VOL. XXII. No 5 MAY 1937

MECCANO MAGAZINE

6D.

THE NIGHT FLYER

HORNBY RACING BOATS

Enjoy the thrills of boat racing

Hornby Racing Boats are superb! Compare these swift, powerful models with real racing craft. You will see they have the same design, the same slim, smooth lines.

The series of Hornby Racing Boats is composed of three exceptionally fine models. Each boat is extremely "quick off the mark," and maintains a high rate of speed throughout the whole length of its run.

Your dealer will be pleased to show you the range of Hornby Racing Boats. Once you have seen these wonderful boats you will not be satisfied until you have one of your own.

Each model is available in a pleasing colour combination that gives it an exceedingly attractive appearance.

Manufactured by MECCANO LTD., Binns Road, Liverpool 13.

HORNBY RACING BOAT No. 1 "RACER I." Price **4'6**
Travels over 120 ft. at high speed on one winding. Finished in Cream and Green. Dimensions: Length 8½ in. Beam 2⅜ in.

HORNBY RACING BOAT No. 2 "RACER II." Price **8'6**
Travels over 200 ft. at high speed on one winding. Finished in Blue and Cream. Dimensions: Length 12½ in. Beam 3 in.

PRODUCT of MECCANO LIMITED LIVERPOOL

HORNBY RACING BOAT No. 3 "RACER III." Price **14'6**
Travels over 300 ft. at high speed on one winding. Finished in Red and Cream. Dimensions: Length 16½ in. Beam 3½ in.

HORNBY WATER TOY

This novel boat, which travels over 100 feet on one winding, is particularly suitable for young children. The deck carries a realistically moulded model of a Duck, as shown in the illustration.

Dimensions: Length 9¼ in. Beam 3 in.

Price 2'6

EXTRA SPECIAL EDITION

GRAND CARGO BOAT

Hamleys News

HAMLEY · BROTHERS · LTD · ESTABLISHED · 1760

200-202, REGENT ST., LONDON, W.I. OUR ONLY ADDRESS
Telephone: REGENT 3161

No. 20 *May, 1937*

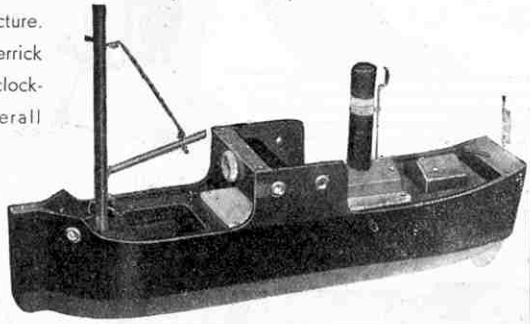
Huge Cricket Scores Predicted

HAMLEYS MAKE NEWS WITH NINE THRILLING AND WONDERFUL MODELS

Fun for Youthful Mariners

Here is a wonder-bargain cargo boat which all marine-minded youngsters will be keen and proud to have. The hull is painted black, with red waterline and brown super-structure. Complete with derrick and extra strong clockwork motor. Overall length 14 ins.

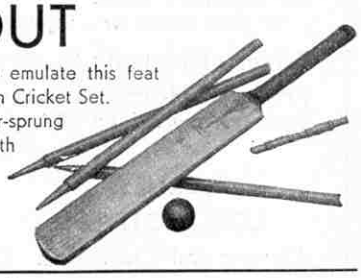
Price **7/6** Post 6d.



JONES MINOR MAKES 98 NOT OUT

Young cricket aspirants desiring to emulate this feat should practice with this Presentation Cricket Set. The bat is beautifully made with rubber-sprung splice and a rubber grip, complete with four stumps, bails and compo. ball.

Price **7/6** Post 9d.



POWERFUL LONG-RANGE GLASSES

These powerful binoculars, with adjustable focus, are strongly made, and a handy size, absolutely ideal for the holidays.

Price only **2/11** (*Foreign*) Post 3d.

OVER THE HEADS OF MOST PEOPLE

When you go to the Coronation procession, the Corona Periscope will be absolutely invaluable, the powerful mirrors will give you an uninterrupted view. It is cleverly made to fold up flat in a case.

Price **7/6** Post 6d.

Aeroplane gives a flying start

Novel aeroplane mascot for speedy cyclists. Very strongly made, delightful finish and colouring. Special bracket that is no trouble to fix.

Price **2/-** Post 3d.

Coronation Novelty for Patriotic Sportsmen

Celebrate the Coronation and add to your cycling pleasure by fixing this attractive propeller to your cycle. Specially designed in Coronation colours, with bracket for fixing.

Price Post 2d. **1/-**

SKIP YOUR WAY TO HEALTH

This attractive skipping rope will help to keep you fit. The rope is made of strong white Manilla and will stand lots of wear, the handles are painted in bright Coronation colours. Well worth having.

Price Post 3d. **2/6**

Young Photographers Made Good

With this Gnome Camera, measuring only 3 ins. x 2½ ins. It has an easily detachable view-finder and is ideal for your first experiments in photography. This camera will give you 16 pictures 3 x 4 cm., on standard V.P. film. Film 1/- extra. (*Foreign*).

Price only **3/9** Post 3d.

BAD NEWS FOR HENRY COTTON

Fine quality Juvenile Golf Set for prospective golf champions. Well made, consists of two irons, a putter and driver, in stout canvas bag. Suitable for children aged 5 to 9 years.

Price Post 9d. **15/6**

HORNBY ELECTRIC & CLOCKWORK TRAINS

Boys, start a railway of your own!

They're just like real trains

You have spent many happy hours watching real trains at work. Now start a railway of your own and enjoy the thrill of operating Engines, Coaches, Wagons, Signals and Points on actual railway principles. It's the most fascinating pastime in the world!

From the day of their introduction Hornby Trains have always represented the latest model railway practice. Designs are continually being improved and new items added so that the system is complete in practically every detail. There are Locomotives for all duties, driven by electric motors or by clockwork. There is Rolling Stock of all kinds including Pullman Cars, ordinary Coaches and Guard's Vans for passenger services, and numerous Wagons and Vans for freight working.

The Accessories are now better than ever before, while with the Rails, Points and Crossings an endless variety of layouts can be constructed, both for Electric and Clockwork Trains.

Ask your dealer for a copy of the latest Hornby Train price list.

Prices of Hornby Electric Trains Sets from 15/- to 75/-

Prices of Hornby Clockwork Trains Sets from 4/11 to 65/-

HORNBY LOCOMOTIVES

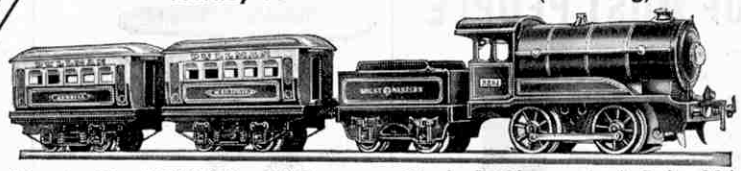
Electric and Clockwork

All Hornby Electric Locomotives can be controlled for speed, and for starting and stopping, from the lineside.

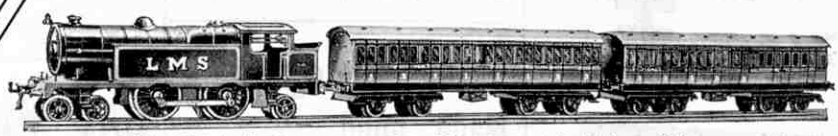
Hornby Clockwork Locomotives are the longest-running spring-driven locomotives of their respective types in the world. The motors fitted are perfect pieces of mechanism with accurately cut gears that ensure smooth and steady running.

A SELECTION FROM THE RANGE OF HORNBY ELECTRIC AND CLOCKWORK TRAINS

Hornby No. O Goods Train Set (reversing). Price 17/6



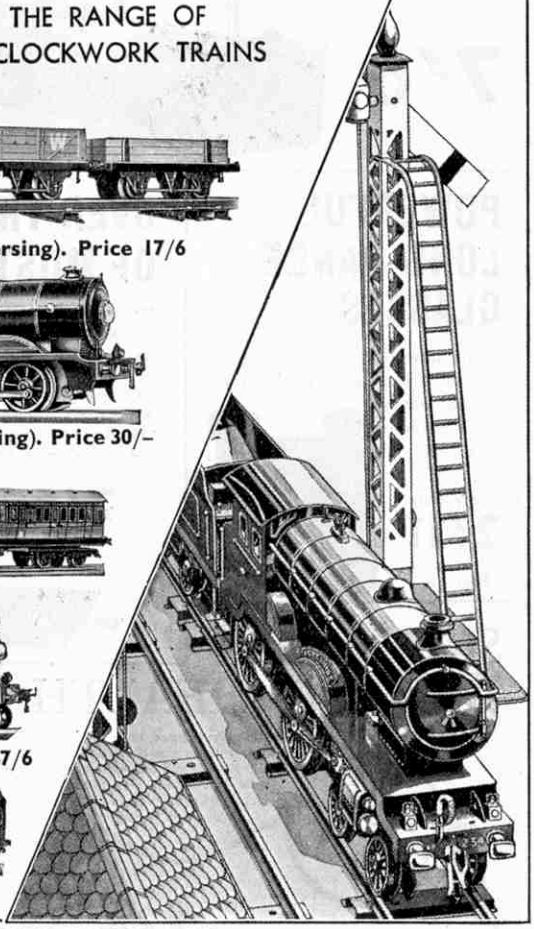
Hornby No. EO20 (20-volt) Passenger Train Set (reversing). Price 30/-



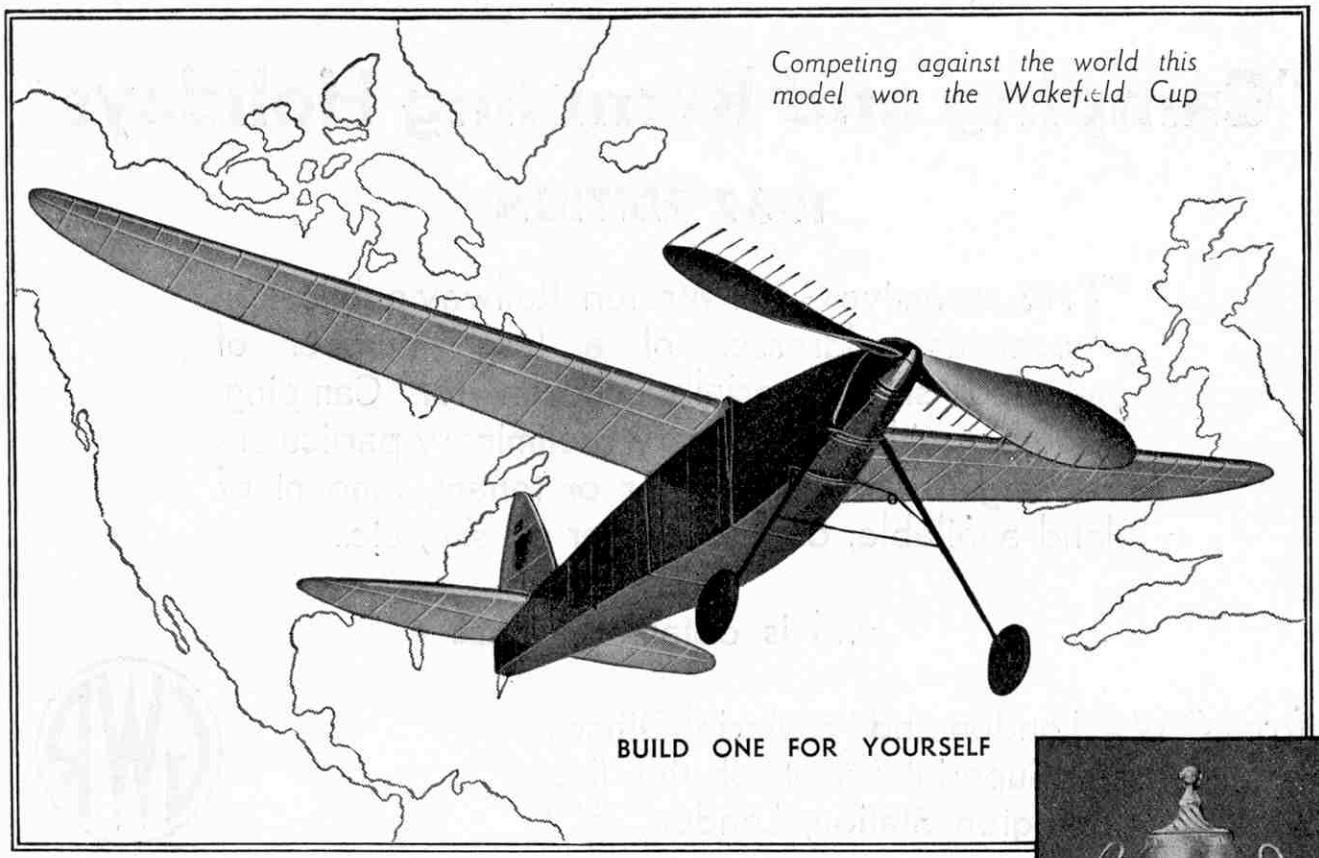
No. 2 Tank Passenger Set (Clockwork). Price 40/-

Hornby No. E220 (20-volt) Mixed Goods Train Set (automatic reversing). Price 47/6

No. 2 Special Pullman Set (Clockwork). Price 65/-



MECCANO LTD. BINNS ROAD LIVERPOOL 13



WAKEFIELD TROPHY WINNER 21/-

COMPLETE KIT OF PARTS NOW ONLY

When the team of model aeroplane constructors went to America recently, this model, constructed by its designer-pilot, Mr. A. A. Judge, won for England the Wakefield Cup. During one of its flights it remained in the air over eight minutes.

International Model Aircraft, Ltd., realizing that many enthusiasts would like to possess a similar model, purchased the exclusive World rights and arranged to manufacture it as a Super Construction kit, under the personal supervision of its designer.

Every wood part in this Kit is shaped out ready to fit together, every wire part is formed to shape; the airscrew is carved out, requiring finishing only, and the famous free-wheel and rubber tensioner device are supplied complete. Full size drawings are, of course, included.

THE FROG **COMPETITION MODEL**

Entirely new model specially designed to give high performance and for use in S.M.A.E. competitions. Obtainable ready to fly **49/6**

Or as a Construction Kit..... **15/-**

Other FROG Construction Kits from..... **2/6**

FROG REGD. TRADE MARK

OBTAINABLE AT ALL GOOD TOYSHOPS AND STORES

COUPON

To Lines Bros. Ltd. (Dept. 5), Morden Road, London, S.W.19

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled Air Force Pilot Badges.

Name.....

Address.....

.....

Please write in block letters. 5/37

FROG MODEL AIRCRAFT

All FROG Model Aircraft are covered by World Patents granted and pending. Made in England by International Model Aircraft Ltd. Obtainable at all good toyshops and stores. Sole concessionaires:

LINES BROS. LTD., Triang Works, Morden Road, Merton, LONDON, S.W.19

Learn to fly with the

SILVER ARROW

ONLY 2/6

LOW WING MONOPLANE SINGLE ENGINE AIR LINER

For the first time, air-minded boys can buy a real flying model for half-a-crown: true to type, with a good performance, the Silver Arrow reproduces latest developments in Air Liners.

SPECIFICATION—Aluminium Fuselage: Propellor and Nose Piece detach in a crash: Accurate pitch Propellor: Adjustable Controls: Transparent Windows: Wing Span 16½ inches: Spare motor and Insertor rod: Double Surface detachable Wings.

FROG

MODEL AIRCRAFT

Trade Mark Regd.

Obtainable at all good toyshops and stores

All FROG model aircraft are covered by world patents granted or pending. Made in England by International Model Aircraft Ltd.

Sole Concessionaires:

LINES BROS. LTD.
Triang Works, Morden Road, Merton, London, S.W.19.

COUPON To Lines Bros. Ltd. (Dept. 5)
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Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled Air Force Pilot Badges.

Name.....

Address.....

Please write in block letters. 5-37

TOYS OF QUALITY MADE BY MECCANO LTD.

DINKY TOYS

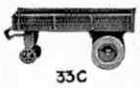
250 VARIETIES

A FASCINATING COLLECTING HOBBY

Dinky Toys are the most realistic and the most attractive models in miniature ever produced. They are unique in their perfection of finish, and their range is so wide as to appeal to all tastes. Start now to collect these delightful little models.

STREAMLINE SALOON
Dinky Toys No. 22h
Assorted colours. Fitted with rubber tyres.
Price 4d. each

ROYAL AIR MAIL SERVICE CAR
Dinky Toys No. 34
In correct colours. Fitted with rubber tyres.
Price 6d. each



MECHANICAL HORSE AND FOUR ASSORTED TRAILERS
Dinky Toys No. 33
Fitted with rubber tyres

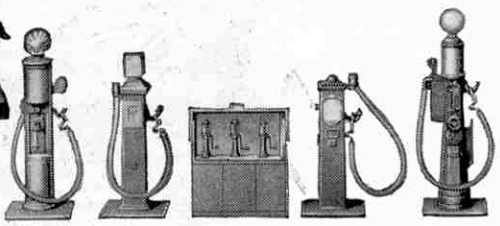
No. 33a	Mechanical Horse ...	each	6d.
No. 33b	Flat Truck	,,	6d.
No. 33c	Open Wagon	,,	6d.
No. 33e	Dust Wagon	,,	8d.
No. 33f	Petrol Tank	,,	8d.

Price of complete set 2/9

MOTOR VEHICLES
Dinky Toys No. 30

No. 30a	Chrysler Airflow Saloon ...	each	6d.
No. 30b	Rolls-Royce Car	,,	9d.
No. 30c	Daimler Car	,,	9d.
No. 30d	Vauxhall Car	,,	9d.
No. 30e	Breakdown Car	,,	9d.
No. 30g	Caravan Trailer	,,	6d.

Price of complete set 3/11



PETROL PUMPS
Dinky Toys No. 49
Scale models fitted with rubber hose pipes. Finished in correct colours.

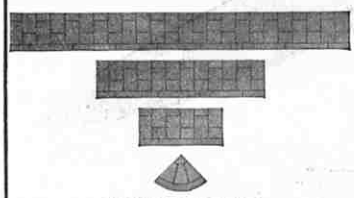
No. 49a	Bowser Pump	each	3d.
No. 49b	Wayne Pump	,,	3d.
No. 49c	Theo Pump	,,	3d.
No. 49d	Shell Pump	,,	3d.
No. 49e	Oil Bin (Pratts)	,,	3d.

Price of complete set 1/3

DELIVERY VANS
Dinky Toys No. 28/1

No. 28a	Hornby Train Van ...	each	6d.
No. 28b	Seccotine Van	,,	6d.
No. 28c	Manchester Guardian Van	,,	6d.
No. 28e	Firestone Tyres Van ...	,,	6d.
No. 28f	Palethorpe's Sausage Van ...	,,	6d.
No. 28n	Atco Lawn Mowers Van ...	,,	6d.

Price of complete set 3/-



PAVEMENT SET
Dinky Toys No. 46
Containing four 3-inch strips of pavement, six 6-inch strips of pavement, four 12-inch strips of pavement, and four quarter discs for corners.
Price of complete set 6d.

PILLAR LETTER BOX AIR MAIL
Dinky Toys No. 12b
Price 3d. each

DELIVERY VANS
Dinky Toys No. 280

No. 280a	Viyella Van	each	6d.
No. 280b	Lyon's Van	,,	6d.
No. 280c	Shredded Wheat Van ...	,,	6d.
No. 280d	Bisto Van	,,	6d.
No. 280e	Ekco Van	,,	6d.
No. 280f	Mackintosh's Van ...	,,	6d.

Price of complete set 3/-

PILLAR LETTER BOX G.P.O.
Dinky Toys No. 12a
Price 3d. each

BEACON
Dinky Toys No. 47d
(Realistic models of the Belisha Safety Beacons).
Price 1d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47a
(Four-face)
Price 3d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47b
(Three-face)
Price 3d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47c
(Two-face)
Right-angle or Back-to-back.
Price 3d. each

HOTCHKISS RACING CAR
Dinky Toys No. 23b
Assorted colours. Fitted with rubber tyres.
Price 4d. each

R.A.C. HUT, MOTOR CYCLE PATROL AND GUIDES
Dinky Toys No. 43
This set is representative of the familiar personnel and road hut of the R.A.C. Each item is finished in correct colours.

No. 43a	R.A.C. Hut	each	6d.
No. 43b	R.A.C. Motor Cycle Patrol	,,	9d.
No. 43c	R.A.C. Guide directing traffic	,,	3d.
No. 43d	R.A.C. Guide at the salute	,,	3d.

Price of complete set 1/9

A.A. HUT, MOTOR CYCLE PATROL AND GUIDES
Dinky Toys No. 44
Every collector of Dinky Toys will find this new addition to range the of particular interest. Each item is finished in correct colours.

No. 44a	A.A. Hut	each	8d.
No. 44b	A.A. Motor Cycle Patrol	,,	9d.
No. 44c	A.A. Guide directing traffic,	,,	3d.
No. 44d	A.A. Guide at the salute	,,	3d.

Price of complete set 1/11

MOTOR TRUCK
Dinky Toys No. 22c
Assorted colours. Fitted with detachable rubber tyres.
Price 6d. each

STREAMLINE TOURER
Dinky Toys No. 22g
Assorted colours. Fitted with rubber tyres.
Price 4d. each

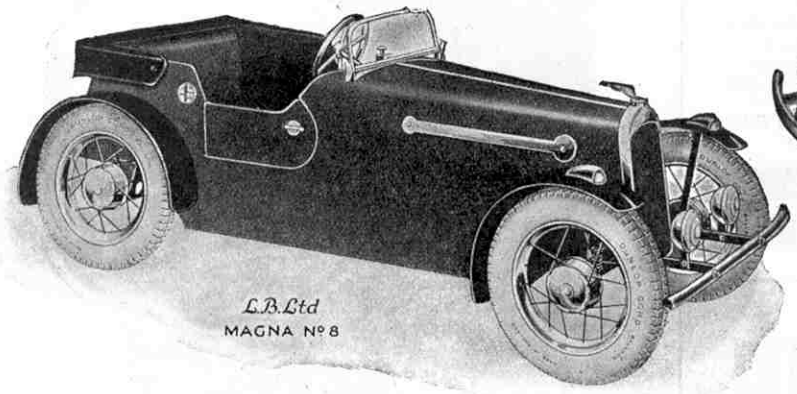
RACING CAR
Dinky Toys No. 23a
Assorted colours. Fitted with rubber tyres. Price 4d. each

Ask your dealer for a complete illustrated list of Dinky Toys

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

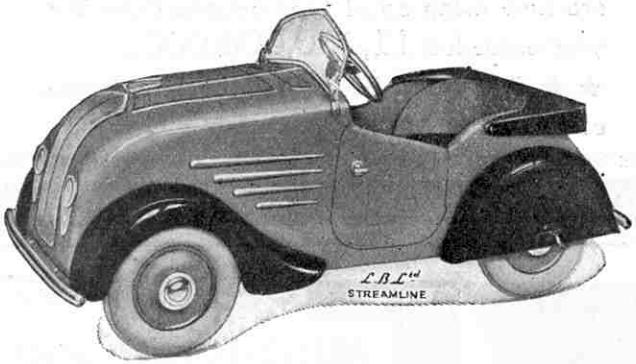
TRI-ANG

TRI-ANG SPORTS
Realistic streamlined model, with opening side door and luggage boot. 8 in. balloon disc wheels. ¼ in. rubber tyres. Ball-bearing back axle. Plated bumper and streamline dummy side lamps. Windscreen, direction indicator and dummy hood. Length 41 in.



MAGNA No. 8
A magnificent sporting car, coach-built body, fully sprung, ball-bearing back axle, opening side door, windscreen, dummy hood and lamps, tubular bumper, Dunlop pneumatic tyres on tangent spoke wheels, all bright parts CHROMIUM PLATED, including hubs and rims, louvres, bumper and streamline mascot. Length 54 ins.

TRI-ANG TRICYCLE No. 5 (Regd. Trade Mark)
NOW FITTED WITH BALL-BEARINGS THROUGHOUT AND ROLLER BRAKE
Cycle chain drive with free-wheel. Frame best quality weldless cycle tubing. 14 in. wheels, 1¾ in. jointless sponge-rubber tyres. Improved handlebars. Rim brake. Coil-spring saddle. CHROMIUM-PLATED FITTINGS. Black, blue or maroon.



STREAMLINE
Body of pressed steel. Crank drive on ball-bearing back axle. Facsimile airflow radiator with mascot. Dummy headlights. Tubular bumpers back and front. Adjustable seat. Latest type mudguards. 9 in. balloon disc wheels. ⅝ in. rubber tyres. Length 45 in.

L. BROS. LTD. LONDON BROS ENGLAND
TRI-ANG TOYS
REGD. TRADE MARK

OBTAINABLE AT
ALL GOOD TOY SHOPS
AND STORES

TRI-ANG "FAIRYCYCLE" (Regd.) MODEL No. 2
Tubular frame. 14 in. wheels. 1¾ in. grey imitation pneumatic tyres. Ball-bearing pedals. Rim brake. Two-coil saddle. Chain cover. Stand. CHROMIUM-PLATED FITTINGS. Black, blue or maroon.

D SCOOTER
NOW FITTED WITH BAND BRAKE ON REAR WHEEL
Strong steel frame with back rest, nickel-plated handles with rubber grips, 8½ in. dia. tangent spoke wheels, 1 in. cushion tyres. Hardwood step varnished, and frame enamelled red.

Made by LINES BROS. LTD., Tri-ang Works, LONDON, S.W.19

NEXT MONTH: "CAVES LIGHTED BY GLOW-WORMS." PUBLISHING DATE: 1st JUNE.

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Vol. XXII. No. 5
May, 1937

With the Editor

The Coronation

This month "*M.M.*" readers throughout the world will be joining with me in sincere good wishes to our King and Queen. I have always looked upon His Majesty as the "boys' King," for he has always shown keen interest in the welfare of boys in general, and particularly of those who are engaged in one or other of our great industries. In some of the happiest pictures that we have of him he is seen enjoying games and sports and joining in camp fire fun at the annual camps organised with his active support to bring together in open air comradeship boys from all parts of the country and all stations in life. In August 1931 two boys employed at the Meccano Factory, one a Boy Scout and the other a member of the Boys' Brigade, were honoured with invitations to the camp at Southwold, and they came back full of enthusiasm for the Duke of York, as His Majesty then was. They were particularly impressed with the Duke's complete absence of formality; he was in every sense just one of themselves.

Their Majesties King George VI and Queen Elizabeth.

Another characteristic of His Majesty that will appeal particularly to Meccano boys is that he is keen on engineering matters, and in particular with the machinery used in our great workshops and factories. In my Editorial in the "*M.M.*" for January this year I referred to His Majesty's visit to the Meccano Factory and recalled the genuine interest and keenness he displayed throughout his tour of the Works. He missed nothing of any importance, and his questions showed that he was really anxious to grasp the essential points about every process. The gracious manner in which he showed his appreciation of the dexterity and speed of the workers will long be remembered.

His Majesty's Career

His Majesty served in the Navy, entering the Royal Naval College, Osborne, in 1909, going from there to Dartmouth before joining the "*Collingwood*" as a midshipman in 1913. He saw active service during the Great War, and as a Sub-Lieutenant was present at the Battle of Jutland in 1916; the last of our monarchs before him who took part in a battle at sea being William IV, who as Duke of Clarence was present at the fight off Cape St. Vincent in 1797. Later our King entered the Air Force. He qualified as a pilot during the later stages of the War, and in 1920 became Wing Commander. His public duties have prevented him from continuing his career in the Air Force, but he has retained his interest in that branch of the Service and in flying. In 1935 he flew with the Queen, then Duchess of York, to Brussels to visit the Belgian National Exhibition, and thus Her Majesty Queen Elizabeth is the first Queen of England who has ever flown.

His Majesty succeeded to the throne in December 1936, on the abdication of King Edward VIII.

Coronations are always outstanding events, but this one will be definitely unique in many respects. Thanks to the marvellous developments that have taken place in radio, television and sound films, those of us who have the misfortune to be unable to be in London on 12th May will be able to hear and see a great deal of the actual ceremony, and to realise something of the wonderful pageantry of the occasion. Above all each one of us will be able to hear a message in His Majesty's own voice broadcast throughout practically the whole of the civilised world.

Now in conclusion the National Prayer: "God Save The King."

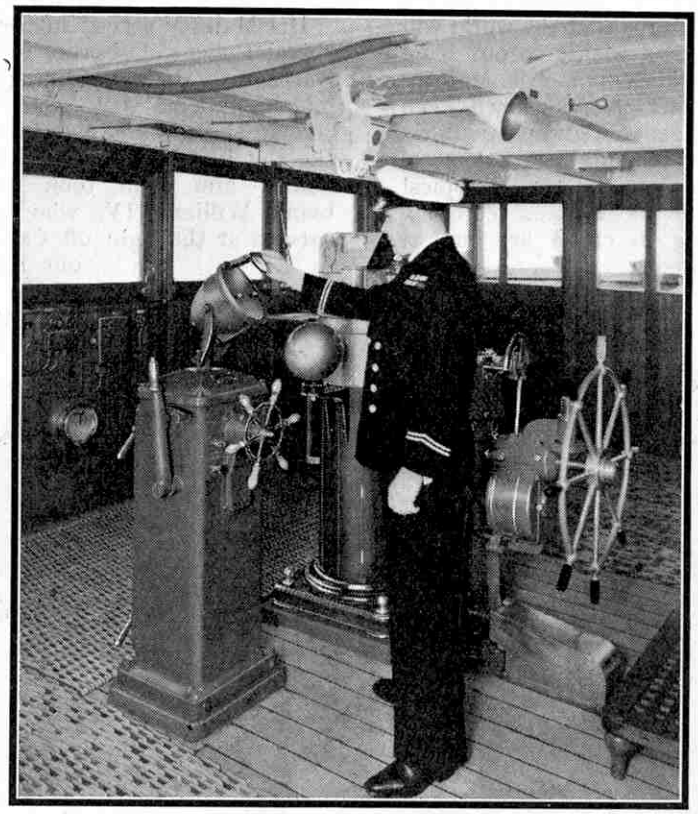
Spinning Tops that Steer Ships

How the Sperry Gyro Compass Works

EVERY year thousands of ships make regular voyages across the open seas, travelling unerringly from one point to another. This miracle of navigation is now a commonplace, yet it is only a comparatively short time since the instruments with which the sailor used to find his way about were crude and unreliable. To-day all vessels, whatever their size, can be equipped with scientifically designed instruments of the greatest accuracy. The most important of these is the compass, the introduction of which was the greatest single advance ever effected in the art of navigation. The magnetic compass has been in use in ships for some 1,500 years. It is first mentioned in Chinese writings of 2634 B.C., which record its use on land, but the earliest reference to its use at sea seems to be one in the Great Chinese Encyclopædia, written between the third and fourth centuries of our era.

The magnetic compass was introduced into the West about the 10th century, and by the 12th century it was in use throughout Europe. In its crudest form, it probably consisted of a piece of lodestone, or magnetic iron ore, suspended by means of a thread, so that it was free to take up a line pointing roughly north and south. Later the magnet was floated on water. The first compass bowls appear to have been constructed of china or wood, marked inside with lines to indicate the four cardinal points, and a magnetised needle was supported by a cornstalk, or a small piece of wood, in order to make it float on the surface. These early compasses were known as "sail stones" or "adamants," and cannot have been very accurate. They must have been seriously affected by the rolling and pitching of the small vessels in which they were mounted.

As larger sailing ships were built, the compass was progressively improved. In later instruments a circular card carrying needle-shaped bar magnets was pivoted on a fine point, and was marked with 32 points at equal intervals and also in degrees. It had long been known that the needle of the magnetic compass does not point to the true North, but to one side of it or the other, the position and angle varying at different points on the earth's surface. Navigators made allowance for this difference or "variation," as it is known, without much difficulty.



The wheelhouse of the steamer "Awatea." An officer reading a compass "repeater," which is connected with a Sperry Master Gyro Compass. The illustrations to this article are reproduced by courtesy of the Sperry Gyroscope Co. Ltd.

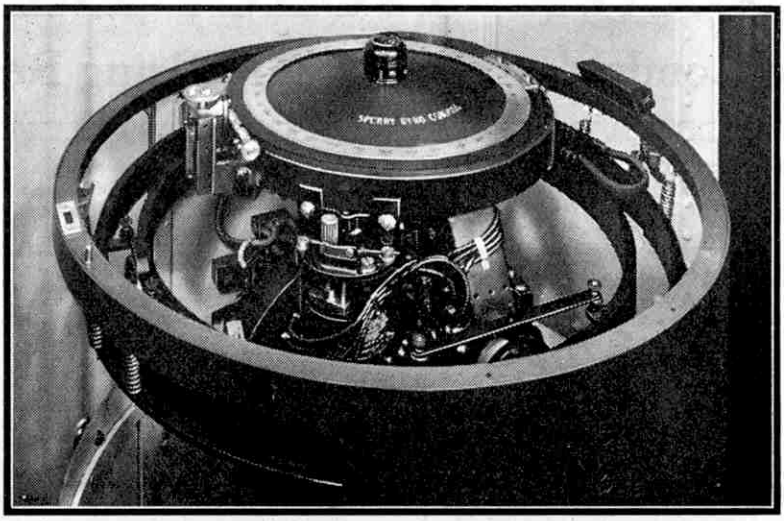
The introduction of iron and steel into ship construction in the last century gave rise to serious difficulties. An iron ship becomes a permanent magnet while being riveted on the stocks, in the same manner as a poker is converted into a weak magnet when it is held pointing roughly north and south and its end is tapped with a hammer. In addition the presence of the soft iron in the hull affects the magnet of the compass, and causes serious errors.

Most of the errors can be compensated for by placing small permanent magnets in the lower part of the "binnacle," or compass stand, and by putting masses of soft iron close to the compass. These corrections cannot be either complete or lasting, however, and every ship fitted with a magnetic compass therefore is "swung for adjustment of compasses" soon after launching, and at frequent intervals during her career. The ship is steadied on each point of the compass in succession, while bearings are taken of celestial bodies or of prominent objects whose actual magnetic bearing is known. The difference in each instance between the compass bearing and the magnetic bearing gives the "deviation" of the compass for that particular direction of the ship's head. These deviations are tabulated, and applied whenever a course is set or a bearing observed.

The increasing use of electrical auxiliaries in the modern ship caused further complications, and made it increasingly difficult to find a suitable place for the magnetic compass, where it would be free from the influence of magnetic materials and electrical machinery. In naval vessels, submarines and merchant motor ships, it is impossible to keep all electrical interference at a safe distance from the magnetic compass. In addition, the loading, transport and discharge of iron and steel cargoes cause marked changes in the magnetic state of the vessels in which they are carried, resulting in further variable errors in their magnetic compasses.

The modern magnetic compass for ships is a triumph of skill and ingenuity, and of course is still largely used in merchant ships. It is still, however, subject to the unavoidable errors of deviation and variation, and certain drawbacks which have been entirely overcome by the introduction of a novel type of compass known as the Sperry Gyroscopic Compass, invented and introduced about 1910.

More usually known as the gyro compass, it was perfected by Elmer A. Sperry, an American scientist who has more than 400 inventions to his credit. Its action is complicated, but is similar to that of the familiar toy gyroscope. This is a heavy wheel, capable of being spun at high speed and mounted in gimbals so that the spindle on which it rotates may be swung in a horizontal plane or tilted in a vertical plane. When the wheel is spinning rapidly, it opposes any force tending to turn it out of the plane in which it is rotating. If no force is applied, the axis of the gyroscope therefore is capable of maintaining a fixed direction in space.



The Sperry Gyro Compass is a non-magnetic instrument, and therefore has the advantage of not being affected by electrical or metallic influences, as is the ordinary magnetic compass.

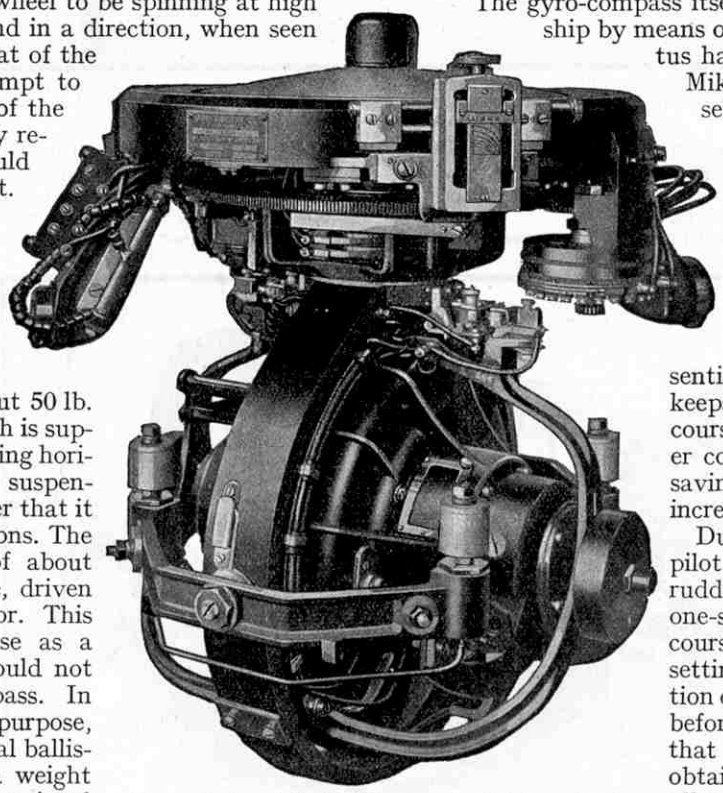
In addition, if a weight is suspended from the gimbal ring at one of the bearings of this spinning wheel, the gyroscope does not tilt down on that side. Instead the axis turns aside at right angles with a characteristic motion known as precession. This movement is definitely smooth and at right angles in the direction of rotation to the direction of application of torque. It can be illustrated by supposing a heavy horizontal wheel to be spinning at high speed on a vertical axis, and in a direction, when seen from above, opposite to that of the hands of a clock. An attempt to push away the upper end of the axis would then be strongly resisted, and the wheel would turn over towards the left. Efforts to bring the top of the axis forward would be followed by a turning movement in the opposite direction.

In the gyro compass a rotor, or accurately balanced wheel, weighing about 50 lb. is enclosed in a casing, which is supported by delicate ball-bearing horizontal pivots and a patent suspension device in such a manner that it is free to turn in all directions. The wheel spins at a speed of about 6,000 revolutions a minute, driven by an A.C. electric motor. This gyroscope would be of use as a direction indicator, but would not be a north-seeking compass. In order to make it serve this purpose, what is known as a mercurial ballistic is used. This acts as a weight attached to the end of the axis of the spinning wheel in the manner already described. Thus the compass makes use of gravity, and the weight, together with the rotation of the Earth, brings about a precessional movement that causes the axis of the gyro compass to set itself in alignment with that of the Earth, that is pointing true North and South.

The compass will remain in this position under all the conditions of speed, roll, pitch, and yaw encountered in a vessel at sea. The true meridian is the only position in which the gyro rotor axle will steady and settle. It therefore makes no difference in what direction the axle is pointing when the motor is started up, for the axis will slowly turn to the true North and South line, and remain there.

A master compass is installed in a room, preferably near the centre line of the ship, where the rolling of the vessel is least pronounced, and its indications are transmitted electrically to "repeater" compasses, just as the time shown by a central clock is sometimes repeated on dials placed in other positions. One of these repeaters, of enlarged scale type, is placed on the bridge for the use of the helmsman, and the actual course steered is recorded by a special automatic recorder. The efficiency of the helmsman is revealed by the changes in direction of a line drawn on a moving chart, and this also shows when the course of the vessel has been altered for any reason.

The gyro-compass itself also can be made to steer a ship by means of a gyro pilot, and this apparatus has become known as the "Iron Mike." Once the course has been set on this automatic helmsman, the slightest variation due to wind, waves, or other causes is immediately corrected by the gyro pilot. The "Iron Mike" is far more watchful and speedier in action than the best of helmsmen, and the line on the chart of the course recorder representing its efforts shows that it keeps the ship nearer the true course in any weather. The straighter course it steers leads to a large saving in fuel costs, and a slight increase in speed.



The mechanism of the Gyro Compass, showing the casing in which the rotor is mounted.

During fine weather, the gyro pilot can be set to apply corrective rudder as soon as the ship deviates one-sixth of a degree from her true course, and it is because of this fine setting, which permits the correction of a swing away from the course before it attains any proportions, that such excellent steering is obtained. During rough weather, allowance can be made for the natural "yaw" of a vessel by movement of a small knob on the gyro pilot, which delays the application of corrective rudder until the ship really starts to swing away from the set course. Additionally, allowance can be made for a greater or less amount of rudder to be applied according to the state of loading of the ship, and the consequent depth of immersion of the rudder.

Electric Trolley Buses

How London's Tramcars Are Being Replaced

ALTHOUGH electric trolley buses have only recently come into prominence in many of our cities, they have been in use for nearly 40 years. The first appeared in 1899, and from 1904 onward successful installations were in operation in various parts of Europe. By 1911 there actually existed in European countries outside the British Isles 33 electric trolley bus systems, on which more than 100 vehicles of this type ran on routes having a total length of about 200 km., or 124 miles.

In this country electric trolley buses were then used chiefly in conjunction with existing tramcar routes, to convey passengers from the termini to outlying districts. Some of the earliest systems were to be seen in Yorkshire, particularly in the rural districts around Bradford and Halifax. There the roads in many places are hilly and winding to provide easier climbing. For this reason they are unsuitable for trams, which require a fairly wide turning range and would have had difficulty in negotiating the sharp turns. Trolley buses were much more satisfactory in these circumstances. Overhead wires could easily be suspended in suitable positions, and the buses themselves could make use of the full width of the road in rounding curves.

An A.E.C.-English Electric trolley bus with front exit, supplied to Newcastle Corporation Transport Department. This photograph and the upper one on the opposite page are reproduced by courtesy of The Associated Equipment Co. Ltd., Southall.

Early trolley buses were fitted with solid rubber tyres and could ply over all kinds of road surfaces, mostly stone sets or macadam laid specially for the convenience of horse transport. They resembled tramcars in deriving current from overhead wires, but there was an important practical difference in their electrical circuits. In a tramcar the current flows from the overhead trolley wire to the motor, and thence through the running wheels to the track rails. As there are no rails in the case of the trolley bus, the current at first was made to flow from the motor back to the power station through the earth, the connection between the motor and the ground being made through a flexible cable attached to a metal trailing skate dragged along the road under the rear axle. Where the road surface was particularly rough the skate was inclined to bounce. Its intermittent contact with the ground then caused interruption of the electrical circuit, and sparks were seen between the skate and the ground. This gave rise to electrical difficulties, and in consequence trolley buses rarely ran at a speed above 6 m.p.h.

In spite of their low speed the buses were popular in hilly country districts, and as the demand for them increased their design and their electrical equipment were continually improved. Earthing and return current difficulties were overcome by using two trolley wires for each track. Thus the current returned from the motor to the power station by an overhead conductor. This system has proved satisfactory in every way. It provides a smooth electrical drive, and as pneumatic tyres were brought into use at an early date trolley buses can now transport passengers in comfort over most roads at speeds up to the 30 m.p.h. limit. Control of steering by the driver is a great help in this. He can anticipate the turns in the road and make the change of direction more gradually than in the case of a tramcar, which is pushed round curves by the rail on which it travels.

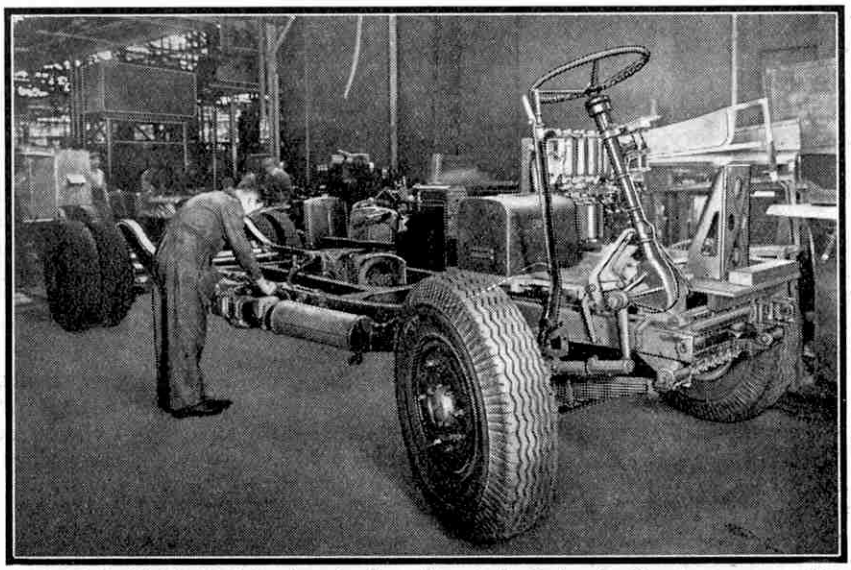
A comparison of trolley buses with tramcars reveals the superiority of the former. Except in special cases where tramcars run on private track, these vehicles are at a disadvantage in having to keep to the rails laid down for them. In busy streets therefore they are seldom given a clear run, and themselves become obstructions owing to their low speed. In addition the cost of relaying worn out track and of carrying out general repairs to the carriageway on each side is very high. Trolley buses require no metal track, and their average speed of running is 12 m.p.h., against that of 9½ m.p.h. for tramcars. They are as capable of moving large crowds as are cars, for they carry practically as many passengers and move more quickly. In addition they are safer, for they draw up at the side of the road to take up or set down passengers, who usually can only board or leave tramcars in the middle of the road, and therefore are subject to considerable risk in busy centres.

One of 488 Leyland trolley buses supplied to London Passenger Transport Board. Photograph by courtesy of Leyland Motors Ltd., Leyland.

There are very few countries in which trolley buses are not now in use. In Great Britain there are 30 systems now at work, and between them these have a total of approximately 2,000 vehicles. The rapid extension of the trolley bus routes of the London Passenger Transport Board is an indication of the value of these vehicles. There it is proposed that all tramcars are to be replaced by trolley buses. There are four zones in which trolley buses are already being used. These include the districts surrounding Woolwich, Shepherd's Bush, Crystal Palace, Hounslow and Malden, and in the near future it is proposed to substitute trolley buses for tramcars on a further 148 route-miles in different parts of the London area. The changeover is comparatively recent, for in June 1934 there were only 61 trolley buses in London. Now over 900 have been ordered or are in use, and London

Transport are now the world's largest operators of trolley buses.

Trolley buses were introduced in London because the tramcar tracks were becoming worn out. This made expensive renewals necessary, unless an alternative system of transport could be provided, and for this trolley buses were considered to be suitable, largely for two reasons. One was that their carrying capacity was practically equal to that of the tramcar. The second reason was that there was already in existence a plentiful supply of electric current, and the only change necessary was to substitute two wires for the one already in existence on the tramcar routes.



An A.E.C.-English Electric trolley bus chassis receiving final adjustments. The air compressor of the braking system can be seen on the outside of the frame.

The changeover from tramcars to trolley buses on any chosen route is of great interest. The trolley buses invariably make their first appearance on a Sunday, when there is less traffic on the roads and more time is available for the work that has to be done. Tower wagons work all night erecting the dual wire system in its new position close to the side of the road. Further changes may be necessary, for the greater weight of two overhead wires may require the provision of stronger steel poles; tower wagons then remove the existing poles and plant stouter ones in their places. As the changeover proceeds, particularly on the routes that terminate in the city, provision has to be made for turning the buses round with a continuous forward movement, for in the city no vehicle is allowed to reverse. This may necessitate a turn round a block of buildings; in others a large turning circle is arranged. In any case the overhead construction to support the trolley wires will have to be altered.

It has been found that tramcar drivers when trained are perfectly suitable for work on trolley buses. Trials are given to all who are displaced when a changeover is made, and well under five per cent. fail to make good. They first learn the controls in the depots, where they drive slowly on private ground, and are then taken out in groups of three on a bus with an instructor for eight hours. Each drives for half an hour in turn and in the intervals watches his colleagues; thus they are not subject to undue strain while becoming accustomed to their new vehicles.

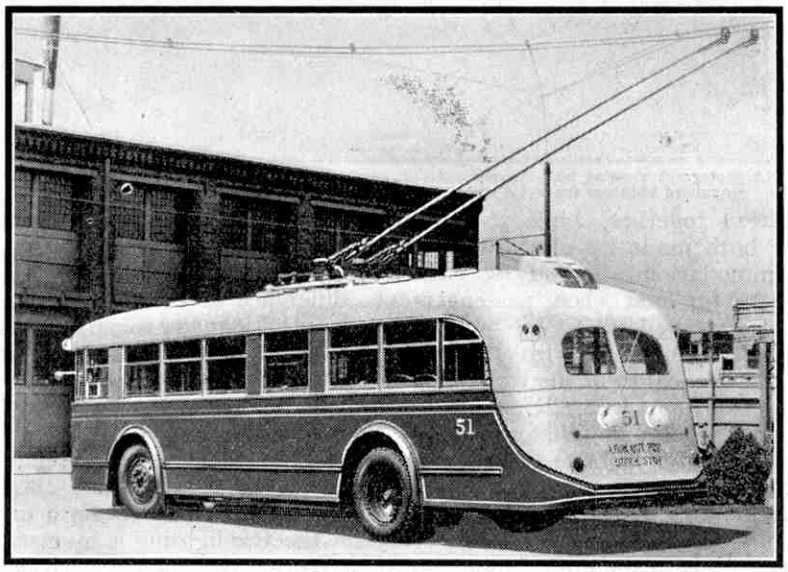
Trolley buses can now pick up current through a sliding collector shoe instead of a trolley wheel. The shoe runs more smoothly and is less noisy in action. It consists of a V-shaped skid with an angular opening of about 65 deg., and contact with the trolley wire is made through carbon inserts on each side of the "V." These inserts have a working life of between 1,000 and 2,000 miles and can be replaced quickly and inexpensively. With this type of collector it is necessary to lubricate the overhead wire with a graphite mixture, and a petrol bus driven along the route supplies lubricant under pressure in the requisite small quantities through special booms and shoes. In due course the wires become burnished and require less frequent lubrication.

The A.E.C.-English Electric trolley buses are interesting examples of these vehicles. They include single and double deckers with seating accommodation up to 74. The modern 74-seater has two rear axles. The motor is mounted under the low floor, and a short propeller shaft transmits the drive to the axles through needle roller couplings. There are three differentials, the third being mounted in the worm casing of the middle axle, and this gives even distribution of driving power over all four rear wheels and avoids uneven wear on the tyres, when going round curves.

All six wheels are fitted with internal expanding brakes operated by compressed air, and in addition a hand lever operates the brake shoes in the drums of the four rear wheels independently of the compressed air system. The total area of braking surface is 825 sq. in. A foot lever controls the compressed air braking, pressure on it admitting air as required to small cylinders mounted near the ends of the axles, from which it operates the shoes. Air at a pressure of 85 lb. per sq. in. is obtained from a reservoir tank carried on the side of a chassis, and this pressure is maintained by means of a compressor driven by a 500 volt motor.

An interesting feature of the system is an anti-freezer. This feeds alcohol from a small reservoir through a wick into the air stream inhaled by the compressor. The alcohol condenses with any moisture in the air, and the mixture has a lower freezing point than water alone and thus prevents solidification.

A trolley bus is insulated from the ground by its tyres and for this reason effective insulation, capable of withstanding exposure and road splashing, is necessary for every part of its equipment. All electrical units are mounted on secondary insulators, and even if one of them became alive there would be no leakage to the body or chassis of the bus. A special multiple testing plug is fitted to enable the electrical insulation resistance of these units to be measured by means of the depot testing apparatus. Triple insulation is provided on all electrical resistances and between the trolley heads and the bus body. After erection the entire equipment is subjected to a test for one minute under a voltage of 2,500 volts.



A 40-passenger trolley coach at San Francisco. Photograph by courtesy of the British Thomson-Houston Co. Ltd., Rugby.

The motor of the 74-seater trolley bus is of 80 h.p. and is governed by means of a master controller placed under the driver's seat and operated by means of a foot pedal. A hand-operated reverser is mechanically interlocked with the controller, which automatically returns to the "off" position when the pressure of the driver's foot is released. Regenerative braking, in which the vehicle is controlled by current produced by the motor, is employed. Plain regenerative equipment would not be effective at speeds of less than 10 to 12 m.p.h., however, for the motor then cannot generate current at a voltage equal to that of the overhead line supply. A special patented system incorporating rheostatic braking that operates at all speeds therefore is used.

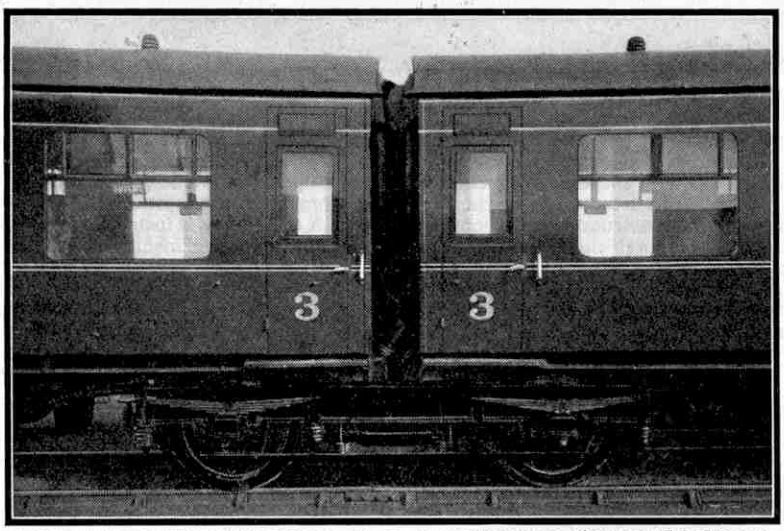
During the last 14 years trolley buses have been finding favour in American cities. At present some 1,500 of them are in operation in the United States, and these are mostly of single deck construction carrying 30 to 40 passengers. The lower illustration on this page shows a 40-seater trolley coach, with electrical equipment made by the General Electric Co. of New York, in service in San Francisco. It has 65 h.p. electric motors.

New L.M.S.R. Trains

Twin Articulated Units for Excursions

THE L.M.S.R. are putting into service 11 new trains of vestibuled stock specially intended for the long-distance excursion traffic that is such a feature of modern railway operation. The new trains have been designed by Mr. W. A. Stanier, the Chief Mechanical Engineer of the L.M.S.R., and the first of them was completed at the Derby Carriage Works of the Company a little time ago.

These new trains are of outstanding interest, apart from the special purpose of their construction, for each train is made up of five twin articulated units. This is the first occasion on which the principle of articulation has been used by the L.M.S.R. The articulating arrangements are on the Gresley principle, as applied to L.N.E.R. stock and to the new C.L.C. trains described on page 268 of this issue. Standard buffers and couplings are provided at the outer ends of each twin unit, and these ends have the ordinary full-length corridor connections as compared with the shorter connections at the points of articulation.



A photograph showing how the adjacent ends of the coaches of one of the new L.M.S.R. twin articulated units are supported on the centre bogie. Photograph by courtesy of the L.M.S.R.

At the end of each 10-coach train is a twin articulated unit consisting of a brake third and a third class vehicle. The centre unit of the train consists of a first-third composite and a third class coach articulated together, while the two remaining twin units are both made up of third class coaches. The total accommodation afforded by each train amounts to 18 seats for first class passengers and 511 seats for third class travellers.

The vehicles are all of the end-door type with a central corridor running throughout the length of the train. The use of end doors follows present-day L.M.S.R. standard practice, and is an interesting point of difference from the L.N.E.R. "Tourist" trains, which have their doors in the centre of the coaches.

Apart from the introduction of articulation, the design of the new stock is interesting in that the bodies of the vehicles are built integrally with the underframes, so that these two become one structure. Ordinarily the body of a coach is built as a separate unit from the underframe. Electric welding is largely employed in building the new trains, and is being employed to an increasing extent in L.M.S.R. coach-building practice. The solebars and cantrails, or the top members of the sides below the roof, are of channel section high-tensile steel and have welded to them steel sockets into which the vertical body pillars or supports are fitted and secured by steel pegs. The remaining members of the underframes are of mild steel, and the whole of the underframe is welded.

The side panels of the coach bodies are of sheet steel, welded throughout, and they are secured as units to the side pillars by means of screws. The galvanised steel sheets forming the roof are welded in position to the curved roof members after these have been secured to the cantrails also by welding. The corrugated steel sheets forming the base of the floor are welded directly to the underframe members. They are then covered with cork and linoleum. The space between the sheets forming the sides and the roof and the interior finishing is ventilated to allow of the passage of a through current of air, in order to prevent condensation occurring on the inside surfaces of the steel sheets.

The bogies are of the usual L.M.S.R. pattern, and are constructed of mild steel welded throughout.

By the use of these new methods of construction, the complete trains have been made shorter and lighter than would have been possible without them. The introduction of articulation alone has meant a reduction of five in the number of complete bogies in one train, and altogether the weight of one of the complete 10-coach trains built on these new lines is 55 tons less than that of 10 similar vehicles of ordinary bogie stock. The total weight of the articulated train is 245 tons, but the weight of the ordinary train would be 300 tons, a difference of 1.16 cwt. per passenger. The reduction in length is equally remarkable. Each of the new articulated trains is 566 ft. 6 in. long, while a comparable train of standard stock would be just over 40 ft. longer.

Panelling with a flush finish has been adopted for the interior decoration of the vehicles. Dappled mahogany is used in the first class section, and various woods are employed in the third class, but the vehicles are so marshalled as to obtain a uniform effect.

Electric lighting is by means of the standard L.M.S.R. "Wolverton" system, each coach carrying a self-contained axle-driven dynamo, regulator and battery. The main lighting is by ceiling fittings, provided with panels to screen the lamps from the eyes of passengers. The lights throughout the train are under the control of the guard, but means are also available for the individual control of all coach units. Electric bell communication is provided throughout.

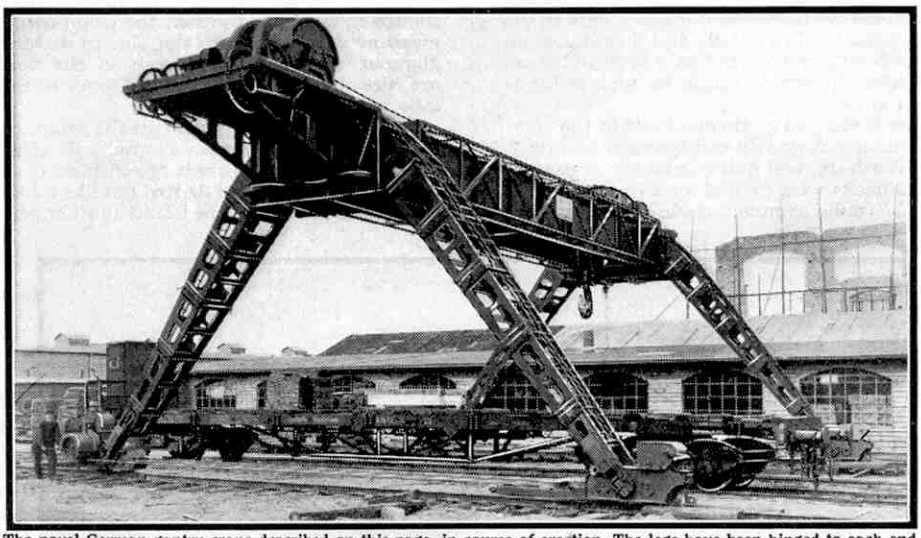
This year the L.M.S.R. will build 33 non-corridor coaches arranged as articulated units, but these will be in sets of three instead of twins.

A Portable Gantry Crane

Sections Put Together in Six Hours

By H. F. Kutschbach

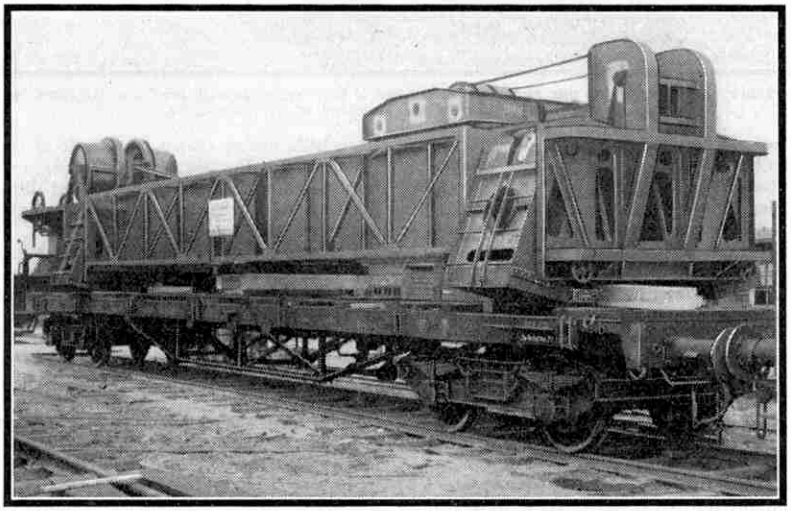
A NOVEL self-contained travelling gantry crane that can be dismantled, loaded on railway trucks for transportation to a new working site and then re-erected in a few hours, has been developed by Ardeltwerke G.m.b.H., Eberswalde, Germany. Its special construction does away with the necessity for scaffolding, either in erecting or dismantling the crane, and no special lifting tackle is required. All the work is done by hand-operated winches and pulley blocks that are incorporated in the crane itself. It is therefore an easy matter to transport the crane to any desired point, and this fact makes it particularly suitable for use in large stock yards, such as those at a pipe works or shipyard, since it allows the stock to be spread out over an extensive area instead of being piled up in stacks. When the latter method is adopted considerable time often is wasted in lifting and replacing material that is not immediately required in order to obtain wanted goods lying underneath.



The novel German gantry crane described on this page, in course of erection. The legs have been hinged to each end of the main girder and the man on the left of the illustration is pulling their feet together, and thus raising the gantry, by means of hand-operated winding gear.

The crane consists of five units. These are a main girder, 41 ft. in length, on which the hoisting trolley travels, and four stout girder-built legs on which the main girder is supported. There are two legs at each end of the girder and each is fitted with travelling feet or wheeled end-pieces that run on tracks on the ground. When the crane has to be moved from one works to another the main girder is mounted on a turntable on a railway truck, and a second truck accommodates the four legs and incidental equipment.

The upper illustration on this page shows the crane in course of erection. The sequence of operations is as follows. Ground tracks are first laid on each side of the trucks, the distance between them corresponding with the length of the main girder. The turntable on which the girder is mounted is then rotated so that the girder lies at right-angles to the ground tracks. The four legs are in sections of such a size that each can be handled by four men for aligning and bolting together. When they have been assembled their upper ends are joined by pin hinges to the ends of the main girder, and the travelling feet are next placed on the ground tracks and bolted to their lower ends. Wire ropes are then attached between the legs, and these are drawn together by means of winding gear. The work at this stage of erection is seen in progress in the illustration.



The main girder of the crane mounted on a railway truck for transportation. It is carried on a turntable so that it may be slewed at right-angles to the metals for erection.

When the main girder has been raised to its full height the legs on each side of the crane are connected by a steel link. The winding gear by which the legs are drawn together is used also to move the crane along the track when it has been erected and is at work. All the erection work can be carried out by 12 unskilled men in six hours, while to disassemble the crane and re-load takes only five hours.

The crane is capable of handling loads up to 75 tons, and is operated entirely by hand. Loads are raised and lowered by means of a powerful winch mounted at one end of the main girder. This is operated by men pulling on endless chains, which pass round pulleys on the winding gear.

For moving the main girder from one place to another two caterpillar trucks are provided.

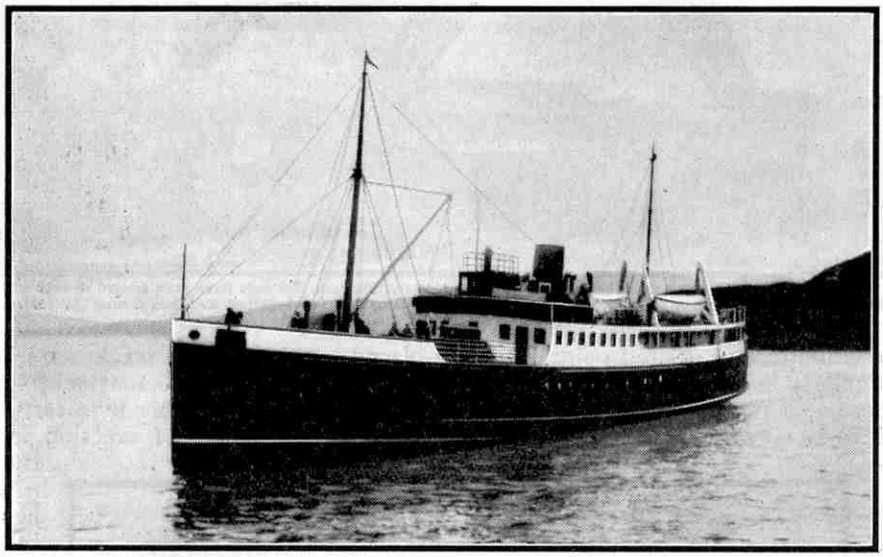
In Hebridean Seas

II.—From the Outer Isles to Mallaig

By O. S. Nock, B.Sc., D.I.C.

LAST month I described how the *"Lochmor"* crossed from the mainland of Scotland to the Hebrides, and how we called at various tiny places in Harris. I broke off just at the point where we were nearing the island of North Uist. Imagine a wide treeless expanse of dead-flat peaty moorland, never more than five or ten feet above sea level. It is studded with fresh-water lakes; only to the south of this big sea loch does the land rise at all, and then it goes up to the solemn purple crags of North and South Lee; a score of houses are clustered round the western sweep of the loch. Such is Lochmaddy, the largest place in North Uist.

As we edged up to the pier it seemed as though most of the community had come to welcome us. A goodly consignment of bread, cakes, flour, and onions went ashore, and quite a number of passengers joined the ship; then the decks were cleared for a very unwilling cargo. A carefully arranged "traffic avenue," made out of hurdles, was erected on the quayside; on the *"Lochmor"* a gangway was slung into position leading from the main deck down into the hold, and then a flock of 98 sheep were ushered on to the jetty. In a few seconds the commotion was indescribable; dogs barked, men shouted in Gaelic, and from the ship the seething mass of wool reminded me of a "pancake grease" on Shrove Tuesday! The sailors seized one or two sheep and sent them head first down the gangway, others followed, and soon there was a general procession into the hold. Suddenly there was a cry; "One's gone for a swim!" I turned and looked over the rail and there in the loch was a sheep swimming round in circles, quite unperturbed. One of the dogs went after it, but after grabbling several times ineffectively at the sheep was called off. The sheep was finally caught by two men in a rowing boat.



The "Lochmor" approaching the pier at Mallaig at the end of her voyage through the Outer Hebrides. In the background are the hills of the mainland of Inverness-shire.

As we left Lochmaddy the Chief Officer told me of some even more fractious cargoes they had handled; black Galloway cattle that suddenly take it into their heads to sit down in the gangway, after which no amount of kindness or "rough-stuff" would induce them to move either way. Still worse were some wild Shetland ponies; each of these took six men to handle, one to each foot, one to the head, and one to the tail!

Writing of animals, among some passengers' luggage piled on one of the seats was a kitten in a cardboard box. The lid was tied on with string and a small hole had been made in it to give fresh air. The little cat had not been on board long before it set up a persistent mewing; this did not have the desired effect, so Pussy took the law into his own hands and ate his way out of the box!

We were now making a course due south through the Sea of the Hebrides. The hills of North Uist on our starboard beam looked more solemn and majestic than ever for the abrupt way they rose from the flat surrounding plain. In the small island of Benbecula, which lies between North and South Uist, there is not an undulation, let alone so much as a hill. At low tide it is connected with both North and South Uist by fords. Crossing these fords can be a perilous business for the inexperienced, for the tides are capricious and the onrush of water at times very rapid. Looking at Benbecula from the passing steamer it seems little short of miraculous that this flat island has withstood the Atlantic storms for centuries.

Under grey skies evening came on earlier than usual to-day bringing with it a seascape of a wistful, almost ethereal beauty. Now indeed were the Hebrides casting their spell! I paced the boat deck of the little ship alone. The wind came up cold from the Atlantic, and north and south stretched the whole chain of islands, little grey humps rising from the sea; the cloud-capped peaks of Harris, far away now, blended into the blue of distant sky. Theirs is not the glamour of remote coral reefs in the South Seas; the Hebrides are isles of the mist, where dwell some of the kindliest and simplest folk in Britain.

As we approached South Uist the summit of Hecla was covered in cloud; although the sky was gradually clearing, a wreath of white vapour, dazzling in a shaft of sunshine, clung to the mountain top, and blown by the wind drifted out like a pall of smoke over the sea. As we came abeam of the island another passenger came to the rails and looked quizzically at these steep slopes; he told me he was going to South Uist on County Council business, from Inverness. "This is some country" he remarked. He had left Inverness at 4 o'clock the previous day in order to do a couple of hours' work in Lochboisdale; it was now Wednesday, and he would not be home again until nearly midnight on Thursday. It takes a little longer to sail from Kyle of Lochalsh to Lochboisdale than to travel from London to Inverness by train!

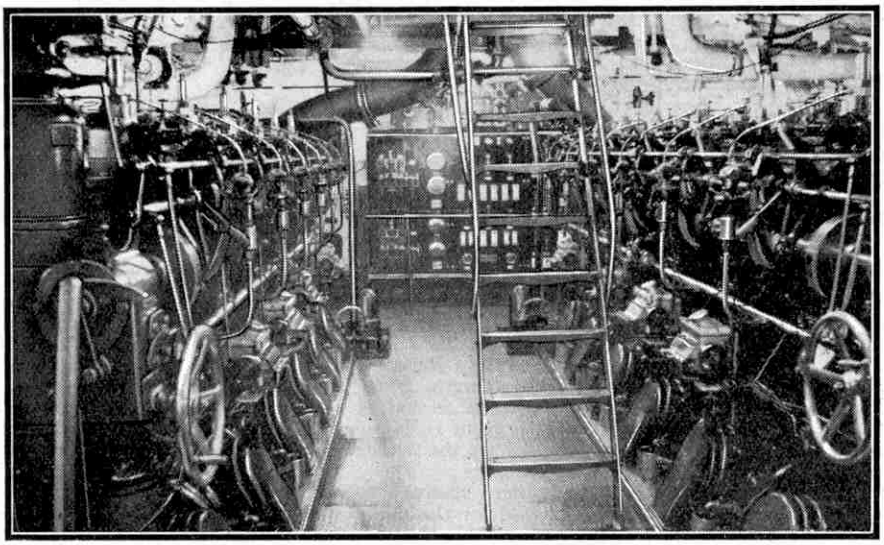
With lights up we turned into the loch. It was nearly dark now, and sailing beneath the southern shoulder of Stulaval I could only just pick out the skyline ahead, where these bare hills sweep down to the dead level plain that extends to the south end of the island. A tiny beacon was winking on the hillside, a few scattered lights ahead showed the whereabouts of Lochboisdale, and astern of us the navigation lights of another ship appeared round the south entrance to the loch. This was the Oban boat, which had come by way of Mull, the flat inner islands of Coll and Tiree, afterwards calling at Castlebay, Isle of Barra, the southernmost port of the Outer Isles. This service is operated by the *"Lochearn,"* a sister ship to the *"Lochmor."*

From the tourist point of view Lochboisdale is perhaps the most important place on the voyage, and for an hour after our arrival the stone jetty of this little Hebridean village had the glamour and bustle of a London railway terminus. Motor cars were unloaded, others came aboard; bag upon bag of mails went ashore, and in the meantime many passengers were embarking, their very luggage testifying to the variety of holiday pursuits followed in South Uist—fishermen, artists, or just lovers of wild nature. The animation of the scene was increased two-fold by the arrival of the *"Lochearn"*; she berthed abreast of us, for the pier is not big enough to accommodate two ships. Her passengers came across the deck of the *"Lochmor,"* while the sheep were transferred from hold to hold.

At 9.30 p.m. the *"Lochearn"* was away again. We, on the other hand, remained at Lochboisdale till the early hours of the morning, and then slipped away so quietly that I, having gone to bed about 11 p.m., never roused until 5.30 a.m. when the steward brought some tea and told me we were nearing Canna. We had made a course almost due east from Lochboisdale and now were approaching a group of islands which, both in name and shape, are the queerest and

most fantastic-looking in the whole of Britain—Canna, Eigg (pronounced Egg), Rhum, and Muck!

I cannot imagine anything more appealing in its soft wistful beauty than the sight of a Hebridean isle at dawn. I came on deck just as we were sailing round the headland of Rudha Carr-Innis and entering Canna harbour. It was an exquisite scene. Daylight was just coming, the stars still bright overhead, a winking light on the hillside, a gentle splash from the sea, and on the little stone jetty there were but two fishermen with lanterns to welcome us. In contrast to the Outer Isles, the hills of Canna are a vivid green, and this colour was now intensified by the gleam in the eastern sky. South-eastward, against the strengthening light, lay the mighty peaks of Rhum, a formidable group of mountains rising sheer from the sea to well over 2,000 ft.



The engine-room of the "Lochmor," showing the two 6-cylinder Diesel engines, working on the 2-stroke cycle. They develop about 600 h.p. and give her a speed of about 10 knots.

We left Canna about 7 o'clock, and for the next half-hour were making a course round the north shores of Rhum. Banks of heavy cloud lay over the sea to the north and I was for some time peering into the gloom for a first glimpse of the Cuillins of Skye which I knew lay only twelve miles off. Below a broad orange-coloured rift of clear sky a mass of cloud hung dark against the sunrise, all piled up like the spires and crags of some fantastic mountain range. For a few moments I watched it, fascinated; like all great cloud-masses seen afar off it appeared quite motionless, a deadly silhouette of villainous thundercloud, fringed by weird off-shoots and shapes that seemed in violent eruption but suddenly frozen stiff. One particular group of cloud pinnacles drew my attention, their shape seemed vaguely familiar, and then, with a shock that almost took my breath away, I realised that I was looking, not at some freak cloud-form but at the Cuillins themselves! Seen thus from the deck of the *"Lochmor"* they were an awe-inspiring overwhelming sight.

Soon we were turning south, and the broad inlet of Loch Scresort could be seen penetrating into the mountains. Among the islands Rhum has a striking individuality; although none can boast of so many great peaks packed within a small area, its shores, at any rate on the north and east, are comparatively quiet. Nowhere do you find vast, almost terrifying cliffs like those of Skye, and its round topped mountains go down to the sea in long continuous sweeps. The hillsides were deep in heather, and as we entered Loch Scresort the early morning sun was glinting on the summits of Barkeval and Hallival, each of which was wreathed with white fluffy cloud. There is no pier, and a motor boat was putting out to meet us. Rhum is a lonely almost depopulated island that is preserved as one huge deer forest, and one of the passengers joining the *"Lochmor"* brought with him a magnificent pair of antlers. The hamlet clustered round Kinloch Castle, which lies at the head of Loch Scresort, is one of the few settlements on the island.

Sheep being loaded into the hold of the "Lochmor" at Lochmaddy, in North Uist.

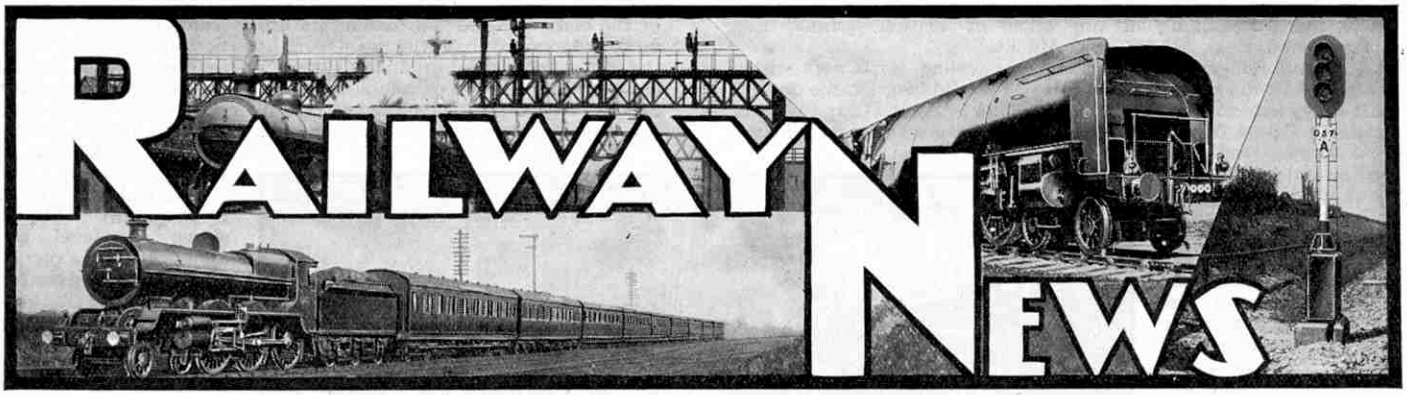
Soon we were off again and heading for Eigg. This queer shaped island had come into sight soon after we left Canna, but in the half light before full day little could be seen of its natural features. Of all this odd quartet of isles Eigg is the oddest of all; its two ranges of high ground are inclined to each other in such a way as to present a bewildering diversity of aspects when viewed from different points of the compass, and the baffling nature of the landscape is never more pronounced than when seen from Loch Scresort. In the north of the island the ground gradually slopes up from west to east, ending in a vertical rock wall of columnar basalt that faces the mainland of Scotland. Running diagonally between the two areas of high ground is a broad valley south of which the land rears itself up to a precipitous crag known as the Sgurr.

Although of no great height, only 1,289 ft. above sea level, the Sgurr of Eigg is one of the most distinctive mountains in all Scotland. When sailing across from Rhum one sees its least startling aspect; from Mallaig and the Sound of Sleat it looks a particularly inaccessible crag, and from the mainland farther south it has the appearance of a huge hook. But perhaps the strangest comparison that I have heard came from an engineer friend who knows the Scottish Highlands very well. He was reading the September 1936 issue of the *"M.M."* and came to the picture of the L.N.E.R. streamlined Mikado engine *"Lord President,"* on page 515. After studying it a moment he remarked: "What a funny shaped front. That sweeping curve with the chimney sticking out of it reminds me of the Sgurr of Eigg!" I laughed a good deal at the time, but I must admit that when the mountain is viewed from Arisaig, on the mainland of Inverness-shire, the similarity is really amazing.

When crossing the Sound of Rhum, Muck can be seen lying to the south-west of Eigg. This queer sounding name means the isle of porpoises. Muck, although hilly, has more the appearance of the Outer Hebrides and its Beinn has the same kind of smooth rounded summit. By now we were steaming southward beneath the lofty eastern cliffs of Eigg, and with full daylight a grey gloom was spreading westward casting a rather ominous haze over the sea. Although the west coast of Scotland was barely seven miles away there was only a vague hint of land eastward. Quite abruptly the range of high cliffs fell back and revealed a green fertile land dotted with farms, but what rivets the attention is the Sgurr rising behind, utterly unreal and unbelievable. From smooth gentle slopes it rises, a coal-black column, sides quite vertical, like some great chimney of colossal girth. We were looking at the Sgurr almost end-on and an extraordinary spectacle it was! As we came into Galmisdale bay three motor boats put out to meet us, and by now most of our passengers were up and lining the rails. A few minutes of lively chatter, much loading, and many farewells, and we were off again.

The voyage was nearly over; when I came up on deck again after breakfast the isles had well-nigh vanished into the haze, and on our starboard beam was the mainland of Inverness-shire, range upon range of purple-brown hills. Despite the gloom the silvery-white sands of Morar stood out with startling clearness, and farther along the houses of Mallaig straggled up the hillside. Soon the jetties were at hand, and shortly after eleven in the morning we came into Mallaig with screaming gulls wheeling incessantly round the ship.

Later, just before I left for the south, the engine driver came up for a chat and in one sentence summed up the whole trip. "Aye-he," he murmured, looking out towards the isles, "The're a r-r-remnant of th'auld wur-r-rld"!



Arctic Conditions on Irish Railways

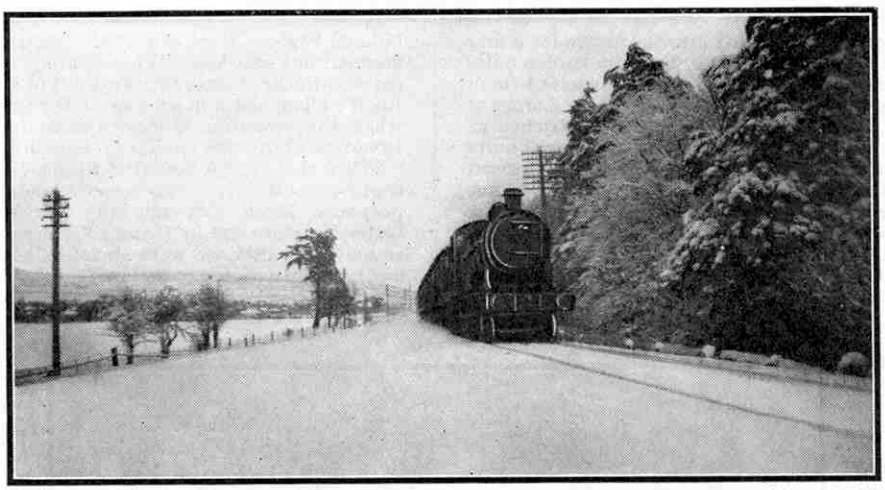
A three days' blizzard of exceptional severity from 12th to 14th March brought conditions in Northern Ireland such as one usually associates only with the Scottish Highlands. A N.C.C. train was snowed up and abandoned on the Ballyclare branch. Telegraph wires were down everywhere and caused a failure of the electric tablet on the Belfast–Larne line, while on the Clogher Valley light railway a huge drift formed at one of the passing loops, and two trains that should have crossed one another wedged themselves into opposite sides of the drift, each apparently unaware of the other's proximity!

By the morning of Saturday, March 13th, the snow was lying 18 in. deep in the environs of Belfast, and rods and signal wires had to be extricated and snow dug away from points. Perhaps the most bizarre effects of the storm were upon the few engines standing in the open which were not under steam, however. With snow piled high on their boilers, domes, and cabs they looked like huge mishapen modellings of their real selves. On the N.C.C. lines leading out of Belfast snow was lying fully six inches above rail level, and the rails themselves were deep in troughs worn by the passage of wheels and were scarcely visible. Mr. O. S. Nock, who sent us these details and the photograph reproduced on this page, tells us that he had to plough along the line knee-deep in snow in order to secure this illustration.

At the same time these exceptional conditions had little effect upon train running, except in the few localities where signals and staff instruments were out of action. The N.C.C. 2–6–0 engine No. 96, *"Silver Jubilee,"* made an excellent run to Portrush with the *"North Atlantic Express,"* keeping time on both stages in spite of several slacks. With a four-coach train weighing 125 tons gross speed was maintained at 43 m.p.h. up the 1 in 76 of Greenisland bank, although the weather had been worst of all here, and great masses of snow were projecting over the tops of the cuttings like vast overhanging caves.

The same engine also did very well in the reverse direction on the up afternoon mail from Londonderry, which leaves Coleraine at 4.50 p.m. The load was 240 tons, and in starting from Ballymoney up the steep climb to Dunloy speed rose to no less than 43 m.p.h. on the 1 in 130 ascent. As usual no advantage could be taken of the gently falling length from Dunloy, on account of the succession of curves, and the 19.9 miles from Ballymoney to Ballymena took exactly the 26 minutes allowed in the timetable.

At Ballymena station *"Silver Jubilee"* was exchanged for the very latest 2–6–0, No. 98, *"King Edward VIII,"* the former engine taking the through portion for Larne Harbour. With a reduced load of 180 tons No. 98 got away really brilliantly passing Antrim at 71 m.p.h. and, in spite of the fact that it was again snowing hard, climbed the 8½ miles bank to Kingsbog Junction at the remarkable average of 58 m.p.h. Then, after two very bad signal checks, the 31 miles into Belfast were completed in 40 minutes, only two minutes over booked time.



A wintry scene in Northern Ireland. This illustration shows an up train on the Larne line hauled by an L.M.S. (N.C.C.) "Castle" class 4-4-0 locomotive. The down track is completely hidden by snow. Photograph by O. S. Nock.

L.N.E.R. "Football Club" Engines

An interesting ceremony took place a short time ago at Manchester when L.N.E.R. locomotive No. 2862, *"Manchester United,"* was named by Mrs. Gibson, wife of the Chairman of the Manchester United Football Club. The ceremony was witnessed by the Lord Mayor of Manchester and supporters of the Manchester United Football Club. The engine was placed in traffic immediately after it had been named.

Further engines of this class now in service are Nos. 2863, *"Everton"*; 2864, *"Liverpool"*; 2865, *"Leicester City"*; and 2866, *"Nottingham Forest."*

Manchester and Sheffield Electrification

The first contract in connection with the electrification of the lines between Manchester, Sheffield and Wath has now been placed by the L.N.E.R. Strangely enough it is for a steam locomotive coaling plant! Its capacity will be 250 tons.

One of the most interesting features of the electrification scheme is the new locomotive running shed which is to be built at Darnall (Sheffield), which will be the first in the country to be equipped for dealing with both steam and electric locomotives. This shed will be responsible for the maintenance of all electric locomotives working from the Sheffield end, together with the steam locomotives working southward and eastward, including those now stabled at Neepsend Depot. It will be equipped with a 70 ft. articulated turntable, a water tank with capacity of 100,000 gallons and all the latest mechanical appliances. A "fly-over" line is to be constructed in order to avoid occupation of the running lines by light engines, either steam or electric, passing to the new dual-purpose locomotive shed at Darnall from Sheffield Station.

Special Cruise Train for Boy Scouts

Recently 180 boy scouts left King's Cross station on a special cruising train for Benavie near Fort William, where they spent three days, which were devoted to climbing, walking, and outdoor activities. The tour lasted for one week and the train, which consisted of 13 coaches hauled by the streamlined locomotive No. 4482, *"Golden Eagle,"* was fully equipped with sleeping accommodation.

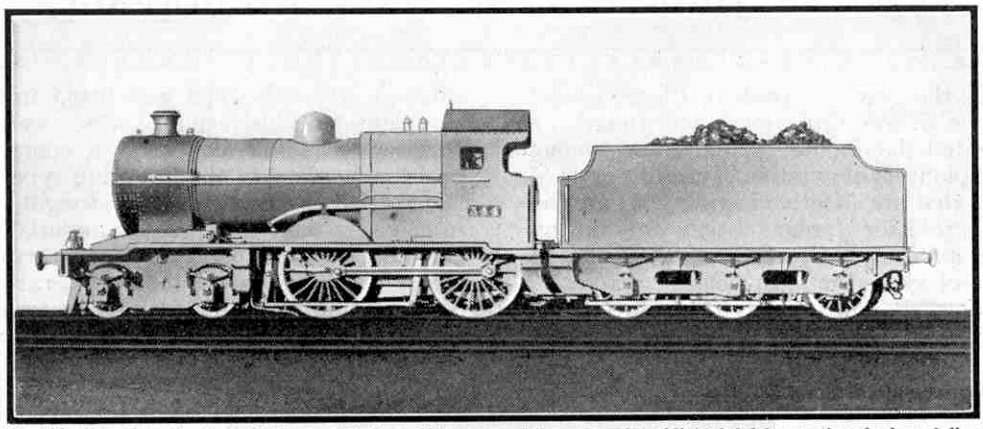
New Locomotives for the L.M.S.R.

In addition to the five 4-6-2 engines that are being built for the high-speed services between Euston and Glasgow, the L.M.S.R. are to build 15 standard 0-6-0 freight tender engines and 65 standard 2-6-2 passenger tank engines for suburban services.

Class 8 freight tender 2–8–0s Nos. 8021–23 and No. 8095, Class 4 2–6–4Ts Nos. 2483–6 and Class 5P5F 4–6–0s Nos. 5322–33 are now in traffic. No. 5524, formerly *"Sir Frederick Harrison,"* has been renamed *"Blackpool"* and No. 5504 is now *"Royal Signals."*

New G.S.R. (Ireland) Locomotives

A series of five new 4–4–0 tender locomotives has recently been put into service by the Great Southern Railways of Ireland. One of these engines is shown in the upper illustration on this page. They were designed by Mr. A. W. Harty, late Chief Mechanical Engineer, and have been built at Inchicore Works for operating heavy passenger traffic on branch lines where the weight on each axle is restricted. The boilers have Belpaire fireboxes and are provided with superheating apparatus. Steam is supplied at a pressure of 180 lb. per sq. in. to two inside cylinders 18 in. in diameter with a piston stroke of 26 in. The admission of steam is effected by piston valves operated by Stephenson's link motion. The driving wheel diameter is 5 ft. 8½ in., and the tractive effort at 85 per cent. of the working pressure is 18,800 lb.



No. 344 of the Great Southern Railways of Ireland. This is one of the new series of light 4-4-0 locomotives for branch line traffic referred to on this page. Photograph reproduced by courtesy of the Great Southern Railways of Ireland.

The leading end of the engine is carried on a bogie which is somewhat unusual in having outside frames, springs and axleboxes, as can be seen in our illustration. The tender is of modern flat-sided design, with raised side sheets, and accommodates seven tons of coal, and 3,450 gallons of water. The bogie axleboxes of one engine and the axleboxes of one tender have been fitted with roller bearings.

The engine weight in working order is 53 tons 3 cwt., and of this 33 tons are available for adhesion; the weight of the loaded tender is 35 tons. The new engines are numbered 341-5, and they form a modernised version of the earlier engines Nos. 336 to 340 that were introduced for similar duties on the heavily-graded Rosslare route during the years 1906-9.

G.W.R. Locomotive News

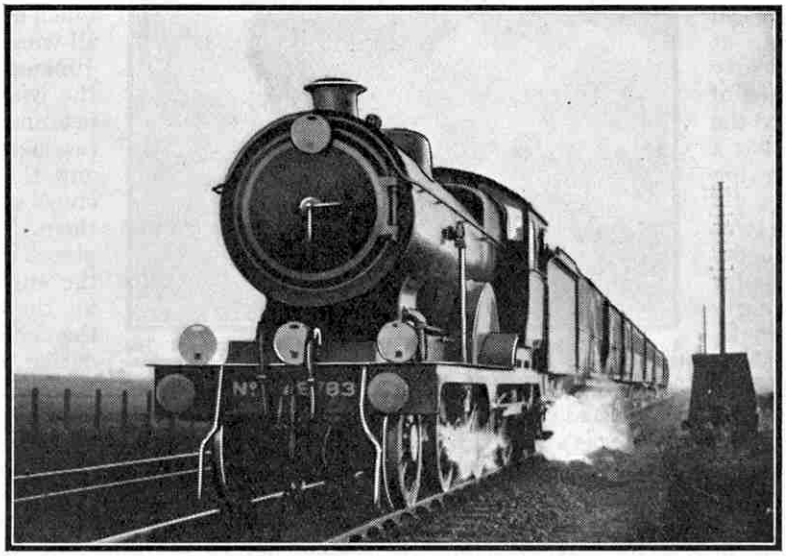
Nos. 6810-24 of the "Grange" class are now in service and have been given the following names, *"Blackmere Grange"; "Crambourne Grange"; "Chesford Grange"; "Eastbury Grange"; "Enborne Grange"; "Frilford Grange"; "Frankton Grange"; "Gwenddwr Grange"; "Hardwick Grange"; "Highnam Grange"; "Kingstone Grange"; "Leaton Grange"; "Manton Grange"; "Oakley Grange";* and *"Ashley Grange."* Nos. 6825-49 of this series are yet to be built, and will bear the names of the following "Granges," *"Llanvair"; "Nannerth"; "Llanfrechfa"; "Trellech"; "Burmington"; "Buckenhill"; "Bearley"; "Brockton"; "Calcot"; "Dummer"; "Eastham"; "Estevarney"; "Forthampton"; "Goodmoor"; "Hewell"; "Hazeley"; "Marlas"; "Nunhold"; "Poulton"; "Penhydd"; "Paviland"; "Ruckley"; "Tidmarsh"; "Toddington"* and *"Walton."*

The 10 "Hall" class locomotives that were mentioned in the January issue of the *"M.M."* will be numbered 5966-75 and will be named *"Ashford Hall"; "Bickmarsh Hall"; "Cory Hall"; "Honington Hall"; "Hengrave Hall"; "Merevale Hall"; "Olton Hall"; "Rolleston Hall"; "Wallsworth Hall"* and *"Winslow Hall."*

Nos. 3277, *"Isle of Tresco,"* and 3285, *"Katerfelto,"* of the "Duke" class and Nos. 3392, *"New Zealand,"* and 3403, *"Trinidad,"* of the "Bulldog" class have been withdrawn.

Bradford Locomotive Depot Improvements

The L.N.E.R. are to proceed immediately with a comprehensive scheme of improvements to their locomotive depot at Bradford where 63 engines are stationed. A bunker-type coaling plant, having a capacity of 175 tons, is to be installed with the necessary accommodation for coal wagons. The arrangements for the inspection of locomotives also will be modernised.



Down L.N.E.R. Royal Train near Cambridge, displaying the four white discs used to identify it. The engine is 4-4-0 No. 8783, one of three "Super Claud" 4-4-0s specially painted and maintained for Royal Train duties on the G.E. Section. H.R.C. prize-winning photograph by J. C. Button of Crewe.

Water Softening Plant for Colchester

A water softening plant is to be installed at Colchester on the L.N.E.R., the object of which is to ensure an adequate supply of soft water for locomotives. The plant will have a capacity of 7,500 gallons.

The L.M.S.R. Royal Train at Liverpool

On the occasion of the recent visit of their Majesties the King and Queen to Liverpool the L.M.S.R. Royal Train, which was used for the first time during the present reign, was hauled in both directions by two Class 5X "Silver Jubilees" Nos. 5741, *"Leinster,"* and 5742 *"Connaught,"* both from Edge Hill Motive Power Depot.

Among the many locomotives observed at Aintree on Grand National day were L.N.E.R. "Pacific" No. 4476, *"Royal Lancer,"* with corridor tender, which worked the *"Pullman Race Special"* from King's Cross; for the first time a "Football Club" engine was seen at Aintree. This was No. 2852, *"Darlington."*

Several L.M.S.R. engines strange to the Liverpool district worked special race trains. Among them were Class 5P5F, Nos. 5275/8, Class 5X, Nos. 5505 and 5736, the former piloted by Standard Compound No. 1121. A veteran combination, according to modern standards, was seen on a special train from Bristol, at the head of which was Midland Compound No. 1003 piloted by No. 1028 of the same class. No. 1003 was one of the first five Compounds, built in 1903. No. 1028 was built in 1906 to the modified Deeley design, to which the first five engines were subsequently rebuilt.

"The Locomotive Stock Book (1936)"

Readers interested in locomotive matters will welcome the appearance of the third edition of the Locomotive Stock Book, published annually by The Railway Correspondence and Travel Society. This gives the classification of all the steam locomotives of the chief British railway companies as existing on 31st December 1936, with their numbers, and the totals for each class. This year a departure is made by including also the engines of the railways in the Irish Free State and Northern Ireland; but its most interesting feature to many *"M.M."* readers will be the inclusion for the first time of engine names. A summary of locomotive practice in 1936 is given, and the book contains illustrations of new and obsolete engines.

Copies of the booklet can be obtained from Mr. D. R. Pollock, 102, Disraeli Road, Putney, London, S.W.15, price 2/6, post free.

Names for Latest L.N.E.R. "Pacifics"

Among the names selected for the latest "Golden Eagle" type "Pacifics" that are being turned out from Doncaster Works are *"Sea Eagle"; "Osprey"; "Great Snipe"* and *"Woodcock."*

German All-Metal Air Liners

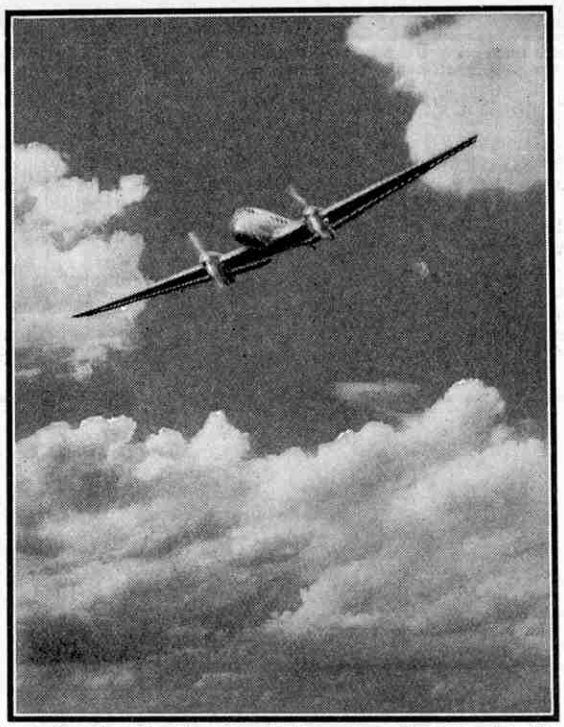
Types of Junkers Low Wing Monoplanes

THE founder of the firm of Junkers Flugzeug-und -Motorenwerke A.G. was Professor Hugo Junkers, a designer who invented the opposed piston Diesel engine and was one of the pioneers of aviation. The only parts of a normal aeroplane that are effective in giving lift are the wings, and when Professor Junkers began to take an active interest in aviation he realised that, from the purely flying point of view, the most efficient aeroplane would be an "all-wing" monoplane. In 1910 he took out a patent for an aeroplane in which the engine, fuel system, crew, passengers and freight were all accommodated within a single huge wing, to reduce air resistance to the minimum.

In 1915 Junkers founded the firm that bears his name, to introduce new ideas and to develop all-metal aeroplanes fitted with thick cantilever wings. The first Junkers product was the experimental J.1, a low wing monoplane, the cantilever wings of which were made from steel sheet by electric welding. This single-engined monoplane was also the first all-metal aeroplane, and to-day it is one of the historical exhibits in the Museum at Munich. The J.1 weighed nearly a ton, and by flying at a speed of 106 m.p.h. utterly confounded the many critics who declared that a metal aeroplane would be too heavy to fly.

After the War attention was centred especially upon the development of aircraft suitable for commercial air services, and early in 1919 the Junkers F.13 single-engined low wing monoplane was produced. It was built of duralumin, which is much lighter than steel, and had seating for six people. It proved a great success and was adopted by many air transport concerns. One of the first F.13s was acquired by the Deutsche Luft Hansa, and was in regular use on their air lines until four years ago, and machines of this type played an important part in the early development of air mail services in America. After 1922 new Junkers types became much more frequent, and included both low and high wing single-engined monoplanes. Among them was the G.24, the first triple-engined all-metal civil aeroplane, the engines and the fuel tanks of which were in the wing.

While developing his principle of all-metal construction, Junkers strove to make his Diesel engine suitable for use in his aeroplanes, and in 1923 he founded a company solely to manufacture Diesel engines to his design. In 1931 successful flying tests were carried out with the Junkers "Jumo" heavy oil compression ignition engine, and subsequently this type was fitted in the F.24K light aeroplane, an illustration of which was published in the January 1934 *"M.M."* It is a commercial five-seater cabin monoplane of the low wing type, designed for the transport of passengers and freight. The wings and fuselage are built of metal, the material employed for the skin being the customary Junkers corrugated duralumin sheet. The F.24K attracted considerable attention when first introduced because of its water-cooled heavy oil engine, which develops between 600 and 720 h.p.



A Junkers Ju.86 in the air, with the undercarriage retracted. The illustrations to this article are reproduced by courtesy of Junkers Flugzeug-und -Motorenwerke A.G., Dessau.

In 1930 the Junkers company produced the G.38, the largest landplane ever built in Germany. This multi-engined low wing monoplane has a wing span of 144 ft. 4 in., a length of 75 ft. 6 in. and a height of 21 ft. 4 in. Its weight when fully loaded is no less than 24 tons, and the enormous wing, with its area of 3,130 sq. ft., quite overshadows the fuselage. The machine provides accommodation for 34 passengers, and actually would be capable of carrying 80 persons if there were room for them. In design it is much nearer the Junkers ideal, an all-wing monoplane, than previous Junkers aircraft. The interior of the wing is very striking in appearance. Corridors run from the fuselage towards the wing tips, and these are so lofty that the crew can walk upright along them. Berths for passengers are placed in the wings, and rooms for the engines and accommodation for the crew also open out from the corridors. There is accommodation for two pilots in a totally enclosed cockpit constructed above the leading edge of the wings, while immediately behind is a central control room. The power units are four 780-850 h.p. Junkers L.88 water-cooled engines, and the top speed of the aeroplane is 138.5 m.p.h. During the past six years the G.38 and a twin machine have been in regular use on the European air routes of the Deutsche Luft Hansa.

The Ju.52/3m and the Ju.86, the two Junkers types illustrated here, are not exceptional in size or design. Both are low wing monoplanes designed for passenger or freight service. Like the G.38 they have proved their worth in actual service, and are included among the varied Junkers aircraft to be seen daily on D.L.H. air routes. Our cover, for which we are indebted to Junkers Flugzeug-und -Motorenwerke A.G., shows a Ju.52/3m as a night mail aeroplane operated by the D.L.H.

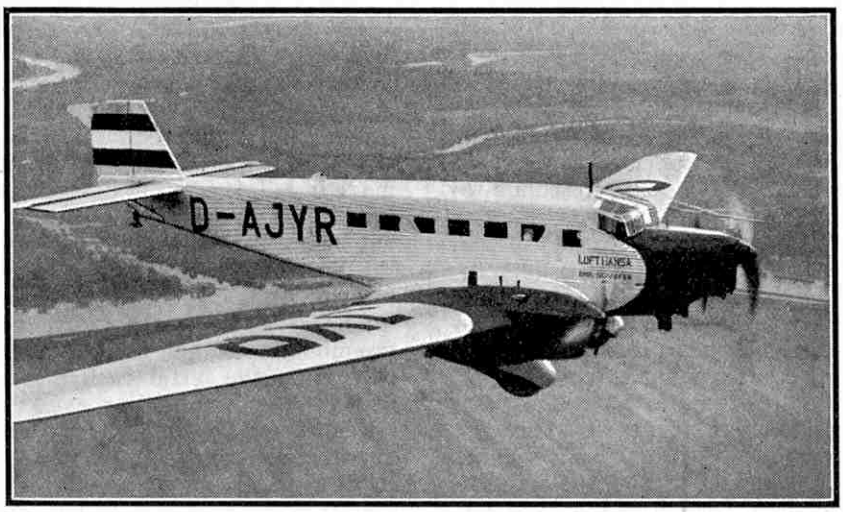
The Ju.52/3m was produced first. It is very pleasing in appearance, and the horizontal corrugations of the metal

covering of the fuselage do not detract from the streamline effect of the gracefully tapered framework. Special attention seems to have been given to the placing of the pilots' cabin. This is well forward and much higher than the passenger cabin, so that the pilots are well clear of the wings, the sharp taper of the wings being a further aid to providing a good downward view. The long passenger cabin can be fitted with seating for up to 17 passengers, and the machine can also be used as an air ambulance, in which case the cabin is equipped to accommodate 12 stretchers.

Another photograph of a Ju.86, and one that reveals the graceful contour and smart appearance of this new German air liner. The tail unit differs from the types seen on British machines.

The pronounced backward sweep of the wings is very noticeable in our illustration of this machine, and the neat merging of the large engine nacelles into the wings is also evident. The wings are secured by patent screw couplings to the wing centre section, which is an integral part of the underside of the fuselage. The fuselage is built up of a duralumin framework covered with corrugated light alloy sheeting.

The Ju.52/3m can be easily converted into a seaplane by replacing the undercarriage wheels with twin floats. As a landplane it is of 95 ft. 11 in. span, 62 ft. in length and 14 ft. 10 in. in height. The seaplane version is a few inches longer and is 17 ft. 9 in. in height. The three engines are B.M.W. "Hornets," air-cooled, and the maximum speed of the aeroplane is 174 m.p.h., and the cruising speed at 3,000 ft. is 162 m.p.h.



A Junkers Ju.52/3m seen from another aeroplane flying slightly ahead of it. This triple-engined monoplane carries up to 17 passengers, and can be adapted for use as an air ambulance.

The Junkers Ju.86 was produced last year, and a machine of this type attracted attention recently by winning the Circuit of the Oases, one of two contests arranged by the Egyptian Royal Aero Club at their third international Aviation meeting held at Cairo in February last. The winning machine, named "*Kismet*," is shown in the upper illustration on this page. The Circuit was not a speed contest, and the competitors spent considerable periods between the laps of the flight in sightseeing. The chief points taken into consideration in deciding the winner were the speeds, fuel consumption, and range of the competing aircraft, and such factors as their safety, comfort, night flying equipment, and arrangement of their controls and instruments. The success was especially gratifying to the Junkers Company, as the air liner was fitted with the latest type of "Jumo" heavy oil engines.

The Ju.86 is a beautiful aeroplane, and its high performance in varied climatic conditions has proved that its attractiveness is not at the expense of efficiency. The standard twin engines, mounted in streamlined nacelles that project from the front of the wings, are of the B.M.W. 132 type and develop 760 h.p. at 9,515 ft., at which altitude the top speed of the air liner is as high as 233 m.p.h. The cruising speed is 224 m.p.h., so that the machine is faster than the triple-engined Ju.52/3m when this is going "all out." Several other types of engines, including the "Jumo" 205, can be employed instead of B.M.Ws. The fuel and oil tanks are inside the wings, the former near the leading edge and the oil tanks at the wing root. There is room to install auxiliary fuel tanks immediately behind the main ones, if provision has to be made for exceptionally lengthy flights over territory lacking refuelling facilities.

The span of the Ju.86 is 73 ft. 10 in., and the great breadth of the wings at their fuselage end has necessitated a very sharp taper in order to make the rather blunt wing tips as narrow as is the case. The long narrow flap attached at intervals to the trailing edge gives the effect of a double wing, and is a feature of several recent types of Junkers aircraft. This flap can be manipulated by the pilot from the cockpit, so as to give increased lift to the wing, and the outer sections of the flap can be operated separately as ailerons.

The fuselage differs from that of the Ju.52/3m, chiefly in being of oval cross-section and in having a smooth, light metal covering instead of a corrugated one. The covering is attached to the framework of the fuselage by flush rivets, so as to ensure perfect streamlining. The tail unit also differs from that seen on most air liners, and the twin fins and rudders are mounted at the ends of the tail-plane. The undercarriage can be retracted when the aeroplane is in flight. The passenger cabin has seating for 10 people.

Making Chains Without Welding

Links Rolled from a Red Hot Steel Bar

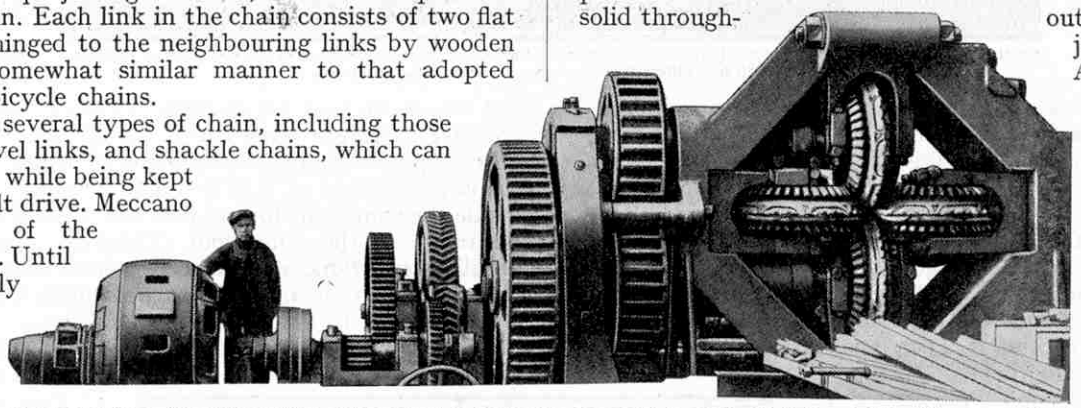
ONE of the oldest occupations in the world is that of the chain maker. Chains used as ornaments 6,000 years ago have been found in Egypt. These chains were made of soft metal, which could readily be joined by hammering to form the links, and many centuries elapsed before iron chains appeared, for they have not been traced any earlier than 1,000 B.C.

It is interesting to find that chains actually have been made of wood, and wooden chains are still used in several countries. In some parts of the Austria Tyrol, wooden chains can be seen in use in corn grinding mills driven by water power. In one of these mills a water wheel turns a wooden shaft about 60 ft. long, and reduction gear is provided by broad flanged wooden wheels, with radial wooden pegs projecting outward, over which passes a wooden chain. Each link in the chain consists of two flat side plates hinged to the neighbouring links by wooden pins in a somewhat similar manner to that adopted in making bicycle chains.

There are several types of chain, including those made of swivel links, and shackle chains, which can only be used while being kept flat like a belt drive. Meccano chains are of the shackle type. Until comparatively recent years the most widely used type of chain was made by bending rod to shape and welding to complete the links. In this process the required length of rod for each link is cut off, and the rod is then made red hot and bent into the form of the letter "U." The open ends are then again heated, flattened out like wedges and bent round to form an oval link, with the two flattened edges brought close together to form what is called the "scarph" of the weld. Finally the middle of the straight part is bent to bring the two ends together, with the two flat sides overlapping and in contact. The metal rod can only be flattened and bent and worked easily when the metal is red hot. When the link is approximately in its final shape the two "scarphed" ends are raised to white heat, and the weld completed by hammering the ends together into a solid mass. The next link is made in the same way, but is passed through the loop of the first before it is welded.

Chain making is a specialised branch of blacksmith's work, which in this country has been carried on chiefly in the Staffordshire district, where the chain maker works as an individual craftsman, using as his raw material iron rod of various sizes up to $\frac{7}{8}$ in. in diameter. Heavier chains required for use with cranes and ships' steering gear and anchors are made in a similar manner, but their manufacture necessitates the use of heavy machinery. The links of large chains are usually manufactured with a cross-bar, called a "stud," in them. The anchor chains in use on the Cunard White Star liner *"Queen Mary"* are of this type and are among the largest made. They are 330 fathoms in length and weigh 150 tons. A single link of one of these chains is more than two feet long and $14\frac{3}{4}$ in. wide, and weighs two cwt.

When an ordinary welded chain is broken, the link that gives way usually is found to be fractured at the place where the weld was made. The weld therefore is the weak point, and it is generally assumed that the welded part of a link is weaker than the material of which it is made by 30 per cent. From time to time efforts have been made to overcome this weakness as much as possible. For instance, in some chains alternate links were stamped out from a solid bar, so that only the connecting links were welded. The ideal of course is to have no welded links at all, and many inventors have striven hard to produce chains with links that were solid throughout without any joints in them. After many costly experiments the problem of making weldless chains has been solved, and such chains of steel and other alloys are now produced on a commercial scale at Gartsherrie, Scotland. There lengths of chain are manufactured out of a solid bar with no welds at all. The bar used is of cruciform shape, that is, its section has the form of a cross, and the length of chain that can be made from it is equal to that of the bar itself. This may be up to 70 ft. in length. A bar has to be made nearly white hot before it can be converted into chain, and it is only the length of furnace required that limits the length of chain that can be made in one piece.

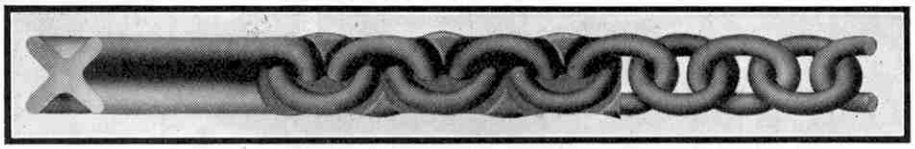


The chain rolling mill in which weldless chains up to $1\frac{1}{4}$ in. in diameter are manufactured. The illustrations to this article are reproduced by courtesy of Weldless Chains Ltd., Gartsherrie, Scotland.

The method of producing weldless steel chains bears no resemblance to that used in the manufacture of welded chains. In the latter each link is produced separately from a piece of round bar, as has already been explained, but in the weldless chain a long length of chain is produced directly from the bar by passing it through a rolling mill to form the links. The rolling mill employed is a very special type. A mill in which ordinary plates, rails and angle sections are rolled has two rolls, top and bottom, and the material passes between them. In the chain-rolling machine there are four rolls or dies, one pair rotating about vertical axes and the other about horizontal axes. These four chain rolls are set in bearings diametrically opposite one another at the four corners of the main frame of the machine. Thus the two rolls of one pair are in line vertically, and those of the other are similarly aligned horizontally, and the bar is pressed by the rim of each roll as it passes through the machine. When looked at from the front, the rolls give the

impression of two sets of bevel wheels geared together.

For making steel chains, mild steel cruciform bars, which may be termed the raw material of the weldless chain, are heated in an oil-fired furnace to an ordinary rolling temperature, and automatically drawn through the mill at a speed of about 30 ft. per min. by the four chain rolls. The rim of each roll is V-shaped, and more or less fits into one of the recesses of the cruciform bar. It is shaped to make the desired impression on the bar, and the chain actually is formed by the combined effect of the four rolls in one passage through the mill. In this operation the chain links are shaped out on the webs of the bar, but they are not as yet separated, thin webs of material remaining to connect the links. The product, which may be called a chain bar, is kept perfectly straight and is supported upon a long steel bed in order to keep it straight until it is cool enough to be removed.



Successive stages in forming the links of a weldless chain from a bar with a cross-shaped section.

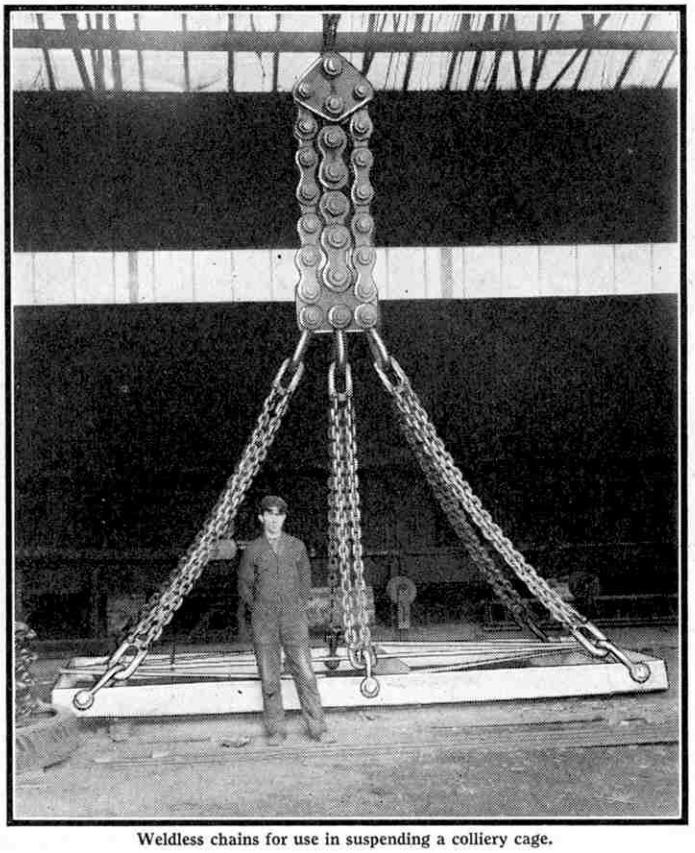
The next step is to remove the webs in a special punching machine. After each descent of the punches the chain bar is turned through an angle of 90 deg., so that each plane in turn is brought into the horizontal position, and thus all the outer and inner webs surrounding its links are removed although it passes only once through the machine.

The main work of forming the chain has now been completed, although the bar is to some extent held rigid by small portions of the core of the bar at the inner ends of the links. These are removed in another machine in which V-shaped blocks with obtuse angles enter the angles of the chain bar and twist off the thin webs still joining the links. The result of the action of this machine is a chain that is flexible, and this is placed in a barrel to be shaken with steel punchings or other material in order to remove its rough edges and make it easier to handle during the operations that follow, in the making of the finished chain.

Next a smooth finish is given to the chain, and this is done by dies between which first one end and then the other of each link is squeezed under tremendous pressure. A certain quantity of surplus metal is thrown out in this operation and this afterwards is stripped off in other dies. A perfect chain of separate links emerges from this operation. The links are necessarily wider than is required, on account of the manufacturing process, and the chain therefore passes through a machine having dies that completely surround the links and close them to the required dimensions. The chain is carefully annealed, and is then ready for testing.

It is often asked how a weldless chain, say hundreds of feet long, can be made. The answer is that two weldless chains can be connected by a solid forged steel shackle of approximately the same size as the chain link. This shackle is passed through the end link of one chain, and connected to the next length of chain by a heavy steel rivet or pin. In this manner chains can be made up to any length, and they can be joined by means of special riveted shackles to solid rings and hooks for making into lifting chains.

Examination of the links of a weldless chain shows that their ends are thicker than their sides. This is a great advantage, for extra metal is provided at the points of contact of the links of a chain, where the heaviest stresses are applied and where the greatest wear takes place. A further advantage is that the chain maintains the full strength of the material of which it is made, since there are no joints liable to cause weakness. The chains are of great strength because of the use of mild steel in making them and, because of the extra strength given by the absence of welds, there is a higher margin of safety than with welded chains. It is calculated that a weldless steel chain is twice as strong as a welded iron chain of the same diameter.



Weldless chains for use in suspending a colliery cage.

After a chain is put to work the ends of the links begin to wear, and as each link of an iron chain is of the same diameter all round, the margin of safety becomes reduced with wear. In a weldless chain, the strength is calculated on the diameter at the sides of the link. The cross-sectional area of the ends of the links is about 25 per cent. greater than that of the sides, however, and a weldless chain often is used for years before the ends of the links become worn to the same diameter as the sides. This means that a weldless chain retains the same margin of safety practically throughout its life.

Mild steel with a tensile strength of 20 to 32 tons per sq. in. is the usual material for weldless chains, but alloy steels also have been used, and tests with a 15/16-in. diameter nickel steel weldless chain showed this to have a breaking stress of 46.5 tons per sq. in. Weldless chains are costlier than the ordinary type, but have so many advantages that they will undoubtedly come into more general use.

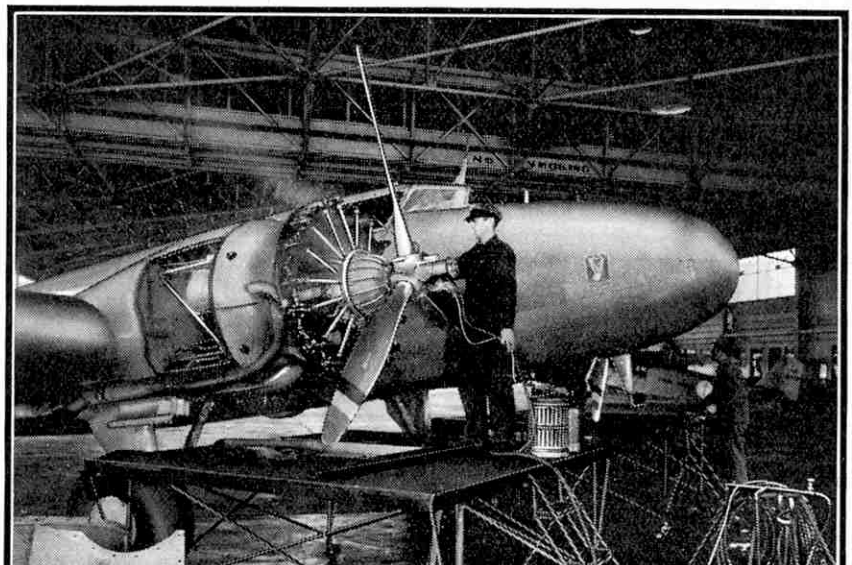
We are indebted to Mr. Ian M. Smith, General Manager, Weldless Chains Ltd., Gartsherrie, Coatbridge, for information contained in this article.

Air Mail Progress Since 1911

The Coronation Year of King George VI coincides with the introduction of the carrying of Empire air mail without extra fee, and it is interesting to recall that in 1911, the Coronation Year of King George V, the operation began of the first air mail experiment in England to be officially sanctioned by the Postmaster General. The two Coronation Years thus serve as milestones in the history of air mail transport.

The great progress made by this form of transport since 1911 can be illustrated by some striking comparisons. For instance, the 50 h.p. aeroplane employed in 1911 to carry a 23 lb. bag of mails between Hendon and Windsor flew at about 50 m.p.h., whereas the giant 3,000 h.p. Empire flying boats of to-day can attain a speed of 200 m.p.h., and carry about three tons of mails in addition to 24 passengers and a crew of five. In carrying letters between Hendon and Windsor in the experimental service of 1911 pilots were flying over a route of only about 20 miles; to-day the aerial network flown over by the aircraft of Imperial Airways and its associated companies covers nearly 30,000 miles.

In 1911 the total number of letters and postcards flown between Hendon and Windsor was only about 100,000. During a recent period of 12 months Imperial Airways carried about 30,000,000 letters.



Mechanics overhauling the engines of a Boeing 247D owned by United Air Lines, an important American air transport company. The 247D is a twin-engined low wing monoplane of all-metal construction, and carries 10 passengers and a crew of three.

The 1937 King's Cup Air Race

Last year the King's Cup Air Race was held in July, but this year it will be held on 10th and 11th September. The Race will again be a two-day event, the first day being devoted to an eliminating contest, and the second day to the race itself. The eliminating course will be about 800 miles in length, and will begin at Hatfield. Competitors will fly northward to Newcastle-on-Tyne and from there to Aberdeen, where they will turn westward to Glasgow and on to Newtownards, in Northern Ireland, then fly south to Phœnix Park, Dublin, where they will halt for the night. The aircraft taking part in this contest will be grouped in two classes, one for machines with engines totalling up to 150 h.p., and the other for those with more powerful engines.

On the second day the competitors will fly back to Newtonwards and then across the south-west coast of Scotland and southward to Blackpool and Cardiff. The final lap of the course will be from Cardiff to Hatfield, and the total distance of the Race will be about 600 miles. The winner will receive both the King's Cup and a prize of £1,000 presented by Viscount Wakefield, who is also offering second and third prizes of £350 and £150 respectively, and two extra prizes, each of £250 for the fastest times in the eliminating contest, one in each class. There is no sign yet of any new types of British aircraft being entered for the Race.

New Rolls-Royce Aero Engines

New types of Rolls-Royce aero engines, cooled with ethylene-glycol, are to be fitted in some of the latest military aircraft ordered for the R.A.F. The engines are of the 12-cylinder "vee" arrangement. The type to be installed in the Fairey "Battle" bombers will be the "Merlin I," and that chosen for the Hawker "Spitfire" and "Hurricane" single-seater fighters will be the "Merlin II." The two types differ only in certain minor modifications.

Asbestos Suits for Rescue Work

A tragic feature of air crashes is that the aeroplanes involved often burst into flames before rescuers can reach the wreckage and withdraw the unfortunate occupants. The equipment of R.A.F. stations includes asbestos helmets and gloves for use in such emergencies, but frequently these have proved insufficient to enable rescues to be effected, owing to the intense heat of the burning aircraft.

The Air Ministry have now decided to provide R.A.F. stations with asbestos suits that can be quickly donned by the rescuers when a crash occurs in the vicinity of the station. During the period that the aircraft of the station are in use, two of the airmen on duty with the fire tender will wear the lower part of their asbestos suits, so as to be ready to answer any summons for help. When a summons is received they will immediately slip on the top portion of the suit. Thus protected they will be able to approach much closer to the blazing wreckage than otherwise would be possible, and will have a much better chance of being able to rescue the occupants. This form of protective clothing was subjected to severe tests before its adoption for the R.A.F. was decided upon by the Air Ministry, and nearly 200 of the suits have been ordered.

The "Hannibal" and "Heracles" Air Liners

Up to the end of last year each of the "Hannibal" class air liners employed on the Empire routes of Imperial Airways had flown nearly 700,000 miles, and two of the "Heracles" class air liners, operating on the company's Continental air services, had covered about 900,000 miles each.

These two classes of air liner differ in their internal equipment, being adapted to suit the routes over which they operate. Externally the aircraft are the same, however, and they are of particular interest in being sesquiplanes, in which the upper and lower wings are unequal in span. The machines are 86 ft. 5 in. in length, and their four Bristol "Jupiter" engines give them a top speed of 120 m.p.h.

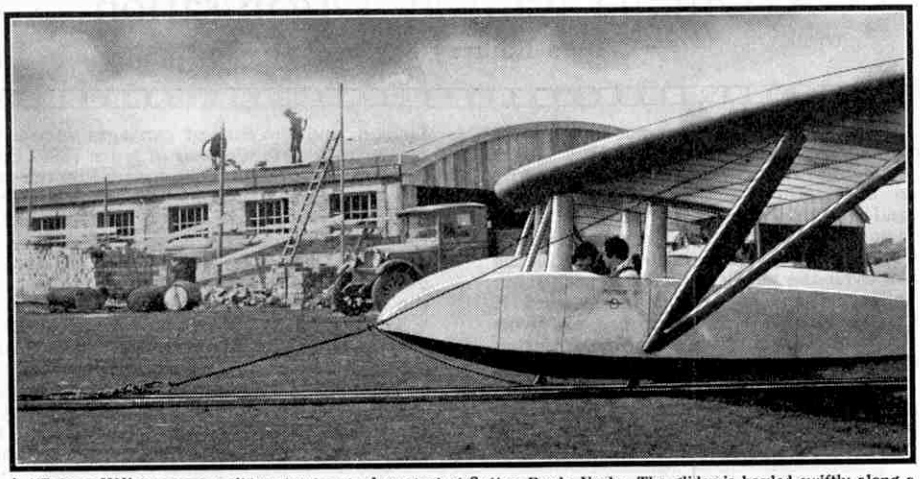
Arranging Europe's Summer Air Services

Every winter the International Air Traffic Association, of which over 30 of the chief air line companies are members, holds a conference at which the main features of the forthcoming summer's programmes are decided. First the conference makes decisions as to traffic to and fro along main routes, and after this it becomes a question of further detailed arrangements by the various companies to fit in the arrival and departure of "feeder" services establishing connections with the main lines. The introduction of faster aircraft on the main routes also has to be taken into consideration, and the revision of the express services, such as that by which passengers can leave London after breakfast and be in Budapest in time for dinner the same evening, enable a general speeding-up of connecting services to be obtained.

After their preliminary meetings the members of the Association have much detailed work to carry out before their timetables can be drawn up and approved for the actual commencement of summer services in April. For instance, it has become particularly important to ensure adequate and frequent connections between the many European routes. Travellers are showing an increasing disposition to make lightning air tours of the Continent, visiting as many cities as possible in a limited period of time, and this rapid touring necessitates very accurate connections between one air line and another.

The Continental services of Imperial Airways have, as usual, been augmented to cope with the heavy summer traffic. The summer service between London and Basle and Zürich is being operated on weekdays in co-operation with Swissair, as last year, and there are two departures daily each way. The afternoon departure from Croydon has been fixed at a time that enables passengers flying from Belfast, Dublin, or Liverpool by Railway Air Services to catch the Swiss-bound machine at Croydon. On Sundays the service is operated only by Swissair. This company are running a summer service between Zürich and Berlin, in co-operation with Deutsche Luft Hansa, the well-known German air transport company, and also a service between Zürich and Paris. Some details of the summer timetable of Air France were given in these pages last month.

There was heavy traffic on most of the important European air services from Croydon during Easter.



A "Falcon III" two-seater glider about to be launched at Sutton Bank, Yorks. The glider is hauled swiftly along a grooved runway by means of a wire rope attached at one end to the fuselage and at the other to a drum fixed to the back wheel of a jacked-up motor car. The glider rises rapidly, and when it is sufficiently high the rope is released. Photograph by J. H. Illingworth, Harrogate.

A Great Japanese Flight

A remarkable flight half round the world was completed when the Japanese aeroplane *"The Divine Wind,"* piloted by M. Iinuma, with K. Tsukagoshi as wireless operator, landed at Croydon Airport at 3.30 p.m. on 9th April last. The fliers had left Tokio at 5.12 p.m. on 5th April, and had thus covered the 10,000 miles in 3 days 22 hrs. 18 min., at an average speed of about 200 m.p.h. The flight established records for the journeys between Tokio and London and between Tokio and Paris, the previous best time for a flight from Tokio to Paris being 6 days 20 hrs., taken by the French airmen Coste and Le Brix in 1923.

The flight was notable both in being accomplished in record time and in being carried through without the slightest hitch.

The Koolhoven F.K.46, a Dutch two-seater training biplane with staggered wings. It is fitted with a 130 h.p. D.H. "Gipsy Major" engine and has a top speed of 108.6 m.p.h. Photograph reproduced by courtesy of N. V. Koolhoven Vliegtuigen, Rotterdam.

Special interest is attached to it by reason of the machine employed being built entirely in Japan. It is a low wing monoplane, and in appearance resembles a typical high-speed American cabin monoplane. It has a wing span of 39.4 ft., and a 550 h.p. engine.

The airmen brought a Coronation message of goodwill to Britain from the Japanese newspaper *"Asahi Shimbun,"* which sponsored the flight.

The flight has aroused great interest throughout the world, and in a later issue we hope to give further details of it and of the machine used.

Preparing for the Empire Flying Boat Service

Preparations for the extension of Imperial Airways flying boat service to India and Burma are making good progress. At Rangoon moorings for the boats are to be laid at two different sites. The north-east monsoon moorings will be at the mouth of the Regu River, and the south-west monsoon moorings will be higher up the river. Fast motor launches will convey passengers and mails between the moored flying boats and the shore base. Facilities for refuelling the machines are also being arranged.

It has now been decided to make Karachi a first-class international airport, and important improvement schemes are being put in hand, in addition to the work already in progress in connection with the flying boat base. The improvements include the erection of a three-storey administration building, and quarters for the staff.

New "feeder" air lines are being planned in India to link up with the main air routes, and thus enable the mails that will be carried under the flying boat scheme to be distributed by air over wide areas.

Proposed Stratosphere Flight

Professor Jean Piccard is said to be planning another ascent into the stratosphere, during which he hopes to attain a height of 20 miles, seven miles higher than any previous stratosphere ascent. In the new attempt he proposes to employ large numbers of small rubber balloons to provide the necessary lifting power. These will be capable of expansion from 4 ft. to 16 ft. in diameter as they ascend into rarer regions of the atmosphere, and will burst on reaching their greatest size. He hopes to carry out a preliminary test flight this summer from somewhere in Minnesota, when he will use about 80 of these small balloons secured together in bunches, with a gondola only large enough to contain himself suspended from them. Dynamite caps will be fixed at suitable points so that the Professor will be able to explode them and thus to cut one balloon or more loose when he wishes to stop rising.

If the test flight is successful preparations for the 20-mile ascent will be hastened forward. The gondola will be lifted by means of 2,000 balloons. These will not all burst at once, and many are expected to reach a height of 20 miles. The present height record is 74,000 ft., made on 11th November 1935 by two United States Army air officers in the balloon *"Explorer II."*

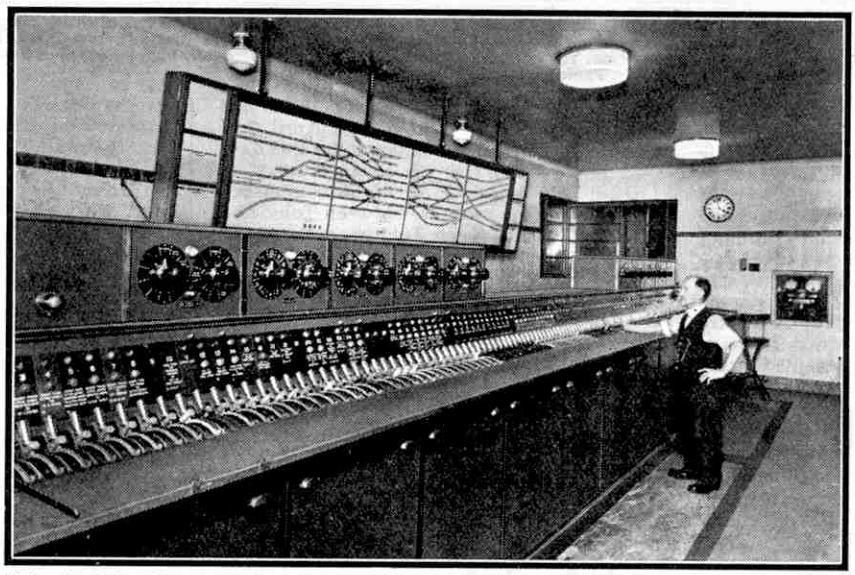
London's Underground

A Unique Railway Organisation

By a Railway Engineer

THE Underground railway system of London is one of the most outstanding transportation concerns in the world. To a visitor the secret of its efficiency may well seem wrapt in mystery, and its ramifications may prove bewildering in the extreme; but to Londoners the Underground is rapidly becoming a kind of "Magic Carpet," where you put your pennies in the slot of an automatic ticket machine and are taken swiftly to any destination in the Metropolis. Compared with even the smallest of the British main line railways its route mileage is trifling, and I have heard it referred to, even among railwaymen of wide experience, as "a bit of a tramway." Yet the Underground boasts a traffic organisation infinitely more intense than that of any main line system, either in Britain or overseas.

Trains are run to an extraordinarily close headway—in rush hours the standard interval on its busiest routes is one minute-and-a-half—and considering the frequency of stops the intermediate speeds are very high. In such intense service signalling is vitally important, and elaborate safeguards that would be deemed an expensive refinement elsewhere become an absolute necessity. On the Underground it is impossible for a driver to pass a signal showing "danger," on account of the automatic train stop system installed. On our main line railways similar equipments are confined to a few short stretches where there is a busy electric service, and the cases recorded where drivers have inadvertently passed a signal at danger are so very few that the enormous expense of installing train control is not considered to be justified. But by far the greater proportion of Underground mileage is in tunnels no more than 12 ft. in diameter, and on such a line the remotest possibility of a collision is unthinkable. The result of such precautions is that Londoners have grown so accustomed to the reliability of the tube railways that a hold-up, however small, invariably calls forth bold headlines in the evening newspapers.



Acton Town Signal Box. The black dials below the illuminated diagram are train describers. The illustrations to this article are by courtesy of the London Passenger Transport Board.

Before dealing with some of the most notable features of Underground organisation it will be of interest to recall the history of the tube form of tunnel, especially as work has just begun on some fresh extensions. In the latter part of the nineteenth century the Greathead Shield was invented for boring tunnels. Having perfected his idea, the inventor, in seeking some means of demonstrating its utility, launched a scheme for a cable subway between Southwark and the City of London. Through the influence of Mr. C. G. Mott, a director of the Great Western Railway, the cable traction scheme was abandoned in favour of electricity, and so the City and South London Railway came into being. The tunnel had to be bored deep down in order to pass under the Thames, but this very depth proved a great advantage; it was far below all foundation, pipes, and drains, and the extreme difficulties encountered in the building of lines like the District and the Metropolitan were avoided. Ever since, the tubes have been made as deep-level lines.

The City and South London Railway was admittedly an experiment, and one that was not altogether successful. The whole atmosphere of the line was rather forbidding. The journey was made in the very bowels of the earth, and the dingy stations and queer-looking trains did little to dispel the impression. Tiny electric locomotives were used, which nosed their way along in crab-like fashion, and the earliest carriages were little better than glorified cattle trucks—in the year of grace 1890! Each had a row of narrow slits for windows; a conductor rode on the gangway and shouted out the names of the stations; and it was not altogether surprising that these coaches became known as "the padded cells." A journey on this line was infinitely more depressing than anything the steam-operated District or Metropolitan Railways could provide, and it does not require a big stretch of the imagination to picture what the Inner Circle was like in those days!

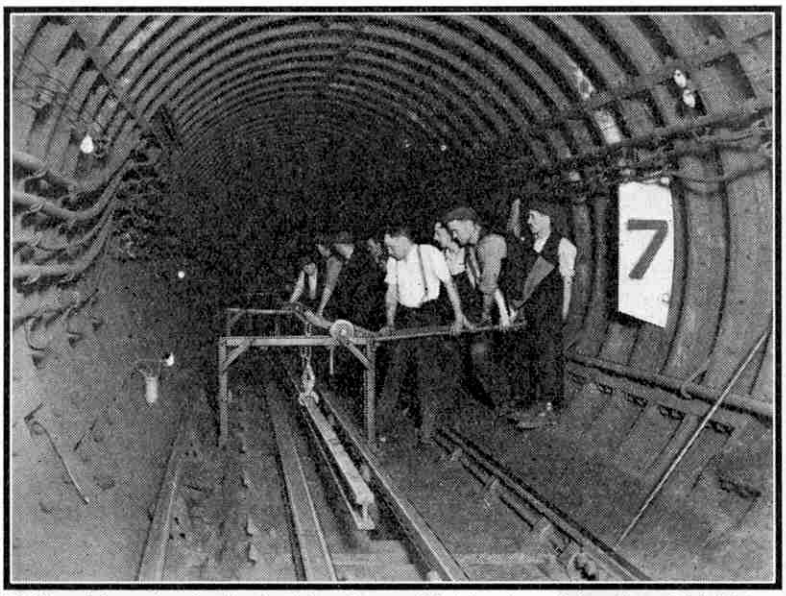
The next tube opened, the Central London, was a great advance in every way. The size of the tunnels was increased to approximately the present standard, stations and carriages were brilliantly lighted, and the whole atmosphere was one of bright and cheerful hustle. This line, which was opened in June 1900 by King Edward VII, was constructed on what is sometimes called the "dipping gradient" principle. Although the tunnel could easily have been bored so as to provide a level track from end to end, the gradients were so arranged as to help a train when accelerating from a station stop. For a short distance beyond each platform the track descends on a fairly steep gradient, which assists a train in getting away smartly. Then the line runs level until approaching the next station, when a sharp rise is encountered that helps in making a rapid stop and, by rendering less braking force necessary, reduces wear and tear.

Mention of gradients in tube tunnels leads on to the curious alignments that are to be found in some parts of the system. On the Central London for example, over by far the greater part of the route the east and westbound tunnels run parallel to each other and at the same depth below surface level; but at Notting Hill Gate station the two tubes are at different levels, and an imaginary line joining the centres of the tunnels would be inclined at about 45 degrees to the vertical. This at first sight seems rather odd; but just as the land has to be purchased for surface railways, so also has payment to be made for boring tube tunnels. Even though carried so deep down, they have a certain effect upon the buildings above, and in consequence they are constructed as far as possible beneath streets. This explains the alignment at Notting Hill Gate, for the High Street above is a narrow bottleneck compared to the width of Oxford Street, Bayswater Road, and other highways under which the railway runs. Similar circumstances account for the extremely puzzling twists and turns made by the Piccadilly line between Brompton Road and South Kensington.

One of the most intricate pieces of tunnelling on the system is to be found at Camden Town. Here, going north, the old City and South London, now completely modernised, and the Waterloo, Charing Cross, and Euston line converge; then immediately beyond Camden Town station the line forks again, one route going to Highgate and the other to Edgware. If laid in like an ordinary double-line surface junction, the down Highgate line would cross the up Edgware track and a headway of two minutes would be impossible on either route owing to the conflicting movements involved. A similar state of affairs would exist at the south junction. The tunnels accordingly have been arranged on the "flying junction" principle which, though fairly common practice on surface railways, is a highly involved and complex layout to construct when

the work has to be carried out deep down in the earth.

Camden Junction was constructed in 1923-4, when the City and South London Railway was enlarged to standard size and extended from Euston to join the Hampstead line. The signalling of the layout created a good deal of interest at the time owing to the fact that the cabin was hidden away in a little annexe of the station, and the signalman never saw a single train during the whole of his day's work. In these days, however, signal operation entirely by means of an illuminated track diagram is no longer a novelty, but some of the latest features of Underground signalling are of outstanding interest. I referred earlier to the automatic train stop system. Nowadays, when a signal lever is pulled to the "off," it lowers the trip arm of the train stop, and only when the trip arm is fully lowered are electrical contacts made and the light signals altered from danger to clear. Although the signals give a visible indication of the state of the line ahead, the train stop is the first line of defence against a collision, and if a driver through misreading his signals, or a misjudgment, attempts to pass a signal showing danger, the train stop arm, striking the trip cock on the motor coach, makes a full emergency application of the brakes. Even if the train were travelling at speed it would be brought to a stand in a few yards.



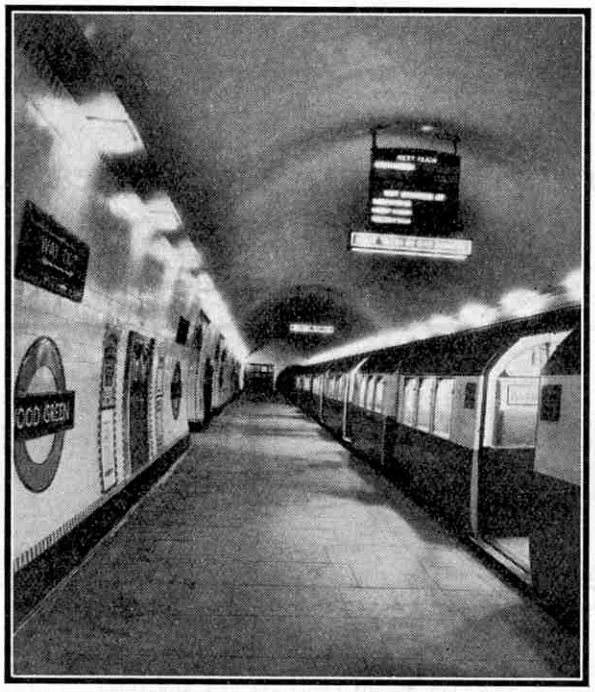
Night work in progress in a London tube, where a rail is being changed. Operations of this kind can only be carried out between the end of one day's service and the beginning of the next.

With such elaborate protection drivers can run with confidence at the high speeds now scheduled, which often entail maximum rates of 45 m.p.h. between adjoining stations; but no less important in the maintenance of such excellent times is the brake equipment. The newest type of multiple-unit trains are fitted with one of the latest developments of the Westinghouse air brake in which power is applied electrically. In the ordinary Westinghouse compressed-air brake, when the driver makes an application, although each vehicle in the train carries its own supply of air in what are called auxiliary reservoirs, it takes a few seconds for the controlling air to pass from the driver's valve to the rear coach, and so the brakes do not come on quite simultaneously all down the train. In the electro-pneumatic system there is no need for air to pass down the train pipe; the valves on every coach are released simultaneously, and those few seconds saved produces a much more rapid retardation. But still more important is the fact that this brake permits a driver to make a full application and then gradually release as the train slows down. With the ordinary Westinghouse system the brakes must be released completely or not at all.

Returning once again to the signalling equipment, perhaps even more remarkable than the train control that it provides is the system of interchangeability employed. Every single piece of apparatus is designed in such a way that any failure of the power supply, or a breakage of any part of an instrument, will instantly cause the signals to go to "danger"; this is essential in the cause of safety on so busy a line. So far so good; but when trains are passing through at the rate of 40 per hour it does not take many minutes' delay to create a bad hold-up. Accordingly all the signal apparatus is arranged so that the vital parts can be replaced at literally a moment's notice. At first sight this may seem a gross exaggeration, but it is not so. The track circuit relays, which may have 20 or more electric wires connected to them, are provided with detachable terminal boards; these can be swung clear while a faulty mechanism is removed and another substituted, and in a trice the new relay is at work without a single electric wire having been disconnected. Equally ingenious devices allow the pneumatic cylinders that operate the points and train stops to be removed and replaced without disconnecting or cutting off the air supply.

Cases of failure are certainly very rare, but when they do occur the maintenance men seem to appear from nowhere, and in a very few minutes trains are running again. A great deal of this immunity from breakdown is due to the close inspection that takes place every night. Readers who have travelled by the last train on any tube route will probably have noticed that the tunnels were lighted; this is in readiness for the maintenance staff who each night examine and test every single piece of signal apparatus. On the latest extensions the night work involves other activities; in the tunnels of the Piccadilly line the tube walls are washed down with hosepipes in order to keep the atmosphere perfectly clean.

This leads me to the very important subject of ventilation. The air in the tube stations and tunnels is kept fresh by means of a large number of fans, working on the exhaust principle. Ventilating shafts are provided as near to the stations as possible, the tunnels are connected at intervals by cross passages, and the suction caused by the fans draws a current of fresh air down through the station entrances. This not only makes the station platforms the freshest part of the whole system, but enables passengers to enter the tubes along an ingoing current of air. The fans are of the centrifugal pump type, and are of such ample capacity as to be able to change the air in the tunnels four times an hour. With such powerful machinery very careful consideration has to be given to the design of the fan houses on the surface so as to minimise noise and vibration. The fans themselves are mounted on a bed of compressed cork insulation, and discharge through louvred openings.



A train at Wood Green Station, on the Piccadilly line. This photograph shows typical "tube" station construction and equipment.

One of the most interesting air extraction plants is at Finsbury Park. Here the normal type of fan could not be used as the apparatus had to be located beneath the Park itself. In this case a propeller type of fan is employed, situated on a level with the tube tunnels. The discharged air is carried up one of the 12 ft. diameter shafts that were used when boring the tunnels, until near the surface, and then carried westward just beneath the Park to a discharge grid facing the L.N.E.R. main line.

This very successful ventilation system is in striking contrast to the conditions obtaining in steam days on the District and Metropolitan. Even to-day the blackened tunnel walls of the Inner Circle still tell their tale of an atmosphere incredibly foul. Each train was composed of nine four-wheeled coaches, carrying first, second, and third compartments, and was hauled by one of the ungainly Beyer-Peacock 4–4–0 tank engines. These were about the ugliest engines that have ever been built. The bogie wheelbase was very short, the cylinders were steeply inclined outside the frames without any covering, and the characteristic Beyer dome was mounted cheek-by-jowl with the

chimney. As motive-power units, however, they were good engines, and were able to maintain a 3-minute service over the South Kensington–Mansion House section.

In these times when careful attention is paid to every detail affecting the passengers' comfort, a consideration almost as important as the ventilating of tunnels is the elimination of noise. The sound of the train motors reverberates in the confined space, and the rhythmical beat of the wheels becomes intensified into a sharp irritating tattoo. These two noises, inherent in any electric railway system, can sometimes produce a positively nerve-racking din, especially if one is travelling in a motor coach. The noise is of course greatly lessened if all the windows are shut, but in this case, even with the opening of the entrance doors at each station, a carriage would become very hot and humid, especially at rush hours. Accordingly experiments have been made with an air-purifying system that would permit of permanently closed windows. This is somewhat similar to the principle of "air conditioning" that is being widely adopted in America.

A Piccadilly train at Sudbury Town. This station was rebuilt some years ago and now has the up-to-date appearance characteristic of surface stations of the London Passenger Transport Board.

More recently the problem of noise on the Underground has been tackled at its source. The blow at each rail joint has been greatly reduced by the building of light-weight rolling stock, and now the rail-joints themselves are being eliminated. Until the construction of the Cockfosters extension of the Piccadilly line the standard rail length had been 42 ft.; on that new line 90-ft. rails were used, and it was found that noise was considerably reduced. With the exception of some 120-ft. rails that have recently been rolled for the L.N.E.R. East Coast main line, 90 ft. is the longest length of rail that has yet been rolled in this country, and it was at first thought impracticable to handle any longer section in the tube tunnels. The rapid developments in the science of welding, however, have brought a novel solution to the Underground noise problem. In the permanent way shops three 90-ft. rails are welded together, and these 270-ft. lengths are run into the tunnels on flat trucks. After being laid in position these long rails are themselves welded together, so as to produce an infinite length of track without a single rail-joint. An experimental length of track put down on the Hampstead line has proved so successful that eventually the whole tube system will be modified.

To deaden the noise of the motors various experiments have been made, the latest of which involves the fitting of an asbestos shield projecting horizontally from the tunnel walls, level with, and almost touching the footboards of the carriages. The purpose of such shields is to trap the noise from underneath.

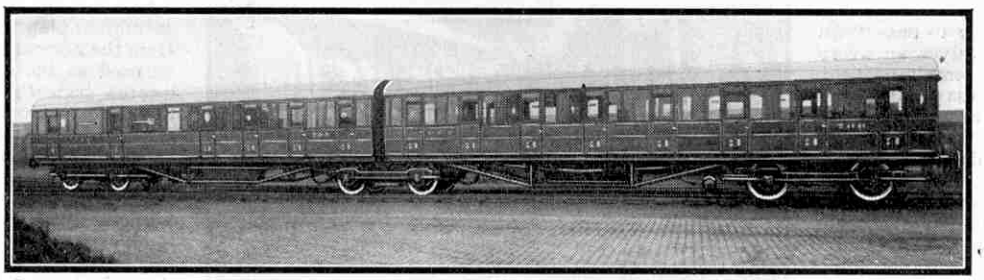
The great and vital nerve centre of the whole Underground system is the Lots Road power house, Chelsea. Current for practically the whole of the Underground lines is generated here, the average output for a day being over a million kilowatt-hours. From this central supply power is carried to over 50 substations where the 11,000-volt 3-phase alternating current supply is converted to 630 volts direct current for traction purposes.

Ceaseless vigilance all the time traffic is running, and a wealth of inspection and renewal during the night hours, have given London the most efficient railway service in the world. It is small wonder that visitors marvel at its regularity, and in closing I cannot do better than quote a story that appeared in *"Punch"* many years ago. An old countryman and his wife sat in a tube station for half an hour or more watching spellbound the ceaseless regular passage of trains. At last the old man could suppress his wonderment no longer and he turned to his wife with " . . . Plumb in the 'ole every time!" This story, appealing as it is in its quaint humour, might well serve as an epitome for the whole Underground organisation which aims at and usually succeeds in giving one hundred per cent. service every day.

New Trains for Cheshire Lines Railway

THE Cheshire Lines Railway is an interesting system, jointly owned by the L.N.E.R. and the L.M.S.R., that links Manchester, Liverpool and Chester, and also serves Southport. Its affairs are directed by the Cheshire Lines Committee and its main line—in spite of the title "Cheshire Lines"—forms one of the three chief routes between Manchester and Liverpool.

With a view to improving the standard of comfort in the trains operating on this route, three complete new trains have recently been obtained. They have been designed by Sir Nigel Gresley, who, as Chief Mechanical Engineer of the L.N.E.R., is also responsible for Cheshire Lines rolling stock; and they have been built by Craven's Carriage and Wagon Company Ltd., of Sheffield. Each train consists of eight coaches made up of four twin articulated units, a new development for Cheshire Lines stock. The two twin units in the middle are a third-class and a composite first-third coach respectively, which together weigh 48½ tons, and at each end is a twin unit consisting of a brake-third and a third-class coach, together weighing 47½ tons. Thus a complete train weighs 192 tons. Accommodation is provided for 40 first-class and 468 third-class passengers.



One of the twin composite and third-class units of the new Cheshire Lines trains described in this article. Photograph reproduced by courtesy of the Cheshire Lines Committee.

The coach bodies are constructed of teak and are mounted on steel underframes. Externally they resemble closely standard L.N.E.R. stock, but they are lettered "C.L.C." to denote their ownership, as the accompanying illustration shows.

Considerable local interest was aroused by the introduction of the new trains for, prior to being placed in service, the first of them with a party of officials on board was run from Manchester (Central) to Liverpool (Central) on 9th April last. Before the start, and during the special stops made at Warrington and Farnworth, the train was "on show," and on arrival at Liverpool it was visited by the Lord Mayor of that city. The Editor of the *"M.M."* of course was invited to the inspection, and the train, headed by L.N.E.R. 4-6-0 No. 2824, *"Lumley Castle,"* in charge of Driver Calvert and Fireman Clunan, of Gorton Shed, made an excellent appearance. On this special occasion a buffet car was attached next to the engine.

Smart outside with their glistening teak sides and white roofs, and running on brown-centred white-rimmed wheels, the trains are even more appealing in their interiors. Well-cushioned seats, Rexine-covered walls and ceilings, and chromium-plated fittings give an air of modern comfort.

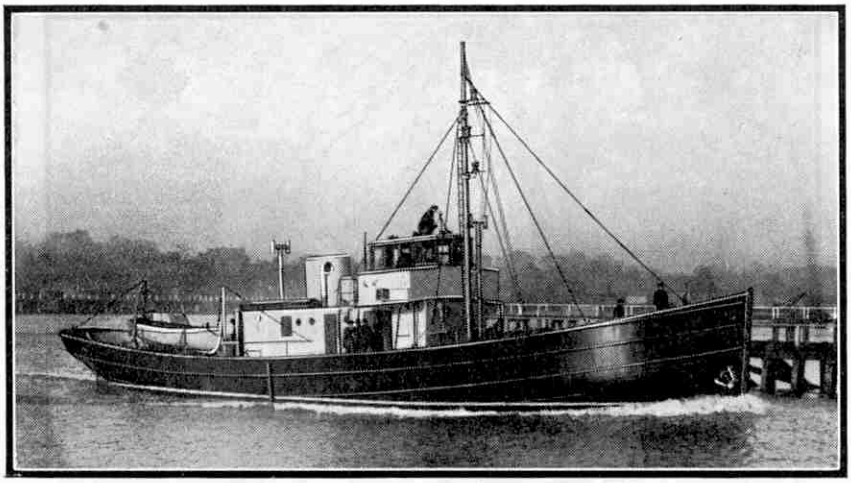
The Pilot Cutter "*Vigia*"

Vessel with Diesel-Electric Drive

THE first pilot cutter in the world to employ Diesel-electric equipment for propulsion was recently built by Fellows and Co., Great Yarmouth, for the Corporation of Trinity House, the authority controlling lighthouses, lightships and navigational aids on the coasts of Great Britain. This vessel is the "*Vigia*," which completed her official trials in January last. Her Diesel engines run at over 1,000 r.p.m., and are coupled to direct current generators supplying current to the propelling motor. The use of reduction gearing between the main motor and the propelling shaft gives the vessel a special interest.

The "*Vigia*" was originally designed for fishing and had all the characteristics of a North Sea drifter. If she had been completed as projected her power would have been derived from steam. The installation of Diesel-electric drive instead has given many important advantages. For instance, it has effected a considerable reduction in machinery space, and also has enabled increased accommodation to be provided for pilots and crew.

With a slightly raked stem and an elliptical stern, the vessel has a flush deck forward to aft and a single low funnel amidships. The enclosed wheelhouse is set at the forward end of the amidships deckhouse, which contains a well appointed galley capable of cooking for 23 persons. Accommodation for officers, crew and pilots is below deck. The pilots' saloon, comprising berths both to port and starboard and a large centre table with seating for 14 persons, is placed forward, and the officers' double berth cabins and the crews' quarters are immediately forward and aft of the engine room.



The pilot cutter "Vigia," the first vessel of her type in the world to be driven by Diesel-electric machinery. Her oil engines were supplied by The Associated Equipment Company Ltd., of Southall, by courtesy of whom this photograph is reproduced.

On deck forward is a Hyland hydraulic windlass operated by an electrically-driven pump in the forepeak, and capable of dealing with a pair of 5 cwt. stockless anchors, and there are davits for two boats.

The engine room, 23 ft. long, 19 ft. 6 in. wide and 8 ft. 6 in. high, absorbs only one quarter of the vessel's length of 92 ft. between perpendiculars. With a moulded breadth of 20 ft. and a moulded depth of 10 ft. the "*Vigia*" thus has an unusual amount of living and working room below deck for a vessel of her size.

The three oil engines driving the generators for supplying current to the propulsion motor are of the A.E.C. 6-cylinder standard type, designed for this class of work. Operating on the 4-stroke compression ignition cycle, and embodying the A.E.C. Ricardo air cell, they have a bore and stroke of 115 m.m. and 142 m.m. respectively and develop 100 b.h.p. at 1,655 r.p.m.

Among the many features of the engines may be mentioned monobloc type cylinders fitted with detachable hardened liners of special cast iron to keep cylinder wear as low as possible. They have overhead valve gear, pistons of heat-treated aluminium alloy with hardened iron pressure and scraper rings and connecting rods made from "H" section drop forgings of nickel chrome steel. Lead bronze bearings are fitted to the big ends and the seven bearing crankshafts are of exceptionally stiff design.

The fuel pump and nozzles are of C.A.V. Bosch design, the nozzles being adjusted to an injection pressure of 105 times that of the atmosphere. An engine governor of the centrifugal type is driven from the same shaft as the centrifugal water pump, and although compact in size is exceedingly powerful in action. Both governor and flywheel have been designed in conjunction with each other in order to obtain the minimum variation in speed between full and no load.

Forced lubrication is provided to all main and crankpin bearings, and the valve gear is fed with low pressure oil bled by a special device from the main oil pump.

An interesting feature is that the engines employ a fresh water cooling system, the fresh water being circulated through each unit and a heat exchanger by individual centrifugal type pumps. The lubricating oil also is cooled by a circulating column of fresh water passing through the engine oil cooler and the heat exchanger. The fresh water is itself cooled by the continuous pumping of sea water through the heat exchanger. This method of cooling has the special advantage that it eliminates sea water corrosion in the cooling system.

The lighting aboard the "*Vigia*," including all navigation lights, is maintained on a 24-volt system employing large capacity nickel-iron batteries. These are in three sets, each of which is charged by one engine and supplies one section of the vessel.

Several novel features are embodied in the electric propulsion equipment, the auxiliary electric machinery and the switchgear, all of which have been made by the British Thomson-Houston Co. Ltd. The three A.E.C. oil engines are directly coupled to 66 kW 250 volt direct current shunt wound generators, which supply current to a propulsion motor capable of developing 50 s.h.p. at 500 r.p.m., and 240 s.h.p. at 1,050 r.p.m. The speed can be lowered to 125 r.p.m. by means of double helical reduction gearing.

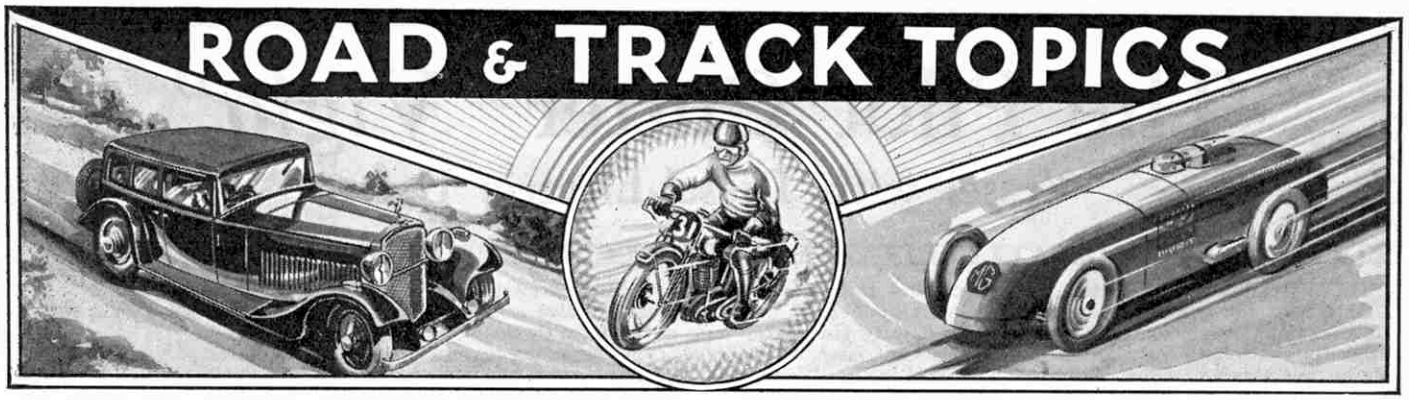
The switchboard comprises panels for the three 250 volt generators, one panel with engine room control gear, and one auxiliary motor panel equipped with starters for a 3 h.p. circulating pump motor. A panel is also fitted to control the 12 h.p. windlass motor and battery lighting. The equipment includes a bridge controller, an illuminated propeller tachometer, or revolution counter, and a direction indicator. The bridge controller can be moved from full ahead to full astern, or vice versa, as rapidly as needed.

An outstanding feature of the propelling equipment is that it requires the minimum of attention, only one engineer being necessary. The vessel can be operated at full power in less than two minutes after starting from cold, and thus the stand-by operating charges are considerably reduced when compared with those of a steam driven vessel.

The heavy weather experienced off the east coast at the end of January, when the official trials were carried out, gave a valuable opportunity for observing the "*Vigia's*" behaviour in difficult conditions. During these trials the passage from Great Yarmouth to Harwich, a distance of 49.5 miles, was accomplished in a choppy sea in 5 hrs. 15 mins., the "*Vigia*" travelling at one period at a speed of more than 9½ knots. It was noted that at any power with one, two, or three engines there was no sign of propeller racing.

A highly satisfactory feature also established during the trials was that the engine room is remarkably free from vibration, while noise or "whine" cannot be heard from the propeller gears at any loads. There is in fact no more noise to be heard on deck than when standing beside a modern bus, and in this respect the vessel is claimed to be superior to any of the Diesel-electric tugs put into service in English waters during the last four years. This freedom from noise applies equally to rapid manœuvring and to steady propelling periods.

We are indebted to The Associated Equipment Co. Ltd. for the information given in this article.



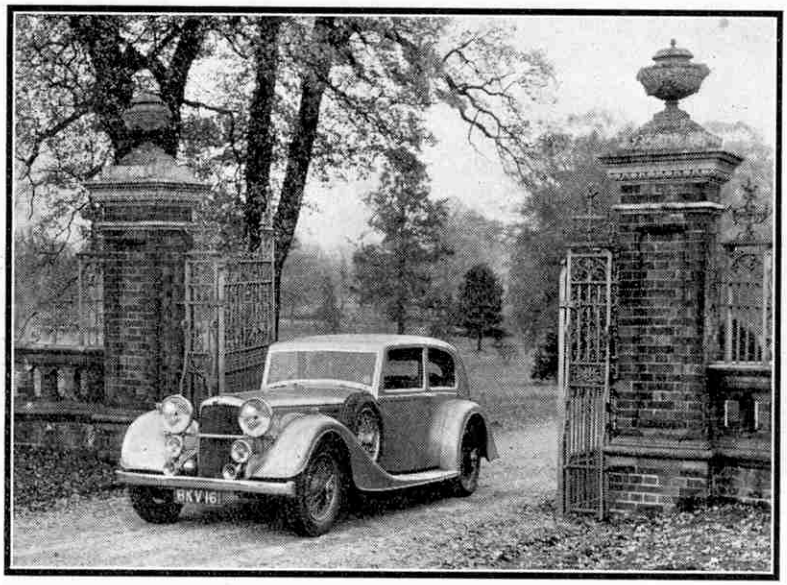
More British Road Racing This Season

The 1937 season promises to be a very exciting and busy one for English racing drivers, for this year two new road circuits will be available in addition to the already well-known and popular course at Donnington Park. There will therefore be more road racing events than ever before.

One of the new circuits is situated at Brooklands, less than 20 miles from London, and the other is a two-mile course that has been built in the grounds of the Crystal Palace. During the winter months, while the Brooklands track has been closed for repairs, work has proceeded on the making of a road course, and this will be completed in time for the first race to be run on 1st May, when famous British drivers, both men and women, will compete in a scratch race for the Campbell Trophy. This race will be run over 100 laps of the course, making a total distance of approximately 220 miles, and will be limited to 30 cars. In addition to the Trophy there will be a cash prize of £250.

Important races to be run at the Crystal Palace Course this year are the London Grand Prix on 17th July, Crystal Palace Cup Race on 14th August, and the Imperial Trophy on 9th October.

Donnington Park also will have a busy season. On 12th June the race for the Nuffield Trophy will be run. This will be followed on 28th August by the 200 Miles Race organised by the Junior Car Club and the Donnington Grand Prix which will be run on 2nd October, over a distance of 300 miles.



An Alvis 1937 model 4.3 litre saloon car shown in an attractive setting. It is fitted with independent front suspension and is very smooth and silent in operation. Photograph by courtesy of Alvis Ltd., Coventry.

In June the famous R.A.C. 200 Miles International Race, which is limited to cars up to 1,500 c.c. capacity, will take place at Douglas, Isle of Man. Last year the event was won by R. J. B. Seaman's Delage at an average speed of 69.76 m.p.h.

136 m.p.h. in Brooklands' Fastest Race

The fastest race run at Brooklands since the famous track was opened in 1907 thrilled a great crowd of spectators at the first meeting of the 1937 season, held on Easter Monday. The chief event of the day was the Broadcast Trophy Handicap, won by John Cobb, who drove his huge silver machine at 136.03 m.p.h. from a standing start.

Cobb had to give starts to nine other competitors, but he won with ease. His car, which is capable of 170 m.p.h., and has maintained 150 m.p.h. for 24 hours, holds the Brooklands' lap record at 143 m.p.h. Third in this race was Mervyn-White's Bugatti. This machine won an earlier race at the fine speed of 121.4 m.p.h.

Prince Birabongse of Siam, who races under the name "B. Bira," made an exciting beginning to the season's racing. When taking part in two "mountain" races, in which he won a second and a third prize respectively, he twice narrowly avoided collisions, and it was only his skill and daring that got him out of tight corners on several occasions when he was within inches of disaster.

Small Car to Attack Land Speed Record

Mr. F. W. Dixon, the motor-racing driver, who has a reputation for making small unsupercharged cars produce speeds far beyond their designers' hopes, is building a small car of his own design, with which he intends to attack the world's land speed record. Dixon believes that the car will be capable of a speed of 375 or even 400 m.p.h. It will be shaped something like a dart or a hollow cigar, and the driver will sit in the nose or point of it. All four wheels will be driven, and all of them will move in response to turns of the steering wheel.

The engine will be designed on an entirely new basis. It will be a two-stroke 1,000 h.p. supercharged unit, and will not have a crankshaft like an ordinary engine; instead the pistons will be set radially about a centre and the drive will be transmitted through an improved swash-plate.

Dixon plans to attack the record next year either on the Salt Lake beds at Utah in the United States of America or, more probably, on one of the great European motor roads.

£200,000 Race Track in New York

A four-mile serpentine dirt track, which has cost £200,000 to build and accommodates more than 50,000 spectators, has been constructed on the old Roosevelt Field in Long Island, New York City. The track has a specially prepared dirt surface and its width varies from 60 ft. to 100 ft. The track carries on the speed tradition of the site on which it is constructed, for many famous transatlantic flights, including those of Colonel Lindbergh and Commander Byrd, have been started from Roosevelt Field.

The track is protected on each side throughout the full length of the course by steel guard rails. Outside the rails, and between the track and the space for spectators, there is a safety zone 30 ft. in width, and at the edge of this zone there is a heavy steel wire fence. At the most important turns additional protection is provided by concrete walls, and chutes have been built so that cars travelling at high speeds and overshooting the turns can roll harmlessly down them, out of the way of cars behind.

At various points on the course signal lights have been installed, each having a red, a yellow, and a green light. In the event of a serious accident, any one of five field judges situated in towers at different points round the course can signal all cars to slow down by showing the yellow light. The red light is used to stop all cars if necessary, and the green light is an all-clear signal.

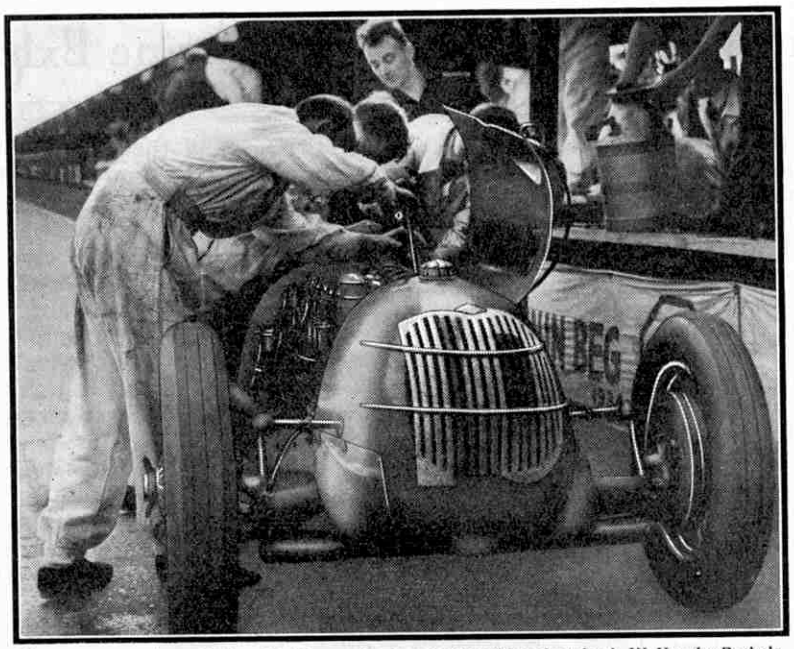
How B.R.D.C. Star Marks will be Awarded

The system of allotting marks to British racing drivers competing for the two stars awarded by the British Racing Drivers' Club has now been decided. The road star marks for the first five places in an international race, with the exception of the B.A.R.C.

events, are 10, 8, 6, 4 and 3 respectively. Mountain races such as those held at Brooklands are worth one mark for a win, except in the championship, in which there are two for a win and one for a second place. The winners of races up to 25 miles held at Donnington Park, Crystal Palace and the Brooklands Road Circuit will receive two marks for each event and the second driver will be awarded one mark. Wins in races of over 25 miles and up to 99 miles at these courses will count three marks, with two marks for a second and one for a third place. For races of 100 miles and over the marks to be awarded are 4, 3, 2 and 1 respectively for the first four in order.

If two drivers handle a car during a race, the second driver has to drive for 40 per cent. of the distance, instead of 25 per cent. as last year, when the race exceeds six hours; otherwise the marks will be halved. Eight starters are necessary in all races.

In outer circuit races up to 20 miles the first three drivers will receive 6, 4 and 2 marks respectively. Races of 20 to 100 miles will bring 8, 6 and 4 marks for the first three places; the first five in races of 100 to 250 miles 12, 9, 6, 3, 1 marks; and in races of over 250 miles the first six to finish will receive 15, 12, 9, 5, 4 and 2 marks respectively. Team races are excluded and in races with several heats and a final, only the final will count so far as the awarding of marks is concerned.



When every second counts! A quick fill up and a change of sparking plugs for A. W. Von der Becke's Riley, during the B.R.D.C. 500 Miles Race at Brooklands last autumn. Photograph by courtesy of "The Riley Record."

Brilliant E.R.A. Victories in South Africa

The famous E.R.A. racing cars, which achieved so many notable victories in 1936, opened the 1937 season with brilliant wins in the series of three races run in South Africa early in the year. In the South African Grand Prix, which was run at East London, an E.R.A. driven by Pat Fairfield maintained an average speed for the course of 89.17 m.p.h., and finished first from two Riley cars driven by B. Meyer and F. Chiappini respectively. The E.R.A. cars beat not only several other crack British racers, but also a number of Auto-Unions, driven by famous Continental drivers.

Accidents and engine trouble caused a number of retirements early in the race, so that with the event only half run only 15 of the original 24 starters were left. One of the Auto-Unions driven by Rosemeyer made a record lap at 115 m.p.h., and later caused great excitement when the near side rear tyre of his car burst with a report that could be heard half-a-mile away. The car skidded viciously across the road, but Rosemeyer skilfully regained control and dashed to the pits for a change of tyres.

In the last lap a Riley, driven by B. Meyer, a South African driver, took the lead from Fairfield's E.R.A., but both cars were going so well that at this period it seemed to be anyone's race. After an exciting tussle Fairfield succeeded in overhauling his rival, however, and managed to hold first place until the end.

A splendid performance was put up by R. Seaman's Delage, and this driver was most unfortunate when the rear wheel of his car came off while completing the last lap. The Delage tore along on three wheels and one brake drum. Little damage was done, but Seaman was obliged to retire.

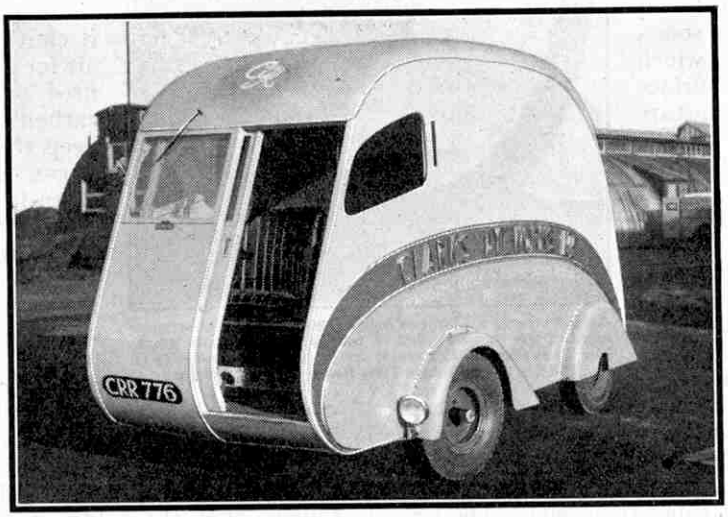
The next race in the series nearly resulted in a victory for an E.R.A., this time driven by Lord Howe. From the start Lord Howe gave a wonderful display of fearless and skilful driving, and flashed into the lead at the three-quarter stage. With only four laps to go, however he was forced to call at the pits for a change of plugs. This gave an opportunity for an Auto-Union driven by Von Delius to reduce the lead, and in the third lap from the end another Auto-Union driven by Rosemeyer flashed past both these machines into the leading place, which it held until the end after a very close and exciting finish.

The final race of the series ended in a splendid win for Fairfield's E.R.A., Lord Howe being second. The race took place over a circuit 2½ miles in length and Fairfield's average speed was 53.43 m.p.h. for a distance of 170 miles. The Auto-Unions did not compete on this occasion.

In addition to these fine wins in the South African races an E.R.A. car driven by Connell, who was at the wheel of one of these machines for the first time, was second in the Swedish Ice Race, which is very creditable in view of the fact that Connell had no previous experience of racing under such slippery conditions as those met with in this annual race over frozen lakes and roads.

A Noiseless Motor "Horn"

A noiseless motor "horn," which is intended to be used as a signal to the driver of a heavy motor lorry that he is about to be overtaken, has been invented and tested in Germany. Ordinary horns often are unheard by the driver of a noisy lorry, but the warnings of the new device cannot remain unnoticed, for it emits high-frequency electric waves that set in motion an electric buzzer and also switch on a lamp in the driver's cabin. The lorry driver then presses a button that changes the rear red light to green to indicate that he is ready to be overtaken. Simultaneously a light in the front of the lorry is switched on to warn oncoming traffic.



The one ton electrically-propelled delivery van described on this page. It was manufactured by Erewash Electric Traction Co., Heanor, to whom we are indebted for our illustration.

Electrically-Propelled Delivery Van

The lower illustration on this page shows an interesting streamlined one ton delivery van that is propelled by a specially designed electric motor supplied with current from batteries housed in lead-coated steel cases. The motor is controlled from a new form of pedal-operated controller, which gives three speeds forward and reverse, and the batteries are of sufficient capacity to give the vehicle a working range of 50 miles. The maximum travelling speed is 18–20 miles per hour. The vehicle has a wheel-base of 6 ft. 6 in. and the chassis is fitted with Bendix brakes, including a new pull-on type hand brake, which is fitted to the dash.

The outstanding feature of the streamline body is a front sliding door in front, which gives access to the driver's cab. The rear of the van is enclosed by a sliding shutter, which disappears into the roof, and the interior is fitted with two large chromium plated racks for goods that require special care in handling. The vehicle was manufactured by the Erewash Electric Traction Co., Heanor, for Clarke's Dyeworks Ltd., Retford.

The Clarkson Thimble Tube Boiler

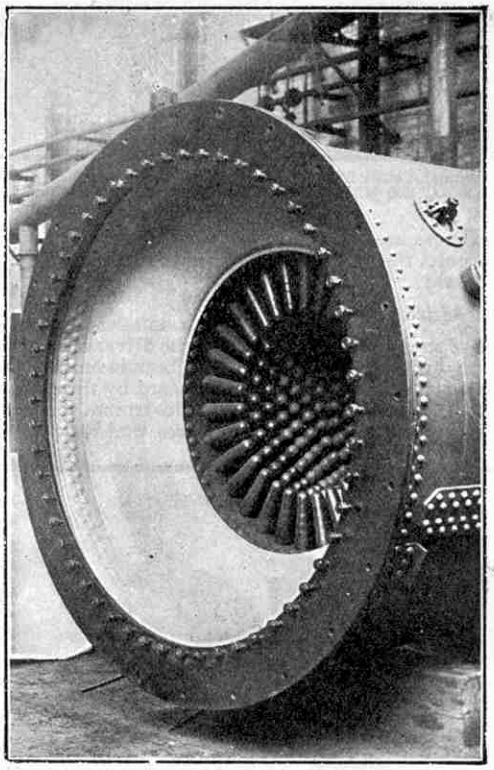
Using Waste Heat of Diesel Engine Exhausts

WHEN a gas or oil engine is working the waste gases that pass out of the exhaust ports are at a very high temperature. Normally these gases after leaving the cylinders, pass through a silencer and thence direct into the atmosphere. The heat contained in them is therefore wasted and in the case of a very large engine, such as the great Diesel engines used to propel modern motor ships, the amount of heat thus lost is considerable. By passing the gases through a properly designed boiler, however, the greater part of their heat can be recovered and utilised to generate steam for working auxiliary machinery and afterwards for accommodation heating.

Boilers of this kind are known as waste heat boilers and many different types are now in use, some of which are designed for working on exhaust gases only while others can be fired by exhaust gas and oil or other fuels simultaneously or separately.

One popular type of waste heat boiler is the Clarkson Thimble Tube unit. This is suitable for many duties on land and sea, and can be adapted for use on various fuels, but is chiefly designed to extract heat from the exhaust gases of internal combustion engines and to utilise the heat recovered to generate steam.

The essential feature of the Clarkson boiler is an arrangement of small water tubes, in shape somewhat like elongated thimbles, which comprise the main heating surface of the boiler. These thimble tubes are fitted into a cylindrical shell or firebox that forms the inner wall of the boiler. How this is done is seen in the lower illustration on the opposite page, where a boiler of this type is shown with part of its outer shell removed. The tubes project inward into the central cylindrical space through which the hot exhaust gases pass. In a single boiler unit there are many hundreds of thimble tubes, each of which is tapered to accommodate them into the centre space and to allow plenty of room for proper spacing. The water is contained in the space between the inner and outer shells, and of course, in the thimble tubes themselves. The circulation and percussive action of steam generation is dealt with later on.



An end view of a Clarkson boiler showing the radial arrangement of the thimble tubes in the path of the waste gases. The illustrations to this article are reproduced by courtesy of The Clarkson Thimble Tube Boiler Co. Ltd., London.

For the purpose of explanation the arrangement of these thimble tubes may be likened to that of the bristles of a bottle brush, which is used for removing dirt from the walls of a bottle or other cylinder. A brush of this kind has a stiff central stem with bristles projecting outward from it. If we imagine this brush turned inside out with the bristles pointing inward, we have a fair representation of the form of the Clarkson boiler, which is used for "scrubbing" the heat out of hot gases that are passed upward through the thimbles.

When the boiler is in operation the exhaust gases impinge on the thimble tubes at right angles causing steam to generate near their closed ends. The steam is blown outward toward the mouth. Immediately this occurs water rushes into the tube to fill up the space thus made, and this sets up a percussive or beating action that has a frequency of about 90 to 160 beats per minute. As a result of this action particles of scale-forming matter contained in the water are unable to settle, and gradually they work down the annular water space into the boiler, where they fall to the bottom and are easily removed by means of a blow-down valve or the mud doors provided.

A core fills up the space in the centre of the boiler and forces the hot gases to follow a tortuous path between the thimbles. In this manner the gases have the heat more or less "combed" out of them as they pass through the boiler, and they are then exhausted to the atmosphere.

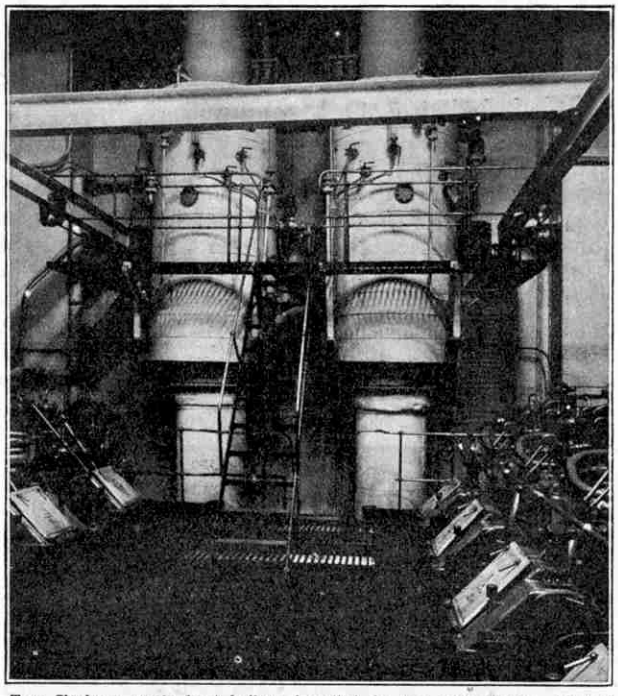
The illustration on this page shows the end of a Clarkson boiler with the centre core removed. The chief purpose of the centre core is to divert the gases through the nests of thimble tube heating surface, but it can be used also for heating the air for the burners if the boiler is oil fired, or as a soot blower to remove carbon deposits from the tubes and keep the heating surface clean, and it can also be used to by-pass the gases from the thimbles.

A cylindrical baffle is placed in the water space between the inner and outer shells of the boiler. The purpose of this is to set up proper circulation of the water and to distribute the cold feed, bringing fresh quantities of water to the tubes in a constant steady flow to replace the water evaporated. The water inside the baffle is nearest the heated tubes and this is hotter and lighter than that on the outside. It therefore tends to rise upward. From this it automatically follows that the colder water outside the baffle must travel downward and pass round the lower edge of the baffle to take its place. The constant circulation that is essential for efficient steam raising is therefore set up.

The Clarkson Thimble Tube unit is made in two forms with tubes turning inward and outward respectively, and in order to meet various requirements, the boiler is made in a large range of different types, each of which is designed for a particular kind of work. In all these types, however, the basic principle of the thimble tube system

of construction is maintained.

In one form of Clarkson boiler that is admirably suited for use in twin screw ships propelled by two Diesel engines, two boiler units are used and one of these has tubes turning inward for oil firing and it is placed inside the second, which has tubes turning outward for exhaust gases, with wide water space between. The outer thimbles are enclosed in separate casings for port and starboard engines respectively, and the oil-fired unit is distinct from the exhaust gas unit. Steam can be recovered from waste heat, or generated by oil firing either independently or simultaneously.

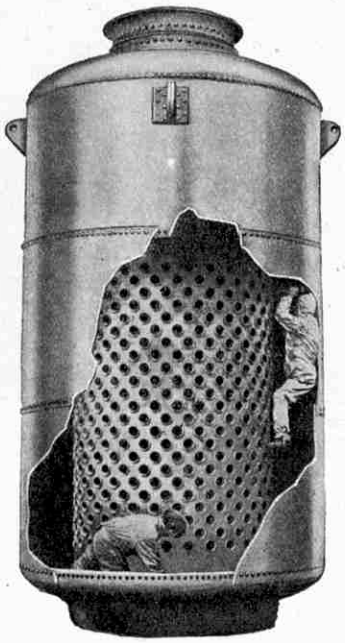


Two Clarkson waste heat boilers installed in the engine room of M.V. "Calgarolite." They are used for supplying steam for heating oil tanks and the accommodation on board, and also for galley purposes.

Steam demands vary considerably in ships of different types. In a passenger ship, where steam is used for heating the passenger accommodation and for other domestic purposes, there may be periods during the day when more steam is required than it is possible to generate by exhaust heat alone, while during the night more steam is generated than can be utilised. In cases like this composite boilers are sometimes installed. In these boilers exhaust gases and oil or coal fuel can be used simultaneously or separately. It is generally found that sufficient heat is stored during the night, and part of the day, to supply requirements at peak loads without lighting the oil burner, however, and if this has to be done, it is usually only for short periods. In some installations, the burner is lighted automatically when the steam pressure falls below a predetermined level and remains in action until the pressure returns to normal when it is automatically shut down.

To meet these requirements, the Clarkson Thimble Tube Co. Ltd. has developed a system that has been proved very successful on land installations and Diesel-engined rail cars, and is now being installed in several new motor ships that are under construction in this country and abroad.

A standard Clarkson Thimble Tube oil-fired boiler is fitted on the engine-room floor, and is connected up to the steam range and equipped with a feed pump in the usual manner. A Clarkson Thimble Tube silencer-economiser, which is operated by the exhaust gases from the main engine, is installed between the exhaust pipe of the Diesel engine and the funnel. A special centrifugal pump circulates the boiler water through the economiser, where it collects the heat from the exhaust gases, and from there the steam and water return through a pipe to the steam space of the boiler. At this point a steam separator is fitted and this returns the excess water to the boiler and liberates the steam, which is taken off through the main stop valve.



In this view of a Clarkson boiler part of the outer wall is cut away to show the inner cylinder, into which the thimble tubes are fitted. Ample space is provided between the inner and outer cylinders to permit inspection and cleaning. Note the diagonal passage for the gases, which can also be seen in the illustration on the opposite page.

When the main engines are not working, the economiser heating surface is disconnected from the system by stopping the circulation, thereby reducing heat losses. With this arrangement, one or several silencer-economisers operating on waste heat from various sources, such as from the main engines and auxiliary engines, may be connected up to the main oil-fired boiler.

A particularly interesting use for the Clarkson boiler has been found in connection with Diesel-engined railcars. On a steam-driven train the boiler of the locomotive constitutes a reservoir of steam that is available not only for propelling the train, but also for heating the carriages and for use in the kitchen car services.

In a Diesel-engined train, this heat is not available and it is therefore necessary to provide an alternative supply. For this purpose a special type of Clarkson boiler using heat from the exhaust gases of the propelling motor, has been produced. This boiler is designed on the thimble-tube system adopted for the standard Clarkson boilers, but certain modifications are introduced to fit it for use as a silencer without water during the summer months, when no heat is required for the coaches.

A boiler of this kind forms part of the equipment of a new A.E.C. Diesel railcar built recently for the G.W.R. The railcar is illustrated and described on page 277 of this issue. It is designed to haul a load comprising a trailer coach, horse-boxes and other vehicles amounting to about 60 tons, and the Clarkson boiler is used for heating the trailer coach. This boiler is installed in the luggage compartment. It works in conjunction with an economiser, which is also heated by the exhaust gases from one of the two Diesel engines, and is automatically fed with water from tanks carried beneath the floor of the trailer.

The Clarkson Thimble Tube boiler units already described have various other uses. For instance, large industrial concerns and institutions frequently generate their own electricity by Diesel engines, and in order to obtain the highest thermal efficiency the waste heat from the engine exhaust is used to heat water for central heating. In instances where the output of the generating plant is erratic, the load on the engine is levelled by installing electric immersion heaters in the waste heat boiler to use the surplus current.

For use in works where a quantity of refuse has to be destroyed, a boiler that works in conjunction with the general heating system is available.

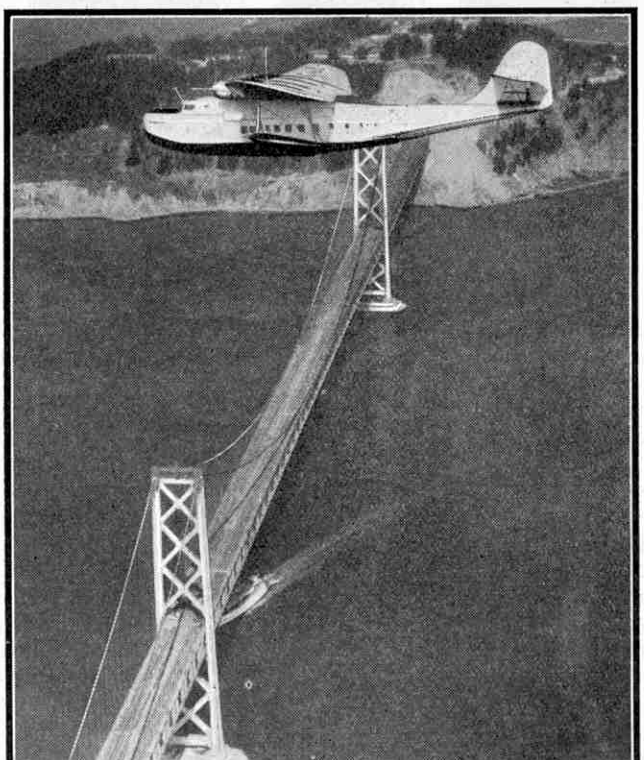
Across the Pacific By Air

Flying a Martin "Clipper Ship"

By E. O. McDonnell

THE 14th of October 1936, is a date to set down in the historical calendar of aviation, for it marks the start of the first passenger flight from continental United States to China. At three o'clock in the afternoon of that day the *"Philippine Clipper,"* Captain J. H. Tilton in command, with a crew of six, a passenger list of eight and several hundred pounds of mail and cargo, roared along the rippling surface of San Francisco Bay. Her four "Twin Wasp" radial engines worked up almost to their full revolutions, and she climbed into the air, bound west for Cathay. Her total load was almost 26 tons, and yet she took less than 60 secs. to get into the air, a tribute to the machine, the pilot, the power of her engines and the efficiency of her constant speed propellers.

My first view of the *"Philippine Clipper"* was from the bridge of the steamship *"Lurline"* not long after sunrise on the morning of 15th October. We had left San Francisco on 10th October, four days ahead of the flying boat, and we travelled on one of the famous greyhounds of the Pacific. Our steamer, fast as she was, seemed to be anchored when the wide-winged Martin "Clipper" came flying out of the orange and red sky of the morning, to salute us with a graceful dip of the big wings and a wide circle before speeding on toward Diamond Head and a landing at Pearl Harbor, Honolulu. Later in the day we learned that the crossing from dock to dock had been made in 17 hours and 43 minutes.



The "Philippine Clipper" clearing the Golden Gate Bridge, San Francisco, and heading outward towards the Pacific Ocean at the beginning of its flight to China. The machine is a Martin flying boat, with four 830 h.p. Pratt and Whitney "Twin Wasp" radial engines.

Long before daylight next morning the passengers met for breakfast in the dimly-lighted dining room of our hotel, and half an hour later we were speeding out through a forest of tall green sugar cane and avenues of the red blossomed hibiscus to the beautiful little terminal pier on Pearl Harbor. The passengers were shown to seats in the cabin, in accordance with the allocation ordered by the first officer, who joined the captain at the controls for the take-off. The navigator sat in the navigation compartment, just forward of the big lounge, his charts for the flight to Midway spread out on his roomy nine-foot table. The third officer sat in the lounge with the passengers, and the engineering officer was perched almost over our heads, practically in the wing, where he was surrounded by more than 40 instruments and dials. Directly behind the "bridge," which is the name of the cockpit in this sea-going aeroplane, was a small cubby with chair and desk for the radio operator.

With crew and passengers thus distributed we took off after taxi-ing a mile or so from the pier down a narrow channel to open water. The skipper swung the big flying boat around into the wind and opened up each engine. Then we straightened out. The "Twin Wasps" settled to their work, and in 50 secs. the *"Philippine Clipper"* shook the last drops from her hull and started her climb. We were not 500 ft. above the water when the captain cut the engines to two-thirds throttle, and in a few minutes, a mile in the air, we left Barber's Point astern. This is the southernmost point of Oahu, on which Honolulu stands, and we were still climbing when the blue-black mountains of the island dropped towards the horizon.

I don't know who is busier aboard the *"Philippine Clipper,"* the navigator or the engineering officer. The navigator's chart table is 9 ft. long and at least 3 ft. wide. An aperiodic compass and a chronometer set to Greenwich Central Time occupy two wells in the table top. Beneath are sets of drawers with charts, and on shelves above are books filled with navigation tables and data. There are also two bubble octants and a drift indicator. On the floor beneath the table are crates of flares, and smoke bombs and aluminium bombs to use in finding drift. Navigation on the surface of the ocean offers many problems, but in the air in a machine moving along at 150 knots, when different winds are encountered at different levels and the objective is a tiny reef not 10 miles across and 1,300 miles away, the difficulties are increased many times.

The visitor has to crawl on his hands and knees to reach the engineering officer, who sits in a low hung deck chair, a writing board on his knees and several sharp pencils close at hand. On this board is a special lined and ruled pad on which he makes 170 entries an hour, or more than 10,000 for each Pacific flight. This comprises a complete record of power plant

performance. When a sheet is filled the engineering officer signs it, the skipper initials it, and it is filed for study later. Throughout our entire journey of almost 20,000 miles those engines droned along without a single skip. They started quickly each morning and at the end of the journey were working just as smoothly and efficiently as at the start.

The automatic pilot does most of the flying, but there are always two pilots on duty. Out of the crew of six, at least four are experienced boat pilots with 1,200 hours or more to their credit. All are qualified radio operators and, with the exception of the skipper, they take their turn at the radio. In addition at least three are competent to relieve the engineering officer, and at least two in addition to the skipper can take over the duties of the navigator. There are always five men on duty, and the bridge is connected by telephone with the radio, navigating and engineering stations, so that the skipper can talk to any one on duty without leaving his seat.

The "Philippine Clipper" at Midway Island, one of the intermediate stations of the trans-Pacific route from San Francisco to China.

Shortly after noon the steward served us lunch and some of us slept awhile. We passed over Necker Island, a bleak rock sticking up out of the blue Pacific, French Frigate Shoals, where the flying boats of the United States Navy sometimes alight inside a 25-mile reef, and several other reefs on that first day out from Honolulu. Then late in the afternoon we were informed that Midway was visible ahead and a few minutes later we could see the deep blue of shoal water fringed with a lace surf. We circled over the lagoon and looked down on the two tiny islands, one containing perhaps 30 and the other 100 acres or a little more, and presently were greeted by the airport manager.

Morning found us on our way to Wake, another atoll 20 miles in circumference, with a shallow lagoon three miles across sheltered by three islands set down in a rough horseshoe nowhere more than 300 yds. wide. We made the 1,252-mile flight from Midway in 9 hrs. 38 min. and arrived in time for a swim before dinner. Again there was the comfortable hotel with baths, and hot and cold water with each room. The water is heated by the sun and we were informed that in less than an hour enough hot water was produced to meet the requirements of the hotel for an entire day.

The engineering officer at his station, where he keeps watch on more than 40 instruments. He is reporting by telephone to the captain on the "bridge."

During this part of our flight we crossed the international date line and skipped from Saturday, October 17, to Sunday, October 18, so that it was Monday when we took off for Guam. The skipper caught a tail wind and we made the 1,560-mile jump in 10 hrs. 10 min. The United States Navy has controlled Guam ever since the war with Spain in 1898, and the condition of the natives and their villages is a tribute to naval administration.

Next morning we were again up before daylight for the 1,600-mile hop to Manila and Captain Tilton made a beautiful take-off with a load of 52,000 lb. amid swells that alternately clutched at the hull and battered it as our speed went up. We climbed to 9,000 ft. and held to our course for the first hour. Then to clear clouds and a typhoon that lay ahead we detoured, but in spite of flying further than the great circle distance we were on the water at Cavite, in Manila Bay 12 hrs. 20 min. after leaving Guam. That should have been our terminal, but after two busy days in Manila we took off for Macao and Hong Kong. The sky was overcast most of the way, and in places the clouds piled up above to a height of 35,000 ft. After lunch at Macao we flew 40 miles further on to Hong Kong.

We spent the night at Hong Kong, and on the next morning began the return voyage across the Pacific Ocean. In general this was much like the outward journey, but we were held up at Guam by typhoons, and were also delayed at Midway. On our arrival at Honolulu we found that shipping was crippled by a marine strike on the West Coast of the United States. In consequence the load of mail waiting for us to carry forward was 650 lb. heavier than usual.

There are many things to remember about the flight from Honolulu to California, the final stage of our return journey. Two stand out prominently in my mind, however. One is the extraordinary accuracy the navigators achieve in their difficult task. The other is the splendid manner in which the great Pacific "Clippers" ride the air.

A Giant Plate Band Conveyor

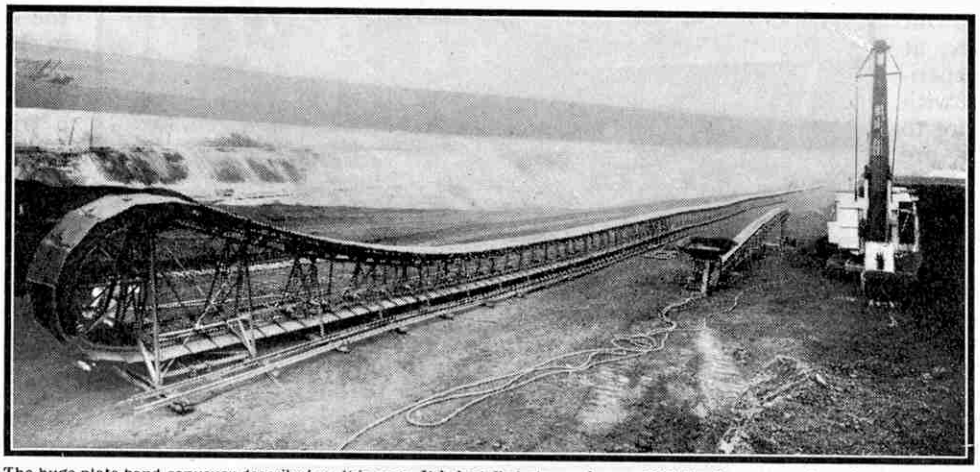
Transporting Brown Coal from Open Mines

By H. F. Kutschbach

A MEANS of transporting materials cheaply and efficiently from one part of a factory or works to another is of the utmost importance in all industries where materials have to pass through several departments in the course of production. The old-fashioned method of transporting goods by means of trucks pushed by men, which was used until comparatively recent years, was costly on account of its relative slowness, and also because of the great amount of labour involved.

Nowadays ingenious but simple mechanical conveyors of various kinds have been introduced to do the work, and are largely used in modern factories where large quantities of raw materials or finished goods have to be dealt with.

One of the simplest of these devices is the gravity conveyor, which is particularly suited for carrying boxed products and goods that have at least one flat comparatively hard surface. A gravity conveyor requires no motive power, but relies for its action entirely on gravity. It consists usually of a series of steel rollers horizontally mounted on ball bearings between steel side supports, the whole arrangement being inclined so that there is a slight gradient. The goods to be transported are placed on the rollers at the top of the incline, and slide slowly to the lower end. Gravity conveyors take up little space and can negotiate bends easily, and because of their many advantages they are widely used in a variety of industries.



The huge plate band conveyor described on this page. It is installed at a surface coalfield in Germany and carries a continuous stream of coal from the workings.

Loose materials such as ores and coal often have to be carried a short distance from the loading point, and then lifted and discharged into storage hoppers. For instance, coal has to be lifted to the feed hoppers of the mechanical stoking plant of boiler installations. In cases of this kind bucket conveyors are installed. The material is carried in a series of buckets mounted at short intervals on an endless steel chain that runs round driven sprockets at each end. Conveyors of this kind can be used in either a vertical or horizontal position, and they are made in all capacities up to hundreds of tons per hour.

Anotner view of tne plate band conveyor shown above. It runs alongside the surface workings and the workmen dig the coal and load it directly on to the travelling band.

Where large quantities of light dusty materials have to be dealt with, as in flour mills and grain warehouses, special conveyors often are installed. These are simply long steel spirals of coarse pitch that rotate in steel-lined troughs into which the material to be moved is fed. As the spiral rotates its coils push the material forward.

The most widely used type of conveyor, however, is the continuous band or belt, which also is largely employed in flour mills and grain stores. For carrying light goods and materials the band is made of canvas or rubber, but in the larger and heavier sizes it is constructed of steel plates hinged together and pivotally attached to a chain, which passes round driven sprockets at each end. The lighter band conveyors are used for carrying continuous streams of goods to automatic packing or assembling machines, while plate band conveyors are extensively used for the transportation of loose and heavy materials such as ores, gravel and coal.

A huge plate band conveyor specially made for outdoor work is shown in the illustrations on this page. This conveyor is installed at a German brown coal mine, where the coal is found near the surface and is mined by digging after the overburden, or earth or clay covering, has been removed. Brown coal contains a large proportion of water and the conveyor illustrated is used for removing it to drying grounds.

A conveyor of this type can be loaded at any point throughout its length, either by hand or mechanical means, and can be moved from place to place as required. The unit method of construction adopted in its design enables conveyors of any required length to be built up, and changes can be made quickly whenever they become necessary. Repairs and renewals also are easily carried out without delay since the plates and other parts are standard and interchangeable.

Special discharging platforms or similar devices are unnecessary, and the conveyor is flexible, so that it can be taken over rough ground, and even up and down hills, as well as round corners and along curves. Although it is intended mainly for use in surface coalfields, it is also suitable for carrying away material excavated in preparing the foundations of roads, and for conveying cement, gravel or other constructional materials to the required points, while it can be used without difficulty in underground mining.

The conveyor consists of an endless band of curved steel plates which are strengthened with iron angles and mounted on roller bearing runners that travel on rails supported by a framework of angle girders bolted to wooden sleepers. The trucks are pivotally connected to a continuous chain driven by sprockets spaced at suitable intervals along the conveyor line and operated by individual electric motors, all of which are controlled from a common centre.

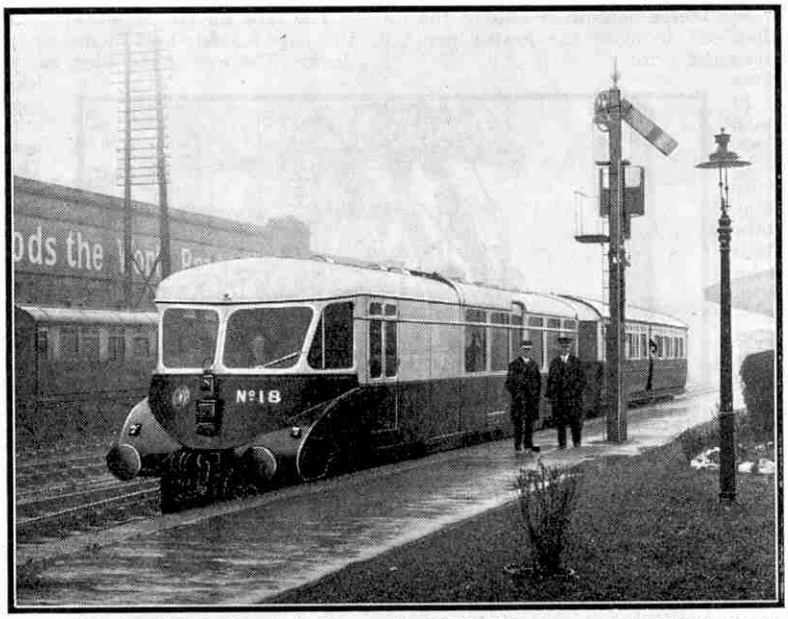
At points where the conveyor passes over a hillock a sprocket chain without drive is employed on the downward side, so that the weight of the loaded trucks descending is utilised to assist in driving the whole conveyor, thus lessening the motor power required.

New Railcar for the G.W.R.

Special Design for Branch Line Working

IN recent years the practice of the G.W.R. has been notable for the use made of streamlined oil-engined railcars for an increasing variety of purposes. In December 1933 we recorded the introduction of the first vehicle of this kind, which was called *"No. 1,"* and placed in regular service in February 1934. It was designed for local working and fitted with two A.E.C. heavy-oil engines of the type used in many of London's buses. This railcar evidently has proved an adaptable prototype. The main features of its design were retained in the cars subsequently introduced with buffet service for express working between Birmingham and Cardiff and other routes, and also in the streamlined express parcels railcar *"No. 17"* that was brought into use last year between London and local stations to Reading and Oxford. The first 17 G.W.R. railcars have covered over 1¼ million miles since their introduction, and of this the share of *"No. 1"* is about 170,000 miles.

"No. 18," the latest development of the original pattern, has been in service on the Lambourn Valley branch of the G.W.R. since 5th April. The previous 17 cars were designed to operate as single units. The purpose of *"No. 18"* is to replace the steam-hauled branch line trains that have until the introduction of the new car been operating the Lambourn Valley branch. It therefore embodies several special features. The chief requirement was that it should be able to haul a trailer coach for additional passenger accommodation. It also had to be capable of light shunting and of taking also an additional van or two, such as horse boxes or other vehicles, that so frequently have to be attached to branch line trains. This meant that standard buffers and drawgear had to be added, while the hauling of extra passenger stock meant the fitting of vacuum brake pipes and the provision of steam heating pipes to ensure the safety and comfort of travellers. To avoid turning or running round at terminal points, and to obtain the same advantages as a steam-operated "pull and push" rail motor unit, special arrangements had to be made to allow the car to be controlled from the trailer coach when pushing this vehicle in front of it.



"No. 18," the latest A.E.C. oil-engined railcar on the G.W.R. It has been specially designed to haul a trailer coach or other vehicles in branch line operation. Photograph reproduced by courtesy of The Associated Equipment Co. Ltd., of Southall, the builders of the vehicle.

The exterior of *"No. 18"* differs a little from that of earlier types. The valances along the sides, covering in the wheels and the engines, that were so characteristic of the previous cars have been omitted, except immediately over the engines. The standard drawgear, buffers, and brake and steam heating pipes are used, and of course are an innovation in railcar design.

In addition to these special features *"No. 18"* incorporates various improvements as a result of experience with the earlier vehicles, although in general principles of construction the chassis or underframe of the car remains the same as that used for its forerunners. There are two A.E.C. 130 b.h.p. oil engines, in this case mounted centrally, one on each side of the main frames. These drive the wheels of the car through a transmission consisting of a fluid flywheel, a pre-selective epicyclic gearbox and suitable variable reduction gear. The car of course is a bogie vehicle, and the drive from each engine is taken to a separate bogie, that on the right driving the leading bogie and that on the left the trailing bogie. In former cars the engine stood slightly above the frame, but in the new design the power units have been altered, and their height reduced, so that the floor is level. The radiators are slightly altered in position and cooling air is drawn over them by large, slow-speed fans driven by belts and bevel gearing. The main drive is similar in principle to that previously used; but the epicyclic gearbox now has five speeds instead of four, and the reverse gear is incorporated in the final drive, which is now effected by double reduction gear.

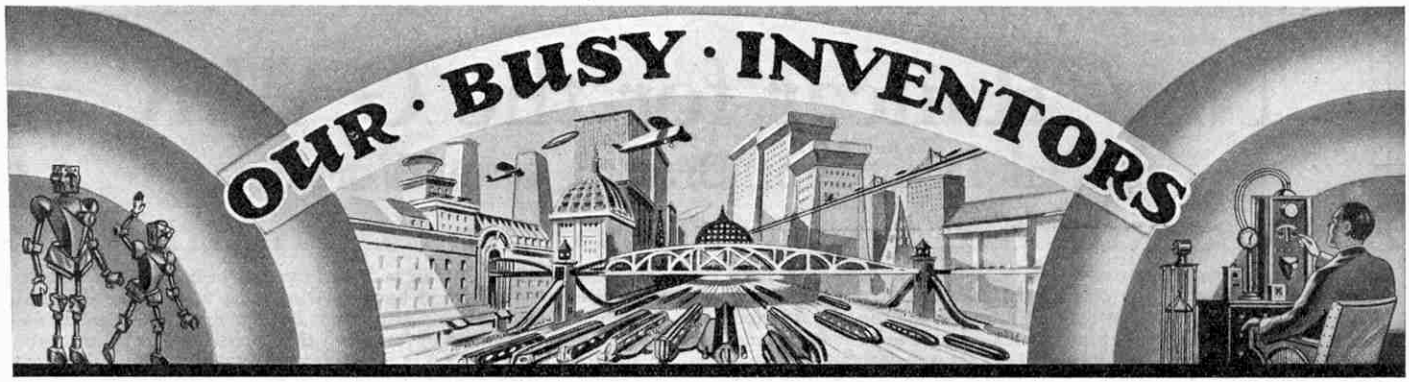
Trailer operation on the "pull and push" principle has necessitated a change in the type of control gear. Formerly this was mechanically operated, but is now electro-pneumatic, except for the engine throttle, which has to be brought into use before the engine can work up the required air pressure. In addition to allowing the car to be controlled from a trailer vehicle it also becomes possible to couple up two similar railcars, if necessary, and operate them as one unit.

In the driving compartment, which has an excellent outlook, the various hand-operated controls are grouped on a table within easy reach of the driver. On the top of the table at the left-hand side is a group of press-button switches. Two of these control the starter and the heater respectively, and the other two are connected to electro-pneumatic valves controlling the air cylinders that operate the clutch and effect the reversing of the engine; air also is admitted to the sanding valves by the same system. Then comes the reverse lever, and the lever for pre-selecting the gears projects through a small "gate" mounted in the centre of the table. In front of the gear lever is a new feature in the engine revolution meter, with two pointers each recording the speed of one of the engines. A special advantage of this type of instrument is that the driver can see exactly when to change gear, and it acts as a speedometer when the car is running in top gear. The pointers also give warning of any excessive heating of the engines by dropping to zero. On the right is the vacuum brake handle, and on the front edge of the table, which is much like the dashboard of a motor car, are the air pressure and vacuum gauges.

The reverse switch is connected to the vacuum brake system and cannot be moved until the brakes are applied. This prevents the driver trying to reverse the car when running. The reverse switch handle is loose and is taken by the driver to whichever end of the car he is driving from. It cannot be withdrawn except in the neutral position; when it is so withdrawn it automatically engages "neutral" in the gearbox and isolates the pre-selecting and clutch switches.

For trailer heating there is a boiler installed in the luggage compartment. This is of the Clarkson thimble tube type described on page 272 of this issue, and it is heated by the engine exhaust. The boiler feed water, carried beneath the floor, is introduced into the boiler by means of an electrically-driven pump, automatically controlled by switch gear. The interior decorations and fittings of the new car, which has seats for 49 passengers, follow the luxury lines that are characteristic of those previously put in service, but an improvement has been made in the ventilation.

The new railcar will not be called upon to make fast runs, but its ability to travel at high speeds has already been demonstrated by a run of 22½ miles at a speed of 67½ m.p.h. and other notable performances. The capacity of *"No. 18"* for hauling trailer coaches and other vehicles widens considerably its sphere of operation, and its performance will no doubt be watched with interest in railway circles.



By P. A. Tent

Prizes for Inventors

The Mining Association of Great Britain has offered a prize of £500 for a lamp that will give an automatic signal when fire damp is present in the atmosphere of a coal mine. The device must be readily portable, like a miner's hand lamp, and must be capable of giving the alarm within two minutes at most of the appearance of the gas. If two or more of the lamps submitted satisfy the general conditions, the one that can indicate the lowest percentage of fire damp will be given the prize.

It is essential that the apparatus should be robust and simple in construction, for the lamp will have to be cleaned and prepared for use in the lamp rooms of collieries. In addition it must not give false alarms when blasting is taking place, or when other changes take place in the atmosphere. Details and drawings of lamps entered for this prize must be sent in not later than 30th June of this year.

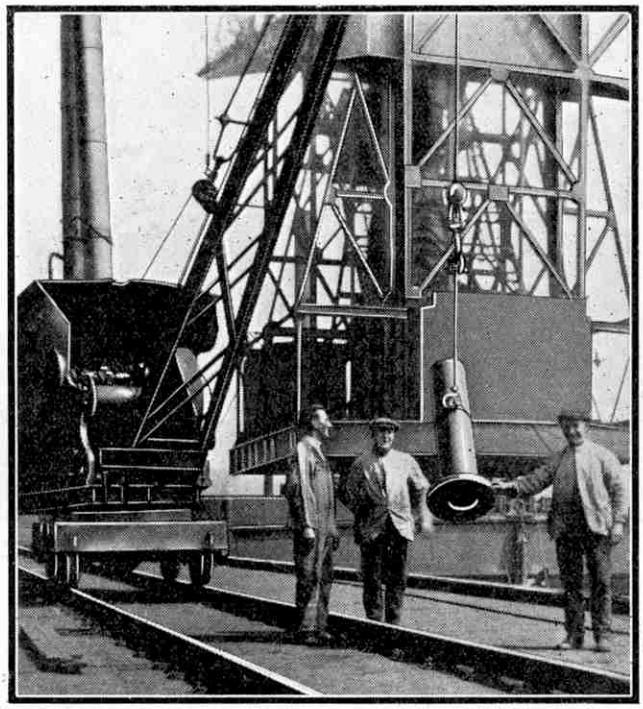
It will be interesting to see what the result of the competition is. Inventors have been working on problems of this kind for a considerable time, and a remarkable lamp that shows a brilliant red light when the percentage of the fire damp becomes dangerous was described in the *"M.M."* as long ago as September 1929. This lamp actually measures the percentage of fire damp in the atmosphere.

Another prize that is open to inventors is one of £20 that has been offered for an ear cap to keep out noise. The origin of this is of interest, as showing how problems for the consideration of inventors may arise. The offer has been made through the medium of *"The Inventor,"* the official journal of the Institute of Patentees, by a lady who wishes to sleep comfortably through the noise made by cars and heavy traffic. Noises of this kind are only too prevalent, not only in cities, but also in country districts through which main roads pass, and an ear cap that will totally exclude them will be a boon to many people.

Smoothing Out the Waves of the Sea

A simple plan for preventing rolling of vessels at sea has been devised by a French inventor, who proposes to place pumps at the sides of the vessel by means of which water can be taken in and ejected. If the rolling of a vessel takes the starboard side downward, the movement can be checked by pumping water outward through the outlets on that side of the vessel. Similarly a roll to port is checked by means of the pump on the port side. When in use the pumps are to be kept running continuously, and the jets will be controlled by means of special valves operated electrically by a small gyroscope, which responds almost instantaneously to the movement of the vessel.

A Russian inventor has gone further than this by working out a method for smoothing the waves of the sea, particularly in harbours in which seaplanes alight. His plan is to sink a series of parallel pipes to a depth of 30 ft. and to release compressed air through perforations in them whenever a wave passes over them. Tests are said to have resulted in the reduction of waves three or four feet in height to such an extent that the crests were completely smoothed out.



A demonstration of the use of a patent sling lock that prevents the slipping of loads. The lock can also be used with mooring ropes. Photograph by courtesy of the Thirlwell (Patent) Sling Lock and Engineering Co. Ltd.

A Foolproof Sling Lock

The tube shown suspended from the crane in the illustration on this page is safely held by means of an interesting new sling locking device. The eye of the sling carrying the tube is prevented from leaving the hook by means of a special pin that is turned out of alignment when it is pushed right home, so that it cannot fall out. The loop of a double rope can be secured in exactly the same manner when this simple but ingenious device is used, and a load can be fixed in the sling, or a loop can be maintained, by means of a screw that tightens the rope against the side of the lock.

The invention also can be employed for mooring boats to bollards, when it is practically foolproof, so that there is no possibility of a boat slipping its moorings. An interesting feature is that there is no difficulty in freeing the lowest of several loops on the same bollard, for all that is necessary is to take the load off the cable, and to release the lock.

Improving the Gold Prospector's Pan

The well-known pan of the pioneer gold miner and prospector has not escaped the attentions of inventors. In its original form the pan is useful for testing purposes. Except with rich gravels it does not enable sufficient material to be dealt with to yield more than a bare existence to the miner, however, for even an expert can only pan out a small amount in a day.

An inventor who has realised the limitations of the pan has tried to make it more efficient by fitting it with a petrol motor. The new pan exactly imitates the peculiar rotary motion of the primitive implement that has been in use for so long. It makes 240 oscillations a minute, and the power unit also operates a pump that supplies water. From 1½ to 2 cu. yd. of gravel can be washed in an hour, and the invention can be used for treating mine dumps and mill tailings as well as gravel in newly discovered gold fields.

Camera Built Like a Watch

One of the most interesting developments of recent years in the photographic world is the introduction of miniature photography, that is photography in which negatives of small size are made on sensitive films with a very fine grain, from which enlargements can be made. This plan has the great advantage that running costs are very low, and only those negatives that are entirely successful need be enlarged.

Miniature photography so far has not necessarily meant a miniature camera; the camera itself has remained comparatively

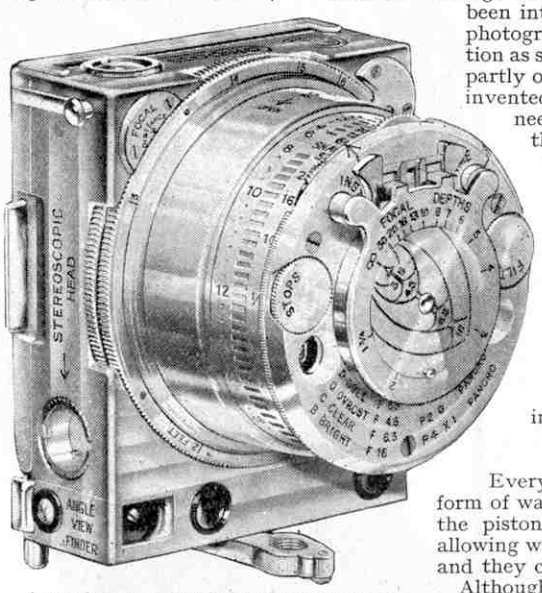
large, and the weight of the apparatus required is increased by the need for such accessories and attachments as exposure meters and range finders. Now an inventor has taken the camera in hand and has produced one that is really a miniature. This is the Compass Camera, which is made like a watch, and is shown in the lower illustration on this page. Although it weighs under 8 oz., and is smaller than a cigarette case, it has all the necessary accessories actually built into it, and these make it into a complete unit that is simple to use and swift in operation. A wide-angle lens working at a maximum aperture of f3.5 is fitted, with a shutter of an entirely new type giving automatic speeds from 1/500 to 4½ secs. in addition to time exposures.

A Complete Photographic System

When using the new camera little time is lost in finding the correct exposure. All that is necessary is to look at the subject through the view-finder and to pull out a slide marked "Exposure Meter." This causes the image to become progressively darker, and when it has practically disappeared a number on a scale on the slide indicates the setting of the shutter that will be necessary. This is the setting for the largest stop, with no light filter. Three light filters are built into the camera and placed in position by merely turning a milled nut, and the different stops are similarly brought into play. A number is shown automatically for each of these, and when conditions make their use necessary, the numbers are simply added to the reading of the exposure meter to give the corresponding shutter setting. One of the filters is orange and is particularly valuable for taking photographs in a hazy atmosphere and for giving good sky renderings.

The camera can be focussed by estimating the distance of the subject and setting the focussing ring, or by the use of a range finder incorporated in the camera. The range finder is linked mechanically with the focussing adjustment, so that this operation is performed automatically with complete accuracy and certainty. Other attachments include a spirit level, lens hood and tripod bush. A depth of focus indicator is provided, and there is a ground glass screen for direct focussing. The view finders are of the reflector prism type, and a right angle view attachment is included so that pictures can be taken with the camera pointing sideways, as well as straight ahead, a very useful feature for taking action photographs of people who might behave unnaturally if they saw the photographer aiming directly towards them. The camera is also adapted to stereo photography and the taking of panoramic views.

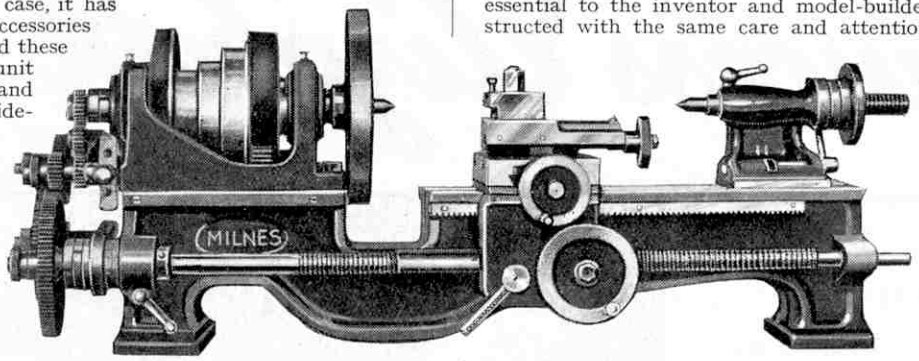
A wonderful new method of loading the camera is a complete break from ordinary practice. In this sensitive films or glass plates are packed in a little light-tight paper wrapping, known as the Compass Envelope. The envelopes are the equivalent of the metal or wood dark slides used in larger cameras, but of course are less cumbersome and costly. The negatives are developed, fixed and washed without removing them from the packet, so that the films or plates are not touched by hand until they are dry and ready for printing. They are therefore kept free from dust and mechanical injury, and their condition is perfect for contact printing or enlargement purposes. A special daylight developer is available for use with Compass Envelopes. Roll film spools for six exposures and glass plates also can be used in the camera, the special methods employed for loading ensuring complete efficiency.



A complete camera smaller than a cigarette case. Photograph by courtesy of Compass Cameras Ltd.

A Tool for the Inventor's Workshop

The ranks of inventors include many who are never so happy as when they are in their workshops, building models and trying out ingenious devices or simplifications of complicated arrangements. Many of them have only the simplest of tools to work with, but few who really devote themselves to inventive work either do not possess a lathe or are not eager to have one. In addition there are many mechanically-minded readers of the "*M.M.*" and others whose greatest enjoyment is engineering work on a small scale, and to them also a lathe is invaluable. Lathes used for purposes of this kind are small, but for really good work—and precision work is essential to the inventor and model-builder—they must be constructed with the same care and attention to good engineering features as the larger lathes used in engineering works.



A 3¾ in. centre lathe suitable for use in the workshop of the inventor and model-builder. It is built on precision lines for work of great accuracy. Photograph by courtesy of Messrs. Henry Milnes.

The lathe illustrated on this page is one of a range of this type. It is suitable for commercial engineering production as well as model-making, special consideration having been given to its design in order to ensure that it fulfils the conditions already noted. The leading screw, on which the accuracy of lathe work depends so largely, is cut to precision limits, and special care is taken that complete accuracy of alignment is maintained between the spindle and the tail stock, irrespective of wear. The lathe is arranged for either electric motor drive or for use with a foot treadle, and the possession of a machine of this quality will be a source of great satisfaction to all to whom creative work has an irresistible appeal.

A Wonderful Japanese Invention

A few years ago a wonderful camera was invented for photographing the inner lining of the stomach. This consists of a tiny box at the end of a flexible tube. After it has been swallowed by the patient a little lamp in it is switched on and a succession of very small photographs taken. These are enlarged for closer examination.

Now another ingenious use of photography of a similar kind has been introduced. When joints are diseased, X-ray photographs do not always give as much information as surgeons require, but this difficulty has been partly overcome by the use of a very small camera invented by a Japanese doctor. In this case a long needle-like tube is inserted in the joint. At the end of the tube is a very small lamp that illuminates the portion of the joint reached by the needle, and this is photographed by the camera, which is carried on the outer end of the needle. The rays of light are reflected by mirrors up the hollow interior of the needle to the camera itself.

The device is known as the Arthroscope, and it can be fitted with small revolving brushes and other accessories in order to bathe the joint. One advantage of this remarkable camera is that its needle-like extension can be inserted between the bones of the joint.

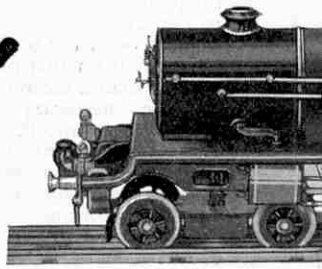
An Ingenious Pump

Everybody is familiar with the old and simple form of water pump in which flap valves are fitted in the piston. On the down stroke the valves open, allowing water to pass to the upper side of the piston, and they close on the ensuing up stroke.

Although this simple form of pump has been in use for a long time, it is only recently that it has been developed into a form in which the piston itself acts as a flap valve. This new form has been invented by a French engineer who experienced difficulty in dredging channels that were full of weeds or loose sand. Ordinary pumps were not very successful, and the engineer designed one in which the piston consists of semi-circular flaps hinged on a crosshead at the end of the piston rod. When the rod is pushed forward the flaps turn back on their hinges until they are almost in contact with the walls of the cylinder. Then they push the contents of the cylinder before them. On the return stroke they swing into the centre and allow free passage for the liquid, which is carried forward by its momentum.

The pump has proved very successful, working well even when comparatively large pieces of solid matter are present. Choking can be prevented by using a grid on the suction pipe, and soft weeds can be cut into small pieces by means of knives fitted in suitable positions on the piston rod.

"Princess Elizabeth"



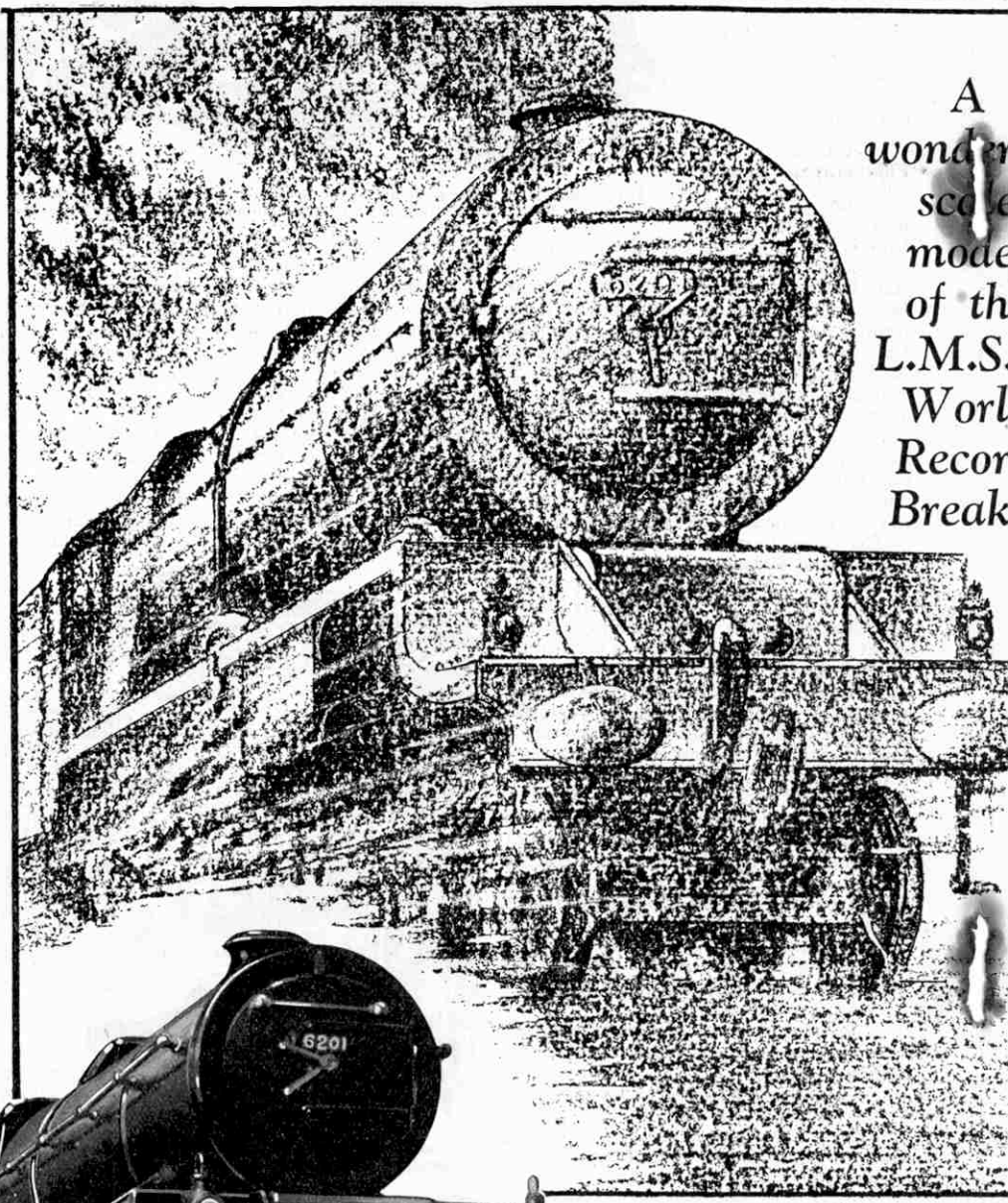
QUALITY FEATURES

The Hornby "*Princess Elizabeth*" incorporates all the outstanding features of the actual engine, and the detail work from end to end is splendid. See the realistic appearance of the front, even to the large oval-headed buffers. Look at the tapered boiler and fire-box, the sturdy chimney and other fittings.

Look inside the cab! There's the regulator handle, the reversing screw, everything ready for the crew to step up and take charge!

The enamelling and lining follows L.M.S.R. practice faithfully, and the general finish is of the highest Hornby quality.

This is a locomotive to be proud of!



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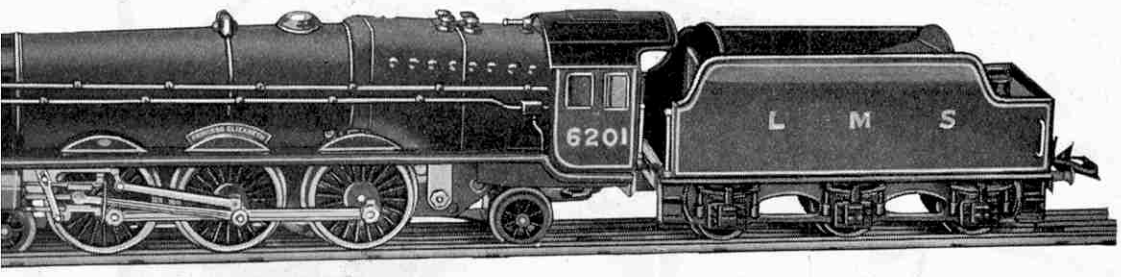


The new Hornby Locomotive "Princess Elizabeth."

Driver Clarke in the cab of No. 6201 "Princess Elizabeth."

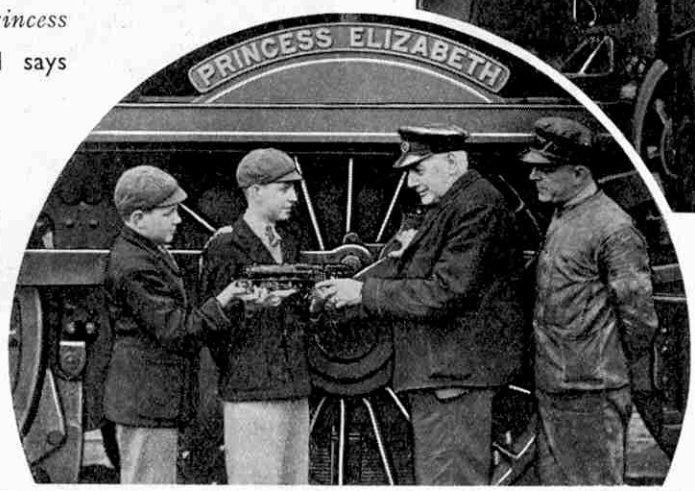
Four hundred miles non-stop at an average of 70 m.p.h.; maximum speeds of 95 m.p.h.; Beattock bank and Shap incline surmounted at 66 m.p.h. with a 260-ton load! These remarkable feats were performed by L.M.S.R. 4-6-2 *"Princess Elizabeth,"* in charge of Driver T. J. Clarke, on a special run in November 1936.

Think of the thrill of owning a model of such an engine; not merely a perfect reproduction in miniature but one having the same qualities of power, speed and efficiency! This is now made possible by the latest product of Meccano Ltd.—the magnificent Hornby scale model locomotive *"Princess Elizabeth."* Look at the photograph above! What a splendid appearance the model has with its massive six-coupled driving wheels, fascinating valve gear, and Royal nameplate! It is driven by a 20-volt electric motor, fitted with the world-famous Hornby Remote Control.

Driver Clarke of the real *"Princess Elizabeth"* has seen the model and says "It's fine."

Price, complete with tender, in special presentation box, £5 5s. 0d.

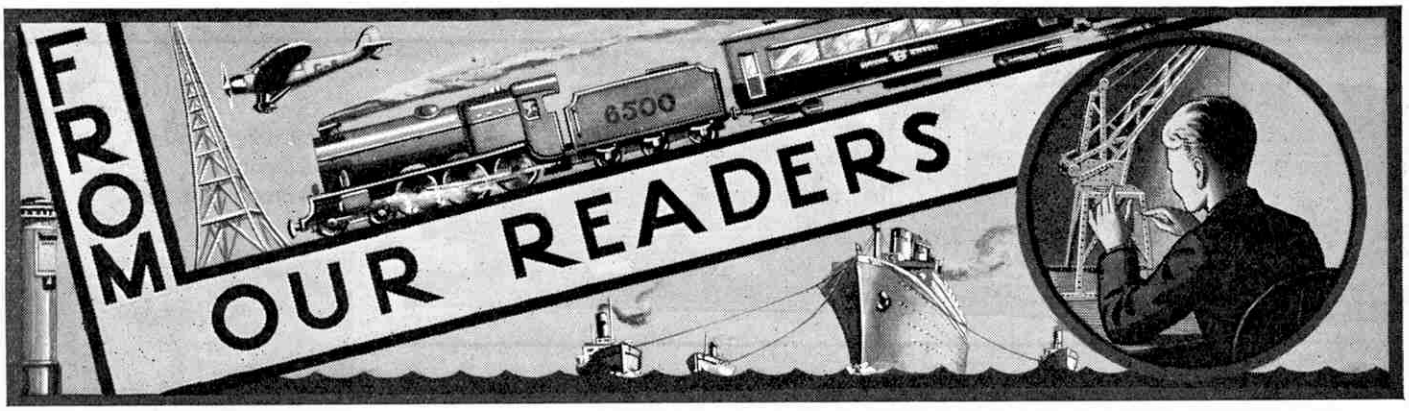
The model may be purchased also through the new Hornby Deferred Payments Scheme. Ask your dealer for details. (Not applicable to the Irish Free State.)



Expert examination! Driver T. J. Clarke inspects the Hornby "Princess Elizabeth" in the shadow of its giant prototype. "It's fine," he says.

ORNBY TRAINS

Manufactured by MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13



These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Two Strange Pets

Recently I saw two rather unusual pets, one a bat and the other a falcon. The bat was one of a species found only in parts of South Devon, its chief haunt being a wood a few miles from Plymouth, and it was claimed to be the only one capable of doing tricks. When placed on a curtain it hung by its legs until its master spoke to it, and then it flew round the room. After having flown round some 12 to 15 times it evidently considered it had done its duty, and returned to the curtain. Its owner next took up a piece of meat and spoke to the bat, which immediately flew up and seized the meat. It was clear that the bat knew its master, for it did not pay the slightest attention when anyone else spoke to it.

The falcon to which reference is made in one of the articles on this page. The bird is capable of diving through the air at a speed of over 90 miles an hour. Photograph by A. R. White, Plymouth.

The falcon performed tricks similar to the bat. The greatest problem in keeping a falcon is how to provide it with exercise. The one I saw is taken as often as possible into the country in a car. It perches on the back of the front seat, and to ensure that it does not fly about and damage its wings its owner has made a little leather hood or cap that covers its eyes, but leaves its beak exposed. As it cannot see it does not attempt to fly about.

On being released with its head uncovered the bird immediately flies away at high speed. It is recaptured by swinging a decoy, consisting of a bundle of red rags and feathers, fastened to the end of a length of cord. Even when the falcon is two miles away it instantly sees the decoy and returns in a series of steep dives at a speed that has been calculated to be more than 90 m.p.h. It circles overhead and suddenly dives at the decoy, when the owner creeps up and slips on its cap. A small bell is fastened to one of the falcon's legs to enable it to be traced should it escape. It often tries to capture small birds, but never succeeds in doing so.

A. R. WHITE (Plymouth).

A Visit to a Bird Sanctuary

On the right bank of the River Nene, near Sutton Bridge in Lincolnshire, is a bird sanctuary owned by Mr. Peter Scott, son of the late Captain Scott, the famous Antarctic explorer. Mr. Scott and two companions live in one of two old lighthouses that stand on the river bank, and in the sanctuary are specimens of nearly all the wild fowl of the marsh and many birds from foreign parts.

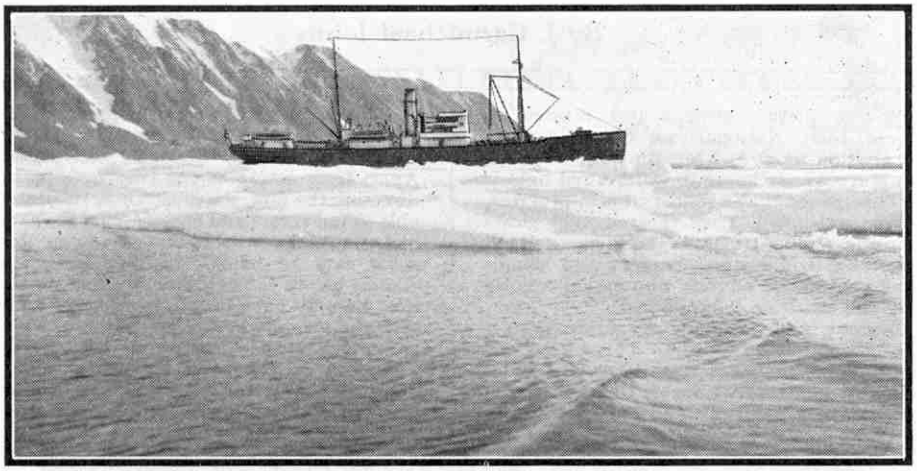
When I visited the sanctuary recently I was greatly interested in the variety of birds to be found there. There are many specimens of geese, including the rare grey-lag goose and the commoner bean and pink-feet geese. In addition I saw several Chinese geese, which are much larger than ordinary farmyard geese, and a few small birds with red breasts, specimens of the rarest species of goose in the world. Great numbers of wild duck and widgeon are to be seen, and some of these have been made captive by clipping their wings. Among the many uninvited guests are large flocks of wild fowl that often stop a day or two in this sheltered spot before continuing their journey elsewhere.

I was told that the birds nest regularly in spring, and that the young when able to fly sometimes depart to the surrounding marshes, and sometimes stay with their parents. Wire-netting enclosures like enormous chicken runs are used to confine certain birds. The pen in which the ducks live is provided with a large natural pool. While I was there another large run had just been erected and the birds were passing from their old pen across a bridge over a deep creek into the new one. The birds are fed once a day on corn, but of course find many tit-bits for themselves. As I was leaving a large flock of mallard or wild duck were alighting on the pool. This formed an interesting ending to an enjoyable and instructive visit.

J. E. COOLEY (Long Sutton).

Patrolling Canada's Arctic Seas

Once a year the Hudson's Bay Company's sturdy little steamship "*Nascopie*" sets out from Montreal for a survey of the "Land of the Eskimo," and 12 weeks are spent patrolling the waters of the Eastern Arctic regions of Canada. If the weather holds good she returns at the end of the cruise, but if the winter "freeze-up" were to occur earlier than expected she might be held fast in the thick ice in spite of her ice-breaker bow, with its steel plates $1\frac{1}{4}$ in. in thickness.



The steamship "Nascopie," owned by the Hudson's Bay Company, at Craig Harbour, Ellesmere Island, on her annual patrol. She is the only vessel to sail regularly so far north. Photograph by J. R. Dingle, Halifax, Nova Scotia.

The "*Nascopie*" has a tonnage of 1,200 and has been specially constructed for her work. Her bow stands high out of the water so that she can drive on top of the ice and break through it by her weight, aided by that of the 300 tons of concrete in her fore-peak. Steam for her reciprocating engine is supplied by two coal-fired Scotch marine boilers, and she has a speed of 12 knots.

The vessel begins her patrol at Montreal, steaming down the St. Lawrence River and along the coast of Quebec to Labrador. She proceeds northward and across Hudson Bay to Fort Churchill, calling later at Chesterfield Inlet and Southampton Island. Then she crosses to Baffin Island, and the most northerly point of her patrol is Craig Harbour, which is in Ellesmere Island, at the head of Baffin Bay and only about 1,000 miles from the North Pole. The weather conditions there are extreme, and in early September, when the "*Nascopie*" usually calls, the thermometer reading is well below zero and icebergs are plentiful.

The Eskimo to whom Baffin and Ellesmere Islands are "home," live by hunting and trapping, exchanging the skins of fur-bearing animals for guns, powder, shot, and everything else required for their simple life. For eight months of the year they scarcely see the Sun, and their world is a white wilderness of snow.

From Craig Harbour the "*Nascopie*" turns south and the homeward journey begins. On 1st October she steams into Halifax Harbour, after having travelled thousands of miles, broken through ice fields, delivered tons of mail and provisions, replenished medical supplies, and visited all the posts in Canada's Eastern Arctic.

J. R. Dingle (Halifax, Nova Scotia).

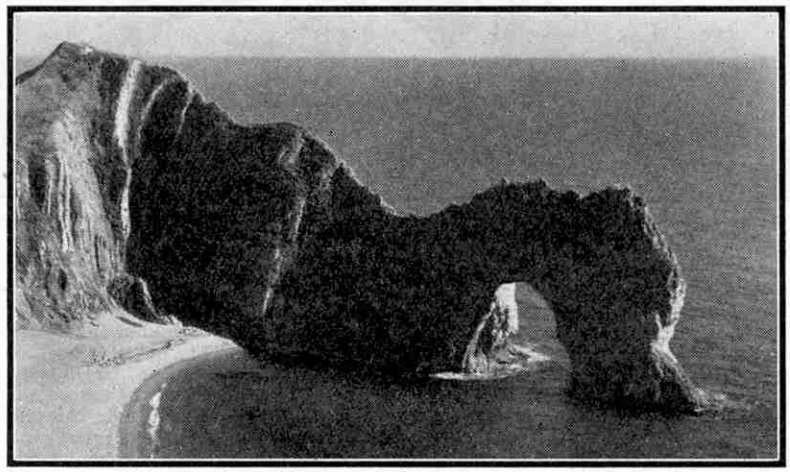
England's Largest Salvage Department

Recently I was one of a party visiting the Birmingham salvage department, which is claimed to be the largest of its kind in Great Britain. The work of this department is to collect and destroy the rubbish and litter of the town.

On arrival at the works, our guide first took us on an elevated roadway, along which the refuse - collecting lorries, after being weighed, take their loads. At the far end they dump their loads into large tanks. The contents of these tanks at first glance seem to be stationary, but after watching for a few minutes the floor of each is seen to be moving slowly away, carrying the refuse with it and dumping it into one of two large revolving drums, from which it is distributed on to slow-moving conveyors. A man stands at the head of each conveyor and picks out all the rags, which are then packed up and sold to papermakers.

The conveyors then pass over magnetic rollers that separate metal from the refuse and deliver it into a separate chute. This metal is shovelled into a trough, where a hydraulic machine compresses it into blocks about a cubic foot in size. These blocks are then sterilised in huge furnaces before being despatched to be melted down. The heat from the furnaces is used to produce electricity for lighting purposes, and also for charging the accumulators of a fleet of "Electricars," which collect the rubbish.

E. L. French (Birmingham).



"Durdle Door," the interesting rock formation that forms the western point of Lulworth Cove, on the Dorset coast. Photograph by C. A. Reader, London.

Lulworth Cove

The lower illustration on this page shows a remarkable natural archway known as "Durdle Door" or "Barn Door," which forms the western point of Lulworth Cove, Dorset. The arch is about 30 ft. high, and a fair sized boat could easily pass through it.

Lulworth is a charming unspoiled village on the coast of Dorset, and the Cove is a delightful basin in the cliffs that is almost circular in form. There is a great variety of interesting rock formations to be seen in the neighbourhood. The cliff is formed of hard Purbeck and Portland stone, backed by softer materials such as sand and clay, and where the sea caused rifts in the harder rocks the softer materials are washed away, leaving gaping caverns. Probably the best known of these is a chasm west of Lulworth, called Stair Hole.

C. A. Reader (London, S.W.18).

Behind the Screens

How Talking Pictures are Produced

By J. Carmichael Johns

ON arrival at the modern picture studios just erected at Teddington by Warner First National, we follow a commissionaire into his little waiting-room and remain there while he telephones through to the stage we are going to visit. A red light is winking above the door. This means that a rehearsal is in progress, and disturbance will not be welcomed. Then the red light glows steadily, sirens scream inside and outside the building, and all becomes silent. "Shooting" has commenced; camera and sound-recorder are in action, and woe betide anyone who makes a noise that will be picked up by the sensitive microphone.

At last the red light goes out, and we follow our guide down a passage to a door marked "Absolutely no visitors." This door opens ponderously. Sound-proof padding makes it as thick as it is wide, and as it thuds to behind us we find that we are on the stage itself. First we notice the smell, in which paint-oils and arc lamp fumes predominate; then the heat, and then the blinding light flooding from above. We look up and see floodlights and arcs mounted on overhead staging that makes almost a second roof in the lofty building, and on it electricians move about manipulating the spotlights, not at all concerned by the drop beneath them. Directly in front is the scene, or "set," for the Claude Hulbert picture, *"It's Not Cricket."* Part of it seems real, but the lavishly furnished foyer of a hotel complete with cloakroom and cashier's desk runs into masses of broken-up scenery on one hand, and into the green grass and pavilion of a cricket pitch on the other. This incongruous effect is common to all studios, for as many sets as possible must be constructed simultaneously, since production costs may be anything around £3 a minute during the actual taking of a film.

Edwin Styles thoroughly enjoys himself building a Meccano model in "Patricia Gets Her Man." The illustrations to this article are reproduced by courtesy of Warner Bros. First National Productions Ltd.

Contrary to popular belief, the Producer, not the Director, is in complete charge of a picture. He chooses the rest of the executive staff and, keeping in complete harmony with the Director, he must see that the costs of the picture do not exceed the amount allotted to it. His production schedule is mapped out ahead, minute by minute, and hour by hour, to the end of the film; and he has the last word at the numerous conferences that are held.

Another of the Producer's many tasks is the choice of a story suitable for filming. When the story has been selected, it is handed to the Director, and this important personage then goes into conference with the Scenario Editor, who is aided by one or more Script Writers in adapting the story into the form that it will take in the picture. Each Script Writer is allotted the section—consisting of description, dialogue, or situation—for which his writing is best suited. During all this time, and even when the scenario is complete, the Cutting Editor keeps his finger in the pie. His job is to maintain "continuity" by the effective cutting and re-joining of the film as the scenes are taken.

Once the scenario is written, the Director, still working in conjunction with the people just mentioned, must make himself the medium between the story's author and the actors. The technique is totally different from that of the stage, for in films the actors—though they do not like to admit it—are but puppets in the Director's hand. They, together with the camera, scenario, lighting, and dialogue, form material for the Director's creative art.

Now we come to the Floor Secretary, or Continuity Girl. She is to be found in every studio, sitting at the Director's elbow, armed with a stop watch, "shooting" script, telephone, and typewriter. Apart from acting as the Director's personal secretary while he is directing the film, she must know full details of each "take," and be able to tell actors and camera-men the exact position of everything, including stage property, in any scene. For instance, on one day an actor may be "shot" passing through a door. Perhaps a week elapses before the cameras find him on the other side. During that time he may have forgotten whether he was wearing his gloves or carrying them, whether his coat was buttoned or not, or possibly how much of his handkerchief was showing in his breast pocket. From her notes, made at the time the scene was "shot," the Continuity Girl must be able to reassure him on these points.

Of those directly concerned with the photography, the Chief Cameraman ranks first. He does not actually handle the camera, for in commercial filming illumination is the most important factor, light being the medium through which the Chief Cameraman expresses his creative powers. Thus the electricians work to his orders, arranging their many units to light each set to its fullest advantage. His second-in-command is the camera operator, who is assisted by an apprentice responsible for numerous technical jobs, such as focussing, and by the crew manœuvring the camera, which more often than not is mounted on a universally mobile trolley.

Working in conjunction with the camera are the sound technicians. Sound is recorded as a series of light and dark shadings on the film. Although this process goes on inside the camera, the strength and quality of reproduction must be controlled externally. There are two systems. In the first the sound "mixing" compartment is situated somewhere in the roof of the studio. It consists mainly of a control panel like that of a giant radio. Wearing ear-phones, the "mixer" sits in front of this panel and regulates the tone and strength of the actors' voices, which he hears exactly as they will be reproduced in the finished "talkie." He is unable to watch the scene, and he relies on telephonic communication with his partner, who operates the microphone on the set. In the second system the "Sound Booth" is much smaller, and is mounted on a trolley close to the camera. The "mixer" is then able to watch proceedings through a window.

The microphone itself is detached from the camera. It resembles a telephone mouthpiece suspended from the end of a boom, which in turn is actuated on a universal head, elevated from a mobile standard. The standard is adjustable to all heights, while the microphone receiving disc can be turned in any direction. Thus, by manipulating the controls for these movements, the operator can pick up sounds from any part of the "set."

Let us watch these movieland characters at work, not on this set, but in studio two, where *"The Windmill,"* a spy picture, is being shot. The scene is the attic of an old French mill, and stage carpenters are putting the finishing touches to its atmosphere of dust and age. Those solid-looking beams are papier mâche, but the rusty mill-gear and burst flour sacks strewing the floor are genuine. The harassed property man probably had a lot of trouble finding them.

He has to provide anything from an egg to an elephant, or from a Rolls-Royce to a rickshaw, at a moment's notice. A man is at work with a cobweb machine, an apparatus like an electric hair-dryer; with it he can festoon the place in five minutes with a five years' growth of cobwebs.

The Assistant Director is peering into the view finder of the camera, making sure the scene is exactly as it should be. The Operator stands back, ready to take over. Beside them, reading from her notes, the Continuity Girl checks the position of everything on the set. The Director himself is talking to Glen Alyn, the star of the picture, giving her final instructions.

The rehearsal has been finished, and now they are going to begin "shooting." The "silence" gong goes.

Director: *"Quiet now."*

Assistant Director: *"Really quiet now, boys."*

The Lighting Expert: *"Hit your blue."* The blue daylight arcs flare, whine and splutter for a moment, and settle to a steady glare. *"Floods,"* and from overhead the lamps blaze down like strong sunlight.

Director: *"All ready."*

Voices: *"All ready."*

Assistant Director: *"Roll 'em."*

This is an order to start the cameras.

Microphone Operator, telephoning to the sound-booth: *"Are you O.K.?"* Then to Director: *"Sound O.K."*

Three shrill pips from a buzzer indicate that camera and "sound" are working.

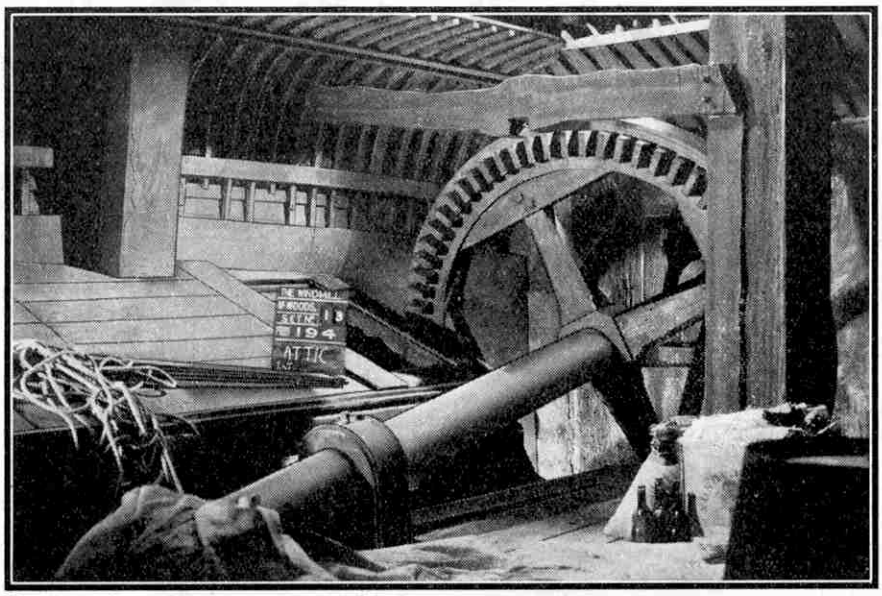
Director: *"Action!"*

The "clapper boy" steps in front of the camera, holding a blackboard on which the production details are indicated in white. He says *"'The Windmill.' Number 15. Take one,"* and clicks the clapper on top of his indicator, thereby synchronising action and sound on the film.

A trap-door in the floor opens, and a French peasant girl—Glen Alyn—scrambles out. She drops the trap-door behind her; someone shouts, and rattles it, as she slams home the catch. Terror-stricken, she looks round; sees a pile of straw in one corner. Beside it, on an upturned barrel, are matches and a candle. With a little cry she runs over to them. On its long boom the microphone sails down to pick up her laboured breathing; the camera trolley glides forward for a close-up. She seizes the matches, lights a handful of straw, and rushes towards the little mill window; bursting it open she throws out the burning distress signal. But behind her the whole straw pile has caught fire. With a flour sack she tries to beat it out, but the flames lick higher. All round her concealed smoke bombs vomit heavy yellow fumes. She is not acting now, her panic is too real as she staggers back against the wall.

At this moment the Director calls *"Cut!"* The girl jumps off the set, and stage hands quickly douse the flames with wet cloths and fire extinguishers. Soon nothing is left but the smoke pall hanging over everything.

"All right, save your blue" orders the Lighting Expert, *"and kill those floods."* The light sinks to normal.



The set used for the fire scene described in this article. The blackboard indicator is the same as that used by the "clapper boy" when the filming of the scene was about to begin.

"Better take that again," says the Director. *"The flames didn't spread quickly enough."*

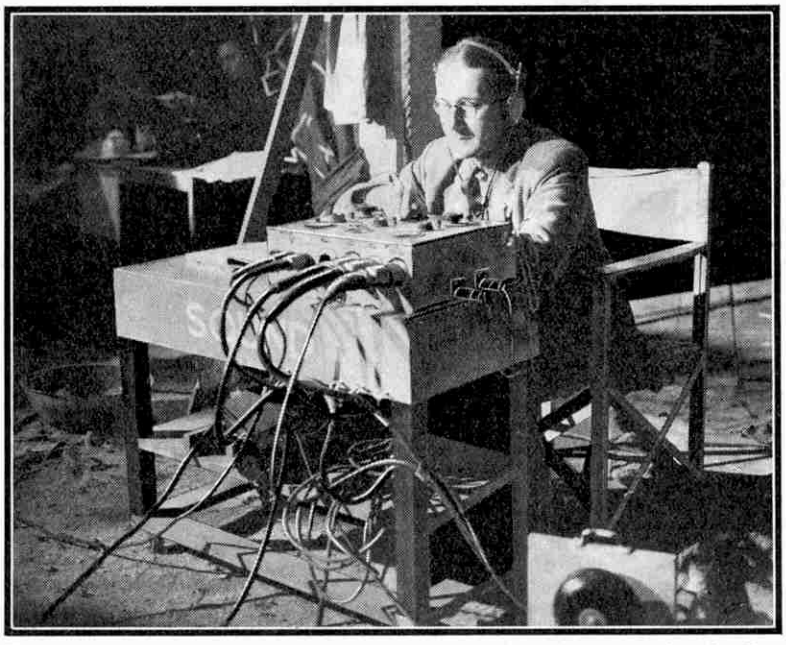
"And we want more light when Miss Alyn comes through" adds the Lighting expert, who raises his voice to call out, *"Hi! Let's see you hit that trapdoor with Number 15."* In response Lamp Number 15 beams down from overhead on the area in question.

"All right, relax," says the Director. The gong rings twice, lifting the silence ban, and once more babel breaks out.

So the machinery moves on. Perhaps five or six "takes" will be made before the Director is satisfied.

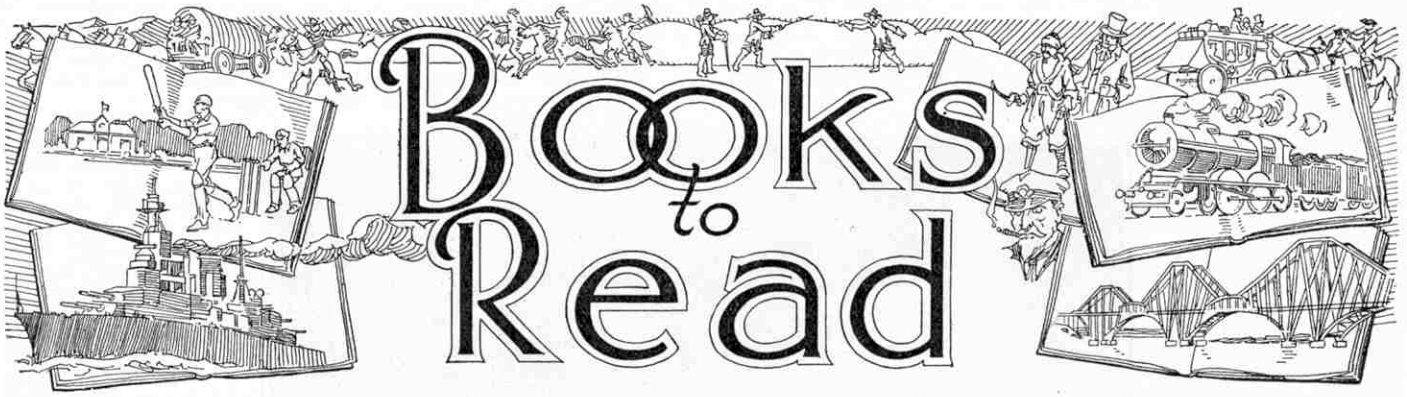
The uninitiated might find technical conversation rather startling, for the "talkies" have a language of their own. "Put a jelly and snoot on your chubby" is not meant to be facetious; it is the electrician's way of saying "Put a mica filter and a hood on the small lamp." "Scram" is universally used for "take away." "Kill," "ease," or "save" mean "switch off." Small lamps are often termed "babies," or "chubbies." "Nigger" is a particularly expressive description for the black adjustable screen used to cast shadows, or shield the camera from lights turned too directly into its lens.

One imagines that in a "musical" picture the artists or orchestra perform before the camera and microphone in the normal way. But singers and orchestras may cost pounds a minute, and only on rare occasions are first-time "shots" successful. So the "play-back" system is used. The singer and orchestra perform before the microphone, without the camera, the sound being recorded on the track of a blank film. A rough record known as the play-back is made simultaneously; and when the act is about to be shot, the artist repeats his performance before the camera, synchronising his action and lip movements with his own voice, which is reproduced for him from the play-back loud-speaker. Any number of rehearsals and re-takes can be made, as the play-back never gets tired, and the artist need only sing in a whisper. When action has been "shot" to the director's satisfaction, it is combined with the previously recorded sound track in the "dubbing" theatre.



The sound "mixer" at work. The chief sound-recording engineer during the shooting of a film.

"Dubbing" offers endless scope. By a reversal of the process already described a silent film may be converted into a talkie, or a talkie in English may be "dubbed" in another language. The artist responsible for the new voice speaks into a microphone, synchronising his words with the actor's lip movements, which he watches as the silent picture is screened before him.



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/– for postage to the price. Postage on different books varies, but any balance remaining will be refunded.

"Nine-Fifteen From Victoria"

By Victor Bayley, C.I.E. (Robert Hale. 12/6 net)

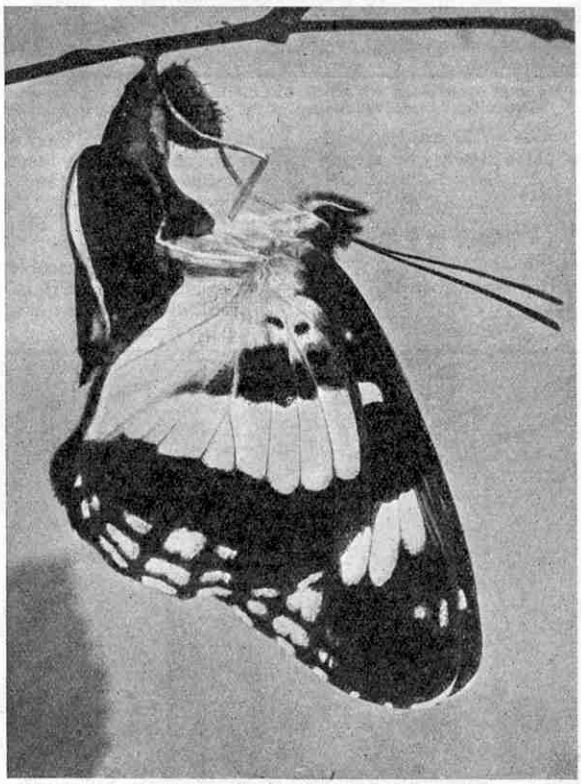
Here is a book that will appeal to all older readers of the "*M.M.*," and especially to those who are seriously thinking of becoming engineers. It is the story of an engineer who, from early boyhood, had the ambition to build a great railway, and who realised his ambition in the building of the line that runs through the Khyber Pass.

Mr. Bayley commenced his career as an apprentice at a Bristol works, and he gives a graphic account of the conditions that prevailed. He began work at six o'clock in the morning in a shop lighted only by a few gas jets, and heated by glowing braziers of coke which, while utterly incapable of warming the workshop, were extremely effective in filling the air with sulphurous fumes. The men with whom he worked were a rough lot, but they were real craftsmen who took the utmost pride in the perfection of their handiwork. From Bristol Mr. Bayley went to the drawing office at the G.W.R. works at Swindon, where he attracted the attention of the Chief Mechanical Engineer, Mr. Churchward. Later he was transferred to the "Experimental Section" of the office, where his duties included the actual testing of locomotives on the road. He describes the sensations of riding in a rough wooden shelter on the front of an engine travelling at 70 or 80 miles an hour, and recalls one terrifying occasion when the gear for operating the recording instruments came adrift and was smashed to fragments.

Then came the great day when Mr. Bayley was appointed to the post of assistant engineer in the Public Works Department for Railway Construction of the Government of India, and here begins the most thrilling section of the book. He was put in charge of the construction of a 20-mile section of line in the wilds of Rajputana, where he had to learn the difficult art of handling native labour. He soon found that he was not only an engineer, but also a general adjudicator of disputes of an astonishing variety. When most of the preliminary work on his section had been completed, Mr. Bayley was given the task of bringing to the site of a river bridge that had to be built all the materials necessary for the construction of caissons for compressed air working. This involved first the designing of the caissons to be built at Calcutta, and the purchase of the necessary steam cranes, compressors, dynamos and so on. All this material was despatched to the terminus of a narrow gauge line of a native state, some twenty miles from the river. Next he went to Agra, took a broad gauge locomotive and wagons to pieces, sent the pieces to the end of the narrow gauge line, reassembled them, and built a broad gauge line from there to the river. So by degrees the material was conveyed to the bridge site.

"*M.M.*" readers are familiar with the use of caissons for the preparation of bridge foundations. This work is difficult and even dangerous under the best conditions, but here it presented unusual problems because the natives knew nothing of compressed air and could not understand it. How all the difficulties were finally overcome is told in a fascinating manner.

The author passes on to deal with his desperate struggle against a cholera epidemic, and adds stories of tigers, black panthers, snakes, and other creatures. The book concludes with war experiences in Mesopotamia and an interesting chapter on the Khyber Railway.



A White Admiral butterfly waiting for its wings to harden before making its first flight. From "Introducing British Butterflies," reviewed on this page.

"Introducing British Butterflies"

By Harold Bastin. (Philip Allan. 2/– net)

Mr. Bastin has written a delightful little pocket volume that is just the thing for beginners, and will be appreciated by those who already know something of this subject. It enables its readers to identify each butterfly at a glance, and to find out where and when it is most likely to be met with. What its caterpillar looks like and what it feeds on also are explained, and the wealth of interesting information given makes the book a handy and complete guide to the butterflies of this country.

The author writes pleasantly in dealing in turn with each of the seven families of British butterflies and their 68 members, all of which are carefully tabulated, with notes of the time of their appearance, the places where they may be found and the foods they like. Readers are encouraged throughout to look into things for themselves, and most of them will be surprised to find how much about butterflies remains to be discovered. Many of the stories of the butterfly world that are known are remarkable. For instance, the caterpillar of the Large Blue Butterfly spends the winter in an ant's nest, where it is treated as an honoured guest, although it preys on the baby ants. Another curious fact is the habit of the Purple Emperor of using the highest branch of a large tree as a resting place, from which it is best tempted, not by the scent or colour of flowers, but by a dead bird or rabbit.

A calendar of butterfly life explains exactly what the collector and breeder should do in each month of the year, and a series of Mr. Bastin's excellent butterfly photographs, one of which is reproduced on this page, adds greatly to the value of the book.

"Across the Sahara"

By F. J. Davar, F.R.G.S. (Stockwell. 3/6 net)

Mr. Davar and a companion crossed the Sahara Desert on two ordinary bicycles and with practically no kit, and the story of their adventure is told in this pleasantly written book. The travellers relied entirely on a friendly approach in dealing with the strange people with whom they came in contact, both in the Sahara Desert itself and in the tropical regions to the south of it. Readers will follow with interest their progress across the wastes of sand, where at times they were compelled to travel by camel; and will sympathise with their thirsts in the desert and in the fevers that nearly overcame them. Interesting glimpses are given of animal life, and native customs in the regions travelled through, and the book is illustrated by 19 photographs.

"Clyde River and Other Steamers"

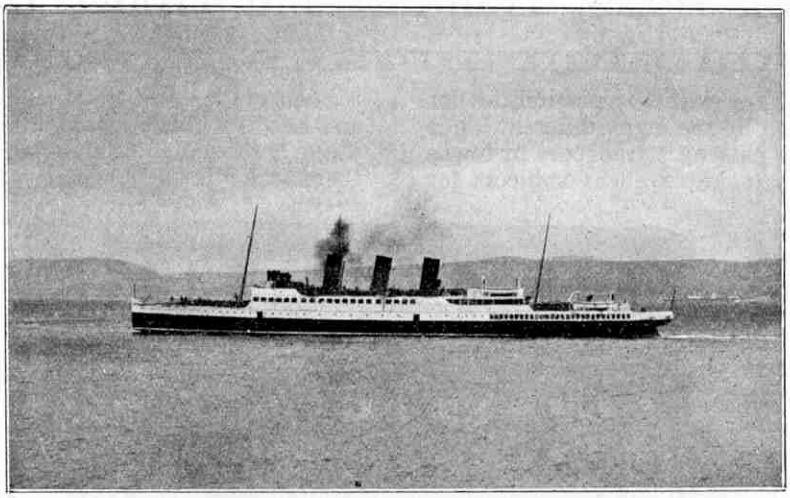
By C. L. D. Duckworth and G. E. Langmuir
(Brown, Son and Ferguson Ltd. 7/6 net)

Every reader who has gone down the Clyde by steamer, or has cruised among the islands of the west of Scotland or elsewhere on our northern coasts, will welcome this account of the many interesting vessels that have sailed in those seas. The authors have made a close study of the famous steamers of Scottish waters, and their book on the West Highland steamers of David Macbrayne Ltd. was reviewed in the *"M.M."* for October 1935. In the present volume they have extended their work to cover railway and other steamers operating in the same region.

The longest sections of the book deal with the steamers of the L.M.S.R. and L.N.E.R. When railways first ran vessels to the Clyde coast resorts their action was resented by the existing steamboat owners, and severe rivalry followed before it was realised that co-operation between the railways and steamboat owners in general was to the advantage of both. The Caledonian and Glasgow and South Western Railways also conducted a war of their own, each running a line to the Clyde resorts from which its steamships sailed. Each continually challenged the other. For instance, the Caledonian Railway built the *"Duchess of Hamilton,"* one of the most beautiful and best known of Clyde railway steamers, and the first to have the promenade deck extended to the bow, a feature that afterwards became the rule. The appearance of this vessel on the run from Ardrossan to Arran led to the building by the Glasgow and South Western Railway of the *"Glen Sannox,"* a slightly faster boat; and for a time the Arran ports enjoyed a wonderfully fine service as a result of the keen rivalry.

When the Great War came, many Clyde steamers were called on for service as mine-sweepers, and visited the North Sea, the English Channel and more distant waters, one actually being stationed for a time at Archangel, in Northern Russia. In recent years many handsome new turbine steamers and motor vessels have been placed in service, and these fully maintain Clyde traditions. One of the most interesting of these is the *"Talisman,"* the most recent addition to the L.N.E.R. fleet, for she is the first Diesel-electric paddle vessel ever built.

The Clyde steamers of David Macbrayne Ltd. are dealt with less briefly than in the author's previous work, only those that operated on the Clyde during 1935 and since being described. Other chapters are concerned with vessels that sail from Glasgow to the Hebrides, the steamers that ply on Loch Lomond and other inland waters, the ferries of the Clyde Navigation Trust, and the Firth of Forth ferry boats. The book is well illustrated by 71 plates.



"Saint Columba," the first Clyde steamer of normal design to have three funnels. From "Clyde River and Other Steamers," reviewed on this page.

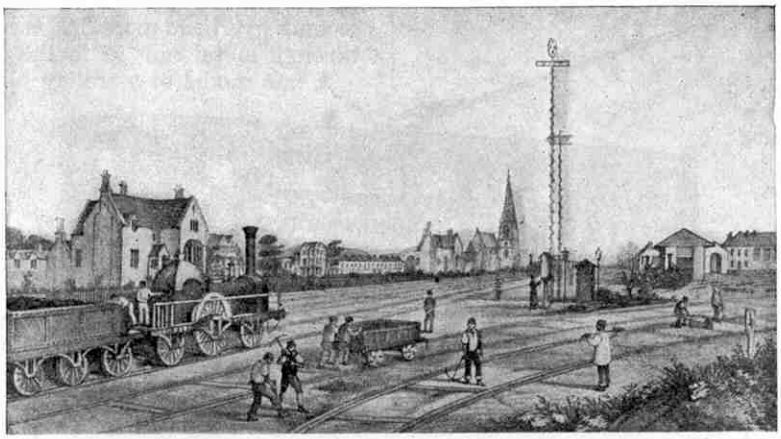
"Wonders of World Engineering"

Edited by Clarence Winchester
(Amalgamated Press. 7d. weekly)

Readers who are familiar with *"Railway Wonders of the World"* and *"Shipping Wonders of the World"* will welcome this new work, planned on similar lines, and now appearing in weekly parts. Each issue is packed with informative and stimulating articles that illustrate the great part that engineering plays in civilisation. Railways, aeroplanes, steelworks, giant dams, huge bridges and great generating stations are described, and stories are given of the inventors and engineers who gave us them.

The first part is representative of the aims of the editor. It includes articles on the great bridges of San Francisco, the new Empire flying boats, the Niagara Falls Power Station, and other great engineering projects. Later issues describe the Mersey Tunnel and the building of Boulder Dam, and other topics dealt with include the production of motor cars, the building of lighthouses, and the triumphs of the engineer in providing water for irrigation purposes in India, Egypt and elsewhere. Each article is splendidly written and well illustrated, and there is also a special illustrated section in photogravure.

Practically every outstanding engineering marvel of the world will be dealt with in the 50 parts of this work to be issued, and these will form a splendid record of the achievements of the world's great engineers.



Swindon, the famous Great Western Railway centre, as it appeared in 1847. The gauge of the G.W.R. lines then was 7 ft. From "English Railways," reviewed on this page.

"English Railways"

By Vernon Sommerfield. (Nelson. 7/6 net)

The romance of the development of railways in England, particularly in their earliest days, is Mr. Sommerfield's subject. The author is at pains to show how each of the great railway companies of pre-grouping days developed its own special character and, in his own words, his book is much less history than a biography of their personalities.

The story begins with an account in brief of railways and locomotives prior to the opening of the Stockton and Darlington Railway in 1885. Then each of the great railways in turn is dealt with, beginning with the Great Western Railway, the only system in any country to be built on the 7-ft. gauge. The struggles and mistakes of its early days are well told, and then follows the story of the battle of the gauges, in which Stephenson's 4 ft. 8½ in. track was triumphant over the 7 ft. track of Brunel.

Next comes the old London and North Western Railway, long looked upon as the country's premier line; and the story is continued with the Midland Railway, the monument of George Hudson, the Yorkshire draper who became a railway king; the Great Eastern Railway, the parent company of which was the butt of countless jokes in the press; and the Great Northern Railway, over the tracks of which the *"Flying Scotsman"* and other famous expresses have run daily for many years.

The rivalry of the southern railways is the subject of the following chapters. This was keenest in the south east, where for years the South Eastern and London, Chatham and Dover Railways fought each other tooth and nail.

Finally Mr. Sommerfield deals with the present position. He strongly disapproves of the grouping scheme, which he thinks has destroyed the "personalities" of the old companies, but he realises the advantages that grouping has brought.

"Facts About British Railways"

British railways are the principal means of transport in this country, and it is to make known the extent of their activities that the booklet *"Facts About British Railways"* is issued annually. The 1937 edition provides a useful summary of railway services and equipment, and gives interesting details of last year's working, such as the number of locomotives in service. An interesting account of the chief railway developments of 1936 also is given, and a useful map of the British railway system is included.

The booklet is a mine of information on railway matters of all kinds, and will be of the greatest interest and value to every railway enthusiast. Copies obtainable free on application to the British Railways Press Office, 35, Parliament Street, London, S.W.1.

In Search of New Models

Motor Buses, Tramcars and Trolley Buses

THIS month we are dealing with the possibilities for model-building provided by the many different kinds of public vehicles used for passenger transport in towns and cities. These vehicles make excellent subjects for models, and they are now made in such a variety of types and designs that their reproduction gives ample opportunity for the display of model-building skill. Models of this type are particularly well adapted for the inclusion of Clockwork or Electric Motors, so that after the fun of building and completing them, there is the additional pleasure of setting them in motion.

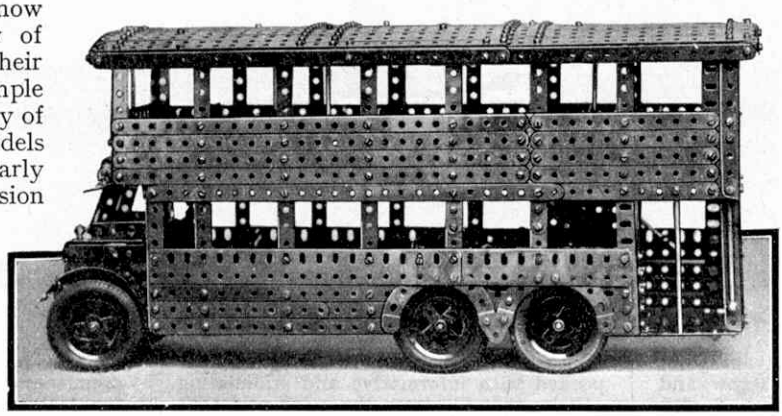


Fig. 1. A well-proportioned model of a double deck motor omnibus, the coachwork of which consists chiefly of Strips and Flat Girders. It is the work of A. Leonard, Blackheath.

One of the oldest public passenger vehicles is the electric tramcar, and owing to the ease with which the outlines and mechanism of these vehicles can be reproduced, they make very suitable subjects for model-builders of limited experience. The earliest tramcars were fitted with four wheels, and were of the single deck open-ended type. They were inclined to sway and vibrate when travelling at speed, however, and in an effort to produce a more silent-running and stable vehicle an improved type fitted with two four-wheeled bogies was introduced. These vehicles are less noisy and run more smoothly than the four-wheeled types, and generally the front and rear are completely enclosed.

Tramcars may be grouped into two main classes, one of which includes all those of the single deck type, and the other those having two decks. The single deck tramcar is very popular in some foreign countries, and has reached a high standard of efficiency. The more interesting forms of this vehicle offer plenty of scope for experiment, and in addition provide opportunities for those who delight in detail work. In this country single deck tramcars have not proved popular. The majority of tramcars in service in the British Isles have two decks, the upper one being reached by spiral stairways at the ends of the vehicle. An excellent model of this kind is shown in Fig. 2. Its realistic appearance and its main constructional details will be evident at a glance.

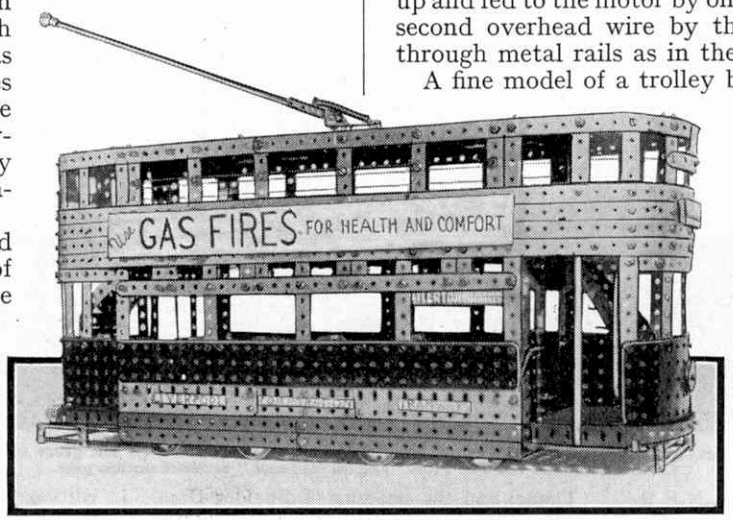


Fig. 2. A fine model tramcar built by P. Giese, Buenos Aires. It is an excellent example of the neat appearance that results from skilful combination of Strips and Flat Plates.

Some of the latest tramcars are elaborately streamlined, and Flexible Plates should always be used in reproducing these. If the design on the Plates is not desired to show in the model, it is a simple matter to turn the plain side of the Plates outward and thus to obtain a plain blue finish. The model should be strengthened by cross braces at suitable points to prevent the Flexible Plates from buckling.

Another type of electrically-propelled passenger transport vehicle that is used in many towns in this country and abroad is the trolley bus, an article on which appears on page 252 of this issue. These vehicles are particularly useful for service in towns where the roads are narrow, for they are more flexible in their movements than tramcars, and as they run on rubber-tyred wheels they are not so noisy in operation. They are propelled by powerful electric motors, which obtain their current supply from overhead conductor wires by means of two long trolley "pick-ups," similar to those fitted to tramcars. The current is picked up and fed to the motor by one trolley and is returned to a second overhead wire by the other trolley, instead of through metal rails as in the case of a tramcar.

A fine model of a trolley bus is shown in Fig. 4. It is simple to build, and the pleasure of operating it when completed will amply repay the labour needed for its construction. One of the two trolleys feeds the current to a 6-volt Electric Motor mounted in front of the model, and the drive is transmitted through a two-speed gear box and a Universal Coupling and Bevel Gear to the back axle. Internal expanding brakes operated by a foot pedal are fitted to the rear wheels, and the worm operated steering is of the Ackermann type. Both the front and the rear axles are mounted on semi-elliptic springs.

The saloon is built mainly from Plates and is roofed with Strips. The trolleys are each mounted on separate Strips that are insulated from the saloon roof by 6 B.A. Bolts and Insulating Bushes and Washers. The Strips are connected by rubber-covered wire to the Motor terminals, and $\frac{1}{2}$" loose Pulleys mounted in small Fork Pieces at the

upper extremities of the trolleys engage with the overhead wires and pick up the electric current. The overhead conductor wires are suspended from standards built up from Angle Girders, with Strips for the overhanging arms.

The strong coil springs that keep the trolley pulleys in contact with the overhead wires are made with Meccano Springs, and the complete unit is extremely realistic. The trolleys may be mounted in several different ways according to the parts available. In the model illustrated they are mounted on short Rods fastened in Swivel Bearings that in turn are journalled in Double Bent Strips bolted to Strips spaced from the roof. This arrangement allows the trolleys to swivel in any direction just like the trolley of an actual vehicle when turning corners or drawing in to the roadside.

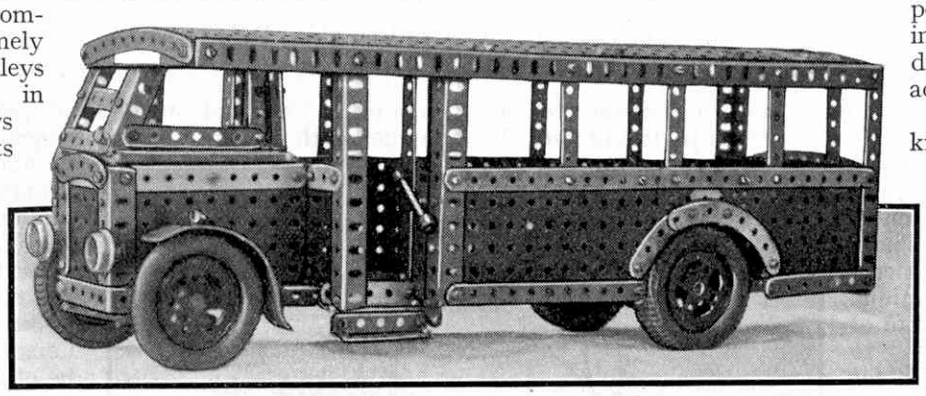


Fig. 3. C. Bills, Blackpool, is the constructor of this model single deck motor omnibus. An interesting feature is the realistic appearance of the cab, obtained with simple parts.

The trolley bus model illustrated is of the single deck type. The double-decker type that is now in use in London and many other cities and towns offers very attractive possibilities to the keen model-builder, and those who are unable to obtain by direct observation the details they require should have no difficulty in building good models of the buses illustrated in the article on page 252 to which reference has already been made.

The most popular public vehicles for passenger transport are motor omnibuses, and among the different designs of these vehicles are many excellent subjects for models. Generally they have six wheels, but a few are still made with only four wheels. In most cases the engine is forward mounted, and the driver is accommodated in an enclosed cabin alongside. In some vehicles the engine is mounted behind the driver, however, and this arrangement facilitates streamlining of the front of the vehicle because of the absence of the radiator. There are various designs of bodywork, some with entrances at the front or in the middle of one side, and the model-builder has an almost bewildering choice in this respect.

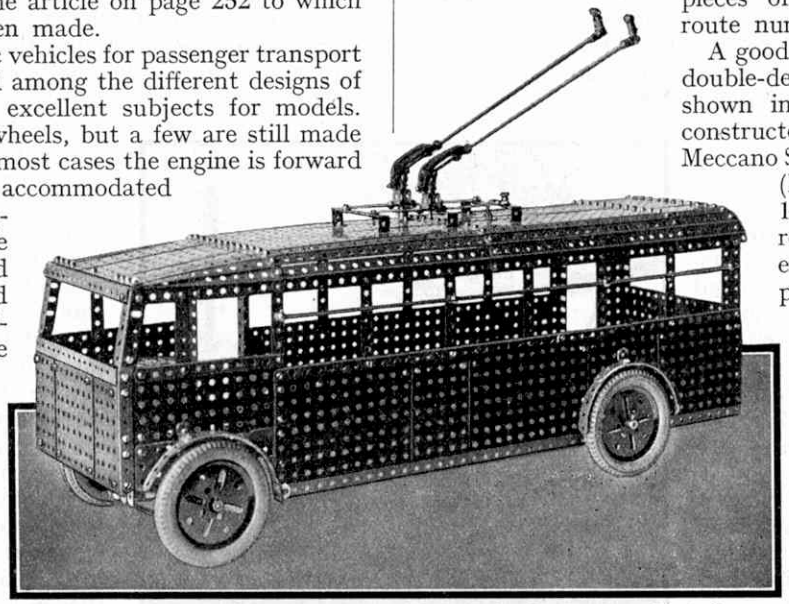


Fig. 4. This neat model of a trolley omnibus was built by P. Grenier, Barcelona. The trolleys are mounted on a platform insulated from the roof.

Before commencing to build a model it is best to decide whether it is to be power-driven or not as this will greatly affect the method of construction. If a power unit of some kind is to be included, sufficient space must be provided in the chassis to accommodate it. If it is decided to use a Clockwork Motor it is best to mount this near the side of the model so that it is easily accessible for winding. An Electric Motor can be placed at any suitable point, however, as it will not be necessary to obtain access to the Motor once it has been connected to the source of current supply. The connection should be made with twin flex.

The power unit should be mounted in position when the main part of the chassis is completed. In small models where a complete system of transmission is not possible, it is a good plan to mount the Motor directly over the rear axle, and to transmit the drive through suitable reduction gear. If it is intended to incorporate all the main details of a motor chassis, however, the Motor should be mounted in a position corresponding to that of the driving unit in the actual vehicle.

In constructing any kind of motor vehicle it is best to build the coachwork as a separate unit, so that it can easily be removed from the chassis. If the parts available are limited, internal details such as seating and staircases can be omitted, but where a realistic appearance is desired, these items must of course be included. To avoid difficulty in bolting the seats in position it is best to build each seat as a separate unit. Several seats should then be bolted in rows to Strips of suitable length. It is then only necessary to place the Strips in position in the interior of the coach and to bolt down their ends. Accessories such as number plates and destination boards can be represented by Strips and Double Angle Strips, but a more pleasing effect can be obtained with pieces of cardboard bearing the route number and destination.

A good example of a six-wheeled double-deck motor omnibus is shown in Fig. 1. The chassis is constructed on similar lines to the Meccano Super Model Motor Chassis (Instruction Leaflet No. 1a), and it is fitted with rear axles that are mounted between short Strips pivoted in the centre and arranged to form springs. Steering gear of the regulation pattern and operating on the Ackermann principle, is another feature of the model, the front wheels being moved by a Crank attached to the lower end of the steering column.

In designing the cab of a model of this kind it is great fun selecting suitable Meccano parts to represent the various controls and there is ample opportunity here for the clever model-builder to display his knowledge of the uses of the various Meccano parts.

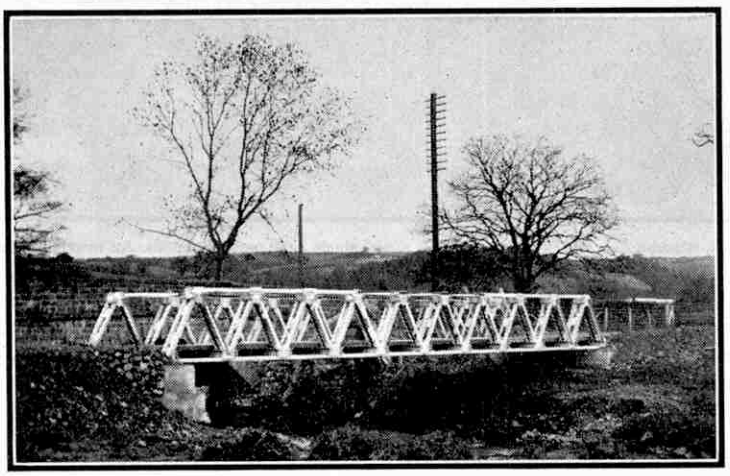
Considerable interest can be added to a model omnibus by equipping the interior of the coach with electric lighting. For this a number of 3.5 volt bulbs may be screwed in Meccano Lamp Holders wired up to a switch mounted in the driver's cab. Alternatively, the pea lamps supplied with the Meccano Lighting Sets may be used to advantage. These may be arranged as flush-fitting wall lights similar to the lighting units in some actual vehicles.

Bridge Built Like a Meccano Model

A Unique Construction System

By H. M. Pearson, A.M.Inst.C.E., B.Sc.

ONE hardly expects to find a modern bridge erected on the Meccano principle of standard parts and sizes all bolted together to form a complete structure. Yet such a bridge has recently been constructed near Newtown, Montgomeryshire, by this unique method. It is therefore of particular interest to readers of the "*M.M.*," for the Meccano model has in fact become the prototype.

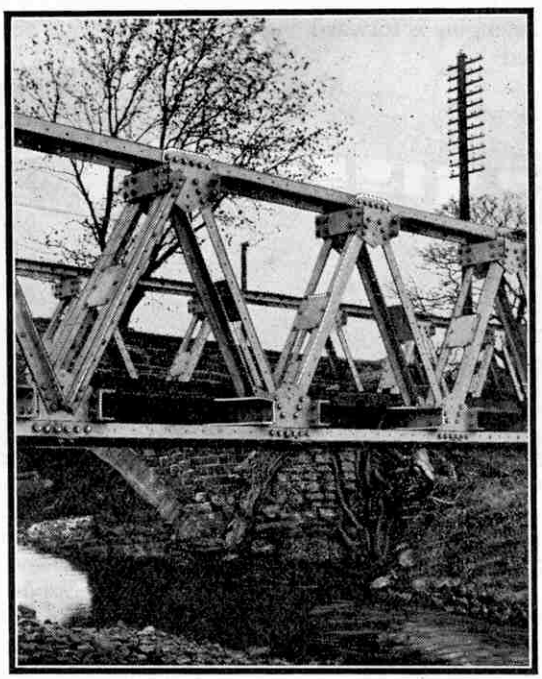


The temporary road bridge across the Dulais river that replaced a stone arch bridge swept away by floods. The remains of the original bridge can be seen in the lower illustration on this page.

The bridge was required to replace a masonry arch structure that had been swept away by floods following severe thunderstorms, and a roadway had to be provided at the shortest possible notice. The floods were those resulting in the destruction of the G.W.R. railway bridge over the Dulais river, so graphically described by "Railway Engineer" on page 20 of the issue of the "*M.M.*" for January last. The original masonry structure carried the road across the river, a short distance away from the railway bridge. Ex-Ganger Haynes, a retired permanent way man who saw the destruction of the bridge, had to cross the road bridge on his way to his home in order to give warning by telephone of the disaster. Although the road was flooded he managed to get across, but he had scarcely done so when the bridge was swept away. Haynes later went out to warn motorists of the destruction of the bridge, and continued to do this until two o'clock next morning.

The design of the new bridge is based almost wholly on the use of light steel angles 3 in. by 3 in. by $\frac{1}{4}$ in., 5 ft. long, which weigh only 25 lb. each and so can be very easily handled. These are provided with holes at intervals to take $\frac{3}{4}$ in. diameter bolts, thus enabling the various pieces to be assembled and bolted together as required. All the standard components were galvanised after manufacture.

The general design consists of two triangulated Warren trusses, 12 ft. apart, built up of the standard angles held together by means of light gusset plates. On the lower flange of the main trusses so formed rest 6 in. by $3\frac{1}{2}$ in. channel floor beams carrying a 4 in. cross timber deck constituting the roadway. The whole of the lower portion is cross-braced underneath the decking with diagonal angle ties in order to afford lateral stability against the effects of lurching vehicles and wind pressure.

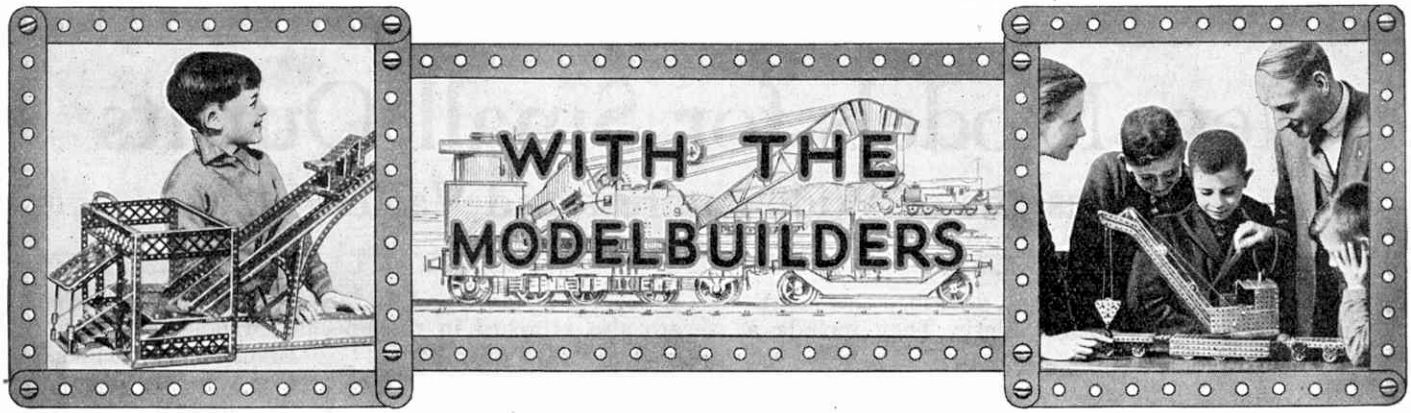


This close-up view of triangulated panels of the bridge shows the method employed in its construction.

Bridges constructed by this method, known as the Callender-Hamilton Unit Construction system, may be of almost any size and span to suit the site conditions, and have the advantage of being assembled with great rapidity. Increased strength is cleverly provided by the use of additional angles, top and bottom, which are bolted on alongside the two through angles in each flange of the truss. Thus the first bay or panel will have two angles only, the next two panels three angles and the centre panels four, the number of angles then decreasing in the same way on the remaining half of the truss.

The bridge was to span 50 ft. and to carry a load of 8 tons. Within a fortnight of the order being given, all the loose parts had been delivered to the site and the work of erection had begun. Low concrete abutments were first of all built up on each side of the river in the field adjoining the old bridge, and the new structure was assembled on one of the banks. Two stout timber masts about 30 ft. high were then temporarily erected on the opposite bank, carrying wire ropes attached to one end of the completed superstructure. By means of winches the whole structure was finally launched into position, the free end being suspended by the cables from the mast heads, and slowly hauled across until it rested squarely on both abutments.

About 7 tons of standard components and bolts were used in the superstructure, which was constructed and launched in the almost incredibly short space of 360 men-hours. This constitutes a very creditable piece of speedy construction. Although this type of bridge has been used with considerable success overseas, this is the first occasion in which the system has been adopted in this country.



REVERSING MOVEMENT OPERATED BY ECCENTRICS

New mechanical movements are always of interest to model-builders, especially when they are adaptable for use in a wide range of models. B. Pearson of Nottingham has been busy building a model of an excavator that is driven by an Electric Motor and works for long periods without attention. Included in the mechanism of this model is an automatic gear that reverses the movements of the shovel arm and jib at the end of each cycle of operations. When Pearson started to construct this portion of the model, he discovered that he had insufficient parts to make an orthodox reversing motion, so he set to work to design a simple mechanism to his own ideas. He experimented first with various systems of pulleys, but these did not work satisfactorily owing to the fact that the cords slipped and the sequence of the movements was upset, thus spoiling the realism of the model. Eventually he evolved an efficient lever movement worked by Eccentrics, and when properly adjusted, this device proved very satisfactory.

The main part of the mechanism consists of a shaft that is driven by Worm Gearing from the Electric Motor, which is placed in the cab of the model. On this shaft two Triple-Throw Eccentrics are fastened so that a 1″ stroke is obtained. The arms of the Eccentrics are then connected to two levers that consist of four 5½″ Strips bolted face to face. These levers are pivoted on a second Rod that is journalled in bearings provided in the sides of the cab. The position of the pivot point for these levers depends on the amount of movement that it is necessary to impart to the jib and shovel arm. Lengths of Sprocket Chain are attached to the other ends of the levers, and are then passed over guide Sprocket Wheels fastened on a Rod journalled below an opening provided in the roof of the cab. One of the Sprocket Chains is attached to the end of the shovel arm, and the other is passed over a Sprocket Wheel fastened on a Rod at the jib-head, and then is bolted to the front of the cab. As the levers are moved up and down by the Eccentrics the jib is luffed and the shovel performs the digging motion. The idea seems one that could be extended to other models.

A FREE WHEEL MECHANISM FOR SMALL MODELS

Most of the standard Meccano free-wheel devices make use of Ratchet Wheels and Pawls in conjunction with large Gears and Sprocket Wheels, and are too clumsy for small mechanisms. H. Candeland however, informs us that he has devised an effective arrangement that can be fitted to any of the small Pulleys, Gears and Sprockets in the Meccano range. His device is compact, and is small enough to allow its inclusion in models in which space is limited.

The free-wheel part of the mechanism is made by winding 22 S.W.G. steel wire on a rod of diameter slightly less than that of the standard Meccano Rod to produce a coil similar to the Meccano Anchoring Spring. A short end of wire is left for making a loop that can be bent at right-angles, and is secured to the boss of a Gear or Sprocket by means of a Set Screw spaced with Washers. The complete unit is then pushed on to a Rod.

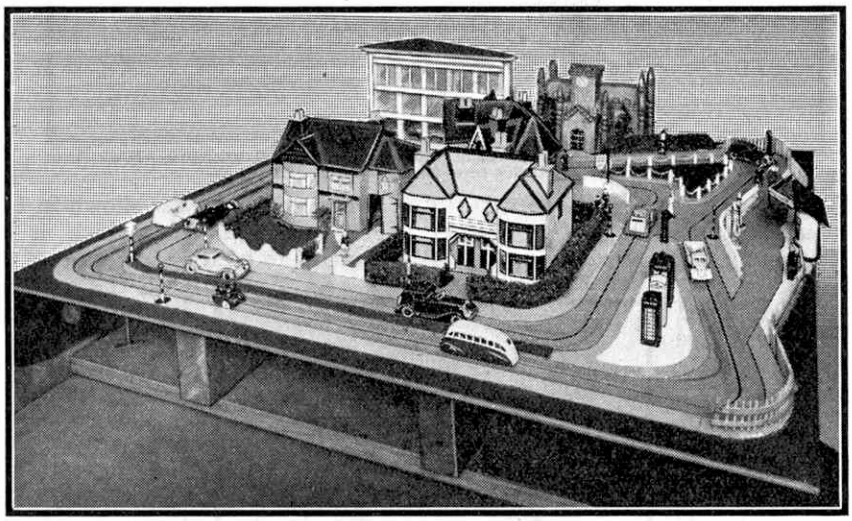
The device operates in the following manner. When the driven wheel is rotated in one direction it tends to tighten the turns of the coil, so that they grip the Rod firmly and cause it to turn with the Gear. When the Gear is rotated in the opposite direction, however, the turns of the coil tend to unwind and allow the Gear to rotate independently of the Rod.

When the device is free-wheeling the Gear Wheel to which it is attached tends to move along the Rod, but this can be prevented by the use of either Collars or Anchoring Springs fitted on each side.

Meccano Anchoring Springs could be used in the place of the home-made coil. The coils of the Springs would have to be opened out slightly to prevent them from gripping the Rod too tightly.

A SUGGESTED MECCANO SPANNER

D. Manson, Inverness, suggests that a new spanner should be introduced for the purpose of placing and securing nuts and bolts in complicated models. He suggests a spanner similar in design to the winding keys for the Clockwork Motors, but with a square section bore of dimensions similar to those of the Meccano nut. As an alternative to this idea Manson suggests that the end of the present winding key should be enlarged into square section so that it could be used either as a spanner or for its normal function of winding Clockwork Motors. These ideas are good, for spanners of the kind suggested would enable nuts to be placed in awkward positions and secured without difficulty. Such spanners, however, would be limited in their practical uses. For example it would not be possible to use a spanner of this type in making structures such as box girders or small models of box-shaped construction. For work of this kind the present Meccano Spanner and Box Spanner have the advantage.



A splendid working model in which two streams of Dinky Toys vehicles travel in opposite directions. The layout was designed and assembled by H. Williams, Birmingham, 16, and its main constructional features are described on this page.

PERFORATED FIBRE STRIPS (reply to A. G. Emms, Lyttelton, New Zealand, and others)

When building electrical models, it is often necessary to insulate several Terminals from Strips or other Meccano parts on which they are mounted. This can be done by means of Insulating Washers, but dealing with each Terminal separately takes a considerable time. In order to speed up the work A. Smith, London, N.W., glues thick brown paper on each side of a long Strip and then fastens the Terminals in position after puncturing the paper with the 6BA Bolts, taking care not to tear the paper. This method provides efficient insulation for low voltages.

An alternative suggestion comes from A. G. Emms, Lyttelton, N.Z., who thinks that perforated fibre strips of the same lengths as the standard Meccano Strips should be introduced for the purpose. Fibre strips of this kind would have useful applications in other directions. For example, in architectural model-building they could be used for reproducing curved portions of the model, thus eliminating the necessity of bending the ordinary Strips.

The only trouble likely to be experienced would be the tendency for the bolts to enlarge the holes in the strips. This could be overcome, however, by using the standard Meccano Washers on each side of the fibre strip.

A DINKY TOYS LAYOUT OPERATED BY MECCANO MECHANISM

Meccano model-builders who are also collectors of Dinky Toys will be interested in the realistic layout shown on this page. It is the work of H. Williams, Birmingham, and was awarded a prize in the "Autumn" General Model-building Contest, announced in the October 1936 "*M.M.*"

The layout is arranged on a baseboard 40″ square that is raised on supports to permit the driving Motor and operating mechanism, which consists mainly of Meccano parts, to be accommodated underneath. The driving Motor is placed below the three telephone boxes shown on the right of the illustration, and drives Sprocket Wheels through Bevel reduction gearing. The Dinky Toys Motor Vehicles are drawn along by means of wires that pass through slots cut in the baseboard and are attached to endless lengths of Sprocket Chain that move in opposite directions. The wires are curved at their lower ends so that they can be attached to the Chains at any desired point.

It is really good fun arranging layouts of this kind and many enjoyable hours can be spent in designing crossings and road intersections that can be "worked" by the Sprocket Chain method. It should be possible to include also colour light traffic signals at the road junctions and to link these up with the main operating Motors in such a way that the vehicles come to a standstill when the lights are against them. There are opportunities for many fascinating experiments of this kind, and we hope that any model-builders who decide to try their skill in this direction will send us details of their models.

A NEW USE FOR SPRING CORD

In models incorporating pulley-driven mechanisms trouble is usually experienced in preventing the various belts from slipping round the Pulleys. J. C. Blakeman of Wolverhampton experienced this trouble in connection with a model workshop he was constructing, in which all the machines were driven from an Electric Motor through several Cord and Pulley transmissions. He found the following methods useful in overcoming the difficulty.

In the longer belts he fitted a novel type of tension device. This consisted of a piece of Spring Cord 3 in. long, which was incorporated in each belt by stretching the last quarter inch of Spring at each end, thus leaving small coils spaced by a length of wire. The ends of the Cord were threaded through these coils, and were then knotted to prevent their being pulled out again. The belt was then stretched round the Pulleys it was desired to drive, and the Spring Cord kept the belt in sufficient tension to prevent slipping. Rubber bands were placed in the grooves of the Pulleys in order to give the Cord a good surface to grip.

In models where the larger Pulleys are used, a Meccano Spring may be incorporated in the belt in place of Spring Cord. The tension supplied by the Spring will be found sufficient to enable considerable loads to be transmitted without any appreciable amount of slip.

MAGIC MOTOR DRIVEN MODELS

The *Magic* Motor, the smallest of the Meccano power units, is used by many model-builders for driving motor cars that are too small to be operated by the larger Clockwork Motors. For this purpose suitable reduction gear must be provided. A good plan, and one that does not appear to attract much attention, is to make use of the winding shaft of the Motor by securing a Pulley to it. In this way a very powerful drive at approximately correct speed can be obtained.

New Models for Small Outfits

Designs of Wide Interest and Variety

THE four models illustrated and described this month are remarkable for their variety. They include a simple motor car and an aeroplane, types that are very attractive to model-builders, together with two working models, one of a planing machine and the other of a pneumatic driller at work. The fourth of these models is particularly effective when in motion, and is an excellent example of the clever and amusingly realistic models that can be so readily built with Meccano Outfits.

The first model to be described is the planing machine, shown in Fig. 1. It is driven by a *Magic* Motor, and can be built with Outfit D. Construction is commenced with the main framework that supports the table. Two $12\frac{1}{2}''$ Angle Girders are joined together at one end by a $3\frac{1}{2}''$ Strip, and at the other end by two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates 1 overlapped three holes. $2\frac{1}{2}''$ Strips overlapped three holes are bolted across the Angle Girders at the centre, in the position shown in the illustration, and the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plate 2, and the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate 3, are added.

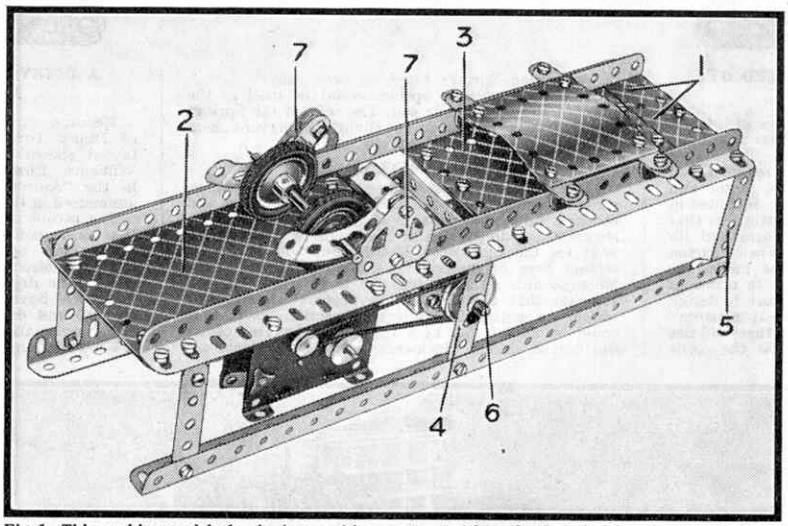


Fig. 1. This working model of a planing machine constructed from Outfit D, is driven by a Magic Motor and has a sliding cover for the revolving blade.

The lower Angle Girders are attached to the table of the machine by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips at 4 and 5, and the remaining legs are represented by $2\frac{1}{2}''$ Strips. The rotating blades are then constructed. Four $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are fastened to a Bush Wheel that is attached to a $4\frac{1}{2}''$ Rod 6. The free ends of the Double Angle Strips are bolted to $1\frac{1}{2}''$ Strips, also with the $4\frac{1}{2}''$ Rod passing through them. A 1″ Pulley is fastened next to the Bush Wheel, and the complete assembly is journalled in the centre Double Angle Strip 4. The roller, which on the actual machine holds down the work, is built by bolting two Flat Trunnions 7 as shown, and locknutting two $2\frac{1}{2}''$ small radius Curved Strips to them by $\frac{3}{8}''$ Bolts spaced with Washers. Two 1″ Pulleys fitted with Rubber Tyres are fastened to a 3″ Rod and journalled in the Curved Strips.

The cover for the rotating blade consists of a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate suitably shaped. At each corner a Flat Bracket is fastened and by the same bolt Angle Brackets are also attached in the unoccupied holes of the Flat Brackets. Further Angle Brackets are bolted in the unoccupied holes of the Flat Brackets, so that the parts at each corner of the Flexible Plate form a groove into which the top Angle Girders fit.

The *Magic* Motor is added last, and its position is clear from the illustration.

Parts required to build the model Planing Machine: 1 of No. 3; 6 of No. 5; 2 of No. 6a; 4 of No. 8; 4 of No. 10; 10 of No. 12; 1 of No. 15a; 1 of No. 16b; 3 of No. 22; 1 of No. 23; 1 of No. 24; 6 of No. 35; 53 of No. 37; 4 of No. 37a; 8 of No. 38; 8 of No. 48a; 2 of No. 90a; 2 of No. 111c; 2 of No. 126; 1 of No. 186; 2 of No. 188; 1 of No. 190; 1 of No. 191; 1 of No. 195; 1 *Magic* Motor and 2 Tyres 1″ (not included in Outfit).

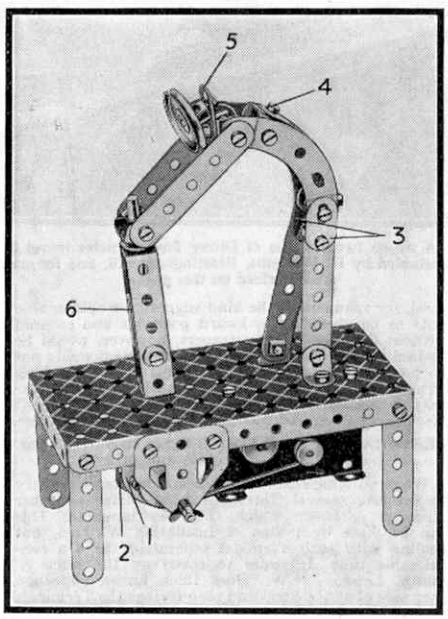


Fig. 2. An amusing model, showing a miniature pneumatic driller at work, that can be built with Outfit B. When the model is set in motion the figure shakes violently.

The next model is the small streamlined car shown in Fig. 4. This is the latest "pear-drop" design, which is considered by motor engineers to be the ideal form of streamlining. It is built with the contents of Outfit C, and is easy to construct, and very effective in appearance.

The chassis consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, to one end of which is fastened two Obtuse Angle Brackets. A $2\frac{1}{2}''$ small radius Curved Strip 1 is bolted to a $2\frac{1}{2}''$ Strip in the centre hole, and the Curved Strip is attached to the Flanged Plate. A $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 2 is fastened to the top hole of the $2\frac{1}{2}''$ Strip, and also is bolted to a similar Strip on the opposite side.

The front is next added. A $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate is attached to the Obtuse Angle Brackets already mentioned, and two $2\frac{1}{2}''$ Strips overlapping the Flexible Plate two holes hold the front to the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 2. Further Obtuse Angle Brackets are also fitted by means of the same bolts.

A $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate has attached to it a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate 3, which is raised up one hole, and is overlapped three holes. This part is bolted to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate as shown, and the remainder of the coachwork completed. Two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips 4 are fitted on, one on each side of the body, and the $5\frac{1}{2}''$ Strip added. A $4\frac{1}{2}'' \times 2\frac{1}{2}''$ and a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate are bolted together, and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is fastened at the join. This and another Double Angle

Strip, fastened in the middle of the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate, hold the $2\frac{1}{2}''$ small radius Curved Strip 5 and a Flat Bracket that supports the $2\frac{1}{2}''$ Strip 6. The end of the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate is attached to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and to Obtuse Angle Brackets on the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 2. The rear axle is a $3\frac{1}{2}''$ Rod, and the front axle is a $3\frac{1}{2}''$ Strip fitted at each end with Angle Brackets. The 1" Pulleys that are used for the front wheels are held by their set screws to $\frac{3}{8}''$ Bolts that pass through the Angle Brackets, and the complete assembly is then pivotally mounted to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate.

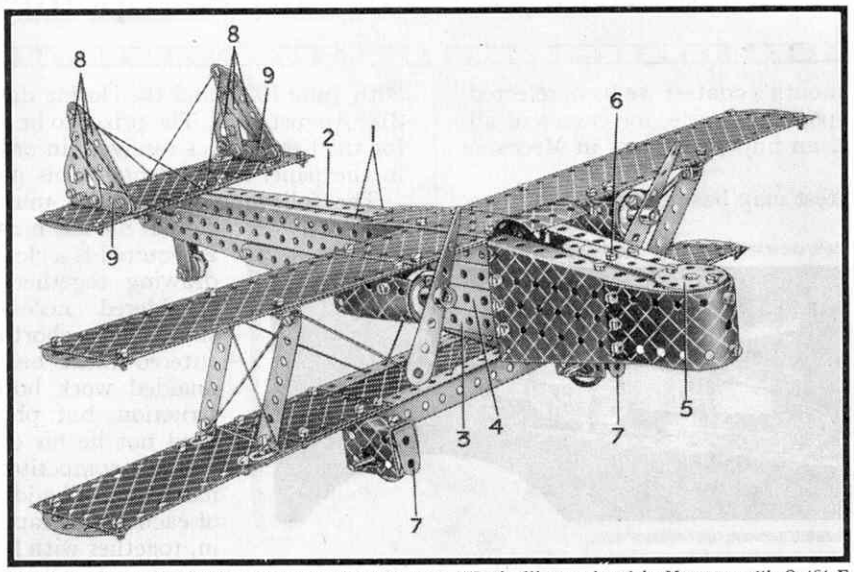


Fig. 3. A fine model of the well-known Handley Page "Heyford" reproduced in Meccano with Outfit E.

Parts required to build the model streamlined car: 2 of No. 2; 1 of No. 3; 8 of No. 5; 2 of No. 10; 2 of No. 12; 4 of No. 12c; 1 of No. 16; 4 of No. 22; 1 of No. 23; 52 of No. 37; 1 of No. 37a; 2 of No. 38; 5 of No. 48a; 1 of No. 52; 4 of No. 90a; 4 of No. 111c; 2 of No. 188; 2 of No. 189; 1 of No. 190; 1 of No. 191; 1 of No. 192; 4 Tyres 1" (not included in Outfit).

The model shown in Fig. 3 is a miniature of a Handley Page "Heyford" night bomber. It can be built with Outfit E and construction should be commenced by bolting two $12\frac{1}{2}''$ Angle Girders 1 together at one end by their elongated holes, and fastening the $12\frac{1}{2}''$ Strip 2 to them by the same Bolt. In a similar manner this construction is used for the underside of the fuselage but the free ends of the Angle Girders and $12\frac{1}{2}''$ Strip are bolted together by Flat Brackets and the two components are joined at the tail by means of Flat Brackets.

A $5\frac{1}{2}''$ Strip 3 is fastened in the seventh hole of the lower Angle Girder and the $12\frac{1}{2}''$ Strip 4 is bolted in the ninth hole from the tail as shown. A further $12\frac{1}{2}''$ Strip is fitted with a Nut, Bolt and Washer, and is clamped in the position shown in the illustration. The fuselage is completed on the opposite side, and the $4\frac{1}{2}''$ Flanged Sector Plates that form the nose are added.

Two $2\frac{1}{2}''$ Strips overlapped four holes are attached to the Bush Wheel 5, and by the Bolts 6 to Flat Brackets secured to the Flanged Sector Plates. An Angle Bracket holds the Bush Wheel in place in the nose.

The engines are next built. A $2\frac{1}{2}'' \times 2\frac{1}{2}''$ U-Section Flexible Plate is fastened to a Double Bracket in the second hole from the end, and the remote corners are pulled together by a bolt and nut. Two $\frac{1}{2}''$ Pulleys hold $1\frac{1}{2}''$ Rods on which the propellers are mounted.

Two 1" loose Pulleys are used for the wheels and the wheel covers are $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates bent into U-shape and covered in at the front by $1'' \times 1''$ Angle Brackets 7. Two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates overlapping five holes and fitted with $2\frac{1}{2}''$ large radius Curved Strips represent the tail plane. Each of the tail fins consist of three $2\frac{1}{2}''$ Strips 8, a $1\frac{1}{2}''$ Strip 9, and a Flat Trunnion. The method of rigging the model with Cord can be seen from the illustration.

Parts required to build the model "Heyford": 10 of No. 1; 2 of No. 2; 4 of No. 3; 2 of No. 4; 8 of No. 5; 2 of No. 6a; 4 of No. 8; 8 of No. 10; 2 of No. 11; 12 of No. 12; 2 of No. 12a; 2 of No. 22; 2 of No. 22a; 1 of No. 23; 1 of No. 24; 4 of No. 35; 105 of No. 37; 1 of No. 37a; 6 of No. 38; 1 of No. 44; 1 of No. 52; 2 of No. 54a; 2 of No. 59; 2 of No. 90; 4 of No. 90a; 1 of No. 111; 2 of No. 126a; 2 of No. 188; 2 of No. 189; 2 of No. 190; 2 of No. 191; 2 of No. 195; 2 of No. 197; 2 of No. 199.

The model pneumatic driller shown in Fig. 2 is built with Outfit B, and is yet another of the many amusing models that can be built with this Outfit.

The working part of the model is a $3\frac{1}{2}''$ Rod to which is fastened a 1" Pulley, and a Bush Wheel 1 carrying two Angle Brackets, one of which can be seen at 2. The Brackets are fastened by their elongated holes, and they are inclined at an angle so that they form a cam. It is necessary to adjust these when the model is completed.

The figure is easily constructed. The bolt 4 holds a $2\frac{1}{2}''$ Strip to the two Angle Brackets and the Flat Bracket 5 carries a 1" Pulley. The Flat Brackets 3 are pivotally attached to the $2\frac{1}{2}''$ Cranked Curved Strips that form the body of the figure.

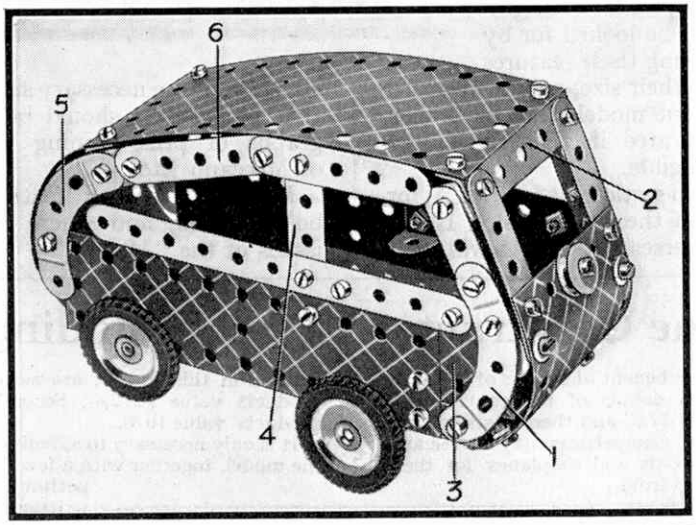


Fig. 4. Streamlining in Meccano. This model car forms a novel subject for owners of Outfit C.

The sides of the drill are held together by a Cranked Bent Strip 6, and the protruding end of the 4" Rod is arranged to come into contact with the Angle Brackets on the Bush Wheel 1.

The *Magic* Motor is fitted as shown, and when this is set in motion, an amusing effect is produced provided the model is carefully adjusted. Care must be taken to ensure that the Angle Brackets on the Bush Wheel are positioned so that the Rod does not engage in their holes. The distance through which the drill is raised by the cam can readily be varied as the model-builder wishes. The smaller it is made the higher the speed at which the *Magic* Motor will operate the model, and the more effective the movement.

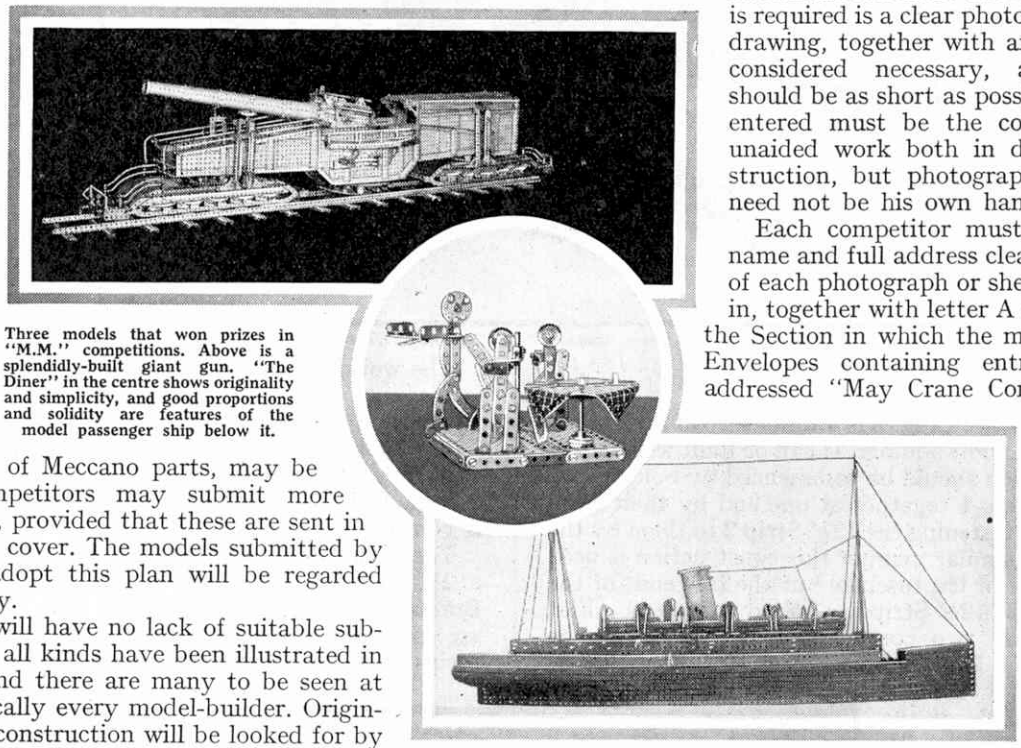
Parts required to build the model pneumatic driller: 9 of No. 5; 3 of No. 10; 2 of No. 11; 8 of No. 12; 1 of No. 15b; 1 of No. 16; 2 of No. 21; 1 of No. 23; 1 of No. 24; 3 of No. 35; 29 of No. 37; 5 of No. 37a; 2 of No. 38; 1 of No. 44; 2 of No. 48a; 1 of No. 52; 2 of No. 90a; 3 of No. 111c; 2 of No. 126a; 1 of No. 186; 1 *Magic* Motor (not included in Outfit).

Meccano Model-Building Competitions

Prizes for Model Cranes and Aeroplanes

For the subject of this month's contest we have selected cranes. This should be a popular choice, for cranes of all types have always played an important part in Meccano model-building.

Competitors in this contest may base their entries upon any type of crane they prefer, or with which they are familiar, and their models may be of any size, from small reproductions of portable cranes to larger models of giant block-setting cranes. Any size of Outfit, or any number of Meccano parts, may be used, and competitors may submit more than one model, provided that these are sent in under the same cover. The models submitted by entrants who adopt this plan will be regarded as a single entry.



Three models that won prizes in "M.M." competitions. Above is a splendidly-built giant gun. "The Diner" in the centre shows originality and simplicity, and good proportions and solidity are features of the model passenger ship below it.

Competitors will have no lack of suitable subjects. Cranes of all kinds have been illustrated in the "*M.M.*," and there are many to be seen at work by practically every model-builder. Originality and good construction will be looked for by the judges, and the models showing these features in the highest degree, whatever their size, will be awarded the prizes. Reproductions of crane models that have been previously described and illustrated in the "*M.M.*" or in Meccano Manuals are not eligible.

Entries will be divided into two sections as follows: A, for competitors of all ages living in the British Isles, B, for competitors of all ages living Overseas. Section A will close 30th June 1937, and the closing date for Section B will be 31st August 1937. The prizes to be awarded in each section for the best entries received, in order of merit, are shown in the panel at the foot of this page.

The following instructions must be followed closely. Actual models must not be sent. All that is required is a clear photograph or a good drawing, together with any explanations considered necessary, although these should be as short as possible. Any model entered must be the competitor's own unaided work both in design and construction, but photographs or drawings need not be his own handiwork.

Each competitor must write his age, name and full address clearly on the back of each photograph or sheet of paper sent in, together with letter A or B to indicate the Section in which the model is entered. Envelopes containing entries should be addressed "May Crane Competition, Meccano Ltd., Binns Road, Liverpool 13."

Photographs or drawings of unsuccessful models will be returned to the senders, provided that a stamped addressed envelope of the necessary size is enclosed with the entry for that purpose. It should be noted, however, that photographs of prize-winning models become the property of Meccano Ltd.

Models displaying features of unusual interest will be described, and where possible illustrated, in future issues of the "*M.M.*"

May "Crane" Competition

THE PRIZES

The following prizes will be awarded in each Section:
1st Prize, Meccano or Hornby products value £3/3/0.
2nd Prize, Meccano or Hornby products value £2/2/0.
3rd Prize, Meccano or Hornby products value £1/1/0.
A number of consolation prizes also will be awarded.

"Aeroplane Constructor" Model-Building Contest

This competition is arranged for the benefit of owners of Meccano Aeroplane Constructor Outfits. Full details of the contest first appeared in the April issue of the "*M.M.*," and there is still plenty of time to prepare and send in entries. Competitors may choose any type of aeroplane, including flying boats and seaplanes for their subjects, but their models must be built from Meccano Aeroplane Constructor parts. Standard Meccano parts also may be used, but the principal portions of the models submitted must be made with the Aeroplane parts.

The competition is open to readers of all ages, living in any part of the world, and there will be only one section, but the ages of competitors will be taken into consideration when judging the models. The prizes to be awarded for the best models entered in this contest are as follows. First, Meccano or Hornby products value £2/2/–; Second, products value £1/1/–; Third, products value 10/6.

It is only necessary to submit either a photograph or a drawing of the model, together with a few details of its construction. The competitor's age, name and address must be written on the back of every photograph or drawing sent in. Entries must be addressed "April Aeroplane Constructor Contest, Meccano Ltd., Binns Road, Liverpool 13," and must reach this office on or before 31st July, 1937.

Since the first Aeroplane Constructor Outfits were introduced, several new parts have been added. Competitors who wish to bring their Outfits up to date should ask their dealer for our latest price lists.

Model-Building Competition Results

By "Spanner"

Christmas "Architectural" Contest

Full details of this competition were announced in the December 1936 issue of the "*M.M.*" Competitors were invited to submit models of any kind of architectural subject, and no restrictions were placed on the number of parts or size of Outfit to be used. The competition was open to "*M.M.*" readers of all ages, living in any part of the world, and attracted so many interesting and well built entries that similar contests will be announced in the near future.

The full list of prizewinners is as follows:

1st Prize, Meccano or Hornby products value £5/5/–: J. de Proft, Willebroeck, Belgium. 2nd, products value £3/3/–: H. Munson, Marlow, Bucks. 3rd, products value £2/2/–: F. Nunn, Colchester, Essex.

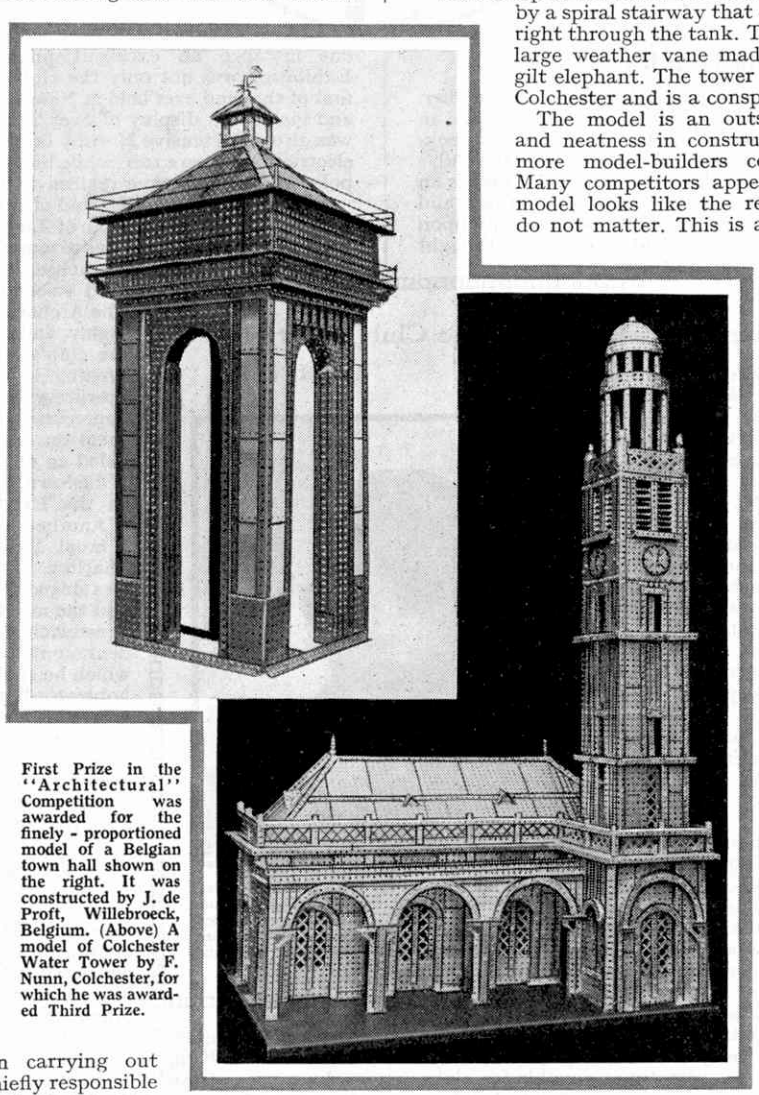
Products value 10/–: D. Hofsommer, The Hague, Holland; J. Willems, Antwerp, Belgium.

Products value 5/–: R. Drake, Dorchester; L. Stear, Bristol; R. Hilling, Ipswich; J. Kennett, Richmond, Surrey.

One of the finest features of architectural model-building is the splendid opportunity provided for the exercise of artistic ability. This is well shown in the beautiful and original model submitted by J. de Proft, the winner of First Prize in this Contest. The model represents a town hall of a type familiar in Belgium, and it is a striking example of the possibilities of Meccano for work of this kind. It is one of the neatest and most cleverly built architectural models that I have seen. The design, construction and decoration of the model are excellent, and I like particularly the tall and stately tower.

The illustration shows that the model is made entirely from Meccano parts, and readers who wish to improve their own work should study it closely, for they will find in it many constructional items that will be helpful to them.

J. de Proft had not submitted an entry in a Meccano competition for some time previously, and I hope that his success will encourage him to take part in future contests.



First Prize in the "Architectural" Competition was awarded for the finely - proportioned model of a Belgian town hall shown on the right. It was constructed by J. de Proft, Willebroeck, Belgium. (Above) A model of Colchester Water Tower by F. Nunn, Colchester, for which he was awarded Third Prize.

Originality and patience in carrying out minor details were the factors chiefly responsible for earning Second Prize for H. D. Munson, Marlow. This competitor succeeded in building a fine model of the Crystal Palace with a limited supply of parts at his disposal, and has every reason to be proud of his achievement. If the same constructional skill and original ideas had been put into a smaller and less ambitious model he might have been even more successful, as large and complicated structures are suitable subjects only for those who possess ample Meccano resources. I hope that he will carry on the good work with the increased supply of Meccano parts his success has brought him, and that he will endeavour to make each model he builds better than the last.

The frequently repeated statement that it is not necessary to build a large and complicated model in order to win a prize in these monthly competitions is well borne out by the other model illustrated on this page. A glance at the illustration will reveal that it is a very simple structure, yet it was successful in winning Third Prize for its builder F. Nunn, Colchester. It represents the Colchester Water Tower, known to local people as "Jumbo" on account of the massive construction of the four legs that support the water tank, and it owes its success in this contest chiefly to its admirable proportions, the neat manner in which the various pieces are assembled, the excellent taste shown in the selection of parts.

At the top of the tower is an observation room, which is reached by a spiral stairway that climbs a central shaft and passes right through the tank. The structure is surmounted by a large weather vane made in the shape of an enormous gilt elephant. The tower stands on the highest ground in Colchester and is a conspicuous landmark in the vicinity.

The model is an outstanding example of soundness and neatness in construction, and I should like to see more model-builders concentrating on these points. Many competitors appear to think that so long as a model looks like the real thing neatness and solidity do not matter. This is a great mistake and often leads to many otherwise interesting models failing to secure awards.

The English Pavilion at the International Industries Fair held in Brussels in 1935 was the subject that J. Willems chose for his model. The building is in the form of a plain circular tower, at the front of which are several massive pillars, and has no intricate details to reproduce. Willems' model is neat and accurate, and he well deserves the prize he was awarded for it. The main building is constructed of Strips bolted to Flat Girders, which have been bent into a circular shape. The pillars at the front of the structure are represented by Flat Girders and Angle Girders bolted together. Realism is added by cardboard lions and Union Jacks, which are placed at either side of the model.

D. Hofsommer won a prize with a model of the town hall of Hilversum, Holland. It represents a building of a different architectural style from that of the First Prize model, and has many corners and projections in its somewhat rambling construction. In spite of the many difficulties of such a subject, Hofsommer succeeded in building a good model, in which Flexible Plates and Flat Girders were freely used.

An interesting feature of the actual building is the almost complete absence of curves in its construction. This obviates the necessity for bending Meccano parts. The model is dominated by a massive square clock tower, which is reproduced with 12½" Strips, 2½" × 1½" Flexible Plates being used for buttresses. The tower contains a bell chamber, but in the model the bells are omitted.

"Autumn" General Model-Building Contest (Overseas)

1st Prize, products value £3/3/–: J. Diehl, Buenos Aires. 2nd, products value £2/2/–: N. Soderberg, Falun, Sweden. 3rd, products value £1/1/–: M. Gutierrez, Martinez, Republica Argentina.

Products value 5/–: D. Munton, Johannesburg: J. Nie, Shanghai, China; L. Merrick, Cambridge, New Zealand.

A Camping Holiday

Camping is an ideal way of enjoying a healthy, outdoor holiday. Every summer an increasing number of Meccano clubs arrange an annual camp for a week or a fortnight, or organise a series of week-end camps at various places within reasonable distance of the club's quarters. I should like to see others follow this example. There is an impression in a few quarters that there are many discomforts and difficulties waiting "round the corner" for those who venture upon this type of holiday. This is not so if sufficient care and forethought are taken in preparing for the camp, and a suitable site is chosen.

How to Select a Site

This question of choosing a site is not easy to settle without some guidance. Useful help can be obtained from this year's *"Camping and Rambling Holidays,"* issued by the Great Western Railway. This booklet gives a list of seaside and country camping sites throughout the area served by the G.W.R., together with the names and addresses of their owners or others to whom application should be made. Details also are given of the amount of land available, the whereabouts of the nearest drinking-water supply—always a very important point and one often overlooked by prospective campers—and the nature of the surrounding country. With this information a Leader is easily able to decide whether a particular site is likely to be suitable or not. The booklet can be obtained on application to the Superintendent of the Line at Paddington Station, London, W.2, or to any G.W.R. London or provincial office.

The other British railway companies issue similar information about camping sites in the areas they serve. Leaders who are interested should apply to the officials at their nearest railway station. When making enquiries Leaders also should remember to ask for particulars of the important concessions made by the companies in regard to fares for camping parties. There are also fare concessions for excursions and outings generally.

The larger a camping party is the greater the amount of enjoyment that can be obtained, and it is sometimes possible for clubs situated fairly close together to join forces for a camping holiday.

Successful Exhibitions

During the past two months I have received very interesting accounts of successful club Exhibitions held during the 1936–7 winter sessions by clubs in this country and as far afield as Australia and New Zealand. A pleasing feature is that each winter an increasing number of Meccano club Exhibitions are reported in local newspapers. Such notices bring the existence and the good work of clubs to the attention of more prospective members and friends than could be reached in any other way, except by an expensive and widespread advertising campaign.

A good example of an Exhibition reported in the local press was one organised by the recently-affiliated Mount Senior School (Newark) M.C. Full notices described the attractions well, and in one instance an excellent photograph was reproduced. This Exhibition was not only the club's initial effort, but also was the first of the kind ever held in Newark. It was held in the School Hall, and included a display of over 20 Meccano working models. There was also an extensive Hornby layout on which both clockwork and electric trains were run, while lineside accessories such as telegraph poles and hedges gave realism to the scene.

Perhaps the most interested of the many visitors was the Ven. H. Larken, M.A., Archdeacon of Lincoln, who is a very keen model railway enthusiast and has a remarkably fine all-electric layout at his house, where rooms on three floors are used solely in connection with his hobby. The Archdeacon praised the Exhibition very highly, and such was the irresistible appeal of the club's Hornby railway that during the evening he gave the members a hand in operating their trains. The members greatly appreciated the many useful hints he gave them on constructing scenery, and he provided an unexpected thrill by producing one of his own locomotives and "trying it out" on the Exhibition layout.

Another recent success was the sixth Annual Exhibition organised by the Old Charlton (London) M.C. This Exhibition was staged in the Charlton Assembly Rooms, and the many visitors included the Mayor of Greenwich. Mr. H. Crosby, the Club President, contributed an introductory address in which he spoke of the value of Meccano as a hobby for boys. There was a splendid display of engineering and other models, and the miniature railway built by Mr. S. Fish, the Leader, was a great attraction. During the evening a film show was given by members of the Charlton Amateur Cine Society who were past members of the Old Charlton M.C.

Meccano Club Secretaries

No. 40. Mr. R. Lunn

R. Lunn is secretary of the Regent Street Central School (Heywood) M.C., one of the largest clubs in the Guild. It was affiliated in 1930, and model-building has always been the chief of its many and varied activities. Lantern lectures are also very popular.

Cricket Fixtures Wanted

Mr. R. H. Smart, the secretary of St. Oswald's M.C., Thornton Heath, is again organising a club cricket team, no member of which will be older than 15 years. He would like to hear from other secretaries who are organising cricket teams this season, with a view to arranging fixtures. Those interested should write to Mr. Smart at 14, Kingston Avenue, Thornton Heath, Surrey.

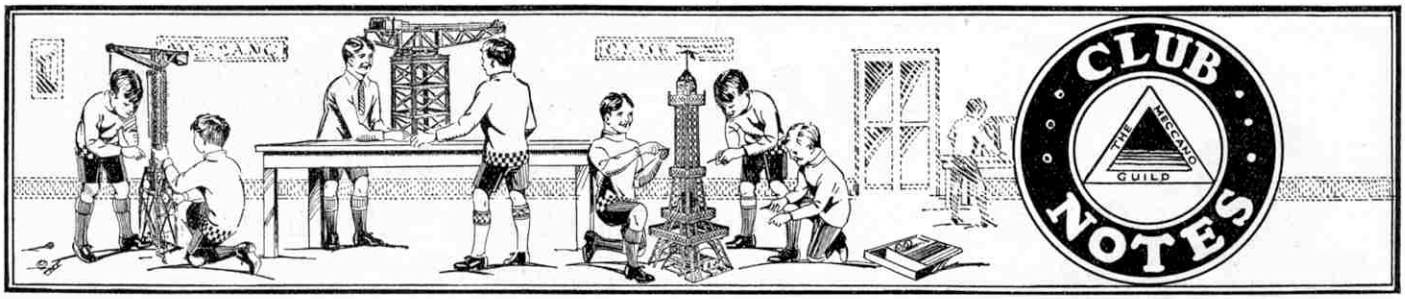
I am very pleased to print this invitation, and shall be delighted to perform the same service for any other Meccano club.

* * * *

The Islington M.C. will hold an Exhibition on Saturday, 29th May. This event is being organised in association with the Islington Branch of the Hornby Railway Company, and will be held in St. Giles Mission Hall, Westbourne Road, Barnsbury, London, N.7. The display will be open from 1 p.m. to 9.30 p.m., and a cordial invitation is given to all who are interested in Meccano model-building, miniature railway operations, and club work generally. The charges for admission are: adults 6d.; children 3d.

Proposed Clubs

BOURNE—C. Stubley, 4, Coggles Causeway, Bourne, Lincs.
CORK—M. Lynch, 2, Spa Walk, Mallow, Co. Cork, I.F.S.
ISLANDMAGEE—S. McCready, Islandmagee, Co. Antrim, I.F.S.



Colchester M.C.—A fine model roundabout has been completed, and a fully equipped model airport is under construction. The control tower and Customs hall of the airport have been finished. A Talk on "*The Carburettor*" was much enjoyed, and was followed by an interesting discussion. Many games have been played during recent meetings. Preparations for an Exhibition are in hand. Club roll: 20. *Secretary:* E. J. Tracey, 199, Harwich Road, Colchester.

Tolworth Central Boys' School (Surbiton) M.C.—Meetings have been devoted chiefly to model-building and Hornby Train operations. A Competition for the best layout of a goods yard produced some excellent plans. Arrangements have been made for a series of Lantern Lectures, and members are busy constructing models for the School Exhibition. Club roll: 40. *Secretary:* G. Boulter, 7, Hook Road, Surbiton.

Breich (West Calder) M.C.—Model-building meetings have been varied by introducing special subjects. On Shipbuilders' Night members made models of tugs, liners, and other types of ship. A Contractor's Night has been held, and Packet Contests have been arranged. Future arrangements include Visits to several local places of interest. Club roll: 10. *Secretary:* M. Anderson, 36, Breich Terrace, West Calder.

Mary Swanwick Senior School (Chesterfield) M.C.—A member brought his electric railway to one meeting, and permitted the others to operate it. Members have been asked to design a new electric track for the club layout, and the proposed designs are to be submitted to the secretary. Games continue to be a very popular feature of the meetings, and have included table tennis, table football, dominos and draughts. Club roll: 19. *Secretary:* K. Leatherday, 128, Church Street, Old Whittington, Chesterfield.

Plymouth M.C.—Attendance at meetings has been very good. Additional Meccano equipment and a projector have been bought. The Leader has given a Lantern Lecture entitled "*How you Get your News*," the slides for which were kindly loaned by "*The Western Morning News*." The Lecture was regarded as representing the activities of the club's Printing Section, and others are to be given by the Leaders of the Meccano, Hornby and Woodwork Sections. The Annual Exhibition is being keenly anticipated; proceeds from it are to be added to a fund for the club's first Annual Outing. Tickets for the Outing have been prepared by the Printing Section. Club roll: 71. *Secretary:* R. G. Symons, 47, Lisson Grove, Plymouth.

Cold Harbour M.C.—Recent important events have been two very interesting Lantern Lectures. One of these was given in the Village Hall and parents and friends were invited. This Lecture described and illustrated a trip to America in the Cunard White Star liner "*Queen Mary*." The other was entitled "*Across Canada*." Club roll: 12. *Secretary:* R. S. Hill, Anstie Farm, Holmwood, Nr. Dorking.

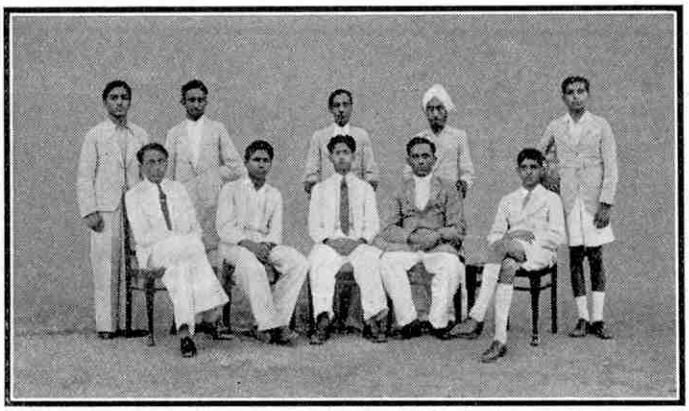
Exeter M.C.—The total of 34 Meccano models completed within a recent month indicates the club's continued keen interest in model-building. The models were of high quality and ranged from various types of vehicles and bridges to airships, pianos and even a bed. One of the most interesting of the models was a miniature rotary airport, based on that illustrated on the cover of the February 1937 "*M.M.*" Club roll: 46. *Secretary:* A. J. Hancock, 237, Monks Road, Exeter.

Mall School M.C.—Several new members have been enrolled, and an interesting programme is being carried out. A treasure hunt was much enjoyed. Interesting Hornby Railway operations have been carried out. Club roll: 23. *Secretary:* D. Rubin, Mendip Lodge, 33, Clifden Road, Twickenham.

St. Stephens (Saltash) M.C.—A very popular series of Lantern Lectures has been given by the members. The Model-building Section have been very busy, being chiefly concerned with the construction of an Aeroplane, a Station, and a Bus. At one meeting half the membership worked on cardboard models under construction and the other half co-operated with the Hornby Section, acting as point operators. Two table tennis matches have been played against a team from a local works. A Darts Section has been formed as a branch of the Games Section. Club roll: 20. *Secretary:* B. Braund, 9, Homer Park, Saltash.

Sid Vale (Sidmouth) M.C.—Outstanding events during recent months have been an Exhibition and the Annual Party. The Exhibition was the largest and best ever organised by the club. The models occupied eight stands and included several contributed by the Exeter M.C. A large Meccano Fairground occupied one stand and attracted much attention. A Models Carnival, to which the public were admitted, has been held. At one Model-building Evening excellent results were obtained in a Fire Engine Contest for the seniors, and a Fire Escape Contest for the juniors. Some of the models built by the seniors were fitted with three-speed gear-boxes, and all the models were notable for their great amount of detail. Other Model-building Evenings have been devoted to the construction of aeroplanes, tractors and traction engines, and a fairground. The introduction of table tennis, which is played during the concluding part of meetings, has proved very popular, and a tournament is in progress. Club roll: 25. *Secretary:* S. R. I. Gliddon, Sheffield House, Sidmouth.

Burnley Grammar School M.C.—The Leader recently gave a Lecture on "*Colour*," and illustrated it by a series of experiments demonstrating the properties of coloured light. Several meetings have been devoted to model-building, in preparation for a Hobbies Exhibition. Club roll: 21. *Secretary:* J. S. Keighley, The Meccano Club, Grammar School, Burnley.



Officials and members of the Rawalpindi M.C., with Mr. I. H. Lotia, Leader, who is second from the right on the front row. This Indian club was affiliated in October 1936, and the enthusiasm of its members promises well for its future. The chief occupation at club meetings is model-building, and active interest is taken in Fretwork, Photography and Stamp Collecting.

Hornsea M.C.—The varied subjects of recent Lectures have included "*British History*," "*Cinemas*" and "*Railways*." Some interesting film shows, in connection with Socials, have been held. A Talk to the Senior Scientists on "*The Mechanism of Clocks and Watches*" was greatly enjoyed. Club roll: 15. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

Winchmore Hill Collegiate School M.C.—A varied programme has been carried out. Members are very enthusiastic about the new model railway layout under construction. A Shunting Contest has been held, and there was great excitement when one member completed his task well ahead of the others. A Visit has been paid to the works of the Associated Equipment Co.Ltd., Southall. A Model-building Contest in which "*Vehicles of the Future*" had to be constructed produced some excellent models, a particularly outstanding entry being a streamlined railcar. A Film Show at the club proved very enjoyable. It is hoped to arrange a visit to the B.B.C. Television headquarters at Alexandra Park Palace. Club roll: 32. *Secretary:* J. A. Piejus, 22, Woodland Way, Winchmore Hill, London, N.21.

Bryntirion M.C.—There has been considerable model-building activity and excellent models, mostly of engineering subjects, have been built for an Exhibition. Several members have become interested in Fretwork, and have already produced attractive work. Club roll: 16. *Secretary:* P. Parry, Castle Hill House, Carmarthen.

Regent Street Central School M.C.—The enthusiasm of the members has been reflected in an increased number of meetings. Model-building continues to be very popular, and a variety of interesting models have been completed. A Lecture on "*Northern Ireland*" has been much enjoyed, and one on "*The Youth Hostels Association*" greatly interested the members. London will be visited on the annual School Trip this year. Club roll: 150. *Secretary:* R. Lunn, 14, Pickup Street, Heywood.

AUSTRALIA

Maylands M.C.—The Christmas Exhibition was the fourth organised by the club during last year, and was considered by many visitors to be the best the club has ever staged. These displays have brought the club much publicity in the local press, and have been the means of increasing membership. Visits have been exchanged with the Perth Branch of the H.R.C. The photograph reproduced on the "*Branch News*" page of the January 1937 issue shows members of both organisations and was taken during a joint excursion. Club roll: 35. *Secretary:* M. Thomson, 13, Kennedy Street, Maylands, W.A.

Melbourne M.C.—Several excellent models were brought to the club-room at a recent Meccanograph Night, when the members found new interest in drawing the designs of each other's models. Most meetings have been devoted to Hornby Railway operations, and the introduction of timetable working has greatly increased the enjoyment of those taking part. A party of members recently inspected the Gauge "O" electric railway of Mr. Eadie, Richmond, a model railway enthusiast. A demonstration was given of electric uncoupling and of the electrically-operated turntables, signals, and reversing of trains. The party were also interested in the excellent scenic effects of the layout. Club roll: 10. *Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

CANADA

Peterborough (Ontario) M.C.—Meetings are held at the local Y.M.C.A. An Exhibition was organised at Christmas and was very successful. The club Library has been increased. *Secretary:* K. Brown, 763, George Street, Peterborough, Ontario, Canada.

Strathcona (Edmonton) M.C.—Seven of the 11 models entered by the club in the Edmonton Boys' and Girls' Fair were awarded prizes, and one club competitor won a shield. The display was favourably reported in a local newspaper. Leader: Mr. M. Stanley, 9715, 83rd Avenue, Edmonton, Alberta.

EGYPT

Zagazig M.C.—The New Year celebrations included a tea-party on the verandah of an hotel, which was greatly enjoyed by the members and the many other guests. Interesting Lectures have been given on "*Our Club in 1936*" and "*Civilisation and Meccano*." Club roll: 22. *Secretary:* Miss B. Mangourie, 39b, Gannabiet Sikka Hadid Avenue, Zagazig.

HOLLAND

Maastricht M.C.—Meetings have been held regularly, and members show great interest in the programme arranged. The Leader recently gave a second Lecture on "*Dutch Railways*." Club roll: 29. *Secretary:* L. Mulders, Houthemerweg N. 20, Meerssen bij Maastricht.

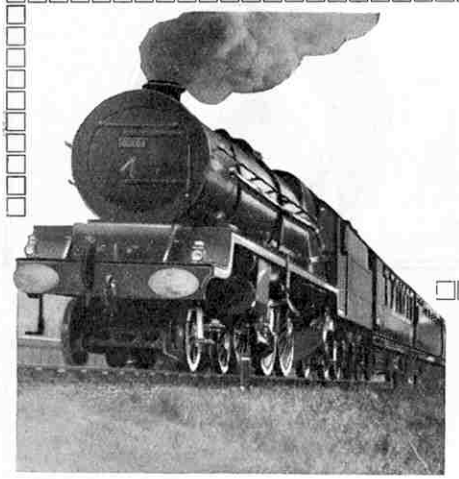
ITALY

Milan M.C.—At one meeting an excellent Meccano and Hornby Display was arranged, and the parents and friends of the members were invited to inspect it. A Lecture by the secretary on "*Stainless Steel*" was much enjoyed. Games, including table tennis, continue to figure prominently in the programme, and a Draughts Tournament has been held, in which all the members took part. Film Shows are always very popular. Club roll: 14. *Secretary:* E. Vigo, Corso Genova 19, Milan.

SOUTH AFRICA

Berea M.C.—An interesting programme is being carried out. Meetings have been devoted to lectures, treasure hunts and tennis. Club roll: 15. *Secretary:* L. Michelow, 74, Hillbrow Street, Berea, Johannesburg.

Continental (Capetown) M.C.—Models are being built of the various machines seen during a visit to a workshop at Paarl. It is proposed to add Fretwork to the club hobbies, and there is also a growing interest in Stamp Collecting. Table tennis and other games are often played, and chemistry experiments carried out. There is a growing demand for more outdoor activities, and a mountain climbing expedition has been planned. Club roll: 10. *Secretary:* J. Bruyns, 57, Constitution Street, Capetown.



"Princess Elizabeth," L.M.S.R. 4-6-2 No. 6201, which last year hauled a train from Glasgow to London in 5 hrs. 44¼ min.

L.M.S.R. "*Princess Elizabeth*" in Miniature

Driver Clarke says "It's Fine!"

By "Tommy Dodd"

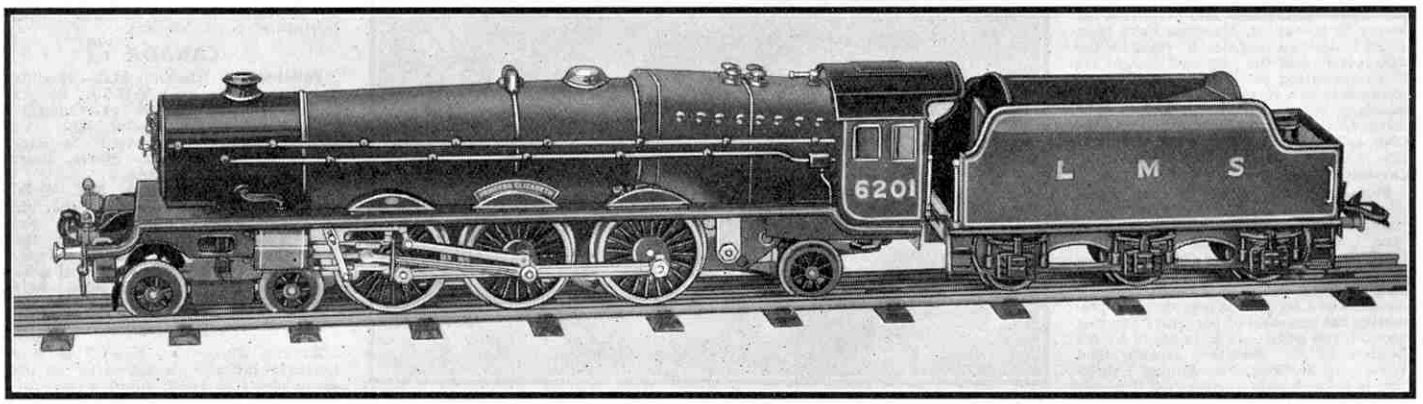
THE news that a reproduction of the famous L.M.S.R. locomotive "*Princess Elizabeth*" was to be introduced in the Hornby Series sent a thrill throughout the miniature railway world, and Hornby Train owners have simply bombarded Headquarters with questions, asking what the new engine looks like, how it runs and when it will be available. I am not surprised that the announcement has created so much excitement. The inclusion in the Hornby Series of a locomotive with six-coupled wheels is a great event in itself. The interest is heightened by the fact that the new engine is a replica of the 4–6–2 locomotive that recently set up a world's record in steam travel by covering the 401.4 miles from Glasgow to London non-stop at an average speed of 70 m.p.h.

Driver Clarke, one of the top link men from Crewe, says that the Hornby "*Princess Elizabeth*" is fine, and he ought to know, for he was the driver of the real engine of that name when the world's record I have just referred to was set up! After a glance at the illustration of the new Hornby introduction that is reproduced on this page, I am sure that all railway enthusiasts will agree with him, and they will be even more emphatic in their agreement when they have obtained one of the engines for themselves! The longer one looks at the model, the more remarkable does it appear from the point of view of realism and faithfulness, down to the smallest detail. Hornby locomotives have always been remarkable for perfection of workmanship and finish, but all previous efforts have been surpassed in the production of this magnificent new engine.

Every reader will be eager to learn more about the details of the Hornby "*Princess Elizabeth*." It is electrically driven and is designed to work on alternating current supplied from a 20-volt transformer. The famous Hornby Remote Control system of course is incorporated. This means that every movement can be controlled from a central point by merely manipulating a lever; there is no need to touch the locomotive at all.

It is when one looks at the locomotive from "ground" level that its real beauty is appreciated. It is the same of course with real locomotives. For instance, the L.M.S.R. "*Princess Elizabeth*" looks imposing and handsome when she is seen from the platform of a station, but she seems far larger and more powerful and her appearance is far more impressive, when she is seen from rail level. By the courtesy of the L.M.S.R. I was able to examine this giant from this point of view recently, as I was given permission to visit the Locomotive Depot at Edge Hill, Liverpool, when she was being prepared for a return trip to London on the 5.25 express. I had with me one of the new Hornby "*Princess Elizabeths*," and I was able to make a direct comparison between the two. The characteristics of the large engine are reproduced in the miniature one in a marvellous manner. In each case there is the same long tapered boiler barrel, which has a really graceful appearance that is well seen in the model. The top of the fire-box slopes downward from the point of junction with the boiler to the cab in the Hornby locomotive in exactly the same manner as in the real one, and has on it a group of four safety valves. In front of the cab is an excellent reproduction of the hooter now fitted to all new L.M.S.R. engines.

From my new and unusual point of view the great driving wheels, the cylinders and the valve gear were of course very prominent indeed, and I hastened to compare them with the corresponding parts of the Hornby locomotive. The reproduction is remarkably effective. The valve gear components are obviously robust and yet retain an attractive appearance, the cylinders are well proportioned and correctly placed, and the entire effect, especially when the engine is in motion, is most



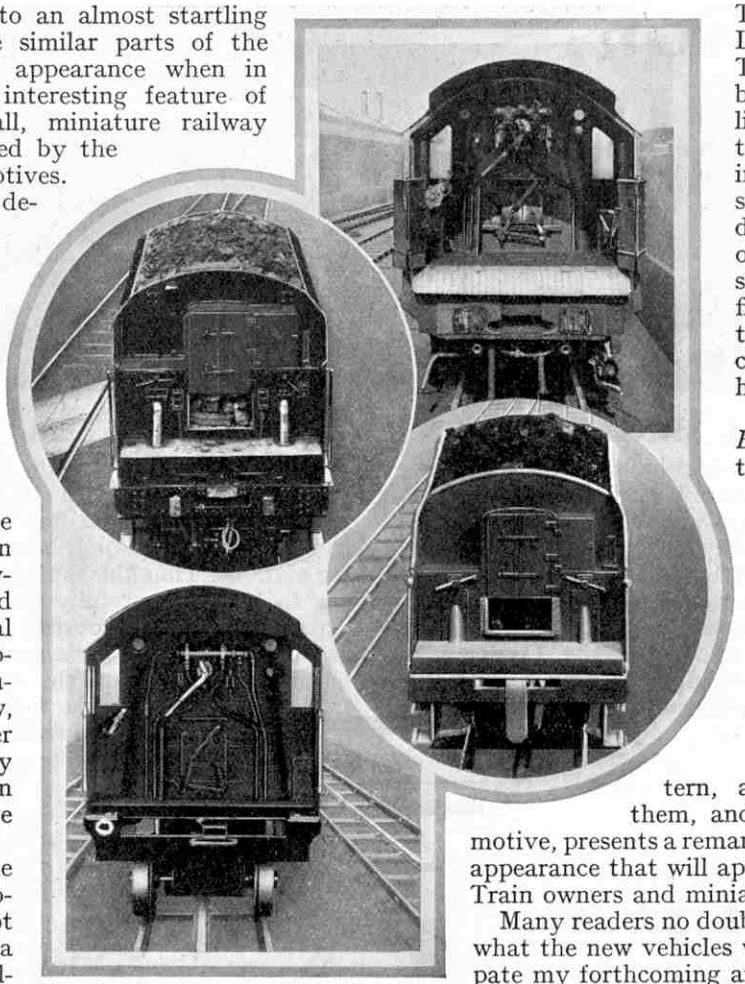
A broadside view of the new Hornby L.M.S.R. 4-6-2 Locomotive "Princess Elizabeth." This photograph shows how splendidly it reproduces the massive design and beauty of detail of the real engine.

impressive and resembles to an almost startling extent the motion of the similar parts of the real engine. I think the appearance when in motion is a particularly interesting feature of the new engine. After all, miniature railway owners are chiefly attracted by the running of their locomotives.

There are many other details that I should like to tell you about in connection with various parts of the locomotive. I am afraid that I shall have to leave you to see these for yourselves, however, or at least to keep some of them for a further article. I have only space to tell you about the cab, which I think is the finest I have ever seen on a model engine. Everything that is to be found in the cab of the real *"Princess Elizabeth"* is represented in it—the regulator handle, reversing screw, fire doors, steam and water gauges. Everything ready for the crew to step on to the footplate and drive away!

The footplate of the tender is equally well produced, and it would not be difficult to imagine a fireman hard at work shovelling coal forward and into the fire-box, watching the water levels, operating the water scoop and generally keeping everything right in his Hornby engine! The tender indeed is really a splendid production, with sides with high raised coping and their edges turned over, just like those of the real tender. Similarly the coal space has correct division plates in it and the tank has a sloping roof so that the coal can naturally slide forward, ready for the fireman.

After examining closely one detail after another of the Hornby *"Princess Elizabeth,"* the eye always returns to the general appearance and finish of the engine. How much care has been taken to give a smooth and realistic outline can be judged from the fact that no projecting lugs are used anywhere in assembling it, all the important joints being soldered.



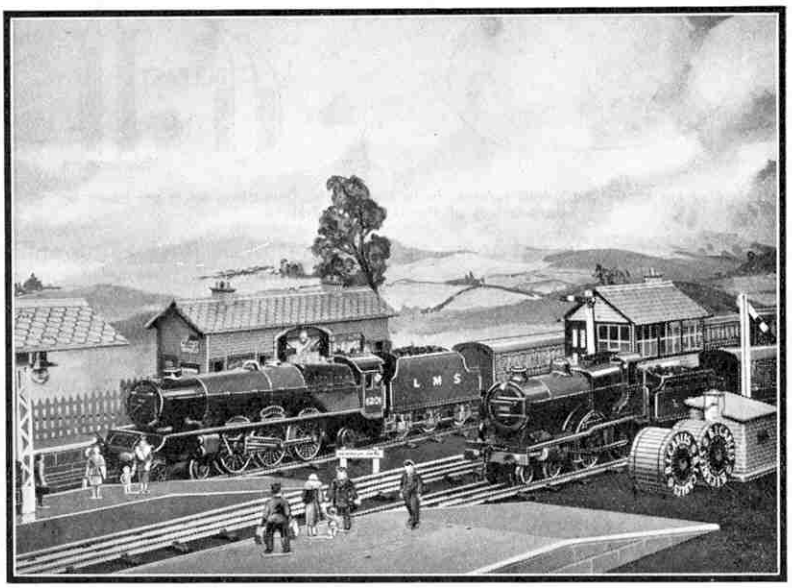
Interesting views comparing the model cab and tender arrangements with those of the actual locomotive. (Top) L.M.S.R. 4-6-2 cab. (Centre, left) L.M.S.R. 4,000-gallon tender. (Centre, right) The Hornby Tender. (Bottom) Cab of the Hornby "Princess Elizabeth."

The colour scheme follows L.M.S.R. practice perfectly. The black and gold lining brings out the handsome lines of the engine, and the numbering and lettering on the cab and tender sides is an exact reproduction in miniature of that on the real engine. The splendid nameplate adds a final touch of realism to the most magnificent Hornby engine that has yet been produced.

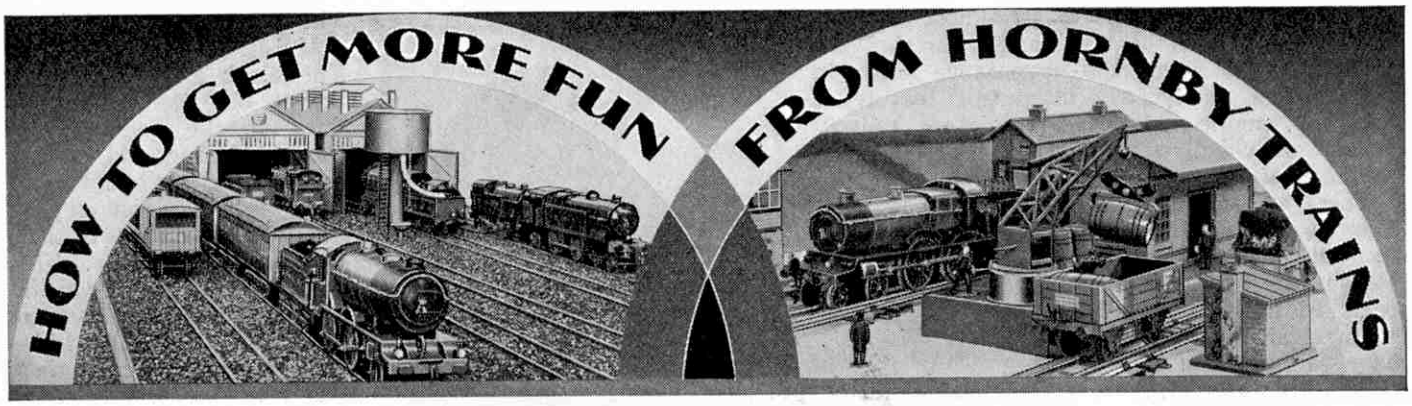
The Hornby *"Princess Elizabeth"* will be seen to the greatest advantage when she is running at the head of a train of the splendid corridor coaches that are to be introduced shortly into the Hornby System. I hope to describe these in next month's *"M.M."* They will include coaches correctly modelled on the most recent L.M.S.R. pattern, and a train composed of them, and hauled by the new locomotive, presents a remarkably realistic and effective appearance that will appeal strongly to all Hornby Train owners and miniature railway enthusiasts.

Many readers no doubt will be impatient to know what the new vehicles will be like, so I will anticipate my forthcoming article in order to give them some idea of the appearance of the L.M.S.R. coaches. They will represent the latest steel-panelled stock with end doors and flush finished sides. The most up-to-date details of finish will be included, and the new No. 2 Corridor Coaches as a whole will be a considerable improvement in this respect on previous Hornby stock. Two patterns of coach will be available, one a first-third and the other a brake-composite.

I am now able to make a preliminary reference to a further introduction that will occur a little later on. Although *"Princess Elizabeth"* will run quite satisfactorily on the standard Hornby 2-ft. radius tinplate track, it was felt that an improved form of track was desirable to display its powers to the full. All-steel track with curves of approximately 3 ft. radius, is to be introduced into the Series shortly. I shall look forward to drawing your attention to its special features in a later issue.



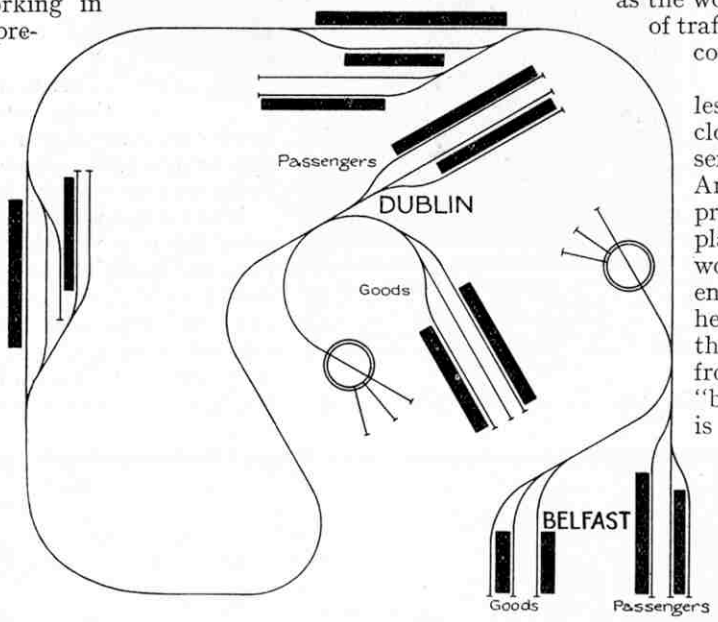
The Hornby "Princess Elizabeth" in service. This photograph gives a splendid idea of its realistic appearance and its size. Think how fine this engine would look on your railway!



A MINIATURE G.N.R. (IRELAND) SYSTEM

MANY Hornby railway owners have built up layouts that reproduce in miniature the working characteristics of sections of real systems, and this month we give a description of an interesting layout that is based on the main line of the G.N.R. of Ireland. The prime mover in the development of this line was A. Donaldson (H.R.C. No. 6868) of Belfast, who was assisted by R. O'Sullivan, and F. Graham. Others have since joined the "Company" and the stock operated as a result of this amalgamation is extensive, while the working in general is a convincing representation of real G.N.R. of Ireland practice.

The layout started as a fairly simple oval track, with a terminal branch representing Dublin, and has grown into the non-continuous layout shown in the diagram on this page. This does not include necessarily all the various sidings and track connections, but illustrates more particularly the route of the main line developed by this small but energetic "Company." Fortunately plenty of space has been available, for the room that accommodates the system is approximately 25 ft. square and the layout has been developed so that it fully covers the area.



This diagram shows the layout referred to in this article. Operations on it are based on the services of the G.N.R. of Ireland.

The system is portable, the track, accessories and buildings having to be put down and taken up each time the line is used. Hornby Rails are used almost exclusively and as the line is laid on the floor, it has not been possible so far to incorporate much in the way of scenic effects. The line is signalled throughout in accordance with standard practice, most of the signalling apparatus having been constructed by members of the "Company."

The operations, based on the real G.N.R. services, are extremely realistic and at the moment a total of 89 trains is operated according to timetable within a period of 2 hrs. 40 min. Proficiency in handling this number of trains has only been reached after careful experiment and it is anticipated that the number of trains will be increased in due course. Although a particularly intensive service is carried out from the "Belfast" end of the line, "Dublin" still has some slack periods and it is proposed to remedy this as soon as possible. The character of the services at present in operation is all the more remarkable when it is recalled that the main line is single track throughout, passing loops and sidings being situated at the intermediate stations. Thus the timing of the trains up and down has to be very carefully arranged so that their paths "cross" at the appropriate points. There is separate accommodation for passenger and freight trains at the terminals, however, and this eases matters to some extent, as the working in and out of one kind of traffic need not interfere with the conduct of the other.

"Dublin" is situated more or less centrally in the area enclosed by the system. The passenger station represents the Amiens Street terminus of real practice, and includes two platforms with a total of three working faces. These are long enough to accommodate the heaviest trains, but owing to the single main line the exit from the station is rather of a "bottle-neck" character. There is the advantage that the layout is far less complicated than would be the case if a double main line were used, however, and ready access to each of the station roads is provided. This applies also to the Dublin goods depot, representing Sheriff Street of actual practice, which has two platforms for loading and unloading and a total of three tracks. These tracks converge and join the main line soon after the passenger roads have resolved themselves into single line.

The connections leading to the Dublin locomotive depot occur after the passenger and goods lines have combined. As a result engines can easily pass to and from the depot, whether using the goods or passenger station. Locomotive accommodation at both Dublin and Belfast is arranged on the "roundhouse" principle, the turntable providing the means of access to each of the radiating shed tracks. This is a convenient arrangement in miniature, for it is economical of space and avoids the use of an excessive number of points.

From Dublin outward the line describes roughly a big "S" bend, owing to the central situation of Dublin in the layout, and then straightens out to follow approximately

the walls of the room. After swinging to the right round the curve at the bottom left-hand corner in the diagram, it passes an intermediate station representing Dundalk, which in actual practice is an important junction, and the locomotive, carriage and wagon building centre of the G.N.R. It is also of interest in that it is one of the two Customs examination posts on this route, the other being Goraghwood, for between them the G.N.R. passes from the Irish Free State to Northern Ireland and is thus a truly international line. A passing loop and a dead-end siding are situated at the miniature "Dundalk" and there is also a short branch serving a small station that represents Cavan, Omagh, Enniskillen or elsewhere according to the service being operated, a convenient device frequently met in miniature practice.

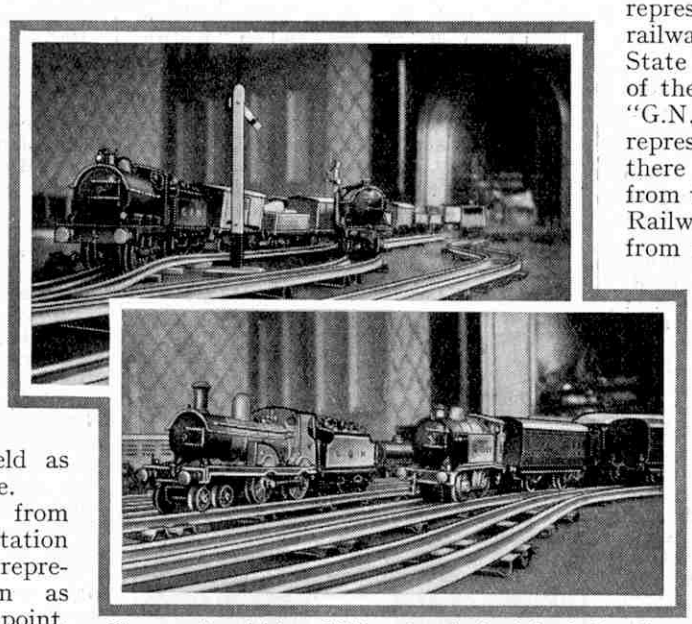
From Dundalk the line proceeds through the Carlingford Mountain section to the next intermediate station, which represents Portadown. This is another crossing point with through and terminal platform faces, and a central through line, not shown in the diagram, that is very useful for providing a road for non-stopping trains in the event of both platform lines being occupied. This is a point of importance when timetable operation is the usual practice. Trains also can be held as required on the central line.

A branch line diverges from Portadown to serve another station of variable identity, which represents Londonderry (known as "Derry"), Newcastle, Warrenpoint, or indeed any other place, according to circumstances. Then comes the final stretch of main line from Portadown to "Belfast," where the layout of passenger, goods and locomotive depots is generally similar to that at "Dublin," different only in certain minor details. The passenger station represents the Great Victoria Street of real practice, while the goods depot is the miniature counterpart for working purposes of the real Grosvenor Road.

Of the various services operated, much attention is given naturally to the Dublin and Belfast express trains. These are referred to according to the real departure times, such as for instance the "8.15 a.m.," "10.30 a.m.," or "7.10 p.m." trains from Belfast. The through trains in addition to their main operations convey coaches for Cavan, Derry, Enniskillen, and Warrenpoint, and on the "10.30 a.m." the total load at times rises to over seven bogie vehicles. As this represents the maximum load permitted to a single locomotive, piloting is necessary on these occasions. Local and intermediate passenger and goods services also are worked between Belfast and Newcastle, Antrim and Warrenpoint, Dublin and Dundalk and Dublin and Howth, and also between Derry and Omagh, Portadown, Warrenpoint and Cookstown.

The chief trains are made up largely of Hornby No. 2 stock in L.M.S.R. colours. These have been selected owing to the fact that recent practice on the G.N.R. has favoured the finish of many vehicles in the colour resembling the familiar Midland red. The designation of G.N.R. coach livery is "varnished mahogany," which is similar to the teak finished character of L.N.E.R. vehicles. Hornby L.N.E.R. coaches therefore probably could be used with equal correctness. An interesting point in connection with Hornby coaching stock is that corridor vehicles in the style and finish of the four English groups are to be introduced iu the Series next month. The L.M.S.R. vehicles will be of the latest steel-panelled low-waisted type with flush finished sides, and might be used effectively to represent the similar modern steel-panelled vehicles of the G.N.R. on a layout of this kind. Alternatively the No. 2 Corridor L.N.E.R. teak-finished coaches that are to be introduced could be used to represent the G.N.R. "mahogany" vehicles.

For freight services there are 46 goods wagons of various standard types. Many of these have been re-lettered to represent the stock of the various railway systems of the Irish Free State and Northern Ireland. Many of these of course bear the initials "G.N."; others lettered "G.S." represent Great Southern stock and there are also "B.C.D.R." vehicles from the Belfast and County Down Railway and "L.M.S. (N.C.C.)" from the Northern Counties Committee section of the L.M.S.R.



Views on the miniature G.N.R. system developed by A. Donaldson (H.R.C. No. 6868) of Belfast. The smart blue livery of the passenger locomotive shows up well in the lower illustration.

Motive power is provided almost entirely by standard Hornby Clockwork Locomotives of various types. Most of them have been altered in detail by the ingenious and enterprising "Locomotive Department" of this miniature system, however, in order to represent more exactly various G.N.R. prototypes. The passenger engines have been repainted in the blue shade now used for the five big 4–4–0 compounds that were referred to by "Railway Engineer" in the "*M.M.*" last October. Although in actual practice this smart livery of blue, with red frames and black and white lining, so far is confined to the engines of this class, the miniature system has extended the practice to all passenger types, including both tender and tank engines. Combined with G.N. initials, numbers and a reproduction of the coat-of-arms this gives a very smart appearance and the striking result is sufficient to justify this possible anticipation of actual practice. The blue livery has the advantage of being favourable for photography, and in consequence the engine shows up well in the lower of the two illustrations reproduced on this page.

The 4–4–0 tender engine, No. 89, which is prominent in the illustration referred to, is a Hornby veteran of 10 years' service. It is actually one of the now long-obsolete No. 2 Tender Engines suitably rebuilt as far as superstructure is concerned to represent one of the older G.N.R. engines of class "P." In spite of its age it can haul seven bogie vehicles at a "scale" speed of about 75 m.p.h.! This is a testimony to the workmanship put into the original mechanisms, and also to the careful attention the engine has received in service. It is employed on the shorter distance expresses, as its length of run when heavily loaded is less than that of the larger and more recent No. 2 Specials. The latter engines deal with the heaviest express trains on the main line services.

Branch News

FOLKESTONE.—The Branch track has been laid on a base constructed in four sections. Further improvements have included the addition of new stations, engine sheds, signal boxes and other accessories made by members. Meccano bridges are to be built for use in extending the line. Extensive train operations have been carried on, and smoother running has been experienced with the new track, which has been effectively ballasted with chicken grit. Special Easter services were scheduled in addition to normal services, and shunting work to timetable has been satisfactorily tried out. More members are wanted, and the secretary will be glad to hear from Hornby Train owners wishing to join. Secretary: F. E. Saunders, 79, Dover Road, Folkestone.

WATERLOO (DUBLIN).—Regular track meetings have been held by this Branch, which operates the "Kent and East Sussex Railway." The full winter service has been maintained strictly to timetable, regardless of the extreme weather conditions. New rolling stock has been added, and the locomotives have been overhauled. Secretary: S. B. Carse, 38, Oakley Road, Ranelagh, Dublin.

GREENOCK.—Visits to the B.B.C. Broadcasting House at Glasgow, several local factories and railway depots are included in this club's interesting programme, while a tour was made recently of the training ship H.M.S. *"Carrick"* at that time lying in James Watt Dock, Greenock. Talks on *"How a Branch should be Run"* and on *"Railway Practice"* have proved beneficial, especially to the younger members of the club. Track operations have been devoted to shunting and the running of goods expresses. A Library has been formed; a small fee is charged for the loan of each book issued. Secretary: G. Bruce, 8, Margaret Street, Greenock.

ACTON.—A larger Branch room has been obtained, and members have been occupied with work in connection with the removal. This was successfully carried out, and members are now settling down in their new quarters. Visits are to be paid to places of railway interest as soon as the weather improves. Secretary: S. W. Simmons, 7, Alfred Road, Acton, London, W.3.

ST. STEPHENS (SALTASH).—Recent meetings have been devoted to a variety of activities. Track operations have been enthusiastically carried out, a different layout being formed each evening. Shunting and the working of pick-up goods trains have proved popular, and efficient running has been maintained at all meetings. A Party was held to encourage new members. Games are played occasionally, and the Table Tennis team has contested several matches with local clubs. Lectures have been given on *"Printing"* and on *"Modern G.W.R. Locomotives,"* and *"Electricity v. Clockwork"* was the subject of a model railway Debate. Secretary: B. Braund, 9, Homer Park, Saltash.

COTTESMORE.—Meetings are held after school every Wednesday. The Branch layout has been replanned, and is now fitted with new control points and electric signalling. Operations on the new layout have been successful, timetable services proving popular. A visit to Colwick Goods Sidings and Locomotive Sheds was greatly enjoyed. Further visits are proposed to a local pumping station, and to Liverpool, where it is hoped to inspect the numerous places and objects of interest and to visit H.R.C. Headquarters. Secretary: J. S. Butler, Cottesmore School, Lenton, Nottingham.

Group of members of the Acton H.R.C. Branch No. 308. Chairman, Mr. H. Green. Secretary: S. Simmons. This Branch has made splendid progress since its incorporation in June 1936, and recently a move into a larger clubroom became necessary. Track operations, games, lectures and visits to places of railway and general interest are prominent features of the programme followed.

BURNLEY GRAMMAR SCHOOL.—A Hobbies Exhibition held recently was a great success. A varied programme has been followed at ordinary meetings, comprising train operation and competitions of railway interest being based on *"M.M."* contests. Lectures have been given on *"Colour"* and on *"Colour Photography."* Members visited the Rose Grove Locomotive Depot, where they closely examined several locomotives and inspected the new coaling plant. A few members demonstrated their strength by turning an 0-8-0 locomotive on the manual turntable, being rewarded by a footplate trip. A Library has been formed and already contains many excellent books on miniature railways. Secretary: J. M. Leedham, 9, Red Lion Street, Burnley.

SUTTON COLDFIELD.—Meetings at present are being held every Wednesday at members' houses. This necessitates the laying of a new track at each meeting, but interesting train services have been run. Members have greatly improved in the handling of trains, and it is hoped shortly to introduce timetable operation. Games Nights are now held regularly, and a small prize is given each evening. Woodwork and Meccano sections are to be formed, and a club Magazine is to be started. Efforts are being made to obtain a suitable club room. Secretary: G. C. Low, 272, Baldmere Road, Erdington, Birmingham.

ISLINGTON.—A new and more suitable clubroom has recently been obtained, and members are busy constructing scale track for a new layout. Prior to the removal an evening was spent in overhauling the Branch stock to ensure efficient working on the new layout. The club's Annual Social provided members with an opportunity, in the words of the secretary, of showing their ability to devour other things than railway knowledge. Secretary: J. D. Straker, 48, Onsloll Gardens, Muswell Hill, London.

CANADA

OTTAWA.—A new Branch room has been obtained, and in re-constructing the layout many new features have been added. The layout includes over 400 ft. of track, which is ballasted with chipped white marble. Specially painted scenery extends the full length of the track, and a very fine station is one of the main features of the layout. Leader: Mr. E. Gray, 251, Flora Street, Ottawa, Canada.

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 below.

COVENTRY—P. Whitehouse, 9, Rochester Road, Earlsdon.

HOUNSLOW—B. Smith, 83, Clifford Road, Hounslow West, Middlesex.

HESTON—L. W. Jones, 26, Orchard Avenue.

LONDON—L. Silverstein, 17, Ham Park Road, Forestgate, E.7.

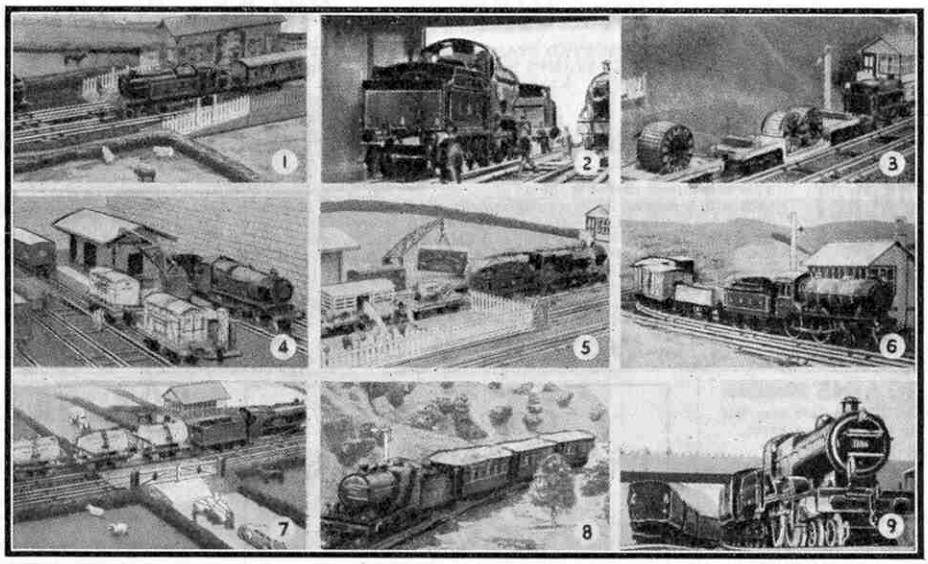
Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

MODEL RAILWAY PHOTOGRAPH VOTING CONTEST

The nine photographs reproduced on this page show interesting views of Hornby railways. Some of them concentrate attention on the locomotive or on the train, their principal features being interesting formation or working; in others lineside arrangements and the surrounding scenery are more prominent, and these combine with the trains to form strikingly realistic scenes. For our chief contest this month we ask members to study the nine photographs carefully and to place them in order of attractiveness, according to their own ideas on the building up of miniature railway layouts.



In this contest each competitor is asked to do only two things. First he has to decide the order in which he would place the photographs, and to make a list in this order, representing each photograph by the number shown on it. Next he must state, in as few words as possible, his reasons for selecting as the most attractive the photograph that he has placed first on his own list.

There will be the usual two sections, Home and Overseas, and in each prizes consisting of products manufactured by Meccano Ltd. to the respective values of 21/–, 15/– and 10/6 will be awarded to the three competitors in whose entries the order in which the photographs are placed is nearest to that in the list compiled by taking the votes in all the entries into account. In the event of a tie for any prize, the award will be made to the competitor who gives the best statement of his reasons for his choice of the photograph that he considers the best. If necessary the judges also will take into consideration the neatness and novelty of presentation of the entries. This is a point that is worth bearing in mind in this, and indeed in all H.R.C. competitions.

Envelopes containing entries must be marked *"H.R.C. May Voting Contest"* in the top left-hand corner, and each sheet submitted must have on the back the name and H.R.C. number of the competitor. Entries in the Home Section must be posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st May. The closing date for competitors in the Overseas Section is 31st August.

Railway Photographic Contest No. 2

This month we announce the second Contest in the Summer Series of Railway Photographic Contests. Photographs of any railway subject are eligible. For the benefit of those readers who did not see our announcement last month, we repeat that there are no restrictions in this Contest, except that the actual exposure must have been made by the competitor himself; the developing and printing may be the work of a professional. On the back of every print submitted should appear a short description of the scene of the photograph, the competitor's name, H.R.C. membership number and his full postal address. Prize-winning photographs will be filed for possible use in future issues of the *"M.M."* Competitors desiring their entries to be returned should send a stamped addressed envelope of suitable size.

The Contest will be divided as usual into two sections, Home and Overseas, and in each will be awarded three prizes of photographic material if desired, or any products manufactured by Meccano Ltd., to the respective values of 21/–, 15/– and 10/6.

Envelopes containing entries must be marked *"H.R.C. Photo Contest No. 2"* in the top left-hand corner, and should be posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st May. The closing date for Overseas competitors is 31st August.

COMPETITION RESULTS

HOME

March "H.R.C. Locomotive Problem Contest."—First: L. R. Adams (33529), Watford, Herts. Second: T. G. Cook (43441), Croydon, Surrey. Third: R. Barbary (5580), Mevagissey, Cornwall. Consolation Prizes: B. Hull (30795), Walton, Liverpool 4; K. Costain (5108), Bolton, Lancs.; R. Burrows (6144), Wembley, Middlesex; H. E. Russell (16413), Walsall, Staffs.

March "H.R.C. Articles Contest."—First: J. L. Makin (30933), Penwortham, Preston. Second: F. Hodson (9430), Bolton, Lancs. Third: M. Colson (30227), Bassett Green, Southampton. Consolation Prizes: B. Hardie (6792), Sea Mills, Bristol 9; R. Barbary (5580), Mevagissey, Cornwall; M. Hoskins (16653), Exeter, Devon.

COMPETITION SOLUTION

"January Mixed Names Contest"

Woodhall Spa, L.N.E.R.; *"Lady Godiva,"* L.M.S.R., 4–6–0, Class 5xP; Rock Ferry, L.M.S.R. and G.W.R. Joint, and Mersey Railway; *"The Golden Arrow,"* S.R., London (Victoria)—Dover (Marine); *"Brown Jack,"* L.N.E.R., 4–6–2, Class A3; Starcross G.W.R.; *"Torbay Limited,"* G.W.R., London (Paddington)—Torquay; *"The Puckeridge,"* L.N.E.R., 4–4–0, Class D49; *"The Comet,"* L.M.S.R., Manchester (London Road)—London (Euston); *"The Merseyside Express,"* L.M.S.R., Liverpool (Lime Street)—London (Euston); Swanwick, S.R.; *"Duchess of Kent,"* L.M.S.R., 4–6–2, Class 7P; The *"Queen of Scots,"* L.N.E.R., London (King's Cross)—Glasgow (Queen Street); *"The Lancastrian,"* L.M.S.R., Manchester (London Road)—London (Euston); *"Kimberley House,"* L.N.E.R., 4–6–0, Class B17; Pontyberem, G.W.R.; Ulverston, L.M.S.R.; *"Sir Sagramore,"* S.R., 4–6–0, "King Arthur" Class.

SETS (Postage Extra)

20	Australia	6d.	
5	Barbados	2d.	
5	Brit. Guiana ...	3d.	
15	Ceylon	4d.	
4	Cayman Is. ...	6d.	
3	Charkari	2d.	
5	Cyprus	3d.	
5	Fiji	4d.	
3	Gibraltar	2d.	
5	Gold Coast ...	3d.	
10	,, ,, ...	6d.	
3	Grenada	2d.	
10	Hong Kong ...	5d.	
20	India...	6d.	
12	Iraq	6d.	
10	Jamaica	5d.	
5	Kenya	3d.	
5	Nigeria	3d.	

JUBILEES

1	Australia	1d.
1	Bahamas	4d.
1	Bechuanaland ...	4d.
1	Brit. Guiana ...	2d.
1	Cayman Is. ...	3d.
1	Ceylon	2d.
1	Cyprus	3d.
1	Gold Coast 1d....	2d.
1	,, ,, 3d....	6d.
1	Grenada	2d.
1	Hong Kong 3c. ...	3d.
1	,, ,, 5c. ...	5d.
1	,, ,, 10c. ...	9d.
4	India	6d.
1	Jamaica	2d.
1	Kenya...	3d.
1	Mauritius	9d.

J. RUSSELL,
23. SHANKLIN DRIVE, WESTCLIFF-ON-SEA

K. E. VIII & VIMY

Collections of K.E. VIII issues are hardly complete without a souvenir of the only Official Public Ceremony at which he officiated abroad as King of England. We offer 2 Official View Cards, showing all 4 stamps complete (2 Impressed and 2 Adhesives) with special VIMY RIDGE P.O. cancellation, dated UNVEILING DAY at **5/-**. These are REALLY RARE!

Fuller details and price lists FREE.

NORRIS & CO. (Dept. M.), NORWOOD, LONDON, S.E.19.

THE BELGIUM RED CROSS & MONTENEGRO PKT. FREE!

This is one of the finest packets we have ever distributed, and includes amongst the 31 different stamps one of the beautiful Red Cross Issues which were sold in Antwerp in 1914 just before the town was occupied by the Germans. A really historic stamp which every collector should have. There are stamps from Hungary (large Parliament), Bohemia, France, old Canadians (K.E.), Australasians, I.F.S., Italians, Sets, incidentally NO COMMON GERMANS, Philippine Islands, India. Finally there is a wonderful COMPLETE SET of 8 Montenegro, the famous "too late" issue, featuring King Nicholas and Royal Crown. All free. Just send 2d. postage requesting approvals and lists of further similar gifts.

LISBURN & TOWNSEND LTD. (Dept. M.M.), LIVERPOOL 3

FREE Wonderful 1937 offer 20 New Issues and Novelties

Including **Algeria** (centenary), **Bermuda** (Hamilton Harbour), France (new colour), Ivory Coast (head of Native Girl), Jugo-Slavia **(Boy King Peter)**, Morocco Agencies **(King Edward VIII)**, **Perak**, Roumania **(Air Mail)**, **Selangor**, Senegal (bridge), etc. I will send this collection absolutely free to all stamp collectors sending 2d. postage. (Abroad 4d.)

G. P. KEEF, Willingdon, Eastbourne, England.

THE "DIAMOND" PACKET IS THE ONLY PACKET

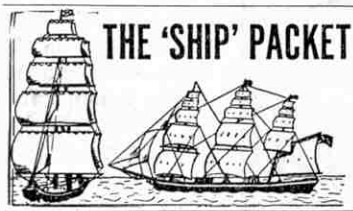
OF UNSORTED STAMPS ON THE MARKET with 15 years' reputation behind it. It contains approx. **1,000 UNSORTED STAMPS** from Convents abroad. **MANY RARE STAMPS** have been found in it. 1 pkt., **1/6**; 3 pkts., **3/9**: 5 pkts., **6/-**. All post free inland. Postage to Colonies 3d. per pkt. extra. Foreign, 6d. extra.

Ask your stationer for the "Diamond" packet.

SPECIAL TURKS ISLANDS JUBILEES complete set, used or unused, 5/6.

O. NERUSH (Dept. A), 68, TURNPIKE LANE, HORNSEY, LONDON, N.8.

THE 'SHIP' PACKET



This marvellous packet is offered under cost as an advertisement, **45 different stamps each with a ship on it.** A regular armada. **GABOON,** New Issue **SENEGAL** (Canoe), wonderful flotilla of caravels from **DENMARK** (complete set), **NEW CALEDONIA, UKRAINE, COSTA RICA,** a fleet of **7 CHINESE** junks usually sold at 10d., **TRINIDAD & TOBAGO, MAURITIUS, KENYA-TANGANYIKA, NEWFOUNDLAND, U.S.A., B. GUIANA,** set of **S. AFRICA, GREECE, POLAND, INDO-CHINA, FRENCH OCEANIA, WALLIS & FUTUNA ISLANDS.** etc. Price **4½d.**, postage **1½d.** (abroad 3d. extra). Purchasers of this packet asking for approvals receive **FREE** set of **3 SPAIN** (Columbus, each with his ship on it). Senders of addresses of stamp collectors receive **FREE** set of **6 VENEZUELA or 6 PERSIA, 100 BRITISH COLONIALS 1/-, 20 AIRPOST 6d., 6 TRIANGULARS 7d., 50 PERSIA 4/-, 9 POLAND New Pictorials 8d., VOLUMES OF B.O.P. CHEAP.**

H. C. WATKINS (M. Dept.), Granville Road, BARNET

MORE BARGAINS

MOROCCO. King Edward VIII Complete sets (11) Mint at 1/3; Fine used at 1/9. Postage extra.

CORONATION ISSUE.

N. Zealand, Cooks, Niue at 11d. each; Nauru 1/8; N. Guinea, 2/-; Papua, S. Rhodesia, 1/3; Aden, Ceylon, Seychelles or Somaliland, 9d.; Gilberts, Hong Kong, Kenya, N. Rhodesia, St. Helena at 8½d.; Ascension, Bechuanaland, Basutoland, Br. Guiana, Solomons, Fiji, Gold Coast, S. Leone, Swaziland, 8d.; Caymans, Falklands at 6d. All Mint.

OTHER COLONIES ON REQUEST.

KING GEORGE V PICTORIALS.

Mint SHORT SETS to 3d. value. LAST OPPORTUNITY.

Ascension (5 stamps) 1/-; Bermuda (6) at 1/3; Cyprus (6) at 1/2; Br. Guiana (5) at 1/-; Basutoland, Bechuanaland, Nyasaland or Swaziland (4) at 9½d.; Nigeria (5) at 1/3; Caymans (7) at 1/3; St. Lucia (6) at 1/3; St. Helena (5) at 1/-. Postage Extra.

HUGHES, "Ibis Cottage," AMERSHAM, BUCKS.

The NEW "TRANSPORT" Packet

Contains a wonderful assortment of 44 foreign and colonial stamps including the following, which depict various means of transportation, **Tunis** (water carrier), **Senegal** (bridge and boats), **Mauritania** (crossing desert), **Mid. Congo** (train and bridge), **Sth. Africa** (ship), **Germany** (aeroplane), **Austria** (horseman), **Indo China** (boat), **Mozambique** (aeroplane), **Gaboon** (raft), **Greece** (bridge and liner), **St. Pierre and M.** (trawler), **Fr. Guinea** (native carriers), **Dutch Indies** (steamboat), **Madagascar** (native transport), **Brazil** (aeroplane), **Belgium** (train), **Roumania** (aeroplane), **Newfoundland** (steamship), **Fr. Morocco** (camels). Price **6d.** Purchasers asking for approvals will receive **Ceylon** Silver Jubilee and Pictorials free.

BURDOCK & FLURY,
4, MARLBOROUGH ROAD, LONDON, S.W.19.

CHEAP APPROVALS

My beautiful Approval Selections are ideal for filling those vacant spaces. Pictorials, Colonials, and hard to get items. Selections from 4 a 1d. Free Gift Bi-coloured Persia all applicants.

A. V. TAPP, 26, WINDSOR ROAD, BRISTOL, 6.

COMPLETE USED CROWN COLONIES SET

26/-

Single sets on cover, face value plus 1½d. each, any number.

This is the cheapest price this set has ever been offered to the Philatelic Public.

Simply send 45 addressed envelopes, sealed and with nothing thicker than a post card inside (to preserve corners, etc. of the covers). I can supply same for 2/-. These will be forwarded to my Agents who will affix the necessary stamps and post to you.

This will ensure **Early Delivery** of your Sets.

Used sets of all the Dominions supplied on similar terms. Full particulars on application.

Terms—Cash with order.

K. HUMPHRIES,
DEPT. M, EAST WITTERING, CHICHESTER, SUSSEX.

MINT CORONATION SETS — RELEASED MAY 12th

I am now booking orders for the following:

Antigua	7d.	Falkland Is.	6d.	Montserrat	7d.
Ascension	9d.	Fiji	9d.	N. Rhodesia	9d.
Bahamas...	6d.	Gibraltar	8d.	St. Helena...	9d.
Basutoland	9d.	Grenada ...	7d.	St. Lucia ...	7d.
Br. Guiana	9d.	HongKong	10d.	Somaliland	9d.
Cayman Is.	6d.	Kenya ...	8d.	Swaziland...	9d.
Cyprus ...	8d.	Malta... ...	6d.	Virgin Is. ...	7d.

Cash with order. Postage extra.

H. L. GOMM, 41, Upper Cranbrook Rd., Redland, Bristol, 6.

CORONATION STAMPS

To be issued May 12th, 1937.

Set of 135 stamps ... ... **£1 7s. 6d.**

Representative set of 45 (one stamp from each of the 45 Colonies) ... ... **4s. 6d.**

Postage extra. Cash with order.

Full list free on application. Order early, remember the Jubilee rush.

ERRINGTON & MARTIN.
South Hackney, London, E.9. Estab. 1880.

ONE THOUSAND STAMPS ON APPROVAL

From which you may select any 100 for 3/-.

This selection is not made up of the very commonest varieties, but contains stamps catalogued at 1/- each or more. (I do not sell less than 100.)

H. HARDY, "Hoyland," Potter Heigham, Norfolk.

CORONATION STAMPS ON APPROVAL AND A GRAND FREE GIFT!

Have **CORONATION STAMPS** sent to you on approval—and see them before you buy!!

WRITE NOW for a selection of stamps "on appro" asking for Coronation Stamps to be included. A Grand Free Gift will also be included with your selection if your request reaches me by Sat., May 8th. But, please do not wait till the last day, write letter now, enclosing 2d. in stamps, to:

G. KINGSMILL (Dept. MM), NEW BARNET, HERTS.

SILVER JUBILEE FREE

A Mint Silver Jubilee of St. Lucia, together with an Australian. Free to all approval applicants. Postage 1½d.

AGEC, 12, Wellesley Road, Clacton-on-Sea, Essex.

100 Different Stamps Free to applicants for ½d. approvals. Cox, 14, Broadmead Av., Worcester Park.

8 Coronation Stamps 9d.; 45 for 6/- or complete 27/6. Order now. Sanders, 3, Commercial Rd., Southampton.

FREE. 100 different stamps. Request approvals. Collector, 81, Rosendale Road, London, S.E.21.

CORONATION PACKETS TO SUIT ALL POCKETS

8 Different, 9d. 12 Different, 1/-. 18 Different, 1/8.
25 Different, 2/6. 34 Different, 3/9.

One Variety from each of the 45 Colonies (45) Stamps **5/-**
135 Different (3 from each of the 45 Colonies) **£1/7/6**

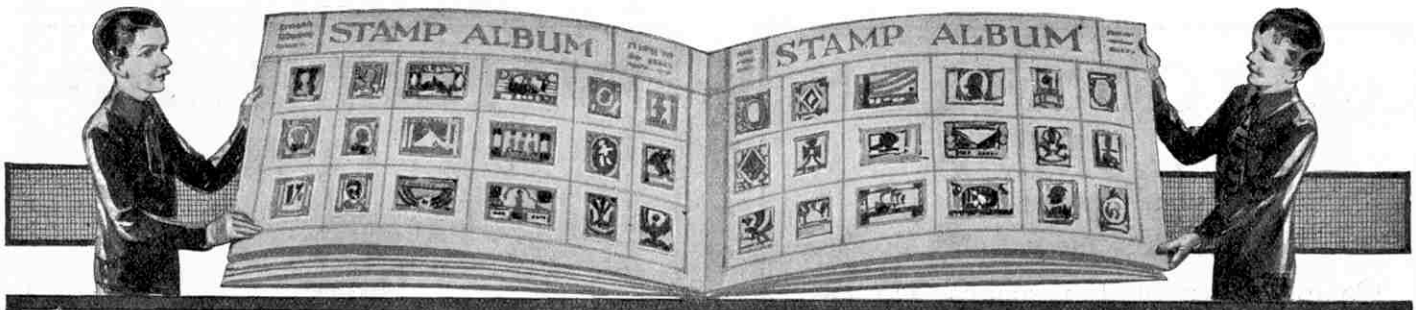
To secure delivery immediately after May 12th, prompt ordering is advisable. Cash with Order. All Postage Extra.

MINT COLONIAL PICTORIALS

An Entirely New Departure. Containing only **LARGE COLONIAL PICTORIAL STAMPS,** including Scenery, Zoological, Native Types, Industries, Ships, Arms and Map Stamps from about 35 Different Colonies in the South Seas, West Indies, Asia, Africa and America. ALL MINT. Price only **3/9** per packet of FIFTY Different.

PACKET of 75 Diff. as above, but including higher values, Price **7/-**. Post Free.

EDWARD SANDELL — 10, EVELYN GROVE — SOUTHALL, MDDX.



STAMP COLLECTING

CORONATION STAMPS OF OTHER DAYS

THE Coronation stamp to be issued in Britain this month will be the first of the kind to appear in this country. Other countries have made such issues from time to time, however, and any reader who feels disposed to build up a collection of Coronation issues, as a background for this month's British productions, will find sufficient material to provide an interesting task.

Pride of place in such a collection must go to Newfoundland's issue of June 1911. This series of 11 stamps commemorated the coronation of the late King George V, and is particularly interesting to-day because it includes the first stamp portrait of H.M. King George VI. This portrait is on the 4c. value, reproduced on this page, and shows the King as he was when Prince Albert.

The other 10 designs in the series showed portraits of other members of the Royal Family, King George V and Queen Mary, the Duke of Windsor (then Prince of Wales), the Princess Royal (then Princess Mary), the Duke of Gloucester (Prince Henry), the Duke of Kent (Prince George), the late Prince John, the late Queen Alexandra, and the Duke of Connaught, who will celebrate his 87th birthday on 1st May, the day on which this issue of the *"M.M."* appears.

The only other Coronation issue that has a direct connection with the British Royal Family is the Roumanian series of 1922 that marked the Coronation of King Ferdinand and Queen Marie, who is a grand-daughter of our late Queen Victoria. The 6L. value of this series shows Queen Marie in her Coronation robes. The 5b. stamp shows the cathedral of Alba Julia, in which the Coronation was celebrated.

The most interesting stamp that could be included in this collection undoubtedly is the famous Serbian "death-mask" issue of 1904. This series was issued for the dual purpose of celebrating King Peter's accession to the throne on 15th June, 1903, and marking the centenary of the founding of the Karageorgevitch dynasty in 1804. It comprised eight values, using two designs, and each of the five low values bore the "death-mask" design illustrated here. This shows the features of Peter and Karageorge, his ancestor, but the designer worked in a death mask portrait of the king he had succeeded and who had been assassinated. This can easily be traced if the stamp is turned upside down. Then it is seen that Karageorge's nostril and eyebrow form Alexander's left eye and moustache.

Pictorial stamps among the Indian Native States are comparatively rare and therefore the two Coronation sets available from this source, one from Jaipur and one from Travancore, are particularly interesting.

The Jaipur set was issued on 14th March, 1931, to celebrate the investiture of the Maharaja Man Singh II as ruler. There were 12 stamps in the set, each bearing a different design illustrating prominent buildings of the State, interesting ceremonial dresses and portraits of the Rajah and his predecessor. We illustrate the 2a. value, which shows a native soldier in armour, mounted on a ceremonially dressed charger.

The Travancore set was issued on 6th November 1931 to mark the Coronation of the Maharaja Rama Varma. There were only three stamps in this set, the designs being as follows: 6c. Sri Padmanabha Shrine, the scene of the Coronation ceremony; 10c. (illustrated) the State Chariot, drawn by three pairs of white horses with outriders, and 3 ch., a portrait of the Maharaja Rama Varma.

Japan has issued two series of Coronation commemoration stamps, the first being on 10th November, 1915, when the Emperor Yoshihito was crowned. This series consisted of four stamps, the two low values, 1½ and 3 sen, both of which we show here, using respectively designs showing the ceremonial cap worn at the Coronation and the Imperial throne. The two high values, 4 and 10 sen, showed the shrine in which the Coronation was celebrated.

Japan's second set was issued on 10th November 1928, when the Emperor Hirohito was crowned. Again there were four stamps, the 1½ and 6 sen showing a Phœnix, symbolic of the rising of the new Emperor, while the 3 and 10 sen values used the design illustrated here, showing the Coronation Temple.

One of the most attractive Coronation issues was that issued by Iran (perhaps better known to our readers as Persia) in 1915 to mark the Coronation of Shah Ahmed. There were three designs used over a series of 17 stamps. The 1 to 5 kr. values showed the ancient Persian King Darius sitting on his throne borne on the heads of a gang of slaves. The nine lower values showed the Imperial Crown and the four high values showed the gateway to the Shah's Palace at Persepolis.

This Shah was unfortunate enough to see also a special series of stamps commemorating his deposition. This series was issued by the provisional Pahlavi Government on 31st October, 1925, and consisted of current fiscal stamps overprinted with the wording "Provisional Pahlavi Government, 31 Oct. 1925."

It will be seen that the number of stamps in this Coronation collection is not big and the stamps are all fairly easily obtainable.

Stamp Gossip

and Notes on New Issues

Canada's King George VI Stamps

By courtesy of the Postmaster General at Ottawa we are able this month to reproduce the design used for Canada's new stamps bearing the portrait of King George VI.

The same portrait is to be used for the six low values of Canada's normal issues, and the 1c. green, 2c. brown and 3c. red denominations were placed on sale on 1st April. The 4c. bistre, 5c. blue and 8c. orange denominations will be placed on sale about Coronation Day.

* * * *

We illustrate this month one of the stamps from the series issued in Hyderabad in February last to commemorate the Nizam's Silver Jubilee.

The complete series comprised four stamps with designs as follows: 4p. Unani General Hospital; 8p. Osmania General Hospital; 1a. Osmania University; 2a. Osmania Jubilee Hall.

Each of the stamps bore also the inscription "H.E.H. The Nizam's Silver Jubilee."

Bisected Stamps

So much has been made in the press of the recently-auctioned bisected "Penny Blacks" that we think it desirable to give our younger readers a warning less they be tempted to experiment with current issues.

It is an offence against postal regulations to mutilate stamps to be used for postal purposes. It is unlikely that the Post Office would institute proceedings against a casual offender, but only in very special circumstances would the letters bearing the bisected stamps be allowed to pass unsurcharged.

There is no real philatelic interest attaching to bisected stamps if the bisection has not been officially approved as a means of meeting a shortage in certain essential values. All other "bisects" are mere freaks.

* * *

One of the most interesting stamp designs of the year was issued on 19th January by Brazil to commemorate the Ninth Brazilian Esperanto Congress held at Rio de Janeiro in November last.

As can be seen in the accompanying illustration, the design shows the flags of 32 nations on staffs radiating from a green star, the Esperantist emblem.

Esperanto is the international language introduced in 1887 by Dr. Zamenhof, which has since achieved considerable success.

Coronation Stamp Notes

In the House of Commons on 22nd March the Postmaster General announced that Great Britain would issue a special Coronation stamp of 1½d. denomination, this being the value most commonly used for Inland and Empire mails.

Australia has announced that a special Coronation set will not be issued. Instead there will be two new designs, bearing portraits of King George VI and Queen Elizabeth, and these will appear during Coronation week. The stamps will be notable for the fact that Australia has never previously featured the portrait of the reigning Queen on its stamps. During Queen Victoria's reign the individual States used her portrait, but Commonwealth Stamps have not been so distinguished previously.

It is possible that later values in this new permanent issue may bear portraits of Princess Elizabeth and Princess Margaret Rose and, on the higher values, a composite portrait of the King and Queen.

Newfoundland is to issue a complete Coronation series of 11 stamps. The designs will be based upon pictorial designs previously used on Newfoundland stamps, but King George's portrait will be superimposed and a tablet will bear the date of the Coronation.

Papua is to issue one Coronation stamp, a 2d. value. The design consists of the King's head on a plain ground, with the name "Papua" across the top of the stamp. The wording "Coronation of King George VI" appears in two lines at the foot with the word "Postage" below and to the left of the King's chin, and the figure of value on the same level to the right of the stamp. The whole effect is reminiscent of Great Britain's King Edward VIII stamps.

There will be four values in a special Coronation issue from Southern Rhodesia. These will have a common design, showing portraits of King George and Queen Elizabeth superimposed on a view of Victoria Falls. South-West Africa will have a special set of eight values, in bilingual pairs as usual, and these are to appear on Coronation Day.

Owing to the early date at which the "*M.M.*" has to go to press, and the extreme haste with which the Coronation stamps have had to be prepared, most of the Dominions and the Crown Agents for the Colonies have found it impossible to provide advance illustrations of the designs. We hope to be able to give a complete range of illustrations next month, however.

Aden's First Issue

We are indebted to Mr. A. F. McQuarrie for specimens of Aden's first stamps, brief reference to which was made in the April "*M.M.*"

As our illustration shows, the main feature of the design, which is used by each of the 12 stamps in the new series, is an Aden-built dhow. The central design is flanked by a dagger on each side, a reference to Aden's antiquity.

Aden has been a British naval base for nearly 100 years, guarding the southern end of the Red Sea and Suez Canal route. It is one of the most important oil-fuelling stations in the world. A post office was already established there when the Suez Canal was opened in 1869 and, together with British issues, stamps of the East India Company were used to frank correspondence until 1882. Since then the stamps of India have been employed, the colony having been administered by the Bombay Presidency up to 1932 and from then until 1936, when it came under the direct control of the Colonial Office, by the Indian Imperial Government.

Best Designs of 1936

Readers will be interested to learn the result of the contest, recently organised by "*Gibbons' Stamp Monthly*," to determine the 12 best new stamp designs of 1936.

The list is as follows: 1. Gt. Britain, King Edward VIII. Joint 2 and 3, New Zealand, Anzac issue and St. Lucia, 1½d. Ventine Falls. 4. Belgium, 70c. Borgerhout Town Hall. 5, 6 and 7. Bermuda 2d. Yacht "*Lucie*," 3d. Point House, 6d. House at Par La Ville, respectively. 8. Germany, 42 pf. Brown Ribbon Horse Race. 9. Ceylon, 50c. Elephants. Joint 10, 11 and 12. New Zealand, 2½d. Chamber of Commerce, U.S.A., 25c. Trans-Pacific Air Mail, Australia, South Australian Centenary.

The most interesting feature of the voting is the fact that the Bermuda Pictorial series secured three places in the winning list, a very high tribute to the excellence of this series.

Most of the stamps in the list have already been illustrated in the "*M.M.*"

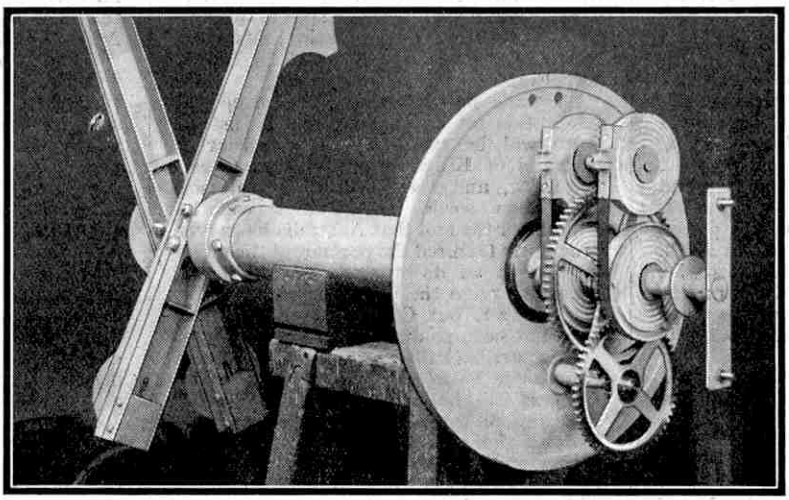
We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Luton Town Hall Clock

An Electric Timekeeper Built In Units

By T. R. Robinson

WHEN the Duke of Kent officially opened the new Town Hall at Luton recently, he made a special point of climbing the 140-ft. tower to see the large clock that has been installed in it, and there he closely examined the mechanism, the dials and the bells on which the chimes are sounded and the hour struck. The clock is one of the few that have been honoured by a Royal visit. It is of special interest as an example of the simplicity that electrical action brings to big timekeepers. Not many years ago such a clock would have needed a mighty mechanism, with a long pendulum, huge weights and a long weight-shaft, and would have called for laborious winding every few days. The Luton clock requires none of these, for it is divided into several neat and compact units, all electrically operated, and the whole mechanism is controlled and synchronised by a precision master-clock that is no bigger than the "regulators" one sees in a watchmaker's shop.



The dial unit of the Luton Town Hall clock, showing the slip rings and brushes leading current to the neon tubes on the hands. Photographs by courtesy of Gillett and Johnston Ltd.

Another feature of the clock is that its dials are illuminated at night by glow-tubing of the new kind known as "white neon," which enables the time to be read very clearly, and in bad weather gives far better visibility than the older forms of illumination in bad weather. The colour of the glow is a very pale blue, which is more suitable for clock dials than the red, blue or green of tubes used for advertising signs.

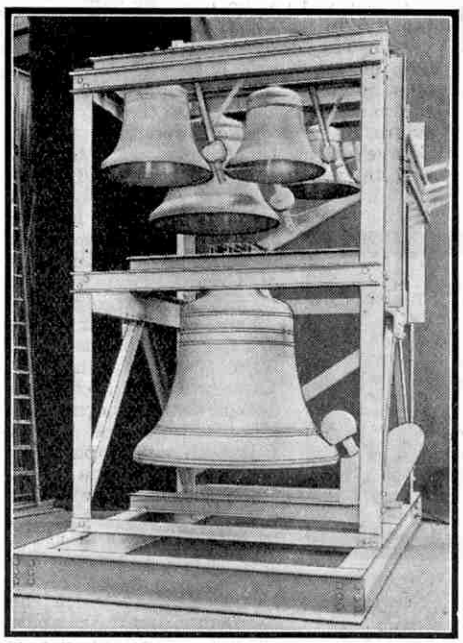
The fitting of glow-tubes calls for hands of a heavy form, and a powerful weight-driven timepiece unit of simple construction is employed to drive them. The weight hangs from a steel wire-rope wound round a large barrel on the main-wheel spindle, and the going-train, consisting of only three spindles, is controlled by a trigger that is tripped at half-minute intervals by the master clock. This is done through a spider with four radial arms that fall, one by one, on the trigger pallet, and are released in turn when the trigger magnet is energised by the impulses from the master clock.

The re-winding of the main driving weight is automatic, the switch controlling the motor being automatically moved to the "on" position when the weight has descended to a certain point. The motor, which operates through a worm-gear and a roller-chain drive, then raises the weight, and is automatically cut out when the latter has been wound up to its original position. In order to allow for failure of the mains current, enough additional rope is wound on the barrel to keep the clock going for 24 hours, and a hand-winding attachment is also fitted as an emergency precaution.

The dial units are very massive, and the 12 to 1 gears that operate the hour hands are mounted on circular castings, which are bolted to the inner surface of the tower walls, large tubular housings passing through these walls and giving protection to the tubular hand spindles. Inside the hand-tubes are placed the cables that conduct the current to the glow-tubing, and at the inner ends these cables are fed by large slip-rings mounted on the motion work. The rings are shown in the upper illustration on this page. They are fitted to large porcelain insulators, and the brushes which make contact with them are also mounted on insulators. Special care was necessary to prevent the high-tension current from leakage, for the return path of the current is by the metal of the mechanism.

The hands are of copper, stiffened by reinforcing ribs on the backs and they are attached to their spindles by castings which give a secure fixing. The tubes are fitted to special clips that allow of their being rapidly changed if they should fail.

The chiming and striking units are simple mechanisms, in which the cams that raise the hammers are driven by motors through enclosed worm gearing and subsequent spur gears. The chiming unit has a barrel with the quarter cams arranged on it, and the hour unit a single snail cam which rotates once for each stroke of the hour. Each unit is started up by a special impulse from the master clock, which rocks over a switch and starts the motor. As each set of four notes of the quarter or stroke of the hour is sounded, a ratchet pawl steps a count-wheel one-tooth, and when the chiming or striking is completed, a pin on the count-wheel trips the switch back to the "off" position, the unit then stopping until re-started by the master-clock. As the motors are started up suddenly, a centrifugal clutch is fitted between the motor and the worm gearing so that the motor only takes up its load when running at fair speed.

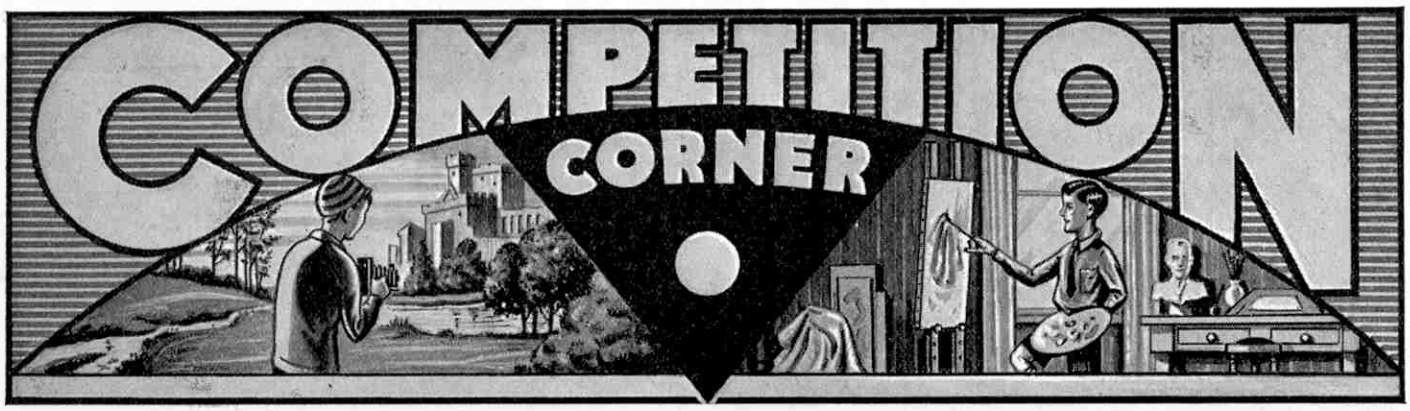


The bells in their frame. The large hour bell weighs 2¼ tons and its note is C.

The spacing of the interval between the chiming and striking at the hour is also controlled by the master-clock, a special attachment ensuring that a definite number of seconds elapse between chimes and striking.

The bells sound the Westminster quarters, and the hour is struck on a 2¼ ton bell, all five bells being mounted in a special steel girder frame, as shown in our lower illustration. The hammers are arranged to enable the connections to the levers on the striking and chiming units to be made very direct, and long wires and crankwork are dispensed with. This is one of the chief advantages of electrical operation, for the units can be placed close to their bells, electric connections of a very simple kind linking them to the master clock.

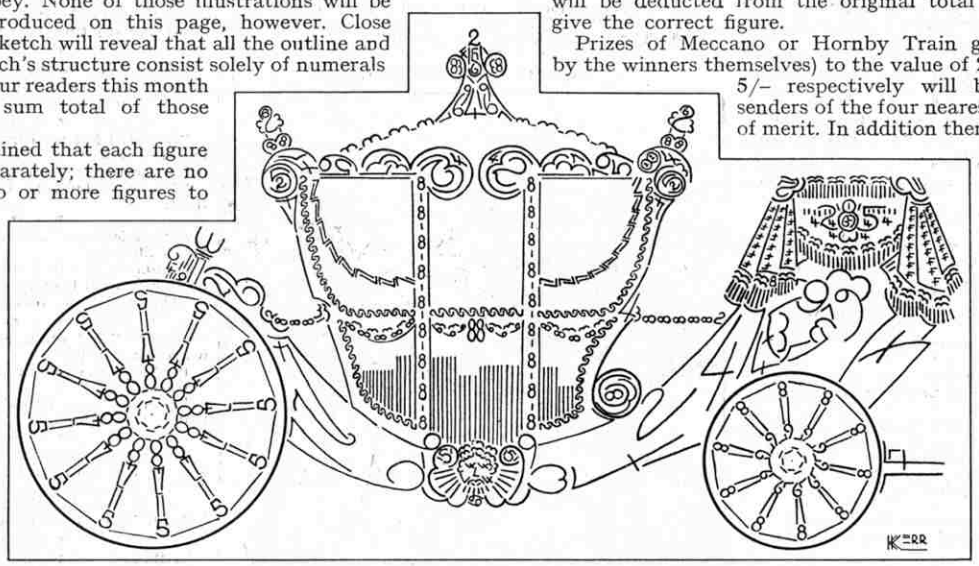
There are four dials to the clock, each 10 ft. in diameter. The numerals are Roman, and they are all fitted with glow tubes that outline them at night. The chimes of the clock are silent during the night hours, for the master clock operates a step-by-step mechanism that then opens contacts in the low-voltage circuits by which the master clock is connected to the units.



A CORONATION EYE TEASER

Many magazines this month will show illustrations of the State Coach that will bear Their Majesties to and from their Coronation at Westminster Abbey. None of those illustrations will be quite like ours, reproduced on this page, however. Close examination of our sketch will reveal that all the outline and the details of the coach's structure consist solely of numerals and the task we set our readers this month is to discover the sum total of those numerals.

It should be explained that each figure is to be counted separately; there are no combinations of two or more figures to make numbers such as 12 or 123. Only the figures 1 to 9 are employed, and some are upside down, while others are just a little eccentric in form. The sixes and nines must be scrutinised carefully; but it will facilitate identification if it is explained that the curl of the sixes is closed and joins up to the stem of the figure; that of the nines is open.



A unique drawing of the Coronation Coach. Can you find the correct total of the numbers of which it consists?

To ensure that no one shall know the exact total of the figures before the closing date, the Editor and the judges each erased a figure from the sketch before it was reproduced. No one knows which figures the others took out, for all those removed are in sealed envelopes in the Editor's desk. At the close of the contest these envelopes will be opened and the total of the figures disclosed will be deducted from the original total in the drawing, to give the correct figure.

Prizes of Meccano or Hornby Train goods (to be chosen by the winners themselves) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four nearest estimates, in order of merit. In addition there will be a number of consolation prizes for those whose entries come next in order. In the event of a tie for any or all of the prizes, preference will be given to those entries showing the neatest or most novel preparation.

No competitor may submit more than one entry.

Competitors should write their solutions clearly on a post card, and give their full name and address. The post card should be addressed to "Coronation Coach Contest, Meccano Magazine, Binns Road, Liverpool 13," and must reach this office not later than 31st May. A duplicate set of prizes is reserved for Overseas competitors, whose entries must arrive not later than 31st August.

May Photo Contest

Each month throughout the coming spring and summer we shall offer prizes for the best photographs submitted, irrespective of subject, size, make of camera, film or paper. The only restrictions will be that each print must bear a title and the exposure must have been made by the competitor.

Entries for each month's competition will be divided into two sections, A for readers aged 16 and over, B for those under 16; and prizes of Meccano products or Photographic Materials, as chosen by the winners, to the value of 21/– and 10/6 will be awarded in each section.

The competitor's name, age and address must be given on the back of each print. Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose. In the ordinary course prize-winning entries are retained, and it is a condition of entry that the Editor shall have the right to reproduce any entry without fee.

Entries sent this month must be addressed "May Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st May.

There will be separate sections for readers Overseas with prizes of the same values. Overseas entries for the May competition must arrive not later than 31st August.

Competition Closing Dates

HOME

Coronation Eye Teaser	31st May
May Photo Contest	31st May

OVERSEAS

Price Codes	31st May
February Drawing Contest... ...	31st May
Car "Faces" Voting Contest ...	30th June
March Drawing Contest	30th June
April Crossword Puzzle	31st July
April Photo Contest	31st July
Coronation Eye Teaser	31st August
May Photo Contest	31st August

Watch the Closing Dates

COMPETITION RESULTS

HOME

Car "Faces" Voting Contest.—1. P. Yorke (Redcar). 2. D. Taylor (North Wylam, Northumberland). 3. J. McHutchon (Glasgow). 4. A. Calvey (Portishead, Somerset). Consolation Prizes: P. M. E. Harmes (Brighton); W. Steele (Falkirk); C. W. Patterson (Hawick); L. Clare (Leeds); P. Brackett (London, S.W.17); L. Harvey (Newton-le-Willows); M. Hoskins (Exeter).

March Drawing Contest.—First Prizes: Section A, J. E. A. Burley (Birmingham 6); Section B, C. Fanning (Kildare, I.F.S.). Second Prizes: Section A, H. Wilson (Leek, Staffs.); Section B, L. M. Tucker (Reigate, Surrey). Consolation Prizes: V. J. Stewart (Retford); C. Thwaites (Sutton); D. Rain (Penicuik); D. Marshall (Chesham); A. Letzer (Bromley); Miss B. Walker (Huddersfield).

OVERSEAS

December Drawing Contest.—First Prizes: Section A, S. D. Kurlawalla (Bombay); Section B, M. V. Nathan (Conjeevaram, S. India). Second Prizes: Section A, J. A. Rodriguez (Montreal); Section B, M. O. O. Akinsehinwa (Ibadan, Nigeria). Consolation Prize: M. Conly (Dunedin, N.W.1).

Jig-Saw Advertisement Contest.—1. R. Danis (Montreal). 2. A. Conley (Vancouver, B.C.). 3. R. W. Roddick (Rosario de Santa Fe, Argentina). 4. J. C. Oleaga (Buenos Aires). Consolation Prizes: D. Rose (East London, S. Africa); N. Fairbridge Smith (Bechuanaland Cape, S. Africa); Miss M. Bedlington (Auckland, N.Z.); J. Lamont (Regina, Canada).

Christmas Shopping Contest.—1. J. C. Carter (Capetown, S. Africa). 2. B. Hibblewhite (Featherston, N.Z.). 3. D. P. Wallace (Timaru, N.Z.). 4. R. Scott (Hastings, N.Z.).

A BROAD HINT

Tommy: "Aren't you driving rather fast, dad?"
Dad: "You don't want to be late to school, do you?"
Tommy (thoughtfully): "No–o–oo. But I'd much rather be late than absent!"

* * * *

"I'm sorry, sir," said the constable, "but you'll have to be summoned for driving at 50 m.p.h. along this road."
"Couldn't you charge me with driving 80, officer?" asked the culprit eagerly. "I want to sell the car, and it would put the price up."

* * * *

Mother: "Boys, boys! Stop fighting this instant!"
Boys: "We're not fighting. We're just defending ourselves from each other."

* * * *

"Mother, what becomes of a car when it gets too old to run?"
"Somebody will sell it to your father."

* * * *

Employer (to applicant): "Are you a clock-watcher?"
Applicant: "Certainly not. I never was at an inside job. I'm a whistle-listener."

* * * *

Tomkins: "Now, where have I seen your face before?"
Timkins: "Where you see it now."

* * * *

Magistrate: "Have you ever been up before me?"
Defendant: "Dunno; what time do you get up?"

* * * *

Constable (to foreign pilot compelled to make a forced landing in a field): "'Ere, you mustn't come down in fields like that. What's yer name?"
Foreigner: "Je ne comprend pas."
Constable: "'Ow d'yer spell it?"

* * * *

Jack: "I once lived on apples for three weeks."
John: "That's nothing. I've lived on earth for fifty years."

* * * *

Professor: "Can you give me an example of wasted energy?"
Student: "Yes; telling a hair-raising story to a man with a wig."

* * * *

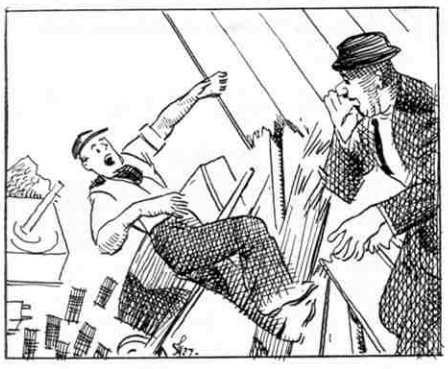
Guest: "Well, good night. I hope I haven't kept you up too late."
Host (yawning): "Not at all. We should have been getting up soon in any case."

* * * *

Visitor (touring America): "I've just been over to San Juan."
American: "Stranger, the 'J's' are pronounced like 'H's' out here. You should have said San Huan."
Visitor: "Well, give me a little time. I've been in this state only two months—Hune and Huly."

* * * *

USING HIS HEAD



Foreman (shouting to workman who is falling from high scaffold): "Fall on yer head, Bill—you'll get more compensation!"

NOSEBAG TALK

Bill: "In these hard times we should put a bridle on our appetites."
Fill: "I would rather put a bit in my mouth."

* * * *

Robson: "It's really wonderful what some insects can do. A grasshopper can jump 200 times its length."
Hobson: "That's nothing. I once saw a wasp raise a 200 lb. man three feet off the ground."

* * * *

GOING OR COMING?

Motorist: "Am I taking the correct way to the railway station?"
Farmer: "But which way be you a'goin' of?"

Courtesy "*L.M.S. Magazine.*"

* * * *

Teacher (warning her pupils against catching cold): "I had a brother seven years old, and one day he took his new sledge out in the snow. He caught pneumonia, and three days later he died."
There was silence for a few seconds, and then a voice from the rear said: "Where's the sledge?"

* * * *

Customer: "How much are these chickens?"
Dealer: "Half-a-crown, madam."
Customer: "Did you raise them yourself?"
Dealer: "Yes, madam; they were two shillings yesterday."

* * * *

The film cameraman met an old farmer. "I've just been taking some moving pictures of life out on your farm," he said.
"Did you catch any of my men in motion?" asked the old man curiously.
"Sure I did."
The farmer shook his head reflectively, then said, "Science is a wonderful thing."

* * * *

A struggling young author had called on a publisher to enquire about a manuscript he had submitted.
"This is quite well written," admitted the publisher, "but my firm publishes only work by writers with well-known names."
"Splendid," cried the writer. "My name's Smith."

* * * *

Farmer (to labourer he had just engaged): "Now, my man, have you ever done anything in the milking line before?"
Labourer: "Yes, coconuts."

STILL LIFE

"Is this applicant steady?"
"Steady? He's practically motionless!"

* * * *

Bill: "And so you please yourself about hours in your new job."
Jack: "Sure! I get in any time I like before nine and leave any time I please after six."

* * * *

Shopkeeper: "What does little Jim want to buy to-day—chocolates?"
Jim: "I'll say I do, but it's got to be soap for Mother."

* * * *

"Officer, I left my car here a few minutes ago, and now it's gone."
"It must have been stolen, sir."
"No, it couldn't be that. It was insured against theft."

* * * *

Shoe Salesman: "Here's a good strong pair sir, last you a lifetime."
Customer: "Good. That's the kind of thing I've been looking for. I'll take those."
"Thank you, sir. Will one pair be enough?"

* * * *

Uncle: "And what, Freddie, are you going to do when you grow up?"
Freddie: "I'm going to raise mint."
Uncle: "Mint?"
Freddie: "Yes, that's where daddy says all our money comes from."

* * * *

The schoolmistress wrote on the blackboard: "It was me that spilt the ink."
"Now Tommy," she said, "correct this sentence."
Tommy picked up the chalk and altered the sentence to read: "It wasn't me that spilt the ink."

* * * *

"I think," said the ear-aching subscriber, as he put aside the telephone, "that I'll go fishing."
"Didn't know you cared for fishing."
"I don't, but it's the only chance I have of finding myself at the end of a line that isn't busy."

* * * *

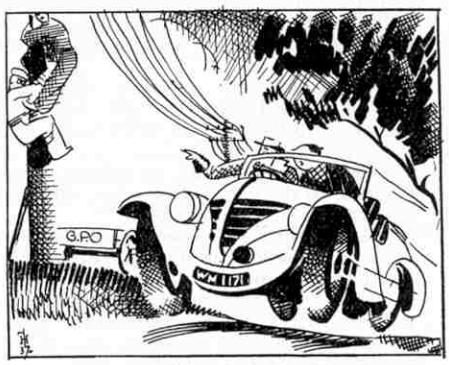
Teacher: "What is meant by a skeleton in the cupboard?"
Tommy: "A chicken after the second day's dinner, sir."

* * * *

Australian entering hospital:
"'Ullow, Bill."
"'Ullow, Steve."
"Come in to die?"
"No, yesterdy."

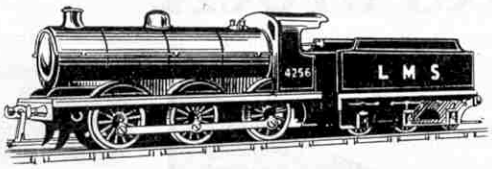
* * * *

SAFETY FIRST



A motorist was driving furiously along a country road, when he noticed a couple of repair men climbing telegraph poles.
"Humph!" he exclaimed to his companion, "they must think I've never driven a car before!"

MINIATURE MASTERPIECES



by BASSETT-LOWKE

The model illustrated is their gauge "O" 0-6-0 Goods Locomotive—a smart, yet inexpensive model of the "Maid of all Work" of British railways. The outline is a combination of L.M.S. and L.N.E.R. externals and the engine is available in either companys' colours.

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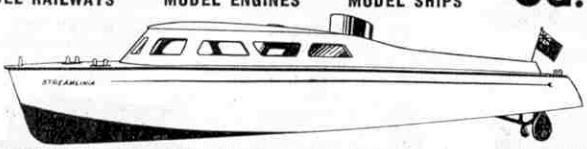

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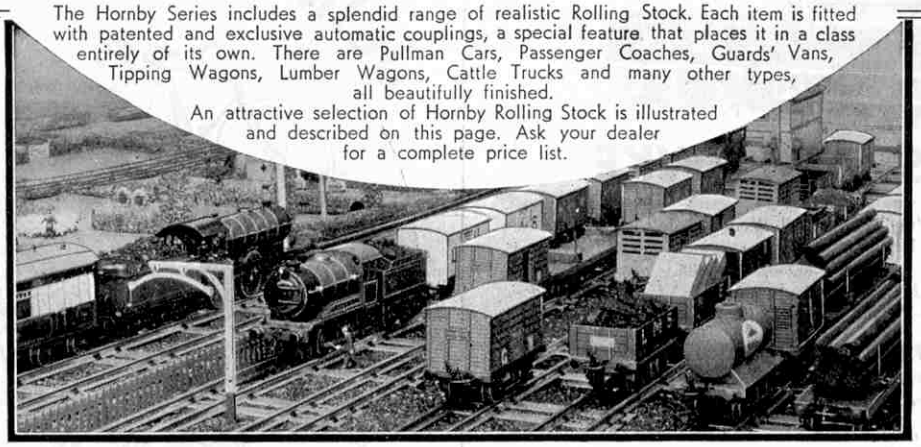
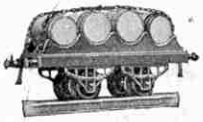
An attractive selection of Hornby Rolling Stock is illustrated and described on this page. Ask your dealer for a complete price list.





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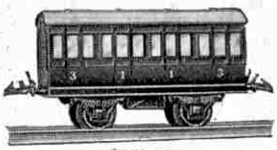

***COACH No. 1 PASSENGER**
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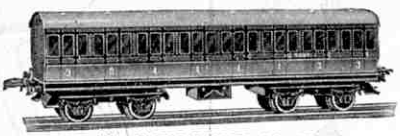
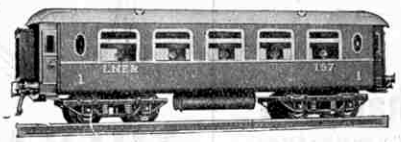
COAL WAGON
Fitted with embossed representation of coal. Price **2/3**



***No. 2 PASSENGER COACH**
Suitable for 2-ft. radius rails only. First-third, or Brake-third. Price **7/6**



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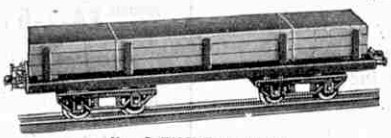
TROLLEY WAGON
Fitted with two Cable Drums. Price **4/3**



No. 2 TIMBER WAGON
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **2/6**

No. 2 HIGH CAPACITY WAGON
Finished in correct colours of G.W.R. and L.M.S.R. "Loco Coal" Wagons, or L.N.E.R. "Brick" Wagon. For 2-ft. radius rails only. Price **3/9**

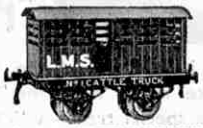
In L.M.S., N.E., G.W. or S.R. Lettering.

OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red.
Price **2/-**

COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. Lettered "Nord." Price **2/6**

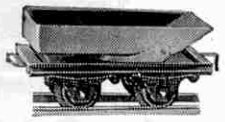
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors.
Price **2/9**

No. 1 CRANE TRUCK
Finished in brown and blue.
Price **2/11**



***No. 1 CATTLE TRUCK**
Fitted with sliding doors. Very realistic design.
Price **2/9**

FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **1/9**



MO ROTARY TIPPING WAGON
Container revolves and tips at any angle. Price **1/-**

GAS CYLINDER WAGON
Finished in red. Lettered gold.
Price **1/11**

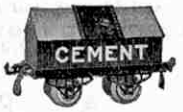
***OPEN WAGON "B"**
Fitted with centre tarpaulin supporting rail.
Price **2/-**

No. 1 ROTARY TIPPING WAGON
Finished in orange.
Price **2/6**

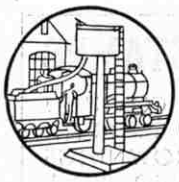
CHOCOLATE VAN "CADBURY'S"
This van is beautifully enamelled in blue with white roof.
Price **2/9**

***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

MILK TANK WAGON "NESTLE'S MILK"
Price **4/6**



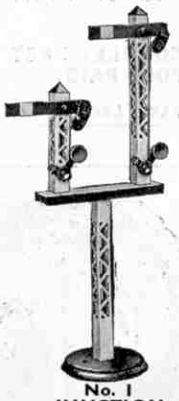
CEMENT WAGON
The door at the top opens. Finished in bright red.
Price **2/6**



HORNBY ACCESSORIES

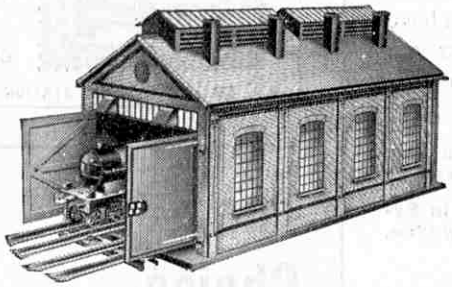
There is a splendid range of Railway Accessories in the Hornby Series, each one built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is shown on this page. Ask your dealer to show you the full range.



No. 1 JUNCTION SIGNAL
"Home" or "Distant."
Price **2/9**

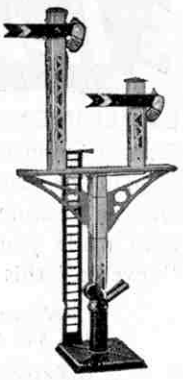
No. 1 SIGNAL
"Home" or "Distant."
Price **1/-**



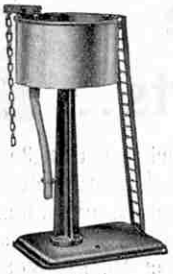
No. 2 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 17½ in.
Price **22/6**

No. 1 SIGNAL, DOUBLE ARM
"Home" and "Distant."
Price **1/6**

No. 2 SIGNAL, DOUBLE ARM
"Home" and "Distant."
Price **2/6**

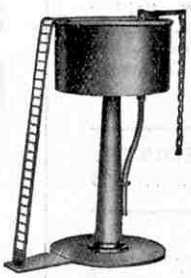


No. 2 JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model. Price **4/9**



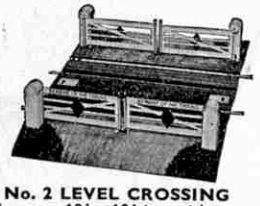
No. 1 WATER TANK
Height 7 in.
Fitted with flexible tube and valve lever.
Price **3/-**

TELEGRAPH POLES
Price per pair **3/6**



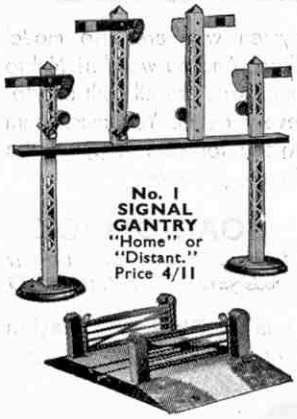
No. 2 WATER TANK
Height 9 in.
Fitted with flexible tube and valve lever.
Price **5/9**

MANSELL WHEELS
These solid die-cast Wheels can be fitted to Hornby Coaches, Vans, etc.
Price per pair **3d.**



No. 2 LEVEL CROSSING
Measures 13½ x 10½ in., with two tracks of gauge O rails in position.
Price **5/6**

No. E2 LEVEL CROSSING (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price **7/6**

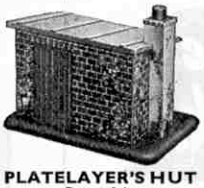


No. 1 SIGNAL GANTRY
"Home" or "Distant."
Price **4/11**

No. 1 LEVEL CROSSING
Suitable for a single track only.
Price **2/11**

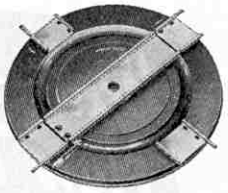
No. E1 LEVEL CROSSING (Electrical)
Similar to No. 1 Level Crossing, but fitted with electrical track.
Price **4/-**

No. 1 SIGNAL CABIN
Finished in colours.
Price **2/6**



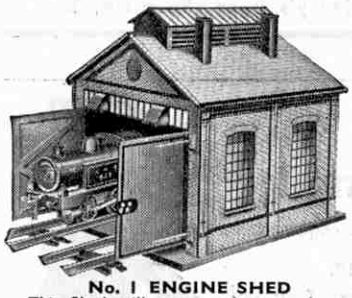
PLATELAYER'S HUT
Price **1/-**

No. 2 SIGNAL CABIN
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price **3/9**

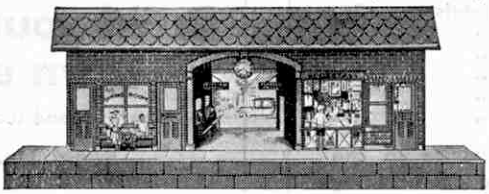


No. 1 TURNTABLE
Price **2/6**

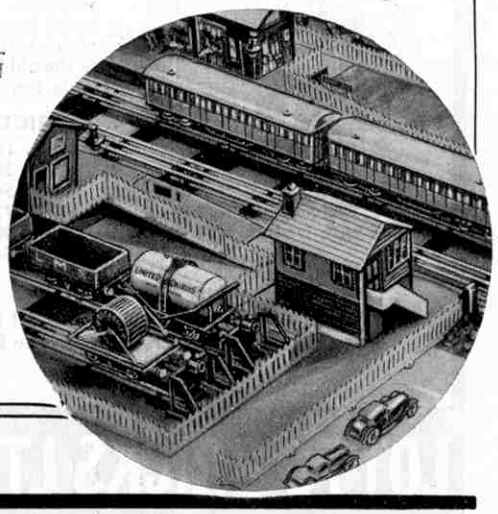
VIADUCT Price **6/6** **VIADUCT (Electrical)** Price **7/6**
VIADUCT Centre Section only ... ... Price **4/-**
VIADUCT (Electrical) Centre Section only ... Price **4/6**



No. 1 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¾ in. Price **15/-**



No. 1 STATION
Length 16¾ in., width 6 in., height 6 in. Price **4/6**



MECCANO LTD., LIVERPOOL 13

READERS' SALES

Readers should note that all advertisements of Hornby Trains and other Meccano products included in this column relate to items no longer featured in the catalogue. Advertisements of current products cannot be accepted for this column.

Wanted "M.M.'s," December 1932, February, May 1933. Sale, Bowman "Seahawk" Speed Boat, 12/6 complete with all equipment (new 42/-).—Newton, 5, Fulham Park Road S.W.6.

"M.M.'s," Jan. 1926-Dec. 1930. Complete and in excellent condition. 25/- or nearest.—Kenneth, Oakhurst, Brooks' Green, nr. Horsham, Sussex.

Exchange stamps. Jubilee for Jubilee. Enclose postage. Sale, Album and stamps, 5/-.—James McPherson, 40, Watson Crescent, Edinburgh.

Wanted. Small Induction Coil, also small X-ray tube. State price.—Evans, 119, Greenoak Crescent, Stirchley, Birmingham.

Sale. Meccano Set 6 with numerous additions, non-enamelled, superb condition, in polished cabinet, electric motor.—Perry, "Bossiney," Norton Road, Woodley, nr. Reading.

Sale. Red-Green Meccano, cost £5, take £1. Model Railway, 3 Engines, wooden carriages and rails, cost £9, take 30/-. Part slightly used. Either sold separately. Stamp list.—29, Warwick Road, Clapton, London, E.5.

Sale. Cricket Bat (4), Hockey Stick, Model Railway Track, Air Gun, Soccer Ball, "Simplex" Typewriter.—Allen, The Mount, Malvern Wells.

"M.M.'s" 1928-33 (5 missing), 15/-, carriage paid.—Gore, 18, Spring Grove Walk, Leeds, 6.

Stamps. Collector's Duplicates, 100 for 1/- post free.—Mackey, 7, Orchard Drive, Edinburgh.

Stamp Collection for sale. Valued at £5/10/-. What offers.—Millen, 14, Vicars Close, Wells, Som.

Sale. Railway Locomotives and Lines, cheap. Bowman Steam Engine. Also Railway Magazines; Bicycle; Wireless. Stamp particulars.—B. Woodman, 45, Regents Park Road, N.W.1.

12 "Railway Magazines" (1936), 5/-; 24 "Meccano Magazines" (1935-1936), 4/-; G.W.R., L.M.S. Magazines; collection Boys' Books. Send stamp for list.—Muirhead, 70, Brent Street, Hendon.

Headphones, best makes, very sensitive, as new, 3/6 pair, post free, 6 pairs only.—60, Avenue Approach, Bury St. Edmunds.

For Sale. Complete Home Laboratory. Built up over years. Every essential piece of apparatus; 20 proper bottles, chemicals, acids, etc., in shelved wooden cabinet, 33/-. Glasgow area.—P. McGregor, 107, Crown Road, North, Glasgow, W.2.

Wanted. "M.M.'s," December 1932, February, May 1933. Sale. Bowman "Seahawk" Speed Boat, 12/6, complete with all equipment (new 42/-). Also 50 British Railway Photographs in filing cabinet, 6/-.—Newton, 5, Fulham Park Road, S.W.6.

Stamp Collection (cat. £2), in album, 5/-.—178, Keedonwood Road, Bromley, Kent.

Sale. 36 in. Racing Yacht, two suits, spinnaker, automatic steering, £3/10/- or offer.—Clayton, 187, Knutsford Road, Grappenhall, Cheshire.

Wanted. Railway Magazines, Vols. 1 to 78, preferably bound. State price, condition, etc.—Hamilton, 29, Woodvale Avenue, Whitecraigs, Glasgow.

£1 or nearest. Ten scale model Wagons and Vans. Good condition. Details on application.—Palmer, Handborough, Oxford.

Sale. Set of 5 Red-Green Meccano and extras, £2. Also 60 recent (1930 onwards) Meccano Magazines, 10/-.—Quarmby, Eype, Hartley Way, Purley, Surrey.

Sale. Collection and Duplicate Stamps, 100 for 1/3, 150, 2/-, also Strand Album, hardly used, 3/-.—Joad, Catherine Cottage, Burgh Heath, Tadworth.

"Snipe" Bowman Steamboat. Practically new. Powerful engine with automatic lubrication, etc., 12/6. Also numerous Hornby accessories—cheap.—Particulars, Davies, "Northlands," Maesteg, Glam.

Sale. Model Railway, stamp list. Steam Engine, Meccano holes, 5/-; Horizontal Engine, 9/-; or nearest offers.—Carter, Belmira, Hardenhuish, Chippenham, Wilts.

Sale. Meccano Red-Green Nos. 5 and 7. Electric Motors. About £30 worth. Offers.—1, Green Walk, Hendon, N.W.4.

Large Chemistry Set, 15/6 or nearest.—Peters, "Conies," N. Halling, Rochester, Kent.

Sale. £3; £8 worth of Meccano (nickel finish) including Electric Motor, Transformer, good condition, and cabinet.—67, Muncaster Road, London, S.W.11.

Voigtländer Cameras

The Voigtländer "Rangefinder Bessa" is a compact high-efficiency camera of light weight that has a streamlined body and can easily be slipped in the pocket. Although it is so small it contains all the requirements for perfect photography built into it, including an optical range finder that takes the guesswork out of focussing, simple controls and a filter. A choice of three lenses is available and pictures of two sizes can be taken.

Voigtländer products also include two reflex cameras, the "Superb," which is a well-designed and reliable precision camera for the expert, and the "Brilliant," the reflex lens of which acts as a view-finder. The beginner will find the second of these cameras a splendid introduction to high-class photography. Illustrated brochures describing all these cameras can be obtained free by "*M.M.*" readers on application to Schering Ltd., Voigtländer Dept., 185-192, High Holborn, London, W.C.1.

This Month's Special Articles

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/- per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

MECCANO

The World's Finest Hobby for Boys

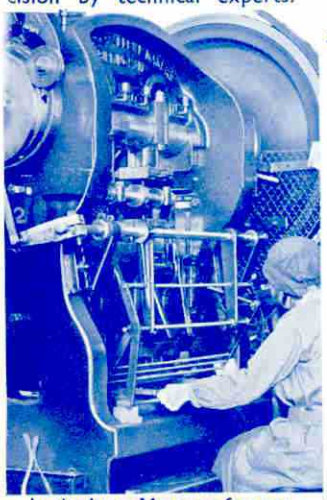
Every part in the Meccano system is designed with precision by technical experts.

Every boy is happiest when he is inventing, creating and building. That is the reason for the everlasting popularity of Meccano. It is the most fascinating hobby in the world, because it enables full scope to be given to all the inclinations and desires that are the natural heritage of boys.

The Meccano system is composed of approximately 350 different parts, each of which serves a definite mechanical purpose. These perfectly finished parts combine to form a complete miniature engineering system with which practically any mechanical movement can be reproduced in model form.

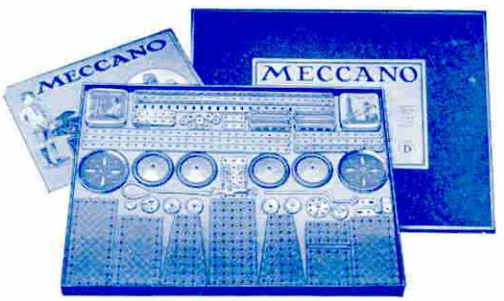
B Meccano Outfit

Meccano Boys Build and Invent



In the huge Meccano factory, high-grade machinery and the best material obtainable combine to produce the world's best hobby for boys.

PRICES OF COMPLETE MECCANO OUTFITS



D Meccano Outfit

COMPLETE OUTFITS

A	Outfit	... each	5/–	G	Outfit	... ... each	55/–
B	,,	... ,,	7/6	H	,,	(Carton) ... ,,	72/6
C	,,	... ,,	10/–	Hw	,,	(Cabinet) ... ,,	97/6
D	,,	... ,,	15/–	K	,,	(Carton) ... ,,	132/6
E	,,	... ,,	20/–	Kw	,,	(Cabinet) ... ,,	157/6
F	,,	... ,,	30/–	L	,,	(,,) ... ,,	400/–

ACCESSORY OUTFITS

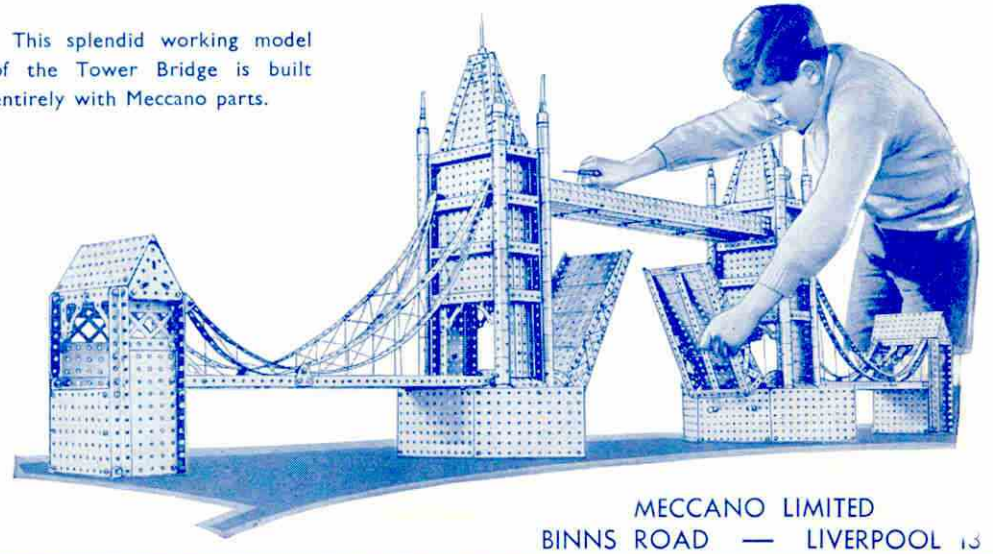
Aa	converts	A	Outfit	into	B	...	...	... each	2/6
Ba	,,	B	,,	,,	C	...	...	... ,,	3/–
Ca	,,	C	,,	,,	D	...	...	... ,,	5/6
Da	,,	D	,,	,,	E	...	...	... ,,	5/6
Ea	,,	E	,,	,,	F	...	...	... ,,	11/–
Fa	,,	F	,,	,,	G	...	...	... ,,	26/6
Ga	,,	G	,,	,,	H	...	...	... ,,	17/6
Ha	,,	H	,,	,,	K	...	...	... ,,	60/–
Ka	,,	K	,,	,,	L	...	...	... ,,	225/–

Real Engineering in Miniature

There is a Meccano dealer in practically every town in Great Britain.

Call at your local dealers today and—take Dad with you!

This splendid working model of the Tower Bridge is built entirely with Meccano parts.



MECCANO LIMITED
BINNS ROAD — LIVERPOOL

HORNBY SPEED BOATS

The best of all outdoor pastimes

Sailing a model speed boat is one of the most thrilling hobbies you could have, brimful of excitement from start to finish. But the amount of fun you get depends on the kind of boat that flies your colours. That's why you'll be proud to own a Hornby–every inch a champion, sleek, smart and swift.

Remember, Hornby Boats are the best that you can buy–best in appearance, and best in performance and reliability.

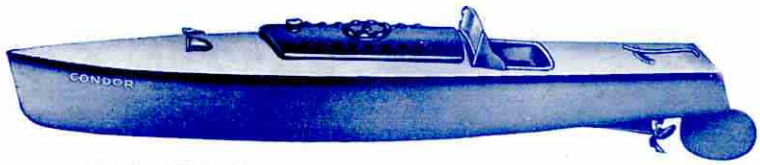
There are five splendid models from which to choose, beautifully finished in attractive colours. Each one follows closely the design and general characteristics of a famous speed boat prototype.

Each model is built with the same precision and craftsmanship as the famous Hornby Trains. Ask your dealer to show you the full range and see for yourself how perfect they are!

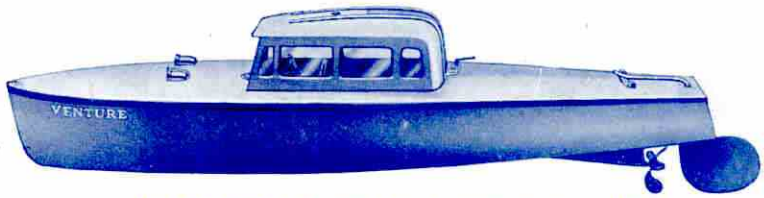
Manufactured by MECCANO LTD., Binns Road, Liverpool 13.

HORNBY SPEED BOAT No. 1 "CORONATION." Price **2'11**
Travels over 100 ft. on one winding. Dimensions: Length 9¼ in. Beam 3 in.

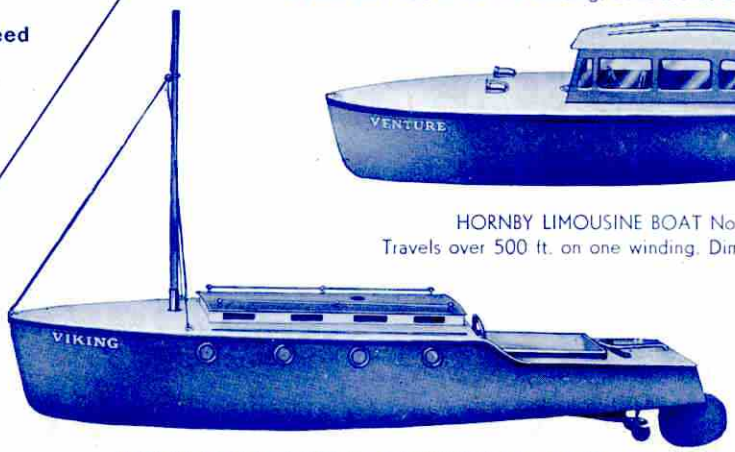
HORNBY SPEED BOAT No. 2 "SWIFT." Price **7'6**
Travels over 300 ft. on one winding. Dimensions: Length 12½ in. Beam 3 in.



HORNBY SPEED BOAT No. 3 "CONDOR." Price **12'6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.



HORNBY LIMOUSINE BOAT No. 4 "VENTURE." Price **15'6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.



HORNBY CABIN CRUISER No. 5 "VIKING." Price **16'6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

Join the Hornby Speed Boat Club

If you own a Hornby Boat you should join the Hornby Speed Boat Club. You can do this by purchasing a special badge (illustrated above) from any Meccano dealer, or direct from Meccano Ltd., price **6d.**

Pennants

Pennants for Hornby Speed Boats Nos. 3 and 4 may be purchased separately. They add the final touch of realism to these boats. Price **2d.** each.

PUBLISHED BY MECCANO LTD., BINNS ROAD, LIVERPOOL 13, ENGLAND.
Printed by John Waddington Ltd., Leeds and London.