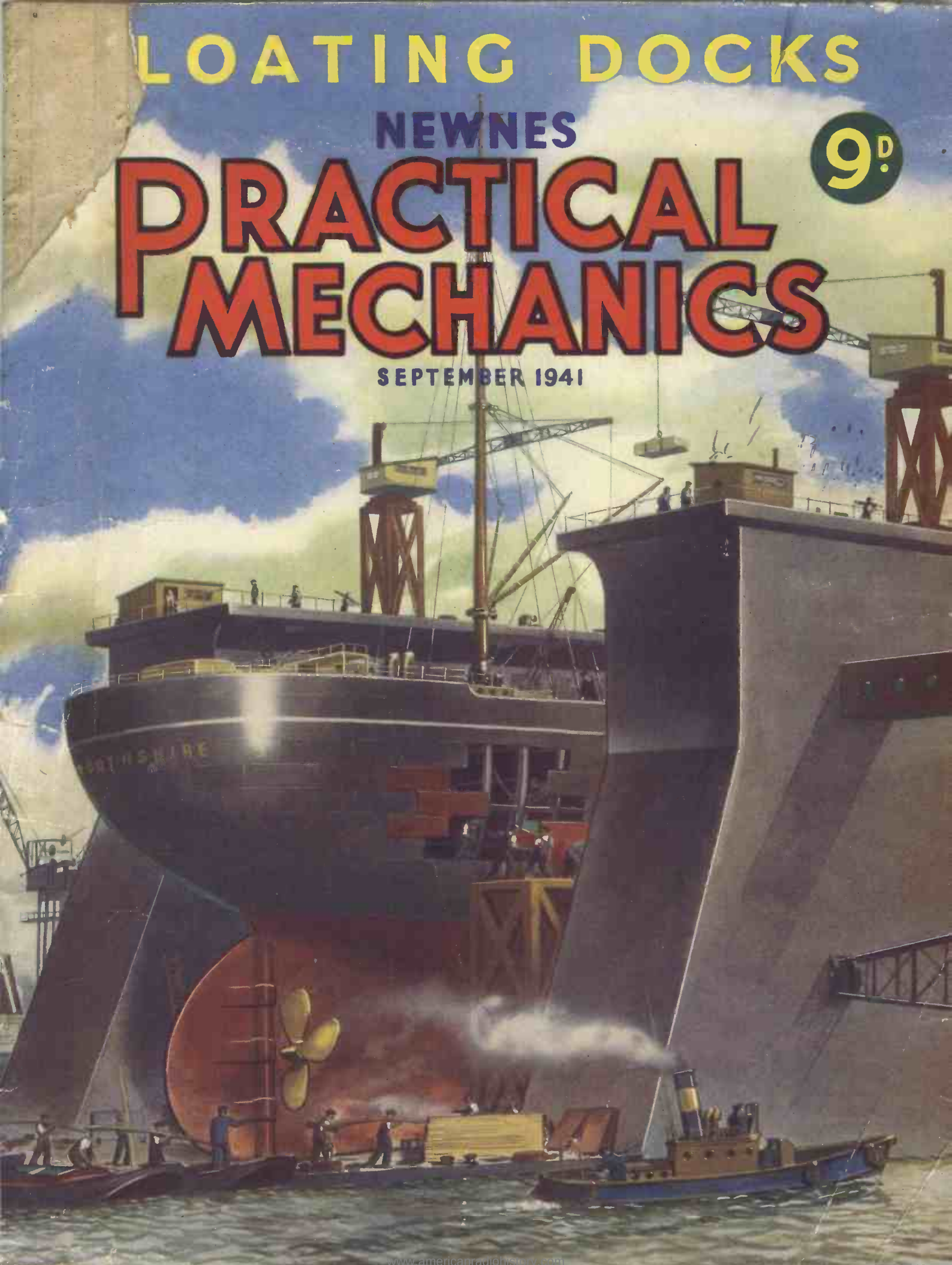
LOATING DOCKS

NEWNES

PRACTICAL MECHANICS

9D.

SEPTEMBER 1941



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PRACTICAL MECHANICS

Owing to the paper shortage "The Cyclist" and "Home Movies" are temporarily incorporated

Editor : F. J. CAMM

VOL. VIII. SEPTEMBER, 1941 No. 96

FAIR COMMENT — BY THE EDITOR

More Opportunities

THE supply of skilled engineers has long since been exhausted, and it is amongst their own operatives that employers must look for the skilled labour they require. Experienced men in the shops must be upgraded to take on work to the limit of their capabilities and a regular system of training organised even at the expense of a temporary loss of production. This is in strict accord with the desire of the Ministry of Labour and National Service.

To assist employers in their own training effort courses arranged by the Ministry are already in operation to train employers' operatives as auto, capstan and milling machine setters, as well as toolroom workers. The courses are given in Government training centres, technical colleges, and industrial establishments. The instruction is given by competent craftsmen, and is planned on practical lines. The course lasts a few weeks.

The employer under this scheme is enabled to get his skilled operatives trained to a higher degree, free of charge, but the men remain on the pay-roll of the employer and are paid their wages by him in the ordinary way during training. The men are returned to the employer after training so he need have no fear that he will lose his skilled personnel. In appropriate cases the Ministry is prepared to provide limited financial assistance to meet expenses which the employer may incur owing to the man's absence. If for the purposes of training men are required to move to another district, their fares will be paid, and they are eligible for lodging allowances at the rate of 3s. 6d. per night on the same terms as for transferred workers. An employee attending a training course may receive any excess of fares over his normal daily travelling expenses and when he returns to his employer he may look forward to any increase in wages which may result from his increased skill.

Trainees from Government Training Centres will be provided temporarily to take the place of the men undergoing training. The full scheme is explained on leaflet P.L. 92/1941, obtainable from any local office of the Ministry of Labour.

Courses of Foremanship

THE Ministry of Labour is also organising courses of lectures in foremanship, and the establishment of a course in a particular district will depend upon local demand. The lectures cover general principles of foremanship and supervision, principles of production and planning, elements of labour management, costing and remuneration.

The courses will normally be of 72 hours duration, and will usually be given in two evening meetings of two hours each. Allowances or expenses will not be paid by the Ministry in connection with this course, which is free. It is appreciated that personality and considerable technical experience are required to make a successful foreman and that it is impossible to produce one simply by a course of lectures. The intention of the courses is to give the wider background for men already possessing these important qualifications. On this account only existing foremen and other men with the necessary experience will be accepted. Employers are invited to put forward men of the same type whom they consider will benefit from the course. Names and addresses of those applying for the course should be sent to the local Employment Exchange. An examination will be held at the conclusion of each course, and those who pass will be given a written statement to that effect.

Here are further opportunities for those with the necessary aptitude to improve their knowledge and experience and equip themselves for the post-war period.

Post-War Air Travel

AIRCRAFT design is being forcibly advanced by the war to a stage which it would require 50 years of ordinary private enterprise to attain. A few years ago an Atlantic flight was front page news. To-day the Atlantic is being flown by large numbers of aircraft in a few hours every day.

It is obvious that America is daily being brought nearer to us. The conflict has knitted the two nations together, and after the war we shall be even closer from a commercial point of view by reason of air travel. Then it will be possible to fly from this country to America to perform a business transaction and return to this country within 24 hours. Civil aviation will develop.

The Military Aerodromes which have been created during the war will undoubtedly be used as Civil Aerodromes. All private flying has been suspended for the duration of the war, and private aeroplanes are grounded. After the war the country will be linked by the aerodromes and we foresee a lively and rapid development in private and commercial flying. This would be one of the few good things which emerge from war, which is largely destructive. Stratosphere Flying, which is now a practical possibility, will cause the world to shrink. Life will be at a quicker tempo than it is to-day. It seems reasonably certain that aircraft designers will turn their attention from high-powered, high-speed fighters and bombers to comparatively low-powered private and commercial aircraft.

In America private flying has reached enormous proportions. It is possible to buy a machine for less than £200, and business men own their fleet of aeroplanes as those in this country own private cars. The aircraft industry is thus providing golden opportunities for those choosing a career, although most of the opportunities will go to those who at present are engaged in military aviation, and will naturally wish to remain in the industry. The three professions which provide the best post-war opportunities are the engineering, aviation, and building trades.

"Mastering Morse"

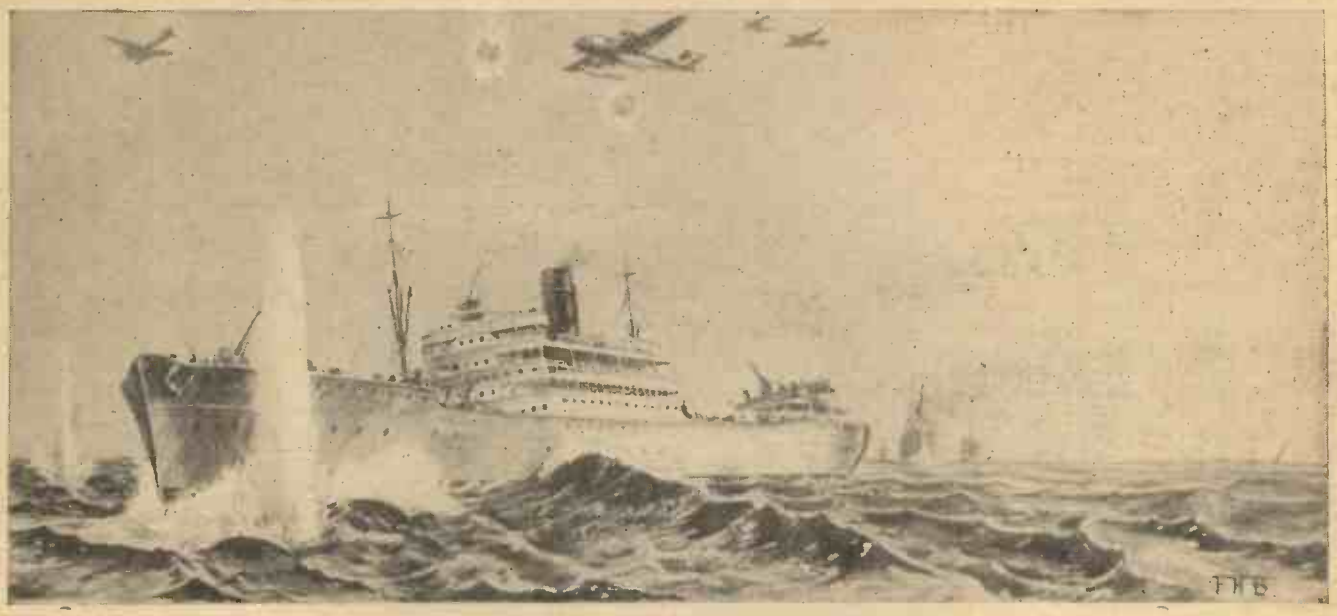
IN view of the great demand of the Services for those with a knowledge of radio and the Morse Code, we have recently produced at the price of 1s. a small handbook entitled "Mastering Morse." This deals exhaustively with the subject. It includes circuit diagrams for Morse Practice Sets, and a two-valve short-wave receiver. It will be sent by post for 1s. 3d. Address orders to The Publisher, Geo. Newnes Ltd., Tower House, Southampton Street, Strand, W.C.2.

"The Engineer's Vest Pocket Book"

THERE will shortly be published from the offices of this journal an important Engineers' Reference Book in Vest Pocket size. It contains no less than 604 pages of tables, memoranda and formulae relating to screw-cutting, gear-cutting, press tools, springs, pulleys, hacksaws, milling machines, weights of materials, mensuration, planimetery, longimetry, stereometry, moments of inertia, keys, limits, etc., etc. For further details apply to the address given above.

Our Companion Journals

A REMINDER that our companion journals *Practical Wireless* and *Practical Engineering* may only be obtained against a regular order. The former journal costs 6d. a month, whilst the latter is 4d. every Thursday.



A ship in a convoy being bombed by enemy aircraft.

Floating Docks

Marvels of Engineering that are Capable of Lifting a 60,000 Ton Vessel.

THE Merchant Service is undoubtedly playing a very important part in the winning of the present war. That the Germans have realised this is obvious from their intensified efforts to sink or damage ships carrying essential war produets to this country. The effectiveness of our system of convoying ships, however, is shown by the steady stream of supplies reaching our shores. Of course, it is impossible to safeguard every ship, and quite a number are sunk or damaged by enemy action. Obviously, little can be done in the case of a sunken ship, but where a ship has been damaged it is generally possible to repair it and make it seaworthy once more. Ships of a small tonnage are easily handled and repaired, but in the case of larger ships the floating dock must be used in order to carry out a speedy repair.

A modern floating dock is an ingenious piece of engineering. It consists of a huge trough-shaped raft formed of a hollow bottom and two hollow sides. In order to raise a ship, the bottom and sides of the dock are filled with water until it sinks below the ships' keel. Hawsers are then employed to manoeuvre the ship until the keel and the keel blocks of the dock are in line. When the ship is in position the water is pumped from the dock, which then rises to the surface, carrying the ship with it.

First Floating Dock

In 1776, a shipwright named Aldersley built a floating dock which was the first to be used in Great Britain. This was followed by Christopher Watson's dock which was built in 1785, and used on the River Thames at Rotherhithe. The principle of these early docks was similar. They consisted of a shell which had a gate in one end into which the vessel was warped. The gate was then closed, and the water was pumped out of the shell. That the docks were strongly built is proved by the fact that Watson's dock was in use for nearly fifty years.

Subsequently, the design of the docks was improved by providing them with hollow walls and bottom, thus making them buoyant. In 1809 appeared another type of dock patented by Richard Trevithick and Robert Dickinson. It was described as a caisson, to be built of wrought-iron plating ½ in. thick and internally resembling a ship. The size of the shell was 220 ft. by 54 ft. by 30 ft. deep and for additional strength the dock had a large flange 6 ft. wide, extending outwards horizontally. The workmen also used this flange to stand on when repairing a ship. It was surrounded by water-tight chambers semi-cylindrical in shape, and in a barge alongside was a 12-h.p. engine for working the pump which raised the dock. G. W. Lennox patented a similar design in 1834, but neither of these designs was ever put into practice.

American Docks

The first to put into practice a design for a hollow dock were the Americans, and these were made of timber. In 1848, a hollow dock was built for the Navy Yard at Portsmouth, New Hampshire, and this was the first of any note. For some time the Americans continued to build hollow-walled wooden docks of considerable size, and in 1866 one was built at Rangoon which was 300 ft. long. So far wood had been used for the construction of floating docks, but in 1852, James Taylor of Birkenhead patented a design for an iron dock. The floor of his design was divided into four separate compartments, and pipes led from these compartments to separately controlled pumps, the trim being maintained by further compartments in the side walls. But it was not until the hydraulic lift dock was designed in the early 'fifties by Edwin Clark that iron began to be freely used. This design differed from previous practice, inasmuch as the dock was formed of rectangular iron pontoons which depended for their lift from a number of hydraulic rams which were embedded in heavy foundations at the bottom of the harbour. Thus the pumping method of lifting the dock was dispensed with. The method of operating this type of dock was to cause the pontoon to sink on to the ram heads by filling it with water, thus enabling the ship to float over it. The pontoon and ship were then lifted high enough to allow the water to run out of the pontoon. The pontoon valves were then closed and the rams released, leaving the pontoon floating with the ship on top of it. The best example of this type of dock was the Victoria Dock, London, which was built in 1857, whilst others were installed in Malta in 1871 and Bombay in 1872. This type of dock, however, is now obsolete.

First Bermuda Dock

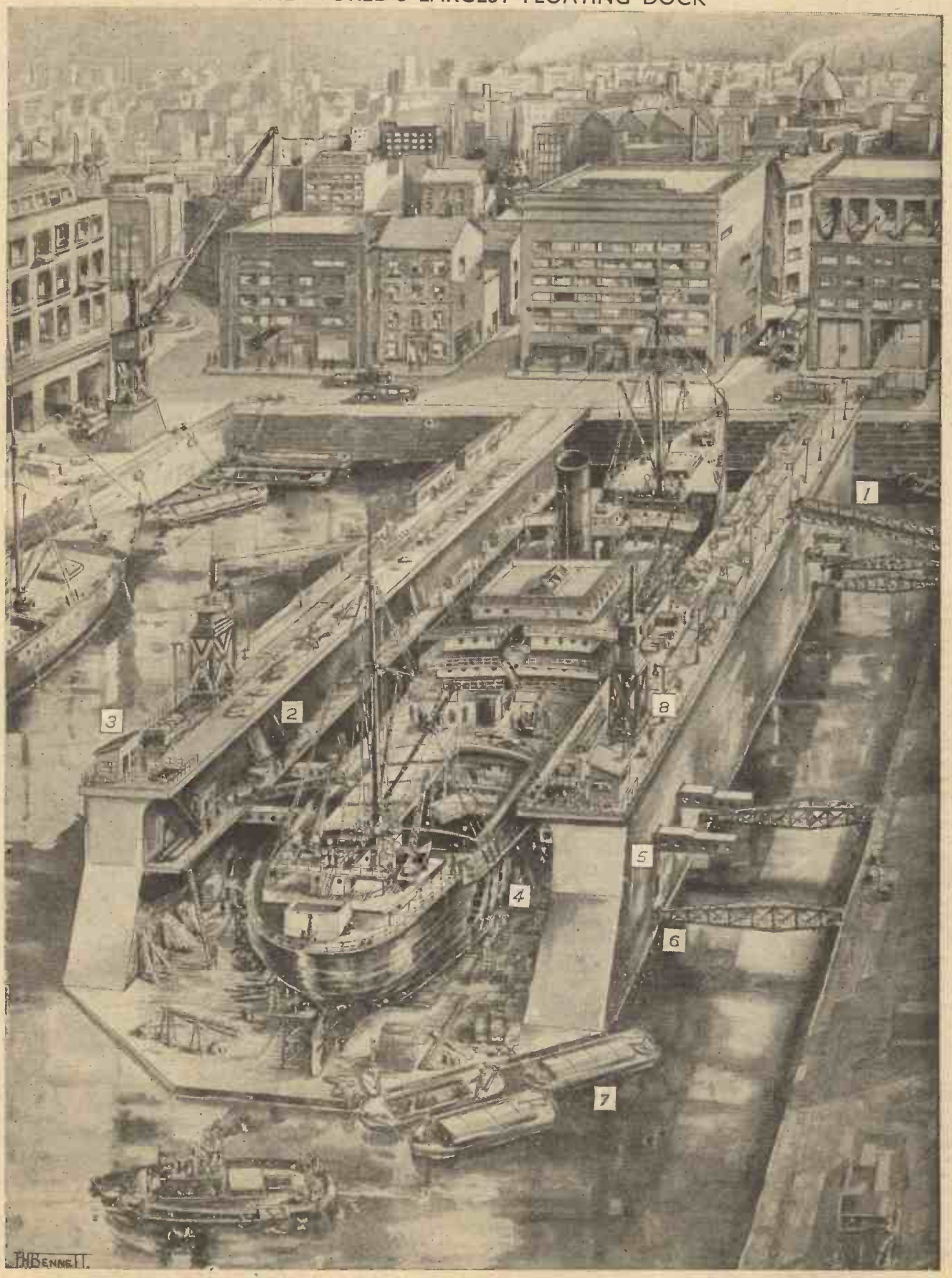
An interesting example of a hollow-walled iron dock was that built to the order of the Admiralty in 1868. It was the first Bermuda dock and was used by the West Indies Squadron. This dock depended for part of its lift upon the pumping dry of compartments contained within the walls themselves. On top of the walls of the dock were mounted eight steam-driven pumps, and these were used for emptying twenty-four water-tight compartments which were contained in the walls, which when emptied exerted a lift of 3,000 tons.

Box Docks

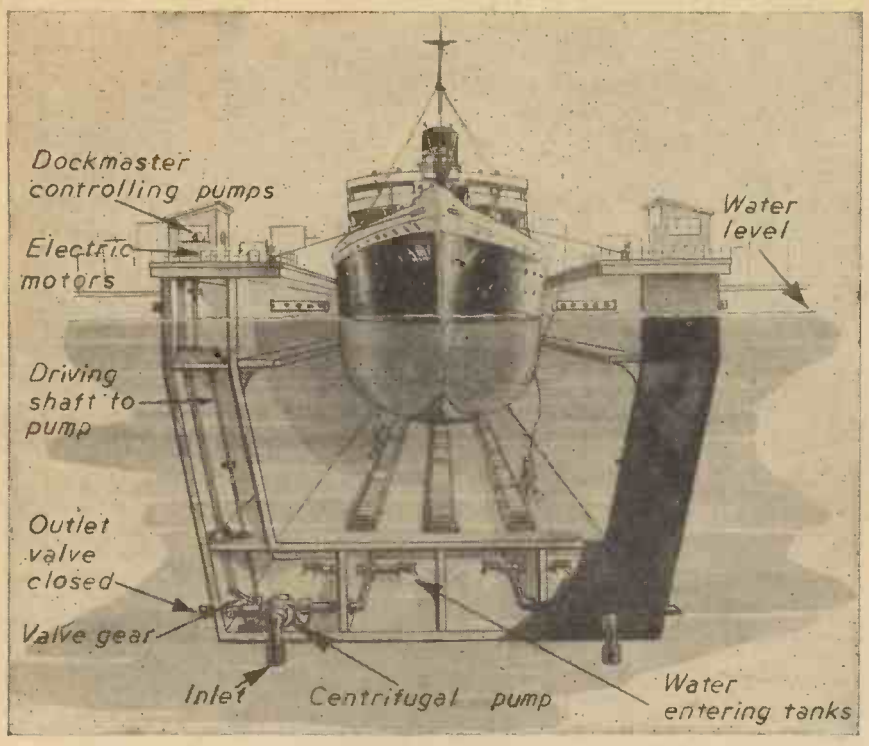
Up to this date most of the docks built were classified as box docks, that is to say, they were built in one piece. With this method of construction, however, it was found that the docks themselves could not be docked, as they were too large to go into any masonry dock. It was found that the simplest method of overcoming this drawback was to build the docks in several small sections. It was soon discovered, however, that this type of sectional dock lacked rigidity.

Clark and Standfield, the Westminster firm of consulting engineers, have been largely responsible for the further improve-

THE WORLD'S LARGEST FLOATING DOCK



KEY TO ILLUSTRATION—1. Gangway to dock. 2. Lower deck. 3. Dockmaster's control room. 4. Repairs being made to hull of ship. 5. Side-shores supporting ship. 6. Hinged girders anchoring dock. They are hinged to allow for the tidal rise and fall of the floating dock in relation to the stone wall of the harbour dock. 7. Barges supplying material for repair work. 8. Travelling crane on top deck.



Dock submerged, and ship entering dock. Divers place keel blocks in position.

ments that have taken place in the design of floating docks during the past fifty years. Their Havana design introduced in 1895 greatly increased the longitudinal strength of floating docks. The best known example of this type is the second Bermuda dock built by Swan, Hunter and Wigham Richardson of Wallsend-on-Tyne in 1902. It is 545 ft. long, and has a width of 100 ft. The lift given by the pontoon was 15,500 tons.

Sectional Box Dock

Although the Havana type of dock was extremely rigid, it was decided that a still more rigid type of dock was desirable. Clark and Standfield, therefore, designed the bolted sectional box dock, which was a reversion to the old type of sectional dock. With this type the sections are rigidly bolted together, thus forming a continuous trough-shaped girder of enormous strength.

We now come to the Southampton dock built by Armstrong Whitworth for the Southern Railway, which is the largest floating dock in the world. It is capable of raising a 60,000 ton vessel. It is of the sectional box type as mentioned above, and is divided into a number of water-tight compartments which can be filled and emptied by centrifugal pumps located in the bottom of the dock and driven by shafts operated by electric motors on the top deck. Fourteen pumps are employed, and no less than 56 valves have to be operated to raise and lower the dock. All operations are controlled from the dock-master's control room situated on the top deck. When the ship to be renovated is drawn by tugs into the submerged dock, large sliding girders, called side-shores, are moved inwards by electric power until they touch the sides of the hull and hold the vessel upright. Whilst the ship is rising, during the pumping out of the water, divers place bilge blocks in position so that they may support each side of the keel. When the water is pumped out, additional shores of wooden planks are then built up under the keel.

Mooring Operations

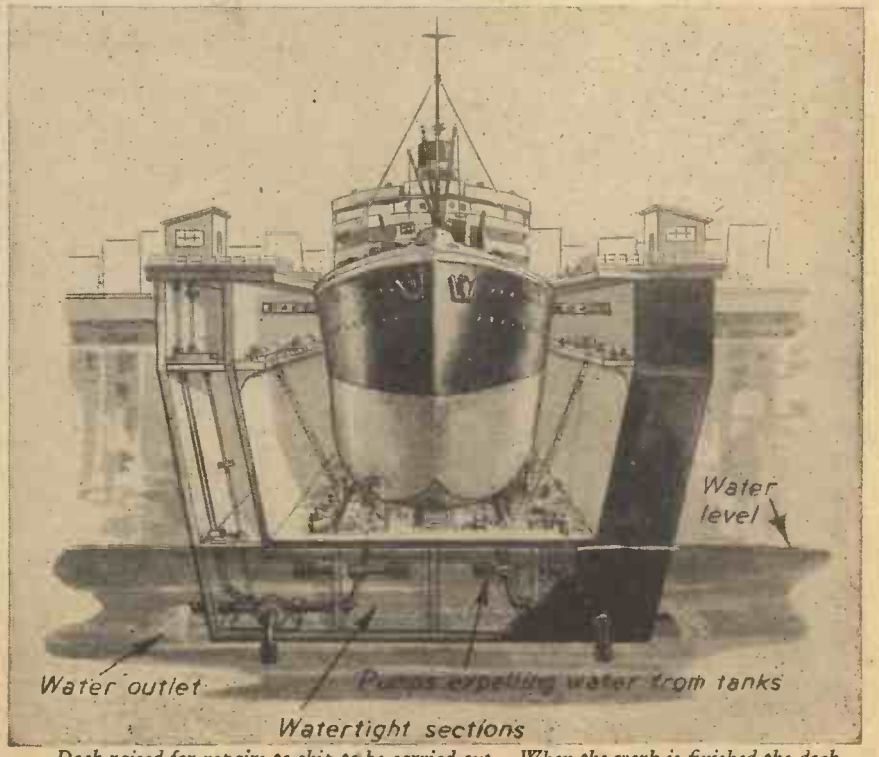
Steel beams attached to the side of the dock are used for mooring to the dock side. Being hinged, they allow for the tidal rise and fall of the water. Access to the dock is by a sliding gangway. Gates can be positioned at either end of the dock when work is required at either bows or stern.

The Depositing Dock

The "off shore" and "depositing" docks were interesting developments of the floating dock. The advantage of the "off shore" type was that it could be used in a fixed position near the shore. When in use the outer wall can be dispensed with, and stability is assured by using pivoted girders to moor the inner wall to the shore. Thus the girders allow the dock to rise and fall, whilst still keeping it in a horizontal position. Clark and Standfield were responsible for the development of the depositing dock in 1876. This type was designed to hold ships that were so wide that they could not be accommodated in the conventional dock. Long hollow fingers connected to a hollow wall were used in the construction of the dock. A staging or grid-iron was built along the shore, the spacing between the grids corresponding with the spacing between the fingers of the dock. In use, the ship was lifted in the usual way, and the dock with the ship in it was then towed in sideways to the staging. The grids of the staging and the fingers of the dock were then made to interlace, and the dock was then sunk and withdrawn leaving the ship high and dry on the staging.

Whilst this type of dock had the advantage of accommodating ships of unusual width, it could also be used for depositing other ships on further lengths of staging. Examples of depositing docks are still to be found at Barcelona, in Spain; at Kobe, in Japan; and at Vladivostok and Nikolayev, in Russia.

The mobility of the modern floating dock is one of its most valuable characteristics. It can be constructed at the most suitable place where every facility is available, and then towed to the scene of its intended operation. Manila rope of 18 to 20 in. circumference is generally used for towing, and in order to take the chafe of the bollards, a 6-in. Bullivant bridle is fitted on either end of the rope. Strong as this gear may seem, towing in heavy weather is impossible, owing to the enormous area which the sides of the dock present to the wind. The tugs have to stand by, whilst the dock is cast adrift to look after itself until the bad weather abates.



Dock raised for repairs to ship to be carried out. When the work is finished the dock is submerged again for the vessel to be towed out.

A " Liberator " four-engined bomber in flight over the sea.

Dead Reckoning Navigation

Various Methods by which an Aircraft Navigator can Ascertain his Position

DEAD reckoning navigation is the means of finding the position of an aircraft relative to the ground, either by observation of the ground and reference to maps, or by navigational instruments.

It calls for a thorough knowledge of the magnetic compass and various instruments such as air speed indicator, altimeter, course setting bomb sight, and wireless. The information regarding the position of an aircraft relative to the ground is of the utmost importance to a pilot, for, knowing his position correctly, he should have little trouble in finding his way about, should any other navigational difficulty arise.

Finding position by the ground and reference to map or chart is the best known of all methods, but to find the position of an aircraft when no ground object is visible owing to bad weather, etc., the navigator or pilot has to use the instruments at his disposal. The following notes describe a few of the methods that navigators use to find out their position.

An aircraft flying along the line A.B. (Fig. 1) would, if the wind was blowing in direction shown, arrive at a point somewhere along the line C.D.

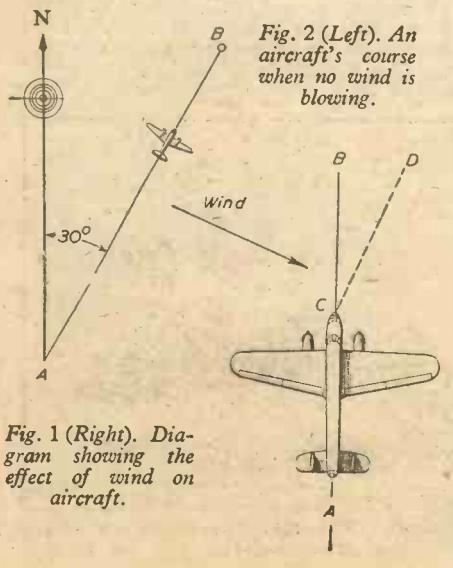


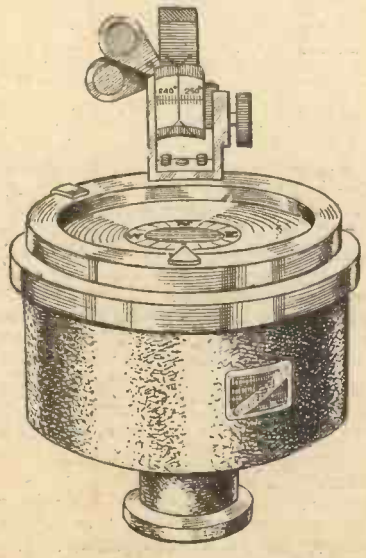
Fig. 1 (Right). Diagram showing the effect of wind on aircraft.

Fig. 2 (Left). An aircraft's course when no wind is blowing.

Triangle of Velocities

Triangle of velocities, or drift and vector triangle, is the basis of all dead reckoning navigation, and each line represents a velocity (e.g., both direction and speed). In the triangle of velocities there are six values, and given any four of these one can work out any triangle of velocities problem.

Your course and air speed can be read off instruments, and the track and ground speed can be read by observation of the ground.



An observer's aperiodic compass.

A plane flying from A to B (Fig. 2), when no wind is blowing, would fly on a course of 30 degrees and then wait until the point (B) came into sight. If the wind was blowing from the west (270°) (Fig. 3), and the plane was heading 30° as before, he would not arrive at B, but at the point (C). In Fig. 3, which is drawn to scale, we imagine the aircraft to have completed one hour's flight.

Track

Track is the actual path passed over the ground by an aircraft.

Drift

Drift is the angle measured between the course and track of an aircraft, and is measured to port (left) or starboard (right), according to the direction the wind is blowing the aircraft. It can also be determined by means of a drift sight, which is to be explained later.

Ground Speed

The speed of an aircraft relative to the ground, can be determined by taking the distance between two objects passed over by the aircraft.

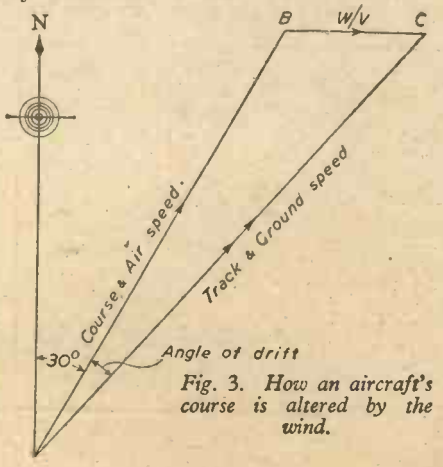


Fig. 3. How an aircraft's course is altered by the wind.

Fixing Positions

The aircraft passes over a castle which is recognised by reference to the map. This is the simplest method of all.

It is not always possible for a navigator to know his exact position, but it is frequently possible for him to find out some information regarding his position.

If a bearing of an object, such as a castle (Fig. 4), be taken from an aircraft, then the aircraft must be somewhere on a line drawn from the castle in the reciprocal direction.

Thus, if the castle is 270° from the aircraft at a certain time, then the aircraft must be somewhere along a line (270°—180°=90°) from the castle.

If the castle is marked on the map, then the navigator or pilot is able to draw a line from the castle at 90°, thus giving him a position somewhere along this line.

Transit

When two objects appear to be in a straight line from the aircraft, they are said to be a transit, and these two objects give a position line (Fig. 5).

A plane flying along as before takes a bearing of a castle, and also direct in line with it is a church steeple; by using these two objects, he is able to obtain a position line with more accuracy and then by reference to a map can draw in his position line.

Cross Bearings

If two bearings can be made simultaneously and they intersect (Fig. 6), a fix can be obtained at the point of intersection. Before taking bearings of any two objects, it is necessary to make certain that the two objects in question appear on the map, and also that a note is made of the course.

A plane flying on a course of (360 T) (Fig. 6) finds the compass bearing of a castle to be 300°, and at the same time the bearing of a lighthouse to be 220°. He can, therefore, lay down his position lines on the map from the castle and the lighthouse as (300°—180°=120°) and (220°—180°=40°), and his position will be the point of intersection of these two lines.

Position by Estimation

At a certain time a pilot notices that he is very near a certain object marked on his map. He does not pass over it, but he estimates that he is due west of it, and about three miles away. This is called position by estimation.

Running Fix

A fix by two bearings of the same object at different times involves a knowledge of the track and ground speed.

While a plane (Fig. 7) is flying on a track of 20° at a ground speed of 120 m.p.h., the navigator takes a compass bearing of a church spire on an island, and finds it to be 300° and draws on his map a line from the

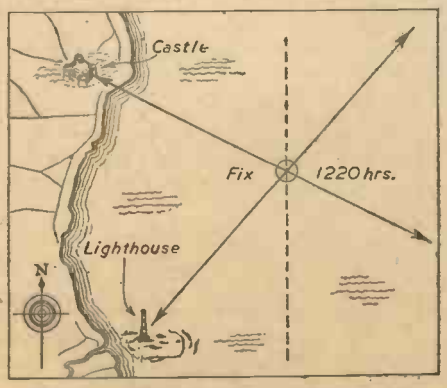


Fig. 6. How the intersection of the bearings gives an aircraft's position.

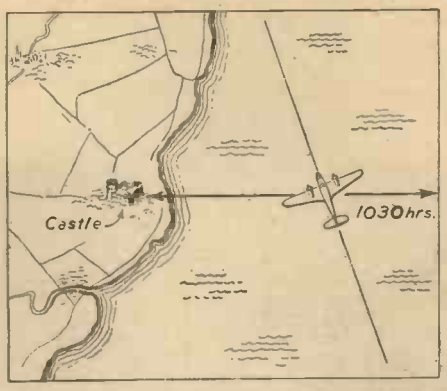


Fig. 4. Taking bearings from a land object.

island (300°—180°=120°). Ten minutes later and still on the same track, he takes another bearing of the church and finds it to be 240°. He then lays off another line from the church on his map of (240°—180°=60°). During this time the plane has actually flown 20 miles, and the navigator then plots this distance on his map. He then draws a line on his map parallel to the first position line and also one parallel to its dead reckoning track, and at the point where these lines intersect is the exact

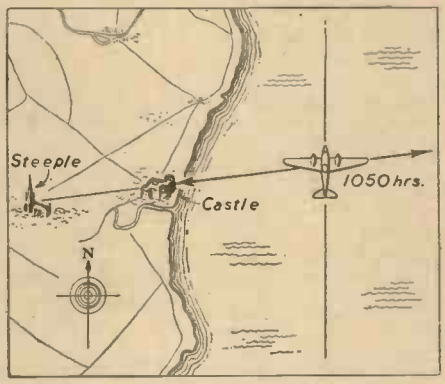


Fig. 5. How two land objects give the position line for an aeroplane.

position of the aircraft. (Note.—A transferred position line always has two arrows at either end.)

There are many other ways of finding the position of an aircraft, or the position of various objects on the ground, especially while flying in bad visibility, but they involve many navigational instruments which are beyond the scope of this article. However, the following notes briefly describe a few of the instruments used.

Air Speed Indicator

The purpose of this instrument is to measure the speed of an aircraft through the air.

Altimeter

By means of this instrument the pilot is able to read the correct height of his aircraft above the point of departure.

Height and Air Speed Computer

Owing to the pressure and temperature of the air, the altimeter and air speed indicator are apt to misread, and by means of this instrument the navigator is able to make the necessary corrections.

Course and Speed Calculator

This is a very useful instrument as by means of it navigators are able to work out all problems concerning drift, wind, track, course and speed, etc.

Navigational Computer

This instrument is used for working out all "Triangle of Velocities" problems, and becomes the navigator's best friend when flying in bad weather.

Drift Sight

This is used to observe the angle between the longitudinal axis of the aircraft, and the direction from which the object appears to move towards the aeroplane.

Tail Drift Sight

Practically the same as the drift sight, except the angle of drift is measured from the tail of the plane, and always measures the angle of drift of objects not passed over by the aeroplane.

Course Setting Bomb Sight

Although in the first place this instrument was made for the purpose of bombing, it is now considered to be one of the most useful navigational instruments. It can be used for setting courses, and also the triangle of velocities, etc. It consists of a compass and bowl, drift bars, height bar, and air speed gauges, etc.

Direction Finding Wireless Telegraphy

Direction finding by means of wireless has become very useful in aerial navigation, and also position lines can be laid down on charts.

Magnetic Compass

All magnetic compasses indicate the direction of the magnetic meridian, and show the course of the aircraft relative to this meridian. There are many types of compasses used in the R.A.F., such as pilot's compass and observer's compass.

Pilot's Compass

Pilots' compasses are used to indicate the course of the aircraft by means of a lubber line which is fixed to the outer ring of compass.

Observer's Compass

Most observers' compasses are intended for taking bearings of objects, etc. The outer ring rotates, and is fitted with a prism and special sights. It can also be fixed by means of a clamp.

When taking compass bearings of objects, etc., the deviation and variation on the true course of the aircraft must always be applied at the instant of observation. Then the position line can be drawn on the map from the object in the reciprocal direction of the true bearing thus obtained.

Young boys and men whose ambition it is to become members of air crews, etc., should and must have a sound knowledge of navigation, and its instruments. It is therefore an advantage to understand a little of this important subject before entering the R.A.F.

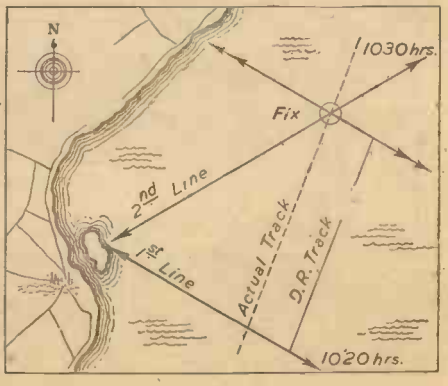
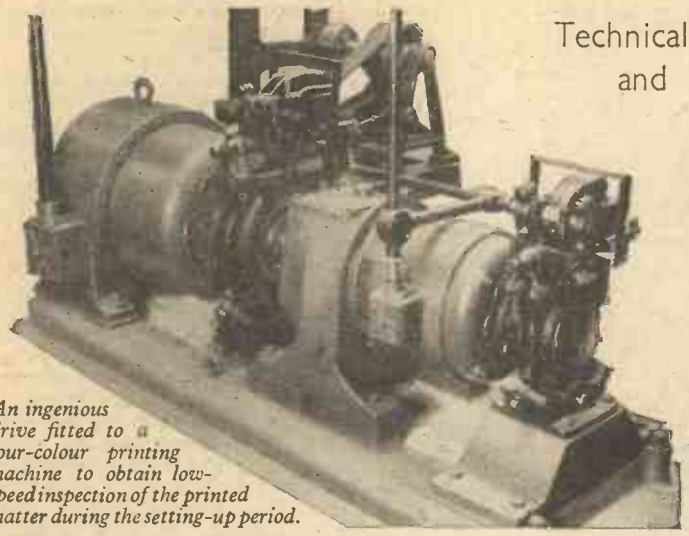


Fig. 7. How the dead-reckoning track is plotted.

Electric Motor Problems

Technical Points Concerning the Installation and Maintenance of Electric Motors



An ingenious drive fitted to a four-colour printing machine to obtain low-speed inspection of the printed matter during the setting-up period.

ALTHOUGH electric motors generally are reliable machines, calling for little maintenance, there are various problems which arise in service, and the following information, extracted from a recent service booklet issued by Brook Motors, Ltd., Empress Works, Huddersfield, will help electrical engineers in solving some of these problems.

Inspection

When receiving the motor from the works, it should be inspected for damage or missing parts, and any losses should at once be reported to the carriers, or the makers, quoting the motor number.

Installation

For ordinary working, slide rails should be used which are held by bolts fixed in cement, or with coach screws. Slide rail adjusting screws must be on the side between the motor pulley and the driven pulley. Allow, when running, for the motor to be moved along the slide rails for belt adjustment.

Lining up a Belt Drive

To line up a belt drive, run a cord along the face of the large driven pulley and pin the other end to the floor, then move the motor itself on its slide rails roughly into position. The pulley on the motor being relatively small, it is difficult to ensure that

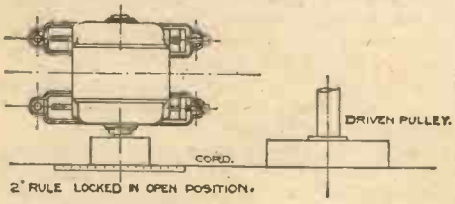


Fig. 1. The method of lining up a belt drive.

the shaft of the motor is parallel with the driven shaft—an important point on modern chain and vee belt drives.

If a steel two-foot rule, however, is locked in its open position and placed across the end of the pulley as shown in Fig. 1, the motor can be squared up by checking the cord position with the ends of the rule.

Direct Coupling

A flexible coupling should always be used, as small inaccuracies in mounting are compensated for in the drive. Ensure that the shaft does not protrude beyond the coupling, otherwise thrust between driving and driven parts can cause a damaged bearing.

Where solid couplings must be used, absolutely accurate aligning is essential, otherwise there is the possibility of a broken shaft. It is advisable to notify the maker of a proposed solid drive so that $\frac{1}{8}$ in. end play can be introduced into the motor. When setting on site, the rotor should be central so that it can be moved $\frac{7}{16}$ in. either way.

Fitting Two-step Pulleys

When two-step pulleys are fitted to the shaft, keep the largest diameter pulley

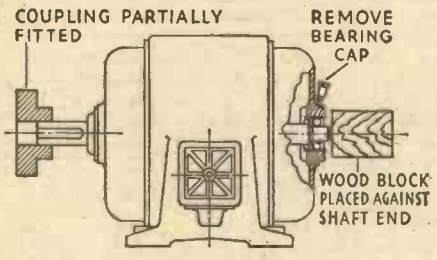


Fig. 2. Fitting vee pulleys and couplings.

closest to the motor bearing. Oversize pulleys in either diameter or length mean extra shaft strain. Larger diameters than given in the following table are not recommended; for greater pulley length a third bearing should be used.

Motor .. .. .. h.p.	1½	3	5	10	20	40	60	80	120	175
Maximum pulley width in.	5	6	7	8	10	12	14	16	18	20
Maximum pulley diam. in.	5	6	8	9	11	13	15	17	20	24

Adapting Motor Speed to Machine

Very frequently the question arises that a machine of about 150 r.p.m. requires to be driven by an electric motor, and the maker is asked to advise a suitable motor application. With modern drives, compactness is essential to conserve floor space, and a vee-belt drive is recommended. However, the maximum speed reduction, except in the case of drives of one horse power and below, should not exceed four-to-one, which means that the highest speed motor which can be used is 600 r.p.m. synchronous. Such a motor has low efficiency; a better alternative is either a geared unit or a four-to-one speed reduction.

With such a unit the most efficient speed of motor, namely, 1,500 r.p.m. synchronous, can be used, giving a countershaft speed of approximately 370 r.p.m. From the countershaft a belt drive of 2.5 to 1 would give the final speed required (see Fig. 3).

Pulley Sizes

Wherever possible, order pulleys to the nearest half inch in diameter, and one inch in width. Sizes between these cost fifty per cent. more to make and cause considerable delay in despatch. It is very rare that an exact machine speed is essential, and the pulley nearest the next standard size above will usually be found satisfactory.

If the motor and machine speed is known, the size of pulley for motor shaft is given by following the simple formula—

$$\text{Motor Pulley Size (ins. dia.)} = \frac{\text{Machine Speed (in r.p.m.)} \times \text{Machine Pulley Size (ins. dia.)}}{\text{Motor Speed (in r.p.m.)}}$$

Fitting Vee Pulleys and Couplings

In this case the coupling should be made 0.0005 in. under size, to allow a tight fit of one-thousandth of an inch. Always clean both the shaft and coupling bore and smear lightly with oil. The rear end cap should be removed, and after taking precaution that no dirt can enter the bearing, hold a heavy block of wood against the shaft extension, should force have to be applied. This will protect the bearings and shaft from damage. Where the rear end cannot be supported in this way, arrange for the coupling to be heated in oil or air to a temperature of 100 deg. F. when it will press easily into position (see Fig. 2).

Avoiding Bearing Trouble

When fast and loose pulley drive is employed, always arrange to have the drive to the fast pulley when the belt is nearest to the shaft bearing. If the drive is taken when the belt is on the far edge of the pulley, the leverage is sufficient to damage the bearing in time.

Guarding the Factories Act

The end shields of all motors, accessible fans, and all rotating parts must now be fully protected. This can be done with metal screening of not more than $\frac{1}{4}$ in. mesh. Care must be taken so that the natural cooling circuit of the motor is not interfered with. All modern motors of reputable make are now, of course,

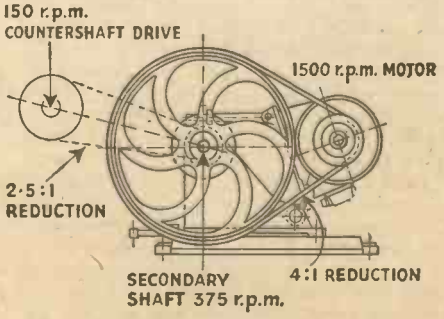


Fig 3. Adapting motor speed to a machine.

adequately guarded to comply with this Act.

Starting Torque

When a motor is quoted as having 33 per cent. torque, this means that the motor can develop one-third of its full load running torque, at starting.

The full-load torque is obtained by calculation from the equation—

$$\text{Full load torque} = \frac{\text{H.P. of Motor} \times 5250}{\text{Syn. Speed}}$$

Speed of an A.C. Motor

The synchronous or no load speed of an alternating current motor of any type in

$$\text{r.p.m.} = \frac{\text{Frequency} \times 60 \times 2}{\text{Number of Poles}}$$

Frequency is now standardised at 50 cycles per second.

Reversing Three-phase Motors

It is common knowledge that to reverse a three-phase machine it is only necessary to reverse two of the incoming lines. The use of a triple-pole change-over switch enables this to be done frequently, and without damage to the motor, by simply throwing the handle over from one position to the other. (Fig 5).

Reversing Single-phase Motors

In the case of single-phase motors, it is necessary to reverse the starting winding relative to the running winding, consequently any links between the starting and the running winding terminals should be removed. A triple-pole change-over switch is again used, one pole ensuring a break in the electric supply. A wiring diagram for this is shown in Fig. 6.

Avoiding Maintenance

Whilst electric motors are extremely robust machines, the following recommendations will prove excellent insurance against future trouble. Avoid where possible—

(1) Damp and falling moisture.

(2) Dirt, especially fluff, which can cause the motor to overheat by interference with the cooling circuit.

(3) Inaccessible positions in case anything does go wrong.

(4) Excessive heat. This may cause the grease in the bearings to flow, leaving the bearings dry. Secondly, as the normal temperature rise is 70 deg. F., the final temperature of a motor in normal air is 135 deg. F., and air temperatures much higher than normal will tend to deteriorate the windings.

A good engineer can find means of avoiding the above without difficulty and will be repaid in reduced maintenance.

Direction of Rotation

It is sometimes necessary where duplicate plant is installed to ensure that the second motor will rotate in the same direction as the first machine. The normal method would be to run the machine light, but in the case of direct coupled plant, for instance, this is impracticable.

The mains are disconnected from the supply of the existing motor, and a battery and voltmeter connected as shown in Fig. 4. The shaft is turned by hand in normal running direction, and the rise and fall of the voltmeter carefully noted for a definite mains

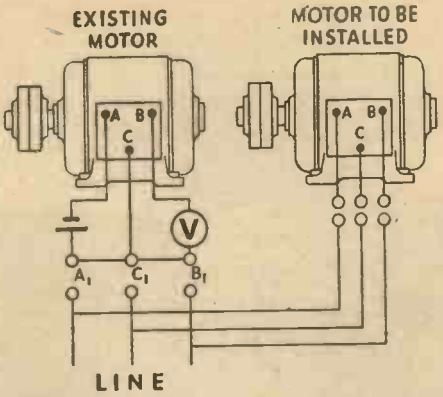


Fig 4. Where duplicate plant is installed it is sometimes necessary to ensure that the second motor will rotate in the same direction as the first machine.

connection A, B, C. The battery set is then connected across the motor to be installed, and the shaft of this motor turned by hand. If connections are identical, the voltmeter will move in a similar manner to before. If not, leads A and C of this motor should be exchanged. If the mains connections to each motor are identical, then the new

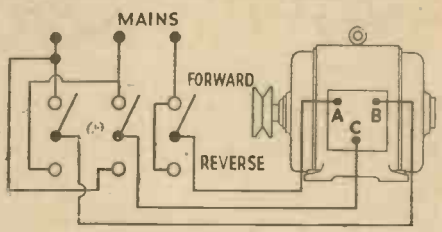


Fig 5. Reversing Three-phase motors.

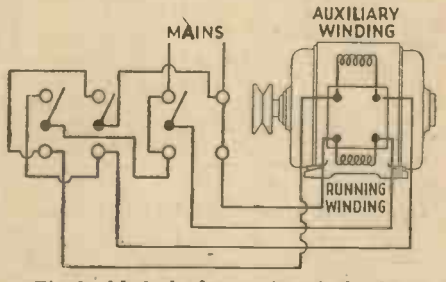


Fig 6. Method of reversing single-phase motors.

installed motor will move in the same direction as the existing one.

Fuses

The most frequent cause of single-phasing and burn-outs on three-phase motors lies with the use of fuses. An earth fault on a cable may cause one fuse to melt

Fig 7. Increasing the life of slip-ring gear.

and the motor to run with overloaded windings. It should be appreciated that fuses are the safety valve of the electrical system and are designed to protect the wiring, not the motor. As a protection for a motor, a fuse is practically useless.

For motors up to ten horse-power, the fuse should blow at not less than three times the full load current of the motor. Above ten horse-power, a fuse twice the full load current should be satisfactory.

Fuses deteriorate with time; they should be inspected every twelve months, and replaced if necessary.

Slip-ring Gear

The breakdown of a slip ring motor can often be attributed to faulty slip rings. Keep these clear of dust and grit by occasionally wiping with a cloth when the rotor is stationary. If conditions are very dusty the maker should be consulted as to the possibility of a totally enclosed cover.

When brushes are worn down to $\frac{3}{4}$ in., replace them. During refitting, place a sheet of emery paper face upwards between the rings, then, by rocking the rotor, the brushes will bed down to the contour of the slip rings. Wipe away all carbon before starting the motor (see Fig. 7).

Lubrication

It is advisable not to overgrease. Except in really warm situations, the lubricator cap should be refilled with grease and screwed down once in every six months. Do not lose the lubricator cap—the admission of even a little grit can ruin a ball or roller bearing. For the same reason do not remove the bearing covers unless really necessary.

Capacitor Start or Capacitor Start and Run

It is now well known that there are two such types of single phase capacitor motor, but the advantages of one over the other are not always too clear.

The capacitor start and run type has the advantage of higher efficiency, overload capacity, and power factor, which means that its running cost will always be less than any other type of single-phase machine, due to the assistance of the auxiliary winding used in conjunction with the condenser.

The capacitor start motor, on the other hand, uses its condenser for starting only and operates as a normal split-phase motor.

Checking Condenser Capacity

Capacitor motors are now becoming the accepted form for power driving on single phase supply, as they are the only type to combine good electrical performance with high over-load capacity.

Such condensers are in use in the electrical circuit during both the starting and running positions. The success of such a motor depends entirely on the reliability of the condenser, and if such a motor should give trouble, e.g., fail to start when connected to the mains, or stalls easily on load, it is not always appreciated that the failure is likely to be in the condenser and not in the motor. The capacity of the condenser is stamped on its side, and should some of the condenser sections have failed they may account for the erratic performance of the motor. To check the condenser capacity, the condenser should be connected across the 50 cycles supply in series with ammeter and several lamps, the latter forming the resistance. A voltmeter should be connected across the terminals of the condenser.

$$\text{Capacity (m.f.d.)} = \frac{\text{Amperes} \times 100}{\text{Voltage}} \times 32$$

The "Crusader," an 18-ton cruiser tank which is one of the fastest tanks in the world. It has the speed and easy handling of a light car

THE MONTH IN THE WORLD OF

Science and Invention

A Man-made Waterfall

SHASTA Dam, the highest overflow dam in the world, with a 480 ft. high cataract pouring from the upper lip, is shortly to bring about vast improvements in the heart of California. It is part of the Central Valley irrigation scheme. Shasta Dam's cataract will be three times greater than that at Niagara and the dam will hold the waters of three rivers, creating a 30,000-acre reservoir.

Silk (Wool) Stockings

THE use of wool for making "silk" stockings is an imminent possibility, according to a member of the New Zealand Wool Council. By using the pulp of tropical fruit, the paw-paw, in a special treatment, he said, wool could be made into silk.

Vitamin C

THE Institute of Biochemistry of Moscow has discovered that unripe walnuts contain a large quantity of vitamin "C." It can be extracted "in the chemically pure and crystal form necessary for medical purposes," the Institute states.

Gasmask Spectacles

HOME Guards who require them, will shortly be issued with special spectacles for use with their Service gasmask.

Bomb-proof Umbrella

AN engineer has designed a steel bomb-destroying umbrella for the protection of the Panama Canal. On the top of a one hundred and fifty foot steel tower there is a rotating hub, and steel cables unroll themselves from drums. The hub would be set in motion at the approach of enemy aircraft, and the cables would unreel, whirling about the tower at tremendous speed over an area five hundred feet in diameter. This would deflect or explode bombs dropping in the area, leaving the sheltered area unharmed.

Plastic Glass

PLASTIC materials are being used in increasing quantities in the manufacture of numerous articles. An American aeroplane has been moulded in two parts from hardwood veneer impregnated with a modern plastic. Chemists have succeeded in synthesising resins from simple chemicals such as coal and oil. The first to appear on the market was acrylic resin, in 1935, when it caused quite a stir on account of its wonderful optical properties. This plastic can transmit light through its curved forms, and is even clearer than glass. It may have a big future as a substitute for glass. Tables and chairs of great rigidity have been made from it and used in artistic interior decoration.

Stratosphere Flying

THE recent stratosphere bombing by Flying Fortresses lends interest to the altitudes to which man has already ascended into the atmosphere by balloon and aeroplane. A Russian sounding balloon reached a height of 25 miles, and in 1935 the United States explorers, Anderson and Steven, reached 72,395 feet in a balloon. In 1932 Piccard and Cosyns reached 54,789 feet in a balloon, and in 1934 Soviet balloonists reached 72,178 feet. Flight-Lieutenant Adam, of the R.A.F., broke the altitude record for a heavier than air machine in 1937 by climbing to 53,937 feet. Shells from "Big Bertha" reached a height of 34 miles.

Deep Sea Photography

A NEW kind of deep sea photographic apparatus consists of a flash-bulb camera which can be lowered to a positon near the ocean bed, where it can get a snapshot of an area about two and a half by three and a half feet in size. It has worked successfully in waters from about one hundred and twenty-five feet to more than a mile deep. A dense ocean bed population of animals is shown in photographs taken in the waters of a famous fishing ground north-east of New England. No sign of plant life was found on the photographs.

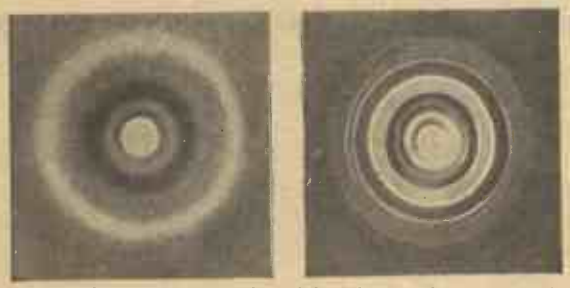
Million Volt X-Ray

THE new million volt X-ray outfit in the General Electric Company's research laboratory will take a picture through four inches of steel in less than two minutes, a job formerly requiring an hour's exposure. Three similar X-ray units are in use in hospitals but this is the largest to be used in industry. A special building, which has unique construction features, houses the unit. The walls are of solid concrete, fourteen inches thick, plus twelve inches of brick on the interior. The total thickness is the equivalent of approximately four inches of lead. The door is of solid concrete eighteen inches thick, encased in one inch steel plating, and is opened and closed by means of a motor hoist. The tube and all the necessary operating devices are contained in a large cylindrical tank. It is operated through remote control, and when the tube is in operation all persons connected with the work leave the room. At the controlling switchboard there is a periscope which enables the operator to make visual inspection of the job as it progresses.

Non-Contractable Glass

GLASS that may be heated to a cherry red and immersed in iced water without breaking it, has been manufactured by the Corning Glass Works, Corning, New York. Its resistance to both expansion and con-

traction was demonstrated by pouring molten iron into a glass dish which was standing on ice. The dish did not crack under this exacting test. The new glass is made by mixing two borosilicate formulae, one of which is soluble in acid and the other not. When this mixture is melted, the glass is moulded or blown to the desired shape, after which it is soaked in dilute nitric acid. This eats away the soluble ingredients, leaving the glass honeycombed with air spaces. The glass becomes solid after a further application of heat, and shrinks 35 per cent. in volume. It may be two years before it is manufactured on a commercial basis.



The illustration on the right shows the pattern of aluminium hydrate on silica; that at the left of silica alone

Motor-Driven Switchboard Clock

A DIRECT reading motor-driven clock has been developed by the Bell Laboratories of America, in conjunction with the manufacturer, for mounting on switchboards to time toll calls. It replaces the spring-driven clocks now used in small offices and generally those operated magnetically from a master clock in large offices. Time is shown by four rotating drums which carry the hour, minute and second numerals. The hour and minute drums advance periodically and the seconds drum rotates continuously. The figures, which indicate the time, are seen through an aperture in the top of the moulded case. A 20-volt synchronous motor drives the clock through a transformer on 60-cycle controlled frequency. The new clock operates more quietly than the clocks now used, and it shows the time to the nearest second instead of changing at six-second intervals, like those magnetically driven.

Puncture-Proof Inner Tubes

A NEW type of puncture-proof inner tube, known as the Goodrich "Seal-o-matic," has recently been placed on the market by the B. F. Goodrich Company. The tube is suitable for cars and commercial vehicles. A "self-healing" lining inside the tube instantly seals any punctures and also makes the tube 60 per cent. stronger than the ordinary one.

A New Alloy

IN seeking for a substitute for aluminium for milk bottle caps, the Tin Research Institute announce the discovery of a new alloy of tin, zinc and nickel which has a remarkable combination of strength and ductility. The improved tin foil rolled from this alloy has 2½ times the strength of ordinary tin foil. It has been found satisfactory for milk bottle caps and it is likely that other useful applications will develop.

A Tin-rich Bearing Alloy

THE discovery of a new tin-rich bearing alloy, suitable for use in the tail shaft bearings of large ocean-going vessels, is also announced. Experimental data are quoted in support of the claim that the alloy is equi-potential with steel in sea-water, has high corrosion resistance, improved anti-friction qualities, and does not seize in sea water even in the absence of lubricant.

Electron Diffraction Patterns

SILICOSIS, the lung disease to which stone cutters and others who work in dusty trades are subject, develops rather quickly in rabbits exposed to the air containing moderate concentrations of fine quartz particles. It is completely prevented if there is as little as one-hundredth as much aluminium dust as silica in the air breathed. This preventative action was discovered at the McIntyre-Porcupine Mines, and has been ascribed to an extremely thin coating of an aluminium compound deposited on the poisonous silica particles. The action of the aluminium is sufficiently striking and important to justify a fuller understanding of the nature of the film which it forms upon quartz particles and Dr. Frary, Director of the Aluminium Research Laboratories, suggested that the answer might be forthcoming through a study of electron diffraction patterns.

In experiments carried on by L. H. Germer and K. H. Storks, a beam of high-speed electrons was shot through thin films of silica which had previously been exposed to aluminium and water at body temperature. The diffraction patterns obtained showed a layer of aluminium hydrate less than one-millionth of an inch thick on the silica. Although extremely thin, this layer is sufficient to keep the poisonous silica from injuring the lungs. The illustrations above show the pattern of aluminium hydrate on silica; that at the left of silica alone.

Fire Fighting with Chemicals

A DRY chemical dust, ejected by means of compressed carbon dioxide, is reported as a method of fire fighting in the States.

A suitable powder is sodium carbonate, while any inert gas, such as CO_2 or nitrogen may be used as the propellant. The gas is contained in a small cylinder, and on being allowed to escape behind the charge of powder, can, if sufficient pressure be used, throw out the powder as far as fifty feet. It is stated that a hand extinguisher of 26-55 lb. gross weight can hold 8-25 lb. of carbonate dust, while larger, wheel-propelled units holding 1-3 cwt. dust, throwing it 50 ft. by means of compressed nitrogen, are in use.

Synthetic Resin Paint

A SYNTHETIC resin, of the polyvinyl group, is the basis of a new paint, which, it is claimed, resists corrosion, introduced by the B. F. Goodrich Co. Called "Koroplate," it is liquid at ordinary temperature, and can, therefore, be painted or sprayed on to metals, to protect the latter from corrosion. It can be thinned out like the usual paint, but a special solvent thinner is required, and the finish produced is a semi-glossy black. While it is resistant to normal acid vapours and liquids, it is attacked by formic acid and acetic. A valuable feature of this new preparation is the fact that it is unaffected by plating solutions for copper, tin, nickel and zinc, which suggests its employment as a stopping off agent in electroplating.

Photo-sensitized Metals

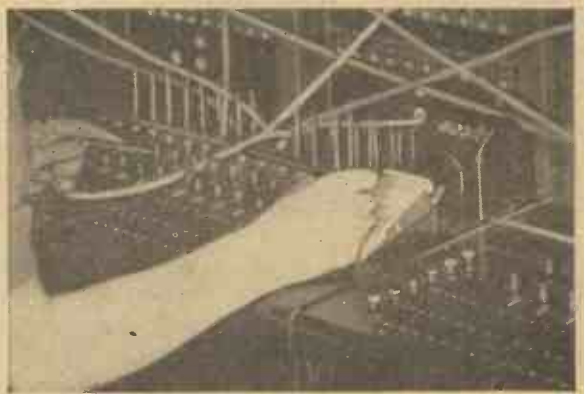
THE Lockheed Aircraft Corporation have stated that a process for printing blueprints direct on to metals, developed by Eastman Kodak, saves them 20,000 dollars on each aero model produced. By this invention, which is referred to as the Matte Transfer Film, engineering drawings can be printed by projection or by contact on to the metal, so enabling the latter to be cut straight away in the template department. Drilling, punching and filing can also be carried out, straight from the drawing, a valuable time saving where new models are being developed. The film is glued to the metal by a lacquer, and the sensitised surface is then ready to take any photo-image, while being matte, it can be altered by pencil.

Self-Aligning Pivot Bearing

A BALL bearing on the lines of a jewel pivot bearing is among the interesting items thrown up by the tide of progress in the U.S.A. Made from high carbon-chrome steel, the bearing is not only self-aligning, but takes radial and thrust loads. The pivot, which can be obtained separately, should be preferably of hardened steel, with a 60 deg. cone end.

A Rival to the Caliper

THE G.E.C. have produced an ingenious device for measuring thicknesses down to one-thousandth of an inch. A flat gauge head is placed on the plate to be examined, and the depth of the latter is shown immediately on a dial. The gauge head is a permanently magnetised unit, and the depth of a plate brought into contact with it will, therefore, determine the magnetic flux or density of the field in the vicinity of the head. The flux is shown on the dial of the recording instrument, in terms of plate thickness, the instrument being portable, and a little larger than an average sized box camera. It is stated that thicknesses from 0.01 in. to over ½ in. can be measured, and it will be seen that an advantage of such an instrument is that the average depth of large plates can be quickly assessed, by running the gauge over the surface.



A direct reading motor-driven clock

PHOTOGRAPHY

Printing by Artificial Light

By JOHN J. CURTIS, A.R.P.S

Printing, Developing and Fixing Gaslight Prints

IT is very encouraging to know that many readers of *Practical Mechanics* have already experienced some of the thrills which were promised, in the previous articles on Successful Photography, to all camera owners if they would start doing their own developing. In the present article we enter the second field of this engrossing hobby, the printing stage.

It is a thrilling experience to see a picture gradually forming on what was a plain piece of white paper until an ounce or two of a chemical solution was poured on to it; certainly, it had been exposed to artificial light for a few seconds, but there was naught to be seen as a result of that exposure; nevertheless, the light had some effect on the thousands of tiny grains of silver contained in the emulsion which coated the paper, and it was the further reaction of the chemicals in the solution on those silver grains which caused the picture to be revealed.

In the last article you were given some information on printing-out-papers, and we will now proceed to discuss "developing" papers, of which there are three main classes; gaslight, bromide and chloro-bromide, each of which again can be classified as slow, fast and medium, in so far as their reaction to artificial light is concerned. Usually it is the gaslight variety with which amateurs make their first attempts, therefore I will deal with this group first.

Apparatus Required

Let me give you some idea of the apparatus that will be required in order to make a start; the following list will only interest those who have not yet started doing their own work, as those of you who are now doing developing will have got most of the articles already.

Assuming that your camera is one which takes films of the popular size of 3¼ in. by 2½ in., you will require the following :

Printing frame complete with a piece of glass. Costing approx. 1/9.

Two porcelain dishes, 4¼in. by 3¼in. (½-pl. size) deep. Costing approx. 2/3 each.

Glass measure, 4-ounce size. Costing approx. 1/6.

Orange bulb, or cover for the electric light. Costing approx. 3/-.

If you have not electric light, then you will require a piece of orange glass (costing a few pence) for your dark-room lamp. The chemicals required are a packet of Johnsons Metol-Quinol, costing 3½d., and an 8-ounce tin of their acid-fixing powder, costing 1/-; this is the same powder as is used for fixing films. Finally, a packet of gaslight paper, and I would recommend Barnet semi-matt or glossy, whichever surface you prefer. The present-day price for all makes is 1/5 per packet of 26 pieces, 3½ in. by 2½ in.

I have already tried to impress readers that the surest way to success in photography is to standardise their method of working as much as possible, and the first step to good printing, and the most economical, is to spend a few minutes in sorting the collection of negatives that are to be printed, into at least three groups according to their density; thin, medium (or normal), and dense or, as some prefer to term them, thick; by doing this it becomes easier for you to judge the approximate exposure each negative will require.

Standardisation

Now for another item of standardisation;

A simple wooden box placed on the table forms an excellent chamber in which the developing and fixing of gaslight paper can be carried out.

always work with your white light for exposing at twelve inches from the printing frame, and take note of the following factors which will help you to, more or less, standardise the time required for your normal or second group of negatives:— 40-watt electric bulb, six seconds; incandescent gas light, six seconds; paraffin lamp (double-burner), thirty seconds. These are fairly accurate for most grades and surfaces of gaslight papers.

Kitchen as Workshop

It is not necessary for you to have a darkroom for this work, as it can be done in the comfortable surroundings of a sitting room or kitchen, so long as daylight or any other white light is completely excluded, and measures taken to prevent spilling chemical solutions on the carpet. There is no need to upset the general arrangements of the home; usually the other members of the family are ready to be entertained, and to give a help.

An arrangement which I have frequently found very convenient is to place a chair on the table, fold a cloth over the seat so that it falls down on three sides of the chair to the table, leaving the back of the chair free, and then build up by means of books on the seat until the distance between the light hanging from the ceiling is just 12 inches; the space under the chair becomes my dark-room for loading the printing frame and developing the print, and there is also room enough to take my orange lamp besides the two dishes.

Improvised Table Darkroom

Another portable or rough-and-ready table darkroom can be made with a wooden box about 19 inches long by 15 inches wide and 15 inches deep; if this is stood on its end at one end of the table as far away from the white light as is possible, you will find that you can, quite conveniently and without risking your paper, do the developing inside the box and also fill the frame ready for making each exposure at the spot where you have measured 12 inches from your illuminant.

Although you have sorted your negatives into three groups, and I have given you the approximate exposure for the normal group, I want to follow up my usual procedure and to give you advice that will enable you to secure a greater average of successful results, avoiding not only waste of paper but also time. I therefore suggest that you try out the following method of trial exposure.

Trial Exposure Strips

Switch on your orange light and place a piece of gaslight paper in the frame, emulsion side next to the emulsion side of the film, close the frame and find a piece of card the same size as the frame. Take the frame to the position where the exposure is to be made and cover five-sixths of it with the card and expose the uncovered portion to the white light for two seconds and switch off the light. Now uncover a further sixth of the negative and expose for a further two seconds and again switch off the light, uncover the next sixth and expose for two seconds and switch off, repeat this until the last sixth of the negative is exposed. You will now have a piece of paper which has received six exposures ranging from two seconds up to twelve in a series of two-second stages, and when you realise that the approximate correct exposure is six seconds, you will also realise that you have one section of the print that is hopelessly under and another that is hopelessly over exposed, but somewhere between these two limits will be found the correct time to give to that particular negative, and that you can make as many exposures from it as you wish, and every one will be a perfect result so far as exposure is concerned.

Developing and Fixing

There is, however, still the question of development to be considered; I must assume that you are going to use a 3½d. packet of Johnsons Metol-Quinol developer, and that you have dissolved the contents in 4 ounces of water, and in another measure or dish the fixing bath is ready; this is made by dissolving one ounce of the fixing powder in 15 ounces of water.

Turn out all white light and switch on the orange bulb, remove the paper from the frame and place it face upwards in the developing dish and pour the developer

carefully, but not too slowly, over the whole of the print, taking the precaution to avoid or to remove any bubbles that may be formed. Probably you will see a part of the image appearing almost as soon as the solution reaches the surface; carry on for 1½ minutes, and at the end of the time take the paper out of the dish, give it a quick rinse in clean water—if you have some handy—but this is not altogether necessary, then plunge it into the fixing bath, making certain that it is completely submerged, and move it about for a few seconds underneath the surface of the solution.

Inspecting the Test Strip

At the end of ten minutes it will be fixed, and on turning up the white light you will find that the picture is there, but it is in bands of different density; these bands are the six exposures from which you will be able to gauge the accurate exposure to give to all the prints you intend making from this particular negative when using that same make of paper. To make this perfectly clear, let us examine very closely each section; the first is very obviously under-exposed, and the second also; the third is fairly good but you could do with a little more detail in the highlights if it is possible to get them without clogging the shadows. The fourth band looks rather good, and there is plenty of detail in the shadows as well as the highlights, and it is better than the fifth and sixth, which are rather on the dark side.

Having come to this conclusion, it is the right thing to make a print giving 8 seconds exposure to the light, the time the fourth band had, and then you will recognise that the result is far better than you anticipated, and certainly better than you could have made if you had guessed at the exposure.

Important Points

Here are one or two points which it is as well to keep in mind when using gaslight paper; if you find a paper that suits your taste do not be anxious to make a change, it is better to stick to it until you have thoroughly mastered all its characteristics; remember always that some makes are faster than others, and therefore require less exposure than we have just been considering. Generally speaking, the image will appear in 15 seconds in the developer and go on building for 1½ minutes; if it has not appeared in 15 seconds you have under-exposed; if the image blackens all over before the 1½ minutes is up, then you have over-exposed. Do not keep the print after developing out of the fixing bath, or it will certainly develop stains.

A Self-Releasing Parachute

Adaptable to Any Model Aircraft

THE most thrilling battles in this War owe much of their daring and success to the men of the parachute divisions. The mass descent of hundreds of paratroops slung beneath the swaying, vari-coloured umbrellas stirs the imagination, and has re-inspired many aero-modellists to devise ideas to imitate this spectacle in model aircraft.

Self-releasing model parachutes have been made in various ways for many years, but, in the writer's experience, most of them involve complications that necessitate permanent alterations to the machine, and rob the aircraft of its best flying performance. The design described here does none of these things. The entire releasing gear is detachable, and is external to the fuselage.

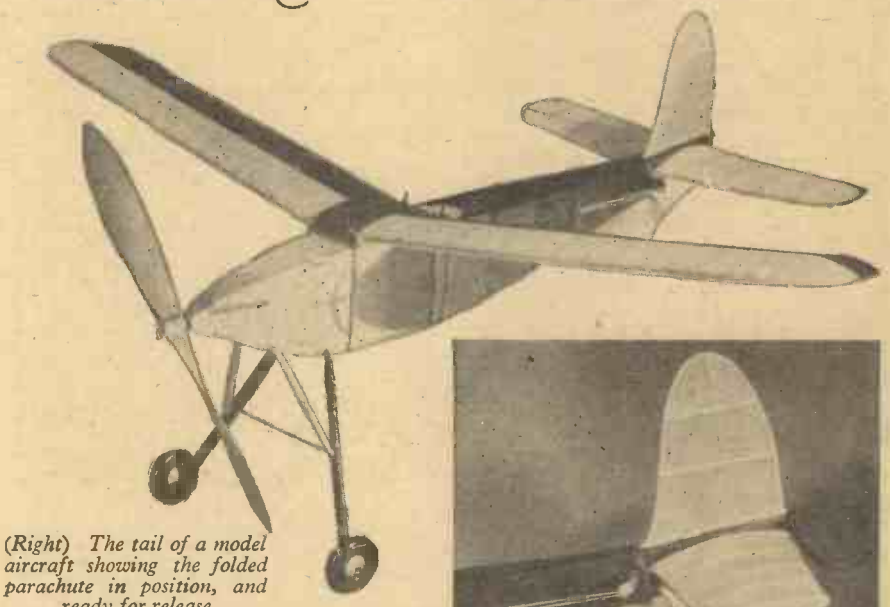
The important point to consider when designing a parachute release gear is, of course, a means of ensuring a positive release at the maximum ceiling of the aircraft. This is achieved by making the operation of the catapult dependent upon the tension of the motor. For this purpose, the rear anchorage of the rubber motor is provided by the usual type of wooden pin inserted in holes drilled in each side of the fuselage, as shown in Fig. 2. It will be obvious that so long as the motor is driving the airscrews, the aircraft is climbing or in horizontal flight at the top of its climb; whereas, the moment the motor runs out, the nose of the machine will drop and the glide to earth commence. This, then, is the moment when the model pilot is required to "bale out."

General Arrangement

Referring again to Fig. 2, the general arrangement of the device is clearly shown. The near side hole, in which the motor anchorage pin is located, is enlarged to form a slot to allow for a metal pin, of the same diameter, to be placed in front of the anchor pin. Similarly, the slot is extended may then move through an angle of 30 deg., to about ⅛ in. behind it. The anchor pin pivoted about the hole on the off-side of the fuselage.

Since the rubber motor is anchored to this pin, pressure is exerted on the metal pin at its side, whilst the motor is wound and overcomes the power of the rubber catapult to withdraw it. The moment of release will arrive when the slackening tension of the motor becomes less than the pull of the rubber band employed as the catapult. This latter is stretched over an extension piece to a peg located in the fuselage 4 in. forward from the anchor pin, and positioned to place the catapult parallel to the line of thrust.

The required tension of the catapult will depend to some extent upon the length of the motor, though experiment has shown that with most types of motors, a 2 in. rubber band, obtainable at a popular sixpenny stores, stretched to a peg 4 in. from the anchorage, will release just before the aircraft goes into the glide.



(Right) The tail of a model aircraft showing the folded parachute in position, and ready for release

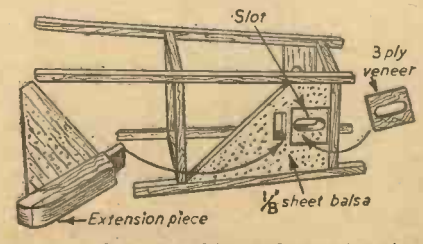


Fig. 1. Balsa wood filling and extension piece.

Construction

The making of the catapult gear is very simple. The first job will be to cut the slot at the near side anchorage hole. Unless the fuselage is solid sided at this place, it will be necessary to insert a piece of ⅛ in. sheet balsa here to provide sufficient area to cut the slot, and provide the rectangular hole to receive the extension piece. Fig. 1 shows a method of arranging this and, if the parachute gear is to be used frequently, a veneer of thin 3-ply will provide a hard-wearing surface for the movement of the anchor pin.

The extension piece consists of ⅜ in. by ⅛ in. balsa, having a tongue which fits tightly into the rectangular hole in the fuselage, and braced by a triangular piece of ⅛ in. sheet balsa, cemented to the extension, and lying along the side of the fuselage.

The protruding end of the extension piece is rounded to allow the catapult to move more easily over its surface.

It is important that the extension piece should be at right angles to the line of

thrust, and fitted so that the metal pin lies parallel against its surface, when held there by the anchor pin.

This arrangement permits the metal pin to be withdrawn gradually as the motor tension slackens, and its action is interesting to observe. The length of the extension piece should be about 1¼ in., thereby throwing the parachute clear of the aircraft. The metal pin should be about ¾ in. long.

It is convenient to cut two grooves in the end of the metal pin, one to fix the rubber band by passing one end through the other over the pin and tighten by stretching; and the other to receive the ends of the parachute strings.

The remaining fitting is the chute to contain the folded parachute. This consists of a piece of stiff paper cut to the shape of a cone, as shown in Fig. 2, and attached to the lower sides of the fuselage. Gum makes an excellent attachment but, if it is desired to make this detachable also, two 1/16 in. by ⅛ in. strips of balsa may be cemented to the fuselage, overlapped by two similar strips, forming a slide into which the paper can be fitted.

The size of the chute will depend upon the dimensions of the parachute, and interesting experiments can be made in trying out different diameters.

The style of chute illustrated measures 4 in. long and allows a parachute of 5 in. radius to protrude about 1 in., making for easy withdrawal.

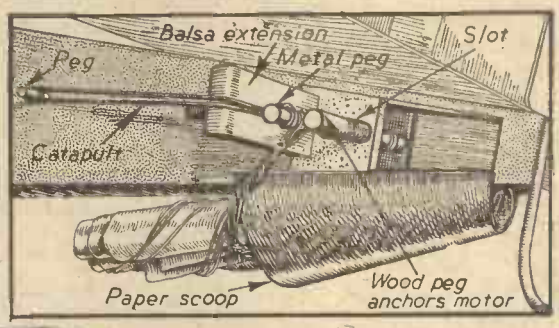
The Parachute

Japanese paper tissue, used for covering aircraft, makes suitable material for the parachute. To make it, first describe a circle on the paper of, say, 5 in. radius, cut out and fold into eight sections. With a razor blade, cut out one of the sections and gum the cut edges together. This will make the paper assume the umbrella shape of a parachute. Next, at each of the seven sections around the circumference, fix 10-in. lengths of cotton to form the strings. Secure these by gumming a disc of paper over the cotton. Knot the ends of the cotton together and tie round the metal pin. The parachute is folded along the sections and the strings wound round it, commencing at the narrow end and winding towards the open end. This ensures that the parachute is thrown out of the chute immediately, and aids its quick opening. It can now be placed in the chute, and the metal pin put into position. Do not stretch the catapult over the peg until the motor is wound up. Better results will be obtained if a hole ¼ in. in diameter is made at the centre in the top of the parachute. This allows the trapped air to escape slowly instead of spilling out of the sides. This latter is inclined to make the parachute sway from side to side.

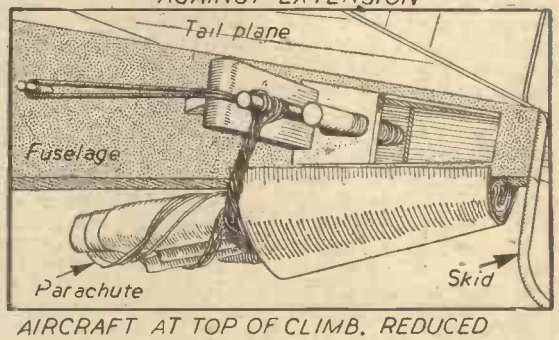
The motor wound up, the catapult may now be stretched over the peg. Everything is now ready for the flight, and parachute descent.

Another Method

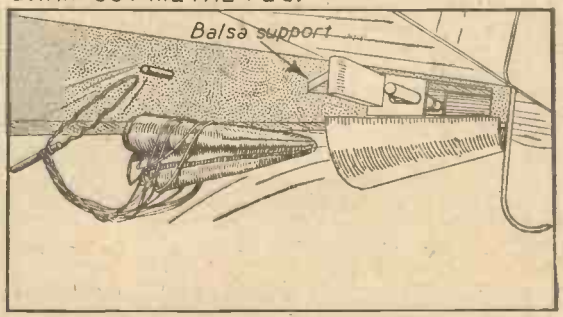
There are numerous self-operating parachute releasing devices in use for model aeroplanes, most of which are generally operated by the unwinding of the rubber motor. One simple device consists of a trapdoor in the fuselage of the plane which is held in place by the nose block which holds the propeller shaft. As soon as the elastic motor unwinds the trapdoor is automatically operated by the nose block falling away, thus releasing the parachute. The weight to be used for the parachute depends on the size and stability of the plane. The added weight of a parachute can affect the aeroplane when in flight. A few experiments with different weights will determine which is most suitable.



AIRCRAFT CLIMBING. MOTOR IN TENSION, HOLDS METAL PEG AGAINST EXTENSION Fig. 2



AIRCRAFT AT TOP OF CLIMB. REDUCED MOTOR TENSION ALLOWS CATAPULT TO DRAW OUT METAL PEG. Fig. 3



METAL PEG RELEASED CATAPULT FLINGS PARACHUTE CLEAR OF AIRCRAFT Fig. 4

(Left) Model aircraft in flight just after releasing its parachute.

The World of Aviation

The Me 113 ; Strength of R.A.F. ; Dive Bomber Improvements, and Test Pilots of the R.A.F.

The Air Sea Rescue Service of the R.A.F. is responsible for saving the lives of many pilots and air crews. Our illustration shows a rescue dinghy dropped by a Lysander spotting aircraft to a pilot in the sea, the aircraft then directing the high speed rescue launch to pick up the pilot.

Fastest Fighter

TESTS of the new Airacobra fighter carried out by an R.A.F. officer in America prove the plane to be the "fastest single-engined craft now in production," says an official of the Bell Aircraft Corporation. Its ceiling was more than 35,000 ft., top speed about 400 m.p.h., and its cannon and six machine guns were satisfactory at above 30,000 ft. in temperatures of 60 degrees below zero.

The Messerschmitt 113

THE announcement from Berlin regarding the new German fighter, the Me.113, which they state is capable of a speed of 475 m.p.h., should be treated with considerable reserve. It will be recalled that in April, 1939, the Germans claimed that Fritz Wendel had flown a Messerschmitt at the amazing speed of 469 m.p.h., thus setting up a world's speed record. Later they said that the machine was the standard Me. 109, a statement that was subsequently disproved. Before this an attempt was made on the landplane speed record with a machine called the Me. 113R, which achieved a speed of 300 m.p.h. It is thought that the new German fighter may be based on this aircraft. It was said to resemble the Me. 109. The machine used by Fritz Wendel had a special Daimler Benz 601a engine, giving about 1,800 h.p. A curious feature was the cruciform tail, in which the fin extended as far below the tail plane as above it.

Nazi Tricks

SINCE the days of the last war, when embryo pilots were warned to "Beware of the Hun in the Sun," the German pilots have had a reputation for trickiness. Some of the dodges they employ are fair enough, others definitely of the "below the belt" variety. One of the tricks that the Luftwaffe has tried to pull over the R.A.F. is to fly patrols of fighters at sea-level, cunningly camouflaged to blend with the sea. The idea is to get beneath British aircraft unobserved, and pull up into an attack from below. Another trick is for a bomber to drop coloured flares when attacked. Sometimes the Hun is signalling to his escort fighters for help, but it may simply be a ruse to "give pause" to the attacker. Nazi crews sometimes bale out when shot down and dive their apparently empty machine towards the sea. But one member has stayed behind for a while in order to fire a Parthian shot at the British pilot approaching to witness the end of the victim. Another trick is occasionally to instal a gun on a bomber in an unusual position on an otherwise familiar aircraft. A fighter pilot approaching a known blind spot may perhaps be met with a disconcerting burst of gunfire.

New Dive Bomber

THE R.A.F. is to be supplied with a new type of dive-bomber known as the Brewster Bermuda now undergoing flight tests. The type will shortly go into production at the works of the Brewster Aeronautical Corporation.

Machines of the R.A.F.

WHEN Britain entered the war the R.A.F. had but two principal types of fighter aircraft—the Hurricane and the Spitfire. Both are single-engine monoplanes of the low-wing type and of similar general design. British bomber types were rather more diverse, but the main long range offensive operations were carried out by three types of twin-engine bombers—Whitleys, Wellingtons and Hampdens.

Many new types of operational aircraft, both fighters and bombers, have come into use since. Some are British, some American. There have been new departures in fighter design, the turretted Defiant, and the two-motor night fighting Beaufighter. New type bombers include four-motor types such as the Stirling and Halifax.

Not many details of the new American types have yet been released, but among those which have already been in action are the Curtis Tomahawk, a sturdy fighter comparable to the Hurricane, the Douglas D.B.7 (known in its bomber version as the Boston, and as the Havoc when used as a night fighter), and the Consolidated Catalina flying-boat. Boeing Flying Fortresses and Consolidated Liberators are heavy bombers which are now arriving and which will add to the offensive power of the R.A.F.

Hitler's Headache

THE 82-ton Douglas B.19 bomber which has been named "Hitler's Headache," has successfully completed its first test flight in America. Six Tomahawk fighters escorted the plane, with instructions to keep all other aircraft at least a mile away from it. Designed as a bomber or troop carrier, the B.19 can carry 28 tons, including 18 tons of bombs, or 125 soldiers, 7,000 miles. It has four 2,000 h.p. engines, a wing-span of 212 ft., a length of 132 ft., and a speed of about 210 m.p.h. Experts consider it the most powerful as well as the largest plane ever built. Its armament is secret, but is rumoured to be much heavier than that of any other bomber in operation or production. Unusual features of the plane are tricycle landing-gear and sound-proofing for the radio operator's and navigator's compartments. It carries a crew of ten and has sleeping accommodation for eight of them. Five hundred engineers worked for more than four years to bring "Hitler's headache" into production.

Test Pilots of the R.A.F.

THE Royal Air Force has some test pilots who are never called upon to make hair-raising power dives in untried types or juggle with slide rules in the air, calculating flight figures. Their work appears to be more humdrum, but it can be quite hazardous. It has developed through the requirements of war conditions. The flying life of one of these test pilots is interesting and varied, for he may be required to fly five or six types in any given day, varying from Tiger Moths to Whitleys. Apart from the essential difference in flying technique and flight characteristics between types, there is an endless array of "knobs and dials" ever present in the pilot's mind.

He must have the capacity for dis-association when he steps from one type to another. He must be capable of jumping from the cockpit of a Roc or Lysander into a Wellington, and isolating his mind from the previous flight so as to persuade himself that this is the machine he has been flying all his life. The tests themselves are simple but effective. The engine is tried at its maximum five minute permissible, and then at maximum "weak" cruising. All instrument readings are taken, including air speed indicator (which last gives a fair insight into the correctness of rigging).

What is an Explosion?

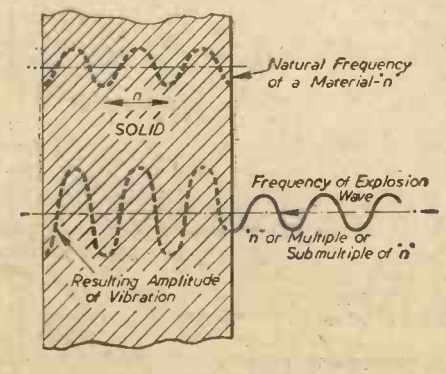
Notes on the Thermodynamics of High Explosives

THERE is an analogy between the explosion in the cylinder of an internal combustion engine, and that arising from the ignition of an explosive, which helps to explain the mechanism involved. Strictly speaking, the so-called "explosion" in an engine is really a rapid combustion of petrol vapour, and may be compared to a propellant, such as black powder, as opposed to true H.E. To understand one, however, is to understand both, for essentially, the two rely on the process of oxidation of a substance. If we unite oxygen with, say, hydrogen, the result is either a gentle flame or a violent explosion, depending on how fast the union is allowed to proceed, but in both cases, the same ultimate chemical product results, water. Both petrol and explosives contain hydrogen, in addition to which there is carbon, while in the latter other elements such as nitrogen, oxygen and sulphur may be present.

A molecule of oxygen and of hydrogen both contain potential, or atomic, energy, and when they unite there is more energy in the partnership than is required. Consequently, some of it is thrown out in the form of free energy, which may be expressed as heat, pressure or light (all being interchangeable forms of energy). The three forms are emitted both with H.E. and petrol, and the proportion of the three determines to a certain extent the violence of the explosion, or combustion, if the reaction is slow. Let us consider the case from its elements, in the first place. The oxidation of hydrogen may be expressed by the following equation :—

$$2H+0=H_2O+68_2130 \text{ calories}$$

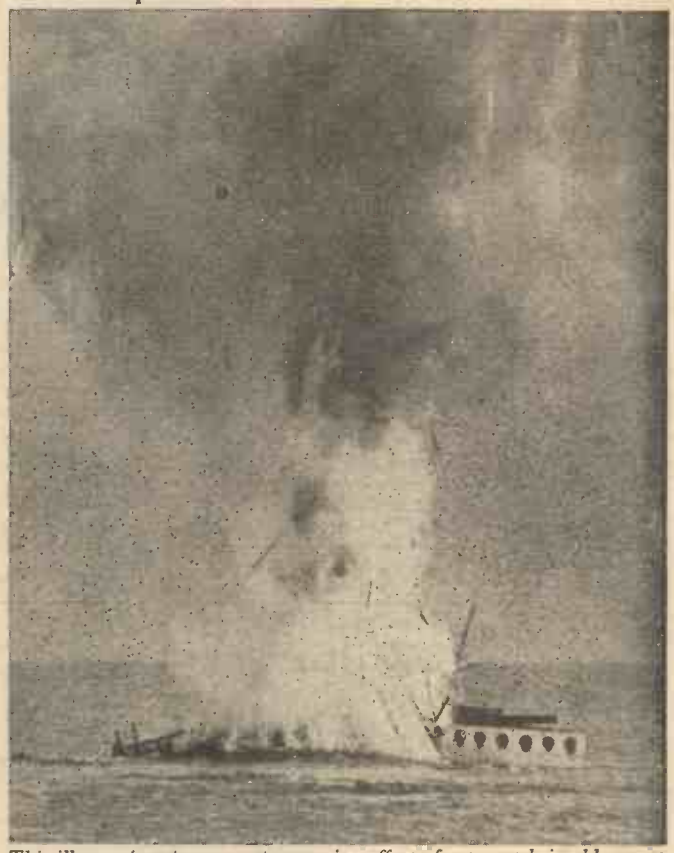
A considerable amount of heat is evolved, which raises the temperature of the whole system. When petrol is thus oxidised, the heat given out is sufficient to raise the gas in the cylinder by over 2,000° C. Now, if we use hydrogen in a solid form, or to be more exact, combined in a solid and unite oxygen with it, not only is there an evolution of heat but a violent expansion, because the molecule resulting from the union occupies a far greater volume as steam. The outcome is sudden pressure, and so we get a pressure wave, or explosion. The rise in temperature also causes an increase in gaseous volume, which adds to the pressure rise. It will be seen that two values are involved: heat and dynamic pressure, and so we find ourselves considering the thermodynamics of explosives, or their fundaments.



Curves indicating amplitude of vibration due to explosion wave

Gunpowder

We are now ready to discuss the practical case of gunpowder, or potassium nitrate, mixed with carbon and sulphur. Bearing in mind Nobel's qualification that the ignition of gunpowder cannot be adequately represented by a simple equation, we are in order in setting it out as follows, for the purpose of calculation:



This illustration shows the devastating effect of a target being ll w.i-up by a charge of T.N.T. during mine-laying tests.

$$2\,KNO_3+S+3C=K_2S+N_2+3CO_2$$
$$(2\times101+32+3\times12)\text{ grms.}=(4\times22.3)\text{ litres gas}$$

270 grms. powder = 89.2 litres gas

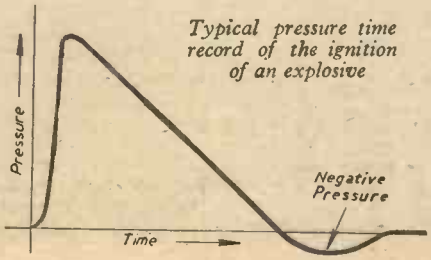
The volume occupied by 270 grammes of powder is approximately 100 c.c., while the heat liberated by the oxidation raises the temperature of the gas to about 2,000° C. This heat expands the gas to about eight times its volume, according to Charles' Law, and the energy equivalent of the work involved, by simple calculation, is, approximately, 2,800,000,000 ergs. Using the old familiar $\frac{1}{2}$ mv_2 formula, we can say that this energy will impart a speed of over 90 ft./sec. to a bullet weighing one ounce.

Tri-nitrotoluene

From this we can move on to a more advanced example, that of T.N.T. Here we have a compound, the combustion of which can only be commenced, at least easily, with the aid of a detonator. Once, however, the process is started, auto ignition sets in, which gathers in speed rapidly. Decomposition of the explosive begins at below 150° C., being rapid at 200° C., and proceeding to explosive violence at around 280° C. It is important to appreciate this, explaining as it does the purely chemical mechanism of the initial stages of an explosion. One can set out the explosive ignition of tri-nitrotoluene or T.N.T. by the following equation:

$$2C_6H_2\,CH_3(NO_2)_3 + 21O = 14CO_2 + 5H_2O + 3N_2$$

T.N.T. + Air → Carbon dioxide + Water + Nitrogen



Typical pressure time record of the ignition of an explosive

As in the case of black powder discussed above, the volume of carbon dioxide, of water in the form of steam, and of nitrogen is vastly greater than the volume of the original T.N.T., which is a solid. The result is an expansion, which in effect, constitutes the explosion.

T.N.T., Amatol, and some of the other well-known H.E. require the aid of a detonative explosive to start oxidation. Thus, the fulminates, sensitive to slight percussion, can be used for this purpose, and their function is purely to start the combination of atmospheric oxygen with the high explosive. Why this should be so may not be apparent until one understands that sudden, or momentary, pressure generates heat. A percussion cap sets off the detonative charge, which gives the main charge of H.E. a sort of violent hammer blow. The blow produces intense localised heating, which raises the explosive above its ignition point, and as already mentioned above, the oxidation then proceeds with violence, the gases formed forcing their way out at all costs.

Stages of Detonation

There are four stages in the detonation: (*a*) the transformation of the mechanical energy of the fulminate, or blow, into heat

or thermal energy, (*b*) the passage of this thermal energy into chemical form, or oxidation of the H.E., (*c*) the evolution of heat from the oxidation or chemical reaction of explosive with air, and (*d*) the conversion of this heat into expansion or mechanical energy. An idea of the pressure involved in the expansion mentioned in (*d*) may be gathered from the fact that it may reach 10 tons/sq. in. in a rifle, and 4 tons/sq. in. in a shotgun.

Having initiated our explosion, it remains now to consider what happens to the expanding gases, which cause the damage from an explosion. To be effective as an H.E., the speed of detonation of a compound must be high; that is to say, the expansion must be rapid and the following table of four well-known types of explosive places them in their order of violence:

Explosive	Velocity of Detonation, metres/sec.
Black powder	200— 300
Dynamite	4,000—5,000
T.N.T.	4,000—6,000
Picric acid	5,000—7,000
Fulminate	8,000—9,000

These values are approximate, to the nearest thousand metres, and while fulminate ranks highest, it cannot be used conveniently for large explosive charges owing to its "touchiness," expense and convenience of manufacture on a big scale.

A difficulty of research work on the actual nature of an explosion from T.N.T., for example, in the past has been the lack of suitable apparatus but this has been remedied in recent years. The piezo quartz instrument enables high pressures to be recorded with minimum time lag, while the development of remote control equipment has made possible work on relatively large charges in the open. It is now known that when the gases formed by an explosive expand they set up pressure waves on the air, some of which travel faster than sound. A wave front with a velocity of about five times that of sound has been recorded. Such high speeds, as one might expect, set up peculiar phenomena, as for example, the considerable vacuum troughs in the explosion wave. These may cause a wall to collapse towards the origin of the explosion.

Resonance Effect

Then, again, there is the resonance effect, in which windows quite remote from an explosion may be shattered. If a friable material, like glass, happens to have a period corresponding to that of the wave frequency of the explosion wave, resonance may set up which will bring about the collapse of the glass, due to vibration, particularly if the latter is in a state of strain, which is frequently the case.

No attempt has been made in these notes to cover the subject of explosions in any but the briefest way, the real object being to show the resemblance between combustion, and explosive combustion. At one end of the scale one has, as an example, the slow combustion of coal; an intermediate case is smokeless propellant, which burns with a controlled velocity, but at a sufficient speed to impart much of the mechanical energy of expansion to the object which it is desired to propel. At the higher end of the scale there is the H.E. type of compound, where the rapidity of combustion is great enough to constitute almost an instantaneous mechanism. The speed with which this is accomplished determines to a certain extent the efficiency of the explosives, because the losses due to radiation of heat into the air are at a minimum for a high detonation velocity, and one conserves as much as possible of the converted energy from the oxidation into mechanical force.

Skilled Work in a Home Workshop

A Brief Account of a Well-equipped Workshop in the West of England

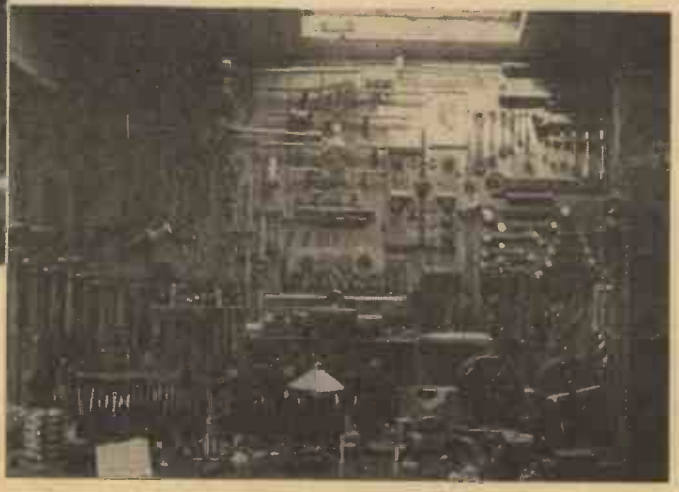
IN connection with business I often make a journey to Bath, and within twenty miles of this famous and historic spot lives Commander Hippisley, who is head of a well-known family in that district and still keeps up its engineering tradition. In the last war he was engaged on coastal service in conjunction with the Admiralty Intelligence Service, and was responsible for many new devices in this delicate work. He was one of the early experimenters with the Telephone, Rontgen Rays and Wimshurst machines. He served his early apprenticeship at the Brush Electrical Company, and had one of the first motor cars built by this firm about 1903.

My friend, Sidney Horstman, was a student under him for several years, and the first Horstman motor-car engine was designed and constructed in his workshop in the year 1898. His grandfather was a friend of the famous engineer, Nasmyth, who made the first steam hammer. Nasmyth spent most of his spare time in the old workshop of Commander Hippisley's grandfather, which then formed part of the house. The first traction engine was made there, and many features of this early production, including chain steering, are still used in the traction engine of to-day; a model of this is, I believe, still to be seen.

After the last war he built a new workshop fitted with every type of small engineering equipment, both machine and hand tools. He still has several of the famous old tools used by his grandfather, which include a straight-bed 8 in.-centre screw-cutting lathe by Dell of Bristol, built in 1847, also a planing machine by J. Williams and Co., of Bath, built in 1848. Among his modern tools he has a watchmakers' Lorch lathe with all its elaborate equipment.

(Below) A fine example of orderliness, as seen in Commander Hippisley's workshop

(Above) Commander Hippisley in his well-equipped workshop



Work of National Importance

At present he is using his workshop for work of national importance. Commander Hippisley is a regular reader of *Practical Engineering*, a contemporary of "Practical Mechanics," and when I visited him he had an open copy lying on his bench, and evidently he finds it helpful. His workshop is the most orderly and clean I have ever visited: there is a place for anything, and everything in its place. In 1921 he did experimental work for the War Office in connection with various electrical devices on tanks, and a 1916 model tank is still to be seen in his grounds. He also uses his workshop for general repairs and maintenance of plant and machinery connected with the estate. His saw mill is a model of up-to-date handling of lumber, and so is the winch-gear and travelling gantry in his workshop.—W.J.B.-L.

A Bristol Beaufighter in the Air.

Secrets of the Beaufighter

The World's Most Heavily Armed Fighter

SECRETS of the Bristol Beau—the Beaufighter—which have been kept a closely guarded secret during several months of successful night operations against enemy raiders have at last been released. It is considered the world's most heavily armed fighter, and is at present being built in scores of "dispersal" factories all over the country. It is also being built in Australia.

The Beaufighter is a high-performance, all-metal, mid-wing monoplane fitted with two 1,400 h.p. Bristol Hercules III air-cooled engines of the types installed in the new giant Stirling bomber. It has a nominal speed of 330 m.p.h., a range of 1,500 miles and carries a pilot and an observer. During a power dive the machine has reached a speed of well over 400 m.p.h. It has been mainly designed for long-range operations and night fighting.

Armament

The Beaufighter carries a battery of six Browning machine guns (three in each wing) which fire armour-piercing .303 bullets at the rate of 7,200 a minute, and four 20 mm. Hispano-Suiza cannon which can fire high-explosive shells at the rate of 2,000 a minute. On the pilot's control wheel is an electric button for operating the guns.

The machine has a wing-span of 57 ft. 10 in., is 41 ft. 4 in. in length and 13 ft. 4 in. in height. Its all-up weight is slightly over 9 tons. The equipment of the Beaufighter is rather exceptional. It includes navigation, formation-keeping and identification lamps, landing flares, auto-recognition equipment, signal pistol, oxygen apparatus, cine-camera mounting, stowers for computers, and map cases, fire extinguishers, first-aid outfit and axe. Mounted in the wings are four self-sealing fuel tanks having a capacity of 550 gallons. Provision is also made for carrying a 4-gallon water tank for desert use. The pilots' and observers' seats are entered by means of two special hatches, which also serve as emergency exits by parachute.

Each door opens by means of a quick release so that part of the door protrudes outwards into the air stream beneath the body. A "dead air" region is thus created through which the crew can drop without risk of injury, even in a dive up to 400 m.p.h.

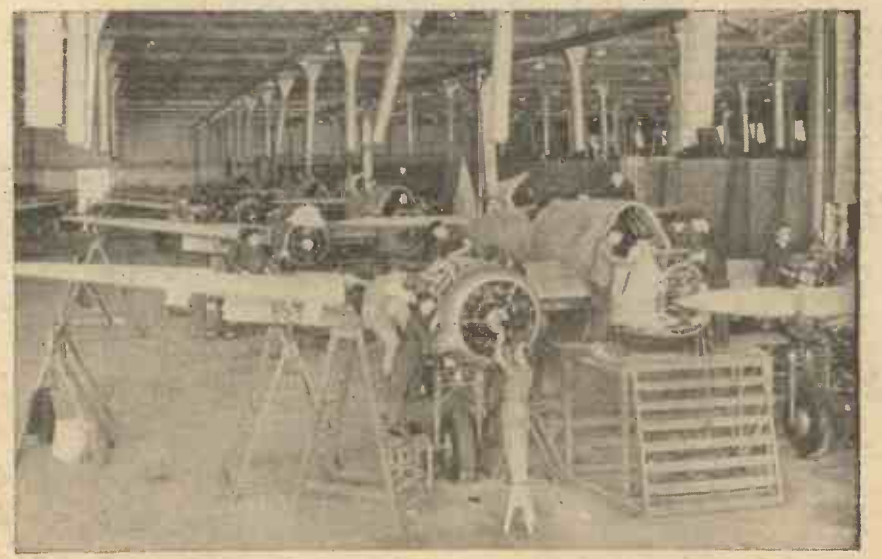
There is a cabin heating system, controlled from the pilot's seat, by which hot air is admitted to the cockpit from the engines. Both the undercarriage and the tail wheel are retractable. The machine is also fitted with airscrew de-icing, and Lorenz beam approach equipment.

Other Features

Above the observer is a hinged hood, and on the starboard side of the pilot a knock-out panel, also a hinged window above him, all of which can be used as emergency exits should the necessity arise. The fuel tanks previously mentioned can also be jettisoned in an emergency by pulling a lever on the pilot's instrument board. Another interesting feature of the Beaufighter's construction is a secret process for masking the tell-tale glow of its exhaust.

A test pilot who has flown in a Beaufighter describes it as "big, extremely fast; makes very little noise; requires very little maintenance; and is very heavily armed against 'back-fire' from enemy rear-gunners."

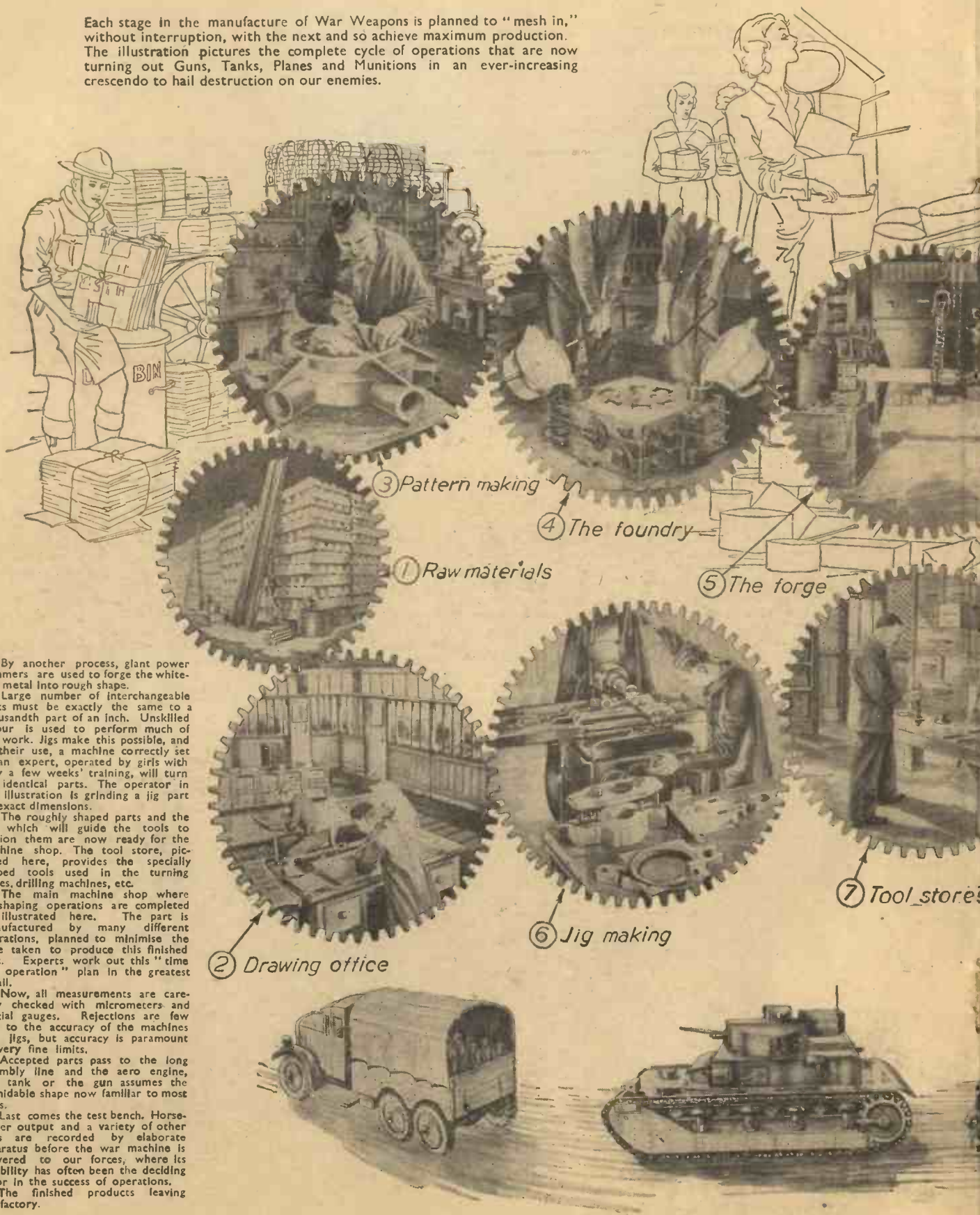
When the machines leave the factories they are fully armed and painted jet black. The general lay-out permits the installation of a fire-turret amidships. As a tribute to their devastating fire power, Beaufighters have returned from night operations smothered in German oil and festooned with bits and pieces of raiding planes that have been held for a second or two in their gun sights.



Beaufighters approaching completion in the shops.

How the Wheels of our Grea

Each stage in the manufacture of War Weapons is planned to "mesh in," without interruption, with the next and so achieve maximum production. The illustration pictures the complete cycle of operations that are now turning out Guns, Tanks, Planes and Munitions in an ever-increasing crescendo to hail destruction on our enemies.



5. By another process, giant power hammers are used to forge the white-hot metal into rough shape.

6. Large number of interchangeable parts must be exactly the same to a thousandth part of an inch. Unskilled labour is used to perform much of the work. Jigs make this possible, and by their use, a machine correctly set by an expert, operated by girls with only a few weeks' training, will turn out identical parts. The operator in this illustration is grinding a jig part to exact dimensions.

7. The roughly shaped parts and the jigs which will guide the tools to fashion them are now ready for the machine shop. The tool store, pictured here, provides the specially shaped tools used in the turning lathes, drilling machines, etc.

8. The main machine shop where all shaping operations are completed is illustrated here. The part is manufactured by many different operations, planned to minimise the time taken to produce this finished part. Experts work out this "time per operation" plan in the greatest detail.

9. Now, all measurements are carefully checked with micrometers and special gauges. Rejections are few due to the accuracy of the machines and jigs, but accuracy is paramount to very fine limits.

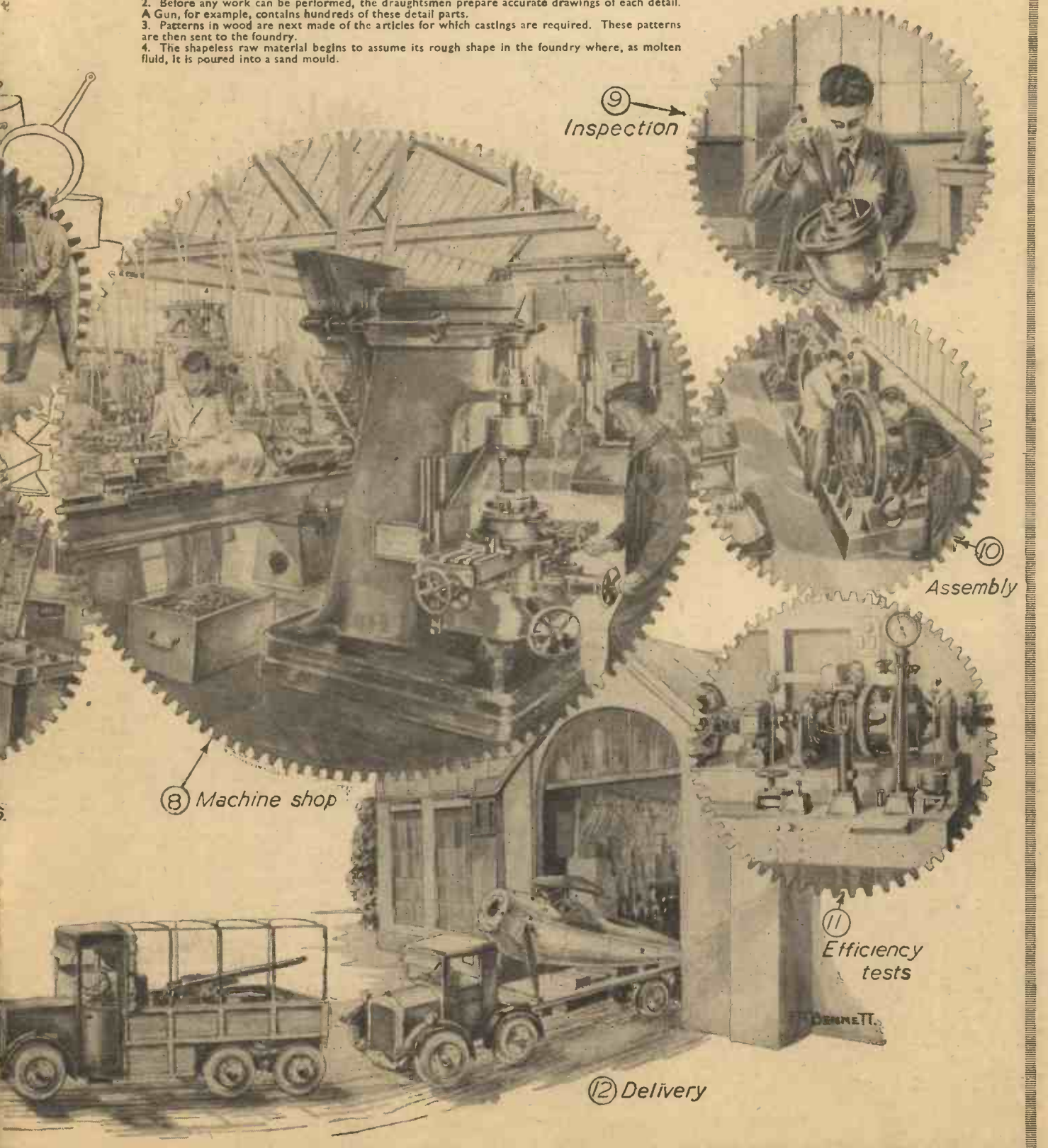
10. Accepted parts pass to the long assembly line and the aero engine, the tank or the gun assumes the formidable shape now familiar to most of us.

11. Last comes the test bench. Horse-power output and a variety of other tests are recorded by elaborate apparatus before the war machine is delivered to our forces, where its reliability has often been the deciding factor in the success of operations.

12. The finished products leaving the factory.

at War Effort Keep Turning

A. Waste paper voluntarily collected provides valuable raw material in the manufacture of explosives and other munitions.
B. Housewives are contributing tons of the precious metal, aluminium, used so largely in aircraft construction.
1. The source of all modern machines of war is shown in these uninspiring blocks, bars and plates of metal stacked in the raw material stores. Iron railings, old keys and household junk are helping to swell the supply of this vital material.
2. Before any work can be performed, the draughtsmen prepare accurate drawings of each detail. A Gun, for example, contains hundreds of these detail parts.
3. Patterns in wood are next made of the articles for which castings are required. These patterns are then sent to the foundry.
4. The shapeless raw material begins to assume its rough shape in the foundry where, as molten fluid, it is poured into a sand mould.



Our Busy Inventors

By "Dynamo"

Automatic Raft

THAT lifeboat substitute, the raft, has proved to be the salvation of many of those who go down to the sea in ships. But inventors have premeditated more than one of these life-saving vessels. For example, deck seats have been designed which, in case of shipwreck, can be rapidly converted into a raft or at least a kind of enlarged lifebuoy.

It is undeniable that, especially in wartime, a lifeboat must be ready for launching with a minimum of delay. Therefore, it is the practice to keep the boat's davits swung outwardly. To prevent damage to the lifeboats, occasioned through their being thrown against the ship's side, the boats are lashed to the davit stanchions or the side of the vessel. A lashing spar is interposed in order to keep the lifeboat from moving.

During launching, owing to a rough sea or hostile attack, lifeboats are in danger of being capsized or damaged. Accordingly, it is imperative to furnish some means of rescuing the survivors.

To attain this object, new life-saving apparatus has recently been invented. It comprises a lashing spar constructed in the form of a raft and adapted to be interposed in the conventional manner between the ship and the boat, when the latter is swung outboard. This spar is so arranged that, upon the lifeboat being launched, the spar is allowed to fall into the water and floats as a raft.

Pram Brake

A BRAKE of simple construction has just been introduced which will enable a perambulator or an invalid chair effectively to be held stationary.

The device comprises a pair of transverse bars, each mounted within guides, in combination with means for moving the bars in a lateral direction within the guides. This forces them against the wheels and applies a braking pressure to the four wheels simultaneously.

This invention will prevent unattended baby carriages from precipitating themselves down a sloping footway into the stream of passing traffic.

Genial Garments

SEPTEMBER now marches in the pageant of the months, and is a herald foretelling the period when nature acts as a refrigerator. This makes appropriate the advent of certain freshly designed warm garments. But their special heating power is not due to wool. It is owing to the fact that they are electrically heated. And this effect is produced in a way which differentiates them from previous clothing of that type.

The heating element consists of gauze made of conducting material. This gauze can easily be cut in any shape or size, and we are told that it can be rendered suitable for any desired current supply. Moreover, the material is adapted for flexing without the danger of breaking. Even if some of the wires were fractured, the efficacy of the heating element would not necessarily be affected, owing to the large number of conductors.

The heating arrangement can be stitched into position by an ordinary sewing machine, and it may be embodied with clothing when it is manufactured. It is in electrical connection with press studs, and current is supplied through sockets fitted to a belt. There is a supply cable provided with a plug for connecting to an accumulator.

This method of heating may be applied to gloves, boots, socks, muffs and blankets.

Armour for the Forces

IN the Middle Ages armour was an important part of the soldier's equipment. The breastplate was so constructed that it caused an arrow to glance and be diverted from its deadly course. When the winged shaft was replaced by the cannon ball and the bullet, armour would have been an encumbrance rather than a shield.

Dr. William V. Houston is here seen with his electronic microscope which was recently demonstrated before scientists at the California Institute of Technology.

However, to-day warships and tanks are armoured, and the Forces are entitled to any bodily protection possible. Therefore, an improved armoured body shield which has appeared deserves consideration. It consists of manganese or other suitable material covered with compressed vegetable fibre. The covering is secured by rivets and other fastenings. The object of the inventor is—to use his words—" to deaden, enclose or pocket shots and to prevent them from ricochetting." It is also intended to nullify the damaging effects of shrapnel and splinters from bomb shells and hand grenades. Bayonet thrusts and sword cuts are included among the dangers from which this waistcoat is designed to protect.

The device comprises front and back shields and the waistcoat is capable of being folded up. This permits it to be conveniently packed and carried.

Air space is allowed between the body and the shields which are held in place by means of straps and buckles at the sides, and on the shoulders. The waistcoat can be adjusted to fit persons of various sizes.

While it is too much to hope for the devising of a body shield which will guarantee immunity from the consequences of a direct hit by a bullet, it is at least possible to modify the impact of some missiles.

Warm and Buoyant

A NEW kind of clothing has two reasons for its existence. Intended for those who travel by sea, firstly, it is claimed for it that it will keep out the cold. Secondly, its inventor has formed a device, which, in the event of the wearer being suddenly immersed in deep water, at once becomes a life-saving appliance.

The invention is a jacket, preferably sleeveless, provided with insets of Kapok both at the front and the back. The distinguishing feature of this garment is that the front of the jacket, at the lower part of the side seams, is not attached to the back. As a consequence, the front part can be turned up or rolled up to produce a double layer of Kapok on the wearer's chest. It is so arranged in order to support him face upwards in the water.

Light on the Water

HERE is yet another invention for the saving of those in peril on the sea. This time it is an improved battery-operated electric lamp fitted to rafts and life-jackets. It is of the kind in which the lamp is automatically lit when the water is entered. The device comprises a holder fitted with a lamp bulb having a transparent cover. The electric circuit to the lamp bulb closes to illuminate the lamp when it touches the water. The automatic switching is effected by a movable contact member arranged to engage one of two fixed contacts in the lamp circuit. The movable contact member is operated by a float member. The two fixed contacts are normally bridged by a ball of mercury when the lamp is in a vertical position. Tilting or inverting of the lamp causes the mercury to roll from the bridging position, which breaks the electrical circuit.

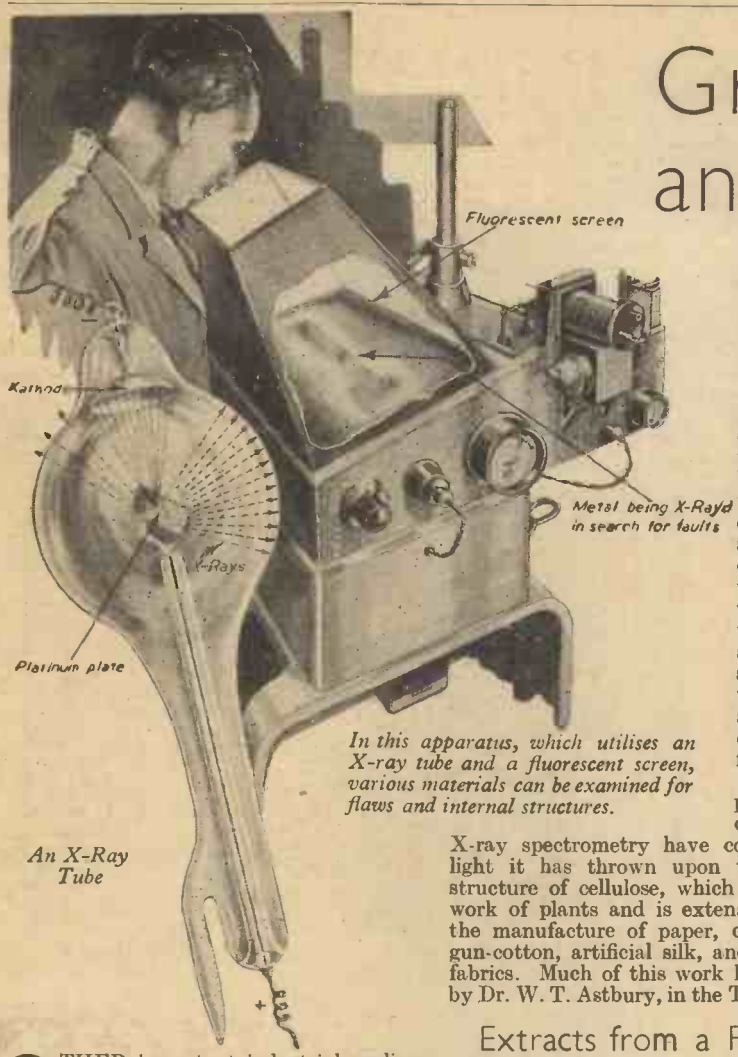
The benefit of this invention is twofold. It will enable rescuers to locate the survivors of a shipwreck, and it is intended to prevent them from being run down by an oncoming vessel.

Constant Curls

IT seems that the alleged permanent wave is impermanent. Though some " perms " may be more durable than others, they do not endure for ever. An inventor has set himself the task of increasing the longevity of waves and curls on the heads of the fair sex, and he has applied for a patent in this country.

He uses a spring-closed tong-like curler, having a central tube with perforations; a perforated hair-clamping blade; and a spring-closed heating clip. He also employs an electric heater which can be regulated so that exactly the desired degree of heat can be transmitted to the clip.

Great Inventions and Discoveries



In this apparatus, which utilises an X-ray tube and a fluorescent screen, various materials can be examined for flaws and internal structures.

An X-Ray Tube

Extracts from a Paper Read Before the Royal Society of Arts Recently. By Sir Richard Gregory, Bt. F.R.S.

(*Concluded from page 400, August issue.*)

OTHER important industrial applications of X-rays arose from what would commonly be called academic or scientific discoveries, rather than from practical inventions. After it had been proved by such investigations that X-rays were waves like those of visible light, but about ten thousand time shorter, it was suggested that these waves might be used to reveal the arrangements of atoms in crystals. The wave-lengths of X-rays are less than the distances between such atoms, and are, therefore, able to produce diffraction effects, the crystals acting like a diffraction grating. Laboratory experiment showed that, when the crystal was placed between a beam of X-rays and a photographic plate, a pattern of spots was recorded upon the plate, and that it revealed the lattice arrangement of the atoms in the crystal.

Spectrum Analysis

Sir William Bragg and his son, now Sir Lawrence Bragg, then took up the subject of X-ray crystal analysis and became the most renowned authorities upon it by their work. They devised and used on many investigations of crystal structure an X-ray spectrometer, by which the pattern from any planes of the crystal target could be photographed. Later, it was discovered that when the primary X-ray beam was reflected from the substance under examination, a more powerful means of analysis became available. The spectrum thus obtained shows characteristic lines of the constituents in the material of the target, and also distinguishes between perfect crystals and a mosaic of small crystallites. By this secondary emission method, a thin layer of powder can be used for analysis, instead of a single crystal, and it can reveal characteristics which are beyond the power of an optical microscope. It thus enables a spectrum analysis to be made without using any of the substance under examination, or changing its form.

Unexpected practical applications of X-ray spectrometry have come from the light it has thrown upon the molecular structure of cellulose, which is the framework of plants and is extensively used in the manufacture of paper, celluloid films, gun-cotton, artificial silk, and many other fabrics. Much of this work has been done by Dr. W. T. Astbury, in the Textile Physics Department of the University of Leeds, X-ray analysis showed that the fibre substance of natural silk was built up of chain-like molecules lying roughly parallel to the fibre axis. Natural protein fibres, hair, muscle, nerve, horn, feather, and the like are built up in much the same manner. While, however, in silk the molecules have a straight-chain configuration, the structure of wool consists of long chains of molecules, cross-linked by side chains. The main chains are normally folded; but in the presence of water the folds can be pulled out by mechanical force, and they recover their former arrangement when the stress is removed. This accounts for the power of recovery of shape by woollen garments after stretching when wet. At higher temperatures, such as that of steam, certain of the cross-linkages are broken down, and the material largely loses its power of recovery. This fact is used in various industrial processes, including that of the setting of ladies' hair in the so-called "permanent wave." It has long been known that wool is elastic, but silk is not so; and X-ray analysis has shown that the reason is a difference in molecular structure.

Electro-Magnetic Waves

Radio-communication and broadcasting are impressive examples of practical developments directly derived from original scientific investigation undertaken with no other purpose than that of inquiring into natural causes, consequences, and relationships. Reasoning on principles discovered by Faraday as to the nature and influence of the electro-magnetic field, Clerk Maxwell, in 1864, succeeded in proving by mathematical equations that light is an electro-magnetic effect, and that waves originating in wires conducting electric currents are propagated through space with the same velocity, 186,000 miles a second. The only difference between waves which affect the sense of sight and those used in broadcasting is in wave-length, or pitch, to use a musical comparison. The first demonstration that the waves could be used for such signalling, and would pass through walls of buildings, was made by Sir Oliver Lodge in 1894. The "invention" stage of the subject began two years later, when Mr. Marconi, who had been experimenting with electric waves in Italy, came to England and took out the first patent ever granted for radio-telegraphy.

The Two-Electrode Valves

The development of radio communication from telegraphic signalling by the Morse code to the transmission of speech and other sounds by the telephone, were based

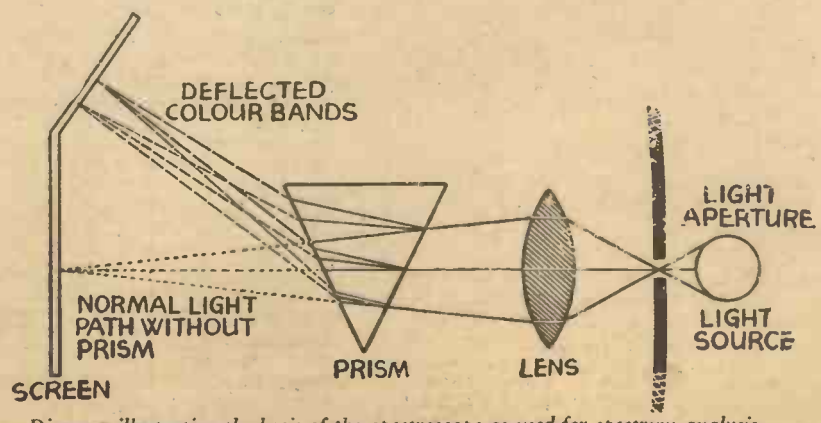


Diagram illustrating the basis of the spectroscope as used for spectrum analysis.

upon the discovery that the glowing carbon filament of an electric lamp gave rise to discharges of negative electricity. This is known as the "Edison effect"; and its nature was investigated by fixing within a glow-lamp a thin platinum plate to collect the negative discharge and convey it outside the bulb by an insulated wire. Twenty years after this "thermionic" phenomenon had been discovered, Sir Ambrose Fleming made a detailed study of it, and communicated the results of his experiments to the Royal Society. He surrounded the filament with a thin metal cylinder supported within the bulb of the glow-lamp by a platinum wire. By this device, the rapid alternating current produced at an electric power station could be "rectified"; so that it became of the one-way character necessary for use in telephony. Such a contrivance was a two-electrode electric valve, and represented the first practical application of the property, discovered many years earlier, that many incandescent metals and other substances give out negative electricity, now known to consist of minute particles called "electrons."

Dr. Lee de Forest

Fleming patented his electric valve in 1904 as a means of rectifying and detecting wireless waves, and he thus bridged the gap between laboratory experiment and practical invention. Three years later, Dr. Lee de Forest modified the Fleming valve by interposing copper gauze, or a spiral of thin wire, between the incandescent filament of a glow-lamp and the platinum plate. By the introduction of this "grid," the flow of electrons from the filament can be controlled and magnified at either a transmitting or receiving station, and several of these three-electrode, or triode, valves can be joined up in series to increase the effect desired. The use of these thermionic valves for generating continuous electric waves, and as a sensitive means of detecting them, marked the most important stage in the practical development of radio-telephony and broadcasting. Purposeful invention became the chief motive, rather than the promotion of natural knowledge. The many advances made since then have been achieved by the combination of scientific and industrial research.

There was an interval of twenty-four years (1864-1888) between the publication of Maxwell's theory of electro-magnetic waves and their actual generation by Lodge and Hertz: eight years elapsed (1888-1896) before the first wireless patent was taken out by Marconi: twenty-one years (1883-1904) between the discovery of the Edison effect and Fleming's patent for the use of a thermionic valve as a rectifier of wireless currents and detector of electric waves: only two years (1904-1906) separated this valve from Lee de Forest's triode with its grid, which led to the beginning of broadcasting in the U.S.A. fourteen years (1906-1920) later, and the establishment of the British Broadcasting Company in 1922. It took more than half a century, therefore, for this great engineering performance to fulfil the promise revealed by Maxwell in his mathematical conclusion concerning the propagation of electro-magnetic waves in space.

Application of Tungsten

The bright filaments of the thermionic valves used in broadcasting, and also in most electric glow-lamps, are now nearly always made of the metal tungsten, which can be raised to a higher temperature than any other metal without melting, and gives off a copious supply of electrons when incandescent. There was a long interval between the discovery of this metal and the use of its properties in glow-lamps, and radio communications. Tungsten was isolated in a metallic state from its compounds so long ago as 1783, and it remained a curiosity of the laboratory until the middle of the nineteenth century, when its use in the production of special steel alloys began to assume industrial importance.

At the beginning of the present century, the use of tungsten in steel manufacture became general; and a few years later filaments of the pressed metal were used in glow-lamps, but they were too fragile for reasonable length of service to be widely adopted. What was needed was a means of melting and casting the metal in order to make fine wires from it. Tungsten has, however, such a high melting temperature that, unlike other metals it cannot be dealt with in the same way. The production of ductile tungsten was both a discovery of a particular nature of the metal and an invention of high scientific and industrial importance. After a long and intensive series of experiments in the research laboratories of the General Electric Company, Schenectady, U.S.A., Dr. W. D. Coolidge found that, by welding together powdered tungsten into the form of rods and heating this compressed material, it could be consolidated and hammered while hot, so that finally it could be drawn out into extremely fine and strong wires with a high degree of ductility. Tungsten wires produced by this new process have since displaced other metals as lamp filaments, because of their durability and efficiency for illumination and radio applications.

New Metallic Elements

The uses of the special properties of tungsten for inventive purposes is only one example of many in which important industrial applications have grown out of the discovery of new metallic elements often after a long interval. One of the best known of these metals is manganese, which is found in many rocks, and compounds of which have been known from early times. The metal was first obtained in a pure state as a laboratory product towards the end of the eighteenth century; but in this form it has no industrial value. Several millions of tons of manganese ores are, however, now mined annually, and 95 per cent. of it is used in the production of alloys of iron and steel and other metals. The use of manganese in modern steel-making began in the first quarter of the nineteenth century, when a patent for it was taken out by J. H. Heath. This discovery, or invention, led to developments which have revolutionised the art of steel manufacture.

Systematic research on the influence of different proportions of manganese upon the properties of alloy steels were begun by Sir Robert Hadfield in 1882; and they resulted in the discovery of his famous manganese steel, containing about 13 per cent. of manganese. He took out the first patent for this discovery in the following year. Manganese steel is a remarkably tough material, and is also practically non-magnetic as well as a poor conductor of heat and electricity. It marked the dawn of the age of high alloy steels; and to-day nearly the whole of the world's output of steel makes use of manganese in one form or another. Other chemical elements first isolated in the course of scientific research, and now used in the production of alloy steels with special properties are nickel, chromium, tungsten, molybdenum, cobalt, silicon, vanadium and aluminium. The stainless steels now familiar in cutlery, and used for many engineering purposes, because they resist atmospheric and other influences which lead to corrosion, contain either about 12 per cent. of chromium alone, or with about 7 per cent. of nickel. The high-speed tool steels which have enormously increased the rate of work in machine shops contain about 16 per cent. of tungsten, other alloying elements in much smaller percentages being manganese, silicon, chromium and vanadium. Tungsten steel is also largely used in the construction of permanent magnets for magnetos and other apparatus subject to powerful demagnetising influences. Cobalt steel is superior for this purpose, but more costly to produce.

Sir Robert Hadfield, Bart., whose discovery of manganese steel revolutionised the industry. He also introduced silicon steel.

Silicon Steel

The chemical element, silicon, was obtained in the form of an amorphous powder early in the nineteenth century, but its importance in steel manufacture was not discovered until about seventy years later, when Sir Robert Hadfield invented the iron silicon alloy known as silicon steel. No other steel alloys possess the special properties of manganese and silicon steels, or can replace them efficiently in engineering practice; manganese steel on account of its durability and toughness, and silicon steel by greatly reducing losses in electrical transformers and other machines.

Wanted—Better Bicycle Transmission

By C. A. (Bath Road) SMITH

THERE is a general impression that bicycles have reached finality in design, but I propose to show that it has far to go before that idealistic stage is reached. Writing with over 50 years of consistent cycling experience behind me, I say that the most neglected as well as the most important part of the cycle is the gear. Gear wheels and sprockets are still turned out in the cheapest possible way. The disadvantage of this particular method is that the cheapest way happens to be the worst.

A healthy human being is capable of exerting for a few hours a day a maximum of 1/10th h.p. or 3,300 foot lbs of energy. Every atom of that power which is wasted makes cycling hard work. Pedalling power is transmitted to the wheels by means of the pedals through the chain wheel via the chain to the sprocket. I cannot criticise chain manufacture, which to-day is so exact that chains are used as drilling jigs. If, however, you inspect a new bicycle you will find that the chain wheel itself does not revolve concentrically, that it wobbles from side to side and that the tooth form is incorrect. If you examine a sprocket you will find that this is also eccentric. I will dispose of the latter item by criticising first of all its method of attachment. However accurately made and cut, a sprocket cannot revolve truly if it is screwed to a hub. It must be splined to the hub or attached to a taper shaft with a Woodruff key. Another point is that the hub itself must be true.

Cheapness of Manufacture

Cheapness of manufacture cannot be advanced as the reason for a continuation of this system of manufacture. Chain wheels are stamped, but even if we admitted that the stamping process was good enough (which it is not), there is no reason why they should be stamped to form. I suggest, backed by sound engineering opinion, that chain wheels should be made of steel (not mild steel), hardened and tempered, and that the teeth should be generated by one of the well-known machines such as the Fellowes, the Gleason, or the well-known hobbing process. Cutters and hobs made to the correct roller-chain tooth form have been on the market for half a century, and the cost of making chain wheels by this process could not amount to more than a few pence per machine. Even if they cost a few shillings more, they should still be used, and the public should not be permitted to have a say in the matter at all, for it is a waste of money to run extremely accurate chains on extremely inaccurate chain wheels and sprockets. All the chain does is to act as a gauge of the inaccuracies of the two wheels on which it runs and to give audible signal of those inaccuracies in the form of groans, squeaks and clicking noises.

The trade uses stampings made of soft metal and that is the reason why we come across so many noisy cycles on the road, so many people messing about with their chains, and find too many instances of chains running off the chain wheels.

Cut Gears

An important thing to note about cut gears is that they are quite silent and improve with use. If your chain, therefore, is not silent, you know that it is due to the chain wheels. The tooth form now adopted as a standard by the B.S.I. was originated by Hans Renold many years ago. It was accepted by the trade as the best. No one has yet improved upon it.

As I have pointed out elsewhere, if the gear makes a noise, if the chain is tight in one place and loose in another, or if the chain picks up on the gear wheels, or chain breakages occur and frequent chain replacements become necessary, it is entirely due to the fact that the tooth form is at fault. The easy running of a machine absolutely depends upon the gear, and cyclists should give more attention to this instead of having stupid inhibitions about special tubing, special forks, special angles, special handlebars, and special I don't know what. One thing to be noted is that cycles fitted with the "stampings" command a "special" price. I wonder which big firm will one day wake up and seize this opportunity of getting on top? They should use as their slogan "Cut Gears for Cute Cyclists."

A year after starting in business at Salford, Hans Renold patented in 1879 the bush roller type of chain, and J. K. Starley, at once appreciating its virtues, took it up. Starley up to that time had been unsuccessful in finding a chain suitable to withstand the strains and stresses set up by pedalling motion.

Chain Breakage

In the nineties I had so much trouble with my bicycle gears that chain breakage was a frequent occurrence, and I began seriously studying the matter. I was riding a Beeston Humber, and so I wrote to the manager, one Bassett, who promised to build some special chain wheels of his own design. These came along and gave reasonable results for some weeks until the Bath Road Hundred of 1891, when I had the mortification of the chain breaking during the race. I was vexed, and then insisted that the Humber Company should send the gear blanks to Hans Renold to cut the wheels for me. After that I had no more chain trouble. Hans Renold wrote me as far back as 1898 about tooth form, and proved to me why a larger tooth gave a better bearing surface, and therefore lasted longer. He advised me to use a larger chain, pointing out that the ½th inch chain only reduced the weight of a cycle by 7 ozs.

Unfortunately, mass production usually finds the cheapest and, therefore, the most inefficient way of turning out components, and thus we find that gear wheels and sprockets are stamped out and supplied to the trade at a very cheap rate. The motor cycle trade has experienced the same transmission complaints; chains break and run off the wheels due to a wrong tooth form.

Mr. C. A. (Bath Road) Smith

The Author of this article, famous record breaker, Past President and Hon. Life Member of the B.R.C., here explains his arguments in favour of improved cycle transmission, which he has advocated for the past 50 years.

Hans Renold Tooth Form

Now, forty years ago, the chain manufacturers (there were lots of them then!) admitted that the Hans Renold tooth form was the best, but, of course, the cycle trade manufacturers, with their conservative outlook, would not accept this doctrine, and so it has come about that various firms at the present time have their own idea as to what is good for the public. The B.S.I. has a standard set out for everything, yet the trade ignore most recommendations.

Of course, the trade is now busy, but I hope that they are not too busy to ponder over my remarks and provide cyclists with a decent machine, not one with chain wheels that can be bent with the fingers, that have incorrect tooth form and make a noise like a mowing machine. They must recognise that a gear is an engineering job and requires skilled attention. Stamping made from inferior metal has passed muster for many years, largely owing to the ignorance of the public, but nowadays intelligent riders are demanding a better bicycle.

I am asking for Renold tooth form to be recognised as it is the best, and I am looking forward to another "John Marston" coming forward in the trade. Members of cycling clubs have shown the trade that it is not necessary to build such large frames, thus saving the use of miles of tubing and providing cyclists with a machine with less wind resistance, less weight and greater rigidity.

It is amusing to hear that the Centipede Club, chiefly members of the cycle trade, have found that the excursions they have made at holiday times are somewhat too lengthy. Rides of 50 miles, they say, entail too much exertion! It has recently been suggested that the distance they should cover in the day should be reduced by at least 20 miles, and quite right, too. It must be hard work pushing these heavy bicycles about. It has been said that mine is a voice crying in the wilderness. Wilderness is the operative word!

"MOTILUS" PEEPS INTO THE

Some Interesting Model

Model submarines made by boys of the Y.M.C.A. Grafton Boys' Club, Northampton.

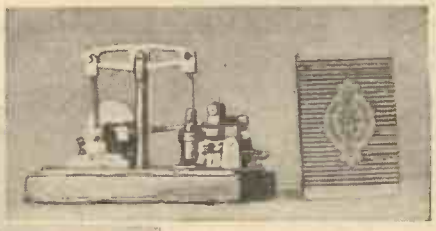
Miniature Steam Engine Models

A REGULAR reader of this feature, who lives at Perth, has sent along three very interesting photographs of his own models. He says : " For the past few years I have been interested in miniature models and am sending along photos of some I have completed." No claim is made on the grounds of their exceptionally small size, but the maker does claim that they work perfectly under steam. The first, an oscillating engine, has a bore and stroke of ¼in. The cylinder was machined from a " Solex " carburetter jet, and a piece of round silver steel was turned to act as a piston. With a steam pressure of 4 pounds per square inch, it develops a remarkable turn of speed, and maintains sufficient power to drive a model circular saw. The boiler was made from a section of cycle pump barrel, and steam is superheated before reaching the cylinder.

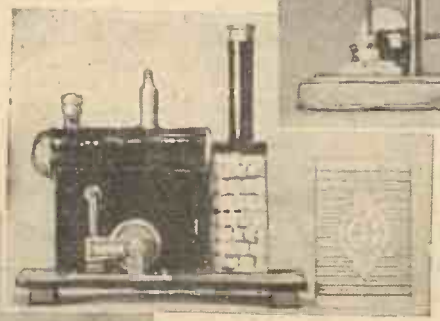
The second model is a free-lance design of a beam engine and stands 1⅞ in. high. The cylinder has a bore and stroke of 5/32 in. and 3/16 in. respectively, and is a double-action slide valve type. The somewhat complicated valve mechanism is adjustable and both cylinder and steam chest have packing glands incorporated. This engine requires 10 pounds per square inch to operate owing, no doubt, to the friction set up by the valve gear. It is capable of a high rate of speed, but refuses to run slowly.

The third model by this Scottish miniature enthusiast is a well finished little donkey engine, standing, from boiler base to top of funnel, two inches high! It is complete with working water gauge and safety valve. The oscillating cylinder has a bore of ⅛ in. and stroke of 3/16 in. and the model will run for two minutes at one filling. The boiler has a central flue and the whole job—except water gauge—was silver soldered.

This reader concludes by " wishing our interesting magazine every success."



(Right) A miniature oscillating steam engine made by a Scottish reader.



A tiny working model beam engine fitted with a double-acting slide-valve cylinder. Note its size compared with a matchbox.

This miniature donkey engine model is only two inches high.

Realistic Scenic Model

I was turning over some old photographs the other day when I came across one that took me back to the good old days of 1924, when the Wembley exhibition was the topic of the moment. It depicts a model made by Bassett-Lowke Ltd., for the National Life Boat Association to demonstrate the saving of life at sea. On the right-hand side of the scene is a wrecked cargo steamer partly on the rocks, with the sea washing over her stern. In the centre is a lifeboat lying off the wreck and saving life by means of the breeches buoy. This was a real working model! The effect of a moving sea was given by rotating cams under the sea, the lighthouse threw out its beams most realistically and added to this, intermittent flashes of lightning created a lifelike storm at sea! The model, if I remember rightly, caused quite a stir at the Wembley exhibition.

Model made for the National Life Boat Association to demonstrate the saving of life at sea. Shown at the Wembley Exhibition in 1924.

Miniature Wartime Posters

The introduction of something new in the model world at the present time is very difficult because of the great percentage of skilled labour now employed in work of National importance.

However, one well-known model-making company have, with their usual enterprise, just introduced a little novelty which I feel sure will appeal to the model railway owner. This is an accurate reproduction of the series of wartime posters issued by the British railways. The original posters have been well displayed by the railway companies, and in most cases have been produced jointly. They are thoroughly up to date and include many " Lines behind the Lines " posters; there are twenty-one in all, three reproductions in miniature of Double Royal, and eighteen of Quad Royal posters. The miniatures are all of a size suitable for either gauge " 00 " or gauge " 0 " railways, and are made up in a

MODEL WORLD

Examples of Miniature Making

packet, costing 6d. post free, and if you are interested, the Editor will be pleased to send you the address of the firm supplying them.

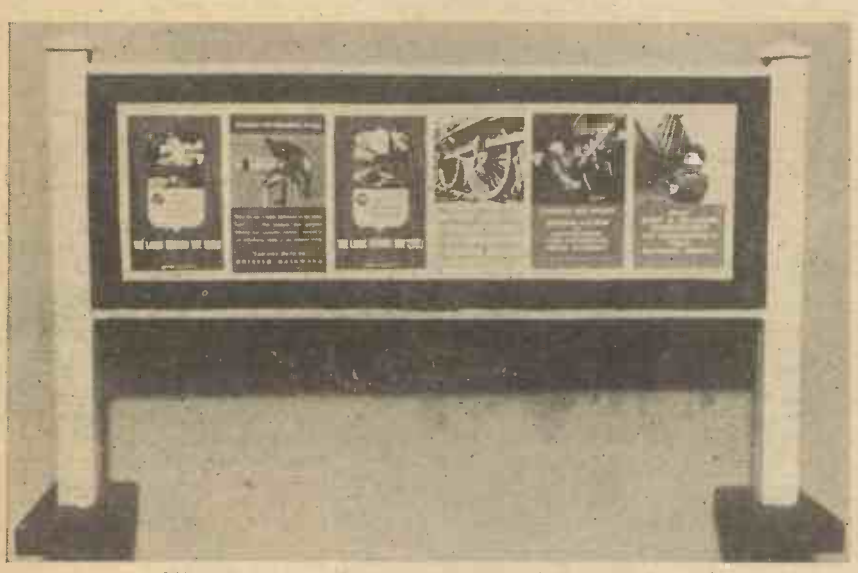
A "Zipp" model aeroplane made by a 17-year old factory worker.

Boy Model Makers

All over the country, despite the war, there is a keen interest among boys' clubs in the art of model making. I recently had occasion to visit the Y.M.C.A. Grafton Boys' Club at Northampton, and was agreeably surprised both at the quality of the work and the number of boys participating in the hobby. There were fifteen boys in the class, and their average age was about fourteen years. Their instructor, a local modelling man, particularly complimented them on their workmanship and keenness. We illustrate a "Zipp" model aeroplane which the class made last winter. They all made the same model, but had to make their own drawings on cartridge paper before cutting up the Balsa wood, and to give each model individuality each was allowed to choose his own colours to paint the model. When all the model aeroplanes were finished, prizes for the best were awarded, and the model in our photograph is the work of a seventeen-year-old boy—Leslie Griffin—who works in a factory in the daytime. The second prize was awarded for an unfinished model—the work of sixteen-year-old Roy Martin. "The covering of the model," the judge said, "is practically perfect." The "Zipp" is a duration flying model, designed by the instructor of the class himself, and nothing on it is fixed permanently. Everything is held in position by elastic bands so that, on alighting from a flight, the elastic gives and the model stands a better chance of emerging undamaged from its trials.

Model Submarines

One year the Grafton Boys modelling class made submarines, and this coming winter they are going to try their skill at model ships. Three or four of the keenest are at the moment working on a 100-ft. to the inch model of the French liner, "Normandie," from parts presented to them by Mr. W. J. Bassett-Lowke, and when it is finished he will give his opinion on their modelling skill. There must be hundreds of similar clubs in England which are still "going strong" at model making, and Motilus will always be interested to hear of their activities.



Miniature wartime posters introduced by Bassett-Lowke, Ltd.

Gauge 1 L.N.E.R. "Mogul"

Gauge 1 steam lovers, and there are many of these, including that stalwart of the group, Victor B. Harrison, will be interested to know that, despite the war, Messrs. Bassett-Lowke Ltd. have been able to improve on their two Moguls in the batch recently delivered from the works. Both the L.M.S. and the L.N.E.R. are excellently finished and incorporate the leading features and characteristics of this very popular mixed traffic engine. They are fitted with the standard piston-valve cylinders and many other items used in the previous production are not altered, but the general improvement in outline of design, and several additional features, make the models a very attractive proposition at the present price of £15.0.0, free of Purchase Tax.

Catalogue of Gauge "O" Equipment

Despite the war, Bassett-Lowke Ltd. have produced a very fine 1941 catalogue on gauge "O" model railway equipment. The cover is of an attractive design and is printed on a special leather surface paper, which is particularly effective. Several pages have been added to the list, including one devoted entirely to finished accessories for the model railway builder, bogies, axle guards, buffers, ventilators, wheels and all the various "bits and pieces" that are the "life blood" of the model making hobby. In looking carefully through the list the following new items will be noticed: a 2-6-2 L.M.S. Tank (companion for the 2-6-4 model so popular since its introduction two years ago and which this year has been redesigned): the long promised new design L.M.S. wagons—open, covered and goods brakes, which will be eagerly purchased by model owners whose rolling stock needs additions. For those who like their own permanent way, the new check rail chair with cast key should prove very useful in point work. I am pleased to see that tinplate rail and points are again included. These make inexpensive and satisfactory track for those who require only a simple layout that can be easily assembled, and as easily taken to pieces again. A full set of scale model signal parts, including upper quadrant frames is also available, and a model signal cabin with an entirely new design of lever frame which has a bracket to hold the diagram and card. The page devoted to the extremely popular gauge "O" steam Mogul parts will be welcomed. A full range of mechanisms is also included.

A fine model L.N.E.R. Mogul in gauge 1.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page iii of cover, must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Condensation in Anderson Shelter

COULD you please inform me if there is any preparation or treatment that could be applied to the inside of an Anderson shelter to stop the metal from "sweating." I have succeeded in making it entirely waterproof from without, but the beads of water which collect on the inside make the bedding very damp.—B. Allen-Milbourn (Southsea).

YOUR problem is a difficult one. The "sweating" of the inner sides of your shelter is due to the warm air of the interior of the structure condensing its moisture on the cold sides, and as long as the air is warm inside the shelter and the sides of the structure are cold, you will always have such "sweating."

Your only hope of a satisfactory cure is to line your shelter walls with some efficient heat-insulating material, such as asbestos. The exact manner in which you will do this depends, of course, upon the precise design of your shelter. However, if you act upon the above principle, i.e., of interposing some heat-insulating material between your shelter walls and the surrounding soil, or, alternatively, on the inner sides of the shelter walls, much of the trouble will disappear. We cannot, of course, guarantee that you will get a complete cure of the trouble in the above manner, but it will, at least, be very much lessened.

An asphalt lining to a shelter makes an effective heat-insulating medium. Probably you could procure one or two blocks of asphalt from a local building contractor.

Cement Floor : Damp Walls

A CEMENT floor which I laid recently is very dusty, and ravelling a little. Can you suggest anything to prevent this as in time I think a hole would be worn in the floor?

Also, how can I prevent dampness coming through a wall and destroying wallpaper?—Denis A. O'Connell (Cashel, Eire).

ARE you quite sure that the cement mix from which the floor was laid was of correct composition and that it contained its requisite proportion of coarse particles? If the cement has been incorrectly mixed, no amount of after treatment will put the floor right, and from what you say about the floor ravelling, we are inclined to think that you have had a faulty balance in the materials of the cement.

On the other hand, the trouble which you mention may be just "floriation," i.e. an exudation of salts from the concrete, which, in time, will cease.

It is extremely difficult for us to give a really reliable opinion as to the cause of the trouble without actually inspecting the floor. We should, however, be inclined to leave the floor for another month or six weeks, during which time the floor should be washed down frequently with plenty of water, and afterwards carefully dried. If, after this period, the floor is still "dusty," you might try swabbing a moderately strong solution of sodium silicate into it. The silicate would penetrate the concrete and would tend to bind the loose particles together. After this, an application of an emulsified wax polish, such as "Britphalt" polish (obtainable from British Asphalt & Bitumen, Ltd., Preston, Lancs.) would do much to impart a smooth and lasting surface to the floor, provided the latter was devoted to ordinary uses.

As previously mentioned, however, before a definite prescription for the treatment of the floor could be given, it would have to be inspected, and the details of the cement composition would have to be known.

2. Here, again, in the case of your damp walls and wallpaper, you do not give any details which would enable us to form an opinion as to the cause of the dampness. It is hardly possible to produce a wallpaper which will resist dampness. We can only suggest that you look for the cause of dampness and try to cure it. If the dampness is incurable, you can combat it by pasting on to the wall sheets of "laminated lead" (i.e., lead foil) which is obtainable from most decorators' stores. Alternatively, you can make up a solution of aluminium stearate in cold naphtha, and brush this on to the wall. This solution will provide a damp-resisting medium, and, indeed, it can be applied to wallpaper, but, of course, a certain staining would result.

Aluminium stearate can be obtained from Messrs. A. Boake, Roberts & Co., Ltd., Stratford, London, E.15. You might also be able to obtain it from Messrs. Harrington Bros., Ltd., Shandon Chemical Works, Cork. In making up a solution of aluminium stearate in naphtha you must be very careful not to heat the solution, otherwise a useless gelatinous mass will result. Dissolve the aluminium stearate in the cold or only slightly warm naphtha, and always remember, of course, that naphtha is inflammable.

Transformer for Arc Welding

I AM building an electric arc-welding apparatus to work on 200 volts A.C. I am familiar with the welding principles, but I am at a loss to know which is a suitable type of transformer to buy, or make.

I wish the machine to supply current from about 40 to 150 amperes with sockets to supply current for different gauge electrodes. I would be obliged if you could supply me with details.—C. J. Levens (Highbury).

ASSUMING the average arc voltage to be 24 volts, and the maximum welding current you require to be 150 amperes, the rating of the transformer would be 3,600 volt-amperes. The primary coil is placed on one of the long limbs, the secondary coil on the opposite limb, as good voltage regulation is not essential, but rather detrimental than otherwise, the design called for being one in which a momentary short-circuit on the secondary shall introduce a large volt drop in the secondary and so tend to self-regulation. The core is to be built of insulined "Stalloy" sheets or strips, obtainable from Sankey & Sons Ltd., Albert Street Works, Bilston, Staffs. The primary winding, allowing a flux density of 60,000 lines per square inch and a reactance of 0.89 volts per turn on 50 cycles will consist of 225 turns of No. 11 SWG d.c.c. copper, with tappings at 200 and 205 turns. Variations in the secondary output are to be obtained from these instead of employing series resistance control. For the secondary coil copper tape will be required, having a section of 0.105 sq. in., say, 1 inch wide by 0.1 inch thick, treble cotton covered. For construction details, see A. H. Avery's "Auto Transformer Design."

Magnetic Figures

CAN you please inform me how to obtain magnetic lines of force visibly? Also is it possible to control magnetic lines of force in a straight line or other direction if magnets of any kind were suitably arranged? If so, should I require powerful magnets?

Is blotting paper suitable for filtering liquids? I believe there is a glass core tube for holding the filters.—H. L. Haigh (Southwark).

TO render the so-called magnetic lines of force visible to the eye, the usual method is to place a magnet under a sheet of thin white card and dust over the surface with fine iron filings from a muslin bag, tapping the card gently until the filings arrange themselves in definite lines. The lines cannot be controlled in any definite direction unless guided or compelled to take abnormal directions by the presence of other magnets or masses of magnetic material. The only circumstances in which a "straight" line of force naturally occurs is when a filing diagram is made with one pole of the magnet fixed vertically under

the card, as the lines then radiate outwards in apparently straight lines with the pole as a centre. Even then the lines are not really straight, since in actual fact there is no such thing as a "line" of force; the whole of the space surrounding any magnet pole is filled with magnetism, and does not consist of definite lines with blank spaces between, and it is more correct to regard it as a "field" of force since there is no possible portion in which magnetic influence is not present. The reason the iron filings set themselves in certain approximate lines is that being material particles they can only take up one position at a time. Magnetic lines from similar poles are always self-repellant, hence they naturally curve away from one another in the endeavour to reach a pole of opposite polarity.

Contact Sparking

WILL you please answer the following queries concerning the chiming gear for the Electric Master Clock, described in the October, 1938, issue of "Practical Mechanics." The operating drum is driven by a small A.C. geared motor, as advertised by Messrs. Gamages in your magazine. This motor is running on 16 volts, A.C. My trouble is that considerable sparking takes place at the contacts when the circuit is made and broken, and I wish to reduce this, if possible. Can I do this by connecting a condenser across the contacts, and if so, what would be a suitable rating, and where can such a condenser be obtained? Would it not cause some leakage of the A.C. current through the motor windings when not in use?—C. W. Rose (Rushden).

IN a general way contact-sparking can be reduced to a negligible extent by shunting the contact gaps with a small capacity, possibly in series with resistance. As to the most suitable values, actual experiment is the only safe guide, and it is suggested that you employ a 4 mfd. condenser, both with and without a 1000-ohm resistance in series with it, and note whether the results point to an improvement which indicates further combinations. Both items are usually obtainable from any "wireless" dealers, but if any difficulty locally apply to The Telegraph Condenser Co. Ltd., Farm Road, North Acton, London, W.

Electric Furnace

COULD you tell me how to construct a laboratory type electric furnace capable of melting up to ½ lb. of hard brass? Would a high frequency induction type be the most suitable, or would the more simple type of resistance furnace do for the purpose? Is there a good book on the subject?—Crisp Lucy (Wollaston).

BY far the simplest type of melting furnace is the "resistance" type, consisting of a suitable refractory primer or muffle wound with nickel chrome wire, and packed round with suitable heat insulation. There are, of course, a good many other technical points and precautions to take, as for instance, the choice of a refractory that is impervious to molten metal, otherwise a separate container or crucible will be needed to insert inside the muffle. Assuming you require to melt up to ½ lb. of brass, and that a temperature not exceeding 1000 deg. C. will suit your purpose, you cannot do better than build up the furnace by winding 65 turns of No. 26 S.W.G. 80/20 per cent. nickel chrome wire on a Morgan Crucible Co. muffle of the "AZ" size in "Triangle W" quality, spaced 12 turns per inch. The wire must be tightly wound over the outside of the muffle and afterwards liberally coated with aluminous cement N.29, obtainable from the same source, afterwards mounting the wound muffle in an outer shell iron casing with a radial thickness of at least 2 inches of heat insulating material all round. The grade known as "Newtempheit" is one of the most suitable, obtainable from Turner & Newall, Ltd., Asbestos House, London, S.E. The muffles are obtainable from The Morgan Crucible Co., Ltd., Battersea Church Road, London, S.W. A furnace such as the above will take about 30 to 40 min. to heat up to 1000 deg. C., starting cold, and the consumption on 230 volts will be 500 watts. A good book on the subject is "Industrial Electric Heating," by J. W. Beauchamp.

Hand-Cleansing Cream

CAN you please give me the list of ingredients for a hand-cleansing cream, which, rubbed into the hands before any dirty work, forms a kind of invisible film, which, when washed off, removes any grease, dirt, etc.—F. Walwyk (Hounslow).

THE following is the formula of a good hand-cleansing and protective cream of the type which you require:—

Glyceryl monostearate	..	8 parts
Magnesium stearate	..	14 ,,
Beeswax	..	3 ,,
Vaseline	..	10 ,,
Mineral oil (say, medicinal paraffin)	..	5 ,,
Water	..	60 ,,

The above parts are by weight. Heat the ingredients to 70 deg. C., adding the *warm* water last. Stir rapidly until cold so that a thick white emulsion is formed. If required, the above cream can be perfumed by adding a few drops of any scent or essential oil during the final stirring.

We expect that you will now have considerable difficulty in obtaining the above materials. The best firm to make your enquiries for these is:—Messrs. A. Boake, Roberts & Co., Ltd., Carpenters Road, Stratford, London, E.15.

Changing 3-phase to 1-phase Motor

I WOULD greatly appreciate your advice on the following matter.

I have bought a ¼ h.p. motor of 220 volts, 25 cycles, 3-phase, and my supply is 220-volts 50 cycles, single phase. Would you please tell me what alterations are necessary?—G. T. Gosnell (Sidcup).

A QUARTER horsepower 3-phase motor, if rewound as a single-phase machine, would only develop about sixty per cent. of its original power output, namely, one-sixth horsepower. It will have to be entirely rewound, as single-phase motors need two separate windings, one main winding and one starting winding, the latter displaced by half a pole-pitch from the main coils. The speed on 50 cycles will need to be either 2880 or 1440 r.p.m., according to whether it is a 2-pole or a 4-pole stator winding. The latter will be rather the easier to carry out.

Setting out Holes in Division Plate

I WISH to construct a division plate for a 5½ in. S.C. lathe, and am thinking of fixing the plate to the driving wheel, and index to the side of headstock. Can you inform me of the exact method of setting out holes in a division plate?—Milton Thompson (Colne).

TO obtain accurate results you should get someone to drill the plate on a lathe provided with a division-plate. Or it can be done in a universal miller, using the dividing head, and a high-speed drilling attachment.

THE Cyclist
Editor: F. J. CAMM

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'Phone: Temple Bar 4363

Telegrams: Newnes, Rand, London

Comments of the Month

By F. J. C.

The Post-War Bicycle

NEARLY every cycle manufacturer is now engaged on war work. He is making devices far removed from bicycles, and in order to carry out this work he has been compelled to instal machinery which in the normal way is unnecessary for bicycle manufacture. Conversely, several firms who did not previously make bicycles have installed machinery well adapted for the manufacture of bicycles. After the war, therefore, when firms will be compelled to find work for machines no longer necessary for the making of munitions, competition for the home market will be keener than before the war. We know of several firms who propose to enter the bicycle market, and have already prepared designs for improved bicycles.

Old-established bicycle manufacturers, on the other hand, will also plan to produce an improved machine, but we suggest that the improvements should not be along the usual rut of flamboyant finishes, upright bicycles, special frame angles, and cut-away lugs. Unfortunately, some bicycle manufacturers have minds which are still back in the 'nineties. They presume that finality in design has been reached, and what was good enough 50 years ago should be good enough to-day.

Perhaps some of them, now that they have taken to cycling through the medium of the Centenary Club, may perceive directions in which they can improve their wares. In one direction at least they could do so, and that is in the direction of the transmission. The chain has proved itself as a reliable connection between the crank and the rear wheel.

Chain Wheels

UNFORTUNATELY, chain wheels still have a long way to go before they match up with the multi-linked device which runs on them. The attachment of the sprocket to the rear wheel is the first thing which must be remedied. A sprocket which is screwed to the hub cannot run true on it. It should be driven on to a taper extension of the hub as in motor cycle practice, or it should drive by means of splines as in later models of the Sturmey-Archer hub. It will then run truly.

The chain wheel needs to have correct tooth form, and it needs to be re-designed so that it revolves truly both circumferentially and sideways. A disadvantage of the chain drive is that even with a fixed gear there is a certain amount of lost motion because of the necessary slack in the chain, and this has revived interest in the shaft drive.

The F.N. shaft-driven bicycle was perhaps the best known of this style of transmission. It was positive, excellent for hill climbing, and one had the feeling that every bit of power was reaching the wheels. It went out of favour because of trouble with the bevel gear. This trouble could easily have been remedied, by fitting slightly larger gears of different pitch. The teeth were too fine, the material (no doubt the best that could be supplied at the time) was not quite suitable for the work, and the result was that occasionally the teeth stripped. The principle, however, was sound; with modern high-grade steels, gear grinding and generating machinery, and our greater knowledge of the strength of gears, it should be possible to produce a shaft-driven bicycle with all of the advantages of the chain drive and none of the disadvantages of the present chain wheels and sprockets. Also, the shaft drive provides the means of incorporating a speed gear, and it eliminates at once the need for a gearcase. It provides for oil-bath transmission. It is not a difficult manufacturing proposition, and should not add to the cost of the bicycle at all. The gears would need to be generated, hardened and ground and would last for ever, as they do on machine tools.

The alternative, if we are to continue with chain wheels and cranks, is for the chain wheels to be made of high-tensile steel, heat treated and with correct tooth form with ground finish.

Cut Gears

IT is said that most chain wheels on the market to-day are cut, but we require a definition of what constitutes cutting. A notching machine will cut teeth, and so will a press. We are referring, however, to teeth cut by the hobbing process, or by the Fellows or Gleason type of gear-cutting machines. We repeat what we have said in other issues that on a mass production basis it would not cost any more to supply correct gears, and it is, therefore, futile for cost to be advanced as an argument against their use.

Manufacturers will supply what is demanded of them, for that is the first principle of successful trading. If cut gears are demanded they will be supplied. The public needs to be convinced that they should demand them, but it should be easier to convince them on a subject which does not admit of argument, than it has been to convince them that special frame angles or upright bicycles are advances in design. We observed one or two competitors using block centre chain in recent time trials, and this has much to recommend it, although the disadvantage of such chains is that they tend to pick up grit. Theoretically, of course, only four teeth are needed on the chain wheel, for it is not the number of teeth in the chain wheel which decides the gear ratio, but the diameter. The less teeth, therefore, in the chain wheel, the less would be the friction, and the less the wear on the chain.

Head bearings can be improved. A cone bearing in the head is wrong. In fact, a cone bearing whilst it does its work well, is wrong on any part of the bicycle. Annular bearings are ideal and particularly in the head. The present head bearings tend to work loose in the frame and no amount of adjustment will eliminate the "rock."

Dynamo Lighting

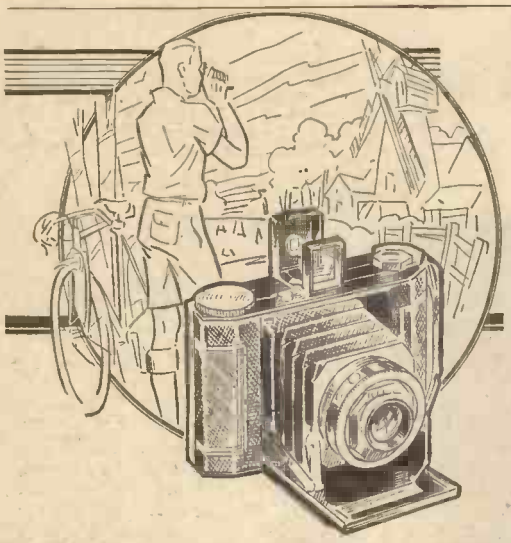
IF electric lighting is to be a standard form of bicycle illumination (and there are indications that this will be so), the present form of dynamo needs to be redesigned. As an adaptation to existing bicycle practice it performs its work well, for dynamo manufacturers cannot expect the makers of bicycles to redesign their machines to suit their accessory. After the war, however, when new designs will be laid down on the drawing board, it should be easy to incorporate a gear drive for the dynamo at the point where the power is applied, namely, in the bottom bracket. It is wrong to drive the dynamo from the wall of the tyre, although, as we have said, it is a satisfactory arrangement during the transitory period in bicycle design. A great deal of spoke breakage would be avoided if hub flanges were of larger diameter, and so designed that "bent" spokes were eliminated. It is bad practice to apply tension to a spoke which is bent at right angles close to the head end.

These are but a few of the directions in which the post-war bicycle could provide the cycling public with better bicycles and better cycling. We know that several firms are thinking along the same lines.

The Cyclists' Club

IN the late 'nineties there existed in London The Cyclists' Club where cyclists could call for luncheons and dinners at moderate fees. There was a library, reading room, and rooms for committee meetings. It was intended to provide cyclists with a meeting place in the Metropolis in much the same way as the R.A.C. has club headquarters in London. The Cyclists' Club did not, of course, exist as a road club.

In view of the many millions now cycling it seems strange that such a club does not exist to-day. Although the early effort failed financially, we feel that after this war such a venture could be made to pay. It would in our view be a move in the right direction, and provide something which at present is lacking. It would draw its members from thousands of cyclists who live and work in London and its environs. Perhaps the C.T.C. would care to consider the matter. There may be snags, but none insurmountable.



Paragrams

"Dod" Lawrie Missing

"DOD" LAWRIE, holder of the Scots 50 record in 1936 [illegible], has been reported missing in the Near East. A member of the Aberdeen Wheelers and the Aberdeen Paragon C.C., Lawrie was serving in the R.A.O.C. as a storekeeper.

Kent Wants Better Traffic Lights

KENT County Council has recommended that a new type of mask for traffic lights should be legalised. The device will make the lights more visible in daytime.

New Youth Hostel in Derbyshire

A NEW youth hostel was opened recently at Bretton, near Eyam, the Derbyshire village famous for its heroism during the 17th century. The hostel is on simple lines, and will be useful to Sheffield, Manchester, and North Midlands week-enders.

New Youth Hostel in the West

ANOTHER youth hostel was opened some weeks ago at Olveston, ten miles north of Bristol, and three miles east of the Bristol Channel. It will be useful to cyclists travelling towards South Wales and the Wye Valley.

Borstal for Cycle Stealing

A HULME (Manchester) youth, George William Leigh (19) was before Manchester City Sessions recently, having been committed from the City Police Court, on a charge of cycle-stealing.

Leigh admitted stealing 68 bicycles, mostly from outside public libraries and schools, and was sent to a Borstal Institution.

Award for Offside Door Victim

A CYCLIST who was knocked off his machine was recently awarded £10 by the Norwich County Court. He was riding in the black-out when he ran into the offside door of a parked car.

Percy Scholes a Sub-Lieutenant

PERCY SCHOLES, formerly an official of the Cyclists' Touring Club, Rochdale Section, and the West Pennine Road Club, has been made a Sub-Lieutenant in the Navy. Besides living in Lancashire, where he was a pass-storming enthusiast, he was also well-known on the north-east coast, where he resided before joining the Navy.

Speedy Scotsman

J. ARMOUR, Auchterderran Wheelers, clocked Scotland's fastest 25 time of 1941 (up to the end of June) in the Lanarkshire Road Club event. His time of 1 hr. 1 min. 29 secs. is the best of the year north of the Border, and the entry of 69 was also Scotland's best of 1941.

Cycling in the Far North

DESPITE the difficulties created by the war, cycling goes ahead in the far north-east of Scotland, where the Forres C.C. and ex-clubmen stationed with the Forces nearby are keeping the game alive. D. M. Sutherland, secretary of the Forres club, travelled 500 miles to be present at the Cumnock rally.

Ex-Ayrshire Champion Home

RECENTLY home on leave was "Chips" Drummond, of the Ayr Road Club, former Ayrshire champion. He is serving with a balloon barrage unit in Wales. When home, Drummond was along the road with old clubmates. He volunteered for service while on tour just before war broke out.

Clydeside's First of 1941

CLYDESIDE'S first track event of 1941, an open half mile at the Helenvale track, Glasgow, was won by J. Kilday, St. Christopher's C.C. The meeting was promoted by the Glasgow Union of Boys' Clubs.

Hendry Breaks Course Record

RIDING in the Lomond Roads 50, Alex. Hendry, Glasgow Wheelers, clocked the fastest Scots 50 of 1941, 2 hrs. 10 mins. 31 secs., and broke the course record.

Scots Official Has New Address

ROBERT MACKIE, secretary of the Road Records Association of Scotland, has changed his address. His previous home suffered in a Clydeside air-raid. Mr. Mackie now resides at 1663 Dumbarton Road, Glasgow, W.4. Notices of attempts on Scots road records should be sent to him there.

Rider's Successful Come-Back

H. SAMUELS, 40-year-old member of Southgate Cycling Club, whose champion he was 17 years ago, has staged a successful come-back after 14 years' absence from cycling. He won his club's fifty-mile event; secured the first handicap, and was five minutes faster than the next man. He is a member of the Metropolitan Police War Reserve and has secured several of their cycling handicaps.

Clubman as P.T. Instructor

BOMB. J. B. WADLEY, Colchester Rovers, has finished an extensive physical training course prior to becoming an instructor. He is with the Royal Artillery.

Club Secretary Marries

MR. E. M. BARKER, Becontree Wheelers Social Secretary, has married Miss E. Steel, one of the club's members.

Speedman Killed in Action

ONE of the most popular members of his club and an outstanding rider over short distances—his club 30-mile record still stands—A. Jackson, Bedfordshire Road Club, has now been officially reported killed in action.

Tandem Riders Killed

HARRY SPARSHATT, well-known Portsmouth cyclist and runs sec. of the Century section of the Portsmouth D.A., has lost his life while serving with the Royal Navy. He was a regular tandem rider, both racing and touring, with Buddy Wareham, who has been killed in an air-raid.

Clubman Was On H.M.S. Hood

ROY BEVERIDGE, Barnesbury C.C., was serving on H.M.S. Hood. Just prior to his call-up he set up a new local record of 9 hrs. 46 mins. for the Newcastle-York-Newcastle tricycle trip.

Record Holder's Death at Sea

MEMBERS of the Kynoch C.C. are mourning the loss, as the result of enemy action at sea, of Petty Officer Frank Hillyard, one of their most promising riders and holder of the club's 25-mile record.

Well-Known Sprinter Missing

J. F. SMITH, Hemsworth Wheelers, a brilliant sprinter, is missing. It is feared he died after baling out from his plane.

Ladies' 30-mile T.T.

THE Rookery C.C. is to promote a ladies' 30-mile time trial in memory of their popular member, Miss Nancy Gittins, who was killed in a road accident. A trophy has been allocated to the event.

Prisoner of War

QUARTERMASTER-SERGEANT PETER CHILD, Kingston Phoenix C.C., is a prisoner of war in Germany.

Sprint Champion's Marriage

SGT. W. W. MAXFIELD, National Sprint Champion, now in the R.A.F., has married Miss Betty Smith.

Jackie Brown

REPORTED "missing" over a year ago, Jackie Brown, Scots polo internationalist and member of the Paisley C.C., is now reported safe and well, but a prisoner of war.

Attacked by a Crocodile

SGT. HAROLD STOTT, Swallow Wheelers, of Rochdale, Lancs., had an alarming experience in Africa. He was swimming across a river when a crocodile seized his leg. He escaped, and after treatment was none the worse for his experience, although his leg was badly scarred.

Midland Rider Joins R.A.F.

GEORGE POSTLETHWAITE, Sheffield Phoenix C.C. star, one of the outstanding personalities of road sport in the Midlands, has joined the R.A.F.

Popular Clubman Missing

"DICKY" MOORE, popular member of the Wolverhampton Wheelers, is reported "missing," following a naval engagement in the Near East. He was on a destroyer.

Peterborough C.C. Carries On

THE Peterborough C.C., one of the oldest clubs in the country, is still maintaining an active existence despite the heavy calls made on its members by the Forces.

Popular Sunday Fixtures

KINGSTON Road Club manages to average an attendance of 21 members on all-day Sunday fixtures.

Rider in Open Events

F. R. TUGWELL, whose name appears as a competitor in open events, is the son of Mr. E. R. Tugwell, president of Norwood Paragon C.C.

Road Club's A.R.P. Unit

THE Bedfordshire Road Club is a self-comprised A.R.P. messenger unit and members have had special training.

Veteran Speedman as President

E. BLOODWORTH, prominent speedman of a decade ago, is president of his old club, the Broad Oak C.C.

Golden Wedding

HERBERT SYNER, famous exponent of the "Ordinary," and a former president of the Fellowship of Old Time Cyclists, has just celebrated, with Mrs. Syner, the golden anniversary of their wedding.

Queen's Park Clubman in R.A.F.

A FORMER London massed-start expert, H. W. Buckingham, Queen's Park C.C., is now a sergeant-pilot in the Royal Air Force.

Red Cross Contests

EVERY Cycling Club affiliated to the N.C.U. is to be given an opportunity of giving valuable help to the Red Cross by running interesting competitions with prizes for the winners. A supply of forms is available at N.C.U. Head Offices giving full details of the competitions, which will be known as the "Red Cross Cycling Contest." The contest may be either in the form of cycle races or reliability runs, or such club-room activities as roller contests, darts, or any of the hundred and one things that are provided by the average progressive club. The entrance fee for each contest is 1s. per member, 16 entries comprising one event. The 16s. should be sent either to the British Red Cross Sports Committee or the N.C.U. Head Offices, and the prizes are provided for the winners. Winners may select their own prizes from among the following: Memorial Cup, fountain pen, cuff links, carvers, set of Dorwin darts, "Zipper" powder compact, pewter tankard, jam dish and spoon, presentation twin pack playing cards, case of six fruit spoons and serving spoons, case of six tea-spoons, or shaving kit. The Union hope that every affiliated club will find some means of running a competition to support this very worthy cause.

Around the Wheelworld

By ICARUS

The Bath Road "100"

THE Classic Bath Road "100," the leading event in road sport, and which has been run almost continuously for 51 years (last year the Committee considered that war conditions would not permit them to run the event in a manner worthy of the club traditions) was this year run off on Sunday, August 3rd. Usually, of course, it is held on the Bank Holiday. The race this year had lost none of its glamour or interest, and a full card of 100 entrants eventuated from the 140 applications. It is interesting to record that it is precisely 50 years ago that C. A. (Bath Road) Smith won the event by one second from S. F. Edge. Greater interest attached to the trial this year for C. A. Smith himself was one of the judges of the event which he had made famous.

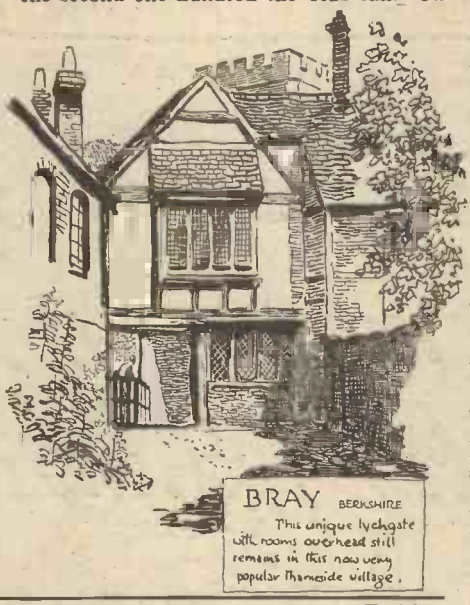
Timekeeper Dudley Daymond dispatched 87 riders out of the 100, and it was evident that some fast times would be made in view of the excellent weather. The field included such well-known names as Gawman, Pape, Crowther, Seath, Carr, Possard, and Straw. At 23 miles the forecast of fast times was borne out when Sibun, Perring and Pape clocked 1 h. 1 m. 30 s., 1 h. 2 m., and 1 h. 2 m. respectively. It is significant that Carr who finally finished second in the race, was not amongst the first twelve at 23 miles. At 50 miles Sibun had dropped back to 7th place, whilst Gawman had taken the lead at 2 h. 13 m. 0 s., with Perrin running second. At the turn (73 miles) Timekeeper Camm indicated that Gawman had got into the lead, at 3 h. 16 m. 53 s., with McCarthy second and Pape third. In the final run home, McCarthy, who had performed well and seemed certain to run into second place, had spoke trouble, and so no one caught Gawman, who returned the excellent time of 4 h. 30 m. 28 s. The first twelve riders are as follow:

Position	Name	Club	23m.	50m.	73m.	Finish
1	Gawman, D.	13th Wheelers	1 2 45	2 12 45	3 16 53	4 30 28
2	Carr, J.	Barnsley R.C.	1 5 0	2 18 0	3 24 31	4 38 14
3	Perrin, D.	Clarence Wh. C.C.	1 2 0	2 13 0	3 23 1	4 39 12
4	Henderson, P.	Kent R.C.	1 4 0	2 17 15	3 24 25	4 39 57
5	Seath, L. M.	Vegetarian C. & A.C.	1 3 30	2 16 0	3 22 40	4 42 12
6	Pape, F.	Castlenau C.C.	1 2 0	2 13 50	3 22 14	4 42 55
7	Attwood, A. W.	Balham C.C.	1 4 45	2 19 40	3 26 45	4 43 16
8	Furnari, V.	Ealing Manor R.C.	1 3 15	2 15 30	3 28 45	4 43 27
9	Crowther, T.	Derbyshire R.C.	1 2 45	2 16 30	3 25 50	4 43 50
10	Barfoot, R. H.	Hampshire R.C.	1 4 30	2 17 45	3 24 41	4 43 59
11	Witcombe, J. G.	Twickenham C.C.	1 6 45	2 21 0	3 28 29	4 44 2
12	Counsell, C. F.	Southern Roads C.C.	1 3 45	2 17 40	3 26 52	4 44 4

A large crowd had turned up to witness the event, which was unmarred by incident, except for a report by some of the competitors that one at least had received pace. This complaint, which was not reported to the judges at the time, is being investigated by them. The winner's time should be compared with that of C. A. Smith, who 50 years ago returned 5 h. 59 m. 11 s. He expressed the view that it would not be long before the "100" was won in 4 hours or less.

In connection with the race, C. A. Smith writes:—"Despite the shouts of those who said you must not hold events in war time this annual race took place over the holiday period and there were no complaints from anyone. It was a triumph of organisation usual to B.R. affairs. I cannot remember any special gears winning this contest, but I am going to point out that Gawman won on an 83 *plain* gear. And the time was 4½ hours! Would he have done any faster on any of the gears so much in vogue; My reply to that is—"No"! Carr, too, was on a plain gear, and his time was 4 hrs. and 38 mins. Third was Perrin on one of the chain gears, whilst Henderson got 4th best time. His machine was fitted with gears. At the start I counted 53 ordinary gears, 17 derailleurs, and 17 hub gears. When I was racing in the 'eighties and 'nineties we were not thinking then of 20 miles in the hour, but now I am thinking we shall see 25 miles an hour for hundreds in another year or so! Gawman has shown what a big gear can do 4½ hours, so if he really hurried a bit more next time I shouldn't be surprised to see much better time!

"I was reminded at the race that it was fifty years ago when I won the B.R. 100, the second one hundred the Club ran. On this occasion a Challenge Cup was put up. Any club member winning it twice to be the winner. There was a good entry, and in the run-in I was a few inches in front of S. F. Edge. The next year I won again, and thus the Cup became my property. Last year it may be recalled, I returned this Cup to the Bath Road Club, so that it might be competed for again. The times were: 1891, 5.59.11, and 1892, 6.15.31."



It is also interesting to record that the race was timed with one of the late F. T. Bidlake's watches, which had been specially tuned by Mr. F. J. Camm for the Kew "A" Subsidiary Certificate. It passed with flying colours. It also should be set on record that many of the riders suffered tyre trouble. The other judges were E. Coles-Webb, and Percy Beardwood.

Immobilising the Bicycle

THE question of immobilising the bicycle in the event of invasion has been the subject of correspondence between the Ministry of Home Security and the National Cyclists' Union. The Ministry sent the following letter to the N.C.U.:

"I am directed by the Minister of Home Security to inform you that consideration has been given to the question of immobilising bicycles should they be in danger of falling into the hands of the enemy in the event of an invasion of this country. As a result it has been decided that one uniform method of immobilisation should be recommended and that this should be the removal of the driving chain. If there is time to do so, it would be desirable if the nuts of the rear wheel and the pedals of the bicycle could also be removed. But these additional measures should not be regarded as alternatives to the removal of the chain. Any parts so removed should, of course, be hidden."

Hampshire R. C. "25"

I SEE that E. V. Mills completed the Hampshire Road Club's "25" recently in 1 h. 3 m. 31 s., and W. D. Paul in 1 h. 4 m. 7 s. This is the manner in which each finished a week's holiday. I understand also that Marguerite Wilson did a private time trial over the same course in 1 h. 9 m. 8 s. About a year ago I timed Marguerite Wilson over a 25-mile course on a private time trial, on the Portsmouth Road when she returned 1 h. 6 m. 0 s. I understand, however, that on the Hampshire course she had trouble with the transmission. By the way, when *is* she going to attack that "50" record at present held by Mrs. Briercliffe?

The latter recently attacked Miss Wilson's Glasgow—Edinburgh and back record, which she holds at 4 h. 33 m. 0 s. The out and home distance is 88½ miles, and Mrs. Briercliffe started from Gyle Bridge and kept to schedule as far as Glasgow where she had lost a minute. At about 6 miles from the finish, however, it was apparent that she was well out of record, and she retired at Broxburn.

Ross Appeals

L. J. ROSS has appealed against the decision of the National Committee, which declared that he was no longer an amateur.

In accordance with the Rules, the Chairman has set up a Committee to hear the appeal and the following have accepted the invitation and will hear the appeal:—R. J. Austin, A. E. Armstrong, and S. Pontin.

R. J. Austin is the Secretary of the Manchester and District T.T.A., is a member of the Anfield B.C., and is the Chairman of the Manchester District Council of the R.T.T.C.

A. E. Armstrong is President of the Northumberland and Durham C.A. and is a prominent worker for the sport in that area.

S. Pontin is a member of the Finsbury Park C.C. and is the hon. secretary of the London North R.T.T.C. District Council.

Barnstaple Wheelers Suspend Activities

THE Barnstaple Wheelers have decided to suspend its official activities for the duration of the war. This was determined at a general meeting. In addition to the very large number of members lost to H.M. Forces, another club has been formed in the town, which has still further decreased their membership. Under such conditions it was decided to disband for the duration and thus safeguard the club funds. By so doing the club will be able to make a fresh start when their members return. As far as possible the club will continue its activities in an unofficial capacity.

CAVALCADE *of* CYCLING

Horse v. Cycle

A print bearing the date 1819, while yet the bicycle had not emerged from the hobby-horse stage, nevertheless is eloquent of the excitement occasioned by the new mode of transport. Whether this epic contest was ever staged is not known beyond the evidence afforded by the print, but the description "Match against Time," or "Wood beats Blood and Bone" is certainly prophetic.

THE MOST NOTABLE CONTRIBUTION to the development of cycling was the introduction, scores of years later, of the pneumatic tyre, by a Scottish veterinary surgeon, John Boyd DUNLOP. *Destined to revolutionize mechanical transport, it made cycling popular for the million.*

IH/302

WAYSIDE THOUGHTS

By F. J. URRY

Latest Advice

THE cut in the petrol ration will make hundreds of thousands of folk think in terms of cycling as the next best thing. Whether they will be able to implement that thought with action is another matter, for bicycles are in short supply, and even the few that are coming on the home market will grow less and less as the war wears older. For a long while now I have tried to warn folk of the possible petrol shortage, but the motoring mentality of many people will not allow them to imagine the fuel will dry up—so far as private supplies are concerned—until that moment arrives, and then they are unprepared for a quick change over. I have no desire to croak or gloat—times are too imperative to waste moments in "I told you so" discussions—but as I read the latest edict, pleasure motoring will soon cease altogether and "convenient" motoring—as opposed to necessary journeying—will be cut to the limit. There has, of course, been a lot of wangling, the juice has been "borrowed" from lorry supplies, and fairy tales have been told regarding essential journeys; and indeed most folk who run a car have found some means of obtaining an occasional tankful beyond their allotted quantity. I speak of things I know about, even if I cannot prove them. The powers that be are well aware of these things and doubtless know how to check such little invasions when the moment is ripe so to do; and that time appears to be approaching. So let me once more suggest to all whom it may concern that the value of bicycle ownership is steadily increasing, and if you know where there is a good one for sale—buy it.

The Machine to Buy

BUT don't, I beg of you, buy the wrong type, even though you may be prepared to give quite a respectable sum for it. Think in terms of comfort and ease, and not so much in the appearance of what used to be known as the "de luxe" model. That, indeed, was usually a delusion and snare—heavy, awkward and ungainly. You are not likely to obtain anything very special these days, unless you know your dealer and can trust him; then take his advice. If you have a cycling friend, talk to him about the matter; he may upset your preconceived notions of the bicycle you need; but trust him to know best. This matter of bicycle selection is important, for on it depends the building up of a faith that there is more in cycling than you thought. Let me give you my own specification for a machine that may be obtainable to-day. It is a replica of my mounts, except in little personal details not now procurable, such as four-speed-hub gears, and special all-black finishes. If you are of average build, a 22 in. frame with 10½ in. bracket, 26 in. by 1¾ in. tyres of lightweight build, pedals wide enough to take ordinary walking shoes, a Brooks B72 saddle or good leather 4-wire seat of similar-pattern, gear not more than 63 in. for a single-geared machine, or 60 in. normal with a 3-speed hub or Cyclo derailleur, a flat or slightly dropped bar with good cable brakes, and the best model you can obtain answering this description. On a machine of this type I ride nearly 70 miles every week to and from work, run in an occasional week-end, and do endless pleasure rides whenever the leisure falls to me. I am a happy cyclist because the bicycle fits me, and you can go and be likewise inside a month of quiet riding.

Get the Machine in Order

I KNOW there is a feeling among people who are only just beginning to become cycling conscious that the easiest thing in the world is to walk in a shop and buy a bicycle. That may still be so in some districts; but even so, I'm doubtful if it would be the right type of bicycle. When the maker and dealer are excusing themselves for non-delivery of orders, the reason is not one given to annoy you, but genuine shortage of supplies. Hundreds of cycle retailers and repairers have gone into the war factories because they cannot get sufficient goods to sell to enable them to obtain a decent living, and hundreds more will eventually have to do similarly for the same reasons. Months ago I could foresee this state of things coming, told you so, and warned you to buy then, or if you were satisfied with your present mount, have it put in first-class order while the opportunity was with you. I have, with the result that my diminished stable of machines is now in first-rate condition and fit to face the rigours of winter. Also I was lucky enough to buy a spare set of macks long before the incidence of the Purchase Tax or the coupon system, lucky—because none of us could guess these things were to occur: but we should have been able to realise that a shortage of good goods was likely. So if you have a bicycle in commission now, just spend a few minutes on examination of tyres, chain, brake-blocks, etc., and if renewals are wanted, go to your friendly dealer and see what he can do for you. The bicycle is going to be more valuable than ever as a travel convenience. See you are equipped for easy journeying now.

The Wear By Neglect

I WORK in a factory where over fifty per cent. of the people employed use bicycles as the means of travel, so I have every opportunity of noting the condition of the hack bicycle in daily use. And generally speaking it is deplorable, due, almost entirely, to lack of adjustment and lubrication. The latter point I cannot understand because the oil-cans in this place are never out of sight, and no one at work in it would be denied the few spots of oil needful for bicycle lubrication. There are a few exceptions, men who really take care of their property, and in almost every such case the machine is of the better class. These folk know it pays to buy the best they can afford, and then take care of it. Of the others, it seems quite hopeless to talk to them or tender advice. I have shown a few of them how to keep a machine correctly adjusted, but in a month the state of the bicycle is as bad as ever, and apparently no notice is taken of the little lesson until breakdown occurs, when the maker is blamed for the lapses of the owner. In normal times, perhaps, this condition of affairs is good for trade because it does more to wear out bicycles than the riding of years; but to-day the need to keep every possible machine in commission is important, and these careless folk are beginning to find that out, with the result that I am pestered for advice and help because the dealer cannot give the service needed, and if he can, then the price of it shocks these folk. What a pity it is that so much decent machinery is ruined by neglect.

Notes of a Highwayman

By Leonard Ellis

Cotswold Tour (continued)

THERE is a curious charm about the Cotswolds that never palls. Some scenes in other parts of the country please and are forgotten, but one cannot forget the Cotswolds. It is true that as the years pass one is apt to adjust one's values but this may be due to an actual change for better or for worse in the places themselves. At the present time the Cotswolds are suffering from the world-wide malady. To give details would be unwise, but it is sad to see the glorious landscape carved and mutilated for such horrible purposes. On re-visiting the area one is apt to be a little disappointed, but the new tourist will not only fall in love with the district but will realise that later visits, when times are more normal, will bring even greater pleasure. It is true that a few of the villages have become insufferably sophisticated. They are still beautiful, as show places always are, but they are not natural, and do not please as they should. And so one adjusts the scale of values as it once related to Broadway and Bourton-on-the-Water. Of all the Cotswold towns there is one that is changeless, unless it grows even more attractive. Opinions are dangerous, but one is entitled to one's own. My opinion is that there is no other place in England like Chipping Campden. A small quiet town, utterly unspoilt, saved from vandalism and ruin by a far-seeing society who did not seek "to improve," Chipping Campden remains to be seen and appreciated more and more with every visit.

War-time Difficulties

THE intense heat during this little trip made long distances undesirable, but we managed to re-visit many of the old favourite haunts. Accommodation for meals was not easy to find, so that our standing camp, a caravan in an orchard, was ideal. In any case, the gradients in the district are far more severe than many of the roads in the mountain regions. Whereas in the mountains a road ascends and often stays in the clouds, the Cotswold roads change every few miles and keep ringing the changes on the altitude marks from 200 to 900 feet. One morning after climbing for a mile to the "Five Mile Drive" we dropped into Snowshill, lovely and secluded as ever, and then got utterly and unaccountably lost in an endeavour to find Stanton. Anyway, we reached Stanway and then Winchcombe by lunch-time, only to find that it was closing day in addition to war-time. Our plight was terrible, but the proprietress of a C.T.C. appointment saved the day and our souls—may she thrive. Of all the hills in the district few are so beautifully cruel as Sudeley. Two miles of slow walking in the sweltering sun and then reward—mile after mile of easy descents—the road edges paved with yellow rock roses.

The Venice of England

OVER the hills and not far away to Guiting Power, and then to Naunton, that so successfully by-passes the main road. A few more lanes and turns, across another main road and Bourton-on-the-Water for tea. The Venice of England is still beautiful, but one sometimes sighs for the old-fashioned shops instead of the large emporiums; for the rough river-side grass and the ducks instead of the trim lawns, and that the whole could be as natural as it once was. On the way back to camp we paid a flying visit to the world-famous Slaughters and Swells, just as sweet and as natural as ever, but most difficult to photograph. Then came Stow-in-the-Wold, standing aloof from the collection of radial roads, a long downward sweep with magnificent views to east and west and into Moreton-in-the-Marsh. Just a few more miles, left and right, right and left, over a course carefully memorised in these signpostless days, past the old church at Batsford, through straggling Paxford and back to Ebrington, one of the prettiest and probably one of the least-known of all the Cotswold villages.

A corner of old-world Campden

N.C.U. Secretary Visits Lincolnshire

THE General Secretary of the National Cyclists' Union, Mr. A. P. Chamberlin, gave an address on the Union's policy and progress in wartime at a Special General Meeting of the cycling clubs of the Lincolnshire Centre which was held in Lincoln recently.

My Point of View

BY "WAYFARER"

THERE is a fortune awaiting the inventor who will give us a fly which is fitted with an effective steering apparatus that is guaranteed to keep him clear of the eyes of cyclists. Another fortune awaits the inventor who can produce a midge—especially in Scotland—which has been brought up on strict vegetarian lines!

Remedy

THERE would be hardly any road accidents if every motorist drove, and every cyclist rode, as though they were carrying a basket of eggs—and if every pedestrian remembered that the yolk of eggs is not easily removed from one's clothes and person!

Seeing the Pictures

"TO-NIGHT," I said, at the end of one of the longest of our lovely summer days: "To-night I went to the pictures." "So did I!" was the quick rejoinder, and my friend reeled off the names of the film-stars he had paid to see. "As for me," I resumed, when the opportunity presented itself: "I cycled along the Ridgway until a special vantage-point was reached, and there I lingered, gazing over leagues of lovely country. I saw the Malverns and Bredon and the Cotswolds, together with other (and lesser) uprisings. My eyes dwelt on the sublime beauty which is still known as the Forest of Arden. I did my best to assimilate a series of gorgeous pictures, noting here a slumbering English village, and there an isolated rural cottage home. I turned to the sky and watched 'the sacrament of sunset'—watched the clouds develop into imaginary islands and bays and lakes—watched the joyous blue and green of the western heavens stained with red and pink and purple. And then, in the gloaming, I came back home—and the whole show didn't cost me a cent! Those," I added, "are the pictures for me—every time!"

Happy Confusion

IT was said in these columns a few months ago that the absence of sign-posts adds a new piquancy to one's cycling. I specially observed that happy flavour on a recent Saturday when, in the course of a periodical pilgrimage to a pleasant house of call in glittering Shropshire, I suddenly made up my mind to take a dive into the unknown—or, at any rate, the lesser known. I turned this way and that, and soon lost my bearings. But what delightful lanes fell to my lot—a steep pitch here, a one-vehicle-width road there, and a much-bent lane somewhere else—and all within 25 miles of Birmingham! So many twists and turns were made that all sense of direction was lost. Fortunately for me, the sun was shining, and I kept that in what I conceived to be the correct position—approximately. When really at fault—a heat haze hiding familiar hills—an enquiry at a wayside cottage set me right, and I soon found the main road of my desire, tea-time being at hand. Before emerging from the lane-maze, however, I was joyed to encounter an ancient red-brick, black-beamed farm-house which some wise townsman (presumably), possessing both money and taste, has re-bushed and brought into line with the requirements of what we call (often with tongue in cheek) Civilization. What a lovely picture it constituted in the blaze of a baking summer day!

Nemesis!

AFTER tea—and such a tea, quite forgetting war conditions!—I was called upon to pay the price for all this pleasure—and I didn't care a hoot. Distant rumbling became a thing of greater intimacy, and I cycled home in one of the most savage thunderstorms I have ever encountered. For 2½ hours, at least, there was a continuous performance of heavy rain, vivid lightning, and crashing thunder. At one point I thought that the world must be coming to an end, for overhead there was a violent tearing sound as though all the calico in Christendom were being ripped to pieces. The effect of this fantastic weather was quickly seen in the condition of the roads. Here they were flooded: there swift streams swept from side to side: at half-a-dozen points a thick bed of sand lay across the road, forming an unpleasant obstruction to encounter had it been dark. On emerging from lesser roads on to a great main highway, I began to participate in the free distribution of shower-baths. By then, however, I was just about as wet as I could be, and the hurrying motor-vehicles did me no harm. When home was reached, a hot bath and a change of clothing soon saw me right, and I was glad to have had the experience. It struck me that the price paid was small in comparison with the joys which had fallen to my lot earlier in the day.

On the following afternoon, for the third successive day, I was again cycling in violent thunderstorms. On this occasion I might easily have been the victim of a very unpleasant—perhaps fatal—accident. Suddenly, a violent tornado sprang up, and the heavily wooded road immediately ahead of me was instantly littered with great boughs which the combination of furious wind and torrential rain wrenched from the trees, almost completely blocking the highway for 30 or 40 yards. The experience was a startling one—but how much worse it might have been!

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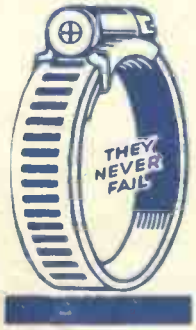

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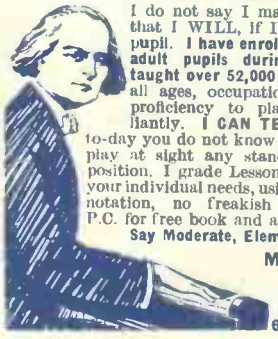

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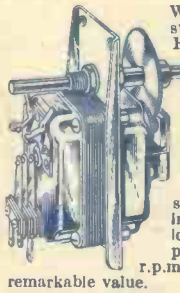

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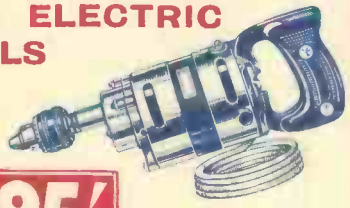

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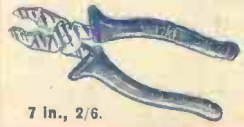

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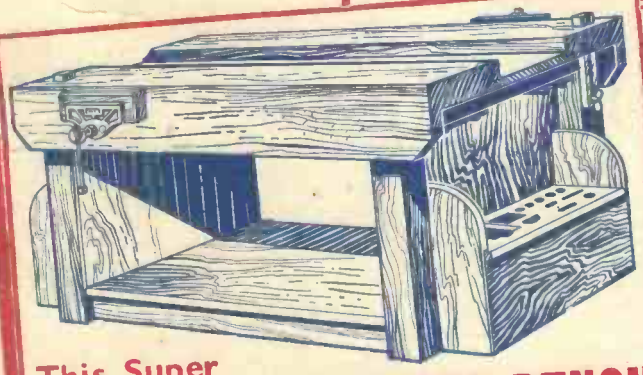

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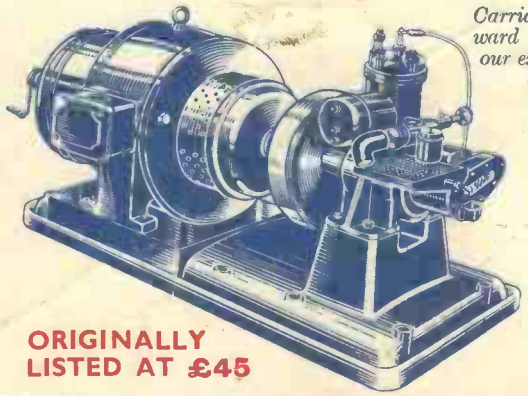

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