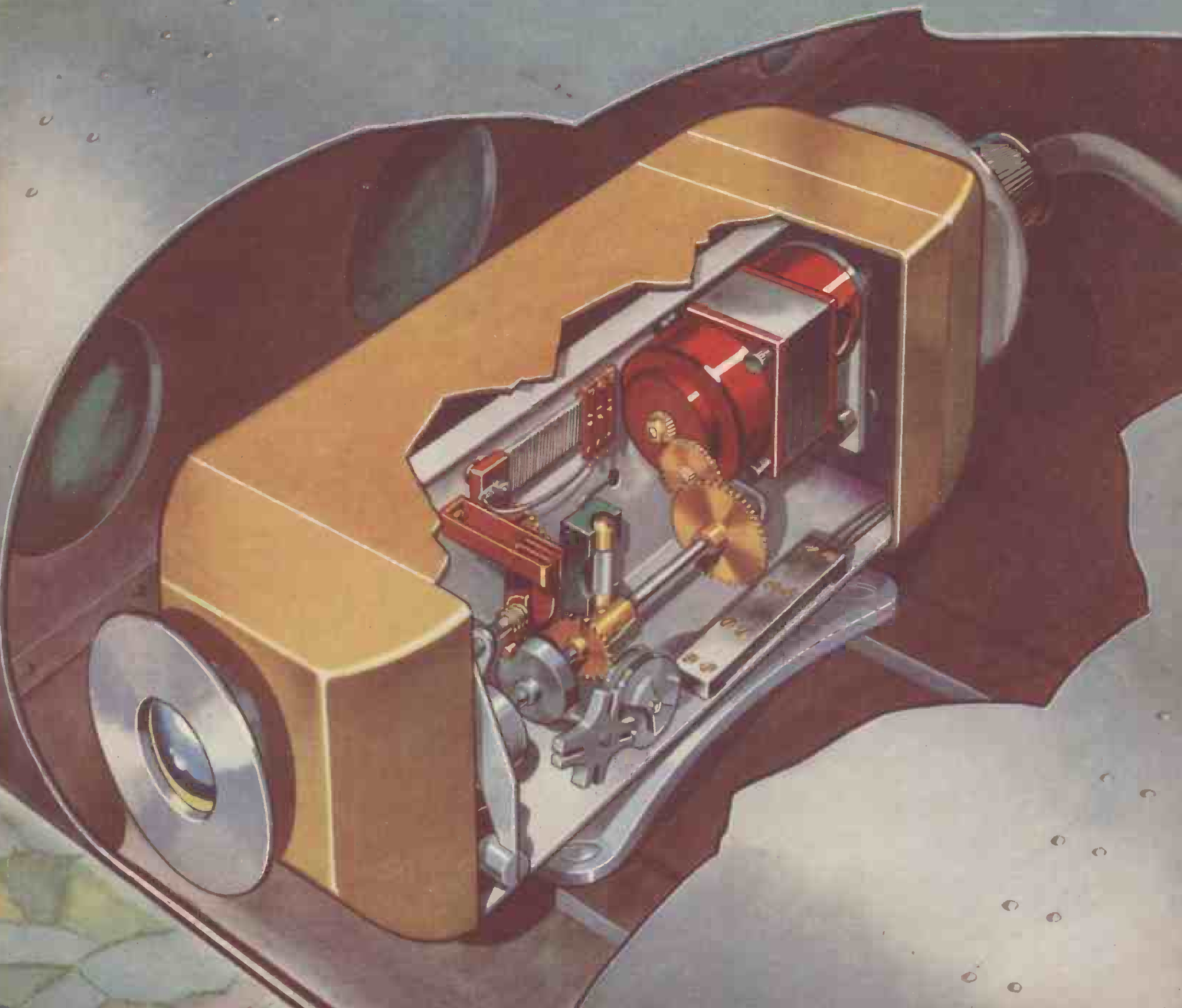
THE CINE CAMERA AIRCRAFT GUN

NEWNES

PRACTICAL MECHANICS

9D

JULY 1941



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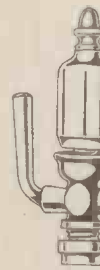

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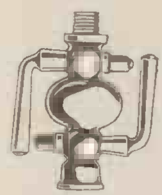

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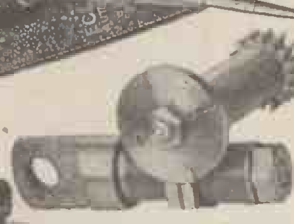

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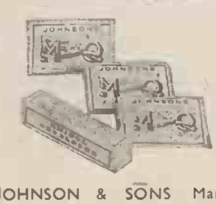

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PRACTICAL MECHANICS

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

Editor: F. J. CAMM

VOL. XIX. JULY, 1941 No. 94

FAIR COMMENT — BY THE EDITOR

Replanning

A GREAT deal is being said and written about Replanning Britain, Building Again, and the overhaul of our democratic system which is to take place after the war. There are those who blame the public and those who blame the Government. A country, it is said, gets the Government it deserves.

Most of the speakers overlook one important point. It is this. As it is quite impossible to forecast how and when the war will end, equally impossible to forecast what conditions will be like when the war ends and, further, what new conditions will arise, it is sheer waste of time to make plans for the post-war period and to postulate for the unknown. Let us not waste time making plans which may have to be scrapped, but give our undivided attention to winning the war.

But amongst the pious talk and idle chatter there are grains of common sense, and it is dawning on many that the practical people are those of most value to the State. In that direction we must certainly replan in a number of directions, if we are not to be caught napping again. Firstly, our Government must make up its mind that disarmament—at any rate for the next 25 years—is impracticable, and certainly undesirable. It cannot expect men to train as engineers if the workshops are not adequately supplied with orders, nor can it expect shipbuilders and marine engineers to remain in industries which do not provide them with reasonable livelihood. They drift into other jobs, and when needed are not available. We must encourage the bootmaker to stick to his last. This can partly be achieved by a free flow of Government orders, and development of our export trade. We must remember that, if export trade is necessary to pay for the war, it is equally necessary to pay for the peace-time reforms which public speakers assure us are to be brought into being; and exports must also help to pay our debts to America.

After the War

IN the meantime individuals can consider the replanning of their own lives after the war, and those about to choose a career should consider the prospects. It is certain that certain trades are going to boom and particularly the engineering, building, aircraft, wireless, automobile and bicycle industries, if we may consider the two latter as special branches of engineering. Aircraft, still a young but expanding industry, is having a forced development owing to the war, and that development will undoubtedly be applied to civil aviation. The Atlantic is being flown daily, and post-war inter-continental travel will cause the world to shrink. We may hence go farther afield in search of opportunity. Good prospects, therefore, in aviation. It is beyond all doubt that the building trade will flourish to remedy the ravishes of war. The new Britain must be planned to render it less vulnerable to air attack, and there will be opportunities in this industry also, and particularly for the man of ideas who can design, and mayhap invent some new system of building construction which eliminates the age-old method of laying one small brick on another small brick.

The engineering industries will be busier than ever, and so will the automobile, wireless and cycle industries.

Let us replan usefully, not merely evolve wonderful policies for other people to carry out. Individual effort and incentive are far better than reliance on State support.

Automobile Research

AT a recent meeting of The Institution of Automobile Engineers, Mr. W. A. Tookey and Dr. Edmund Giffen presented papers dealing with research in the Automobile Industry. A keen discussion followed in which emphasis was laid on the need for greatly enhanced support of co-operative research on behalf of the industry on the part of the manufacturers of motor vehicles, components and accessories, and in this connection Mr. Tookey pointed out that on the basis of the figures given in 1935 Census of Production for the Motor and Cycle Trades, nearly £54,000,000 was the amount of added value to cost of material, fuel and electricity, represented in the £132,000,000 quoted as the value of products. Thus, the £4,000 now subscribed for co-operative research by the vehicle manufacturers, engine makers and motor cycle firms amounted only to three-quarters of a hundredth of one per cent. on the £54,000,000 of added value.

Further points made in the discussion included references to the direct benefit accruing to the public from the results of co-operative research, in the form of quieter and more efficient means of transport and enhanced safety to the users of the road and the general public. Much had been done during the last ten years during which time the Research Committee had been under the aegis of the Institution but much remained to be done. It could really be called the Automobile Allied Industries Research Committee because much of its work (such as that on bearings and gearing) was of much wider application and valuable to all industries which used mechanical devices, in a greater or lesser degree.

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The R.A.F.

A short history of their cussion of their Chief

An air photographer operating a Lewis camera gun.

ALTHOUGH the title refers specifically to cine camera guns, this discussion deals with the progress that has been made in air gunnery training, first by the application of still photography, and then, as a perfectly natural development, the change over to continuous cinematographic methods. This development has not been rapid and has been accompanied during the course of the last twenty years by a considerable amount of painstaking research and experimental investigation, the fruits of which are just beginning to be appreciated in service to-day.

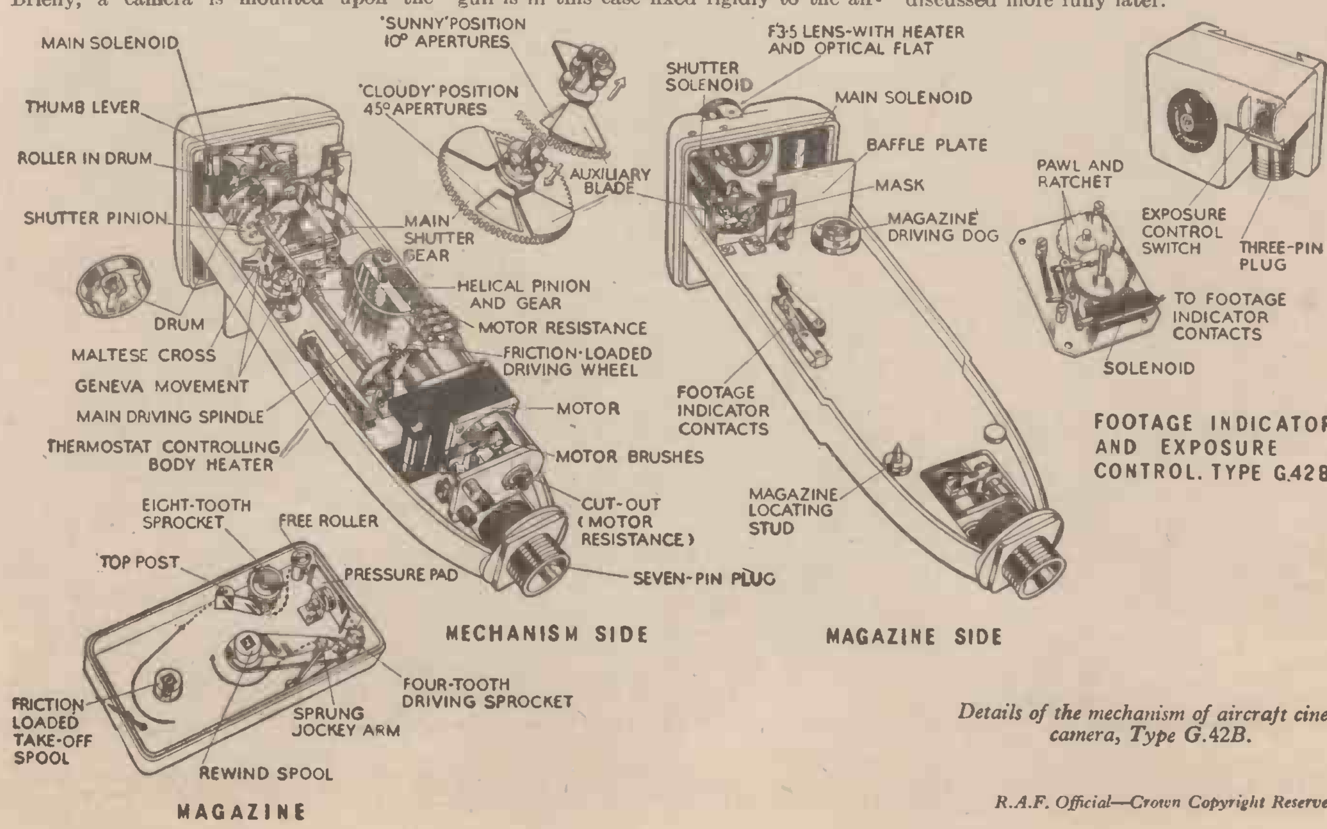
Replacing a Gun by a Camera

The idea of the camera gun is not new and was first bruited during the last war. Briefly, a camera is mounted upon the aircraft or the aircraft gun and is operated by the gunner, who may be the pilot, either deliberately, or automatically when he performs some other operation, such as depressing a gun-firing control inside the cockpit.

The early cameras were designed to take an instantaneous picture. It is, of course, necessary for the camera to be aligned to point along the axis of the gunsight, or for the camera to be itself provided with a set of sights by which it is aimed at the instant of firing. It is as well to distinguish here, I think, between two main types of installation, which have led at the present time to two main avenues of development. The first is the fixed camera gun, which corresponds to the fixed aircraft gun. The camera gun is in this case fixed rigidly to the airframe or wings and is aimed, as are fixed guns, by the pilot manoeuvring his craft so that the target is placed correctly in a fixed sighting device, which he looks through at the time of firing. The second type is the free gun, in which the camera is mounted on a movable mounting and may be aimed independently of the aircraft by the gunner, who aims and fires the camera gun just as he would a free aircraft gun. The power-operated turrets, of which so much has been heard lately, are merely an extension of this latter type of installation.

Type of Record

The record obtained by such means is used to assess the accuracy of aim of the gunner. It will be familiar and obvious, I think, to everyone, that it is necessary to aim in front of a moving object to an extent dependent on the relative speeds and angles of approach, an operation known as "deflection" shooting. To record a deflection shot, the optical system of the camera gun must be designed to embrace a field of slightly wider angles than the maximum deflection likely to be employed in practice shoots, and, of course, it is necessary to be able to measure from the central axis the angle of deflection the gunner has used. This was originally accomplished by superimposing on the record circular graticule lines which corresponded to standard types of deflection rings in the gunsights in current use. This practice was later discontinued for reasons discussed more fully later.



Details of the mechanism of aircraft cine-camera, Type G.42B.

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Cine Camera Gun

Development and a Dis-Design Features.

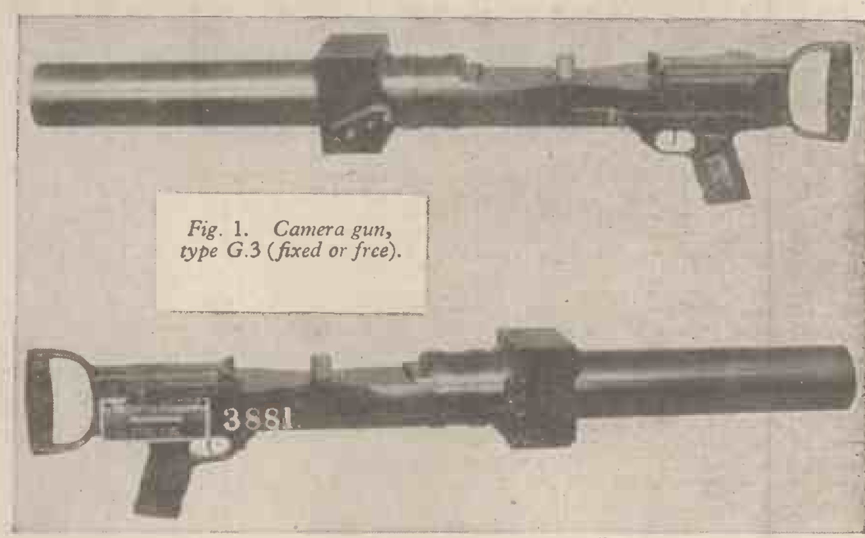

Fig. 1. Camera gun, type G.3 (fixed or free).

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In addition, it was considered essential in the early days to have a time recorded on each shot so that comparisons could be made during the assessment. An illuminated watch unit was generally focussed by an auxiliary optical system on one corner of the record and arranged to operate on each exposure being made. This practice has also been discontinued with the advent of

By C. J. DUNCAN, B.A.

(Technical Publications Department, Royal Aircraft Establishment, Ministry of Aircraft Production).

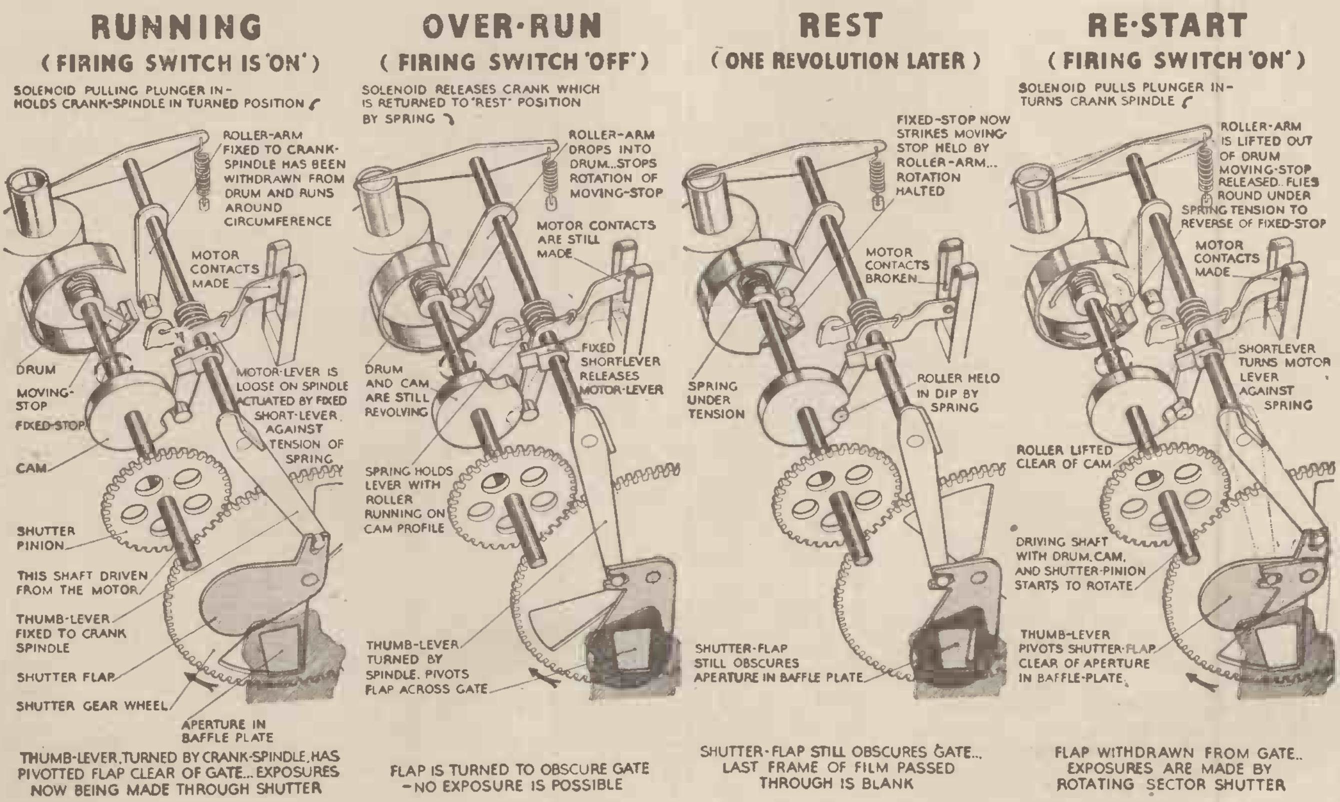
continuous cinematographic apparatus.

Gunnery Requirements

It is as well to realise from the start that this equipment is designed exclusively to suit the requirements of the gunnery side. It is an incidental fact, although a most important incidental, that photography enters into the picture at all, as it does in numerous other scientific and industrial applications. The cameras are designed to show the ground staff what the air gunner has actually aimed his gun at, and how he has maintained that aim, and if they fulfil that purpose then they are good gun cameras.

Any improvements of quality, steadiness and accuracy that are obtained must be primarily judged from this standpoint, and it must be borne in mind that simplicity of operation and maintenance, so far as is consistent with good quality, is a highly desirable feature of any apparatus likely to be handled by all types of service personnel in the course of their duties. Therefore, is is not surprising that the outward forms and arrangements of these cameras correspond so closely to the actual guns they simulate or replace—that they are operated in many cases in an exactly similar manner to the gun itself—that the mechanism is in some cases more robust and heavier than some of the professional cinematographic apparatus; since, although considerations of size and weight are important with regard to the design of any apparatus likely to be carried into the air, there is room and power in some cases for the extra strength which makes for a trouble-free service life for the equipment.

Latterly, however, compactness and unobtrusiveness have become increasingly important factors in design, with the result that some of this extra margin of strength



Stop and start cycle of operations of cine-camera G.42B. *R.A.F. Official—Crown Copyright Reserved*

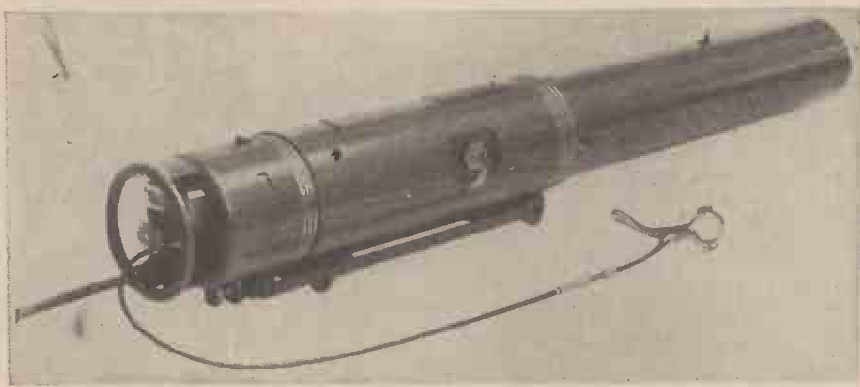


Fig. 2. Cine camera, Type G.9 (fixed).
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has had to be sacrificed. Nevertheless, these cameras are sturdier than many of the other instruments carried in the modern aeroplane.

G.3 Camera Gun

The forerunner of the present camera guns was the G.3 type, otherwise known as the Hythe Mark III (Fig. 1), which was made exactly similar in shape to the familiar Lewis gun, and in which the camera was fitted inside the barrel group. The size of picture it took was 2¼ ins. by 1½ ins., and it was fitted with a rapid rectilinear lens of 11 ins. focal length and maximum aperture of approximately f/11. The film used was of the Verichrome type, daylight loading on the normal 120 type spool. It was fitted with a three-leaf between-the-lens ever-set shutter. By pulling the spring-loaded cocking handle of the gun to the rear, a chain of gears was rotated to wind on the film. Pressure on the trigger tripped the shutter through a wire link and bell crank and released the cocking handle forward. At the same time that the pannier of the dummy gun was placed on the platform, a punch perforated the film record to show that the correct gun firing drill had been carried out. In the focal plane was placed an engraved graticule with cross hairlines and circular rings, by means of which the deflection could be read directly. The dummy gun was provided with the standard sights as fitted to the real gun, and previous to use these sights and the lens axis were aligned to coincide with each other. This gun was both fixed and free type; in the former case it was rigidly mounted in the aircraft to fire through the arc of the air-screw or in some cases on the wing, with a bowden-type remote control operated from the pilot's cockpit, and in the latter case could be mounted on an adaptor bracket to fit in the observer air-gunner's cockpit on the rotatable gun mounting. It could be used not only for air to air fighting, but also for ground to air and air to ground, and, of course, ground to ground.

Among its other inherent disadvantages was, however, the fact that it replaced the gun completely and no actual firing was possible at the same time as the photograph was taken. It remained in active use until 1931, when it was largely superseded by the types of G.22 and G.28.

Types G.9 and G.10

Between 1920 and 1924, experimental work was proceeding on rather different lines to produce the first type of *cine* camera gun. Even at this early date the advantage of a continuously recording camera was realised, although it is as well to emphasise that, the cine record having been made, it was intended to be examined frame by frame or step by step, and not to resort to continuous projection methods in assessing critically the results obtained and marking them on some standard basis.

The cameras that were developed, known as the types G.9 and G.10, used commercial standard 35 mm. film. The G.9 (Fig. 2) was designed as a fixed gun, and the G.10 (Fig. 3) as a free gun, both to simulate the Vickers machine gun, which was a standard armament in those days. Apart from their outward forms and the simulation of the gun cocking on the G.10, these cameras were practically identical. It was a bulky and expensive instrument, but in its precision and in its application of cinematography to the problems of air gunnery training, it was years ahead of its time and was a magnificent piece of work. It incorporated many of the features which we shall find in the present types in use. First of all, it was electrically operated, having an electric motor to drive the mechanism It was fired by a pressure trigger or bowden control. The film was contained in a daylight-type magazine previously loaded in the darkroom. A watch unit was fitted and the lamps switched on to illuminate the dial at the end of each burst of fire. It was fitted with standard attachments which could be bolted to the normal gun mounting. A counter of the "Veeder" type, driven from the mechanism, was placed at the rear of the camera gun in view of the operator to show the passage of film through the gate. A sighting unit consisting essentially of a ground glass screen and a 45° inclined mirror was provided, by means of which the camera axis could be harmonised to the axis of the gunsights. A graticule was provided in the focal plane engraved with cross hairlines. Two interchangeable lenses could be used, a Zeiss Tessar of about 4½ ins. (112 mm.) focal length and maximum fixed aperture of f/4.5, or, alternatively, an 11 in. lens. A

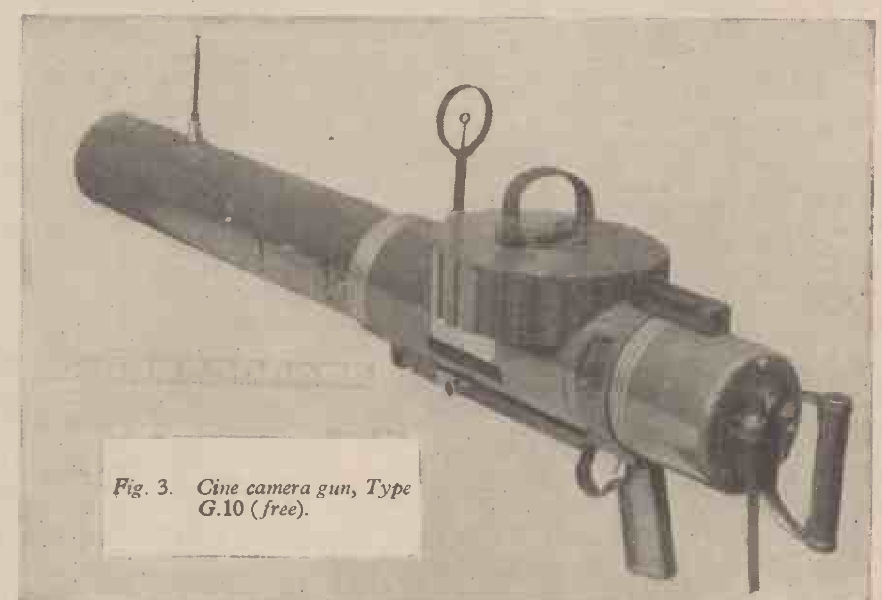

Fig. 3. Cine camera gun, Type G.10 (free).

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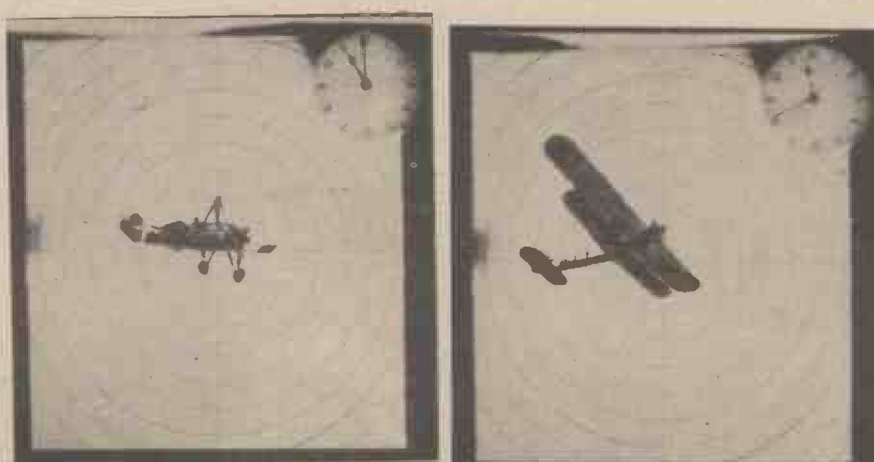

Fig. 5. Exposures made with a G.22 gun camera (note the double image of seconds hand).
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shutter flap over the front of the lens was swung out of the way before each burst. The sector shutter was conical in shape, set at an angle to the optical axis—an arrangement familiar in commercial cine cameras.

The G.10 closely resembled the G.9. It was, however, provided with bead and ring sights, a pistol grip and cocking mechanism. The cocking handle had to be pulled to the rear before the gun was fired. A dummy cartridge magazine was fitted to the gun, and it was provided with a single point of attachment to the gun mounting.

These early guns were built on the interchangeable unit principle. The mechanism was easily accessible for maintenance operations and the watch unit could be removed for cleaning, winding, and lamp replacements. The magazine as a separate unit could be loaded, cleaned and overhauled with ease. The lenses were removable for cleaning.

Unfortunately, the complexity, bulk and expense of the camera precluded its use in large numbers, and in addition, the problem of processing lengths of 35 mm. film without bulky and expensive apparatus seemed insuperable at that time. So the cine method was shelved for the time being and work proceeded on the development of a still camera which would go some way to meeting the above criticisms.

G.22 Camera

In 1931, the G.3 was replaced generally in the service by the type G.22 (Fig. 4). The G.22 was a fixed gun type and was followed later by a free gun adaptation, the G.28. The G.22 was small and was partially streamlined, and was generally mounted on the wing of the aircraft, although this depended on the particular aircraft in use. It was a single-shot camera using 120 type film in 10 or 16 exposure lengths, giving a picture approximately 2¼ ins. by 2¼ ins. The lens fitted was a Dallmeyer tele-anastigmat of 12 ins. focal length and maximum aperture of f/7.7. The shutter was of the louvre type, and the speed was roughly adjustable from about 1/25th second to 1/100th second for "dull," "fine" and "bright" weather conditions. It was provided with two separate controls, both of the bowden type, although pneumatically operated controls were introduced later. The first control wound on the film, operated a counter and set the shutter; the second released the shutter, taking the picture and illuminating the watch lamps through a dashpot or mechanical delay switch on the return stroke of the shutter setting lever. The shutter mechanism was provided with a stop to enable the louvres to be held in the open position for sighting, and once the setting lever had been moved forward the setting mechanism was automatically disengaged. The controls were carried inside the cockpit and placed near the gun controls. Over the front of the camera was provided a double or single-blade visor. This was originally provided as a protection against spray on seaplanes. It was opened before the exposures were made. The double type could be opened and closed, but once the single type was opened the air pressure prevented it being closed. They did, however, serve the double purpose of assisting in the streamlining and in keeping the lens clean, especially during the take-off and landing.

This camera gun was sighted by removing the battery from the back and viewing through the camera a ground glass screen placed in contact with the graticule, when the alignment could be checked. As the camera gun was now situated at a distance from the pilot's gunsight, it was necessary for the gunsight axis and the camera axis to be aligned on a sighting disc or target at a predetermined range from the aircraft. They would not coincide at any other range. This camera gun was used *in addition* to the real gun or guns, and the *range* now became important in assessing the results, not only on its own account, but also because it affected the record of the aim that the camera gun gave. These are two familiar features of present-day camera guns. In addition, the mounting provided for the G.22 and the accuracy with which the seating surfaces were reproduced in manufacture were realised to be of great importance if it was desired to remove the camera gun and to be able to replace it on the mounting and still retain the harmonisation. This is an essential feature also of our present types.

Fig. 5 is a typical G.22 record. There are the usual graticule rings and hair lines. The spacing of the rings is regular and represents on the axis or near it an angle corresponding to 7.4 feet at 200 yards range. In order that the length of burst should be recorded, the watch lamps were operated both at the beginning and end of the burst so that a double image of the seconds' hand was obtained. Various modifications were later introduced, the most important of which was to operate the shutter a second time on release of the trigger, so that a second picture was obtained of the target at the end of the burst. This gave, besides a time record of the length of burst, the point of aim at the beginning and end of the burst, so that some degree of interpolation was possible. This feature marks the transition from the still to the cine method. The second exposure was distinguishable in doubtful cases from the first as it was generally flatter in comparison with the first. Since the exposures in both cases were of the same duration and approximate intensity, this seems to indicate that the first or single exposure was generally on the toe of the characteristic curve.

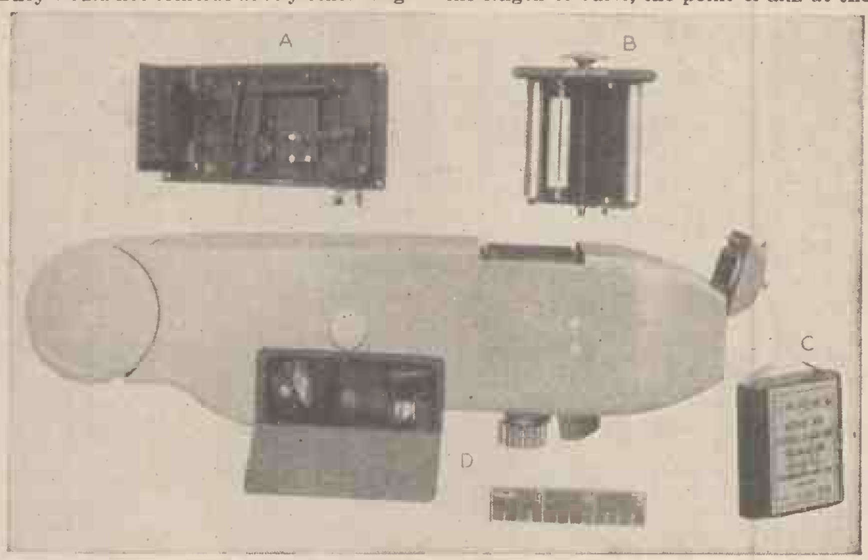

Fig. 4. Gun camera, Type G.22 (fixed).
A. *Louvre-shutter mechanism and watch lamps delay switch.* B. *Film holder.*
C. Battery removed for sighting. D. *Watch, watch lamps, and watch lens.*
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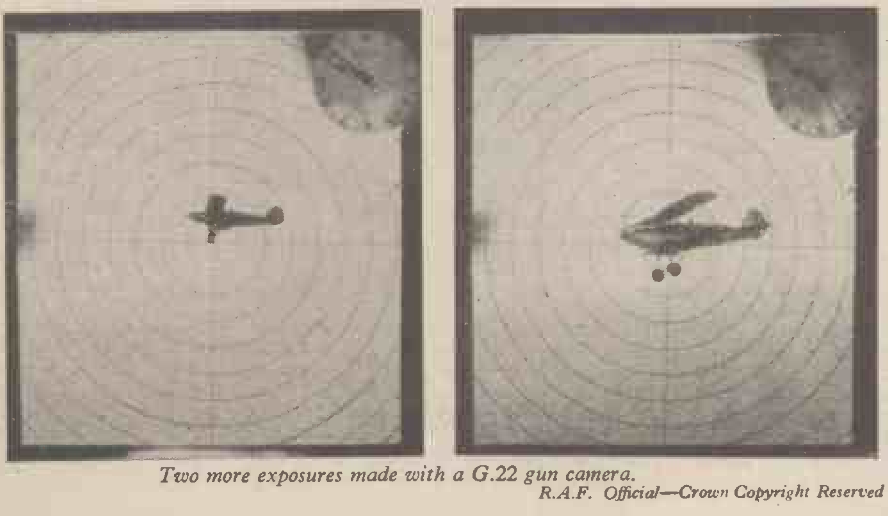
One advantage of this size of negative is that it is possible to mark the results by direct viewing of the negative or a contact print. This is one of the reasons, added to the ease with which the short length of 120 film could be processed, which accounted for the popularity this method achieved. The big disadvantage was, of course, the lack of evidence of the steadiness of the gunner's aim and his smoothness and accuracy in traversing. In fact, experienced camera gun operators could fire their camera to obtain perfect aim and deflection every time, and yet were proved, during practice with the real gun, unable to reach the standard set by their own camera gun records. The double record narrowed down this loophole somewhat.

(To be continued)



Two more exposures made with a G.22 gun camera.
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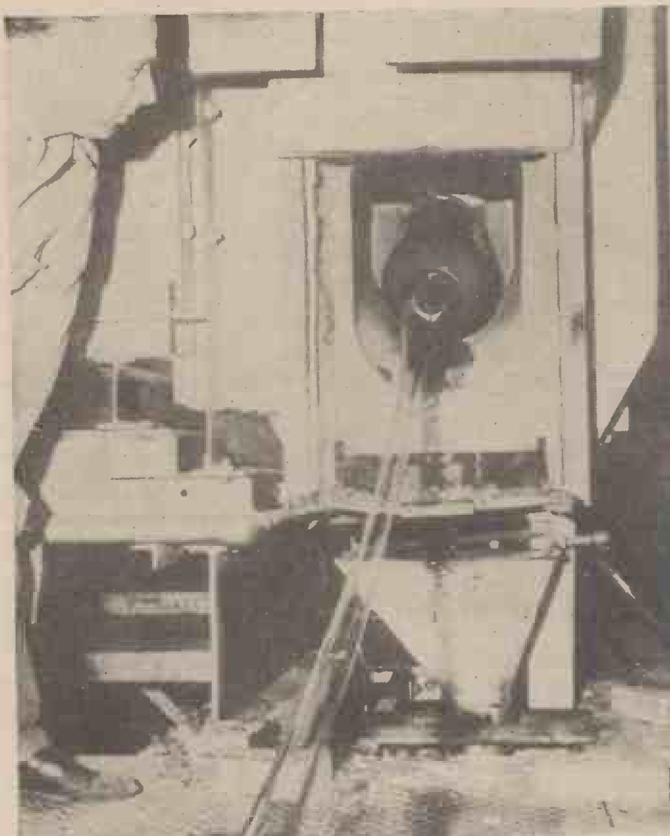


A stream of molten glass in the World's largest fluorescent glass plant at Jackson, Missouri.

THE MONTH OF SCIENCE

Wristlet Radio

A LIEUTENANT in the Polish Army, and Mr. I. Solar, a Dunfermline electrical engineer, have devised a wristlet broadcasting set. It is designed to help rescuers locate people trapped beneath wreckage. The set which weighs only six ounces and is three inches in diameter, can send out oscillations on a fixed wavelength by slight pressure on a celluloid strip. An ordinary portable set can pick up these oscillations and thus enable rescuers equipped with a receiver to locate a trapped person. It will operate for forty-four hours continuously on a small dry battery and will cost less than five shillings when mass produced. The Home Office are to test it.

A Powerful Incendiary Shell

A NEW type of anti-aircraft incendiary shell has been invented by Mr. John Pomeroy, of Melbourne, Australia, and his son. Even the most modern military aeroplanes it is claimed will not be immune from this shell as it can destroy even rubber coated petrol tanks.

The inventor claims that "it will penetrate quarter-inch steel armour and then explode, setting up terrific heat, which, if near the engine of the plane, will cause the pistons to seize. At the same time fire will spread over an area of 48 square feet."

Spray Gun for Mirror Making

THE old method of silvering mirrors, which has been in use for one hundred and five years, is likely to be superseded by a new process which promises very much finer mirrors. In the old method the glass lies flat on a table and two chemical solutions, a salt of silver, and a reducing agent are poured over by hand. It takes about half an hour for pure silver to be precipitated out of the solutions and plated to the glass.

The new process utilises a compressed air spray in silvering and is made possible by a new reducing agent which took its inventor nine years to discover. This new chemical causes instantaneous "planting out" of the silver, and only one-quarter of the factory space will be required. The glass to be silvered by the new process is placed almost vertical on movable conveyor racks, and the time needed for complete manufacture of a mirror, including washing the glass, silvering, drying, and putting on protective backing is greatly reduced.

Electron Lenses

A NEW and more powerful type of electron microscope has been made by engineering experts. The principles embodied are similar to those employed in an optical microscope, with magnetic electron lenses taking the place of glass lenses. The limit of useful magnification of microscopes using visible or ultra-violet light is, at the present time, 3,000 diameters. This is due to the relative long wavelength of the observing medium. High velocity electrons, which have an extremely short effective wavelength, can, with the aid of electron optics, be used in an electron microscope to obtain magnifications that are about 100 times greater than those obtained with a light microscope.

An Aquatic Tank

ACCORDING to U.S. observers in Berlin, German attempts to create a big aquatic tank have failed. Dr. Brunn, designer of Nazi heavy land tanks, has been experimenting for months on the banks of the Rhine, and when his invention was launched recently it sank in 30 seconds.

Atomic Research

THE General Electric Research Laboratory have recently installed a fourteen-foot "test tube" to be used for the separation of atoms of different weight by thermal diffusion. The principal parts of the instrument are two glass tubes, 14 ft. long, one inside the other, and a gold wire extending from top to bottom in the inner tube. This tube contains in gaseous form the material to be separated and is kept at a fixed temperature by passing steam through the inner tube. When the gold wire is heated, the lighter atoms go to the top and the heavier ones to the bottom where they are collected.

The Grand Coulee Dam

THE Grand Coulee Dam, which was to produce electricity for sale by 1943 and to cost £77,000,000, has two 20,000 kilowatt generators in operation two years ahead of schedule. They are the forerunners of giant 108,000 kilowatt generators, and were turned over by Dr. F. A. Bates, supervising engineer for the interior, to Paul J. Rayer, who is to market the electricity.

The Bangalore Torpedo

ONE of the devices used extensively in our advances into Italian territory, is the Bangalore torpedo, which was introduced on the Western Front in 1915. The invention of a young R.E. officer at Bangalore, in Mysore, which was headquarters and depot of the Q.V.O. Madras Sappers and Miners, it received the name of Bangalore. The device is used for clearing a pathway through barbed wire entanglements. An iron tube fitted with a conical wooden head is filled with high explosive and a fuse is inserted in its base. After thrusting it into the obstacle it can be exploded either with a safety lighter, match or electric lead—whichever conditions permit. If defences are deep, several tubes, each over eight feet in length and four inches in diameter, can be joined together and fired by one fuse. The torpedo is usually carried by two men. With the rest of the party they advance over No Man's Land to the enemy's wire, making use of all available cover. (See page 369.)

A Nut Cracking Machine

THE cracking of nuts is brought to a fine art by a new type of nut-cracking machine which can handle eight tons of nuts an hour. Not only does it crack the nuts but separates them from their shells, conveys them through a solution of brine where they are washed and salted to taste. In order to prevent the brine trough becoming corroded by the salt water, Monel was used in its construction as this is unaffected by the corrosive salt solution.

New Application for Nylon

NYLON, which is a synthetic fibre material used extensively for hosiery, is now being used for stringing tennis racquets in place of cat-gut. A method has been introduced whereby Nylon can be produced in the form of strings of about one-sixteenth inch diameter. Its advantages over cat-gut are that it is unaffected by atmospheric changes and does not fray as it is homogeneous throughout.

Mass Produced Ships

PLANS for small cargo ships of 1,000 tons to be turned out on mass production principles are being worked on by Admiralty engineering and shipbuilding experts. Many ideas have been examined and the most likely schemes are to be discussed at a meeting of experts which will be called shortly. An engineer inventor claims that

IN THE WORLD AND INVENTION

1,000 and 1,200 ton merchantmen, able to stand up to worst Atlantic weather, could be turned out quickly to a standardised design.

Plastic Cars

HENRY FORD has announced that the dies for the first cars with plastic bodies have been made at Detroit. The chassis will be of tubular steel, welded, and the plastic will have the composition: 30 per cent. synthetic resin and 70 per cent. fibre. The high content of fibre will mean a consumption, for 1,000,000 cars a year, of about 1,000,000 bales of cotton, wheat running into half a million bushels, and other ingredients from agriculture. The impact strength of the resin so formed is claimed to be ten times greater than steel, but has only half the tension properties of the metal. It will, like most other plastics, be moulded under heat and pressure.

Glass Tyres

IT has been stated by K. D. Smith, Technical Superintendent of the Goodrich Co., of U.S.A., that experiments with tyres made of synthetic rubber and glass have passed the blueprint stage. Investigations are being conducted on steel, glass, flax, cotton and rayon for incorporation in the treads, the cotton referred to being, of course, improved material. A drawback of certain types of synthetic rubber up to now have been their ack of staying power, and so the new developments will be watched with more than usual keenness by the tyre folk all over the world.

Glass Substitute

WHILST on the subject of glass it is of interest to note that yet another substitute for glass has appeared on the market. It is known as Dufay and consists of a thick transparent cellulose-acetate film in sheet form into which strong netting is embedded. Government institutions are now using this material which is stated to be the equivalent of ¼ in. thick plate glass.

New Tank Attachment

AN American development in connection with the tank is a new type of grappling arrangement for attaching to the back of a tank, so that it can rip a passage through barbed wire or other obstruction.

Movable Shelters

INSTEAD of going to shelters, workers in vital war industries are having their shelters brought to them. A conveyor belt brings them to the side of the production bench. The new shelters provide last-minute protection, and are blast and splinter proofed by 12 in. reinforced concrete, with a breaking resistance of 5,000 tons to the square inch. The smallest shelter accommodates four persons and will withstand tremendous debris loading.

A New Steam Engine

A NEW steam engine has been designed by S. L. G. Knox, and tested by Prof. J. I. Yellott, of The Illinois Inst. of Tech., Chicago. It develops 90 h.p., consumes 14.6 lb. steam per hr., at 595 lb. per sq. in. and 750 deg. F., its normal speed being 1,000 r.p.m. A double expansion engine, of 450 lb. weight, it can operate in reverse, by passing the steam through the inlet valves for normal operation, and through the exhaust valves for reverse working. The valves are actuated by an auxiliary crankshaft, driven through gears from the main crankshaft, and the cylinders are arranged with the low pressure between the two high pressure, with the dimensions 4½ in. by 4½ in. and 3¼ in. by 4½ in., respectively. At 75 per cent. loading a mechanical efficiency of 53 per cent. is claimed.

New Chemical Salt

BY heating gypsum in a solution of magnesium sulphate, a new chemical salt of the same composition as plaster of Paris (Magnesium sulphate) has been produced. Ordinary plaster of Paris is made by the dry calcination or burning of gypsum. It is claimed that the new product is about twice as strong as plaster of Paris, and approaches the strength of Portland cement. Production is not expensive and among uses suggested for it are tiles, wall boards, and pre-cast building products.

Synthetic Rubber Gasket

AS asbestos is no longer available in Germany, a new type of cylinder-head gasket has been devised in which synthetic rubber, known as Buna, is used. Three sheets of Buna and two layers of fine steel wire netting are used. The wires of the two layers are placed at angles of 45 degrees with each other, and the whole is vulcanised together. Buna, unlike natural rubber which softens when exposed to high temperatures, has a tendency to "tighten." The new gasket is said to have better holding properties than the conventional type, owing to the elastic nature of the rubber and the fact that it is not coated with graphite. It is claimed that the new gaskets are resistant to hot water and hot oil up to 330 degrees F., and also to glycol, petrol, and leaded petrol.

Electron Heat

TREMENDOUS heat raised by electrons is used in a new furnace for melting metals. It consists of a very small crucible which is placed in a little tantalum cup. This cup is placed in a vacuum vessel in which there is a red-hot electric filament. The cup, charged with positive electricity, attracts the electrons streaming off the filament, and their bombardment results in heating it up. Apparently there is no limit to the heat to which the pot can be raised, but there are limits to the materials of which the crucible can be made. With the aid of this electron furnace, new alloys of platinum, tungsten, and other metals are being discovered.

Bricks from Soapsuds

BECAUSE of the shortage of wood, the Germans, according to the free Dutch newspaper, are now mixing clay and soapsuds to make an easily baked brick. This also saves fuel. The soapsud brick is porous and is mainly used for interior walls.

The Moving Road

SCIENTISTS have been called in to stop a main road near Vicksburg, Missouri, from moving in the night. A section of the highway, 17 ft. long has moved away from the main path and is still advancing at the rate of four inches a day. During one night, in addition to moving forward four inches, the road sank five inches.

New A.A. Device

DURING recent demonstrations of the latest equipment of the Royal Armoured Corps, cadets of an anti-tank O.C.T.U. saw a new secret anti-aircraft device, more spectacular than anything yet devised to beat Nazi bombers, in action for the first time.

Incendiary Bombs

THE Institution of Electrical Engineers have recently prepared for the Ministry of Home Security a memorandum dealing with the automatic detection of fire bombs. Principles of detection fall into five categories: impact, sound, light, heat, and products of combustion. Many ways of making each method raise an alarm have been discovered, particularly with light and heat.

The Bangalore torpedo for clearing a pathway through wire entanglements. (*See page* 368)

The Diaphragm Pump

Details of Construction and Operation of a Simple Hand-operated Unit.

THE diaphragm pump is not so much used as one would expect when the particular features of its operation are taken into account. It is simple to make, and simple in upkeep, since there are no parts subject to the pressure of the fluid being handled which have sliding or rotating frictional resistances against each other. It has no sliding plunger and it needs no packing gasket or gland requiring constant adjustment or renewal.

The only moving part, the valves excepted, which comes in contact with the liquid is the diaphragm. This is of a material which is very cheap—rubber, leather, etc.—and easily applied, requiring no expert machining; it can be made up from odd material by a pair of shears and drilling—a simple operation not requiring any great accuracy.

The pump can also be driven in many ways. The diaphragm can be moved in one direction by a cam, eccentric, crank or lever. In the case of the cam it can be positively moved on one stroke, generally the pressure stroke, and returned by a spring interposed between the wall of the casing and the diaphragm.

Eccentric Operated

Quite a wide variety of mechanical movement can be employed to move the diaphragm, and in no case need the operating mechanism come in contact with the fluid. In our illustration is shown a sectional view of a diaphragm pump operated by an eccentric. The diaphragm A is nipped between the body of the pump B and an intermediate cover C, while a top cover D, registering on its periphery with both B and C, serves as an oil bath cover and bearings for the operating shaft, as well as a bearing for the reciprocating cross-head E, the complementary bearing being on the intermediate cover C.

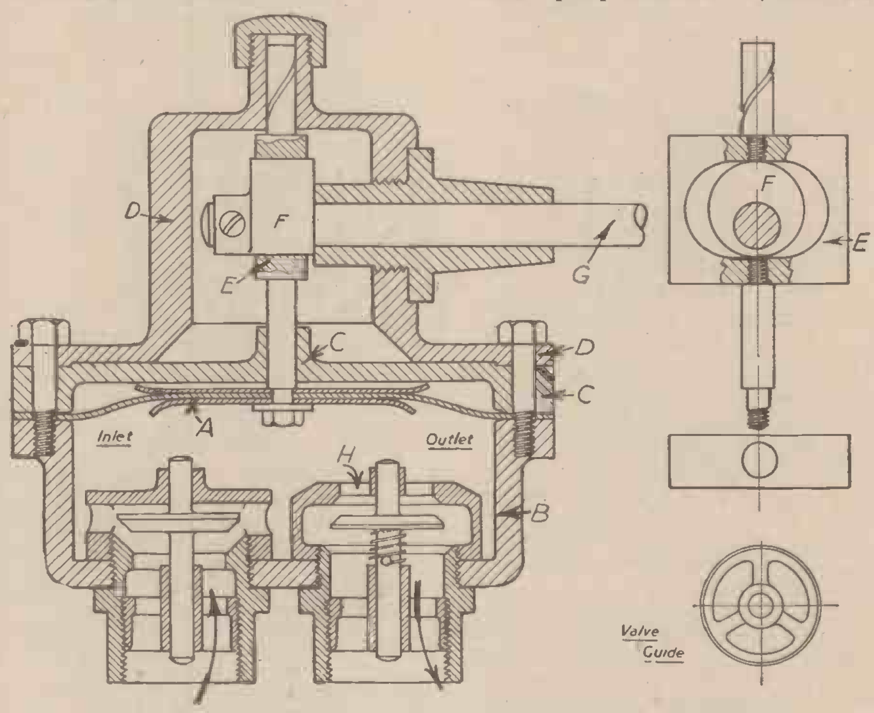
The cross-head E is formed of two spindles in alignment with each other and a central casting having a slotted recess in which rotates an eccentric F. A front view of the cross-head and incorporated spindles is shown inset. The eccentric F is carried at the end of a drive shaft G to which it is pinned by a taper cross-pin driven through the boss of the eccentric, and the drive shaft, G.

None of the mechanism, including the lower bearing for the cross-head spindle, is inside the water or liquid chamber of the pump and the chamber enclosed by the top cover D and the intermediate cover C can be flooded with lubricant which cannot, by virtue of the diaphragm, get into contact with the liquid in the valve chamber of the pump. Therefore this type of pump can be used for comestible liquids. Since, again, no liquid gets in contact with the operating mechanism acid fluid can be dealt with. Only the valves can be affected, and since they are solid valves they can be made of stainless steel, seating on stainless steel seatings.

Pump Body

The body of the pump can be in cast iron or bronze metal. One arrangement of the valves is shown, which is suitable where the pump is dispositioned as indicated in the illustration. But if the pump is to be more conveniently located with the axis of the diaphragm horizontal instead of vertical as in the section shown, the valves may be located with their axes vertical, or at right angles to the axis of the diaphragm.

The arrangement of the drive shaft allows of either a vertical or horizontal drive, and where the diaphragm axis is horizontal, since the body of the pump is fairly wide this would often be found most convenient for bolting the pump to a vertical surface. The valves would then be in the walls of Chamber B.



Sectional view and details of an eccentric operated diaphragm pump.

It will be noticed that any oil which leaks past the lower bearing of the reciprocating spindle will pass to the space between the diaphragm and the intermediate cover C where it can do no harm, and where it will simply be under the pressure of the upward movement of the diaphragm which will prevent its ever filling the space between the diaphragm and the cover C.

The upper spindle works in a long bearing in the upper cover, the top of the bearing being closed by a screw cap. The spindle has a spiral groove around it so that imprisoned air can escape from the top of the guide hole back to the space below without causing any obstruction to the upward movement of the spindle.

It will be seen that, whether the pump is arranged in either of the ways described the two valves, inlet and outlet, are similar units which can be screwed into the body, the latter being drilled, bored and screw-cut to take them. They can be placed in any position as may be most suitable for the arrangement of the liquid flow.

Variety of Uses

Such a pump made to a very small scale would be found suitable for lifting and delivering lubricant—oil or cutting compound—for boring, drilling and general turning work on the lathe, or for drilling and milling machines or, indeed, for any purpose where a simple and direct acting pump is required, whether for lubricant or other liquids. The inset sketch shows how the valve-stem guide is made in one piece to screw into the valve cases, and how the cover in each case forms an upward guide to the valve which has a guide stem above and below the mushroom part.

The inlet valve needs no spring. The outlet valve has a helical spring which is sufficient to lift the weight of the valve only, and thus prevent a time lag in seating.

A pin through the stem prevents this valve falling far enough to restrict the outlet. It is shown at the bottom of its travel in the drawing. As an alternative to the pin the guide stem may be made of larger diameter in the top guide hole than in the bottom guide one, and a shoulder thus formed will limit the bottom travel of the valve.

Inset is the screened guide showing the shape of the fluid passages. The inlet to the outlet valve at H is similarly shaped.

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NEW SERIES

Making a Success of Your Photography

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

Development on Scientific Lines.

THE last article of this series was written expressly for those amateur photographers who had never enjoyed the thrill of developing one of their own spools, and we hope that many readers have followed the advice and can now claim to be real amateurs instead of " snapshotters " only.

In this article it is the intention to give further help to beginners and also to the more advanced workers so that all may become quite expert in this work, and be able to produce a good average of successful results or, at least, successful in so far as development is concerned.

There are actually three ways of judging developing of films and plates; in the early days of dry plates it was by inspection, the plate being placed in the solution, and as the image appeared and increased in density the worker would remove it from the dish and examine it under the light of the ruby lamp to see if all the detail had made its appearance or whether it had to be returned to the solution for a further period; this had to be repeated until he was satisfied that the plate was " cooked." Obviously, many mistakes were made by beginners, for until much experience had been gained, it was impossible to be sure of the work, so the professionals in those days had to adopt a form of standardisation consisting of the use of only one make of plate, and using one formula for their developer. This answered for a time until brands of plates became more and more numerous, and better ones or improved grades made their appearance, and professionals realised that alterations had got to be made if they wished to keep up to date.

Factorial Method of Development

Until the latter years of last century, this method of developing by inspection continued; then a system invented by Mr. Alfred Watkins in 1893, and known as the Factorial Method of Development was tried and proved to be of value by many of the leading photographers of those days. Mr. Watkins had found that with any given developer the actual time of appearance of the image on the plate was a factor by which the full time of development could be calculated, and that so long as no alteration of the emulsion was made by the manufacturers that make of plate would always require the same time to be accurately developed, and he also found that this time was subject to strength and temperature of the solutions.

This was a definite departure to get a standardised method of working into the darkroom, but it took many years to convince workers that it was a good move, in fact, there were many arguments against the Factorial System. It has lost favour to-day, not through any very bad fault in it, but rather due to improvements and alterations of the emulsions of our sensitised material as, for instance, the introduction of panchromatic films which, because they have to be developed in the dark, cannot be watched to see how long the image takes to appear. Again, the emulsions have become so very highly sensitive that even the ordinary darkroom light is not safe if used too close to the dish, and if the film is closely examined by removing it from the dish, there is the risk of fogging. Further, developers have had to be adjusted to suit the present-day films and plates, and so we have had to find more accurate methods.

Johnson's adjustable film developing tank.

Ideas have been improved, numerous experiments and testings have been carried on in the laboratories of our chemical manufacturers and by the emulsion makers with the result that to-day everyone, whether amateur, professional, commercial, or even the cinema-photographer, can do this branch of the work on lines that are based on truly scientific principles, and have consequently proved eminently satisfactory, reducing the number of failures to a minimum.

Tests have proved that all emulsions have a definite time when correct development is reached, that this time only varies when a change has been made by the manufacturers of the particular brand of film, when the usual developer formula is changed, or when there happens to be a change in the temperature of the solution. It therefore follows that if all these factors are standardised, i.e., remain unchanged, then development becomes also a matter of giving the film always the same time in the solution, and we shall be certain of getting a series of perfect negatives so far as the development is concerned. Certainly our work will be much more successful than if the old haphazard methods of judging by inspection, or guessing when the work is completed.

Temperature of Developers

What does such a system offer amateurs who have never done this work? Many of the ready-made developers which are obtainable in these days have the times for developing any films or plates already calculated and set out; the chemical manufacturers have by tests found the times to give when using the developer at various strengths and temperatures. The films and plates are arranged in groups, and the times for these are shown in columns against the temperatures ranging from about 55 to 85 degrees; the finding of the time for the film in use is so simple that it is almost impossible for the user to make a mistake.

The time and temperature system is for use by any method of development, and can, therefore, be used in the dish and see-saw way suggested in the last article, and as the manufacturers of Azol developer were among the first to introduce the method into the directions with Azol, and other of their preparations, let us examine these directions. Films and plates are divided into seven groups, and if one of the most popular films is

Johnson's developing tank taken apart.
A. Adjustable section of film holder. B. Notched portion. C. Protection guides. D. Back stop. E. Central inlet. F. Pouring slot. G. Light-tight groove for lid. H. Stirring rod.

selected, it will be found in group five; referring to the table for dish development strength of solution at a temperature of 65 degrees, we find that the time given for this group is nine minutes, and at the end of that time the film will be accurately developed.

This is equivalent to saying that if you follow out these instructions you cannot help securing perfectly developed negatives, and that the results are the best that can be expected from the exposures.

There is, however, one or two possible risks with dish development; it is possible to have an inferior darkroom lamp, one that will cause fogging on an ultra-fast film such as we are in the habit of using in these days, and there is also a slight risk of the developer oxidising and causing stains.

These risks are only slight, but there is a method by which even they can be completely obviated. The most careful and experienced amateurs now prefer to do all their development in a tank, and unquestionably this is the most convenient and the safest, for when used in conjunction with the time and temperature tables, there is no reason why anyone should make mistakes or take risks with their films.

Adjustable Developing Tank

There are several makes of tanks but the most convenient is the one I have seen advertised in this magazine; it is known as the Johnsons Adjustable Tank, adjustable because it can be altered to take four different sizes of spools, and also half of a miniature 36 exposure spool; this is achieved by moving a sliding section of the spiral up or down a notched spindle of the second part of the spiral. This is particularly useful to the individual who has two or more cameras taking different sizes. The spiral is for holding the film, and the film coils itself, by gentle pushing, round this spiral by means of grooves in each of the sections; this part of the process is so easy that after once trying to load with the light from the darkroom lamp it can be

The Kodak adjustable film developing tank. Made of stainless acid-resisting steel, with a cover of moulded material.

accomplished in the dark or, as many an amateur had to do in the old days of plates, do the loading beneath the bed clothes before retiring at night.

Having once loaded the film into the tank, the necessary quantity of developer, which is very small, is poured in, taking note of the exact time when this is done; a few turns of the stirring rod, and when the time is up the developer is poured back to a stock bottle, and the fixing solution is then poured into the tank. Again, a few turns of rod, and in ten minutes the fixing bath is returned to its stock bottle, and then the tank can be placed in a suitable spot in the sink for water to run into it for washing the film in a most effective manner in the shortest possible time.

What a great convenience such a piece of apparatus can be for amateurs who have limited accommodation or when on holidays; developing, fixing and washing all in the one piece, and no dark room wanted, for, if the film is placed in the tank after dark of an evening, the rest of the work can be finished in the daylight. Note what an advantage this is when on tour or holidays, for if a mistake has been made in the exposure time, or if the camera suddenly went wrong during the day, it would be possible to find the error in time to rectify it before leaving the district.

It is fairly safe to say that never before have amateur photographers had such facilities for obtaining such a large average of successful negatives, and so little risk of spoils; the basis of this great advantage is unquestionably—standardisation—in the selection of one film, one developer, one temperature, strength, and one time. It needs but few experiments, and but little expenditure to find the film and developer to suit your requirements or particular work, but whatever is spent will be worth while for the number of failures will automatically fall to a minimum.

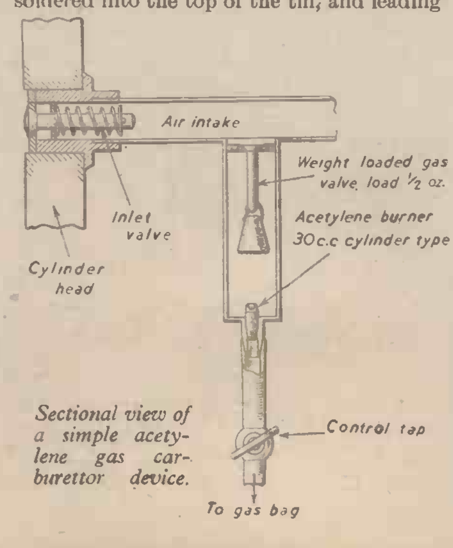
From Petrol to Acetylene

Details of an Interesting Conversion. By T. Elliott.

THOUGH aware of the unfortunate results of some early experiments with acetylene gas as a motive power, the collapse of petrol supply for private use in my district drove me to seek other methods of keeping my amateur plant going in production of some munitions parts, which some amateurs had the opportunity of doing, when the great shortage was revealed in the last European war. My house and workshop were lighted by acetylene. The petrol engine was a single-cylinder horizontal, 4-in. stroke by 2¾ bore, spring loaded auto. inlet valve, exhaust operated by rocker from cam on cam shaft which also carried a wipe contact for the ignition system which was the old type buzzer coil and 4 v. battery; a single 15 in. flywheel is fitted, and a 5-in. pulley at the other end of crankshaft: revolutions 650. The cylinder had a separate fine grey cast-iron liner, and was water-jacketed, but the head was a plain ¾-in. thick plate, manifold cast with it, bolted to the cylinder, and the water circulation was thermal to an overhead tank.

Simple Carburettor Device

I removed the petrol carburettor and connections and substituted a trial device for acetylene, as shown in accompanying sketch, from which it will be seen that the gas was let into the air induction pipe through a T-connection by a very small gravity valve (which was, in fact, the head of an ordinary 1 in. wood screw nail, ground into its seat), weighted with ½ oz. of lead. Acetylene gas was admitted on the induction stroke, fed in below the valve by a 30 c.c. acetylene burner, barrel type, from which I removed the small plug of loose cotton introduced below the Davy mesh in these burners, as the strong suction caused it to block the gas altogether, the burner being designed only for about four water inches of gas pressure. A couple of hours effected the conversion, and it was a complete success, the only further thing required was a gas bag, for which I used a two-gallon petrol tin containing about three inches of water into which the ¼-inch supply pipe from the gas main, soldered through a hole in the top of the tin, projected just clear of bottom of the tin, the gas passing out by another ¼-in. pipe soldered into the top of the tin, and leading to the control tap. This gas "bag" functioned perfectly.



Sectional view of a simple acetylene gas carburettor device.

Economical Working

It was really a pleasure to work with this new engine, which started unfailingly at the first pull of the belt, and the astonishing thing was that 1 lb. of carbide, then costing 21/- per cwt. (2¼d. per lb.), and yielding on the gasometer about 4¾ cub. feet, lasted the same time as ½ gallon of petrol costing, when supply ceased, 2/- per gallon (there was no petrol duty then). The only trouble was with the ignition plug, which would only last about two months before shorting, as the porcelain became impregnated with the very fine dry carbon product of combustion which could not be removed in any way known to me, so it was sometimes a new porcelain, if available, or else a new plug. The cylinder head kept free from the type of deposit of the petrol combustion, no trace of moisture or oil at all, only a dusting of the fine dry carbon. Probably the present-day plug would stand up longer. I used the engine till 1925, when I installed a complete electric lighting plant with a 3 h.p. petrol engine which also easily drove my plant. It is important to note that there was no brass or copper used in the converted fitment, except the control tap, and there was no explosive mixture, save that immediately at the intake valve. Finding, however, that the ram action of the intake value just caused the presence of gas to be noticed, I continued the air intake pipe right out through the wall to the open, a couple of feet from the exhaust outlet.

Synthetic Diamonds

A Glimpse at one of the Features of a Future Age if Scientists Succeed in Imitating Nature's own Diamond-making process.

DIAMONDS! The word conjures up visions of wealth untold, of luxury, ease and elegance. Throughout the ages men and women of all nations and civilisations have, by common consent, imparted to the diamond a store of value not merely on account of its comparative rarity but, also, in consequence of the exquisite beauty of the finely-cut stone.

The diamond is a symbol of perfection in the inanimate or mineral world. In it, Nature has welded together atoms of pure carbon into an architectural structure of truly enormous strength, so much so that a diamond, no matter whether it takes the form of a handsome and costly stone in an article of jewellery or of a whitish impalpable powder, is the hardest and the most resistant material in the world.

Perfect Inherent Beauty

Nothing is harder or more enduring than the diamond. No stone has been endowed with anything like the perfect inherent beauty of the diamond, to say nothing of its usefulness. Nature, indeed, has lavished her gifts of perfection upon this favoured mineral form of carbon and it is not surprising that scientists of the past and present generations have repeatedly striven to produce diamonds which would equal in size and in all other characteristics those of the natural diamond.

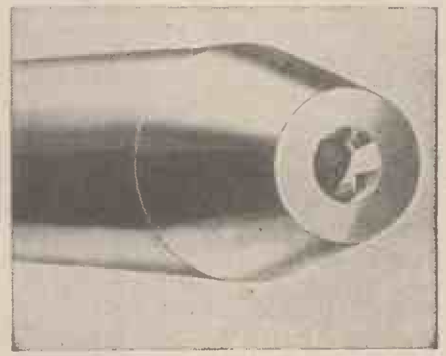
Could we but make diamonds as easily, say, as we can manufacture calcium carbide or carborundum there is little doubt that a minor revolution in the world's economic markets would take place. From being the most precious of all gem stones, the diamond would fall to the position of a very common and ordinary commodity. Yet its usefulness would be quite unimpaired. For we must remember that, quite apart from its employment as a gem stone, the diamond has a variety of applications in the world of industry. It would, for instance, be an exceedingly difficult task to drill for petroleum if there were no such things as diamond-tipped drills capable of boring through the hardest of rocks with comparative ease. Diamonds are employed on account of their exceeding hardness in a multitude of modern industries. Even in artificial silk making, the diamond finds a use, very fine threads of synthetic silk being drawn out through tiny holes drilled in a diamond "plate."

Hardness

All these uses follow in consequence of the diamond's unequalled hardness. You can take even an inferior diamond specimen and compress it between two steel blocks with a hydraulically-applied pressure of no less than 180 tons per square inch, yet you will not succeed in fracturing the stone by this enormous pressure. All you would do under these circumstances would be merely to squeeze the diamond into the steel block, leaving it perfectly unbroken and uninjured.

If it were only possible to manufacture synthetic diamonds the number of useful applications which could be made of such artificially-produced material would be legion. Diamond brake-blocks on cars and cycles, unwearable diamond parts for the vitals of aeroplane construction, diamond "bricks" for building purposes,—even, one may prophesy, pathways paved with diamonds and roads containing mineral diamond "fillers" which would never wear out or develop pot-holes or other irregularities under even the heaviest of traffic conditions. Such a diamond-surfaced roadway, in consequence of its unwearable qualities, would constitute an asset of much material value to any modern community.

Curiously enough, a diamond, despite all its perfections, is composed of nothing more than carbon. Soot, lampblack and graphite are, also, forms of carbon and they only differ from the diamond in consequence of having their individual atoms arranged according to a different pattern. All that we have to do, therefore, if we wish to make diamonds artificially is to take ordinary soot, lampblack or graphite and, by some means or another, to rearrange the constituent atoms of such material to the pattern of the diamond's inner structure. How, the reader may wonder, has it been proposed to effect this atomic alteration and so to bring artificial diamonds into actual being?



A large size natural diamond set in the tip of a drill for rock-boring uses.

There is only one possible mode of effecting this modification and that consists in a more or less intensified imitation of Nature's own method of diamond-making.

Masses of black carbon obtained from gas works. The problem of making diamonds rests solely upon the finding of an effective means of crystallising this material.

Properties of Carbon

Carbon is a very remarkable substance, despite its ordinarily dirty and unattractive, soot-like appearance. One of its many extraordinary and unique properties is that it boils without melting.

It is well known that when any ordinary substance is heated it first melts and then boils, provided, of course, that the heat is intense enough to bring about these results. But with carbon, the case is different. Carbon boils before it melts! If, for instance, we heat carbon up to the enormous temperature of 3,600° C. it passes off into a vapour without going through any liquid phase. But if it were practicable to devise some means of submitting the heated carbon to a very high degree of pressure there is little doubt that the material would melt before boiling into a clear, almost water-white liquid. All we should have to do under such circumstances would be to cool this liquid very slowly and it would crystallise out as large transparent diamonds, bigger by far than even the largest-known of natural diamonds. It would, indeed, by this method, even be possible to obtain transparent blocks and slabs of crystalline carbon—of pure diamond!

Such a vision is naturally one of the future. It is not a fantastic vision, however, for provided we can get the right conditions, we can re-arrange the carbon atoms in almost any way we please.

No Satisfactory Answer

How then are scientists going to set about the above problem of getting carbon to melt before it boils and of manufacturing diamond material as a result of this feat? Frankly, there is, at the present time, no satisfactory answer to this technical conundrum. Although it would not be difficult to generate the pressure required for the melting of the carbon, there is, so far as we know, no material out of which a container could be made to hold the carbon during its heat and pressure treatment. Even the thickest steel would melt and swirl away in the form of a thin metallic vapour at the heat to which the molten carbon would have to be subjected, whilst, at the pressure required to crystallise the liquid carbon into diamond slabs it would be possible to make ordinary ice red-hot without melting it.

The problem is truly one of enormous practical difficulty, for it takes us into those little-worked realms of applied science in which extraordinary manifestations result from the interplay of gigantic pressures and no less gigantic temperatures. Yet, there is no doubt that ultimately the problem will be solved, and elucidated, perhaps, in some wholly unexpected way.

A French chemist, Henri Moissan, made a brilliant initial attempt at solving the problem of artificial diamond making as far back as the eighties of the last century, and, to a certain extent, he succeeded.

Moissan dissolved small amounts of pure carbon in white-hot molten iron. Then, when the iron was just beginning to boil, he allowed the crucible containing it to drop suddenly into a bath of cold water. Instantly the outer layer of the iron solidified. A tremendous pressure was thus exerted upon the still liquid core of the mass of iron, and this pressure forced some of the dissolved carbon to crystallise out in the form of diamonds, so that when, ultimately, the iron was dissolved away by acids, the diamonds remained.

Moissan's Diamonds

In this manner, Moissan actually made diamonds and proved the theory of the diamond-making process to be correct.

Unfortunately, however, Moissan's diamonds were not very spectacular creations. None of them was more than a thirty-second of an inch in diameter, and the majority of them were poorly coloured, and far from being transparent. Furthermore the expense of making them was far in excess of the value of natural diamonds of a similar size.

Within very recent times, however, diamonds weighing up to a quarter of a gram have been obtained by modifications of Moissan's original method, some of these productions having a diameter of an eighth of an inch. Such diamonds, however, are quite useless from a practical standpoint, since their cost of production is out of proportion to their essential value.

Despite, therefore, the promise which the future holds out for the large-scale manufacture of artificial diamonds of all sizes, varieties and types, we must, of necessity, for the present, still rely for our supply of these precious commodities upon the past efforts of old Mother Nature. In ages past she has, within the unknown and mysterious depths of her earthly laboratories, ten, twenty and even fifty miles below the earth's surface, subjected the exceedingly refractory carbon to the influence of temperature and pressures which can be but faintly imitated by even the resources of modern science. Then, having forced the unwilling carbon atoms to crystallise out in clear transparent form, she has, by various processes of volcanic upheaval, cast a few of these precious crystals to the surface of the earth, there to be picked up and afterwards eagerly sought for by man.

Untold Wealth

Some say that deep within the bowels of the earth compacted masses of diamond may exist in untold amount. This is only a theory, however, and there is, of course, not a shred of sound evidence to prove the assertion.

Scientists, however, were, in pre-war days, seriously on the trail of the synthetic diamond, and, no doubt, in due course, this fascinating quest, now interrupted by the havoc and turmoil of war, will again be resumed.

How long the engrossing chase after the secret of the diamond will last or into what unknown regions of practical science it may lead, no one can tell. One thing is tolerably certain, however. Mankind will, one day, manufacture real diamonds and diamond material just as it will, also, make its own gold and countless other naturally scarce commodities.

Problems of atomic structure and of atomic interchange are at the present time only just beginning to be studied by the ordinary scientist. When atom-building becomes a practical science, workers in that branch of chemistry and physics may very conceivably find it readily practicable to produce diamonds and diamond material in any required amount. It is within the power of carbon to bring a diamond age to the world. All we have to do is to devise ways and means whereby this transformation may readily be brought about.

Making Simple Gauges

Some Useful Tools for the Workshop.

THE gauges described in this article are intended mainly for jobs where the quantity of parts to be machined is insufficient to justify purchasing expensive precision gauges. Their degree of accuracy will naturally depend on available tools, and on the method adopted for grinding or lapping to finished dimensions.

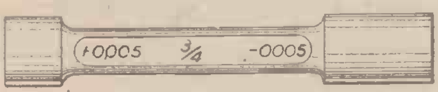
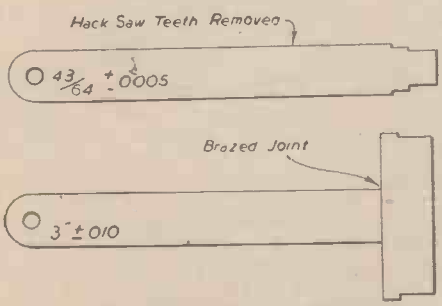


Fig. 1. A plug gauge.



Figs. 2 and 3. Details of a gauge made from a hack-saw blade.

Plug Gauge

The well-known plug gauge (Fig. 1) needs no explanation, but it is advisable that after turning (leaving, say, .01 for grinding) the finished size should be stamped on each end of the stem, with the exception of the last decimal point, so that in case of any slight error in grinding the hardened plug it can be stamped with the actual size.

Simple gauges can be made from old machine hack-saw blades, as in Figs. 2 and 3. This gauge is particularly useful for odd dimensions where there is no plug gauge in stock, and for large diameters.

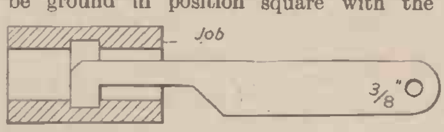
The joint shown in Fig. 3 should be brazed. The gauge size may be satisfactorily stamped on the opposite side from which the teeth have been removed. The gauge may be ground by holding the stem in a four-jaw lathe chuck, with grinder in tool rest.

The use of this ready hardened and easily made gauge should be remembered when boring or recessing in awkward positions, turning cast boxes and lids, large diameter washers, key-ways, etc., as indicated in Figs. 4 and 5.

Snap Gauge

A simple form of the snap gauge (Fig. 6) can be made from ⅜ in. square mild steel for measuring up to 2 in. diameter. A web ⅛ in. thick welded on to stiffen the back.

A "Go" and a "No go" hardened 1.BA screws are fitted dead square opposite the bottom jaw, which has a $\frac{1}{16}$ in. milled slot to take a length of hack saw blade, held in position by two 2.BA countersunk screws. Instead of drilling this blade for the fixing screws, it may be easier to grind two slots. The measuring edge would then be ground in position square with the gauge. Finally, adjust the screws on to slip or plug gauge as required.



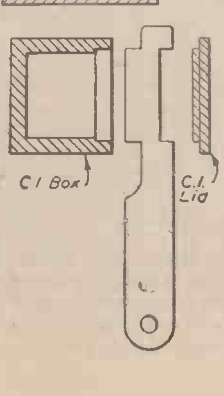


Fig. 4 (Above) and Fig. 5. Showing uses of simple gauges made from hack-saw blades

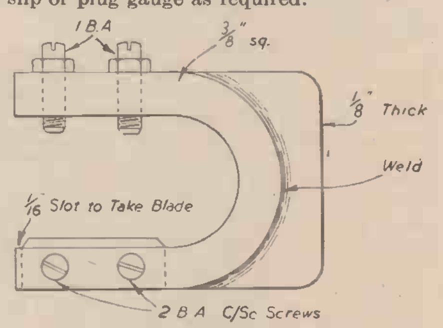
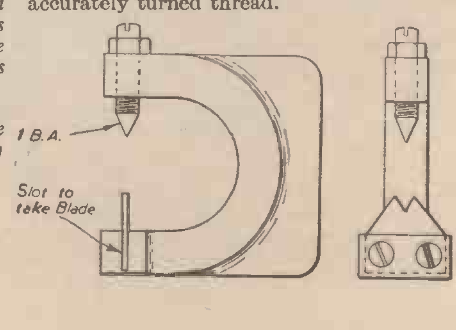


Fig. 6. A simple form of snap gauge.

Thread Gauge

The thread gauge (Fig. 7) is on the lines of the snap gauge. The top adjustable 1.BA screw would be turned to 55 degrees (presuming the gauge to be for a Whitworth thread) and mounted opposite to the V-blade, which is adjustable sideways, and held in position by two 2.BA screws. If there is any difficulty in making this bottom blade, it may pay to remove the required blade from a thread pitch gauge of standard make, and grind off the thread form not required. As in the snap gauge, the setting would either be adjusted to a hardened thread standard or from an accurately turned thread.

Fig. 7 (Right). Side and front view of a thread gauge.



A bomb load being taken out to one of the R.A.F. night-bombers just before the crew took off for a recent raid on Hamburg and Berlin.

The World of Aviation

New Types of English, American and German Aircraft. A Controllable "Contraprop," new Engine, and how R.A.F. Pigeons are kept dry.

A 43-ton Aeroplane

THE U.S. Office of Production Management have recently issued the Lockheed Aircraft Corporation with a certificate to build a huge new four-engined landplane designed to fly to Europe in 10 hours, carrying between 50 and 80 passengers. The machine will be the largest and most powerful landplane in the world with the exception of the B19 bomber which is now being tested in California. The machine will weigh 43 tons, and Pan-American Airways have ordered nine such planes.

The " Thunderbolt "

A NEW American fighter, with a speed of more than 375 m.p.h., is now being tested at Farmingdale, New York, by the U.S.A. Army authorities. The machine is known as the Thunderbolt, and is equipped with a 2,000 h.p. Pratt Whitney air-cooled engine, which is super-powered. The aeroplane is described as being of revolutionary design, which makes it suitable for mass production. It was built by the Republic Aviation Company, which has already built the P-47.

Plane Output

AMERICA has sent nearly 3,500 'planes to Britain since the war began, declared Mr. James Jouett, president of the Aeronautical Chamber of Commerce, in Washington recently. The U.S. would produce an estimated number of 18,000 'planes in 1941 and 30,000 in 1942. The monthly output of U.S. 'planes was now nearing that of Britain and Germany, he said, which figure he put at 1,500 each. America was making every effort to beat the night bomber, and factories were working on 16 new models, including interceptor aeroplanes to try to do this.

A New Dive-Bomber

A NEW American dive-bomber said to have a greater performance than any known aeroplane of similar type in the world is being produced for the R.A.F., the Vultee Aircraft Company announced at Nashville, Tennessee, recently. It is called the Vengeance. Details are secret, but the makers say it has the most modern protective devices, and a range and performance far greater than the Ju87 Stuka dive-bomber. American reports have already referred to the Vengeance as the Vultee 72. It is powered by a single engine, and is probably an improvement on the Vultee Vanguard single-seat fighter, which is quoted as having a speed of 350 miles an hour.

A Controllable "Contraprop"

A NEW type of airscrew for improving the efficiency of British military aircraft and especially of Fleet Air-arm machines, has recently undergone exhaustive tests. It has been developed by Capt. A. G. Forsyth and Mr. G. J. Smith-Pert, who claim that it is the first controllable " contraprop " in the world. It has controllable pitch blades and may be visualised as two airscrews arranged close together and mounted on two shafts, one running inside the other, and turning in opposite directions.

Aircraft Experts Meet

AT a British airfield recently, 250 leading British aircraft designers and test pilots inspected every type of fighter and bomber from America. Included in the conference were aircraft company directors and Atlantic ferry pilots. On looking into the fuselage of the Liberator, the designer of Britain's largest four-engined bomber, the Stirling, remarked, " There seems one fault with American 'planes. They do not put enough guns into them at present."

World's Biggest Bomber

THE biggest bomber in the world, the Douglas B19, which weighs 80 tons and took three years to build, recently carried out its first test flight. The machine has a wing spread of 212 ft., carries a crew of 10 to 20, and will fly non-stop for 7,000 miles. It would probably be impossible for a fighter to get close enough to the Douglas B19 to shoot it down, so heavy is its fire power. It will also fly at great heights.

The Lockheed P38 Fighter

THOUSANDS of Americans recently witnessed a remarkable demonstration of the Lockheed P38 fighter, an American machine which is stated to be capable of a speed of 500 m.p.h. During the test the pilot put the fighter through a vertical climb, making it at an estimated 300 m.p.h. It has a tricycle undercarriage and is more highly loaded for its wing area than any British fighter.

New Aircraft Engine

OFFICIALS of the Ford factory at Detroit have announced a new American engine which is now ready for mass production. The engine is expected to produce between 1,800 and 2,000 h.p. at 3,600 r.p.m., giving a weight power ratio of less than 1 lb. per horse power, making it lighter than any other engine possessed by the Army Air Corps. Special features are being introduced into the usual Ford mass production methods to turn the engines out as quickly as possible. One of these is the casting of certain parts such as the cylinder sleeves and crankshaft, instead of forging them to an approximate shape and machining them to the required size.

Rubber Dinghies for Pilots

ONE of the latest safety devices for R.A.F. fighter pilots is a small collapsible rubber dinghy which is carried underneath the parachute. Their operation is quite simple and they fold down to a size of less than 2 ft. square.

If a pilot is forced to bale out over the sea, he waits until he has reached the surface of the water, and then pulls a cord something like the ripcord of his parachute. The dinghy, together with a bottle of gas for inflating it, are then released and the pilot can pull himself aboard. Once in the dinghy the airman can further inflate it by means of small bellows.

Collapsible dinghies of a larger type are carried by both R.A.F. and German bomber crews, and fighter pilots had to rely on their "Mae West" life-jackets if they were forced down into the sea. Pilots regard the new dinghies as a great advance on the life-jackets.

A Home-made Aeroplane

CORPORAL MAURICE HALNA DU FRETAY, of the Free French Air Force, escaped from France and reached England in a single-engined aeroplane which he built secretly in a wood near a small French village. During the day he camouflaged his 'plane ith branches and leaves, and at night worked by the light of a torch. He had to wait for a tail wind to help him on his journey because of his limited petrol supply.

New German Fighter

THE latest type of German fighter 'plane now in service with the Luftwaffe is the Messerschmitt 109F. It is not in the same class as the Typhoon or Tornado as regards performance, but compares more with our Hurricane Mark II and Spitfire Mark V. It is more highly-powered than the Me 109E of last summer and is fitted with a Mercedes Benz DB601 engine with a higher degree of supercharge to enable it to give its full power at around 20,000 ft. The climbing powers of the Me 109F have been improved by a better wing form and other refinements include a retractable tail wheel, which adds several miles an hour to the speed, a cantilever tailplane, and a new design of cockpit enclosure. These modifications enable the Me 109F to fly and fight at heights above 38,000 ft.

Colour Codes in Engineering

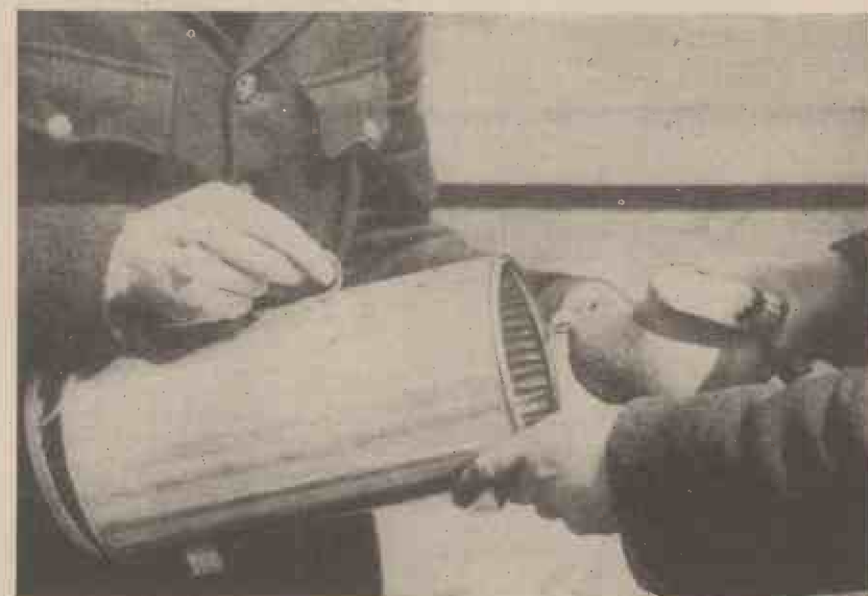
THE Glenn L. Martin Company, of America, have introduced some interesting methods for making the best use of labour which is not highly skilled, in building B26 twin-engined bombers. Unskilled operators may drill holes of the wrong size, so in the Martin plant all hole sizes are given a distinctive colour and the corresponding tint is painted round each hole in the drill plate. If, owing to pressure of work, operatives of still less skill have to be employed, the actual drills will be dipped in paint. Then the workers will not even have to know the sizes, but will simply use, say, the green drill for green-painted holes. Air frames are assembled on revolving fixtures. On the base of the jigs, to act as a constant reminder to the workmen, are drawings giving all the manufacturing information, which are reproduced photographically on sensitised metal plates. The bombers are divided into 32 major components for delivery to the final assembly floor, and these 32 are supplied by 650 minor sub-assemblies.

Fighting the Night Bomber

CANADA has nearly 1,000 radio mechanics now in England assisting in the operation of a new secret device which Britain has perfected as a defence against night bombing, stated Mr. C. G. Power, Canadian Minister of National Defence, recently. British scientists collaborating with research experts in Canada and the United States, have devised this new and powerful weapon. The details are, of course, secret, but in general terms it means that by using a great number of small radio sets of modern design, technicians posted at ground points all over the British Isles will be able to detect enemy 'planes in the air and direct anti-aircraft fire with deadly precision.

The Douglas Havoc

AN American aeroplane that has repeatedly proved its worth as a night fighter over this country and German occupied France is the Douglas Havoc. This machine is an improved version of the earlier D.B.7, and with its retractable tricycle undercarriage is admirably suited for work at night. It has a top speed of 325 m.p.h., carries a crew of three, and though it has a wing span of 61 ft., is unusually manoeuvrable. In its latest form in America, this aircraft is powered with two 1,600-h.p. double-row Cyclone radial engines, which give it a top speed of no less than 380 m.p.h. with a loaded weight of 19,050 lb.



R.A.F. pigeons are kept dry by being placed in special metal containers

Keeping the Pigeons Dry

HOMING pigeons used in rescue work by the R.A.F. are now being carried in new type containers specially designed to be watertight and buoyant. The idea is to keep the pigeons warm and dry in the event of the aircraft making a forced descent in the sea. Various experimental types of metal container are now being tried out, based on designs evolved by the pigeon specialists of the R.A.F. One type is cylindrical, and being light as well as watertight it is sufficiently buoyant to afford considerable assistance to a member of the crew perhaps swimming from a sinking aircraft to the emergency dinghy. Another sort is square.

Forced descents on the water by aircraft returning from raids or reconnaissance patrols sometimes occur at night. If their radio cannot be used their pigeons form a vital link with the aircraft's home station. But as the birds cannot home by night, it is necessary to keep them dry and fit until the dawn, ready for their long flight to base, and rescue for the crew. Wet feet literally give a pigeon cold feet; and worse, possibly cause its death. That is why the R.A.F. is experimenting with new designs for pigeon containers with the same thoroughness as it tries out new type aircraft.

Air Pictures on Tour

THE R.A.F. is taking to nearly every important town in the country a picture record of its work since the war began. Six separate exhibitions will be running simultaneously. They will be showing identical pictures at each place, except that a special section, varied at each town, will include photographs of local heroes. First of the series to be on view are those at Birmingham, Manchester, Sheffield, Newcastle, Glasgow and Belfast. After a stay of three weeks they move on to Wolverhampton, Aberdeen, Bolton, Middlesbrough, Nottingham and Londonderry. Thereafter other towns will be visited.

Over a hundred photographs, the pick of the R.A.F. library, show the activities of each of the different Commands of the R.A.F. Bomber, Fighter, Coastal, Training, Balloon Commands are represented in separate groups of pictures. Other sections show the R.A.F. at work in the Middle East and the Balkans; and such auxiliary air services as the Royal Observer Corps and the W.A.A.F., as well as Empire and Allied Air Squadrons are depicted. Besides the pictorial record of R.A.F. wartime achievements, a number of enemy souvenirs will be on show, including German camera equipment. It is hoped to include parts of enemy aircraft brought down in the locality of each town to be visited.

A NEW SERIES

The Story of Chemical Discovery

No. 7. From Laughing Gas to Miner's Lamp. The Extraordinary Part Played by Sir Humphry Davy in the Development of Practical Chemistry.

MODERN chemistry owes its progress and its many triumphs to the continual work of two sets of individuals, the theoretical investigators, such as John Dalton, who placed the science once and for all upon a well-defined and constructive basis, and the practical workers whose main contributions consisted in the bringing to light of many different and hitherto unsuspected chemical compounds.

Throughout the career of modern chemistry, these two sets of workers have ever been inter-dependent, for without the laboratory discoverer, mere chemical theory can achieve but little, whilst, on the other hand, the chance or haphazard discovery of new chemicals would do very little to place chemistry upon the basis of an exact science. Working hand in hand through the last century, however, the chemical theoriser and the laboratory research worker have achieved veritable wonders for chemistry. Not only has their work brought into being some of the world's most dominant industries but it has also contributed much to the raising of the standard, to say nothing of the variety, of living. Chemistry, equally with engineering science, is responsible for many of the good things and conveniences of modern life, as well as, alas, some of the evil things of mundane existence.

Rise of Chemical Science

The beginning of the nineteenth century saw the rapid rise of chemical science. Dalton, as we learned in the last article of this series, was building up his famous theory of atoms and their combining powers. Priestley, and the ill-fated Lavoisier, in England and in France respectively, had contributed much theoretical and practical knowledge to the growing science of chemistry; Berzelius, the great Swedish investigator was busily engaged in laying the foundations of analytical chemistry, and an Englishman, no less renowned than any of the above, was setting forth on a career of scientific brilliance which has hardly been equalled, let alone excelled in the annals of chemical science.

The world has long honoured Sir Humphry Davy on account of his invention of the miner's safety lamp, but it knows relatively little of his chemical career at the Royal Institution, in London, in the then newly-founded laboratories of which this renowned investigator over a prolonged period made at least one fresh discovery every week.

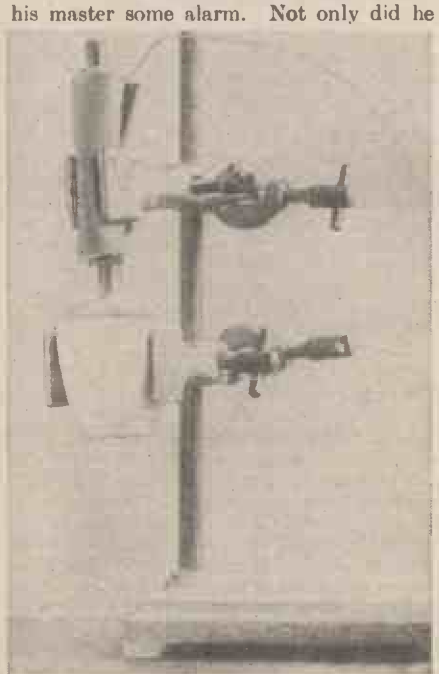
Davy was a Cornishman who came from humble yet yeoman stock. He was born at Penzance in 1778, his father being a wood carver. Owing, perhaps, to some oddity of mental equipment, the boy Davy's thoughts seem even in his youngest days to have been turned to some future greatness which he conjectured might come to him. Throughout his life Davy seems to have had this almost pathological yearning after position and greatness, a characteristic which to no small extent negatived the many excellent and sterling qualities of the man.

The boy Davy was only young when his father died, leaving the widow and her children in very straitened circumstances. Through the kindness of a local apothecary and druggist, the Davy family

Sir Humphry Davy

was taken care of, and the lad Humphry was actually apprenticed to the druggist's trade.

The mental brilliance of the lad caused his master some alarm. Not only did he get through his appointed duties in next to no time, but he found the leisure to make chemical experiments of his own at the top of the apothecary's shop, and to nearly suffocate the inmates thereof by the powerful and odiferous fumes and gases which sank slowly downwards from the upper room.



A modern adaptation of Davy's original experiment: the small scale laboratory preparation of potassium by the electrolysis of potash in a porcelain crucible. Carbon and iron wire electrodes are used.

The time arrived when Davy passed out of his apprenticeship. He had read and studied Lavoisier's great textbook on the "Elements of Chemistry," the bulk of which did not escape his severe criticisms. It was this book that decided Davy on a chemical career and which, as it were, gave him the clue as to the precise direction in which his future "greatness" was to be attained.

"Pneumatic Institution"

About this time there lived in Bristol one Dr. Beddoes, a scientific-minded medical practitioner whose mind had become fascinated by the many chemical gases which had then recently been discovered. Beddoes' idea was that it might be possible to treat all sorts of human diseases with various gases. So he started up in Bristol what he called a "Pneumatic Institution" in which various chemical gases were to be pressed into service as agents for the alleviation and cure of human ills.

Davy's former master, a Mr. Bor'ase, of Penzance, knew Dr. Beddoes and it was through this connection that Davy was, in the year 1798, and at the early age of twenty, appointed "Superintendent" of Beddoes' Pneumatic Institution.

The Pneumatic Institution was taken up in serious earnest by a number of scientific men, being supported by subscriptions from them, but it never did much good. Nevertheless, it provided the means of Davy's getting on his feet as a chemical investigator, and, moreover, it was during his eight months' sojourn at this curious Institution that he made his first big discovery, that of the anaesthetic properties of nitrous oxide or, as it was afterwards popularly called, "laughing gas."

"Laughing Gas"

Nitrous oxide, N_2O, had been known before Davy's time, having been discovered by Priestley in 1772. Davy, however, improved the method of preparing the gas in a pure state (i.e., by heating ammonium nitrate) and, having obtained the fairly pure gas, he essayed to breathe it from a silk bag. Davy found the effect of the gas to be a remarkable one. He experienced "a sensation analogous to gentle pressure on all the muscles . . . the objects around me became dazzling, and my hearing more and more acute . . . at last an irresistible propensity to action was indulged in . . . I recollect but indistinctly what followed, but I know that my motions were various and violent and I danced around the room like a madman."

Davy's friends, the poets, Southey and Coleridge were given doses of the gas. They fell into unconsciousness and laughed and grimaced violently when they came round.

Davy's discovery was a noteworthy one.

His "laughing gas" still has its practical pain-killing value, constituting, as it does, the "gas" employed by present-day dentists for rendering a patient unconscious during the extraction of a "difficult" tooth. Modern nitrous oxide, however, has few "laughing" propensities about it, for it is nowadays very carefully administered mixed with oxygen. Occasionally, however, it does render a patient liable to a momentary and a somewhat violent excitement and hysteria on recovering from its effects.

After eight months at Dr. Beddoes' "Institution" Davy moved to London, where he had been offered a position as lecturer in chemistry in the newly-founded Royal Institution. Davy accepted the position as "Assistant Lecturer," which post, after twelve months' service, was officially changed to that of "Professor of Chemistry." Thus installed, Davy's only duties were to prosecute actively his chemical researches, and from time to time to give "popular" lectures on chemistry to London audiences.

The discoveries which Davy made at the Royal Institution were legion. Only one other investigator exceeded them, that individual being the renowned Michael Faraday who first attended Davy's lectures in a very humble way, afterwards became his assistant, and finally succeeded him in the Royal Institution laboratories.

To some extent Davy had a certain amount of luck throughout his life. He was a man of an active, trained and intelligent mind who happened to be in the right place at the right time. It may be that Davy could not possibly have helped making discoveries. Chemical interest was growing speedily in England and on the Continent. The power of the electric current in bringing about chemical changes had been hit upon when the two experimenters, Nicholson and Carlisle, in the spring of the year 1800 first passed a current through a quantity of water contained in a glass vessel and had noted the production of bubbles of oxygen and hydrogen.

Further Experiments

One of Davy's first tasks when he entered upon his duties at the Royal Institution was to repeat the experiment of Nicholson and Carlisle, using for the purpose the large battery which was then the pride of the Royal Institution laboratories. From the effects of the electric current on water, it seemed to Davy that similar effects might be produced with other materials. He had small cups of gypsum (calcium sulphate) made in which he placed pure water and then passed an electric current through the liquid. Lime was formed around the negative electrode and sulphuric acid was detected in the water, proving that the current had made some interference with the composition of the gypsum.

Davy now commenced a long and a systematic series of experiments on the electrical decomposition of various materials. He showed that an electric current was capable of splitting up many varying materials into their simpler components. "Hydrogen and the alkaline substances," summarised Davy, "are attracted by negatively electrified metallic surfaces, and repelled by positively electrified metallic surfaces; and contrariwise, oxygen and acid substances are attracted by positively electrified metallic surfaces, and repelled by negatively electrified metallic surfaces; these attractive and repulsive forces are sufficiently energetic to destroy or suspend the usual operation of chemical affinity."

Here was clear reasoning on Davy's part and inductive logic which led him to really important discoveries.

Experimenting with solutions of caustic potash, Davy found that when these were electrolysed, hydrogen and oxygen alone were liberated. He, therefore, tried the effect of passing the electric current through a piece of solid caustic potash which had been rendered sufficiently moist to conduct the current. The experiment was an instant success, and it raised Davy to a veritable pinnacle of chemical fame. For at the electrode where previously bubbles of hydrogen had appeared, metallic-looking globules showed themselves. Some of these exploded or took fire spontaneously,

A Davy safety lamp as used in mines at the present day.

whilst others remained, and were able to be collected, although they quickly tarnished, and lost their metallic nature.

Discovery of Potassium

Davy had discovered a new metal, the metal which existed in potash, an alkali which had been known and used since Biblical times. The first discovery of *potassium*, as the new metal logically became called, took place in the Royal Institution laboratories on 19th October, 1807, and in the laboratory book entry for this day Davy has inscribed the brief comment "A capital experiment."

Wildly enthusiastic over his achievement, Davy a few days later repeated the same experiment, using caustic soda instead of potash. Again the metallic-looking globules were formed, but this time they were not quite so energetic or explosive in their reactions, and they obviously comprised a different metal from potassium. Davy called his second new metal obtained from soda *sodium*, and subsequently he also prepared the same metal by heating common salt (sodium chloride) with metallic potassium.

Napoleon's Electric Shock

It appears that the French savants were extremely envious of Davy's discovery of the alkali metals. Napoleon, particularly, was greatly angered that the honour of the discovery should go to a British chemist. He called a meeting of the French scientists in Paris and demanded to know why they had not been before Davy in the discovery of the alkali metals, potassium and sodium. The reply was that the French *Academy* had no electric battery as powerful as Davy's. Napoleon commanded them at once to have one made, and when it had been completed he made a personal journey to the Academy to inspect it. Before anyone could warn him, he placed the leads from the battery to his tongue in order to test the strength of the current. The battery was a powerful one and in new condition. The shock which Napoleon received must have been a truly terrific one, for he gave an enormous howl of pain and surprise, and forthwith strode out of the Academy without saying another word.

Davy next tried to electrolyse baryta, lime and strontia, which substances we now know to comprise the oxides of the metals barium, calcium and strontium respectively. These experiments took place in the year 1808 and, at first, they were not very successful. Then Davy repeated the electrolytical experiments in the presence of mercury with which the liberated metal amalgamated forming an amalgam from which the mercury could be removed subsequently by distillation. In this manner, Davy succeeded in obtaining the new metals barium, calcium and strontium which came to be known as the "metals of the alkaline earths" since the naturally-occurring "earths" containing these metals commonly comprise the simple oxides of the metals.

New Metals

From lime Davy obtained calcium, from baryta he obtained barium, and from strontia (strontium oxide) he derived metallic strontium. These newly-obtained metals, however, were not in a state of absolute purity, since they were nearly always contaminated with mercury. It was only in later years that other experimenters, working with different methods, succeeded in obtaining the metals in a condition of absolute purity.

Another discovery of Davy's in 1808 was that of magnesium, nowadays a most vital and important metal. Davy obtained his magnesium as an impure metallic powder by heating pure magnesium oxide (*magnesia*) in the vapour of metallic potassium. He called the new metal *magnium*, but afterwards the name was changed to "magnesium" in order to prevent confusion with "manganese," the name of another metallic element.

Davy attempted to isolate metallic aluminium, but this experiment proved to be one of his very few failures. The affinity of aluminium for oxygen was so great that Davy found himself unable to devise a method of separating the aluminium from the oxygen in the compound *aluminia* (aluminium oxide), Al_2O_3.

Experiments in Photography

Had Davy been less busily occupied with his brilliant series of chemical experiments on the effects of the electric current, he might have invented a practical system of photography long before the inception of camera portraits on silvered plates by Daguerre in 1839-40. Davy actually obtained photographic shadow-prints by making use of paper impregnated with silver chloride, but he was never able to fix the images so produced. Curiously, he seems to have regarded these very early "sun-printing" experiments with a good deal of impatience. It apparently annoyed him to realise that he had not succeeded in discovering a "fixing" agent for his crude prints. A little more thought on his part, however, and a little more patience would undoubtedly have earned for him the fame of being the discoverer of practical photography long before that honour went to succeeding experimenters in France and in England.

Numerous chemical compounds and reactions were almost daily brought to light by Davy during those crowded years of his at the Royal Institution. His popular lectures, too, were brilliant ones and attendance at them became almost a fashionable pastime of the London society of the day.

Davy showed that the acidic property of acids was due to their containing hydrogen, and not to any oxygen which they might contain. Hence the name "oxygen" (from the Greek, meaning "acid-producer") clearly became revealed as a misnomer, for a number of acids (as, for example, hydrochloric acid, HCl) contain no oxygen.

It was Davy who gave the name "chlorine" to the active, greenish-yellow, corrosive gas which had been previously isolated, and which he himself had proved to be contained in salt and other chlorides. The name was derived by Davy from the Greek word *chloros*, meaning "greenish yellow" in allusion to the colour of the gas. For some years, chlorine had been assumed to comprise an oxygenated form of hydrochloric acid, or of "muriatic acid" as the latter was then termed. It was Davy who first showed that "oxygenated-muriatic acid" contained no oxygen but that it was a veritable new element—chlorine.

Early in his career in London, Davy had been elected a Fellow of the Royal Society. In 1807 he was appointed one of the Secretaries of that august body. In 1812 he retired from his chemical professorship at the Royal Institution, having married a wealthy widow, Mrs. Apreece in that year. In the same year, also, he was made a Knight in recognition of his discoveries, and his service to science.

Touring the Continent

During the next two or three years, Sir Humphry Davy and his wife toured the Continent, taking young Michael Faraday, the new assistant at the Royal Institution laboratories, with them. Davy's treatment of Faraday at this period is by no means above reproach, for he seems to have regarded the latter as a very menial person. Perhaps, however, the real fault was on the part of Davy's wealthy wife, the former Mrs. Apreece. As for Davy himself, he had obtained his much-desired "fame and position," but, at the same time, he still retained his scientific interests and capabilities.

When travelling in France with his wife, Lady Davy, he paid a visit to Paris and made a number of experiments on the then recently discovered element, iodine, which material he conclusively proved to be elementary in nature. He also performed a similar service for the heavy red liquid, bromine, which was also a new discovery of the times.

In the Autumn of 1815, Davy's attention was turned to the subject of explosions by the news of an extensive colliery accident which had occurred in Northumberland. He had been spending a holiday in the Scottish highlands, and, as he passed through Newcastle on his way back to London, he collected several samples of *fire damp* from mines and took them with him to London to be analysed.

Davy's Safety Lamp

For a couple of months, Davy worked continually on the problem of suppressing explosions in mines. In the December of 1815 he had completed his *safety-lamp* which consisted, in principle, of a wire gauze cylinder within which a candle was allowed to burn.

Davy, from the experiments which he made, showed that a flame or an explosive wave of burning gases could not pass through a fine network of wire. Hence a flame so protected with wire gauze could be safely taken into an atmosphere of explosive gas without any fear of an explosion being set up, for although the explosive gas could reach the naked flame within the gauze cylinder of the lamp, any igniting gases so set up could not penetrate through the gauze from the flame to the outer atmosphere.

The results achieved by the safety-lamp were spectacular. Accidents and explosions in collieries diminished with great rapidity and Davy's name became more than ever famous, not merely in England but all the world over. For his discovery of the safety-lamp, Sir Humphry Davy was feted, honoured and eulogised throughout the country. He refused to patent the lamp when urged to do so. "My sole object," he said, "was to serve the cause of humanity, and if I have succeeded I am amply rewarded by the gratifying reflection of having done so."

There is no doubt of the fact that Davy's *safety-lamp* was a great discovery and one of tremendous practical import. Strangely enough, however, George Stephenson, the renowned railway constructor, also brought out a similar lamp about the same time and, to this day, the question of the priority of the Davy and the Stephenson lamps have never really been satisfactorily settled.

More Chemical Discoveries

Davy made many more important chemical discoveries, but perhaps his very best discovery took the form not of a chemical reaction, a new gas, metal or compound, but a living individual. Such an individual was the young lad, Michael Faraday, whom Davy made his assistant, and who, in after years, became even more renowned as a discoverer in both the chemical and electrical worlds than his master.

Davy's activities in the pursuit of chemical discovery, and in the enjoyment of his popularity, were such that they caused him to burn the candle of his life at both ends over a long period. Never robust in health, he fell into a decline from which he never recovered and he died, prematurely, at Geneva, on the 29th of May 1829, before he had completed his fifty-first year.

Davy's work for chemical science was rapid, accurate, widespread and spectacular, so that he gained a praiseworthy scientific reputation which he truly deserved.

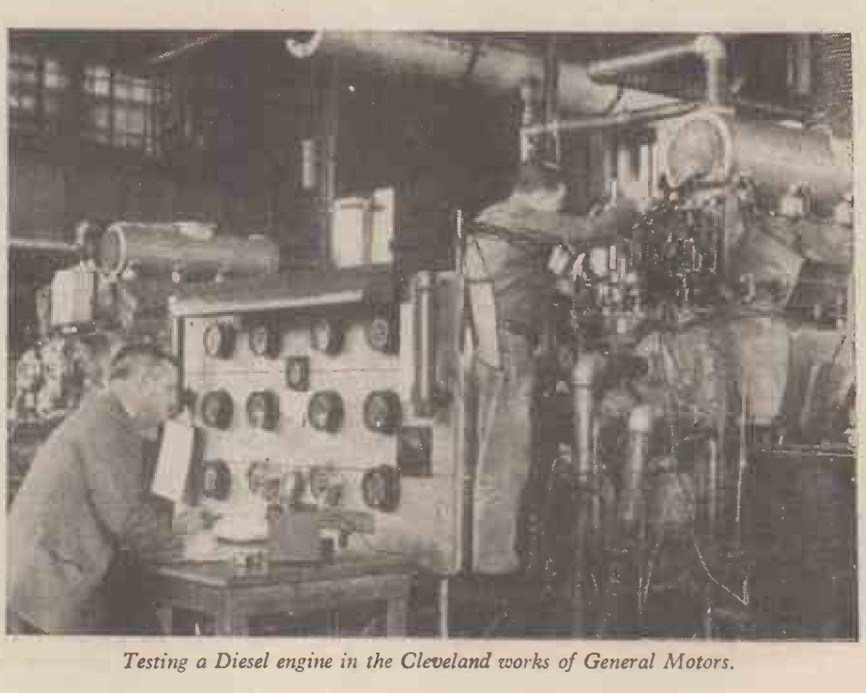
Testing Diesel Engine for U.S. Navy

IN the General Motors Cleveland Diesel Engine Division plant, H. W. Watson, U.S. Navy Inspector, and Anthony Mayer test one of the Diesel engines being built to power U.S. Navy vessels. With the intensification of the national defence programme, this plant has converted almost its entire production to propulsion machinery for Uncle Sam's fleet. General Motors' orders for Diesel engines from the Navy and other defence units total 89,400,000 dollars. With a recent addition nearing completion, the General Motors Cleveland plant now has more than 200,000 square feet of floor space.

For Tanks and Tractors

In addition to Diesels being produced in Cleveland for marine use, General Motors is producing large numbers of Diesel engines at the Detroit Diesel Engine Division for use in tanks, trucks and tractors.

Diesel power is becoming more and more important to the modern Navy. For instance, the modern submarine has been made possible largely through the use of Diesel engines. Many other ships of various kinds and sizes are powered by these engines. The giant Diesel engines built to propel such large ships as submarines must be assembled with extreme accuracy, and must pass rigid Government inspection.



Testing a Diesel engine in the Cleveland works of General Motors.

"MOTILUS" PEEPS INTO

Our Model Man Hears from abroad; Models Future; The Model Railway of a Post

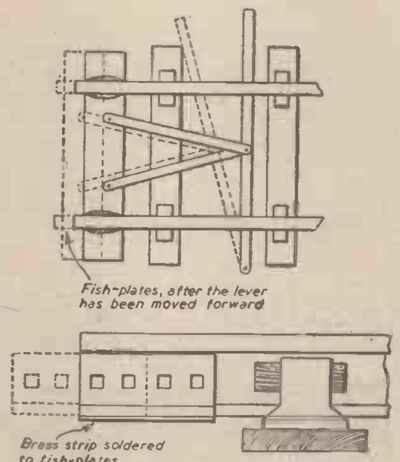
AFTER a long interval, owing to the war, I have received an interesting post-card from model-making colleagues in Switzerland, which gives the welcome news that the hobby is still very much alive there.

Model engineers in Switzerland—a post-card "Motilus" recently received from Baden.

It reads "Many kind regards from a birthday party of a new 'rail baby' " and is from my old friend Hugo Hurlimann, who took the picture. Other members shown on the photograph have signed their names, including Walter Siegwart of Baden, president of the Schweizerischer Eisenbahn-Amateur Klub. This club has its headquarters in Zurich and numbered in peacetime 110 members, of whom 55 were actual model-makers. When I visited it in 1939 23 were engaged in building gauge "1" model locomotives, 25 gauge "O" and 7 gauge "OO". Eleven members were specially interested in model and real railway photography and two were timetable "fans" and experts. The remainder are all interested in various forms of railway modelling and working.

Among the signatories is Walter Brast of Brugg, who is a gauge "1" enthusiast and the possessor of some of the early models made by the late Captain Lockhart. At the time of my visit Mr. Brast was building in his garden a most attractive railway raised from the ground by means of viaducts built in reinforced concrete. Viktor Brast, his brother, has also signed. The Brast brothers have a garage at Lucerne—beauty spot of happy peacetime memories—and were building a 1½ in. scale model of the 4-4-0 L.M.S. "George V" from Bassett-Lowke castings.

I have asked the editor to publish the photographic post-card, which has found its way, after two long months, from Switzerland to England. It shows the new "rail baby"—a 7¼ in. gauge "Royal Scot" constructed from Bassett-Lowke castings, drawings and parts—a fine job, and the work shows the proverbial Swiss precision and accuracy. On the extreme left is the president Walter Siegwart, third and fourth from the left the Brast brothers, and second from the end (right), smoking his pipe as usual, is Mr. Willie Gassman.



Details of part of the track of the Swansea model railway.

Town Models

Before the war many architects used models of their designs for new municipal and other types of buildings to demonstrate to their clients in a progressive form what the building they proposed would look like when completed. This method has been the means of many a scheme being modified and altered before being put in hand, to the advantage of the client and all concerned! Here is a skilled craftsman engaged on the modelling of a new Town Hall erected "somewhere in England" just before war broke out. When the conflict is over it is highly probable that the demand for models of this description will be greatly increased. Even models may be used for whole cities—such as Coventry, Bristol, Plymouth and Portsmouth—that have been badly blitzed, as the complete centres of towns like these may have to be replanned. Coventry is already well ahead in this matter and the City Architect, Mr. D. E. E. Gibson, M.A., A.R.I.B.A., A.M.T.P.I., has already drafted out new plans for the centre of this city, and his suggestions are now under consideration by the Government Departments concerned.

Gauge "O" Electric Railway

This is the ideal time of the year to "operate" with a railway out of doors, and a Swansea reader has sent me photographs and scale drawings on squared paper of his gauge "O" electric railway.

It is an extensive layout, mostly out of doors, most attractively planned, and members of the Forces in the Swansea district are welcome to visit it (will those interested please inform the editor and the address will be forthcoming). My "Swansea reader" writes "You will see I am a believer in starting on squared paper. I spent nearly six months of spare time in this way before actually commencing work. This was partly due to domestic objection to the disfiguration of the garden and partly to the necessity of getting to know the types of electrical equipment available, as well as the question of gauge. I would like to give a tip to would-be model railway enthusiasts—that is—schemes should always be started on squared paper so that at

A close-up view of the Bassett-Lowke model loco, Princess Royal, on the up main line.

THE MODEL WORLD

of Britain's Towns of the Office Engineer.

a glance it can be seen what space a layout will take up. If a few schemes have to be scrapped at that stage it is *only on paper*."

The railway is called the Lindum Monk-Abbey and Swallowbeck railway (L.M.S.) and here is a brief description. The external track, "O" gauge, is of brass running rail with "OO" gauge nickel silver rail for the centre live rail, soldered on the head of brass screws which pass through fishspine beads, screwed into sleepers. The track is mounted on three longitudinal battens supported by posts at six foot intervals along the straight and 3 ft. 6 in. on curves. Ground level variations necessitate the use of some fairly long posts, up to 4 ft. 6 in., while the height of the track indoors is 3 ft. 6 in. from the floor. The internal track is laid on sleepers on a solid baseboard and the running rail here is steel. The humidity and salty nature of the atmosphere at Swansea is such that steel rail, though sheradised, rusts in about eight to ten weeks and is therefore useless for out of doors. The steel rail in the shed has been in use five years and is beginning to corrode and the war has prevented the owner renewing this with dead scale nickel silver rail.

A scale model of a new Town Hall which was erected "somewhere in England" just before war broke out.

A Four-Road Turntable

A special feature is the four-road turntable. It serves a dual purpose. On arrival of an up train the engine is uncoupled and runs on to the table on either of the up roads and when *turned* the engine is automatically transferred to one of the down roads and can be used again to take the same train out, or can go into the depot as required. The turntable is large enough to accommodate a Bassett-Lowke "Princess Royal" on any road—the longest engine in his "fleet," which comprises over a dozen locomotives, 40 wooden wagons, eight L.M.S. bogie coaches and four L.M.S. bakelite bogie coaches. His engines are a really interesting assortment. There is a G.N.R. "Stirling" 8-footer, by Beeson with 8-pole armature, three Peckett tanks, 0-6-0 by Bond, the "Princess Royal," two "Royal Scots" and a 4-4-0 "Princess Elizabeth" by Bassett-Lowke, and one or two locomotives made "in the shop" and fitted with Bond, L.M.C. and Bassett-Lowke d.c. mechanisms. He remarks that he has fitted the B-L mechanisms with morganite brushes by soldering pieces on bronze brushes supplied by the makers.

The electric power system is 6-8 volts d.c. worked from accumulators and/or mains units, which latter are also used to charge the batteries. The control panel, another original idea of the owner's, is made up of a number of "piano" keys which, when pressed connect with a bus-bar and rheostat for direction and speed control. The keys spring back on release, thus forming a "dead man's handle."

It would be taking on too complicated a task to describe the sectionalisation of the system, and if further confirmation is needed, the fact that no less than 30 keys are in use, should suffice! 7/22 wireless aerial wire is fixed beneath the track battens for use as feeders.

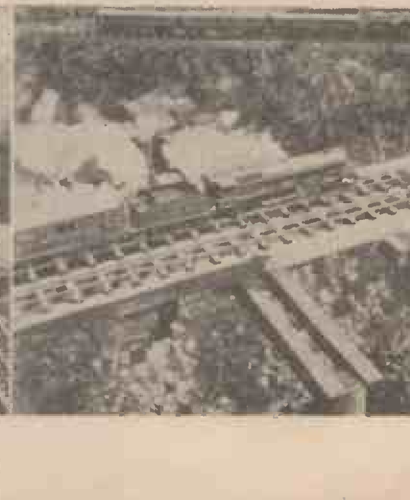
(Above) The control room of the Swansea model railway, and its approaches.
(Right) Main line, looking south, and the "Princess Royal" on the up main line.

Track Entrances

Signalling has not yet been introduced, though one experimental post may be seen in one of the photographs—at the exit from the control room. The track entrances to control centre are made in the form of tunnels to exclude the rain, the apertures being closed by means of sliding shutters at the inner ends. The windows of the centre enable the operator to see the whole of the external track and the system can be operated without moving from control point except for coupling up trains and locomotives.

The rather modest owner writes: "The scheme may at first glance seem incomplete, but one has to crawl before running. It was my intention to build an additional housing immediately north of the present centre, to accommodate a Main Station and Goods Yard but this scheme is now held up indefinitely. I am not very familiar with steam engines, but in any case I consider electrical control to be best suited to any one-man show.

"This installation has taken about five years to build, as I had to acquire my knowledge by mistakes, but luckily, being a Post Office engineer, I had no difficulty with the electrical side of the business."



Automatic Steering for Model Boats

Details of a Novel Device which can be applied to either Steam, Electric or Clockwork-driven Model Ships.

THE usual procedure in model boating is to cruise from bank to bank, which soon becomes rather tiring. With the device shown in the accompanying sketches, one can stand at any given point on the edge of the pond, and the boat, after being released, continues its voyage, and at a certain distance out at "sea" makes a complete turn and comes back to the shore near the place from where it started its journey. This interesting manoeuvre gives the effect of life on board the model.

The device is simple and inexpensive, the materials required being a cheap clock mechanism, two gear wheels ($\frac{1}{2}$ in. and $1\frac{3}{8}$ in. diameter), one rubber band, one cycle spoke, and a few odd pieces of brass rod and strip.

Constructional Details

It will be seen, with reference to Fig. 1, that the larger gear wheel is fixed to the rudder post with a grub screw, and this wheel meshes with the small gear wheel mounted on a spindle positioned on the centre line of the boat. This spindle, and also the rudder post are supported in wooden mounting strips, as shown in Fig. 2. A piece of brass rod is soldered into the grub-screw hole of the small wheel, and to this rod is soldered a small brass hook, a corresponding hook being screwed into the side of the hull. Over these hooks is slipped a rubber band.

The clock mechanism is mounted on a wooden block fixed to the bottom of the hull (Fig. 2), and to the winding spindle is soldered a strip-brass lever, upturned at the end to engage with the end of the rod fixed to the small gear wheel. A short piece of bicycle spoke is passed through a hole in the deck to pass between the spokes of one of the clock wheels, to prevent the clock making a premature start.

Operation.

After winding the clock spring, the lever attached to the winding spindle is moved to the starting position (Fig. 1). When the boat is started on its journey, the locking pin is pulled up to free the clock mechanism which slowly moves the lever. It usually takes about one minute for the lever to contact the gear-wheel rod, and by this time the boat is well out to "sea." The rudder is then moved slowly, till the clock lever disengages the gear-wheel rod which is pulled back by the rubber band. The stop-piece on the large gear wheel causes the rudder to set a straight course, and the boat continues its journey in a direct line from "home," as depicted in Fig. 3.

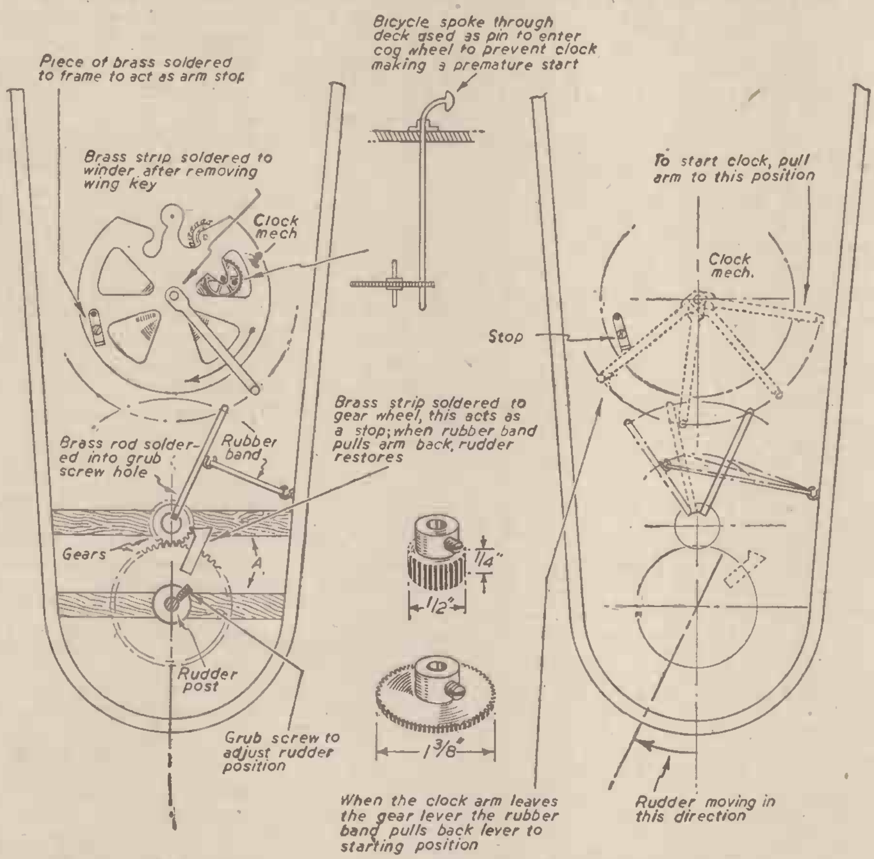


Fig. 1. Plan views of the stern of a model ship giving details of the automatic steering mechanism.

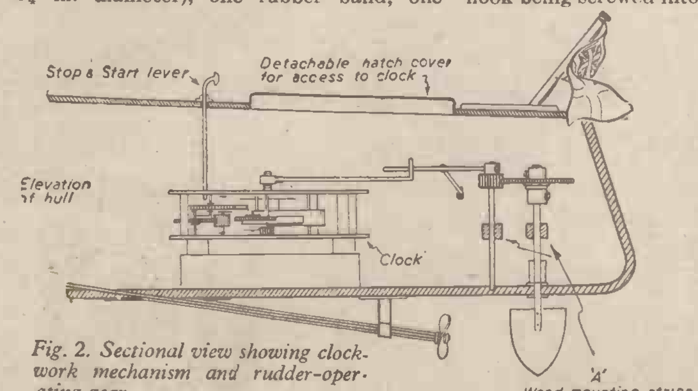


Fig. 2. Sectional view showing clockwork mechanism and rudder-operating gear.

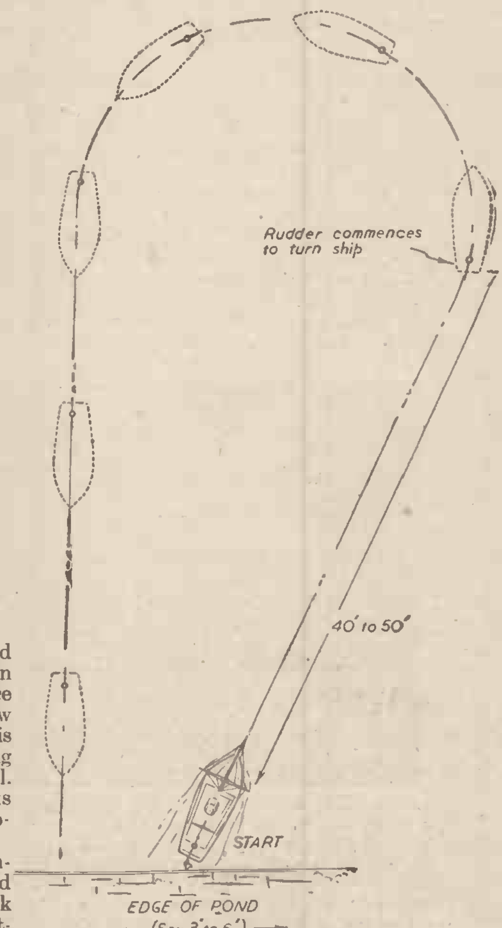


Fig. 3. Diagram illustrating the course taken by a model ship fitted with the automatic steering gear described in the text.

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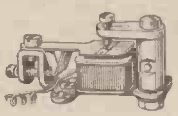

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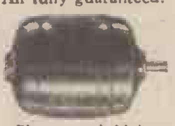

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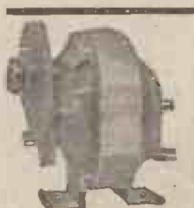

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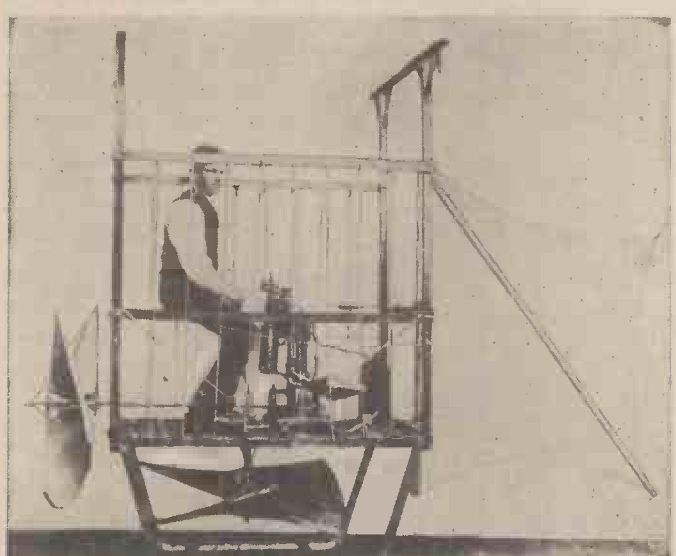
MASTERS OF MECHANICS

No. 68. Langley's Folly. The Story of one of the World's First Aeroplanes, and of its Inventor, Samuel Pierpont Langley.

SAMUEL PIERPONT LANGLEY hated to be called an inventor. He preferred to be known as a "working scientist." Actually, this brilliant American who first conclusively demonstrated to the world the essential practicability of mechanical flight, was by inclination, training and career an astronomer. He had devoted much study to problems connected with the sun's radiation and several discoveries relating to solar physics had been made by him before ever he began to take up the quest of mechanical flight.

The apparent miracle of a bird's steady and often almost effortless motion through the air had been a source of much wonderment to Langley ever since his boyhood days when, in company with one or two kindred spirits, he had roamed the open countryside around his home and had repeatedly observed the great wheeling flights of some of the large American birds which were numerous in his district.



An early aeroplane engine constructed in Germany in 1888. It comprises a 4 h.p. Daimler motor operating vertical and horizontal propellers. Note the quaint shape of the "plane."

But it was many years before Langley took up the solution of the problem of mechanical flight in real earnest. In Langley's early days, any man who gave attention to the subject of aerial navigation was dubbed a fool and a lunatic. It was believed by all classes, as by a sort of unwritten faith, that mankind would never be able to fly. As the years rolled on, scientists in their laboratories and professors in their comfortable studios and lecture-rooms evolved various demonstratinns which conclusively proved (to their own satisfactions) that human flight was utterly impossible. Even the world's Patent Offices fell victims to this pathetic delusion. It is on record that even as late as the year 1896, one official patents examiner rejected an application for a patent covering a projected "flying-machine" on the grounds that it was obviously impossible ever to construct any engine which would lift its own weight.

Samuel Pierpont Langley came into the world at Roxbury, near Boston, U.S.A., on August 22nd, 1834. He was a brilliant, studious lad with a passion for scientific experiments. Graduating in physics, he ultimately became Professor of Astronomy in the Western University of Pennsylvania in 1867, and in 1887 he was appointed Secretary of the Smithsonian Institution at Washington, an American foundation somewhat akin to our own Royal Institution, in London.

Astronomical Work

As an astronomer, Langley made a name for himself in consequence of his brilliant researches into the absorption of the sun's heat by the earth's atmosphere and by planetary bodies. Much of this work was carried out at the Observatory of Alleghany (now part of the city of Pittsburgh) and it was here that Langley began the long series of experiments which proved conclusively the practicability of mechanical flight, and brought into being an approximation to the actual form and shape of the first successful aeroplane.

Langley, having attained the status of a scientific celebrity in the year 1887, might have rested comfortably on his well-earned laurels. Instead, however, he devoted the whole of his now increasing hours of leisure to a scientific investigation of the subject of human flight in an endeavour to bring into being a machine which would carry a man safely through the air with, at least, some of the assurance of a bird in gliding through that medium.

Langley had long observed the fact that an American bird known as a "turkey buzzard" could remain with almost motionless wings in the air for long periods at a time. The fact that the average turkey buzzard weighed some four or five pounds at once gave the lie to those scientific wiseacres who gloomily asserted that it would require enormous power to support any heavier-than-air mass in the atmosphere.

Experiments in Aerodynamics

Just before his removal to the Smithsonian Institution at Washington, Langley began his now fundamental experiments in aerodynamics in the old and now defunct Observatory at Alleghany. His apparatus comprised a rapidly-revolving "table" some sixty feet in diameter which was driven at first by a gas-engine, but afterwards by a steam-engine. The peripheral or edge speed of the whirling table was seventy miles per hour.

With the aid of this apparatus, Langley studied (by means of a resistance-gauge or "dynamometer-chronograph") the influence of air on surfaces and planes of various dimensions, these articles being secured to the whirling table at various angles. Then he made similar experiments on stuffed birds, these being similarly whirled along through the air at a high speed by the revolving table.

After four years of these experiments, Langley published his results. They showed (in direct opposition to the theoretical teaching of many of the professors of the day) that the force required to sustain planes in horizontal motion through the air decreases with increased velocity of the planes. In other words, according to Langley, when, ultimately, you had made your flying-machine, you would find that as its speed through the air increases, it would take less power to support it in the air, other factors, of course, being equal.

This demonstration came in marked contrast to the conditions obtaining in the case of land and water transport, for, as Langley pointed out, "whereas in land and marine transport increased speed is maintained only by a disproportionate expenditure of power, within the limits of experi-

One of the first of the world's commercial aeroplanes about to take off from a field in France about 1909.

ment in aerial transport, the higher speeds are more economical of power than the lower ones."

Langley proved, also, that it would take no super high-powered engine to drive a flying machine through the air. He demonstrated the fact that even a single horsepower, rightly applied, would be sufficient to maintain a plane of 200 lbs. in horizontal flight through calm air at the rate of about 40 m.p.h.

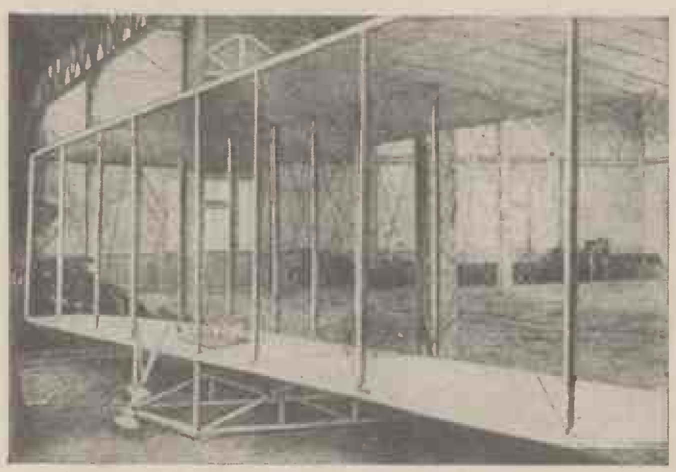
When Langley first started his experiments in 1887, the form or shape of the aeroplane was unknown. True it is that a few English inventors had developed flying-machines built up on kite-like principles, but such configurations were, to say the least, entirely arbitrary ones, and they rested upon no clearly proved scientific foundation.

Aeroplane Models

In an endeavour to elicit the main principles of equilibrium of bodies in the air, Langley, between 1888 and 1893, constructed about forty different aeroplane models. They were all driven by rubber motors, and, so far as actual flying was concerned, they were all failures. But with his forty rubber-driven aeroplane models, Langley garnered an enormous amount of practical knowledge concerning aerial equilibrium. He found, for instance, that an aeroplane must have a tail and that it must be given wing surface of fairly large area in order to enable the machine to rest upon the air.

The problem of launching or taking-off from the ground and of alighting after a flight, Langley entirely ignored at this stage. His aim was a fundamental one. It was to find out exactly what was the best shape for an aeroplane to take, or, in other words, to solve the problem of the aerial equilibrium of solid bodies.

About 1893, Langley, having got a certain way with his investigations into the shape of planes, commenced to provide his models with steam power. These steam-driven models were made, for the most part, of steel, and they weighed about a thousand times as much as the air they displaced. Many months were expended by Langley in designing suitable launching apparatus for the models. For this purpose, he constructed something like a short stumpy tower on a houseboat, from which the models were mechanically shot off. The experiments were carried out on the Potomac river, on the surface of which the models might alight without any serious or expensive damage.



An early biplane in the making. Photograph taken about 1909.

Steam-driven Aeroplane

On May 6th, 1896, Langley gave a demonstration of a large steam-driven aeroplane. The aeroplane embodied a light steel frame, a small steam engine heated by paraffin, wooden propellers and wings, and it weighed about 24 lbs. It was launched from the tower of Langley's houseboat and it rose steadily to a height of about 70 feet above the river Potomac. It flew steadily, veering slightly to the right and remained in motion for one minute and twenty seconds. Then the propellers began to slow down owing to the exhaustion of the fuel. The aeroplane descended quickly and dived ultimately into the river.

The scientific spectators present were amazed. Never before had it been possible to get a flying machine to remain in the air for more than a second or two. General consent was accorded to the fact that Langley had definitely demonstrated the possibility and, indeed, the practicability of mechanical flight. Langley himself felt so, too, and this time he *was* inclined to rest upon his laurels, and to allow the commercial exploitation of the flying machine or aeroplane to be taken up by others, for, as previously mentioned, this former successful astronomer had an intense dislike to being known as an inventor.

However, Langley's innate desire to construct a man-carrying aeroplane spurred him on to further action. In consequence of the Spanish War which had broken out in 1898, it seemed to the American War Department that a satisfactory flying machine would be of much service to the nation. The attention of the United States President (McKinley) was drawn to Langley's experiments, and he at once appointed a Commission to investigate them and to go into the whole question of mechanical flight. In the December of 1898, Langley was granted fifty thousand dollars with which to carry on experiments in the building of a serviceable man-carrying flying machine.

Langley's chief difficulty was with the engine. He had hoped to obtain a small petrol motor from some outside firm of automobile manufacturers, but motor-car making was then in its infancy, and Langley was unable to obtain the type of engine which he required. Ultimately, he had to make the engine himself. It was a five cylinder engine, weighing about 120 lbs. and developing some 52 h.p.

"Langley's Folly"

The Langley engine was fitted into a plane which took the form of a monoplane more than anything else. The machine had to be mechanically launched, and it was not until 1903 that it was ready for trial. Many interested watchers, on observing the weird-looking contraption, dubbed it "Langley's Folly," and felt certain that it would never fly.

A small edition of "Langley's Folly" had also been made. It was not a man-carrying machine, being only about one-quarter the size of the larger plane. This smaller machine was launched above the Potomac river (about 40 miles below Washington) on August 8th, 1903. It flew for about 350 feet in a straight course and then slowed down. Almost immediately it picked up again and, veering to the right, flew upwards for another three or four hundred feet before it swiftly but gently descended to the water.

The larger aeroplane was launched on October 7th, 1903. It had Langley's engineer, Manly, on board, but, owing to some unexplained mishap connected with its launching, the machine flew only a few yards and then plunged headlong into the river.

Two months later—on December 8th, 1903—a similar attempt was made, but again difficulty with the launching gear was experienced, and Manly once again found himself suddenly immersed in the river.

At this stage a sense of failure seemed to overcome Langley. He had used up the fifty thousand dollars granted to him by the United States Exchequer, and, hurt by the repeated and often unfriendly allusions to "Langley's Folly," he gave up his active endeavours to construct a man-carrying aeroplane.

Langley's literal descendant in the aeroplane world was Louis Bleriot, the noted French aviator who first flew the English Channel on a monoplane based on Langley's design on July 25th, 1909. Langley, however, never witnessed this feat, for he died in 1906, just as his dream of practicable flight was about to come true.

The Launching Problem

There is little doubt that if only Langley had solved the launching problem by fixing wheels to a light undercarriage secured to his aeroplane, as Blériot did for the first time in 1907, his machine would have flown perfectly well, for it was only in consequence of its inability to take-off satisfactorily that "Langley's Folly" failed.

Eight years after its inventor had lain in the grave, Mr. G. H. Curtiss, of the Curtiss Aviation Company, was invited to send an aeroplane for a demonstration which was to be held at Washington in celebration of "Langley Day," 6th May, 1896, on which occasion Langley first proved the practicability of mechanical flight.

Curtiss expressed the desire to vindicate Langley's memory by making an actual flight in the original "Langley's Folly" which had failed in its trials on December 6th, 1903, and had thereby caused Langley to retire to practical aeroplane construction.

Curtiss's request was granted. "Langley's Folly" was removed from its museum and taken to the Curtiss Aviation Field at Keuka Lake, New York, where it was fitted with hydroplane floats.

Langley's Folly Flies!

Manned by Curtiss himself and operating on its own original motor, Langley's 1903 ill-fated aeroplane skimmed gracefully over the wavelets of the Potomac river on "Langley Day," 1914, and rose gracefully into the air, completely maintaining its equilibrium for several minutes. When, subsequently, it was fitted with a new 80 h.p. motor more in keeping with the added weight of its undercarriage, the plane rose easily from the water and made a prolonged flight.

Thus was the memory of Samuel Pierpont Langley vindicated for all time. As one American journal expressed it in large and spectacular headlines :— LANGLEY'S FOLLY FLIES!

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Long Life for Batteries

THE black-out has made the torch a necessity, and the torch depends for its efficiency principally upon the battery. When the long nights arrive, there will naturally once more be a great demand for this method of lighting. But it is not possible to lay in a store of batteries far ahead because they deteriorate while being kept.

An inventor has set himself the task of providing a battery free from this drawback. He affirms that it can be stored or allowed to remain unused for any desired period without loss of life or capacity. A dry battery is so constructed that it can be manufactured and sold in an inactive or uncharged condition. It possesses one or more openings, through which plastic electrolyte is inserted as soon as the battery is required to be used.

Bird Messengers

THAT tiny aerial aide-de-camp, the carrier pigeon, may now be equipped with a dispatch case which will not be easy for an unauthorised person to detach. The message holder is characterised by its being furnished with a closure which, when turned into its final position, completes its attachment to a ring or clamping means for embracing the leg of the bird with a correct fit.

Instead of Glass

THERE is a somewhat ancient recitation which tells of a man who one night broke all the windows of the village church to help his friend, the local glazier. His friend, alas! had signed a contract for a yearly sum to keep all the church windows in a perfectly glazed condition.

Such violent fracture, owing to enemy action, has of late been unpleasantly general in some of our towns. This makes very appropriate the appearance of a glass substitute convenient for a time of emergency.

The new substitute for glass consists of expanded metal treated with a plastic substance to film over the openings in the metal.

People who live in glass houses please note.

Fighting the Flames

IT is now possible for a mechanical fire-watcher to come on duty. An apparatus for the detection of fires, including those caused by incendiary bombs, has appeared on the scene. The object of this invention is a simple method whereby a number of detector points are distributed round a building. These points are coupled to operate on a central warning unit.

A valve oscillator is tuned to an audio-frequency and coupled to a photo-electric cell circuit in such a way that the oscillator is prevented from acting, unless light and heat radiation, or either of these, fall on the photo-electric cell.

Oscillations are supplied to an indicating or signalling device directly sensitive to the oscillations, such as a loudspeaker.

Foot Overcoat

ON cold and stormy days, it is usual for one to turn up the collar of one's overcoat. This idea has now been applied to the other extremity of the body. An invention relating to footwear arranges for the conversion of a shoe into a bootee, protecting the ankle and part of the leg from inclement weather.

A certain type of shoe has a turned-over tongue and an upper with a turned over top.

The information on this page is specially supplied to "Practical Mechanics" by Messrs. Hughes & Young, Patent Agents, of 9 Warwick Court, High Holborn, London, W.C.1, who will be pleased to send free to readers mentioning this paper a copy of their handbook, "How to Patent an Invention."

The object of the invention is the construction of a shoe of this kind in such a manner that, by a simple adjustment, it can be worn as a bootee. The turned-down top of the upper and the turned-over tongue can be turned up like a coat collar, thus guarding against the severity of the weather.

We are told that, in whichever form the shoe is worn, it presents a neat and pleasing appearance.

A fourteen-foot test tube being used for atomic research in the General Electric Research Laboratory, Schenectady, New York. Further particulars are given on page 368.

Bombs that Bounce

TO retard penetration of the soil by a bomb and to ensure its bursting above the surface, are the aims of an invention for which a patent in this country has been applied.

The device consists of an aerial bomb constructed in such a manner that, after striking an objective, it rebounds before exploding. This enables it to do greater damage than if the impact were modified by its burial in the earth.

Tube Shelter

THE object of a newly-devised cage-like structure is to protect the occupants of a shelter from injury. This is an arch-shaped tubular air-raid shelter. It comprises a number of tubes secured side by side by spacing tie bars at a distance apart sufficiently limited to prevent the passing of splinters and other harmful substances.

The tubes may be filled with loose material such as sand, which to a considerable extent prevents splinters from a bursting bomb from completely penetrating the tubes. Even should they penetrate them, the velocity of the splinters is so reduced that they do not cause any injury.

The tubes are preferably formed from mild steel; but for large structures concrete pipes may be used. The fact that the tubes are spaced apart allows a minimum weight of material to be employed.

The inventor states that his curved tubular shelter is cheap to produce and easy to erect.

Serial Bombs

THE originator of improved bomb-dropping means hails from Poland. And the British Patent Office has accepted his application to patent the idea.

The invention contains a number of bombs which, during their descent, are dropped automatically and in succession at pre-arranged intervals. The device also embodies means, such as a parachute or air-screw, for retarding the descent. As a consequence, a comparatively large number of bombs may be precipitated over a wide area.

Reversible Raft

NUMEROUS contrivances to protect those in peril on the sea have been introduced from time to time. One of the latest of these is a new type of raft, a characteristic of which is that it can be launched either way up. Consequently, if it turns turtle, it is still the right side up.

Built in the shape of a tank, this life-saver is automatically released, should a ship be sunk without warning. It can also be launched in the customary manner, and it is equipped with a sail and oars.

Tubular Cookery

AS a result of strenuous digging, the potato to-day bulks largely in the supply of home-grown food. Should communal kitchens become general, the cooking of great quantities of this vegetable will be necessary. This will make apposite a new continuous process of cooking potatoes.

According to the invention, potatoes or other vegetables are caused to travel slowly downwards through a tube containing hot water. Live steam is introduced into the tube at its lower end. And from the bottom of the tube the cooked articles are removed for further treatment.

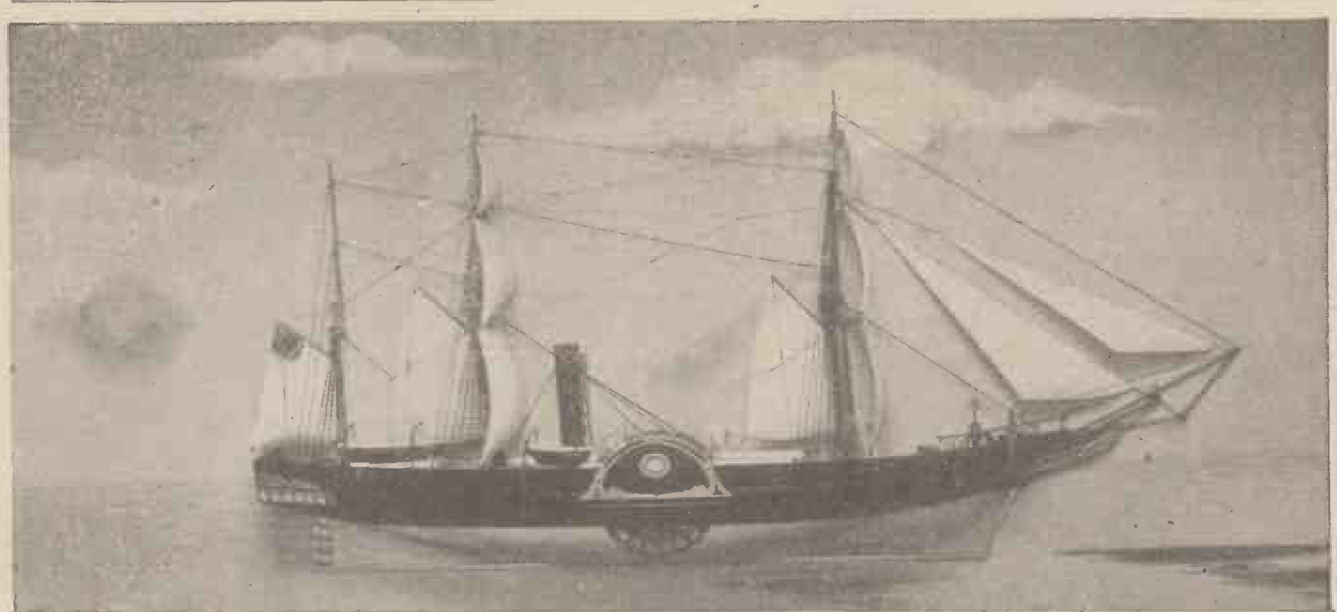


Fig. 2 The "Britannia" model by J. Johnson of London, displayed at an exhibition in New York.

Model Shipbuilding

How to Build a Waterline Model of the Famous Pioneer Cunarder, *Britannia*

EVERY ship has a personality and from the captain down to the smallest rating, whether Royal or Merchant Navy, every sailorman becomes attached to his ship, and when he leaves her it is with a certain amount of regret (even when it is for a better ship), and when she goes to the breakers it is almost like the funeral of a dear friend.

Not all of us can become so intimately connected with a ship, but some of us who are fond of ships can get many hours of enjoyment in a museum, where there are hundreds of models of all types of shipping craft portrayed with beauty and fidelity.

To build a large and accurate model of a ship is often a work of many years—almost a lifetime job—and it is to this type of work that the skilled professional craftsman or brilliant amateur is devoted. But for the man who has only a limited number of hours to spare for a hobby a smaller model will prove more satisfactory.

Famous Little Ship

So for this article has been chosen a small waterline model of a very famous little ship—the *Britannia*. For your guidance there are reproduced two photographs of large models of this ship, which will help you with the details. Fig. 1 shows the ⅛-in. to the foot scale model now in the South Kensington museum. The second picture, Fig. 2, with scenic background, is by Mr. J. Johnson, of London. It is a half section model ¼-in. to the foot and was built for the New York World's Fair, in conjunction with other famous ships of the Western Ocean, chief among which was the huge 28-ft. *Queen Elizabeth* made by Bassett Lowke.

The model described is 50 ft. to 1 in.—approximately 6 in. long and the full set of parts are shown in Fig. 3. You will no doubt be pleased to see some of the difficult jobs like soldering the spars, stepping the masts and mounting the lifeboats on davits have already been done.

The model described was made up by a fifteen-year-old lad and Fig. 4 represents six hours of his work. First of all he stuck the decking to the sloped hull with glue. It was dry in ten minutes and then he cut it close to the edge with a razor blade. The next job was the bulwarks which were bent to shape and fixed firmly with glue. While they were drying he put on the bowsprit, and then assembled the two paddle wheels on their sponsons. The next job was to sandpaper the hull and then glue the paddle wheels to the boat.

The only thing left to complete the boat up to Fig. 4 was to set out the masts from the drawing and drill the holes for insertion with a fine drill—a pin or a needle, filed like a brad awl, will suffice.

The Deckhouses

The small deckhouses drying in the background have Bristol board tops which are attached first and overlap the small wood part. These are fixed on pins, painted white and then stuck up to dry.

Next item on the programme is to fit the deckhouses. Mark them out first from the plan, and the catheads of wood also must be fixed to the right angle, and the small winch forward.

The funnel is supplied correctly painted, but close in front you must drill a small hole and fasten the steam pipe into it. Then come the paddle box bridges, small strips of Bristol board, fixed in the exact

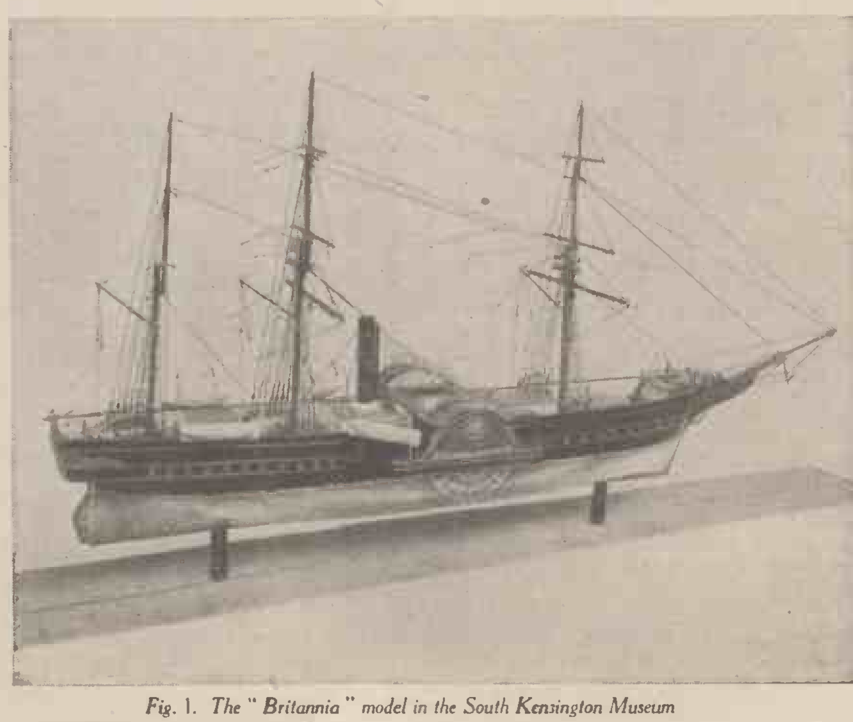


Fig. 1. The "Britannia" model in the South Kensington Museum

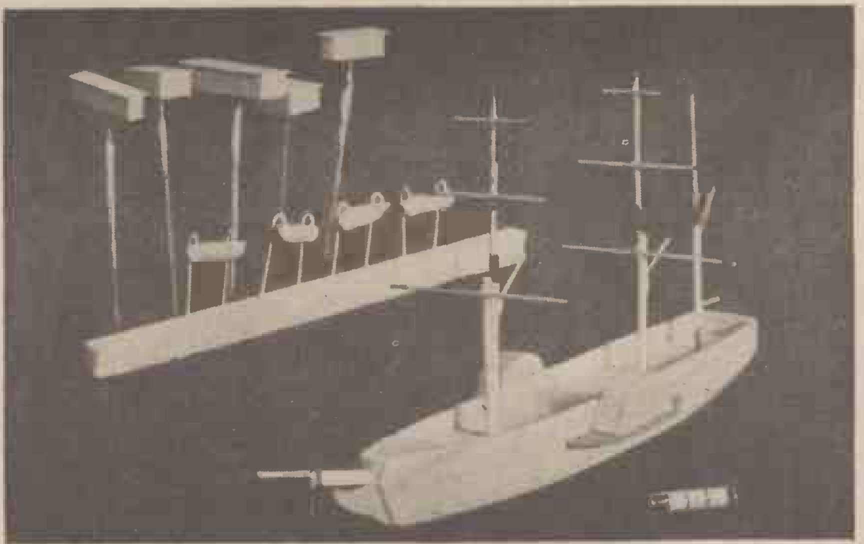


Fig. 4. The model in the process of construction

positions given from the drawing. This completes the deck fittings, so fix in the masts finally with a strong dose of adhesive!

For drilling the rigging holes you must have the minutest drill, and a small pin will prove satisfactory. Drive half its length into a pen holder (or any piece of wood convenient to hold) and when fixed file to a fine point. When drilling for rigging there is no need to go to any great depth as the holes are only required to take the ends of the ropes. All are shown on the drawing.

Painting The Hull

Now, as most of the handling of the model is over, is the time for painting the hull and paddle boxes black, but before fixing the model to the blue base you must also finish off the paddle wheels. You can cut out the wheels, or, by filling in the spaces between the red structure lines with black paint, the same effect can be produced. Then attach the model to its base, either by adhesive or screws and it is ready for the next interesting task.

Rigging

Commence rigging at the foremast with the black rigging silk. Tie the first shroud at the position shown on the rigging plan, and make one end fast in the first hole in the deck by the foremast. Similarly fasten the other end at the other side. Fit all the lower shrouds to all masts, and then add the two back stays.

The two lower forestays are tied at the bottom of the stepping in each mast, the ropes then running down to the deck, to be made fast as shown on the plan.

The top fore-stays and single ropes can easily be followed. They run down the ship from mast to mast, being made fast in the bows of the ship.

Next comes the running rigging for which use cream rigging silk. The lifts and braces run from the mast stepping to the end of either yard, and from yards down to deck. Finish off with vangs and lifts fixed to the gaff of each mast. The lift is tied to the top of the stepping in the mast and runs to the end of the gaff, where you fix it with a little adhesive. For the vangs, tie the rigging silk where the lift ends, taking the ropes down to decks either side and make fast.

Lifeboats

It is a comparatively simple task to fit the four lifeboats, and now you come to add vangs to your little ship with the sails.

Cut each little sail out, place it on your knee dull side down and roll with a pencil to give a billowy effect. Then with a tiny spot of adhesive fix it to the yard. Do not cut them all out before fixing, or you are liable to get them mixed up.

The sheets, or ropes controlling the sails, may be added to the lower sails by passing a length of rigging silk through a small hole in the corner of the sail.

All that now remains to be done is an individual matter as far as the model-maker himself is concerned. He can add the gilt decorations with his own brush, or from the designs in the set, and if he wishes to keep the model free from dust can make up a show case from glass parts with passe partout joints, and a shaped wooden base to take the blue imitation sea. 50 ft. to 1 inch is a good standard scale for the

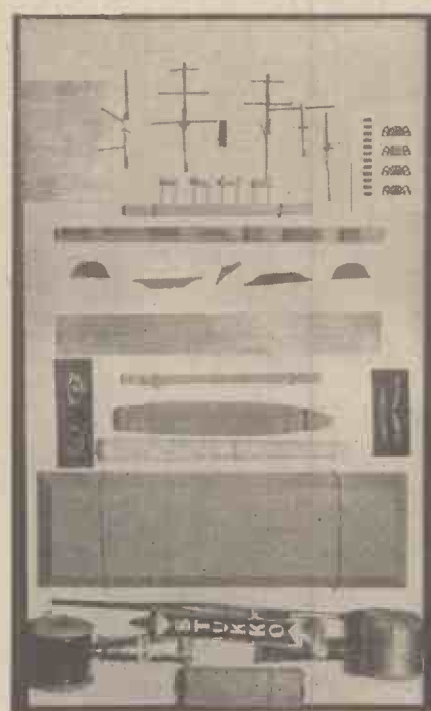
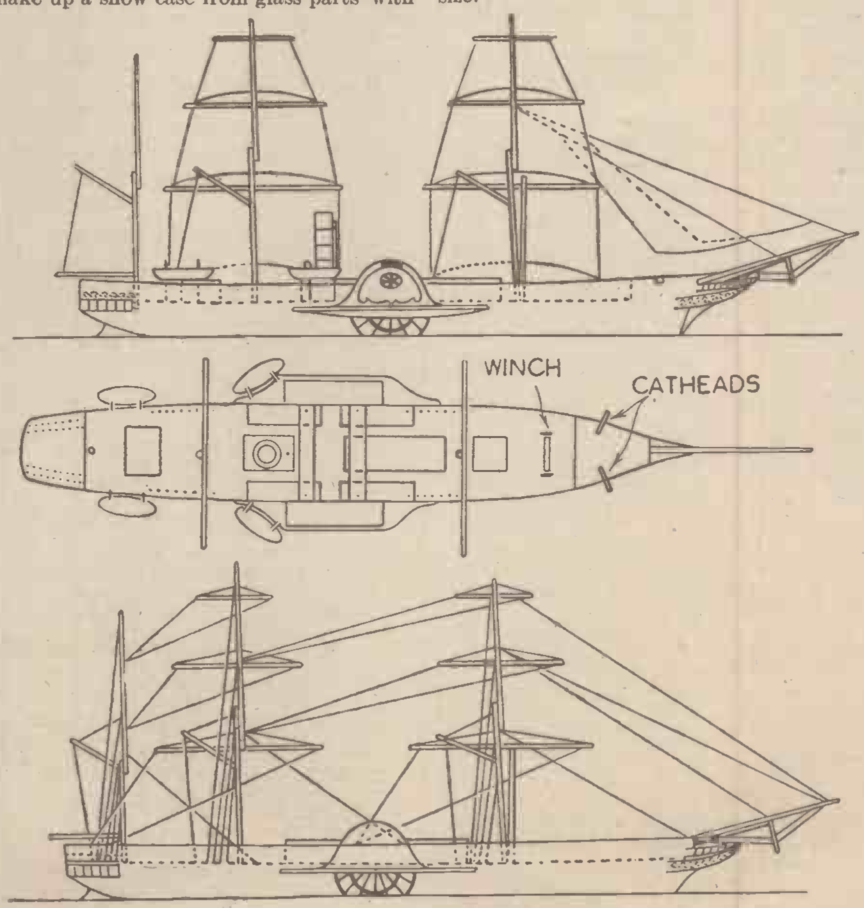


Fig. 3. The set of parts for making the 50 ft. to the inch model of "Britannia"

historic waterline model, and there are several other sets of parts made to this size.



The drawings of the 50 ft. to the inch model of "Britannia"

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.

Cracked Aluminium Castings

I HAVE made a die from cast iron to chill cast aluminium crank cases for model aero engines but find that they crack whether the model is hot or cold. It seems to be the core that is the fault; also I have covered it with black lead but this makes no difference. They will run all right in type-metal, but this is too heavy. Can you please advise me? Also, where can I get a book on die or chill casting?—Francis H. Day (Banwell).

WHEN metal cores are used, it is necessary to withdraw them at the proper time after pouring has been done. The reason is that aluminium alloys are unusually weak at temperatures just below their melting point. The cores, therefore, must be withdrawn as soon as the casting has set sufficiently, and before solidification shrinkage is complete, otherwise cracks are liable to occur, since the cores being of metal, do not yield.

Here are some books on Die Casting:—

Die Casting Practice (Stern) 15/-. McGraw-Hill Publishing Co., Ltd.

Die Castings (Chase) 17/6. Chapman & Hall.

Die Castings (Street) 4/6. Emmott & Co., Ltd.

Die Casting Dies 2/6. Machinery Publishing Co., Ltd.

Television Queries

I HAVE been making attempts to perfect a device in connection with television, and shall be glad if you can give me information on the following three points.

(1) What ingredients can be used to make fluorescent material for coating the inside of a television tube to give a sharply defined image which, as far as possible, is only produced on that part of the material which is actually hit by the electron beam. It must also be capable of retaining its full brilliancy three to five seconds after the electron beam has been removed from the fluorescent surface?

(2) How can I mechanically determine which small square unit (say 2 x 2 sq. m/m) of a television tube face is emitting the most brilliant rays of light? It is imperative that the whole image be taken collectively because as the number of units would amount to about 3,000 it would be impracticable to focus and simplify each unit individually.

(3) Lastly, where can I obtain $\frac{1}{4}$ lb. quantities sheet tin .001 inches thick?—W. Moughtin (Billericay).

THERE are several fluorescent materials which could be used for your purpose. The best of these is, we think, natural willemite, or zinc silicate, which will fluoresce with a green colour and which will have an appreciable "lag" after the exciting electron beam has passed. Synthetic zinc silicate "contaminated" with a trace of manganese may also be used. This will give a brilliant green-yellow florescence.

You could also use zinc beryllium silicate also "contaminated" with manganese. This gives a fluorescence varying from almost white to pinkish-white according to the precise proportions of the three constituents.

Cadmium silicate or cadmium borate may also be used. These fluoresce with a pink hue.

(2) There are no mechanical means of determining which small area of the fluorescent screen is fluorescing the most brilliantly. This is a problem which, to our knowledge, has not cropped up before. It might possibly be solved with the aid of a highly sensitive photo-electric cell coupled to an amplifying device, the readings of the photo cell being taken as the cell was moved about over the outer surface of the fluorescent screen. We think, however, that such a cell would have to be specially made for this purpose, but, at the present stage of the war, it would be practically impossible for this to be done.

(3) Your most likely source for pure tin sheet of .001 inch thickness is Messrs. Johnson, Matthie & Co. Ltd., Hatton Garden, London, E.C. If this firm is now unable to supply this material, we would advise you to write to The International Tin Research and Development Council, Fraser Road, Greenford, Middlesex, enquiring whether supplies of this commodity are now obtainable. Messrs. Johnson, Matthie & Co., Ltd., is also the best firm to make enquiries concerning natural or synthetic fluorescent materials above mentioned. At the present time, you may find it extremely difficult to obtain even small supplies of any of these materials.

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The 1-c.c. TWO-STROKE PETROL ENGINE
Complete set, 5s.

STREAMLINED WAKEFIELD MONOPLANE—2s.

A LIGHTWEIGHT GLIDER
Full-size blueprint, 2s.

WAKEFIELD MODEL
Full-size blueprint, 2s.

"FLYING" LOW-WING PETROL MODEL PLANE
Full-size blueprint of wing sections, 6d.

LIGHTWEIGHT DURATION MODEL
Full-size blueprint, 2s.

P.M. TRAILER CARAVAN
Complete set, 10s. 6d.

The above blueprints are obtainable post free from Messrs. G. Newnes Ltd. Tower House, Strand, W.C.2

Westinghouse Metal Rectifier

I HAVE a metal rectifier which has the oxide burnt off one side of the copper washers. Will you kindly tell me the name of the oxide so that I can put some on? Also the name of the thin small white washers. Is the centre washer made of steel?—W. Hierons (Thornton Heath).

IT is not possible for Westinghouse Metal Rectifiers to be repaired except by the manufacturers. In the first place, the oxide surface of the elements is liable to be damaged if a rectifier is dismantled, and secondly the amount of pressure applied when the complete unit is reassembled on its spindle, has to be very carefully regulated. The white disc to which you refer is made of a special lead alloy and the centre spacing washer of iron.

As a matter of interest, we append a short description of the rectifier.

The Westinghouse Metal Rectifier consists of a disc of copper on which is formed, by a series of heat treatments, a layer of copper oxide, contact being made with the outer surface of the oxide by pressing a lead disc against the oxide face. Rectification occurs at the intimate junction of the oxide and the copper. Such a rectifier cannot be formed by covering a disc of copper with copper oxide.

The temperature to which the copper is subjected is carefully predetermined, and, when oxidisation is complete, the washer is cooled, either naturally or by quenching, according to the type. It should be noted that the discs are oxidised on one side only.

If your rectifier is damaged, we suggest that you return it to Westinghouse Brake & Signal Co., Ltd., Rectifier Service Department, 82 York Way, King's Cross, London, N.1.

Torpedo Nets

WILL you please inform me why torpedo nets are not used by our merchant ships at sea? I believe they were used a little in the last war by our ships while at sea, but for some reason were discarded. Noticing a recent picture of a warship at anchor with a torpedo net around it, I am rather puzzled as to why they are not used to-day by ships of the M.N.—W. L. Barnes (Liverpool).

TORPEDO nets were discarded shortly after the outbreak of the last war by all the belligerent navies. This was because they were of doubtful efficacy, even in the most favourable circumstances, when the ship was stationary, as a protection against the latest high-speed torpedoes, especially if fitted with a net-cutting device.

Such slight protection as they might afford was more than counterbalanced by the disadvantage resulting from the reduction of speed and of manoeuvrability which they produced. Their retention for use when at anchor was discarded because it was found that they were liable to break away from their stowage positions during action, and to foul the propellers. The photo of this war to which reference is made is doubtless one taken from the air showing a damaged Italian warship in Taranto harbour being salved, with torpedo net set round her. Such a net would be of a heavier type than that formerly carried by warships, and would be too cumbersome and weighty to be used, or even to be carried, at sea by any ship.

Rewinding an Electric Iron

COULD you please tell me how to convert an electric iron from 100/110 volts, 450 watts, to 240 volts A.C.?—E. A. Lloyd (Claygate).

IN calculating the length and gauge of wire required for rewinding domestic appliances of this nature, allowance has to be made for the different degrees of heat radiation due to the presence of heat insulation of varying thickness. This is always difficult to estimate unless the particular characteristic and design of the appliance is known from previous tests, and the following figures, therefore, must be considered approximate only, and possibly subject to revision after testing out. If the electric iron is taking 450 watts on a 100 volt circuit, and the same heating capactiy is desired when used on 240 volts, the current consumption will now be 1.87 amperes instead of 4½ amperes, and the resistance of the new winding must be 128 ohms. Using a nickel-chrome alloy of 80/20 per cent. composition, a No. 33 SWG wire should be about correst in order to give the final temperature desired. This gauge has a resistance of 6.48 ohms per foot, so that in order to arrive at the correct 450 watt loading which necessitates a total resistance of 128 ohms. the actual length of wire required will be slightly under 20 feet. It usually proves much cheaper in the long run to purchase a new ready-wound element from the makers than to attempt to rewind an old element, as the mica support becomes very brittle from heat.

Fluorescent Screen

IN order to be able to conduct some experiments, I wish to make a form of fluorescent screen. Would you please let me know whether it is possible to construct an efficient screen with limited resources as possessed by the average amateur at home, and what chemicals are used for making the screen of television tubes, that is, a screen sensitive to an electronic emission? Also what chemicals are used for coating fluorescent screens as used with X-ray apparatus?—L. Clayton (Shirley).

THE fluorescent screens of television tubes are usually compounded from more or less secret formulae, and hence it is very difficult to copy them. You can, however, make up a fluorescent screen by dissolving scrap celluloid in a mixture of equal parts of amyl acetate and acetone, until a liquid of varnish-like consistency is produced. Into this liquid you should stir very finely powdered calcium tungstate, natural zinc silicate, potassium-uranium sulphate or cadmium silicate, each of which materials will fluoresce under cathode-ray excitation. The same materials will suffice for an X-ray fluorescent screen, although, in this instance, the most sensitive salts are barium or magnesium platinocyanide. These materials, on account of their platinum content, are expensive, but they can be obtained from Messrs. Johnson, Matthie & Co., Ltd., Hatton Garden, London, E.C.1.

If you do not wish to employ celluloid varnish, as above suggested, you can use any other binding medium for the fluorescent salts as, for example, a solution of gum arabic or gelatine. Since Messrs. Johnson Matthie & Company specialise in the production of fluorescent salts, we would advise you to procure your requirements of these salts from them. For the making of a small screen, only two or three grammes of any given salts would be necessary.

Polishing Fine Brasswork

CAN you inform me of a preparation suitable for cleaning and polishing fine brass work? Some time ago I was able to procure a liquid named "Komo," but cannot find it in any shop here.—J. R. Yarr (Newbury)

SO far as we have been able to ascertain, the compound "Komo" is not now on the market. You can, however, readily make a polishing composition for fine brass-work by mixing the following ingredients:—

Powdered Castile soap, 1 part.
Jeweller's rouge, 2 parts.
Finest sieved whiting, 2 parts.
Kieselguhr, 1 part.

The above ingredients (finely sieved) should be ground together for some time, and then made into a paste with solvent naphtha containing about 5 per cent. of methylated spirit. Only a very small quantity of this paste will be needed. It should be applied with a soft rag.

If you prefer polish in the liquid form, you can take one part by weight of the above mixture and shake it up with four parts by weight of solvent naphtha or white spirit. It will have precisely the same polishing effect. Neither of the above polishes is intended for very dirty work, but if required, the polishes may be "coarsened" for heavier work by increasing the proportion of whiting in the mixture.

Solenoid for Alternating Current

I SHALL be glad if you can give me particulars of how to make a solenoid suitable for 250 A.C. 50 cycles, with a pull of 20 lbs. and with a plunger travel of 1 to 2 inches?—P. W. Stanley (Abbots Langley).

THE dimensions of a solenoid to give a 20 lb. pull over a distance of 2 inches on 250 volts 50 cycles A.C. is a matter for experiment rather than calculation, in the absence of tested results, and some modification must be allowed for after trial. The estimated dimensions will probably lie within the following limits:—Length of bobbin, 8 inches. Diameter of cheeks, 3½ inches. Iron core, 1 inch diameter, divided in the centre, and with one half fixed, the other a sliding fit. The bobbin cheeks are of mild steel plate, 3/16 in. thick, and an iron jacket of 1/8 in. thick tube closely fits over them, giving an "ironclad" construction. The cores, centre tube, cheeks, and outer jacket require slitting radially almost to the centre with a 1/32 in. metal saw to restrict heating from eddy currents. Wind with about ten pounds of No. 22 SWG d.c.c. copper, and provide liberal insulation everywhere, as the inductance will be very high.

Testing a Focal-plane Shutter

CAN you inform me of an accurate method of testing the speeds of a focal-plane camera shutter? It is fitted on a modern folding camera, and under present conditions I do not wish to send it away for test.—M. Hedley (West Ardsley).

IT is difficult for an amateur to test the speed of a focal-plane shutter as special apparatus is required. You might try spinning a cycle wheel at high speed, having put several white marks on the tyre and photographing a part of the wheel as large as possible with a foot rule close behind the wheel so that it appears on the photo, then the movement of the white mark will give an approximate indication of the shutter speed.

For instance, if you get the wheel going at 600 r.p.m. the peripheral velocity of the marks on the tyre will be 880 inches per second. Then if one of the marks shows a movement of one inch, the shutter speed will be 1/880th of a second.

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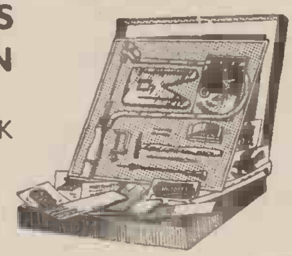

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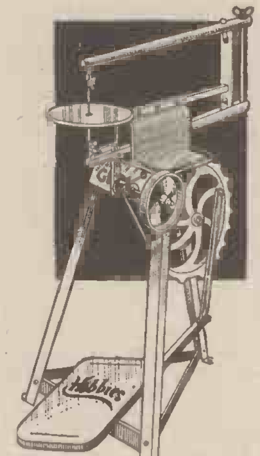

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THE Cyclist

Editor: F. J. CAMM

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Comments of the Month By F. J. C.

Accidents — Can We Prevent Them?

THE Royal Society for the Prevention of Accidents has recently analysed 2,500 reports of inquests on those killed on the roads during September-December, 1940. No less than 4,380 people were killed during that period, when fewer vehicles were on the road than in peace. The Society labels this as a "disgrace," refers to "futile waste of valuable lives," and states that "if road deaths are not again to exceed an average of 1,000 a month, there will have to be a considerable improvement in road behaviour by everyone concerned. Immediate action is necessary."

Analysis shows that Saturday was consistently the deadliest day, that Christmas Eve was the worst day of all, and that accidents conform closely to phases of the moon. Other features were:

More than 75 per cent. of fatal accidents to adult pedestrians occurred during the black-out; most of the victims were between 60 and 70, and three out of every four were men; 9 to 11 p.m. was the worst period, and a large proportion of the victims had just left well-lighted places.

One in 13 of the black-out deaths occurred during air raids, when driving vision is practically nil.

We must not overlook the fact that the black-out was primarily responsible for this tragic increase in the number of accidents. No doubt this year the figure will drop because the public has by this time preferred to become traffic conscious instead of black-out unconscious, and because petrol rationing, still further reduced, will put many more cars off the roads.

In a war people are killed in a variety of ways—by bullets, shells and shrapnel, as well as by privation. The black-out is a necessary concomitant to modern aerial warfare, and we do not think, therefore, that particular blame should attach to cyclists or motorists for accidents caused by the black-out. And we must also remember that many use vehicles during the black-out blitzes because normal public services are suspended. No doubt if, during peace, public services had coped with the rush-hour problem, there would have been less private vehicles on the roads, and therefore less accidents. The public will not tolerate longer than necessary the discomfort of packed-to-standing railway carriages, buses and trams.

Military vehicles, too, were responsible for a goodly percentage of the accidents, and it is, therefore, pleasant to be able to record that the percentage has dropped from 19 per cent. to 12 per cent. But these figures alone are meaningless, unless we know the number of military vehicles *in use on the roads* during the months to which the percentages relate. Have the military authorities removed the incompetent and reckless drivers? Now that national defence is established, are there not fewer military journeyings? These two questions, if answered in the affirmative would account for the reduction.

Yet during the month of April, 726 people died as a result of road accidents, compared with 451 in April 1940. During the hours of darkness, 247 were killed compared with 178 in April 1940, and 479 were killed in daylight, compared with 273 in April 1940.

In March 1941, road deaths totalled 834 against 496 in March 1940. So the Royal Society for the Prevention of Accidents, whilst it is busy finding causes and analysing statistics has not found a cure. In this they fail in good company, for a succession of Ministers of Transport (we have had 14 in 21 years) have similarly failed. This is what the Chairman of the Roads Improvement Association said recently:

"No road user will regret the passing of the Ministry of Transport. This unhappy department, created without proper consideration in 1919, was based on unsound constitutional foundations. Party politicians with an average tenure of office of less than two years cannot solve the difficult problems of transport. Some of the 14 occupants of the office, so far from making transport cheaper and more efficient, have added to the delays and increased the costs."

The Chairman might have added that they have undoubtedly between them increased the dangers of road travel. There are too many bodies all busy analysing statistics and drawing false conclusions from them—too many road users' associations blaming each other. The creation of pedestrian crossings on which pedestrians have absolute right of way are a failure—chiefly because they are not used, and because their use was not made compulsory. The pedestrian cannot commit an offence in the eyes of the law; and a point often overlooked is that pedestrians often *cause* accidents in which they themselves are not involved.

In many other directions our traffic policy has been wrong. There are too many traffic lights, which build up clots of traffic and thus congest the roads and create dangerous conditions. They are insensitive to the needs of the moment, in that they bring traffic to a standstill, even when the roads facing the green light are devoid of traffic. Stopping places for buses and trams are fixed on the "wrong" side of the traffic lights. Buses often pick up or drop passengers as the lights turn green, but by the time the bus is ready to move, the lights have returned to red.

Money has been wasted on the construction of unnecessary cycle paths. Horse-drawn vehicles are still permitted to obstruct the roads. There has been insufficient attention to road surfaces, too much ribbon development along new roads designed for fast traffic, too much consideration of effect instead of cause, and too much reliance on the records provided by the survivors of accidents. There is a natural tendency to blame the other man, especially when the man who could offer rebutting evidence is dead.

There is not one case of fatal accident on record where the survivor has admitted responsibility. Public speakers are already orating on the subject of post-war replanning. Lord Reith is the Minister charged with the duty of preparing those plans; but judging from published statements, they are more concerned with replanning the political system, than in planning our social and industrial future.

We do not need to waste money building roads merely to convey week-enders to the coast. New and safe roads are needed to relieve the pressure on existing roads and to cut out danger spots. We do not want the Minister of Transport, nor national bodies to act as Recording Angels of Accidents; they should not waste time drawing false conclusions from statistics, but approach the problem in a rational frame of mind and in the presumption that most road users endeavour to avoid accidents. It does not help to lay the blame at the door of a particular class of road user. Let their efforts be confined to search for practical solutions.

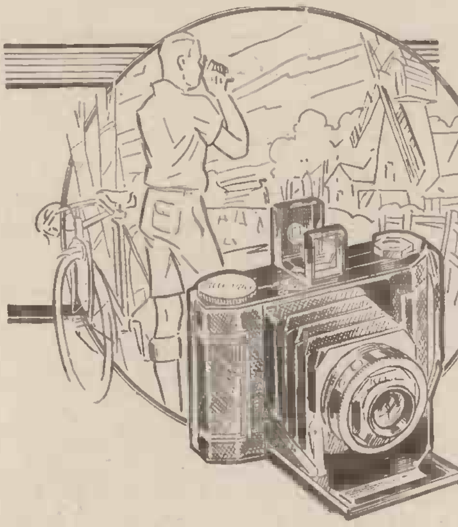
The U.C.I.

IT is rumoured that the International Cyclists Union is to move to Berlin, but confirmation has not been forthcoming. For many years it had its headquarters in Paris, and last year attained its fortieth birthday. The last meeting held under their aegis was at Milan in 1939, but the meeting was cut short owing to the outbreak of war. According to present information, it is intended to make the U.C.I. a travelling bureau when the war is over.

If rumour should prove correct, it appears that the U.C.I. is now pro-Nazi, and many bodies as a result raise objections. There have been severe criticisms of the U.C.I. in the past, and whilst replanning the world and new orders are in the air, it may be opportune to reconstitute that body, which had developed into a social body more concerned with lunches, dinners and speeches than with control of the sport. We in this country should not support any body in sympathy with our enemies.

British Machines in America.

SPLENDID tributes are being paid in American press to the superiority of British bicycles which America is importing in large numbers. The lightweight British bicycle is a revelation to American cyclists, and thousands of American youths have now taken up the pastime. Cycling is booming in U.S.A.



Paragrams

Cycle Tyre Shortage

BRITAIN has not yet suffered a shortage of bicycle tyres on account of the war, but Germany is so short of rubber that the only replacements available are those for tradesmen's carrier machines.

Mishap

DURING an air-raid on Clydeside, Jimmie Fordyce, West of Scotland T.T.A. timekeeper, had a favourite bicycle damaged. Debris fell on his top tube and ruined the frame. Mr. Fordyce is safe and sound, however, and so are his wife, family, and home.

Fewer London Hostels

AT the outbreak of war there were 39 hostels in the area of the London Regional Group of the Y.H.A. Now there are only about twenty.

New Scots Hostel Opened

THE latest and largest youth hostel in Scotland was opened recently at "Dunselma," Strone Point, Firth of Clyde. A handsome residence situated at one of the most prominent points on the estuary, the hostel has room for 100. Sir John Sutherland performed the opening ceremony, which was attended by many Glasgow cyclists.

Demand for Second-Hand Bicycles

AS the demand for bicycles grows and is not met by the small home outputs from the factories, dealing in second-hand machines increases. Many retail firms are making good business out of second-hands by renovating them, and then offering the machines to the public. In Scotland, one big firm is advertising for a million second-hands, so that these can be converted into usable machines again.

Good Advice

SIR JOHN MAXWELL, Northern Area Traffic Commissioner, recently advised workmen and women to make greater use of bicycles for transport to and from work. He said that not only would they find this more healthy, but it would save room on trains, 'buses, and trams.

Cycle-Stealing on Clydeside

AS a result of air-raids, cycle-stealing on Clydeside has increased. Bicycles have been stolen from outside shops, and later offered for sale. One victim of such a theft was James Harvey, the Ivy C.C. time triallist of a few years ago. He lost a favourite machine from outside a Glasgow cycle shop, and has not yet recovered it.

Lumberjacks Fascinated by Cycling

NEWFOUNDLAND lumberjacks at present working in Scotland are fascinated by cycling. They have bought up stocks of machines on Royal Deeside, for example. Recently, a clubman from Aberdeen was riding near Ballater when he saw fifty lumberjacks riding bicycles.

Sergeant Hannah, V.C., a Cyclist

IT is not generally known that Sergeant Hannah, R.A.F., who won the Victoria Cross after putting out a fire in a 'plane, was a cyclist before joining-up. Now only twenty years of age, he was interested in touring. His brother, James Hannah, was associated with the Cyclists' Touring Club, Glasgow D.A., before own call-up.

Fire at Kingshouse

THE Kingshouse House, at the head of Glencoe, and very familiar to cycle tourists in the Highlands, was ablaze recently from an unknown cause. Damage was caused to some rooms, but the inn is carrying on. Situated below Buchaille Etive Mhor, the hill which dominates the north-west end of Rannoch Moor, the inn was called the loneliest in Scotland by Christopher North.

Germans in Paris Using Bicycles

THE Germans in occupied Paris are now using bicycles. At first, they had plenty of petrol for motor vehicles, but this is now scarce. Meanwhile, in Germany the Hitler Youth is now compelled to use its feet more, as there is a shortage of rubber for tyres.

Lord Alness Supports Rear Lights

SPEAKING recently in Edinburgh, Lord Alness said that he welcomed the law which compelled cyclists to carry rear lights. He also desired stricter enforcement of existing legislation as regards motoring offences. A more helpful suggestion made by Lord Alness was that pedestrians should conform to traffic and police signals as motorists and cyclists had to do.

Clarion 1941 Handbook

ALONE of the national cycling organisations, the National Clarion C.C. is issuing its 1941 handbook, and members are receiving copies as they rejoin. Reduced in size compared with pre-war editions, the handbook nevertheless contains all the essential information regarding the club.

The names and addresses of district (but not section) secretaries are included, and there is a list of recommended caterers. The national secretary of the Clarion is E. Sugden, 15 West View, Halifax, Yorks.

Edinburgh Helper a Pilot

MALCOLM SMITH, former manager of the Halford Cycle Depot in Edinburgh, was recently on leave in Glasgow, where he met old friends. He is training to be a pilot in the R.A.F. Mr. Smith is well-known as a helper of record-breakers making Edinburgh their headquarters, and is acquainted with such professional stars as "Shake" Earnshaw, Harry Hill, and Margaret Wilson.

Tudhope Another Scott?

HAVE the Crawick Wheelers, of Sanquhar, unearthed another record-breaker in Jack Tudhope, who had won every event he entered during 1941 by the end of April? Tudhope is a contemporary of Will Scott, the Scots record-holder. His last victory in April was the Ayrshire and Dumfriesshire C.A. "25," which he won with a time of 1 hr. 5 mins. 32 secs., three minutes ahead of his nearest challenger, clubmate David Scott, brother of Will.

Cock O' The North

J. TOPP, Aberdeen Wheelers, seems set on repeating his 1940 successes. At the end of April he won the North-East of Scotland T.T.A. "25," with a time of 1 hr. 7 mins. 9 secs. and earlier in the month tied in an open with P. Taylor, Sprite Roads.

Bill Scott Home

WILL SCOTT, the Sanquhar lad who holds the Scots 25, 30, and 50 records, was home on leave recently from the Royal Engineers. During his leave Scott visited Greenock, and saw again the scene of his many victories in the days before he was called-up. Scott's club, Crawick Wheelers, is carrying on, and with the nearby Upper Nithsdale C.C. is keeping the sport alive in Dumfriesshire.

Footpath Along Highland Railway

IT has been suggested by ramblers' organisations that the line of the now-abandoned Welsh Highland Railway should be converted into a hikers' footpath. The line is familiar to all cyclists who have toured North Wales.

Crack Rider in Grade 3

ALEX. HENDRY, crack rider of the Glasgow Wheelers, who won several open events last season, had been passed as grade 3 after his medical examination. Hendry, a miner, has an injured thumb. He expects to ride in open time trials for most of the present season, and has already filled second place in the opening event of the Clydeside season.

My Point of View

BY "WAYFARER"

Sunset

THE bicycle was suspended from the back of the Local Authority's dust-cart, on its way to wherever such vehicles carry their usually unsavoury burden. Quite obviously it was sunset for the bicycle, which had indeed seen better days. Rust was now the predominating feature. One of the main tubes was fractured, the handle-bar was bent, and the tyres and chain were missing. As a bicycle, its career was ended. It might come to life again in the form of safety-razor blades, or a battleship, or a lawn-mower, but never again would it carry its owner along the road between fragrant hedges to meet the boys and girls of the Club at tea: never again would it hurry its owner, in tights, over a strenuous "25": never again would it be the medium whereby some laddie—or lassie—would indulge in a joyous holiday spread over a week or ten days and a dozen counties, gathering up mental and physical health, seeing all sorts of sights, and meeting all sorts of people, and returning home to "the daily round, the common task," feeling and looking aggressively fit, possessed of a great store of happy memories with which to fortify and make tolerable the days of toil lying ahead. So this, I say, was sunset for the bicycle. The old and battered machine went on its way . . . just as we humans have to go when our little day is done.

Roundabouts

ONE delightful feature about cycling—specially apparent, perhaps, in these days of expensive rail travel and of rationed petrol—is that you can indefinitely increase the length of any projected journey without perceptibly adding to the cost. On a recent day ride I decided that, wherever I obtained my lunch, I would make a point of reaching the Shakespearean village of Aston Cantlow for tea. Now, this particular member of the Aston family is just twenty-one miles from my home, but I scored an exact three-score miles before I arrived there, and the roundabout process carried me with sustained delight through the Vale of Evesham and along the foothills of the Cotswolds. After tea, by dint of "ringing the changes," it took me an hour to reach a village a mere couple of miles away, and I ultimately finished my day's journey, very contentedly, with the best part of a century to my credit. In this same connection, I recall that one Saturday in the late winter, I had tea at a place only sixteen miles from home—though it cost me twenty-eight miles to get there. Afterwards, desiring to make the most of a feeling of extreme fitness and also of a grand night, I turned my back on home and finally reached there, by devious ways, with another thirty-two miles on the tally, and all without any perceptible addition to the cost of travel. That's the bicycle!

I have always specialised in "short cuts" and roundabout excursions. Probably my best effort in this direction was to return from a cycle tour in the south-west of Ireland by way of Dublin, Belfast, Stranraer, Ayr, Carlisle, and Shap! A costless business, my masters!

Superlative

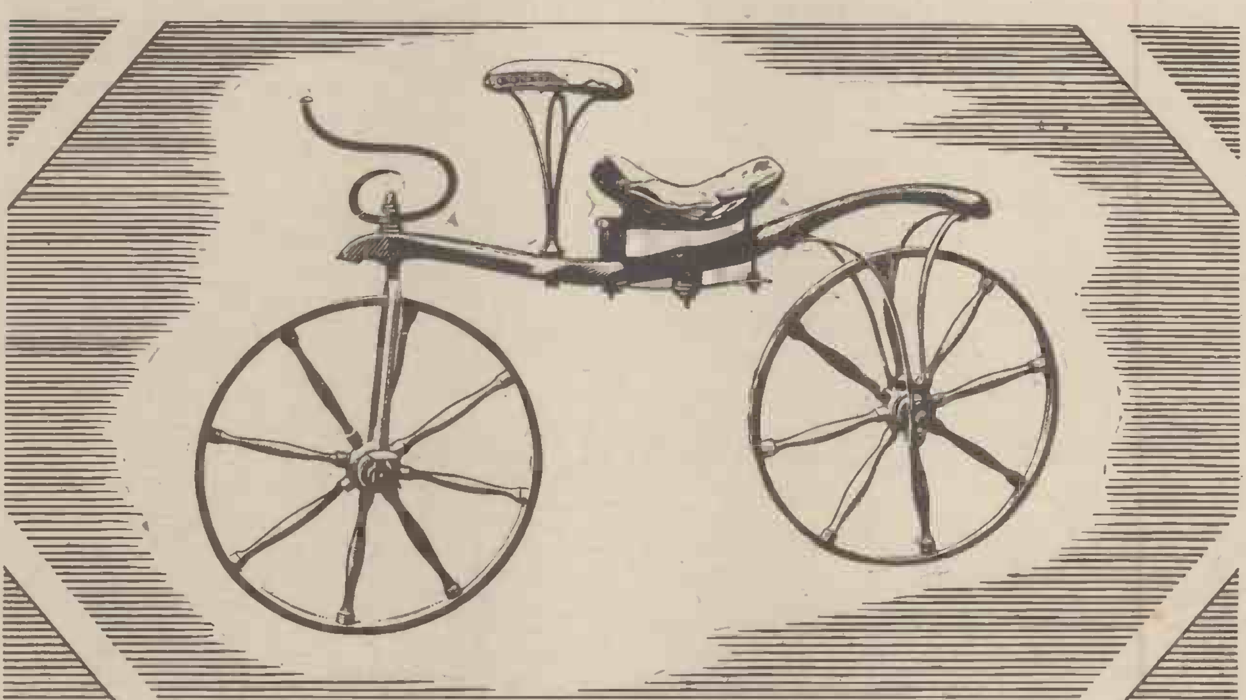
IN the course of a long career as a cyclist and a cycling publicist, many—far too many—compliments have been paid me. The one I most appreciate arose in this manner: During the last war (before I went away and won it!) when I was living in Salisbury, I paid the first of a series of visits to a delectable cottage in the New Forest. After tea, followed by a chat with my hostess who was well-read and a great (and interesting) talker, I started back home. She saw me off from the garden gate, and, as I rode away, she said to herself: "'Some' cyclist!" When she told me of this, months afterwards, I appreciated the compliment, and now, a quarter of a century later, I hope that the characterisation remains true to the extent of 100 per cent. I am still—so I believe—"some" cyclist, yielding to none in my active devotion to and appreciation of the greatest of pastimes, and, actually, being more enthusiastic about the game than ever.

Travel—and Travel

AT the moment of writing I have just sent off to the Ministry of War Transport a frank criticism of their advertisement, relative to Whitsuntide, which has been occupying valuable space in our newspapers—partly at my expense! If you happened to read the whole of the announcement, you would probably get the full intention thereof, but the man-in-the-street would most likely note only that portion which appeared in heavy type, thus: PLEASE AVOID TRAVELLING AT WHITSUN. To the nabobs, whose splendid salaries you and I pay, "travel" comprehends the use of public transport, and they fail to realise that there are millions of cyclists (and walkers) who can (and should) "travel," without in any way obstructing the national effort of winning the war.

But what "beat the band" in this connection was an apparently inspired paragraph in *The Times* which said that "the public are requested *to refrain from travelling as far as possible*." The italics are mine!

CAVALCADE OF CYCLING



THE HOBBYHORSE *(circa 1818) Presented to the Bartleet Collection of Historic Cycles by Lord Iliffe.*

The first word in bicycling, and positively the "last word" in those days of the bucks and beaux of the Regency period was the hobby-horse. Propelled by striking the foot smartly on the ground, this stylish model embodied the latest devices, such as foot-rests for the thrill of "coasting" downhill, and an adjustable saddle!

In later days . . .

John Boyd Dunlop's introduction of the DUNLOP *Pneumatic Tyre was destined completely to revolutionise mechanical transport. His great pioneering achievement was, and remains, the most outstanding in the history of cycling.*

1H/301

The catering van—a modern corollary to road time trials.

AROUND THE WHEELWORLD—By Icarus

Jubilee

MANY Jubilees have been celebrated during the past three years, reminding us of those halcyon days when cycles were heavy, roads bad, and solid tyres and Ordinary bicycles were in being. Those were the bad old days of professionalism, and one might also say that shamateurism is now also celebrating its jubilee.

Now the Herne Hill track, scene of many a famous race, and on which many riders achieved notoriety and fame, has attained its jubilee. The idea of running a Jubilee Meet in July or August has been mooted. Unfortunately, if such a meeting is held, many of those who have raced on the track and have helped to make it famous would not be present, and on the whole I should prefer such a meeting to be shelved until after the war, when a combined Jubilee and Victory meeting could be held.

Marcus L. Hurley

AN American correspondent writes that Marcus L. Hurley, the amateur sprint champion of America from 1901 to 1904 and world's amateur sprint champion in 1904, died in his room at the New York Athletic Club during the night of March 26-27, apparently from a heart attack. Marcus was one of the American team of riders that almost made a clean sweep of the world's championship meeting at London in 1904. Marcus defeated Reed and Benyon, English riders, in the final of the amateur title race, while Iver Lawson, the Salt Lake City lad, defeated Thorwald Ellegaard, the Dane, and Henry Mayer, the German, in the final of the pro. sprint title. Then to make it a good American victory, Bobby Walthour, Sr., father of "Bobby Junior" and uncle of Jimmy, the tavern keeper, won the paced championship from the late Caesar Simar, of France, and Arthur Vanderstuyft, the Belgian. It was a great day for the Americans. Marcus never turned professional, and after he retired from cycling, he played basketball for Columbia College, from which he graduated as a mining engineer and followed that vocation up to the time of his death. He is interred in Kensico Cemetery, Westchester, N.Y.

Hansen—Track Manager

HANSEN, professional rider who made his name in America a quarter of a century ago, is now General Manager of the Ordrup Track, near Copenhagen. After he returned to Denmark from America he applied for re-instatement as an amateur, and this was granted after he had remained in Denmark for one year. Isn't this professional and amateur status funny? And has *anyone* ever defined the true amateur? The R.T.T.C. has tried—with anserine results, providing plenty of loopholes for the professional amateur.

Starting

I HEAR a whisper that the point I raised concerning starting in road events has been discussed by the R.T.T.C. National Committee. Isn't it astonishing that so important a matter should have been overlooked? And ought not the R.R.A. to do something about it? Surely, the latter body should give the lead.

Watches Again

DURING recent chats with timekeepers, I learned that there is reluctance to place Kew watches in hands other than the makers, or a skilled watch timer. The Kew A certificate is current for two years, and at the end of that time the watch is "off its rate," and needs cleaning and re-adjusting. This is a task for the expert, who should be permitted to give a certificate as to performance. I suggest, therefore, that owners of Kew watches should get their pet rater to apply for appointment as an R.T.T.C. tester; or, alternatively, that he should purchase a cheap "knock-about" watch of the seventeen jewel type —any make of which will easily comply with the R.T.T.C. rule and pass the test.

Bicycles and the Invader

THE Ministry of Home Security has accepted the suggestions of the National Committee on Cycling representing the chief organisations of cyclists in Great Britain, that, in the event of invasion, a bicycle can best be immobilised by removing the pedals, or the nuts of the back wheel, or the chain.

"In all these cases," the Ministry states, "the parts removed should, of course, be hidden."

The W.R.R.A. "50"

I LEARN that Marguerite Wilson is again contemplating an attack on the "50" record, wrested from her by Mrs. Annie Briercliffe who returned a time well within the two hours. Miss Wilson is fit and, I understand, in training. She intends to use the Scottish course on which Mrs. Briercliffe broke the record. This means a wait for a favourable south-westerly wind. Given that, I have no doubt that Miss Wilson will knock several minutes off record. She already holds all of the other W.R.R.A. solo records.

NOTES OF A HIGHWAYMAN

By L. ELLIS

A Sussex Cathedral City

CHICHESTER does not seem to rank high in the estimation of cycle tourists, but this is probably due to the fact that the town is not set in glorious surroundings. In addition to the magnificent market cross that is so well known, the town has many other attractions. The Cathedral, though not regarded as being among the finest of English cathedrals, is nevertheless a beautiful structure, and has many points of outstanding interest. The campanile, or bell-tower, is detached; the aisles are double, and it is said that the spire is the only English cathedral spire visible from the sea. Chichester Cathedral, the widest with the exception of York, was founded by Bishop Ralph Luffa in the reign of Henry I, and quite a good portion of the original masonry exists to-day. The church was considerably damaged by fire in 1114 and rebuilt some ten years later. A second fire in 1186 necessitated further rebuilding. The central tower collapsed in 1861 and was replaced by a modern one. It is claimed that as Queen Victoria reigned at the time of the collapse, the truth of an old proverb was proved. It ran: "If Chichester Church steeple fall, in England there's no king at all," which was of course perfectly true. A portion of the city walls still survives, and at the Cross the city's four principal streets meet. They are appropriately named North, South, East and West Streets.

The Cathedral, Chichester.

Stately Home of Romance

HADDON Hall, in Derbyshire, occupies a very high place on the list of England's stately homes. It is beautifully situated on a slight hill overlooking the Derbyshire Wye and is surrounded by charming scenery of a type that is characteristically Derbyshire. Of course, it is known all over the world as the scene of Dorothy Vernon's romantic elopement. Part of the story is true, but quite a lot is sheer invention. There is a door through which Dorothy is supposed to have passed on her way to elope with John Manners. Alas, the door was not built until long after their wedding. It has been stated that so far from any elopement being necessary, her attachment to John was known and encouraged by her parents. The Hall dates back to Norman times and it is thought that even Saxon work may be traced in the foundations.

A Venerable Old Tree

AMONG the millions of trees in this island, some few dozens have acquired a name and fame. Many of these, like Robin Hood's Larder, the Boscobel Oak, and the Major Oak, have passed into history, and they are habitually visited by tourists. These have stories but others are just extraordinary, and perhaps, therefore, not so well known. In the village of Cowthorpe, in Yorkshire, stands what is left of the famous Cowthorpe Oak, now rapidly falling into decay. At five feet from the base it measures 36 feet in circumference; close to the ground, 60 feet. The tree was once 85 feet in height, and its 50-foot main branch was ten feet in girth. It is said that in 1718 a branch weighing 5 tons and extending over 90 feet fell away, and that in its heyday the tree's shade covered half an acre.

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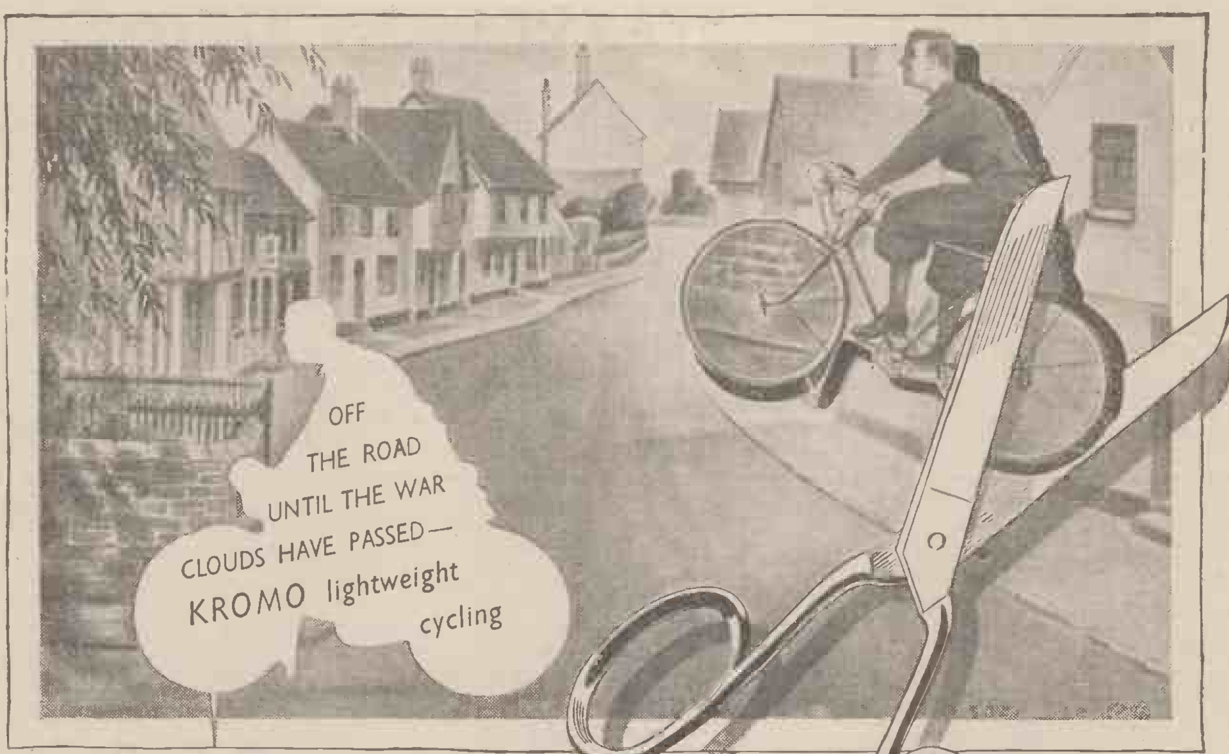

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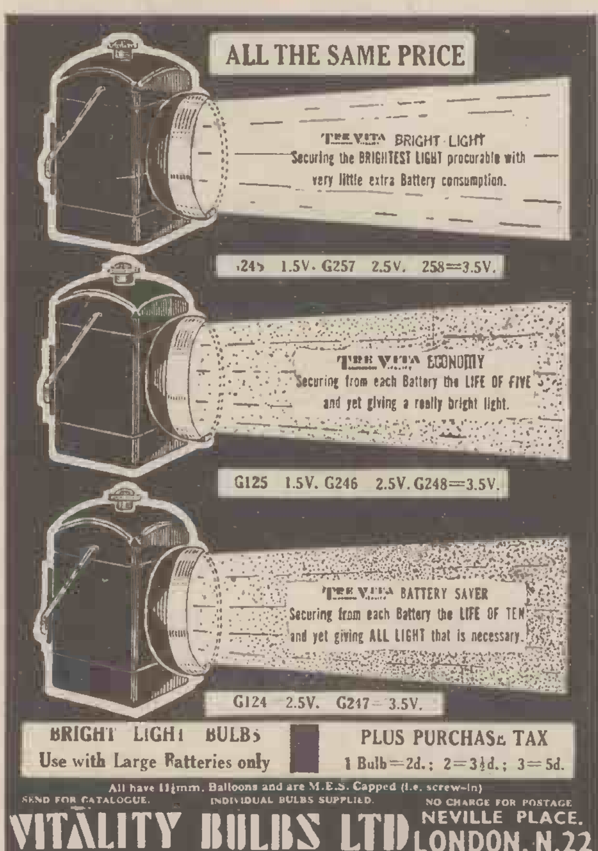

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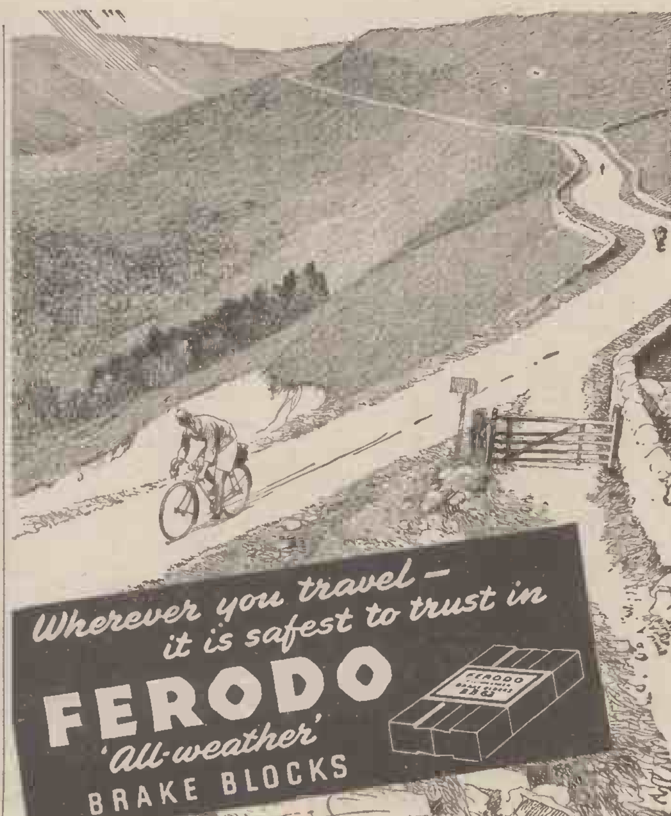

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WAYSIDE THOUGHTS

By F. J. URRY

The Marvel

HAVE you ever stopped awhile to consider a bicycle materially, as an engineer would consider it, seeing it for the first time? It is worth a few moments' contemplation because it gives you rather an extraordinary sense of security in possession, and a stray thought of thanks to the long line of designers and builders who have helped to bring it to such perfection. My own impression always runs to the thought that if I could conceive an engineer examining a bicycle for the first time, having been told what it will do, and has done for mankind, he simply would not believe it, nor should I be the one to blame him. I frequently look at my thirty pounds weight of bicycle and marvel that its seeming simplicity hides such a wonderful piece of engineering. That thirty pounds of fragility safely carries my thirteen stones thousands of miles, over rough roads and smooth, down hills at the velocities of a motor car, and up slopes when every ounce of my muscularity is expanded. I can check its headlong speed with the gentle pressure of the fingers, ease the driving energy by the intelligent use of four changes of gear, and ride a hundred miles in a day with enjoyment running through every furlong. Considered thus, the bicycle is the most remarkable piece of machinery man has yet devised, for it is the very embodiment of light-weight engineering, and is without compeer. Because it is common to all men, we have forgotten these things, and because it was the great emancipator of "freedom of travel," we pay it less than the respect due to it and its designers and makers. Yet it remains the marvel in the travel world, despite its lauded off-shoots of the motor-cycle, the car and the aeroplane. If you have a bicycle, then you possess freedom in simplicity; and an occasional stray thought given to its evolution over a century should leave you with an appreciation sufficiently developed to give you a higher regard for "the bike" that means so much to so many millions, and obtains such faint praise even from the ardent votaries of the sport and pastime.

Tyre Value and ease

I HAVE read recently the advice by the experts to fit heavier tyres because the state of the road surfaces demand the extra protection, and have no cause to find fault with that dictum. Those of us who live near big industrial areas and ride regularly, know well enough the risk of puncture has enormously increased because of the broken glass scattered everywhere, due to blast. Yet I have been singularly fortunate in sustaining only three punctures during the last nine months, the period when the devastation started, notwithstanding the fact that my tyres are all of the open-sided lightweight type. One can only speak as they experience, and I am not content to handicap my ease of cycling by fitting heavier tyres because road surfaces are glass-scattered. A few days ago I had the third puncture, the trouble being a dagger of glass: and in repairing the perforation found that cover was giving notice of hard wear, and the tube had slightly stretched, a sure sign that replacement would be a wise move. Now it happened I had taken careful mileage measurement of the running of that machine since it was new, and found the total was 7,152 miles compiled in a trifle over three years. Remember, this is only one of my small stock of machines, and also that it takes its turn along the daily journey when in use. The Dunlop Sprite cover cost 7s. 6d. when new, and I've no fault to find—only praise—for a light and lively tyre that gives me a thousand miles of easy running for a bob. Perchance the new cover and tube will not be granted the luck that clung to the old one, but I'll risk that; and indeed would take a much greater risk rather than trundle round a stodgy tyre, the very knowledge of which would seem to make the bicycle slower. As a matter of fact, I believe these lightweight covers are built on a tougher foundation than the heavier types, for on detaching that cover for repair, I found a sliver of steel embedded, that the fabric had resisted and turned horizontally under the rubber tread. I am not seeking to give you advice on this matter of tyre fitment; I am only stating facts, plus my liking for travelling as easily and freely as I can. You must form your own conclusions: I know mine.

Why wing-nuts?

AT the end of April I was out for a week-end with my friends, the manufacturers, who formed the Centenary Club in 1938 to mark a century of cycle development. It was a gay and gallant gathering, and as it happened included some serious cycling, a sixty-three miles round of Welsh roads, the last five and twenty of which led into an eastern gale with chunks of Siberia in its make-up. Twenty-three riders covered the 120 miles of the week-end route, and the only things of note that occurred to the bicycles were the shaking loose of the front wheel wing-nuts on three machines, due, no doubt, to long swift descents over rough roads. I have always hated wing-nuts; they are ugly, heavy and awkward, and why they became fashionable beats me. On numerous occasions I have known them shake loose, and many a time when starting a racing man I have seen him pull the rear wheel against the forks because the wing-nuts have not been secure. Nor can your hand tighten a wing-nut nearly as effectively as a spanner can tighten the good old hexagon pattern. It is worth remembering that other than these little occurrences, the proper adjustment of a saddle, and the slight attention to a couple of chains, the machinery ran perfectly, and not even a thorn found a home in a tyre, although the majority of the covers were of the lightweight type.

Cheap outings

A WEEK later I was out the week-end with a party of Chester boys who had promised to show me a few of the lanes ways running over the Clywds, and did the job joyfully and with a welcome that makes me their debtor. The ways we went do not matter much; they were tip-tilted and often entailed long walks to high ridges from which expansive and magnificent views unrolled. A prominent member of the trade asked if he could accompany me on this little jaunt, a man who has only recently taken to serious cycling—serious in the sense he is prepared to get, and to keep fit—and when the Sunday evening came he told these lads of Chester he had never so thoroughly enjoyed a couple of days' outing, and certainly never at a figure commensurate with that cost. I mention this matter because some people seem to think cycling touring must be an expensive business these days; but if you know the ropes (and they are not difficult to learn providing you are a clubman) then it is about the cheapest form of travelling holiday you can obtain. Lunch, tea, supper, bed and breakfast, and lunch and tea on the Sunday cost me considerably less than 16s., and all I took with me was a small packet of sugar—in case.

THE BUDDLE INN, NITON, ISLE OF WIGHT
A famous old smuggling inn known to all cyclists who visit the 'back' of the island. The road in front overlooks St. Catherine's Lighthouse, perched far below on the rocks.

Security?

I AM inclined to think that something might come of the Yale operated cycle-lock I have previously mentioned in these columns, and I am glad of it. But we shall have to wait until after the war before the article is on the market, which in to-day's circumstances is not surprising. I am glad because a light, neat and easily operated cycle lock is badly wanted, but mostly for the reason that unless the industry gives us some thief-proof form of bicycle, then the police authorities will go on pressing for the registration of cyclists under the notion that such an impost (and it would cost at least 5s. a year), would ease their work in tracing stolen machines, and make the crime of stealing more difficult. Therefore, in our own interests we should be wise to look with favour on a machine where the turn of a key would secure our property from theft. After this present trouble is past, I think public attention will be drawn to the matter of making the bicycle thief-proof, and I know of no better, lighter or neater device than the one to which I refer.

The importance of position

MY mention of saddle adjustment on the Centenary Spring run brings to mind the importance of seating position. Unless you are comfortably perched it is impossible to enjoy cycling. I am a hardened rider, and any type of saddle does not make me sore, provided it is adjusted correctly. This particular case of adjustment arose from the fact that a rider admitted discomfort and frankly asked me if I could suggest the cause. It seemed obvious to me, for the nose of the saddle was a couple of inches or more higher than the cantle plate, with the result that the forward pressure was hurting. I levelled the saddle, dropped the handle-bars an inch, and relief was immediate. Notice how many saddles are up-tilted and the riders apparently unaware that on a long ride it is a certain method of creating discomfort. For myself, I like the saddle horizontal, finding this position gives me room for slight movement within the seating accommodation; and a change of perch position is as good as a rest. Many of my friends fix their saddles with the nose slightly higher than the rear—but only slightly, not sufficient to bring any inordinate pressure to bear. These are the ideal positions, I think, and they are worth remembering and trying out for your own satisfaction and comfort.

SCOTTISH DATES LIST

A LIST of open time trials planned for Scotland during the present season is the main feature of the 1941 edition of the annual of the Scottish Amateur C.A. Time trials in most parts of Scotland are dated and listed.

There is also an up-to-date table of Scots officials, as well as the emergency war-time constitution of the Association.

The list of Scottish Open Competition records shows that during 1940 there were only two changes. Will Scott improved his time for the "25" record to 1 hr. 0 mins. 54 secs., and the Glasgow Wheelers' time for the "25" team record is 3-9-59. Copies of the handbook are available at threepence post free from Harry Price, secretary, Scottish Amateur C.A., 42 Clyde Place, Halfway, Cambuslang, near Glasgow.

Glasgow's first 1941 track meeting, promoted by the Glasgow Corporation Transport Sports Club, will be run off at the Helenvale track within the next few weeks.

Cycling events include an invitation Australian Pursuit and an invitation Team Pursuit. Proceeds go to Clydeside Air-Raid Distress Funds.

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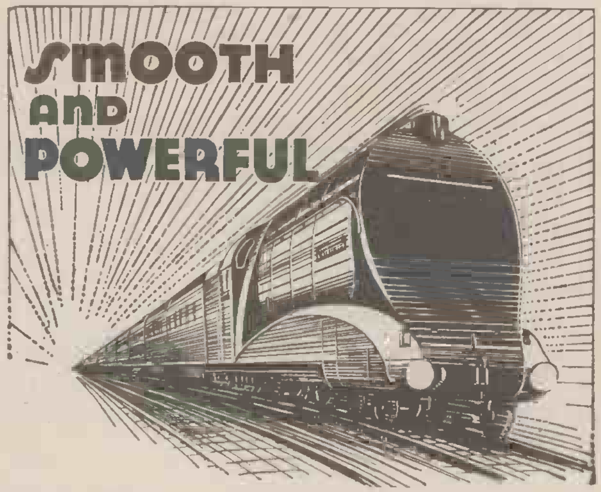

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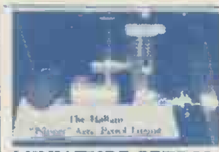

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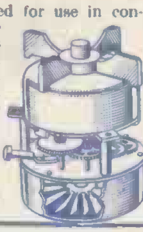

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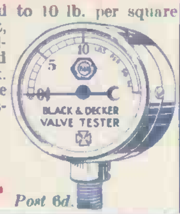

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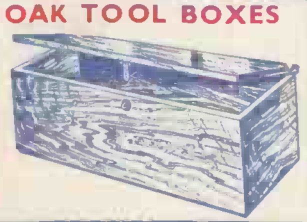

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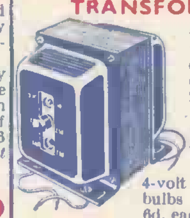

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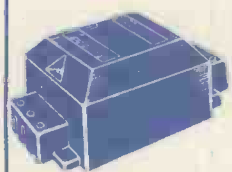

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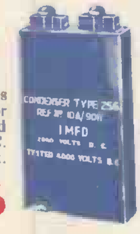

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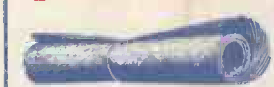

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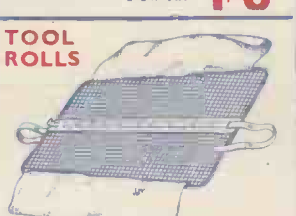

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