AIR CONDITIONING

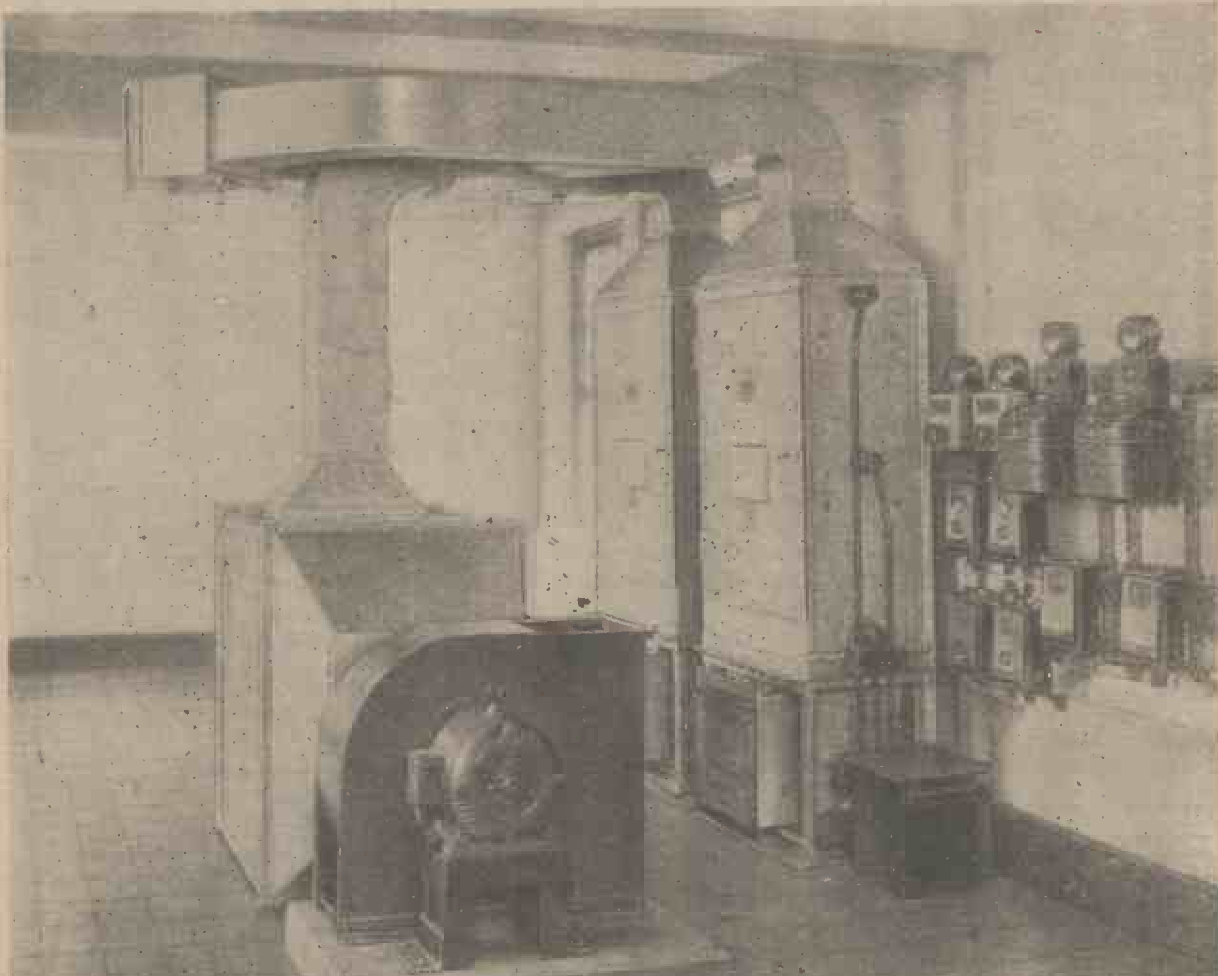
NEWNES

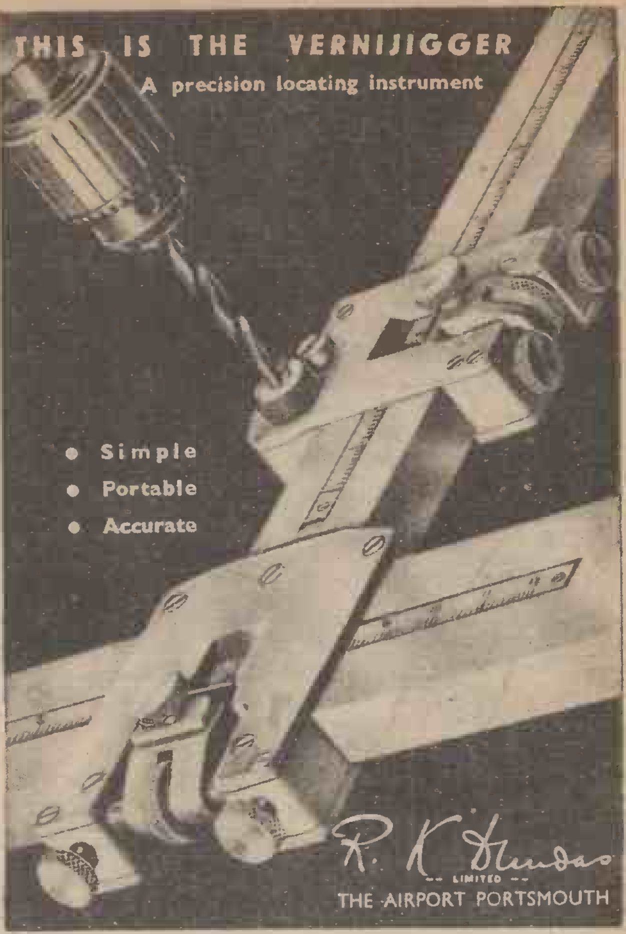
PRACTICAL MECHANICS

9D.

EDITOR: F. J. CAMM

OCTOBER 1945





THIS IS THE VERNIJIGGER
A precision locating instrument
• Simple
• Portable
• Accurate
R. K. Dundas
LIMITED
THE AIRPORT PORTSMOUTH

78-79

SUBSCRIPTION RATES
(Including postage)

Inland - - - 10s. 6d. per annum.
Abroad - - - 10s. per annum.
Canada - - - 10s. per annum.

Editorial and Advertisement Office: "Practical Mechanics," George Newnes, Ltd.
Tower House, Southampton Street, Strand, W.C.2
'Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

PRACTICAL MECHANICS

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

Editor: F. J. CAMM

VOL. XIII OCTOBER, 1945 No. 145

FAIR COMMENT—BY THE EDITOR

De-gaussing

ONE by one the war secrets are being released. We have not been told, hitherto, a great deal about de-gaussing, but now the full story has been released. The first occasion that German magnetic mines with parachute attachments are known to have been laid was on the night of November 21st, 1939, when German aircraft dropped mines of this type in the Thames and Humber estuaries, and in Harwich Harbour. At about 10 p.m. the next day a second mine-laying attack was made, and a mine was seen to drop in the water off Shoeburyness. It was realised that this would be exposed at low water, and two specialist officers were deputed by the Admiralty to secure the specimen intact. Special non-magnetic tools of brass were made locally, and when the tide fell *two* mines were exposed. One of them was stripped of its external fittings—these being the bomb fuse, detonator, primer and hydrostatic clock. The mine and its fittings were landed and sent to the Torpedo and Mining School, whilst the fuse was sent to Woolwich Arsenal. Removal of the rear door exposed the rubber-mounted dome of the unit, and removal of the dome, the hand-set latitude and adjustment labelled Gauss, which indicated that the mine was magnetic. Dismantling of the various components, tracing out the wiring, repairing the damage and interpreting the results were carried out, and within 18 hours the principle of the unit was understood, enabling counter-measures to be put in hand. The possibility of achieving some measure of de-magnetisation by a system of current-carrying coils is self-evident.

The history of de-gaussing began during the 1914 war, when the idea that the external magnetic field of a ship could be used to operate devices for detecting or destroying was first mooted. From the year 1917 the loop method of detection and a magnetic firing device were under consideration, developed and put into service. Between 1919 and 1922 further experiments were carried out. As a result of progress made later, a committee was set up in the Admiralty in 1936 to consider counter-measures to magnetic firing devices. At this time the main British mining development was with the buoyant mine. The policy adopted was to magnetise the ship so strongly that the weapons would fire at a safe distance. H.M.S. "Curacoa" was wound with various coil systems, and surveys were made of the ship, using types of magnetometer designed for the purpose. It was decided to fit all ships with coils. At first they were fitted externally, a few feet below the upper deck. Such arrangements were unseaworthy, so a permanent system of de-gaussing was devised, which consisted of heavy copper strip fastened round the outside of the ship in rubber channelling. This was unsatisfactory, and, as a result of model trials, it was found that the coils could be fitted inside the hull. Important general principles were established within a few weeks, and the model laws were confirmed.

By the end of May, 1940, 2,000 merchant ships had been fitted with temporary coils, and this figure was increased to 4,400 by the end of the year, when 1,704 warships had been similarly equipped. This, in brief, explains why it was that the first of the German secret weapons had such a short life, and it explains why the Germans abandoned it.

Television

THE Television Development Committee of the Radio Industry Council, at a special meeting in London, decided to make formal application to the Government for immediate introduction of a television still pattern picture transmission from Alexandra Palace.

The Committee states that it is the intention of the industry to rehabilitate a large number of servicemen who have been on radar and communication work.

It will only be possible to do this if a test signal is put on at once in order that facilities are available for training. The Committee also states that it is unable to deal with the considerable uneasiness in the minds of television set owners who have been unable to get their sets overhauled and tested because of the lack of a transmission.

They disclosed the fact that the B.B.C. had already begun to send out test signals on the television sound channel. The chairman of the Committee, in addressing the meeting, said that the change in the international position encouraged the whole industry to feel that television programmes should start at an early date. The ending of Lend-Lease had made it imperative that this great spear-head for British export trade should be got under way immediately.

Bosh!

A DAILY pictorial newspaper, whose main speciality is comic strip, emanates from the same stable as a Sunday pictorial newspaper, which boldly asserted that Germany would not go to war with Russia at a time when Germany had actually invaded Russia. One of the readers of this daily newspaper, Mr. J. Taylor, of Kenton Lane, Harrow (Middx), sent to the Editor a copy of a paragraph written by a contributor in our issue for January, 1934. We would state that nothing which has happened since has caused our contributor to modify his own comments. Here is the paragraph, as carefully abbreviated and torn from its context by the newspaper concerned:—

> "A scientist stated . . . that there is no latent power in the atom. Hence vanishes one of the dreams of scientist cranks and other fantastic characters who for years past have regaled the public with ungarnished tosh about propelling Atlantic liners and aircraft with the latent energy of this or that . . .
>
> "The Association (i.e., the British Association) could help to remedy this state of affairs by tightening up the rules of membership."

The editorial comment on that paragraph was:

> We Old Codgers agree . . . so that membership could be denied to the scientist whose knowledge was so little as to call the claims of men like Rutherford on the atom "tosh." He must feel a little sick to-day.

The comment of old codger is just bosh! (Dictionary definition of bosh: *empty words, nonsense, or just tosh!*)

For the information of "old codgers" (dictionary definition of a codger: *a testy or eccentric old man, a clownish fellow, a beggar*) we are constrained to point out, what he apparently does not know, that the atomic theories advanced by Boyle, Dalton, and Rutherford, have since been proved wrong. Rutherford, for example, thought that all the electrons were round, like cricket balls. But then, as stated in our original paragraph (we note that old codger was careful to omit this paragraph) misleading statements like this, "are bruited about by large headlines in daily papers, which seldom report on a simple happening without making a mistake."

The scientist referred to in our original paragraph, whose words our contributor was quoting, made his statement before the British Association, and he was hitting at old codger journalists who in 1934 had been writing tosh and bosh about power units no larger than pin-heads which were going to propel motor-cars, aircraft, and ships.

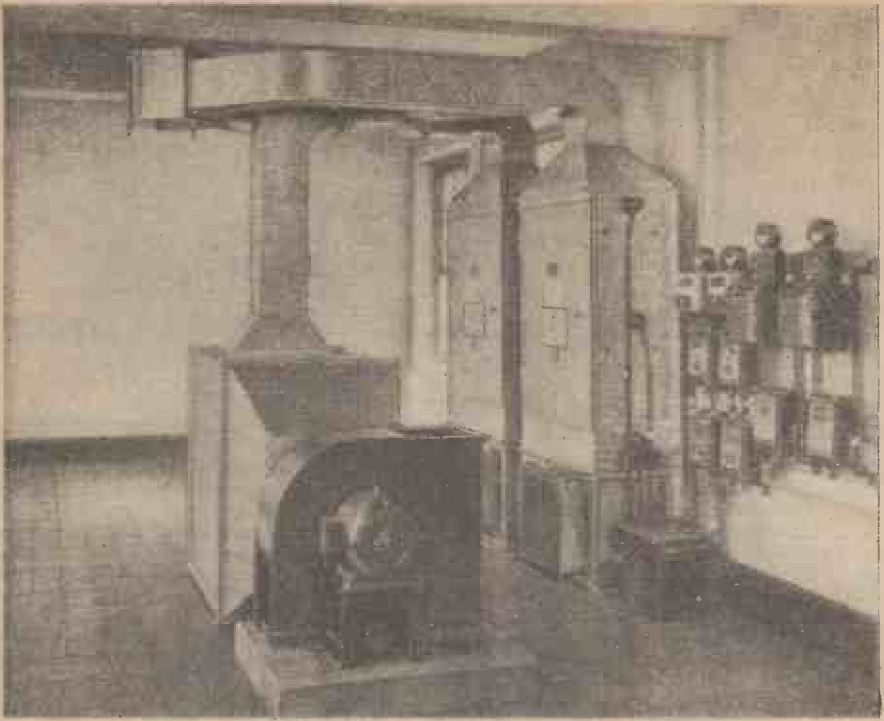
A good deal of nonsense has been written and spoken, even to-day, about the atomic bomb, but we would remind our readers that the splitting of the atom has a long way to go before it emerges from the state in which it now is, namely, a purely destructive force.

Moreover, we should not overrate the results of that bomb on Hiroshima and Nagasaki. These two towns were largely shacks, and it is observed that stone buildings were not completely destroyed. Writers of live letters to the *Daily Marrow* please note!

Air Conditioning

How the System Operates, and its Uses

By A. A. FIELD, G.I.H.V.E.



An ozone plant. The ozone generators standing by the switchboard will supply "concentrated oxygen" into the main ducts of the air-conditioning system. (By courtesy of Ozonair, Ltd.)

IN preparing this article on present-day air-conditioning it is hoped to dispel some of the shades of mystery and even contempt that seem to surround its name.

The common conception of air-conditioning, in many cases, is limited to such expressions as: "air-conditioned motor-tyres," "air-conditioned shoes and hats," and in practice to noisy ventilating fans and ugly roof-cowls.

Then—what is air-conditioning? It may be defined briefly as the science of continuously maintaining a given atmospheric condition in an enclosed space, regardless of outside variation. Thus it will be seen that air-conditioning goes further than merely exchanging air in a space with the "fresh" air outside it. Factors such as temperature, air change and movement, dust and pollen, humidity (the amount of moisture in the air), ozone and bacteria content are all simultaneously controlled. In other words, it is an artificial weather-maker.

What is the use of this artificial weather? Its application may be classified as:

(a) Industrial conditioning.
(b) Comfort conditioning.

First, take section (a). Its uses vary over different fields, and it is proposed to select a few cases to illustrate the general principle.

Much has been heard of late of the new master-drug penicillin, but few realise how difficult would be its mass production were it not for air-conditioning. Bacteria colonies form on the yeast only under a particular set of conditions as regards temperature and humidity. This can be maintained by the air-conditioning plant all the year round, regardless of rain, snow or intense heat.

Another application is to the cotton mills. Up to a short time ago the North of England was the only place where cotton could be subjected to its various processes without fear of breakage, due to the high humidity. Nowadays cotton may be manufactured in any place of the globe with proper control by air-conditioning.

Rayon is a subject of interest to-day, primarily because of its shortage. This is another substance that relies almost entirely on air-conditioning for its proper manufacture. Other industrial processes, such as de-hydration, drying substances by heated air—as in laundries—temperature and humidity control on food ships coming from tropical regions, and, another wartime subject, the storage of works of art are all reliant on constant atmospheric conditions.

It will be seen that in certain industrial fields air-conditioning is a vital necessity.

Comfort Air-conditioning

First, it is proposed to state some physical facts concerning the effects of temperature and humidity on the human body.

When a person feels "comfortable" as regards temperature, several forces are at work to produce this condition. It is well known that the body loses heat, and it is the "rate" at which it loses this heat that produces the sensation of comfort. The body's heat loss is influenced by:

(1) Ambient temperature (i.e., surrounding air temperature).
(2) Humidity of the surrounding air.
(3) Air-movement over the body.
(4) Temperature of surfaces adjacent to the body, such as cold walls or hot surfaces.

If, say, the surrounding air temperature were maintained at 10 deg. F. above blood temperature (98 deg.), it will be seen that no heat could be lost by convection in this manner. Thus the heat-regulating centre would provide for more loss by evaporation of moisture off the skin into the air and possibly more loss by radiation, accomplished by an increase in skin surface temperature.

An interesting experiment carried out by the American Society of Heating and Ventilating Engineers shows the following effects on the average human organism when in unfavourable atmospheric conditions. The temperature was 76 deg.-80 deg. F., and an average moisture content.

(a) Increase in heart beats.
(b) Increase in sweating.
(c) Increase in body temperature.
(d) Increase in skin surface temperature.
(e) Increase in rate of breathing.
(f) Attacks of cramp.
(g) General lassitude and dizziness.

This type of overheating occurs on hot summer days, say, when confined to an office or factory, where heat loss due to transmission to cool surrounding air is partially arrested.

Exposure to these conditions for some time will weaken germ resistance and so makes the system more susceptible to illness, robbing the consciousness of much of its alertness.

It may be argued that in tropical climates a white man survives temperatures and humidities in excess of this. Quite true—but only after acclimatisation. This process takes more than a year to achieve, and it will be admitted that in the English summer, or even extending to the Mediterranean, there is not sufficient time to achieve this condition. As a matter of interest, acclimatisation consists merely of the slowing down of bodily

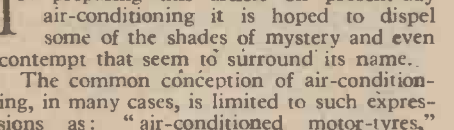


Fig. 1.—Diagram illustrating the principle of air-conditioning.

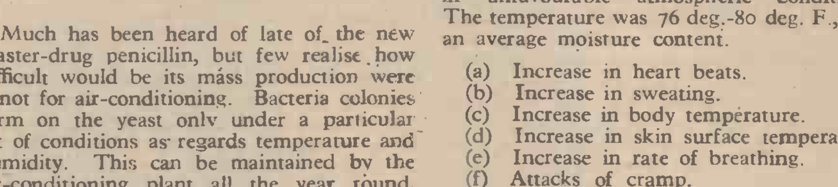


Fig. 2.—Diagrammatic layout of an air treatment installation.

heat production, which is not enough, however, to be comfortable.

The opposite to excess heat is obviously excess cold. Again, as is well known, this has a deleterious effect on the organism, producing colds and illnesses. The susceptibility to disease in winter is caused by the action of the heat-regulating system, which robs the outer skin surfaces of its blood supply and feeds an excess to the kidneys and internal organs. This lowers the resistance of the mucous membranes in the nose and throat, thus causing colds, etc.

Another effect of intense cold is to slow combustion and thus drop body temperature. If this falls below 80 deg. F. a complete collapse of the organism takes place, resulting in a coma which ends in death.

Temperature and Humidity

From these examples it will be seen that the task of air-conditioning is to provide a steady equilibrium or balance between room and body conditions.

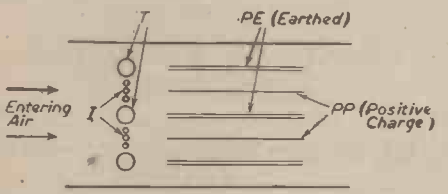


Fig. 3.—Diagram illustrating the principle of the electrostatic precipitator.

This balance may be achieved in many ways: A high temperature and a very low moisture content may be provided, thus enabling evaporation from the skin to be extremely rapid, with resultant comfort conditions. However, this process is not to be recommended as the dryness of the air has a damaging effect on the organs of the nose and throat.

In the tropics, the principle that rapid air movement over the body will produce a cooling effect is reflected in the number of propeller or desk fans in use.

So again—air-conditioning must achieve a balance between these extremes.

The most favourable humidity point for the trachea was decided from medical evidence, and this, in combination with figures for air movement, decided the average temperature. It must not be thought that these atmospheric conditions suit everyone, for, as in most things, what suits one person does not satisfy the other. The chosen values, however, strike a fairly happy mean. In technical language, these figures are approximate: 68deg. F. dry bulb. 60 per cent. relative humidity for winter. 77 deg. F. dry bulb. 55 per cent. relative humidity for summer. Winter values do not vary for a given external temperature, but the summer values are based on an external temperature of about 87 deg. F. If the temperature goes higher than this, the internal 77 deg. F. must be increased so as to maintain an approximate difference of 10 deg. F. This precaution is to reduce shock when passing from a cool atmosphere to a hot one. In winter this difference does not matter so much, owing to the fact that a change from, say, 68 deg. room temperature to a freezing temperature is accompanied by an increase in clothing insulation.

Dust Control

So much for temperature and humidity, now about dust control.

Dust is really very small inorganic and organic matter that is suspended in the air due to either its specific gravity being lower than that of air, or to the motion of the air stream around it. This dust may be caused in many ways. Primarily, in cities, it is caused by factory and household chimneys. Secondly, by the decay of vegetable matter, and dust stirred up from dry roads. It may consist of wood, rust, paper, cloth, and earth. In factories these dust particles may be suspended steel or copper, silica from grinding wheels, paint fumes, etc.

Dust in concentration, then, is an enemy to humanity It destroys books, pictures, blackens public buildings and stops engines. To humans it is harmful to the respiratory tract and also to general health by reason that it cuts off a certain amount of ultra-violet radiation from the sun. To dust and pollen may be attributed hay fever, bronchitis and the aggravation of tuberculosis.

Thus, until the factories adopt schemes of smoke abatement, it is the task of air-conditioning to provide a hygienic indoor atmosphere.

Now bacteria. It is a popular expression to-day that "coughs and sneezes spread diseases." Nothing could be more true. By sneezing, a cloud of water vapour is sprayed into the air of a room, and each droplet contains viruses. These float around for several hours, a source of potential danger.

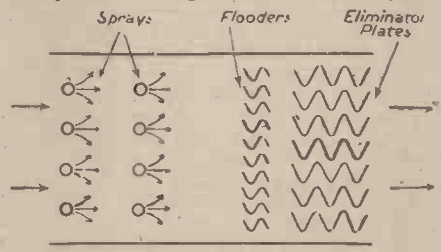


Fig. 4.—Illustrating the principle of the air-washer.

So to achieve again hygienic conditions the disease type of bacteria must be destroyed. This may be accomplished by irradiation of the air by ultra-violet light or by vaporising ethylene glycol.

Control of Odours

Odours alone are not dangerous to health, but if a room has a peculiar smell, such as that from cooking, a bad psychological effect is created. The air-conditioning plant is regarded as an inefficient job, and all the dust and bacteria control possible will not alter this opinion.

So odours must be eliminated, and this is the task of the ozone generator.

Ozone is alotropic oxygen, or concentrated oxygen, composing three atoms of oxygen in the molecule instead of two. It is found generally at the seaside and on mountain tops, and may be generated electrically by utilising the principle of brush discharge. It is a powerful oxidising or bleaching agent, and by virtue of this property burns up and destroys offensive "smell particles."

Even flies will not enter a room that is ozone treated, which is admittedly an asset.

It is claimed, in various circles, that ozone exerts an exhilarating effect on the human system and puts the tang of the sea in the air, but it is a much-disputed point and must be decided individually.

The method of applying these various processes in correct proportion is the science of air-conditioning.

Air-conditioning Plant Described

Let the diagram (Fig. 1) represent a space S to be treated and let A be the central plant. Outside air is taken from point F, passed through the conditioner and forced along pressed steel or plastic tubes to distributing points D. Vitiated air is extracted at X. When this principle is followed, a mechanical extraction of about 40 per cent. of the inlet air quantity is maintained, thus the surplus 60 per cent. will try to escape through cracks in windows, floorboards and doors, so creating a slight pressure in the space, and making draughts flow outwards. Although many buildings may use complicated arrangements of tubes or so-called ductwork, this general principle is followed.

The processes contained separately in A vary considerably for different plants, and Fig. 2 shows an installation incorporating most air-treatment devices.

Air is taken from outside at A. Dust is removed to the extent of roughly 90 per cent. by the filter F. This piece of apparatus takes many forms, but generally consists of a mat of fibrous material coated with oil or other viscous substances to make the dust particles adhere.

Next the electrostatic precipitator. This removes "dust" as fine as tobacco smoke, and will give 100 per cent. efficiency. Fig. 3 illustrates its principle diagrammatically.

The whole apparatus is contained in the ductwork. Dust-laden air enters the duct and passes between tubes T and fine ionising wires I, which have existing around them a positive electrostatic field, and in passing through this field the dust is itself ionised air, then passes to a series of plate, PE and Pp. Plates Pp are positively charged and repel the now positively charged dust particles on to the uncharged plates PE, which are oil coated and earthed. After some usage the dust plates are cleaned and re-coated.

A small air-conditioning unit.

From here the air flows to the next stage, the air-washer. This piece of apparatus serves several purposes. Air may be cooled, heated, de-humidified, or humidified by it.

Basically, the system is as Fig. 4, a galvanised steel tank is used, open at both ends and connected to the rest of the apparatus. Air enters at one end, passing through a mist or spray caused by vertical banks of atomising nozzles being fed with water at high pressure. In its finely divided state the water will mix readily with the air, and so increase its humidity almost to saturation point. The water temperature may also be varied to suit summer or winter conditions. Thus in winter the spray temperature will be warm, to impart a certain amount of preheat to the air, and, in summer, refrigerated to a low temperature to cool and dehumidify the passing air.

The next step in the washer is the scrubber plates. These are for use mainly when the washer is used without a dry filter preceding it, and their action is to maintain a stream of water down a set of vertical plates so that all free dust in the air is entrained and washed into the settling tank below.

The last stage of the washer is the eliminator plates. These are arranged vertically in a zig-zag fashion so as to trap free moisture particles and prevent the spray from blowing through the rest of the apparatus.

The next stage of the plant is the heater battery. This consists of a series of finned tubes or pipes arranged in a bank across the duct, supplied with steam or hot water, or they may be electrically heated elements. The rapid air movement over the coils causes a rise in temperature of air, so that when delivered into the treated space the air maintains predetermined conditions.

Eliminating Bacteria

After the heater is the bacteria treatment chamber. Here the air is subjected to short wave, ultra-violet radiation, which acts as a "death ray for microbes" and is almost 100 per cent. efficient. There are various ways of producing this radiation, and a recent development is the "Sterilamp," produced by the Westinghouse Lamp Division of America. It consists of a thin quartz glass tube, gas-filled with neon, argon and mercury vapour. An electrical discharge through this gas mixture produces intense ultra-violet light. Several of these lamps are arranged in a bank across the duct, and on an average installation they will number 40-50 tubes.

To remove completely all bacteria, it is advisable to locate ultra-violet lamps in the conditioned space itself, where they are so arranged that persons in the room are not directly exposed to the rays.

With this combination bacteria are eliminated almost as soon as they are produced.

Another way of destroying bacteria is by introducing glycol vapour into the space. This is an entirely new method, and is still in the experimental stage.

The last stage of the air-conditioning plant is the fan, or air-mover. This may be of the axial fan or centrifugal type, driven by an electric motor. Its action is to induce air through the apparatus and force it under pressure into the space.

Control in Air-conditioning

Although outside temperatures and humidities may vary, it is necessary to maintain a standard condition inside a building. So that on some days more heat will be needed than on others, or vice versa.

Control may be effected by valves, dampers in the air tubes to reduce volume, and various mixing devices on the refrigeration or heating plant.

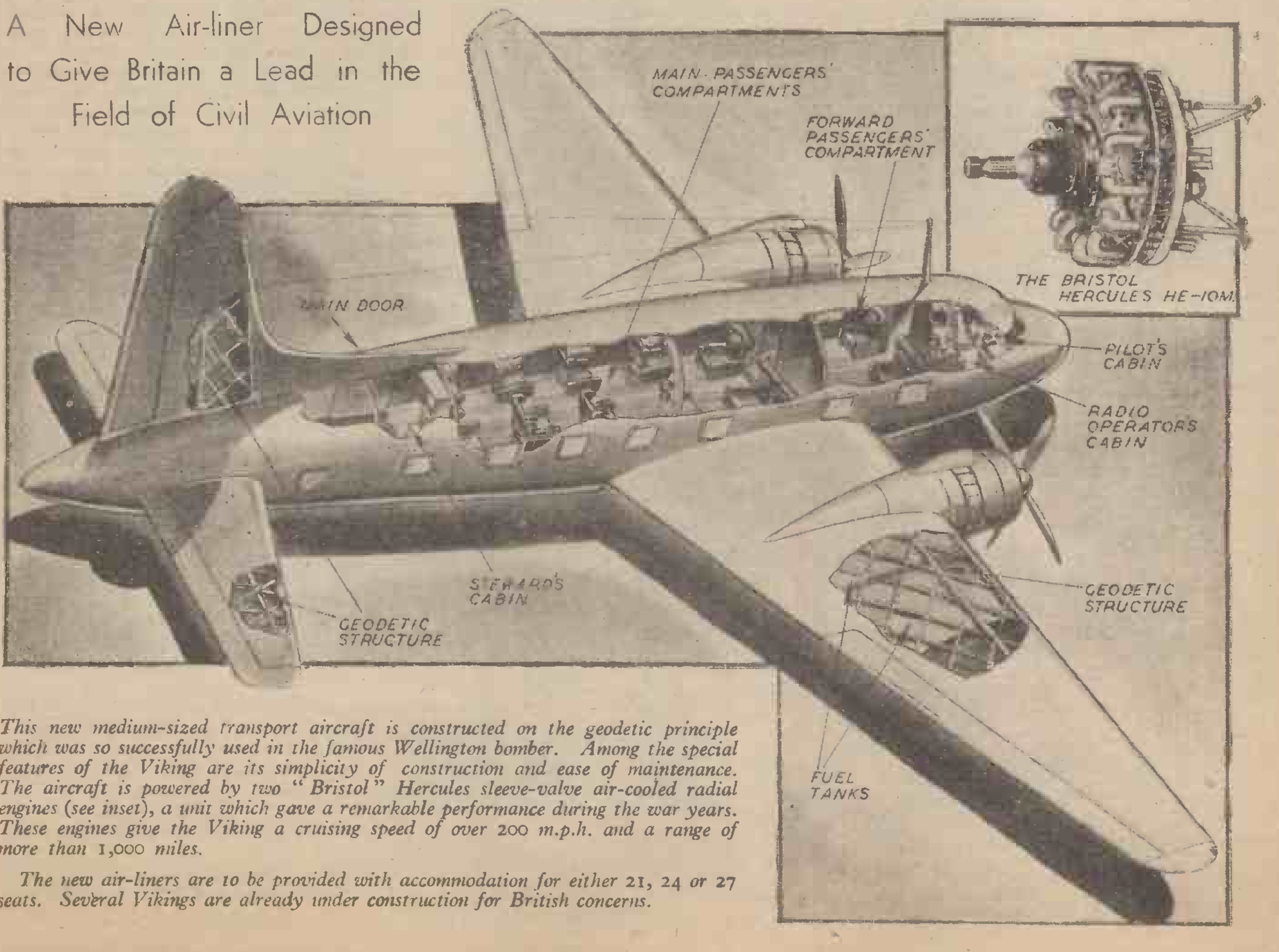
With proper equipment this regulation may be within less than 1/5th deg. F. or ½ per cent relative humidity.

Conclusion

In conclusion it must be regretfully stated that even now it is not possible to manufacture sea breezes in the laboratory. Air-conditioning is still waiting for a way of "putting the kick" into treated air.

The Vickers-Armstrong Viking

A New Air-liner Designed to Give Britain a Lead in the Field of Civil Aviation



This new medium-sized transport aircraft is constructed on the geodetic principle which was so successfully used in the famous Wellington bomber. Among the special features of the Viking are its simplicity of construction and ease of maintenance. The aircraft is powered by two "Bristol" Hercules sleeve-valve air-cooled radial engines (see inset), a unit which gave a remarkable performance during the war years. These engines give the Viking a cruising speed of over 200 m.p.h. and a range of more than 1,000 miles.

The new air-liners are to be provided with accommodation for either 21, 24 or 27 seats. Several Vikings are already under construction for British concerns.

An Electric Gas-lighter

Constructional Details of a Useful Domestic Appliance

By "HOBBYIST"

ELECTRIC gas-lighter elements now seem plentiful in shops again. Batteries however, still appear to be in short supply. Assuming then that you can manage to obtain an element and possess a small unused 2-volt radio accumulator, a novel improved type of electric gas-lighter can be constructed—a "cable" gas-lighter.

The accompanying drawings and details give a good idea of the construction. A special wooden holder shaped like a gun is made for the element and its holder. The trigger is a contact; pressure against a screw-head completes the circuit. Since an accumulator supplies the necessary power, such a gas-lighter will last indefinitely and should be a good deal cheaper to use than the usual dry-cell battery normally employed. Failing the use of a small accumulator, one can resort to 9-volt grid bias batteries, the element being plugged into 1½ volts.

The accumulator or dry battery can be housed in a wall case fitted with a hinged door. The gas-lighter gun hangs on a cup-hook below the case, ready for instant use. A very light touch on the trigger is sufficient to ignite gas, more particularly if the gas is first turned on and the element held in the jets prior to touching the trigger.

The Gun Pieces

The pistol is built up from three shaped layers of wood, the central shape being cut from ⅜in. thick stuff, while the cover pieces are cut either from ⅛in. or $^3/_{16}$in. material. both being identical in size and shape. The centre piece and a cover is plotted in ½in. squares, as in Fig. 1. The grain of the wood, of course, runs with the *length* of the gun shape. The covering pieces may be cut so that the grain runs with the handle; this is preferred, since the assembly prevents the wood from warping.

Deal could be used, being soft and easy to cut with a fret-saw. A hardwood is preferred, such as plain oak, mahogany or satin walnut. American whitewood (bass-wood) is a happy medium between hard and soft woods. Almost any sort of wood can be used, provided it is in good condition and not too tough.

Glue and panel pin one of the covers to one side of the centre piece. This helps to make the latter more firm while shaping the barrel end to fit a 1¾in. length of ½in. diameter metal tubing. A piece of towel rail will serve, by the way, but the rod must be ½in. diam. Make it a neat but not too tight fit. An ⅛in. hole is bored right through the barrel centre for one of the element contact wires (see Fig. 2), using a drill for the purpose.

Similar holes are bored in the gun for the trigger bolt and its contact bolt. A $^3/_{16}$in. hole is bored in the base of the handle shape for the lead-in wires (see side view). The other cover piece must not be attached at the moment.

Element and Holder

A suitable holder is needed for the element. The cup of an M.E.S. bulb holder is ideal, the usual sizes being given at Fig. 1. The cup is generally fitted with an insulated base (a disc of red-coloured fibre) into which a small machine screw is screwed. The tiny set screw in the cup itself can be removed as it is not wanted.

Now the cup must be a force fit in the length of tube previously mentioned. It may be necessary to file it a trifle. Force the cup half-way into one end of the tubing, as shown by the broken cut-away section view (Fig. 1). The holder cup is made from brass; it is usually arranged on a supporting bracket bent from a strip of thin brass, the latter being removed, of course. However, the tin holders found on flash-lamp bulb testers can be utilised. The brass type of holder is the best thing to use, if it can be obtained.

The Wiring

A short length of double-cotton covered coil wire, or thin flexible wire (as used for miniature lighting or leads from the coils of transformers, loudspeaker coils, etc.) is threaded through the gun barrel to project about ⅛in. at the nose; the projection is bent over flat with the nose, and this is done after the wire is bared ½in. at the end.

Remove the screw from the element holder, slip the tube over the gun barrel to its full length, then drive in the screw.

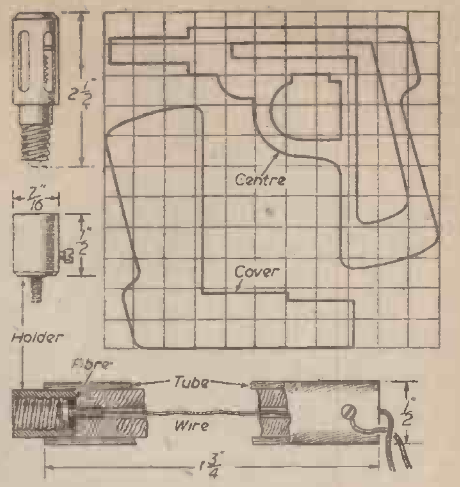


Fig. 1.—Outline of gun shapes plotted in ½in. squares, with enlarged details of element, holder and tubing, with broken section.

The wire running through the centre of the gun barrel is connected to the bolt holding the trigger in place. Make the trigger from thin brass ¼in. wide × $^3/_{32}$in. thick, then drill it for the bolt (see detail at Fig. 2).

A second wire (end of flex) is connected to the tubing by means of a ¼in. long screw. It is thus necessary to drill a hole in the tube (see views at Figs. 1, 2 and 3). The screw must not drive deeply into the wooden core (gun barrel), since the point may foul the wire running through its centre.

You will need 2ft. of standard twin flex Tie a knot in this about 4in. from the end, then insert the opposite end through the handle hole via the interior and draw out until the knot engages with the hole. The knot prevents "chugging" on the connections when the lighter is in use.

The ends of the double flex wire are bared and looped for connection to the contact bolt, and screw on the side of the barrel, as shown. Having done this, the second cover piece is attached. It will be essential to make a tiny groove on the joining side of the cover to provide a "bed" for the wire running from the tube screw to the trigger screw, otherwise the cover will not lie flat at the point where the wire comes between the cover and the centre shape.

Finishing Details

Having smoothly glass-papered the pistol, with all sharpness removed from edges and corners, it is coated with ebony spirit stain, following this with two coats of thin ebony polish, i.e., black shellac polish. An alternative is jet glaze enamel paint, one coat sufficing if the wood has been spirit stained. A high glossy finish is not desired.

A ⅜in. brass eyelet screw is driven into the "heel" of the pistol for hanging-up purposes.

Accumulator Wall Case

If a small 2-volt accumulator is used, a suitable wooden wall case should be made for it. This can be constructed from ⅜in. wood on the lines suggested at Fig. 3. The case is provided with a hinged door and wall hanger plates, plus a hook for the pistol screw-eye.

A hole for the entry of the flex leads is bored in one side, near the top. The wire is brought to the inside and a knot tied to

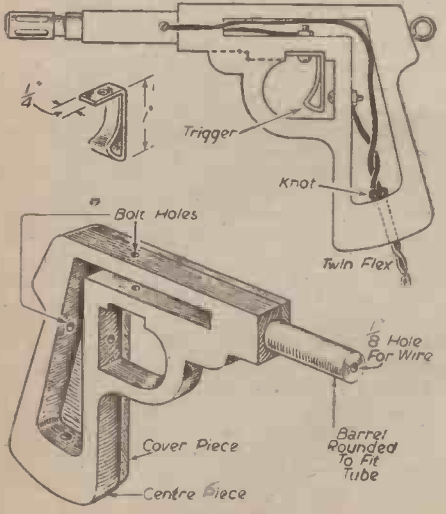


Fig. 2.—Side view, with cover piece removed to show interior and wiring, with general view of gun parts.

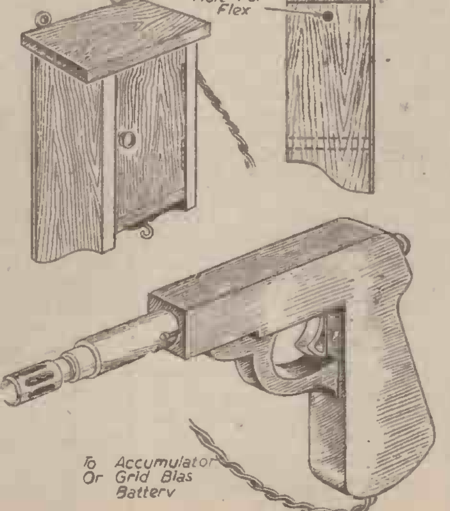


Fig. 3.—Completed gun, with suggested form of wall case for accumulator.

prevent it being pulled out from the outside. Spade connectors are fixed to the ends for connection to the terminals of the accumulator. Allow plenty of length and room in the case for accumulator, its handle, plus the connection wires.

This gas-lighter will operate on 1½ volts or 2 volts. A higher voltage will fuse the element. Should your accumulator—fully charged—fuse the element, it is possible to fit a small fixed resistor within the case, or alternatively make use of a low-voltage resistance of the variable type. These are made as circular coils on a polished wood base, with a moving contact so that the resistance can be graded up to about 2½ ohms. As the voltage drops the resistance can be also suitably reduced.

Using a Grid Bias Battery

On the other hand, a case could be made to hold a single 9-volt grid bias battery. The gas-lighter is plugged into 1½ volts. The wander plug is kept in the 1½-volt socket. As the power becomes reduced, the voltage is maintained by inserting the plug in fresh sockets, step by step, until the battery is completely exhausted.

The lowest voltage is 1½ volts, of course. The next lowest voltage is 3 volts. This is liable to fuse the element. Be wise and keep to the 1½ volts. The element wire should glow faintly red. When held in gas fumes the glow changes to a white heat, and thus ignites the gas.

What Do You Think?

Comments on Some Topical Subjects

By Prof. A. M. LOW

SO many things seem to me obvious and yet so much is a matter of opinion that I ought to be used by now to being wrong. Upon the few occasions in my life when I have been absolutely accurate, knowing well that black was black and so on, it has given me enormous satisfaction. Once upon a time I went to see a stereoscopic cinematograph, and I was shown a report by a scientist of such international fame that I almost took off my hat before reading his words of wisdom.

When I read the first six lines I went back to the beginning and read them again. They stated that by taking a right and left picture of an object it was only necessary to show these alternately upon the screen for true stereoscopy to be obtained.

Being a cautious Scotsman, I reserved judgment, but the conviction soon grew on me that I was actually right. It seems true that stereoscopy can only be obtained if the audience wears glasses, and that the method of showing alternative pictures only functions if the right picture is not allowed to be seen by the left as well as by the right eye.

Hence the coloured glasses, which, when used to look at pictures alternately dyed red and green on the film, gave a stereoscopic effect which was positively astounding. Hardened old men ducked their heads as someone on the screen squirted a siphon of soda water at the audience. There are now many methods for obtaining "shadow" stereoscopy by screens with curved surfaces or by the use of prismatic viewers, but none of them really achieves its full object, and glasses are still despised by every member of a well-conducted audience. It is, in short, like the printing of colour pictures at high speed, a very tricky problem.

A Screwdriver Question

To make it more impressive, let me recount the other occasion when I was right. At least I think so! But I would be glad to have your ruling. An annoyingly cocksure friend once explained at a lecture that the long-handled screwdriver was a farce. He pointed out that it was width of handle that mattered in gaining the necessary leverage. Try it for yourself. My theory is that with a very long screwdriver the blade can be inclined without jumping out of the slot, thus allowing the departure from vertical at the top of the handle to be appreciable. The screw is then pulled round, as it were, just as if one stuck the blade of a penknife into the screw slot to pull it round. Think it over.

Wasps and Bees

One can hardly deal with screws in summer-time without thinking of wasps. These creatures, I am not certain if they are insects or not, appear to have stings like the blade of a stiletto. When you have been stung, you knock the wasp away with a howl of rage and the beast flies off seemingly none the worse for wear.

In the interests of science, you should be prepared to suffer, so make the same experiment with a bee. The bee, like the dog in the poem, is the one that dies. Now let a bee sting you again, and as the harm is done there is no point in knocking it off. The bee walks round and round on your hand screwing out its sting, which appears to be in the form of a corkscrew. Interesting, is it not, to find that Nature designs more cleverly than you or I?

Nature having got us in her grip, there is some more information which I require. And I want a blunt answer, not a dissertation on the origin of species. How exactly does a tree draw up its moisture to a height far greater than the usual 30ft.? And if each section is isolated by a form of valve, these valves must be operated "knowingly" or we could design a similar species of perpetual motion machine.

Car's Performance at Night

Basic petrol is introducing all the old stories. Cars, in my opinion, do not run better at night. It is the result of apparently reduced distances owing to the lack of far-sighted vision. Nor do I attach much importance to the moisture in the air theory, because if moisture is to be introduced to an internal combustion engine it should, I imagine, be put in as liquid against the hot metal. We want it not to reduce the temperature of the burning gases, but to absorb heat which would otherwise be wasted by passing into the radiator through the jackets.

"Planitettes"

A recent discovery attributed to the United States Television Department suggests that mirrors could be established in a kind of artificially constructed baby planet. The Germans, it is said, were hoping to establish these small worlds in order that the rays of the sun might be directed upon the earth. My calculations may be quite wrong, but it seems that the heat upon the earth's surface directed in this way would be hundreds of times less than that of the sun itself, and if it was concentrated the area would be so small that it might be useful rather than otherwise. Someone might decide that a similar reflector could be used for television. Far from being unpleasant, it might be most useful. And another difficulty—would not this planitette have to travel some miles in every second to keep pace?

Interplanetary Navigation

Lest you think these speculations are mere folly, let me tell you that for nearly twenty years before the war a German Rocket Society had been supported by many of their best technical men, and that it is due to their efforts that the V2 made its unpleasant arrival. The discovery of new oxidising agents may also prove of great value, a point by no means lost upon the old British Interplanetary Society.

That body, at its early stages, was rather ridiculed by our air experts, just as they sneered at the possibility of flying the Atlantic or of using television. There are now a large number of very serious-minded men who believe with every confidence that a visit to the moon will be a possibility of the next century, and I will dare to say that their plans are very likely to mature in course of time.

The problems of interplanetary navigation, the astounding conditions which will exist on the moon from our human standpoint, and the undoubted knowledge we shall obtain to whatever end it may be put, make a fascinating study for those a little bored with political platitudes. The B.I.S. has been vindicated only too well by its suggestions and principles being put into operation by our enemies, who did not originate one single part of the main British plan.

The "Flying Car"

It seems to me, to take a little example, that the flying car is now a distinct possibility. It has been the subject of recent experiments in Russia, as has the use of buried cables driving small cars, without any material contact, by induction. We may yet see our main roads carrying electrically driven vehicles, and find ourselves paying far too much to the authorities for heat or power.

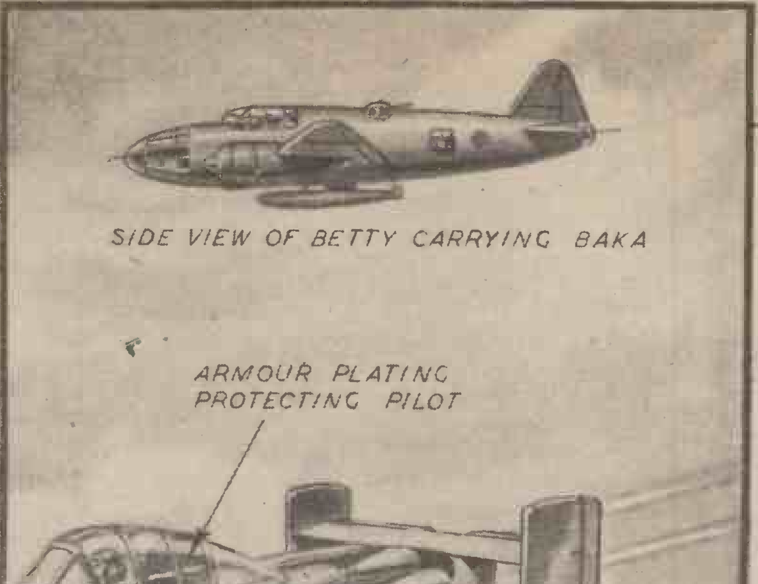
But flying cars or more intriguing. Hybrid vehicles are always bad. To fly needs a horse-power far in excess of that required for a car. To make folding wings and all these parts of an inventor's dream implies exceedingly low aero-dynamic efficiency. Supposing we think, however, of tiny engines, high octane fuel and far better alloys as the result of war research now ready for application to road motoring. Then consider the employment of rocket fuel for very short periods of flying. It would mean that flying efficiency was quite unimportant, for we would gladly pay large sums of money to be able to fly for a few minutes only on a combined vehicle.

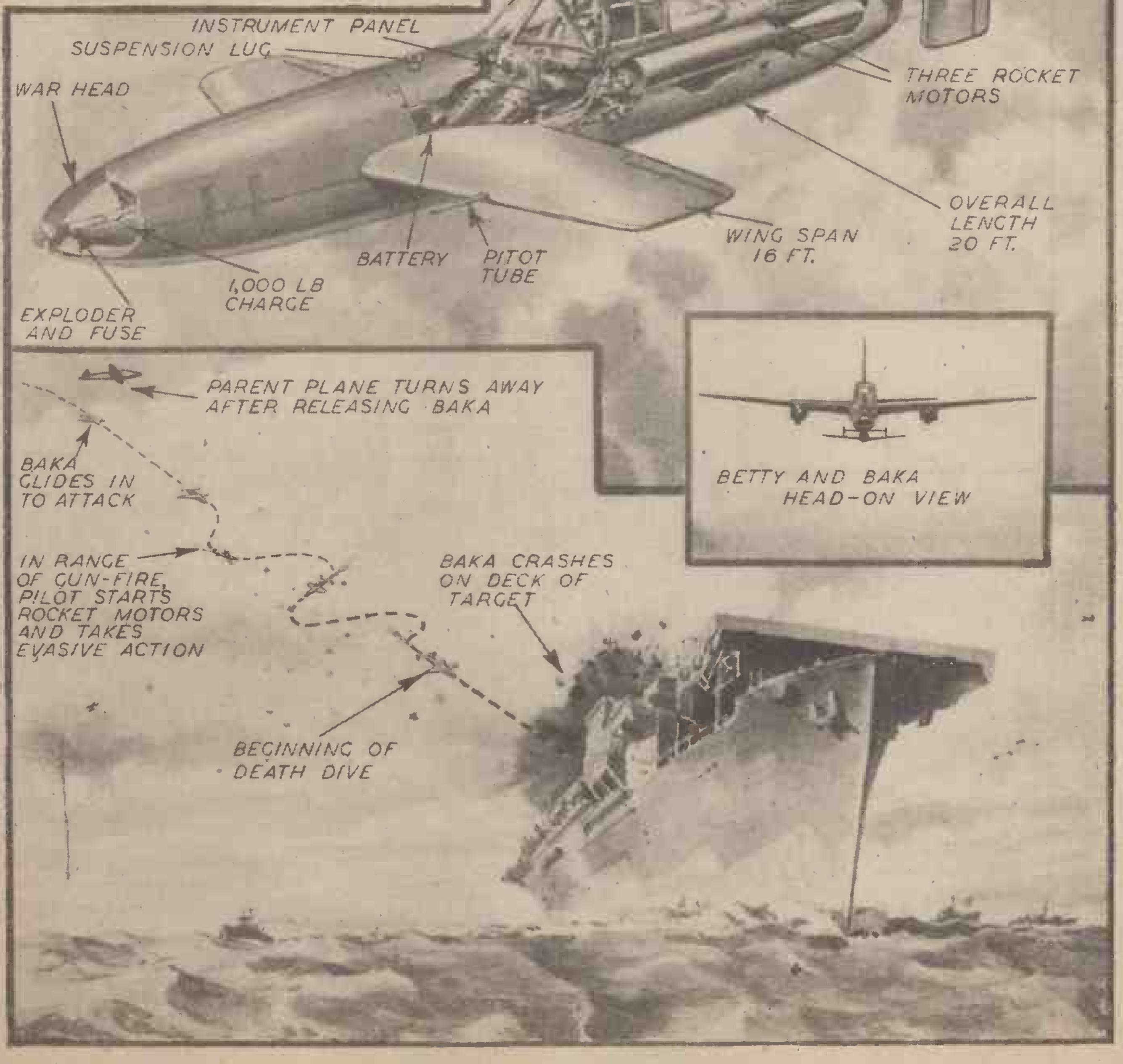
Pleasant to be able to motor to Croydon, take off as far as Preston Park and still have the car (that is the important point) for your drives up and down the promenade.

It is entirely to the point when I remind you that there are many forms of efficiency. A big limousine is not efficient thermally, but it is very efficient indeed from the aspect of convenience and comfort. I believe that physical comfort, so that our minds may think much more easily, is one of the vital differences between now and the future. We are still very savage indeed.

The Jap "Suicide"-'plane

American naval and military authorities have now made a complete survey of the Japanese "Baka" bomb, examples of which were captured intact during the fighting for Okinawa Island. The accompanying drawing is our artist's impression of the result of the American examination. The bomb forms the nose of the small 'plane which is carried below the fuselage of the parent aircraft from which it is launched preparatory to making an attack. The tiny 'plane is guided to its target by a "suicide pilot," and on the last phase of its journey the 'plane is propelled by rocket motors. The object of the pilot is to crash his machine on to the deck of the aircraft-carrier or warship at which he is aiming. The fuselage is about 20ft. long and the wing-span is 16ft.





High-power Short-circuit Testing—6

Further Notes on Break Test Recording

By S. STATON

(*Continued from page 414, September issue*)

AT the end of the last article the phase voltage traces of a "break" test was considered. The particular record under consideration was given in Fig. 9. It was noted that the arc voltage was in phase with the arc current and, consequently, reversed direction with each reversal of the latter. The arc current is interrupted on or about the instant of the zero position of the current wave. Due to this the current in one phase will be interrupted first, since the three phases do not pass through zero at the same instant. When one phase has been cleared the system becomes single-phase. This is so because the currents in the two remaining phases are equal and opposite. On examination of the phase voltage trace No. 3, it will be noticed that at the instant of arc interruption, the voltage drop across the arc rises to a peak value. This peak value will be noticed to be considerably higher than the normal peak value of the subsequent sine wave. Reference to Fig. 10 will make this clear. This shows diagrammatically the circuit conditions at the instant when the first phase clears. The generator is shown star connected. Two of the phases are shown as still being short circuited whilst the other is shown open. This latter phase represents the one in which the arc has been cleared. The voltage recorded by the oscillograph in trace 3 is that across the contacts, i.e., the open circuit volts between the open-circuited phase and the short-circuited phases. This, if vectors are drawn, will be found to be 1.5 times the normal phase value. On the interruption of the arc in the two remaining phases, the voltage across them becomes normal phase value again. At the same instant the voltage across the contacts of the first phase also becomes normal. These conditions are then continued to the end of the trace.

Phase Watts

These values are recorded on trace numbers 4-7 and 10. For the most part the traces are a straight line, indicating, of course, that no power is being absorbed. Actually, the record is one of the arc watts plus the watts dissipated in the test circuit resistance and the

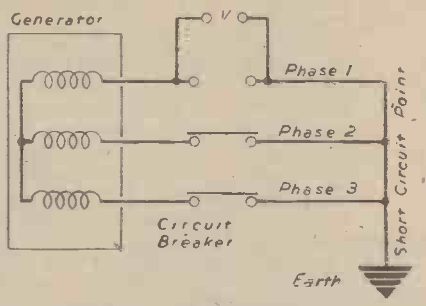


Fig. 10.—Circuit diagram at instant of arc extinction in phase 1. $V = 1.5 \times$ normal phase volts.

conductors of the circuit breaker under test. It will be seen on reference to the particular traces in Fig. 9 that they become deflected between the points X and C. This deflection is proportional to the product of the instantaneous values of the arc current and voltage. The arc power or watts can be obtained by measuring the area between the zero or undeflected axis of the trace and the deflected trace.

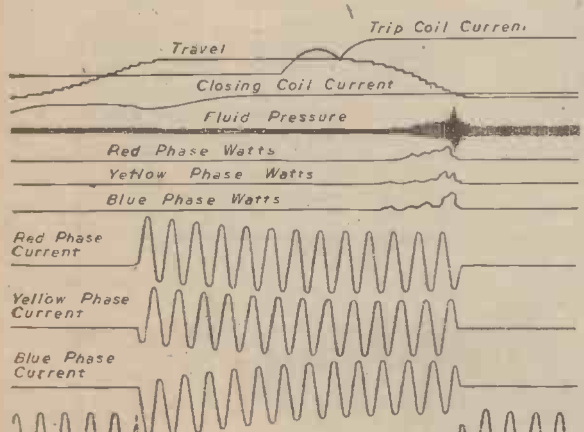


Fig. 11.—Oscillograph record of make-break test with breaking current symmetrical.

Fluid Pressure

This value is recorded on trace number 11. It will be recalled from the diagram of the recording circuit in article 3 that the oscillograph element was shown to be connected in the bridge circuit which is normally balanced. The supply to the bridge circuit is a high-frequency supply (1,000 cycles per second being a typical frequency). Reference to Fig. 9 will show that the trace is mainly a straight thick black line.

An increase of pressure is noted just prior to the point C. This increase is impulsive and very quickly dies down again to a steady value, being mainly due to the sudden generation of gases by the arc. The record is obtained by the bridge circuit becoming unbalanced as described in article 3 and hence the oscillograph light spot is deflected a proportional amount. The actual fluid pressure record at the point of increase is, therefore, a high frequency wave trace, and to obtain the pressure at any given instant measurement is made across the wave envelope and the dimension obtained multiplied by the particular scale.

Travel of Contacts

Trace number 12 shows the travel of the contacts. As the circuit breaker under test is closed before the film record for a break test, the trace is a straight line until the opening stroke. A detailed explanation of such a trace was given in article 4, in connection with the no-load timing test record. Little more can be added to what has already been said, except that the slope of the stepped portion is greater than on the no-load test. This is explained by the fact that on a short-circuit test there are additional forces acting on the contact carrying bar to what is the case in a no-load test. In a no-load test the forces on the contact carrying bar consist of those due to gravity and the accelerating or "throw off" springs. In a power test, these forces are augmented by gas pressure which acts on the arcing contact surface and an electro-magnetic force acting on the contact carrying bar. These forces vary with the value of the short circuit current. Their effect, of course, is to accelerate the opening of the circuit breaker and thus the slope of the travel record is correspondingly increased.

Closing Coil Current Trace No. 13

This is not recorded in Fig. 9, since no

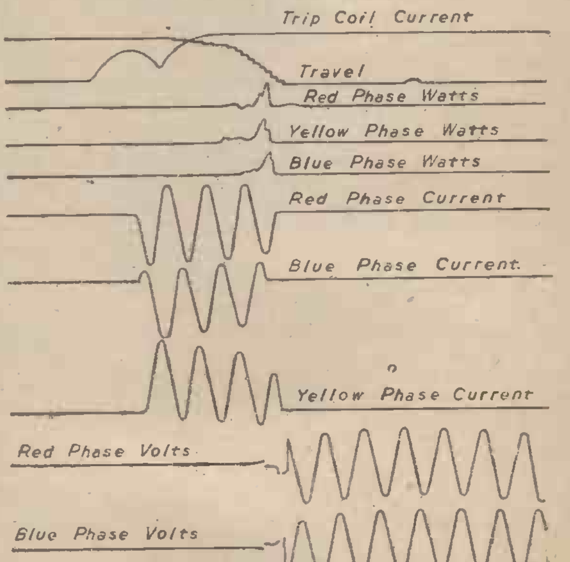


Fig. 13.—Oscillograph record of make-break test. Breaking current asymmetrical.

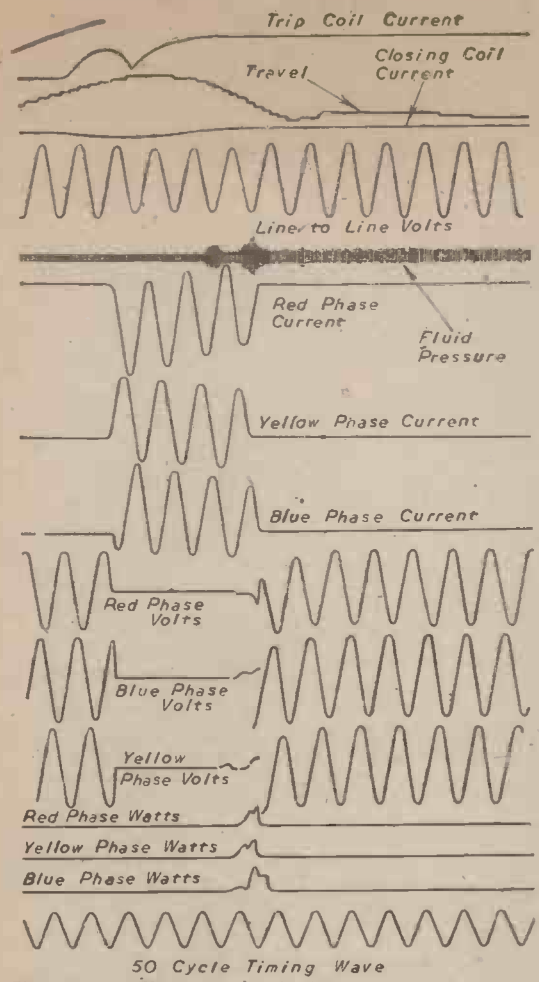


Fig. 12.—Oscillograph record of break test with breaking current asymmetrical.

closing of the circuit breaker is affected during the film record as explained above.

Trip Coil Record

This is shown in trace number 14. The shape of the trace and general features were discussed in some detail in article 4. It is not proposed to add anything further since no additional features are found in the power test.

50-cycle Timing Wave

This record in trace number 15 is the same in every way to the one described for the no-load test in article 4.

Having considered in some detail the features of a typical record, the reader should find little difficulty in understanding the shape of records shown in Figs. 11, 12 and 13.

Figs. 11 and 12 are records of make break tests. In Fig. 11, the D.C. component of the current never exceeded 20 per cent. in any one of the phases and it is therefore a symmetrical test. In Figs. 12 and 13, the D.C. component exceeded 50 per cent., thus making them asymmetrical tests. The main additional feature in Figs. 11 and 12 is the closing coil trace. This is shown in trace number 3. The closing coil of a circuit breaker is an inductive winding and the current in it follows the same law as that described for the trip coil in article 4. Generally speaking there is an initial rise of current in the coil. This is followed by a decrease as the plunger is attracted into the coil. A little observation of Figs. 11 and 12 will show that this dip coincides with the completion of the first stepped portion of the travel record. The reason for the dip in the trip coil trace being more pronounced than that of the closing coil is explained by the fact that the trip coil plunger moves considerably faster than the one in the closing coil. The closing coil plunger has to actuate the closing mechanism of the circuit breaker, whereas the trip coil plunger is free to move through the coil and does no work until it reaches the top of the coil, where it knocks off the toggle catch by reason of the momentum it has gained in its travel.

Methods of Measuring Test Results from Oscillograph Records

Before considering the short-circuit test records some reference will be made to the data obtained from the no-load timing test record shown in Fig. 8 (article 4). One of the main items of data obtained from this record is the "Instant of Contact Separation." The line x—x through the record, Fig. 9, represents the instant of contact separation and it will be recalled that this line was obtained from the no-load record. The indication of the instant of contact separation on this latter record is given by a step in the top current trace. There are, of course, several other values which may be taken from this record, but these may also be obtained by reference to the short-circuit oscillograms.

Values Obtained from Short-Circuit Records

The following list of values are obtainable from short-circuit records.

(1) Applied generator test voltage.
(2) Recovery voltage.
(3) Making current.
(4) Breaking current.
(5) Power interrupted.
(6) Energy in arc.
(7) Arcing time.
(8) Making speed.
(9) Breaking speed.
(10) Short-circuit duration.
(11) Opening time.
(12) Make break time.
(13) Total breaking time.
(14) Fluid pressure.

Two other values, viz.: Short time current and system power factor, will be discussed in a later article.

We shall now consider the official methods of measuring each value mentioned in the above list.

Applied Generator Test Voltage

Fig. 14 shows a pure sine wave symmetrically disposed about its zero axis representing the applied generator voltage. The voltage wave envelope is measured as indicated

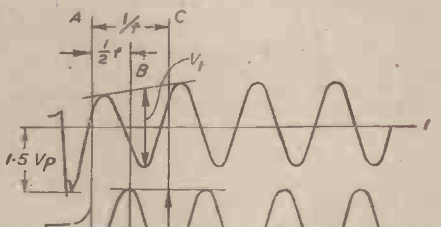


Fig. 16.—Measurement of recovery voltage by phase components.

by the line A—B. This dimension is then multiplied by the voltage scale and divided by $2\sqrt{2}$. Thus: $-V = \frac{A.B. \times \text{scale}}{2\sqrt{2}}$ volts. The measurement is made on the oscillograph record at the instant immediately before the short circuit occurs.

Recovery Voltage

There are two ways of measuring recovery voltage. One is to measure from the line-to-line generator voltage traces, and the other is

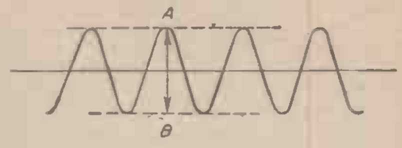


Fig. 14.—Method of measuring generator line-to-line test voltage.

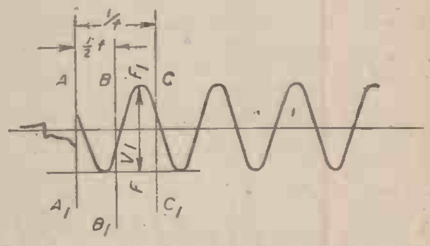


Fig. 15.—Measurement of recovery voltage from line-to-line volts.

to derive it from the phase components of the voltage. Fig. 15 demonstrates the first method. The line $A—A_1$ is the instant of final arc extinction. $B—B_1$ is drawn in at a time ½f from the line $A—A_1$ where f is the normal power frequency. $C—C_1$ is drawn in at the instant 1/f from the line $A—A_1$. The recovery voltage is then found by measuring across the voltage wave envelope at the peak which occurs after the instant ½f from $A—A_1$, and not later than the line $C—C_1$ or 1/f from $A—A_1$. This measurement is shown by the line V_1 between the points $F—F_1$.

The recovery voltage is then given by:

$$\frac{V_1 \times \text{scale}}{2 \times \sqrt{2}}$$

The phase component method is shown in Fig. 16. In each phase the same instants of measurement are used and the values computed in the same way as for the line-to-line method. The recovery voltage is then computed as follows:

$$\text{Recovery voltage} = \frac{V_1}{2 \times \sqrt{2}} \text{ for phase No. 1}$$

$$\text{Recovery voltage} = \frac{V_2}{2 \times \sqrt{2}} \text{ for phase No. 2}$$

$$\text{Recovery voltage} = \frac{V_3}{2 \times \sqrt{2}} \text{ for phase No. 3}$$

Therefore average recovery voltage:

$$= \left[\frac{V_1}{2 \times \sqrt{2}} + \frac{V_2}{2 \times \sqrt{2}} + \frac{V_3}{2 \times \sqrt{2}}\right] \div 3 \times \sqrt{3}$$

$$= \left[\frac{V_1 + V_2 + V_3}{2\sqrt{2}}\right] \div \sqrt{3}$$

In phase No. 2, Fig. 16, it will be noticed that the voltage peak occurs at the exact instant ½f from the line $A—A_1$. When this happens the measurement across the voltage wave envelope is made at the peak immediately following, as shown by the line V_2.

In the case of a short-circuit test on one phase only of a 3-phase circuit-breaker the recovery voltage is given by $V_1 = \frac{\sqrt{3}}{1.5} \times$ value across voltage wave envelope.

For a test on a single phase breaker the value would be merely the value across the voltage wave envelope. In both these cases measurement is made at the same instant as for the full 3-phase test.

In addition to recovery voltage as described above, B.S.S.116/37 contains clauses which determine the minimum value of "Active Recovery Voltage." This, however, is closely connected with the high-frequency re-striking voltage and it will be more convenient to discuss the two matters together in a later article.

Making Current

This is taken from the current zero line to the peak of the wave of the first major loop of current after the instant of "Contacts make" or short circuit. The measurement is then multiplied by the scale to give the current value. Reference to Fig. 17 will make this clear.

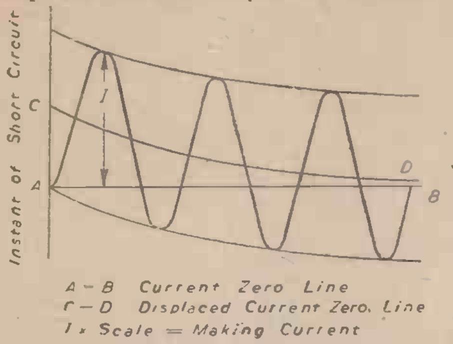


Fig. 17.—Measurement of making current.

Breaking Current

This is measured at the instant of contact separation. If the D.C. component exceeds 20 per cent. in any phase the current is said to be asymmetrical. For an asymmetrical test, however, the D.C. component in one of the phases must exceed 50 per cent.

Fig. 18 sets out the method of determining the breaking current. The line A represents the current zero line. C.D. represents the displaced current zero line. E.F. represents the R.M.S. value of the symmetrical current at any instant measured from the line C—D. G.H. is the instant of contact separation. J is the value of the D.C. component of the current at the instant of contact separation. K is the peak value of the A.C. component of the current at contact separation. The percentage of D.C. component at the instant of contact separation is then given by:

$$\frac{J}{K} \times 100$$

The value of the symmetrical breaking current is given

$$I_{sy} = \frac{K}{\sqrt{2}} \text{ amps.}$$

The asymmetrical breaking current is computed thus:

$$I_{asy} = \sqrt[2]{\left[\frac{K}{\sqrt{2}}\right]^2 + J^2}$$

In the next article a typical record will be given and actual values computed from it.

(*To be continued.*)

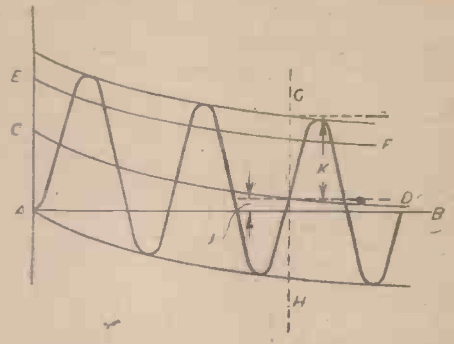


Fig. 18.—Measurement of breaking current.

Charging Car Batteries

Various Methods of Charging 6- or 12-volt Car Batteries at Different Rates from A.C. and D.C. Mains are Described, and Constructional Details are Given of Easily Made Chargers

It is not very often that a car battery becomes completely discharged, but when it does it is a great convenience to be able to charge it at home, or at least in the home garage. After all, it is a bulky and heavy item to have to carry to a charging station and the modern car with coil ignition cannot be run without it.

A charging rate of 2 amps. is adequately high if the battery is to be given merely a "refresher" at frequent intervals, but it is rather low when the accumulator has been completely exhausted—due to leaving the ignition switch on or to having made too much use of the starter, for example. In such a case as this it is desirable to recharge at a rate of at least 3 amps., whilst a good deal of time can be saved if about 5 amps. can be passed through the battery.

Charge and Discharge

This point can be best understood when it is remembered that as much power must be put into the battery whilst charging as is taken out during discharge. Thus, a battery rated at 50 ampere-hours, for example, would require to be charged for 50 hours at 1 amp., whilst it could be brought up to full capacity by charging for 25 hours at 2 amps. or only 10 hours at 5 amps. Actually, these figures assume that the process of charging is 100 per cent. efficient, and it is generally most satisfactory to charge for a few hours longer than the theoretically correct length of time.

Rather than charge for any calculated or estimated time it is best to continue charging until the specific gravity of the acid attains the correct figure which is quoted on the case or in the car instruction manual; this is generally about 1.300, and is measured by means of a hydrometer, as shown in Fig. 1. Another method is to continue charging until the cells gas freely, so that bubbles can be seen, and heard, coming through the surface of the acid. After bubbles first appear, charging should be continued for a few more hours.

Charging at 6 volts 2 amps.

The main purpose of this article is to describe the construction of one or two different types of battery charger which can be easily assembled from standard parts. In the first place, it will be assumed that supply of

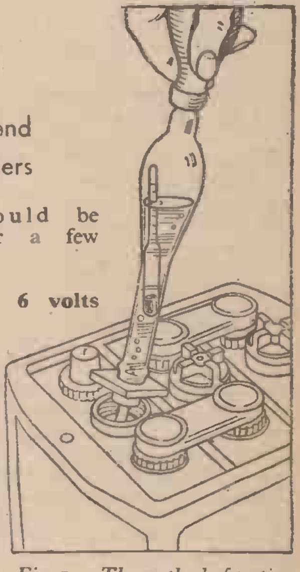


Fig. 1.—The method of testing an accumulator by means of a hydrometer. A reading of about 1.300 should be obtained when the battery is fully charged.

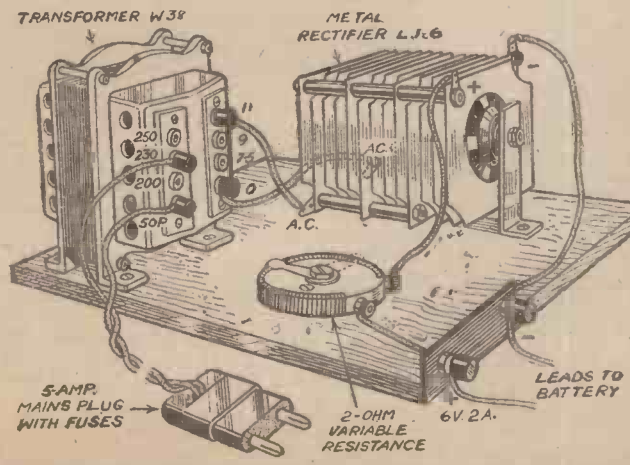


Fig. 2.—Constructional details for a simply and easily made charger, using standard components. The slider is connected to the right-hand terminal.

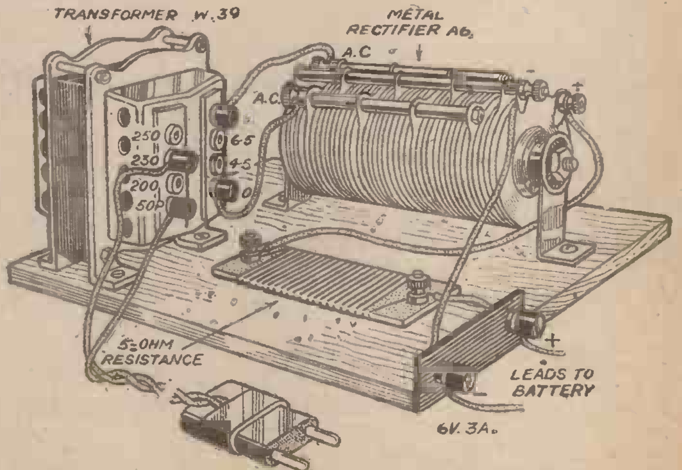


Fig. 3.—A charger employing an A.6 rectifier and intended for an output of 3 amps. The home-made resistance should be supported on pillars to permit of air circulation around it.

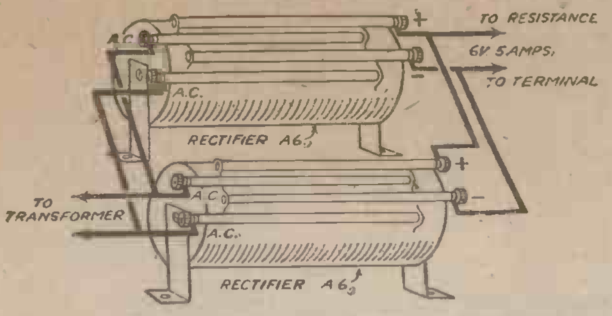


Fig. 4.—A 6-volt accumulator can be charged at about 5 amps. by connecting two A.6 rectifiers in parallel, using a special transformer.

alternating current (A.C.) is available in the garage or in an outhouse, and that a charging rate of 2 amps. is required for a 6-volt battery. The only parts required are a couple of 1 amp. fuses, a mains transformer, a metal-oxide rectifier, and a controlling resistance; a pair of terminals can be added as a convenience, if desired. The method of connecting the parts together is shown in Fig. 2. The rectifier is a Westinghouse, style L.T.6., the transformer is a Heayberd, type W.38, and the resistance a Heayberd 0-2 ohms variable one. The fuses are contained in the two-pin, 5-amp. plug, which is a Bulgin, type P 27; the terminals may be a pair of ordinary wireless type mounted on a strip of ebonite or on a Belling Lee mount.

Connecting the Components

All the parts can be mounted on a small wooden baseboard, and connected together with short lengths of flex similar to that used for making connection with the mains power point. The wire, incidentally, should be of good quality. Normally, the slider on the variable resistance should be set to the approximate position shown, and it can be left in that position afterwards. It will be seen that there are four output terminals on the transformer, but only the two indicated are required in this case; these are alternative primary terminals for the mains-lead connections and that marked 50P should be used in conjunction with that marked to correspond with the voltage of the mains supply. Generally the 230-volt terminal will be used, but the voltage of the mains can be ascertained by examining the plate on the supply company's meter.

Modifications for 12 volts

Precisely the same arrangements can be used for charging a 12-volt accumulator at 1 amp. by using a Westinghouse, style H.T.5 rectifier, in conjunction with a Heayberd, type W.37 transformer, and setting the slider of the variable resistance to the position indicated by broken lines in Fig. 2.

A Higher Charging Rate

The above chargers are in the nature of trickle-chargers, but a 6-volt accumulator can be charged at 3 amps. by employing the circuit shown in Fig. 3, where the Westinghouse rectifier is a style A.6 and the Heayberd transformer a type W.39. In this case a small fixed resistance of .5 ohm and capable of carrying 3 amps. is required, and this could be bought ready-made or it could be constructed by winding 30in. of 20-gauge Eureka resistance wire on a strip of hard fibre or asbestos as shown. The turns of the wire should be slightly spaced and the ends of the winding should be joined to a pair of terminals passed through the former. Were it desired to charge at a still higher rate a charging current of about 5 amps. could be obtained by connecting two A.6 rectifiers in parallel as shown in Fig. 4, and using a special transformer obtainable from the makers previously referred to. Those who have some knowledge of electrical apparatus might expect the charging current to be doubled by using two rectifiers in parallel, but there is a slight loss of efficiency when this system is employed, and this accounts for the theoretically low current mentioned.

When it is desired to charge a 12-volt accumulator at 3 amps. this can be arranged by connecting two A.6 rectifiers in series as shown diagrammatically in Fig. 5. In this case a special transformer is required, and can be obtained at slightly extra cost, which has two secondary windings, since each rectifier must be fed separately. It will also be seen that two controlling resistances are employed

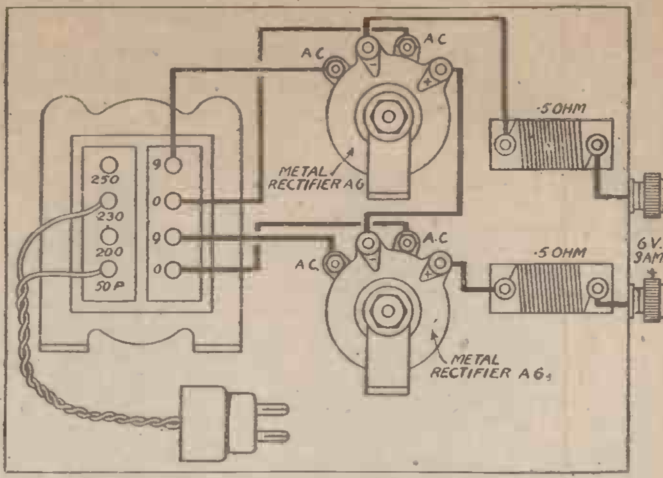


Fig. 5.—A diagrammatic circuit for a 5 amp. charger for a 12-volt battery.

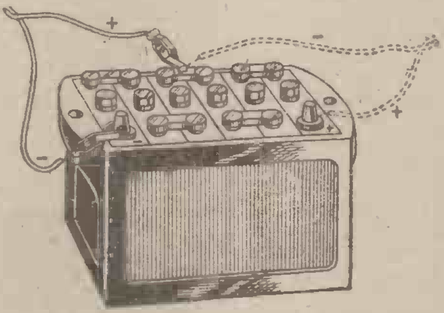


Fig. 6.—When other means are not available a 12-volt car battery can be charged in two halves.

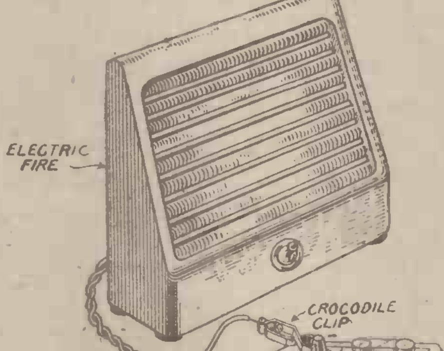


Fig. 7.—A method of charging from D.C. mains. Great care must be exercised in doing this.

Charging at a Higher Rate

If a 12-volt accumulator is to be charged at a higher rate than 3 amps. the problem is not quite so easy of solution, because there is no standard rectifier available except at a high price; consequently, it would probably not be thought worth while by the average owner-driver who wishes only to charge his own car battery, and, perhaps, the wireless batteries, at comparatively infrequent intervals. The simplest method is to charge the complete accumulator in two halves—this is often a simple matter due to two separate batteries being employed. When the single unit is used the method of connection for each half is as shown in Fig. 6, where it will be seen that connection is first made to the positive lug and to a bus-bar, and then to the negative lug.

Using D.C. Mains

When D.C. mains are run into the garage or house either a 12-volt or 6-volt battery can be charged with equal ease, although less efficiently. This is because the voltage of a D.C. supply cannot be "stepped down" by means of a transformer, but must be "wasted" or "dropped" by including a resistance in circuit. A very simple method of charging is as shown in Fig. 7, where an electric fire is connected in series with the battery and the mains supply. If the fire is of the 1-unit type the charging rate will be nearly 5 amps., and it can be increased to nearly 10 amps. (this higher rate is recommended only for a very large battery) by using a 2-unit fire, or by switching the second element into circuit when the fire is of the 1-unit or 2-unit pattern.

It is scarcely necessary to mention that this system must not be adopted in the garage, where there would be a danger of causing conflagration due to the use of the "open" fire. And when charging is carried out in the house the battery must be well away from the fire and from naked lights, and must also be placed on a sheet of lead or large enamelled plate to avoid possible damage to the floor covering by the acid spray which is liberated when the accumulator is nearly fully charged. Another point to be watched is that the correct polarity be applied to the battery terminals, and this must be determined by the use of pole-finding paper. Even this must be carried out with care, and for this reason persons whose knowledge of electricity is very limited are strongly advised against the use of D.C. supplies for charging purposes. If pole-finding paper is used care must be taken that the bare ends of the wire are not touched by the fingers; for this reason the leads should be held with strips of rubber from an old inner tube.

Inventions of Interest

By "Dynamo"

Day Shaving

OWING to the minutes spent in lathering, the old-style morning shave occupies more time than is convenient when one is hurriedly preparing to leave for business. Consequently, the dry shaver is a time saver.

But the distinct advantage gained in this respect has to be paid for. An objection to electric shaving is that it is costly.

However, one remembers that in its early days the safety razor involved a considerable outlay. But after a few years it came within the compass of the common purse. And so the electric shaver will doubtless eventually be materially reduced in price.

This economy has been foreshadowed by an inventor if he can substantiate his claim that he has produced a dry shaver which not only makes for improved shaving efficiency but can be cheaply and accurately manufactured.

The applicant for a British patent for this device states that shaving implements of this type usually comprise co-operating inner and outer shearing members, These, he asserts, have blades formed by a series of slots not below .008in. or over .012in. in width.

Manufacturing difficulties and waste, the inventor declares, are involved in forming such narrow slots accurately in solid steel. And the cost of production is high.

The new apparatus has inner and outer shaving members provided with co-operating shearing blades. These are formed by producing a series of transverse slots in the blank for each member by one or more cutters or grinders with a bevelled peripheral edge. As a result only the bevel edge penetrates the blank. The slotted members are so folded to shape and assembled in shearing relation that the faces which were remote from the cutter or grinder are brought together.

Sunshine Roof

AN inventor has thought out what he contends is an improved sunshine roof for cars. He has aimed to devise a construction of this kind which is inexpensive, neat in appearance and easy to manipulate.

His idea comprises the combination of a fixed outer panel made with an opening of segmental or other form. And there is a rotatable member mounted beneath and adapted to close an opening in the outer panel.

Short Landing Runs

A SIMPLE improved form of arrester gear has been devised with a view to shorten the landing run of an aircraft subsequent to its touching down on alighting on a confined space. For example, a small field and the deck of a ship have both a limited landing area.

This gear comprises at least one cross-wire for engagement by the tailwheel or arrester gear pick-up of an aircraft in landing. And there is a mass of substantial weight operatively associated with the ends of the cross-wire in order to provide the arresting force.

In preferred constructions there are a number of cross-wires to be successively engaged by the aircraft when it is pulled up on its landing run immediately after touching down. And, preferably, the mass is arranged so that additional increments of it supplying the arresting force become effective in successive stages.

Photographic Printing Paper

A PROCESS relating to photographic printing paper is the subject of an application recently accepted by the British Patent Office.

The inventor points out that one of the disadvantages in using ordinary photographic printing paper has been the fact that the paper after washing takes a considerable time to dry. The reason is that not only has the photographic emulsion to be dried out, but the paper base has also to be freed from moisture.

Normally, paper absorbs water, and a large part of the drying time is usually taken up in drying the paper base.

This disadvantage, states the inventor, can be overcome by using waterproofed paper as the material for the base. But the selection of a suitable waterproofing agent presents its own difficulties. Such an agent must be capable of being readily coated on the paper; it must be practically colourless, and it must have no deleterious effect on the photographic emulsion.

Moreover, the waterproofed paper must have, in addition to good water resistance, a high degree of flexibility. And there must be no tendency for the waterproofing material to separate from the paper. Further this material must be quite inert to the processing solutions. For example, it must be unaffected by the alkali developers.

It is likewise desirable that the quantity of material necessary to give satisfactory waterproofing should be small.

The newly devised photographic material includes a paper base carrying a coating of what is called a hydrophobic polyvinyl acetal resin on each surface and having at least one photographic emulsion layer. Only a very thin coating of the paper base with the resin is necessary to secure excellent waterproofing.

> The information on this page is specially supplied to "Practical Mechanics" by Messrs. Hughes & Young, Patent Agents, of 7, Stone Buildings, Lincoln's Inn, London, W.C.2, who will be pleased to send free to readers mentioning this paper a copy of their handbook, "How to Patent an Invention."

For Trolley Buses

A STEERING indicator for trolley buses is the subject of an application for a patent which has been accepted by the British Patent Office.

The inventor points out that indicators which reveal to the driver merely the angle between a horizontal projection of the poles and a line representing the direction of the vehicle's progress are ineffective. This is due to the fact that the vehicle may assume a considerable angle to the direction of the trolley wires without the angle giving any indication of such condition. In that case, the indicator would imply that all was well with the direction of the vehicle, whereas actually it would be proceeding laterally away from the wires.

The main object of the improved invention is a steering indicator free from the above objection.

The arrangement embodies a trolley shoe for engaging a trolley wire. And mechanical means connect the shoe with a pointer visible to the driver. This invariably points in a direction parallel to that of the trolley wire. And there are means which indicate to the driver the angularity between a vertical projection of the trolley pole and the longitudinal axis of the vehicle.

The invention also consists of indicating means comprising a spring-urged brush engaging a series of contact strips controlling indicating devices visible to the driver.

Situated in a corner of the vast grounds of Horton Emergency Hospital, in Surrey, is a low-lying building, which attained peculiar significance during the war years. It is a research department in the world-wide battle against malaria. In our illustration early pioneers in the fight against this dreaded disease look down from the walls of the laboratory to watch Mr. P. G. Shute, Assistant Malaria Officer to the Ministry of Health, at his research work.

Masters of Mechanics—106

Aimé Argand

The Story of the Oil Lamp

IF we were to call Aimé Argand the "Father of the Oil Lamp," we should invest him with a title which belongs to the past, for, with the exception perhaps of the railway companies which still pin their faith to oil as an illuminant for long-distance signals, the users of oil lamps are becoming increasingly few.

To-day, the oil lamp, apart from its employment for a number of specialised purposes, is becoming very much a back number. True, it must yet be used in many villages and hamlets which do not possess an electric supply. Nevertheless, whenever electricity becomes available at reasonable rates, even the best of oil lamps rapidly and invariably succumbs to the greater convenience of electric light.

There was a time, however, when the nowadays despised oil lamp was regarded far and wide as a new-fangled gadget. People even looked upon it with suspicion in consequence of the ease and the reliability with which it shed its mellow light around it.

Those were the days, nearly a hundred and fifty years ago, when the contemporary generation had been brought up to regard tallow candles as the best and the most reliable source of artificial illumination.

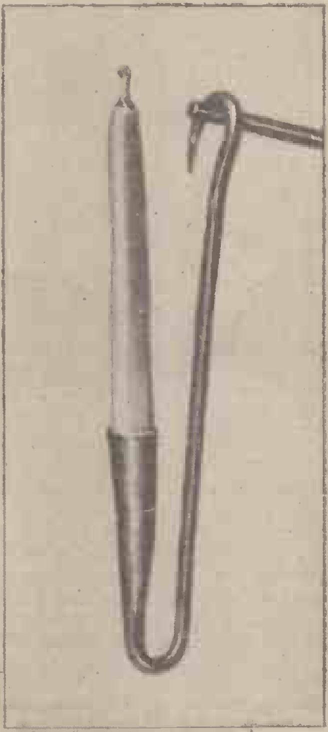
Even lighthouses used candle light in those times, the famous Eddystone lighthouse employing a group of tallow candles arranged on a hoop-like frame for more than 40 years before it went over to the then more advanced oil lamp illumination.

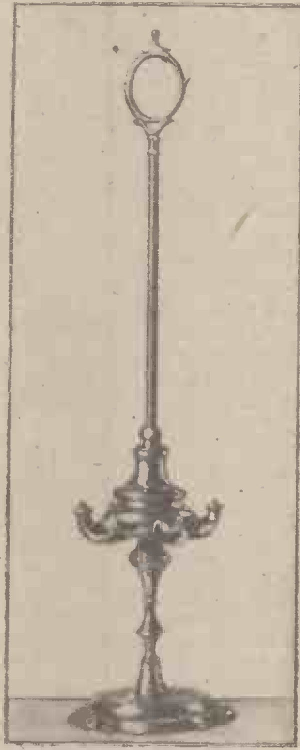
"Penny Dips"

The candles of those days were considered to be an improvement on the older "rushlights," which latter were made by soaking dried rushes in molten fat and grease of all kinds, but even these old tallow candles—"penny dips" they were frequently termed after their price had become standardised—were anything but pleasant to use. They contained wicks of loose tow, which required frequent trimming during the burning of the candle in order to keep the flame from going out. The soft tallow would nearly melt under the heat of the hands, so that during the burning of the candle it ran away from the flame, the greater amount of it, perhaps, escaping combustion, whilst the tallow which did actually burn gave forth such an overpowering smell that the olfactory discomfort created by the burning of several candles in a room could often be very great.

Bad, however, as were these old-time tallow candles or "dips," the crude oil lamps which essayed to compete against them for domestic usage were, in the main, many times worse. Oil lamps of one description or another had been used in this country since the times of the Romans. Such devices employed a rope-like wick which dipped into an oil reservoir and burned with a small, smoky flame at the upper end. And even when colza oil, a vegetable product, was introduced to burn with a clearer and brighter flame, the oil lamp was still denied popularity. It was too messy to be of much use. Its illumination was no better than that of a candle, and its smell was usually much worse.

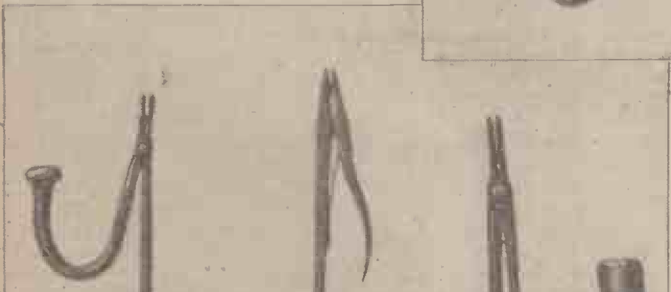
A close up view of a tubular wick burner constructed on Argand's principle.





(Above right). A "Lucerna" or brass oil lamp. It burned colza oil from four wicks and was used even as late as the end of the last century.

(Above left) An original "penny dip" or tallow candle in a contemporary (eighteenth century) iron candle holder. This provided the illumination which, before the oil lamp, sent our forefathers "early to bed."



Before the oil lamp—old-time iron rushlight holders used in cottages and farmhouses throughout England.

Britain, therefore, at the time of the French Revolution, which took place towards the end of the eighteenth century, clung to her native tallow candles in spite of the greater headway which the oil-burning lamp made on the Continent.

A Fundamental Notion

It was a few years previous to the revolutionary turmoil on the Continent that Aimé Argand, a Swiss-born physician, arrived on the scene with a fundamentally new idea in the realm of oil illumination. Argand was merely a poor doctor and nobody of importance took much notice of him. Indeed, the French Revolution more or less extinguished his hopes of getting his invention generally accepted, the result being that this man, whose invention was a genuinely brilliant notion and one on which a whole multitude of oil lamps were afterwards fundamentally based, fell into a decline of mind and body, from which he never subsequently recovered.

Aimé Argand was one of the world's many *bona fide* inventors whom Fate has dealt with most unkindly. Posterity has just about preserved his mere name, but of his life-history, his environment, and, above all, his personality, little reliable information has survived. Argand, whatever his failings may have been, experienced much unfair dealing. His patent action was lost, and for the work, the efforts and the hopes which he put into his invention, he gained nothing in return.

Aimé Argand seems to have been born in the year 1755. The record of his birth is obscure, but there is no doubt that his birthplace was Geneva, Switzerland, then, as now, an important centre in the affairs of Europe. His parents were able to give him a basic education and to equip him for the short medical training which then sufficed to make a man into a physician.

Had Argand kept strictly to a medical career his life-history would assuredly have been very much different from that which it actually turned out to be. But Argand's mind persisted in straying far beyond the bounds of the then severely restricted domain of medicine. He studied the scientific chemistry which was just taking its rise in England and on the Continent, and he apparently made some sort of a hobby of mechanics and constructional work. Argand, in fact, possessed an original mind, a mind which, filled with the ever-increasing scientific knowledge of the day, was quick to investigate clues and to follow up possibilities.

Argand was fond of England, as many of the Swiss are, and he came over to our country about 1783. It has been asserted that he made his oil lamp invention in this country, but this is almost certainly untrue, for he had had dealings respecting the lamp with other people in France before he came over here.

We have already noted that the early oil lamps had rope-like wicks, which were, in fact, very often merely pieces of waste tow. Some time after the middle of the eighteenth century a Frenchman named Lexiere suggested the use of a flat wick for an oil lamp instead of a round wick, his idea being that by admitting a greater surface area to combustion, the latter would be more perfect and thus produce more light and less smoke.

The idea was adopted fairly universally. Flat wicks were certainly cleaner in use than the round, rope-like ones, but their illumination improvement was very little.

The Smokeless Oil Flame

Exactly when, how, and where Aimé Argand gave himself and his inventive mind over to the subject of oil lamps is not known. Nevertheless, his invention seems to have been a fairly readily made one. It was clear to him, as it had been to many people before him, that the main cause of the smokiness of an oil-lamp flame was the incomplete burning of the oil. Indeed, the great and justly renowned Leonardo da Vinci, who died as far back as 1519, had come to the conclusion that an "overpowering draught of air" would render an oil flame less smoky, but, despite this prophetic utterance, nobody had ever given much attention to the problem.

Very probably it was in his Geneva home that Argand first worked out the principle of his oil lamp. He conceived the idea of having a tubular wick, a wick whose cross-section was that of a ring. The wick fitted into a hollow cylinder up which a current of air was allowed to pass. In this manner the resultant circular oil flame was supplied with air on both its inside and its outer side.

Argand found that by this means the flame burned brighter and much more steadily. He also found that the oil consumption decreased. Still the flame continued smoky. In order to draw off the smoke he arranged an iron tube or cylinder directly above the flame. This had a good effect, for, by increasing the speed of the uprising air, it made the flame burn still a little brighter.

Legend has a habit of entering into the circumstances of many basic inventions. And in the history of Argand's discovery this legend element has entered into it to some extent.

Argand's Accident

Anyway, it appears that Argand's brother amused himself one day by "fooling about" with a broken oil flask, the bottom of which had dropped out. This, by a mere chance, he happened to place around the flame of his brother's tubular wick oil lamp. Immediately, to the lad's astonishment, the flame jumped up into a previously unattained brilliance, and all its smokiness disappeared.

The incident at once set Aimé Argand on the idea of the glass cylinder which fitted around the burning flame, and by creating that which old Leonardo da Vinci had long ago called an "overpowering draught of air," had so speeded up and improved the oil's combustion that the smokiness, that centuries old characteristic and drawback of oil illumination almost completely disappeared.

Thus came into being not only the first of the present-day forms of oil lamps, but also the first oil lamp in which the flame burned within a glass enclosure.

There was no doubt that Argand's lamp represented a revolutionary improvement on the older types of oil lamps. Yet from the very first its inventor had trouble with it. Not long after Argand had published the details concerning it a Frenchman named Ambroise Langé, of Paris, came forward with the claim that he had on a previous occasion invented a form of lamp chimney which, therefore, in his opinion, precluded Argand's claim to be the sole inventor of the lamp.

A pre-war "made in Germany" type of common oil lamp burning paraffin oil by means of a flat wick, and a modern type of portable oil lamp constructed on Argand's principles. It is fitted with a parabolic reflector to direct the illumination.

The Joint Patent

Foolishly, Argand, instead of challenging Langé to prove his contention, entered into an agreement with him to patent the lamp invention in their joint names and to share the eventual profits.

A patent was obtained in the combined names of Argand and Langé, but when the manufacture of the lamps began in Paris, the tinmen of that city conceived the invention to be antagonistic to their own interests and declined to manufacture it.

Then came the French Revolution and a new French Government, which issued a decree abolishing all patents, proprietary rights and other exclusive privileges.

Before the French Revolution broke out in all its initial fury in 1789, Argand, as we know, had been over to England. It appears that soon after he came to this country he sought to arrange patent rights and manufacturing licences in Britain. Apparently he got into touch with an influential individual named Parker after having obtained a British patent for his invention (Patent No. 1425, March 12, 1784). Parker introduced him to the celebrated Matthew Boulton, of Soho Foundry, a partner of James Watt, and at that time indisputably the "king" of the British manufacturing industry.

British Patent Invalid

No sooner had the Soho foundry got going with the Argand lamp than a host of imitations flooded the market. Argand, and to some extent Boulton, endeavoured to stem the avalanche, but without effect. The lamp was easy to make, and it could be produced almost by anybody.

But the final blow came in 1786 when, at some legal proceedings, the validity of Argand's patent was challenged by the opposing interests. A clever lawyer was able to prove the ground of "prior disclosure," with the result that the Argand lamp patent was declared to be invalid.

Under the date February 24, 1786, Matthew Boulton wrote to his partner, James Watt:

"The Judge and Jury have this day given all the merit of the lamp to Argand, but, at the same time, they have given a verdict against him in consequence of Maggelan and another proving that ye invention was introduced in England a few days before ye date of his patent, although Maggelan said he could not answer precisely the dates as he had lost his first letter from Paris. Poor Argand is oppress'd with grief. Some of the Jury express'd their reluctance at giving a verdict against Argand, but bow'd obedience to the letter of the law. The verdict was certainly not just."

Had the British patent been upheld as regards its validity there is no doubt that both Boulton and Argand would have reaped much gain from the manufacture and sale of the lamp. Both of these individuals lost money over the action, but to Matthew Boulton, a rich man, the financial loss was of little consequence. Indeed, he did afterwards manufacture Argand's lamps until the end of the century, but, of course, he comprised only one of many competing manufacturers.

Boulton does not seem to have done much for the luckless Argand after the failure of the lamp patent. In fact, he seems to have almost forgotten about him altogether. Other people's misfortunes hardly interested the great Matthew Boulton, and they certainly did not concern his scheming partner, James Watt.

So it was that Argand quietly left England and returned to France. In the following year (1787) he established an oil lamp factory at Versoix, near Geneva, but this ceased to function with the outbreak of the French Revolution two years later, and with the demise of the Versoix factory, Argand's hopes, efforts and aspirations ceased for ever.

From that time onwards he lived a secluded and a retired life, almost without friends, almost without income.

At last, worn out by trials, tribulations, vexations, disappointments, and last, but not least, by continued lack of means, Aimé Argand died on October 24, 1803, entirely friendless and unknown.

Both in Britain and on the Continent, Argand's lamp invention, now used without restriction, soared onwards and made fortunes for many. It popularised oil lighting and, in due time, was applied to gas burners. Even to this day the Argand gas burner remains a well-used article.

Rocket Propulsion

A National Rocket Society: The British Interplanetary Society: The "Lunar Space-vessel"

By K. W. GATLAND

(*Continued from page* 417, *September issue*)

As may be gathered from the foregoing, particularly with respect to the development of powder rockets, a great deal of the research carried out by one group has invariably been nothing more than a duplication of another's prior efforts.

The early rocket groups worked very largely in ignorance of any other similar bodies, and comparisons of their records make it obvious that the continuous repetition of experiment which ensued among the various rocket societies caused much waste of effort, time and money, and hence the rate of pre-war development was a slow process. Only under war conditions, when ideas and resources have been pooled and fostered by unlimited research grants, has anything approaching the ideal been attained in rocket engineering; but the lessons learned from wartime methods are not likely to be forgotten.

A National Rocket Society

It is clear that there is a definite need in rocket engineering for the establishment of a central body, possibly a coalition of the existing rocket societies, whose principal function would be the collection of experimental reports and technical data under a suitable reference system. This would provide intending experimenters of a particular problem with a complete history of any previous work conducted and possibly form the basis for more advanced research.

An organisation such as this would not, in view of the great technical advances of recent years and the limited finances available within the society, hope to sponsor active research, but would give every aid to manufacturers of commercial rockets—particularly those who will be concerned with the development of meteorological rockets, who would in their own interests become Associates of the Society.

Apart from the manufacturers, the group would be open for membership to any person interested in rocket development, and offer various grades of admittance rated on age and technical ability. It would also publish a regular journal keeping its members informed of latest advances in the many fields of rocket research, and, in fact, foster the development of the rocket engine and astronautics in similar vein to the Royal Aeronautical Society, whose pioneer work for aviation has had great bearing on the evolution of heavier-than-air flight.

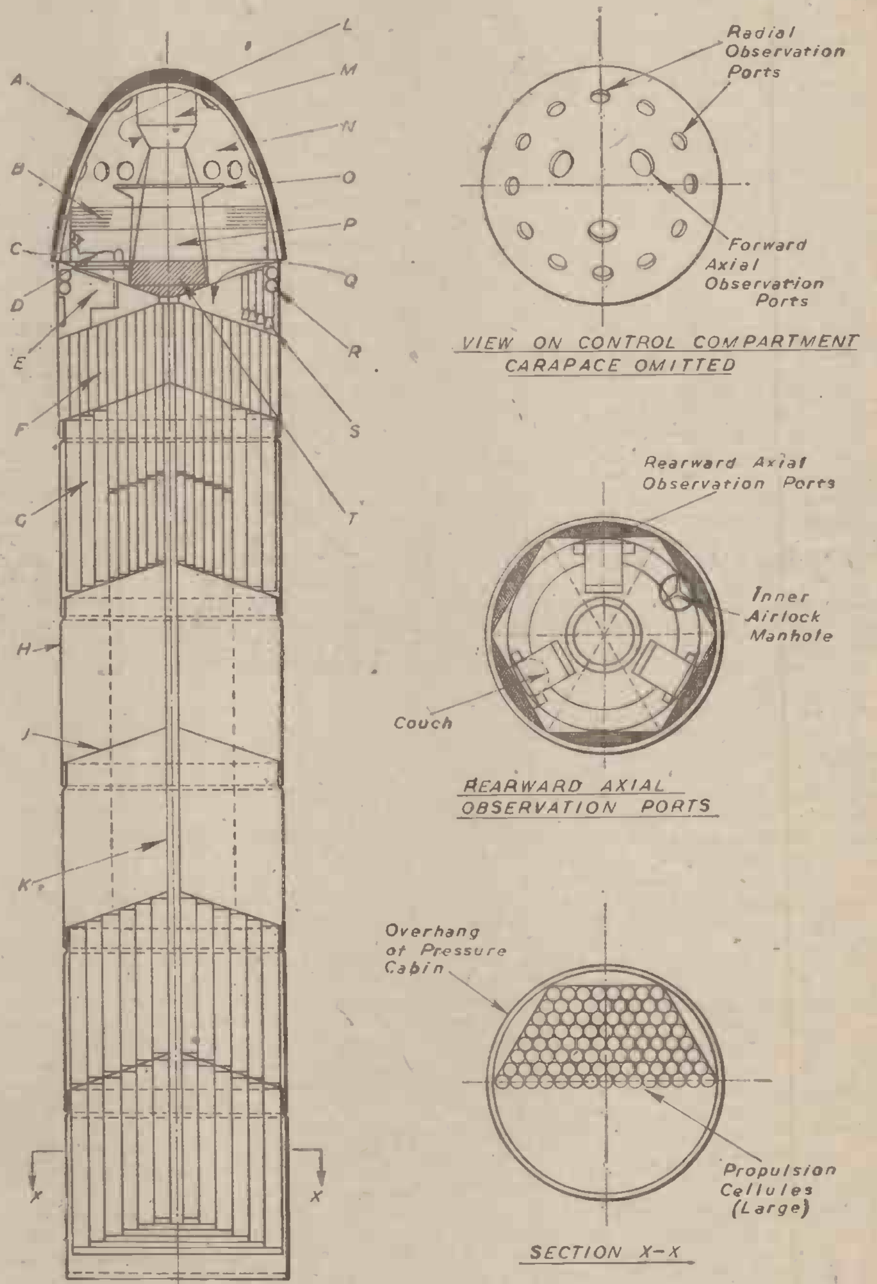
Already a beginning has been made in this direction by the amalgamation, early in 1944, of the two existing British rocket groups, the Manchester Astronautical Association and the Astronautical Development Society, under the title Combined British Astronautical Societies. This is the first positive step toward complete unification, and it is planned that the large national organisation which it is hoped will be the ultimate result of this merger will be recognised by all and sundry, engineer and layman alike, as *the* authority on *astronautics*. In this way it will be possible to direct the development of the science with a minimum financial outlay, and at the same time obtain the fullest advantage from the societies' knowledge and labour.

Other Pre-war Groups

Beside the rocket groups already mentioned, there was also, prior to the war, a Leeds Rocket Society, organised by H. Gottliffe in 1936, and a Hastings Interplanetary Society, inaugurated at about the same time by J. A. Clarke. Unfortunately, both were in existence only a few months.

The Junior Astronomical Association, too, whose headquarters was at Glasgow, added an astronautical section in 1938. The J.A.A., however, ended its activities with the war.

Some mention has already been made of the British Interplanetary Society, and a great deal more remains to be said of this pioneer body whose theoretical studies, prior to the groups' dissolution with the outbreak of hostilities in 1939, have undoubtedly con-



A.—Heat resistant carapace (jettisoned after leaving atmosphere). B.—Walkway. C.—Firing control. D.—Navigator's couch. E.—Airlock.—F.—Propulsion cellules (small). G.—Propulsion cellules (large). H.—Cage. J.—Thrust web. K.—Cable duct. L.—Instrument panel. M.—Parachute compartment (for earth alightment). N.—Shell of pressure cabin. O.—Handrail and supports. P.—Food and tool lockers. Q.—Air, water and liquid fuel tanks. R.—Torque jets. S.—Axial liquid fuel control rockets. T.—Ignition power pack.

Fig. 38.—Sectional diagram of the British Interplanetary Society's "Lunar Space-vessel" conception (1938).

tributed much toward the evolution of the extra-terrestrial rocket. Before going on to review this work, however, a word about the Society's function and of those responsible for its success.

The British Interplanetary Society

Through the enterprise of P. E. Cleator, founder and first President of the B.I.S., Liverpool became the birthplace of astronautics in Great Britain, and from there the first journal of the then new-born science was published in January, 1934. That issue, a six-page official Society booklet, not outstanding in appearance and simply illustrated by hand-carved blocks, will long be remembered by those few engineers whose "revolutionary" ideas were first expressed in its pages.

For a year or two the development of the journal was the Society's prime activity, and with time the "booklet" became increasingly more dignified in appearance, having articles by specialist technicians of almost every branch of science. Its size, too, was much improved, and interest was further stimulated by the inclusion of photographs and line drawings—an achievement not easily maintained by a small amateur group.

In 1936, a branch of the B.I.S. was established in London and the inaugural meeting took place on October 27th.

At about the same time, P. E. Cleator, through pressure of other business, was forced to relinquish the Presidency.

Almost a year later, in the autumn of 1937, the headquarters of the B.I.S. was transferred to London, and at its first City General Meeting, Professor A. M. Low was voted the Society's second President. This post he held throughout the remainder of the group's activity.

In August, 1938, the Society set up a Midlands branch, and early in 1939, as already mentioned, the Manchester Astronautical Association and the Paisley Rocketeers' Society were granted affiliation. This latter agreement brought about increased benefits to members of each group, principally through an exchange of publications. It also involved a better balance of research due to the improved liaison.

In the summer of 1939, meetings of the B.I.S. were held at both the Royal Aeronautical Society and the Science Museum, Kensington. At these places, the Society showed particularly high attendance, which continued on the same level until September when the outbreak of hostilities brought the work of the B.I.S. to an untimely close.

The B.I.S. Space-vessel

The research for which the British Interplanetary Society is best known concerns their theoretical study which culminated in the provisional design of what has been termed the first practical engineering conception of an interplanetary "Space-vessel"—a work which occupied the Society for a year and a half.

Had the war brought no great advances in the field of rocket development, the very mention of "interplanetary communication" would have invariably been met with scepticism, but to-day, in the light of the outstanding strides made in recent years, particularly in the development of the V-2 rocket weapon, there must be few who remain unconvinced of these vast possibilities inherent in the rocket projectile. The V-rocket has given striking evidence in support of the pre-war B.I.S. declaration that, given the necessary backing, an exploratory journey to our satellite, with provision for landing on its surface and returning to earth, could be undertaken with present knowledge, engineering facilities and materials. Such an expedition, it has been calculated, would occupy three weeks, and the Space-vessel design has been based on accommodating a crew of three for that period. The implications of the V-2 rocket have already been mentioned in my previous writings ("All About The V-2," and "More About The V-2," PRACTICAL MECHANICS, January and February, 1945), in which stress was laid on the plausibility of adapting a V-rocket of slightly improved fuel-load as a two-step rocket, the smaller component replacing the explosive head. The calculations, based on an initial overall mass of 20-30 tons, show that the second step having discharged at the "carrier" rocket's greatest velocity would be capable of increasing its speed (approximately 5 km./sec.—3 m.p.s.—at release) to 11.2 km./sec.—7 m.p.s. —the velocity of gravitational escape. By careful timing of the experiment, the small rocket could be made to crash on the Moon.

It must be emphasised that the B.I.S. design is intended to be no more than an intelligent engineering conception of what the B.I.S. Research Committee considered in pre-war days as practicable using then known methods. As has already been pointed out, much advance has been made under stress of war, and doubtless many improvements due to this work will be incorporated when the British group can allow more time to such development.

As yet, nothing of a detailed nature has been attempted, apart from the design and construction of certain radical instruments affecting navigation, which were considered necessary to prove the basis of the design. Much of this work, unfortunately, will need to be duplicated owing to the destruction of the finished apparatus during an air-raid early on in the war.

The Propulsion System

From the diagram (Fig. 38) it can be seen that the layout is somewhat of a departure from any previously conceived "space-rocket." The vessel is designed to use solid propellant, which it embodies in myriads of separate "motors" set in cellular formations, permitting fully 90 per cent. of its mass to comprise fuel. Of this method of construction something has already been said. A principal advantage, it will be remembered, is the elimination of heavy forming members in the rocket structure through the arrangement of the cellular charges in lateral contact. Apart from the life compartment at the rocket "head," the entire strength lies solely in the propulsion charges, which are stacked in conical layers for optimum structural stability. There are six primary layers, or banks of cellules, each hexagonal in section (see Fig. 38), and this arrangement provides the closest possible packing of the charges.

The propulsion cellules, each a precision made "fuel-store" rocket motor, are assembled in groups of varying sizes and powers within the banks, and their ignition is set by an automatic relay causing the tubes to fire in rings according to a pre-calculated sequence.

As can be determined from the diagrams, the largest charges, those employed for take-off and the building up of initial acceleration, are contained in the first firing bank.

When ignited, the thrust of the cellules causes them to lift fractionally from the release pins (which lock each tube in place until firing takes place) until they are expended, when, due to the vessel's acceleration, they disengage and drop away. As each bank is reduced, the light webbing structure and release gear are similarly jettisoned, which all adds to bring about a steady improvement of the fuel-weight ratio—a further important advantage of cellular construction.

The B.I.S. design provides for the greatest possible strength obtainable in a cellular formation, and clearly the maximum fuel density in this arrangement largely dictates the external form—as will be observed, streamlining is conspicuous by its absence.

The nose form is designed not so much to reduce resistance at low speeds but to "part" the air at supersonic velocities and produce a partial vacuum along the sides so as to overcome the effect of frictional heating which might otherwise prove disastrous through detonation of the fuel. The nose attachment, which is provided to fit over the nosing portion of the life-container, is envisaged as a detachable carapace of reinforced ceramic compound. This is intended to withstand the main effect of friction and to release immediately the "Vessel" has risen beyond the atmosphere layer.

The cross-sectional diameter of the body shell is determined by the smallest practical size for the life-container; having in mind provision for the crew of three and the essential requirements, pressure conditioning, controls and instruments, etc., etc., and also the minimum firing area required. The latter consideration is highly important, as if the area were too small, the greater power necessitated would cause excessive pressures in the cellules and entail a heavier construction. Obviously, a balance must be found between the most ideal condition in each instance and the final dimension developed accordingly.

Stability

Since only 0.1 per cent. of the Lunar flight would lie within the bounds of atmosphere, the "Vessel" is provided with no fins or wings as adorn the hyperthetical "space-ships" of popular conception. Working on an acceleration of 2g., the limits of the earth's atmosphere would be passed within three minutes. At this same rate of acceleration, a further period of four minutes would realise gravitational release, and having attained release velocity at approximately 2,410 kms., the ignition would be cut and the "Vessel" allowed to travel under momentum until such time as its forward speed were checked prior to the landing manœuvres. From the time of liberation, the "Vessel" would reach the Lunar orbit within 45 hours.

Stability in the B.I.S. conception takes effect in axial rotation; the "Vessel" rotating once in every three seconds. As the experiments with model rockets have shown, the instance of greatest directional instability is that immediately following launching, and accordingly, a system of launching has been developed which will provide pre-rotation at the required angular momentum.

Artificial Gravitation

The "Vessel's" rotation will also assist by stimulating a gravitation condition during the period of momentum, which is necessary to avoid nervous and digestive disorders that might otherwise render the crew insensible.

As has already been mentioned, the "Vessel's" acceleration would at no time exceed 2g.; a figure easily borne for prolonged periods. This question of acceleration and its effect on the human system is one which has caused much controversy, and there are many who still hold the view that a rocket must necessarily travel at accelerations prohibitive to the carriage of living beings. The truth is simply that, as centrifuge tests have shown, a well protected man in good physical condition is able to withstand accelerations up to 6g. for quite long periods.

Provided with special suits and drugs it should be possible to better even this figure; but it is unlikely that rockets will ever be required to operate at more than about 5g.

(*To be continued*)

The Tempest II

THE Tempest II—which is designed by Sydney Camm, C.B.E.—is a low-wing, single-engined fighter with single fin and rudder and carries a crew of one.

It is powered by a Bristol Centaurus V-engine of over 2,500 h.p., driving a Rotol 4-bladed constant speed propeller.

The armament consists of 4 x 20 mm. cannon situated in the wings. The chief dimensions are as follow:

Span ..	.. 41ft.
Length	.. 33ft. 6in.
Height	.. 14ft. 6in.
Wing Area	.. 302 sq. ft.
Weight	.. About 11,000lb.

No further details of this aircraft may yet be published.

Items of Interest

SAFETY RAZOR LOCKING DEVICE

MANY users of safety razors find that if they screw the blade very tightly it does not cut very well, and when screwed moderately tight the blade becomes slack when in use.

The accompanying illustrations give details of a simple locking device to prevent the blade shifting when in use.

Description of Parts

A is the bottom plate, B is the blade and C is the top plate—all being standard details. D is the "locking" plate (see Figs. 1 and 2), the hole in which could be broached. F is a sleeve, screwed internally. G is a sleeve screwed externally and grooved externally at the blade end, to suit D. The length of the grooved part is equal to the width of D. The part between grooves and thread is turned to bottom of thread diameter, and is wider than D. The centre hole is tapped full length. H is the handle, one end being screwed to suit G, the other end being bored out for lightness.

Assembling of Handle

Sleeve F is threaded on to sleeve G. (Note, it cannot pass over the grooved end.) The handle H is now screwed vice-tight into sleeve G. The three parts, F, G, H, form one unit. Turn sleeve F by hand up to handle H, as shown in Fig. 3. Next slide locking plate over G and up to F.

How to Use

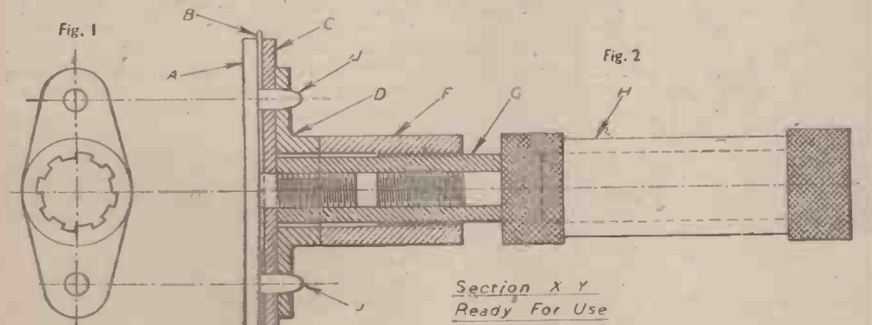
The handle and locking plate are now assembled. Add blade B to plate A, cover with C and screw on the handle, as in Fig. 3. Many users screw tight and slack back a little.

Now slide locking plate D over grooves on G, and also over the two pins J. Screw sleeve F up to D finger-tight.

The razor is now ready for use.

The blade cannot slack back because the handle is locked by the pins J.

To undo, hold the razor vertically, unscrew sleeve F and allow plate D to fall on to F. The handle can now be unscrewed.—A. W. BOASE.



Sectional view and details of a safety razor locking device.

New Gas Lighter

AN improved gas lighter has made its appearance. The originator remarks that a lighter of this kind is frequently a tool with tongs with its two arms resiliently connected together. The flint, which wears away in use, has to be held in one arm and preferably in such a manner that it can be readily adjusted to allow for wear. Commonly in retaining the flint in one arm a screw or other part involving a turning operation has been employed. This increases the cost of production. And it is not always easy to adjust the flint into the most favourable position.

The inventor of the improved lighter has endeavoured to produce a simple form of holder for the flint, so that no turned parts are required, and he affirms that the moving parts are all of the simplest character.

One arm of the tongs has pivoted upon it a lever made as a thumb-piece. This is shaped in co-operation with the arm itself so as to grip a flint by a camming action, by a resilient or spring action, or a combination of both. A further alternative is the pressure exerted by the operator's hand. Then, as the lighter is ordinarily held in the one hand, the thumb is pressed on the lever by the same action which is exerted in operating the lighter. And the flint either remains firmly held or the grip is increased by the thumb pressure.

Atomic Power

Some Technical Insights into a Force which Stopped a War

WHEN on the 16th of July last a new type of bomb was mechanically hoisted to the top of a tall steel tower on the Alamogorod bombing range in New Mexico, and after being likewise automatically released, not only completely destroyed but even vaporised the heavy steel tower, a positively new era was introduced into the world.

On that now historic occasion atomic power, that fundamental force of the universe, made its close-up bow to mankind. Exactly twenty days later the same power gave a sinister demonstration of its inherent capabilities when, in a split second, it almost completely demolished the Japanese town of Hiroshima, and sent a few square miles of buildings up in an awe-inspiring, mountainous pillar of smoke and dust.

For more than 40 years it has been known that, locked within the atoms of matter, there exists a source of energy which far surpasses in amount or intensity any of the forms of energy which we have previously been acquainted with.

You may, for example, heat up the strongest steel boiler until it explodes with truly disastrous consequences, yet such a sudden release of force is not to be compared with the energy release which takes place when an atom flies to pieces. In a boiler explosion, gigantic as it may well be in its effects, the constituent atoms of the super-pressure steam still remain whole and entire. It is only their sudden flying apart as a result of their pent-up heat energies which creates the damage.

Lord Rutherford, of Nelson, founder of our modern theory of atoms.

Now, when we come to deal with the super-scale explosion set up by the atomic bomb, we find ourselves at once on an entirely different footing, for here we have not just a mere rapid flying apart of stable atoms, but, rather, an actual disruption of the atoms themselves, a veritable destruction of matter, in fact, with all its attendant release of the enormous sources of energy which has served since the far-distant creation of those particular atoms to hold their parts together, to give them regular motion and to weld such parts together into a more or less stable structure.

That is why when a few billion atoms can be made (as, indeed, they have been made) to explode almost simultaneously the result is no ordinary happening. From an atomic explosion, the outrush of released energy is, compared with the ordinary "molecular" explosions of T.N.T., nitroglycerine and similar substances, colossal, being almost as far removed from them in magnitude as is the detonation of a rifle cartridge from the sudden pricking of a toy balloon.

It has, indeed, been truly remarked that with this year's introduction of atomic power mankind is well on the way to the mastery of the means of destroying itself utterly.

That is the black side of the picture.

The Bright Side

But there is another aspect of the matter, and a very bright aspect it is, too. For since colossal energies can now be released explosively from atoms there is no reason why before very long it should not be possible to release the same energy in a controlled manner in much the same way as we release high-pressure steam from a boiler or compressed air from a cylinder.

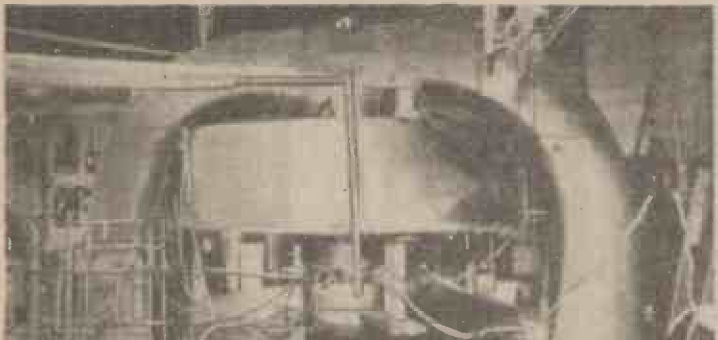
In other words, we have, under our feet, as it were, super-energy supplies in abundance. Such a fact is clear enough, so that all we require now is a suitable valve through which we can collect the available energy in controllable amounts as and when we require to do so.

That is the problem which physical science sees immediately before it. Never mind explosive liberations of atomic energy. The atomic bomb must lead surely to man's ultimate destruction, but the controlled release of energy must equally as surely lead on to his greater liberation and to the greater and truer triumph of mind over matter.

It is, indeed, a fact that a giant liner, such as the *Queen Elizabeth*, could be propelled across the Atlantic on a few teaspoonfuls of matter.

Wanted—an Engine

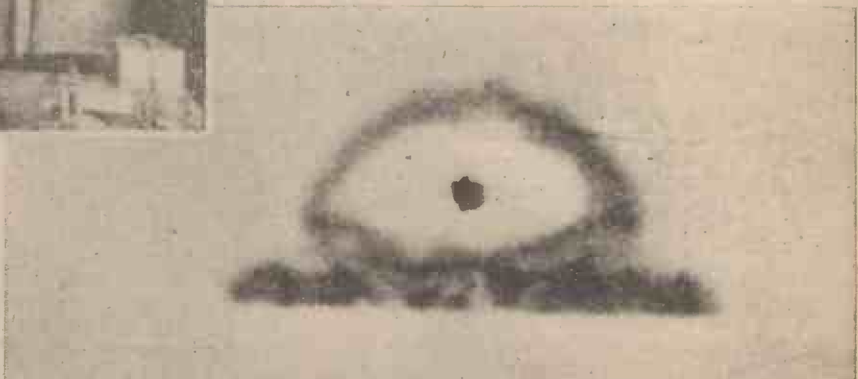
All we require for the above result is an engine—and probably only a miniature



America's most famous atom smashing machine, the cyclotron, invented by Cockroft and Lawrence for the purpose of obtaining streams of fast atomic projectile particles.

Dispersed, Not Destroyed

Much the same thing happens when an explosive material such as T.N.T. or picric acid is detonated. Under the sudden and intense shock of detonation the constituent atoms of the compound disperse almost instantanously in all directions, creating, as they do so, an enormous pressure wave. But each individual atom concerned in the explosion still maintains its "wholeness" and its inner stability. Such constituent atoms, despite the enormous force of the explosion, have merely been dispersed, *not* destroyed.



The explosion of an atomic bomb. Taken at a range of six miles, these photos record the historic test in the remote desert land of New Mexico, which preceded the actual application of the terrible weapon against Japan. The beginning of the explosion. A small cloud at first, like one that preceded the hurricane, it grows bigger, assuming egg shape. The black spots in the middle of the blast actually were brighter than the sun at midday, causing a reverse on the photographic negative.

form of engine—which will control and make orderly the stupendous rush of energy which takes place when atoms are destroyed. We want something roughly analagous to our present-day internal combustion engine which derives energy from the chemical breakdown of molecules, the atomic engine, of course, being able to obtain its energy from the breakdown of *atoms*.

How is energy liberated even explosively from atoms so as to make possible the atomic bomb?

The detailed answer to such a question cannot be given, since the make-up of the atomic bomb is, by agreement between the principal nations, to remain a close secret. But there are many pointers to the secret of atomic energy liberation, chief among which, perhaps, is the fact that apparently only one type of atoms—those of the metal uranium—can at present be made to give up their energy.

The Idea of Atoms

The idea of the atom goes back at least to the days of ancient Greece, but it was Sir Isaac Newton and the Honourable Robert Boyle (originator of the famous "Boyle's Law") who gave us our first modern notions of atoms. The whole atom business was systematised and put on a scientific and workable footing by the famous Quaker philosopher, Dr. John Dalton, of Manchester. On Dalton's "Atomic Theory" the entire edifice of modern chemistry was reared.

But in 1896 a Frenchman named Henri Becquerel discovered the phenomenon of radioactivity, and that discovery gave a terrific shock to the complacent scientific theories of the period, because here, under their very eyes, scientists had perforce to witness what were seemingly explosions or energy-outpourings of atoms which, according to all contemporary opinions, were essentially stable and solid particles.

The scientific conception of atoms went for a time more and more to pieces until before long there arose a genius who used the then known facts of radioactivity to piece together an entirely new and revolutionary theory of atoms, upon which theory almost the whole of our present knowledge of atomic physics has been based.

Lord Rutherford

This genius was at that time an unknown scientist of the name of Ernest Rutherford. He became a professor at Montreal, then at Manchester, where much of his work in atomic physics was done, and finally at Cambridge, where he was created a baron, and where, ultimately, he died.

Rutherford started his atomic work at Montreal, but, going to Manchester in 1911, he began his main attack on the atom. He recognised that what he called "alpha particles" (later realised to be nuclei of helium atoms) were hurled off radioactive substances at exceedingly high speeds, and it was these alpha particles which he used as projectiles for actually bombarding the atom.

Sir Charles Darwin, Director of the National Physical Laboratory, one of the scientists who played an important part in the experiments which led up to the production of the atomic bomb.

Lord Rutherford discovered that alpha particles, shot off from radioactive materials, will pass completely through thin solids, but that most of them were deflected in so doing. He found that some of the alpha particles were deflected through a right angle, these particles emerging from the metal at its side instead of at its rear.

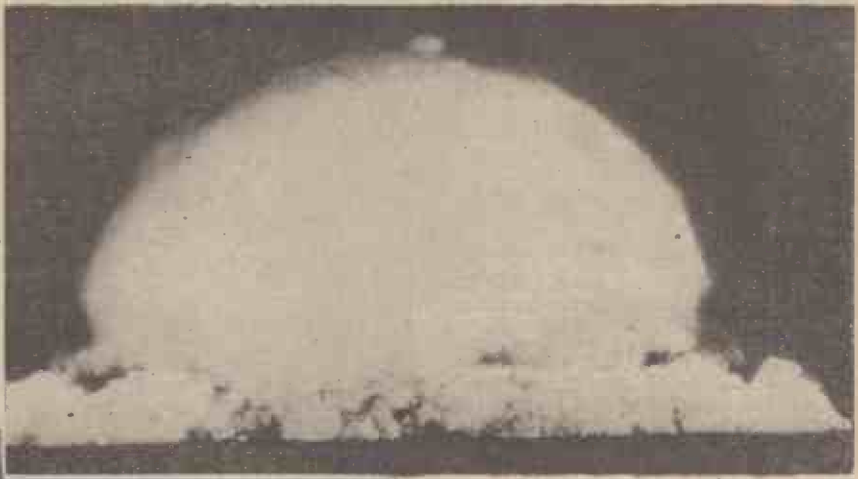
The true explanation of these big deflections Rutherford conceived to be the head-on collision of a single alpha particle with a single atom or, rather, with a massive heavily charged portion of an atom. By careful measurement of the varying degrees of deflection of his alpha particles shot out from bits of radium material, Rutherford was gradually led to his theory of the atom.

On this theory, as developed by Lord Rutherford, the atom is anything but the hard, impenetrable billiard ball-like entity which nineteenth-century scientists had imagined it to be. Mostly, the atom was shown by Rutherford to comprise empty space. It had at its centre what Rutherford called a "nucleus" which was positively charged. Around this nucleus revolve a varying number of electrons according to the precise nature of the atom. Relatively speaking, the electrons revolve an enormous distance away from the nucleus, they have practically no mass or weight, and they are, of course, negatively charged. The sum of the negative charges of the electrons is equal to the positive charge of the atomic nucleus, so that, as a whole, an atom is a neutral body and possesses no electrical polarity.

The Rutherford Atom

So far, so good. Rutherford had introduced an entirely new conception into physics, a notion which could pretty well be proved on all sides. The solid atoms of our forefathers had become almost nothing, as it were. Very nearly the whole of their bulk was sheer empty space, having at its extremes a number of revolving electrons and at its centre an extremely minute although relatively heavy "nucleus." Rutherford's atom was, after all, a veritable replica in miniature of our own sun and planets or the "solar system" as we call it.

The electron mechanism of the atom was clear enough to Lord Rutherford, but the nature of the nucleus puzzled him a great deal. Was the nucleus a real solid ball-like entity or was it a mere hollow shell or a centralised assembly of other smaller and entirely unknown particles all bound together by positive charges?



Third stage. The base begins to spread, and grows steadily.

The writer of this article (a former student of Rutherford's) well remembers his pondering over this question in front of his class. For a time he came to the conclusion that the problem was an insoluble one, or that it would not be solved in his time.

But it was not long afterwards that Rutherford himself began to knock bits off atoms. This he did towards the end of 1918. By aiming high-speed helium atoms at nitrogen atoms he partially disintegrated the nitrogen atoms.

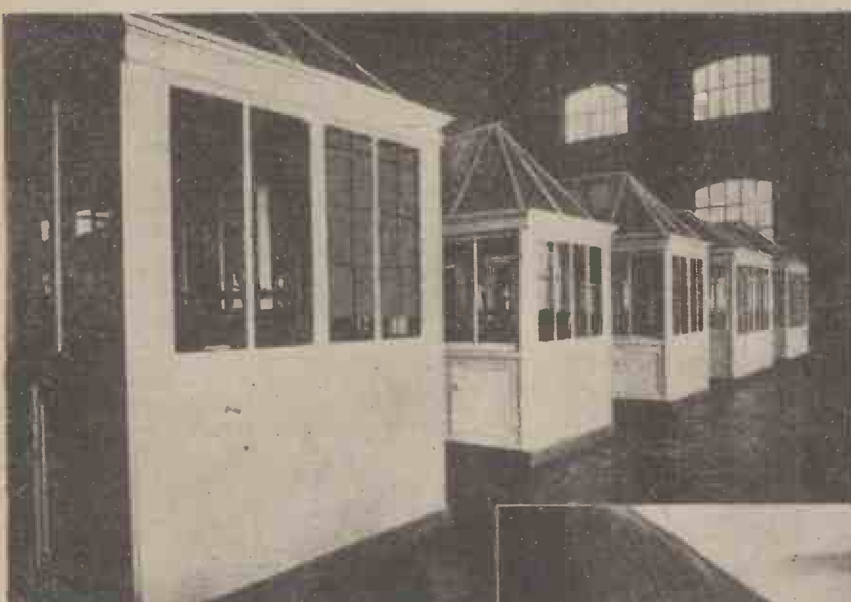
The second stage of the explosion. The cloud assumes an egg shape.

Rutherford's high-speed helium projectiles, however, carried electric charges with them, and it was these very charges which spelt failure to his attempts to disintegrate completely the bombarded atoms. For it will be remembered that the central nucleus of an atom, that is, the exceedingly small but, in reality, the main or principal part of the atom itself, is positively charged. This powerful positive charge on the nucleus invariably repelled Rutherford's helium particles. It, therefore, became evident that there was no hope of disrupting an atom, of getting inside its nucleus, until a particle could be discovered which would not be repelled by the said nucleus.

Fourteen years elapsed, during which time it was fairly clearly demonstrated that atomic nuclei were, in the main, clusters of *protons* (the nuclei of hydrogen atoms) and *alpha particles* (helium nuclei).

The Neutron

Then cames James Chadwick, also of Manchester, who, in 1932, discovered the *neutron*, a tiny particle devoid of electrical charge and which was found to be capable of slipping into the nuclei of heavy atoms and disrupting them without much trouble. About the same time, also, Dr. J. D. Cockroft, still another member of Rutherford's Manchester school, and others invented electrical methods of generating large numbers of fast atomic particles by means of the *cyclotron* and similar large-scale electrical devices.



The separate cubicles set up in a uranium factory for extracting radium from the uranium concentrates.

Then come Hahn, a German, and Strassman, who, in 1939, showed that carefully aimed neutrons can split up certain kinds of uranium atoms into roughly two equal parts, and that in doing so about 200,000,000 electron-volts of energy were produced. Since the neutron itself has only about 1/30th of a single electron-volt of energy, it follows that this trigger action of the flying neutron results in the release of about 6,000,000,000 times its own energy.

On the heels of this recent discovery, the French physicist, Joliot (who afterwards devoted the whole of his energies to the French Resistance Movement), drew attention to the fact that when one of Hahn's neutrons disrupted a uranium atom it released four neutrons from the atom, and that each of these released neutrons could be regarded as projectiles for the bombardment of neighbouring atoms. Hence, given the right conditions (which were then unknown) an exceedingly rapid neutron-release could be initiated in a mass of uranium so that an atomic disruption or explosion could be built up throughout the mass of uranium material.

From the practical side, however, things were not quite so simple as one might suppose. This is on account of the fact that many atoms exist in different types or species called "isotopes," each type having a different weight from its associates.

Uranium's "Isotopes"

Now uranium has three of these "isotopes," but only one of them was found to be sensitive to Hahn's "fission" process. In ordinary uranium this particular isotope occurs only to the extent of about 3 per cent. All isotopes are exceedingly difficult and tedious to separate from one another, especially in quantity. Hence, one supposes, the enormous amount of factory plant which is said to have been put up in America in connection with the production of the atomic bomb. The pre-war world production of uranium was about 80,000lb. of the material, from which about 10 grams of radium might be extracted. From this quantity of uranium some 500lb. of the sensitive uranium isotope might be expected to be forthcoming.

Just how the sensitive uranium isotope is set off at a given instant or at a moment of impact into its characteristically disastrous and titanic explosion is, naturally, *the* secret into which we will not attempt to pry.

So far as we are aware, it is only with this particular uranium isotope that atomic explosions can be made to occur. Ordinary uranium or its salts, which latter compounds are sometimes handled by amateur photographers for green-toning purposes, are quite harmless. Whether it will ever be found possible to get the atoms of commoner and less heavy elements (for uranium is the heaviest of all elements) to detonate or explode is a moot question. The fact, however, that a handful of scientists working in close secrecy have been able to obtain the explosive release of atomic energy does certainly point to the fact that the modern theories of atomic structure are at least approximately correct.

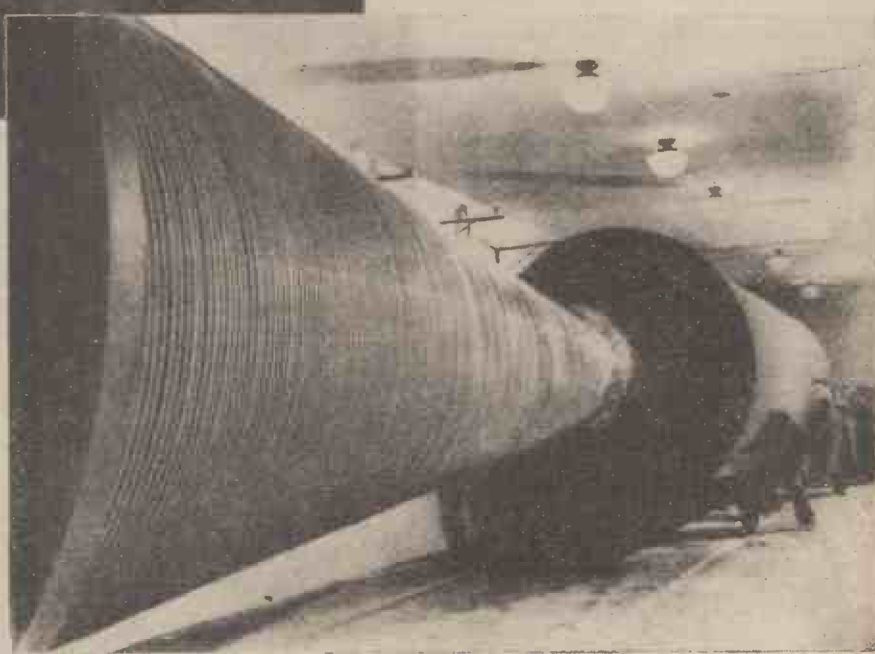
A World Explosion!

It has been suggested by some press correspondents that a large-scale uranium explosion may, even in peacetime, endanger the very existence of mankind in that it might well initiate a trail of atomic disruption which would almost instantaneously travel through the whole earth and, consequently, blow our planet to pieces.

It would be futile to deny the possibilities inherent in such suggestions, but they are all in the highest degree unlikely. Most of the earth is composed of lighter elements. To disrupt these, vast amounts of energy must be expended, and a corresponding amount of energy would not be released.

What we want to know now is whether there are any other elements besides this particular rare isotope of uranium which can be exploded, heavy elements, for instance, such as thorium, bismuth, lead, thallium, and mercury, and whether, also, their explosions can be made controllable.

Such is the target for modern atomic scientists. Many minds will be applied to it. Let us hope that, in the time to come, our own countrymen will be the first to realise it.



Side view of the new atom smasher at Notre Dame University, Ind., U.S.A. The apparatus is capable of generating eight million volts, and is used for experimental work in the disintegration of nuclei by high-speed electrons.

The Annals of Electricity—7

The Advent of "Galvanism"

THE story of Galvani and the frogs' legs, like many a popular historical tale, is not entirely a true one. It was first given currency by an individual named Alibert, who published a book on Galvani in 1802, some four years after the latter's death. Alibert stated that the frogs' legs, whose electrical twitchings first started Galvani on the route to "galvanism," were being skinned in order to prepare a nourishing soup for Madame Galvani, the professor's wife, who was in ill health, and from this ill-considered statement a host of absurd variations on the theme of Galvani and the frogs' legs have taken their rise.

Common sense, however, must enforce the conviction that the dissecting rooms and anatomical laboratories of universities and medical schools do not convert their products into soups and broths even for the benefit of their professors' wives, but, of course, the reading public loves a legend, and, doubtless, the pseudo-history of Dr. Galvani and his skinned frogs will, like that of King Alfred's cakes, Sir Isaac Newton's apple and James Watt's steam engine, go down the ages still inseparably associated with the aura of veracity which has become so falsely attached to them.

Luigi Aloisio Galvani stands as a rather picturesque figure in electricity's annals. He manages to comprise an important figure, also, despite the fact that, fundamentally, he was anything but an electrician. Indeed, Galvani was a medical man, an individual very high up in his "trade," one who had attained the status of university professor, and had obtained no little celebrity in the science of anatomy.

Chance Discovery

But Galvani, by the merest chance, happened one day to stumble up against an experimental discovery which quickly revolutionised the entire conception and progress of electrical science. For this he has been dubbed "the luckiest of all famous men of science," a compliment which is, perhaps, rather a doubtful one.

In a word, Galvani was the discoverer of *dynamic* electricity as opposed to the "static" electricity of the frictional machine. His discovery set investigators on the track of the electric battery and of the electric current. Nevertheless, to the end of his days Galvani never properly realised the true significance of his epoch-making discovery. He grasped the experimental stick at the wrong end, and went off into ecstasies concerning "animal electricity," and similar chimeras, leaving others and, in particular, a countryman of his own named Volta, to develop logically the essential truth of his discovery.

Luigi Aloisio Galvani was born at Bologna, the famous town of northern Italy, on September 9th, 1737. He came of a good, hard working family and, after his schooldays were over, his first intentions lay in the direction of joining a religious order. However, his father seems to have opposed such a desire, with the result that the youthful aspirant determined to adopt a medical life as a career.

He excelled at his medical studies, duly qualified as a doctor, married his professor's good-looking daughter, set up, for a time, as a general practitioner, then took a post of demonstrator and lecturer in medicine at Bologna and carried out a good deal of anatomical research there. He became what we call in these days a "brilliant surgeon," although, of course, in Galvani's time it would hardly be truthful to describe any of the operations-without-anæsthetics as being particularly brilliant!

Anyway, in 1762 Galvani came out with a treatise on the formation of bone structure in the body, the result of some of his outstanding researches, and this apparently won for him so much renown that when (in 1775) the professorship of Anatomy in the University of Bologna became vacant, he was unaminously appointed to the post.

Luigi Aloisio Galvani.

The Super-specialist

Galvani, even then, was only a comparatively young man. Yet he had led an exceedingly full and interesting life of scientific effort and activity. He had become famed throughout Italy as an original anatomist, medical teacher and consultant.

Then, as if by way of a gift-token from some kindly Fate, came the chance discovery of dynamic electricity or, rather, of some of its effects, the discovery which will ever be associated with the muscular twitching of frogs' legs.

The discovery brought immense (if somewhat transient) fame to Galvani. "Galvanism" became regarded almost with a degree of mystical fervour. Its discoverer penned long, wordy treatises concerning it. It wellnigh engulfed him and dominated his whole life. Yet, as we have already mentioned, he clung so long and so persistently to the false interpretation which he put on his discovery that he finally contrived to work his scientific downfall.

The truth was, of course, that Dr. Galvani was no electrician. Had he been otherwise, he might have brought about other electrical discoveries and developments which, as things happened, were made by others.

The Galvani discovery came about on the morning of November 6th, 1780, and it occurred in the laboratories of the University of Bologna. Galvani, together with an assistant, had been preparing dissections of dead frogs for anatomical demonstration to students. A frictional electrical machine of the then usual glass disc type stood on the same metal bench, and its presence inspired Galvani to repeat some older experiments whereby an animal muscle could be made to contract violently by passing a discharge of frictional electricity through it.

Electrical Twitchings

Whilst Galvani dissected his frogs, the laboratory assistant busied himself in "warming up" the electrical machine. Suddenly the leg muscles of the lifeless frog twitched spasmodically under Galvani's dissecting scalpel. It was when the main nerve connecting the leg muscles was touched with the blade of the knife, and when (at the same time) the assistant had begun to draw sparks from his machine, that the convulsive twitchings occurred.

The twitchings themselves were nothing really extraordinary, but what puzzled Galvani enormously was the fact that these jerky movements took place without there being any apparent contact between the dead frog and the electrical machine. Yet, when the machine stopped working, the muscular movements also ceased. Also, when Galvani held the dissecting knife by its bone handle only the muscular convulsions refused to show themselves, although the assistant worked his machine most vigorously.

It was only, as Galvani determined by careful experiment, when his fingers made contact with the knife blade and a spark was drawn from the machine at the same time that the twitchings took place.

Evidently, Galvani surmised, some electrical effect was responsible for the pheno-

An illustration from an old engraving showing Galvani (right foreground) demonstrating the muscular twitchings of the legs of a dissected frog.

menon, but precisely what the cause of this was he was unable to discover.

There was one significant factor about the whole mysterious business which Galvani noticed also. It was that when the frog's nerve was touched with a glass rod (the electrical machine being worked simultaneously) the characteristic twitchings could not be produced, whereas they could be generated almost at will whenever the glass rod was changed for a metal one.

To the present scientific reader, the cause of the Galvani phenomenon will be plain. The muscular twitchings of the dissected frog were due to the animal being in electrically conducting communication with the earth through the metal object which was held in the hand of the operator.

The next step was for Galvani to determine whether other sources of electricity would produce the same effect. He experimented with a Leyden jar, or frictional electricity accumulator, and he found that the extraction of a spark from the jar would, under the above conditions, produce a contraction of the frog's legs.

Galvani, advancing a little further with his discovery, connected the dissected legs of a frog to a wire which was attached to a lightning rod elevated above the roof of the laboratory building. When a thunderstorm occurred, the frog's legs so violently convulsed that they were almost torn asunder.

The Frog Electroscope

To Galvani, it seemed possible that the prepared legs of a frog could be made to act as a delicate electroscope or detector of electricity. He prepared a number of these "frog electroscopes." In the spinal marrow of each one he inserted a brass hook and then hung each specimen on an outdoor iron railing. He found that the legs became convulsed not only when lightning flashed in the heavens, but even on fine days when the sky was perfectly clear. Such effects he attributed to the "electricity of the atmosphere," as he called it.

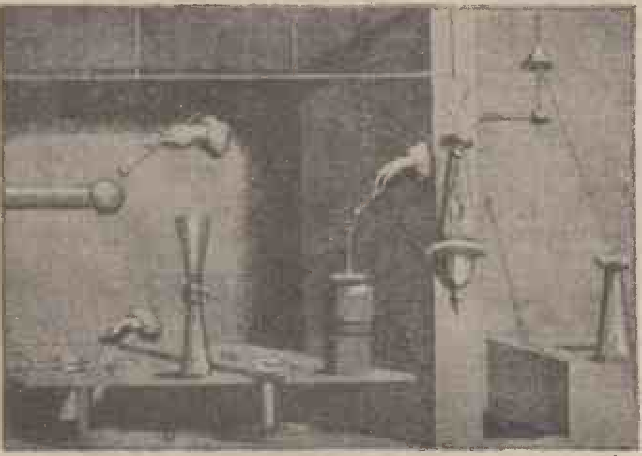
But on one occasion when there was "nothing doing" with these frog electroscopes as, in clear weather, they hung on the iron rail or, rather, iron trellis, Galvani happened to press one of the brass hooks tightly against the ironwork of the trellis. Immediately the convulsive muscular movements of the frog's legs began. As Galvani pressed, one by one, the brass hooks of his specimens against the iron trellis, each set of legs went through its customary performance, although, so far as Galvani could determine, there was not the slightest trace of electricity in the atmosphere.

More than ever puzzled, Galvani pondered. Then the idea flashed into his mind that the nerves and muscles of the frogs' legs were in reality acting as electrical conductors, and that the electricity was coming not from without, but actually from within the dissected animals.

In other words, Galvani on the spot conceived his famous idea of "Animal Electricity," of electricity being generated within the animal body. It was, of course, entirely a false idea.

Animal Electricity

As time went on, Galvani became more and more obsessed with the idea of animal electricity. All the numerous detailed experiments which he made seemed to confirm his notion of electricity being generated in the body of an animal, even of a dead animal.

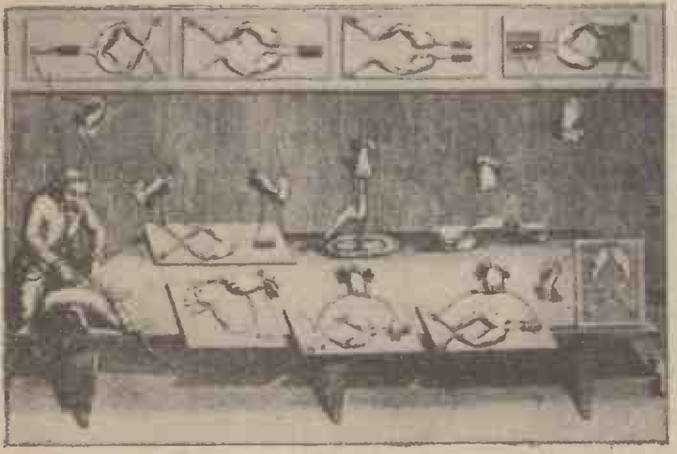


A reproduction of a plate from Galvani's historic book on "Animal Electricity." It illustrates the various experiments described therein.

He began to regard the animal muscle as a sort of natural Leyden jar or accumulator of electricity. The nerve and the metallic connection which was made to it during the course of the experiments were merely electrical conductors through which a discharge of the muscle-accumulated electricity took place. Positive electricity, he said, passed from the interior of the muscle, through the nerve, and from thence through the metallic conductor back again to the exterior of the muscle.

Altogether, Galvani devoted almost the whole of his spare time throughout eleven long years to his experiments on this supposed "animal electricity," or "galvanism," as it subsequently became called.

He kept a detailed log-book and a diary of his day-to-day experiments, and he published a full account of the latter in 1791, together with his philosophical views on the subject. Galvani's lengthy *Treatise* produced a sensation in the scientific world. Many savants of the day ranged themselves enthusiastically in support of Galvani's scientific views, that is to say, in agreement with his theories of animal electricity. But after a time the supposition that electric charges can be generated in animal muscles began to be questioned by physiologists.



Galvani's original illustration to his essay depicting his experiments on the nerves and muscles of frogs' legs.

The physicists, also, took up the growing challenge. To one of them in particular, Alessandro Volta, it appeared that the electricity came not from the body of the frog, but rather, from the metals which made contact with it.

Galvani versus Volta

A memorable dispute arose between Galvani and Volta, which dispute will be dealt with more fully in our ensuing article on Volta. Suffice it now to state that, according to Volta's views, the electricity responsible for the twitching of the frogs' legs was an entirely new kind of electricity generated in some way by the mere contact of two dissimilar metals. Galvani, however, pooh-poohed this idea, contending that the presence of a metal was not necessary to induce the leg muscle contractions under certain conditions.

The scientific contentions and arguments went on for a number of years. At times they became decidedly acrimonious, as each side adduced further experimental evidence (or would-be evidence in support) of one particular contention. But at last Volta triumphed, and, as a result of his invention of the first *chemical* electrical current-producer based on the contact of dissimilar metals, he proved beyond doubt that the origin of the manifested electricity in all the countless frogs' legs experiments which Galvani had made came not from within the frog, but from without it, the electricity being generated by the contact of two different metals.

To the end of his life, however, Galvani refused to be convinced of the truth of Volta's interpretation of his experiments and of the fallacy of his own theories.

Yet, despite his stubbornness, Galvani was an unassuming and a modest man.

"But all this I have thought out," he writes in his *Essay on the Force of Electricity in the Motion of Muscles* (1791), "in order that it may be considered by the great and the learned. . . . For eminent men of learning will be put in a position through reading this *Essay* to develop these results themselves further by consideration and experiment and, above all, to reach that goal towards which we have striven but from which we are, perhaps, still very far."

Galvani Gets the Sack

Galvani was 54 years old when his famous and now historic *Essay* was published. It was his last sustained effort in the scientific world, for ill health had begun to assail him, and the times had become troublous. The great Napoleon raided north Italy in 1796 and set up a Republic there. Galvani refused to swear allegiance to the Napoleonic power. As a result, he was at once dismissed from his post and removed from all his university offices.

Poverty also assailed Dr. Galvani. He had become very much the stricken hero. Perhaps it was this fact which struck at the conscience of the new republican Government of Northern Italy, for, towards the end of 1798, it reversed its former edict in respect of Galvani, and reinstated him in all his former offices unconditionally.

But the Government was too late in its intentions, which were arranged to take effect as from the beginning of the year 1799, for on the 4th day of the previous month (December, 1798), Galvani died in his native town of Bologna at the comparatively early age of sixty-one.

Plastic Armour

The Story of a Naval Scientific Production that Saved Lives and Steel : Its Post-war Uses for Roads and Factories

By Dr. J. P. LAWRIE (Royal Naval Scientific Service)

Plastic protective plating on a lorry used for airfield defence.

THE following particulars tell the story of "plastic armour," a product of naval scientific ingenuity which saved thousands of lives and tons of steel.

In the grim days of Dunkirk it was observed, on some of the "little ships" with bituminous flooring, that bullets from attacking aircraft failed to penetrate, but were retained in the deck composition. Examination showed that although these stopped bullets were probably almost spent, or had arrived at an angle, the composition of the deck sheathing tended to prevent penetration, and an investigation of the possibilities of developing a "plastic armour" was begun.

The deck sheathing mentioned is usually a form of mastic asphalt consisting primarily of bitumen and limestone powder, to which is added some grit. Heated, the ingredients form a soft paste which, spread in position, hardens when cool. In peacetime it is mainly used for covering flat roofs, floors, or as a road surfacing.

In August, 1940, the Admiralty requested the Road Research Laboratory of the Department of Scientific and Industrial Research to carry out an investigation to ascertain whether a bituminous mixture of this nature could be produced which would provide superior protection against aerial attack to the sand-cement concrete slabs then in use on merchant ships. Concrete, used thus to protect wheelhouses and gun positions, was found to be ineffective and very dangerous on account of flying fragments.

Valuable Background

Experience with bituminous road materials and in the development of structural materials to resist attack by shell splinters and projectiles provided a valuable background for the investigation. Their research on concrete led the laboratory to the belief that the use of larger particles of stone would improve the resistance of plastic armour. Trials showed that, using a larger stone in the ratio of 50 per cent. to the asphalt, 0.303 armour piercing bullets were stopped by a protection weighing only 38¾lb./sq. ft. compared with 50lb./sq. ft. for concrete.

As the weight of solid mild steel to give protection against 0.303 A.P. bullets is 36lb./sq. ft. it was apparent that, in view of the acute shortage of steel and armour plate then prevailing, a stone-filled mastic asphalt offered good possibilities as a protective armour.

Further investigations were conducted to ascertain whether plastic armour would give the same protection at extremes of temperature, whether high temperatures affected its resistance to flow, and whether it was likely to catch fire during an attack.

One Month Later

Satisfactory results were obtained, a working specification was drawn up, and under the joint supervision of the Admiralty and the laboratory *exactly one month after the research had been begun work was commenced on the armouring of vital parts of a merchant ship.*

This first *in situ* plastic armour had the following composition :-

⅜in. granite chippings ..	55%	by weight
Limestone powder ..	37%	"
Soluble bitumen ..	8%	"

The "plastic" for plastic armour is made by mixing the stone and bituminous mortar in a normal 4–8 ton capacity mixer, as used in the asphalt industry, for 3–4 hours, after which the mixture is run off and poured into the space between wood or steel shuttering and the surface to be protected. Removal of the shuttering leaves the plastic in position. In the early days of plastic armour prefabricated 2½in. slabs with a $^3/_{16}$in. mild steel backing were produced by spreading the plastic in horizontal wooden moulds. These slabs were used round wheelhouses, radio rooms, machine-gun posts, or any other position requiring protection, especially where vision slots, ports, or vents were required. The steel walls of deckhouses provide ready-made backing for *in situ* plastic armour, but when precast slabs are used a steel backing plate is provided to the slab.

Towards the end of October, 1940, when initial difficulties of manufacture and application had been overcome, a more detailed investigation into the principles of design of plastic armour was begun. The first tests were chiefly concerned with stopping A.P. shot, but tests were later made with bomb and shell splinters and 20mm. H.E. shells.

Plastic armour consists of a packed mass of stone particles held together with a bituminous mortar and backed with a mild steel plate. The stone particles break or turn the bullet or projectile, and the ductile steel backing plate stops the relatively slow fragments of shot and stone which would otherwise be projected from the back of the plastic. The bituminous mortar plays little part in the protection beyond holding the stones in position.

Important Factors

It was soon obvious that the type, size and amount of stone were the most important factors affecting the protective qualities of plastic armour. Experimental targets of plastic armour were first made, therefore, with some 50 different types of stone. The results of tests made with 0.303in. A.P. bullets showed that certain flint and quartzite gravels gave the best protection. The granite, which was then in use, was immediately superseded by these new materials.

The next factor investigated was the best size for the stone particles. Tests were made with 0.303in., 0.55in. and 20mm. A.P. shot on plastic containing as wide a range of stone size as possible. It was found that best protection was obtained when the size of the stone particles was twice the diameter of the shot to be stopped. Later tests with bomb and shell-splinters showed that against this type of attack the size of stone in the plastic had no effect on the efficiency of protection.

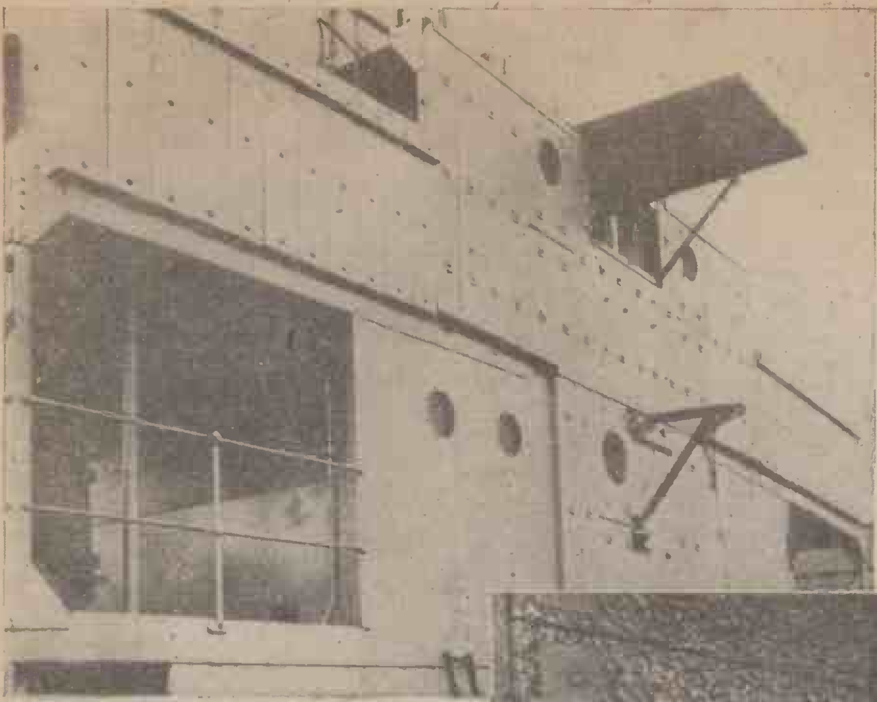
When tests were made to find how the proportion of stone to bituminous mortar affected protection it was found that, when special methods of consolidation were used, 70 per cent. by weight of stone could be packed into the plastic, resulting in a considerable improvement in protection over the existing plastic which contained only 55 per cent. of stone. Unfortunately, plastic with such a high stone content could not be consolidated behind shuttering or by hand in moulds. Advantage was taken of this discovery, however, in the development of a new form of plastic armour known as plastic protective plating.

Plastic protective plating is made by consolidating the hot plastic by vibration into "trays" of thin sheet metal and then bolting on the backplate to the open side of the tray. In this way the plastic is totally enclosed in metal; this gives the plastic protective plating a much greater resistance than plastic armour to incidental damage from attack and during transport, and, what is more important, it allows the best proportion and size of stone to be used.

Special Light-weight Plastic

In 1942, at the time plastic protective plating was introduced, it became desirable to reduce imports of bitumen, and the problem rose as to whether pitch could be used in its place. When tests were made it was found that the use of pitch allowed better consolidation of the plastic. Advantage was taken of this fact to develop a special light-weight plastic consisting of pitch, fine sawdust and lime for use in plastic protective plating.

Plastic protective plating was not only lighter in weight and more efficient and of

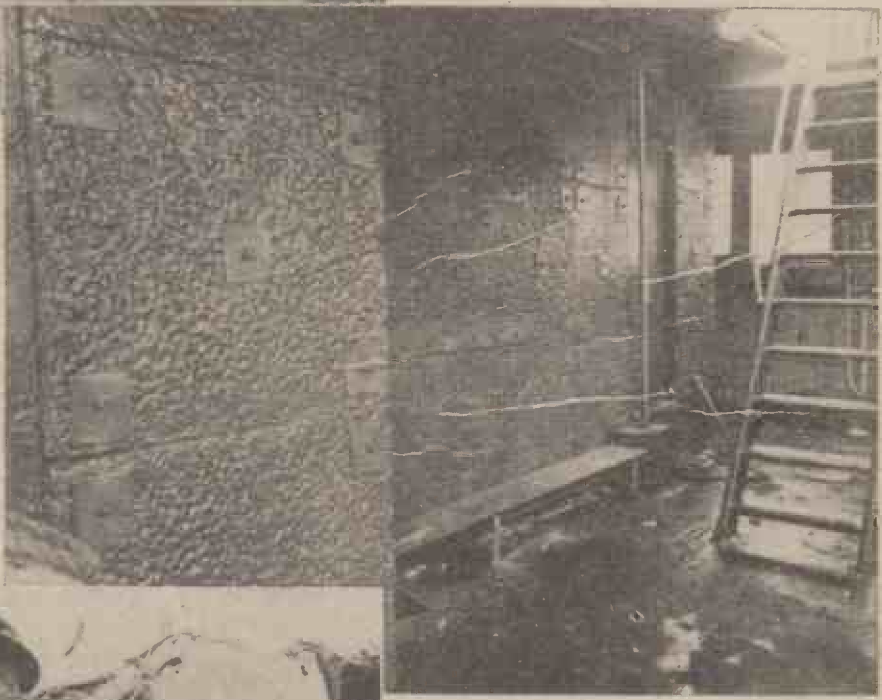


Plastic protective plating used for bridge protection on a merchant ship.

better appearance than plastic armour, but it lends itself particularly to factory mass-production. By the end of 1942 the majority of gun positions were being protected by plastic protective plating instead of *in situ* protective armour. Since then the proportion of plastic protective plating used has increased steadily.

Plastic protective plating first went into action in the Dieppe raid, when 2½in. non-magnetic plastic protective plating with ¼in. brass backing, used to protect the helmsman, was hit by small arms A.P. shot, 20mm. H.E. shells, and at least one 4in. mortar bomb. Only one splinter from the mortar bomb perforated the protection and everything else was stopped. This result confirmed the suitability of plastic protective plating for use on landing craft and resulted in its wide use in preparation for D-Day.

The protective qualities of plastic protective plating compared with steel armour plate varies to some extent according to the type of weapon with which it is attacked. Against A.P. shot it is better than mild steel, but not as good as armour plate. For example, if the weight per sq. ft. of plastic protective plating required to stop A.P. shot is represented by 100, the weight for armour plate is 75 and that for mild steel is 116 and that for plastic armour of the original type 122. (The actual weight of plastic protective plating required to give protection against 0.303in. A.P. bullets at muzzle velocity is 30 lb./sq. ft.) Against bomb splinters the degree of protection varies with the speed of the splinter, e.g., for splinters at 5,000 ft./sec., say, from a 500 lb. bomb or large shell, plastic protective plating is more efficient than an equal weight of steel armour. Against splinters striking at 3,000 ft./sec., say, from a German S.D.2 butterfly bomb, plastic protective plating and steel armour would give equal protection; at a striking velocity of 1,500 ft./sec. such as would be expected from fragments of an "S" mine, plastic protective plating gives equal protection to mild steel but is inferior to steel armour.



Plastic armour slabs used on a ship of the Merchant Navy.

The good resistance shown to splinters from large shells and bombs has been proved on a number of occasions on ships passing through the Straits of Dover during the shelling.

By May, 1943, approximately 100,000 tons of P.A. and P.P.P. were being produced annually, and it was being made in Canada, South Africa, India and the Middle East. In 1941 officers specially instructed in its manufacture were sent to the U.S.A., where production was immediately begun.

Preparing for D-Day

During the "Battle of the Atlantic," the plastic armour used was of the *in situ* variety, while P.P.P. was installed on ships in preparation for D-Day in enormous quantities. Special plates were made for use on bulldozers and flame-throwers to give protection to their drivers. In practice it has been found that the protection offered is in excess of that

(*Continued on page* 31)

Plastic protective plating on a landing craft on its return from Dieppe. There were no casualties.

THE WORLD OF MODELS

Town Planning Models, and Some Examples of the Model Work of Members of the Admiralty Service Staff at Bath

By "MOTILUS"

DURING the election campaign most of the leaders of the various parties toured the country speaking for their candidates and Northampton was favoured by a visit from the Rt. Hon. Clement R. Attlee —at the time Deputy Prime Minister—now Prime Minister of the new Government. During his stay in Northampton he took the opportunity, with Mrs. Attlee, of seeing some parts of the city and in visiting some of the industrial establishments, including the model works of Bassett-Lowke, Ltd., where important model-making for the war effort was in progress.

Our illustration, Fig. 1, shows Mr. Attlee in the waterline department being shown the production of hand-made waterline models used extensively throughout the war for recognition purposes and operational training. He was conducted round the works by Mr. W. J. Bassett-Lowke, and the works director.

Fig. 1.—The Prime Minister, the Rt. Hon. C. R. Attlee, snapped while on a tour of the Bassett-Lowke model works at Northampton. With him is the works director, Mr. P. F. Claydon.

Models of Coventry

Coventry is very much in the picture nowadays, being one of the few blitzed cities for which the entire centre has been carefully replanned, and this new scheme is sure to be one that will be brought forward for the early attention of the new Minister of Town and Country Planning.

Fig. 2.—A model of the ancient city of Coventry made by the boys of Broadway Senior Boys' School, Earlsdon, Coventry.

A Coventry school—the Broadway Senior Boys' School, Earlsdon, Coventry—have interested themselves in the ancient city of Coventry and I am sure our readers would like to see how the remains of the blitzed city—such as the cathedral spire and Trinity Church—also will fit into the new Coventry. To do so, just compare the two illustrations, Figs. 2 and 3—the one of the ancient city, and the other an eye-level view of the remains of the cathedral and surrounding old buildings and Holy Trinity Church blended with the proposed modern type buildings also in the picture.

Miss P. J. Davies, handicrafts teacher at the Broadway Senior Boys' School, sends interesting details of the model built by boys between the ages of 11 and 14 years.

The model stands on a board $5\frac{1}{2}$ft. by $6\frac{3}{4}$ft., and the board is covered with grey paper, which, outside the city walls, has been painted green and brown to represent ploughed and pasture land. Here and there are clumps of trees, plasticine trunks with foliage of painted synthetic sponge.

Miss Davies found it necessary to make use of two scales in the model, for in making the houses of a size easily handled by the boys the corresponding size of the cathedral and Trinity Church would have been too large for the space available. The scales were used

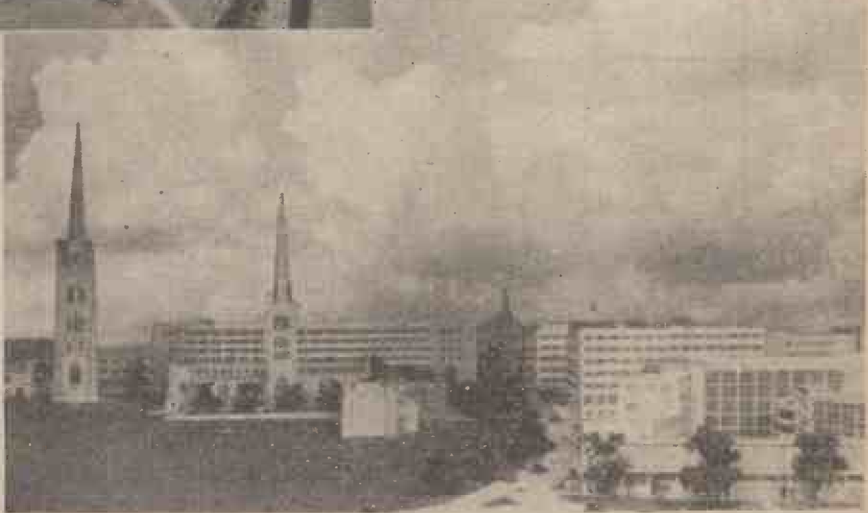


Fig. 3.—Mr. D. E. Gibson the city architect's plan for the modern buildings which will surround the cathedral and Holy Trinity Church. Actually only the spire remains of Coventry cathedral, but a plan for the rebuilding of this historic building of Coventry has been prepared by Sir Giles Gilbert Scott.

as follows: Houses, wall, city gates, 10ft. to the inch, churches and free school, 35ft. to the inch. This of course makes a comparison of the sizes of building difficult but does not detract from the workmanship of the individual buildings.

The boys of the top classes, aged 13 years, did the model work on the cathedral and other churches, and the rest of the work was shared throughout the school. Boys from 11 years to 14 years contributed something. The younger boys made the smaller houses, using black-and-white poster paint and designing the "half-timbered" work from a study of houses still existing in the city. The houses are in six pieces, with overhanging upper storeys. The roofs are of plasticine painted black, or tiled and painted red. Some of the very small houses have thatched roofs of painted "Pyruma" and are made in four pieces.

Teacher and pupils discussed the project, sketched a likely plan and then each boy made his own paper templates. The model took four months to complete, and was not done in school hours. The boys were so keen that they came early every morning, gave up recreation time, and stayed after school to work on their individual sections.

Fig. 4.—The town planning model prepared to go before the Hayes and Harlington Urban District Council to show clearly to those concerned the proposed plans for developing the areas in question.

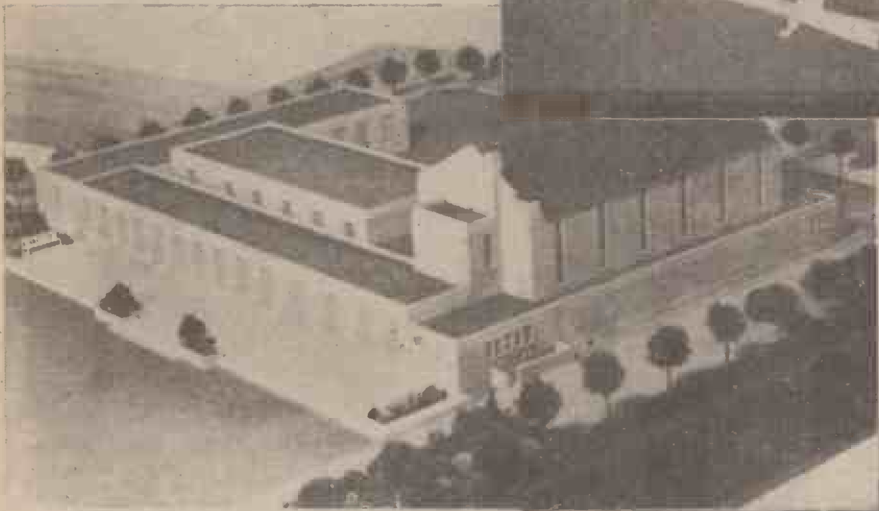


Fig. 5.—Model for a place of worship with surrounding community centre. This model of a Methodist church and its environs was displayed at the Methodist Conference at Nottingham in July.

The stained glass window in the cathedral was copied from old paintings. The stocks, pillory, pumps and mill wheel are in brown plasticine, the walls in grey "Pyruma," while the pool and river are painted on the ground paper in blue. Poster paints were used throughout.

Figs. 6 and 7.—Work of the Service staffs of the Admiralty made for a special sale effort in aid of the Mayor of Bath's Comforts Funds for the Forces. The illustration above shows the ladies' effort, and on the left the men's handiwork is displayed.

Unfortunately, owing to the large size of the model, it could not be included in the Municipal Exhibition, but it has been much admired, and the photograph of the new plan of Coventry makes an interesting comparison for our readers.

Town Planning Model

A town planning model also of interest has recently been completed for the new layout of an area which comes under the jurisdiction of the Hayes and Harlington Urban District Council. The model has been made to show before the council and includes the widening of old roads, the making of new ones and the improvement of the whole civic centre. Laid out to the scale of 1/1,250ft., or approximately 104ft. to one inch, the major buildings of the model are in full detail while the others are indicated merely in low relief plan form. The civic centre is in full detail comprising town hall, youth centre, social centre, swimming baths, large restaurant, etc. On the model provision is made for three new schools—elementary, secondary and senior. The model measures 42in. by 56in., which gives an actual size of 1,526 yards by 1,942 yards. A particular feature from the modelling side is the large number of trees—there are over 600 in all on the model—but trees help greatly to give the effect of realism on work to so small a scale.

Model Church

Before leaving models of this type mention must be made of an entirely new design for a place of worship with surrounding community centre. This has been designed by the well-known architect Ernest Prestwich, of Messrs. J. C. Prestwich, of Leigh, Lancs., who has been responsible for many modern buildings before the war which bore the stamp of clean straightforward lines and ideal of "Fitness for Purpose."

The group of buildings, besides the Methodist church, comprises a lecture hall with stage for concerts, meetings, etc., and also class rooms for students. There is also a car park shown on the model.

This model was prepared by Bassett-Lowke, Ltd., to the scale of $\frac{1}{8}$in. to the foot for display at the Methodist conference at the Albert Hall, Nottingham, in July, and is notable as being all the work of one highly skilled craftsman, representing about 120 man hours, which for the quality produced is "quick work" in modelling.

The idea appears to be that this design of church, with certain modifications, should be a basis for rebuilding the damaged Methodist churches of this country.

It is common knowledge that during the war a portion of the Admiralty was housed in the famous city of Bath and has been there since the beginning of hostilities. Recently members of the Service staffs have interested themselves in the Mayor of Bath's Comforts Fund for the Forces, and made a number of models and toys for sale on the Admiralty Stall. Here are two illustrations (Fig. 6 and 7), showing some of their work, one showing the work of the lady members of the staff in the form of dolls, garments, embroidery and all kinds of cloth animals and woollen toys, whilst the men's effort (Fig. 7) includes a fine full-size doll's pram, some humorous tumbling figures and, of course, models of warships, which have among them the *King George V* and a destroyer. The work of the D.N.C.'s department was judged by Mr. W. J. Bassett-Lowke, and the whole Admiralty effort from the sale held afterwards in the pump room Bath was a great success, and the amount raised has been earmarked for Naval and Mercantile Marine charities.

Letters from Readers

The Phenomenon of Light

SIR,—In reply to the letter by E. G. Nicholson in your last issue, I should like to make a few further observations on the same subject.

Agreed that the velocity of light is 299,776 KM/Sec. (calculated by Anderson, Cambridge, 1940), and that it is the same over the whole universe, yet Wallis and myself in former letters have knowingly suggested what to present-day knowledge seems the impossible—that matter should move faster than radiation for the purpose of experiment, and have speculated on the impressions of an observer so doing.

If I travel at, say, 100,000 KM/Sec. and flash a light forward in the direction of motion, I do not expect the light ray to take on a speed of 299,766 KM. plus 100,000 KM. per second, nor should I deprive the ray of a similar velocity if I direct the beam towards my wake.

To quote Sir Oliver Lodge in *Ether and Reality*, he writes: "The ether, as it were, stands by, always ready to pick up any loose energy and broadcast it with the speed of light" (chapt. IV).

But, and this is still my contention, once released as radiation at fixed velocity, it must share a relative nature with all matter. If, as Nicholson writes, "it is the same at any place in the universe and in regard to any piece of matter," then surely the velocity of any piece of matter must have some corresponding relationship with radiation at any place in the universe.

It is also suggested that my former letter was fallacious in so far as I maintained the relative nature of the speed of light. Imagine two projectors similarly situated. One projects a flash of light, the other expels a piece of matter at a speed greater than radiation, say, 300,000 KM/Sec. Is it not difficult to believe other than a difference of 224 KM/Sec. velocity between those two projectiles?—C. J. WILLIAMSON (Scalloway).

Synthetic Proteins

SIR,—In the article on "Modern Glue Manufacture," in the September issue, it is stated that "materials which are in very many ways like natural proteins have been created."

It is only due to the long and arduous work carried out by E. Fischer that we know this much. How near to the natural materials may be judged by the fact that he discovered octadecapeptide, a gigantic molecule containing 15 glycyl groups ($-NH.CH_2.CO-$) and three leucyl groups ($-NH.CH\ (C_4H_9).CO-$), this compound has a molecular weight of 1212. It belongs to a group of compounds called polypeptides. It has a formula thus: $NH_2\ CH\ (C_4H_9).CO.[NH.CH_2\ .CO]_3\ .NH.CH\ (C_4H_9).\ CO.[NH.\ CH_2.CO]_3.NH.CH.[NH.CH_2CO]_8.NH.CH_2.COOH$. It was made by treating an amino acid with phosphorus pentachloride and acetyl chloride, and the acid ester so obtained in the form of hydrochloride is reacted with an ester of an amino acid; this is used as a starting point for further condensations.

It is almost the same as a natural protein, and, like the latter, does not diffuse through parchment membranes, and is precipitated by tannin. It gives all the colour reactions of a protein (orange with nitric acid, gives Biuret reaction, and a red colour with Millon's reagent).

Whether these polypeptides are proteins is rather an open question, for although pepsin hydrolyses proteins, and has no effect on polypeptides, the carefully regulated hydrolysis of proteins gives polypeptides that can be obtained synthetically.—M. J. SOULAL (South Harrow).

PLASTIC ARMOUR

(*Continued from page 28*).

anticipated. Parts of "Mulberry" prefabricated harbour were also fitted with P.P.P. and there have also been land uses, such as portable blockhouses, for which 137,000 plates were made.

Special barges fitted with large tanks for carrying petrol and water were protected by a framework of steel carrying P.P.P. over the top part of the tanks and with large quadrant slabs at the ends.

As enemy aircraft were sneaking over and firing at our coast-wise railway engines, experiments were made to protect the locomotives, and at Eastleigh the cab of the engine "King's School Wimbledon" was fitted with 2½in. P.P.P. special size slabs, but the matter was not furthered, as these raids ceased during December, 1942.

Outlets for the use of plastic armour when no longer needed have been considered. The original P.A. can be melted down to provide a material suitable for road surfaces at bus stops and where there is heavy traffic or for factory flooring. Surplus plastic protective plating finds a use as a flooring on which to stock shells and cartridges at various depots.

It is highly satisfying to record, albeit briefly, this history cycle of a development sponsored by the Royal Navy which, while saving lives and steel, has done much to foster and maintain the high morale of the Merchant Navy. ■

The Stereoplanograph

THE discovery in Germany of a number of stereoplanographs may help town and country planning experts in the task of rebuilding the new Britain. These stereoplanographs are highly developed map-making instruments which were used by the German Air Force.

Whereas formerly maps were drawn from photographs by hand, these instruments automatically record contours of areas from aerial photographs. The instruments were discovered hidden in a mining engineering college and an adjoining copper shaft in the Hartz mountains.

The machine is so delicate that among the parts was a special type of vacuum cleaner to keep out dust, and, when not in use, a silk sheet covered the entire instrument. It even had its own specially designed pencil sharpener and particular type of pencils.

S/Ldr. F. C. Crowdy, a staff officer of the disarmament staff of B.A.F.O., and a photographic expert, was the first to examine the instrument.

"The stereoplanograph, which was made by the German firm of Zeiss, is a model of precision engineering," he said. "There is no doubt that if it is used by our town and country planning experts it will be of the utmost use. Parts of the United Kingdom could be photographed from the air and the stereoplanograph would produce an accurate map from the photographs taken by the aero-camera."

QUERIES *and* ENQUIRIES

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

Quick-drying Paint

WOULD you please inform me how to make some "super quick drying paint," that will dry in approximately 10 minutes ? I am in need of such a paint for toys.—C. W. Hider (Denbury).

YOU can make a quick-drying paint by obtaining collodion and incorporating the necessary dry pigment into it. The resulting paint will dry in about a *minute*. Collodion is rather expensive and, on account of its volatility, does not keep well. It can be obtained from your local druggist. It is made by dissolving nitro-cotton in a mixture of equal parts of alcohol and ether.

A slower drying paint can be made by dissolving clear scrap celluloid in a mixture of approximately equal parts of amyl acetate and acetone, or in a liquid known as "cellusolve" (these liquids obtainable from Messrs. A. Boake, Roberts and Co., Ltd., Stratford, London, E.11). To the resulting clear varnish, the dry, ground pigment is added. By increasing the proportion of acetone in the paint, you will shorten the drying time, but if the proportion of acetone is increased beyond a certain limit, the paint will dry dull.

Casting Perspex

CAN you supply me with a formula for the rapid hardening of methyl methacrylate so that small castings can be produced ? Also, can you give me any information concerning the price and supply of any accelerator required in the process ?—A. Steers (Southampton).

METHYL methacrylate, being a definite chemical substance, cannot be hardened or caused to "set" at more than its normal rate. It is possible, of course, that other compounds may be incorporated with it in order to increase the hardening rate of the whole, but, if so, these admixtures have never been published. A large amount of information concerning plastics technique has been and is maintained closely secret, so that, in this particular matter, we can only advise you to apply for any published literature on the subject to Imperial Chemical Industries, Ltd., Millbank, London, S.W.1. We do not think that any other firms will be able to help.

White Glazed Tiles

(1) Please let me know the materials from which white glazed tiles are manufactured, and how the glaze finish is produced ?

(2) I have seen white deposits (stalagmites and stalactites) in caves, and the substance appears to have a beautiful glossy finish (of course, I understand that it takes years for nature to build up these marble-like statuesque figures), nevertheless, will you let me know the nature or composition of the mixture which comes through the roof of the caves to form these stalagmites ? In your opinion is it possible to copy nature and produce a mixture which will harden with a glossy white finish ?

(3) Can a hard, smooth substance be produced from skim milk ; if so, will you let me know the process.—John Phelan (Bandon).

(1) White glazed tiles are generally manufactured from ordinary pottery clay or china clay, this material being lightly compressed into shape and then "fired" in a muffle furnace at a white heat. Subsequently, a white glaze is brushed or sprayed on to the tiles, and the latter are again fired in an oven at a temperature of about 1,200 deg. C. The actual glazing material may be of various compositions. Here is a typical one :—

Borax, 100 parts (by weight) ; china clay, 55 parts ; whiting, 60 parts ; feldspar, 75 parts.

It is almost impossible for any amateur, unless he is specially equipped with gas-fired high-temperature muffle furnaces, to embark on the production of glazed tile manufacture, the technicalities of which are exceedingly difficult to carry out on a small scale.

(2) Stalagmites and stalactites are composed for the most part of calcium carbonate, together with a little iron and magnesium carbonates and a small amount of silica. It takes about 10,000 years for Nature to build up a good example of either of these objects. Water is charged with soluble calcium *bi*carbonate together with dissolved carbon dioxide gas. When slowly dropping through the roof of a cave, each drop looses some of the carbon dioxide, and insoluble calcium carbonate is produced. Some of this falls to the ground with the water drop, and so produces the stalagmite, but a little of the carbonate attaches itself to the roof of the cave, and so gradually produces the stone-like icicle which grows downwards from the cave roof and to which the name "stalactite" is applied. It is hardly possible to copy this natural process—at least within any reasonable time. The "furring" of kettles and the production of boiler incrustations is a similar process.

(3) You can make a plastic material from ordinary milk (not merely skim milk) by putting the milk in a churn and adding a quantity of rennet (about 10 ccs. of rennet to every 10 litres of milk). The best temperature of the milk for rennet treatment is 37 deg. C. As soon as the milk begins to set, the churn should be rotated and, after an hour, the contents discharged into a vat or pail and allowed to settle. The curd is then filtered off through fine cloth. It is then dried and lightly pressed. In this form it consists for the most part of casein. The casein may then be mixed with an equal amount of slaked lime, together with a little sawdust (fine), and moistened with a solution of caustic soda (1 part of caustic soda in 10 parts of water). Pack the resulting paste into moulds and allow it to set. It will produce a hard, whitish solid. By mixing pigments, as, for example, iron oxide, etc., with the casein, you will be able to obtain coloured materials. The process, however, is expensive, and is not adapted to large-scale working.

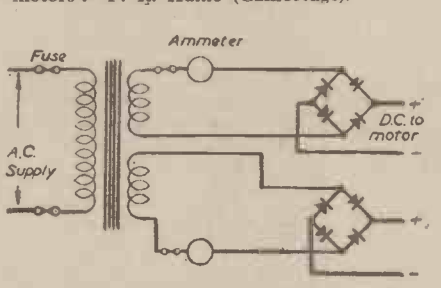
Transformer-rectifier

I REQUIRE a transformer-rectifier to drive two 12-volt motors ; it is essential that the rectifier gives two separate outputs of 12 volts 2 amps. Input will be 200/240 volts 50 cycles A.C.

I am given to understand that a suitable unit will cost anything up to £12. It has occurred to me that by purchasing the necessary components I can make one up at very much less cost. Can you :

(a) Advise me what type of transformer and rectifier (metal) I shall require and where they can be obtained ?

(b) Supply a circuit diagram incorporating fuses to guard against shorting in the motors and an ammeter to show current taken by motors ?—F. R. Hume (Cambridge).



Circuit diagram of a transformer-rectifier.

WE suggest you use a 72-volt-amp. transformer having a single primary winding tapped for 200 to 240 volts, with two secondary windings each having an output of 18 volts 2 amps. This could be used with two bridge-connected metal rectifiers having outputs of 2 amps. at 12 volts D.C.

The rectifiers could be obtained from the Westinghouse Brake and Saxby Signal Co., Ltd., of 82, York Road, Kings Cross, London, N.1. As it is quite likely the transformer would have to be specially made, we suggest the cheapest way would be for you to construct this item yourself.

Removing Spots from Watercolour Painting

I HAVE a small watercolour painting (seascape), and five years in an unheated room has caused mildew spots to appear about ⅛in. across. They show only on blue-white sky and blue-green sea, but mar the picture.

Can you tell me of a simple cure ? I once soaked a small watercolour in ammonia, but while it improved mildew spots it weakened colours. The painting is on proper drawing paper, pasted on to card for mounting.—E. H. Hanson (Burnham).

IT is quite possible to remove the spots from your watercolour drawing provided that they are not too large. You refer to "mildew" spots, but we take it that you mean brown or yellow spots which have been caused by the picture being in a damp place for a prolonged time. These are known as "foxing" spots, and they are not quite the same as markings due to actual mildew growth. They are mainly due to impurities in the paper, plus, of course, prolonged exposure to damp surroundings. The paste at the back of the picture may, also, have a great influence in their causation.

Your best mode of procedure for dealing with these spots is the following :

First of all, remove the card mount from the picture. This is best done by laying the picture face downwards on to a flat wad of clean white blotting-paper, or, alternatively, on to a sheet of plate glass, and damping the back of the mount. When the mount has become sufficiently softened by the water it will be able to be scraped away and peeled off in layers. This, of course, is a most delicate operation, but it can be done quite successfully given sufficient time and patience.

Having removed the mount, examine the back of the picture. If the foxing spots are present thereon, they must go right through the paper to the picture side. If not, then the foxing is only on the picture side of the paper and is probably only superficial.

In any case, the next operation consists in drying the picture and in laying it down, picture side upwards, on a clean sheet of glass. Now take a fine camel-hair brush dipped in Milton and very carefully apply it to the centre of each spot. Use a hand lens for this operation. Allow the drop to remain on the paper for a minute. Then carefully remove it with blotting-paper. Repeat the process two or three times until the yellow spot has disappeared, leaving, perhaps, a white spot in its place.

Having treated all the spots in this manner, allow the paper to dry completely. Then turn it over, picture side downwards on to a sheet of clean glass and very carefully wash the back of the picture with a sponge, soap and warm water. Try, during this operation, not to let the water penetrate to the other side of the picture, nor away from the edges of the latter. Remove the soap from the back of the picture by means of a clean water rinse and then remove as much water as possible by means of blotting-paper. Finally, allow the picture to dry (still face downwards) without heat.

Now make up a small quantity of a solution by diluting one part strong ammonia with seven times its volume of water. Hold the dried picture up to the light, the back of the picture facing you. Dip a fine camel-hair brush in the ammonia solution and moisten the paper behind each spot (or, rather, behind where each spot has been). Repeat this operation. Then lay the picture face downwards on glass again and, using a soft sponge, swab over its back with clear water to remove all trace of the ammonia. After this, let the picture dry between blotting-paper and under slight pressure.

Finally, remount the picture on to a fresh mount by means of the dry-mounting process (any photographer will do this for you). Do *not* use paste for the mounting, since paste is productive of spots.

It will then be necessary for you to "touch in" each spot area with a very little colour so as to match up the spot area with its surroundings. Again use a hand lens for this job, which, if carefully done, will render such areas absolutely indistinguishable from the rest of the picture.

A spotted watercolour drawing treated in this manner will be completely restored, and, provided that it is not returned again to damp surroundings, its restoration will be permanent.

Cement for Lenses

COULD you please tell me what kind of adhesive is used for the joining of lenses, and where may I obtain such adhesive ? Is there any special method for obtaining a faultless joint ?—J. E. Castell (Middlesbrough).

THE usual cement for the joining of optical lenses and other glasses is Canada balsam dissolved in benzene, turpentine, toluene or chloroform. You can purchase the Canada balsam yourself (pre-war price about 5s. per lb.), or, better still, you can purchase it in the dissolved state, price about 1s. per oz., which quantity ought to be sufficient for ordinary use.

The Canada balsam cement can be obtained from Messrs. Flatters and Garnet, Ltd., Microscopists, Oxford Road, Manchester, or from Messrs. Harrington Bros., Ltd., 4, Oliver's Yard, 53A, City Road, London, E.C.1.

A thin coating of the balsam is given to the glass surfaces which are to be joined and the article is then put away under slight pressure in a warm room for the balsam to set. This takes about a month. The result is a perfectly transparent join. If, for any reason, the cementing has been done faultily, the article can be "unstuck" by soaking it in turpentine for a day or two and then very gently easing the component glasses apart.

Glass cementing is not an easy task, particularly when working with lenses, but it is well within the scope of an amateur. Care, however, must be taken to avoid air-bubbles between the glasses.

Chalks and Crayons

COULD you kindly give me particulars for making chalks and crayons, using only the simplest method and easily produced tools? I am able to obtain various reclaimed greases which I thought may be used in making the crayons.—F. Rushton (Kingsbury).

ORDINARY writing chalks are usually made up on a basis of china clay pigmented by the addition of some coloured mineral substance.

Take approximately equal parts of china clay and powdered magnesite and mix these intimately with one or two parts of ultramarine, lime green, ochre, or whatever colour may be desired. Make the mixture into a very stiff dough with the least possible quantity of water. Pack the dough into cylindrical moulds made in the two halves of a block of wood or metal. If the resulting chalks are too soft, add more china clay. If too hard, add more magnesite. Magnesite can be obtained from Messrs. Harrington Brothers, Ltd., 4, Oliver's Yard, 53a, City Road, Finsbury, E.C.1.

Coloured crayons are made by mixing pipeclay with water to form a stiff paste. Usually, soapy water is employed in order to give a certain amount of "grease" to the crayon. The colours are produced by mixing suitable mineral pigments (blue, red, green, etc.) to the pipeclay in the amount required. Instead of moulding, as above, the pigmented clay may be made up into small balls, which are each rolled down between flat wooden boards and then cut up into suitable cylindrical or pencil-like lengths, which are then dried, first in the air and finally in a gentle heat.

Cellulose Cement

I WISH to make cellulose cement and understand that it can be made by dissolving cotton in a solvent.

I should be much obliged if you could advise me as to the best solvent and method of making, or suggest an alternative.—C. Thomas (Norbury).

THE best type of "cellulose cement" for your purpose is made by dissolving scrap celluloid in a mixture of two parts amyl (or butyl) acetate and one part of acetone. The two liquids are mixed and the celluloid is shredded and then added to the mixed liquids in a bottle. Dissolve by shaking only, not by heat. By dissolving the celluloid in this manner you can obtain any consistency of cement which you may require.

Alternatively, you can employ "cellusolve," a clear liquid, in place of the above mixed liquids.

These materials may be obtained normally from any large paint stores, or from Messrs. A. Boake, Roberts and Co., Ltd., Stratford, London, E.4. Alternatively, any firm of laboratory suppliers should stock them, although at the moment acetone is very difficult to obtain.

Another type of cellulose cement may be made by dissolving nitro-cotton in a mixture of equal parts of alcohol and ether. The previously mentioned cement, however, is the better of the two.

Refrigerator Functioning

WILL you please give me details of how the non-electric refrigerator for domestic use functions? In this type of instrument there are apparently no pumps, and the source of the "cold" supply is obtained by means of a small oil or gas burner.

Can you give any details, please, to enable a small cabinet to be constructed: sizes and lengths of pipes and the fluid used, etc., together with any snags which have to be avoided.—W. R. Knight (Launceston).

IT is not possible for us to go into the precise details of refrigerator functioning within the space of a short reply. There are quite a number of books available on these subjects, and we have published articles concerning the principles of refrigerator operation from time to time.

In brief, however, the non-electric refrigerator functions in this manner: the heat source (gas or paraffin oil) serves to vaporise a quantity of a liquid known as the "refrigerant." The vaporised liquid circulates through the internal circuit of the refrigerator and in so doing it expands considerably. Now when a gas or a vapour expands, it must do so by utilising the heat energy of its surroundings. Consequently, its surroundings must become cooler owing to the heat energy which has been abstracted from them. The construction of the non-electric refrigerator so arranges matters that the greatest expansion of the refrigerant takes place in coils which surround the freezing compartment of the refrigerator. After expansion, the refrigerant vapour or gas continues its circular flow. It again becomes condensed, in which condition it flows towards the "evaporator" (i.e. the chamber or coil in which it is again heated), and in this way its cycle of expansion is again renewed.

We are of the opinion that it would be an extremely difficult matter for any private individual to make for himself a satisfactorily working refrigerator on the lines of the commercial models. For one thing, their designs and dimensions are more or less secret, and, furthermore, it is a very difficult matter to get the exact "balance" of the refrigerant within the refrigerator. If this "balance" is not obtained, the machine will not work.

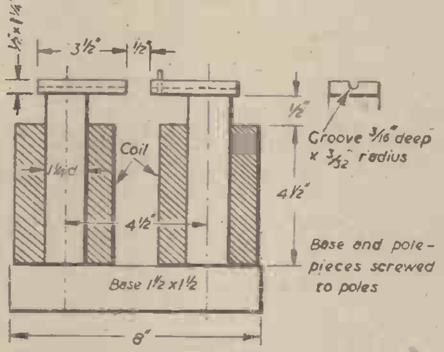
Our best advice is that you should acquaint yourself more fully with the details of refrigerator construction and principles in order that you may more readily be able to size up the great difficulties inherent in the construction of such machines. The following books are to be recommended, and may in some instances be obtained secondhand from a good technical bookseller such as Messrs. W. and G. Foyle, Ltd., Charing Cross Road, London, W.C.2, or Messrs. Wm. Boyce, Lothian Street, Edinburgh: A. M. Greene, "Elements of Refrigeration", (23s.); H. Williams, "Mechanical Refrigeration" (20s.); J. A. Ewing, "Mechanical Production of Cold" (15s.); H. B. Hull, "Household Refrigeration" (20s.); W. H. Metz, "Principles of Refrigeration" (37s. 6d.). Prices given in brackets represent net pre-war published prices of these volumes.

Making Small Bar Magnets

I WISH to make several small round bar magnets ⅞in. long by $^{3}/_{16}$in. diameter. Could you please tell me the best method of doing this, also the type of steel, and how to give the magnets exactly the same magnetic intensity?—C. H. Cole (Spennymoor).

IN order to give the magnets practically the same strength it will be necessary to use exactly the same quality of steel for each and to give them exactly the same magnetic treatment. Steel such as "Ticonal," supplied by Mullard Wireless Service Co., Ltd., of Century House, Shaftesbury Avenue, London, W.C.2, should give good results.

We suggest you build up a magnetiser of soft iron or mild steel as indicated below. The poles should be fitted with pole pieces having a circular groove of $^{3}/_{32}$in. radius into which the steel bars can be dropped,



Sectional view of magnetiser for small bar magnets.

a brass locating pin being fitted in one pole-piece. For use from a 12-volt D.C. supply each coil could have about 3½ lb. of 16 D.C.C. copper wire, the two coils being connected in series to create poles of opposite magnetic polarity. The coils will then take about 8 to 10 amps. For use on a 6-volt supply the two coils could be connected in parallel, to take about 16 to 20 amps.

The steel bars are magnetised by placing them in the grooves in the pole-pieces with one end up against the locating pin, the current then being switched on and off a few times. In order to retain maximum magnetism in the bars a soft iron or mild steel keeper should be placed between the poles of the bars, i.e. along the top and in contact with the bar, before removing it from the magnetiser. A keeper should be kept alongside the bar in this way until final assembly, if possible, although the magnetised bars may be packed parallel with each other and with poles of opposite polarity in contact to serve the same purpose. The intention is to avoid interrupting the magnetic circuit of the bar magnets.

Leather Dyes

I SHALL be pleased if you will supply me with a reliable formula for leather dyes for the following colours: Black, navy blue, light brown and dark brown. I wish to dye about one square yard at a time. If there is likely to be any difficulty in obtaining chemicals, please indicate a suitable source of supply.—E. Hanson (Great Houghton).

WE cannot give you a "formula" for making leather dyes for the reason that all these dyestuffs are chemically manufactured products of highly complex composition, which can only be produced with the highest chemical skill. However, provided that you can obtain the necessary leather dyes, you should not experience much difficulty with their application.

A true leather dye is soluble in oil, and the leather is dyed by immersion of the article. This, however, is an unsatisfactory method to apply on a small scale. It is better to use a spirit soluble dye (many of the leather dyes are spirit soluble), and to dissolve the dye in methylated spirit, afterwards brushing the dye solution on to the clean leather surface until the required shade is obtained. In this way, some of the brightest colours may be produced on the leather. By this method, the leather is not usually dyed throughout, the dye usually penetrating to about an eighth or a quarter of an inch. This penetration, however, is usually sufficient for all needs.

After the application of the dye, rub a little castor or neatsfoot oil on to the leather surface in order to "seal" the dye and to heighten its depth of shade. Always remember that after this oil treatment, the colour will appear darker on the leather. Hence, always make allowance for this fact when deciding on the required shade of the colour on the leather.

Spirit and oil soluble dyes may be obtained from Messrs. Harrington Brothers, Ltd., 4, Oliver's Yard, 53a, City Road, Finsbury, London, E.C.1, or from any other firm of laboratory suppliers, such as Messrs. Reynolds and Branson, Ltd., of Leeds. An average price is 1s. 6d. per oz. of dye. One ounce of dye will suffice for the treatment of many square feet of leather. You can also obtain oil and spirit soluble dyes from Messrs. A. Boake, Roberts and Co., Ltd., "Ellerslie," Buckhurst Hill, Essex (temporary address).

Calotype Process

COULD you tell me if there is such a process in photography known as Calotype where the negative is soaked in peroxide of hydrogen and then laid flat on plain paper, this paper when placed in a solution of iron salts giving a positive print? If there is such a process could you please give me details?

Where can I buy "Ferrotype Sensitiser"?—J. Fitpatrick (Liverpool).

THERE is a photographic process known as the Calotype process, but it is not the one to which you refer. Indeed, we can discover no such process as the one described by you. The Calotype process was discovered about 1840 by Henry Fox Talbot, one of the original inventors of photography. It is, of course, quite obsolete now. Good quality paper, in the Calotype process, was brushed over with a solution of silver iodide in potassium iodide. It was then dried, and, when required for exposure it was brushed over with a solution of gallo-nitrate of silver and exposed in the moist condition in the camera for about five minutes. Subsequently, the paper was developed with a solution of gallo-nitrate of silver in excess of gallic acid solution. The resulting negative was then fixed and washed in the usual way. Finally, it was dried and then impregnated with wax in order to render it semi-opaque.

We doubt whether "Ferrotype Sensitiser" is now being manufactured. However, an inquiry to Messrs. Wallace Heaton, Ltd., New Bond Street, will bring you a quotation for this material if it is still available. You might also try Messrs. J. Chapman & Co., Ltd., Albert Square, Manchester.

Solvent for Scale in Pipes

COULD you give me a formula of a solvent to assist in the removal of lime or chalk fur from domestic hot-water boilers and pipes?—C. M. Chick (Sparsholt).

SOLUTIONS of caustic soda are very effective in removing scale and fur from hot-water systems, but we fear that, in your case, this remedy might be too drastic, and that it might result in some corrosion of the joints of the system. We think, therefore, that you had best rely on ordinary washing soda. Place a handful of this in the hot-water system every week or so for a month or two. It will loosen the scale, partially dissolving it, and will bring it away. You can use a greater quantity of the soda if you wish, but, in our opinion, it is better to apply the milder treatment, repeating it at intervals until the scale has disappeared.

Trisodium silicate (obtainable from Laporte, Ltd., Luton, Beds, at about 2s. lb.) is also excellent for the same purpose, and can very conveniently be mixed with the common washing soda in the proportion 3 parts of soda to 1 part trisodium silicate.

Treatment of Damp Cellar

CAN you help me to solve the following problem? I have a small cellar, the walls and floor of which are very damp. I intend to give the floor (which is of brick, badly broken in parts) a layer of concrete. I had also thought of doing the same to the walls, which are also bare brick. Is there anything that I could add to the cement to make it damp-proof? Or would it be better to dress the walls with something first?—C. Chamberlain (Bootle).

THERE is very little you can do to your cellar to make it waterproof. You can, of course, remove the lowest row of bricks in the walls and insert a slate or other type of dampcoursing therein, afterwards replacing the bricks, but this, naturally enough, would constitute a rather big job. The rendering of the walls with a good cement would also improve matters, but it would not make the walls entirely damp-proof.

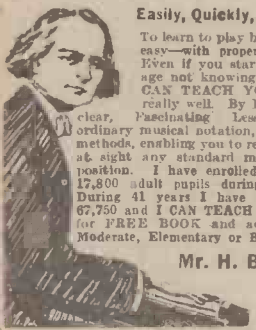
The same applies to the floor. No concrete is entirely damp resistant. However, in your case, much good would be effected by laying two coats of cement on the floor, and by giving an ample concrete "coving" (i.e., up-turning) at the junction of the walls and floor. Use a mixture of equal parts of sharp sand and Portland cement for the work.

In order completely to waterproof the walls and floor, treatment with asphalt would be required, but this highly-skilled job requires the application of hot asphalt, and we do not think that you would be able to tackle it. However, if you care to experiment in this direction you may be able to obtain a few blocks of asphalt locally from the Penmaenmawr and Trinidad Asphalt Works at Bootle.

B.A. thread screws, one gross useful sizes, 2/6 ; ditto, nuts, 2/6 gross ; assorted gross screws and nuts, 2/6 ; ditto, brass washers, 1/6 gross ; fibre washers, 1/6 gross ; assorted soldering tags, 2/- gross ; assorted small eyelets and rivets, 1/3 gross. Large stock of screws, etc. State requirements. S.A.E. Rubber-covered stranded copper wire, 1d. yard ; heavier quality, 1½d. yd. ; very heavy quality, 2½d. yd. ; ideal for aerials, earths, etc. Single cotton-covered tinned copper wire, 25 g., 12 yds., 9d. ; 50 yds., 3/- ; tinned copper connecting wire, 20ft. coil, 6d. ; ditto, rubber-covered, 10ft., 6d. ; finest quality push-back wire, 12 yds., 2/3 ; twin bell wire, 12 yds., 1/9 ; ditto, heavier quality, 12 yds., 2/3 ; ditto, flat rubber-covered, 3d. yd. ; twin flat braided electric cable, 6d. yd. ; Wood's metal stick, 2½in. by ¼in., 1/-. Cotton-covered copper instrument wire, ¼lb. reels, 18, 20, 22, 24 g., 1/6 ; 26, 28 g., 1/9 ; 30, 32 g., 2/- ; 34, 36 g., 2/3 ; silk-covered ditto, 2oz. reels, 24, 26, 28 g., 1/6 ; 30, 32, 34, 36 g., 1/9 ; 42 g., 2/- ; 16 g., double silk-covered, 1lb., 5/- ; 18 g., enamelled, 1lb., 3/6. Sensitive permanent crystal detectors, Tellurium-Zincite combination, complete on base, guaranteed efficient, 2/6 ; glass tube crystal detectors, complete, 2/- ; reliable crystal and cats-whisker, 6d. Reconditioned headphones, complete, 4,000 ohms, 12/6. All postage extra.

**POST RADIO SUPPLIES,
33, BOURNE GARDENS,
LONDON, E.4.**

MASTER THE PIANO



Easily, Quickly, Enjoyably

To learn to play beautifully is easy—with proper teaching! Even if you start at middle age not knowing a note, I CAN TEACH YOU to play really well. By POST. Sun-clear, Fascinating Lessons using ordinary musical notation, no freakish methods, enabling you to read and play at sight any standard musical composition. I have enrolled more than 17,800 adult pupils during the War. During 41 years I have taught over 67,750 and I CAN TEACH YOU. Send for FREE BOOK and advice. Say Moderate, Elementary or Beginner.

Mr. H. BECKER

(Dept. 358), 69, FLEET STREET, E.C.4.

JUBILEE WORM DRIVE HOSE CLIPS

Patent

The long-life clip with the ever-tight grip

The Best Known

For Radiator Joints, Air, Oil and Water Hose Joints

We guarantee a Tight Joint

L. ROBINSON & Co.
25, London Chambers,
GILLINGHAM, KENT

CHEMISTRY ARE YOU INTERESTED?

Whether you dabble in experiments or pursue a course of serious study you will need our LABORATORY EQUIPMENT.

Send 1d. stamped envelope for PRICE LIST.

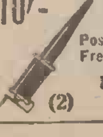
BECK

(SCIENTIFIC DEPT. A), 60, HIGH STREET, STOKE NEWINGTON, LONDON, N.16.

Booklet : "Experiments in Chemistry," 7d. P.O.

"VIBRO-ARC" Engraving Pen

10/- Post Free



For rapid engraving any metal—hard or soft. Operates from 4–6v. Battery or A.C. Transformer.

HOLBOROW,
(2) Boroughbridge, Yorks.

LET ME BE YOUR FATHER

You need help and Fatherly advice in difficult times like these. I am in the position to give that to you FREE.

We teach nearly all the Trades and Professions by Post in all parts of the world. The most progressive and most successful Correspondence College in the world.

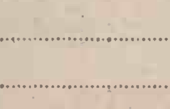
If you know what you want to study, write for prospectus. If you are undecided, write for my fatherly advice, it is free. Distance makes no difference.

DO ANY OF THESE SUBJECTS INTEREST YOU?

Accountancy Examinations
Advertising & Sales Management
Agriculture
A.M.I. Fire E. Examinations
Applied Mechanics
Army Certificates
Auctioneers and Estate Agents
Aviation Engineering
Aviation Wireless
Banking
Blue Prints
Boilers
Book-keeping, Accountancy and Modern Business Methods
B.Sc. (Eng.)
Builders' Quantities
Building, Architecture and Clerks of Works
Cambridge Senior School Certificate
Civil Engineering
Civil Service
All Commercial Subjects
Commercial Art
Common Prelim. E.J.E.B.
Concrete and Structural Engineering
Draughtsmanship, all Branches
Engineering, all Branches, Subjects and Examinations
General Education
G.P.O. Eng. Dept.
Heating and Ventilating
Industrial Chemistry
Institute of Housing
Insurance
Journalism
Languages
Mathematics
Matriculation
Metallurgy
Mining, All Subjects
Mining, Electrical Engineering
Motor Engineering
Motor Trade
Municipal and County Engineers
Naval Architecture
Novel Writing
Pattern Making
Play Writing
Police, Special Course
Preceptors, College of
Press Tool Work
Production Engineering
Pumps and Pumping Machinery
Radio Communication
Radio Service Engineering
R.A.F. Special Courses
Road Making and Maintenance
Salesmanship I.S.M.A.
Sanitation
School Attendance Officer
Secretarial Examinations
Sheet Metal Work
Shipbuilding
Shorthand (Pitman's)
Short Story Writing
Speaking in Public
Structural Engineering
Surveying
Teachers of Handicrafts
Telephony and Telegraphy
Television
Transport Inst. Examinations
Viewers, Gaugers, Inspectors
Weights and Measures Inspectors
Welding
Wireless Telegraphy and Telephony
Works Managers

If you do not see your own requirements above, write to us on any subject. Full particulars free.

COUPON. CUT THIS OUT



IF YOU ATTEND TO THIS NOW IT MAY MAKE A WONDERFUL DIFFERENCE TO YOUR FUTURE.

To Dept. 76, THE BENNETT COLLEGE, LTD., SHEFFIELD

Please send me (free of charge)
Particulars of............................
Your private advice about............................

(Cross out line which does not apply)

PLEASE WRITE IN BLOCK LETTERS

Name ....

Address ....

....

A.C. BATTERY CHARGER

For charging car accumulators, either 6 or 12 volt at 1 amp., in enclosed metal case. Input and output flex, leads and **ADAPTORS.** A thoroughly efficient job. Price 39/6, post 10d., state 6 or 12 volt.
COMPLETE SET OF PARTS, including case and blue print. Price 32/6, post 10d.
BOAT MOTORS, low centre, wound field, high-speed, weight 18oz. Size 5″ x 1¾″ x 2″. Well made—No Rubbish. Price 26/-, post paid.
ELECTRIC ENGRAVERS. Powerful instrument in cylindrical cases, on stand, with spring attachment and switch, suitable for dog collars, identity discs, etc. A.C. Mains Model, 200-240v. 75/-. 4-6-volt Battery Model, 55/-.
SWITCHBOARD METERS, A.C.-D.C. N.P. cases, 1¾″ dial. Readings up to 0-25 volts, 0-25 amps. Price 15/6 each.
TOOLS. Send 2d. stamp for list of over 200 useful tools of all kinds.

ECONOMIC ELECTRIC CO.,
64, London Road, Twickenham, Middlesex.
Tel. : POPesgrove 1318.

"Peace On Earth"

It has come again but this time let it be a lasting peace based on mutual understanding between nations. The quickest way to accomplish this is to learn Esperanto, the international language which is spoken and written in over one hundred countries all over the world.

A correspondence course, including text-book and correction of exercises, costs only 5/-.

Write for full particulars to the BRITISH ESPERANTO ASSOCIATION, INC.
Dept. P.M.3, 140, Holland Park Avenue, London, W.11.

GIVE THOSE YOU LOVE

A Radio You Have Made Yourself.

The "JB VICTORY FOUR" is :
(a) Child's play to build.
(b) Suitable for work off A.C. or D.C. mains and bang up to date.
(c) Portable, it needs no aerial or earth.
(d) Ideally suitable for Bedroom, Nursery, Workshop, etc.
(e) Guaranteed 6 months and subject during this time to free service.

Complete kit of parts, including valves and all items, even nuts, bolts, wire, etc., with full detailed layouts and wiring instructions, £7/17/6. Diagrams, etc., only, 5/- ; refunded if complete kit bought later.

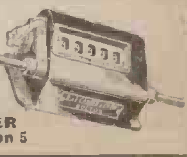
V.E.S., Radio House, Ruislip.

MODEL MAKERS PAMPHLETS

The following carefully illustrated pamphlets are now available at the reduced price of 1/- each. Please enclose stamped and addressed envelope to: **Mr. HOPKINS, 191 Smarts Lane, Loughton, Essex.**

L.670. Details of 5in. spark coil (including condenser, etc.).
L.673. How to re-make old torch batteries at approx. 1d. each.
L.671. Details of 4in. spark coil.
L.615. How to electroplate at home using simple apparatus.
L.626. Details of Shocking Coil.
L.646. Full details of 2- and 6-volt Trickle Chargers (A.C. mains type).
L.372. Details of 2in. spark coil.

RATCHET & REVOLUTION COUNTERS



Ask for Leaflet No. 18/3

Speed up to 6,000 r.p.m.

B. & F. CARTER & Co. Ltd., Bolton 5

THE Cyclist
Editor: F. J. CAMM

All letters should be addressed to the Editor, "THE CYCLIST," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London

VOL. XIV OCTOBER, 1945 No. 284

Comments of the Month By F. J. C.

Our Road System

IN March, 1939, there were 27,545 miles of Class 1 road, 17,634 miles of Class 2 road, 135,348 miles of unclassified roads, making a total of 180,527 miles. Trunk roads totalled 4,456 miles, or one-sixth of the mileage of first class roads. Trunk roads are controlled by the Minister of Transport, under the Trunk Roads Act, 1936, which commenced to operate in April, 1937. Sections passing through leading cities and boroughs, however, are not under his control. There are still 111 level crossings on trunk roads and the Minister has not exercised his powers to force the railways to build overbridges, and traffic is still incommoded by this archaic and dangerous railway system which, like the tramways on the open roads, reflect the inanity of the legislators of the past century.

In 1910 there were 175,437 miles, and so our road mileage has only increased by 2.9 per cent. in 29 years. Yet the number of vehicles on the road is 21 times greater now than it was in 1910. It is important to remember that much of the increased road mileage is accounted for by roads in housing estates. These roads thus cannot be considered as roads in the real sense of the term.

In the last 10 years the mileage of unclassified roads in Great Britain increased by only 9.5 per cent., and in that period commercial vehicles and omnibuses had increased in numbers by 55.6 per cent.

There can be no doubt that our roads in general are highly inefficient and dangerous, causing congestion, accidents and delays. According to Ministry of Transport figures the London-Birmingham road, which is 110 miles long, has 23 types of road surface. The Bristol road, 120 miles long, varies in width 19 times, from minimum of 20ft. to a maximum of 40ft. On the Great North Road there is single-line traffic each way for nearly two-thirds of its total length, or 190 miles out of 316 miles. Prior to the Trunk Roads Act it was controlled by 31 different authorities, or an average of 12½ miles each.

No less than 1,300 local authorities control our general road system.

Centralised Authority Wanted

THE reason why our roads are in such a parlous state is that there is complete lack of centralised authority or progressive planning; there is reluctance to pay for them, and they are merely a development of service roads of the past designed for purely local needs. Local control of roads nearly always amounts to obstruction. Some, indeed, of the blame must be attached to those organisations hostile to mechanical transport.

Good roads stimulate traffic. A road system inherited from the past and originally constructed for animal as well as pedestrian transport, must be adapted to enable modern road users to move from point to point safely, rapidly, pleasurably and cheaply. Thus the question is partly one of reconstructing the old roads and of building new roads. The fundamental requisites of a good road system are visibility, clarity, simplicity, and standardisation of all signals, sign-posts, crossings, and road-siding junctions to motorists. The question of the segregation of traffic, and which section of it is to be segregated, is one which is being keenly debated at the present time. The question of cost and also of time must weigh before this question of segregation can be finalised. It is a waste of time for the Government to make regulations and to embark upon publicity and education in the schools on road conduct if the road system itself cries aloud for improvement and proclaims to all the causes of road accidents. Undoubtedly there must be constructed special motor roads, reserved for the use of motor traffic. The County Surveyors' Society in 1938 produced a map showing where those roads could be cut. Motor-ways of this type will reduce costs on all commodities by the provision of faster carriage, prevent accidents, caused on our present roads by the intermingling of fast and slow traffic and by intersecting roads, by sharp turnings and, to some extent, by the carelessness of the public. They would also relieve congestion on other roads and assist in the preservation of the beauties of England by making road widening in picturesque towns and villages unnecessary. They would also encourage touring, both by the British and by overseas visitors.

In deciding where new roads should be built it is necessary to bear in mind the needs of industry and agriculture, the necessity for linking up the road system with railway, air, canal and coastal services, the requirements of military security, and the importance of enabling townspeople to enjoy the amenities of the country, the sea and the mountains. The chief aim of all road planning in built-up areas must be the acceleration of main-road travel, combined with greater safety and convenience of local traffic and the public. This involves diversion of all through traffic by means of radial roads, arterial ring roads and by-passes; treatment of local roads so that through traffic of any kind is discouraged from entering; development of sub-arterial roads within districts to facilitate trans-urban traffic, no buildings permitted within 200ft. of any new arterial road or by-pass.

In all plans for built-up areas it is important that the pedestrian does not suffer in any way as a consequence of new arrangements made for road vehicles. Pedestrian crossings should always be placed at the shortest distance between the points.

The earliest recognition by Parliament of the use of mechanically propelled vehicles on the roads was in 1831, when a Select Committee of the House of Commons was appointed to inquire into the tolls imposed upon coaches and other vehicles propelled by steam or gas. The railway, however, ousted road and coaches between 1830 and 1840. It was not until the year 1900 that road traffic commenced to develop again, and to-day it is the most important means of communication; 700,000 people are employed in railway transport, whereas those engaged in mechanical transport including cycles number nearly 1,500,000. In this country, there are 24.6 motor vehicles in use per square mile and this is far higher than in any other country. Belgium is second with 13.5. The number of motor vehicles per mile of classified road has increased from 35.2 in 1924 to 69.6 in 1938, or on all roads from 7.4 to 17.2. Just before the war the total number of motor vehicles in use was over three millions. It was presumed that there were ten million cyclists also using the roads. Before the war, also (the last period for which figures are available) there were 494,866 goods vehicles.

These statistics indicate that Government policy on roads has culpably lagged behind scientific and industrial development. All the Government has done is to apply the magic word, control, so much in evidence at the present time, and created over 2,000 offences which road users of the mechanically propelled vehicle type can commit. Penalties and regulations will not solve the accident problem. A bold road policy is necessary. Unfortunately, the money which was subscribed through the Road Fund was not used for the purpose. By a piece of political chicanery it was used to balance budgets by Governments whose minds were still in the horse-drawn era—the Bonar Laws, the Chamberlains, the Baldwins, the MacDonalds, and Lloyd Georges. Had the money been used for the purposes for which it was intended, accidents on the roads would have reached vanishing point.

The Affairs of the R.R.A.

THE Secretary of the Road Records Association has resigned, and the moment seems opportune to make the suggestion that it should now exist as a separate entity, free from any C.T.C. influence. It should become entirely self-supporting, have its own offices and cease to rely upon the charity of the C.T.C. At present, its affairs are conducted from those offices, and it has been the custom for a member of the C.T.C. staff also to be the Secretary of the R.R.A.

Let the Cyclists' Touring Club confine its activities entirely to promoting cycle touring, and cease to take a charitable interest in the Road Records Association. If necessary, the subscription to the R.R.A. should be increased, so that offices can be rented and a paid secretary employed, who should not be actively associated with any other National body. It should not, in other words, be regarded as an office for a member of the C.T.C. staff.

Simpson is Best

JACK SIMPSON, Barnsley C.C., is the National Fifty Mile Champion by virtue of his ride of 2.5.57 in the Barnsley Road Club's "50." National team race holders are A. E. Derbyshire, L. Dunster and R. L. Brown, Calleva C.C.

Family Tradition

BY riding 241⅛ miles in the Polytechnic "12" Douglas Hepplestone becomes National 12-hour Champion. He has many sterling rides to his credit this year, and looks like emulating some of his famous brother's rides.

Another Finsbury Park Loss

A. J. TILLING, appreciated member of the Finsbury Park C.C., has been reported missing, presumed killed, following an air combat at the close of the Pacific war.

A Long Climb

WELL known to all North Wales touring cyclists, the famous Horseshoe Pass, Llangollen, has been used this year as a test hill for hill-climbing enthusiasts.

R.R.A.

NOW that the war is ended it is presumed that the R.R.A. will elect a new committee. It will be remembered that the R.R.A. committee at a General Meeting, in the early days of the war, voted itself into power for the duration of the war.

The time has come when this body needs fresh blood and the tonic of an early Special General Meeting. We suggest that one of the constituent clubs should propose that the R.R.A. be removed from the C.T.C. offices and C.T.C. influence, and also that members of its committee should not serve on any other committee.

R.R.A. affairs of recent years have indicated that the Association needs to be brought up-to-date, and its rules altered to align with modern conditions. Timekeepers should not be permitted to serve on the committee, nor should any member of any other national body.

Pressmen, too, should be excluded from the R.R.A. committee. As noted elsewhere, Leonard Ellis has resigned from the secretaryship of the R.R.A., and severed his connection with all other cycling clubs and associations of which he was an officer or a member.

12 Hours National Championship (1945)

AT a meeting held on September 9th the National Committee confirmed the result of the 12 Hours National Championship as announced by the Polytechnic C.C. D. Heppleston, Yorkshire R.C., is the champion, with R. J. Brown, Calleva R.C., second, and K. Redford, Altrincham Ravens, third. The team champions are the Calleva R.C.

No rider on the finishing list has been credited with mileage covered off the scheduled roads.

1946 *National Championships*

THE National Committee is making early announcement of the details of the 1946 National Championships in order that the events may become the framework of the 1946 calendar. The allocation and dates are as follows:

Distance.	*District Council.*	*Week-end No.*
25 Miles.	East.	14
Women's 25 Miles.	North Midlands.	18
50 Miles.	West.	17
100 Miles.	London East.	20
12 Hours.	Yorkshire.	28
Hill Climb.	Central.	35

Week-end numbers correspond with those in the 1945 Handbook.

Reading Wheeler Decorated

FOR his bravery and courage in a plane crash at his aerodrome, Sergeant C. J. Wicks, former member of the Reading Wheelers, has been awarded the B.E.M.

Fast Work in Scotland

TWO of the riders in the Ayrshire and Dumfriesshire C.A. 12-hour event beat "evens." They were D. Scott, Crawick Wheelers (245 miles), and J. Allison, Musselburgh R.C. (243 miles).

Veterans at Work

FORTY-SIX-YEAR-OLD A. Rogerson, Spen Valley Wheelers, won the Open "25" promoted by his club for veterans, with the sterling time of 1.12.34. The handicap was taken by 76-year-old E. H. Stevens, with 1.30.37, which was subject to 20 minutes' allowance.

Practical Traders

MEMBERS of the Manchester Branch of The National Association of Cycle Traders, which includes the president and chairman, A. J. Bradbury, are holding weekly runs.

No Cycle Show

THERE will be no cycle show this year, and it is also problematical whether a full-scale fixture of this kind can be held next year.

A Near Miss

BY 1 minute 15 seconds only did I. Jones, Rapier R.C., miss the Eastern Counties Road Records Association's Stratford to Kings Lynn and back record. He clocked 10.48.41 for the 195 miles, under adverse conditions.

"For Devotion to Duty"

MEMBER of the East Midlands Clarion C.C., Pilot Officer J. S. Spriggs has been awarded the D.F.C. As a Pathfinder pilot he had taken part in 50 operational flights over Germany. At the age of 18 he covered no fewer than 217 miles in his first "12," this being in 1940.

Kilts in Cyprus

A MEMBER of the Lomonds Road C.C., William McCauley, who is stationed on Cyprus, created a sensation when he wore the Scottish national costume during a tour. Certain houses, normally barred to women, also wanted to boycott him!

A Fast Fifty

J. ALLISON, Musselburgh C.C., won the Nightingale C.C. "50" with 2.4.53, nearly five minutes faster than the next best man.

Another Competition Record

HOLDER of the 25-mile championship, C. Cartwright, Manchester Clarion, broke the national 30-mile record with the time of 1.12.51. The record has been in the custody of G. H. Fleming since 1938.

All Change!

MEMBERS of H.M. Forces serving in the Middle East have formed yet another cycling club: this time the Terminus Road Club, which is supported by many noted clubmen.

Western Country Loss

DEVON and Cornwall have lost a great enthusiast by the departure of one of its prominent officials, W. Beckerley, who has taken up a mining appointment abroad.

Round the 'Drome

THE recently-formed R.A.F. club, the Dunmow R.C., continues to progress, and its first 10 mile massed start race around the aerodrome perimeter was won by C. Smith, with a time of 26.20. Of the 15 entries only four finished the race.

Thirty Seconds Outside

JACK SIMPSON, the Barnsley C.C. flier, repeated his win in the Essex and Herts Wheelers "25" with an outstanding ride of 1.0.30.

Purchased by National Trust

BRAMBER Castle, near Steyning, Sussex, has been purchased by the National Trust.

Scots Girl's "50" Record Goes

ISOBELL ADAMS, well-known Scottish girl time-trialist, beat her previous Scottish record for 50 miles by nearly four minutes. The new time is 2.24.47.

Track Fatality

J. E. WOOD, well-known and popular South Wales track rider, who was formerly a member of the Oxford City Road Club, was killed while competing in a Welsh grass track meeting.

Rutland Activity

CLAIMED to be the only active club in Rutland, the Luffenham R.C. (R.A.F.) has been formed by enthusiasts of several London clubs, including the Archer R.C. and Catford C.C.

Monckton Revival

EFFORTS are afoot, chiefly through Arthur Hollender, to revive the Monckton C.C. which, just before the war, was one of the most prominent of clubs. It gave the sport such great riders as Ernie Earnshaw, Eddie Larkin and Arthur Hollender.

Many "Liberation" Clubs

SERVING cyclists in the Forces all over Europe have formed Liberation Cycling Clubs, the latest of which is in Brussels.

A glimpse of the lovely Cathedral spire from Oriel Street Oxford.

Around the Wheelworld

By ICARUS

Champions Concert

VIC JENNER, the energetic backbone of the Charlotteville Cycling Club, tells me that arrangements are well in hand for the Champions Concert at the Albert Hall on November 24th. This is the first event of its type for six years, and it is confidently hoped that the seating capacity of 8,000 will be fully occupied. The concert is being organised by the National Committee of the Road Time Trials Council. It will commence at 6.30 on Saturday, November 24th, and interspersed between the Grand Variety Concert will be the presentation of the trophies and medallions which have been won in the Council's National Championships and the premier awards in the British Best All-rounder Competition.

Thousands of cyclists will wish to be present, and it is necessary, therefore, for club secretaries to reserve seats well in advance. Seats will cost 5s., 3s. 6d., and 2s. 6d. each, inclusive of entertainment tax, and club bookings must be made through the Council's member clubs, or clubs affiliated to the S.A.C.A. Every effort will be made to keep club parties together. Allocation of seats will take place on October 3rd. Every cyclist, whether attached to a club or not, should endeavour to be present on this great occasion. Service cyclists who may not be returning to this country before October 3rd will not be denied the pleasure of attending, for a small block of seats is being reserved for them. Reservations may be made by writing to S. Amey, Wynfrith, Inwood Avenue, Old Coulsdon, Surrey. "Champions Concert" should be written in the top left-hand corner of the envelope.

It is bound to be a memorable evening.

Clements Double Champion

ERNIE CLEMENTS, the Wrekin "flyer," again demonstrated his complete versatility when he retained his B.L.R.C. National Time Trial Championship over 76 miles at Barnet last week, in the time of 3.33.3, beating clubmate Ted Jones by over a minute and a half. Third was H. Bloomfield, Southern Coureurs, probably riding better than ever before, with a time of 3.35.33.

The Junior Championship, over 40 miles, resulted in a win for Horace Poole, Wolverhampton Racing Club, and Junior Midland T.T. Champion, with a time of 1.51.22. Poole, who became a senior (over eighteen) recently, did the ride of his young life, over a tough course and equally tough day, being nearly seven minutes faster than the second junior, A. H. Chick, Ealing C.C.

The Ladies Championship, 24 miles, proved a surprise, with Joyce Burton, Wrekin R.C., returning a super time of 1.7.35, with Gwen Clements, Wolverhampton R.C., favourite for the event, second with 1.10.37, and last year's champion, Mabel Judge, East London R.C., third with 1.11.6.

The event, organised by A. H. Clarke, London Section Events Secretary, again proved that time trials, properly staged, can be an attractive spectacle for the public, and the large crowd at the start and finish was adequate testimony to this fact.

A new announcer, friend Clarke, who was handling the mike, introduced each rider to the crowd as they came up to the line, with a brief commentary on their past performances, then Jimmy Kain, timing, gave the 5–4–3–2–1–go over the loudspeaker.

Half an hour before the girls finished, the crowd had begun to stream back, and when Joyce Burton, starting No. 5, finished close behind Gwen Clements, No. 2 on the card, she received a warm ovation from the spectators, and by the time the juniors had finished a large crowd had gathered either side of the road, eagerly awaiting the seniors.

As each rider crossed the line his time was given, and enthusiasm was high when Bloomfield, Southern Coureurs, No. 8 on the programme, finished first in 3.35.33, and excitement grew when Jones, Wrekin R.C. finished nearly a minute faster. Then the news was given that Clements, the obvious idol of the crowd, had only five minutes left to beat Clubmate Jones. Nearly three and a half of these valuable minutes had slipped by when his familiar green jersey was seen down the road, and the cries of encouragement grew to a crescendo as he flashed past the cheering lane of excited fans to repeat his success of last year over the same course, and to record for the first time a double Championship of both Time Trial and Road. The rides of the other competitors, notably Binfield, Wolverhampton R.C., with a sterling 3.35.43, Tilley, East London R.C., with 3.39.13, and evergreen Charlie Owen, East London, now in his eighteenth year of racing, with a 3.41.22, were all overshadowed by Clements's popular win.

Miss Mather, daughter of the well-known sportsman, Will Mather, and donor of the magnificent trophy for the Five-day Race, suitably adorned the three Champions with their Championship laurels, and expressed the truism that "these young athletes certainly are not troubled with petrol rationing, riding bicycles as they do."

Jimmy Kain, the famous Ealing C.C. timekeeper and National Secretary of the B.L.R.C., assisted by Stan Hemming, West London R.C., looking on for a change, returned the following fastest times:

LADIES.—1. J. Burton (Wrekin R.C.), 1 7 35; 2, G. Clements (Wolverhampton R.C.), 1 10 37; 3, M. Judge (East London R.C.), 1 11 6; 4. I. Butler (West London R.C.), 1 12 15; 5. D. Morbey (East London R.C.), 1 12 56; 6. R. Wakeman (West London R.C.), 1 23 10.

JUNIORS.—1. H. G. Poole (Wolverhampton R.C.), 1 51 22; 2. A. H. Chick (Ealing C.C.), 1 58 2; 3. R. Ferrari (Ealing C.C.), 2 0 46; 4. J. Tanswell (West Hants R.C.), 2 1 38; 5. J. Runnacres (Wolverhampton R.C.), 2 3 43; 6. I. Teece (Wrekin R.C.), 2 6 21.

SENIORS.—1. E. A. Clements (Wrekin R.C.), 3 33 3; 2. E. Jones (Wrekin R.C.), 3 34 49; 3. H. Bloomfield (Southern Coureurs), 3 35 33; 4. H. D. Binfield (Wolverhampton R.C.), 3 35 43; 5. W. Tilley (East London R.C.), 3 39 13; 6. C. L. Owen (East London R.C.), 3 41 22; 7. G. C. Haggitt (Wolverhampton R.C.), 3 52 28; 8. D. Jaggard (Ealing C.C.), 3 54 44; 9. T. E. Pryer (Wolverhampton R.C.), 3 54 51; 10. C. J. Bird (Wolverhampton Wheelers), 3 56 22; 11. R. Filsell (Achilles Velo), 3 59 1.

Len Ellis Resigns

IT is with regret that I record the fact that Leonard Ellis has resigned his position from the C.T.C., and also from the Road Records Association. He has resigned his position as Conservator, Secretary and Treasurer of the Meriden Memorial Fund. He does not state his reasons. It will be remembered that a new C.T.C. secretary was appointed some time ago, as well as a new editor for the C.T.C. house journal. Thus the cycling world is deprived of the services of one who has spent the best part of his life working for various cycling organisations. He has carried on the work of the R.R.A. efficiently since S. M. Vanheems vacated the post. When Vanheems became the secretary the affairs of the Road Records Association were in a somewhat chaotic condition. There was not any office system, and the records were a heterogeny of papers. It was in this confused state of affairs that Vanheems sorted out the position, organised the office and the records and put things into such shipshape order that facts concerning every one of the records could be located within a matter of seconds. Ellis has carried on that good work. I do not know who is to be his successor, but I regret that he should feel, for one reason or another, that he must put aside the tasks he has so cheerfully undertaken these many years past.

Road Accidents—July, 1945

DURING July, 444 persons died, and 12,428 were injured, as the result of road accidents in Great Britain.

A disturbing feature was the steep rise in deaths of motor cyclists, 60 being killed compared with 43 in June, and 17 in May.

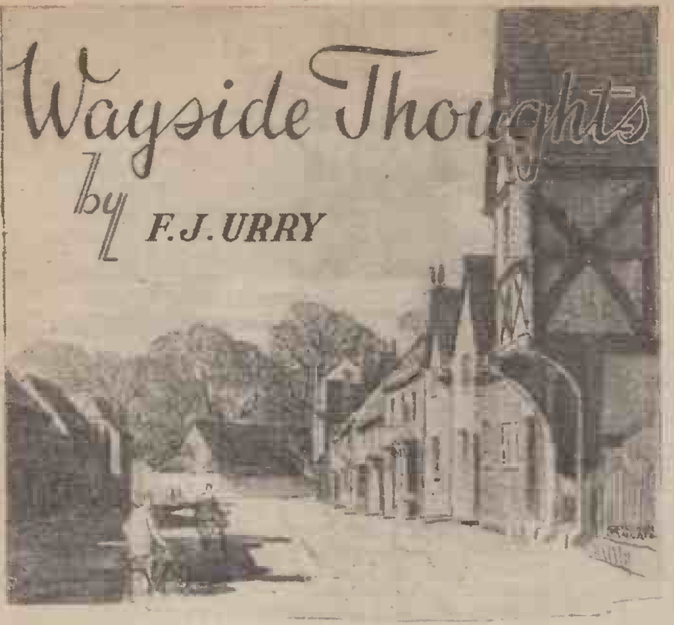
Fatal accidents to child cyclists and child pedestrians numbered 112.

Type of Vehicle	*Number of Deaths.*
Service (British, Dominion, and Allied of the three Services)	82
N.F.S.	1
Public Service and Hackney	59
Goods	89
Private Cars	70
Motor Cycles	64
Pedal Cycles	65
Others	14

The famous old "Ostrich" Inn, at Colnbrook, on the Bath Road, over 800 years old, and famous meeting place for cyclists.

Wayside Thoughts

by F. J. URRY



The Good News

WHEN VE. day came to the nation, I was on the road and heard Mr. Churchill's broadcast in a little cottage beyond the Severn on the way to Wales. And my first intimation that VJ. day was imminent came from the enquiry of a lady who asked me if it were true the Japanese war was over, on a rough hill track between Llandrindod and the Ebw valley. As a matter of fact four of us had been prowling in mid-Wales during August holiday week, and our connection with news print or wireless messages had been very sketchy, so that good dame's enquiry, following the news of the atomic bomb, sent us hurrying to New Radnor in time for the six o'clock news. So the war is over, and now the work of reconstruction begins. An epic has ended, and a new life begins. My over riding thought of the moment is one of thankfulness to the men and women who have kept these lovely islands sacrosanct, and in giving their lives and their scars and toil have preserved for all men a very beautiful place. That instinct—for it is an instinct as far as I am concerned—is natural since most of my leisure has been spent in seeing the manifold beauty of Great Britain, and even after 56 years of wandering I am still ignorant of many places, and the desire to banish such ignorance is in me, so I praise all helpful things towards that end. How great and glorious has been the fortune of we older folk in the possession of so fine a younger generation! Let that thought sink in whenever you happen to feel a little impatient with modern things, and remember that the ending of the war is the most modern of them all, a human miracle for which gratitude should never cease. We are lucky, therefore let us be tolerant in realising our future and our friends. We can do this thing in thankfulness, and it will help.

We Must Wait Awhile

WE are told there will be no cycle show this year, which is a pity, for had such an exhibition been possible, I am convinced it would have been of enormous benefit to the pastime. The difficulty, I am told, is the general one, shortage of labour, a position which will not be cured until the release of men and women from the Forces. We cannot look for a full return to pre-war output of bicycles and accessories until this time next year. That is what the optimists say, and, of course, there are the others, who in the present choatic state of affairs imagine the problems will never become disentangled. My own impression is that the next few months will see a big change. People are tired, they need a little time for recovery; but when that period is passed, and men are at work again, the changes for better things will come rapidly. Goodness knows we want them, for most of us who ride bicycles for joy are short of almost everything that adds its little special pleasure to the comfort of cycling. I could quote from dozens of letters; but to what purpose? Their overall purport is the same; when do you think we can obtain the better goods? Tyres, particularly tyres, rims, bags, saddles, and that most desirable of things, the perfect bicycle. The industry has promised us much in the way of improvement, and many of us are waiting as patiently as we can to see if these promises will develop, and in what form. It would be strange if after six years' period of wartime products the post-war machine had not developed the delayed measure of perfection which would surely have been its lot during six peaceful years. And on top of the natural developments of such time will be the added experience of war work. Unless we are offered bicycles and equipment showing a considerable jump in design and development, the industry will disappoint us; but I don't think it will.

A Matter of Urgency

NOW there is one important thing we cyclists must undertake during the next twelve months, and that is a complete revision of our hotel appointments. It is going to be a gigantic and costly task, but unless it is tackled quickly, and completely, cycle touring will suffer a relapse. Nothing tends to make touring more comfortable than a price list of appointments designed to suit every type of wanderer, and unless such a booklet is forthcoming the cycling cause will suffer. Nor in my opinion must such a list ignore the bigger hotels, for there are still many people touring who, having no need to consider the odd shillings, like to have their accommodation ear-marked, just as much as the other people who are looking for reasonable treatment at prices well within the capacity of their purses. Personally I don't care either way; all I ask for is cleanliness and reasonable food, and the "amenities"—as we have come to call the pile carpet and the chrome plating—can go hang. The war has played havoc with our catering arrangements along the road; the food regulations have been too big a problem for many people to solve; others have found the business of feeding folk a little riot of profit, while still more have concentrated on the drink shop, and have had no use for the genuine traveller. These are facts we all know, we who have been on the road during the war years; and if Britain is to survive as a touring ground for its natives and its foreign visitors, this catering business is of the utmost importance. Cyclists were the first type of roamer to catalogue rest houses, their old iron signs can still be seen on many an hotel up and down the land; and every travel association has copied the fashion they set nearly seventy years ago. Let us not fall behind in this matter now, but rather strive to improve the excellence of our pre-war service to cyclists.

A Celebration Holiday

LATE in June of this year I had a family celebration at Tenby. It was the fortieth anniversary of our wedding, and all the immediate family came to that delectable Pembrokeshire town to make merry. They went by car—for some of them were very, very young—and I went by bicycle, the good people would not deny me that pleasure. On a golden day I started from Hereford, coatless, with a wind to waft me on the way, and full to the brim of joyous thankfulness that I could still ride gaily over the old roads and make merry with people I met en route. It was so good that when I reached Three Cocks Junction, the song of the Wye in half flood was an invitation to take a longer route, to linger in the lazy afternoon by its purling waters, certain that I would find tea waiting in Llangammach; and it was so. Then, in the cooler hours, I faced the long climb over the Sugar Loaf, but the going was so easy that I never dropped below normal gear. The tar was out in little pats of sticky moisture, and provided the only discomfort. That vision of the wild lands west of Sugar Loaf was superb, with the long shadows of the ravines adding a thousand tints in multiform to the grandeur, and if I sat and smoked for the better part of an hour it was with the contented knowledge that I had a bed booked at Llandovery. An hour later a change had wiped away the sunshine, and the Towy valley was full of thunder clouds as I was welcomed at the North-Western Hotel with the satisfying provender that seems natural to that establishment. That was a good day of some 70 miles, as easy as any I have ridden this year.

Home Again

IT rained heavily in the night; but I knew nothing about it until a cup of tea roused me to consciousness. It still rained after breakfast, but gave me a respite for the next 36 miles. I had no need to hasten, and didn't, for the air was hot and heavy, and the great black clouds on either hand went slowly up the Towy, no doubt to break in rain against the mountains of mid-Wales. St. Clears gave me an apology of a lunch, but it was enough to see me over the long rise of Red Roses, one of the best graded climbs in the country; but not before the threat of storm had materialised, for the final couple of miles to the little inn at the summit found me warm beneath a coat and mac. That inn came at a convenient time, for the enveloping clouds bore down on the hills like a fog, and through them lashed a torrent, so fiercely close, that a lorry driver pulled up and sheltered because he could not see. And, like a kindly man, he offered me a lift to Tenby, but by that time the downpour had eased, and the green of the hills no longer wore the grey vestment of moisture; so we each went our way, and, as far as I was concerned, rode into the storm-shattered sunshine before Kilgetty. That was another good day on the road, rounded off by the arrival of the family an hour later, and a fortnight of happy companionship. Two or three times I escaped for a few hours to wander round the lanes to Manorbier and Bosherston, and travel north to glance again at the long line of the Prescellys over whose crests I had gone so many times. I returned home by road, this time with a light sou'-wester to aid me, and found at the end of an easy day I had gathered 93 miles, and was pleasantly surprised. The next day I did hurry a trifle to arrive home in time to make a mark, for it was election day that ended a very charming holiday, and one I shall always remember because of its many congratulations.

Using Holidays

AUGUST week was a general holiday, and, having followed the requests of my family so recently, I was allowed the complete freedom of the road for eight glorious days. We were a party of four, and the other three men were cycle and cycle accessory manufacturers. I mention that matter to prove that some of the trade people do ride bicycles, and, as far as these men were concerned, ride them very well. We intended to make full use of our freedom, not so much for the purpose of covering leagues, but rather to penetrate the lesser known ways, and, if possible, make acquaintance with new scenes. Llangurig was our centre (it was the only place that could accommodate us), and we took a couple of days to get there, staying at the Eagle Hotel at New Radnor (very good, too!) one night, and making the short journey the next day via Abbey Cwmhir. "Where's that?" my friends requested, and I showed them the map. It is a beautiful passage through and over the hills to Rhayader, and from the summit of the steep climb beyond Abbey Cwmhir you can see the lower dam of the Elan Valley lying in the corridor of the mountains. In the old monastic village is the country inn of the "Happy Union," and for us it wore its name in welcome. Then we went over the hill and down the long slopes to Rhayader, climbing quietly again up the valley of the infant Wye to uplands of Llangurig. On the Monday we went over Plinlimmon Pass to Devil's Bridge, along the old coach road by Cwmystwyth, and the Elan valley lakes, back to our hostel. A lovely ride on a stormy day, and something of a revelation to my friends whose knowledge of roads was mainly confined to tarmac. And, let me tell you, that at Cwmystwyth—a mile beyond the village—is The Mines House, where Mrs. Brown dispenses hospitality, and it is the real thing. You may pass such a house quite easily, for it is the end one of a row of ruins in the middle of an abandoned lead mine, the sort of spot that suggests tragedy and disappointment. Don't; and you will go that way again some day. We did.

Happy Return

ON a bitter day for August we climbed to Stay-a-Little amid the uplands of the Plinlimmon range, and returned after an excellent lunch at Mrs. Wigley's Farm by way of some rugged lanes with hills of one in three to the Severn Valley four miles from Llanidloes. That was a bit I had not before traversed; and so was the mountain crossing we did the next day from Llangurig to Cwmystwyth by a track that was the "breakneck" in the last Six Days' Motor Cycle Trial. It is a grand way, opening the glory of the Wye Valley and the road to a lovely little upland farm before it attains its peak footage of 1,746. We went to Cwmystwyth again to make the crossing and to lunch in a place where the latter term is well understood; and it enabled my friends to cross Plinlimmon Pass from the west—a journey they had not previously undertaken on a bicycle. Also, and much against my desire, we climbed Plinlimmon, the spongy mountain of the rounded summit, and though the view was not so clear as on my first and only other visit, it was very satisfying when my "football" foot had rested sufficiently to take the ache out of it. We were 3½ hours away from the farm at the foot of the climb, and when we returned there was good food awaiting us. That farm is not prepossessing in its outward appearance, yet it is a place to mark down when you are that way. On the Friday we started for home, very reluctantly and slowly; and, as I mentioned in the first paragraph of these notes, it was while making the little pass from Llandrindod to the Ebw Valley that the first inkling of world peace came to us. The Eagle put us up that night, and for once the little burg of New Radnor was gay. There was reason to be. All the way home we gathered bits of news, and it was all good, with a last meal of the tour taken with friends by Little Witley, who gave us tea in porcelain cups to mark the great occasion. We shall remember our August week along the road.

Junior Clerk to Managing Director

OLDER cyclists may remember that Mr. C. A. Proctor, Dunlop joint managing director, who recently resigned, did some racing in his younger days. Mr. Proctor, who was the company's oldest servant, began as a junior clerk in Dublin 54 years ago. He was transferred first to Birmingham and then to Nottingham and it was here that he took a keen interest in cycle racing. He is best known for his Dunlop work in Australia, Germany, where he was interned during the 1914-18 war, and France, whose Government decorated him with the Legion of Honour for his work in developing a French industry.

Familiar Topic

IN *The Times* a few weeks ago I observed the recorded demise of one MacGillycuddy, described as of Flesk Castle, Killarney. "Never 'eard of 'im!" as they say in "1066, and all that," but I've heard of the Macgillycuddy Reeks, and of Flesk Castle, and of Killarney. In fact, thanks to cycling, I know them all. There is more in a name, taken at random from the newspapers, than non-cyclists think. As I may have remarked previously, one of the advantages of our pastime is the knowledge it gives you of wide countrysides, and the significance it thus reposes in place-names.

*"After what I saw 'out there'—
no other tyre
will really satisfy
me now"*

Firestone

BEST TODAY ★ STILL BETTER TOMORROW

CYCLORAMA

By H. W. ELEY

The old courtyard of The GEORGE INN Norton St. Philip, near Bath

This inn has held an ale house licence since 1397: It was here that Monmouth was fired upon just before the Battle of Sedgemoor in 1685.

The Labour Government and the Cyclist

EVER since that memorable day when the results of the election were announced, and we knew that there had been a revolutionary "change-over," there have been endless speculations as to what effect a Labour regime would have on our lives—and, chatting with a party of cyclists the other day, I was interested to learn that there is a good deal of wonderment as to how Labour will regard cyclists, and the cycling movement. Shall we see a more sympathetic attitude towards users of the bicycle? Shall we find that a Government composed, one imagines, of more men who have been, or are, cyclists will tackle various problems affecting the movement, and endeavour to rectify anomalies? It all remains to be seen, of course, but I should imagine that there is a good chance of legislation of a more understanding order—once the vital immediate post-war problems have been settled. Cyclists for years have deserved more sympathetic treatment at the hands of our legislators; perhaps now they will get it!

A Tame Jackdaw

THERE are plenty of jackdaws in some of our woods and round about old ruins, where they love to build, but one does not often see a jackdaw riding happily on the handlebars of a cycle! I witnessed this somewhat strange sight the other day, and found that the owner of the bird had secured it, when very young, from a nest, and clipped its wings and tamed it. "Jack" was a very friendly creature, and flew from its owner's shoulder on to the bike, and went for a ride. I was interested to learn, as something of an amateur ornithologist, that the bird had been taken for a raven and a rook by the uninitiated of the district!

British Cycles for Holland

THOSE cyclists who were familiar with Holland before the war will have good memories of the enormous popularity of cycling there. I recall that on my first visit to the country I was amazed at the numbers of cycles in the streets. Everyone, from humble tradesmen's boys to the gracious Queen Wilhelmina herself, rode a bike, and to be in Rotterdam when the factory workers were leaving for home was a sight. I am told that the British cycle industry has large numbers of cycles ready for Holland, and that a healthy business there is anticipated just as soon as things become a little more normal. The Dutchman without his bike would be as strange as the Dutchman without his cigar!

A Saddle should be Comfortable

I WONDER why it is that so many cyclists are content to ride on defective, uncomfortable saddles? I know that there has been a shortage of saddles, and maybe there still is, but notwithstanding this I believe that many riders are foolish in this matter of saddle comfort; they ride with the springs gone, the saddle "sagging" and, generally speaking, do not seem to appreciate that cycling is all the more enjoyable if the saddle is looked after and kept in good order.

Memories of "Faed"—and the Dunlop Book

IT is only recently that A. J. Wilson passed on, and for many years his memory will be kept green by countless cyclists. I remembered him vividly the other day when, in the lounge of a small provincial hotel, I came across a tattered and well-thumbed copy of the famous "Dunlop Book"—handsome and unique touring volume published by Dunlop some twenty odd years ago. It was the work of A. J. Wilson and the late Ed. J. Burrow, and remains, to my mind, a masterpiece in the realm of touring and countryside literature. The little "thumb-nail" sketches by Chas. G. Harper were most appealing, and there was a wealth of information about curiosities of the countryside—together with a series of splendid maps. I wonder if this great volume will ever be re-published? Those who possess a copy should treasure it!

I Re-read "Silas Marner"

AND I have re-read this George Eliot classic with tremendous pleasure—all because business recently took me to Nuneaton, and I slipped along to nearby Chilvers Coton, for ever famous because of George Eliot—or, to give her her real name, "Mary Ann Evans." I found "Silas Marner" gripping in its dramatic strength, and I wondered why we do not browse more often among the classics. But on inquiring at my local library I was informed that there is a steady and increasing demand for the works of George Eliot—and for those of Jane Austen, too. I recommend "Silas Marner" to you if you have grown tired of modern thrillers, and assure you that you will find it hard to put the book down once you have begun it.

Bikes I Have Owned

WE were a little party of—shall I say—"middle-aged" riders, and we were chatting in a village inn after a pleasant ride through some Hertfordshire lanes. Talk came round to makes of bikes we had owned, to the *first* bikes we had owned . . . and we got quite interested in harking back to boyhood days and those first machines—in many cases, birthday gifts from parents. I found that two members of the little party had started their cycle ownership with "Swifts"—made at the once famous "Cheylesmore" works in Coventry. One man remembered that his very first mount was a "Monopole"—also, I fancy, made in Coventry. But another recalled an American "invasion" by telling us that his first bike was a "Mead"—and at the mention of the name I recalled, very vividly, copiously illustrated catalogues issued by the firm, and fell to wondering why the Americans had never captured our home market. My own memories took me back along the years, and I was riding again a "Premier." It was good to indulge in these reminiscences, and we all were of the opinion that all the bikes had been good, and that the British cycle industry kept the "quality flag" flying in a most commendable way.

It Isn't Far from London

AT Northwood, in Middlesex, in fact . . . and its name is "The Gate"—a little country inn of the real old type, with beer drawn from the wood, and a homely little bar where darts are played, and the atmosphere is that of the good old days before reforming brewers gave us ornate "palaces" with chromium-plated fittings and an air quite foreign to the traditions of the English inn. Just on the Rickmansworth road, almost opposite the Mount Vernon Hospital . . . there is "The Gate," and it is kept by a kindly woman who informed me that she had never tasted beer in her life!

Look Forward to Autumn

YES! look forward . . . for autumn is a season of rare delights for the cyclist who loves the countryside. Do not think of autumn as a season of decay and melancholy . . . but as the season when Mother Nature paints matchless pictures in russets and browns and golds; when the blackberries are luscious in the lanes, when the gossamer spiders' webs hang in fairy-fashion from bush to bush, and the succulent mushrooms are in the meadows . . . for all who will get up early and enjoy the delights of those first misty mysterious hours before the great world awakes.

New Appointment

IT was recently announced that the Minister of War Transport, Mr. Alfred Barnes, has appointed Mr. G. R. Strauss, M.P., Parliamentary Secretary to the Ministry, to be chairman of the Committee on Road Safety in succession to Mr. Philip Noel-Baker, M.P.

Notes of a Highwayman

By Leonard Ellis

(Left) Ruins of Much Wenlock Abbey.

Britain's Touring Grounds (11)

THE county of Shropshire is large enough to rank as a touring ground in itself, and apart from its size its scenic merits are considerable. Only fifteen of our English counties are greater in area than Shropshire, which measures 47 miles from north to south, and 39 miles from east to west—about 1,350 square miles of really beautiful country. Throughout its length and breadth there is only one really black spot, and that is the area immediately south of Wellington. Even here the industrial eyesores are mercifully tempered by tree-clad hills and by the proximity of the river Severn. Shrewsbury, the capital of the county, was once the most important place in the west of the kingdom of Mercia, and a glance at the map will show how important, strategically, it could be, ringed about almost on all sides by the river. On the west the country merges almost imperceptibly into Wales—the transformation is very gradual as the Welsh names appear long before the border, and the hills take on the Welsh look before their due time. Northward is Cheshire; throughout its length. Many of the hills are crowned with fortifications and there are many traces of earlier civilisation in other parts of the county. The Clun Forest area in the south-west is a vast tract of country ranging from 600 to 1,000ft., and is a touring area all to itself, with delightful river valleys, charming little towns and villages, and much folklore and legend.

Lakes and Castles

THE northern part of the county is flat and pastoral, with many interesting old towns and a miniature lake district around Ellesmere. The area around Church Stretton, with its lovely valleys, is justly famous, as is Corve Dale, the long valley nestling under the lee of Wenlock Edge. Ludlow, in the extreme south, is a grand old place on the River Teme, complete with city gates, old castle and beautiful buildings. The River Teme is a stream that in the opinion of many tourists ranks equally with the celebrated Wye. At least two of the old abbeys should be visited. One is Buildwas Abbey, an old Norman ruin near Ironbridge, and the other is the beautiful ruin at Much Wenlock. The latter is well known for its glorious arcading. Castles abound in the county, as may be expected in the country of the Marches. Some of the finest parts of the river Severn are easily accessible, and the gorges near Linley are very fine indeed. Depressing as Ironbridge is, it certainly is worth a visit, as the bridge itself is a great curiosity and the river is really picturesque. This brief description of a fine touring ground must of necessity omit many things of interest; quaint Bridgnorth, Boscobel House, Lilleshall Abbey, and even the glories of Shrewsbury, one of England's finest towns, must be dismissed with a mere mention.

southward, the lovely country of the Wye, and eastward is Staffordshire and the Midland industrial area.

Hills and Magpie Architecture

OF its numerous attractions one may say that two outstanding features will commend themselves to all cyclists, the hill ranges with the consequent valleys and the black and white houses. Beautiful half-timbered buildings are so numerous that they become almost commonplace. Perhaps the best known of the hills is the Wrekin, rising abruptly from the surrounding plain to a height of 1,320ft. It is said that eighteen counties can be viewed from the summit, and whether this is true or not it is certain that there are few finer viewpoints for many miles. The Long Mynd behind Church Stretton, the Stiperstones farther west, the Clees in the south, are all over 1,500ft. and offer glorious views and endless interest for the tourist. Wenlock Edge runs due south-west from Much Wenlock and touches 800ft.

Ancient and modern at Ludlow.

My Point of View: By "Wayfarer"

"Halt" Signs

A YOUNG relative of mine was recently challenged by a policeman because he did not put a foot to the ground on pausing at a "Halt" sign. It was not suggested that the boy had ignored the injunction, and, in the circumstances, he naturally asked "So what?" Taking a narrow view, the policeman thought it necessary to drop a foot, but the lad repeated his performance, and demonstrated to the man-in-blue that a momentary pause could be achieved with the feet remaining on the pedals, and the representative of the law was satisfied. Personally, I feel that there is not much in this matter, and, as it is no trouble to place one foot on the ground (which process, by the way, does not necessitate stopping!), it is probably better to do so, thus avoiding arguments. At the same time, it is well for all of us (including the police) to bear in mind the true purpose of "Halt" signs. That purpose—a real safety measure—is attained by an effective stop, whether or not one of the feet contacts the ground.

Reliability Wanted

READING the annual report of an electrical company the other day, I was interested to note that one of their specialities, marketed under the self-explanatory name of "Keepalite," has a great vogue in hospitals, cinemas, banks, and other places where continuous lighting is essential. Now that we cyclists are compelled to carry rear lights, I wish the idea could be adapted for our benefit, so that we could ride in the dark without worrying about the red blob behind us. What about it, Chloride Electrical Storage Co., Ltd.? Is this a business proposition, at a reasonable price?

The Parting Guest

I SHALL not be misunderstood when I say that I rejoice at the recent announcement that U.S.A. army vehicles are leaving this country for "home" at the rate of 300 a day. There are no fewer than 35,000 such vehicles to be taken off our roads, and the end of this year will see the bulk of them gone. I am not unmindful of the great debt we owe to the Yanks, but that debt would have been increased—without any prolongation of the war—had their jeeps, trucks, etc., been driven at, generally speaking, a more reasonable pace on roads which, for the most part, were not constructed for high speeds. Despite this criticism, however, I join in the national cry of "Thank you, Uncle Sam!"

Finding's Keeping

IN the first dozen miles of a Sunday ride I picked up and disposed of three nails and two bottles which were found lying about the road in different places. Then, with the aid of my back tyre, I appropriated a tin-tack, and the air fled. In this connection, two points occur to me. First, can we not all adopt the excellent plan of removing from the roadway anything we notice as being likely to damage cycle tyres? If this appears to be the counsel of perfection (and I don't think it is), then let us aim at the ideal, remembering that, if everybody "does his stuff" in the direction indicated, it is going to be a lot better for the rest of us. It may be argued that "you can't be looking at the road all the while," and that adoption of this advice would mean wasting a lot of time. My reply is that it is not suggested that your eyes should be glued to the road, and that, taken by and large, the suggested precaution will actually be a great time-saver. I wonder how much time would have been in jeopardy if I had not spent, say, a minute in picking up and disposing of those three nails and two bottles? Not my time, perhaps, but that of somebody else—and my turn to be delayed would come another day!

On the evening of the Sunday to which reference has been made, I came across a perfect piece of puncture material, taking the form of the heel off a woman's shoe, with five sharp nails lying in wait for a job. I promptly gathered up the trouble-maker and deposited it out of harm's way down a street-grid. Is not that action an elementary duty which rests on every cyclist? I think so.

The other point which arises out of that puncture incident above mentioned concerns the ease with which some cyclists tackle a roadside repair, and the "heavy weather" which others—including myself—make of it. When I discovered that foreign body in my tyre, I wrung my hands and expressed my feelings—perhaps a bit luridly—and then turned the bicycle upside-down on the grass verge. What would have happened next will never be known, for just at that moment a young friend came along, and, seeing my predicament (what a word!), took over the whole "joint" and repaired the puncture in less than no time. Naturally, I allowed him to use *my* solution and one of *my* patches, and also *my* pump, for the repairing process!

The meeting was entirely accidental, and the curious thing is that about three years ago, when this friend and I were jointly going to the same place towards which we were now proceeding severally, I punctured at practically the identical spot. On that occasion my pal made the repair of the tyre a matter of his intimate personal concern. Whilst I was scanning the horizon for a cottage where we could borrow a bucket of water, or looking for a lake or for some other form of wetness, my friend had found a moist ditch almost under our noses, and he was busily passing the inner tube through it, in search of the unauthorised hole, which was quickly found.

Into the Lanes

THE leader of the club-run was appointed, and a comprehensive lane-route was suggested. Without more ado, the party moved off, and in a few minutes the main road was left. Thereafter, for nearly two hours, we traversed a delightful network of lanes—narrow, tumbled, and sometimes rough. We crossed two main roads and negotiated a couple of slumbering villages. I was impressed by the quietness of the route and by the almost complete lack of other traffic—within a relatively short distance of large and teeming centres of population. Once, and once only, we encountered a motor-car, which occupied practically the full width of the lane, but reduced speeds on the part of everybody concerned avoided the slightest friction, physical or mental. I always find these journeys into the lanes well worth while. Possibly, in the future, they may become rather more desirable than in the past, having regard to main-road traffic developments.

Published about the 30th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and Printed in England by the Newnes and Pearson Printing Co., Ltd., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand—Gordon & Gotch, Ltd. Sole Agents for South Africa—Central News Agency, Ltd. Subscription Rates (including postage): Inland, 10s. 6d. per annum. Abroad, 10s. per annum. Canada, 10s. per annum. Registered at the G.P.O. for transmission by Canadian Magazine Post.