very good lantern, and during the present winter sessions this will be a very satisfactory source of revenue. Their success in this respect may be followed by the purchase of a projector to enable them to make use of the films also included in the list.

Meccano Club Leaders
No. 48. Mr. H. Wicks

Mr. H. Wicks is Leader of the Attenborough Church Choir M.C. This was affiliated in October, 1929, and under his energetic guidance there has been a steady increase in membership and enthusiasm. Special attention is paid to Model-building and the standard of models built for Exhibitions is now very high.

How to Secure Good Reports

I again wish to impress upon secretaries the importance of sending in reports as regularly as possible. Often members are greatly disappointed when they fail to read in the Magazine good accounts of the work carried on in their club, and occasionally they write to me to complain about it. In certain instances the omission may be due to lack of space, but in others the difficulty is the absence of news from the secretary, or the lack of interesting matter in his reports.

I am well aware that in general, secretaries of Meccano Clubs are very busy individuals, and that their duties are extremely varied in character. For this reason I suggest that any official who feels that he is unable to spare time to write adequate reports should delegate the duty to an assistant. This assistant could also act as minute secretary. He should take care to note down at each meeting the chief events of the evening, and he would then find it a very easy task to compile from his records a monthly report that is sufficiently full and interesting to enable me to include an attractive notice on the "Club Notes" page. This would lead to an increase in the enthusiasm of members and in addition would show Meccano boys living near the club's Headquarters that the organisation is flourishing and likely to prove interesting to them.

Proposed Clubs

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

BANSTEAD—Hugh A. Templeton, Rosehill, Firtree Road.

BILLERICAY—Leonard Hostler, 148, High Street, Billericay.

BIRMINGHAM—A. E. Jerromes, Waterworks House, Whitacre, Coleshill.

COLWYN BAY—H. Thomas, Abbey House, Willoughby Road, Rhos-on-Sea.

CLACTON-ON-SEA—C. T. McCrea, "Aviedale," Walton Road.

CLUB NOTES

Kendal M.C.—Satisfactory progress is reported. Meccano Model-building is the chief pursuit of members, who are now constructing models for Exhibition purposes. Two models of special interest that recently have been built are a realistic Leyland Lorry and an Overhead Rotating Crane fitted with a two-speed gear box and driven by a clockwork motor. A Stamp Section has been formed and regular Games Nights arranged in addition to the usual programme. Club roll: 10. *Secretary:* A. Brown, 29, Crescent Green, Kendal.

St. Columba's (Sunderland) M.C.—Rambles along the sea coast and inland formed part of the Autumn programme and interesting specimens of pond life were collected. Visits were paid to the Fire Station and the Telephone Exchange. At the Fire Station a special demonstration of a new fire escape was given. Excursions were made to Durham, where the Castle and Cathedral were thoroughly examined, and to Penshaw. A Mock Trial and two Model-building Competitions have been held, one of the last-named being a Simplicity Contest. Club roll: 32. *Secretary:* G. Spain, 6, Collingwood Terrace, Southwick, Sunderland.

Sligo M.C.—A Meccano Steam Engine and a No. 4 Outfit have been purchased for general use. Interesting models are being built in preparation for a special "Meccano Week." A Lantern Lecture was given by the Leader on the "*Advantages of Meccano to the Young Engineer.*" At its conclusion members were asked to construct models from their own drawings, and the builder of the best was appointed "Foreman of the Models" for the week. A Cycle Run to a large railway junction proved interesting and instructive. The Football Team has made a very successful start in the new season. Club roll: 14. *Secretary:* K. Mc Menamin, 78, John St., Sligo.

Earlsfield M.C.—Has now reopened for the Winter Session with an attractive programme of hobbies and outdoor recreations. Model-building Contests have been arranged and the Football Club has embarked on an ambitious programme, having entered three Cup competitions. A Dance in aid of club funds has been held. Club roll: 18. *Secretary:* D. S. Dye, 15, The Drive, Earlsfield, Grantham, Lincs.

Bramley M.C.—A larger and more suitable club room has been obtained and work in preparation for the Annual Exhibition to be held this month is being vigorously carried on. Splendid models were submitted in the first Grand Model-building Competition of the Winter Session, and an extensive Hornby Train Layout is being built up. Club roll: 13. *Secretary:* J. N. Smith, 1, Highfield Street, Bramley, Leeds.

Hackney M.C.—Has now secured affiliation to the Guild and is making good progress. A No. 7 Meccano Outfit has been bought for club use. Funds for this were provided by several friends interested in the club and the Outfit was exhibited in the window of a local dealer as part of a recruiting campaign. The programme includes Model-building Contests, Lectures and Talks, and at a recent meeting the Leader, Mr. R. H. Panther, spoke on "*Pioneers, Explorers and Smugglers.*" New members are required and the secretary will be pleased to hear from boys interested. *Secretary:* A. T. Field, 76, Lavender Grove, Dalston, E.8.

Cranleigh M.C.—A new and more convenient club room has been secured, and a varied indoor programme arranged. Members are chiefly engaged in preparing models for the Club's Exhibition, and rehearsals for a Concert also are in full swing. Club roll: 17. *Secretary:* W. West, Police Station, Cranleigh, Nr. Guildford, Surrey.

Horsforth M.C.—Outdoor Games on club nights and special Sports Meetings concluded the Summer Session's activities. Two Sports Meetings were held, one for Juniors and the other for Senior members. An Excursion to Roundhay Park was greatly enjoyed, exciting Boat Races on the lake being held. Club roll: 30. *Secretary:* H. Giles, 12, Kerry Street, Horsforth, Nr. Leeds.

Alton M.C.—Recent outdoor events have included a Model Aeroplane Meeting in addition to Games and Visits. The Summer Session was ended by an Excursion to Eastleigh Locomotive Works, followed by a visit to Southampton Docks. In preparation for indoor work Meccano Parts to the value of £3 have been purchased. A talk was given by Mr. A. W. Exton, Leader of the Club, on "*Photography.*" Club roll: 24. *Secretary:* G. Chesterfield, 82, Normandy St., Alton, Hants.

Belgrave (Leicester) M.C.—Cricket Matches and a Water Polo Match against members of a local Model Aeroplane Club completed the Session's activities. Members are now following a varied programme of Model-building Competitions and Lectures. A Chemistry Night was a great success, members particularly enjoying the experiments on fireworks, which all ended with satisfactory bangs! Club roll: 9. *Secretary:* K. J. Hatfield, 25, Acorn Street, Leicester.

A merry group of members of the New Durban M.C. Under the guidance of the Leader, Mr. O. G. Pattison, who in our photograph is seated in the centre of the third row, wonderful progress has been made, membership having increased to 70 in eight months. Members show great skill in Model-building, and specialise in large club models.

Pharos M.C.—A Visit to the S.R. first-class passenger steamer "*Canterbury*" proved highly interesting. This boat carries passengers for the well-known train, the "*Golden Arrow.*" Members thoroughly inspected the life-boat gear, the engines, and the propeller shafts, and the working of the ship's compass was explained to them. A Lantern Lecture has been given on "*Aeroplanes,*" and two Model-building Competitions have been held. Club roll: 30 *Secretary:* G. Bailey, 40, Heathfield Avenue, Dover.

Mall School M.C.—The Exhibition at the end of the Summer Session was very successful. Chief prizes were awarded for a Plasticine model of a Village, and a Meccano model of a Battleship. Two Lectures have been given by the Leader, Mr. E. Cooke, on "*Optics*" and "*The Internal Combustion Engine*" respectively. Club roll: 23. *Secretary:* F. M. Beatty, 23, Oxford Road, Teddington, Middlesex.

Braintree County High School M.C.—Double programmes are arranged at each meeting in order to give members a choice of activities. An interesting programme of Lectures is to be given. In these good use is being made of the School Epidiascope, which projects views of apparatus, Meccano parts, illustrations from books, etc., on a screen. Table Tennis and other games are being taken up, and a Magazine called "*The Triangle*" is to be published in order to give club news and results of competitions. Club roll: 19. *Secretary:* P. Allen, "St. Edmunds," Bocking, Braintree.

Hessle M.C.—Model-building Competitions are being made a special feature for the winter programme. Members have brought their Outfits to the club room, where lockers are provided in which to store them, and in which partly constructed models may be kept. The Library has been reorganised and now includes Journals taken by members. Club roll: 11. *Secretary:* T. A. Fillingham, "Red Lea," Marlborough Avenue, Hessle.

CANADA

Lindsay (Ontario) M.C.—The chief activity of members of this newly affiliated club has been Model-building. A club model has been constructed and a new bridge erected in the locality. The closing period of each meeting is devoted to Games and Recreations, the most popular of these being Boxing. Club roll: 16. *Secretary:* J. Beal, 21, Francis St., Lindsay, Ontario.

Moose Jaw (Saskatchewan) M.C.—An excellent club room has now been secured and a recruiting campaign has brought many new members. For a few days before the first meeting a special Model Display was given in the window of the local Meccano dealer. Excellently organised Model-building Competitions have been held and an Exhibition of models is being arranged, when prizes will be awarded for the best entries from members. *Leader:* Mr. Alex Saunders, 207, Times Bldg., Moose Jaw, Sask.

NEW ZEALAND

Dunedin Hobbies M.C.—An interesting Lecture was given by the Leader, Mr. H. F. Griffiths, on "*Mount Cook and its Surroundings.*" The Aviation Section continues to be active, and among the many models of aeroplanes constructed great attention was attracted by one built to scale of "*The Spirit of St. Louis,*" in which Colonel Lindbergh crossed the Atlantic Ocean. Members are greatly interested in Wireless and special evenings are arranged for it. Club roll: 43. *Secretary:* R. W. Millis, 28, Clifford St., Dalmore, Dunedin.

Kaiapoi M.C.—Prizes of 15/- and 10/- were awarded in a recent Model-building Competition. These were won by members who submitted models of a Dredger and an Elevator. Members of the club won the First and Second Prizes in a Model-building Competition held in Christchurch. A talk on "*The Manufacture of Armour Plate, Naval Guns and Shells*" was given by Mr. W. Burnet, of Vickers Ltd. Cycle rides have been arranged for the open air season and the first of these were carried through very successfully. Club roll: 13. *Secretary:* L. Allison, North Road, Kaiapoi, Canterbury, N.Z.

Clubs Not Yet Affiliated

Weymouth M.C.—By kind permission of the Vicar, the club now has the use of a classroom in St. John's Boys' School. Two sections have been formed, each under its own Leader, and an attractive programme of Model-building Competitions has been arranged. Each member submits a model weekly. Points are awarded and the member who has most points at the end of the session will become the holder of a Shield, that has been constructed by a Section Leader and the secretary. A Library has been formed, and an exhibition of models is to be held on 25th and 26th November in conjunction with their Christmas Fair. *Secretary:* C. Chalker, 4, St. Edmund St., Weymouth.

Blackburn M.C.—Meetings were resumed in September and have been well attended. A Hornby Locomotive and a No. 5 Meccano Outfit have been purchased for the use of members, and an interesting programme of Model-building Evenings has been arranged. *Secretary:* K. Charnley, 772, Whalley New Road, Brownhill, Blackburn.

St. Owen's (Hereford) Boys' School.—This newly formed club meets at 7 p.m. on Thursdays in the St. Owen's Boys' School. An interesting programme is being followed, this including Model-building, Talks and Competitions. Experimental Evenings also have been arranged and these will be held in the School Laboratories. New members are required and the secretary will be pleased to give details to any Meccano boy who wishes to join. *Secretary:* D. Williams, 4, St. James Place, Maylord St., Hereford.

Chiswick M.C.—The chief activity of last session was Cycling and on their runs members visited many places of interest near London. An Exhibition has been planned. At these, large club models and a Hornby Railway System will be prominent features. An excellent club room has been secured and it is hoped that affiliation to the Guild will be secured shortly. *Secretary:* H. P. B. Betlem, 139, Park Road, Chiswick, London, W.4.

Competition Page

CODE-WORDS

WORD puzzles have ever been a popular form of amusement with readers of the Meccano Magazine, and have comprised some of our most successful competitions. This month we introduce something that is completely new in this direction. It is an adaptation of crossword puzzles and numerical coding, to which we have given the name "Code-Words."

In the centre panel will be found strings of numbers ranging from 0 to 9. These represent the names of famous men or well-known objects, and accompanying each is a key giving a clue to the hidden subject. At the foot of the panel there are given sets of clues from which the coded letters can be traced. When the letters are sorted into the order indicated in the code, the name of the hidden object will stand revealed. It should be made clear that the numbering gives the correct order of the appearance of the letters in the puzzle, and that when a letter is repeated in any word it is given a distinct number for each appearance.

For example, puzzle No. 1, "A Famous Ship," is lettered from 0 to 9. Therefore, the name of the ship contains ten letters. The solution of the first clue—3, 7, 2, 3, 4; "harden by use"—is "inure," and this gives us five of the letters, which must be placed in the order of their numbers. The letters represented by 0, 1, 3 and 5, for which the clue is "Market Place," make the word "Mart"; and the third clue indicates that numbers 6 and 9 stand for A.A., the initial letters of the organisation known as the Automobile Association. With each of the clue letters in position, the name of the ship stands revealed as "*Mauretania.*"

This example makes the requirements of the contest quite clear, and readers are invited to go ahead with the solving of the remaining 11 puzzles. Prizes of Meccano or Hornby Train products (to be chosen by the winners from the current catalogues) to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the best four solutions in order of merit. In addition there will be a number of consolation prizes. Should there be a tie for any or all of the prizes, preference will be given to the neatest or most novel entry.

Entries should be addressed to "Code-Words, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 29th November. Overseas closing date, 28th February, 1931.

(1) **A Famous Ship** 0 1 2 3 4 5 6 7 8 9	(2) **A Great Cricketer** 0 1 2 3 4 5 6 7 8	(3) **A Sportsman Peer** 0 1 2 3 4 5 6 7
(4) **A Great Inventor** 0 1 2 3 4 5	(5) **A Famous Locomotive** 0 1 2 3 4 5 6 7 8 9	(6) **An English River** 0 1 2 3 4 5
(7) **A British Industry** 0 1 2 3 4 5 6 7 8 9	(8) **A Breed of Dog** 0 1 2 3 4 5 6 7 8	(9) **A Famous Admiral** 0 1 2 3 4 5 6
(10) **A Great Actor** 0 1 2 3 4 5	(11) **A Well-known Footballer** 0 1 2 3 4 5 6 7	(12) **A Great Airman** 0 1 2 3 4 5 6

CLUES

(1) 87234 Harden by use 0135 Market Place 69 Automobile Assoc.	(2) 0182 Fat 34567 Steep Mountainside.	(3) 3145 A washing material 2760 A girl's name
(4) 453210 A Football term	(5) 0549 Substitute 723618 Bolted	(6) 051324 Launching frame
(7) 824769 Indicating 0153 Tumult	(8) 34257 British Possession 068 Racket 1 Alpha	(9) 0654 Original 321 Course
(10) 542 Coin 013 Unwell	(11) 015367 Of royal blood 42 Tonic Solfa note	(12) 064 Sphere 1352 Authentic

GUY FAWKES

A November magazine without some reference to Fireworks, other than in the advertisement pages, would scarcely be topical, and so we introduce the subject here.

The "Fifth of November" is an occasion for fun and frolic, and in all parts of the country effigies of Guy Fawkes, the conspirator, are burnt to the accompaniment of lively displays of fireworks. But the celebrations usually go further than the mere discharge of squibs and crackers around a blazing bonfire, and the origin of the noisy festival is commemorated in curious customs, many of which are of an amusing character. All of them centre round the "Guy," of course, and there are very few places where the "villain of the piece" is not paraded round the district before being reduced to ashes.

Most readers are familiar with local variations of the customs followed, and prizes are offered this month for the most amusing accounts of local "Bonfire Night" celebrations.

The prizes will consist of Meccano or Hornby Train products (to be chosen by the winners) to the value of 21/–, 15/–, 10/6 and 5/– respectively, to be given to the senders of the four best accounts in order of merit. There will be a number of consolation prizes also.

Entries, which should not exceed 500 words in length, and must be written only on one side of each sheet of paper used, should be addressed "Fireworks, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 29th November. Overseas closing date, 28th February, 1931.

COMPETITION RESULTS

HOME

Air Mail Stamp Contest.—At this stage, with the Overseas Section—from several points of view the more important section—still open, it is desirable to refrain from making any specific comment upon the entries. For the moment it is sufficient to say that the "Ayes" have not had matters all their own way, while the "Noes" have some almost unanswerable points to meet.

At a later stage, when the general trend of opinion in the Colonies is available, we hope to return to the subject in the Stamp Gossip columns.

The prize awards in the Home Section are as follows:—1. A. Davis (Boston, Lincs.); 2. E. H. Croston (Liverpool); 3. J. H. Campbell (Castledermot, I.F.S.); 4. C. D. Bates (Stokenchurch, Bucks.). Consolation Prizes: G. E. Cassidy (South Tamborough); L. Grugeon (Chiseldon, Wilts.).

Doublets.—1. R. F. Newton (Buckhurst Hill); 2. A. M. Messenger (Rochester); 3. L. A. Frayn (Plymouth); 4. K. M. Gilliland (Belfast); Consolation Prizes: S. E. Hales (Andover); R. A. Nelson (Liverpool); C. W. Lewis (London, S.W.11); R. C. Bannister (Romford); A. R. Ford (Birmingham); J. Sturrock (Barrow); R. A. Beatty (Teddington).

OVERSEAS

Test XI Contest.—1. H. N. Eustis (Alberton, S. Australia); 2. M. D'Lima (Bombay); 3. K. Tail (Salisbury, S. Africa); 4. E. L. Meek (Wellington, N.Z.). Consolation Prizes: L. R. Tees (Durban, S. Africa); E. F. Speirs (Transvaal, S. Africa).

June Photo Contest.—First Prizes: Section A, J. Credie (Cape Town, S.A.); Section B, C. J. McCain (Sydney, N.S.W.). Second Prizes: Section A, A. Stuart (Cape Town); Section B, R. L. Goddard (Toronto).

Cut Outs.—Specimens of the prizewinning entries from the Home Section of the first Cut Outs Contest have already been reproduced in the "*M.M.*," and at a later date we hope to show also the leading Overseas entries. Their standard was in every way equal to the winning home entries.

The awards were as follows:—First Prizes: Section A, W. Flanderka (Colombo, Ceylon); Section B, J. A. Rodriguez (Montreal). Second Prizes: Section A, V. C. Rodriguez (Berbice, British Guiana); Section B, C. Anderson (Dumbleyung, W. Australia). Consolation Prizes: E. N. Bolder (Auckland, N.Z.); G. P. Brook (Natal, S. Africa).

A NEW TURN "SUNNY JIM"-ACROBAT

Send to-day for the FREE COLOURED DESIGN and make this amusing toy!

HERE is a novelty that will give you a great deal of fun! Sunny Jim, the personification of health and fitness, performs amusing acrobatic feats.

With the aid of the coloured design, which you can obtain *free* by sending the coupon below *together with one top from a "Force" packet*, it will take you only a few minutes to construct the model. Full directions are given on the design.

Those lucky people whose Mothers provide "Force" and milk for breakfast or supper every day, will be able to send the packet top and coupon at once and be amongst the first to get their "Sunny Jim—Acrobats."

If you are not able to be one of them, ask Mother to do you a favour and purchase a packet of "Force" so that *you* can send for your "Sunny Jim—Acrobat" too.

Then you will also be able to have delicious breakfasts of "Force" and milk that will help to make you strong and fit, full of energy and health. "Force" is full of goodness. It is the finest food for those who wish to be fit, because it is made from whole wheat and contains its wonderful health-giving vitamins.

"Force" needs no cooking. It is shaken straight from the packet and served with hot or cold milk.

"FORCE"

WHEAT—MALTED, FLAKED and TOASTED

— the food that makes you fit!

FILL IN AND SEND TO-DAY—

CUT OUT

YOUR COUPON for FREE COLOURED "SUNNY JIM—ACROBAT"

To Sunny Jim, (Dept. C.P.9.)
A. C. FINCKEN & CO., 197, Great Portland St., London, W.1.

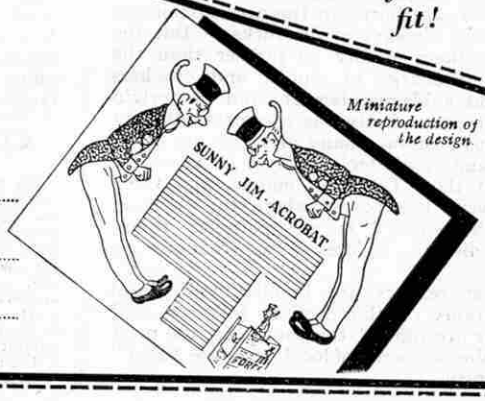
Please send me a Free coloured "Sunny Jim — Acrobat" design, together with full instructions for making the model. I enclose herewith ONE TOP FROM A "FORCE" PACKET.

Your Name .....

Your Address .....

Town .....

(This offer applies in Great Britain, Northern Ireland and the Irish Free State only)



Miniature reproduction of the design.

ON THE DEFENSIVE

"If a man smashed a clock, could he be convicted of killing time?"

"Not if the clock struck first."

* * * *

The soldiers marched to the church and halted in the square outside. One wing of the building was undergoing repairs, so there was room for only about half the battalion.

"Sergeant," ordered the captain, "tell the men who don't want to go to church to fall out."

A large number quickly availed themselves of the privilege.

"Now, sergeant," said the captain, "dismiss all the men who did not fall out and march the others in—they need it most."

* * * *

The motorist was hopelessly lost in a narrow country lane. Suddenly he saw an old man approaching.

"Hi!" he shouted, "do you know the way to Ecclesbury?"

The old man shook his head.

"No, danged if I do," he said.

The motorist drove on slowly, and when he had gone a short distance he heard loud shouts behind him. He stopped and looked round. The old man had been joined by another and they were waving him back. Slowly and painfully he backed his car toward the countrymen.

"Well?" he said, on reaching them.

"This be my mate George," said the old man. "'E don't know, neither."

* * * *

Distraught Mother: "Quick, papa! Baby has swallowed the camera films!"

Father: "Gracious! I hope nothing will develop."

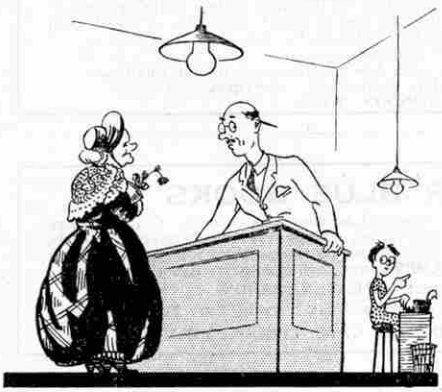
* * * *

Ambulance Man: "Were you in the train, too?"

Injured Passenger: "No, I was under it."

* * * *

A MINISTERING HAND



"Can I see the Minister of Agriculture?" enquired the dear old lady.

"Well, he is very busy, madam; what do you want to see him about."

"I want him to tell me what is wrong with this geranium of mine."

* * * *

Jim had had a nasty fall when at work on the scaffolding, and his pals went round to see him when he got better.

They were curious to know what the sensation was like. With some imagination, he described all he had felt.

"But what I wants to know," said his mate, "is whether it's true that all your sins flashes before you. Did yours?"

"Talk sense," said Bill. "I fell thirty feet, not thirty miles."

COLD COMFORT

Isaac and his son were in a picture palace.

"Fader," cried little Abe, "I'm so hot. Will you buy me a drink of lemonade?"

"No, my boy," said Isaac, "vait until the interval."

The boy was not satisfied and soon repeated his request for a cooling drink.

"No," said Isaac again, "vait until the interval, and I'll tell you a ghost story that will make you go cold all over."

* * * *

A FAIR DIVISION

Burly Bill: "Got a penny on yer, guv'nor?"

Little Smiffey: "Certainly, but what do you two men want with one penny?"

Beefy Bert: "We wants to toss up, guv'nor, to decide which of us is to have yer watch and which yer money."

* * * *

First Darky: "What fo' you name yo' baby 'Electricity,' Mose?"

Second Darky: "Well, mah name am Mose, and mah wife's name am Dinah, and if Dinahmose don't make electricity, what does dey make?"

* * * *

A Lancastrian sent his son to be tutored and "polished" by a cultured university man. He was particularly anxious that he should lose his Lancashire accent, and the tutor assured him that in six months the boy would have no trace of it. At the appointed time the father visited his son.

"Hello, pater, I'm frightfully bucked to see you again," said the latter in flawless accents.

The father was delighted and went off to congratulate the university don. That gentleman looked at the parent in perplexity for a few moments. Then recognition dawned on his face.

"Ba goom," he said, "Ah mind thee now. Tha's young 'Arold's feyther."

* * * *

Tommy had handed in his homework and the teacher examined it very closely.

"Tommy," he said, "this looks very much like your father's writing. What have you got to say?"

"Well, teacher," said Tommy after a long pause, "Now I come to think of it, I used his fountain pen."

* * * *

Smith: "I've got a little attachment here for your radio."

Brown: "Thanks very much, Smith. Let's have a look at it; I'm always interested in something new."

Smith: "Well, it's just a brick and a yard of rope, and the river's the second turning on the right."

* * * *

Mother: "What did you do with the money that Uncle Tom put in your bank?"

Willie: "Well, he said it was for a rainy day, didn't he?"

Mother: "Yes, but what has that to do with it?"

Willie: "But, Mother, it rained yesterday!"

* * * *

Traveller: "Porter, I've lost my baggage."

Porter: "Good. You won't need a porter now, will you?"

* * * *

The brakes on the bus had failed at the top of a steep hill. Women passengers fainted, while even men turned pale at the thought of what might happen in a few moments.

The bus went faster and faster, and all inside gave up hope. The driver, however, did not lose his presence of mind.

"Quick, Bill!" he yelled to the conductor. "Change the destination boards!"

A GOOD COMBINATION

The captain of the local Rugby team was talking to the referee before the beginning of an important match.

"Rather noisy spectators, don't you think?" asked the referee, a nervous little man.

"Splendid view, though," replied the captain. "Hospital in the north, nursing home in the east, cemetery in the west, and a duckpond in the south."

"And, what's more," he went on deliberately, "we've never once lost a home game!"

* * * *

The branch line was notorious for its lack of speed, and a tired traveller was complaining of the time taken to complete a short journey.

An old gentleman present resented this remark.

"I've been travelling in this train for fifteen years," he announced, "and no one has ever heard me say anything against it."

"No!" returned the first speaker, "but how far are you going!"

* * * *

Patient (in asylum yard, to new superintendent): "Who are you?"

Superintendent: "I'm the new superintendent."

Patient: "Oh, it won't take them long to knock that out of you. I was Napoleon when I came here."

* * * *

"Imagine! Here's a man suing his wife because he can't drink the coffee she makes!"

"He calls it grounds for divorce, I suppose!"

* * * *

Teacher: "Really, Johnny, your hand-writing is terrible. You must learn to write better."

Johnny: "Well, if I did, you'd be finding fault with my spelling."

* * * *

"Yassah," said old Link, "business is very good. Done bought a pig fo' ten dollars, traded pig fo' a barrer, barrer fo' a calf, calf fo' a bicycle, and sol' de bicycle fo' ten dollars!"

"But yo' don' make nothin', Link!"

"Sho' 'nough, but look at de business Ah been doin'."

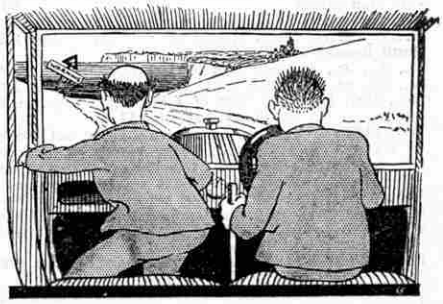
* * * *

"Aren't you going to Manville by train?"

"No: the trains always make me sea-sick, so I'm going by boat!"

* * * *

THE LESSER EVIL



Horror-stricken passenger as car gets out of control: "Heavens! I hope we don't hit anything!"

Driver: "I hope we do. The road ends at a cliff further along!"

* * * *

Wife (at 2 a.m.): "Wake up, John, wake up There's a burglar in the next room."

Husband (sleepily): "Well, I've no revolver. You go in and look daggers at him."

* * * *

Mr. Spenditt: "You have overdrawn my account £50. What do you mean by being so careless?"

Mrs. Spenditt: "Well, the bank's advertisement showed that their resources are over £100,000,000."

* * * *

"What's your name, little boy?"

"Sam."

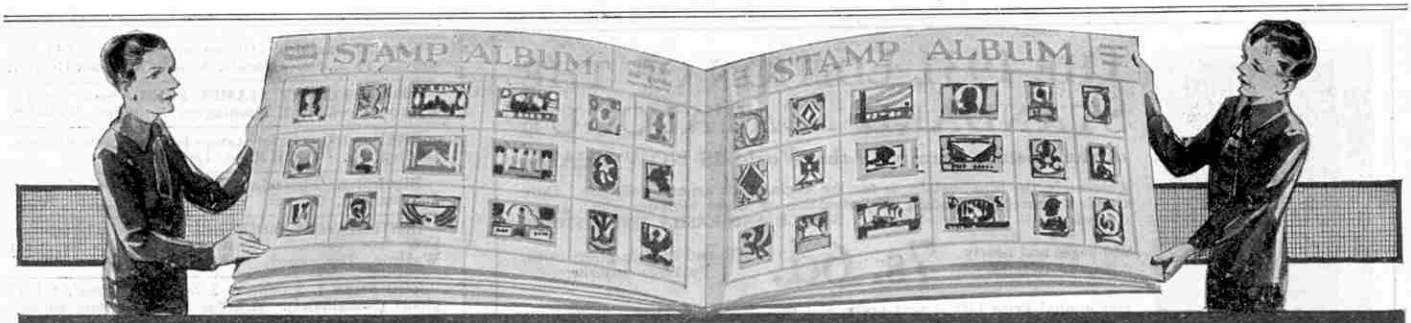
"What is the rest of it?"

"Mule."

* * * *

"Your husband is always in the yard nowadays, Mrs. 'Iggs, burning papers."

"Yus. 'E's got a job distributing circulars."



STAMP COLLECTING

THE STORY OF THE PANAMA CANAL

GREAT engineering feats have ever been a profound source of inspiration for stamp designers, and most of the really important enterprises—and not a few of the unimportant—have figured on postage stamps. The Panama Canal probably can claim the distinction of providing the greatest number of designs, for in addition to providing the inspiration for two complete series issued by the Republic of Panama in 1915 and 1918 respectively, it has been featured extensively on U.S. General and Canal Zone issues.

In a short article such as this, it is, of course, impossible to relate the complete history of the Panama Canal, the greatest canal undertaking in the world, and readers who desire to delve fully into the subject are commended to the series of articles that commenced in the issue of the "*M.M.*" for November, 1927. Nevertheless, the stamp story of the canal makes interesting reading, and for our first illustration we must take the 1c. stamp of the Panama 1915 issue, showing a relief map of the isthmus of Panama and the track of the canal across it.

The map makes clear how full advantage was taken of the natural features of the isthmus in driving the canal through. Commencing at the Atlantic seaboard, the canal is carried through Limon Bay near Colon, the coast-line of this bay being five miles from deep water, where the canal really begins and from which the measurements are taken. At the seventh mile the canal enters the Gatun Lake by the three Gatun Locks. From here to the Culebra Cut is 22 miles, and four miles beyond the cut is the Pedro Miguel Lock. After passing through this lock, Lake Miraflores is entered, at the far end of which are the Miraflores Locks that bring the canal back to sea-level. From the Miraflores Locks to deep water is another eight miles, the total distance between deep water in the Atlantic and deep water in the Pacific being very slightly less than 50 miles.

The early history of the canal really dates back to 1502, when Columbus endeavoured to discover a natural waterway from the Atlantic to the Pacific. On failing to find one, he appears to have become convinced that the coast line was in reality part of Asia. Subsequently, in 1513, the Spaniard, Vasco Nunes de Balboa, crossed the isthmus, and thenceforward throughout the 300 years of Spanish dominion, the canal project was continually under discussion, although it rarely advanced beyond the stage of dreams. It came to the front again in 1850, when an agreement was concluded between the U.S. and Great Britain, guaranteeing open passage for the ships of all nations in the event of the canal being constructed. In 1869, the opening of the Suez Canal gave it further prominence, and in 1879 the Colombian Government granted a concession to a French company actually to construct the canal. A start was made in 1881 with De Lesseps, the engineer of the Suez Canal, as the Chairman of the Company and Chief Engineer.

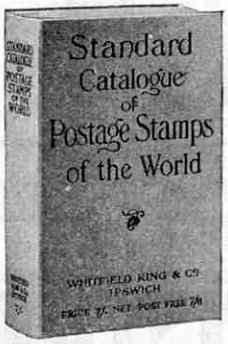
Progress was slow, for the difficulties were enormous, and eventually the company collapsed. A second company was formed and fared a little better, but in 1903 the U.S. Government bought up its rights and assets, and, having obtained a new concession from Colombia, took the completion of the work in hand.

Almost immediately, the scheme was jeopardised by Colombia's refusal to grant control of the territory bordering the canal, to the United States, but the inhabitants of Panama were determined that America should be given the chance to see the job through. They revolted, formed a republican government, and on 18th November granted the U.S. Government perpetual occupation and control of a ribbon of territory, ten miles in width, stretching across the isthmus. This extended five miles on each side of the route of the canal, and the area thus marked out forms the Canal Zone of to-day.

The political obstacles thus having been overcome, the Americans were able to turn their attention to the practical side of the job. The difficulties were stupendous. The cut through Culebra Hill, for example, involved the excavation and removal of nearly 80,000,000 cu. yds. of earth and rock.

An excellent impression of the enormous scale of the operations here is obtained from the 5c. stamp of the current Canal Zone issue, which shows small-gauge locomotives at work removing the material excavated from the canal bed. One of the great difficulties in the Culebra Cut was the constant collapse of the embankment sides, and it was found necessary to arrange a very gentle slope, although, where rock was encountered, the sides were cut almost perpendicular, of course. The 12c. value of the Panama 1918 issue makes this point clear. On it a steamer is shown passing through the completed canal, on one side of which the bank slopes gently away, while on the other it stands boldly upright.

It will be clear from the relief map that the making of the canal was not a mere matter of carving a way through the hills. The canal virtually goes over the hills, a feat that was accomplished by maintaining sea level over the first seven miles from Colon to Gatun, at which point a great dam was constructed across the River Chagres, creating a lake 22 miles in length extending to the Culebra Cut. Access to this lake—the summit point of the canal—is by means of a three-tier double flight of locks. The 5c. stamp of Panama's 1915 issue gives an excellent view of the locks, and of the runways, or ramps, at the side, along which run the electric locomotives that tow steamers through the locks.



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All "Meccano Magazines" prior to December, 1923, are out of print. Each of the 1924 issues, with the exception of January, February and September is in stock. Only the June, July, October and November, 1925, issues are available. All the 1926, 1927, 1928, 1929 and 1930 issues are in stock, with the exception of January, February, April and May, 1926, January, March, July and August, 1927, January and February, 1928.

Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues, 1925 and 1926, and all the issues of 1927, 1928, 1929, and 1930 are 8d. each.

Quotations for complete bound volumes may be obtained from the publishers—

"Meccano Magazine," Binns Road, Old Swan, Liverpool.

Stamp Gossip

The 1931 Catalogues

There is something very satisfactory to a collector in the knowledge that whatever he is collecting is increasing in value. In this respect the stamp collector is no exception, and for this he experiences a thrill on the annual appearance of the stamp catalogues. The Stanley Gibbons and Whitfield King Catalogues gain in interest as the years roll by, and the bulk of the 1931 issues, now to hand, is ample evidence of the great growth of our hobby.

From the Whitfield King catalogue we learn that 1,656 new stamps have been issued during the past 12 months, an increase of 160 over the previous period. For this, presumably, the many new air mail issues must be held responsible. The total number of stamps issued to date, allowing only for major varieties, as listed by Messrs. Whitfield King, is 51,859, of which Europe claims 16,203, Asia 9,562, Africa 11,717, America 8,598, West Indies 3,158 and Oceania 2,621. The biggest increase, as is to be expected, comes from Europe, with 895 new stamps, and the lowest from the West Indies, with 38.

A particularly interesting feature in this catalogue to the specialist collector, is the complete revision of the Turkish lists to include the many wartime issues, concerning which information has so far been scarce.

The Whitfield King catalogue is ideally arranged to be of service to the young general collector, for it concentrates on the major varieties and omits much of the minute detail that, to the specialist collector, is so valuable a feature of the more expensive catalogues, but which, to the novice, can be so confusing.

Further details of the Whitfield King catalogue, which is priced 7/6 (post free) and is attractively bound in light green cloth, can be obtained from Messrs. Whitfield King & Company, Ipswich, whose advertisement will be found on page 910.

Made up, as usual, in two parts, dealing separately with the issues of the British Empire and the remainder of the world, the Stanley Gibbons' Catalogue lists every important stamp variety that is known to have been issued, and illustrates most of them. Faced with the problem of still further increasing the number of pages, to provide space in the 1931 edition to list the hundreds of new issues, Messrs. Gibbons have actually succeeded in reducing the bulk of their volume—little short of 1,500 pages—into two inches, and the feat has been accomplished without sacrificing anything of the clarity of previous volumes!

The important feature, however, is the vast re-marking of prices, over 22,000 figures having been revised or added. There are some spectacular increases, the most important being the air mail issues of Newfoundland used for Hawker's flight in 1919 and the de Pinedo flight of 1927. Unused specimens of the Hawker stamp have jumped from £150 to £300, and "de Pinedo's" from £85 to £150. At the commencement of his flight Col. de Pinedo was presented with 66 copies of the stamp used on the mail he carried. One wonders how many he now retains!

Those of our readers who have advanced from the novitiate stage would find the Gibbons' Catalogue a tremendous help in the pursuit of their hobby; it is the greatest thing of its kind in the world, and will save its cost over and over again each year.

The Whole World volume, containing Parts 1 and 2, is priced 15/- (15/9 post free), but, for those who specialise, the British Empire Section (Part 1) and the Rest of the World (Part 2) can be obtained separately, priced 6/6 (6/11 post free) and 10/- (10/9 post free) respectively. Overseas readers should allow 6d. additional postage for the Whole World volume and 3d. each for the others. Further details may be obtained from Messrs. Stanley Gibbons' advertisement on page 908.

* * * *

We illustrate here one of the designs that were used in the four-stamp set issued by Peru to celebrate the opening of the Sixth Pan-American Child Welfare Congress.

By a curious error, each of the stamps refers to the "Seventh" Congress.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which our illustrations have been prepared.

Italy's Ferrucci Commemorative

As promised in the October "*M.M.*," we reproduce this month the four designs that were employed in the recent Italian commemorative issue celebrating the 400th anniversary of the great Florentine soldier, Francesco Ferrucci.

There were eight values in the set, of which three stamps, 50c., 1L. and 5L.+2L. were for air post service, and employed the design showing Ferrucci with a falcon perched on his outstretched arm. The murder scene, described fully last month, appears on three of the values of the general issue, 25c., 50c. and 1L.25. The remaining general designs show Ferrucci at the head of his army, on the 20c. value, and a portrait on the 5L.+2L.

Stamp Collecting

—(*Continued from page 909*)

The provision of twin locks enables vessels to proceed up and down at the same time. The 24c. value of the Panama 1918 issue shows a steamer actually under way through the Gatun locks, the tow rope from the ship to the engine being clearly visible.

At the Pacific end of the Culebra Cut, at Pedro Miguel, duplicate locks were built and, following almost immediately, two lower steps, each consisting of two locks abreast, brought the canal down to sea level again. Then an eight-mile sea level stretch brings the canal to its Pacific terminal. The locks at Pedro Miguel are shown on the 1p. value of the 1918 series, and the 50c. value of the same series, not illustrated, shows a dockside scene at Panama.

The completed canal, from deep water in the Atlantic Ocean to deep water in the Pacific, is about 50 miles in length, and the passage throughout occupies from nine to twelve hours. The canal has made possible to vessels voyaging from one coast of the United States to the other, a saving of roughly 8,000 miles, while the trans-Atlantic voyage from Liverpool to ports on the Pacific coast, north of the Panama Canal, is shortened by more than 6,000 miles.

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GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines and are beautifully enamelled, mostly in the correct colours of the L.N.E., L.M.S., G.W. or Southern Railways.

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An attractive model. Enamelled green with lettering in red. Price **2/6**

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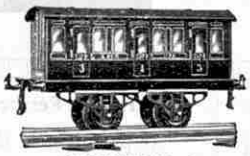
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**



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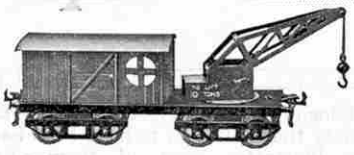
Realistic in design and fitted each side with opening doors. Price **2/6**



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Realistic design, fitted each side with opening doors. Obtainable in L.N.E.R., L.M.S., G.W. or S.R. colours. Price **3/-**

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Fitted with sliding doors. Complete with milk cans. Price **3/6**

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Two kinds are available, one named "Madison" and the other "Washington." Price **1/6**

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This is a beautiful model, substantially built and well finished. Suitable for 2-ft. radius rails only. Price **14/-**

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Model of the type of tank car used in America for the conveyance of oil, etc. Price **1/9**

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Finished in red, lettered gold. Price **2/6**

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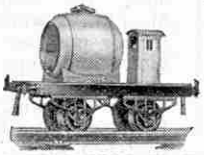
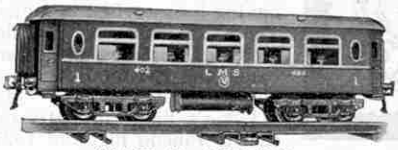
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**

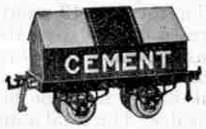


WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/-**



COACH, No. 2 SALOON
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**

COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type, lettered "Nord." Price **3/-**



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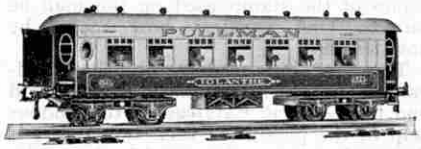
Finished in red. Price **3/-**

TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**

SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/-**

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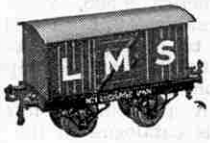
Beautifully enamelled. Fitted with opening doors. Price **3/9**



***LUGGAGE VAN No. 1**
With opening doors. Price **3/6**

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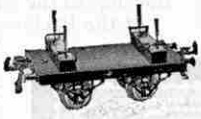
Finished in red. With opening doors. Price **3/6**



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Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

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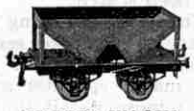
Finished in brown and blue. Price **3/6**



***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**

CABOOSE
Modelled on the type of brake van used on American railroads. Price **2/6**

TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**

BOX CAR
This is a model of the type in use on American railways. Price **2/6**

MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**

JACOB'S BISCUIT VAN
Finished in crimson lake. With opening doors. Price **3/6**

CARR'S BISCUIT VAN
Finished in blue. With opening doors. Price **3/6**

LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/-**

In L.M.S., L.N.E.R., G.W., or S.R. lettering.

CRAWFORD'S BISCUIT VAN
Finished in red. Opening doors. Price **3/6**

SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

HORNBY SERIES

HORNBY ACCESSORIES

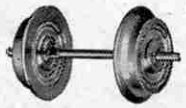
HORNBY SERIES

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.

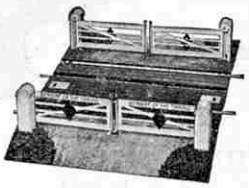
DOUBLE ARM SIGNALS No. 1
Price 4/3 per pair.
DOUBLE ARM SIGNAL No. 2
(As illustrated.)
Price 3/- each.

FOOTBRIDGE No. 3
(Lattice Girder)
Constructional type. Strong and well proportioned ... Price **12/6**



MANSELL WHEELS
These solid die-cast wheels are correctly designed and may be fitted to Hornby Wagons, Vans, Coaches, etc. Price, per pair, **4d.**

M STATION SET, 7 pieces
Price complete **3/6**
The components of the M Station Set may be purchased separately as follows :—M Wayside Station Price, each, **1/-**
M Signal Box ... ... Price, each, **6d.** M Signals ... Price, each, **4d.**
M Station ... Price, each, **1/3** M Telegraph Poles. Price, each, **4d.**



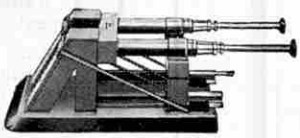
LEVEL CROSSING No. 2
Measures 13½ × 10¼ ins., with two tracks of gauge 0 rails in position ... ... Price **5/6**
LEVEL CROSSING No. 2
(Electrical)
Similar to Level Crossing No. 2, but fitted with two electrical tracks ... ... Price **8/-**

SIGNAL No. 2
Price **2/6** each.
"Home" or "Distant."

TUNNEL
Realistic and finished in colours ... Price **7/6**

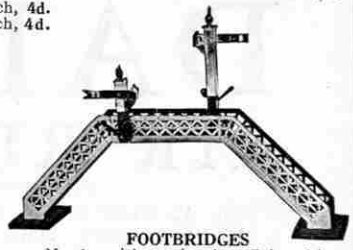
TARPAULIN SHEET
Strongly made. Lettered L.M.S., G.W., N.E. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price **3d.**

TURNTABLE No. 2
Price **4/6**
TURNTABLE No. 2
(Electrical)
Similar to Turntable No. 2, but fitted with electrical rails ... Price **8/6**

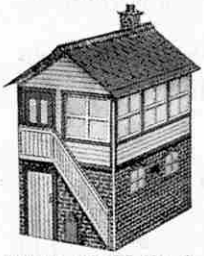


BUFFER STOPS No. 2
(HYDRAULIC)
Price **5/6**

PLATELAYER'S HUT
Price ... **2/6**

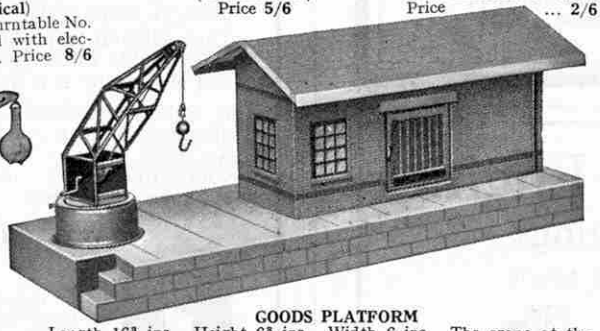


FOOTBRIDGES
No. 1, without signals. Price **4/-**
No. 1a, with detachable tin-printed signal posts and arms ... Price **4/9**
No. 2, with detachable enamelled signal posts and arms (as illustrated). Price **7/6**
Signals only, for No. 2 footbridge. Price ... ... per pair **3/9**

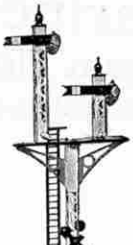


SIGNAL CABIN No. 1
Dimensions : Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price **2/9**

LAMP STANDARD No. 1 (SINGLE)
An electric flash-lamp bulb may be fitted into the globe. Price **3/6**

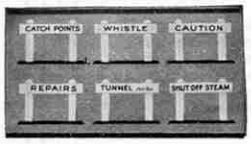


GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **12/6**



JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height. Price **6/-**

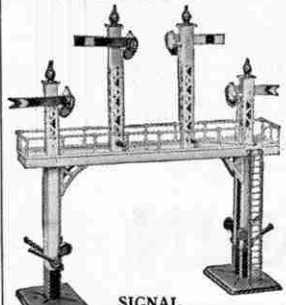
TUNNEL ENDS
Tunnels of varying lengths can be made with cardboard or other suitable material, and then fitted to the Tunnel Ends. Price, per pair, **2/9**



RAILWAY ACCESSORIES No. 8
Notice Boards.
Price, per set, **2/3**

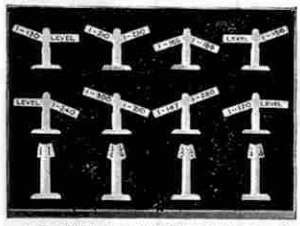
VIADUCT. Price **7/-**. **Centre Section only.** Price **4/9**
ELECTRICAL VIADUCT. Price **8/-**
Centre Section for Electrical Viaduct. Price **5/3**

RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price, per set, **2/6**



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

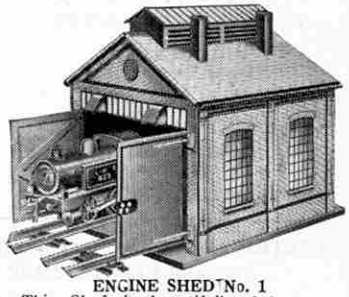
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price **1/6**



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

WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever. Price **8/6**

RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable, Dimensions : Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price **12/6**



ENGINE SHED No. 1
This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, and Locomotives of No. 0 and No. 1 types ... ... Price **15/-**

A real 'man size' liquid pistol for 1/6

LOOKS just like a real automatic and shoots a strong jet of water about 25 feet. It is strongly made from metal with blued steel finish and there are no rubber parts to perish or wear out. It's a pistol that will last a lifetime.

That's the pistol **you** should have—one that will really **do** something. Get one from your nearest dealer—only **1/6**—but be sure it's a DAISY as illustrated above.

A catalogue showing all DAISY Air Guns will be sent free on application.

DAISY
AIR RIFLES

(*Made in U.S.A.*)

Wm. E. Peck & Co. of London, Inc.,
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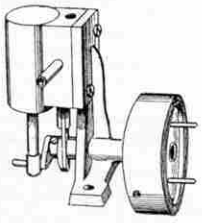
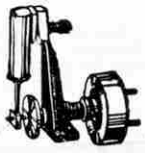
Model Marine Engines
and Steam Fittings

HIGH CLASS, BRITISH MADE



PISTON VALVE ENGINE
½" bore, ⅝" stroke.
Solid Cast Frame, Gunmetal Cylinder.
6/4 each, Post 4d.
Larger D.A., **7/6** each, Post 4d.



OSCILLATING ENGINES
⅜" bore, ½" stroke.
3/- each, larger size **4/6** each.
Post 4d.

BOILERS
Water Tube Type.
Complete with Safety Valve and Steam Tap.
4"×2½"×3" ... **8/-** each, Post 4d.

PLAIN BOILER with Fittings
5/- each, Post 4d.

BOAT PROPELLORS, SHAFTS, Etc.

ACCUMULATORS
Boat Type

4 volt, 4 amp.	...	**5/6** each
4 ,, 6 ,,	...	**6/6** ,,
4 ,, 10 ,,	...	**8/-** ,,

Postage 6d.
All Larger Sizes supplied.

ELECTRIC MOTORS, Very Powerful, 7/6 each (Post 6d.)
ALL GOODS BRITISH MADE AND BEST QUALITY
Write for Catalogue 2d.

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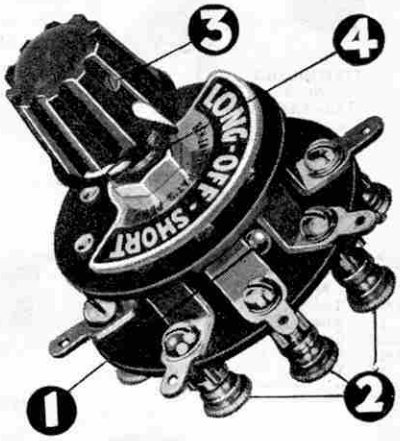
An All Round Switch!



IF you appreciate a sound engineering job, here is a Radio Switch that will make an irresistible appeal.

It is Rotary in action, two phosphor bronze balls being carried spring loaded in the extremities of a bakelite arm which is revolved by, but is insulated from, the spindle.

The Balls snick securely into the spaces between the contact strips making, for each movement of the pointer knob, splendid firm, low resistance contacts between two pairs of strips simultaneously.

The switch thus performs all the functions of a double pole, double throw change over, and both mechanically and electrically it is a first class job.

It is fully described by illustrations and typical circuit diagrams in our Radio Catalogue No. 1142. Drop us a line for your free copy mentioning Meccano Magazine.

Price 3'6

Without terminals, 3/-

1 2 3 4

1. One of the self-cleaning phosphor bronze ball contacts is here seen making a firm connection between adjacent strips. On test it breaks 10 amps at 20 volts fifty times and shows definite improvement with use.

2. A special feature of this switch is the novel terminal which screws down into a castellated base, holding, if necessary, several wires simultaneously in a vice-like grip. Soldering tags and contact strips are in one piece.

3. The Bakelite pointer knob is fixed to the spindle by a grub screw riding in a brass bush—no stripped female thread in the bakelite!

4. The switch is fixed by drilling a ¼-inch clearance hole in any metal or insulated panel up to ⅜-inch thickness. The indication dial reads LONG-OFF-SHORT on one side. The reverse is marked OFF only.

BENJAMIN

THE BENJAMIN ELECTRIC LTD.
Tariff Road, Tottenham, N.17
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BOYS! Here Is A REAL

Super All-Steel Automatic Self-Inking

PRINTING MACHINE!

WILL PRINT ANYTHING FROM A Chemist's Label to an Illustrated Magazine

BOYS! Here is something you've often wished for—a Real Printing Machine! Not a toy or a model but an Automatic Self-Inking All-Steel Adana Machine which uses real Printer's Metal Type and produces work just like that done by Professional Printers.

There's not a more exciting or interesting hobby than printing on my Wonderful Invention. You can print your own Note-headings and Visiting Cards—Entertainment Programmes—Party Invitation Cards—School Magazines and a 101 other interesting things. It's so fascinating that you'll want to spend every spare moment at it!

The Marvellous "Adana" All-Steel Super 1930 Model Automatic Self-inking Printing Machine .... Specially designed for Commercial Use in All Large and Small Printing Establishments.

Price

45/-

Here are some of the things my Machine will Print

- School Magazines
- Fixture Cards
- Concert Programmes
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- Noteheadings
- Visiting Cards.
- Menus
- Tradesmans' Bills
- Club Notices
- Etc., Etc.

A GREAT OPPORTUNITY

NO BOY SHOULD POSSIBLY MISS!

No more "make-shift" rubber stamps or duplicators—here's the real thing and so low in price that you **MUST NOT** miss the chance of getting it!

Let me tell you all about my Wonderful Machine and what it will do. Send the coupon alongside TO-DAY and I will send you ABSOLUTELY FREE actual samples of work produced and explain how I will let you have it on Special Terms.

No boy should miss this Splendid Bargain. It is a Real Commercial Machine, for many men make Spare Time Money by printing on it for Local Tradesmen, etc. Find out all about it NOW. Send the Coupon alongside at once to

Mr. D. A. ADANA (Dept. M.C.6), 17, Church St., Twickenham, Middx.

COUPON

To Mr. D. A. Adana (Dept. M.C.6), 17, Church St., Twickenham, Middlesex.

Dear Sir,

Please send me at once and FREE, full details of your Wonderful 45/- Adana Printing Machine—together with full samples of ACTUAL Work produced.

Cut out this Coupon and Post at once with your full name and address attached.

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this and the following two pages carry full stocks of Meccano Outfits, Accessory Outfits, and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

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24 & 26, Donegall Place,
Tel. 366 BELFAST.

MERCER'S DOLLS' HOSPITAL,
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BATESON'S SPORTS DEPOT,
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Tel. 22719 LEEDS.

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ROBOTHAM'S LIMITED,
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DEMPSEY & CO.,
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For Branch Addresses see advertisement on page 900.

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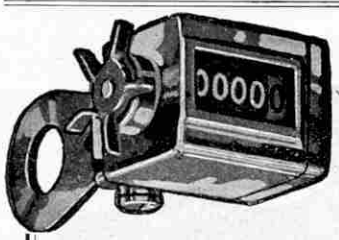

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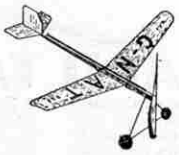

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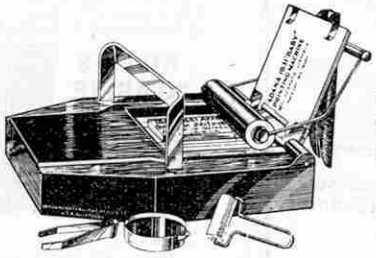

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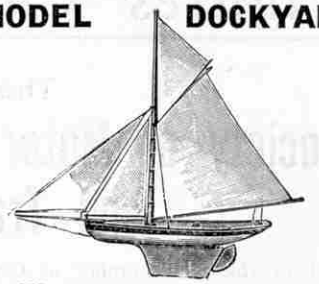

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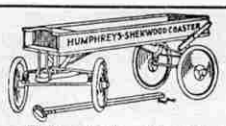

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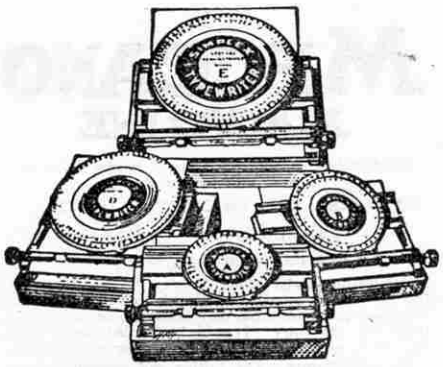

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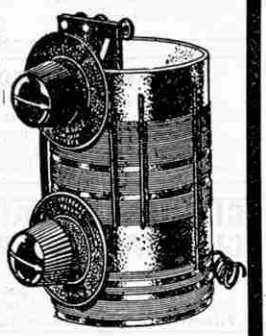

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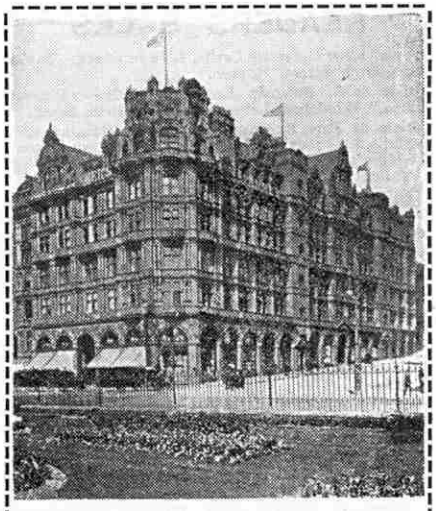

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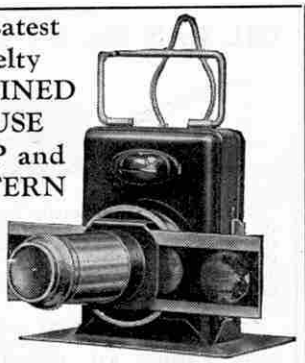

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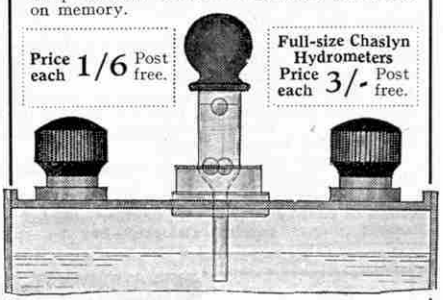

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Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve 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.

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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.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

BOYS!

HERE IS A PLAN

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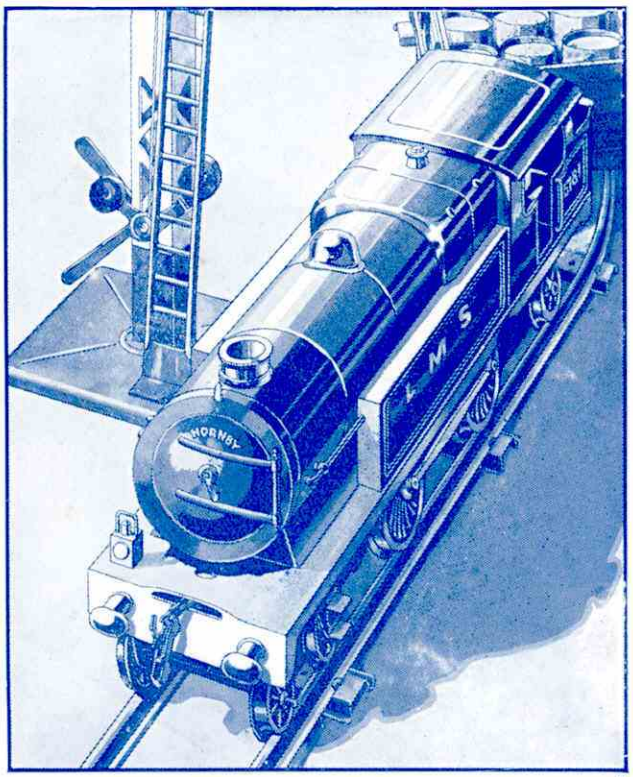

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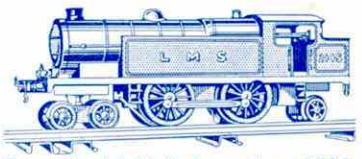
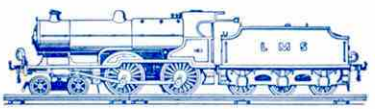
Full details of this remarkable offer are printed in a special leaflet, a copy of which may be obtained from your dealer, or direct from us, free of charge.

NEW HORNBY LOCOMOTIVES FOR OLD!

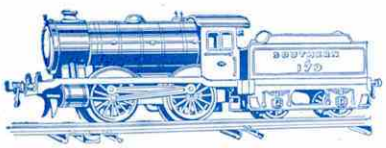
No. 2 Special Locomotive and Tender, L.N.E.R. Prices: Locomotive **27/6**, Tender **6/6**



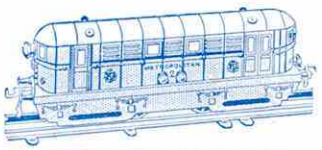
No. 2 Special Tank Locomotive, L.M.S. Price **25/-**



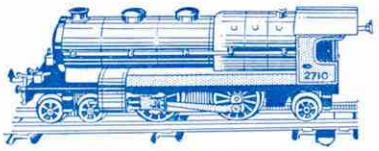
No. 2 Special Locomotive and Tender, L.M.S. Prices: Locomotive **27/6** Tender **6/6**



No. 1 Special Locomotive and Tender, S.R. Prices: Locomotive **18/-**, Tender **3/6**



"Metropolitan" Locomotive
Clockwork ... ... Price **22/6**
6-volt Electric ... ... „ **47/6**



Riviera "Blue" Locomotive
No. 3C Clockwork ... ... Price **27/6**
No. 3E 6-volt Electric ... ... „ **40/-**

HORNBY TRAINS

BRITISH AND GUARANTEED

MANUFACTURED BY MECCANO LIMITED OLD SWAN LIVERPOOL

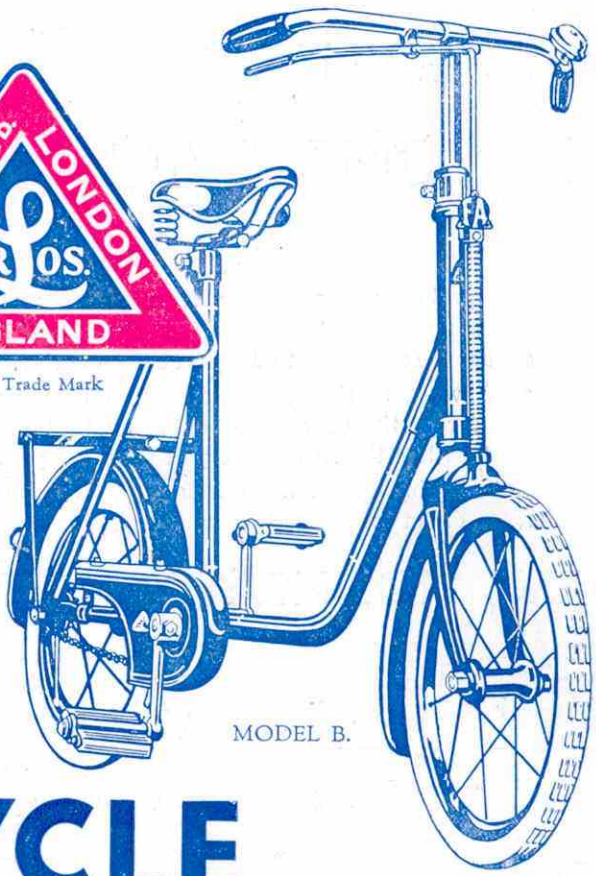
Boys! Here's your idea of a bike

MODEL A.

Here is the Fairycycle. What a handsome bike! Glittering plated handlebars and glossy enamelled frame. What a sturdy bike! Yes, it's built of steel tubing and has tangent spoke wheels. The Fairycycle, you see, is made by skilled engineers. They have fitted it with a chain-guard, a stand, a carrier for your school books and, of course, a reflector and bell. These engineers say: "That's our idea of a good bike." Now isn't it also yours?

L. BROS. LTD. LONDON
BROS.
ENGLAND

Regd. Trade Mark



MODEL B.

MODEL A—Well finished in black cycle enamel, ball-bearing pedals and plated handlebars. Dunlop saddle, 12in. tangent spoke wheels $\frac{5}{8}$in. rubber cushion tyres - - **29/6**

Model Ax.—Like Model A, but larger size, with 14in. wheels and $\frac{5}{8}$in. rubber cushion tyres - - **33/-**

MODEL B—Very suitable for young children, being light and easy to ride. Has 12in. tangent spoke wheels with 1" imitation pneumatic tyres. Complete with chain-guard, reflector, stand and carrier **39/6**

Model Bx.—As Model B, but larger size, with 14in. wheels and 1in. imitation pneumatic cushion tyres **42/-**

FAIRYCYCLE

Besides the models specified above, Fairycycles are made in the following sizes at the prices stated:—

Model C.—Raised pattern plated handlebars, has chain guard, stand, carrier, reflector and bell. Cycle pattern rim brake, 12 in. tangent spoke wheels, adjustable ball-bearing hubs, 1 in. imitation pneumatic tyres **49/6**

Model Cx.—As Model C, but larger size with 14 in. wheels. **52/6**

Model Px.—As Model Cx, but with 14 in. × 1$\frac{3}{8}$ in. Dunlop "Kempshall" pneumatic tyres. **55/-**

Model D.—Cycle type brakes, raised pattern plated handlebars, 2-coil spring saddle, etc. $\frac{1}{2}$ in. × $\frac{1}{8}$ in. roller chain, adjustable ball bearings throughout. 12 in. tangent spoke wheels with 1 in. imitation pneumatic tyres, complete with chain-guard, stand and carrier, reflector and bell. **59/6**

Model 6.—Strongly built for children up to 9 or 10 years old. 16 in. tangent spoke wheels, fitted 1 in. imitation pneumatic tyres, adjustable ball-bearings throughout, cycle pattern rim brake, 3-coil spring saddle, tool bag, bell, etc. **70/-**

Model 8.—The "Rolls-Royce" of Fairycycles, raised pattern plated handlebars, 2$\frac{1}{4}$ in. buttress tread Dunlop balloon tyres. Plated ball-bearing pedals, tool bag, carrier, stand, bell, reflector and pump, etc. **87/6**

All these models, with the exception of Models A and Ax are finished in black or blue, with gold lines.

FAIRYCYCLE ASSOCIATION

Membership free to owners of genuine Fairycycles and badge attached to every machine. Fill up the form when you buy your Fairycycle, post it to Lines and you will then become a member. The badge is shown on the bicycle.

Fairycycles can be obtained at all good toy shops, or illustrated leaflet will be sent on request.

LINES BROS. LTD., MORDEN ROAD, MERTON, LONDON, S.W.19

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