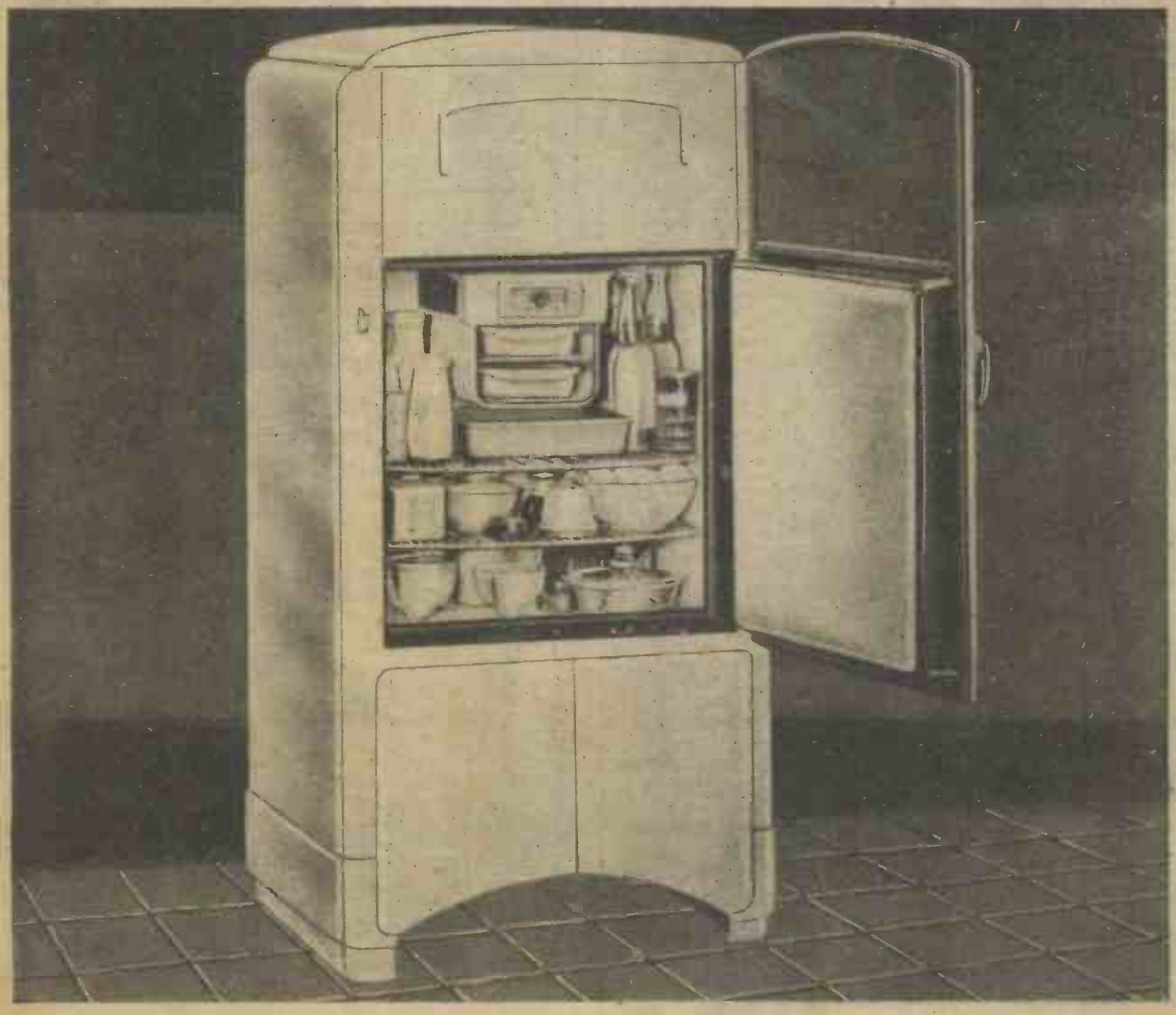
REFRIGERATOR SERVICING

NEWNES

PRACTICAL MECHANICS

9D

APRIL 1945



Have YOU Joined the Well-paid Ranks of the TRAINED MEN?

THERE IS ALWAYS A GOOD POSITION FOR THE MAN WITH A SPECIALIZED TRAINING, BUT THERE'S NO WORTH-WHILE PLACE FOR THE UNTRAINED

Ambitious men everywhere have succeeded through I.C.S. Home Study Courses. So also can you. We offer you the benefit of our 53 years' matchless experience as the creative pioneers of postal instruction. Since our establishment in 1891, more than 1,000,000 British men and women have enrolled for I.C.S. Courses.

53 YEARS OF SERVICE

The man with an I.C.S. Training in any one of the subjects listed below knows it thoroughly, completely, practically. And he knows how to apply it in his everyday work.

Accountancy	Draughtsmanship (State which branch)	Motor Engineering
Advertising	Drawing Office Practice	Motor Mechanic
Aeronautical Engineering	Electrical Engineering	Moulding
Aero Engine Fitting	Engineer in Charge	Patternmaking
Aero Fitting and Rigging	Eng. Shop Practice	Plastics
Aeroplane Designing	Fire Engineering	Quantity Surveying
Air-Conditioning	Fitting and Turning	Radio Engineering
Architecture	Foundry Work	Radio Servicing
Architectural Drawing	Garage Management	Refrigeration
Boilermaking	Gas-Power Engineering	Salesmanship
Book-keeping	Ground Engineer	Sanitary Engineering
Building Construction	Heating and Ventilation	Secretarial Work
Building Contracting	Hydraulic Engineering	Sheet-Metal Work
Business Training	Joinery	Steam Engineering
Business Management	Journalism	Structural Steelwork
Carpentry	Machine Designing	Surveying (State which branch)
Chemical Engineering	Machine-Tool Work	Telegraph Engineering
Civil Engineering	Marine Engineering	Telephone Engineering
Clerk of Works	Mechanical Drawing	Templating
Colliery Overman	Mechanical Engineering	Textile Designing
Colliery Management	Mine Electrician	Toolmaking
Commercial Art	Mine Fireman	Welding
Concrete Engineering	Mine Surveying	Woodworking
Cotton Manufacturing	Mining Engineering	Works Engineering
Diesel Engineering		

And most of the Technical, Professional, and Matric Exams.

Special terms for members of H.M. Forces and discharged disabled members of H.M. Armed Forces.

If you need technical training, our advice on any matter concerning your work and your career is yours for the asking—free and without obligation. Let us send you full information regarding the subject in which you are specially interested. DON'T DELAY. Make "ACTION" your watchword.

The successful man DOES to-day what the failure INTENDS doing to-morrow. Write to us TO-DAY

.....Use this Coupon.....

INTERNATIONAL CORRESPONDENCE SCHOOLS LTD.

Dept. 95, International Buildings, Kingsway, London, W.C.2.

(Use penny stamp on unsealed envelope)

Please send me particulars of your courses in.....

.....

Name..... Age.....

(USE BLOCK LETTERS)

Address .....

.....

ICS

THE "FLUXITE QUINS" AT WORK

"Good Gracious!" cried OO.
"Just look here.
I can't do my washing—that's clear. . . ."
"I'll soon put that right," Said OI," with FLUXITE—
The moths have been at it, my dear."

For all SOLDERING work—you need FLUXITE—the paste flux—with which even dirty metals are soldered and "tinned." For the jointing of lead—without solder; and the "running" of white metal bearings—without "tinning" the bearing. It is suitable for ALL METALS—excepting ALUMINIUM—and can be used with safety on ELECTRICAL and other sensitive apparatus. With Fluxite joints can be "wiped" successfully that are impossible by any other method. Used for over 30 years in Government works and by leading engineers and manufacturers. Of all Ironmongers—in tins, 8d., 1/4d. and 2/3d. Ask to see the FLUXITE POCKET BLOW LAMP, price 2/6d.

TO CYCLISTS! Your wheels will NOT keep round and true unless the spokes are tied with fine wire at the crossings AND SOLDERED. This makes a much stronger wheel. It's simple—with FLUXITE—but IMPORTANT.

THE "FLUXITE" GUN puts "FLUXITE" where you want it by a simple pressure. Price 1/6 or filled 2/6.

ALL MECHANICS WILL HAVE

FLUXITE

IT SIMPLIFIES *ALL* SOLDERING

Write for Book on the ART OF "SOFT" SOLDERING and for Leaflets on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE. Also on "WIPED JOINTS." Price 1d. Each.

FLUXITE LTD., Dept. P.M., Bermondsey Street, S.E.1

MYFORD

AN ANNOUNCEMENT

MACHINE TOOL CONTROL PURCHASE CERTIFICATES

The recent relaxation of Permits means that the purchaser will no longer require a Certificate for the purchase of MYFORD Lathes. There is, however, still a control on manufacture, to ensure that the Government's war-time programme is fully met. The 3½" 'M' type Lathe is in full production. The Ministries, however, stress that Government priorities must be dealt with first, and this, we regret, will mean extended delivery dates for this type Lathe.

ML.2 and ML.4 Lathes.—Production of these types is subject to Machine Tool Control sanction, and will be resumed at the earliest possible moment. We suggest, therefore, that you place your order with your usual Tool Merchant. Due to existing controls, labour/material shortages, it is not yet possible to estimate when production will re-commence; there is, however, no possibility of early deliveries.

Orders.—We can, therefore, only accept orders on the understanding that delivery will be made when possible, and they will be dealt with by the Factory in rotation as and when war-time commitments and manufacturing condition permit.

MYFORD ENGINEERING COMPANY LIMITED
BEESTON · NOTTINGHAM · 'Phone: 54222 (3 lines)

S 78-78

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. XII APRIL, 1945 No. 139

FAIR COMMENT—BY THE EDITOR

The Severn Barrage

AFTER more than 14 years of debate, there is now every possibility that the Severn Barrage Scheme, by means of which we shall be able to convert the tidal power of the Severn into electricity, will be put in hand.

It was in 1933 (some years after a previous committee had considered the matter) that Mr. J. T. C. Moore-Brabazon (now Lord Brabazon of Tara) and his committee appointed to investigate the matter favourably advised upon this scheme. It was shelved because it was going to cost £38,000,000. It was calculated that it would provide a potential output of 2,252,000,000 units per annum, of which 98 per cent. would be available for delivery to the grid. There was to be cross river, road and rail traffic, in addition to the tidal plant, and construction was to be spread over a period of 15 years.

The embankment dam was to be 4,000ft. in length, a sluice dam 6,825ft. long, and a turbine dam containing 72 turbines of an overall length of 4,550ft. A pump storage reservoir was included. The energy required for pumping, being deducted from the total given above, would reduce the net output to 1,610,000,000 units per annum. It was in November, 1943, that the Minister of Fuel and Power announced that he had appointed a panel of three engineers to review the conclusions of the 1929 committee which issued its report in 1933, in the light of later engineering experience and practice and of other developments, and to suggest what modifications, if any, should be made in the proposed scheme in the programme for its execution and in the estimates of its costs. The three members of the panel are Mr. A. G. Vaughan-Lee, Sir William Halcrow, and Mr. S. B. Donkin. This panel has itself issued a report largely supporting the conclusions of the 1933 report, but they consider it would be best to treat the barrage as a power scheme only in the first instance.

The English Stones site has been selected as the most suitable, and that single tide working (development of power on the falling tide only) would be the most advantageous method. They accept as correct the 1933 estimate of the available power.

Since 1933 there has been an impact upon the problem by three important factors. The first is the great development which has taken place in the design of hydro-electric plant, enabling fewer but larger turbo alternator units to produce the same output as that intended in the earlier schemes; the second is the great increase in the price of coal delivered to power stations, and the third is the enormous expansion in the supply and control of electricity and the development of the Grid.

Larger Turbine Units

THE layout now proposed includes a sluice dam with 128 sluices, and the use of larger turbine units, with an output of 25 kilowatts each, permitting the number of units to be reduced to 32 in two turbine dams each containing 16, thus reducing the total length. The division of the turbines into two sections would result in a more concentrated flow of water over the English Stones and create a stream along the Monmouth Shore which would minimise the deposit of silt. The estimated time of construction is eight years, and the cost of construction £47,000,000. The estimated average saving in coal for the first 15 years of operation is 985,000 tons per year, and the cost of energy delivered to the two shore substations would be .209 pence per kilowatt hour.

Experts criticising the scheme say that owing to its intermittent output, which will seldom coincide in time with the peak load on the Grid, it cannot replace coal-fired power stations without pumped storage, and that in considering the economic justification for the barrage the committee has based its calculations on the value of coal saved. This value must have some relation to the cost of energy from the barrage at reception points, if the project is to be regarded as financially sound.

There can be no doubt, however, that the scheme will be put in hand, and thus help to relieve the coal situation. Many similar schemes can be put in hand in this country so that natural power can be converted into electrical energy.

England's coal supply cannot last for ever, and it is useless to wait until the supplies are running out before we institute countermeasures.

The scheme will give employment to tens of thousands of Englishmen, and if justification can be found for the installation of a hydro-electric scheme for Scotland, which is largely a non-producing country (such justification being, of course, that the hydro-electric scheme will help it to become a producing country), we can certainly justify the Severn Barrage Scheme. Opposition at present is coming from rival interests.

Enterprise—Not Controls

NO single Act of Parliament ever threw open the door to progress wider than the Locomotive on Highways Act of 1896, when with the abolition of the man with the red flag who had to precede all motor-cars on the highway, the horse went out and horse-power came in. The original Locomotive Act of 1865 had held the development of motor-cars in a vice-like grip for 31 years. The new Act gave a new lease of life to engineering, because the public could now use speed, and so could commerce. Legislation in this country has always been 50 years behind scientific progress. It never encourages, it does its best to throttle new ideas at birth, as it has done with aviation.

The first patent for an internal combustion engine was taken out in 1862, but it could not be developed because of legislation. We must have all possible freedom for industry to develop its own engineering progressions, and this cannot be done if there is to be a continuation of controls. Mr. Bevin has said, in fact he has warned us, wagging the minatory finger at us as if we have to be punished for winning the war, that controls are to continue. Lord Woolton has propounded the same theme, and so have other Government speakers.

The Chancellor of the Exchequer has warned us that high wartime taxation is to continue in peace. All of these Government speakers seem to forget that, much as they may like to hang on to the power given to them under the Emergency Powers Act, there may be a General Election this year, when the electors will have something to say about post-war controls and taxation. Certainly the British public does not intend to be card-indexed, labelled and docketed, and deprived of their freedom which they have temporarily given up, for ever. It is just as well for the public to be alive to what is happening behind the scenes. If we have confidence in the future peace of the world we must get rid of these controls and these hampering restrictions which will hamper progress and destroy initiative as the Red Flag Act did in the automobile industry. There are many new spheres in which engineering can develop, but it cannot develop if shackled and fettered by a Government which wishes to convert us into a nation of civil servants filling in forms for everything we require.

Queries

WILL readers please note that we cannot undertake through our Query Service to supply designs, to answer legal or medical queries, nor to vary our designs or information to suit individual requirements.

Queries must be strictly limited to the scope of this journal. We do not undertake to answer questions about bee-keeping, gardening, or the curing of rabbit skins, for example. We mention this because readers are submitting queries which by no stretch of the imagination can be brought within the spheres of science, mechanics, and invention with which this journal deals. Queries *must* be accompanied by three penny stamps, a stamped, addressed envelope, and the coupon cut from the current issue.

Rocket Propulsion

Rocket-mail Experiments—in India and Cuba: Modern "Rocket-line" Apparatus

By K. W. GATLAND

(*Continued from page 201, March issue*)

SINCE 1934—until after the outbreak of the present war—experiments with rocket mail carriers have been conducted in India; these due to the efforts of a small group of individuals, headed by Stephen H. Smith, of Calcutta, secretary of the Indian Air Mail Society.

Although this group constructed, and fired, in all well over 150 rocket carriers, the experiment for which they are best known was one made in commemoration of the Coronation, on May 12th, 1937.

The "Coronation Rocket," which was 7ft. in length and contained 200 items of mail, was shot from the reclaimed grounds beyond Alipore. Just prior to the actual mail flight, a small pilot rocket was fired off in order to determine the nature of the wind above ground level. It ascended from the special launching rack—designed for the "Coronation" mail carrier—at about 45 deg., and landed half a mile distant.

In accordance with the observed flight path of the pilot rocket, the launching apparatus was reset, and the large mail carrier fitted for firing. When ignited, the "Coronation Rocket" rose swiftly, against a stiff wind, to land well over a mile from the point of take-off. The mails were immediately recovered and taken by car to a Calcutta post office, where final delivery was made through the normal postal service.

The Indian experiments, however, were by no means all concerned with the carriage of mails. Many of Smith's rockets have been employed in emergencies to carry foodstuffs and first-aid equipment. Such carriers have been used with good effect on many occasions; in delivery across rivers swollen by monsoons, and by bringing supplies to families isolated through widespread flooding.

Specially designed rockets have also carried livestock, including live fowl, and even a snake. These tests were made to gain some idea of the effects of rapid acceleration on living organisms. As a result it was found that the relatively low accelerations of the Smith rockets had little adverse effect on the occupants. The carrier rockets were landed by parachute.

Although Smith can hardly be said to have developed original rocket mechanisms of any great significance, in many ways he improved upon some of the devices originated by the earlier postal-rocket pioneers. As Schmiedle, in Austria, had done before him, Smith built several postal rockets on the "step" principle. These consisted of two distinct sections, each section containing both propellant and mail, designed to deliver their individual postal loads at two separate destinations, situated in the path of flight. Accuracy was achieved through varying the amount of powder in the rocket charges; and by means of a parachute, released as soon as the fuel became exhausted, each section was wafted gently back to the ground at the appropriate point.

Other methods employed in India included a "boomerang" rocket designed to take-off, discharge its mail, and then return to the point of ascent. Smith also constructed "telescopic" mail carriers, designed to vary their carrying capacity in accordance with different types of cargo.

Mail Rockets in Cuba

In October, 1939, some of the most enterprising postal-rocket experiments yet made are stated to have taken place in Cuba under the auspices of the Club Filatelico de la Rep. de Cuba (Philatelic Club of the Cuban Republic).

According to the *Airpost Journal*, one particular experiment concerned the firing of a large postal rocket from the Army Target Field, Havana, to Matanzas, a distance of about 50 miles. It is unfortunate that, apart from a newspaper report, which described the trial as "completely successful" essential details of the rocket and its performance are entirely lacking.

Of particular significance, however, is the fact that these experiments were officially recognised by the postal authorities—three such firings took place in October, 1939, on the 1st, 3rd and 15th.

Postal-rocket experimentation has also taken place in many countries other than those already mentioned; including Holland, Belgium, France, Luxemburg, Italy, Yugoslavia, North Africa, Mexico, and Australia.

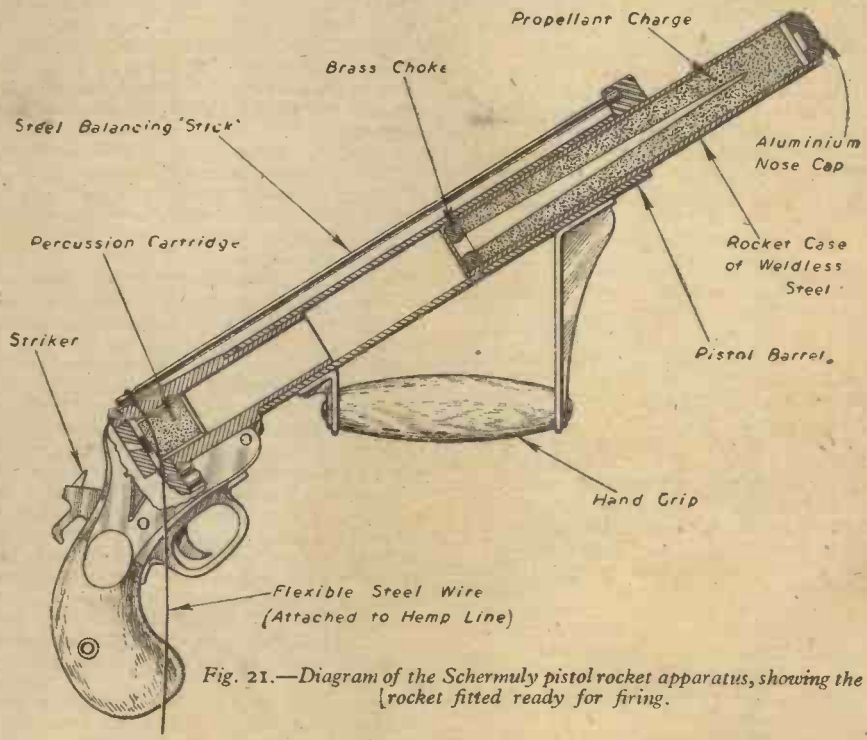


Fig. 21.—Diagram of the Schermuly pistol rocket apparatus, showing the rocket fitted ready for firing.

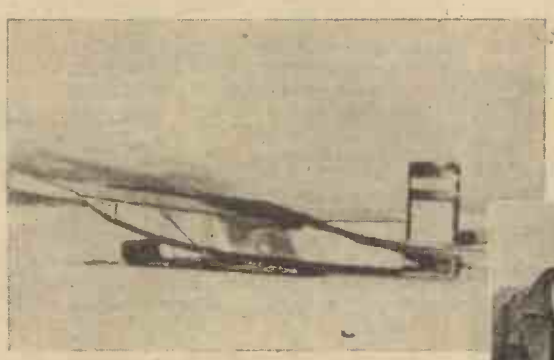
These further references conclude the historical record of the postal rocket. It is unfortunate, however, that in almost every instance there is complete lack of information concerning the rocket carriers themselves and their performance.

The great majority of these experiments concerned powder rockets in their most elementary forms, and many of the individuals responsible had neither the development of the rocket, nor the betterment of postal communication at heart—as promoters, they were solely interested in the financial return. Satisfaction was theirs if the rocket carrier flew for merely a few feet; no one could say that the covers they later offered for sale, had not been actually flown. It mattered little, therefore, whether the distance covered was rated in feet, or miles; in any case, the mails were ultimately recovered and delivered through conventional postal channels—a letter taken aloft in a toy kite, and then posted for normal delivery, would have as much significance. Few indeed of the postal-rocket experiments had any official character—admittedly, in some cases, the trials were viewed with "official interest," but it was invariably little more than just that. Many philatelists and collectors of historical proofs were naturally intrigued by the revolutionary mode of rocket transport and were quite prepared to pay large sums for the flown covers. In actual fact, many of the flights concerned could easily have been duplicated by any "scientifically inclined" schoolboy, and, indeed, often have.

There were, of course, certain notable exceptions. Quite a number of the rocket carriers embodied design features which had definite bearing on development; the parachute landing mechanism, the "step" principle, and winged rockets, among other innovations such as the launching catapult, owe much to the work of the postal-rocket pioneers. Among those whose work in this regard deserve special mention are the following: Schmiedle (Austria, Yugoslavia), Zucker (Germany, Great Britain, Holland, Belgium), Smith (India), and the Carver group (U.S.A.), as well as those responsible for the experimentation in Cuba. These authorities either carried out, or at least centred their efforts toward, the carriage of mails in competition with the normal delivery service—by projecting mails over difficult country, across water expanses, and in cases of emergency. Under such conditions, the mails carried obviously have a genuine historical interest, and British collectors of such material are fortunate in that the world's largest representative stocks are available in

The Greenwood Lake Rocket 'Plane Trials (1936)

Interesting pictures of pre-war experimental flights with postal rocket 'planes, including the Roberti machine



One of the rocket 'planes tied to the sledge on which it was conveyed to the launching site.

Willy Ley (who designed the 'planes), clad in an asbestos suit, addresses the cameramen.

Six-year-old Gloria Schleich christening the aircraft prior to the launch.

The postal cargo being packed aboard.

Charging the tanks with liquid oxygen.

The second 'plane in flight after taking off directly from the ice. (A photograph showing the first flight trial was given in "Practical Mechanics," February, 1945, p. 157.)

The mail is retrieved from the damaged aircraft after the wing had fractured due to structural weakness.

(Above) Willy Ley fires the fusee.

(Left) The German experimenter, J. K. Roberti, preparing a powder-rocket trial in Holland, 1934.

(Right) The Roberti rocket, instead of rising, is blown to pieces on the launching rack.

this country (Francis J. Field, Ltd., Sutton Coldfield, Birmingham).

Modern Rocket-line Design Methods

Although the requirements of the rocket-line carrier are not so critical, technically, as in most of the types previously mentioned, it is obvious that certain aspects of performance demand particular attention. This is especially true since upon the effectiveness of the apparatus may well lie the difference between life and death during emergency at sea.

The authority chiefly responsible for the development of rocket-line apparatus during the present century is the Schermuly Pistol Rocket Apparatus, Ltd., a firm whose beginnings date back to the early 1900's in the work of the late William Schermuly, reference to which has already been made. (PRACTICAL MECHANICS, August, 1944, p. 375.)

The pioneer apparatus of W. Schermuly has its counterpart to-day in the Schermuly pistol rocket apparatus, which is the first equipment of its kind to be approved by the Board of Trade. In recent years, the pistol appliances have achieved almost universal adoption, and now comprise a principal emergency item on all British, as well as a very large number of foreign, ocean-going vessels. Well over 100 coastguard stations, extending all round the British shores, are similarly equipped.

Both large and small ships, as well as the shore stations, are catered for by the various sizes of apparatus which have been made commercially available. Essential details of the types and sizes at present in use are given n the accompanying table.

Rocket-line Sea Rescue Apparatus

The efficient design of sea-rescue rocket apparatus is conditioned by several important factors. The greatest of these is obviously, dependability—under all conditions of weather and emergency.

One of the most severe problems to be countered is—or rather was—*damp*.

SIZES AND PARTICULARS OF SCHERMULY PISTOL ROCKET APPARATUS

No. 1 Size	Range in calm weather	300-350 yds.
	Nominal weight of rocket	6 lb. approx.
	Length of rocket body	19 ins.
	Diameter of rocket body	2 ins.
	Lines	¼ in. circ., hemp line with a minimum breaking strain of 350 lb. each 350 yds. long.
No. 2 Size	Range in calm weather	220-250 yds.
	Nominal weight of rocket	2½ lb. approx.
	Length of rocket body	13 ins.
	Diameter of rocket body	1⅝ ins.
	Lines	½ in. circ., hemp line with a minimum breaking strain of 350 lb. each 250 yds. long.
No. 3 Size	Range in calm weather	130-150 yds.
	Nominal weight of rocket	1 lb. 2 oz. approx.
	Length of rocket body	8½ ins.
	Diameter of rocket body	1¼ ins.
	Lines	⅜in. circ., hemp line with a minimum breaking strain of 350 lbs. each 150 yds. long.
No. 4 Size	Range in calm weather	130-140 yds.
	Nominal weight of rocket	1 lb. 2 oz. approx.
	Length of rocket body	8½ ins.
	Diameter of rocket body	1¼ ins.
	Lines	⅜in. circ., hemp line with a minimum breaking strain of 240 lb. each 250 yds. long.

The early line-carrier rockets, which had paper cases, were fired by matches—no easy matter under storm conditions; and more difficult still if the fuses were made damp by a watery atmosphere. For this reason the rockets sometimes failed to "fire," and lives were lost when, had a more efficient appliance been available, they might well have been saved.

It was this reason that inspired Schermuly to develop the "weather-proof" pistol rocket line-thrower (Fig. 21); an apparatus in which are combined the principles of both the *gun* and the *rocket*. With reference to the diagram, details of operation are as follows: The tubular case of the rocket is of weldless steel, fitted with a brass choke. It has a "piston" fit in the pistol barrel. The rocket is not fired directly from the barrel, but rather ejected by means of the firing of a small percussion cartridge, which serves to force the rocket from the muzzle by virtue of gas pressure—in the same way as a shell fired from a gun—the heat generated subsequently effecting combustion of the rocket charge immediately upon leaving the discharging apparatus. The rocket, thereby, derives an initial impetus which adds materially to its range.

The diagram is sufficient to illustrate the weatherproof characteristic. The powder charge is completely enclosed, and, therefore, immune to damp. Faultless operation is thus ensured under all conditions.

The object of the hand grip is not only to facilitate steady aim but also to aid correct elevation; the relative position of the grip and the pistol barrel being the approximate elevation for the range of the particular size of apparatus concerned.

The smaller types can be fired directly from the hand, with no other support, but as a precaution against the blast of the rocket, an asbestos gauntlet is provided as part of the equipment.

The largest pistol projector requires slight external support because of the greater recoil. A special tripod is available for the mounting of this apparatus (as shown in the opening article of this series—*Practical Mechanics*, July, 1944, pp. 330–1), but in many instances this is more a convenience than a necessity, as a hand rail or even a taut line would serve the aim just as effectively.

In addition to these highly creditable factors, there is still one other—*portability*. The Schermuly apparatus is remarkably light and far less cumbersome than contemporary line-throwing equipment; it can be carried, and fired, single-handed.

The Boxer apparatus affords an interesting comparison in this respect; its weight complete—including rockets, hawsers, buoys, and ropes—is 16 cwt. Because of this, it is impractical to carry the modern Boxer equipment aboard ship; which it is necessary to transport by trailer on land. The largest Schermuly appliance has a total weight of 60lb., which includes the projecting pistol, rockets, lines and waterproof containers—the apparatus complete packs up into a box less than 2ft. square.

Because of its compactness, the Schermuly projecting gear has a varied use; it can throw a line with extreme accuracy and rapidity, and its use is not limited to the coastguard and the seaman. The apparatus has been used with effect by the Fire Departments in gaining access to points beyond reach of the escape ladder. The pistol rocket is also so designed to fire Very signals.

It is rare indeed that any mechanism overcomes completely all the problems entailed in its operation. The Schermuly apparatus is one such device, as thousands of seamen are able to testify; many of whom owe their very lives to its ingenuity.

(To be continued.)

Rescue by Airborne Lifeboat

RESCUE from the sea by lifeboats dropped from aircraft is now a feature of the work of R.A.F. Coastal Command Air/Sea Rescue Service. Lifeboats fitted with two 4 h.p. two-stroke engines, containing everything needed by men suffering from wet and exposure, such as warm waterproof clothing, food, and medical supplies, are dropped from a height of 700ft., suspended by six parachutes. The first rescue by airborne lifeboats was made on May 6th, 1943, and since that date many more have been carried out.

The crew in a dinghy making for the lifeboat dropped by a Warwick aircraft seen flying overhead.

Refrigerator Servicing

Practical Pointers for Beginners in Refrigeration

By A. M. PASCOE, A.M.Inst.R.

(*Continued from page 193, March issue*)

THE driers can be charged with silica gel, activated alumina, or calcium chloride. Calcium is the most efficient drying medium, and in this particular drier the charge will remove .75 oz. of water, silica gel .35 oz., activated alumina .30 oz. Calcium must not be left on the system for longer than 12 hours, otherwise there is a tendency for the calcium to disintegrate and pass round the system with disastrous results. Silica gel and activated alumina can be left on permanently. It is always advisable to fit a permanent drier, especially after overhauls or service. This must be fitted as close as possible to the point of expansion; in the liquid line near the expansion valve is the best. To do this pump the plant down, fit the drier, remove any air from the system, test for leaks, and start up plant as previously described. When moisture has been detected in a plant, and the drier has been fitted, it is often necessary to release the blockage at the point of expansion by the application of heat. It is essential that all frost and ice be removed from the evaporator, otherwise when these parts are opened for repair, moisture will be deposited inside the tubes.

Low Side Float Systems

The low side float works as follows. The compressor draws away the vapour from the evaporator, causing the level of the liquid to fall; this lowers the float and opens the needle valve, liquid refrigerant enters, the level rises and the valve closes again (Fig. 12). This process is repeated continuously during the time the plant is running.

Service Notes

Plant runs but does not freeze. Compressor inefficient or not pumping. Shortage of refrigerant, denoted by hissing noise at valve. Belt slipping. Moisture or air in system. Choked filters; there is often a filter fitted in the liquid line where it enters the evaporator. Dirty condenser.

Plant runs and freezes but fails to cut out. Inefficient compressor. Faulty thermostat. Thermostat contacts shorted. Thermostat set at too cold position. Excessive heat leakage into cabinet through poor insulation or perished door gasket. Leaking float valve needle; the needle must be removed and refitted. Partially choked filters. Air in system.

Plant refuses to run. Faulty motor. Fuses blown. Faulty thermostat; test by shorting out, or examine and note if contacts are open. Compressor seized due to moisture. High-pressure cut-out open, due to air in system.

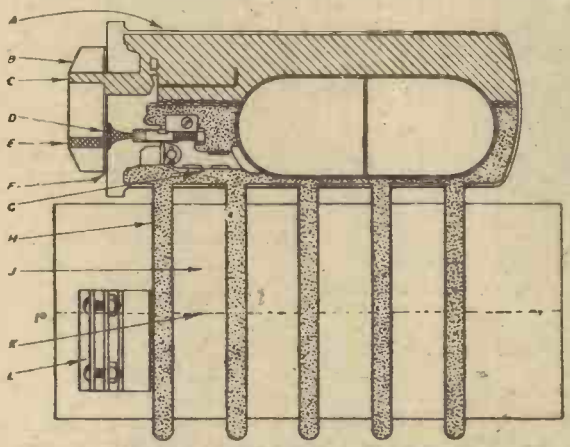


Fig. 12.—Typical low side float valve flooded system cooling unit.

A. Float valve housing; B. Liquid and suction line connection; C. Suction line connection; D. Strainer; E. Liquid line connection; F. Gasket; G. Float valve; H. Vaporising tube; J. Freezing chamber; K. Freezing tray shelf; L. Temperature control bulb clamp. (By courtesy of Kelvinator, Ltd., London.)

Plant cuts out but refuses to start. Faulty thermostat. High-pressure cut-out open, due to air in system, or choked condenser.

Plant noisy. Compressor worn. Belt slack, or worn. Motor bearings worn or excessive end play. Bolts slack. Tubes rattling. Flywheel loose on shaft. Motor pulley or fan blades slack.

Plant short cycles. Motor overloaded and cutting out on thermal overload. Differential on pressure-operated cut-out set too close. High-pressure cut-out operating due to air in system or dirty condenser.

Plant freezes, but suction line frosts back to compressor. Float requires recalibration. Return to manufacturers.

Plant only partially freezes. Float valve needle leaking. Inefficient compressor. Air in system; if running very hot check as described previously. Partially choked filters. Choked or dirty condenser.

This type of system will only work with the refrigerant it was designed for. If the refrigerant is to be changed a suitable float valve must be obtained from the makers. Oil must be added to the evaporator after overhaul of plant if required. The usual amount for domestic machines is half a pint; for commercial machines the makers' advice should be sought. When this type of plant is short of refrigerant it may be found that the head pressure is higher than it should be. Before purging for air, add required refrigerant. In most cases the head pressure will return to the correct reading.

High Side Float Systems

A typical system is shown in Fig. 13. Often a check or pressure maintaining valve is inserted in the liquid line, just at the entry to the evaporator. This valve maintains a pre-determined pressure in the liquid line, thereby keeping the temperature of the line above freezing point. When the plant is started up gas is drawn from the evaporator, passed into the condenser, then into the float chamber; the level of the liquid rises, so raising the float and

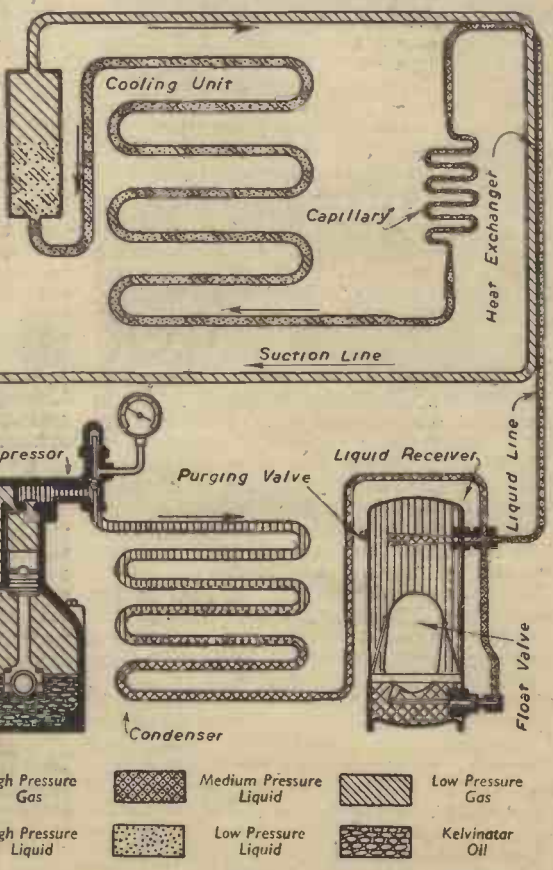


Fig. 13.—Diagram illustrating the Kelvinator system of refrigeration.

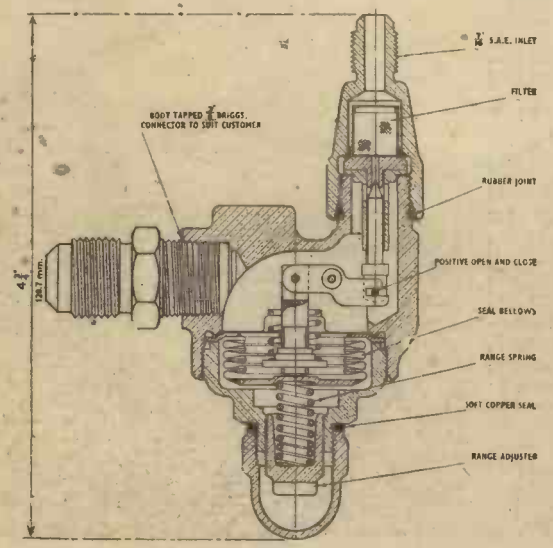


Fig. 14.— Section of a pressure-operated expansion valve.

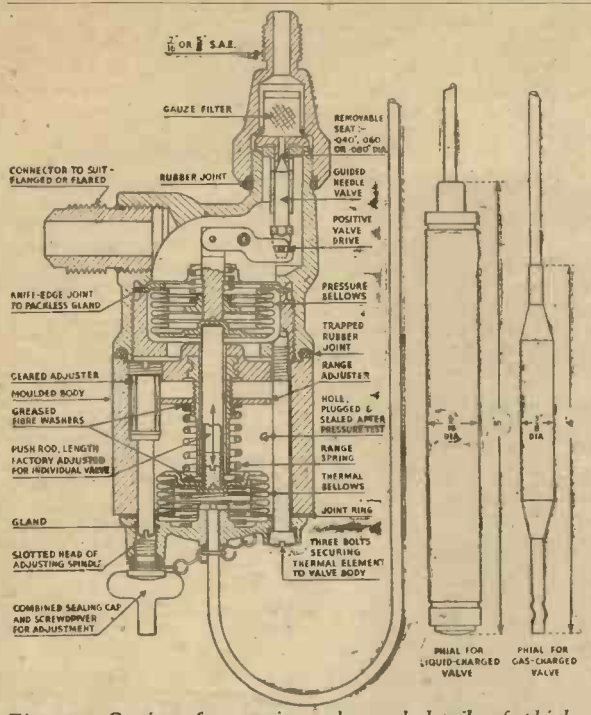


Fig. 15.—Section of expansion valve and details of phials for liquid and gas.
(By courtesy of British Thermostat, Ltd.)

opening the valve, the refrigerant returns to the evaporator and the valve closes. This process continues as long as the plant is operating.

Service Notes

Plant runs but does not freeze. Compressor inefficient or not pumping. Shortage of refrigerant, denoted by valve remaining closed. Moisture or air in system. Belt slipping. Dirty condenser. Stuck open float valve. Overcharge of refrigerant, denoted by a high pressure on the compound gauge.

Plant runs and freezes, but fails to cut out. Inefficient compressor. Shortage of refrigerant. Air in system. Excessive heat leakage into cabinet through poor insulation. Belt slipping. Check valve stuck open, and liquid line frosting. Crankcase flooded with liquid refrigerant, close SSV and pump clear.

Plant refuses to run. Faulty motor. Fuses blown. Faulty thermostat. Compressor seized. High-pressure cut-out open due to air in system.

Plant freezes, but suction line frosts back to compressor. Overcharge of refrigerant. Float valve stuck open, flush by closing the HSFSDV, allow the plant to pump down, open the HSFSDV quickly. This will flush any dirt away from the seat of the valve; repeat if necessary.

Plant only partially freezes. Shortage of refrigerant. Inefficient compressor. Air in system. Choked condenser. Plant cuts out too soon; lower thermostat setting. This type of system can be charged with any of the common refrigerants, but if changing over, the instructions given previously must be followed carefully. Overcharging must be avoided as oil pumping is liable to occur, resulting in damage to the compressor valves. Often on examination the oil level in the crankcase is found to be low. This usually denotes a slight shortage of refrigerant, causing the compressor to draw off oil to replace the lost refrigerant. Add refrigerant till the suction line frosts back to within two-thirds of its length. After four to six hours' running it will be found that the frost line has returned to normal, and the oil level has corrected itself. If this fails, then the crankcase is definitely short of oil and should be topped up. Care should be taken when opening the compressor that the SSV has been closed, the crankcase evacuated, and the CHSDV closed. Moisture in the system usually blocks the point of expansion, either at the float, or if a check valve is fitted at this point. To free the choke, it is necessary to apply heat. This should be done by means of a rag dipped in boiling water, never by means of a naked flame.

Expansion Valve Systems: Pressure Operated

Pressure-operated expansion valves, Fig. 14, are often used on brine tank evaporators, and on ordinary evaporators in domestic machines. This type of valve maintains a constant pressure, no matter what the load. It is not often used on commercial installations due to the very definite limitation that it can only be set to control efficiently under one set of conditions, and cannot adjust itself to varying loads. The opening of the valve is controlled by the pressure existing in the evaporator. As the pressure rises the valve closes; similarly, as the pressure falls the valve opens and admits liquid refrigerant to the evaporator.

Service Notes

Plant runs but does not freeze. Filter choked with dirt and oil. Valve starved, usually denoted by ball of frost round expansion valve. Valve flooded, usually denoted by evaporator, suction line and crankcase sweating, and higher than normal back or suction pressure. Moisture on needle, worn needle and orifice (see Fig. 10). Shortage of refrigerant. Inefficient compressor.

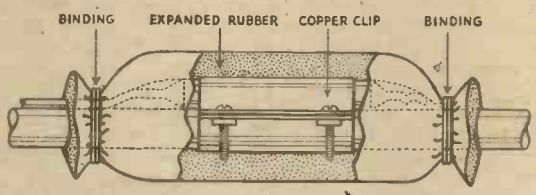


Fig. 16.—Thermal bulb.

Plant runs and freezes but fails to cut out. Valve starved. Valve size too small. Faulty thermostat. Inefficient compressor. Belt slipping.

Plant freezes, but suction line frosts back to compressor. Overcharge of refrigerant. Valve too large. Needle worn. On brine tanks the frost line should extend to about 6in. from the outlet of the tank.

Plant only partially freezes.—Shortage of refrigerant. Inefficient compressor. Belt slipping. Air in system. Dirty condenser.

Setting Valves

It is usual to set these valves at the following pressures, 5in. vac. for SO_2, 5lb. pressure for CH_3CL, 11lb. pressure for F12. Further adjustment is made when the cabinet is at or near its cutting out temperature, opening if the evaporator is not completely frosted, closing if frosting back down the suction line. If the valve size is too large, the setting will be very difficult to make; if too small, the evaporator will fail to frost completely. Shortage of refrigerant is usually denoted by a hissing noise at the valve. Fig. 15 shows the approximate sizes for valves as related to the horsepower of the plant.

Thermostatically Operated

The thermostatic expansion valve endeavours to maintain a constant temperature difference between the refrigerant boiling in the evaporator, and the gas leaving at a point near the thermal phial. This is known as the superheat, and each valve is usually set at the factory at 10 deg. to 15 deg. This setting will be found to be correct in nearly all installations, and before attempting to adjust the valve make certain that the rest of the plant is correctly adjusted. This type of valve allows the full area of the evaporator to be effectively used under all conditions of load. Two types of valves are available, dry and liquid charged. Dry-charged valves must only be used on installations where the cabinet or coldroom temperature is 40 deg. or above, or where the bellows casing of the valve is in a position where the temperature is above that of the control bulb. It is quite possible that the charge may liquefy in the bellows, and close the valve, showing every indication of a faulty unit. Liquid-charged valves can be used on any type of installation.

Service Notes

Plant runs but does not freeze.—Choked filter, shortage of refrigerant. Valve flooded, check for overcharge. Valve starved, check for undercharge. Thermal bulb not clamped to evaporator, not insulated, or loose (see Fig. 16). The position of the thermal bulb is most important and should be clamped to the suction line approximately 1ft. for domestic, 4ft. for commercial, inside the refrigerated space, from the exit position of the suction line. Inefficient compressor. Belt slipping. Moisture in system, usually denoted by ball of frost round valve. Collapsed thermal element; warm thermal bulb and note if suction pressure rises, if not element has collapsed. Make certain filter is not choked. If a gas-charged valve, warm bellows casing; if pressure rises, remove valve to a warmer position or replace with liquid-charged type.

Plant runs and freezes, but fails to cut out.—Valve flooding. Needle and orifice worn. Faulty thermostat. Thermal bulb loose in clamp.

Plant runs but frosts back to compressor.—Valve size too large. Valve flooded. Overcharge of refrigerant.

Valve Hunting.—This symptom is usually caused by the valve being oversize, and causes the plant to frost back to the compressor, and then defrost part of the evaporator. This can also be caused by a loosely clamped thermal bulb. The majority of

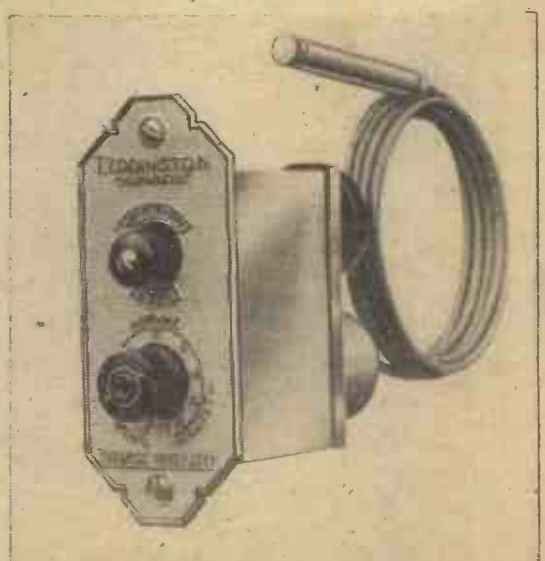


Fig. 17.—A typical domestic thermostat.
(By courtesy of British Thermostat, Ltd.)

thermostatic expansion valves are set to work on a 10 deg. to 15 deg. superheat. That is, the difference between the gas boiling in the evaporator and the gas leaving the evaporator. Superheat can be checked by tapeing a thermometer on to the suction line, just before the thermal bulb. Subtract from the reading given 5 deg. to 7 deg. F., this will give the gas temperature at the outlet. The inlet temperature can be read from the compound gauge, and if the valve is set correctly should read between 10 deg. to 15 deg. lower. The valve should be adjusted if necessary by flooding to lower superheat, and starving to increase. The frost line can then be adjusted by either removing or adding refrigerant. Valve manufacturers state that 90 per cent. of the valves returned to them as faulty are either wrongly adjusted, or choked with dirt or oil. Before condemning a valve as faulty, check as follows: Is the valve the correct type, correct size, not choked with dirt and oil, or wrongly adjusted? Where this type of valve is used on a brine system, it is preferable to clamp the element below the surface of the brine. When installing new valves, no attempt should be made to adjust the valves, as they are factory set; it is always wiser to look for other causes first, such as shortage of refrigerant, compressor inefficient, etc.; if flooding back, the system is probably overcharged, or the valve is too large; if starving, the valve is too small or short of refrigerant, etc. A little extra time spent on correctly adjusting the plant is well repaid by the subsequent trouble-free service of the machine. Repeat or return calls, for the same fault can soon ruin a service business.

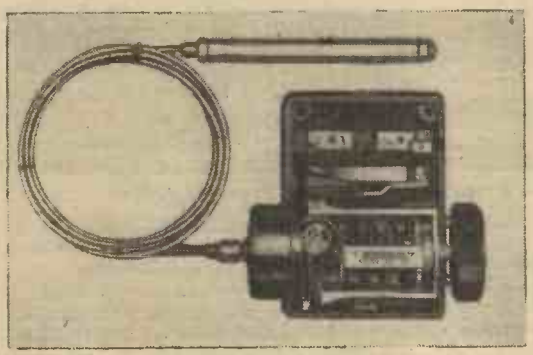


Fig. 18.—A commercial thermostat.

Controls and Motors

Some form of temperature control is required to keep the temperature within desired limits. Two types are in constant use, the thermostatic type, and the pressure operated.

Thermostatic Type

Fig. 17 shows a typical domestic thermostat. The silver contact snap-action switch is controlled by a flexible bellows actuated by the control bulb clamped to the evaporator. This type of switch will handle motors up to ½ h.p. A.C. or ⅓ h.p. D.C. at 250 volts. Where higher h.p. motors are used, a relay must be included in circuit. The range is usually any 20 deg. F. between 0 deg. and + 45 deg. F. Some models are fitted with a thermal overload trip in the motor circuit. If any adjustments are required the manufacturers' instructions should be carefully followed. Fig. 18 shows a commercial model. The control bulb is mounted in the cold-chamber in a position that is free from direct contact with warm air entering through the door, and mounted in a wire cage on the cold room wall at a position equidistant from the floor and roof. As this type of control is worked by the changes in air temperature the bulb must not be allowed to rest against the walls, and must be protected so that stored produce does not rest against it. This model will control motors up to ½ h.p. A.C. single phase, and ⅓ h.p. D.C. up to 250 volts. Three-phase 400/440 volt and higher h.p. motors must have an energised relay in circuit. The temperature between cut-in and cut-out is known as the differential; this particular model has an adjustment of 2 deg. to 5 deg. Fig. 19 shows a typical pressure-operated controller; this type is often used on thermostatic expansion valve systems. As the temperature in the cabinet falls, the pressure in the evaporator also falls so opening the switch contacts. When installing, connect L to the compressor crankcase, and H to the liquid receiver. Electrical connections are made to points E.

Select the cut-out temperature required, and find the correct pressure as described in "Checking quantity of refrigerant in system." Set the cut-out point to this pressure by means of the nut A, turning clockwise to increase the setting, and vice versa to decrease. The cut-in point is set by means of the screw C, clockwise to decrease, anti-clockwise to increase. The high-pressure cut-out is set by means of the nut B, clockwise to increase, anti-clockwise to decrease. Usual settings are 130lb. for SO_2, 150lb. for CH_3CL, and 180lb. for F12. Any settings should be made in small steps, and sufficient time should be allowed between each adjustment to allow the plant to settle down to the new conditions. Under no circumstances must the nuts X, Y and Z be touched as they are factory set. No attempt should be made to force the contacts open, when under pressure, otherwise the spring is liable to sustain permanent damage, so affecting the working.

Motors

Two types of motors are in general use for A.C. installations; the repulsion induction type, and the capacitor type. They must be of the continuous duty type, and able to stand a 40 deg. C. temperature rise over surrounding air. Split-phase motors are unsuitable for refrigeration as the starting torque is insufficient. Generally speaking, refrigeration plants have a high starting load, and this type of motor will usually stall when starting. Direct current motors must be of compound type. Particular attention must be paid to lubrication, half a dozen drops in each bearing every three months is usually enough; oil must be a high-quality, light grade. Over-oiling is just as detrimental as under-oiling. Brush-gear and switch contacts must be kept clean and free from oil. Mention is made here regarding belts, for which tension is most important, and when correctly tensioned it should be possible to depress the belt ½in. when pressed down with the finger. Rotation is also important, and for domestic models it is common practice that the air be blown through the condenser; for commercial models the air should be sucked through the condenser.

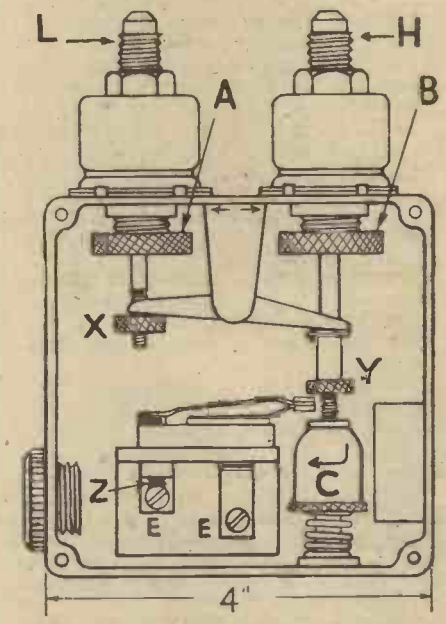
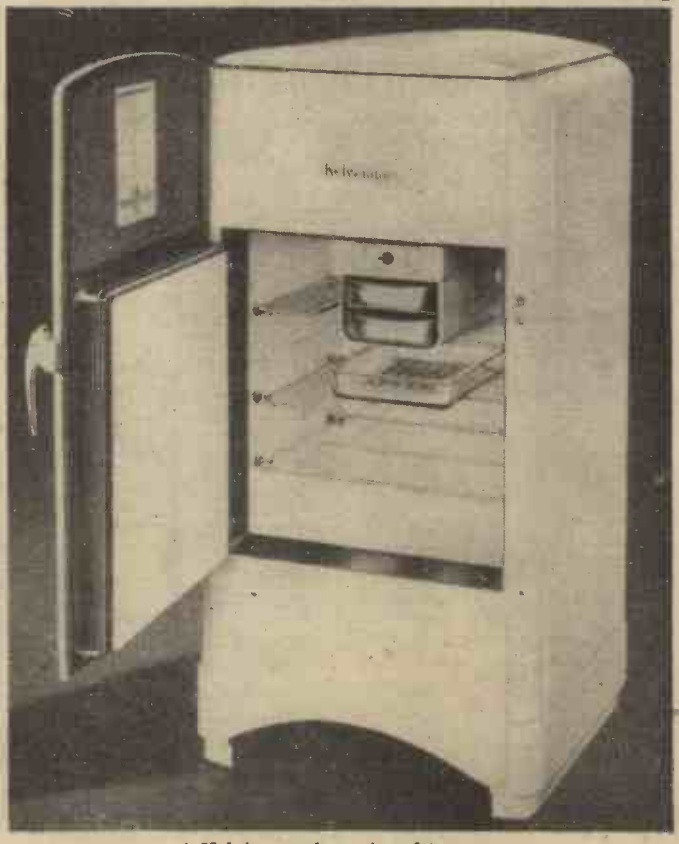


Fig. 19.—A pressure-operated controller.



A Kelvinator domestic refrigerator.

Acknowledgment

The author wishes to thank The British Thermostat Co., Ltd., Middlesex, Refrigerator Components, Ltd., London, and Kelvinator, Ltd., London, for illustrations and information of their products.

Timber Houses

Further Particulars of Mr. J. P. Tingay's Prizewinning Design in the Competition Promoted by the Timber Development Association

IN last month's issue of PRACTICAL MECHANICS, illustrations and preliminary particulars were given of a pair of timber houses designed by Mr. John P. Tingay, A.R.I.B.A. As a considerable amount of interest has been aroused in these attractive houses, he has prepared at our request these further details of construction and plans of the houses given in the present article.

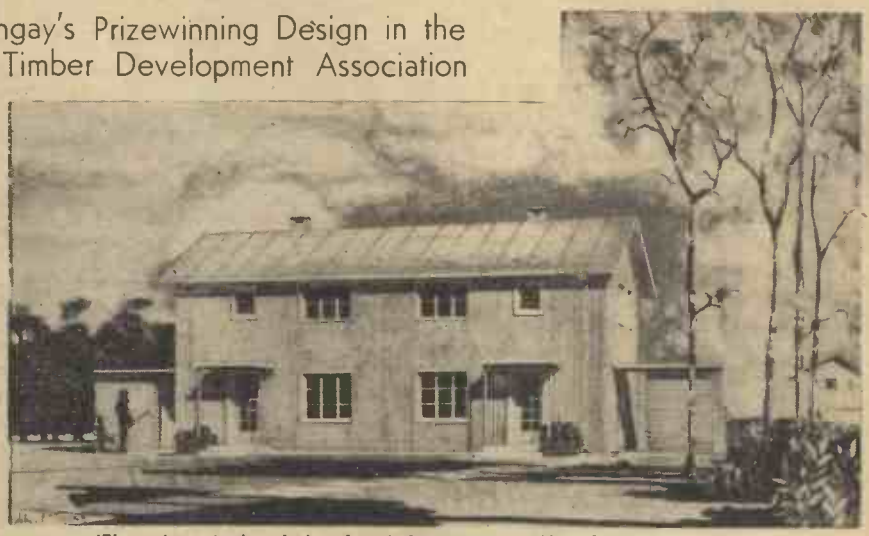
In designing this house, the following are the points which have received special consideration :

a. Economical and rapid erection.
b. Good thermal insulation against heat and cold.
c. Fuel economy.
d. Concentrated heating and plumbing apparatus.
e. Low maintenance cost.
f. Adaptation of plan to suit various aspects.
g. Labour-saving equipment in the kitchen and utility room, and good wardrobe fittings in all three bedrooms.

Layout and Accommodation

The total floor area of the house is 896 sq. ft. (21ft. 2in. by 21ft. 2in.). This figure is calculated from dimensions taken to the internal face of the external walls, no deductions being made for the areas of flues, ducts or partition walls.

The general disposition of the various rooms, and the location of the plumbing and heating units, will be clearly understood from the illustrations. However, a brief summary is given below in order that the more important points may be emphasised.



The prize-winning design for timber houses. View from the road.

The house contains the following accommodation :

Entrance hall and staircase (56 sq. ft.). A coat-hanging cupboard is provided, and there is ample space for a full-sized pram. The front door is three-quarter glazed and will give good light.

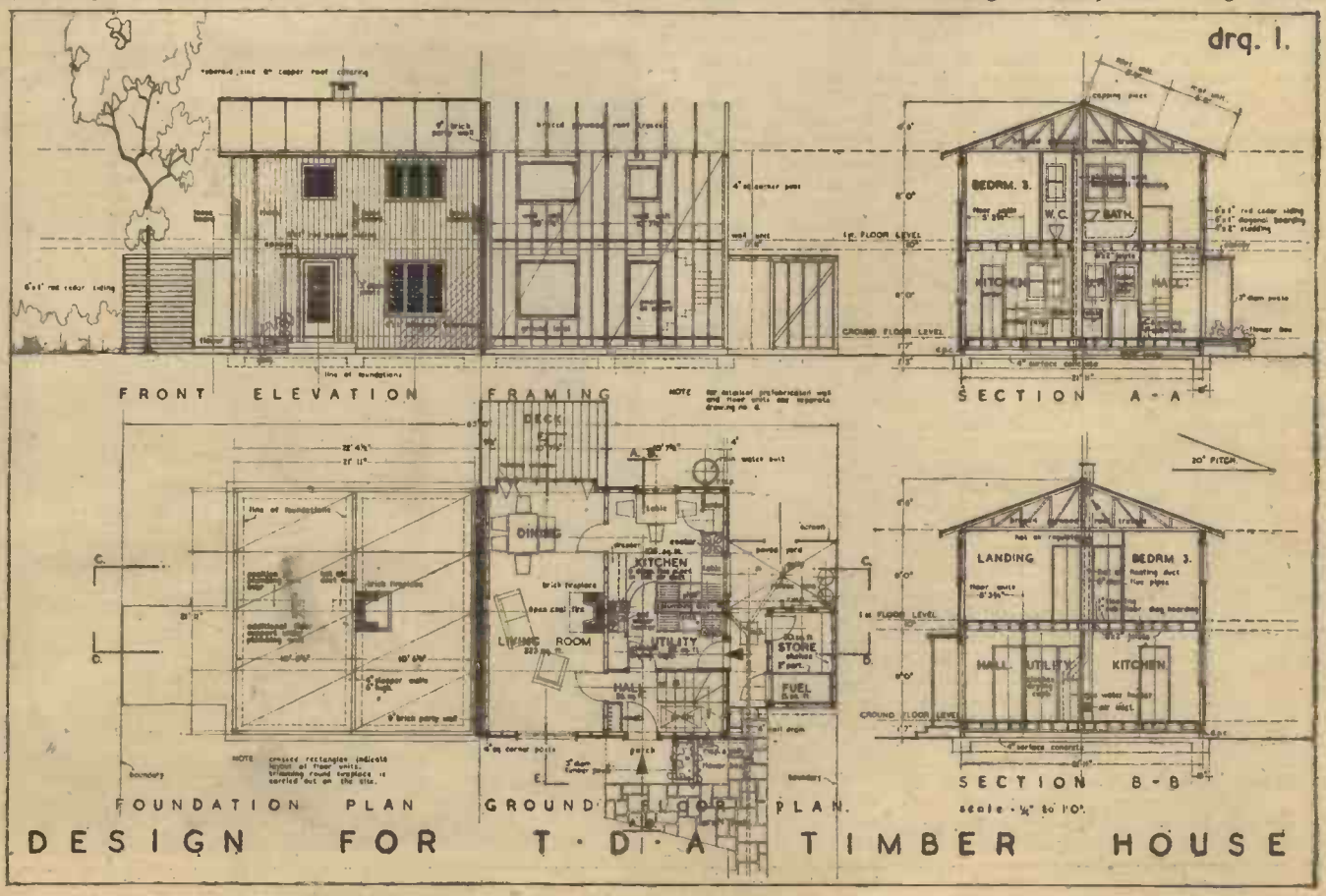
Living-room (223 sq. ft.). This main room has direct access from the hall and runs the full depth of the house (21ft. 2in.). An open coal fire is located centrally on the long wall as it is considered that the vast majority of people prefer a normal open fire in the living-room.

A large folding bay window is positioned at the south end of the room. Western red cedar boarding is suggested as a wall finish, but alternative coverings may, of course, be used to suit individual tastes.

The dining table is arranged at the kitchen end of the room, leaving ample space round the fireplace.

Utility room (52 sq. ft.) is placed between the entrance hall and the kitchen and contains the tradesmen's entrance. This door is of the "stable" type, the top half remaining open during the period of washing clothes, in order that the steam may escape.

The utility room is provided with a deep sink with shelves over, a gas copper or washing machine, and a large clothes-



drying cupboard, which houses the thermostatically controlled gas water-heater.

Kitchen (105 sq. ft.) has direct access from the utility room, and also a door leading to the living room for the purpose of serving meals. There is, however, sufficient space in the kitchen itself for a table and chairs. The kitchen fittings are as follow:

Sink and double draining board.
A gas or electric cooker.
A large work-table directly in front of the side window, with refrigerator under.
A fitted dresser and cupboards.

The larder is located in an external corner of the house, thus allowing the vent to be placed correctly according to the aspect.

The fuel store (15 sq. ft.) is positioned directly outside the back door, but is arranged so that fuel may be fetched without going out into the weather.

Tool store (30 sq. ft.) is adjacent to the fuel store, and is considered to be a very necessary part of the plan, permitting the storage of bicycles, lawn mower, etc. A paved yard with central gully is provided near the back door, and is screened from the garden. This screen also prevents a direct view through from the road, and provides an excellent place for refuse bins.

Landing and staircase (80 sq. ft.). The landing provides separate access to all bedrooms, bathroom and W.C., and is well lighted by a window at one end.

Bedroom No. 1 (131 sq. ft.) is fitted with two large wardrobes, and is heated by means of hot air, which is discharged from the hot air heating duct. The flow is governed by means of a trap regulator in the bedroom.

Bedroom No. 2 (123 sq. ft.) is similar to bedroom No. 1, except that only one wardrobe is provided.

Bedroom No. 3 (65 sq. ft.) is a single room only, and is fitted with one wardrobe.

Bathroom (29 sq. ft.) is located next to the plumbing unit and contains the bath and lavatory basin. The linen cupboard, which has access from the landing, is heated by the hot-water tank (this is fixed in the plumbing unit).

W.C. (15 sq. ft.) is placed on the other side of the plumbing unit, in which is concealed the water waste preventer, the handle only being visible.

Construction

As will be seen from the illustrations, a prefabricated system has been adopted for the scheme, there being four types of unit, as follows:

The Wall Unit.—The wall unit, size 10ft. 7½in. wide by 17ft. 11in. high, has an external covering of 1in. diagonal boarding, a layer of bituminous paper or felt, and a finish of 1in. red cedar siding, fixed vertically in order to facilitate the jointing of the wall units. These finishings, also all door and window frames, are fixed in position before delivery to the site. The units are bolted together and also to the foundations, which are of the normal type. The internal wall linings (plywood, plaster or fibre board) are fixed after erection, as it is considered that there would be a certain risk of damage in transit when dealing with large units.

The Floor Unit.—The floor units, size 5ft. 3¾in. by 10ft. 5¼in., are constructed of 1in. thick T. and G. floor boarding, and a 1in. thick sub-floor (laid diagonally), spiked to 8in. by 2in. joists, which are staggered so that the joists of adjacent units do not coincide, and in order that the units may be reversible.

The Truss Unit.—The truss units (span 21ft. 3in.) are spaced at 2ft. 8¼in. centres and are fixed by spiking to the head of the wall unit. They consist of a plywood web, suitably braced, and are held rigid and square by means of plywood stiffeners.

The Roof Unit.—The roof units are constructed of two layers of 1in. thick boarding spiked together (one layer diagonally), and are supported by and spiked to the trusses.

The roof finish may be bituminous roofing felt, zinc or copper. It is thought that anything in the nature of red cedar shingles would increase the constructional time factor unnecessarily.

It will be appreciated that with this type of construction it would be possible to erect the main walls, floors and roof in the shortest possible time, thereby permitting all internal work to proceed under cover and without delay. The layout of these various units will be understood from the illustrations.

Plumbing and Heating

The whole of the water supply and plumbing system, including the hot-and cold-water tanks and the water waste preventer, is contained in the plumbing unit, size 16ft. 9in. by 5ft. 11in. by 12in. wide. The unit consists of a light steel angle skeleton framework, covered with plywood panels.

The two 6in. diameter flue pipes from the fire in the living-room and the gas water-heater in the utility room are carried up the full height of the house in a sheet-steel hot-air duct. The air, which is heated in the duct, is discharged into the two main bedrooms and the landing. Regulators are fitted at these three points in order that the flow of air may be governed to suit varying conditions.

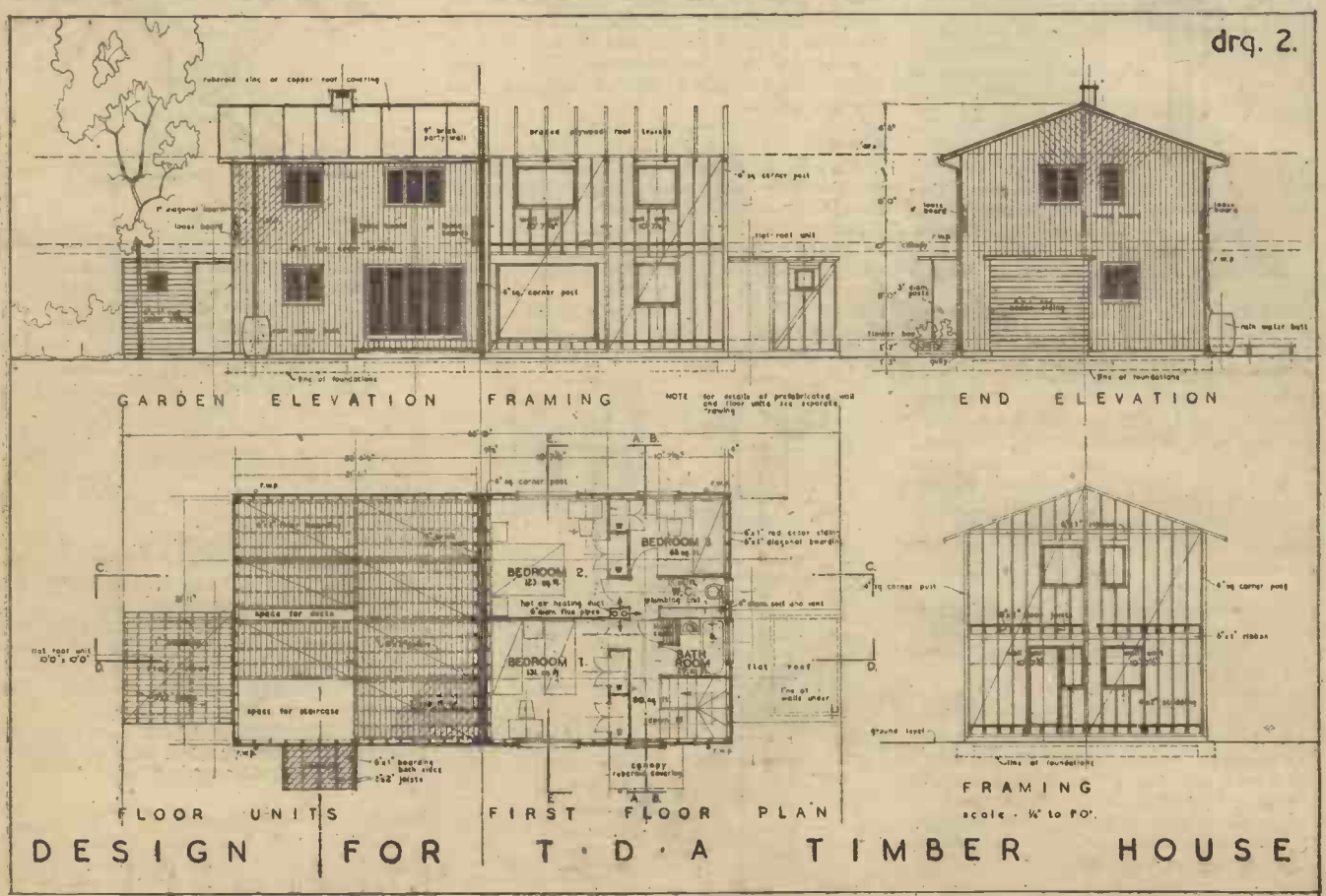
It will be understood that all stoking of fires is dispensed with during the summer months, and that the family will have the comfort of a cheerful open fire in the winter.

Maintenance

Red cedar siding has been utilised for the external wall covering for the reason that it needs no preservative treatment, has a long life, and weathers to an attractive colour.

The window and door frames are painted in order to give colour to the elevation, but, of course, red cedar could be used if desired.

Asbestos cement gutters and rain-water pipes are used, since they require no painting and are absolutely impervious to decay.



Clock Repairing and Adjusting

Notes on the Various Parts of a Clock, and Their Functions

By WILLIAM G. PIKE, F.B.H.I.(Lond.)

CLOCK repairing is fascinating, and any reader who has an aptitude for small precision work should be capable of repairing and restoring his own clocks if certain elementary rules are thoroughly understood. Before commencing work the student should become thoroughly acquainted with the names of the various parts. This will simplify both instruction and the ordering of spares, if and when they are available.

The word clock is frequently used incorrectly. A timepiece is a spring, weight or electrically driven mechanism, balance, pendulum or mains controlled which indicates time. A clock is a timepiece which indicates the passage of time at regular intervals by strokes on a bell or gong.

Let us leave electricity for the present, and consider the weight or spring-driven types. In its most simple form a timepiece consists of (1) the power unit—which can either be a weight or a mainspring. (2) A group of wheels, varying in number according to the length of time the timepiece is required to function with one complete winding up of the weight or mainspring. This group of

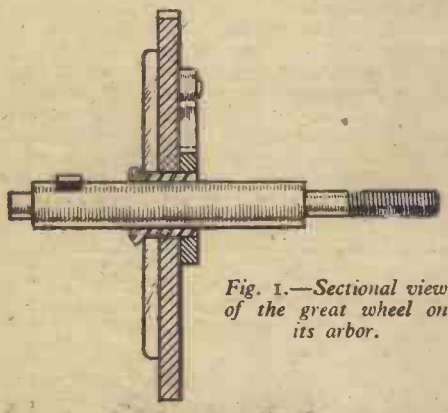


Fig. 1.—Sectional view of the great wheel on its arbor.

wheels is called the train. (3) The controlling device which consists of the release mechanism or escapement as it is more correctly known, and either a pendulum or a balance wheel with hairspring. (4) The group of wheels which transmit motion of the train of wheels to the hands—these wheels are called motion wheels.

The Movement

All the mechanism in a clock, or timepiece, is called the movement, and this is contained within two brass plates, rectangular or circular in shape, termed front plate and back plate. The front plate is usually screened by the dial or face, whilst the back plate is that which is usually visible. The plates are kept the required distance apart by four or more pillars—round shouldered pieces of brass or steel.

The power unit, whether it is a weight or mainspring, is attached to the great wheel, the name given to the first and biggest wheel in the movement. Fig. 1 shows a simple arrangement of the great wheel. It consists of an arbor—the name always given to clock spindles—upon which has been driven the ratchet wheel. The ratchet wheel when engaged with the pawl or click prevents the mainspring from unwinding. Each end of the arbor is turned down to form a pivot. The pivots fit into the bearings or holes—as they are more familiarly called—in the plates.

The Great Wheel

Mounted upon the shoulder of the ratchet wheel is the great wheel, upon one face of which is riveted the click, and the click spring. The click spring is the small spring which returns the click to its lowest point on the ratchet wheel. The great wheel is kept

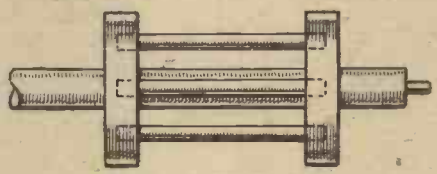


Fig. 2.—Lantern pinion.

in position by a thin steel disc—slightly cupped—and riveted to the ratchet wheel.

At the front or winding end the arbor is screwed or squared to receive a winding key. A hook for attachment to the inner coil of the mainspring is fitted to the body of the arbor, its position is governed by the width of the mainspring and the arrangement of the wheels. The hook is often a pin with a small head driven into the arbor and riveted over, but more frequently the body of the arbor is forced out by means of a special punch to form the hook.

The teeth of the great wheel and the other wheels in the train have to be accurately formed in order to transmit power from the mainspring or weight with the least possible amount of friction. Clock wheel teeth—except the escape wheel—are usually of epicycloidal form. This means that the curved part of the teeth is similar to an epicycloidal curve. An epicycloidal curve is the kind of curve that would be described by a point on the circumference of one circle when rolled around the circumference of another circle.

Pinions

Each of the wheels in the train—except the great wheel—has a second but smaller wheel fixed to its arbor. This small wheel is called a pinion, and its teeth are always referred to as leaves. Pinions, driven by wheels with epicycloidal teeth, have leaves of hypocycloidal formation. A hypocycloidal curve is the kind of curve described by a point on the circumference of one circle when rolled inside the circumference of another circle.

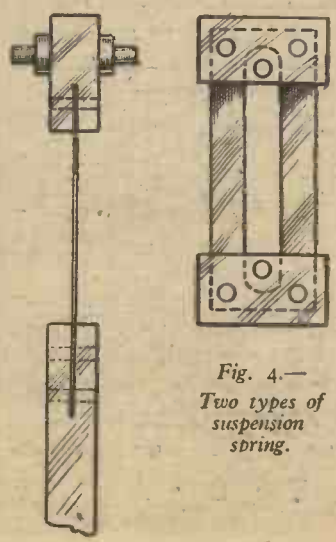


Fig. 4.—Two types of suspension spring.

There is, however, another type of pinion used extensively in clocks, called the lantern pinion. This consists of two small brass discs or shrouds driven on to the arbor. Passing through the discs are a number of round pins which serve as leaves. The holes in one disc are drilled about halfway through, in the other disc the holes are drilled right through to enable the pins to be fitted. After fitting, the brass is burred over to prevent the pins from falling out. A lantern pinion is shown in Fig. 2.

The Escapement

The escape wheel, which is the last wheel of the train, has teeth of an entirely different shape. Its name describes its action which is one of escaping one tooth at a time, the escaping action being controlled by the pallets or anchor in conjunction with the pendulum. The escape wheel of a pendulum clock usually has slender, pointed teeth. This is quite noticeable in the dead-beat escapement. Whereas the teeth of an escape wheel in a recoil escapement are heavier, although the tips are thin.

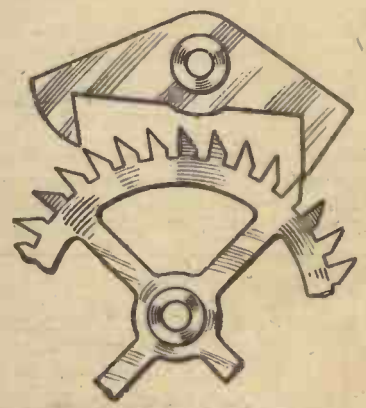


Fig. 3.—Recoil escapement.

The pallets which release the escape wheel teeth one at a time are often called the anchor, as the shape is something like a ship's anchor. The illustration, Fig. 3, shows the recoil escapement. In this escapement, the curves of the pallet faces are such that as each tooth drops, first on the entry face and then on the exit face, a slight recoiling of the wheel is noticeable whilst the pendulum continues its swing—hence the name "recoil." In the dead-beat escapement the curves of the pallet faces are such that the escape wheel stops dead whilst the pendulum continues its swing.

The pendulum is only indirectly connected to the pallets. Attached to the pallet arbor is a slender rod, which is bent to be clear of the back plate. At the end of the rod and at a right angle to it is fixed a pin, a loop or a fork. This rod is termed the crutch. If the crutch has a pin the pendulum rod will have a slot to accommodate it, if it has a loop or a fork the pendulum rod will pass through it; the pendulum rod itself being supported by its suspension spring which is held by a bracket. This bracket, which also carries the back pallet hole, is screwed to the back plate and called the pallet cock.

Pendulum Components

The pendulum consists of several parts, each being called by a different name. Starting at the top is the suspension spring which is a

thin ribbon of steel. Riveted to the top of the spring is a small brass block. When not especially shaped this block is fitted with a stout pin which locates in a groove in the suspension bracket or pallet cock. The lower end of the spring is fixed to another and larger brass block, this larger brass block is screwed to the pendulum rod. The rod may be either wood or metal according to requirements. The end of the rod terminates in a long screw. The weighted part of the pendulum is called the bob and is usually lenticular in shape although a number of clocks have a cylindrical bob. The bob is retained in position by a large nut. This is called the rating nut and raises or lowers the bob to speed up or slow down the timekeeping of the clock. A typical suspension assembly is shown in Fig. 4.

The method of suspension is always the same with the exception of one or two old types of clock—e.g., the silk suspension of some early French clocks, and the wire loop suspension of cuckoo clocks—but the design varies. The suspension described in the last paragraph is the kind used for grandfather or English long cased clocks, as they are more correctly called, and other English types and precision clocks. In modern clocks the suspension spring is very much shorter. The single ribbon of steel is substituted by two narrow strips of steel and the spring is pinned to the pallet or back cock, the pendulum being detachable at the bottom of the spring.

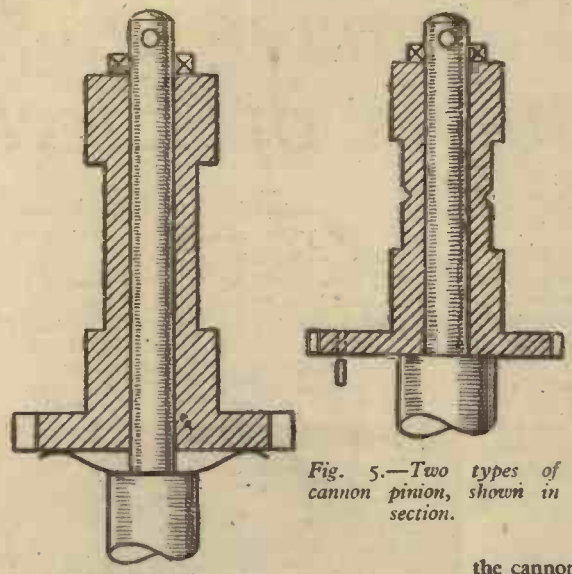


Fig. 5.—Two types of cannon pinion, shown in section.

Regulating Device

Some clocks are provided with an extra regulating device which can be operated from the front of the clock. Attached to the pallet cock is a small pair of close fitting brass jaws or chops. These chops are able to move freely up or down the suspension spring and so alter the effective length of the suspension spring.

The motion wheels are usually mounted on the outside of the front plate and consist of two sets of gearing. The cannon pinion is mounted on the elongated centre wheel arbor. This pinion is either a drive fit on the arbor, a push fit—when the pinion is attached to a tube or pipe—or a slide fit with a small cannon pinion spring underneath to keep it tight. The minute wheel, which is driven by the cannon pinion, is mounted on a stud riveted to the front plate, and is free to turn on this stud. The minute wheel is fitted with a pinion which drives the hour wheel. The hour wheel rotates upon the centre arbor above the cannon pinion, upon the pipe of the cannon pinion, or upon a separate bridge mounted above the cannon pinion. The number of teeth in the wheels and pinions vary, but the ratio must remain 12 to 1 in order that the hour hand makes one revolution to 12 revolutions of the minute hand. Two types of cannon pinions are shown in Fig. 5.

The Avro Lancastrian

Converted Bomber Aircraft for Ocean Service

The new Lancastrian 'plane before taking off.

Engines — Four Rolls-Royce Merlin Engines.
Range—3,570 miles.
Cruising speed—265 m.p.h.
Service ceiling—23,000 feet.
Weight empty—30,426 lb.
Total all-up weight—65,000 lb.

Mr. R. H. Dobson, managing director of A. V. Roe, stated recently that the Lancastrian is on the production lines as an example of "what can be done to produce quickly and cheaply, using standard Lancaster bomber facilities."

LANCASTRIAN long-range mail, freight and passenger 'planes, operated by Trans-Canada Airlines, Ltd., have for some time been used on a regular service across the North Atlantic between Montreal and Scotland. Now a number of transport aircraft of long range and speed are required for a quick service between Britain and Australia. To meet this demand Lancaster bombers are being converted for civil aviation purposes, the result being shown in the accompanying illustrations.

The converted aircraft has the same structure as the Lancaster bomber, but with the nose and tail streamlined. In the passengers' cabin three settees, facing the windows, accommodate nine passengers, and are convertible into three bunks. Another three bunks are folded away above the settees. The cabin is soundproof and centrally heated. Each bunk is provided with a reading light, and a call button for the steward.

The following are a few particulars concerning the Lancastrian:

In addition to passenger accommodation, it has space for 1,572 lb. of mail or freight.

The passenger cabin showing seating and sleeping accommodation.

NEW SERIES

The Annals of Electricity—3

Stephen Gray, Discoverer of Electrical Conduction and Insulation

THE scientific world and its historians seem to have been content to allow the memory of Stephen Gray, one-time pensioner of the London Charterhouse, to remain in the deep obscurity in which it has ever been. Not, indeed, that Gray, as an electrical investigator, ever did anything really spectacular, but he did ferret out in his own curious way the twin phenomena of electrical conduction and electrical insulation, two essentially fundamental facts upon which have necessarily been based all subsequent electrical discoveries and applications.

Very few details concerning Gray's life are known. His birth, parentage, surroundings and general circumstances are all but a perfectly closed book to us. It is possible, of course, that some of the missing details of Gray's earlier life might be brought back from the mists of obscurity by dint of patient and careful historical and genealogical research, and such a self-imposed task is much to be commended to any interested reader having the necessary leisure, experience and facilities for this lengthy, but nevertheless absorbing, work. As matters stand at present, however, the only significant "date" which we have concerning Stephen Gray is that of his death, which occurred on the evening of February 15th, 1736, he then being stated to be in his fortieth year, which statement, if correct, would imply his being born in the year 1697.

The Electrical Machine

Immediately prior to Gray's investigations in electrics, one or two individuals in England, and on the Continent, had managed to construct a few crude "electrical machines," that is to say devices in which a sphere of glass was revolved rapidly by hand-turning on a wooden frame.

A means of continuously generating static charges was thus developed, but Gray, curiously enough, never seems to have availed himself of the above mechanical means for the generation of his electric charges. Instead, he usually employed a long glass tube which was closed at one end with a cork. This, by being rubbed briskly with a dry silk pad, became electrified, in which condition it acquired the power of attracting light bodies, such as paper fragments, to itself.

An individual in London named Francis Hauksbee had risen to some degree of fame as an "electric philosopher" in consequence of his construction of a frictional machine, and, incidentally, it is in the writings of this Hauksbee that the first written mention of an electric spark occurs.

Hauksbee was connected with the then newly founded Royal Society, fulfilling the duties of Curator there, and it is most probable that Gray was induced to take up his electrical studies as a result of his perusal of Hauksbee's writings.

Stephen Gray seems to have begun his electrical experiments previous to 1720, because in that year his first paper on "New Electrical Experiments" was printed in the Royal Society's *Philosophical Transactions;* but what his circumstances or occupation were about this time we do not know. Possibly, he was one of the many individuals of leisure which the increasing prosperity of the times was then beginning to produce.

Electrics and Non-electrics

In his "New Experiments" Gray describes how he was able to find that certain materials, such as silk, hair, feathers, glass, etc., became strongly attractive by rubbing, whilst, on the other hand, things of a metallic kind never could be imbued with attractive properties by rubbing. Accordingly, Gray announced his first generalisation. He divided all things up into two classes, "electrics" and "non-electrics." Iron, to Gray, was a non-electric. It couldn't be made attractive by means of rubbing friction. Glass and silk were strong "electrics," because they could readily be made electrically attractive as a result of rubbing.

The discovery of electrical conduction. Stephen Gray's packthread experiment performed on July 2nd, 1729.

A 50,000-volt electric spark, such as Gray prophesied, might sometime be obtainable.

For his electrical generator, Gray seems to have used a 1in. diameter glass tube, some 3½ft. long. This he closed with a cork "to keep out the dust." When he rubbed this with a silken pad it became strongly attractive to bits of paper, fluff and similar articles. Not only the glass tube became attractive, but, also the cork itself. This seemed to surprise Gray, so he took an ivory ball and cemented it to the cork in order to see whether the "electric influence" would proceed from the cork to the ball. It did.

Going a step farther, Gray pushed a short metal rod through the cork and stuck the ivory ball on to the far end of the rod. He electrically excited the tube and found that the attractive influence was able to travel up the rod into the ivory ball.

Then he carried out numerous experiments with rods of various lengths. They all gave positive results. Finally, he ended up with a conducting rod at least as long as a fishing rod, and this he found to conduct the electric attractive influence to the ivory ball situated at the free end of the rod.

Electrical Conduction

But things began to get awkward in the experimental line at this point. It was impossible to handle a longer rod than the above without the rod touching any other object, and so losing its electric charge. Consequently, Gray's next line of experiment was to suspend the ivory ball from the cork by means of a line of "packthread" (a coarse, hempen fibre). By leaning out of an upper window Gray was able to make his packthread line as long as 26ft., and when the glass tube to which the line was attached was rubbed, the electrical charge ran down the line to the ivory ball at its lower end and caused light bodies to be attracted to the said ball in consequence.

Gray had now obtained something tangible to think about and to experiment with. He realised that he had hit upon a new principle, that of electrical *conduction.* Thought he: "If the electric influence can be conducted in a vertical direction it should be also able to travel in a horizontal manner."

It was not quite so easy to verify this supposition because it is more difficult to fix a line of thread horizontally than it is to suspend it perpendicularly.

Gray's first plan was to suspend his packthread line from iron nails driven into the beams of a ceiling, but in all such instances the experiments which he conducted refused to work. The packthread line resolutely refused to conduct the electrical influence from the excited glass tube to the ivory ball at the far end of the line.

Gray had a friend, one Granville Wheeler, who, like himself, was interested in electrical experiments. Whether it was Wheeler or Gray who first grasped the meaning of the above experiment's failure, we do not know.

Anyway, conferring together, it became clear to them that the reason why the experiments had failed was because the electrical influence generated by the rubbing of the glass tube passed away from the packthread line via the numerous nails from which the line was suspended.

Wheeler suggested that if they could get a *thinner* material to support the packthread line, the attractive influence might be less inclined to pass away from the line into the surrounding objects; and Gray had the idea that thin silk might be used for this purpose.

The Packthread Experiment

The notion was put to the test. And it worked! By fixing several silken threads *across* a room and by laying the packthread line on to these silken supports, the ivory ball at one end of the packthread line became electrically excited immediately the glass tube at the opposite end of the line was vigorously rubbed.

Then came the now historical experiment. On July 2nd, 1729 ("about ten in the morning," says Gray, with characteristic precision), an experiment was performed at the house of Granville Wheeler, in which an 80ft. packthread line was laid across supporting silk lines. The electrical influence from the rubbed glass tube was instantly conveyed along the packthread line to the ivory ball at its opposite end.

The Lengthened Line

Gray then tried to lengthen his conducting line. But the silk supports were unable to bear the strain. They broke under it. Then Gray substituted lines of thin brass wire. Immediately, the experiments failed. The selfsame packthread line which had previously behaved so well as an electrical conductor, absolutely refused to do its duty when supported on brass wires.

Previously, Gray had got it into his head that the success of the silken supports in preventing the leakage of the electrical influence from the packthread line, was due to their thinness. Now, however, the truth of the matter flashed across his mind, and with it a truer realisation of the fundamental nature of electrical conduction and insulation.

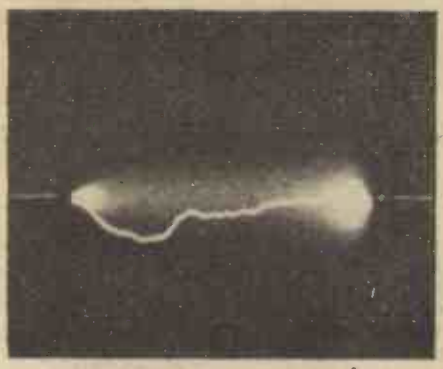
The thin silk supports were successful *not* because they were thin but because they were composed of silk, which is a non-conductor. The brass wire supports failed in all the experiments, *not* because they were either thin or thick, but because they were composed of a metal which was essentially a good conductor of the electrical influence.

Gray called conductible materials "electrics," and the term "non-electrics" he gave to non-conductors.

The way was now clear for Stephen Gray. He used thicker silken supports for his packthread lines and he found, by practical experiment, that their thickness did not in the least influence their insulative nature. He even extended his packthread lines to hundreds of feet in length. Up and down the length and breadth of his room, out of the window, into his garden below and then across the garden and along the surrounding fields went the enthusiastic Gray's packthread line on its strong silken supports, and with its indicating ivory ball dangling from its end. No matter how long the line was made, the experiment always succeeded and gave positive results.

Gray, if he had only known it, had constructed the first electrical telegraph, besides giving the first large-scale demonstration of electrical conductivity.

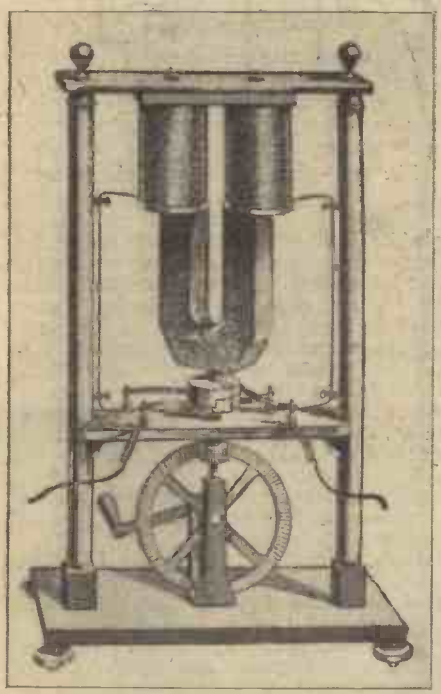
There was, however, a point which Gray never realised. It never occurred to him that the hempen material of his packthread line was essentially an insulator and that it was really the absorbed moisture content of these lines which rendered them conductible.



A single electric spark passing between two points. Stephen Gray was able to produce minute sparks, but electrical manifestations such as the spark here shown were quite beyond his reach.

The Electrified Boy

One of the next experiments of Stephen Gray was to suspend a young servant, or "footboy" ("a good, stout boy," as Gray himself describes him), horizontally on strong silk lines and to allow the "electrical virtue" from the rubbed glass tube to enter his body



Almost a century after Stephen Gray came this, the first practical generator of an electric current. It was developed by Pixii in 1832.

by mere contact of the excited glass tube with the boy's skin.

In this way the "virtue" was passed downwards from the lad's head to his feet, and, also, in the reverse direction. The boy's hair stood on end and Gray found that his face, his nose and his hands and feet became electrically attractive to small pieces of paper, fluff and the like.

Gray was highly satisfied. What the boy said about the experiment is, unfortunately, not recorded.

On another occasion, Gray found that the electrical attractive force in a rubbed glass rod could be communicated to an insulated line of packthread without *any actual contact* between the two.

Here, in the year 1729, we have the now practically unknown Stephen Gray discovering the great principle of electro-static induction almost a century before others hit on it.

The Electric Spark

By electrifying water in a small drinking glass, Gray was able to draw a minute spark or two from it, provided that the glass was well insulated from its surroundings.

"And," observes the worthy Stephen, "although these effects are at present but *in minims*, it is probable in time there may be found out a way to collect a greater quantity of it; and so consequently to increase the force of this electric fire, which by several of these experiments seems to be of the same nature with that of thunder and lightning."

Genius, they say, is both prophetic and intuitive at the same time. Here we have Stephen Gray showing these two characteristics by his dim perception of the identity of the electric spark with the lightning discharge of the heavens, and by his prophetic utterance concerning the future use of his "electric fire."

Practically the whole of Gray's electrical experiments are described in his various accounts of them which are contained in the *Philosophical Transactions* for the years 1720–1735 inclusive. These volumes are in the possession of many big libraries so that readers who are interested in searching out the origins of discoveries may be able to instigate literary investigations of their own.

Stephen Gray's birthplace was probably Canterbury, and, very probably, also, this was the place of his education and earlier life. He must have been in fairly affluent circumstances, for he refers to his house and to the astronomical observations which he was in the habit of making by means of a large telescope from an upper window therein. And his admittance into the Royal Society as one of the august Fellows is also evidence of his substantial social position in those days, so that, on the whole, we may visualise Stephen Gray as an intellectual man of leisure who, towards the end of his life, entered the famous Charterhouse as a "pensioner," and died therein at a comparatively early age.

What Gray died of at such an early age there is no knowing, but he kept his interests and his enthusiasm to the last. When he was lying on his deathbed he summoned up sufficient energy to dictate a scientific paper to his friend Cromwell Mortimer, M.D., the then Secretary of the Royal Society. It was dictated to Mortimer on the 14th of February, 1736. Before the 15th of the same month had ended, Stephen Gray was dead.

Modern Power Transformers

Further Notes on Their Design and Construction

By J. H. M. SYKES

(*Continued from page 204, March issue.*)

THERE are several schemes of on-load tap changing employed. As the current to be dealt with in any switch device is a matter of great importance, all the tap-changing schemes alter the amount of winding in circuit on the high-tension side rather than on the lower voltage winding as the current is obviously less at the higher voltage. An early scheme employed two windings which were normally in circuit together. At one end of each of these a small oil-immersed circuit-breaker was opened by a mechanical cam drive, and then—while the other half of the winding momentarily carried the whole load—a rotary switch was moved on to alter the tapping point. The circuit-breaker on that half was then closed. The change of ratio was thus completed.

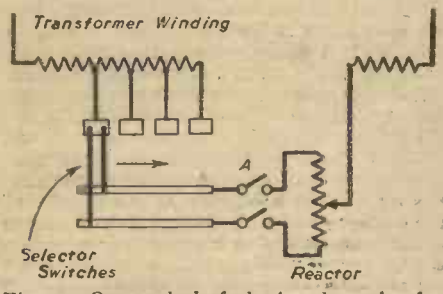


Fig. 9.—One method of altering the ratio of a transformer while on load.

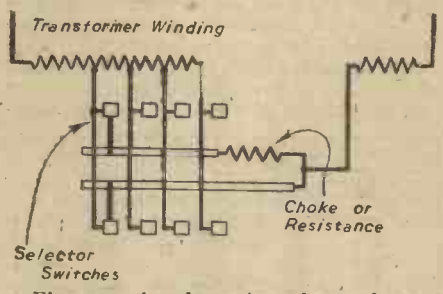


Fig. 10.—An alternative scheme of tap changing.

The more modern types of design either use the mid-point reactor method, or the simple reactor or resistance scheme. Fig. 9 shows the electrical lay-out of the mid-point reactor method whereby one of the circuit-breakers shown at (a) is opened by a spring loaded cam and the selector switch associated with it is then moved on mechanically to the next winding tap, and the circuit-breaker is again closed. This leaves the two tapping switches connected to different parts of the winding which are at a difference in voltage of, perhaps, 2 per cent. But as the two halves of the reactor are energised in opposite directions there is little circulating current and the external lead is connected in fact to a point whose voltage is half-way between the two. Thus with four tapping points, seven voltage ratios are obtainable. The other type of voltage regulator uses a simple reactor or resistance, and here the resistance—as shown in Fig. 10—is provided to absorb the momentary circulating current between the two tapped points while the movement of the contact takes place. In this scheme there are as many tappings as there are voltage ratios required, and, moreover, in any but the largest sizes where special diverter switches are employed, the main current is broken, not on a special circuit-breaker as before, but by the contact itself.

Tap-changing Mechanism

Associated with all these tap-changing methods are extremely ingenious mechanically operated devices. It is vitally necessary to ensure that a transformer can never be left with the tap change incomplete, as arcing and consequent fire or severe damage might result. To overcome this, one manufacturer, for instance, uses a motor which drives a large flywheel and only when the flywheel is up to speed and has thus stored sufficient energy to complete the whole of a tap-changing operation even if the motor supply were to fail at that instant, is it clutched-in to the mechanism to initiate and carry through the operation of the cams and the rotary switches. Various safeguards against overrunning and electrical supply failures are incorporated; and the control scheme from the possibly remote point at which the tap-change is initiated by the operator includes "holding-in" relays which make certain that even if the operator were just to flick the control handle or push-button, the tap-change operation would still be carried through to completion. Other electrical safeguards sometimes provide that if the operation is not completed within, say, forty seconds, the transformer is automatically tripped out. Some systems where isolated substations are unattended, have electrical schemes for automatically initiating the desired tap change if the system voltage varies, and so entirely automatic voltage regulation is achieved. A tap-changer assembly is shown in Fig. 11, the transformer being a 40,000 kW unit.

The Buchholz Protector

An interesting device which was originally developed on the Continent but has been perfected in this country is the Buchholz Protector. It is essential to have the earliest possible knowledge of the development of a fault within the transformer tank, since the unit can then be switched out of service before serious damage is done. Also, if a short-circuit (or any other failure) occurs, it is very desirable that the transformer should be tripped out instantaneously. Since any arcing or flashing-over inside the oil-filled tank causes the oil to be disintegrated, with the consequent formation of gas, the first symptom of incipient trouble is gas formation.

In the pipe between the tank and the expansion vessel, or conservator—which is provided on the majority of transformers to allow for the expansion and contraction of the oil during load cycles—a small vessel is inserted in which there are two floats. Each has, on its fulcrum spindle, a mercury switch. The top of the Buchholz vessel is rather higher than the associated pipe-line, and any gas which is being generated inside the transformer will rise until it is trapped in this space, displacing the oil. The top float will then sink, operating the mercury switch, and giving an alarm signal to the operator, who will then switch out the unit for further investigation.

If an explosion or a major fault suddenly develops inside the tank, a pressure is set up in the oil-space, and the oil is forced up into the conservator at a high velocity. The Buchholz device has a lower float, which may sometimes take the form of a paddle, and this is situated directly in the main stream of oil. Immediately the oil-surge is set up, it will operate this float and trip the switches connecting the transformer to the network. By this means, fires and serious damage to transformer winding have been averted. This device is shown in Fig. 12.

Connections to Cables

In order to make the connection to the cables on the high- and low-tension sides of the transformer, two methods are adopted. In the first scheme, where there are no live connections externally, a cable-box is built on to the side of the tank, and protruding

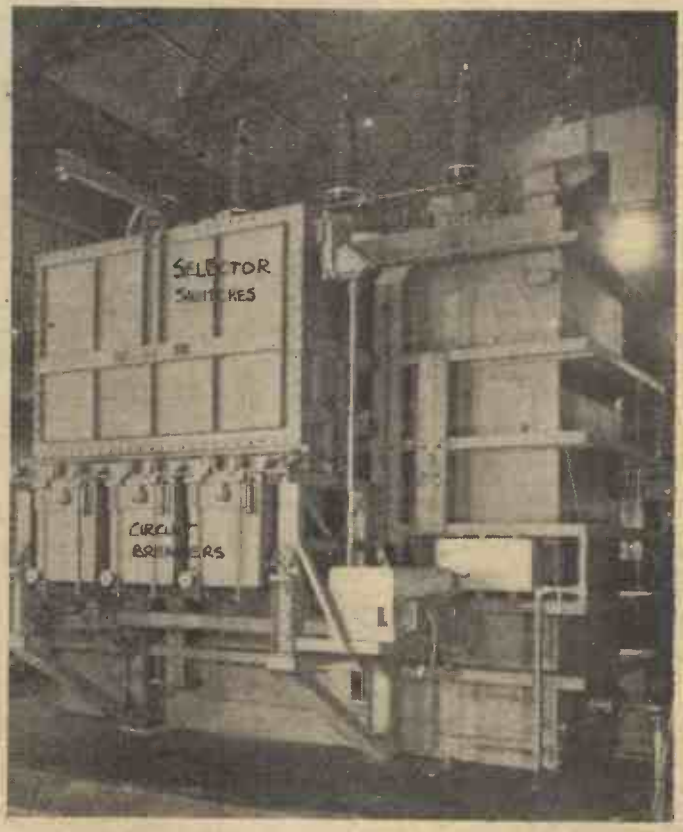


Fig. 11.—A tap-changer assembly fitted to the side of a 40,000 kW 66kV transformer. The operating mechanism box is seen at the side, with a handle for emergency manual operation.

through into this box are porcelain bushings carrying the connections. The paper-insulated cables are made-off in this box, and designers have gone to a great deal of trouble to ensure that the light mineral oil in the tank is not allowed to seep into the cable box, where hard-setting bitumen compound is used to insulate the cable end connection on all except the highest voltages, for which a semi-fluid resinous oil is used.

The alternative method is to use bare external connections, and this is generally adopted for the higher voltages, such as the 132,000-volt transformers on the National Grid. The lower-voltage connections are fairly simple. All that is needed is a copper stem surrounded by a porcelain bushing above and below the tank top, with carefully designed petticoats for weather-shielding purposes on the external side. For the high-voltage connections, greater care has to be paid to the design of the bushing, as here an empty space inside the porcelain might lead to ionisation and consequent breakdown. The most common form uses an oil-filled porcelain, with a reservoir at the top to maintain the oil level as it rises and falls through expansion and contraction. Care is taken to ensure that all connections are flexible, so that expansion does not throw any strain on the porcelain. A 132 kV. bushing alone may weigh as much as a ton and costs in the neighbourhood of £130. Fig. 12 shows a typical 132,000-volt transformer, as used on the National Grid, with bushings, cooling equipment at each end, and an on-load tap-changer.

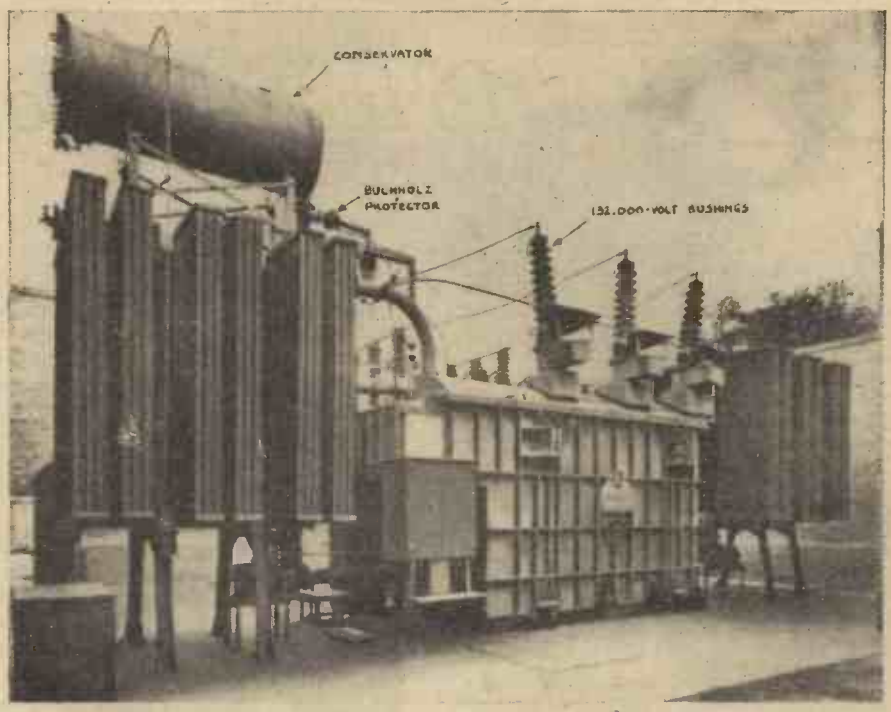


Fig. 12.—A 132,000-volt transformer, with cooling banks at each end, showing the Buchholz protector device, the oil conservator, and the porcelain bushings.

The author is indebted to the English Electric Co., Ltd., for permission to reproduce Figs. 1, 3, 4, 7 and 12, to Messrs. Ferranti for Figs. 2, 5 and 8, and to the Fuller Electrical and Manufacturing Co., Ltd., for Figs. 6 and 11.

Items of Interest

Waterproof Engines for Lifeboats

MOTOR lifeboats fitted with waterproof engines which will run under water, and start easily after being deluged with icy seas, are the latest equipment in many merchant ships.

When the Ministry of Shipping, now the Ministry of War Transport, called for all vessels over a certain tonnage to be equipped with motor lifeboats, Morris Motors were the first to receive orders for suitable engines as their marine power units were well established favourites before the war.

The "Vedette"

ONE of these models, the "Vedette," was promptly adapted successfully to withstand the severest conditions of shipwreck. These engines are now impervious to cold and damp. They even function effectively when partially submerged in heavy Arctic seas. The magneto, a special feature of which is that it has an impulse starter, is totally enclosed in a water-tight cast iron box. The high tension wiring is metallically braided and waterproofed, while the sparking plugs are of the screened water-resisting type.

The whole of the ignition system is thus fully waterproof, and is also incapable of causing any interference with wireless. Several tests have been made by directing jets of high-pressure water on to the wiring and magneto box, but even under this drastic treatment the steady smooth-running of the engine was not interrupted.

Periscope Carburettor Air Inlet

EVEN if the lifeboat should become partially filled with sea water, no ill effects will be caused as the carburettor air inlet has a periscope-type tube attached. This rises about 17ins. from the engine to a flame trap with a cowl, which is thus well above any possible water. The crankcase oil filler and the crankcase vent are also safely out of harm's way, the latter being attached to the carburettor air inlet pipe.

A complete sheet steel engine casing and a useful selection of spare parts are supplied with each engine.

Anti-fire Foam Flown to Blaze

ALTHOUGH visibility was less than 200 yards and runways were covered with snow and ice, aircraft of R.A.F. Transport Command rushed 25 tons of anti-fire foam from England to the Continent early this year, following an Army SOS, saying that a vital centre was blazing furiously. This is believed to be the first time in history that fire-fighting equipment has been flown to quell a blaze in another country.

A signal requesting aid was flashed to Transport Command's Transport Support Group in Southern England, where a Dakota squadron was quickly briefed for the task, while the foam was rushed to the airfield in R.A.S.C. lorries. When the consignment reached the airfield, however, the weather had deteriorated to such an extent that practically all flying had stopped. Severe icing conditions were accompanied by heavy snowstorms, and a thick mist blanketed the ground.

Wing Commander E. C. Deansley, D.F.C., C.O. of the squadron, conferred with his pilots, and it was decided to attempt the take-off, the Wing Commander going first to test the height of the ground mist, and to give the "O.K." to the others if he thought the flight was at all possible.

An intelligence officer, watching the take-off from the control tower, said afterwards: "It was the 'diciest' take-off I have ever witnessed. I heard the Wing Commander's 'Dak' come rushing towards the control tower, but I could see nothing of him until his aircraft was almost opposite me, a hundred yards or so away.

"We had put down beacons to show the line of the runway, but this was not only on account of the mist. The runway was covered inches deep in snow and ice, and there was no other line of demarcation.

"After he got off, he spoke to the squadron, telling them that at 300ft. or so the weather was clear, and then the others—ten aircraft in all—took off. They all got away without accident. It seemed a miracle to me."

The Wing Commander said afterwards: "We flew for two and a half hours, encountering extremely low temperatures and snowstorms, and found that there was only one landing ground open to us on the other side. We were told that it would be possible to land there and we did so without incident. The Army had lorries and men waiting for us, and in a very short time the foam was unloaded and taken away."

Later, the Army Group concerned signalled their thanks and congratulations to the aircrews who had succeeded in getting the foam through in such difficult conditions.

New British 'Plane

A NEW type of British commercial aircraft, intended for business trips to the Continent, was recently announced—the twin-engined VC1 (Vickers Commercial), designed by Vickers-Armstrongs, builders of the Wellington bomber.

The new aircraft will have a range of 1,850 miles, will cruise at over 200 m.p.h., and carry 27 passengers and 300lb. of luggage. Use has been made of components from aircraft already in production, while the fuselage is of an entirely new component.

Masters of Mechanics—101

Prince Rupert

The Curious Contrivances of this Royal Inventor, Army Commander and Scientific Amateur

WHENEVER glass is cooled suddenly it becomes characteristically brittle. In such a condition it shatters at the slightest scratch. This is because the abruptly cooled glass has acquired tremendous internal strains which, persisting unrelieved, ever tend to disrupt the entire mass of the glass at the slightest provocation.

If you were to melt up a quantity of common green glass in a high-temperature muffle-furnace, and then to pour the resultant plastic, semi-liquid product into a bucket of water some of the glass would solidify in bead-like and other irregular, fragmentary forms, but a certain proportion of the glass would instantly congeal in the form of curiously pear-shaped " drops," each of these being an inch or more in length. Each drop would have a thickened, rounded end tapering away into a thin, almost thread-like " tail." These drops would, in many instances, not be unlike an ordinary tadpole in appearance.

Now, the curious feature of these glass drops is that they can generally be hit quite sharply with a hammer on their rounded ends without breaking, but, on the other hand, if their thin, thread-like " tails " are nipped off the drops will instantly explode with a loud report, and at once disrupt themselves into the finest powder.

The phenomenon does not constitute a true explosion, although it is very like one. It is readily explained as being due to the almost instantaneous release of the high internal strains which are inherent within the little lumps of suddenly congealed glass.

(*Note.—Any reader who tries to repeat the above-described experiment for himself must take the greatest care to interpose a sheet of thick glass between his face and the glass drop, otherwise his eyes may very easily suffer damage from flying glass powder.*)

Prince Rupert's Drops

The curious little glass drops which behave so strangely have been known for a long time. About one or two centuries ago they were referred to as " Frozen Tears," or " Dutch Drops," but, more generally, they were known, as they are to-day, by the name of " Prince Rupert's Drops."

Whether this particular Prince Rupert had anything to do with them in an inventive capacity is a difficult matter to determine. Many writers say that he merely introduced them into England, which is almost certainly the case, but they do not credit him with the actual discovery or invention of these curious glasses.

That they were known in England at least as early as the year 1662 is evident from the

A solidified glass drop about 2ft. in length. In this instance the glass has been subjected to slow cooling. Its internal strains are thus much reduced, and it is therefore not " explosive " like Prince Rupert's drops.

Diary of the famous Mr. Pepys, who, under date January 13th of that year, remarks:

" Before 12 o'clock comes, by appointment, Mr. Peter and the Dean and Colonel Honiwood, brothers, to dine with me. . . . Mr. Peter did show us the experiment (which I had heard talke of) of the chymicall glasses which break all to dust by breaking off a little small end; which is a great mystery to me."

And a great mystery these strange " chymicall glasses " were to everyone else, Prince Rupert included, for, naturally enough, in those now far-distant days, the subject of internal strains in materials was quite unheard of.

It seems probable that " Prince Rupert's Drops," or the " Frozen Tears," have been known from the times of the earliest glass makers, but it would seem that they were unknown to " experimental philosophers," as the early scientific and inventive dabblers of Prince Rupert's time called themselves, until that latter military worthy ferreted out, in Germany or in Holland, their mode of preparation and afterwards popularised it among the said English " philosophers."

It would seem, according to some accounts, that Rupert demonstrated these drops to Charles II, who flattered himself on his interest in scientific dabbling. Their true origin, however, is still very obscure, and, for our present purpose, little use would be served by entering more deeply into the question.

But who was this Prince Rupert, whose name has so indissolubly been connected with the explosive glass drops for two and a half centuries? No doubt many readers may dimly recollect this military personage flitting through the pages of their more advanced school history books to the deep concern and anxiety of his contemporaries.

German Origin

Rupert, in fact, was a German prince, being the third son of the King of Bohemia. His mother, the Queen of Bohemia, had formerly been Princess Elizabeth, the eldest daughter of James I of England. Thus Rupert, at his birth in 1619, was half-English, although, subsequently, he received a thorough-going German education, which, true to type, was intensely militaristic, and resulted in Rupert, a naturally gifted and clever individual, being given a positive zest for warfare, and all forms of military activities.

Prince Rupert, a " Royalist " himself, came over to England and placed himself, and his unbounded energies on the side of Charles II, who, it will be remembered, became the reigning monarch after the death of Cromwell and the eventual deposition of his faction.

(Left). " Dutch Tears " or " Prince Rupert's Drops," which explode on scratching.

(Right). When exploding " Prince Rupert's Drops," care should be taken to interpose a screen of sheet glass between the " drop " and the eyes.

That Rupert became a great inventor no historian could truthfully state. Indeed, Rupert was a dabbler all his life, at least in the domain of mechanics, science and invention. But he did serve a useful purpose in stirring up and maintaining the interest in matters scientific which was then beginning to spread among the more seriously minded people in London and at Oxford.

Military Mechanism

Rupert's "hobby," if thus we may style it, consisted in making lock mechanisms for muskets and other rifle-like types of firearms. He made a large number of different lock patterns, each a supposed improvement upon the other and all of which are, of course, long obsolete.

The invention and construction of these mechanisms took him into the realms of the crude metallurgy of the times, in consequence of which he experimented with various types of iron in an endeavour to obtain a non-wearing lock mechanism for his rifles. Whether he was ever successful in this task, history does not relate.

There is, however, a certain alloy known as "Prince's Metal" which is supposed to be the direct invention or formulation of Prince Rupert. This is essentially a type of brass having a golden hue and having the approximate composition: Copper, 70 per cent.; zinc, 25 per cent. The precise history of this alloy has never been followed up and probably never will be now that the metal has become obsolete. All the same, the historical connection between Rupert of Bohemia and the once popular "Prince's metal" is, more likely than not, the correct one.

Prince Rupert shone, also, as a gunpowder maker, just, perhaps, as we might expect a man of his military nature and character to do. He communicated to the then newly-founded Royal Society certain "secrets" relating to his improvements in the manufacture of gunpowder. Judging from available accounts, Rupert's process for powder making seems, in its essence, to have comprised merely the paying of very careful attention to the proportions of the various ingredients of the powder. He seems, also, to have submitted the powder to some sort of compression, which factor would materially increase the powder's density and thus enhance its explosive energy.

The "Water-raising" Engine

Like his more celebrated scientific and engineering contemporary, the famed Marquis of Worcester, Prince Rupert devised a "water-raising engine." The Marquis of Worcester called his device a "water-commanding engine," and, probably, Rupert's was very similar in principle.

These early "water-raising engines," which were the first forerunners of modern steam power, utilised steam to create a vacuum in virtue of its condensation within an enclosed space, into which vacuum water subsequently found its way from a well or other source.

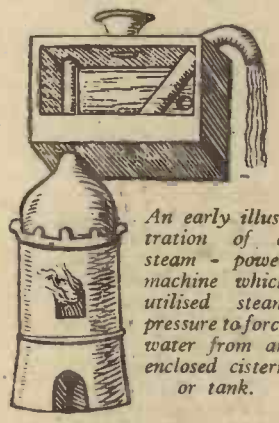
There are no details concerning Prince Rupert's "engine." Maybe, it materialised only on paper, as many of the "inventions" of the earliest mechanics and engineers did. On the other hand, it may have had some successful working in the region of London or Windsor.

The First Machine Gun

Another of Rupert's inventions, or alleged inventions, was a sort of crude machine gun—surely the earliest mechanical gun on record? The purpose of the gun was for the "discharging of several bullets with the utmost speed, facility and safety."

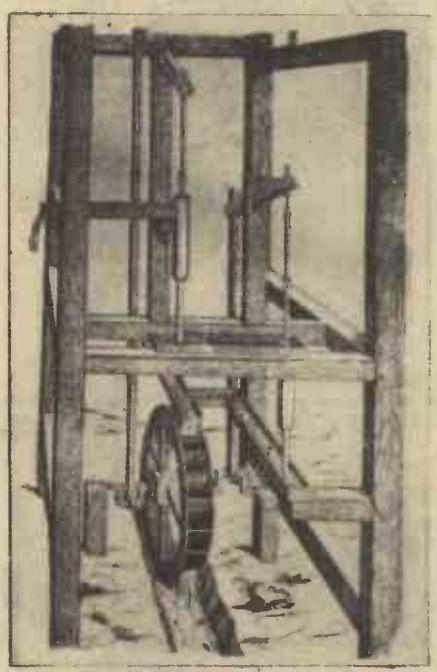
The reading of this announcement may appear curious, but presumably the "safety" above referred to implied the well-being of the operator of the gun, not that of the man who happened to stand in front of it!

The energetic Prince appears, also, to have had some interest in mining. The Royal Society preserves details of an invention of his by means of which he claims to be able to split rocks in mine workings by means of the directed force of gunpowder made specially by him. Apparently, this invention, so far as it can at present be made out, comprises merely a special method of disposition of the powder around the object to be removed, together with the careful screening of the surroundings from unwanted effect of the explosion.



An early illustration of a steam-power machine which utilised steam pressure to force water from an enclosed cistern or tank.

Another Royal Society invention of Rupert's is a mode of making lead shot. This he does by means of dropping molten lead through a perforated grid into cold water, which method forms the basis of the present means of obtaining lead pellets. Prince Rupert's lead pellets could not have been perfectly spherical. They must have been at least slightly pear-shaped or "drop-like" in view of the characteristic formation of a fluid drop.



A mechanical water-wheel device of the time of Prince Rupert.

Another alleged invention of Prince Pupert is a mode of casting black lead in a mould. If by "black-lead" any form of graphite (carbon) was implied, the "invention" was obviously an impossible one, for it is well known that, under normal conditions, all the three pure forms of carbon (diamond, graphite, carbon or soot) are completely unmeltable.

Rupert's "Mezzotint"

Still another mechanical invention of the restless Rupert comprises (so the records show) a peculiar type of clamping or fixing screw for use with a quadrant or sextant instrument at sea, any movement or shakiness of the observer's hand being at once compensated for by the screw mechanism.

But the most famous invention for which Prince Rupert has been credited is precisely the one in respect of which his historic claims have been most assailed. It comprises the invention of mezzotint.

The mezzotint process, as it was first practised, consisted of a method of copper-plate engraving whereby a very even gradation of tones (somewhat resembling those of a photograph) was produced, an impression from a plate so produced being styled a "mezzotint."

In the production of mezzotint, the copper sheet (at a later date, a steel sheet) is uniformly roughened by means of a large number of minute incisions being made on its surface. In the deepest shades of the pictorial subject to be represented by the mezzotint printing-plate, the roughened surface is left practically untouched and in its roughened state. The surface roughness is, by the hand application of certain tools, partially removed or burnished away to form the middle or intermediate shades of the picture, whilst, for the lightest shades of all, the surface roughness of the copper (or steel) plate is completely burnished away.

This style of engraving is ascribed by some to Van Siegen, a Dutchman, in 1643, the legend being that Prince Rupert became his pupil, learnt the secret of the mezzotint, and subsequently introduced it into England, as, also, he is said to have done his famous "Frozen Tears" or "Dutch Drops."

On the other hand, it appears hardly likely that a Military Commander approaching the height of his activities would have time to master the difficult art of engraving. Hence, there would seem to be a considerable case for the assertion that Rupert himself was not actually the inventor of the mezzotint, in however crude a form it may have been then.

Mezzotint Principle

There is a story about Rupert and the mezzotint invention which will bear repeating.

Going out one morning in the suburbs of Brussels, Prince Rupert happened to catch sight of an infantryman cleaning his musket. The musket was very rusty. Evidently, it must have been left out in the open for a few days or more.

The soldier applied a clean strip of cloth to the barrel of his firearm. The cloth, after being pressed up against the gun barrel, acquired a curiously patterned layer of red rust. This is supposed to have given the Prince the idea that it might be possible to make some adaptation of this principle for the making and operation of a printing plate. Thus, if a metal could be given a "ground" of fine holes or incisions it would give an all-black printing impression, whilst by scraping or burnishing away portions of the roughened surface, these portions would print more or less white.

The story goes on to relate that in the same year (1656), Rupert interested a local Brussels artist, one Walleraut Vaillant by name, in his proposal, and that, aided on the mechanical side by Vaillant, the Prince invented a steel roller having on it stout projecting points or pins which effectively roughened a smooth copper or brass plate and so prepared a suitable surface for the subsequent mezzotint engraving.

There is no doubt of the fact that Prince Rupert did himself operate the mezzotint process, for there exist some of his own engravings, the earliest of which is a half-length human figure dated 1658.

Ever dabbling in one project or the other, Prince Rupert of Bohemia peacefully finished his life in London on November 29th 1682, and was subsequently buried in Westminster Abbey.

The Phenomenon of Light

Modern Ideas Concerning Light and its Fundamental Nature

WHAT is light? Is it a form of energy, a material thing, or is it just another of the many strange and perplexing illusions which a whimsical Nature seems to have surrounded us with?

Our brightest light source—a high-power telescopic view of a lower portion of the sun, taken during the presence of sun-spots. (The diagonal lines are merely cross-wires in the telescope.)

Light *cannot* be a mere illusion. It *must* be something positive, because its absence brings about darkness, and, furthermore, because all living things are in some way sensitive to light and respond to its stimulus in various ways. Then again, light is chemically active. Think, for instance, of that nowadays commonplace article—the photograph. This will surely constitute compelling evidence of light's positive existence. You couldn't have photography if the phenomenon of light were a fanciful illusion of our fickle senses.

The ancients pondered a good deal over the nature of light. The far-famed Pythagoras, one of the old Greek philosophers, came to the conclusion that light is material, that it consists of streams of inconceivably minute tangible particles which are shot off from all visible things into the pupils of our eyes.

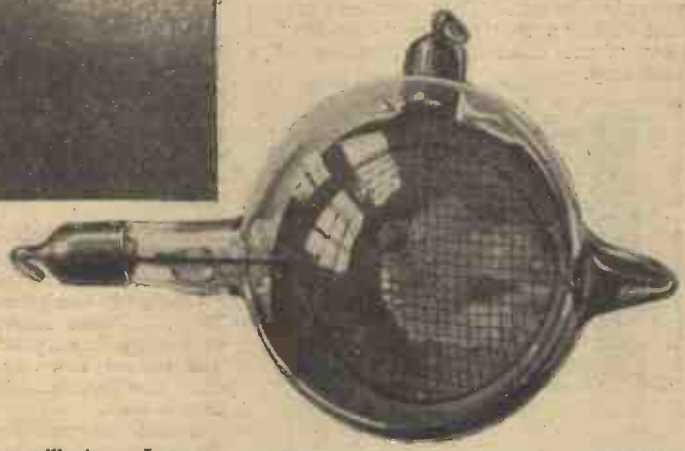
Aristotle, on the other hand, held that light was mere "motion"—the motion of an all-pervading medium which he called the "pellucid."

Those were the two ideas which the ancient thinkers entertained on the subject of light. Apart from that, they knew little else about it, although it is recorded that Euclid (300 B.C.), that innocent enemy of many generations of schoolboys, taught that light always travels in straight lines, and that Hero of Alexandria (famous for his construction of the world's first recorded steam engine), announced that light always takes the shortest path from one object to another.

Newton's Theory

It was not, however, until the time of Sir Isaac Newton in the seventeenth century that inquiries into the nature of light became more persistent. Newton set himself the problem: How does light travel through empty space, and what does it consist of?

In this way, came Sir Isaac Newton's "corpuscular" theory of light. He imagined light to be material in nature and to consist of streams of minute *corpuscles* which were shot off at an incredibly rapid rate from the luminous object. Light, according to this theory (which, as we have just seen, was first stated in pre-Christian times by Pythagoras, the philosopher and mathematician), consists merely of a fanned-out stream of minute bullets ejected, so to speak, from an atomic machine-gun. When you placed an opaque object in the path of the light rays, the "bullets" did not get through. Consequently, the absence of these light-bullets caused a shadow immediately behind the opaque object. Transparent objects were those which did not interfere with the free passage of the light-bullets.



A photo-electric cell in which light impinging on a specially sensitised surface actually generates electrical energy in the guise of an electron flow.

One of the earliest sources of artificial light—a Persian oil lamp of about 1500 B.C.

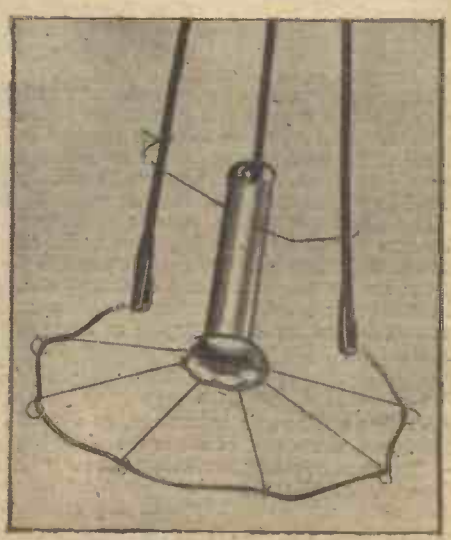
Which was all very well so far as it went. But the trouble with Newton's theory was that it didn't go far enough. It couldn't explain everything about light. It was unable to explain the situation which was once propounded by a scientific wit to the effect that when two individuals gazed into each other's eyes, the two projected streams of light-corpuscles did not come into serious collision and thereby fall inert to the ground, thus rendering the two people invisible to each other!

But the most serious objection came when the actual speed or velocity of light through space was proved beyond all doubt as approximating to 186,000 miles per second, and when it was shown that this speed was much too high for the travel-velocity of any ordinary material particle. No material atom, the scientists said, could ever travel at that enormous speed without at once shattering itself to pieces. And such a statement is probably very true, for, even in our modern times, we know of nor can conceive of no material object, no matter how tiny it might be, which could preserve its material nature when subjected to such a great velocity.

Sir Isaac Newton had a scientific contemporary, a Dutchman, Christian Huygens by name, and it was this Huygens who first proposed the modern wave-theory of Light. But Huygens, with his wave-theory, got himself into technical difficulties at the very outset. You cannot have waves of *nothing*; so that if light rays were not streams of rapidly-moving material particles, as Newton imagined them to be, then, if Huygens's theory were true, they must be waves of *something*.

An Imponderable Something

In order, therefore, to create this necessary *something* for the conveyance of waves through space, Huygens resurrected the old theory of the "ether" (or "æther") an imponderable something which closely filled all space and through which the wave-motions or vibrations of light energy were transmitted. Fill a shallow tea-tray with a single layer of marbles, or other spherical bodies, and you will have some idea of how Huygens (and others



Our modern and everyday source of artificial light—the coiled tungsten wire filament of an electric light bulb.

after him) conceived the funadmental nature of their very necessary "ether."

There was one simple experiment which gave a decided verdict on the side of Huygens's theory. Place a source of light—any sort of a lamp will do—within a box in the side of which is drilled a small hole. Take the box into a darkened room, when it will be observed that the illuminated hole can be seen from any position in the room which is not actually behind it. If, however, Light consisted of a stream of particles travelling in straight lines, the illuminated hole in the side of the box would be invisible unless the observer placed himself directly in the path of the straight-line rays.

It was difficult, also, to explain the phenomenon of colour on Newton's corpuscular theory of light, whereas, assuming light to be a wave-motion, it became very reasonable to attribute colour to different lengths of these waves. The highly-important action of the spectroscope in sorting out the different colours of compound light into elementary bands of "pure" colour was, also, readily explained on the "wave" theory of light.

The spectroscope, an instrument by means of which a beam of light is split up into its components.

Electro-magnetic Waves

It was James Clerk-Maxwell, the mathematical genius of the mid-nineteenth century, who first put light to the acid-test of mathematical expression. Light, to Clerk-Maxwell, was merely a wave-movement of electrical energy. So confident was Clerk-Maxwell of his thesis that he actually predicted the discovery of means of setting up other types of electrical wave-motions in the ether, which wave-motions have, of course, since been created and utilised by modern science in the guise of wireless waves.

Clerk-Maxwell was, indeed, a second Newton in physical science. He argued that the only difference between light and radiant heat is in the length of their wave-motions. Fundamentally, they were both the same, mere electrical vibrations of an all-pervading "ether."

The brightest artificial light source. The arc light which comprises a "flame" of glowing carbon vapour between two carbon electrodes.

But it was just this "ether" business which stuck in the throats of so many of the later scientists. What was the ether? No one knew. Neither could anyone offer a really feasible explanation of it. So scientists eventually ranged themselves into two camps over this question, the "Etherists" and the "Non-Etherists." For a time, the scientific world almost descended to the level of the politician. The ether question became almost one of party politics.

Matters were not made any better when it was argued that if there were really an ether of space and that if the earth rushed through it during its annual journey around the Sun, it ought to be possible to devise some means of detecting a movement or "drift" of this ether.

The Michelson-Morley Experiment

Two American scientists, Messrs. Michelson and Morley, put the question to practical test in Chicago in 1884. Their now famous experiment was a highly important one. Briefly, it was this: They split up a single beam of light by means of mirrors so that the original light beam was divided into two beams at right angles to each other. The light beams were allowed to travel some dozen yards. Then they were reflected back again by means of mirrors and were eventually collected by a small telescope, where they set up "interference," that is to say, produced a number of dark and light bands whose precise positions were dependent upon the times which the light beams took to travel along their respective paths.

The Michelson-Morley interference apparatus was most carefully aligned along the earth's direction of motion, this latter factor being accurately known. Hence, one light beam travelled "with" the earth in its voyage through the hypothetical ether, whilst the other light beam proceeded at right angles to the earth's motion through space.

It was expected that the two light beams would differ slightly in speed, owing to an ether-drag on the light beam which proceeded in the direction of the earth's motion and afterwards (by being reflected) travelled directly against that direction of motion.

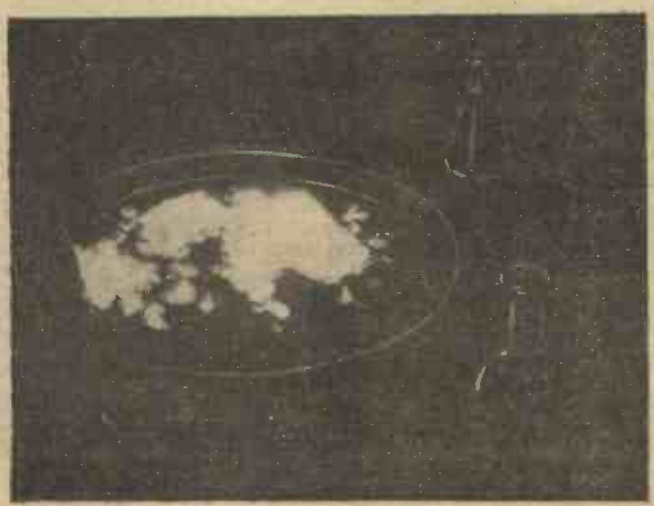
But although the Michelson-Morley experiment was conducted with the most extreme accuracy, no such differences of light-speed were detected. Since the original essay in this experiment was made in Chicago, the same trials have been repeated again and again by other workers, and with the addition of technical refinements, but the result has ever been the same—a complete negative.

It seems pretty certain, therefore, that if the ether does exist, its presence is quite undetectable by any physical tests.

Thus it is that the question of the existence or non-existence of an ether for the transmission of light and other wave-motions remains still undetermined. The concensus of opinion to-day is that if an ether or some such medium does actually exist it cannot be in any way material or even submaterial, but must constitute some existent entity of whose nature we have (and will possibly ever have) no conception whatever.

Nevertheless, despite the terrific and seemingly unsurmountable complexity of the Ether question which, in some aspects, is bound up with the ultimate nature of light, there is no doubting the existence of the latter phenomenon or entity.

Light without heat. A chemical powder which is strongly luminescent in the dark.



A photograph of the same luminescent powder glowing in the dark. This has sometimes been referred to as chemical light.

Light Proceeds from Matter

Modern science, in some respects, has, in recent years, been swinging back somewhat to the conceptions of Newton regarding the question of light.

How does light start? Obviously, light has its origin in a luminous object. The object may be rendered luminous by means of the addition of heat to it in some way, or by electrical excitation or, again, by chemical means. So that, in the modern scientific view, it would seem that light-production is the means by which the atoms of substances throw off or expel their surplus energies. Light, therefore, is a product of excited atoms. If you haven't any atoms or material substances you cannot have light. Matter and light are closely related. All that seems obvious.

When light falls on a material substance it may, in some cases, manifestly excite the atoms of matter therein. It may produce a flow of electrons, thus giving rise to the "photo-electric effect" which is so much heard of nowadays. It may set up a latent chemical change in the material, this effect lying at the basis of all photography. It may, also, excite the atoms to vibrate and to produce light of another colour, thus giving rise to fluorescence and luminescence. So that, again, we have plenty of evidence of the close relationship between light and matter.

The Photon

Modern science has proved the existence of an "atom" of light. This is the "photon." It is not so much an atom such as we should speak of in relation to carbon, oxygen, silver or gold, but, rather, a *unit*.

Whether this photon or light-unit is material, sub-material or, in some way, ultra-material remains still an open question. The fact that a beam of light can be deflected out of its path when travelling in the vicinity of a large mass of material has been amply proved by Einstein and others in the case of starlight beams passing in the neighbourhood of the sun. Here, of course, we seem to have some type of gravitational attraction. Nevertheless, in view of the incredible speed of light—by far the highest known velocity in the entire universe—light-units or photons cannot be individually material in the ordinary sense of the term.

Yet light seems to have "substance," for it has been shown to exert pressure and to have the quality of weight, our own Sun being said to discharge 360,000,000,000 *tons* of light per day.

Another curious fact is that light, like all forms of energy, is never given off in continuous streams by excited atoms. The light is always expelled in jerks.

Water runs from a tap in a continuous stream. The bullets from a machine-gun are emitted one at a time from the barrel of the gun, no matter how small may be the interval of time between the exit of each bullet from the barrel.

Light emission follows the mode of the machine-gun's emission of bullets. Light is sent out from the luminous body in an exceedingly rapid succession of "quanta" or jerks. This is certain, no matter whether light ultimately turns out to be in some way material or merely a wave-motion form of discharged energy.

The Continued Mystery of Light

And that is about as far as modern science has got in its endeavours to ascertain once and for all the real character of light. There are many things unexplained, however.

Why, for instance, should the velocity of light seem to be the greatest possible speed in the whole of the universe? Why should there apparently be nothing quicker than light?

And why, too, should the apparent speed of light *always* remain the same quite independently of the movements of an observer? If, for instance, you run away from an express train the time taken by the train to run over you is greater than it would have been if you had stood still and awaited your mutilation and decease with equanimity. Not so, however, in the case of a light beam travelling towards you with a velocity of 186,000 miles per second (186,326 m.p.s., to be exact). No matter how quickly you or the planetary object upon which you live and have your being may rush away from the oncoming light beam, the apparent speed of the latter still remains the same, and the light ray does not take any longer to reach you than it would have done if you had actually rushed out to meet it.

This constitutes one of the big mysteries of light. In some respects, light would appear to have properties which transcend those of the other entities of the universe. Light seems to be Creation's pet, Nature's favourite child, an entity which can do no wrong. We may tame it, use it, modify it, even create it as we wish, but, in its real character, it still contrives to remain to us that which it has ever been—one of the most profound mysteries in the entire natural order of things.

New Eye of U-boats

This midget autogyro is described by the Germans as the new eye of the U-boat. The machine is housed in a pressure-safe container in the submarine, and rises in the air when the U-boat is operating in the open seas. The propeller is driven by the forward movement of the U-boat, to which the machine is connected by a wire rope. The autogyro can operate up to 1,000 feet.

Inventions of Interest

By "Dynamo"

Hinges for a Clothes-horse

THAT valuable domestic appliance, the clothes-horse, for many a day and night, has been caparisoned by a variety of garments. Its familiar form usually consists of three wooden frames which are generally hinged by means of a strip of webbing or leather nailed to the woodwork. Such hinges require frequent renewal, and the repeated driving of nails into the wood causes damage.

Bearing this drawback in mind, an inventor has conceived a hinge which will contribute to the longevity of the clothes-horse. His idea is a hinge needing neither nail nor screw, and which will allow the necessary angular movement between the two adjacent frames of practically 360 deg.

The hinge consists of two pairs of circular rings. The rings of one pair are joined together at a point so that they lie in the same horizontal plane. In the case of the other pair, the rings are similarly joined. The two pairs of rings are at some distance from one another, preferably at any distance not less than the depth of one of the transverse members of the frame.

Slumber Shelter

THE Anderson and Morrison shelters have a rival. There has been accepted by the British Patent Office an application relating to a shield to protect people in bed from enemy missiles and injury occasioned by the collapse of buildings, and by splinters of glass.

The shelter has uprights supporting a roof-like structure sufficiently strong to resist a weight falling upon it. Instead of a rigid plate the roof may consist of a grid or wire mesh. On the top of this may be placed a cushioning material like a mattress, which would stop flying fragments which are more effectively resisted by a yielding material than by a rigid substance.

The side screens are preferably of a flexible nature such as a stout wire mesh. This mesh would assist the ventilation of the bed. To provide access to the bed one or more of the side screens may be detachable.

The shelter is of sufficient size to enclose a bed, and the standards extend to a height of four feet, so that the occupant of the bed can sit upright.

Razor Sharpeners

A NUMBER of recent inventions concerning safety razors are the subject of applications for patents in this country. One of these devices is a safety razor blade sharpener. It is fitted in the centre with three upstanding portions on which the three-holed blade is placed. The blade is pressed by the hand into contact with sharpening rollers. These rollers, which are rotated by hand, are mounted in bearings in cross-members attached to the centre member.

In the case of another invention relating to shaving, the aim of the inventor has been to provide a simple and economic arrangement in which a blade can be stored so as to preserve a keen edge. A further object is the cleaning and stropping of the blade.

This device comprises two pairs of flaps or plates centrally hinged and spring-pressed to maintain a pair with pads such as greased felts normally closed. The other pair have pads so formed and arranged that the blade may be wiped or stropped when pressed together against the action of the spring.

After shaving, the blade may be removed from its holder and wiped or stropped in one side of the device by gripping the co-operating plates against the action of the spring. The blade can be disposed between the greased pads on the other side of the device, when it will be retained by the spring for further use.

The inventor maintains that the greased felts, by preventing rust or damage, will preserve a keen edge and extend the life of the blade indefinitely.

Yet another contrivance for preventing tonsorial discomfort is an appliance in which the blade is reciprocated in contact with a honing surface and is tilted at the commencement of its travel to cause the opposite edge to bear on the surface. It is characterised by the fact that the blade is mounted in a carriage having depending arms. This carriage can be tilted by spring pressure exerted on the arms of the carriage.

The "Alligator" is an American-made vehicle constructed for use in swampy country and was used by the Americans in the Solomons. Its purpose is for transporting ammunition and supplies to units in the battle area, either through swamp or from a sea landing. The "Alligator" is propelled through the water by means of its caterpillar tracks. It can be launched from a ship and thence direct through the water on to land. The illustration shows an "Alligator" emerging from the water on to the beach.

To Exclude Background Noises

THE inventor of an improved microphone points out that in electrical transmission of sound it is desirable to eliminate background noises in order to assure clearness and perfect broadcasting. This is accomplished on the radio by locating the microphone and the performer in a sound-proof studio. It appears, however, that there are many cases in which it is not possible to locate the microphone in an enclosure sound-proofed against external noises and internal reverberation. Examples of this include broadcasting of sports events, political gatherings and public speeches, when transmission has to be made from noisy locations or reverberatory enclosures.

The primary object of the inventor in question is to furnish a microphone which may be used in the environment referred to above. A chief feature of his device is that the microphone automatically cancels out all or a material portion of the background noises, thereby permitting effective transmission of speech or other required sounds.

According to the new invention, there is provided a non-directional microphone which practically cancels out background noises. This is effected by impressing them in balance at two enclosed spaced microphone portions through only two adjacent openings spaced apart a small fraction of a wavelength of audible sound of the highest frequency it is desired to cancel. The microphone is adapted to have desired sound waves impressed in unbalanced relation at the two spaced portions.

Interior Lights in Cars

A DEVICE relating to the interior lighting of motor-cars is the subject of an application accepted by the British Patent Office.

The applicants point out that hitherto the internal illumination of a car has been attained by means of a lamp placed either in the roof or on one of the side pillars. But, even when fixed at the rear of the driver, such lights cause reflections in the windscreen which inconvenience the driver. And, when placed above or to one side of him, the light tends to distract his attention.

To overcome these disadvantages, the invention provides a hinged visor in front of the driver and the front passenger. This shields the eyes from the sun. In addition, it carries an electric lamp for interior lighting, located in a recess of the visor.

THE WORLD OF MODELS

How Photography Helps Model-making—and Models Enhance the Photographic Art

By "MOTILUS"

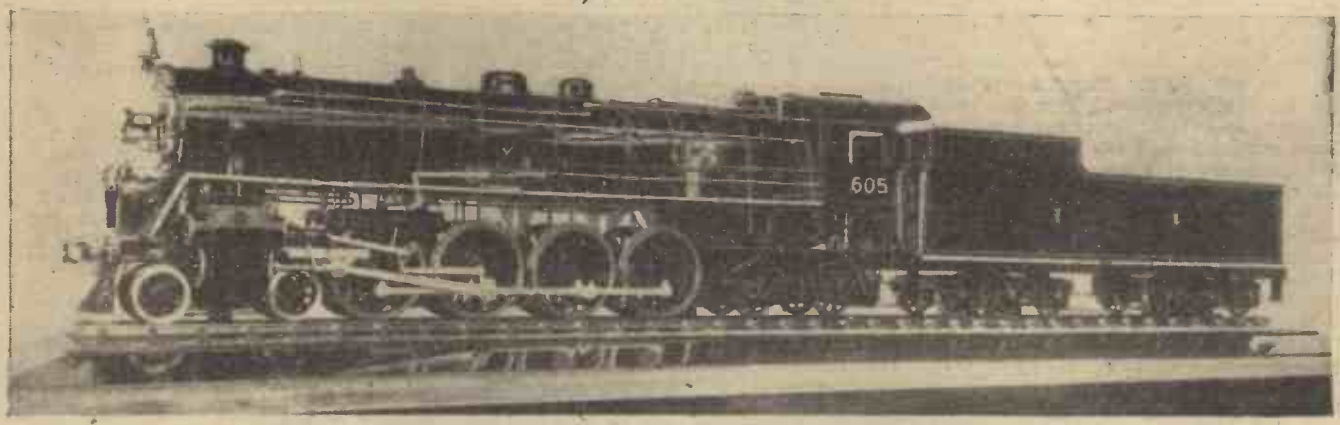


Fig. 2.—A model made by Bassett-Lowke, Ltd., of one of the most intricate locomotives in existence. It will be seen there are 14 pairs of wheels to start off with! The locomotive modelled is one of several made by the Vulcan Locomotive Works for the Chinese National Railways.

HOW often do we find two hobbies which go together—hobbies that are in fact "twins"! Those who play hockey often skate, those who swim are often fond of dancing, those interested in geography collect stamps. Many keen photographers are model hobbyists, and it is often found that model makers are also cameramen.

There is definitely a useful link between the last-mentioned "twins." Only those who are interested in the making, either privately or commercially, of models can realise the help that photographs can give. In the making of scale models, craftsmen work, to a great extent, to drawings and details supplied by builders of the prototype. But often these have been modified in small details, during construction, and therefore are not always strictly accurate. Drawings of ships, for instance, are complicated things, and it is practically impossible to obtain one drawing which contains *all* the details required. Several drawings have to be used and co-related. In peacetime, armed with a camera and deck plan, the ship could be visited and with one press of the button we could record an enormous amount of necessary detail which could only otherwise have been obtained by laborious hours on the drawing board or with a sketch-book.

Conversely, where the prototype does not yet exist, be it building, motor-car, piece of engineering construction, bridge or whatever is contemplated, models again can be brought into use. Should the designer wish to illustrate his masterpiece in the Press or in a catalogue, an accurate miniature can be created and photographed, and the reproduction gives exactly the same impression as the article itself would.

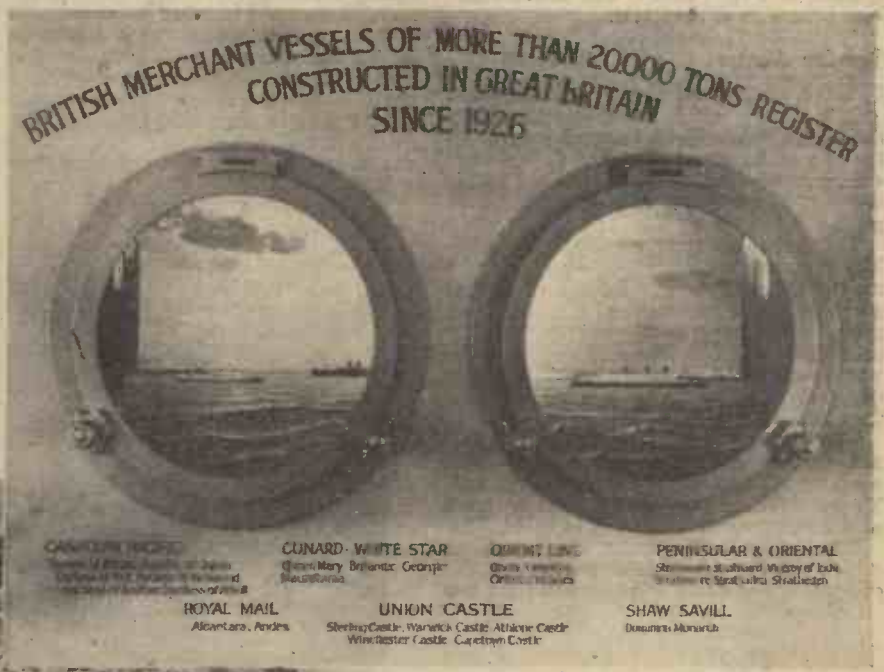


Fig. 3.—A model which shows you how British ocean giants would appear from another ship at sea. Modelling and art combine to deceive the eye! This model was on view in the British Pavilion of the Paris Exhibition of 1937.

Fig. 1.—A portion of the city of Durban modelled to the scale of 100ft. to the inch. Aerial photographs aided the craftsmen to produce a lifelike model of this South African city.

It is my aim in this article to give a few examples of the twin value of these hobbies to prove my contentions.

Model of a City

When modelling architectural models, the basis on which the craftsmen begin is an Ordnance Survey Map and architectural plan. Here we realise the value of aerial photographs.

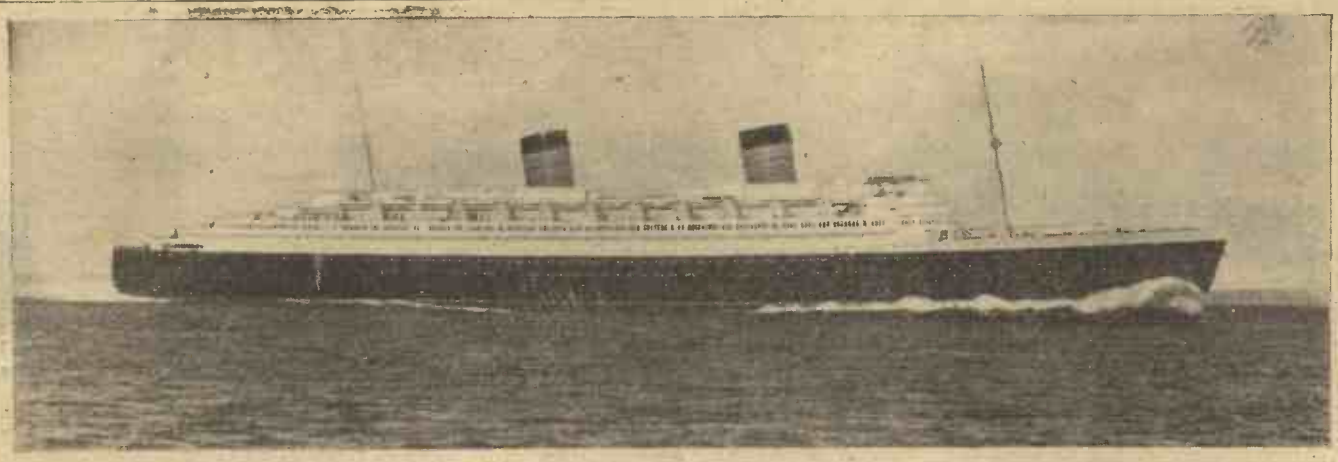


Fig. 4.—This is how we hope one day to see R.M.S. "Queen Elizabeth"!

Illustrated in Fig. 1 is a portion of a model of the city of Durban built to the scale of 100ft. to the inch. The model was made by men and women who had never seen the city, who worked from maps, aerial photographs and close-ups of the main buildings. So perfect was this model when on view at the famous Wembley Exhibition that visitors from Durban were even able to pick out their own homes!

This model was the work of Twining Models, Ltd., of Northampton, and it is an outstanding example of how a city thousands of miles away can be reproduced in lifelike manner with the aid of photography.

An Intricate Chinese Locomotive

Another example of the help photographs can give is in the construction of a model locomotive. Apart from the working drawings from the builder, which are superfluous in many ways if the model is not required to work, the external photographs of the prototype are of enormous aid to the model maker in getting fineness of detail and "life" into the model. Here is a model of one of the most complicated locomotives that has ever been built—a locomotive designed on American lines by the Vulcan Locomotive Works for the Chinese National Railways. The model (Fig. 2), which is to a scale of 1/20th full size, was built with the aid of a full set of original drawings, and certain of the craftsmen also viewed a full-size locomotive, but in the final phases photographs of the prototype were exceedingly useful. The craftsman in charge of the building of this model agreed that wherever possible he insisted on photographs accompanying the drawings to give the best model results.

Realism in Miniature

Here is an example of a combination of models and artistry to give the effect of reality.

The seascape model is part of an exhibit designed by Mr. E. W. Twining for the Paris Exhibition in 1937, and displayed by the Department of Overseas Trade in the British Pavilion. The frame was in the form of two ships' sidelights in bronze giving a view of ships moving continuously across the seascape beyond. All the leading British ships of the Mercantile Marine were modelled to the scale of 100ft. to the inch (1/1200th actual size) and they moved across at their varying speeds as they would be seen from the portholes of another ship at sea. (Fig. 3.)

I mentioned earlier in this article of how photography can be of help when the prototype of a given thing does not exist.

In many cases models have been built to publicise certain ships before they come into service. One of the best examples I have ever seen has been provided for me by the Cunard-White Star Line, and it is a photograph of a model of the R.M.S. *Queen Elizabeth* (Fig. 4), finished in the standard Cunard livery and colouring, depicted against a background of sky and superimposed on a seascape complete with bow-wave and wake added by an artist.

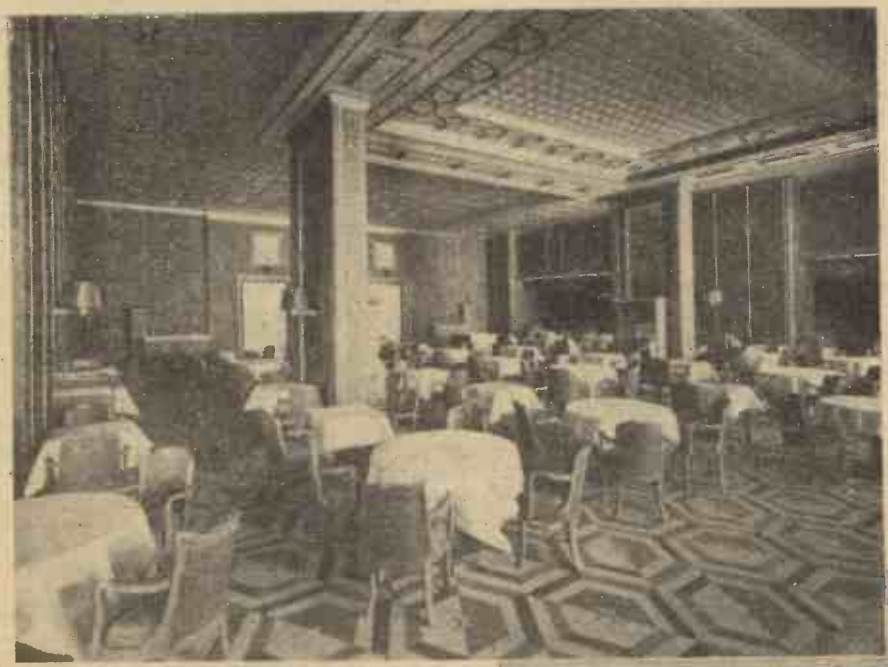


Fig. 5.—A room in R.M.S. "Queen Elizabeth"—or a model? It is a photograph of a 2in. to the foot model made for, and exhibited at, the World's Fair at New York in 1939.

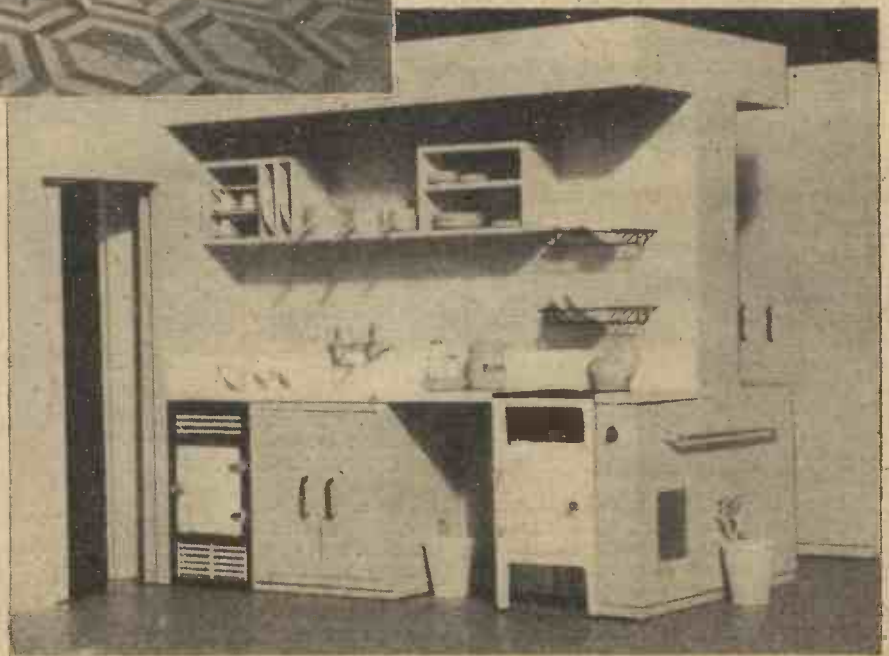


Fig. 6.—A kitchen unit for the post-war world modelled to the scale of 1in. to the foot.

Another photograph illustrating the same idea—that models can be photographed to look like the real thing—is provided by the next illustration (Fig. 5), of the cabin class lounge of the *Queen Elizabeth* as it was to have been when this great ship made her maiden trip. Instead she went secretly into war service, and we have yet to learn how she will look in peacetime.

One of the outstanding exhibits in the British Pavilion at the New York World's Fair in 1939 was a 32ft. long half model of *Queen Elizabeth*, built by Bassett-Lowke, Ltd., of Northampton, and surrounded by other famous ships which had made history with Atlantic crossings of earlier days. Below the *Queen Elizabeth* model were shown the interiors of leading rooms in the ship, including the cabin class lounge illustrated. These rooms were modelled to the scale of 2in. to the foot and such was the exquisite detail and finish that it becomes practically impossible to say whether the untouched photograph is of the actual room on the ship or "merely a model." These two photographs, taken by Mr. Stewart Bale, are reproduced through the courtesy of the Cunard-White Star Line.

Models of Post-war Planning

Another example bringing into use the model to "stand in" for the prototype is connected with the ever-present post-war housing problem, and it is a photograph of the kitchen unit which Mr. D. E. E. Gibson, M.A., A.R.I.B.A., A.M.T.P.I., city architect of Coventry, plans to use in new houses for the city. At least it is a model of the unit! (Fig. 6.) Actually it is built to the scale of 1in. to the foot, and is therefore only about 8in. high, but the photograph deceives you into believing it to be the real thing!

Film producers are not slow to realise the value of the model in this direction and hundreds of models are made in or for the studio just for the purpose of providing a realistic motion picture, which the unobservant public may believe to be real! Sea battles, railway disasters, fires, earthquakes, collapsing buildings are often very much "in miniature" on the screen.

For the still photographer it is amazing how lifelike a small ship placed on a piece of cellophane paper with a background of gas coke and a sprinkling of sugar or flour becomes! The table top shot blossoms forth as a liner sailing by a rocky coast with realistic storm-topped waves!

The clever model maker, if he combines his art with photography, may well create many pleasant illusions for his friends, besides making photography aid him in his own work.

April is here—the time before the war when we all used to get our cameras out—it won't be long now, so bear the idea of photography-cum-model-making in mind for post-war development.

Science Notes

New British Mortar Tank

A NEW type of tank which contributed to the initial breach of the strongly fortified Atlantic Wall was the armoured vehicle known as the A.V.R.E. This vehicle, in general, is similar to the Churchill tank, and the interior has been specially designed to accommodate a crew of engineers, together with specially guarded explosive charges for assault demolition. The main armament of the A.V.R.E. is a special mortar mounted in the turret. This weapon has characteristics entirely different from those mounted in other types of tank, and it can hurl a charge containing many times the weight of explosive of any other projectile of similar dimensions against concrete, steel or masonry. It can also lay flexible tracks across marshy ground or form a causeway across ditch and stream by means of fascines (a large roll of chestnut pailings).

It is interesting to note that when Scottish troops under the command of the Canadian army recently broke through the northern sector of the main Siegfried line, an anti-tank ditch nearly 30ft. wide was the main obstacle to the advance. The ditch was effectively bridged by fascines, so enabling our "Kangaroos" (armoured troop carriers) to get across.

The illustration on this page shows a Churchill tank crossing a ditch over bundles of fascines.

Infra-red Paint-drying Plant

IN factories where a great number of painting jobs are handled, infra-red paint-drying apparatus is found very convenient in giving increased output. For this purpose, the Ergon Electrical Manufacturing Co., of London, has produced a specially designed infra-red paint-drying unit consisting of a metal framework supporting a number of semi-parabolic reflectors each having a row of lamps having crescent-shaped filaments. The reflectors are arranged to form a tunnel, the height and width of which can be varied at will, according to the size and shape of the articles to be treated.

The Boeing C-97

THE new Boeing aircraft, which is practically an enlarged Flying Fortress, is designed for troop transport, and is the biggest of all American 'planes. It carries 100 fully-equipped troops a distance of 3,500 miles, and has crossed America, 2,323 miles, at just over 380 miles an hour. The wingspread is 141ft., and the overall length 110ft.

Empire Television!

SPEAKING to Commonwealth Broadcasting Conference delegates in London recently, Sir Allan Powell, chairman of the B.B.C., visualised a television system covering the Empire by cable. He said:

"Perhaps we shall have a cable as simple as the present submarine cable, and with some device to boost up its strength we will send the picture as easily as we now send a telegram.

"I believe that in a few years we shall by some means or another have television available in most of our homes."

Towed Glider Record

IT is reported that a world's record for a non-stop glider flight was established in India recently when a towed aircraft covered a distance of 1,650 miles from Karachi to an East India base in 11 hours.

The Gyro-magnetic Compass

WHAT is reputed to be one of the greatest scientific discoveries of the war was recently taken off the secret list. It is a compass that cannot go wrong. This perfect pathfinder was designed and developed by the R.A.F. "back-room boys" at Farnborough, but the basic principle was conceived by a young scientist who did not live to see his invention in operation. The instrument is officially described as the "Distant-reading Gyro-magnetic Compass," which, according to airmen, never lets them down.

The new compass, produced by the Automatic Telephone and Electric Co., of Liverpool, is now being used not only by the R.A.F., but also by the U.S. Air Force as well. Among the big operations on which the instrument has materially helped are the precision daylight raid on the Messerschmitt works at Augsburg, the sinking of the *Tirpitz*, and the long-distance raids on the Ploesti oilfields.

Air Clipper Trips from U.S. to London

COINCIDING with the news that Britain is going ahead with civil aviation comes the announcement from the United States that cheap flights to London are to be the order of the day after the war.

Pan-American World Airways visualise nine-hour trips from New York to London at very low fares, and the Clippers used are to carry about 200 passengers and seven tons of freight. The machines will be powered by six engines, with pusher propellers on the trailing edges of the wings. Cruising speed will be about 320 m.p.h., with a range of 4,200 miles. The wing span will be 230ft.

Talkies for Trains

NEW luxury U.S. trains now being designed for post-war travel by the Pullman Standard Company are to be equipped with talking picture apparatus. Afterwards the seats can be cleared for dancing.

A Churchill tank crossing a ditch filled with fascines.

Making Model Railway Track

A Simple Method of Making Tin Plate "O" Gauge Railway Track

By T. HADFIELD

OWING to the war and metal shortage, it is not possible to obtain any spare rails, etc., for model railways. In model railway lines of the tin plate type, it is easy to make spare rails, straight, curved or points, from the old tin cans that are so much in evidence to-day; hence there is no shortage of raw materials. One might object to using these as against the need for salvage, but only the straight pieces on the side, that are very light, are required, and the ends and seams can still go for salvage. These rails, etc., will give pleasure to children for several years, and anyone who can use a soldering iron and who has also a small pair of tin snips and a wooden mallet can easily make these tin plate rails, as described below.

The tin plate must be cut carefully from the cans so as to get the largest piece without buckling or damaging, so first cut straight down the left-hand side of the vertical seam with the snips. Cut off the top rim, again close, and while going round, bend out this rim to clear the snips. Then cut off the bottom in the same way. With the usual can one may obtain a piece about 4½in. x 9in. which will make three rails.

The standard straight length of "O" size rail is 10½in. and this length can be obtained from an old syrup tin, but as I have stated the usual sizes will be 9in. long, and this can be used as a standard length in any rail formation.

Of course, if tin plate sheets can be obtained, so much the better—the thickness should not exceed .010in. which is similar gauge to the usual tin cans for fruit, meats, etc.

Bending Jig

The tin plate is now cut into 1⅜in. wide strips and length to suit either 9in. or 10½in. as the materials allow. Elaborate bending tools will not be required, and I am suggesting very simple ones which can be improved if one desires. The first bending jig can be made from hard-wood as shown in Fig 1.

Fig 2 shows the jig in a vice with a piece of the strip tin in position for the preliminary bend. This bend is made with a loose straight piece of wood so as to give an even straight bend. A ⅛in. straight piece of M.S. or a length of ⅛in. silver steel is placed in the bend and hammered gently with the mallet on a straight steel plate or a hard-wood block, and should now be as shown in Fig. 3 in end view.

The jig for the next forming operation may be difficult to make for some, but if access to a drilling machine or a good breast drill is obtainable it should be easily made by the average amateur.

In making a jig on these lines, I had difficulty in getting strip steel in 5/32in. thickness, so built them up with ⅛in. pieces and 20 gauge by 1in. wide M.S. strips.

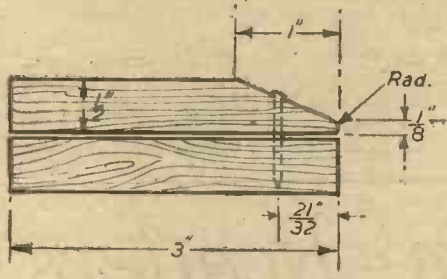


Fig. 1.—Simple bending jig.

Although this looked a crude affair, it was very satisfactory, and I made several dozen lengths with it. Of course, if one can get solid side pieces milled or planed, as in Fig. 5, a more satisfactory jig can be made, and one which can be used indefinitely.

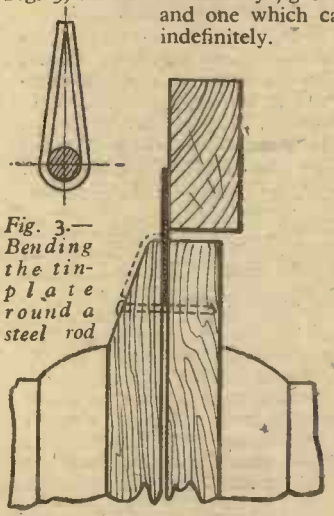


Fig. 3.—Bending the tin-plate round a steel rod

Fig. 2.—The jig mounted in a vice ready for the first bend.

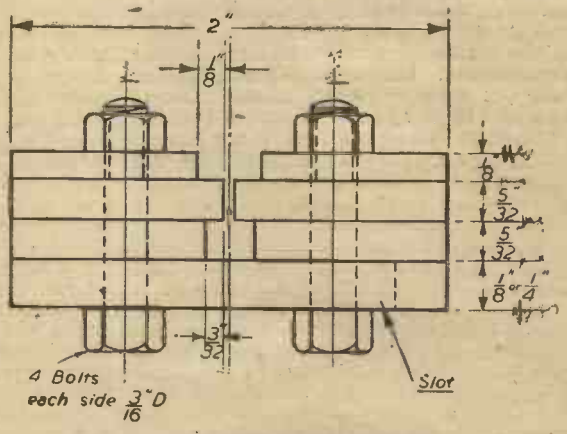


Fig. 4.—A jig built up with strip steel.

In working the tin plate never use a bare hammer face on the plate, but always use hard-wood or a hide mallet; otherwise the metal will be bruised or distorted and buckled. The various operations are shown in stages in Figs. 6-9.

Although this may seem a tedious operation it is very quickly done and should only take five to 10 minutes. I have shown every operation clearly to prevent any mistake. This should result in a straight and stiff tin plate rail, quite equal to any purchased one.

Making the Sleepers

To make the sleepers, pieces of tin plate are cut 2½in. x 1⅜in. wide. A simple bending jig is now required to fold the edges as shown in Fig. 10. The first fold of ¼in. at each side may be made with a simple wood jig similar to the one for the rails with nails for distance stops ¼in. from edge and then the tin plate can be bent up with the fingers. This first fold is beaten flat gently with the mallet and the second fold made in the same jig. This double fold makes a strong sleeper and prevents the sharp edges being exposed.

Having now made the rails and sleepers it is a simple matter to assemble. Two simple gauges or distance pieces should be made for assembling, to the size shown in Fig. 11 in ¼in. plywood; the slot should be a neat fit to the rails.

These gauges will now hold the rails in position whilst the sleepers are fitted underneath and soldered. Three sleepers will be sufficient for one length, the end ones about ½in. from each end, and one in the middle.

The length of rails can be joined as in the usual way by using pins, say, 1½in. long by ⅛in. dia. I would suggest leaving these

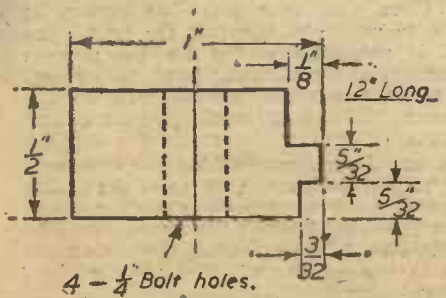
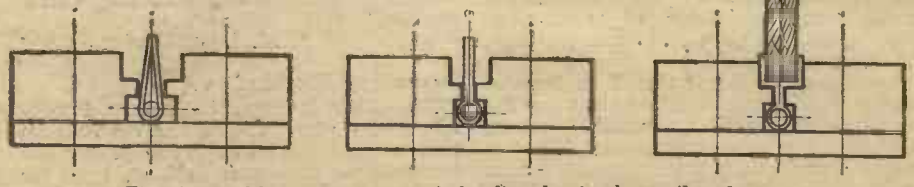


Fig. 5.—A solid side piece for the jig shown in Fig. 4.



Figs. 6, 7 and 8.—Various stages in bending the tin plate rail to shape.

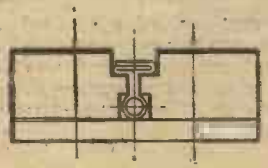


Fig. 9 (left).—The final stage in bending the rail.

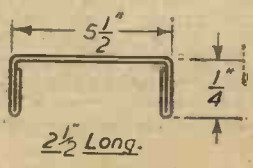


Fig. 10 (right).—Tin plate sleeper with folded edges.

pins loose and putting a slight kink about ¼in. from the end and in the lower side of the round part of the rail and this will prevent the pins being pushed in too far. It will be found an advantage having these pins loose, especially on curved rails when making up any special formation or layout, when the pieces may be reversed easily.

One may find a difficulty in cutting the rails after forming, but if two nicks are filed in the sides of the top round portion with a half-round file, and the bottom flat portions are nicked with the tip of the snip, it is easy to bend the rail and it will break without distorting the section. The ends can then be filed square with a fine, flat file.

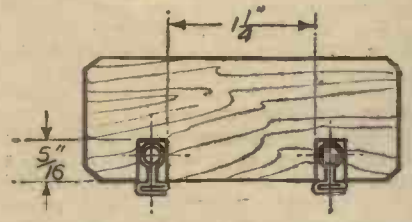


Fig. 11.—Wooden gauge for correctly assembling the rails on the sleepers.

Curved Rails

With regard to curved rails, these are first formed in straight lengths and bent separately with the hand to the required curve. The curves may be different with the various makes, but the standard is 12in. radius to the centre of the rail, and three pieces make a half circle. As these are too long for the jig, I made them half these sizes. Make a template in heavy cardboard or plywood of the required curve and lengths as shown in Fig. 12 and bend the rails to each side and cut to length.

These curved pieces can then be soldered to the sleepers as with the straight ones, using three sleepers to each curve, and set in position with the aid of the template (Fig. 12) as before.

For electric rails a middle rail can easily be fitted with small tin clips soldered to each sleeper in the centre. These must be insulated with a piece of black insulating tape before the clips are closed on to the centre rail. This clip and insulating tape will raise the centre rail the required amount to clear with the pick-up slipper at any cross rail or points.

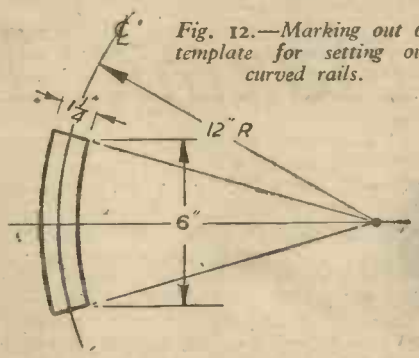


Fig. 12.—Marking out of template for setting out curved rails.

Letters from Readers

A Plea for Inventors

SIR,—Is it not quite time that some definite policy was decided by the authorities in favour of the inventor or patentee? At present, the conditions under which those who pay fees to the Patent Office help that department to make a handsome profit and to give so little in return that inventions are either held up or are rapidly drifting abroad. England is a small country and relies much upon originality in place of quantity production for her industry.

The system of taxation in itself is quite extraordinary. I am told that if an individual sells one patent—the sale is not taxed as income. Should he sell several, it becomes a "business" and is taxed as ordinary income. When does the number permitted become "several," and is an inventor allowed (like a dog) one "bite" a year which may be deducted from the total?

The new Act, if one can rightly understand its legal jargon, simplifies matters by charging all patent sales as income. The inventor is worse off than the Stock Exchange gambler in this respect; but perhaps creative work has always been less profitable than to juggle with other people's money. In this same Act provision is made for research. Presumably the inventor is again left out while the manufacturer with his regimented research department is given another loophole.

It is an unhappy way to encourage originality, and is perhaps one reason why we have seen Germany first in the field with jet fighters, magnetic mines, radio gliders, robots, rockets, trailing bombs, injection engines and other good things. All were British inventions—developed abroad. I almost added "as usual." We have not, it seems, learnt the lesson of 1914, when optical glass, magnetos, dyes, brass pressings, etc., were all imported.

Another queer fact is that if an inventor takes a provisional, so that he can try out his ideas, no models or materials can be obtained. The patentee must wait. He has to spend money on a licence to manufacture under patents when the authorities know that manufacture is impossible. He has often to relinquish the application. A moratorium would solve this unfair imposition.

Worse still, ideas submitted to Government departments can be improved by those who know exactly what is wanted and other patents taken out by the employees of these departments in their own name! This is bad enough, but provisionals (always secret and never published) are now often circulated to Government departments in case they may be interested, and the inventor may arrive at an interview to find that his provisional is already known to those concerned.

For what, then, does the inventor pay? And how is he encouraged unless he chances to be a cog in the department of Heaven-knows-what? The unhappy patentee is in the further difficulty that manufacturers (like shops) have plenty of orders from a customer who always pays (with other people's money) and need show no competitive enterprise whatsoever.

All this is not good for future trade. American motor-cars and radio will not be behindhand in the peace rush for business. They do not need to cope with unknown restrictions, poverty, and taxation which decide design. To the inventor is due the stimulus upon which industry lives, but as far as can be seen the words "nobody cares" express the position very accurately. The Admiralty knew the magnetic mine principle before the war. Some years after it had killed many of our men the authorities claim great credit for discovering the remedy. Nobody cares!

When inventions for new weapons and other war plans were required, only Government employees knew what was needed. No mobilisation of inventive talent was attempted. The U.S.A. Naval Department have published a list of what is wanted so that the whole country can try to help. This plan is so sensible that there is little chance of its being adopted elsewhere. Bureaucracy hates to admit that most great inventions have been originated by those who have no "official position."

A. M. Low (London, W.).

De-nailing Machine

SIR,—I was interested in the short description of the "Snifter" in the Aviation News column, and I thought readers would be interested to learn that in May, 1937, the Quebec Roads Dept. used a de-nailing machine.

The contrivance consisted of a line of magnets arranged between two pneumatically tyred wheels. This "energised axle" was towed by a truck on which the generator was mounted for supplying "juice" to the magnets. These magnets could be adjusted for road clearance by hydraulic cylinders. The speed of the machine was 12 m.p.h. and the width of road de-nailed at one pass was 8ft.—C. R. EVANS (Stourport-on-Severn.)

Ultra-violet Ray Lamp

SIR,—With reference to the article on ultra-violet ray lamps, by K. K. Thomson, in the March issue of PRACTICAL MECHANICS, may I be permitted as an electrical engineer to correct two errors which have occurred?

(1) The inner tube of the commercial mercury vapour lamp (Osira, Mercra, etc.) of 250 watts and 400 watts is *not* fused quartz, as stated in column three of page 188. In both cases it is of *hard glass* (special) and the amount of ultra-violet rays it passes is very small indeed.

In order to obtain the results desired—i.e., sufficient U.V. for medical and general treatment—it is necessary to use the 80 watt or 125 watt sizes, which have quartz tubes, and which need no support when the outer envelope is removed (these lamps have a bayonet cap and fit on to a special holder with three side pins.)

(2) Ultra-violet rays are described as of long wavelength. They are of shorter wavelength than the visible spectrum and lie in the band 3,500 to 4,500 Angstrom units.—EDWARD G. COLLINGE (Chippenham).

SIR,—Referring to the March issue of PRACTICAL MECHANICS, page 188, in an article describing an ultra-violet ray lamp your contributor refers to a 400-watt mercury vapour lamp which is identical in construction with the 300-watt mercury vapour lamp, and whilst I have not had an opportunity of testing one manufactured by Crompton, I have carefully examined those made by other lamp manufacturers and would advise your contributor that the lamp in question is not fitted with a quartz glass tube, but is, I understand, silicon glass.

Silicon glass does not allow ultra-violet rays to penetrate, therefore the light given off is practically useless for the purpose mentioned. On the other hand, the 80- and 125-watt lamps are manufactured with a quartz glass tube and would give the desired results.

I would confirm everything else mentioned by your contributor in so far as the benefit derived from the use of ultra-violet ray is concerned, but feel sure this matter should be cleared up before a number of your readers go to the expense, of purchasing 400-watt lamps, complete with choke, etc., which would not give them the benefit they anticipate.—J. W. THEOBALD (Putney).

Reply to J. W. Theobald:

SIR,—The Editor of PRACTICAL MECHANICS has forwarded to me your letter of February 28th with reference to an article by myself which appeared in the March issue of that journal.

I am grateful to you for the prompt action you have taken in bringing to my notice an apparent misunderstanding of the subject of ultra-violet rays, and it grieves me greatly to think that I may have, unwittingly, misled the readers of that article.

The suppliers of the lamp assured me that where mercury vapour was employed the inner bulb of the lamp was invariably made from fused quartz. I told them of the purpose for which I required the lamp, and was informed that it would give an appreciable emission of U.V. rays.

I, and others who have used the lamp, for varying lengths of time, have experienced sunburning, and some have spoken of "tingling skin" and a clearing of blemishes, confirming my supposition that U.V. rays must be present, although they do not appear to be so strong as I originally anticipated.

If, as you state, the inner bulb is made from silicon glass, to what can I attribute these effects? Does the glass permit the passage of some, if not a large amount, of U.V., or can the effect be due to visible light rays or even heat rays?

Furthermore, during tests I experienced fluorescence of a Vaseline-petrol mixture. This was not vivid, but I attributed the apparent rarity to an incorrect Vaseline-petrol ratio, or to the possible fact that rays were omitted only at the lower end of the U.V. spectrum, 1,800 to 3,000 Angstrom units, omitting those above this value.

Yours faithfully,

Doncaster. K. K. THOMSON.

[*Apropos the article "An Ultra-violet Ray Lamp" referred to by our correspondents, it is pointed out that some of the higher wattage mercury vapour lamps possess an inner bulb of a construction which does not permit the free passage of ultra-violet rays and such lamps, if used, would not give the desired results. Before purchasing any lamp and choke it should be definitely ascertained that the inner bulb is made of fused quartz. This is almost invariably the case with the 80 watt and 125 watt lamps, and any would-be constructor is advised to use a lamp of either of these values.*—ED.]

Engineer-built Houses

SIR,—I must join issue with your correspondents "Derbian" and S. Pearson *re* Engineer-built Houses.

At present, when a house is being built some men start to dig trenches. Then they mix concrete and put in footings.

A skilled man proceeds to put brick on brick, his mortar being mixed by hand—a scaffolding is erected and everything is carried up the ladders.

It is a hand-made job and it is done in the open air, often in the worst possible conditions. That is not my idea of an engineer-built house.

An engineer will obviously use mechanical power wherever he can, as that saves labour. He will, by the use of jigs, use unskilled labour where he can. He will use a gantry on the site and one that can be moved from site to site. He will prefabricate in a factory and reduce man handling to a minimum. He will work out stresses and strains so that he can reduce his costings. He will also know the size to make his doors—and they will fit.

He will produce better houses quicker than they have ever been produced before, and it will not be long before the prices are down to approximately pre-war level.

The potential market of thousands of millions of pounds will undoubtedly attract the best brains.

As to plaster being the only material to absorb moisture, I can say that I lived for some time in a place that had no plaster, being lined with prefabricated boards and we were not troubled by moisture; but I find in my present place that the kitchen walls are painted and the water runs down them, so apparently it all depends on finish. As regards doors—why not sliding doors running into the wall. Doors which swing are a nuisance in a small room.

In the majority of houses the fireplaces are on inside walls and water pipes on outside walls, and all the soot from the chimneys and ashes from the grates are taken into the room and in winter the water pipes freeze.

Too many people think that a prefabricated house will mean a box-like structure like those that at present disfigure our towns, but it doesn't mean any such thing. It would be possible to build fifty houses each with a different elevation. If you want to prove it, get a box of children's bricks and try it.—W. H. BENTLEY (Sunbury-on-Thames).

Notes and News

Kent Model Engineering Society

IN spite of having its headquarters blitzed, this club is perhaps stronger than ever, and the coming season promises to be one of the best through which the Society has passed. Members' locos will be employed to the full.

Very few of the club's projected ideas have been relegated to "after the war," and meetings are held regularly every Monday evening at the Davenport Hall, Davenport Road, S.E.6.

At meetings held during March the following subjects were dealt with:

Machining a 5 c.c. internal combustion engine; Rummage sale; Track discussion on the Society's track; and Discussion on proposed exhibition.

All model engineers are welcome at the meetings, either as visitors or prospective members.

The hon. secretary of the Society is F. H. Gray, 3, Jutland Road, Catford, S.E.6.

Allies' Fast Jet Fighters

IT is now known that both Britain and America possess jet-propelled 'planes which are faster than any similar aircraft produced by Germany. Britain's twin-engined Gloster "Meteor" is so far the only jet-propelled aircraft to go into action against the enemy. The "Meteor" is powered by Rolls-Royce engines manufactured to the basic design of Air Commodore Frank Whittle, the inventor of turbine jet aircraft.

Another British jet fighter, in an advanced stage of development, and engined by the De Havilland Co., is also constructed on Whittle's principles.

An engine built by this company, supplied to the U.S.A.A.F. in July, 1943, was used by the Lockheed Aircraft Corporation as the power unit of a prototype which, with an American engine, developed into the P-80A.

Details were also announced in Washington of the Lockheed P-80 "Shooting Star," whose rate and angle of climb are described as superlative.

The 'plane, which has made many flights in secret tests, is highly manœuvrable and can outfly the tailless Messerschmitt 163 rocket interceptor.

The P-80 can operate over a range equal to that of any conventional fighter, and has a ceiling well above anything propeller-driven aircraft can attain. Armament is concentrated in the nose.

The "Shooting Star" is small and light in comparison with an ordinary fighter, but it can carry a heavy load of ammunition, bombs, fuel and photographic equipment.

When Western Command War Correspondents visited a Royal Engineers training battalion recently, a demonstration was given of wet and dry bridge making. Our illustration shows a floating bay bridge being assembled during the demonstration.

QUERIES and ENQUIRIES

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

Galvanic Action on Metals

I SHALL be glad if you would supply me with some information on the following:

The cause and effects of electrolytic and galvanic action on metals, such as iron and steel, brass, copper, and aluminium.

Deterioration in the case of an alloy caused by galvanic action, also electrolytic action by two dissimilar metals in close contact.—D. J. Campbell (Cosford).

IF we place a zinc and a copper disc on each side of a disc of thin cloth which has been moistened in acidulated water, and if we connect wires to the zinc and the copper discs, we shall find, if we use a sensitive galvanometer, that a current will flow through the joined wires. This generation of current is known as "galvanic action," having first been discovered by the electrician, Luigi Aloisio Galvani, of Bologna, in the eighteenth century.

When any two dissimilar metals are placed in contact in such a manner, an electrical current is generated, the fundamental reason for this action being that some metals are "naturally" more electrically positive than others, whilst a number of metals are strongly negative. Thus, in the above example, zinc functions as the positive metal and copper as the negative one. Thus the current generated makes a complete round of the external circuit, flowing out through the copper and back to the zinc.

Any two different metals in contact, and in the presence of an electrolyte (which electrolyte may consist of almost any dilute solution) will give rise to a "galvanic" or "electrolytic" current, and since, when such an action is allowed to proceed continuously, some of the metal actually dissolves in the electrolyte solution it must follow that deterioration and/or actual severe corrosion of the metal or alloy takes place.

When two dissimilar metals are in close contact, the slightest trace of moisture will often suffice to initiate this electrolytic action, which, once started, proceeds until the contacting metal surfaces are almost destroyed and the metal deteriorated.

Here, in a nutshell, you have the whole explanation of this "galvanic" action going on between dissimilar metals in contact, and in the presence of an electrolyte. The entire action is, of course, based upon the flow of electrons out of one metal into another, this continuous flow being kept up by the gradual solution of the metals in the electrolyte which continuously destroys the electron balance or equilibrium between the two metals.

Copper Plating

WHAT precautions must be taken when depositing copper on cast iron electrolitically to ensure that the copper coating adheres so firmly to the cast iron that it cannot be stripped off, and will not blister when the cast iron is heated to between 200 deg. and 300 deg. F.? Also, is the usual saturated solution of copper sulphate acidified with sulphuric acid the correct electrolyte to use?—W. H. Shortt (Exeter).

THE best way to ensure the greatest adhesion of a copper coating to an underlying metal is to give the article a preliminary "flash coating." This is simply effected by using a 6- or 8-volt accumulator in connection with the copper-plating bath and by turning on the full force of the current for about one second. This results in a thin copper deposit being "driven" into the pores of the iron article, after which the normal process of copper plating follows.

The best copper-plating bath is one containing copper cyanide, a good average formula of which is given below:

Copper cyanide, 4 oz.
Sodium cyanide, 5.5 oz.
Sodium carbonate, 5 oz.
Water, 1 gallon.

This is used at a temperature of 35 deg. C. The E.M.F. required is ¾ to 1 volt, and the current density should be about 13 amperes per sq. ft. of surface to be plated. Use a copper sheet anode.

Owing, however, to the excessively poisonous nature of cyanide solutions, you may be unable to purchase the necessary materials from your local druggist, in which case you will have to rely on the acid bath for copper plating. This has the formula:

Copper sulphate, 27 oz.
Water, 1 gallon.
Strong sulphuric acid, 5 oz.

It is used under similar conditions to the above cyanide bath, but at a temperature of about 60 deg. C. It gives heavier deposits than the cyanide bath, but the deposit is not quite so adherent.

The acid solution which you mention for copper plating will operate, but it will tend to give flaky deposits, being of too great a concentration. It would be quite effective for preliminary "flash" plating.

It is possible that you might obtain ready-made copper-plating salts from a firm of electro-plating suppliers. Try either Messrs. W. Canning and Co., Ltd., Great Hampton Street, Birmingham, 18, or Messrs. R. Cruickshank, Ltd., Camden Street, Birmingham, 1.

Engraving Pen: Charging Lighting Batteries

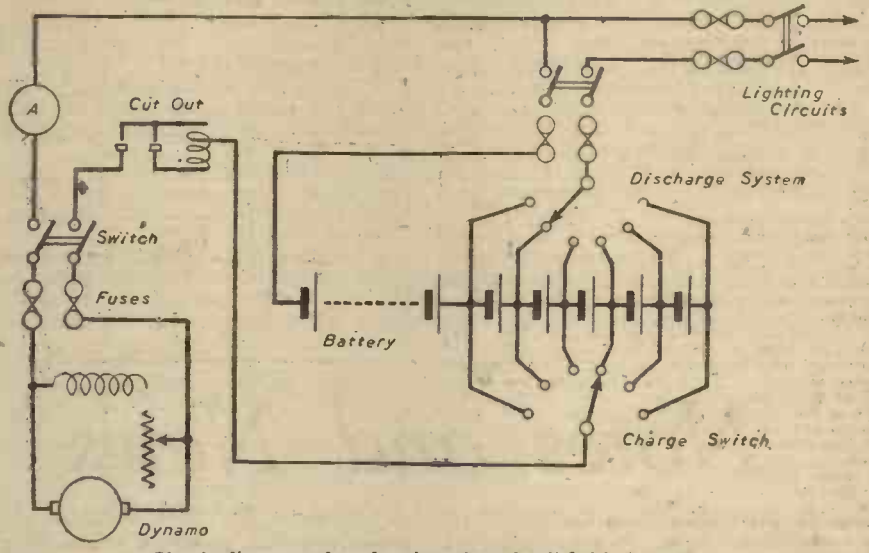
I WISH to make an engraving pen, and shall be glad if you can supply me with the following information:

(1) The S.W.G. of wire required for the coils; the number of turns for the coils; the voltage and current necessary to operate the pen.

(2) Can you also give me a wiring diagram of connections for the charging of lighting batteries used in a week-end bungalow? The batteries are four 12-volt of the motor-car type. The current is obtained from a dynamo driven by a 2½ h.p. paraffin engine. The total wattage in use is 600, and is made up of six 100-watt lamps. I would also like any information on the rate of charge and also how to use lights, direct from the dynamo, or from the battery while dynamo is charging same, or from battery when same is charged up.—R. Larwood (Nottingham).

(1) AN arc engraver could be made up, using a holder in which is mounted a tungsten point which is connected to one pole of a supply, whilst the other pole is connected to the metal article which is to be engraved. This apparatus could be used from a 6-volt accumulator. If it is desired to operate from the 230 volt A.C. 50 cycle mains a transformer could be used, and this could be made on a core having a cross sectional area of 1.25 sq. in. The secondary winding of the transformer could have 42 turns of 13 S.W.G. D.S.C. wire and the primary 1,300 turns of 27 S.W.G. enamelled wire.

(2) We presume you are using the four 12-volt batteries in series to supply lamps of about 50 volts. Assuming these have a capacity of about 60 ampere hours, we suggest they be charged by a dynamo having an output of 6 amps. and a voltage up to about 65 volts. You will no doubt find it most convenient to be able to take the load current from the batteries either when they are fully charged, partially discharged, or are being charged. As the voltage of the batteries varies during charge and discharge this arrangement will necessitate the use of two tapping switches which are connected to the six individual cells of one battery, as indicated in the diagram.



Circuit diagram of a charging plant for lighting batteries.

During charging most of these cells would have to be cut out of circuit by means of the discharge switch in order to avoid burning out the lamps; these being connected in circuit as the voltage falls during discharge. During charging the end cells will probably become charged first, since they have less work than the remaining cells, and can then be cut out of circuit by means of the discharge switch. A cut-out between the dynamo and battery would be a distinct advantage, together with a voltmeter for measuring the voltage on the load circuits, and an ammeter for measuring the charging current.

Synthetic Resin: Quick-Hardening Moulding Material

I SHALL be glad if you can help me on the following points:

(1) Can you give me a list of liquids or semi-liquids which harden (i.e. solidify) when heated?

(2) Can you give me any formulae for a substance which would harden quickly after being poured into a mould; and the composition of the material for the mould?—E. W. Polson (Edinburgh).

(1) SO far as we are aware, there are no pure liquids which self-harden on heating, since any such liquids would obviously be unstable. We suggest, however, that it might be possible to obtain a solution of a thermo-plastic synthetic resin having this property, and we would therefore advise you to write to the Technical Department of Bakelite, Ltd., 40, Grosvenor Place, London, S.W.1 on this point.

(2) Ordinary plaster of Paris will harden within a minute or two after being poured into a mould. Shake the material with a little water and then pour rapidly into an oiled mould. The mould may be of wood, metal, synthetic resin, glue or, in fact, any such suitable material.

Converting a Dynamo for Welding

I WOULD be greatly obliged if you could explain to me how to accomplish the following:

I have a dynamo taken from a Lister set and would like to convert it for welding. Shall I have to dismantle it for alteration to the field coils connection; what thickness of mild steel would it weld? What horse-power will be required to drive it? The machine is rated at 50/73 volts 25 amps., revs. 1,850 per minute. To which terminal should I connect the electrode lead and the earth?—J. E. Bramley (Nottingham).

THERE are three possible ways in which the dynamo could be used for arc welding. If it has no interpoles it might be used above its normal speed with a shunt regulator in the shunt field circuit to reduce the

field current to a value sufficient to give about 75 volts on open circuit. The weak-field will then allow the voltage to fall somewhat on load; or it could be used at normal speed with the brushes advanced from the neutral position so the armature reaction will reduce the voltage on load. The best way of using the machine, however, would be to use it without modification in series with a resistance for reducing the voltage after the arc has been struck. You should be able to weld mild steel plate up to about 1/16in. in thickness, and we suggest the dynamo be driven by an engine of at least 3 h.p. It does not matter to which terminal the electrode lead or the "earth" is connected.

Paper Tape Recording

I AM interested in paper tape recording processes, and wish to experiment with photographic and electrolytic methods of producing either a black and white, or contrasting colours on paper to be reproduced by reflection and the use of a P.E. cell. I have tried potassium iodide, and bromide, also phenolthalein, in conjunction with the electrolytic method, but with little success. I understand from an American handbook that the azo type of aniline organic dyes are normally used, also the salts of the metal molybdenum. I would be grateful if you could tell me if these materials are obtainable, and from whom they might be obtained? Also, whether you could tell me of any other speedy "marking" process that could be produced, either photographically or as mentioned above? Either variable area or density recording would be used. My main trouble with chemicals used so far has been that the "image" or "impressions" have faded very quickly into insignificance.—F. C. Blake (Tadcaster).

A VERY simple electrolytic indicating medium which you could use for coating on paper strip is a solution of starch containing pure potassium iodide. When this is very slightly moistened (to render it conducting), the passage of current liberates a trace of free iodine which at once combines with the starch with the formation of a blue (or dark-blue) coloration which immediately becomes visible on the starch-iodide strip. The strength of the starch solution and the amount of potassium iodide dissolved in it are capable of much variation.

"Primuline" (a yellow dye) would perhaps be the best azo type of dye for you to experiment with, although many other dyes of this type are obtainable, price about 1s. 6d. per oz. Suppliers are Messrs. Harrington Brothers, Ltd., 4, Oliver's Yard, 53A, City Road, Finsbury, London, N.1, or any other firms of laboratory and chemical suppliers.

Molybdenum salts are obtainable from Messrs. Johnson, Matthey and Co., Ltd., Hatton Garden, London, E.C.

By immersing ordinary bromide paper in a 10 per cent. solution of potassium or sodium nitrite (not nitrate), it becomes highly sensitive and rapidly darkens in bright daylight. Perhaps this method might be of use to you, since the darkened image of the nitrited paper is quite permanent. The Infallible Exposure Meter Company, of Wrexham, prepare this type of paper. Perhaps they might be persuaded to coat strips of paper for you to experiment with.

Hectograph Ink and Pad

I HAVE a hectograph jelly duplicator, and through frequent usage the ink has stained it a dark blue colour, which it now imparts to the duplicated sheets. Could you tell me a way in which I could get rid of this inconvenient colour?

It was claimed that it would duplicate 200 copies at one inking, but it is with difficulty that I am able to obtain 50. What might be the reason for this? I use Dryquic duplicating paper, and the jelly as instructed when I bought it.

I think the cause might lie in the poor quality wartime hectograph ink. Could you give me the formula for making some that would be reliable?—J. A. Baskwell (Guildford).

IT is very probable that the cause of your hectograph's failure to give more than 50 copies lies in the ink which you have been using. Hectograph inks consist mainly of an aniline dye dissolved in water and glycerine. The following is a good formula for hectograph ink making:

Dye, 10 parts; glycerine, 20 parts; 25 per cent. acetic acid (i.e. 25 parts acetic acid, 75 parts water), 10 parts; water, 50 parts; dextrine, 2 parts.

Dissolve the dextrine in the heated water. Then add the dye, glycerine and acetic acid.

A simple hectograph ink formula is: Dye, ½ oz.; methylated spirit, 1 oz.; glycerine, ½ oz.; water, ½ oz.

Judging from your remarks concerning the hectograph pad, it would seem that this is too soft or too porous, and has allowed the diffusion of the dye through it. You might remedy matters by gently melting the pad at the temperature of boiling water; but, all things considered, we think it would be better for you to prepare another pad, which is really a simple matter. The following is a good formula for making a hectograph pad:

Glue, 100 parts (by weight); glycerine, 500 parts; water, 375 parts; Kaolin or china clay, or barytes, 25 parts.

Mix the glycerine and water together. Then dissolve the glue in this mixture by heat. Finally, stir in the china clay, which latter will not dissolve, but will give "body" to the hectograph pad and prevent it from being too porous.

The above formula is capable of variation. If the pad seems too soft, melt it up again, and add more glue. If the pad is too hard melt it up and add more water and/or a little more china clay or barytes.

Colouring a Cement Floor: Ignition Coil

(1) I have a cement floor which I wish to colour. Can you please recommend any suitable process for doing this?

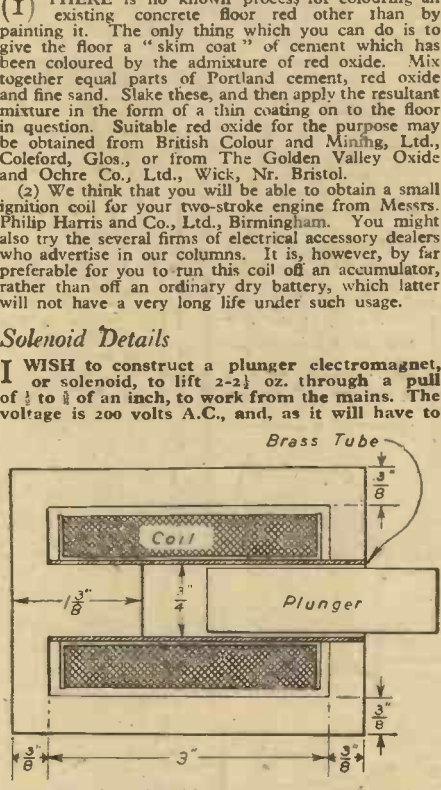
(2) I also have a model two-stroke engine which lacks an ignition coil, can you inform me if there are any firms supplying such things which could be run from an ordinary dry battery?—K. K. Shackell (Burnham-on-Sea).

(1) THERE is no known process for colouring an existing concrete floor red other than by painting it. The only thing which you can do is to give the floor a "skim coat" of cement which has been coloured by the admixture of red oxide. Mix together equal parts of Portland cement, red oxide and fine sand. Slake these, and then apply the resultant mixture in the form of a thin coating on to the floor in question. Suitable red oxide for the purpose may be obtained from British Colour and Mining, Ltd., Coleford, Glos., or from The Golden Valley Oxide and Ochre Co., Ltd., Wick, Nr. Bristol.

(2) We think that you will be able to obtain a small ignition coil for your two-stroke engine from Messrs. Philip Harris and Co., Ltd., Birmingham. You might also try the several firms of electrical accessory dealers who advertise in our columns. It is, however, by far preferable for you to run this coil off an accumulator, rather than off an ordinary dry battery, which latter will not have a very long life under such usage.

Solenoid Details

I WISH to construct a plunger electromagnet, or solenoid, to lift 2-2½ oz. through a pull of ½ to ¾ of an inch, to work from the mains. The voltage is 200 volts A.C., and, as it will have to remain on for long periods, could about 20 watts be made to work it? What size of wire, and how many turns would be required?—H. Simpkins (Worcester).



Details of a solenoid to operate on A.C. mains.

WE suggest you build up a laminated core 2½in. × ½in. × ½in., this being arranged to slide in a thin-walled brass tube having one joint left open by about 1/32in. The magnet yoke may be constructed of laminations to the dimensions given in the sketch. The coil of 10,000 turns of 34 S.W.G. enamelled wire can be wound on a bobbin 2½in. long having ends 1½in. sq., which fits the brass tube, the laminations being threaded over and through the coil when this is wound. The coil will take a momentary power of slightly over 20 watts, this falling as the inductance of the coil is increased when the core moves into the centre of the coil.

Removing Scale from Engine Water-jacket

CAN you supply me with details of any preparation for removing, and if possible for preventing, the formation of scales and salt deposit in the water-jacket of a small outboard engine?

The engine is used exclusively in sea-water, and facilities are not available for flushing the cooling system with fresh water, after a period of use.—T. Gordon (Kyle).

USING ordinary sea-water, as you do, for engine cooling purposes, you cannot hope to prevent the formation of scale and deposits in the water-jacket of your engine. Usually, however, by placing a handful of common soda in the water-jacket of the engine now and again you will be able to minimise these deposits, and this is the means, also, which you must use for getting rid of the deposits, for soda has a strong solvent action on most of them.

Caustic soda or black ash has a still stronger solvent action, but this material is apt to corrode unions and connection, so that its use requires much care.

Another solvent is a mixture of common soda and sodium metasilicate, which is obtainable (price 2s. lb.) from Messrs. Laporte, Ltd., Bedford.

About a handful of the mixed salts is placed in the water-jacket (the water therein being hot). The engine is run for a short time, after which the solution is swilled out with clean water. If the water-jacket deposit is bad, several applications will be necessary.

Reversing Direction of Rotation of A.C. Motor

I HAVE a small 12-volt A.C. electric motor and wish to reverse the direction of rotation. I have tried the usual method of reversing the brush connections without the desired result. Can you tell me how reversal of rotation can be accomplished?

For your information, I note that the two brushes are fixed at 90 deg., and that there are four poles in the field windings. There are only two field connections on the terminal block fixed to the top of the motor to which the two brushes are also connected.—E. H. Jackson (Birmingham).

ASSUMING your machine is a series connected A.C. motor it should be possible to reverse its rotation by reversing either the leads to the brushes themselves or to the field coils, but not both. It occurs to us, however, that the machine may actually be a shunt motor, intended to operate on D.C. only; in which case it will not operate satisfactorily in either direction on A.C. until the field coils are rewound with fewer turns of thicker wire than at present, and connected in series with the armature. If the motor is actually a series motor at present, it may be that one or more of the field coils are reversed; the field coils should, of course, be connected to create adjacent poles of opposite magnetic polarity.

If the motor is a repulsion motor, in which case the brushes will be connected together, and not insulated from the frame, it can be reversed by simply moving the brushes without any alteration of the connections.

Preparing Sodium and Potassium

I SHALL be obliged if you will kindly answer the undermentioned queries:

(1) Is there any method by which I can obtain metallic sodium and potassium from any of their compounds by electrolysis?

(2) Is there any metal which, like sodium, when placed in water, gives off oxygen? If not, is there any alternative method of obtaining a copious stream of oxygen except by that of potassium chlorate?—E. J. Binyon (Sanderstead).

(1) IT is not easy to prepare sodium and potassium on a small scale by means of electrolysis. Nevertheless, it can be done.

To make metallic sodium obtain some sodium hydroxide (caustic soda). Place it in a silica or porcelain crucible and heat it very strongly to a bright-red heat, so that the sodium hydroxide completely melts. Place in the fused soda a thin carbon rod, which forms the anode or positive electrode of a 6-8 volt battery, and use a length of platinum or iron wire to form the cathode or negative electrode of the battery. Globules of metallic sodium will collect on the cathode wire.

Metallic potassium is prepared in the same way, using potassium hydroxide instead of sodium hydroxide.

The whole process is explained in most elementary books of chemistry, and, in many instances, diagrams are given.

(2) Sodium does not give off oxygen when placed in water. It liberates hydrogen from the water.

The potassium chlorate method of generating oxygen is one of the most convenient on a small scale, but there are other methods. Here is a good one:

Mix one part strong sulphuric acid with four parts of water. Take 100 c.c.s of this diluted acid and add it to 20 grams of potassium permanganate. Pour the mixture into a flask fitted with a delivery tube. Gently heat the mixture in the flask. At a temperature of between 50 and 60 deg. C. oxygen will be evolved in a steady stream. Twenty grams of permanganate treated in this manner will generate about two litres (2,000 c.c.s) of oxygen.

Another way of preparing oxygen is by dropping water on to sodium peroxide. In this case no heating is required. Ten grams of sodium peroxide generates about a litre (1,000 c.c.s) of oxygen.

Wall Plastering

(1) I am interested in wall plastering, and would be obliged if you could give me the following information: What is the composition of a plaster which does not set so brittle as do some of the proprietary brands?

(2) How is a uniform "doppled" effect obtained on a wall surface, and can you recommend a comprehensive book on the subject?—A. Cowell (Sheerness).

(1) ASSUMING that your wall is an inside one, you can make up a good plaster using 3 parts fine sand and 1 part lime, slaked to a stiff paste with water. All plaster becomes rather brittle on setting. A good way to strengthen plaster is to incorporate with it a quantity (say 20 per cent.) of a fibrous material, such as asbestos of even hair cuttings, vegetable fibre, etc.

(2) The "doppled" effect to which you refer is obtained merely by trowelling the plaster into ridges, depressions and other formations. If you want a finer effect an excellent plan (supposed to be a trade secret) is to take an old piece of coarse sacking and to impress it against the plaster during its setting. The impression of the sack will be transferred to the plaster, which, as a result, will take upon itself a finely "patterned" surface appearance.

You do not say whether the mortar is to be on an outside or an inside wall. However, a good composition for average mortar is: Sharp river sand, 50 parts; slaked lime, 50 parts: or, soft pit sand, 2 parts; slaked lime, 1 part.

A stronger mortar can be made with: Sand (any variety), 2 parts; cement, 1 part.

In each case, slake the ingredients together with water to a fairly thick mass. It is far better to render the wall with two separate facing coats of mortar than to attempt to do the job with one coat. Each of the two coats should be ¼in. to ⅜in. thick, the first coat being completely dry before the second coat is applied.

Three books on the subject of plastering which should suit you are: A. Millar: "Plastering: Plain and Decorative," 30s.; A. M. Telling: "A.B.C. of Plastering," 8s. 6d.; W. Verrall: "Plastering," 2s.

Prices given refer to publishers' pre-war listed net prices.

THE Cyclist
Editor: F. J. CAMM

VOL. XIII APRIL, 1945 No. 278

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

Comments of the Month By F. J. C.

Rear Light Bill Passed

THE Road Transport Lighting (Cycles) Bill has become law, thus carrying forward into peace the wartime measure. In the debate Mr. Noel Baker stated that he had received only 115 communications out of ten million cyclists, in spite of the fact that cycling organisations have officially in their journals urged cyclists to write to their Members of Parliament, and to the Minister of Transport. Many energetic club secretaries, he said, have gone round to get letters written; that does indeed indicate that cyclists as a class are apathetic and the figures quoted lend colour to Mr. Noel Baker's implied criticism that the main opposition to rear lights came from the staffs of the organisations, and not from the members.

The number of cyclists (115) who wrote to Mr. Noel Baker bears the same ratio to the total membership of the organisations as that total membership does to the total number of cyclists. In other words, cyclists are as apathetic towards the associations as the members of the associations are towards rear lights.

However, we do not know how many letters were received by Members of Parliament. We gather that some of them have had their heaviest post on this subject, but the inspired letter never carries the same weight as the spontaneous letter. An organised campaign of letter-writing against some particular sport or law has about the same weight as a lengthy petition containing tens of thousands of names; that is, practically nil. We all know that it is easy enough to employ a few people to go round with a petition in pubs and taverns touting for signatures. Few people take the trouble even to read what it is all about. If there had been a natural outcry against rear lights it is possible that some notice would have been taken of it.

After all, if a cyclist feels very keenly against rear lights he does not have to be egged into writing a letter of protest. The C.T.C., the N.C.U. and the R.T.T.C. have no claim at all to be able to speak on behalf of cyclists. They have not taken any measures to obtain the opinions of their members on the question of rear lights. Their members are merely told to oppose them. The Cyclists Touring Club exists mainly to promote interest in cycle touring. Since it has become more interested in politics than in pastimes it has become an autocratic body purveying a perverse policy in the framing of which its members cannot take a hand. Full powers are vested in the Council and Committee, who may or may not act upon a resolution passed at an A.G.M.

The N.C.U. exists to control track racing, and the R.T.T.C. to control Time Trials. Had they been truly democratic bodies they would really be able to speak on behalf of their members. Because the secretary of either of these bodies adopts a particular attitude, that is not to say that the members support it, or that they have instructed him to adopt it. It is therefore not true to say, as a contemporary does, that one letter from the C.T.C. represents the views of 30,000 cyclists; it is not true that a letter from the N.C.U. embodies the opinions of 60,000 members. There is a large overlapping membership, for many members of the C.T.C. are also members of the N.C.U. and vice versa. We know many members of both bodies who do not support their organisations on the subject of rear lights. For these bodies, therefore, to accuse Mr. Noel Baker of deception, distortion of the truth, and suppression, is fantastically untrue. It is truer to say that they themselves have been guilty of it. However, everything that can be said about rear lights for and against has been said. We adhere to our view that a reflector of efficient design is good enough for all vehicles. The fact that cyclists must, unless the Act is repealed, carry rear lights in peacetime has largely been due to the careless manner in which the organisations have handled the matter, and they have only themselves to blame for the considerable loss of prestige they have sustained, as well as for their wounded pride.

Now we learn that it is going to be made a major issue at the next General Election. Cyclists are going to refuse their votes for those candidates who are not opposed to rear lights, and pledged to the repeal of the Act. In other words ten million cyclists, in order to impose their will on a comparatively trifling matter, are prepared to put into power any politician who may have the most rabid views on matters as unpalatable as rear lights are to cycling organisations.

Suppose every anti-motorist, every prohibitionist, every anti-vivisectionist, and every other anti adopted the same methods. Parliamentary representation would become a farce. Fortunately, cyclists will not succeed at the next General Election by these methods even if they were minded to do so. Among the ten millions the highest proportion are intelligent and reasonable individuals. Very few of them indeed belong to cycling organisations.

We deplore these methods, which we have labelled in a previous issue as editorial blackmail.

Mr. Noel Baker has stated that other road users are also to be subjected to greater restrictions. Apparently the Government is of the opinion that it can make our obsolete roads suitable for the ever-increasing numbers of vehicles which use them by imposing regulations upon the users.

Successive Ministers of Transport have tried this method without appreciably affecting the appalling numbers of accidents which occur each year. It should be obvious from this that you cannot make laws against human nature and accidents proneness, or, alternatively, that road users are not to blame for the greater number of accidents. It is impossible to refute the logic of this argument. Regulations will not prevent accidents. Had the Road Fund been used for the purpose for which it was introduced, namely the construction of new roads and the widening of old ones, we have no doubt that the accident figures would by this time have reached negligible proportions.

The cycling organisations, however, have for years been attacking motorists and laying the blame for accidents at their door. They cannot complain, therefore, if the Minister of Transport now asks them, as it is expected he will also ask pedestrians, to bear some share of the responsibility for making the roads safer.

It is a great pity that the Government announcement concerning the new regulations to be introduced was not accompanied by a statement of policy on post-war road construction.

The Cambrae Race

SOME surprising statements were made at the meeting organised by the B.L.R.C. in Glasgow last month to discuss the policy of the club. The N.C.U. case against it was well put by several speakers who seemed anxious to occupy the whole time of the meeting, and thus prevent the B.L.R.C. from putting its case. One speaker, having spoken for over 20 minutes, was warned by the chairman, but he continued to hold the floor, and to set aside all constitutional methods of conducting such meetings.

However, one speaker, in arguing against massed-start racing on roads open to the public, drew attention in glowing terms to the N.C.U. Cambrae Race, stating that it was efficiently run because the roads were closed, that there was no danger to other road users, and so on. The startling statement was then made:

1. *The roads to Cambrae were NOT closed because the local Council had no powers to close public roads.*
2. *Motor-cars, horse-drawn vehicles, and pedestrians had free access to the roads.*
3. *At one point the roads were quite busy with passengers alighting from the landing stage.*
4. *Therefore the N.C.U. organised the Cambrae Road Race under the same conditions as the B.L.R.C.—with the co-operation of the police and the local authorities!*

The N.C.U. protagonist was unable to answer this challenge. There is no suggestion, of course, that the race was anything but properly run. This very fact, however, supports the contentions of the B.L.R.C. that massed-start racing on the open roads if properly run is as free from danger as any other form of cycle racing or touring.

What are the C.T.C. Hardriders' Runs but massed-start racing? The N.C.U. will find the Cambrae race a nasty thorn in their side, especially as they adopted the ill-advised procedure of writing to the Home Office, propped up by that newer underling the R.T.T.C., a letter which they thought would result, after the Home Office announcement, in massed-start racing being banned. We are looking into the subject of the closure of the roads for N.C.U. races to ascertain whether it has been legally done in the past.

It is our present view that local authorities have not the power to close roads for purposes of sport, a view which is also held in high quarters. Our only interest in this matter is to see fair play for all.

Twenty Years President

MALCOLM SMITH, re-elected president of the Nightingale C.C. has commenced his twentieth year of office in that position.

Ritchie Dickson Called Up

RITCHIE DICKSON, 1944 rider of the Carluke C.C., has been called up for National Service and is now a "Bevin Boy" in Dunfermline.

Clarion's New Home

THE headquarters of the Clarion in Glasgow have now been moved to 6, Queen's Crescent, St. George's Cross, Glasgow, where a clubhouse has been purchased at the cost of £1,750.

Clubman Honoured

PILOT-OFFICER WM. (SONNY) HENDRY, third brother of the Glasgow cycling family of that name, has been presented with a cheque for £100 to commemorate his award of the D.F.M. by residents of the Glasgow suburb in which he lives.

Peter Glen Called Up

PETER GLEN, club captain of the Glasgow Nightingale C.C., has been called up for National Service, and has joined the Army.

Compassionate Leave

JIMMY McCABE, Zenith Wheelers, has been given three months' compassionate leave and expects a compassionate posting when the leave is up. He has been abroad for four years.

Eleanor Collins's New Club

ELEANOR COLLINS, East Scotland record breaker and former member of the White Heather C.C., has joined the Carluke C.C. for the 1945 season.

Hepplestone's New Role

CYRIL HEPPLESTONE, pre-war crack professional, is the president of the Yorkshire Road Club.

New N.A. President

A. J. BRADBURY, of Manchester, is the new president of the National Association of Cycle Traders. He is also president of the Manchester Wheelers.

Norwich A.B.C. Loss

A. J. NUDDS, Norwich Amateur Bicycle Club, has been killed in action in Germany. He served from El Alamein to Tunisia before going to France on D-day.

Grantham's Coming-of-Age

GRANTHAM Road Club, which this year celebrates its coming-of-age, anticipates promoting a series of road events as well as a track fixture as part of its celebrations.

Massed Start Expert Killed

ALICK BEVAN, member of the 1936 Olympic Team which went to Berlin, and pre-war massed start expert, has been killed in action in Germany. A member of the Fountain C.C., he was at the time of his death a lieutenant in the Army.

Caithness Attraction

THURSO Social C.C., by opening its clubhouse, has achieved the distinction of having the most northerly headquarters. Sir Archibald Sinclair's daughter, Miss Catherine Sinclair, performed the opening ceremony.

Prisoner of War

SGT. K. CONSTERDINE, Manchester Road Club, formerly reported missing, is now known to be a prisoner of war in Germany.

Killed in Action

SGT. H. BECKETT, Priory Wheelers, and Sgt. H. Pearce, Broad Oak C.C., are among the well-known clubmen who have made the supreme sacrifice on active service on the Continent.

Decorated

AMONG the latest clubmen to be decorated for gallantry are Flt./Sgt. A. E. Smith, Tudor Road Club, who has been awarded the Distinguished Flying Medal and Sgt. L. Mahon, Walton C. and A.C., whose Military Medal recognised bravery in Burma.

Appropriate

SERVICE cyclists in Aden have formed the Barren Rock Wheelers.

Adriatic Activities

VIC DIGHT, Somerset Road Club, had the distinction of winning the first time-trial run by members of the Adriatic Wheelers in Italy. He clocked 30 mins. 20 secs. for the 10 miles.

Warm Work

WITH the time of 2.27.40, Dennis Clamp, Doncaster Wheelers, won the Open "50" promoted by the Crusaders Wheelers in Palestine. There were 24 starters and 20 finishers.

Good News

REPORTED missing following the gallant stand at Arnhem, Sgt. L. Hedgecock, Ipswich A.B.C., is now known to be a prisoner of war in Germany.

Hartley Discharged

D. K. HARTLEY, prolific time-trialist of a year or so ago, has been discharged from the R.A.F. and hopes to resume competitive riding this year.

Manchester Road Club's Loss

MANCHESTER Road Club have lost nine members on active service, the latest being F./O. E. Ellis, R.A.F. Ferry Command, whose untimely end occurred while returning to this country from Iceland.

Oldham Rider Decorated

CAPT. A. HARTLEY, prominent Oldham rider, has been awarded the Military Cross for devotion to duty while in action in Italy.

Rotherham President

W. BALL, Rotherham C.C., has been elected president of that club for the eighth consecutive year.

Old Timer Dies

ARTHUR ELLIOTT, of Bramley, Leeds, has died. He was 75 and had been associated with the Yorkshire cycling movement for upwards of 50 years.

L. F. Dixon Retires

LAURIE DIXON, Oak C.C., has retired from the secretaryship of the North Middlesex and Herts Cycling Association. He has been identified with the Association's activities for many years.

D.F.C. Award

F./O. J. POULTNEY, Wolverhampton Wheelers, has been awarded the D.F.C. for outstanding work while engaged on operational flights over Germany.

West of England Loss

PROMINENT in West of England cycling activities for over 50 years, Charles Glenister, of Bristol, has died. He was a life member of Bristol South C.C.

News of Choque

PAUL CHOQUE, the Frenchman who attempted the Land's End-London record just before the outbreak of war, has, from his Paris home, decided to retire from racing. It is said that he hopes to establish a cycle business in the South of France.

Hostel Commemoration

SIR JOHN STIRLING MAXWELL has promised to re-build Loch Ossion Hostel, Rannoch Moor, as a memorial to hostellers who lost their lives during the war.

Survived Dunkirk

ROBERT GIBSON, Farsley and District C.C., who was successfully evacuated from Dunkirk, has been killed in action in Holland. He is the third club member to make the supreme sacrifice.

Southampton's Record

THIRTY-ONE members of the Southampton C.C. are serving with H.M. Forces and the most recent death on active service is that of T. Anderson who was serving with the Merchant Navy.

Early in the Air

RONALD EARLY, Vectis and Hampshire Road Club, is now a Sergeant Air-Gunner attached to a R.A.F. Squadron in Italy.

Around the Wheelworld

By ICARUS

"Hig"

A CORRESPONDENT in a club journal states that Yorkshire people have a terse little word to express a display of peevishness. He was referring to a letter he had received from an M.P., who was so misguided as to *dare* to write to him saying that he had no use for the childish manner in which the C.T.C. is acting, and stating that the red rear light was absolutely essential. He further emphasised that he had no intention whatever of supporting opposition to the Bill.

Well, that word "hig" should be applied to the display of peevishness by many members of the C.T.C. who hail from the County of Broadacres, whose inhabitants are proud of their pugnacious protagonism even for lost causes. In my view, many of these Northerners are more concerned with their wounded pride than they are with the question of compulsory rear lights. For many years these Northerners have been able to boast that their pugnacity resulted in the compromise of reflectors. Personally, I am not concerned what slang terms Yorkshire people apply, for it does not enhance the reputation of a county which smugly imagines that it is a principality like Wales. For too long have Northerners endeavoured to control the cycling movement. For years they have argued against what they like to call control from the south. They have in many instances been a disruptive force in the cycling movement. I therefore do not have to resort to the Yorkshire vernacular in seeking a label for the peevishness now being evinced by these Northerners. The English dictionary is good enough for me. I label it as jut-chinned ignorant bellicosity.

Now I see that they are threatening to use the General Election which may take place this year, to foment opposition to the Act! What a fantastic mentality! We are to have a House of Parliament composed of Members put into power to oppose rear lights. Because there are ten million cyclists, it is thought that there will be ten million votes for those candidates who are prepared to announce from a public platform that they will press for the withdrawal of the Rear Lights Bill. It does not matter what the views of the candidates are on post-war reform, or other vital matters, so long as they oppose rear lights and cyclists can ride without them. My own view is that rear lights are not necessary on any vehicle, and in any case a reflector is adequate. I cannot, however, support the blackmailing methods now proposed to secure a reinstatement of reflectors only.

There are rather more than ten million people who pay Income Tax, and if every taxpayer refused to vote for any candidate in favour of Income Tax, the country would come to a pretty pass. In any case I do not think that cyclists are going to get their way through the election platform.

Contributory Negligence

THE new Bill, which entitles an injured party to obtain damages even though by his negligence he contributed to the accident, does not specifically mention accidents which occur on pedestrian crossings. It will be remembered that Hore-Belisha, when he was Minister of Transport, gave pedestrians an absolute right-of-way on these crossings, and if a pedestrian were knocked down and injured, or killed on one of these crossings, the cyclist or motorist could not plead contributory negligence.

If a man, therefore, wished to commit suicide without invalidating insurance policies, he only had to jump in front of a bicycle, or a car, on one of these crossings, for a verdict of manslaughter or dangerous driving to be brought against the driver of the vehicle concerned.

This was manifestly unfair, and I discussed the matter at great length with Hore-Belisha, when he was M.O.T. I pointed out to him that people do occasionally commit suicide, but their dependants were unable to frank the insurance policy on the life of the deceased.

I have, therefore, taken up the matter again in relation to the new Bill, and understand from the Government lawyers that the present position is as follows:

The case of Bailey *v.* Geddes was taken by everyone, including the Court, to mean that the defence of contributory negligence was not open to a motorist who ran down a pedestrian on a crossing. This was the view clearly taken of it by Mr. Justice Croom-Johnson in the case of Sparks *v.* Ash. This case, however, went to the Court of Appeal in 1943, where the Lords Justices unanimously decided that Bailey *v.* Geddes did not mean what it was thought to mean, and that the defence of contributory negligence is still open to motorists and cyclists in these cases.

The Law Reform (Contributory Negligence Bill) if it becomes law will affect these cases in precisely the same way as it affects all other cases where there is both negligence and contributory negligence.

The Cambrae Imbroglio

THE meeting organised by the B.L.R.C. at Central Hall, Glasgow, on March 3rd, proved to be a stormy affair. Tempers ran high. But as a result, 24 of those present were in favour of forming a Scottish section and 17 against. There were 27 abstentions, due to the fact that delegates were reporting back to their clubs.

One startling fact, however, emerged. One member opposing massed-start racing on open roads was referring to the Cambrae race organised by the N.C.U., drawing attention to the efficient way in which it was run on closed roads, when his statements were hotly denied by many speakers, some competitors, and some spectators. It transpires that *the roads of Cambrae were not closed because the local council had no powers to close public roads.*

Motor-cars, horse-drawn vehicles and pedestrians had free access to the roads. At one point the roads were quite busy with passengers coming off the landing stage, and therefore the N.C.U. organised the Cambrae Road Race under the same conditions as obtained for B.L.R.C. events—that is to say, with the co-operation of the police and local authorities.

Mr. Taylor, the chief supporter of the N.C.U. at this meeting, was unable to answer these charges.

Such phrases as "shameless journalists who suppress news," "defeatists, appeasers, and men of Munich," "flagrant violation of constitutional methods of discussion" were freely used. Mr. Taylor apparently endeavoured to dominate the meeting, for he was on his feet for over 20 minutes when the chairman had to ask him to abbreviate his further remarks. He left the meeting, stating that he would continue his efforts to prevent B.L.R.C. activities in Scotland.

Bicycle Polo

THE hon. sec. of the Bicycle Polo Association (George Brake, 36, Montpelier Road, Purley, Surrey) states that copies of the illustrated brochure dealing with bicycle polo can be supplied for 2½d. a copy post free. This brochure deals with the history of bicycle polo, advice to the novice, the objects of the Association, the rules of the game, and gives details of the championships.

It is well illustrated. A scheme is afoot for post-war reconstruction of the game of bicycle polo.

Herne Hill

THE N.C.U. announce that plans for the season are well in hand. If any of our readers would like to serve in some official capacity at various race meetings they should write to the National Cyclists Union, 35, Doughty Street, London, W.C.1, as a panel of such officials is being compiled. When writing state whether available for evening, and/or Saturday evenings.

Anson Cycling Club

A NEW Liverpool club, known as the Anson Cycling Club, has been formed; the hon. sec. is L. Potter, and the address of the headquarters is 41, Castor Street, Liverpool, 6. Interested cyclists are invited to get into touch.

N.C.U. General Council Meeting

THE General Council of the N.C.U. will meet in Birmingham on April 14th and 15th; the latter date being reserved for a discussion on the post-war planning committee's report.

S.C.C.U., A.G.M.

A PROPOSITION by the London Clarion C. and A.C. that the S.C.C.U. agrees to the fusion of the R.T.T.C. and the B.L.R.C. was defeated. An amendment to this advocating the recognition of the B.L.R.C. as the controlling body for massed start racing was also defeated. W. A. Smith was re-elected president; S. Amey as secretary; E. E. Cleeve, treasurer; and the new road secretary, S. M. Butler. After five years the trophies are again to be awarded.

The Old Manor House

THE Old Manor House, Solihull, was built in the year 1472 in the Forest of Arden as the ancestral home of the Greswold family. A responsible committee of local residents has undertaken to raise by means of voluntary donations the £12,000 necessary to purchase the Manor House from its present owners, and thus preserve it for Solihull, the Midlands, and the nation. The money will be vested in a Trust Fund, and the property held in trust in perpetuity. Each donor of £5 or more will be given a certificate conferring on him or her certain rights in the future of the Manor House. Unless the money is forthcoming quickly the house is to be demolished. It is proposed to use the Manor House for a dignified meeting and dining hall where residents of all tastes and interests and local societies can foregather in comfort; to offer approved youth movements which at present lack accommodation a resort for recreation and for their healthy activities, and to offer to Service men and women amenities not readily available through existing organisations.

Further details are available from D. D. McLachlan, Britannia Works, Aston, Birmingham, 6.

Wayside Thoughts

by F. J. URRY

In the picturesque village of Lacock, Wiltshire.

The Old Days

AND now we are in the midst of spring, which in ancient days not only made the poets sing, but brought out the butterfly cyclists, brakeless and mudguardless, on to the drying highways. That was 50 years ago, when the comparatively few of us who rode most days of the year, were inclined to consider ourselves little heroes. It is curious to look back to those days, to wonder why we rode without the protection of mudguards, and why we pushed very high gears. I suppose the answer really is that the craze for lightness in cycle construction was as great or greater than it is to-day, and because there were no free wheels our gears were tall for the purpose of scampering down hills at the highest possible speed. In those days of the 'nineties all roads were of the mud-pie variety, and once they had become thoroughly soaked in the late October rains, they remained soaked, and often an inch thick in curly glutinous mud until the coming of the spring breezes, or until frost intervened, and then we had ribbled surfaces to ride on with deepish ruts which were often troublesome to negotiate. And I am speaking of the main roads, for very few of us attempted the lanes in the winter, and there was really no need why we should, for in all consciousness the big highways were lovely enough. Came the spring that dried the mud, swept it into dust; then the April showers to swill the dust away, and I tell you—who so well remembers—that our favourite highways were beautiful tracks over which to ride, reminiscent of a good race path of the red cinder variety. It is a mistake to think the pre-motor era roads were bad; they were good for their purpose; but when the early cars and motor-cycles had chewed them up, they were really bad. But the changes brought the waterproof road surfaces, and gave traffic smooth going everywhere.

Winter Pictures

TAKING it all round I enjoyed a good cycling winter, for in my part of the country snow did not intrude in sufficient quantity to stop travel on two wheels, and icy conditions occurred but rarely, and when they did happen I made my daily journey with circumspection, creeping along near the kerb where the grit has been thickly gathered by the centrifugal force of the passing cars. That type of cycling is the most unhappy condition the regular cyclist has to bear, for it means slow progress on cold mornings, and adds chilliness to the sense of danger. For danger does exist, not so much in the cycling sense as in the fact that, knowing the slippery roads, you are well aware that if you stumble, the overtaking car—if any—has little chance of pulling up in time to escape contact. Fortunately, there haven't been many of those abominations known as a "silver thaw," one of the road surface conditions we have to grin and bear as payment for the benefit of our smooth surfaces. In the old macadam days the worst we had to contend with was the beaten snow and the schoolboy slides down the small declivities; but there were no motor-cars to glissade into us. Since the turn of the year the country scenes have oftentimes been magnificent, and the people who say there is little or no enjoyment in winter cycling lack the spirit of adventure, or being chilly mortals prefer the inside of a warm room. But I contend the comfort and enjoyment of the latter are enormously heightened after a day out in the sparkling atmosphere of a frost, when every twig is jewelled and the sleeping earth is waiting for the spring to awaken it. To change your roof for a meal is to change your outlook and habit; and that is good for everyone. Go warmly clad, stretch your legs frequently by walking hills, know where there is a welcome, a fire and a warm drink, and this winter cycling not only keeps you fit and happy, but gives you a series of pictures in outline that no other season of the year can present.

Everlasting Youth

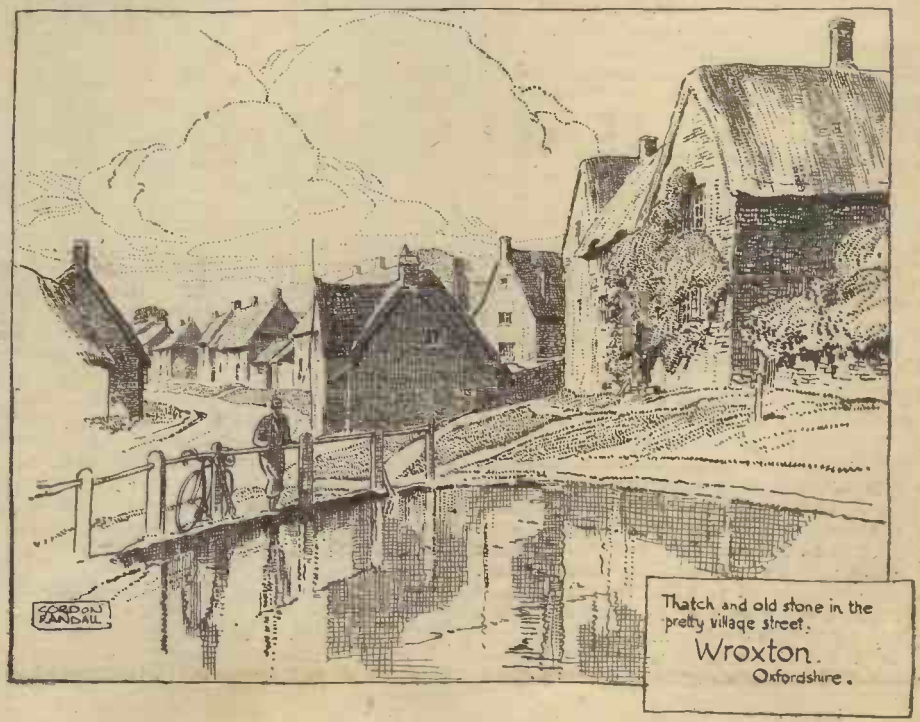
A FRIEND of mine has promised to make me a new bicycle, and have it ready for the road in time for Easter. He has some pre-war material, and with both the maker and customer keen on the object in view, I think we shall manage to turn out a good job. Anyhow, I hope so, for this will be the first new machine I have received since the spring of 1940, and I do love new bicycles. It may be boyish—and I'm certainly not ashamed of it—but I still get a thrill out of possession, and if trial comes up to hope and expectation, then all the youthful happiness returns in full flood, and I begin to re-learn once again how much a bicycle means to my joy in life. As the matter is planned this machine will not be a post-war model in the generally accepted sense of that term, but rather a pre-war specification of the highest class with light tyres, stainless rims and a four-speed gear, and the sombre, but lasting finish of all black, which I always prefer, and which I have found not only saves a whole heap of attention and trouble, but looks right and respectable when it has collected many thousands of miles of travel through the vagaries of our climate, and over the roads and tracks where I shall surely take it. The modern idea is plenty of colour and plate, and I know many young people who pay quite a big price extra in order to satisfy their longing in this matter. Nor am I criticising them, for I did the same thing once, and as far as I remember found a kind of joyful pride in keeping the bright parts bright and the enamel nicely polished. No doubt about it, the post-war bicycles will announce their arrival on the scene by way of their colourful show; it will be the reaction to the present repressions; but my machines will still be black, with personal attention given to adjustment and lubrication, and someone else—I hope—will occasionally remove the mud of the shires.

Rear Lights

LORD LEATHERS' Bill for making rear lights, reflectors and white patches the permanent ware for night riders, has gone through the House of Lords with the minimum of debate, and now is law. I don't like the manner of its introduction. On the first count are rear lights necessary? And when I ask that question I am not confining my remarks to bicycles, but including cars and lorries. The reflector is efficient, and we all know it to be; it is permanent, and once fitted, costless. With the full power of head lights on motor vehicles restored, where is the man who will contend that the road ahead of him and anything on it cannot be seen? If such exist then they are surely self-condemned as incapable of proper sight to be trusted with a driving licence. Red lights should only be used to mark a road excavation and for no other purpose. Rear number plates on cars can be illuminated without a rear-light. Such a law would be simple, efficient, and place responsibility firmly and finally on the proper party—the overtaker. If it is argued that rear lights are essential, then what about the pedestrian? And I ask you in all seriousness what about me, being run down and rendered unconscious, would my rear light have been functioning? You cannot expect people to condemn themselves on their own evidence. I will say no more on this subject at the moment, beyond the manner in which the Bill has been timed to catch cyclists on the hop, without any warning that such a measure was contemplated, and for the purpose, it seems to me, of taking advantage of an old-age Parliament, and the fact that hundreds of thousands of cyclists are in the Services. It is a forecast of the manner in which legislation affecting cyclists is likely to be dealt with by privilege, piecemeal fashion, until this same privilege has steadily robbed us of our hardly won freedom gained in 1888. Unless we defend that freedom from such hole-and-corner attacks as this, we are a pack of easy fools—with a vote and the power to use it.

Keeping On

IN the many letters I receive from the boys in the Forces, always the *leit motif* runs on the same theme: when will the day arrive to go "down the road." In the nature of things, most of my correspondents are young men whose activities were largely spent in the speed game, and many of them wonder if their years of Service life will have worn away that sparkle of youth to which competition is the magnet. What if it has? Does it really matter? I am not one to detract anything from the clean competition of cycle racing in any form, for in any case it would be disloyal in me who had his day, and—here is the point—went on to a still greater enjoyment of the pastime, wherein there were no disappointments of form, and one could enjoy by proxy, the muscular vigours and stretch of speed, without it hurting. I receive other letters from men nearer my own age who delight in the quietude of cycling, its abundant glory in beauty, and the easy fitness it leaves with a man, no matter what his physical or mental conditions may be. These elderly brethren as often as not write of the younger speedsters as missing the real joys of cycling, whereas the fact is that the youngsters are enjoying the preface to real cycling, which their mild critics have probably missed, and doubtless are none the worse off for that. What I would like to say to all the lads, and especially the Service lads, whose main interest has been the sport of cycling, is not to miss the mellower times that lie ahead of them; not to forgo the invaluable lessons of the sport, but to apply them to the glorious pleasures of easy cycling; and to remember the help they received from comrades in the heyday of their great athleticism, and render such assistance to the generation immediately following them. Too many people drop out when their racing days are done, drop out at a time when they can take things easily, being superb riders, and hold their fine physical condition to the very end of life. I know; I have done it—almost, and I tell you such a habit is invaluable in health, activity and the quiet joy of lovely things in a lovely land. It is nice and comforting to know the whole story, for you can never quite "catch up" if you miss a chapter; and that is the reason why I say do not quit, for this is the one game you can play to the last minute of activity, and its variations are endless.



Thatch and old stone in the pretty village street.
Wroxton.
Oxfordshire.

CYCLORAMA

By H. W. ELEY

Kingsand, Cornwall. A steep little street leading to the tiny quay.

The Bike from the Hop County

YES! There's a good bike comes from Kent, the Garden of England, and one of the counties I particularly love. It is, of course, the "Norman"—and I was reminded of it when, at a recent luncheon of the Roadfarer's Club, I sat next to Mr. Fred Norman—and talked to him about his native Ashford, and of hops, and apples, and the glories of Canterbury. I was interested to hear, from Mr. Norman, of that veteran newspaper proprietor Sir Charles Igglesden, of the "Kentish Express"—the author of over twenty volumes about Kent—and still active in his business. But then "Kentish Men" or "Men of Kent" are notoriously tough and long-lived!

Still Short of Cycle Pumps

MANY riders have told me that they still find it very difficult to buy cycle pumps, and they are a little ironical about it, in view of the constant appeals to "keep your cycle tyres inflated *hard*." I suppose that the manufacturers could put up a very good case why we must be patient, and borrow a "pump from a pal" still. Let us console ourselves with the thought that we are, maybe, nearing the end of the long war road, and that soon, lots of things in short supply will be freely available.

A Great Touring Book

I THINK it was about the year 1920 when the first and sumptuous "Dunlop Book" made its appearance—under the direction of the late Edward J. Burrow. It was somewhat of a monumental work, and remains, I fancy, one of the finest touring volumes ever compiled. It was distributed widely to hotels, and even to-day one may often find a well-thumbed copy in the lounge of a country hotel. I have come across the book in remote places in the Highlands, in the coffee-rooms of commercial hotels in industrial towns, and in doctors' and dentists' waiting rooms. Well worth reading, even to-day, is the fascinating article on Motoring by Lord Montagu of Beaulieu—a true lover of the road, and a great pioneer. Edward Burrow has passed on, but the man who collaborated with him in bringing out this famous work, A. J. Wilson ("Faed" of immortal memory), is still alive, and lives I believe in the Cotswolds—where he still rides a tricycle.

Inns and Inn Signs

"THE CYCLIST"—in its early days—made a noteworthy contribution to the literature on this fascinating subject by publishing a "Dictionary of Inn Signs" which gave a mass of information about the curious derivation of inn names, and the history of some of the more famous taverns of our land. I have been "dipping into" this Dictionary recently, and still find it full of interest. There is room for more literature on this subject, for the inn, and its sign, are inherent in the story of England. Our older inns are sign-posts of the past, and tell us, like ancient churches, much of the life of our forefathers. For years I have made notes of out-of-the-way names I have come across whilst cycling, and recently, I was intrigued to see the sign "The True Lovers' Knot"—as near to London as Northwood in Middlesex. It is a pleasing name, with a smack of romance, and is a welcome addition to my collection.

"Hercules" Advertising

THE sight of a new style of Hercules advertisement in the Press the other day, reminded me that G. A. Hoffman, known to a host of friends as "Mick," who has just left the advertising firm of H. C. Longley Ltd., was for several years with Hercules—in fact it was during those years that he built up his wide circle of friends in the cycle industry. "Mick" lives in Birmingham, and is, I understand, establishing his own advertising agency there. He will not lack friends, and possibly, in the future, we shall have evidence that he is behind some big cycle publicity, for good advertising is an asset to any business, and "Mick," with his knowledge of the cycle trade, will know how to put it over.

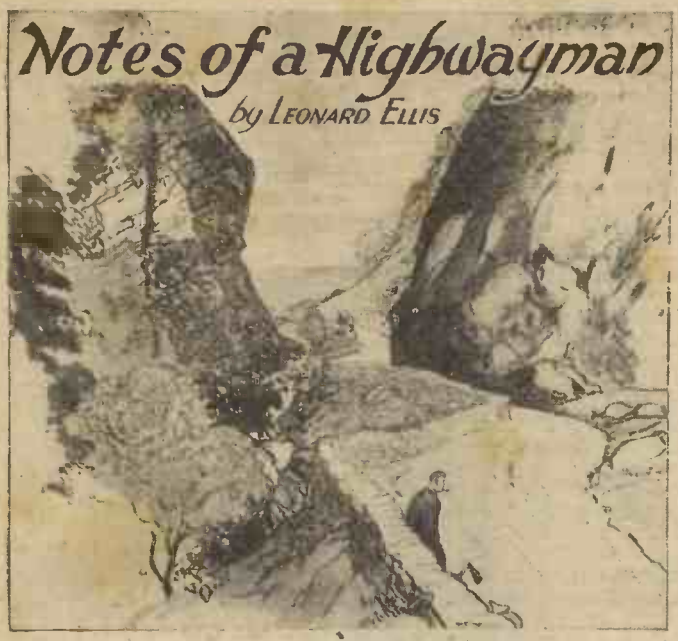
Mary Ann Evans

A COMMON enough kind of name, conjuring up visions of the kitchen maids of our youth. But the lady of this name of whom I am thinking won immortal fame under a pen-name—for "George Eliot" was really Mary Ann Evans. I am thinking of her, and her works, because just recently I had occasion to cycle to Nuneaton, in the Warwickshire coalfield—and nearby of course is Chilvers Coton, where George Eliot was born in the year 1819. The "Shepperton" in her story "Amos Barton" is really Chilvers Coton, and it has always been assumed that she selected the name "Shepperton" because the origin of Chilvers Coton is "Sheepcotes." Despite King Coal, it is a goodly country around Nuneaton, and there are some good villages, like Twycross, and Norton-Juxta. And only six miles distant is ancient Atherstone, on the line of the Roman Watling Street.

Looking Forward

EASTER DAY is on April the First—a date noteworthy for other reasons! And Easter is the time of the first great carnival of the road. I shall hope to spend my Easter in some pleasant countryside, where I can witness the "new stirrings of the good earth," and be rewarded on my ride by the gladsome sights of Spring—daffodils waving in the breeze, lambs frisking in some green meadows, pussy-willow by the banks of a stream, and—who knows?—maybe the gay bunting fluttering out the glad tidings of Peace. In any case, every cyclist I have ever known looks forward to Easter, and the open road, and for those of us lucky enough to snatch from our wartime toil three or four days, the longing we had on other week-ends to journey to those distant hills on over that mountain track, their contours and deviations so often studied on the map, can be realised at Easter; and so I say—roll on Easter.

By the pond at Welwyn, Herts.



The Pass of Melfort, Oban, Argyllshire, Scotland.

Britain's Touring Grounds—(5)

THERE is no doubt whatever that the five touring grounds already reviewed, Devon and Cornwall, Scotland, North Wales, Ireland and the Lake District are the prime favourites. Year after year the numbers of tourists seeking information on these areas easily occur in the first five places on the list. Beyond that point the position is a little obscure. It will be seen, however, that these five are the largest possible touring areas available in the British Isles, and apart from these the other recognised touring grounds are smaller and more compact. Very high up in the list and often occupying sixth or seventh place is a composite area embracing Hampshire, Wiltshire and Dorsetshire, and a tour in this region will soon convince anyone that there is good reason for the choice. In the three counties there is a wide range of types and scenery, and although each county is quite distinct from its neighbours, there are certain overlapping features. Wiltshire is, of course, the county of rolling plains, of chalk hills, of quiet and pleasing towns, and above all a county of antiquities.

A Prehistoric Area

NO other county can show a tithe of the immense wealth of Wiltshire in prehistoric remains. In a brief sketch one may mention the outstanding gems such as Stonehenge, sometimes connected with the Druids, but much more likely to twice as old; Avebury, where only a shadow of the immense city of temple now remains in the form of colossal stones and ditches; Silbury Hill, the largest artificial hill in Europe, akin to the Pyramids, and still a puzzle to the antiquarians; the White Horses carved on the hillside, some going back to the Danes and Alfred, others merely relics of 1914-18; Old Sarum, that amazing and beautiful tended pile of ruins near Salisbury. Then one remembers Salisbury with its lovely cathedral and market cross; Malmesbury with its cross and old abbey, Lacock and Castle Coombe, two of the most beautiful villages in the length and breadth of England.

Forests and Antiquites

HAMPSHIRE contains some of the overflow of these but generally, as a county, it is not really popular as a touring ground. The real interest, apart from scattered features, is centred round two large areas, first the New Forest and, second, the Isle of Wight. Both are beautiful areas and extremely popular. The island is a self-contained little Paradise containing all types of scenery, and to a tourist with little desire for miles it is ideal. The forest is full of beauty, interest and history, and not the least of its pleasing features is the number of wild ponies met with along the roads and even in the villages. Dorsetshire, on the other hand, is a popular county, although again one must admit that the major attractions are concentrated, this time on the coast. Dorset is certainly very fine inland and there are many charming old-world towns and villages, but it is the coast line of Dorset that attracts, and having once drawn it continues to exercise its influence. It is possible that there are few more pleasing little bays than landlocked Lulworth Cove, and apart from its beauty it is otherwise most interesting, being something of a freak of nature.

A corner of old Lacock, Wilts.

Delights of Dorset

WARBARROW HEAD, PORTLAND, the gigantic wonder of Chesil Beach, the grey cliffs of clay from which one can dig splendid fossils with the fingers, the quiet interesting coast beyond Weymouth, with land-locked lagoons and hordes of wild birds, the old swannery and interesting buildings at Abbotsbury; all these are mere headlines. Only three counties, and quite near to London, but what a tremendous amount of real beauty and pleasure.

My Point of View

By "Wayfarer"

The "Curse" of Scotland

WRITING in this page a few months ago with regard to the new committee which has just been set up for the purpose of putting Scotland well and truly on the map as a holiday resort, I suggested that one of the first steps to be taken was to find some means of getting rid of the cannibal midges which infest "the Land o' Cakes." Judge of my gratification —and surprise—two or three weeks back when I happened to pick off the wireless a statement to the effect that a small committee was at work on the midge question. The brutes have apparently been conquered in other countries, and it is hoped that the curse of Scotland can be similarly dealt with. All touring cyclists will share that hope.

Colour Scheme

IT is the custom nowadays (though war conditions have interfered with it), for cyclists to go in for rather startling colour schemes, the black enamel which was almost "the only wear" for many years being now somewhat demoded. At a recent club run which I supported, my best bicycle—only six years old, and in prime condition, except for the rims, which are brown with rust—was made to look dowdy in the extreme, in the presence of so many gaudy colours. Possibly, however, a staid Old Gentleman (who can still move—especially down hill!) is suitably mounted on a bicycle of sombre hue (not forgetting the russet rims!), and I recall, with a measure of consolation, that certain of these gaudy bicycles are not quite so swift and so light as their colour schemes are intended to suggest.

Not for Sale

THE foregoing paragraph reminds me that the other day a facetious friend offered me "five bob for that bike when you've done with it." I chose to take the offer seriously and retorted that, if the "five" were turned into pounds and a nought put after the figure, my reception of the revised offer would be a chilly one. In short, I would require a lot more than £50 for my No. 1 bicycle. And that's a fact. I do not suggest, of course, that the intrinsic value of that bicycle is anything like the figure named, but its worth to me, personally, as an instrument of travel, as a purveyor of manifold delights, and as a producer of physical and mental health, is beyond all reckoning.

Casual Calculation

AT this point it may be germane to add that, in an idle moment over tea (in the open), towards the end of last summer, I asked my companion what would be his estimate of the total value of the bicycles by which we were surrounded. He must have read my thoughts, for he unhesitatingly gave the figure which was running through my head at the moment—£300. There were singles and tandems and a smattering of side-cars, and our hostess would doubtless have been surprised to learn that the aggregate value of the collection littering up her garden was in the region of the sum named.

Little Risk

AN all-weather cyclist is frequently confronted by the question: "But aren't you afraid of catching cold?" Speaking personally, the reply is in the negative. There is no doubt that most of us who cycle all the year round benefit by the hardening process which sets in, making it more and more difficult for us to suffer any ill-effects from exposure to climatic excesses. To say that, however, is not to suggest that we never crumple up. Now and again the weather does find a weak spot in our armour—or, shall one say, a temporary condition of affairs which leaves us susceptible to trouble—but these occasions are few and far between.

In my own case—and I have been "through the hoops" on many and many an occasion—I recall extremely few instances where I have bent under the storm. Certainly I did "cop out" one day a few years ago when cycling (and walking!) from Bettws-y-coed to Ffestiniog. Wind, heavy rain, and an exposed road formed an ideal combination for producing trouble, and 24 hours later I knew that something had "hit" me. It took the form of an internal chill, which was most unpleasant while it lasted, and left me with the strength of a kitten.

Only a few weeks ago I went through one of my supremely difficult and uncomfortable experiences as a cycle tourist, a journey of 62 miles occupying eight hours (including an hour for tea), thanks to the gale, the rain, the cold, and a temporarily defective lamp. On arriving at my destination, at 10.30 p.m., I put my feet into hot water, with mustard, and did not suffer the slightest harm from my exposure to the elements. Wet feet were the order of the day for the next few days, but I was none the worse. Thus, it is not untrue to say that, broadly speaking, one is not afraid of catching cold through exposure to our marine-store climate.

Incidentally, it makes me see red when people blame the climate for all their physical ills, and when they ask how one can possibly keep well "in such weather as this." After all, "such weather as this," is the birthright and inheritance of Britishers. We cannot alter the climate, but we can alter ourselves: we can adjust our habits to meet and conquer the admitted idiosyncrasies of the weather. Without claiming that regular cycling is an infallible preventive, I do positively assert that, if more people would submit themselves to the hardening process which the pastime affords, and if they would make a point of obtaining regular doses of that joyous open-air exercise which the bicycle provides, there would be a great improvement in the health of the nation as a whole, and a reduced tendency to blame "such weather as this" for every sort of common ailment. To me, as an open-air man, the incidence of winter sickness is no surprise, knowing something of the way in which so many people live.

Forgotten Phrases

"ANOTHER plate of bread and butter? Certainly." "What kind of jam would you like—strawberry, raspberry, apricot, greengage, loganberry, or marrow: or apple or bramble jelly?" "Would you like ham and eggs, followed by tinned pears and cream; or fillet of steak, with tipsy-cake to follow?" These are forgotten phrases, which we cyclists shall hear again at our catering establishments, in the good days to come.

HAVE YOU HAD YOUR COPY ?
If not order it now to avoid disappointment.

"AMERICAN MIDGETS"
Radios and Valves.

This useful booklet describes clearly with many circuit diagrams the peculiarities of the small American (Midget) sets from the repairer's point of view. Valves used in these radios are also described with base diagrams and characteristics
PRICE 2/8, post free
From V.E.S. (P), Radio House, Melthorne Drive, Ruislip.

"Easily the best soldering fluid obtainable."
This statement by a regular user of "BAKER'S" expresses the general opinion of motor and engineering trades. Sold in 6d., 1/- and 1/6 tins. *Also in Bulk.*

Baker's Soldering Fluid

SIR WM. BURNETT & CO. (CHEMICALS) LTD.
Gt. West Rd., Isleworth, Middx. *Hounslow 0476*

B.A. thread screws and nuts, 1 gross assorted, useful sizes, 2/6 ; ditto, brass washers, 1/6 gross ; fibre washers, 1/6 gross ; assorted solder tags, 2/- gross ; assorted small eyelets and rivets, 1/3 gross ; rubber-covered stranded copper wire, 1d. yd. ; heavier quality, 1½d. yd. ; very heavy quality, 2½d. yard ; ideal for aerials, earths, etc. Tinned copper connecting wire, 20ft. coil, 6d. ; ditto, rubber covered, 10ft., 6d. ; cotton covered tinned copper wire, single, 25 g., 12 yds., 9d. ; 50 yds., 3/-, many uses ; C.C. twin bell wire, 1/9 doz. yds. ; ditto, heavier quality, 2/3 doz. yds. ; ditto, flat rubber covered, 3d. yd. ; twin flat braided electric cable, 6d. yd. Wood's metal stick, 2½in. by ¼in., 1/- ; Sensitive permanent crystal detectors, Tellurium-Zincite combination, complete on base, guaranteed efficient, 2/6 ; reliable crystal with silver catswhisker, 6d. Reconditioned headphones, complete, 4,000 ohms, 12/6. All postage extra.
POST RADIO SUPPLIES,
33, Bourne Gardens, London, E.4.

TAPS AND DIES
SMALL TOOLS
GARNERS
SHEFFIELD ROAD, BARNSLEY
Phone : 2866.

RATCHET & REVOLUTION COUNTERS
Ask for Leaflet No. 18/3
Speed up to 6,000 r.p.m.

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

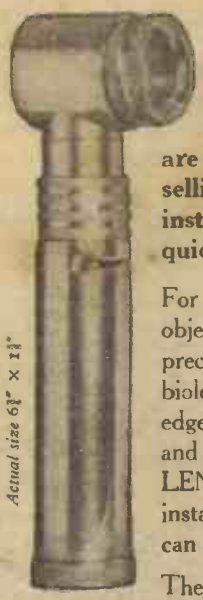

Easily made From Our Castings.
J. HALLAM & SON,
Upton, Poole, Dorset.

MINIATURE PETROL ENGINES for Aeroplanes and Speed Boats.
Send 3d. for particulars

---

4 USEFUL PUBLICATIONS
37, Aldwych, W.C.2.
1. **TOYS FROM SCRAP FOR PLEASURE OR PROFIT,** by W. Lee. 3/6.
2. **"THE ART OF SCALE MODEL AIRCRAFT BUILDING,"** by V. J. G. Woodason. 4/11 (3/6 cloth).
3. **"AROUND THE WORLD WITH PEN AND CAMERA,"** by W. Buchler. 1/6 (3/9 cloth).
4. **"MONEY IN EXPORTS"** (Trading in 41 different countries). 10/6.

NO MAN CAN KNOW TOO MUCH OF HIS PRODUCT


Actual size 6¾" × 1¾"

BRITISH MADE
Full particulars on request.

The Ultra Lens is a revealing eye of six actual diametrical—36 area magnifications, which brings out points of strength or weakness. Whether you are engaged in manufacturing, buying or selling, it is an ally of real value. No instrument you can buy will more quickly justify and pay for itself.

For the close scrutiny of every conceivable object, metals, tools, fabrics, fibres, minerals, precious stones, paint, print, manuscripts, biological and botanical specimens, cutting edges, fractured surfaces, raw materials, and innumerable other purposes, the ULTRA LENS is invaluable, and presents in many instances hitherto unsuspected data which can be used to advantage.

The price is **£4-5-0** complete in case with spare bulb, battery, and transparent measuring scale.

The Ultra Lens Company,
RICHARD BOCK,
75, Finsbury Court, Finsbury Pavement, London, E.C.2.

SMALL TOOLS
Drills, Reamers, Lathe Tools, Micrometers, etc.
EVERYTHING FOR THE ENGINEER-MECHANIC
Bench Millers, Lathes, Bench Drills, Electric Motors A.C. and D.C.
Send 4½d. for Lists
NUTTALL'S (LATHES) LIMITED,
MANSFIELD, NOTTS.

	"00"	"0"
G.O. WAGON PARTS ...	2/6	3/-
Wood, Strapping and Plan		
GRAY'S PRECISION CARD PARTS	—	—
N.E. FRUIT VAN ...	1/3	1/9
L.M.S. CATTLE WAGON ...	1/9	2/3
L.M.S. MILK VAN	1/9	2/3

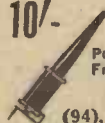
Postage 3d. extra.

BOOKS :
ABC OF "L.P.T.B.", 2/-, by post 2 2½.
"THE McINTOSH LOCOS. OF THE CALEDONIAN RLY.," 3/6, by post 3/9.
"MODEL RAILWAY CONSTRUCTION," 1/6, by post 1/8.
"MODERN LOCOS: & ELEC. TRACTION OF S.R.," 1/6, postage 3d. extra.
"CARDBOARD ROLLING STOCK AND HOW TO BUILD IT," 2/6, by post 2/9.
TYLDESLEY & HOLBROOK,
109, Deansgate, Manchester 3.
'Phone : Bla. 7312

IDEAS *WANTED !*

We are open to consider any ideas or patents of practical worth with a view to making and marketing them. Write in confidence to :
Edron Industrial Group,
7 Park Lane, London, W.1

"VIBRO-ARC" Engraving Pen

10/-

For rapid engraving any metal—hard or soft. Operates from 4–6v. Battery or A.C. Transformer.
Post Free
HOLBOROW,
(94), Boroughbridge, Yorks.

SILVER PLATING SETS
as supplied to Electroplaters, but in miniature, for small parts, etc., instructive small sets, 19/-, inc. post. Send 2d. stamp for printed folder. Materials for use with Electric Current, permanent Electroplating is carried out. Regret that no materials for Chromium, Nickel, Gold or Copper can be supplied owing to permits being required.
ARGENTA PRODUCTS (D. C),
40, Harrogate Road, LONDON, E.9.

Build your own
TOY or MODEL MAKER'S LATHE
from easily obtainable materials, costing 50/- to 60/-. Set of diagrams (6) and clear instructions for making all parts, including two types of Headstock and Chuck—Price 3/9. No castings or machining needed.
P. M. BARHAM, "Hilltop,"
Bradmore Green, Coulsdon, Surrey
(Parts stocked.)

A.C. BATTERY CHARGER

For charging car accumulators, either 6 or 12 volt at 1 amp., in enclosed metal case with change-over switch, input and output flex, leads and pilot light. A thoroughly efficient job. Price 60/-, post paid.

TRANSFORMER AND METAL RECTIFIER only, with blueprint of connections. Requires wood base only. Price 36/-, post paid. Parts, as above, for 2-volt radio cells, 12/6, post 8d.

FOR TRICKLE CHARGING CAR CELLS, parts with diagram. Output 1½ amps. for 6v. cells, 30/- set. For 12v. cells, 35/- set.

MICROPHONE BUTTONS, 2/3.

TELEPHONE WATCH RECEIVERS, 9/6 each.

ECONOMIC ELECTRIC CO.,
64, London Road, Twickenham, Middlesex.
Tel. : PCPesgrove 1319.

CHEMICAL APPARATUS


POST FREE APPARATUS OFFER
10/6
INCLUDING CHEMICALS
21/-
(England, Scotland and Wales only.)
Send 1d. stamped envelope for Price List.

BECK
(SCIENTIFIC DEPT A), 66, HIGH STREET, STOKE NEWINGTON, LONDON, N.16.
Booklet : "Experiments in Chemistry," 7d. P.O.

SPARKS' DATA SHEETS
Provide full constructional details and blueprints of Tested and Guaranteed Designs. **JUST RELEASED**
The LOQA4 PORTABLE A.C./D.C. AMPLIFIER. 8 Watts. P/P Output. Ideal for E/Guitars, Mike and Band work. Full details, 3/6.
Other Data Sheets :

Electric Guitar Units (3rd Ed.)...	5/-
Electronic One-String Fiddle ...	3/6
Microphone Trans./Current ...	2/6
Shocking Coil	2/6
A.C. Charger, 2 and 6 Volt ...	2/6
D.C. L.T. Charger	2/-
3½ Watt A.C. Amplifier ...	2/6
Two-Valve Amplifier (Battery) ...	2/6
High Gain Crystal Set (Coil Data)	1/6
A.C. Quality Two-Valver (Coil Data)	2/6
Compact Straight 3 (Batt.-Coil Data)	2/-
S.W. Super Two-Valver (Batt.) ...	2/6
Automatic Bias Circuits ; Ohm's Law ; Colour Code (R. & C.) ea.	1/3

L. ORMOND SPARKS (M),
9, Phoebeth Road, Brockley, S.E.4

SHORTHAND
DUTTON'S ONE-WEEK SHORTHAND is used by over 60,000 men and women. Accepted by Services and examining bodies. Test Lesson 3d. Write Dept. P.M., 92, Great Russell St., W.C.1.
IN ONE WEEK

You'll be glad you kept on saving when you can again buy an
ADANA
Adana Printing Machines
—TWICKENHAM, MIDDLESEX—

LARGE DEPT. FOR TECHNICAL BOOKS
FOYLES
★ BOOKSELLERS TO THE WORLD ★
New and secondhand Books on Engineering and all other subjects.
119-125, Charing X Rd., London, W.C.2
Open 9 a.m.-6 p.m. including Saturday.
Telephone : Gerrard 5660 (16 lines)
W. & G. Foyle, Ltd.

Free Guide — "Success in Engineering"

One of the following Courses taken at home in your spare time can definitely be the means of securing substantial promotion in your present calling, or entry into a more congenial career with better prospects.

ENGINEERING, AERO, ETC.

Radio—Aero Engines—Aero Navigation—Aircraft Design—Welding—Aerodynamics—Electrical Engineering—Television—Electric Wiring—Talking Picture Work—Generation and Supply—Works Management—Metallurgy—Refrigeration—Planning, Estimating, Rate-fixing—Time and Motion Study—Aero Inspection—Automobile Engineering—Sheet-metal Work—Engineering Draughtsmanship—Aero Draughtsmanship—Jig and Tool Draughtsmanship—Press Tool and Die Draughtsmanship—Structural or R/F Concrete Draughtsmanship — Sanitary Engineering — R.A.F. AND R.N. PILOTS AND OBSERVERS.

GENERAL

Matriculation—College of Preceptors—Chartered Institute of Secretaries—Aircraft Apprentice—Emergency Commissions (Army).

MUNICIPAL SERVICE

School Attendance Officer—Handicraft Teacher—Registrar—Relieving Officer—Sanitary Inspector—Weights and Measures Inspector—Inst. of Mun. and Cy. Engineers—P.A.S.I.

"PRACTICAL ENGINEERING" said—

We recommend all readers interested in improving their position to apply for a copy of this valuable Book. "Success in Engineering" is not a pamphlet. It is a 124-page book, containing valuable and vital information on all branches of engineering . . . There are many engaged in engineering who owe their success to The National Institute of Engineering.

The FREE GUIDE explains:

- Openings, prospects, salaries, etc., in Draughtsmanship, Inspection, and opportunities in all other branches of Engineering and Building.
- How to obtain money-making technical qualifications through special RAPID FULLY-GUARANTEED COURSES.

Write now for your copy of this remarkable publication.

A.M.I.E.E., A.M.I.Mech.E., A.M.Brit.I.R.E., A.M.I.P.E., A.M.I.C.E., A.M.I.Struct.E., A.M.I.A.E., A.F.R.Ae.S., A.M.I.S.E., M.R.San.I., London B.Sc., Degrees.

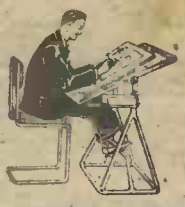
Fully guaranteed postal courses for all the above and many other examinations. Fully described in the Free Guide.

THE BUILDING BOOM— SECURE YOUR SHARE!

The Free Guide also gives particulars of our extensive range of modern Building and Structural Courses, Building Draughtsmanship, etc. The great post-war Building programme offers unlimited prospects to technically trained men.

—BECOME A DRAUGHTSMAN— or AERO INSPECTOR AND EARN BIG MONEY

Men and Youths urgently wanted for reserved occupations as Draughtsmen, Inspectors, etc., in **Aero, Jig and Tool, Press Tool, Electrical, Mechanical** and other Branches of **Engineering.** Practical experience is unnecessary for those who are willing to learn—**our Guaranteed "Home Study" courses will get you in.** Those already engaged in the General Drawing Office should study some specialised Branch such as Jig and Tool or Press Tool Work and so considerably increase their scope and earning capacity.



NATIONAL INSTITUTE OF ENGINEERING

(Dept. 29)

148, HOLBORN, LONDON, E.C.1

NEARLY SIXTY YEARS OF CONTINUOUS SUCCESS

SOUTH AFRICAN BRANCH: E.C.S.A. P.O. BOX 8417 JOHANNESBURG.

FOUNDED 1885—FOREMOST TODAY—OVER 100,000 SUCCESSES

THE ACID TEST OF TUTORIAL EFFICIENCY

SUCCESS—OR NO FEE

We definitely guarantee that if you fail to pass the examination for which you are preparing under our guidance, or if you are not satisfied in every way with our tutorial service—**then your Tuition Fee will be returned** in full and without question. This is surely the acid test of tutorial efficiency.

If you have ambition you must investigate the Tutorial and Employment services we are able to offer. Founded in 1885, our success record is unapproachable.

Why not fill in and post the attached coupon NOW for further details and Free Authoritative Guide to openings in Engineering and Building? This book contains a mine of valuable and exclusive information and may well prove to be the turning point in your career.

PROMPT TUTORIAL SERVICE GUARANTEED.

FREE COUPON

To NATIONAL INSTITUTE OF ENGINEERING *(Dept. 29), 148, Holborn, London, E.C.1.*

Please forward your FREE Guide to

NAME .....

ADDRESS .....

.....

My general interest is in: (1) ENGINEERING (2) AERO (3) RADIO (4) BUILDING (5) MUNICIPAL WORK *(Place a cross against the branches in which you are interested.)*

The subject or examination in which I am especially interested is

.....

To be filled in where you already have a special preference.
(1d. stamp only required if unsealed envelope used.)

"Practical Mechanics" Advice Bureau COUPON
This coupon is available until April 30th, 1945, and must be attached to all letters containing queries, together with 3 penny stamps. *A stamped addressed envelope must also be enclosed.*
Practical Mechanics. April, 1945.

Published about the 20th 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.