GAS-TURBINE DEVELOPMENT

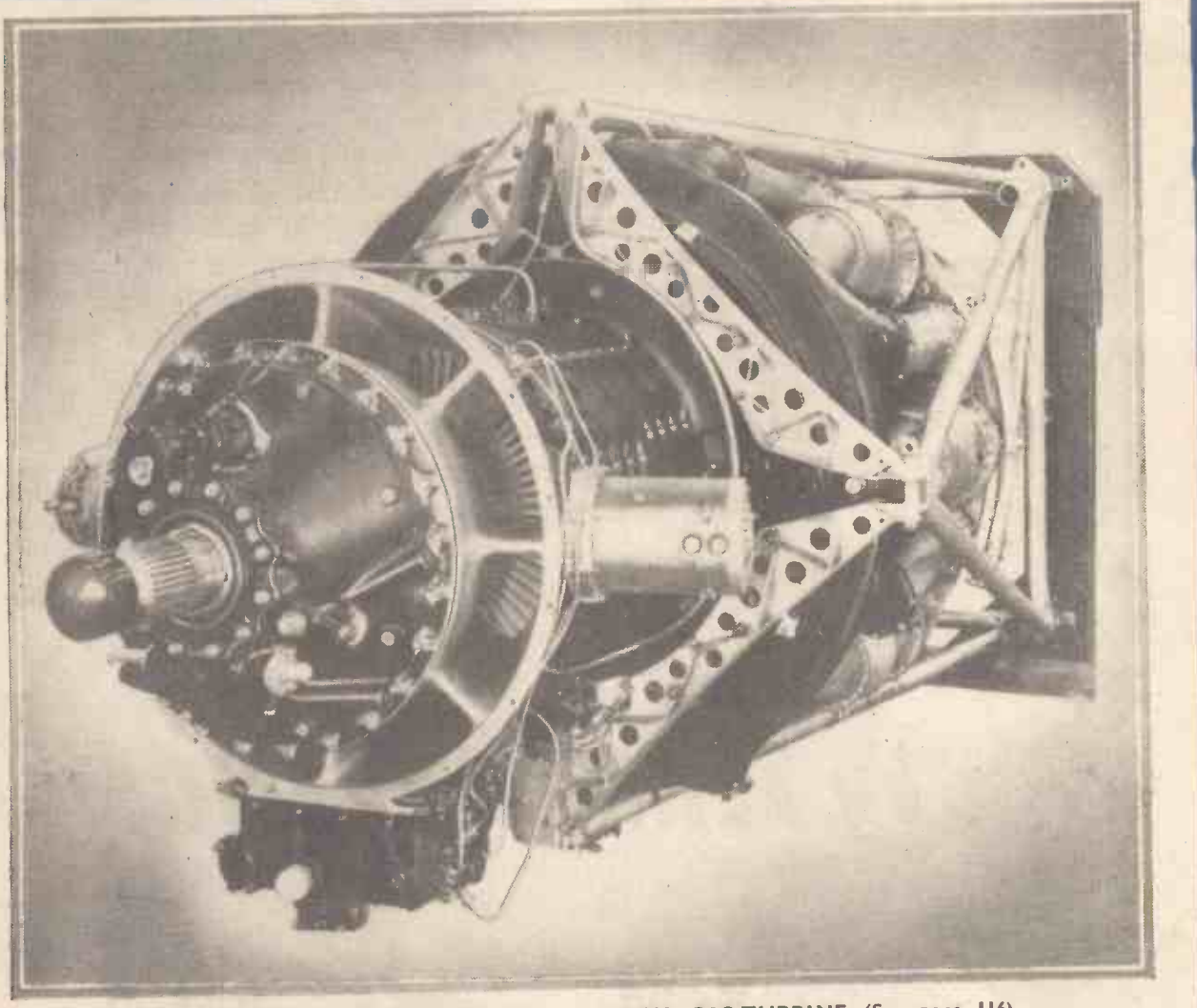
NEWNES

PRACTICAL MECHANICS

9D.

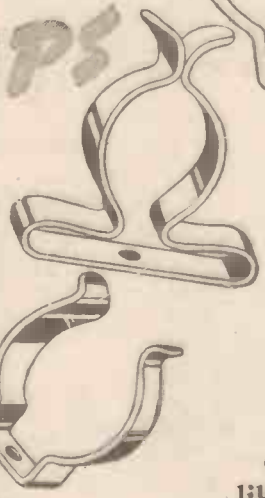
EDITOR: F. J. CAMM

JANUARY 1947



FRONT VIEW OF THE BRISTOL THESEUS GAS-TURBINE (See page 116)

CLIPS CLIPS CLIPS CLIPS



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PRACTICAL MECHANICS

Owing to the paper shortage "The Cyclist," "Practical Motorist," and "Home Movies" are temporarily incorporated.

Editor: F. J. CAMM

VOL. XIV JANUARY, 1947 No. 160

FAIR COMMENT—BY THE EDITOR

Electro-plating

MANY of our readers are addressing queries to us concerning the possibility of doing plating on a small scale at home. Electro-plating is one of the bottlenecks of industry at the present time. There is a great shortage of plant, of skilled platers, and of plating solutions and materials.

Readers contemplating the installation of electro-plating plant may not be aware that suppliers can only supply dangerous poisons such as are used in electro-plating to official orders. The use of chromium solution is strictly controlled on account of its great destructive powers. It can only be used in a properly constructed and equipped vat with an efficient fume exhaust apparatus as required by the Home Office.

The process is quite unsuitable for amateurs who wish to operate it in an ordinary house, and those who have only a few articles to plate are advised to send them to a trade plater. It will be cheaper and more satisfactory. Very few readers could instal the high-speed polishing spindles necessary to secure a finish after the metal has been deposited. Such apparatus is costly and it is only economical to install it when large numbers of parts are to be plated.

Sound Recording

SIMILARLY, many readers are interested in sound recording, particularly by the wire or tape method. We shall shortly commence publication of a series of articles on this subject which cannot be discussed in the course of a letter. Here again there is a great shortage of materials, and very few readers we think would be able to construct a successful tape recorder. Methods suitable for amateurs will be fully dealt with in our articles. In the meantime, readers are advised to get into touch with the British Sound Recording Association, BCM/BSRA, London, W.C.1. This Association was formed in 1936 by a group of electro-acoustic engineers and amateur technicians with the special purpose of uniting in one organisation all those professionals and amateurs in Great Britain engaged or interested in sound recording.

The main objects of the Association are for members to meet for discussion on all aspects of sound recording and reproduction by known methods; to conduct experiments and research; to hold lectures, demonstrations and exhibitions; to visit places of interest; and mutually to assist members by the interchange of ideas and experiences and by collecting and disseminating technical and other information.

The information bureau of the Association offers advice on any problem relating to sound recording. Details of the latest equipment available, authoritative articles, references to current recording literature of the world, and contact with fellow members, are provided free.

There is a widespread and increasing interest in sound recording, and membership of this Association will prove valuable to those whose interests lie in that direction.

Age Limitations in Engineering

AT recent meetings of the Civil, Mechanical and Electrical Engineering Advisory Committee to the Technical and Scientific Register, special consideration was given to the difficulties experienced in meeting the requirements of employers by reason of the somewhat rigid age limitations which are often imposed.

Many vacancies essential to the reconstruction programme remain unfilled because of the shortage of qualified engineers in the younger age groups, though older men between the ages of 45-60 are available. A number of these volunteered for service in the Technical Branches of the Armed Forces, or were called up as Territorials. Some have seen service in two wars.

In view of the declared shortage of qualified engineers the Committee felt that it was uneconomical for the services of these capable men—many of them excellent material and with good administrative experience—not to be utilised to the full. They appeal to engineering employers who are willing to interview such men with a view to offering them, if suitable, reasonable opportunities of employment—either permanent or temporary—to communicate with the Ministry of Labour and National Service, Technical and Scientific Register, York House, Kingsway, W.C.2 (Telephone Temple Bar 8020).

Facilities are provided at that address for employers to discuss with the Technical Officers of the Register the prospects of finding suitable candidates for their vacancies, and to examine in person the registration particulars of men and women who are seeking technical or scientific employment of professional standard. Where desired, arrangements can also be made for employers to interview selected candidates at the offices of the Register.

Business Training

AT fifty technical and commercial colleges in Britain, 1,814 young men and women, whose chances for a business career were prevented or interrupted by war service, are taking the three months' General Business Course of the Ministry of Labour's Business Training Scheme.

Since the start of the Business Training Scheme in April of last year, some 1,158 students in centres up and down the country have successfully completed the General Business Course, which marks the first step in their training for management in commerce or industry. Most of these students have now been placed in Specialised Business Courses approved by the Ministry and organised and conducted by individual firms to give intensive full-length training in the type of business in which the student wants to make his career.

Specialised Courses

The Specialised Courses may last from six months to two years, depending on the nature of the business, and in both General and Specialised Courses the Business Training Scheme provides for financial help where it is needed during the whole period of training.

The response of employers in accepting students for specialised training within their firms has been on the whole encouraging. To date, 792 Specialised Courses have been arranged, providing 1,670 training places.

So far, the biggest response in the drive to arrange Specialised Courses has come from the field of engineering. Engineering firms have provided the largest number of courses, far more than in any other branch of business.

But firms of very widely different business interests have set up Specialised Courses. They vary from the largest industrial concern to the small family merchant employing less than a hundred staff. Frequently the small or medium-sized concern has been able to take a relatively large number of trainees in proportion to its size, and this is particularly true of the type of firm needing young men of high quality and initiative to train in readiness for a forthcoming expansion of their business.

Appeal to Industry

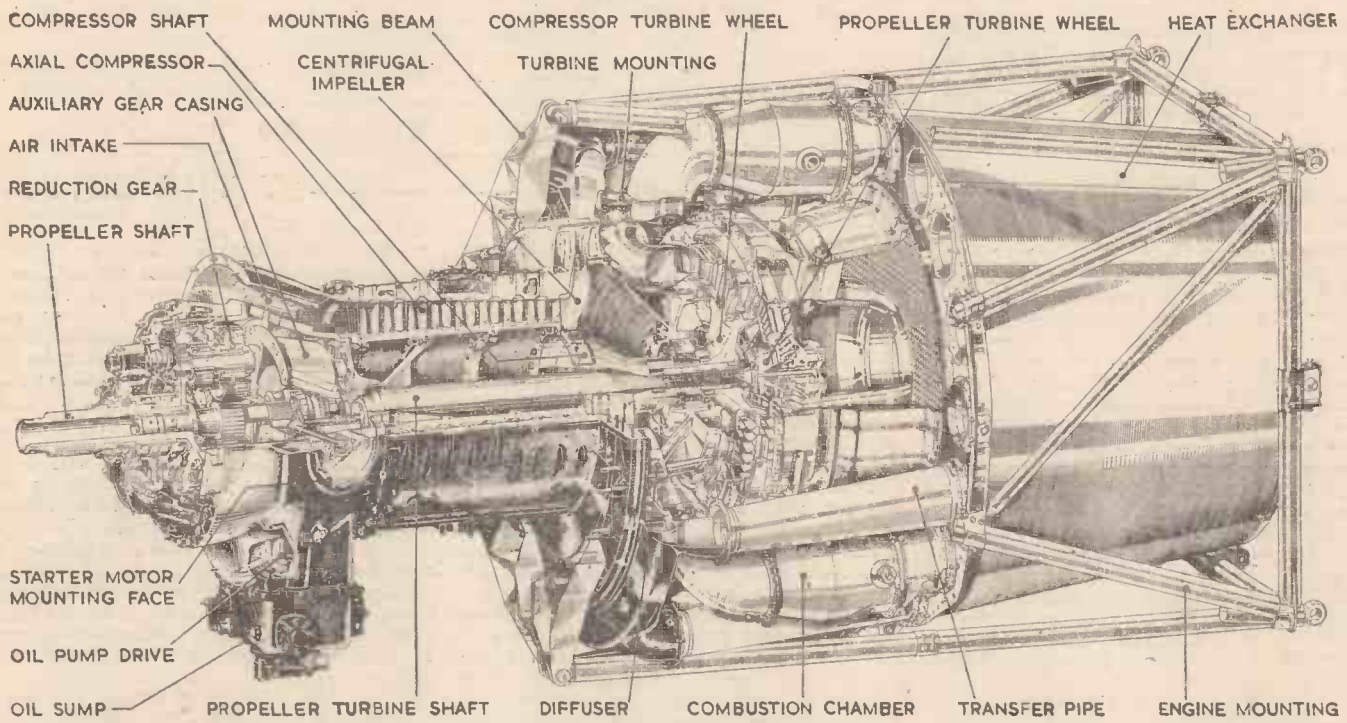
There are still many firms who do not know about the nature and advantages of this Business Training Scheme. This is the principal obstacle in the way of arranging Specialised Courses, and it is found that the most effective way to overcome it is by personal contact. The staff of the Ministry have already made some 5,000 personal calls in this way.

Students who have passed out from the three months' General Business Course take up their specialised training with a firm after being selected at an interview with the employer. Recent experience has shown that some employers are finding it difficult to judge these men on their potential quality. They are inclined to be more intent on finding out a man's background, which in most cases is only slightly, if at all, relevant to business, or they compare this man with others of a similar age who have spent years in business.

A similar problem faced the Ministry in selecting ex-Service candidates for admission to the Scheme.

The Bristol "Theseus" Propeller Turbine Engine

General Description, Technical Details and Operating Notes



Sectional view of the Bristol "Theseus" gas turbine.

THE Bristol Aeroplane Company has always been in the forefront of new developments and the engine division has for many years past taken a keen interest in gas turbines and their associated problems, it being understood that in due course, metallurgical developments would enable them to be developed as suitable power plants for aircraft.

As far back as 1923 a Bristol Jupiter engine was adapted to incorporate an exhaust driven turbo-supercharger and several successful flights were made with this arrangement, but the supercharger was ahead of engine development and the work was therefore discontinued. General investigation did not stop, however, and the good results of the sleeve valve engine in 1937 and 1938 stimulated the design, manufacture and testing of another exhaust-driven turbo-supercharger.

Initial testing was cut short by the outbreak of the war, but theoretical work was continued and investigations into the possibilities of a piston engine and gas turbine combination were made. These studies were given an additional impetus by Air Commodore F. Whittle's success in jet propulsion work.

High Thermal Efficiency

The Bristol Aeroplane Company felt that since their experience lay chiefly in installations for large and long-range aircraft, any form of gas turbine which might be considered should be designed with such application in mind. As a result the general policy of concentrating on units of high thermal efficiency was formulated. It was understood that this general policy would necessitate the design of units suitable for aircraft of moderate cruising speeds, namely, 300 m.p.h., increasing in about five years or so to 400 m.p.h. At these speeds the propulsive efficiency of the pure jet is low and accordingly design work has been concentrated primarily on propeller turbine engines, since it is generally recognised that the propeller is the most efficient means of propulsion for speeds up to approximately 500 m.p.h.

The primary target aimed at, therefore, was the design of a propeller turbine having a fuel consumption comparable to that of a piston engine at 300 m.p.h. and 20,000ft. These conditions were chosen as being the most arduous for efficient operation of a gas turbine, since at higher speeds and altitudes, the efficiency of the gas turbine is increased.

Of the various methods of obtaining a high thermal efficiency from a gas turbine, the idea of utilising the waste heat of the exhaust gases looked very promising, and so a heat exchanger was designed to transfer this heat to the compressor delivery air at a point ahead of the combustion chambers. The adoption of the heat exchanger permitted the use of well established compression ratios and operating temperatures.

Design work along the lines described above has resulted in the manufacture of the Theseus propeller turbine engine, which has now completed several hundreds of hours of bench testing, including a 100 hours' endurance run at operating conditions with most satisfactory results.

Initial flight testing of the Theseus will be carried out on an Avro Lincoln aircraft having the two outboard reciprocating plants replaced by Theseus propeller turbines.

The successful development of the Theseus has caused great interest among aircraft constructors and Messrs. Handley Page, Limited, have already announced their intention to install this engine in a prototype Hermes aircraft.

Heat Exchanger Propeller Turbine

The Bristol Theseus unit is designed primarily as a power plant suitable for long-range aircraft. The fundamental features of such power plants are as follows:

(a) Low fuel consumption.
(b) Long periods between overhauls.
(c) Adequate thrust for take-off.
(d) Efficiency of propulsion over a wide range.

To achieve these ends with the Bristol gas turbine the following salient design features were included. A heat exchanger has been incorporated to recuperate some of the heat that would normally be wasted in the jet, thereby greatly improving fuel consumption. To give adequate take-off thrust and efficient propulsion at moderate aircraft speeds, a propeller driven from a separate turbine stage is fitted. Longevity of engine has been accomplished by limiting the stresses, both thermal and tensile, of the rotating parts to safe values. The combination of the above features results in a unit that is capable of continuous operation at its full designed power for long periods without distress and thereby operating at the turbine's most economic condition.

Power Plants

Briefly, the "Bristol" Theseus I gas turbine consists of an axial flow compressor combined with a centrifugal stage and driven by a two-stage turbine. The air after passing

through this compressor is delivered to a heat exchanger which raises its temperature by heat transfer from the hot exhaust gases. The air then passes through the combustion chambers to the first two-stage turbine, where part of the energy of the charge is used to drive the compressor. After this the gases pass through the third single-stage turbine (where power is absorbed to provide the drive to the propeller) and then pass through the hot side of the heat exchanger. Their residual energy is finally dissipated in the exhaust nozzle to provide an appreciable amount of jet thrust. The main proportion of available power is transmitted from the third stage turbine to a conventional tractor propeller via an epicyclic reduction gear.

The ratio of power used in driving the propeller to that used in providing jet thrust is roughly in the proportion of 80 per cent. to 20 per cent. at 300 m.p.h.

Assemblies

In dealing with the main assemblies of the Theseus I gas turbine it is convenient to follow the passage of the air through the unit and to describe each section in that order. We therefore have the following headings:

Compressor Assembly

The air enters the compressor via a forward facing, annular intake, situated around the periphery of the reduction gear and just behind the propeller. The compressor itself consists of nine stages of axial blading combined with a single-stage centrifugal impeller giving an overall compression ratio of approximately 5 : 1 when flying at 300 m.p.h. and 20,000ft.

The particular combination of axial and centrifugal compressors was chosen for two main reasons. In the first place the use of a centrifugal impeller as the last stage provides an efficient means of getting the air from the smaller diameter of the axial compressor to the larger diameter required by the heat exchanger. Secondly, it is well known that although the axial compressor can be made to operate more efficiently at higher compression ratios than the centrifugal type, the latter has a wider operating range, and so the combination of the two produces a compressor having a high overall efficiency allied with greater flexibility. Mechanically the construction is as follows.

Intake Casing

This is an aluminium alloy casting consisting of an inner and outer shell, connected to each other by means of eight radial and hollow vanes of aerofoil section. The whole of the intake casing is cast in one and provision is made for the attachment of the starter motor on the horizontal centre line as well as for an oil sump at the bottom. The inner shell accommodates the reduction gear and auxiliary gear casing, drives being led through the hollow vases to the starter and oil sump.

Compressor Casing

The main compressor casing is also made of aluminium alloy and is cast in two halves. The axial section and part of the centrifugal one is of double skin construction in order to relieve that portion of the compressor carrying the stator blades of stresses due to propeller loads. The rear portion of this casing forms the front face of the centrifugal impeller chamber and together with the delivery manifold and rear casing forms the centrifugal stage of the compressor. Blow-off valves are incorporated for starting purposes.

Delivery Manifold, Vane Ring and Rear Casing

The delivery manifold collects the compressed air from the impeller after suitable diffusion through the vane ring and passes it to the cold side of the heat exchanger through eight transfer pipes. It is a one-piece magnesium casting, in contrast to the diffuser vane ring which is cast in two halves (also of magnesium).

The rear casing is an aluminium casting which forms the back face of the centrifugal impeller chamber and is extended backwards to carry the main compressor thrust bearing. It is joined to the compressor casing by means of long bolts running through the diffuser vanes.

Axial Compressor Rotor

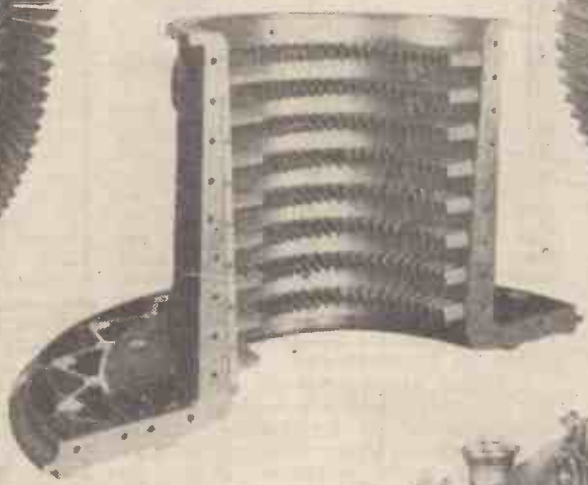
This is of drum construction, being made of a high-grade aluminium alloy forging. The drum is made up out of three identical sections for ease of manufacture and assembly and is supported by two conical steel shafts bolted to the drum and carried in a front roller bearing and a rear ball bearing which also supports the compressor turbine wheel.

The rotor blades, as in the case of the stator blades, are made from high grade aluminium alloy stampings and are fixed to the rotor drum by means of serrated slots running axially. There are nine stages, each of which contains 69 blades.

Impeller

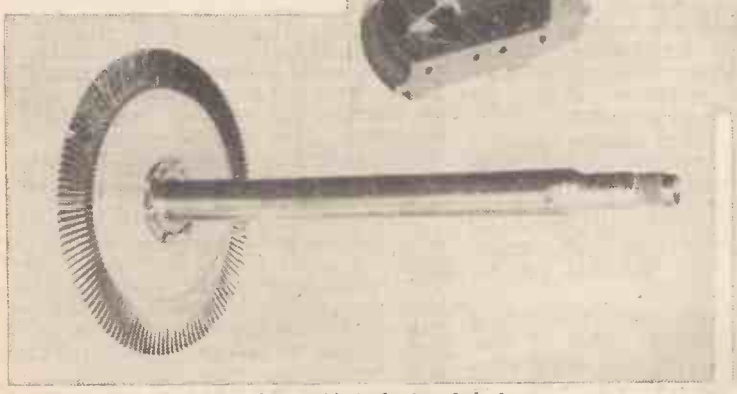
This follows the usual Bristol practice in that it is machined from a solid aluminium forging and is bolted on to the axial rotor drum to form the final stage of compression. The impeller has 23 straight radial vanes and is double shrouded.

Compressor turbine wheel, showing the double row of blades.

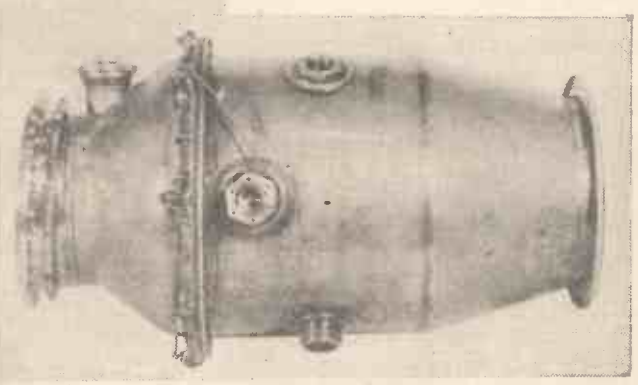


One half of the compressor casing.

One third of the compressor rotor drum.



Propeller turbine wheel and shaft.



The combustion chamber.

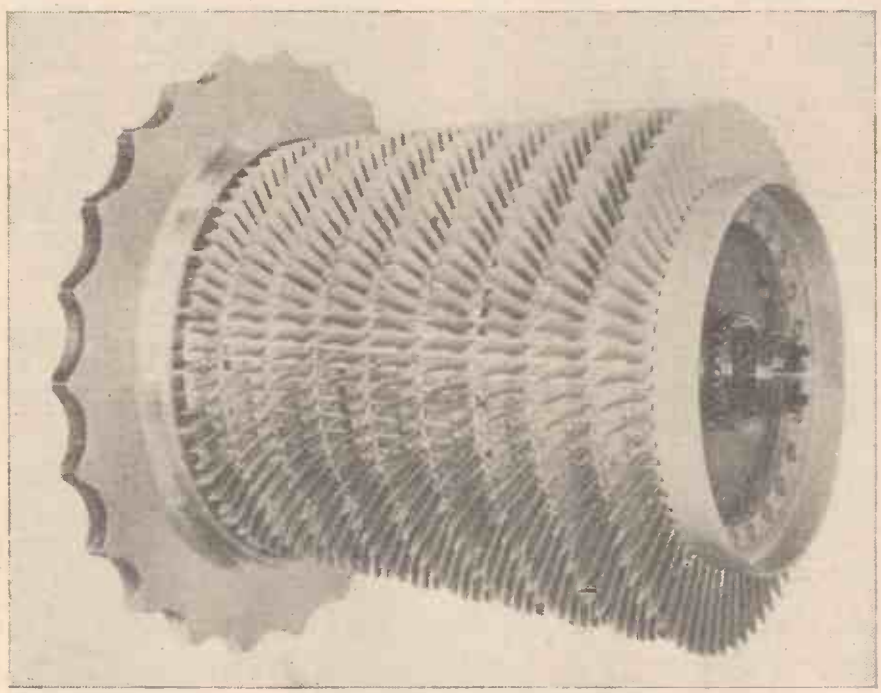
The compressor runs at 8,200 r.p.m. at full throttle conditions and delivers 30 lbs./sec. of air at sea level static conditions. The power required to drive this is approximately 3,500 h.p.

Every attempt has been made in the design to provide a simple and robust construction which results in a low stressed but light assembly.

Heat Exchangers

Following the passage of the air through the unit, the next assembly to be dealt with is the heat exchanger. The air is delivered from the compressor discharge manifold to the heat exchanger by means of eight aluminium diffusing transfer ducts spaced equally around the periphery of the engine.

The heat exchanger is of a matrix type



The compressor rotor assembly.

construction, consisting of some hundreds of straight tubes running parallel to the axial centre line, thus offering the minimum resistance to the passage of the hot exhaust gases which pass through them. The tubes are arranged in 16 sets, 8 inlet and 8 outlet, each batch being separated from the next by suitable headers. The air passes radially inwards towards the centre of the heat exchanger, where its direction is reversed, and it travels radially outwards again to the outlet headers. During its passage through the heat exchanger the air picks up heat from the hot exhaust gases and from the outlet headers it is passed into the combustion chambers.

Combustion Chambers

The combustion chambers, which are spaced between the transfer ducts around the periphery of the engine, are of standard design and are of sheet metal construction throughout. Provision is made for the admission of secondary cooling air to the burning mixture in order that the temperature may be lowered to a value acceptable to the turbine blade materials.

The combustion chambers are interconnected for even flame distribution and equalisation of pressure, and two of them are provided with sparking plugs for initiating combustion during starting. Full provision is made for accommodating any expansions which may occur.

Turbines

The products of combustion are delivered to the first stage nozzles through a tangential delivery manifold. These nozzles, of which there are 48, direct the gases on to the first stage rotor blades, after which the gases are re-directed on to the second stage rotor blades by the second stage stators. Both these first two stages of rotor blades are fixed to the same wheel disc and the power generated is used to drive the compressor and auxiliaries only.

After leaving the compressor driving wheel the gases pass through a third stage of stator blades to be guided on to a single stage rotor wheel, which is coupled to the propeller reduction gear. The propeller turbine revolves at a speed of 9,000 r.p.m. The gases are then led through a diffuser to the hot side of the heat exchanger, after which they are discharged from the jet pipe, which has a variable nozzle.

The separation of the propeller and compressor turbines was decided upon after much consideration. It is obvious that with mechanically coupled turbines, the question of relative speed control becomes very difficult and renders the performance of the engine very critical. By separating the two drives as has been done in the Theseus I, the operation of the engine is simplified, and by means of a specially developed mechanism, the propeller pitch is automatically controlled so as to maintain a constant speed ratio in relation to the compressor.

A further advantage of this separation is that the starter motor has to rotate only the compressor and not the propeller. Consequently a smaller starter motor can be used.

Turning to the mechanical design, the following details may be described:

Turbine Casings. The turbine casing is formed from three separate castings made of high grade heat-resisting steel, the third stage casing also providing a support for the rear bearing of the propeller drive and turbine, by means of eight radial vanes, largely in the manner described for the compressor intake casing.

Turbine Wheels. The compressor driving wheel carries the first two stages of rotor blades and is of forged high temperature resisting steel to Jessop's specification G. 18B. A hollow hub is forged integral with the disc and is splined to transmit the drive to the compressor shaft.

The propeller driving wheel is a Stayblade forging, carrying a single row of rotor blades and having an integral forged stub shaft to provide the support from the rear bearing. The extended driving shaft is bolted directly to the disc and transmits the drive to the epicyclic reduction gear.

The turbine blades are fixed to the wheels by means of fir tree type slots, obtained by broaching.

Turbine Blades. The stator blades are made from precision castings in a special heat-resisting alloy. The rotor blades are forged from the same material and are of the Free Vortex type.

Mounting. The turbine assembly is mounted separately from the rest of the unit by means of a secondary triangulated structure, supported from the main mounting face. This permits of the accommodation of any longitudinal expansions, and in addition the turbine mounting provides for freedom of expansion in the radial direction, whilst maintaining concentricity.

General. Provision is made for the cooling of the turbine wheels by means of tappings from the axial compressor. A system of labyrinths provides effective sealing between the various stages of the turbine.

As in the compressor, the design has aimed at providing a simple and strong construction without any undue sacrifice in weight. The stresses are, therefore, of a low order and care has been taken to avoid any high concentration of both temperature and stress. Expansions have been well catered for and the creep effects have been reduced to a minimum. The maximum gas temperature at the entry to the turbine does not exceed 800 deg. C.

Reduction Gear

Having traced the path of the air circuit in the unit it now remains to describe those assemblies which have no direct bearing on the principles of functioning of the engine.

The reduction gear, as has been stated previously, is of the epicyclic type and is driven from the propeller turbine wheel by means of a long shaft running through and coaxial with the compressor assembly. This shaft is supported on a roller bearing at the front and a ball thrust bearing at the rear. At the forward end the shaft drives through a gear type coupling to the sun wheel of the reduction gear. The sun wheel drives the larger gears of four sets of compound planets carried in a cage bolted to the propeller shaft. The action of the smaller planet wheels on a fixed annulus gear causes the planet cage and hence the propeller shaft to rotate at the speed required, which is approximately 1,070 r.p.m., the reduction gear ratio being approximately 8.4 : 1. The fixed annulus gear is mounted on torque dynamometer pistons and this provides the additional advantage of equalising the tooth loads on all the planet wheels. A single row ball bearing is provided to carry the thrust of the propeller.

Auxiliary Drives

An oil sump is provided underneath the intake casing and incorporates drives to the oil pressure and scavenge pumps and a fuel pump. The drive to these pumps is taken from the compressor rotor via bevel gears contained in an auxiliary gear casing which is in turn housed within the intake casing.

The auxiliary gear casing includes the drive from the starter motor, situated on the horizontal centre line of the intake casing. The starter motor drives through conventional type Bendix jaws to the compressor rotor. The device for controlling the propeller pitch change mechanism is also included in this casing.

(To be concluded.)

The Republic "Seabee"

Details of a Small Amphibian 'Plane Built in the United States

By J. W. R. TAYLOR

Side view of a "Seabee" on the water. Here the prototype, with tapered wings, is shown.

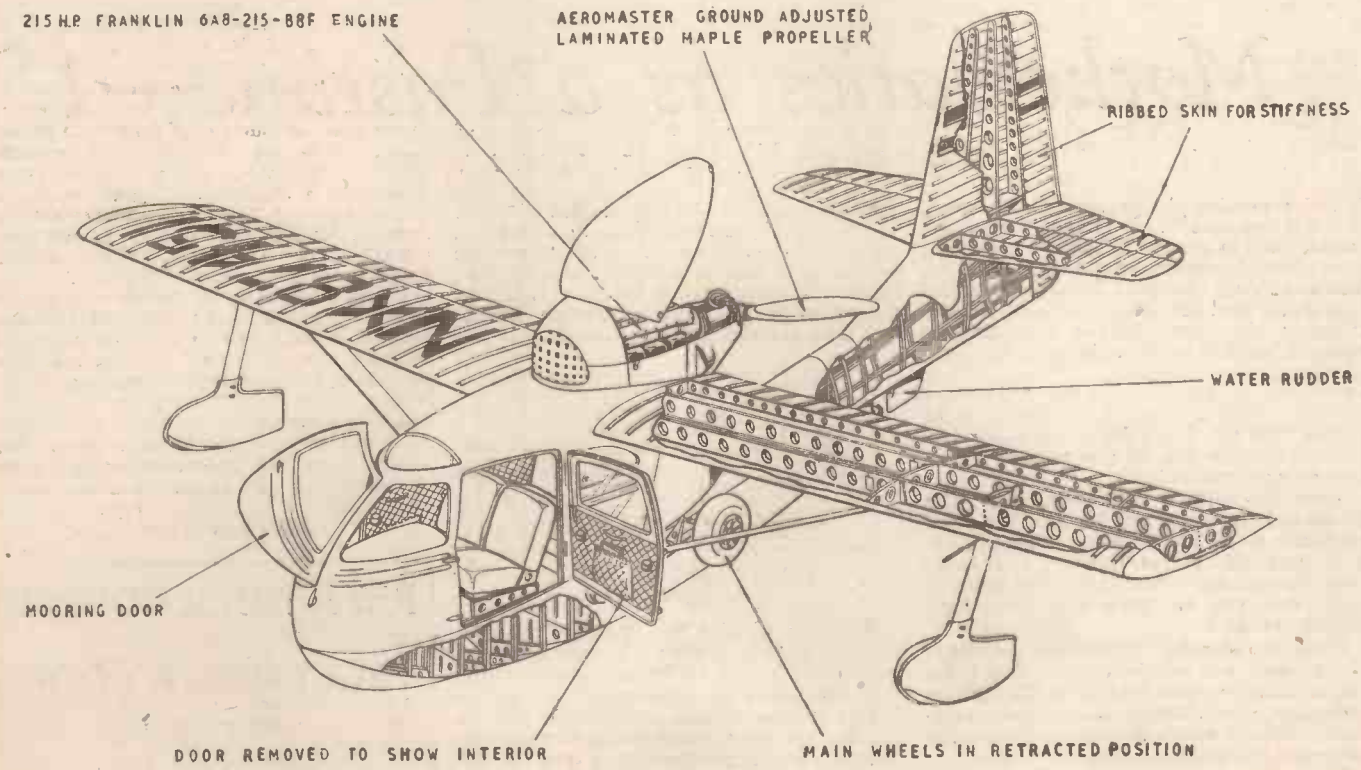
AMERICA is notorious for doing things in a big way. So it is not surprising that, having made up their minds that they ought to be air-minded, the American public are now ordering family 'planes by the thousand. Foremost target of the potential aviators is the little Republic Seabee amphibian, which is hardly surprising, as it seems to be everyone's dream of a post-war family 'plane come true. So Republic's huge Farmingdale plant, which turned out 15,329 ten-ton Thunderbolts during the war, has now been converted to produce about 40 of the little one-and-a-half ton Seabees every day.

All-metal Construction

Think of all the features you'd like to find in your own light 'plane, and ten to one you'll find most of them in the Seabee. For, although it is an all-metal four-seater with a 215 h.p. engine, careful and economical design has kept the initial cost down to about £1,000. It is roomy, sturdy, easy to maintain, has a good performance, can take off and alight on land and water and, because of its low structural weight, is comparatively economical to run.

The prototype Seabee looked very similar in general appearance to the models now coming off the production line, but under that metal skin are revolutionary engineering changes that have reduced the number of component parts from 1,800 to 450, and the time needed to build a Seabee from 2,500 hours to 200 hours. In addition, the airframe weight has gone down from 1,260lb. to 1,140lb., and, in spite of an increase in engine power of 40 h.p., the price has been nearly halved, which, even in hard figures, is quite an achievement!

Republic's originally set out to design an aircraft that would be as comfortable, easy to produce, maintain and handle as a car. Obviously, such a machine had to be independent of large airfields, as the sort of place where Father likes to go fishing or where Junior goes camping is not usually graced by the presence of an aerodrome. So they decided on an amphibian which could not only take off from small, unprepared fields but also from the lakes and rivers which abound in America. They started off with a small cabin, rather like a car body, with ample room for four people. Then they decided to mount the Franklin engine to the rear of the cabin, which ensured a good forward view and reduced much of the usual noise and fumes. This necessitated cutting down the cross-sectional area of the rear fuselage to clear the propeller, until the Seabee looked rather like a tadpole with a very large tail end. But this did not affect the structural strength, so everyone was happy. A high wing arrangement was an obvious choice, to carry the wing well clear of the water and improve the downward view from the cabin—also its bracing struts prevented people barging out of the cabin and back into the propeller. Floats were added under the wings, together with a retractable wheel each side of the cabin, and the result was the Seabee, which first flew in November, 1944.



Cut-away drawing of the Republic "Seabee," showing details of construction of fuselage and wings.

Mass-production Methods

This prototype was quite orthodox in construction and was built chiefly to test the general design. It would have sold at about £1,900 which, it was decided, was too much. So one of their engineers—Alfred Boyajian—and his staff were given the job of producing a £1,000 Seabee.

The major expense in almost any job is, of course, manpower, so it was largely a question of re-designing the aircraft for modern cheap mass-production methods of manufacture. The fact that most impressed Boyajian was that aircraft structure has changed very little in spite of the change-over from wood-and-fabric to metal construction. This seemed all wrong. Fabric cannot absorb or pass on much stressing load, metal covering can—so why should all the internal formers and ribs with fabric covering still have to be retained? Anyway, he decided to experiment with structures consisting of a few basic internal members reinforced by a stiff metal skin covering. Applied to the hull, his theories reduced the number of component parts from 362 to 63, the result being a sturdy monocoque structure to which the cabin is bolted. The latter shows very clearly the influence of car industry production methods, and consists of simple large pressings, the interior furnishings, fittings and instruments being for the large part standard car components.

Wing and Tail Surfaces

The most revolutionary change was made in the wing and tail surfaces, which are similar in construction. First of all, wing taper was abolished to save production time, then the whole structure was re-designed, dispensing with the stringers and all but three of the ribs, and relying solely on three main parallel-section spars and the skin covering for structural strength. The skin is ribbed externally for stiffness, and this gives a corrugated effect rather like the old Junkers designs. The result is a very sturdy structure which, in the case of the wing, has reduced the number of component parts from 114 to 30. The wing floats are each made of just two pressings and all the electrical wiring can be installed in eleven minutes!

A "Seabee" moored by the side of a lake.

In no case has this simplification and economy been allowed to affect comfort, efficiency or reliability, and typical of the Seabee's comprehensive equipment is the fact that two-way radio is fitted as standard. The seats are adjustable and the front ones fold back for conversion into sleeping-bunks. In addition, the backs are detachable for use as buoyant rafts in an emergency. The fuel tank is of the "crash-proof" fabric-bag type and is housed in a water tight compartment in the hull.

The Seabee, which has a span of 37ft. 8ins., and a length of 28ft., has a top speed of 120 m.p.h. and cruises at 103 m.p.h. for 560 miles with full load. It can take-off in 800ft. from land or 1,000ft from water, needing a draught of only 18ins. As a production job it can teach many valuable lessons to almost every aircraft designer in the world. As a family 'plane it brings nearer the day when flying will be cheap enough and safe enough for all.

Mathematics as a Pastime—1

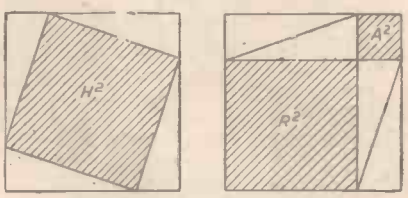
Square on the Hypotenuse. By W. J. WESTON

YOU remember the curious Greek word, "hypotenuse": it means "stretching across," and is applied to the line stretching across the right-angle of a right-angled triangle. You remember, too, this relation between the hypotenuse and the other two sides of the triangle: the square on the hypotenuse is equal to the sum of the squares on the sides containing the right-angle. Thus, draw a horizontal line 4in. long; at one end erect a vertical line 3in. long; you may be quite certain that the line joining the other two ends of the line will be 5in. long (4^2+3^2 is $16+9$, or 25, and 25 is 5^2).

Now, this truth is not self-evident. The Greek mathematician who hit upon the proof sacrificed an ox to the gods in his elation. You, too, ask for assurance; for, being sensible, you don't take things for granted. Well, will you for your satisfaction and delight, do this?

Draw two identical squares (see diagram); 4in. to each side will be ample. Cut every side of the two squares into identical lengths—in one, long-short, long-short, long-short, long-short; in the other, short-long, long-short, long-short, short-long. Join the ends.

You have now, in each of the original squares, four identical right-angled triangles. In the left square you have in addition a square, H^2,—and this is on the hypotenuse of the right-angled triangle. In the right square the corresponding addition is R^2 and A^2 together—and these are squares on the two sides containing the right-angle.



Diagrams used for squaring the hypotenuse.

Whatever division you make of the side AB, the truth emerges: the square on the hypotenuse is equal to the two squares on the sides containing the right-angle.

You will not always, or often, be able to translate the sides into exact figures like our 3, 4, 5. Another instance is 5 and 12 for the sides containing the right-angle. For 5^2+12^2 is $25+144$, or 169; and $\sqrt{169}$ is 13. Another instance is 8 and 15 for the sides containing the right-angle. For 8^2+15^2 is $64+225$, or 289; and $\sqrt{289}$ is 17.

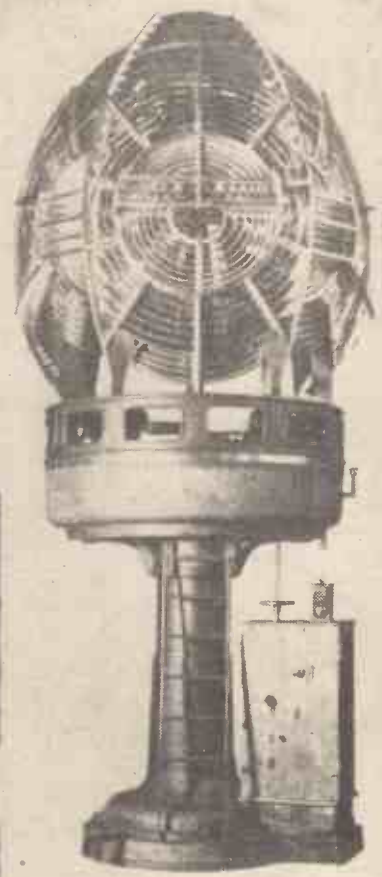
Usually, however, the unknown side will be an intractable surd; and you will then find the square root to whatever degree of accuracy you think fit. Thus, the sides containing the right-angle being 5 and 4, the square on the hypotenuse is $25+16$, or 41; and the square root of this will be greater than 6 but less than 7. How to tackle the problem of getting $\sqrt{41}$ with ever-increasing degrees of accuracy is the theme of next month's diversion.

(To be continued.)

British Lighthouses for Export

New lighthouses and lighthouse equipment are badly needed all over the world and orders are coming into Britain in great quantities. British lighthouse equipment is now being manufactured for Yugoslavia, Finland, Norway, China, India and Dutch East Indies. The ravages of the war years have made the complete replacement of many lighthouses a necessity. This series of photographs taken at Messrs. Chance Bros. of Smethwick, Birmingham, shows how the equipment is being made to execute the overseas orders.

(*Above*) *Prismatic glass for assembling the framework to form lenses for lighthouses. The completed lens is for a lighthouse in the West Indies.* (*Below*) *Final stages in fitting the framework of a revolving lighthouse lens prior to the inclusion of the prismatic glass rings.*



A typical lighthouse optic rotating on a mercury bath by a clockwork mechanism, and giving three consecutive short flashes followed by a single flash every 15 seconds.

Mechanism for rotating the lens which will be assembled on the table shown, at a later date. This apparatus is for Longstone Lighthouse, of Grace Darling fame.

(*Above*) *The finishing process after the glass prisms have been focused in the framework. This lens-panel is for the rotating optic of the Longstone Lighthouse.*
(*Left*) *Grinding a glass prism so that it may fit into the lens framework inside a lighthouse lantern.*

Repairing Domestic Electrical Appliances

Useful Hints on the Upkeep and Repair of Domestic Electrical Appliances, and How to Avoid the Many Pitfalls That May be Encountered by the Home Electrician

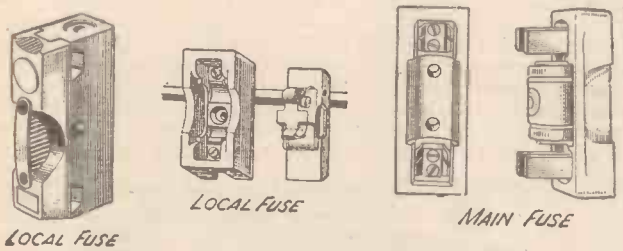


Fig. 1.—Fuses and fuse carriers.

By "Home Mechanic"

IN these notes it is intended to deal with more than the mere replacement of a fuse or a burnt-out lamp. But first we must deal with some "Don'ts."

In this country, very soon, all supply will be A.C. at about 240 volts. Now, the peak voltage on A.C. is 240 multiplied by the square root of two, i.e, 240 x 1.414, or something over 330. If you keep this point in your mind's eye you will be more careful about taking shocks from the mains. When making an examination of any apparatus, always disconnect from the supply, either by removing the plug or by switching off at the mains. If you are doing any work on an installation, such as changing a fitting or plug, or anything connected with the permanent wiring, then switch off at the mains and pull the fuses. This is the only way to make certain that someone will not come along and switch on again.

The Main Fuse

We will start with the point of entrance of the cable and follow it to the various points, dealing with each fault as it arises. If a main fuse blows you cannot replace it, but must 'phone the supply company, who will send a man out to do it. The main fuse box is sealed, and it is an offence to break this. If a main goes, there must be some serious fault in the circuit.

Replacing Local Fuse

If a local fuse blows, first find the reason why. There is always a reason, and a very good one. Generally, it is an overload on the circuit, or some accidental short, worn flexes, or cut wires, and so on. Remedy this and then replace the fuse with the correct size. It is usual to employ 5-amp. wire for lighting circuits, and 10 or 15 for power. Switch off the mains, remove the fuse carrier, clean off all carbon and fused wires, put in the new wire, and replace. Switch on. Remember to remove all the old wire, and make certain of good connections at the fuse clips. (See Fig. 1.)

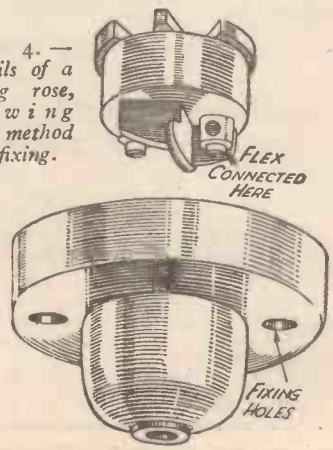


Fig. 4.—Details of a ceiling rose, showing the method of fixing.

Replacing Switch

A switch may often need replacing, especially in such places as garages and workrooms, etc. First get a good switch of the same type and pattern, i.e., 5- or 10-amp., sunk or surface mounting. (See Figs. 2 and 3.) Switch off at the mains; pull the fuses. Now slacken the connecting screws on the switch, remove the fixing screws, pull cut the switch, and then put in the new one. Take care to mount this the right way up and to put the wires on the same sides as before. It is quite possible to put the switch in so that the knob is down and the light off. Don't throw away the old switch, it may be kept as a useful spare in case of repairs.

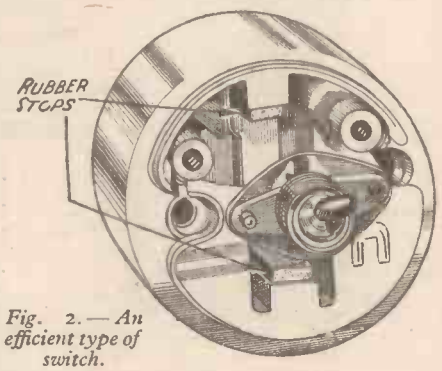


Fig. 2.—An efficient type of switch.

The cover and terminals and the action spring can be removed and put into broken switches. You may not think this worth while, but the repairing of a switch is quite intricate and interesting work. To "open up" remove the sealing wax from the heads of the screws at the back; undo these, and the dolly will pull out. It may leave the movable contacts behind. If so, a slight pull will remove them, exposing the action spring. You now have the switch in pieces, and it is easy if you have a spare to replace a broken part. Contacts may be tightened up by judicious pressure with the blade of a screw-driver. Always use good switches. It should not be possible to hold the contacts, either just in or just out, so that arcing occurs. The switch should open and close quickly with a snap, except in the case of the new silent switches for hospital work. Here the action is barely audible. (See Fig. 3.)

Fig. 5.—Showing how a housewife may obtain a shock from an unearthed iron.

The Distribution Point

Now we come to the distribution point. First the lamp-holder and flex. Flexes often get worn and frayed when the lamp swings in a draught or when a portable appliance is used at that point. If you are doubtful of a flex, replace it—the cost is negligible. In the case of large and powerful lamps, the heat will cause the insulation to perish, and finally the rubber cracks away, causing a short, or the holder to become live. Never remove or replace a lamp with the switch on. In replacing a flex, switch off at the mains and remove the fuses. Unscrew the cover of the ceiling rose, and disconnect the flex. Now, in a more comfortable position, examine the holder. If the springs in the contacts are quite good, it may be replaced on a new length of flex. Slip the rose cover on the flex, climb the ladder, and connect up. Make sure that the weight of the flex and fitting is taken by the little hooks or projections on the rose base, and screw back the cover. (See Fig. 4.)

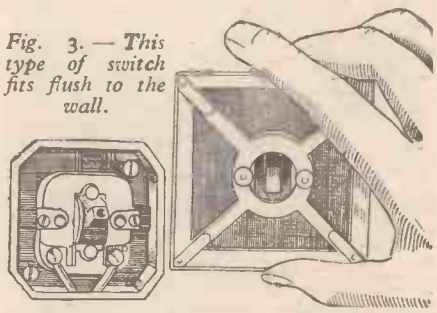


Fig. 3.—This type of switch fits flush to the wall.

A word on using portable appliances from light points and two-pin distribution points. The flex and holder are rated at 3 amps. You should not use anything taking more than 500 watts from a holder. All portable apparatus should be earthed. It cannot be earthed if used from the ordinary holder. Yet, you may say, why are irons, fires and vacuum cleaners all sold with adaptors for use on the light. This, of course, is to give them a universal appeal, but the day is not far off when all apparatus will be sold with a special plug of probably the three-pin type. The sketch shows how easy it is to get a shock from a two-pin point of, say, a fire or iron. The housewife is there, probably with damp hands, in the kitchen, ironing, in easy reach of gas and water taps

and earthed ironwork. A fault develops in the iron. With one hand she touches the stove or a water tap, and a very bad shock results. (See Fig. 5.) The same can happen with open fires of the bowl type. Also, with two-pin plugs and fires with switches incorporated, it is possible for the switches to be off and the plug in and yet the element alive. If you wish to test all these statements, get a lamp, holder and flex with crocodile clips as leads, and use this as your subject or patient. Connect one lead to earth and the other to the iron or fire, as above, and observe that the lamp will light. Wherever possible use only lamps at the lamp-holders and the proper apparatus at the two-pin point. These are designed for use with reading lamps and wireless sets, which, theoretically, may not require earthing.

The Power Point

This has an earth pin which must be used. You may feel tempted to connect up the iron to the plug with the original twin flex. Don't; it is safer to get a good quality triple cable. If the iron is used a lot, then we advise a tough rubber covered cable. The extra safety will well repay the outlay. Braided cable has a nasty habit of fraying at the adaptor and then shorting. The wires in the cable each have their own colour, so that it is an easy matter to earth the correct one. The latest iron adaptor has a small spring tongue that touches the metal case of the iron. This is the earth contact. Bend it out so that it makes good contact. The same general remarks apply here as regards frayed cables, etc., but one must use the cable of the correct size for the appliance. If you are using a 3-kilowatt fire from a plug, don't wire up with lighting flex. Use the correct cable (this is generally supplied with the appliance). On the other hand, if you are using a 750-watt fire from a 15-amp. point, thinner flex can be used, but to protect the circuit the 15-amp. fuse must be replaced with a 5-amp. one. This is very important, because the earth might burn before the fuse blows if a fault develops in the fire. Fig. 6 shows a socket from which any apparatus may be used with safety.

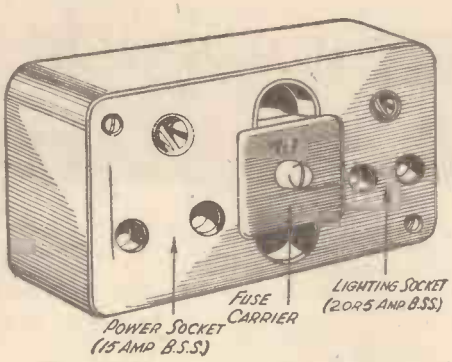
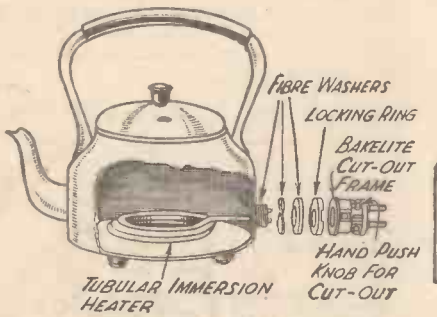
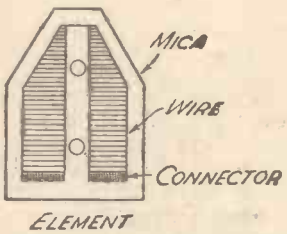


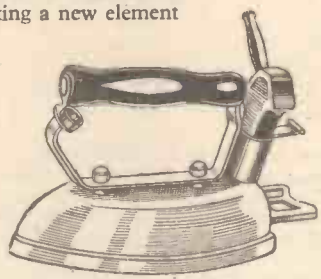
Fig. 6.—A safe socket for all appliances.

Two Types

All domestic appliances can be divided into two types—heating and motor driven. Special notes will be given for the various types, but first a general survey of the heating type. Here we include irons, fires, toasters, hair dryers, kettles, hot plates, stoves and cookers, because in each case the element is a length of wire that gets hot when in use. A group of appliances is shown in Fig. 7. A combination of the two types is found in modern fires and hair dryers, etc. Nowadays all heating elements are standard, i.e., if your iron burns out a new element can be bought from the makers. The sketches (Fig. 8) show a dismantled iron; we will deal with fitting a new element first. Remove the cable connector. The shell is fixed to the base by two fancy nuts, A and B. Unscrew these and gently lift the cover off. In some types connection is made by two springs from the adaptor to the element; in others it is a strip of metal. If by springs, the cover comes straight off; if by strips, unscrew these at the connector. The element is clamped to the base between a heavy iron stop. Remove the two nuts and lift off the iron; the element may now be removed. The element is wound of strip on a mica former and is completely insulated from the frame. When removed, take it to your testing bench and connect in series with a lamp. If it lights then the element is O.K. and the connector must be to blame. A faulty element can generally be spotted by holding to the light; the burnt spot shows as a black dot. Don't attempt to repair an element, but put in a new one, lay flat on the plate, put on the iron weight and tighten up the nuts. Put on the cover, make sure that the springs touch the element correctly, and warm up the iron. When hot, dismantle and put another half turn on the clamping nuts.







—the complete iron, mica element and parts of an electric kettle.

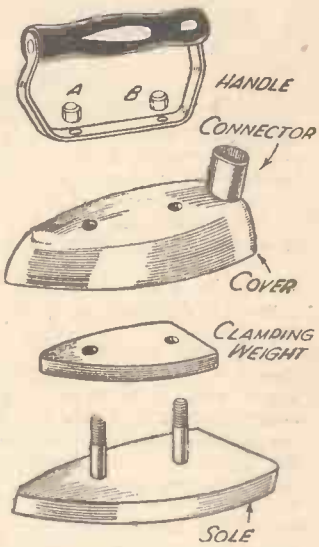


Fig. 8.—An exploded view of an electric iron and below—

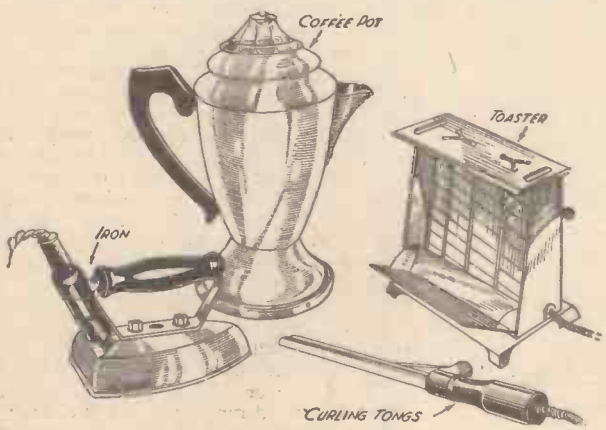


Fig. 7.—A group of "heater" appliances.

Repairing an Electric Kettle

A kettle element is very similar to that of an iron, but is generally in two halves. The replacing of the element is carried out in the same way. First invert the kettle, then remove the cover plate exposing the elements. These are clamped under a thick copper disc by one screw passing through the centre. Remove this and the elements. Connections are made through copper flexibles insulated with porcelain beads. Preserve these, as they must be put back on the new element. Observe the position of the old element and replace the new one in exactly the same way. Connect up as before. Most kettles, sterilisers and similar appliances are fitted with a cut-out of some sort that opens the circuit when the vessel boils dry. Some have a small fusible capsule which has to be replaced each time it boils dry. The commonest method, which is found on all good-class apparatus, is the bi-metal thermostat. The actual design is the same. A bi-metal strip forms part of the circuit, and when this is overheated it bends outwards and opens the circuit. Any repairs here consist in cleaning the contacts, and perhaps bending the strip slightly so that a good contact is made. The contacts can be reset by a knob on the base of the kettle, and need not be touched in the ordinary way.

Sterilisers

In hospitals small sterilisers are very common and are in constant use. These are fitted with robust overload relays generally incorporating a mercury switch. Through over-use the contact spring goes and often needs replacing; minor adjustments to contacts and strip are often required as well.

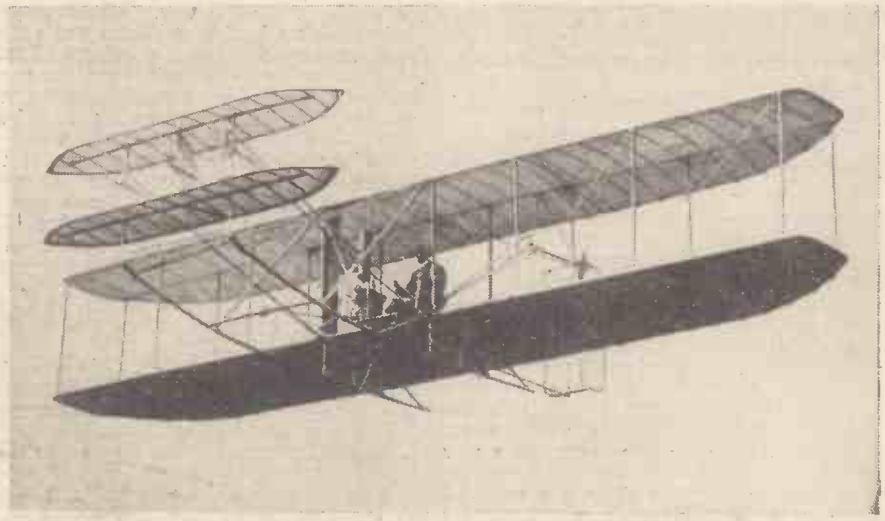
(To be concluded next month)

Notes and News

"Deep" Photographs

STUDIO portraits in which the details stand out in three dimensions are likely to be available in this country shortly. A process for producing these solid pictures quickly and cheaply is to be operated by a London firm.

The new process was invented by Maurice Bonnet, a 39-year-old Frenchman. A special camera moving in an arc takes a series of photographs of the sitter. Lighting is normal, and mirrors play no part in the process. The negatives of these photographs are superimprosed between two glass plates by a secret method. The result, seen with the naked eye, is a picture which looks like a glass box containing a solid sculpture of the sitter. Minute details of form and clothing are faithfully reproduced, and light reflected from hair and jewels appears to scintillate. A three-dimensional photograph can be taken in about five minutes.



The Wright airplane, first airplane to fly and one of the favourite exhibits at the Science Museum, South Kensington, London. The Science Museum has been told by Mr. Orville Wright, surviving brother of the famous Wright brothers, that it is his intention to withdraw it. The airplane was originally loaned to the London museum as a protest against the American failure to recognise it as the first 'plane to fly.

G.W.R. Gas Turbine Locomotive

AN order was recently placed by the G.W.R. with British Brown-Boveri, Ltd., for a gas turbine locomotive. The engine will develop an output of 2,500 h.p. and will be capable of a maximum speed of 90 m.p.h. The locomotive will be used on express passenger services.

British Motor Vehicles for Export

SINCE the Associated Equipment Company, builders of London's buses, resumed production of civilian chassis following the cessation of hostilities, a total of over 1,600 has been ordered for overseas markets. This figure comprises machines of every type—single and double-deck passenger vehicles and goods vehicles ranging from 12 to 22 tons gross. One of the most important orders received was from the Iraq Petroleum Co., Ltd., for 66 special tractor type machines which will be used on the constructional work of that company's new oil pipeline from Baghdad to Haifa. This was the largest order ever placed in this country for vehicles to be employed on oilfield work. Nearly 300 vehicles, mostly single deck buses and coaches, are being sent to Argentina, while over 150 of the same vehicles are destined for Uruguay. Over 80 single deck passenger chassis have been ordered for operation by various companies in Denmark, and recently the British-owned Lisbon Tramways Company ordered 68 single deck buses. Australia, South Africa and New Zealand are taking large numbers of both passenger and goods vehicles, whilst a large post-war order for 50 double-deck buses has been received from Bombay Electric Supply Co. Norway, Holland and Brazil are three other countries for which A.E.C. will be building chassis.

Launching Gear for Jet Aircraft

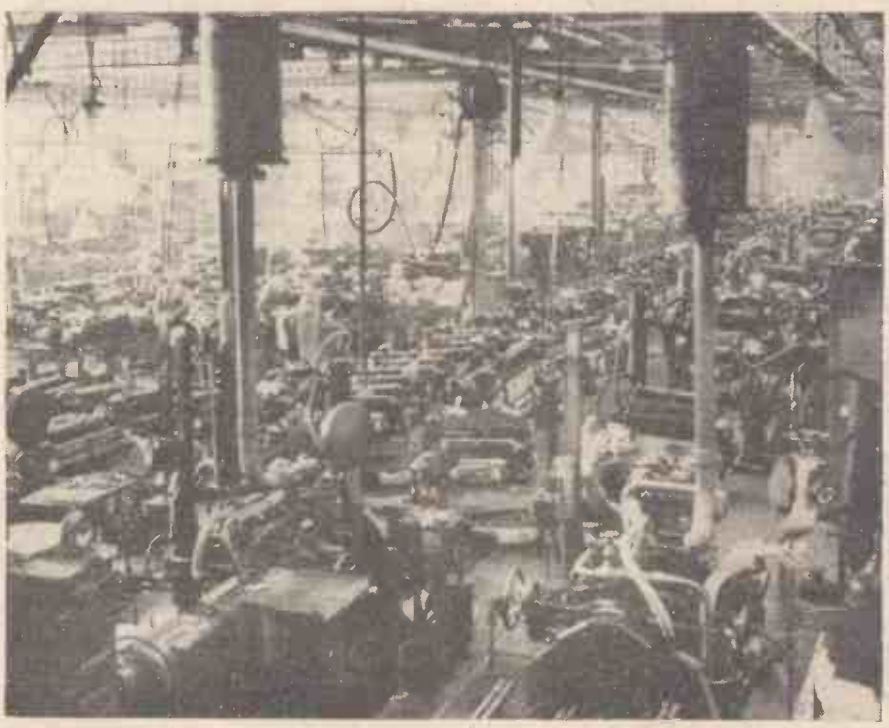
A NEW device, known as the Electropult, has been designed and built by the Westinghouse Electric Corporation for the United States Navy. The machine consists of a linear electric motor, more than a quarter of a mile long, and is intended for launching jet-propelled and robot 'planes and heavy bombers from ships' decks or small landing fields.

The Electropult is essentially a huge electric motor laid out flat. The 1,382ft. track corresponds to the rotor of an ordinary machine and the small shuttle car which runs along it acts as the stator. In operation, a 'plane is hitched to the shuttle car, which speeds down the track and tows the 'plane into the air. In a recent demonstration at the Naval Air Test Centre, Maryland, the Electropult launched a jet-propelled 'plane at 116 miles an hour in four and one-tenth seconds after a run of only 340ft. Unassisted the 'plane would have required a run of about 2,000ft. for the take-off. Running free, without load, the shuttle car has built up a speed of 226 miles an hour in slightly less than 500ft.

The shuttle car itself is 11½ft. long, 3½ft. wide, and extends 5in. above the track. To harness the 'plane to the car a bridle of steel cable is used. The 'plane rides along the track on its own wheels and when flying speed is reached the car is stopped, the bridle drops off, and the 'plane takes to the air.

Atomic Electricity

AN experimental power plant is to be built at Oakridge, Tennessee—one of the original atomic research centres—for the development of nuclear energy in the generation of electricity, Major-General Groves, Chief of the Manhattan Project, disclosed recently.



A general view of the scene of activity in the engine shop at the A.E.C. works at Southall, Middlesex, which is working to capacity with export orders. The engines are "run in" here before being fitted to the chassis.

The Automatic Computing Engine

Historical Notes and Particulars of the New "Automatic Brain," Designed by the National Physical Laboratory

THE idea of using a machine to perform ordinary operations of arithmetic is very old indeed. The beads on wires in a child's play-pen are an example of the *abacus* used in Roman times for book-keeping arithmetic, still used in the East. The earliest true calculating machines were invented by Leibnitz and Pascal in the seventeenth century, but the work of constructing them was unsuccessful. Engineering technique had not developed sufficiently.

Hand-operated Machines

Hand-operated calculating machines, capable of addition, subtraction, multiplication and division were made successfully in the late nineteenth century. They were in use in insurance companies and large business houses, and a few were in use in university departments. Parallel developments between the two world wars were in made in the use of all these types of machines, originally designed as the tool of the cost-accountant and business man, in scientific work. Dr. L. J. Comrie, formerly Superintendent of the Nautical Almanac Office, is an outstanding pioneer in this field.

He adapted a bank ledger-posting machine of American manufacture for the construction and checking of mathematical tables,

The multiplying unit of the Automatic Computing Engine. Through the wiring here seen passes the calculations, which, in a few seconds, give the answers to the problems.

At work on the wiring of one section of the A.C.E. at Welwyn Garden City.

purely adding machines, and the large punched-card accounting machines. The latter were developed originally for the American census at the end of the last century, but their use increased in large business organisations and Government departments between the two wars. They were, in fact, used to demobilise the armed Forces at the end for World War II. For instance, if it is desired to know how many butchers will be demobilised in November, 1946, the machines can give an answer in a few hours. Human labour would take many days and many hands to achieve the same result, with a far greater possibility of error.

Between the two wars great strides were and used the punched-card accounting machines for constructing tables of the motion of the moon up to the year 2000 A.D. In this way the speed and power of the computing aids for the scientific worker have been greatly increased without any duplication of the technical development already undertaken in the commercial field.

During the war, however, it became apparent that the needs of scientific research were outstripping the mechanisms provided by purely commercial development. At Harvard University a machine was constructed which, although its components were such as might be found in a commercial accounting machine, was put together in a novel way and with very different ends in view.

Modern Machines

Thus came about the construction of the Automatic Sequence Controlled Calculator, made by the International Business Machines Corporation and presented to Harvard University. It consists of 72 adding mechanisms, a mechanism for multiplication and division, three tape feeds carrying tables of mathematical functions and a punched card input and output.

These various mechanisms are interconnected through what is virtually an automatic telephone exchange, and the "instructions" to the machine are coded in the form of perforations on a punched tape—the "sequence control" tape, which controls the working of the machine. The setting up of a problem on the machine consists in planning the sequence of arithmetical operations to be performed, converting these operations into the code used on the tape and punching it on a special typewriter.

The speed of this machine is not spectacular, multiplication takes a second or two, addition a fraction of a second. Division may take as much as a quarter of a minute, according to the number of figures involved. The new step in development in this machine was the idea that it should tackle a problem *as a whole*, working automatically to a prescribed sequence of instructions. In all previous machines the

link between one arithmetical operation (addition, multiplication, etc.) and the next had always (except in a simple set of additions) lain through the brain of the operator at each stage. In this Harvard machine the links between successive operations are electrical, through the built-in telephone exchange. Instead of having to make these connections during the progress of the work the human operator plans a long sequence of them in advance and leaves the machine to carry them out automatically.

Although this Harvard machine is an independent and original development, the possibility of the construction of such machines and, indeed, more elaborate ones, had already been foreseen in this country. Dr. A. M. Turing, a fellow of King's College, Cambridge, had written in 1936 a severely mathematical paper in which he had discussed the properties of such machines in connection with certain problems of mathematical logic, without considering practical methods of construction.

Now a telephone relay is a device for switching a current on or off. A wireless valve can be used in the same way, but at much higher speeds. Sooner or later, therefore, someone was bound to attempt to make a machine which would use valves in place of relays and attain hitherto unheard-off speeds of calculation. This has been done. At the Moore School of Electrical Engineering, University of Pennsylvania, there has been constructed an electronic monster which will add two numbers together in less than a thousandth of a second and multiply them in a few thousandths of a second. This machine, christened the ENIAC (Electronic Numerical Integrator and Computor) contains 17,000 valves and consumes 150 k.W.

The A.C.E.

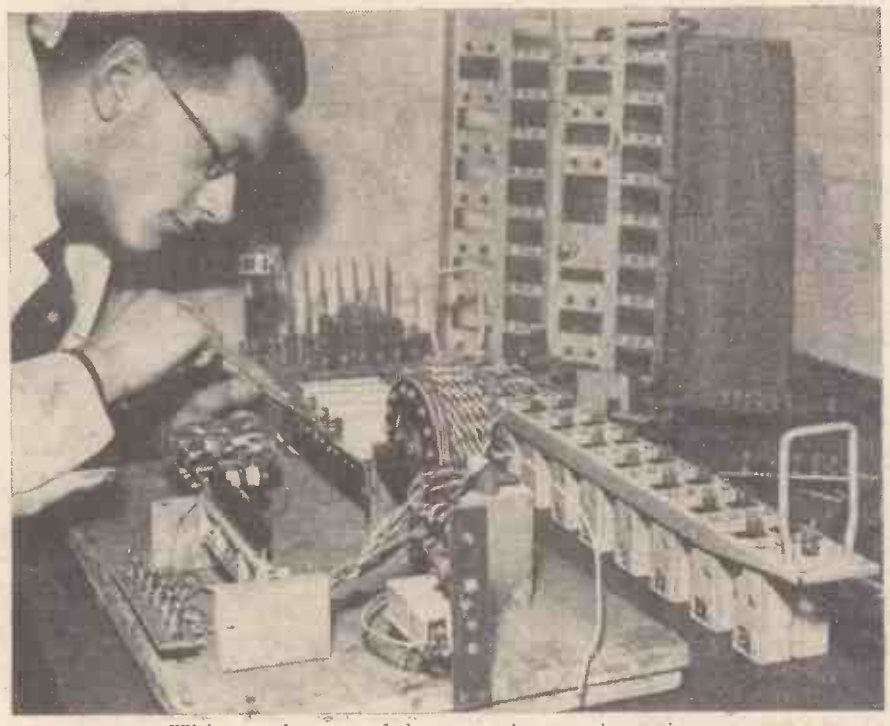
The National Physical Laboratory of the Department of Scientific and Industrial Research has, through its Mathematics Division, maintained an interest in these developments. It has planned a machine called the A.C.E. (Automatic Computing Engine), which will work at the speed of the ENIAC, or possibly somewhat higher, and which will take advantage of new technical developments, making possible both a greater memory capacity and a higher degree of complexity in the instructions.

The logical control mechanism of this machine will be far more complicated than the calculating mechanisms. At these high speeds time cannot be spared to prepare a full set of detailed instructions for each problem. Instead, instruction programmes for standard calculations will be stored in a special library, and the instructions for a particular problem will be assembled from these prefabricated units, possibly linked together by special instructions. It is in the organisation of these instructions that the National Physical Laboratory feels that it has something new to contribute, and the major effort of the Mathematics Division has been in the preparation of these instruction programmes, for upon the form decided upon for these the technical design largely depends.

It will be two or three years before the completion of this machine can be hoped for, since its construction presents formidable problems both mathematical and technical.

To do its work the A.C.E. has to be provided with the equivalent of three things required by the normal human mathematician. Firstly, there is the paper on which the computer writes down his results as he goes on; secondly, there are the instructions as to what processes are to be applied, which normally the mathematician carries in his head; thirdly, there are the function tables to which the mathematician makes reference when working out his problem. These problems all involve storage of information or mechanical memory, and the mechanical device designed for this can be called upon by the logical control to give up its stored information at the required moment. The internal memory capacity of the A.C.E. will be 75,000 decimal digits as compared to 200 decimal digits of the ENIAC.

One of the ways in which the greater memory capacity of the A.C.E. shows its usefulness is in the setting up of problems. Whereas in the ENIAC a problem must be set up by a laborious process of plugging and switching, the A.C.E. may be told what it is to do and will remember what it has been told. The process of "telling" consists of passing a pack of cards through the machine on which instructions have been punched. This may take about a couple of minutes, as compared with several hours in the case of the ENIAC.



Wiring another part of the automatic computing engine.

Internal Working

The internal working of the machine will be entirely in the binary system, in which a number is represented by a series of 1's and o's, the 1's being pulses and the o's the spaces between them. The answers will be given in the decimal system. The following table shows how digits in the decimal system are represented in the binary system:

1 =	1	6 =	110	11 =	1011
2 =	10	7 =	111	12 =	1100
3 =	11	8 =	1000	13 =	1101
4 =	100	9 =	1001	14 =	1110
5 =	101	10 =	1010	15 =	1111
				16 =	10000

A thousand million has 30 digits compared with the ten digits in the decimal system.

The machine will work at very high speeds. For instance, it is intended that the multiplication of two ten-figure numbers shall be carried out in two thousandths of a second. The machine will alter the whole question of what is a difficult and what is an easy problem. There is a class of mathematical problems, which owing to their extreme complexity and the enormous length of time required to solve them, are so difficult as to be almost impossible of solution by the pencil-and-paper mathematician. Such problems are well within the scope of the A.C.E. For instance, simultaneous equations with more than twelve unknowns are beyond the patience and time of most mathematicians, but the machine will be able to tackle equations with fifty or even a hundred unknowns. Problems for which the machine might be used are the construction of range tables, involving the calculation of trajectories by small arcs for various different muzzle velocities and quadrant elevations; the calculation of the radiation from the open end of a rectanglar wave-guide; the finding of the potential distribution outside a charged conducting cube.

The machine will cost in the region of £100,000 to £125,000. It is unlikely that other similar machines will ever be made. So great is the speed with which it will work, that this one machine by itself will be able to cope with all the exceedingly abstruse problems for which it is designed. Furthermore, it is probable that during its construction, or shortly after its completion, further advances will become clear, and subsequent machines will be designed to do even more than the A.C.E.

N.P.L. Team

The work is being done mainly in the Mathematics Division of the National Physical Laboratory. The leaders of the team are Sir Charles Darwin, F.R.S., Director of the N.P.L. and a theoretical physicist of international repute; Dr. A. M. Turing, in whose brain the idea of the A.C.E. developed, who is 34 years old, and who is now with the Mathematics Division; Mr. J. R. Womersley, who is the Superintendent of the Division; and Professor D. Hartree, of Cambridge University, who is the only man in this country who has worked the ENIAC machine in the U.S.A.

The U.S.A. has been ahead of this country in the design of calculating machines, although perhaps the British have been more resourceful in the use of the machines than the Americans. Mathematicians in this country have every reason to be grateful for the pioneering courage of the Americans in this field.

Rocket Propulsion

Problems of High-speed Flight : Research Aircraft

By K. W. GATLAND

(Continued from page 89, December, 1946 issue.)

IN the six previous articles, emphasis has been on the rocket-fighter and the possibilities of the simple ram-jet athodyd. There is still much to be related of the strictly military aspect, but in order to obtain a more complete idea of the problems which, in view of the close proximity of the sonic "barrier" to aircraft speeds, now face designers of fighters, it will be desirable to investigate the methods by which data is obtained to base the design of new types.

Prior to the advent of jet-propulsion, designers were little worried by compressibility. It is true that shock waves were occurring at local points on the aircraft, for instance, behind underslung radiators and at wing joints, but by careful streamlining most of the troubles were satisfactorily overcome.

The position to-day is far more perplexing. In the past it has always been the power plant that has lagged behind, and, very largely, it was the structural designer to whom credit was due in improving performance of aircraft. Now, the case is completely reversed. No longer has the airframe designer to wait patiently for the engine manufacturer to coax a few more horsepower out of his already highly tuned product.

It is a fact that many jet and rocket engines now in production have quite considerable *reserves of power* which literally dare not be used because structures and controls are not yet ready to withstand such great stresses as would be imposed at anything approaching full throttle. So rapid is the rate of engine progress that aeroplanes in project a year or two ago and now approaching production stages will, in the light of new design technique, soon be ready for the scrap heap. Witness the cancellation by the Air Ministry of the Miles M.52 contract.

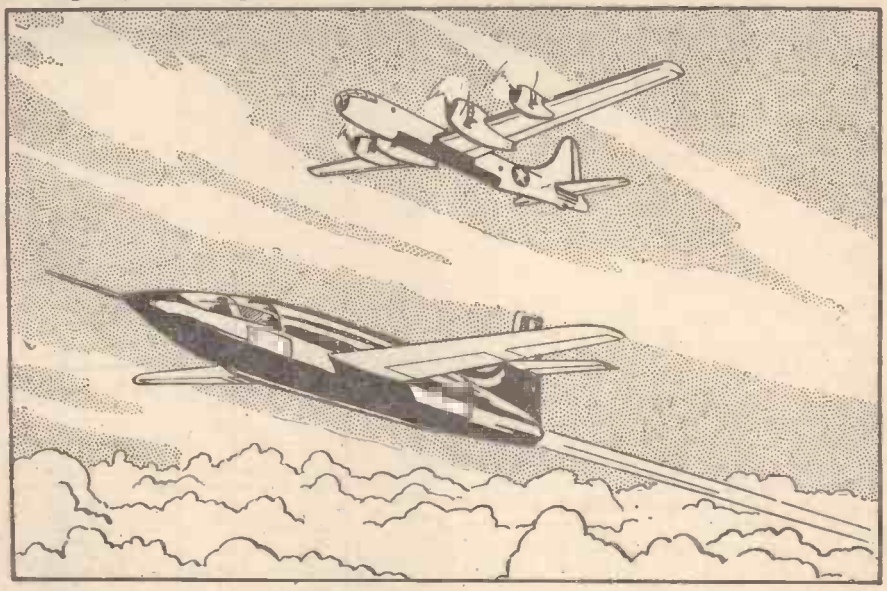


Fig. 87.—An impression of the Bell XS—1 after its release from a specially modified B.29. In forthcoming tests it is hoped to attain speeds in excess of sound and to fly at over 15 miles' altitude.

Dangers of Compressibility Shock

The dangers of flight near the sonic region were made only too clear in the tragedy which overtook Geoffrey de Havilland while testing the D.H.108 tailless research aeroplane. An explosion in the 3,500 h.p. "Goblin" engine was the popular theory for the mishap, but this was soon discounted by de Havilland technicians. The more likely explanation is that the machine was flying at a speed approaching sound values and compressibility caused its break-up, possibly upon encountering an air-pocket. The vibrations set up in the airframe under such conditions would have been considerable.

What then, one may ask, is the best shape for such high-speed aircraft? The answer to this question is open to argument, but high in consideration is the true "flying wing," for in this form the weight could be spread more uniformly over the span. The cantilever wing and tailplane are the most vulnerable in orthodox aircraft because the air-flow is always tending to lever them from the fuselage, and therefore a self-contained structure containing engines, fuel tanks and all other miscellaneous equipment evenly distributed across a single expanse of wing would be far less likely to receive a mortal blow as the result of compressibility. The D.M.2, reviewed in last month's article, is an excellent example of this type.

Higher flying speeds thus introduce a problem of great magnitude—the risk of "flutter." Whereas at moderate foward speeds the air always has a damping effect and causes any vibration (started perhaps by a gust or a sudden movement of the controls) to die out rapidly, the opposite is often the case when travelling at speeds upwards of 500 m.p.h. The damping qualities of the air may disappear or, worse still, actually contribute to *building up* the vibrations with increasing amplitude, when the beats can then become so violent that fracture of the structure follows within a very short time. It is, therefore, obvious that the aircraft which go out to pierce the sonic "barrier" (about 760 m.p.h. at sea level) will have involved some knotty problems for the design and stress technicians who conceived them.

The structural problem, however, is by no means the designer's only headache. His efforts are required to perfect new control systems, both to maintain stability and permit manœuvres at high speeds, and yet enable safe flying in the low speed register.

At present there seems no alternative other than to produce "compromise aircraft," which means that form (exterior) efficiency must always be impaired by the need for a reasonably moderate landing approach. In any event, there does not appear to be a great future for aircraft which fall out of the sky at 170 m.p.h., as the Miles M.52 supersonic research aeroplane was intended to do.

Fig. 88.—Small athodyd ram-jets have been fitted experimentally to the Bell X—83, development of the "Airacomet."

Flying Wings and Supporting Jets?

To satisfy both structural and aerodynamical problems at high speeds, the flying wing layout then emerges as the logical development. Small wing area, knife-edge sections, acute sweep-back—these are the more obvious requirements for trans-sonic and supersonic flight, making the aeroplane efficient in reducing drag at high speeds but, alas, poor in qualities of lift at the time of landing. An ultimate solution may be found in the use of turbo-jets balanced by three-axis gyros to provide an upward or supporting thrust, permitting the aircraft to hover and descend slowly in the same manner as a helicopter; but this is mere speculation as yet. However, there does not appear to be an alternative answer, unless one considers folding or partly retracting wings; but few to-day would suggest that either of these schemes was practicable.

There is little doubt that as flight loads rise and wing areas diminish—as it seems logical to expect in the attainment of increasing speed—landing will present one of the pilot's greatest hazards.

Friction

The difficulties that manifest themselves when flight in or above the speed-of-sound

range is considered are truly enormous. Not only has the structure to be of herculean strength and the control system such as to permit safe flying at all speeds but *friction* also gives rise to concern.

The heat generated by air buffeting may be as much as 400 degrees at 1,500 m.p.h., and so it is reasonably safe to say that pilots and crews will need refrigeration. A solution to some degree, however, is found in flight at great heights. At 80,000 feet, for instance, the outside temperature will be 67 degrees below zero and thus, in order to eliminate as much bulky refrigeration machinery as possible, forthcoming test flights are being planned to take place between 60,000 and 80,000 feet up. Eventually, it is reasonable to expect that all flights by long-distance jet-driven aircraft will be in the stratosphere, for not only does the heating problem find partial solution but drag reduces with altitude. At 60,000 feet the drag for a given speed would be approximately one-fourteenth as much as it would be at sea-level, or, in other terms, only one-fourteenth of the power would be required for propulsion. A climb to 80,000 feet and the resistance becomes one-twentieth that at sea-level, one-half that at 60,000 feet.

This would be an encouraging prospect but for the fact that the efficiency curve for the jet-engine begins to fall off around the 60,000 feet mark. The turbo-jet and the athodyd require vast volumes of air to operate, and again the compromise path is the only one left open. Whether the rocket engine, which—at this stage it is surely unnecessary to stress—operates independent of atmosphere, will eventually rectify this state of affairs is yet to be seen, but its voracious appetite in fuel would seem to limit its application in all normal conceptions of commercial aircraft. A ceiling of 55,000 feet, at least, should give a reasonable operating efficiency for high-speed turbo-jet and athodyd-driven airliners, and this is some consolation.

Definitions

In this vast study that is opening up in flight at ballistic velocities, it is inevitable that new terms will creep in to augment the already extensive aeronautical vocabulary. Already, aerodynamisists have presented us with several additions, and it will be as well to explain some of them. *Mach number*, for instance, is the relation of flight speed to the speed of sound, M=1, and hence, *Machometer*, an instrument recording the relation of flight speed to the speed of sound. More familiar are the speed zone terms: *subsonic*, less-than-sound; *trans-sonic*, range of speed lying between M=0.8 and M=1.2; *supersonic*, faster-than-sound; and then, *compressibility*, phenomenon occurring as flying speed approaches sound values, causing sudden change in density and pressure with accompanying increase in drag and decrease in lift. *Shock waves* are a wave formation—the outward (and under certain conditions visible) sign of compressibility.

Having summarised briefly some of the problems related to flight at trans-sonic and supersonic speeds, it is now possible to investigate matters a trifle more fully in the light of work that is proceeding with high-speed research aircraft, both manned and unmanned.

Undoubtedly the most significant of these special types is the Bell XS-1, a machine said to be capable of 1,500 m.p.h. at 80,000 feet altitude. Some confusion had arisen in early descriptions of this project, for it was originally said to be athodyd-driven and to incorporate a rocket booster, but a recent Press release by the manufacturers has now clarified matters and an impression of the machine is given in Fig. 87.

The XS-1 has a strong outward resemblance to the Miles M.52 supersonic research aircraft (work on which was abandoned last February), but its power derives from four bi-fuel rocket engines and not from turbo-jets or athodyd ram-jets. A possible explanation is that confusion arose from the fitment of athodyd units at the wing tips of a Bell XP-83, development of the "Airacomet" (see Fig. 88), which, incidentally, crashed during a recent test flight.

The fuselage is packed tight with fuel tanks, and the pilot, clad in a pressure suit, fits snugly into the bullet-shaped nose, which had actually been designed to suit the dimensions of Jack Woolams, the firm's test pilot. Short-span thin-section wings and tail-assembly are also the vogue.

The machine had already completed satisfactory glide tests, having been taken up

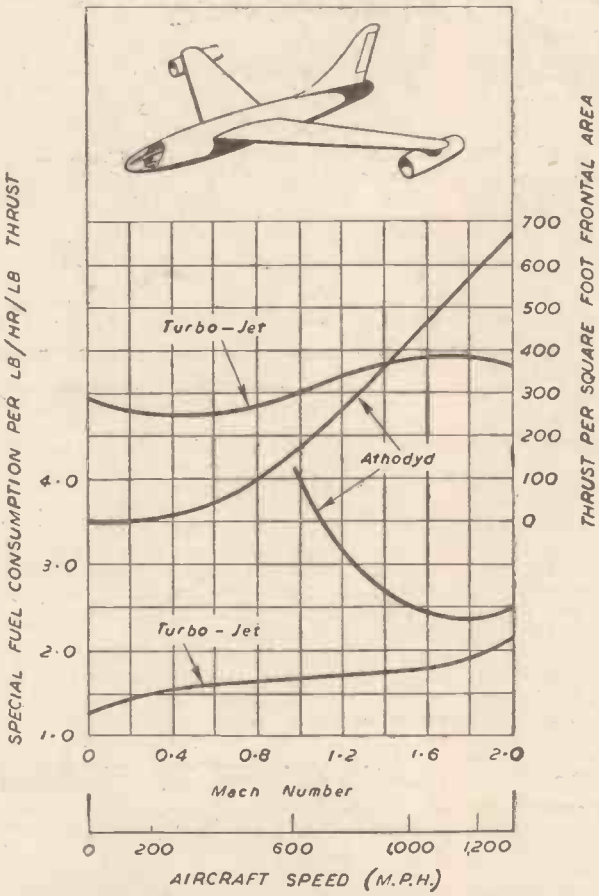


Fig. 89.—A graph prepared from figures given by Dr. S. G. Hooker, of Rolls-Royce, Ltd., comparing a high-output turbo-jet with an athodyd ram-jet at 40,000ft. altitude. In the inset, the author illustrates a logical development, a tailless fighter with athodyd units at the wing-tips, and a booster rocket in the tail fuselage.

to about 30,000 feet beneath a specially equipped B-29 and released. Woolams was loud in his praises of its flying qualities, and so successful in fact were considered the preliminary tests that preparations were in hand for the first flight under power.

Everything went according to plan—until the tragic news was received that Woolams, having entered a special P-63 in the Bentix Trophy Race, had crashed to his death.

Now, with a new pilot at the controls, a further series of glide tests will be necessary, and it may be months before thoughts can again be directed toward powered testing.

When, however, the XS-1 eventually drops away from its parent B-29 and for the first time shoots away under power, it will not be just a "do-or-die" attempt to out-fly sound. The beginning of another testing phase, doubtless even more extensive than the previous glide flights, will have begun, and only when the machine has performed satisfactorily at moderate subsonic speeds and the pilot has gained some experience of flight at really great altitudes will it be reasonable to expect the throttle to be pushed into "maximum boost."

The voracious consumption of its motors will limit the duration under power to within a few minutes, but, nevertheless, having been released at a height of about 35,000 feet, the pilot is expected to climb to between 70,000 and 80,000 feet before making his bid for maximum speed.

The XS-1 has been constructed by the Bell Aircraft Corporation with co-operation from the Material Command of the Army Air Forces at Wright Field and the National Advisory Committee for Aeronautics. The four bi-fuel rocket engines were built by the Reaction Motors, Incorporated, a firm inaugurated during the war and which was responsible for many of the power units of American guided missiles.

A recent disclosure suggests that the new unit develops 6,000lb. thrust at sea-level and that its development occupied the firm in research for four years. It is more powerful than any of the Walter bi-fuel engines and has a far greater operating efficiency.

The unit may be presumed to be a developed version of the 1500N4C, weighing 210lb., and consisting of four cylinders, each capable of delivering 1,500lb. thrust. Each cylinder contains an igniter, combustion chamber and expansion nozzle.

What fuel the machine carries has not yet been made known, but it is probably an alcohol compound with liquid oxygen.

Low Speed Research with Supersonic Aerofoils

An attempt to obtain reasonable lifting characteristics in supersonic section wings at low forward speeds is seen in the tests of a full-scale wing and tailplane of the projected M-52 on a Miles M.3B "Gillette" Falcon, basically a Falcon Six four-seat monoplane powered by a D.H. Gipsy Six Series II in-line engine.

The fuselage of the developed Falcon is the sole link with the commercial version, and even the fully trousered undercarriage, originally rooted in the wings, has been replaced by a strutted chassis fixed around the cabin under-fairing. This has elminated any possibility of turbulence in the air flowing over the "knife-edge" bi-convex wings, which, incidentally, were of all-wooden construction and high-gloss finished.

By the time all modifications had been completed the Falcon was a single-seater, with the cockpit fitted out with a formidable array of special recording instruments and two additional fuel tanks. Flight tests were commenced in August, 1944, and when the machine was satisfactorily trimmed an M.52-type tailplane with independent elevators was fitted. This arrangement, however, was eventually displaced by a special "all-moving" tailplane.

The comparative figures for the two versions are given below, with the Falcon "Gillette" data quoted in parentheses for easy reference: Dimensions: Length, 25ft. (25ft.); span, 35ft. (29ft.); height, 6ft. 6in. (7ft. 9in.);

wing area, 181 sq. ft. (160 sq. ft.); weights: empty, 1,550lb. (1,730lb.); loaded, 2,525lb. (2,500lb.); performance (speeds): maximum, 180 m.p.h. (164 m.p.h.); landing, 40 m.p.h. (61 m.p.h.).

Work on this enterprising little research aeroplane was abandoned when the contract for the M.52 was cancelled. The data obtained from its numerous flights, however, must have proved of immense value in designing the parent machine, and in view of the vast speeds expected of future aircraft it is obvious that more and more attention will need to be paid to research toward ensuring safety in flight at low speeds.

Control Problems

Then there is the problem of maintaining control at *high* speeds. In orthodox aircraft, the first effects of compressibility manifest themselves at about 500 m.p.h.; controls stiffen and become sluggish, and as speed increases still further, the pilot has great difficulty in manœuvring his aircraft.

Several possibilities have been suggested, and one of the most promising is illustrated in the fitment of "drag rudders" at the tips of the new XP-79B flying-wing fighter. These consist of small open ducts, the area of which can be moderated independently. To cause a change in direction to port, it is necessary only to restrict the flow through the port duct. The drag built up on that side then naturally results in the machine turning.

A similar scheme is the fitment of small rocket motors at the tips, but this would be rather wasteful in fuel.

In future high-speed aircraft, especially in fighter types, there is little doubt that athodyd ram-jets will occupy the space at the wing tip, with turbo-jets or rocket units mounted inboard, either in the fuselage or at the wing roots. It should then not prove too difficult a matter to incorporate the principle of the "drag rudder" in the athodyd motor. A device to vary the area of the intake would satisfy the problem admirably.

The light weight of the athodyd makes it ideal for installation at the wing tip (see Fig. 89), and, indeed, this is the logical step to expect from the successful carriage of "overload" fuel tanks and bombs in this manner, an arrangement first tried on the "Shooting Star" and which is now common practice in the U.S. Wind tunnel tests have shown it to be a most efficient location owing to the inevitable formation of vortex. A streamlined protuberance at the tips, therefore, involves no great increase in drag, and with athodyds the form efficiency may be expected actually to benefit.

(To be continued.)

Science Notes

By Prof. A. M. LOW

IT will be interesting when the cinema gives us a reasonable imitation of stereoscopy. Perfect colour, extreme speed, with probably a few smells thrown in. Some of the films that I see are a terrible waste of our celluloid that ought to be devoted to discovery. Not so long ago there was a great discussion as to how a fly landed on a ceiling. Did it fly upside-down, or did it do a somersault at the last moment? High-speed pictures have soon illustrated that these charming insects either make a half-loop or half-roll, as our pilots say, a few inches from the ceiling, thus making a perfectly good six-point landing. Yes, they have six legs. For many years Plato gave the number as four, which was considered to be so logical that no one ever troubled to look. That probably was an early instance of the bad method of learning by alleged logic instead of by the best of all systems—that of scientific observation. The fly, I should mention, has free feet, which can easily hold on to the small hills and dales of a whitewashed surface. Under a microscope, a ceiling looks like the mountains on the moon, a razor edge like a saw, and the most beautiful skin in the world like a rather ancient toad. As I explained before, everything is relative, and beauty is in the eye of the beholder. I want to make it clear that the fly knows that also.

Are You Wrong?

IT is extraordinary that popular errors should last so long. Lightning is not attracted by your penknife on the table. A few miles of air are much more important. But that is the interesting point. There is nearly always some slight truth in a fallacy. To suppose that a small piece of steel could make any difference to a lightning flash is ridiculous, but it is true that the lightning would prefer to pass through steel rather than air. The sun does not put out the fire, but makes it more difficult for you to see whether the little flame is there, and prevents your discovering so quickly that the wretched thing has gone out. Pokers leant against a grate do not increase the draught, but I suppose they would do so to an extent that could hardly be measured by the most sensitive instrument. I often think that some of the most laughed-at sayings of our grandmothers were very true. At one time it was common practice in the West of England to scrape the mould from a copper kettle which had been left in a dark cellar and to use this mould for curing septic wounds. Humiliatingly like penicillin, is it not? We all know that bee venom is an important medicament, but I am sure that doctors who had said so forty years ago would have been condemned as quacks. "The hair of the dog that bit you" is a very common phrase, yet to dissolve the hair of a cat and to inject the resultant liquid has proved very useful in the diagnosis of asthma. Many sufferers are greatly affected by the presence of a cat. I am no believer in witch doctors, but when they used to stick pins into a wax image it is not impossible that this was merely a mascot which helped them to concentrate thought, and that the result was mildly inimical to their enemy. No doubt a far more common case was the surreptitious dose of poison, but I would not like to state that the witches, on the other hand, were quite all nonsense. One should be very careful before stating a fact without adding: "Or so it seems to me."

Don't Hurt the Snail

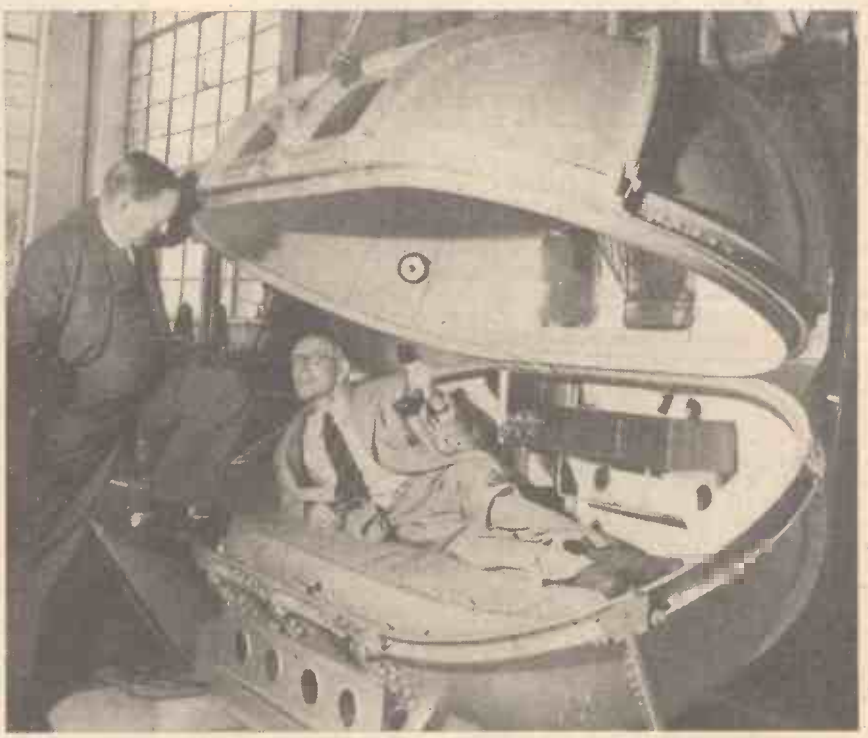
NATURE designed her products so much better than any human being could hope to emulate. Nature also knows all about speed. A jet of water travelling fast could knock a hole in you; travelling slowly it is fars ofter than butter.

Put a razor blade edge upwards and a snail in front of it. The snail will climb over that blade using its own lubrication so that tiny particles of mucous substances act as roller bearings. It moves so slowly that it will safely traverse a bridge which even a fakir might find very troublesome.

Child's Play

HERE is a simple problem to which any child should be able to give an answer; yet it is one which can puzzle all of us very easily.

When a fast bowler is practising spinning a ball can the ball progress faster after its first bounce than the speed at which it is originally thrown? I should say "yes," because he might throw it very slowly, but with so high a speed of rotation that upon contact with the ground its peripheral velocity would be far higher than the rate of its forward motion. So it will jump forward or sideways.



This Easter-egg-shaped pressure chamber was specially designed for Mr. Winston Churchill when his doctors had warned him of the danger of his flying at a greater height than 8,000 feet. The cabin is fitted with a comfortable couch, ash trays, cupboard, bookshelf and telephone.

Britain Can Make It Exhibition

Novelties, Inventions and Gadgets.

By the MARQUIS of DONEGALL

The latest in Television, with an easy chair to match.

WHEN the Editor discussed the subject of this article with me he mentioned gadgets.

What is a gadget? The Oxford Dictionary is of singularly little help. It says: 1886. Origin obscure. Originally in nautical use. (That I can well believe having recently seen the *Queen Elizabeth*.) Continuing with the Oxford Dictionary: "A small tool or piece of mechanism, especially of a *trivial* nature."

Now I come to think of it, my life is conditioned by gadgets: saved, once or twice, by my Sperry horizon and gyro when I was piloting. I was sorry not to be able to find Sperry represented in Britain Can Make It, but probably they have not been able to produce a supplement to the catalogue giving a list of all the firms represented.

Quite apart from gadgets that have saved my life I have, as most gadget-mongers will agree, quite a number that have nearly killed me on occasions.

But our objective is Britain Can Make It. Starting from the basis that everything, from the wheel to radar, must have begun as a gadget, the field is unlimited, and my only task is to differentiate between what was a gadget in 5,000 B.C. and what is a gadget in 1946.

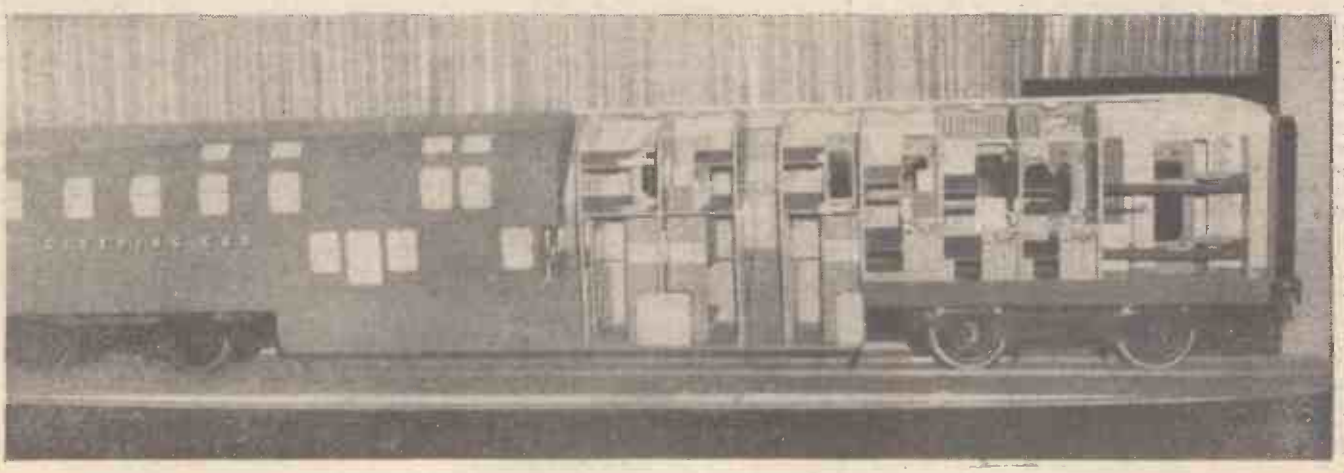
Later in this article I propose to deal with the "Designers' Look Ahead" Section. This cannot be dealt with all at one time because some of it is immediately practicable and other parts of it are practicable only on the drawing board.

Midget Portable

Now let us get some gadgets listed as we go round the Exhibition. One of the first that we come to, photographed as often as a film-star, is the Romac first British Midget Portable radio. I feel that most of my readers must know about it, as it has had so much publicity. I have one, and believe me, it is better than any American.

Then we have the collapsible containers made by the Bristol Aeroplane Company; an internally sprung metal container so that you can return the container in a fraction of the

A streamlined cycle, designed by Mr. B. G. Bowden. The machine has a dynamo and motor set, and is shaft driven



Model of a third-class sleeping car providing accommodation for 34 passengers in private two-bunk and single-bunk cabins.

space in which it went out with its freight. The Bialaddin pressure hurricane lantern is more modern in design than any hurricane lantern I have heretofore seen (Exhibit No. GG8 by Aladdin Industries, Ltd., Greenford.)

Electric Irons

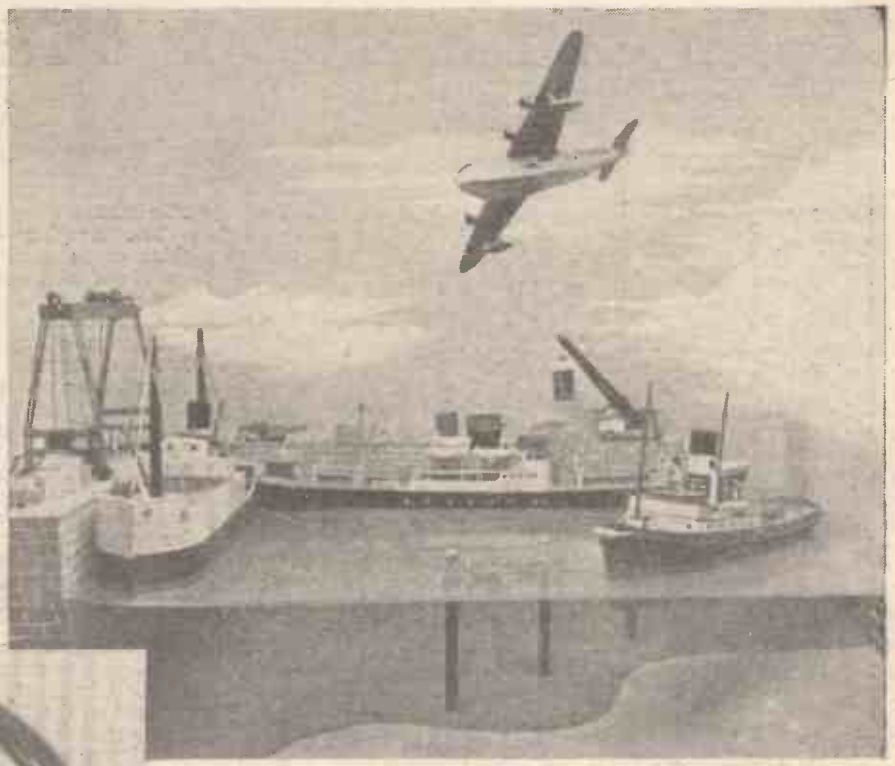
There is nothing much new in the electric irons, but I suppose that GG51 by Clayton, Lewis and Miller, of Southend, could be classed as a gadget on account of its smallness. It is very attractive in red and black.

GG54 in the catalogue qualifies as a gadget and is made by the Hotpoint Electric Appliance Co., London. This appliance, starting from low heat, has an adjustable pointer which designates art silk, silk, wool, cotton, linen, and ending up at high heat.

GG35 is a very nice plate-warmer by English Electric, of Preston, although I doubt if there is anything gadgety about it except its extremely attractive appearance.

I was interested in the latest Hoover (GG24) on account of its adjustability to various house-cleaning jobs; rather like the device that enables the dentist to insert his various instruments of torture into the same appliance.

GG45 is a most attractive black and gold



A panorama in the Toy Section.

relief to my fellow sufferers, as handymen husbands, to know that we will not have to hump wooden things round any longer to mend a fuse. While I am on this subject, we must include the pair of household steps which can be turned into an ironing board or a baby's high-chair.

Housewives should be delighted with British Emulsifiers' (T197) hand-fitting saucepan handles. The handle is shaped to the fingers so that there is no danger of a "slip."

Whether you call Nylon wigs a gadget I do not know. But they are magnificent, and you will find them in the Fashion Hall.

Toy Section

We now have to visit the toy section, and I am not at all sure that the toys are not the best of the lot. There is, of course, the inevitable pedal jeep (L50), by Messrs. W. E. Green, and I wish that the "Jazz-minor" drum set (LL15) had been available when I formed the jazz band at my school in 1919. I had to make mine.

LL228 is a beautiful scale model aluminium dump-wagon. It is made by Woodnote, of London.

A clock with chromium bezel and stand. Spun silver centre, black hands, white zone, black on grey markings. Height 7ins., width 6ins., depth 2¼ins. Designer, Robert Gutman, of London; movement by Ferranti.

Thermovent, by Ekco, of Southend. For the uninitiated, such as myself, they are things that, by the use of a concealed electric fan, blow hot or cold air at you, as desired. It may be very nice, but it isn't really what we call air-conditioning.

There is nothing much new in the water-heaters. I like GG112 purely for the design of Mr. Wornum, F.R.I.B.A. It is finished in green and cream.

GG111 is a modern black and white "Ascot" heater. I particularly like the Ekco Plastalite red table lamp (GG70), although no new principle is involved.

Household Steps

Now to another section, where we find some very attractive steel steps by Sebel Products, of London (T143). It will be a

Kitchen with dining recess in small modern house, designed by Frederick MacManus, F.R.I.B.A.

A modern portable plate rack

There is also LL14—a grand aluminium scooter, made by H. G. Stone and Co., of London. Another fine toy is LL454, a grab-crane by Ridingbery, of Bristol. This picker-upper is finished in red, manœuvrable, with a seat, and is called a "Rotascoop."

The construction units for children are remarkable. I mention invidiously LL290, an electric construction unit which enables the youngster to build a bell-circuit or an electric-light circuit, by Jungle Toys, of London, and LL399, a chemistry unit by Ekco, which enables the kids to make their own "stinks," and (I hope not) blow the house up!

There is also a very workmanlike search-light unit (LL3) and A.A. gun, by Astra Pharos, Ltd.

Through the men's department and, although it is a pre-war idea, the putting of stuffs on to trees to represent the leaves, if artistically executed—as it is at the Exhibition—is arresting.

Designers Look Ahead

As we try to find our way to the "Designers Look Ahead" Section we pass a very modern-looking lawn-mower (S11). It is said to be a Power-Scythe, by Roto-scythe, of Slough. I'd call it a petrol lawn-mower, but the catalogue is probably right.

As we enter the "Designers Look Ahead" we have to be very careful. As gadget-mongers, we *hate* things that do not work. We tolerate things that *could* work, given the materials, labour, etc., and we note down as negligible the more fantastic. So we must divide our section.

(A) Things that work. None.

(B) Things that could work.
- (*a*) The Sleeping Car.
- (*b*) The Yacht.
- (*c*) The Globe Radio.
- (*d*) The New Taxi.
- (*e*) The Portable Sewing Machine.
- (*f*) The Larger Screen Television.
- (*g*) The Convertible Trailer-House.

(C) Things That Might Work Someday.
- (*a*) That Bicycle.
- (*b*) The Space Ship.

Let us take first the Things That *Could* Work within a reasonable time.

The sleeping car, third class; takes 34 on the double-decker bus principle. Single and two-bunk cabins.

Throws a cup of hot tea at you, it's alleged, for a penny in the slot! Ugh!

Is "this happy breed of men, this little world" that pours our tea according to our tips, thus to be ousted? Nay! For Mitropa, Wagon-Lits and graft, into the purse, dear friends!

The yacht is fine. I see no mechanical reason why it should not sail on the flying-boat principle, though I can't see it ever getting up on the "step," except in a hurricane. (And that would not be so funny!) I cannot see that anybody could complain about the dream taxi. All it needs is a perfect taxi-driver. It is constructed to carry bicycles, has a duplicate meter inside, and controlled indicator to show when it is free. (There is no mention of what happens to the indicator when the meter has a glove over it.) Apart from that, the doors open hydraulically, like the underground.

The portable sewing-machine is just a normal development. It is surprising that it has not followed its cousins of the radio and the typewriter before. Maybe, the ladies are less ubiquitous with their sewing than B.B.C. fans or journalists.

No reason whatever why there should not be a larger screen for television. It has been done, *years* ago. The trouble is that what you gain on the swings, you lose on the roundabouts. I gathered that as the late-lamented Baird tried to drum it into my thick skull. It is practicable to-day, of course. But, like many things, it is not commercial.

Convertible Trailer-house

There only remains the convertible trailer-house. As far as I was able to see, you pull everything out of your trailer to build yourself a temporary house on the principle of children's construction sets. There was such a crowd when I saw this exhibit that I hope I am right. Anyway, if I am wrong, it is a good idea for somebody to work out.

Frankly, I don't like the "Globe Radio" as a gadget. The idea is that you have an illuminated map of the world on your wall and you "plug in" your operative unit in a hole denoting Sydney, or other selected town on the map.

The object is that the thing should be a wall decoration. But I think that I know my radio friends well enough to state that they would rather fiddle with knobs until this new system is perfected to a degree that knob-twiddling cannot touch. And that is years ahead.

There you are, my friends, the thermostatic bed will undoubtedly work. Personally, I am old-fashioned and like my sheets and blankets—and, if necessary, a mosquito net. If this ridiculous unborn contraption were portable, worked on dry batteries, were proof against all forms of pests from fleas to mosquitos, that might be something. At present I am not impressed, and prefer my double bed.

Aviation Notes

A Flying Workshop

AMONG the great variety of uses for which the Bristol Freighter is exceptionally suitable, the "flying workshop" is an example which makes the maximum possible use of those advantages inherent in the design of the aircraft. To-day, if mechanical breakdowns occur on engineering or industrial projects in remote areas, valuable time is invariably lost while spares or special equipment are brought up by surface transport. Using a Freighter equipped as a workshop, "breakdown gangs" could be on the spot within a very short time of any mishap.

The spaciousness of the Freighter's interior permits the installation of a variety of machine tools, storage racks, and bins for spares. The floor, designed to support a unit load of 200 lb./sq. ft. with specially strengthened strips on either side to accommodate vehicles with a wheel loading up to 5,000 lb., gives ample strength for the mounting of equipment for light machining operations or work of a similar nature. Full scope for the easy manipulation of bulky material and freedom of movement for the work is provided by the length and width of the hold, while the floor in the Freighter slopes only a little, unlike the floors of most aircraft with conventional undercarriages.

Machinery could be installed and spares loaded with a minimum of effort and within a very short time through the wide-nose doors and, with the door sill but 4ft. 6in. from the ground, only a small loading ramp would be necessary.

Able to operate from the most indifferent landing grounds, the Freighter needs only a comparatively short landing or take-off run, and the aircraft is robust, easy to fly, and economic.

The Bristol "Wayfarer"

MAKING a perfect landing at Bjornholm, Denmark, on a grass runway only 500 to 600 yards in length, a Bristol "Wayfarer" amazed pilots and representatives of Danish Air Lines (Det Danske Luftfartsselskab) who were examining the performance of the aircraft with a view to purchasing Wayfarers or Freighters for operation in their service.

The landing at Bjornholm—"Pearl of the Baltic"—followed a North Sea crossing from Copenhagen recently during which the Wayfarer cruised at an average speed of 180 m.p.h. during the 540 miles journey.

The Danish pilots were quite convinced that the aerodrome at Bjornholm would be too small to land so large a machine as the "Wayfarer" and that Mr. A. J. Pegg, the Bristol pilot, would be obliged to return to Copenhagen without landing. They were astonished when Mr. Pegg made a perfect landing on the short grass runway which, until that moment, had been used only for machines of a much lighter type.

The Triumph Spring Wheel

Notes and Constructional Details

EVER since the days when a reliable spring fork was devised, such as the old Druid type, thoughts of both designers and riders have turned towards adequate rear suspension, and when one considers the multitudinous designs and schemes that have been marketed since the first world war and before, it is quite obvious that the solution to this problem is both complex in principle and difficult of solution in practical manufacture.

From the earliest attempts, such as the Batseat pillar, the enclosed P.V., on to the Matchless, not forgetting the classic A.B.C. of opposed leaf spring articulated arrangement, all have failed one way or another to stick, until we came on to the more modern attempts that largely centred round the plunger type, which was grafted on to a more or less normal frame. To-day there is no marked ascendancy of the plunger Norton/Ariel type over the articulated type of the Velocette racing scheme, the H.R.D., etc. Quite obviously these two entirely different layouts have advantages and disadvantages which vary in ratio according to the purpose for which these machines have been primarily designed, but each has the disadvantage of increased weight, considerably increased cost, and the possibility of eventual lack of rigidity as the parts wear. Therefore, when it was decided that Triumph should endeavour to provide a solution to the rear springing problem as far as that company's machines were concerned, the requirements that any scheme would have to meet were set down in the order of their importance. They were :

1. Maintenance of lateral rigidity.
2. Minimum unsprung weight.
3. Minimum total increase in weight.
4. Moderate cost.
5. If possible a device which could be used on machines already in service and bought as an extra.

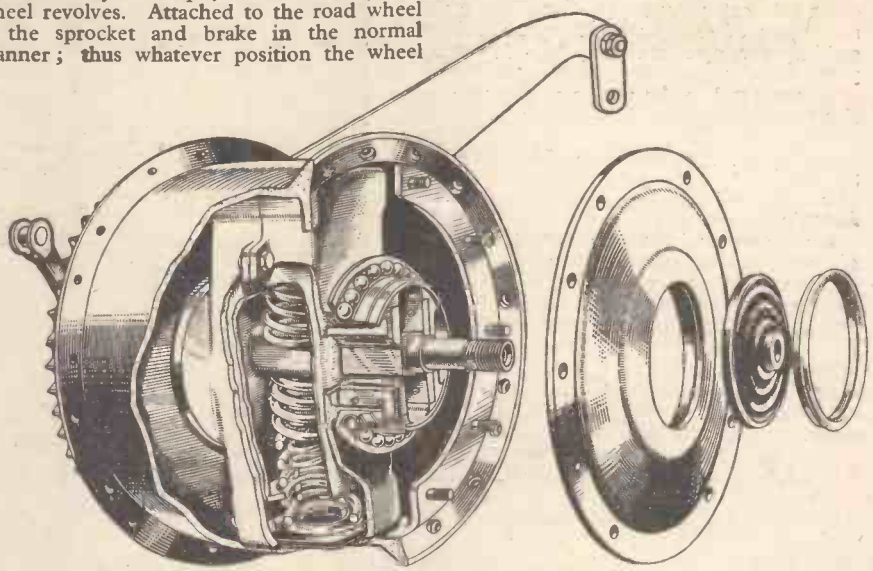
These last two items unfortunately are likely to be affected by the present difficult conditions, but even so these conditions, it is to be hoped, cannot be regarded as permanent and are bound to improve as time goes on to enable manufacturers once more to get back to moderate cost and availability of supplies.

It was visualised that if an efficient device could be incorporated and self-contained within the back wheel, it would leave most of the machine unchanged and would obviate many of the disadvantages of the existing spring frame. Tests also proved that it was not the amount of movement that made such a difference to road-holding and comfort so much as the deflection curve characteristics of that movement. A large unchecked movement is much more disconcerting to the rider than a small controlled movement for minimising the effect of a bad surface. The present invention gives adequate movement for all requirements over normal roads and has a marked effect on the controllability at very high speeds, with a distinctly pleasant, soft ride at normal touring speeds. Moreover, it adds very little to the total weight of the machine—some 12 lb.—which, expressed in terms of percentage extra on 360 lb. in the case of a 500 c.c. "Speed Twin," is only 3 per cent.

Constructional Details

From a structural point of view, although triangulation in motor-cycle frame design has been aimed at, only a semblance of this has been achieved in the two rear triangles of the back stays. These are normally trussed by a fairly rigid spindle so that the rear portion of a motor-cycle at least is fairly rigid. With a plunger frame or with any type of spring frame this rear triangle goes by the board and, therefore, although the spring frame proper may be a comparatively rigid structure, it does not make for rigidity over the whole of the machine from front spindle to rear. With the spring wheel, the two rear triangles of the frame are braced, as with a rigid frame, substantially and rigidly with a fairly massive spindle which is stationary, and from this basis the rest of the scheme is worked out. This rear spindle supports a curved rectangular male guide which encloses springs. This guide is embraced by an aluminium box structure which is free to move vertically, describing an arc which is exactly that formed by the radius struck from the centre of the gearbox drive shaft. This movable bearing box carries two large diameter special races, developed and made by Triumph, on which the road wheel revolves. Attached to the road wheel is the sprocket and brake in the normal manner; thus whatever position the wheel may take by movement, the chain tension does not vary even minutely. The bearing box carries replaceable metal pads which guide complementary sliding pieces on the main spindle. This takes the main pull of the chain and braking loads. These rubbing surfaces are enclosed by synthetic rubber diaphragm seals which, however, are static and merely cope with eccentricity, thus keeping all road dirt away from the rubbing surfaces. The road wheel hub is large enough to clear the vertical bearing box enclosing the springs. There is a certain amount of friction between the bearing box and the male stationary guide, and although lubricated by grease, provides just the amount of damping required to prevent the wheel from being too lively. It has been found over many thousands of miles of tough road-testing that this damping does not vary and the design provides for a fixed value which has been found to be adequate. The brake plate with this device needs to be fully floating, as the brake reaction is taken on the frame and not by the spindle of the wheel. By a suitable linkage this has been found to be entirely satisfactory and, incidentally, the braking with 8in. brake provided by the new wheel has shown much improvement over the standard braking on the fixed wheel, this partly because the brake is larger and partly because of the better wheel adhesion. The unsprung weight is of course only a portion of that of the wheel and represents the minimum possible with any resilient scheme, thus fulfilling the requirements of item No. 2.

It might be pointed out that this wheel is the subject of an invention for which a patent was granted in August, 1940, and was applied for in February, 1939, well before the outbreak of war, and it would have been offered to the public in 1941 had the war not broken out. Unfortunately, as is now well known, the whole factory and all its existing prototypes of experimental work were completely destroyed in 1940, and with it the wheel on which so much painstaking testing had taken place. Drawing records in this case were also destroyed and the whole work had to be started again when the firm's commitments permitted.



Part-sectional view of the Triumph spring wheel hub, with one of the end plates detached.

It is not without amusement to reflect that at one time the spring wheel was the inventor's dream, and a visit to the Patent Office will show a large variety of schemes and inventions to make practicable a wheel, where the hubs could run eccentric to the rim, and whereas the pneumatic tyre made most of these inventions unnecessary, the peculiar requirements of the rear suspension of the single-track vehicle have brought forward the present spring wheel, which is not claimed to have any advantages over pneumatic tyre—actually the functions of each are entirely separate—but to be used supplementary to it. Many readers may ask why a similar device could not be used for the front wheel. The answer is that it could, but the limitations of the scheme prevent sufficient movement for it to be an effective substitute, whereas it is excellent on the rear. The characteristics of this wheel have been studied in relation to the Triumph telescopic forks and the combination gives splendid control at very high speeds and, incidentally, a most comfortable ride to the pillion passenger.

Maintenance

With regard to maintenance, there is very

little on the wheel, apart from an occasional ram with the grease gun that is only required over thousands of miles, and although the bearings were originally adjustable, they are now fitted at the works with the requisite clearance and have been found to wear for such a long period without adjustment that this has been scrapped in favour of shims which can be removed to take any slack that may occur over very long mileages.

With the help of the accompanying illustration, the comparative simplicity of the scheme will be apparent, although it entails a special technique in manufacture which has set many problems, now overcome. The body of the hub is in high duty alloy and provides for direct-pull spoking. In actual fact this has approximately the same diameter as the sprocket, and one has to look twice before one realises there is anything different from a normal back wheel.

Although in practice this wheel will fit all Triumph machines going back to 1938, it is unlikely that any will be available for old machines until the supply improves. The purpose of publishing a description of this hub is to keep riders in touch with the developments of this Company, but unfortunately, until the supply position does become more favourable, there is no guarantee that sufficient will be available to meet all orders for 1947 machines, on which it will be offered as an extra.

The Man-made Planet

A Description of a Space-ship to be Powered by Atomic Energy

AN atom-powered space-ship, capable of travelling to and from the moon, and described by its inventor, Mr. Warnett Kennedy, as a "man-made planet," was one of the features of the "Designs of the Future" section of the "Britain Can Make It" Exhibition.

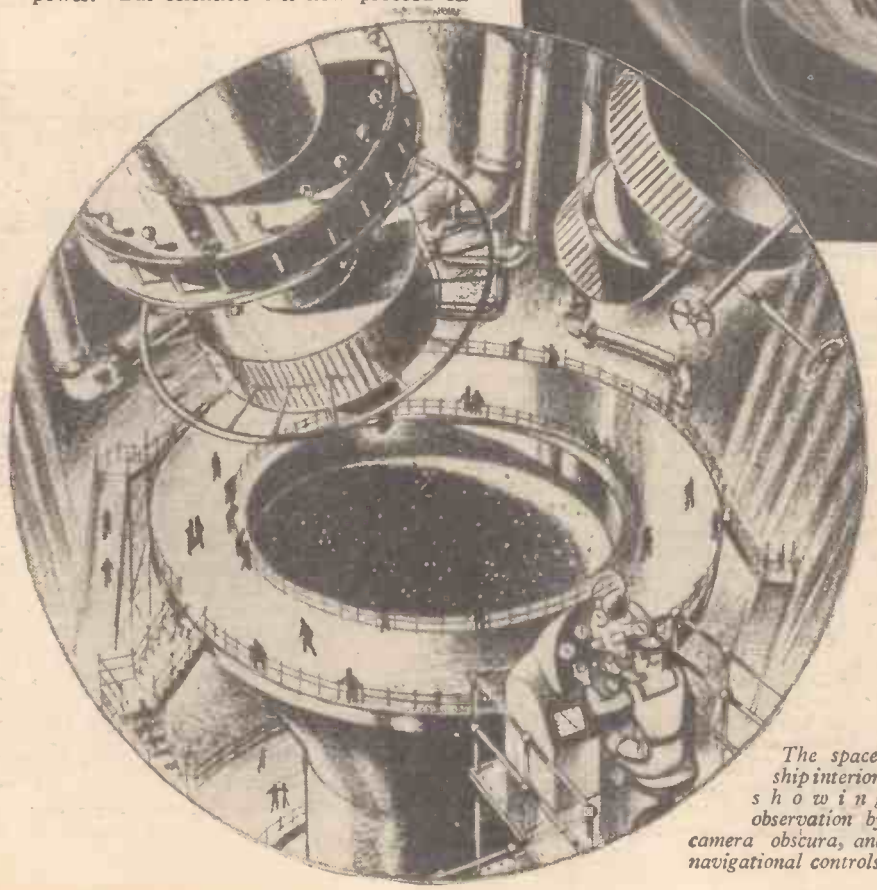
The exhibition demonstrated the remarkable developments now taking place in all branches of industrial design. The special section in which the "space-ship" was exhibited was planned to show, from the standpoint of existing knowledge, the lines of likely development during the next twenty years.

Incorporated in the setting of the "space-ship" exhibit was a photographic record of significant stages in rocket development from earliest conceptions to the first atom bomb.

Atomic Power

Atomic power demands a complete change of outlook on the construction of space-ships and the use of energy. In the past the problem has been to make the best use of limited power. But scientists can now proceed on the assumption that energy for space-flight is theoretically unlimited.

A model of the space-ship, showing the transparent outer shell.



The space-ship interior, showing observation by camera obscura, and navigational controls.

Until the later stages of the war public opinion was sceptical of plans for inter-planetary travel. A space-rocket was regarded as a glorified firework. Derision ceased, however, when the V2 rocket bomb turned the firework into a dangerous weapon; and rocket fuels themselves were outmoded as a source of power for space flight by the atom bombs at Hiroshima, Nagasaki and Bikini.

Problems of Design

Stimulated by the implications of atomic power, Mr. Warnett Kennedy realised that the idea of a streamlined space-ship was out of date. It became legitimate to assume that a space-ship need not begin its journey at volent speed. Air resistance at slow speed was negligible, and the depth of the earth's atmosphere was only a fraction of the distance to be covered in inter-planetary travel.

It became possible also to devise an alternative to existing designs; for a space-ship having a nose and tail would have to revolve

in space at a point where the gravitational pull of another planet began. Otherwise the ship would land on its tail or the passengers on their heads. There was the further objection that there is no atmospheric layer surrounding the moon on which a winged ship could be airborne.

Spherical Shape

Mr. Warnett Kennedy felt that the most sensible shape for a space-ship, not limited by considerations of streamlining, was the sphere. The earth, moon and other bodies are spherical. Why not a space-ship designed as a "man-made planet"?

The strongest shape provided by nature to withstand shock is an eggshell. From the point of view of a constructional engineer, therefore, he arrived at a spherical construction having high strength-weight ratio and a shape which could revolve in any direction, or, when equipped with atomic-powered motors, could move in any direction. From this and other considerations the space-ship became more than a fantasy of design.

"I do not claim that the space-ship is immediately practicable, but I do regard it as an intelligent anticipation of the trend of future design," Mr. Kennedy says.

Transparent Outer Shell

At the "Britain Can Make It" Exhibition Mr. Warnett Kennedy's model of the space-ship was seen hovering near the surface of the moon. It appeared as an intricate construction, with rocket tubes and telescopes, surrounded by an outer transparent sphere. This outer shell, which may represent a surface sensitive to cosmic forces, can be likened to the invisible layers surrounding our own planet, protecting us from the outer cosmic rays or reflecting radio rays.

The space-ship will have a central control chamber where observers during a journey will be able to study views of the earth, moon or planets by *camera obscura* methods.

In connection with the space-ship exhibit the following firms carried out special work on the model: "Triplex" Safety Glass Co., Ltd.; Dufay-Chromex, Ltd.; I.C.I. Ltd. (Plastics Division).

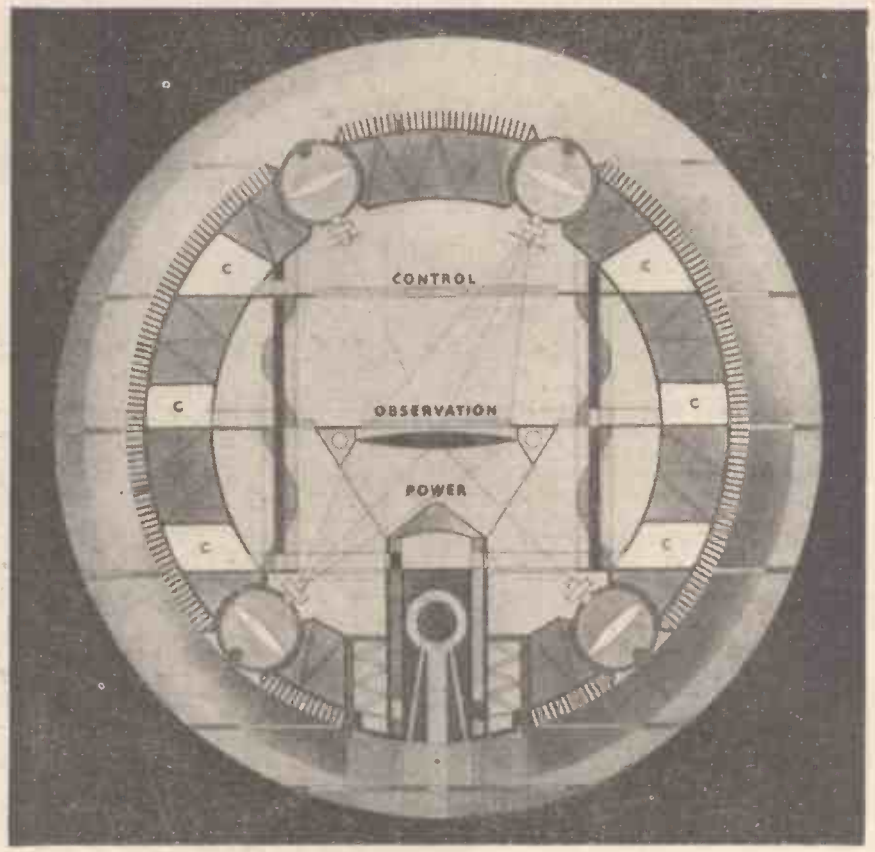


Diagram showing a geodetic braced shell construction containing all equipment and living compartments.

British Planes for America

ORDERS for 100 private aircraft have been received by Miles Aircraft, of Reading, Berkshire, for dispatch to the United States, South Africa, Australia and France. The machine, claimed to be the safest light aeroplane in the world, is the Gemini. Powered with two 100 h.p. Cirrus Minor engines, this low-wing cabined monoplane has seating accommodation for three passengers and the pilot. Wooden construction is used throughout the airframe. An advanced method of plastic bonding makes the aircraft impervious to moisture and suitable for operation in any part of the world. The photograph reproduced on the left was taken at the Miles Aircraft Factory at Reading, where these 'planes are now under construction.

(*Above*) *The completed Gemini aircraft on the airfield ready for delivery after coming off the assembly lines.*

(*Left*) *A general view of some of the Gemini planes on the production line at the Miles Aircraft factory.*

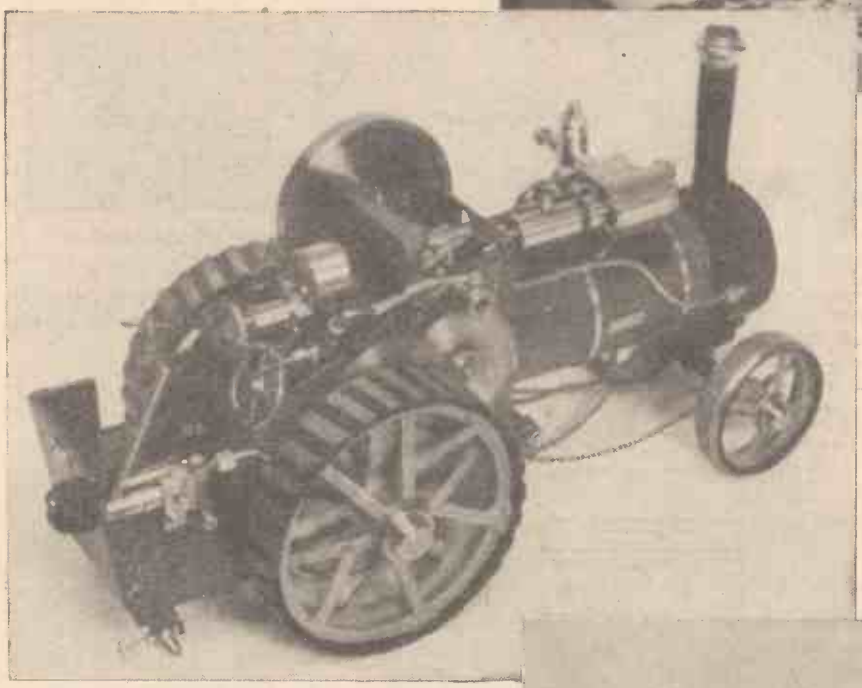
THE WORLD OF MODELS

This is the Eighth Anniversary of the Advent of our "Model Man" to "Practical Mechanics," His First Illustrated Article Appearing in January, 1939. Many Happy Returns, "Motilus"

A display of models used with a lecture given to a convention of school teachers at Leicester.

Lectures on Various Crafts

THE Education Authorities in various parts of this country are now arranging for lectures by well-known personalities connected with various crafts. These lectures show the application of such crafts as models to industry, history, the progress of transport by road, rail, sea and air, and our illustration shows a display of models used with one of these lectures, given to a convention of school teachers at Leicester, the speaker being Mr. W. J. Bassett-Lowke, M.I.Loco.E. His subject was the connection between education and the pursuit of a hobby, and he dealt with model work in all its phases, the progress of better design and more scale appearance in both models of railways and ships. He mentioned that this idea had not only grown up among amateur but also professional model makers, and the inspection of the models would influence boys in their appreciation of good and accurate design in everyday things.



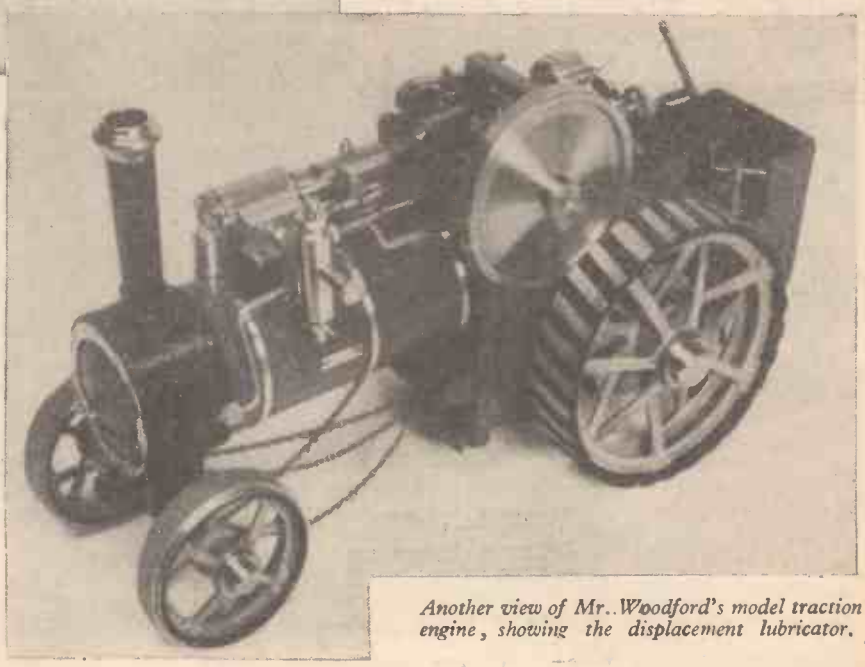
A three-quarter rear view of a ¾in. scale model traction engine made by Mr. H. Woodford, of Chatham.

Scale Model Traction Engine

The ¾-in. scale model traction engine and castings, featured in pre-war days in this magazine, the designs being by the editor, Mr. F. J. Camm, has been one of the most popular lines of this kind ever introduced by the Northampton firm of Bassett-Lowke, Ltd. Many have been successfully built and have taken prizes at exhibitions, and a silver plated model built from the standard castings by Mr. F. J. Camm himself was exhibited at the recent "Model Engineer" Exhibition held at the Horticultural Hall, Westminster, the first post-war appearance of this outstanding gathering of the model fraternity.

This traction engine bids fair to be as popular to-day as it was in the days before the war, and our illustrations show a model recently completed by Mr. H. Woodford, A.M.I.Mech.E., of Chatham, which was awarded third prize in the General Engines and Road Roller Section of an exhibition held at the end of September by the Medway Model and Experimental Engineering Society.

Although an engineer by profession, this is the first model Mr. Woodford has made —an excellent effort, particularly when it is known that he designed and constructed his own gear-cutting attachment, as it was



Another view of Mr. Woodford's model traction engine, showing the displacement lubricator.

not possible at the time to purchase finished gears.

As Mr. Camm himself writes, "I think this particular model has given me greater pleasure in the making than any other, chiefly because it calls for interesting work in several branches of model engineering, namely, marking out and drilling, fitting, boring, screw-cutting, silver soldering and boiler making, turning and assembling." The cylinder, eccentrics, crankshaft, pressure gauge and other small fittings, which it would scarcely pay the model maker to construct himself, are supplied in finished form, and it is good to know this model is on the market again.

Model Pumping Station

I have seen many models of all types, both professional and amateur, in many countries, but never before have I seen a model of a sewage pumping station. This model is the work of Mr. S. Charley, of Strood, Rochester, who is in the rather unique position of having built both the pumping station itself and the miniature.

In 1934, during a discussion with one of the Surveyor's assistants regarding pumps, quite casually Mr. Charley said he would make him a model pump to play with. The assistant replied he would wager 10 Player's cigarettes that he couldn't. The bet was clinched at 20 Player's for a model of the complete station!

This is Mr. Charley's story: "I bought a 2½in. model lathe, with foot motor and four-jaw chuck, and started making the model to 1/24 scale. Then I wondered if I could make an electric motor of that scale to be efficient, so I decided to scrap what I had made and start off again in 1/12 scale.

wheels from an old brass band, such as is fitted to a steam tractor engine around its boiler.

The other pumps and motors are made from wood true to scale and with the necessary detail. The switchgear is of wood except such detail as isolated switches, which are in metal.

The motor which first drove the pump was made up from an old burnt-out motor, which unfortunately got oiled up and burnt up again, so I managed to find a burnt-out 6v. windscreen motor and re-wound it, making the casing from a piece of water pipe.

I had a lot of trouble in getting the model to work automatically, owing to the small size of float (true to scale) and the friction of the pulley gear, etc., but eventually I succeeded by making a zinc float to which I soldered a piece of brass so as to be able to reduce the weight in relation to the counterweight, thereby working the mercury dashpot switch."

Here it might be advisable to add a few details of the real pumping station, which serves the low-level area of the south side of Rochester. The sewage flows into the station by gravitation into the circular tank, in the centre of which is built the pump chamber, of reinforced concrete. The top portion of the building, or the motor room, is built of engineering bricks.

When the sewage rises to a predetermined level, the pumps, consisting of three 6in. and one 8in. Blackstone unchokable pump, are put into operation by float-operated switchgear, thereby starting the induction motors through auto-transformed switch-boxes. The electric supply is 400v. 50 cycles.

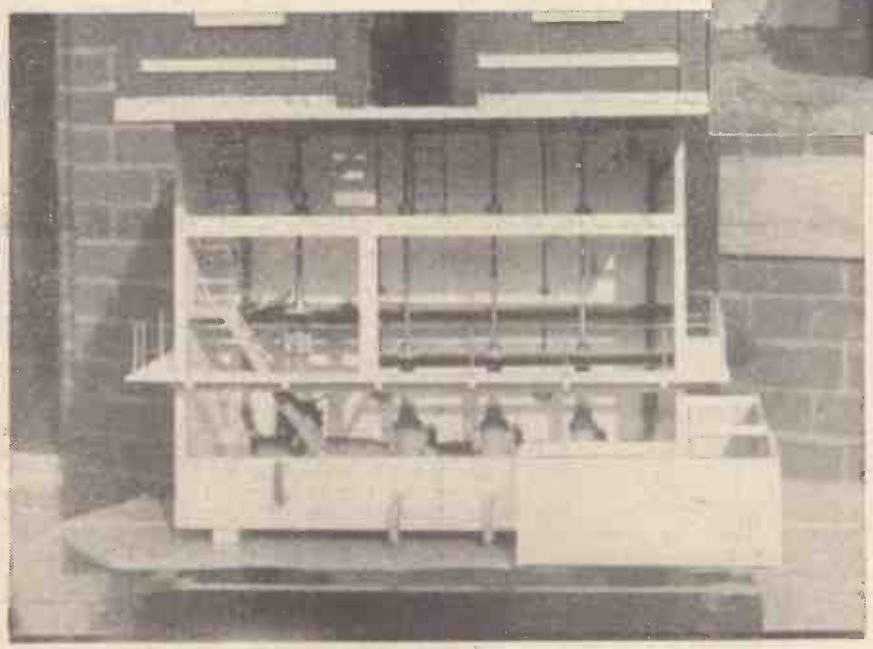
The flow of sewage into the station is recorded by a float-operated recorder and the flow output by a Venturi meter placed in the delivery pipe from the station. Each six-inch pump delivers 1,000 g. p. m. and each eight-inch pump 1,200 g. p. m.

Returning to Mr. Charley's working model, he says that the Venturi meter and level recorder are true to scale and with as much detail as possible, and the weekly charts are removable.

All handrail stanchions are turned from brass and the stairs made from pieces of tin sweated together. The building and tank are made from plywood and are painted as in the original. The brickwork was done by painting in red, the bricks being represented by scribed lines correct as to bonding.

The model, which is Mr. Charley's first ("and I have smoked the cigarettes," he adds!), measures in its case 5ft. 6in. by 4ft. 6in., and took four years to make at an average of four hours on four nights per week.

A model pumping station, made by Mr. S. Charley, of Strood.



Rear view of the model pumping station, showing the pumping gear.

The working pump is made from old scrap pieces of brass—the impeller, for instance, consisting of the boss, shroud and vanes, all being separate pieces 'sweated' together, and if I couldn't find a piece of brass large enough I had to compromise by sweating together a piece of round stock to a disc, such as the gland box and pump casings.

The channels were made from tin cans, etc., being formed over a piece of square metal, and the plummer block bearings were made from the solid. Thrust races were made from mild steel washers and casehardened.

Valves and pipe line were made from ½in. copper tube—the pipe flanges and valve

Post-war Model Supplies

I am afraid this festive season has not been a particularly happy one for those who were anticipating good supplies of models of all types, approaching pre-war conditions. Very few people realised the enormous stocks and varieties of model goods that were held by leading manufacturers and dealers in this country at the outbreak of war in 1939. Practically everything available was sold during the shortage of the war period, and it will take several years before the large range of goods of every description are back again.

A few of the leading manufacturers this Christmas have been able to produce a limited number of productions. Messrs. Bassett-Lowke, Ltd., have brought out again their set of Mogul parts, one of their most popular pre-war lines, also some finished steam locomotives in gauge "0," and various types of castings; also castings and parts and fittings for building the ½in. scale "Flying Scotsman," the Burrell Traction Engine, and generous supplies of track materials. Messrs. Trix, Ltd., despite their best efforts, were unable to produce any of their famous "00" gauge trains, except for export, but I understand there will be a steady flow as the New Year proceeds. Many other model shops in London and elsewhere have recently shown a decided improvement in the amount of goods available, especially those connected with model aircraft and petrol engines.

May this New Year bring us more settled conditions, greater production, and more consumer goods for people who wish to buy.

Glues, Cements, and Adhesives—1

Woodwork Glues and Gluing Processes

By "HANDYMAN"

GLUE has been used to our own knowledge for over 3,500 years. There are examples of Egyptian furniture showing that the ancient craftsmen employed an animal glue of the same general characteristics as the modern adhesive compound so largely used by all woodworkers and which we term glue.

Besides, the common carpenters' glue, which is an animal product, requires heating with water, and is a non-waterproof glue, there are many adhesives of a similar nature, some made from fish offal, others from starches and casein. Silicate of soda (water glass), in which we preserve eggs, is a form of glue used for paper objects. All of these products will be dealt with in the course of these notes.

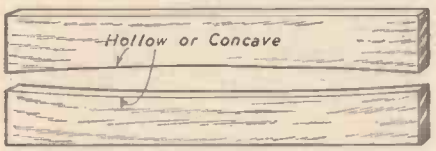


Fig. 1.—Best edge for joining up to make wide boards (exaggerated).

Carpenters' Glue

This animal glue is in its better qualities made from the hides and hoofs of beasts slain for food, cheaper grades being obtained from the bones. The stuff is akin to gelatine, but it is not strictly correct to say that the latter is simply a more refined and purer kind of glue, although the origin of the two substances is the same.

Carpenters' glue is always used in a heated condition, and it may be said that whenever this glue is heated while dissolved in water, a chemical action occurs. Therefore, if the heating be repeated, the strength quality of the product is adversely affected. The heating is not simply a process of making the glue soft; something else is happening. For woodwork a high grade glue is the most economical, but in making a choice it is not necessary to specify the pure "hide glue"; such glues are strong, but are a little like glass, and prone to break on impact. A weaker but more elastic quality is to be preferred.

Testing a Sample of Glue

A glue which smells badly should not be used. It is most probably partly decomposed through not being made from carefully cleansed raw materials. Further, this cleansing process in the manufacture of glue is important, as all grease should be removed. In Government tests of glue the surface of a dissolved sample is examined for the presence of grease. It is also notable that glues which are alkaline are more likely to decompose than samples which on a litmus paper test are shown to be slightly acid. This is due to bacterial activities. Therefore, a glue should not readily go mouldy in a damp atmosphere, as this indicates that it has been adulterated with sugar or molasses. Sour glues are also to be avoided, and while a high gloss on the surface is not an indication of the highest quality, a uniform colour and uniform surface are desirable factors.

In breaking a sample between the fingers and thumb, an even and easy fracture suggests a low strength and brittleness, but if the sheet bends considerably before breaking and does so with a splintery edge, then it is a glue to be chosen.

There are many tests and testing machines for glues and glued joints, but they are not altogether satisfactory, and if the reader adopts them it is wise to take the average of many trials rather than to rely on any single test.

If when a sample of melted glue is rapidly stirred a foam appears on its surface, then its quality is not good. This test may best be performed with an egg-whisk. Good glues should absorb six times their own weight of water and still remain in a jelly form.

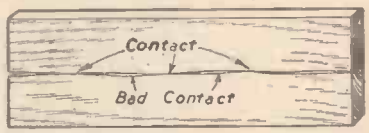


Fig. 2.—A wavy edge to be avoided (exaggerated).

Making the Glue

The old idea that glue to be any good must be "cooked" for one to three hours has been exploded by scientific researches into the nature of animal glues. The same applies to the long soaking of the cakes before placing in the heating pot, so often recommended. The glue should be broken up into small lumps and placed in not more than five times its own bulk of clean water, about three or four hours before it is necessary to use it.

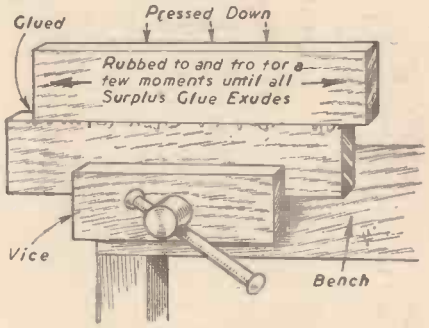


Fig. 3.—Rubbing the glued joints together.

Soaking Glue

The soaking of glue too much in advance of its use is liable to start putrefaction. Perfectly clean water—certainly not the water out of the iron receptacle which in the ordinary appliance surrounds the glue pot—is essential to success. Any water which contains iron or lime in excess seriously injures glues. It has been estimated by laboratory tests that impure water will reduce the value of a glue by one half.

Glue should always be heated in such a way that it never gets hotter than 150 deg. F.; therefore, to put the glue on a gas stove is to absolutely spoil it. The above temperature is below the boiling point of water, but for amateur purposes an earthenware jam jar containing the glue standing in an open saucepan of water will not rise much above the required temperature if the heating water is allowed to simmer quietly on a stove or fire.

Using Glue

The operation of "gluing up" should always be performed in a warm room. On several occasions I have experienced difficulties in applying glue to woodwork in my out-of-doors workshop in the depth of winter. In spite of warming up the job by dabbing it with hot water, I have finally had to take the work indoors into the warm kitchen to finish it off in a satisfactory manner. These difficulties are more acute where the job necessitates a certain time being spent on cramping up the joints in their proper positions after the hot glue is applied. If the surroundings are so cold that the glue goes into a jelly before the parts are joined up, then it is time to seek some other place to do the job.

For woods with an even grain the best finish preparatory to gluing up is that obtained by glasspaper following the use of the plane. In the case of materials like oak, chestnut and oregon pine, which have a natural structure of a mixed hardness, a grain with hard veins in a wood of softer character, it is best to leave the surface as it comes from the steel tool. The use of glasspaper is apt to leave the surface uneven. It removes the softer portion leaving the hard grain standing up, and a perfectly flat contact, which is an essential to a good glue joint, is not obtained.

Jointing Wood

As wide boards are difficult to obtain, and in any case are very expensive, woodworkers resort to the glue jointing up of narrower pieces of stuff. It is very important that such work should be well done, otherwise the opening of joints may spoil the appearance and usefulness of the finished article. If well done the glue joint of this kind is as strong as the natural wood.

Jointing Up to Make Wide Boards

In jointing a long board, the ideal edge is a slightly hollow one, as indicated in the sketch, Fig. 1. Cramps of the usual kind will then pull up the joint quite tightly.

Under no circumstances should the "shooting" of the edges of the boards be done so carelessly that a wavy line is produced as shown in an exaggerated manner in the sketch of the two adjacent pieces (Fig. 2). No amount of cramping will result in the desired perfect end-to-end contact.

The board, should not be dead cold, and with one in the vice, as indicated in Fig. 3, the glue should be applied thinly over the surfaces to be joined. The two parts should then be placed together and the upper one rubbed into the lower one, all surplus glue exuding in the process. All this must be done quickly, so that the job is got between the cramps before the glue gets into the semi-set or jelly state.

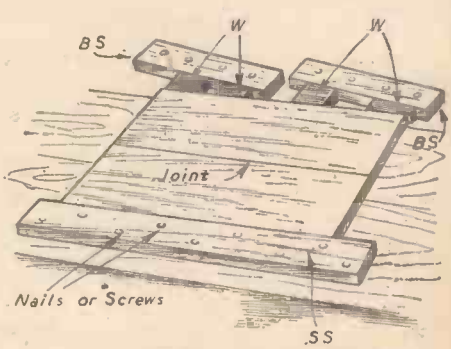


Fig. 4.—Bench wedge cramps.

A Substitute for Carpenters' Cramps

Where carpenters' cramps are not available and the job is too big to get between the jaws of the bench vice, a good idea is to make a series of wedges on the flat of the bench. One board is made to rest up against a stop strip (SS Fig. 4) nailed to the bench, and at the other side two or more backing strips (BS) (according to the length of the job) are nailed down at an angle with a gap intervening. Wedges (W) are then driven in, as shown in the sketch.

All this must be prepared before the glue is applied so that there is no loss of time between the application of the glue and the final fixing up in the cramping device.

The power of a wedge when hammered into place is enormous, and, therefore, the backing strips (BS) must be firmly nailed or screwed down to the bench. If there is any danger of the board cockling in the wedging process means must be employed to keep the job flat.

White Glue

In stopping up a bad place or knot-hole in a plank too small to be filled by a wooden plug, and which has to be finished off in a natural manner, carpenters often resort to a readily made mixture of sawdust, whitening and hot glue. There is no objection to this mixture, except that zinc oxide in moderation is a better "whitener," having no deleterious effect on the strength of the glue. For a really white glue, which may be necessary in some cases, use a mixture of roughly one of zinc oxide to four of melted glue. This can be kept in a separate pot and can be re-heated as occasion may require, always remembering that even ordinary glue cannot be re-heated indefinitely without suffering in its strength quality.

(To be continued.)

Letters from Readers

Back Issues: An Apology

SIR,—With reference to my offer of old copies of PRACTICAL MECHANICS published in the November issue, you will be interested to know that I have had over 90 requests.

I have given first priority to requests for individual copies (I know the disappointment of missing one article of a series). The remainder I have done up in parcels of 12 each and shared them among the first applicants.

I am replying individually to all readers enclosing a prepaid envelope, but should be grateful if you could spare a corner to insert this apology on my behalf for not replying to all the other applicants; the spirit is willing but the cash is short.—L. A. LEADBEATTER (London, S.W.).

Register of Model Engineering Societies

SIR,—During the Model Engineer Exhibition, many visitors called at the S.M.E.E. Stand and at other club stands to inquire for the address of their nearest club. In some cases, we were able to give this information; in other cases, we unfortunately had not the information available.

It was therefore suggested to me by Mr. Bontor, of the Malden Society, that it would be a desirable thing to compile a register of Model Engineering Societies. One of our members, Mr. L. J. Parish, of 27, Coleridge Walk, Hampstead Garden Suburb, N.W.11, has very generously undertaken to do the necessary clerical work in compiling such a register. The idea is that should the clubs support this scheme and send particulars to Mr. Parish, the register of clubs would be prepared, printed or duplicated, and copies sent to all the clubs concerned. It is felt that provided all clubs co-operate, the cost to each individual club would be trivial, and the value of the register would be very great.

I would, therefore, appeal for all clubs who wish to be included in this register to send Mr. Parish, at the above address, particulars of their club as follows:

Name of club and secretary's address.

Time and place of regular meetings.

Speciality of club, if any, e.g., locomotives, ships or general.

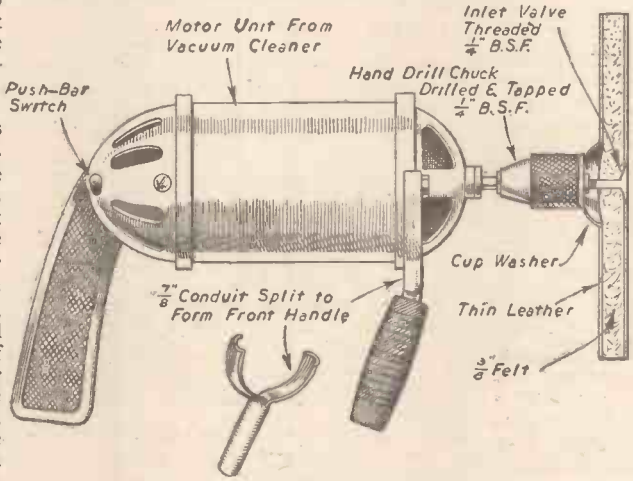
Situation of any special facility, e.g., workshop, sailing water, track.

I think it will be agreed that it is desirable to have standard particulars for each club in order to simplify Mr. Parish's work, and I feel that these particulars do give the information which a prospective member would wish to have of a club he was thinking of joining.—T. W. PINNOCK, chairman, Society of Model and Experimental Engineers (28, Bolton Street, Picadilly, London, W.1).

Rotary Sander

SIR, — Following the publication in PRACTICAL MECHANICS of designs for amateur made spray-gun equipment, it occurred to me that the preparation of the surface to be sprayed is equally important. This can best be carried out by the use of a sander, and as these are somewhat expensive, the details of the one I have constructed and have in constant use may be of help to other readers.

This is based upon the motor unit from an "Electrolux" type vacuum cleaner, which incorporates a pistol grip and switch, the forward handle being constructed from ⅞in.



A motor-driven rotary sander (S. Madders)

diameter electrical conduit sawn lengthwise and bent to the shape of a catapult, the split arm being drilled to go under the motor assembly bolts. A "Shockstop" cycle grip is fitted to the handle part, a drill chuck from a hand-drill is tightened on to the motor shaft, and the chuck spindle is drilled and tapped ¼in. B.S.F. to take the shank of an Austin Seven inlet valve shortened and threaded to suit. Upon this is assembled a countersunk washer as used for adjusting car headlamps; this is to enable the valve head to be pulled down flush with the face of the backing disc, which is 10in. diameter and ⅜in. thick, with packing felt faced with thin leather and stitched. The valve head will be found to be slotted to take a coin for tightening, and it is essential that the valve head be pulled down at least flush with the face of the sander disc, otherwise the work will be marked. Suitable discs may be obtained from motor and paint factors. It is important that three-core flex be used to connect up the tool, using one lead for earthing the tool.

The accompanying sketch will, I think, make the construction clear.—S. MADDERS (Blackpool).

Fuse Wires

SIR,—Further to your reply under Queries and Enquiries, to R. J. Barber, in the November issue of PRACTICAL MECHANICS, I would point out that for all normal types of cables the rating stated by the regulations for the electrical equipment of buildings issued by The Institute of Electrical Engineers (eleventh edition), together with 1946 alterations, is 5 amps. for both 1/.044 and 3/.029 cable. Therefore, for both sizes, the correct size of fuse should be 35 S.W.G. tinned copper fuse wire, or 21 S.W.G. standard alloy of 63 per cent. tin and 37 per cent. lead.

As you will agree, the overloading of cables is a very bad practice owing to the danger of overheating, and the subsequent liability of fire.—F. G. SOUTHWORTH (Holywell).

THE BRITISH INTERPLANETARY SOCIETY

THE lecture programme of the above society, for the session 1947, is as set out below. All meetings will be convened at 6.0 p.m. precisely, at St. Martin's Technical School, Charing Cross Road, London, W.C.2. Visitors are allowed at meetings of the society, but it is requested that they first write to the Secretary, 1, Albermarle Street, Piccadilly, London, W.1, to obtain permission if they are not introduced by a member of the society.

Saturday, January 4th, 1947

"The Energy and Stability of Atomic Nuclei," by L. R. Shepherd, B.Sc., a Fellow of the society. Mr. Shepherd took his B.Sc. at the University of London.

Saturday, February 1st, 1947

"Interplanetary Flight: Is the Rocket the Only Answer?" by A. V. Cleaver, a Fellow of the society. Mr. Clever was, till recently, the chief project engineer of de Havilland Co., Ltd. (Airscrews), and is now engaged on project work with the D.H. Engine Company.

Saturday, March 1st, 1947

"Recent Developments in Rocket Design," being a technical survey of the latest developments which can be published, the results of investigations of German war rockets and other modern work. Lecturer to be arranged later.

Saturday, April 12th, 1947 (at the Science Museum, South Kensington)

"Cosmic Rays," by Lionel Gilbert, A.R.C.S., B.Sc., a Fellow of the society. The lecture is an introduction to the study and peculiarities of cosmic rays, using equipment available for demonstration at the Science Museum.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on back 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.

Chromium Plating

WILL you please give me details of how bright, non-tarnishing plating is put on to the brass clock and watch gear wheels and plates? If this is done electrically, for your information I am on 230 volts A.C. and have a fairly well equipped workshop.—A. Mullineux (Onchan, I. of M.).

"BRIGHT, non-tarnishing plating" means nothing from a descriptive point of view. Platings of gold, rhodium, platinum, chromium are all bright and non-tarnishing.

Whilst, for some purposes, clock wheels and pinions are sometimes plated with palladium, we must assume that you refer to chromium plating.

Now, chromium plating is a difficult job, and you are not likely to be very successful at it if you are a beginner. The plating solution is made up on the following lines:

Chromic acid	..	250 grams.
Sulphuric acid	..	2.5 grams.
Water	..	1 litre (1,000 ccs.).

A high amperage direct current is needed, a current of the order of 100 amps per square foot of surface to be plated. Use a stainless sheet steel for the anode (positive electrode) and employ a glass tank for containing the solution. If stainless steel cannot be obtained, use a strip of lead. The temperature of the solution should be maintained between 40 deg. and 50 deg. C.

We would advise you to study a good introductory textbook on electroplating, such as Messrs. Field and Weill's "Electroplating" (Pitman, 15s. net), which you might possibly be able to obtain second-hand from Messrs. W. & G. Foyle, Ltd., Charing Cross Road, London, W.C. It is, however, almost hopeless to attempt chromium plating without having at least experience in some other branches of electrical deposition.

Waterproofing Processes

I HAVE recently purchased an ex-R.A.F. "buoyant" type flying-suit, which I use for motor-cycling, and I find that it is not waterproof. It takes some time for the material (of which I enclose a sample) to become saturated and as it has a non-detachable kapok lining, it takes a long time to dry out.

Could you please supply me with a formula to make a suitable waterproofing solution or inform me of a proprietary material to make it thoroughly waterproof?—R. L. Bell (Croydon).

IT is a most difficult job effectively to waterproof a made-up garment such as the one you refer to. Published books of formulas and recipes abound in formulas for the making of waterproofing agents, but they are mostly of little use when put to any severe practical test.

The specimen of fabric which you submitted is of a fairly fine double weave, and it would best be waterproofed by some process of rubberising or, alternatively, treated with a drying oil so as to produce a sort of "oil-skin" effect. Neither of these treatments can very well be carried out by you individually since they need special plant and cannot be imitated on the small scale.

It is possible, however, that you might be able to persuade a good firm of waterproofers to undertake the job for you.

Two such firms are: Messrs. J. Nandleburg and Co., Ltd., Pendleton, Salford, 6, Lancs; The Greengate and Irwell Rubber Co., Ltd., Greengate Works, Salford, 6, Lancs.

However, if you wish to attempt a waterproofing process yourself, three types of process are as under:

(1) Immerse the fabric for 10-15 minutes in the following solution:

Glue or gelatine	..	5 parts (by weight).
Water	..	95 parts (by weight).

Wring out the fabric, but do not rinse. Then let it dry in the air and without heat. After this, immerse the treated fabric in a solution made by mixing 1 part of commercial formalin solution and 4 or 5 parts of water. A five minutes' immersion in the diluted formalin solution will be sufficient, after which the fabric should again be allowed to air-dry without heat.

In this process, the glue or gelatine impregnates the fibres of the fabric and the formalin renders the absorbed glue or gelatine absolutely insoluble and therefore water resistant.

(2) Dissolve half a pound of beeswax in 1 gallon turpentine or a mixture of turps and white spirit. Rub this sparingly into the cloth, and, if possible iron it in with a warm (not hot) iron.

(3) Make up the following mixture:

Raw linseed oil	..	1 gallon.
Beeswax	..	13 oz.
White lead	..	1 lb.
Resin (pale)	..	12 oz.

Heat the above with continual stirring until the mixture almost boils. Then apply it (sparingly) *warm* to the upper side of the fabric, wetting the under side of the fabric with a wet sponge immediately before applying the hot mixture to the upper side.

There are no proprietary waterproofing solutions for textile use.

Windings for Small Motor

I HAVE recently obtained some laminations with a view to constructing a small motor for driving a sewing machine. Could you tell me from pattern enclosed:

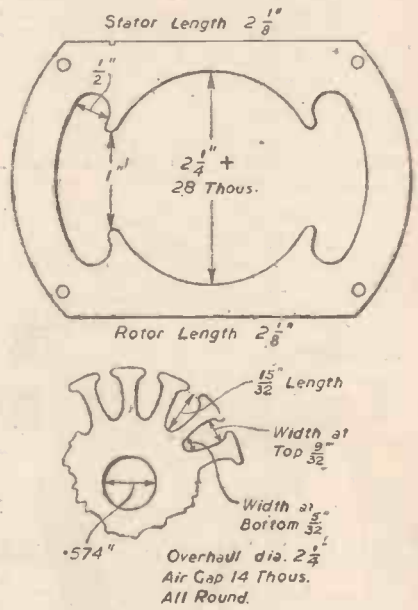
(a) Size of wire and number of turns to wind this with; also coil span to adopt?

(b) What will be maximum h.p. obtainable for this size of motor on a supply of 230 volts A.C.?

(c) Size of commutator?

(d) What size and type of wire should I use to make a variable resistance to control the speed of the motor from full speed to zero?—C. Pearson (Brodsworth).

WE consider the stampings should be suitable for the construction of a motor of about ¼ h.p. We suggest you wind each field coil with 190 turns of 25 s.w.g. S.S.C. enamelled, or good quality enamelled, wire, the two coils being connected in series with each other, so as to create poles of opposite magnetic polarity, and in series with the armature.



Field lamination, and details of armature for a small electric motor.—(C. Pearson.)

Assuming the armature has 15 slots and is to be used with a 30 segment commutator, this could have 15 coils, each with 100 turns of 30 s.w.g. S.S.C. enamelled wire, a loop being brought out from the centre of each coil for connecting to the commutator. A coil span from slots 1 to 8, etc., would be suitable.

With the armature placed so that slots 1 and 8 are equidistant from the centre of one pole-face, number the commutator segment which then lies under the nearest brush, number 2. All numbering is considered clockwise at the commutator end. For clockwise rotation at the commutator end connect the start of the coil in slots 1 and 8 to segment 3, the loop to 4, and finish of the coil to segment 5. Connect the start of the coil in slots 2 and 9 to segment 5, loop to 6, finish of the coil to segment 7, and so on. For counter-clockwise rotation subtract 4 from the numbers of the segments quoted above for the coil connections. The 30 segment commutator could be about 1¼in. diameter on the working face, this face being about ⅜in. long.

A resistance which would probably give you all the speed control required could be made from 20yd. of 32 s.w.g. Brightray resistance wire, as supplied by Messrs. Henry Wiggin & Co., Ltd., of Grosvenor House, Park Lane, W.1, although a longer resistance would be necessary to reduce to crawling speed on light load.

Removing Ink Stains on Wood

CAN you give me some help with the following difficulty? I have recently acquired an oak-topped table which has been so badly stained that I think the top surface must be planed over to remove most of them. There is one, however, of ink which may have sunk deeply into the wood. What do you advise me to do? Is there any bleaching agent which would remove the ink without damaging the wood too much?—R. F. Mellor (Oxford).

WE think that you will find the ink stain to be removed entirely by a simple planing of the wood of your table-top. Aqueous liquids do not penetrate wood to any great extent, so that a very little planing of the wood should remove the offending stain.

You do not tell us what type of ink stain is present on the wood. If the stain is of a carbon (Indian) ink, no amount of chemical treatment will remove it. Most modern writing inks, however, are very fugitive and inferior creations so far as actual fastness is concerned. You will therefore be able to remove the stain by rubbing a paste of chloride of lime and water over the stain and then acidifying the paste with a little dilute acetic acid. The same direction applies to the removal of stains caused by the older iron inks. For the latter, also, you may use a strong solution of oxalic acid (Schedule I poison) used hot. Modern ink stains will also be removed by "Milton" wiped over them, and then acidified with acetic or hydrochloric acid (dilute).

Blueing Solution for Gun Barrel

I HAVE an old shot-gun with a barrel of Damascus steel from which the protective "blueing" has worn off. Can you tell me how this can be restored without using proprietary preparations? I have access to a chemistry laboratory.—M. M. Legge (Omdurman, Sudan).

THE gun barrel must first of all be most thoroughly cleaned and degreased by washing with a hot soda solution. It is then rinsed, dried and polished with fine sandpaper and finally with rouge.

The following blueing solution is now made up:

Mercuric chloride	..	4 parts (by weight)
Potassium chlorate	..	3 parts (by weight)
Alcohol (rect. spirit)	..	8 parts (by weight)
Water	..	85 parts (by weight)

This solution must be made up and used in a non-metallic vessel.

Swab boiling water over the gun barrel until it attains the temperature of the water. Then dry the barrel quickly with a clean cloth and at once swab it over with the hot blueing solution.

The process can be repeated two or three times until the exact shade required is obtained. Polish the barrel lightly between the blueing coats in order to remove any imperfections.

After the final application and while the gun barrel is still hot, apply a thin coat of boiled linseed oil to the barrel with a cloth. The final blue-black finish thus obtained will vary somewhat with the type of steel used for the making of the barrel.

Remember, also, that the mercuric chloride used in the above formula is a powerful poison.

Treating Plaster Casts

I HAVE produced some plaster-cast figures, and require to finish them in a cream colour to give a wax-like effect. Can you inform me of a method of doing this?—A. J. France (Reading).

FIRST of all, obtain a quantity of ordinary cooking gelatine. (Ordinary glue will do also, but gelatine is cleaner and better to handle.) Dissolve 5 parts of gelatine (by weight) in 95 parts of water. This will form a clear solution which will set to a jelly when cold. If this gelatine solution is to be kept for any

length of time, you must add a few drops of carbolic acid to it to prevent it from becoming mouldy.

Warm the gelatine solution and then either immerse your plaster articles in the warm solution or brush the solution on to them. When the plaster has absorbed as much of the solution as possible, allow it to drain and wipe it over with a clean cloth. Then put it away to dry.

Obtain from your local druggist or pharmacist a small amount of commercial formalin solution. Mix 1 part of this solution with 4 parts of water and apply the resulting diluted formalin solution with a brush to the gelatine-treated plaster articles. Then allow the plaster articles to dry again.

By this treatment, gelatine will be absorbed by the pores of the plaster, thereby strengthening the latter, and the formalin treatment will render the gelatine quite insoluble in water, hardening it also. When the plaster articles have finally dried after the formalin treatment, you can apply any type of cream paint to them so as to give the precise effect which you desire. Alternatively, you could give your plaster articles a coating of a good wax polish, which would give them an "eggshell," semi-lustre finish.

Luminous Paint

WILL you please inform me if it is possible to make luminous paint at home, and, if so, what ingredients are necessary and in what proportion ?

Also, are there any other colours of luminous paint except green, and, if so, how are they obtained ?—P. Jordan (Portadown).

IF you can obtain the necessary luminous ingredient, it will be quite a simple matter for you to make up a quantity of luminous paint. The preparation of the luminous ingredient, however, is difficult, and applied on the home scale, it is very unreliable. However, the method is as follows :

Take 1 part of gypsum or plaster of Paris and mix it intimately with 4 parts of charcoal. Dissolve in a little water one or two crystals of zinc sulphate and add this to the mixture. Also add a pinch of manganese dioxide. The mixture is then placed in a tin and heated to bright redness in a hot fire. The heating is continued as long as (but not after) any charcoal remains. The creamy-coloured residue (impure calcium sulphide) is then exposed to bright light, and if the preparation has been successful (which is often *not* the case) it will luminesce, in which case it is ground up finely and incorporated into clear oil or cellulose varnish in order to make the luminous paint.

It is better to purchase luminous calcium sulphide from a firm of laboratory chemical suppliers, such as Messrs. Bair & Tatlock (London), Ltd., 14-17, St. Cross Street, London, E.C.1, or Messrs. A. Gallenkamp & Co., Ltd., Sun Street, Finsbury Square, London, E.C.2. This costs about 2s. 6d. per ounce and gives a greenish luminescence. Luminous zinc sulphide provides a bluer light. This costs about 12s. 6d. per ounce.

You should note that these luminous materials need periodic exposure to strong light for their reactivation. Only luminous substances containing radio-active materials, such as radium barium bromide, are permanently luminous and do not require periodical reactivation by exposure to strong light. Such permanently luminous materials are, however, exceedingly expensive.

Bleaching Wooden Furniture : Parchmentising Paper

CAN you advise me on how to bleach wooden furniture ? The simpler the method the better as it would have to be done at home.

Also, can you give me particulars of a method whereby good white cartridge paper may be treated to give a result like parchment ?—F. W. Wallace (Wickford).

FIRST remove all the paint, varnish, or lacquer from the woodwork, either by scraping, by washing down with caustic soda or soda ash solution or by making use of one of the commercial paint strippers. Give the surface of the wood a good washing down with soap and water, and then apply to it a paste made of water and chloride of lime. When this is semi-dry, brush onto the pasted surface a dilute solution of hydrochloric acid (spirit of salts)—say one part of the acid to four of water. Effervescence will occur and chlorine gas will be liberated. When the action stops, wait for five or ten minutes, and then wash away all the white residue.

The process can be repeated, if necessary. It is effective, but, of course, results in the roughening of the surface of the wood, so that glass-papering is afterwards required. The wetted wood should afterwards be allowed to dry out completely *without heat*, otherwise some degree of warping and/or twisting may occur.

To parchmentise white paper of the cartridge type, make up a bath consisting of pure sulphuric acid of exactly 77 per cent. strength. This strength of acid has a specific gravity of 1.7. Immerse the paper in the acid for exactly 10 seconds and at a temperature of not more than 17 deg. C. Well wash the paper afterwards and then allow it to dry without heat.

An alternative, and better, method is to use a solution containing equal parts of calcium chloride and calcium thiocyanate, the solution having a boiling-point of 155-157 deg. C. The parchmentising action of this solution is completed within about 30 seconds, but the paper may be left in the solution for a longer period without injury. Calcium thiocyanate (calcium sulphocyanide) used to be a commercial product, but we doubt whether its manufacture has yet recommenced. If you are interested in this question write to the Manchester Oxide Co., Ltd., Miles Platting, Manchester.

Electrified Fence

PLEASE advise me how to construct an electric fence energiser (either for battery or mains) which will be sufficiently powerful to contain horses, but be harmless to human beings.—E. M. R. Frazer (Burton-on-Trent).

WE suggest you feed the fence through a small induction coil, which may be constructed as follows : The core could be made of annealed soft iron wires of 20 s.w.g. 3in. long, the wires being bound with fine wire and soldered together at the ends. The primary winding may consist of four layers of 22 s.w.g. D.S.C. or D.C.C. wire ; and the secondary ¼lb. of 36 s.w.g. D.S.C. Each layer of the secondary should be basted with hot paraffin wax after winding on.

One end of the core should be squared off to operate the contact make and break to be connected in the primary circuit. This could consist of a piece of soft iron ⅜in. in diameter by ¼in. thick, mounted on a strip of German silver or brass about 3in. long by ⅜in. wide. The strip should have a tungsten contact to correspond with a fixed contact to be fitted in the end of an adjusting screw. One end of the secondary and of the primary should be connected to earth and the other end of the secondary connected to the fence. The primary should be fed from a 4 volt accumulator with the contact breaker adjusted to operate slowly.

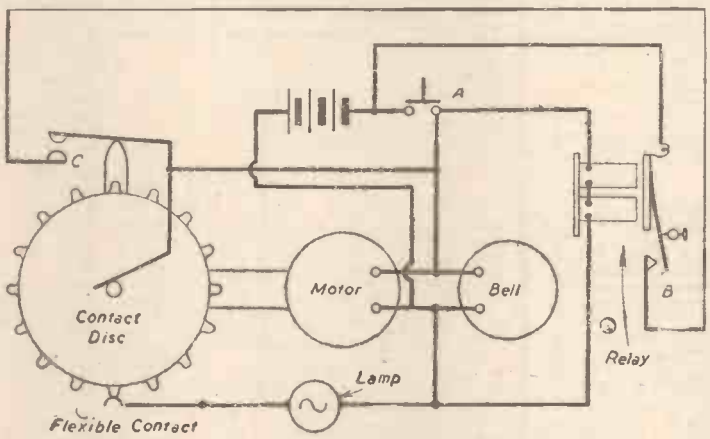
The earth wire should be not less than 0.0045 square inch in cross sectional area and connected to a rod, tube, strip, or plate, having a contact area of not less than 1½ sq. ft., which is buried to a mean depth of not less than 2ft. If the fence is installed in a position where members of the public may reasonably be expected to touch it, signs should be fitted on the posts at intervals of not exceeding 100 yards. These signs may be metal plates or wooden boards not less than 8in. by 4in., painted with the words "Electric Fence" in black letters not less than 1in. high on a red background.

Electric Flash Light

OWING to deafness I cannot hear the door-bell, or anyone knock, unless very loud.

Could you please tell me if it is possible to install some form of electric flash light that would flash for a few seconds after the door-bell was pressed ?—F. Newman (Leeds).

YOU could no doubt meet your requirements by using two electric-bell movements, and a control disc driven through speed reduction gearing by a small motor. The connections of one of the bell movements should be altered as shown in the diagram so that this will act as a relay ; the two bell movements and the small motor should be connected in parallel. The contact or control disc could have equidistant projections at the edges or could be fitted with screws, the heads of which project from the face of the disc at regular intervals. The lamp should be connected to a flexible contact which touches the projections or screw heads as they pass it. A pin or cam should be fitted at the back of the disc to control the contacts C.



Circuit diagram for a flash light for use with a door-bell.—(F. Newman.)

On pressing the bell push contacts A the motor is switched on and the bell rings. At the same time the relay coil is energised and closes the contacts B ; these contacts will maintain the bell, motor, and relay coil circuits closed after the push-button has been released, until the disc has completed one revolution and has then opened the contacts C to de-energise the whole circuit. The contacts C may need a little adjusting to get them correct ; the disc must move far enough to allow these contacts to close again during the period the push-button is pressed. In order to ensure this it may be an advantage to fit a small flywheel on the motor shaft so that after the motor has been switched off by the contacts B it runs on a little so that disc allows C to close again.

Re-silvering a Mirror : Luminous Paint

I SHOULD be glad if you would give me advice on the following subjects :

(1) Details of how to re-silver a mirror, with formula for the "silver," etc.

(2) A recipe for luminous paint. It is required for a dark cupboard to indicate the position of meters, etc.—T. N. Hillyard (Iver).

MIRROR-SILVERING is a difficult operation, and unless you have skill and experience in the matter we would advise you not to think lightly of it.

In the first place, the mirror must be made scrupulously clean. After the old silvering has been rubbed away the mirror must be rubbed with a solution of caustic soda. Then it is well rinsed in fresh water. It is then rubbed over with dilute nitric acid (one in four), again washed in water, which latter, this time, should be *distilled* water. Finally (and immediately before silvering) a 10 per cent. solution of tin chloride (stannous chloride) should be flowed over it. This solution is then drained from the mirror, and the silvering solution is poured evenly over it. Silvering takes place at once and is completed within three or four minutes. The mirror is then gently rinsed in distilled water and allowed to dry slowly.

Silvering solutions are of many types, each having some particular advantage. The following one is as good as any for average work :

Solution 1

Silver nitrate	1 part
Distilled water	10 parts

Solution 2

Caustic potash	1 part
Distilled water	10 parts

Solution 3

Glucose	½ part
Distilled water	10 parts

To prepare the active silvering solution (which must be made up immediately before use) take a sufficient quantity of solution 1 and add ammonia to it, drop by drop, with constant stirring until the precipitate which is first formed just (but only just) redissolves. An equal bulk of solution 2 is now added, and the precipitate which is formed is again dissolved in the same way with ammonia. To the mixed solution a very little solution 1 is added, just sufficient in amount (a few drops only) to produce a slight turbidity in the liquid. The solution is then mixed with an equal quantity of solution 3, stirred rapidly, and then poured over the prepared glass for silvering.

(2) The only luminous paint which will suit your needs (i.e., for use in permanent darkness) is one containing radium barium bromide. This can (or could) be obtained in small amounts from Messrs. Hopkin and Williams, Ltd., 16-17, St. Cross Street, London, E.C.1. Any other type of luminous paint which you may use would have to be periodically reactivated by exposure to bright light. Such paint may be made by grinding luminous zinc sulphide (obtainable from above address) into an oil or cellulose varnish (preferably the latter).

Making Coloured Chalks

I HAVE been experimenting with plaster of Paris and whiting trying to produce what are ordinarily known as white and coloured school chalks. I find, however, that plaster of Paris when mixed with water to the consistency of "dough" sets almost immediately, and does not allow enough time for the material to be shaped into "sticks."

Whiting, although taking longer to set, is too fragile and does not keep together when dry.

Can you please give me a formula that will enable me to produce satisfactory chalks (white and coloured) ?—J. Cassar (Sliema, Malta).

IF you add a very little alum or gelatine solution to your plaster-of-Paris mixture, it will very considerably delay the setting-time of the plaster, so that the latter will then be able to be manipulated as you desire.

Any of your mixtures will be suitable provided that you mix them with a little glue water, which will serve to bind them together.

A suitable mixture is the following :

Chalk or whiting	85 per cent.
Pigment	10 " "
Weak glue solution	5 " "

The pigment is mixed intimately with the white chalk. The weak glue solution is added and the whole mass is kneaded to a putty-like consistency. In commercial installations, the mass is often pressed hydraulically, but it can be moulded in smooth-walled steel moulds.

The necessary materials can be obtained from any chemical merchant, as, for example, Messrs. Baird & Tatlock (London), Ltd., 14-17, St. Cross Street, Hatton Garden, London, E.C.1, or Messrs. A. Gallenkamp & Co., Ltd., 17-29, Sun Street, Finsbury Square, London, E.C.2.

Moulds of various sizes can be obtained from :

Pneumatic Engineering Appliances Co., Ltd., 3, Central Buildings, Westminster, London, S.W.1.

Messrs. John Macdonald & Son, Ltd., Nitshill, nr. Glasgow.

Messrs. Fox & Offord, Ltd., 181-187, Alma Street, Birmingham.

It may, however, be possible for you to utilise locally-made wooden moulds.

THE Cyclist
Editor: F. J. CAMM

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Comments of the Month.

By F.J.C.

Memorandum on Obstruction

THE Roadfarers' Club has recently sent to the Ministry of Transport, the Home Office, and the Press, a copy of its Memorandum on Obstruction.

The congestion of the roads, which has steadily increased since the end of the war, presents serious problems to road users and to commerce, and the Roadfarers' Club in its memorandum analyses the causes and suggests remedies.

It points out that obstruction on the highway is not a new problem introduced by the motor car alone, for the Highway Act of 1835 made provision against obstruction. All road users are effected by traffic congestion, and although the memorandum chiefly deals with the matter from the point of view of the motorist, it is of importance to all road users.

Here are the main points of the memorandum:

1.—Everyone is agreed that in cities and busy towns there is severe congestion of the highways. Presumably, when the Road Fund was established in 1920, and the assurance was given by Lloyd George that this Fund was to be used for no other purpose than for the making of new roads, the repair of old ones, and for the creation of adequate parking places, it was realised that the rapid growth of the motor car industry would create a problem which it was the duty of the State to solve.

2.—Since that time the Road Fund has been used as a budget balancer, and finally the late Neville Chamberlain said "It is fantastic to suggest that the Road Fund should be used for the making of roads," and took the lot. Motorists are now being prosecuted for the so-called offence of causing obstruction.

3.—As the law is at present there is no defence against such a charge. If a motorist proves, for example, that his car has not caused obstruction to any other vehicle or vehicles, the police rely upon the old unreasonable phrase "Causing obstruction to vehicles on the roads, or which might reasonably have been expected to be there."

4.—Yet the police sought and obtained powers to remove from the highway any vehicle causing obstruction and we maintain that the onus is upon the police to prove obstruction and not merely to give evidence as to the time the car has been left unattended. We think there should be more warnings and less prosecutions.

5.—Dozens of cases are brought in the metropolis alone every year against motorists who have left their cars in culs-de-sac. In other cases, such as, for example, in the streets surrounding Covent Garden, where the gravest obstruction is caused by Covent Garden vehicles in those streets (long beyond the hours when they are entitled to be there), the police do not take action, but as soon as the street is clear prosecute a few private motorists.

Discrimination Necessary

6.—We suggest that discrimination should be made between those who are merely using their cars for pleasure purposes, public service vehicles, and those who are compelled to use their cars (and are granted petrol units for that purpose) in the execution of their duty. We think that payment of overtime pay to the police whilst they are in court is wrong in principle.

Street Parking Should be Permitted

7.—Motorists have contributed many millions of pounds to the State to have adequate parking places constructed, and until that is done we fail to see how the problem can be solved by prosecution, which at present is regarded by motorists as merely another form of taxation. They are fined for offences which they cannot help committing. We suggest then that until the various plans for reconstruction of the roads of London and/or cities are brought into being motorists should not be fined or prosecuted for obstruction except in cases where obstruction is proved. We also suggest that parking in certain streets should be permitted until such time as parking places are provided by the State, and we urge that the State must recognise that certain people have to use a car in connection with their work. The London Squares and Parks lend themselves to the parking of vehicles on the nose-in principle.

Lack of Garage Space

8.—Even though adequate garage space were available it is entirely unreasonable to expect motorists to be putting their cars into a garage and taking it out several times in the course of a day. It should be an adequate defence that the motorist concerned uses a car in connection with his business. It is well known that the garage accommodation of central London, largely owing to the attitude of the London County Council, is totally inadequate, and it is also well known that the authorities have signally failed to appreciate the rapid growth of the motoring industry and its use in connection with business. The motor car seems still to be regarded by the police and the Ministry of Transport as a pleasure vehicle. It is, in fact, no longer the privilege of the rich.

No Solution Offered by the Police

9.—Sir Alker Tripp has stated that motorists must understand that the parking freedom of the war years is at an end. But he does not offer any constructive solution except to threaten motorists with further prosecutions.

Causes of Obstruction

10.—It is interesting to trace some of the causes of obstruction, and if suitable remedies were applied it is our view that congestion in the streets of busy places would be considerably reduced even if it did not vanish altogether. In the first place there are far too many traffic lights which, being insensitive to the needs of the moment, needlessly hold up traffic at crossings when other traffic does not wish to proceed at right-angles to it. Many of these could usefully be abolished without introducing the need for police control. Some of these lights are so badly timed that they render ineffectual traffic lights hundreds of yards to the rear. Secondly, where the police do control traffic they will quite often hold up a file of fifty or sixty vehicles in order to allow one vehicle to cross.

It is also our view that horse-drawn traffic in the streets of London should be forbidden during certain hours. It is beyond all argument that one horse-drawn vehicle will cause terrific congestion in places like the Strand and Oxford Street, and build up queues of traffic which extend far beyond the limits of four or five traffic lights, thus rendering the latter useless in any case.

Unilateral Parking

11.—The unilateral parking of vehicles has been successfully adopted in the provinces, and we see no reason why it should not be adopted in certain streets in London. If a motorist cannot park his car and there is not convenient garage accommodation and he is compelled to use his car in connection with his work, how is he causing obstruction? The recent attitude of the authorities seems to suggest that he should give up his job. It is our earnest view that it is the duty of the authorities to provide adequate parking facilities.

Moreover, we maintain that when cases of obstruction are brought the police should give evidence that they have had the car under continuous observation for the whole of the time of the alleged offence.

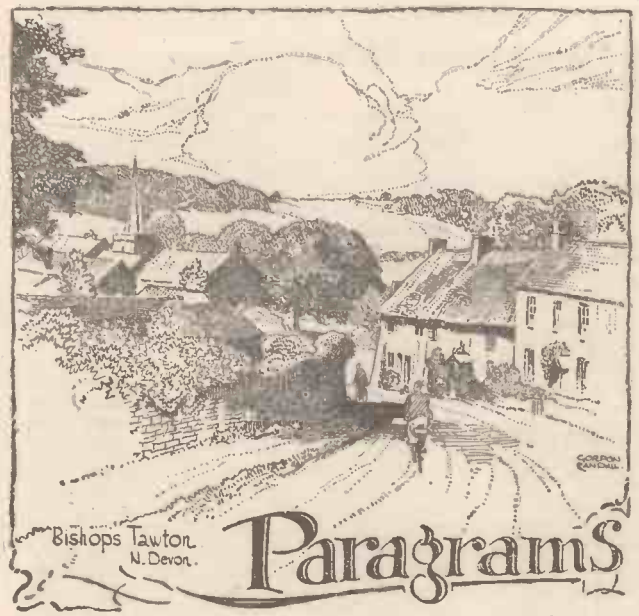
We do not accept the views of Sir Alker Tripp on this matter, for it is imposing unfair burdens on motorists merely to send out hordes of police to prosecute motorists instead of finding a solution.

Abolish Road Islands

12.—The abolition of all road islands, which merely bottle-neck the road and build up traffic into a series of clots instead of keeping it fluid and apart, would help to relieve the congestion which causes obstruction. It is noted that most of the measures for road safety have failed in their object, and as they are merely now obstructive devices which have reduced traffic in London to a farce they should be removed. The average speed through London is about 7 m.p.h.

Bus Stopping Places

13.—The fixing of the stopping-places of public service vehicles at traffic lights or at points where opposing lines of public service vehicles stop and completely obstruct the road is another cause of congestion which is in need of close investigation. It is not so much a maximum speed limit which is required in London and other cities, but a minimum.



Hush Money

AFTER receiving a summons for riding without a rear light, a Leverton (Lincs) cyclist wrote to North Holland magistrates, saying: "As this is my first offence, I am willing to pay an extra amount to keep my case free from the papers." His fine was the same as that imposed on other lightless cyclists and his offer of hush money was not accepted.

Protecting Child Cyclists

IN his report to the Isle of Ely County Road Safety Committee, the Chief Constable explained that special attention was being paid to the condition of the cycles ridden by local schoolchildren, but he was struck by the fact that between 80 and 90 per cent. of them were defective. Even when the poor condition of the cycles was brought to the attention of parents it was only in a very few cases that anything was done to remedy the defects. The Deputy Chief Constable suggested that a police officer in uniform calling upon parents might make them pay more attention.

Cycle Taxis

THE people of Milan are turning more and more to the cycle to replace the motor transport which is almost non-existent. Cycles are being adapted to take two small wheels in front, over which is built an enclosed cabin to carry one passenger in a fair amount of comfort. Another type has an open box container in front over two wheels in which goods can be carried, and also a passenger if it is a fine day. Also popular are various types of trailers which are used for goods deliveries, and for carrying every kind of article, from furniture to firewood.

Asking for Trouble

A CYCLIST riding along the North Road near Stamford, Lincs, was surprised to see two birds whizz past him, as if jet-propelled, and crash into the bonnet of an approaching car. The motorist stopped and picked up one badly injured bird and wrung its neck. Then he started to pick up the second bird and found himself viciously attacked by a hawk, which was not at all pleased at having been robbed of the partridge it was chasing.

Rising Cost of Living

THE cost of everything else has gone up, so Huntingdon magistrates have decided that all cyclists charged with riding without lights in future will be fined £2 at least. The magistrates have been imposing 10s. fines for some considerable time, but they feel that if the fines are larger there will be fewer offenders.

Excessive Fuel Consumption

IT was reported by the treasurer of the Fenland Road Racing Association, at the Association's meeting at Wisbech, Cambs, that the accounts showed a loss of £20, owing to heavy expenses incurred in the feeding of riders taking part in the open time trial. Apart from this, everything was satisfactory. Arrangements were made for the 1947 events, with the exception of the "Open 12."

Beware of Bargains

DURING the hearing of four charges of cycle stealing and four of receiving at Market Rasen, Lincs, the chairman of the Bench remarked that the cases ought to warn people not to buy a cycle or anything else from someone they did not know. "If an unknown person wants to sell you anything," he said, "make sure of his bona-fides. Make sure you know whom you are dealing with so that you can produce him if the need arises."

Behind the Times

AN M.P. has suggested to the Ministry of Transport that "cats-eye" reflectors should be fitted to bicycle pedals. Reflectors of this type were available in the shops before the war, but even if every cyclist used them the motorist, sitting behind his twin searchlights, would plaintively moan: "I didn't see the cyclist."

Still Waiting

"I'VE spent 20 years of my life waiting at this crossing," said a county councillor at the meeting of the Isle of Ely Highways Committee, when consideration was once again given to the bridging of the level crossing at March, at a cost of some £92,000. He added: "Here is a main road carrying heavy traffic and we have never done anything to it to improve facilities for crossing the railway." No definite decision has yet been arrived at, although it was stated that the road has never been altered for 50 years.

Willing to Help

SENTENCED to three months' imprisonment at Nottingham for the theft of a bicycle and other articles from his stepmother, a man asked the Bench: "Excuse me, but can't you make it six months?" The chairman politely agreed to the man's request.

Roller-skater v. Cyclist

MR. EDWARD FIRTH, former licensee of the Tudor Hotel, Tudor Road, Leicester, who has just died at the age of 60, was at one time a professional roller-skater, and in 1910 at Sheffield he was the first man on roller-skates to beat a cyclist in a race.

Sportsman's Death

MR. WILLIAM H. URTON, managing director of the Chesterfield firm of ironmongers, Messrs. William Urton, Ltd., who has died at the age of 75, was in his younger days a keen cyclist and a one-time president of the Chesterfield Cycling Club. For some time he served with a cyclists' company of the local Second Volunteer Battalion, which he joined in 1894. Mr. Urton was an all-round sportsman, being a fine shot and swimmer and a skilful angler.

A Good Fight

FOR many years the Marquess of Bristol regularly cycled from his West Suffolk seat at Ickworth to attend the County Council meetings at Bury St. Edmunds, refusing to use a car, but now, at 83, he has decided that his future trips will have to be made by car. He feels that cycling has become a little too strenuous.

Not so Blind

A MAN who appeared at Widnes (Lancs) Police Court was stated to be nearly blind, but his blindness had apparently not prevented him from stealing bicycles. He pleaded guilty to nine charges and was fined £5.

Up to the Parents

PARENTS in the Isle of Ely whose children are found by the police to be riding cycles that are defective in any way will receive a report setting out the defects and suggesting that they should be put right. There is no compulsion upon any parent, but if a child has an accident through a faulty cycle and the parent has previously been warned there is little doubt as to who is responsible.

Cyclists Won't Play

MEMBERS of Loughborough (Leics) Town Council have been complaining that local cyclists seem to be under the impression that the town's one-way streets are two-way streets where a cyclist is concerned. The police have been instructed to keep an eye open for any future offenders.

New Type Cycle

AN American manufacturer has produced a new pattern light-weight cycle weighing about 19 pounds, made from an aluminium alloy. The frame is of unconventional design and there are ball-bearing disc wheels measuring only 12 inches by 1.75 inches.

Reluctant Admiration

AT the inquest at Norwich on an 85-year-old cyclist, who was described as "rather headstrong about cycling" and was killed when he fell from his machine in front of a car, the coroner commented: "We can't help admiring these old men, but they ought not to do it." A son told the coroner that his father had been a keen cyclist all his life, having ridden ever since the days of the old "penny-farthings."

Cyclists and Pedestrians Only

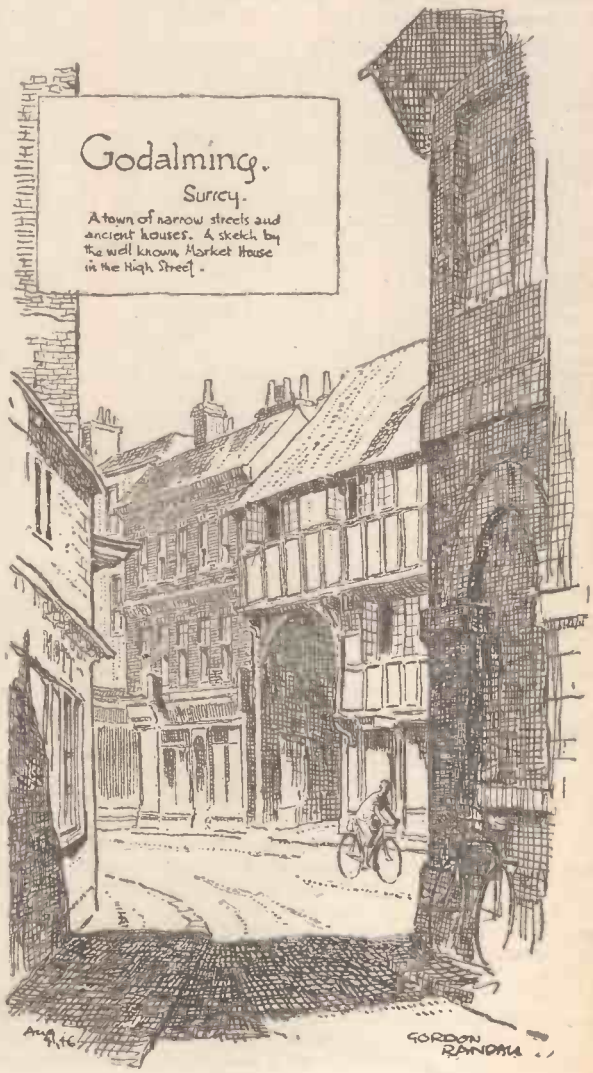
BEDFORD Town Council have decided to build a permanent bridge between Queen's Park, Bedford, and Kempston, for the use of cyclists and pedestrians only, instead of a Bailey bridge as previously suggested as an alternative scheme. The proposed new bridge will cost £4,800.

No Half Measures

DAVENTRY AND DISTRICT ROAD SAFETY COMMITTEE is planning an all-out effort to improve safety on the roads in its area. Some £1,300 a year may be spent on accident prevention and the education of children in road safety, and the chairman aims to have a road-safety programme with a set aim for each month of the year. He told the committee that too many local authorities have been satisfied with holding a road safety week once a year and then forgetting about the whole thing for the rest of the year. Practical demonstrations in road safety technique for child cyclists and pedestrians, rather than posters and talks, are also planned.

Courtesy Club for Grimsby

GRIMSBY ROAD SAFETY COMMITTEE have decided upon the formation of a branch of the Motorists' Courtesy Club in an endeavour to bring back to the town that road courtesy which seems to have disappeared altogether. They feel it is most essential that traffic conditions in the town should be improved without delay and that this improvement will depend upon the efforts of all road-users and not only motorists.



Around the Wheelworld

By ICARUS

The Champions' Concert

THE Champions' Concert at the Albert Hall on November 30th was, from an organisation point of view, a great success, in that the hall was packed with 7,000 cyclists and that 10,000 people were disappointed.

The chairman was A. E. Armstrong, chairman of the R.T.T.C., and the main event, of course, was the presentation of trophies and medallions to the winners of R.T.T.C. championships and the British best all-rounder competition of 1946.

Interspersed in the programme were a number of variety turns, including Percival Mackey and his Orchestra, the Gordon Ray Girls, Mackenzie Reid and Dorothy, Sandy Lane, Jass and Jessie, Arnold Greir at the Organ, the Ben Abderrahman Wassan Troupe, Tommy Fields, Tommy Jover, Raff and Fe, and the Melomaniacs. There was, of course, the usual roller racing contest. The prizes were presented by Miss Doris Miller, V.A.D.

The audience was an enthusiastic one, but the evening was marred by acts of hooliganism which we hope the promoters will take steps to avoid next year.

During one of the turns, a brilliantly performed one, coins were thrown on to the stage, and even the commentator was not given a fair hearing. There were cat-calls and rattles, whilst pieces of paper and improvised paper gliders were freely flitted about the audience and drifted on to the stage.

This is a very bad advertisement indeed for cycling, especially when it is the biggest event in the cycling calendar, and there are present representatives not only of the national Press but of every branch of the industry, the sport and the pastime.

It should have been possible out of a pool of 22,000 applicants to have exercised some selective discretion in the allocation of tickets, and for the promoters to have seen that there were an adequate number of stewards to eject those who were making a nuisance of themselves. We do not want kerbstone wheelers and guttersnipes to damage our movement.

The barracking and interruptions were an insult to all those who had worked so hard to provide a most pleasant evening for 7,000 cyclists.

B.L.R.C. London Section Annual Dinner

THE Annual Dinner of the London Section of the B.L.R.C. was held at Chez Auguste on November 22nd, and it took the form of a dinner, dance and cabaret. Over 200 members and guests sat down to an excellent meal, and my one criticism was that there were far too many speeches, and that each of them was too long.

Most of the speakers drifted from the theme of their toasts so that we found the toast of the visitors being used for propaganda for massed-start racing when it should have been apparent that everyone was aware of the facts. However, it was very evident from the enthusiastic audience that there was no possibility, as was fondly hoped by rival bodies, of the movement dying.

Mr. F. J. Camm, in proposing the toast of the section, paid tribute to all of the officials, particularly E. Lawton, the General Secretary. Previous speakers had criticised the N.C.U., and he said, "De mortuis nil nisi bonum"—speak no ill of the dud! He advised the N.C.U. to go into voluntary liquidation to reconstruct. The membership of the section had grown in the short space of four years from 70 to 300, and this was typical of the growth of the movement throughout the country.

League events had brought more beneficial publicity to cycling in the national Press than it had had in its whole history.

Guests included Mr. H. H. England, Rex Coley, E. Coles-Webb, whilst Jimmy Kain earned a just tribute for his zeal and energy. Many others prominently associated with the cycling movement, must have gone away impressed with the strength of the League.

The work of the section has been greatly extended during 1946. The Irish meeting was especially successful. A. H. Clark has done a vast amount of work as Hon. Events Organiser.

The chairman, D. Carey, presided.

The Charlotteville Annual Dinner

THE president of the Charlotteville Cycling Club, A. V. Jenner, presided at the annual dinner of the Club at the Lion Hotel, Guildford. The chief guest was the Mayor of Guildford. As usual the evening was a great success, with inter-entertainment provided by Lisle Hambourger, Tom Morgan and Dorothy Southon.

The Mayor of Guildford, in responding to the toast of the guests, dealt with the origin of Charlotteville. He had traced it back to Charlotte, wife of Dr. Fell, who at one time resided in Guildford during the period when streets were named after persons.

The history of the Charlotteville is too well known to need repetition here. It was founded 50 years ago and was responsible for the organisation of the first massed-start race.

During the past year no less than 40 new members had joined the club, which now ranks among the leading and most progressive clubs of the country.

The toast of the club was proposed by W. H. Townsend, with responses by H. K. Evans, C. V. Pilbeam, and A. Gettings. The Service and ex-Servicemen were toasted by the chairman, with responses by R. G. Best and R. Puttock, whilst the club president was proposed by H. H. England. Over 120 members and guests sat down to an excellent meal.

Tributes were paid by all to Vic Jenner.

Is the N.C.U. Redundant?

I HAVE received the following letter from D. V. Singleton, of Northolt:

"Having just read your article in the December issue of THE CYCLIST, by R. L. Jefferson, 'Is the N.C.U. Redundant?' I should like to compliment the writer on his outspoken criticism of the N.C.U.

"I am a member of the N.C.U. myself, rejoining through a local club, without due consideration of the pros and cons, after my return from the Forces. Since then I have read criticisms of all kinds through the medium of the cycling press.

"The club I belong to is definitely N.C.U. in its policy, and when once or twice I have broached the subject of the B.L.R.C. I was immediately howled down. I have thought several times of resigning and joining a club affiliated to the B.L.R.C., but, of course, I have made a good many friends in the club, and am very interested in its activities, which makes me loath to leave it. I consider that I'm not the only one who is in the same boat, and consequently hang on to the N.C.U. and its antiquated policies."

Three Boys Cycle Through a Film

A FULL length film, dealing with the adventures of three boy cyclists in the English countryside, has just been completed, and is shortly to be released throughout Britain.

The film is entitled *Nothing Venture*, and tells the story of three 16-year-old town boys from Hull, Newcastle and Bradford, who cycle through Surrey and Sussex into Hampshire to meet the *Queen Mary* at Southampton docks.

The film has been produced by John Baxter, who made *Love on the Dole* and *The Common Touch*, and has now started work on a new comedy film starring Frank Randle.

During the summer Mr. Baxter filmed sequences in Sussex and Surrey, showing the three boys cycling down to the coast. Nearly all of the film is out-of-doors, and besides providing grand entertainment, the picture brings a healthy, open-air feeling to the town audiences, especially to youth.

Motorists and Blind Pedestrians

A LARGE number of motorists and cyclists appear to be unaware of the fact that, with few exceptions, the carrying of a white stick by a pedestrian denotes that the user is blind.

Although these sticks are easily recognisable, they obviously cannot be of any real value unless all are aware of their significance, and the R.A.C. appeals to motorists, cyclists and, indeed, all classes of road users, to look out for the white sticks, particularly in the urban areas, and to extend every possible courtesy and consideration to those who carry them, particularly at pedestrian crossings.

Manifesto

THE following manifesto is issued to British road men by the B.L.R.C.:

(1) Arrange a meeting between the two English Road Racing bodies, having mutual international interests:

(A) Road Time Trials Association.

(B) British League of Racing Cyclists.

(2) Such meeting to explore every possible method whereby the Road Sport of England could be controlled by a joint organisation formed of R.T.T.C. and B.L.R.C. members.

(3) This joint organisation shall apply to the U.C.I. for separate recognition as the ruling organisation for Road Sport in England.

(4) That the R.T.T.C. and B.L.R.C. share U.C.I. representation equally on behalf of English Road Sport.

(5) That the N.C.U. be recognised as the controlling body for Path Racing according to its own constitution, and have U.C.I. representation as such.

(6) That England concentrate on its own problems, and that the formation of separate National Organisations in Scotland, Ireland, and Wales, be encouraged.

(7) That the meeting proposed in (1) be held at the earliest possible opportunity in order that application for International Status and Representation, on behalf of British Road Men be lodged with the U.C.I. in time to be dealt with at the next U.C.I. Congress, to be held in Luxemburg next February.

Wayside Thoughts

By F. J. URRY

Falkland Palace, Fifeshire.
The home of James VI, and visited many times by Mary, Queen of Scots.

Old Ideas Crop Up

A SHORT time ago the daily Press published an illustration of a bicycle giving front wheel traction provided by a rocking handlebar working a dual chain to the front wheel hub. It is said to be the invention of a Signor Colletti, of Milan, but the gentleman is a long way behind the times, for the Bricknell Hand Gear was in being in this country nearly half a century ago, had its little day of novelty, and died because it never was, and never can be, a useful aid to cycling. Harry Green (probably the greatest road rider of all time) created at least one record with the aid—or perhaps it would be more true to say with the handicap—of the Bricknell Gear; but the device never became even mildly popular for the simple and sufficient reason it was not helpful to progress on a bicycle. Nor can such a device ever be to the average individual. Hand gears serve an excellent purpose for use on invalid tricycles, but they will never be the slightest value as an accessory to speed or ease of cycling as we know it. It is rather curious to observe how frequently exploded ideas of an earlier time recur in the minds of the new generation, and I am told by our manufacturers that literally hundreds of notions are submitted to them embodying mechanical principles that have been tried and discarded years ago. It is, indeed, rather astonishing that the early designers of the bicycle came so very near to perfection in general principles so soon, for the outline of the modern product has scarcely altered during the last half century, and improvements have been only effected in details, the major among them being the many varieties of change speed gears. That does not mean to suggest the bicycle has been neglected; far from it, for bearings and tyres, saddles and brakes, the comfort of sponge rubber grips and resilient front forks, have made their marks on the yard stick towards perfection, while equipment in lamps and luggage receptacles, in camping outfits, tools and the small but necessary incidentals have created a minor revolution. But the general outline of the bicycle has remained and, in my opinion, will remain; will, indeed, return to the more comfortable frame angles 68 degs. to 71 degs. rather than the steep steering 74 degs. to 75 degs. now favoured by the racing lads. It is to the small things we must look for improvements, and to the big development in the use of stainless steel, which, in my opinion, is bound to mark the advance of the high-class bicycle. But to expect traction help from the arms, except as a fulcrum aid to the legs, is as much nonsense as it is unnatural. Some years before the war the reclining bicycle was in the news. It was going to revolutionise cycling because some expert had ridden a kilometre at fantastic speed; but as it placed the rider in an unnatural position it never had a chance to develop, not even as a racing machine.

Sound Sense

WRITING to the technical Press, I see a touring cyclist has recently suggested we should plan our journeys and then deliberately halve our daily mileage. He argues that we are in too much of a hurry, and that if the idea of cycle touring is to improve acquaintance with the countryside and the country people, to see and cherish loveliness and obtain the human atmosphere of the land you are roaming, then I think he is right. For a long while the emphasis has been on "how many miles a day you can ride in comfort," rather than how much can you see and enjoy by leaving the furlongs to take care of themselves. Most of us are apt to be critical of the motorist who eats up the miles and imagines he knows a countryside because he has passed through it, but I'm afraid, in our lesser degree of speed, we are very prone to slip into the same error. I know from my own youthful experience how difficult it is to travel on a bearing rein, as it were, when young activity is loosed on a holiday. The idea is to get in all we can during our limited leisure, and if we miss some of the beauty, history and romance of journeying—well, we can repair the omissions another time. I have fallen for that method on many occasions, and on some have made my pilgrimages a hurried and palpitating journey, achieving little beyond the leagues, and some of them not quite so happily attained as the service of a little more time may have given. After all, cycling for the majority of us is just a means to an end, to see our beloved country and take a proper pride in its history and loveliness. The journeying itself partly fulfils these desires if you go comfortably enough to see and observe, and are ever ready to drop a foot, or take a short detour to investigate. That, I take it, is what my mentor means when he says, "plan your daily journey and then halve the mileage or double the time." It is sound sense for a tourist to accept: indeed, it is more than that, for it implies the real touring spirit that "to travel is better than to arrive." For myself it leaves a feeling that right now I should love to put it into practice, and with one good friend go investigating nooks and corners during a season of the year when few other people are out and about. I have always wanted to see many of the places I know in the spring and summer glory under the impact of winter, but never yet have I had the pluck or temerity or speculative spirit to risk pledging a summer holiday for a winter one. There is, of course, the long nights to consider, but eight hours of daylight are enough to make many excursions, and there are always books to read and on moonlit nights the lonely loveliness of a thousand places I know within a few miles of the warm comfort of the inn. Some day I will cling close to the Gulf Stream and see the western coast of Scotland in its winter setting, and then the day's mileage will be short indeed but full of joy and interest, and perhaps the rumbling of storm.

Joy in Utility

IT is a very pleasant thing to ride to work in the morning—even if the day be a poor sample of winter—with the feeling that you can keep on doing this for ever, for it goes to show how excellent regular cycling is for an elderly man. Of course, I know well enough that can't occur, and a time will probably come when weight of years will put me on the shelf, unless someone bumps me off in the fullness of my activity. Yet after 57 winters of fairly constant riding I find the process as fresh and gay as ever, and would not change my method of locomotion for anything or any other form of transport, for I believe, rightly or wrongly, that I owe my health and happiness more to cycling than any other action of life. I've said that before on numerous occasions, and in repeating it now I want to emphasise the fact that neither traffic nor poorly-surfaced roads, nor the knowledge that my average travel speed is slowly dropping, makes my daily journeys less interesting, and certainly not more dangerous. That latter is the point so often made by the uninitiated, the sense of danger. Well, I just haven't got it, mainly for the reason, I expect, that I've grown up with the conditions and slipped into the stream of them subconsciously. The immunity I enjoy from accidents and the fear of accidents is due, I think, to circumspect travel. I'm seldom in a rush to get there, for at best the saving can only be a few minutes on a seven miles journey, and it is far better to take those minutes from the leisure times of morning and evening than endeavour to conserve them on the road. And anyone with a reasonable sense of road conduct and a knowledge of cycling limitations is a pretty safe unit in the traffic stream, not only from the point of mobility, but because of the gathered experience of what the other fellow is likely to do in a given set of circumstances. In practice it is remarkable how frequently this "traffic instinct" turns out right and avoids the perilous position. A M.O.T. official recently said that carelessness is the overriding fault of the average road user, no matter what his vehicle, from shoes to a Rolls, and I'm quite certain he is right. Years, of course, make a difference, for they impose circumspection on the performer, and perhaps a much more charitable outlook; and those facts in themselves are jolly good reasons why the regular daily cyclist should think twice before he gives up his utility journeys.

We're Getting On

WE are going to get good tyres again in the near future. No more synthetic rubber, which, for all the good service it rendered to us during the war years, never failed to remind me of linoleum whenever I handled a "war grade." It is high time, too, as far as I am concerned, for I'm down to my last "Sprite" spare, and on two of my machines tandems of that tyre ilk are servicing the rear wheels. So my little stock of "Sprites" bought in the summer of 1940 are just seeing me through. The last of them are wearing out rather quickly, developing little faults in the allied cotton and rubber; not surprising when it is remembered they have been in stock for six years. Tyres do not improve with keeping once they have matured, and I have been agreeably satisfied that these dainty covers have given me such excellent service through the troubled times since 1940. Soon we shall have "Sprites" again, that excellently named product of Dunlop which certainly gives a good bicycle an elf-like loveliness; and when they are purchasable I shall be compelled to have a wholesale re-tyre, even if I have to draw on my "post-war credit."

Stratford-on-Avon, Warwickshire.
Harvard House built in 1596 (right) and the old Garrick Inn, fine examples of half timber work.

CYCLORAMA

By H. W. ELEY

The SOUTH DOWNS from the slopes of Saddlescombe. Looking over the pretty village of Poynings to Chanctonbury Ring in the far distance

GORDON RANDALL

The Cycle and the Railways

ACCORDING to the National Committee on Cycling (a body which does a deal of most useful work in the interests of the cycling movement) there is only one of the big London railway termini (Charing Cross) which has adequate storage room for bicycles! But following discussions between representatives of the railway companies and the committee, better things are promised in the future, and it is good news that the Great Western company has already undertaken to provide 793 more cycle stands at its stations. In view of the fact that all connected with the cycling movement expect that 1947 will see a very big growth in touring, which will, of course, mean that larger numbers of cycles will be carried to "vantage points" by train, this attention to the storage problem is acceptable . . . and it is of real importance, of course, to the men and women who cycle to stations and wish to leave their bikes there until the return journey home in the evening.

The Export Target for Bicycles

AS is well known, many industries, particularly in the engineering and allied trades, were set an "export target"—many of the industries concerned being asked to make an effort to improve exports by at least 75 per cent. over pre-war. The cycle industry has passed the target, and is now playing a vital part in the country's export trade. Of course, as in other industries, the home market must suffer to an extent, but I think that by now everyone realises that export trade is vital to our national recovery . . . and in any case the cycle industry has not neglected the home market, as a glance in the average cycle dealer's shop will prove; and, what is *really* important, the industry has seen to it that quality has not been lowered . . . the British bike is still the world's best!

"Seed-time and Harvest"

REMEMBER the dire prophecies about famine and starvation at the time of the harvest? Violent storms had flattened the corn in East Anglian fields; farmers everywhere were faced with certain ruin; and the relentless rain fell on every field of wheat and oats and barley. Well, I was ever an optimist so far as harvests are concerned, and I somehow felt, even when the newspaper headlines were at their gloomiest, that it couldn't be as bad as all that! And recently I have cycled in that very East Anglia which was so hard hit by the weather . . . and Suffolk farmers have smiled at me over tankards of ale in village inns, and admitted that they "got through," and that in some districts the harvest was remarkably good.

Festive Windows

ALL through the war years I used to sigh for the "Christmassy" spirit in our streets and towns and shop windows. I think that everyone missed it. Now, as December arrives, many shops have managed to deck their windows and introduce a little of the Yuletide atmosphere. This week I noticed two cycle shops which had "gone gay"—imitation holly, colourful streamers, and a Christmas message. It is all to the good . . . and from a retail trading point of view we should never forget that Christmas has great significance. In normal times, when goods were in free supply, it was the spending season *par excellence*!

Back at "The Towers"

THE Cycle Union, over which Major H. R. Watling presides with dignity and efficiency, is back in its old quarters at "The Towers," in Coventry. The premises were damaged during the Coventry blitz, and the union removed to temporary premises in Kenilworth. I feel sure that "the Major" is glad to be back in his old home . . . where such admirable work has been done in the interests of the cycle industry, and, one may be sure, that good work will continue!

Essence of Essex

NOT many tourists would regard Essex, I fancy, as a "star" county from the scenic point of view. Indeed, I have heard it derided as a touring ground . . . but I have generally found that its detractors have been quite ignorant of its many fine features and the beauty of its interior. It is too often judged by its "London fringe"; but Ilford and the suburbs are not Essex! Ride, as I have done, into the interior and saunter around villages like Tolleshunt D'Arcy, and linger in the "Rodings," and you will find that Essex has great charm. It possesses some of the best agricultural land in all England, and some of its villages are as unspoiled and old-fashioned as any you will find anywhere; oil-lamps are the only illumination in some of its cottages, and the ways of the people are the ways of yesteryear. One day when the winter sun shines (and it does quite often!) put your bike on the train at Liverpool Street and journey, say, to Chelmsford—and from there cycle around unknown Essex; talk with men from farm and field; sip ale in village taverns; look at some of the old churches of the county—and you will come back to town feeling that you have made some good discoveries and found a new and delightful touring area.

Breaking Down the Barriers

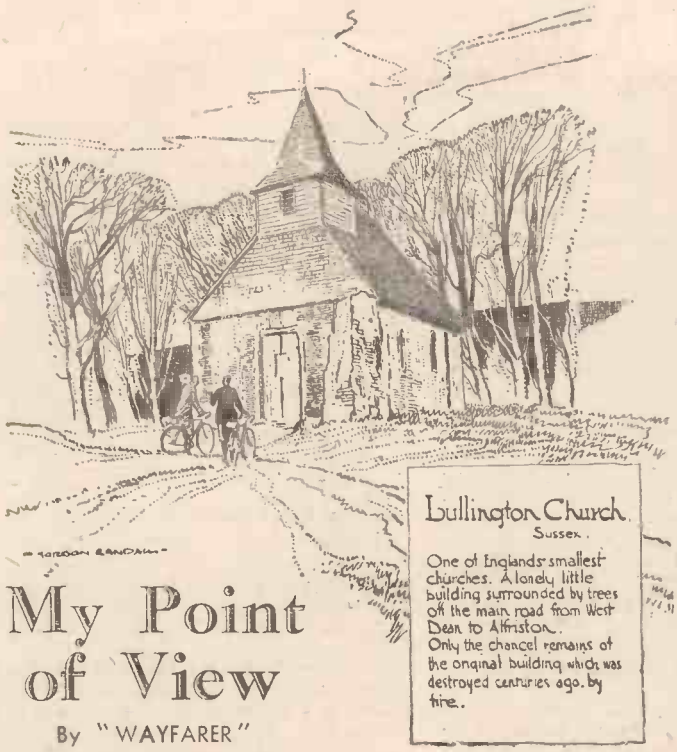
THAT, I think, might well be regarded as one of the jobs of that active and useful organisation, the "Roadfarers' Club," of which Lord Brabazon is the energetic president. I am proud to be a council member of the club, and I always feel, when at its meetings, that it is performing a vital function in breaking down the barriers which exist between the various classes of road users. It is so silly to imagine that the community can be split up into "cyclists" and "motorists" and "pedestrians." At different times a man is all three! What is wanted, if the Highway Code is to be observed more thoroughly, is a new spirit among road users; friendliness, and the courtesy of the road, instead of enmity and mistrust. And the "Roadfarers" are doing what they can to promote that "fellowship of the road" which is so vital if accidents are to be reduced and the road made safe for all.

India and the Bicycle

EVERYONE knows that India is being industrialised . . . quite rapidly. This changing of a great territory was bound to come, and, in the process, "teething troubles" are inevitable. I understand that the Indian cycle manufacturers are having them; the quality of the Indian-made bike is criticised by the Bombay Cycle Merchants' Association, who oppose the imposition of a tariff against the import of British bicycles. Of course, the Merchants' Association is in agreement with the fostering of Indian indigenous industries, but naturally is vitally concerned with quality, and therefore likes the imported British machine . . . which in India, as everywhere, gives complete satisfaction. It is an interesting angle, and I recall that I was informed recently that in pre-war days India bought from Britain between 150,000 and 200,000 cycles a year.

Nocturne in January

EVERY month is a good cycling month . . . to the lover of the countryside! And I like a night ride in January, when there is a trace of frost and the road is hard and the moon is up. Good, on such a night, to ride out into the quiet world and feel the nip of the night air on one's cheek and see the stern beauty of the bare trees and the twinkle of lights in cottage windows . . . and the red blinds of the inn window, welcoming one to warmth and comfort inside. Maybe the pool by Bracken Farm is freezing over . . . and one may look joyously forward to skating. A stray rabbit darts across the road by Coppice End, and from a ruined barn comes the hoot of a wakeful owl. Salute to January!



Bullington Church. Sussex.

One of England's smallest churches. A lonely little building surrounded by trees off the main road from West Dean to Alfriston. Only the chancel remains of the original building which was destroyed centuries ago by fire.

My Point of View

By "WAYFARER"

Compote of Conversation

IT is rather interesting to one who for the past few years has been submerged in a suburban job, hardly ever finding it necessary to adventure into the city centre, to come across so many familiar faces now that the position of affairs is reversed, and every day finds him pacing (on business intent) thronged streets. A light comes into the eyes of a passer-by and his pace slackens. I, too, slow down. We stop and shake hands. "'Wayfarer,' isn't it?" says the semi-stranger, and a guilty plea is entered. "I met you last at Dolgelley, 19 or 20 years ago. . . . Are you still on the road . . . ? I met you one Sunday between Wigan and Warrington. . . . I don't suppose you'll remember, but you provided me with a very fine Irish tour some years back. . . . I've still got that bike for which you drew up the specification in 1930. . . . I'm a motorist, now—wife and family, y'know—but I think with great pleasure of my cycling days. . . . I haven't done much in recent years, but the kids are growing up and the wife and I are coming back to cycling. . . . I indulge in mountaineering, but the old bike's still in use. . . . Yes, I'm still getting them round. . . . It's a grand game, isn't it? And what a time we had during the war, with no motors about . . . ! Still lecturing . . . ? Been to the Cotswolds lately. . . . ? Still riding fixed?" We shake hands again, the writer feeling refreshed by a momentary glimpse into the past, and glad to have been able to help, or inspire, this man and that, in one way or another.

Persisting Joy

ALWAYS, at this time of the year, I am conscious of an urge to say my little piece with regard to a phase of cycling which has held me in its grip for many a long day. When the autumn arrives and, thanks to our "interference with the clock," the hour for lighting-up makes its leap forward, necessitating the illumination of bicycles immediately after tea, then I am ready with my gas lamp, and I experience anew the persisting joy of riding in the dark. Up to the first Sunday in October I had "made do" with an electric battery lamp, but this type of light is inadequate for my night-riding programme, and one of my gas-lamps was then brought back into use after a summer's idleness. This lamp, which is a small one and cost 5s. before the war (perhaps it was before the other war!)—what the price would be now, if the article were obtainable, I do not know—is part of my "fleet" of gas-lamps and is good enough for most occasions, though on really black nights and for my longer journeys I resort to a much bigger lamp, the light from which enables one (in the words of a witty friend) "to see people's underclothing!" But, big or little, I like to sit behind a goodly measure of illumination, which allows me clearly to see where I am going and lets other people know I am coming. From my point of view, any element of danger in connection with night-riding is very largely minimised by the use of a really effective head-lamp. This apart, however, I find an infinite joy about cycling in the dark, and the pleasures attendant on this phase of our pastime do something to water down my regret at the departure of summer.

Recurring Fault

I BELIEVE that I could, with advantage, write a paragraph every month on the subject of tyre inflation. A tremendous amount of propaganda on the subject is still needed. For example (dozens of which could be quoted), the other evening I overtook a lady who was walking her bicycle, the front tyre being dead flat. Seeing that she had no pump, I asked whether I could help. My offer was accepted, and I had the tyre hard in no time. On inquiring as to the state of health of the back tyre, she replied: "Oh, that's all right"—which is just what it wasn't. I gave her such a look and put that tyre right, too, with a gentle word of advice as to the free use of the air which is available in very large quantities. But, bless ye! I don't mind betting tuppence that both those tyres are again being ridden in a flabby condition—to the discomfort of the cyclist and the ultimate gain of the tyre manufacturer.

Fifty Years Ago

MY daily newspaper continues to print, from time to time, a 50-year-old paragraph relating to road matters. For instance, we learn on September 27th that one person was knocked down and injured in the streets of Birmingham every day in the year, while one person was killed every ten days. (That was in 1896. In 1946 one might well say: "What are you shouting about?") The ancient paragraph continues in this wise: "Under the pressure of continual complaint, something is being done to check the 'scorching' cyclist from racing in the public thoroughfares." A day or two later, this paragraph was brought up at a meeting of the Watch Committee, a member saying that the matter called for serious attention and moving that it be referred to the Chief Constable for inquiries. The speaker added that he was of the opinion that rubber-tyred machines (bicycles, of course) ought to have automatic bells ringing whilst being ridden through the centre of the city. That was on September 30th, 1896. Would anybody like to revive the suggestion now? Somehow, I don't think so!

A Right Move

IT is good to know that the Minister of Town and Country Planning has reiterated his promise to make "an end of outdoor advertising in the country," a method of publicity which, in some aspects, is horrifying. Particularly to be deplored is the defacement of natural features of the countryside—rocks, for example—by means of a multitude of posters or by the use of stencilled wordings; while, to my way of thinking, the enamelled signs erected by the owners of a chain of hotels, headed with the silly injunction: "Look Out!" are a complete eyesore, causing the traveller—causing me—to look out *and beware*! It is conceivable, of course, that a small amount of "outdoor advertising in the country" may have its uses. Regulated, and done with good manners and good taste, it might be unobjectionable in the case of cyclists, and other lovers of the countryside.

Nothing New Under the Sun

THE daily Press recently gave a picture of "new style cycling" consisting of an Italian invention for applying power to the front wheel by means of a rocking handle-bar. All that this picture proved was that there is nothing new under the sun. A version of the idea, in the form of the Bricknell Hand Gear, was tried out long years ago, and was accounted a failure—for, I expect, good and sufficient reasons. I do not suppose that the passing years have altered expert opinion on the subject, and I have no doubt that this "new style cycling" is already as dead as the proverbial donkey.

Mr. Know-all

RATHER obviously, he was a short-term cyclist—here to-day and gone to-morrow—and he gave one the impression that he "knew it all." So, when he commenced to air his knowledge on the subject of gas lamps, I offered him a little encouragement by way of questions. Gas lamps were troublesome things to run. Were they? I innocently asked. You had to clean and re-charge them after every using. Have you? I inquired. They were messy things to play with. Are they? I queried. This repetition infuriated Mr. Know-all, as it was intended to do, and he cried, with undue heat: "Well, you ought to know. You use gas lamps, don't you? Aren't they a bally nuisance, and dirty, and all that?"

So I told him, gently, that each of his statements was wrong. Gas lamps were really very little trouble to run. In practice, it might be an advantage to clean and re-charge after every using, but this was not necessary in connection with a series of short journeys—say five or six such. The dirt from gas lamps was good, honest, clean dirt—if a trifle smelly—which was easily removed from the hands. When I turned the tables on him and inquired what experience he had had with gas lamps, he gave me the answer I quite expected: "None!"

We Supply the Power

A FEW days ago a letter appeared in one of the daily newspapers about the desired revival of yacht-racing. The writer said that he could hear people asking: "What is the use of a sailing yacht, pushed about by the wind at 10 or 12 miles an hour?" It might equally well be asked (he added): "What is the use of cricket, football, or rowing?" the answer being "that such sports and pastimes create activity of mind and body—a spirit of competition and team-work which, in the hour of the nation's need, has saved her from disaster." So it is with cycling, which bestows such remarkable physical and mental gifts upon its devotees. Yet there are funny people who say: "You ought to have a motor-cycle!" By the same token it is presumed that the lads who walked from London to Brighton the other day ought to have borne in mind that there is an excellent train service between the two places. By using it they could have saved a lot of time—and some shoe-leather!

After a period of reflection, I rather feel that, when the Oxford and Cambridge boat race is carried on with the aid of outboard motors, the funny people will come into their own, and we shall find it difficult to counter the assertion that "You ought to have a motor-cycle"! For the time being, however, we shall continue to supply our own power.

The Speedy Way

A COLLEAGUE with whom I was doing a business journey by motor-car suddenly turned from our general conversation to comment on the fact that, at times, the bicycle is the speediest vehicle on the roads. He was referring, in particular, to his own experiences when cycling to and from business and participating in the daily rush-hour traffic, morning and evening, and he admitted that the bicycle was a great source of convenience, because it was so readily possible to weave in and out of the crush and to reach one's destination long before the larger units had broken away from their slowly advancing queues. This experience accords with my own. The bicycle may have to take second place where longer journeys and clear roads are concerned, but, when there is congestion, the expert cyclist can readily make good progress and "get there first."

Our Enemies

THESE are the principal (inanimate) enemies of cycling, I thought to myself on a recent day, when making my way homewards: Fog. Probably the worst of the lot—because it does not make cycling "impossible"! It provides us with serious difficulties and discomforts, and is most bewildering. Usually we cannot ride fast enough to keep warm, and the thickened atmosphere tends to hurt the eyes (in my case, it does its best to induce a headache); and makes breathing hard, while a moist fog is as wet as rain—as rain it is, in another form. Fog adds to the dangers of cycling (that never worries me), but consolation is to be derived from the fact that it puts a brake on all forms of traffic, so that the hazards of travel are really relative. Of course, it *is* disconcerting when you fancy that you are well on your own side of the road to find yourself bumping into the offside gutter! One disturbing feature about fog is that it seems to get into your mind, so that, if you leave your proper track, it is difficult to reconstruct the hidden scene and thus to return to the path of rectitude. At least, that has been my experience.

Snow is No. 2 enemy. Falling snow is bad enough—how painful it is when the pellets hit one's eyes!—but lying snow, according to its depth and its ultimate churned-up condition, makes cycling very difficult, if not more or less out of the question. Time was when one revelled in cycling, or in trying to cycle, through a coating of snow, but one was younger then, and falls did not matter. Moreover, in those days one had almost a monopoly of the roads.

While it lasts, a glazed frost, or silver thaw, is No. 3 enemy. It makes cycling extremely difficult, and here again the presence of other traffic is a factor for consideration. It is hard to maintain an even keel when the roads are like glass—rare occurrence, of course—and I, for my part, am prepared for the time being to retire and "give it best." Sometimes, of course, you are caught napping and have to "face the music" in order to return home. And sometimes an odd patch or two of slipperiness leads to your undoing. The last skid I had—ten to fifteen years ago—was caused by running without the slightest warning, in the dark, on to a highly treacherous piece of road. The tandem I was steering lay down very rapidly and the two riders accompanied it "without the option"!

I do not reckon the wind as being of necessity an enemy of cycling. It can be, and a very ruthless enemy, too. It can also be a jolly good friend to cyclists. Nor do I count hills as coming in the enemy class, especially as they go in both directions—down and up. Certain of our hilly districts can be pretty trying—one thinks of, say, the North Riding of Yorkshire or the southern portion of Shropshire—where the succession of banks seems endless. You take half-an-hour to plod up a hill and flash down the other side in five minutes. No: hills should not be counted amongst our enemies. On the other hand, there are certain circumstances in which I would be ready to view a flat country as definitely a menace to cycling. In my opinion, rain is not in the enemy class, nor is extreme heat or cold. And certainly not darkness.

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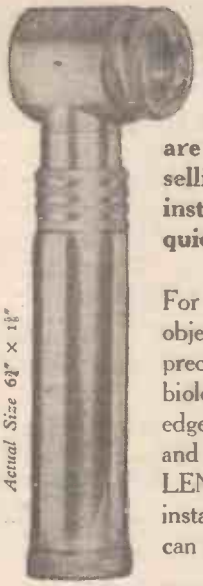

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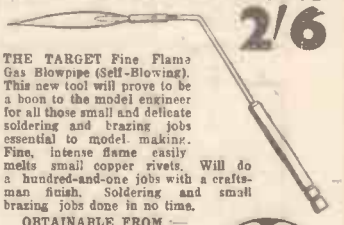

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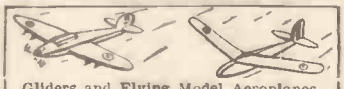

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