MAKING A SIMPLE EPIDIASCOPE

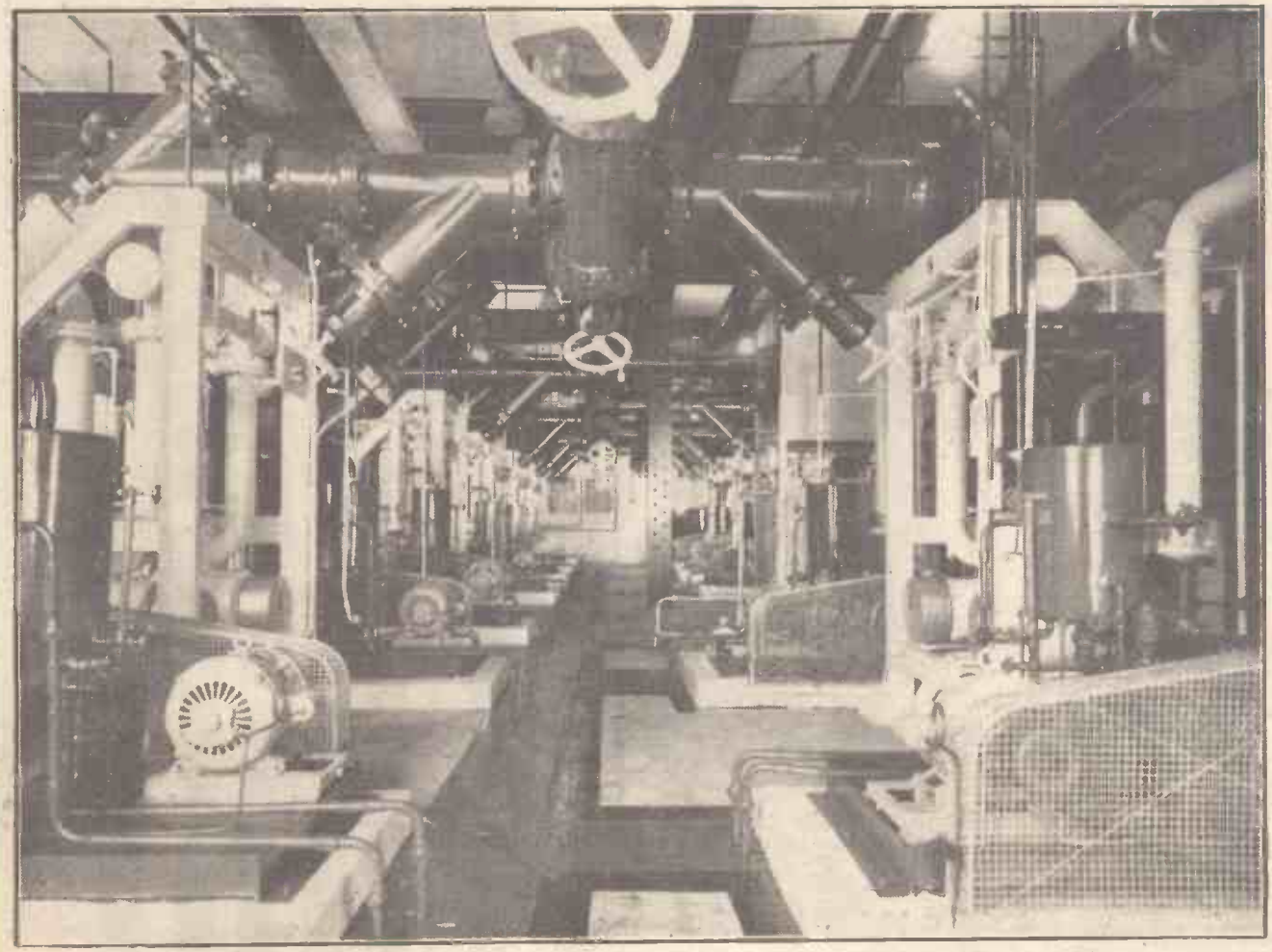
NEWNES

PRACTICAL MECHANICS

9D

EDITOR : F. J. CAMM

JULY 1947



HIGH-VACUUM PUMPS USED IN PENICILLIN PRODUCTION (See page 310)

PRINCIPAL CONTENTS

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

Editor: F. J. CAMM

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FAIR COMMENT — BY THE EDITOR

Mechanical Engineering Research

THE Government, through the Department of Scientific and Industrial Research, is setting up a special organisation to carry out scientific research in mechanical engineering to meet and to anticipate the needs of industry and Government departments. The eventual annual expenditure will be in the region of £350,000, although it is unlikely that this figure can be reached for some years because of the present difficulty in obtaining suitably qualified staff and buildings. The research is intended mainly to supplement the work carried on in other research organisations in this country and will largely be confined to those fundamental problems which underlie all mechanical engineering; thus the subjects in which research is expected to be carried out are: Properties and strength of materials: Mechanics of solids, stress, stability and vibration of structures: Mechanics of fluids; aerodynamics, gas dynamics and hydraulics in their mechanical engineering applications: Lubrication, wear and mechanical engineering aspects of corrosion: Mechanisms, engineering metrology and noise control: Mechanics of formation of materials; machine shaping of materials: Heat transfer, heat exchange apparatus and applied thermodynamics.

Dr. G. A. Hankins, D.Sc., M.I.C.E., M.I.Mech.E., Superintendent of the Engineering Division of the National Physical Laboratory, D.S.I.R., has been appointed Director of Mechanical Engineering Research.

As with all other research organisations in the D.S.I.R., the Director will be advised by a Board, consisting of eminent scientists, technicians and industrialists, serving in their personal capacity, and not as representatives of any organisation to which they may belong.

The location of the Research Station has not yet been decided. For the time being much of the work will be carried out at the National Physical Laboratory, while other work will be arranged for at universities and other institutions. It is clear that the new station will have to work in the closest liaison with the N.P.L., which has a long tradition, in its Engineering Division, of engineering research of high quality, and which will provide the nucleus, in due course, of the new organisation. Unfortunately, no land is available close at hand for the building of the new station, which will require a considerable area.

It is my view that this new organisation was unnecessary in that its curriculum is purely academic, that it duplicates the work of existing organisations who already adequately cover the subjects, and that the money would be better spent in developing machine tools in this country. It is well known that we have to import a large number of machine tools because no one in this country is making them. A department which would develop designs for machine tools is what is urgently required. We do not want a department of academic scientists working out textbook problems, and really contributing nothing tangible. For example, there is little that can be added to our present knowledge on the properties and strength of materials. Stress calculations are largely a matter of guess, based on empirical formulæ, which depend for their success upon the use of a large factor of safety. Similarly, the mechanics of fluids is a subject upon which a large number of excellent textbooks divulge all present knowledge. As far as noise control is concerned we want the devices which make the noise first!

The general plan and the early work of the new organisation will be based on the recommendations of a D.S.I.R. Committee on Mechanical Engineering Research, which reported on the essential needs for research in mechanical engineering and examined in detail the mechanical engineering research facilities available throughout the country.

Wide Scope

The wide scope of the mechanical engineering industry naturally influenced the Committee in its recommendations. Mechanical engineering covers the design and production of all engines and power plant for marine and aircraft propulsion; locomotives for railways, motor-car engines and transmission systems; the production of power from coal, oil and water; the machinery concerned with the manufacture of iron and steel, and the production of chemicals, textiles, foods; ventilating, air conditioning and refrigerating machinery; and many other matters. The central register of the Ministry of Labour schedules 98 separate activities in mechanical engineering compared with 57 in electrical engineering and 21 in civil engineering. There are about 60,000 mechanical engineers in this country eligible for the technical and scientific register of the Ministry of Labour. There are approximately four times as many mechanical engineers as there are civil engineers, and twice as many as there are electrical engineers.

There is a very considerable amount of mechanical engineering research already in progress in this country, at the universities, in Government establishments, at some of the Industrial Research Association laboratories, and in the research departments of the larger firms. There are, however, gaps, such as research in hydraulic machinery, in heat transfer and heat exchange problems and apparatus, in applied thermodynamics, and in kinematics and mechanisms. The visits of the Committee to the various research establishments made two predominant impressions on the minds of the members: firstly, the considerable extent to which such establishments had common basic needs, which could be met by research in a number of subjects contributing to the basis of mechanical engineering science; secondly, the small size of the groups or teams of workers concerned with specific items, so that, in the main, research tended to be confined to the urgent and immediate problems, to the neglect of the fundamental or generic research on which mechanical engineering practice of the future very largely depends.

The main object of the new organisation will be to carry out basic research in mechanical engineering science for the general benefit of industry throughout the country as a whole, and so assist British industry to maintain and extend its position in the forefront of industrial advance. The researches will provide a sound foundation of scientific knowledge on which specific industrial development projects of the future can be based, and be a store of knowledge and research experience from which many industries will be able to draw for their particular needs.

Experimental Work

The purpose of the new establishment will be to provide a convenient centre for the experimental work; groups of research workers will be organised in each of the main branches, and the necessary equipment, some of which will be on a fairly large scale, will be designed and installed. The research workers will be mainly engineer-scientists, but will also include physicists and mathematicians. It is intended that in due course much of the work in progress will be well ahead of the immediate requirements of industry, and that the reputation and standing of the new establishment will be such that other research groups and firms will naturally turn to it for information and advice before starting on new projects. The manpower required for effective research in the various groups will vary because the research treatment of some of the subjects has still to be evolved and the scale of effort required will increase as they are developed. Close contact will be maintained with Industrial Research Associations, since these provide a most convenient way in which the results of fundamental and generic research can be made known and applied in industry. In the mechanical engineering industry there are a large number of firms which are too small to carry out much research for themselves and are not served by a particular research association

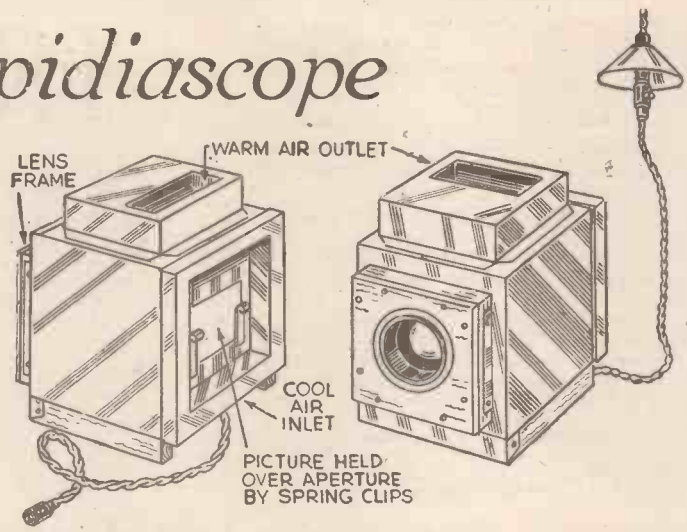
A Simple Epidiascope

Constructional Details of an Easily Made but Efficient Instrument

By R. L. G.

ALTHOUGH the epidiascope about to be described cannot be expected to compare with the very perfect results obtained by the manufactured article, it has the advantage of simplicity of construction, low cost of materials and, like all other home-constructed apparatus, gives added pleasure to the constructor.

It is suggested then that those readers who have not seen such an instrument in use may like to try out this simple arrangement, after which they will understand the general principle of this system of projection and will appreciate the various refinements advertised by the manufacturer of the commercial article.



Figs. 2 and 3.—Rear and front views of the completed epidiascope.

Size of Picture

The apparatus illustrated will give a very brilliant picture of 10in. x 8in. at a distance of 3ft. from the original picture size of 2½in. x 2in., this being increased to about 15in. x 12in. at 4ft. 6in. Both these variations were obtained by suitable adjustment of the lens. The instrument will project quite a good picture at about 9ft. distance, but with the lens used, the recess in the lid would need to be 2in. to bring the picture closer to the lens.

This is one of the limitations of the instrument illustrated. If a large aperture projecting lens is available, then it is possible a much larger picture space could be utilised without loss of definition. The lens used by the writer was a standard condenser lens combination of 4in. diameter, with the front lens removed. The remaining lens is approximately 5½in. focus, and the dimensions given were to suit this lens. It was found necessary to fit a cardboard diaphragm, and the aperture was found to be 2½in. diameter for good definition over the full picture space of 2½in. x 2in.

Using a standard magic lantern lens, no diaphragm was necessary. The front lens only was used, and at 3ft. 6in. a picture 10in. x 8in. was obtained, whilst at 6ft. a good picture of about 17½in. x 14in. was projected. Again, suitable adjustment of the lens in relation to the picture was necessary. A suggested method of adapting a magic lantern lens to the condenser mount, both lenses of the condenser combination being first removed, of course, is seen in Fig. 7.

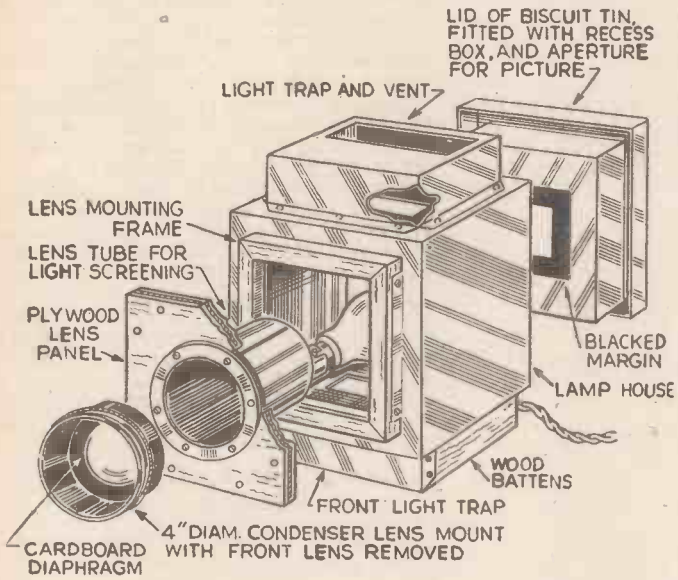


Fig. 1.—Exploded view of the instrument.

Construction

Constructional details can be clearly seen in the drawings. Fig. 1 shows an exploded view of the instrument with the parts in their order of fitting. The main body, or lamp house, is made from a standard biscuit tin measuring 9in. x 8½in. and 9½in. deep, with suitable apertures cut out for mounting the lens and for the necessary ventilating passages. The latter consist of a tin superstructure soldered or riveted on top, with holes to allow escape of warm air. Similar holes are cut out of the bottom of the tin for the cool air inlet. The original lid of the biscuit tin is used for the picture aperture, which is arranged for in a tin recess fitted to the lid. A light screening tube, in which the lens itself fits, is fitted by a flange to the plywood panel, as shown. This panel itself is screwed to the wood frame fitted to the front of the biscuit tin.

A sectional view through the tin lamp house is shown in Fig. 4, whilst three of the four corner electric bulbs can be seen in the adjoining view. The centres for the lamp holder will be found about correct for clearance for 100-watt bulbs. For the purpose of current economy, lower wattage lamps can, of course, be substituted and the projected size of picture kept down to the smaller size previously mentioned. One of the corner lamps can just be seen inside the lamp house in Fig. 1. The lamps are, of course, wired up in parallel, and, although the writer shows the flex connections inside, these might with advantage be taken outside, but in doing so care should be taken that any holes drilled for the purpose are suitably protected to avoid cutting through the insulation. Light leaded cable would prove advantageous if available.

In Fig. 2 is shown a view from the back of the instrument, with a picture or print clipped in front of the aperture by means of the spring clips, which are small strips

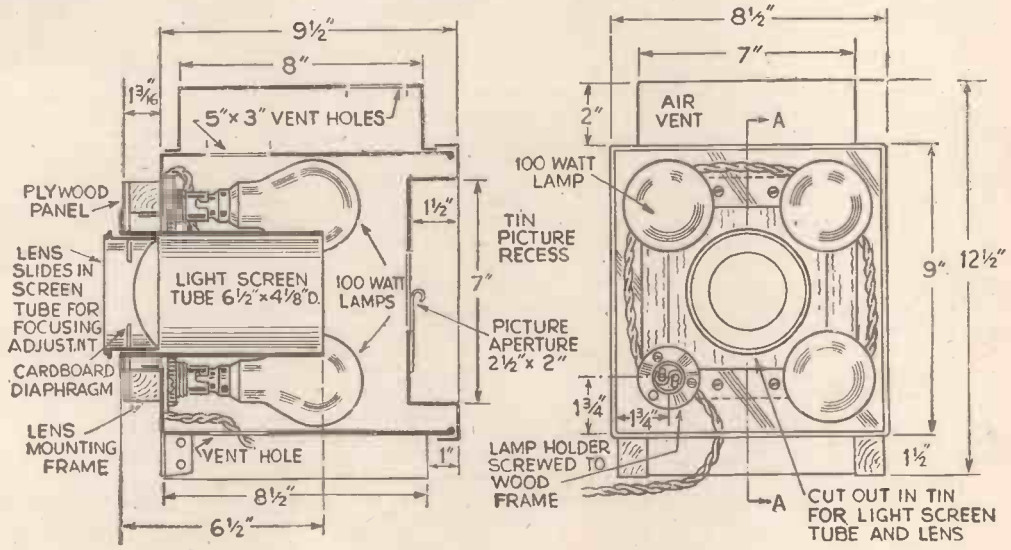
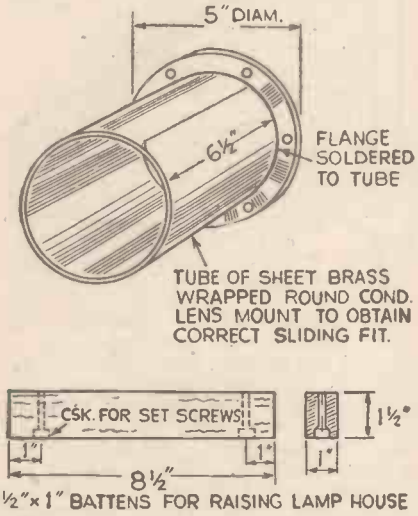


Fig. 4.—Section and end view of the lamp house.

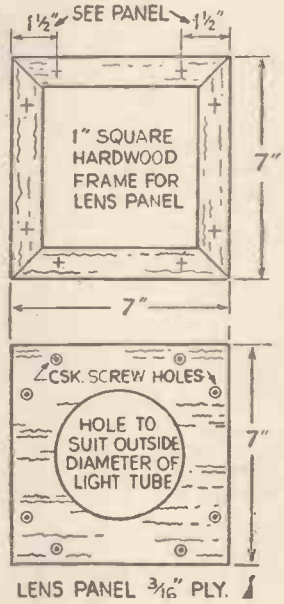
of tin or brass, turned over at their top end and soldered at the lower end. The pictures are inserted from the top, and adequate room should be available if the clips come half-way up the picture width, as shown. Fig. 3 is a view from the front of the instrument, showing it connected to the lamp adaptor. This may be of the switch type, for convenience. In Figs. 5, 6 and 7 are given details of the various parts needing construction. A smaller size of tin might be utilised for the top vent, and this can be soldered or riveted to the main lamp house. It should be given a coat of photographic black, however, before fixing in position. A hole is also cut out of the bottom of the tin for air inlet, and the lamp house is raised upon two battens as shown, with a strip of tin screwed to them at the front end to act as a light trap. As it was found difficult to screw these battens from the inside of the tin, setscrews and nuts were used, the holes being countersunk, as shown.

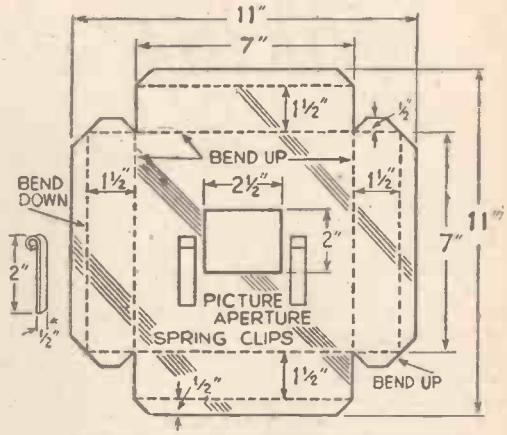


remove from lens mount and solder along the seam. The inside should be given a coat of photographic black to prevent reflections.

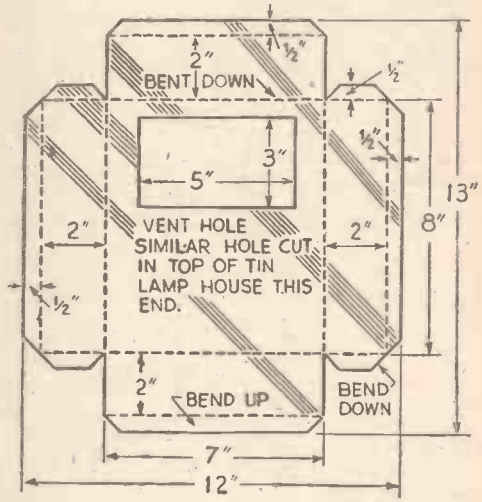
The optical system is shown in pictorial form in Fig. 9, and it will be seen that a mirror is shown at an angle of 45 degrees to the lens. This will correct the projected image as regards right and left, and the screen will have to be to one side of the epidiascope, as shown. If projected straight on to the screen, the image, as well as any lettering, will be reversed. Such a mirror could be readily fixed to the lens panel at the correct angle.

The reader may, of course, vary the sizes given, and much will depend upon the projecting lens available.





SHEET TIN RECESS FOR PICTURE. FITTED OVER 7"×7" HOLE IN LID OF BISCUIT TIN.



Figs. 5, 6 and 7.—Details of the various parts needing construction.

The front strip of tin could, of course, be formed by a cross-batten of the same wood section of 1½in. x 1in. This might be an advantage.

The Light Screen Tube

This is important as it prevents direct light from the lamps striking the lens, and allows only that reflected from the picture passing through the lens. The tube is made from medium gauge brass sheet, cut to size, and soldered to an end or front flange, drilled with fixing screw holes. If using the condenser lens combination the best plan is to wrap the cut sheet of brass round the lens mount, spot solder at the two extreme ends,

Some reading magnifiers may be found suitable, but some experiments should first be carried out to arrive at correct distances, and the largest aperture possible, for good definition over the whole picture area.

If a biscuit tin is not available, the whole lamp house might be made up from sheet tin. Riveting would possibly be easier than soldering. It is suggested that some form of reflectors might be incorporated to increase light concentration on the picture area. The simple air vent and light trap arrangement could be elaborated on, if desired, by fitting a further section above the first, when complete light trapping would be secured. Also the bottom air inlet could be elaborated.

The black margin will be found to prevent reflection near the edges of the projected image. If possible, switch off the lights as often as possible, both to save current and allow the lamp house to keep cool. Finally, it is quite interesting to see the palm of one's hand, reflected in full colour, on the screen, and serves to demonstrate to the "unbelievers" that this is not just an ordinary magic-lantern.

Fig. 8.—Details of lens mounting.

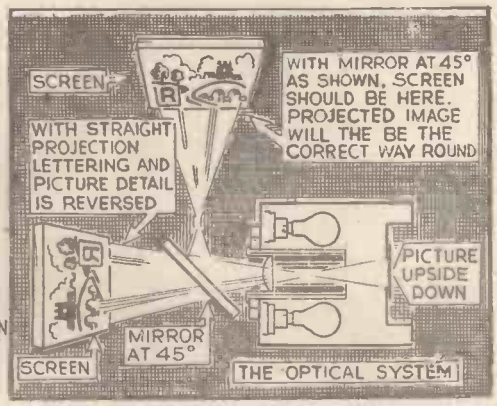
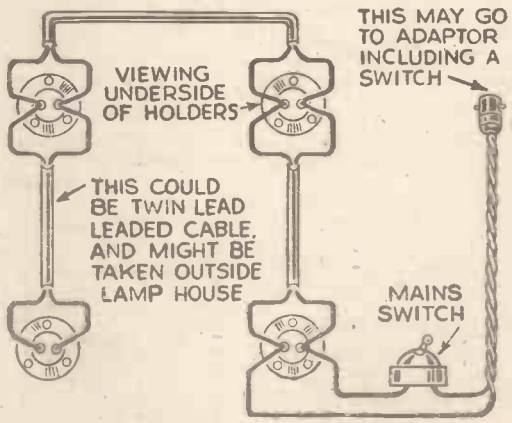


Fig. 9.—Diagram illustrating the optical system.



THIS IS HOW THE WIRING SHOULD GO, WITH ALL LEADS WELL INSULATED.

Fig. 10.—Diagram of wiring construction.

Making a "Skyway Runner"

A Novel Accessory for Kite-flying Enthusiasts

By H. B. BALL

TO kite-flying enthusiasts the idea of the "messenger," the circle of cardboard slipped on to the string and gradually blown up to the kite, is well known. This led to the question being asked if it would not be possible to make something that would not only go up but also return. This started a discussion with a few friends and various ideas were forthcoming. It ended with a little experimenting, and eventually the writer evolved the following design that worked very well. The following description and drawings of the apparatus may be of interest to other readers.

The main idea of this "Skyway Runner," as shown in Fig. 1, consists in the provision of two sails or planes which, on reaching a

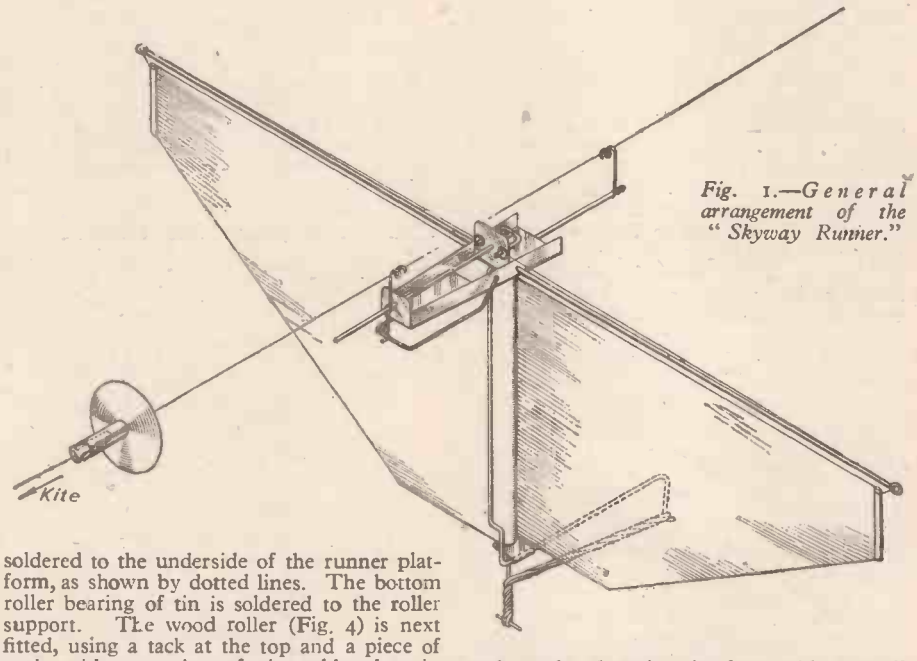


Fig. 1.—General arrangement of the "Skyway Runner."

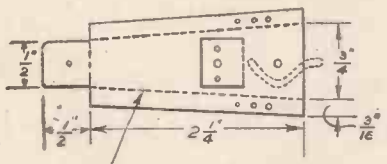


Fig. 2.—The runner platform before being bent to shape.

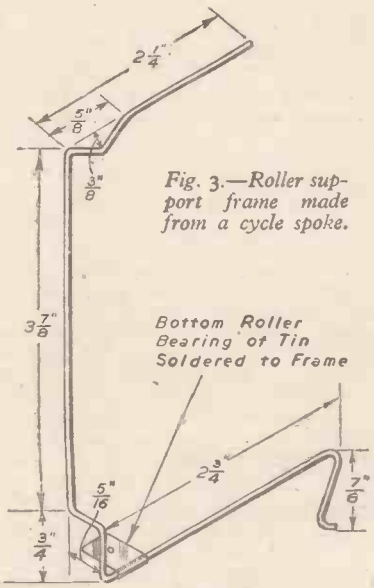


Fig. 3.—Roller support frame made from a cycle spoke.

stop fixed on the kite string a few yards from the kite, roll up tightly and the weight of the runner is sufficient for it to slide down the string.

The materials required are a few cycle spokes, some tin, brass wire about 18 gauge, 4½in. of ¼in. round dowelling, greaseproof or similar paper, thread and elastic bands or model aeroplane motor rubber.

Constructional Details

To construct, first mark out a piece of tin to form the runner platform (Fig. 2). The holes can be drilled or punched to approximate size and cut to shape. Chisel cut the centre on three sides, and bend up on the broken lines, the centre part front end, and sides. A spot of solder at the corners will strengthen it. Bend a cycle spoke for the roller support frame (Fig. 3). This is soldered to the underside of the runner platform, as shown by dotted lines. The bottom roller bearing of tin is soldered to the roller support. The wood roller (Fig. 4) is next fitted, using a tack at the top and a piece of spoke with cross piece of wire soldered on in the bottom. Make sure the roller revolves freely. The striker bar (Fig. 5) is made of spoke 3in. long, with a U-shaped piece of brass wire soldered to one end and made a

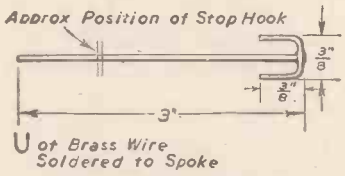


Fig. 5.—The striker bar.

sliding fit in the three holes in the centre piece of the runner platform. The striker bar stop hook is soldered to the striker bar about ⅞in. from the end. This stop hook can be used in conjunction with a parachute carrier (Fig. 6). The runner loops can now be soldered to the front of the runner platform and the end of the roller support frame top.

Fitting the Sails

The two sail arms (Fig. 7) are each made of spoke 7in. long with a small wire ring—⅛in. hole—soldered at one end, the other end being square tapered. The two paper sails are cut and glued to the roller so that they are equal each side. The ends of the sails are strengthened by glueing over a thin strip of cardboard (Fig. 8). Tie a 9in. piece of thread to the end of each sail. With the sails rolled up, fit a rubber band round one end of the cross piece at the bottom of the roller and, giving it one turn for tension and direction, slip the other end of the rubber band over the end of the roller support frame, as in Fig. 1. Fit in the sail arms by putting the tapered ends through large holes, just aft of the runner platform centre, and press the point into the smaller hole on the opposite side. Pull striker bar forward

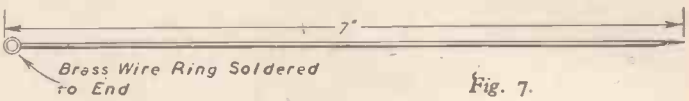


Fig. 7.

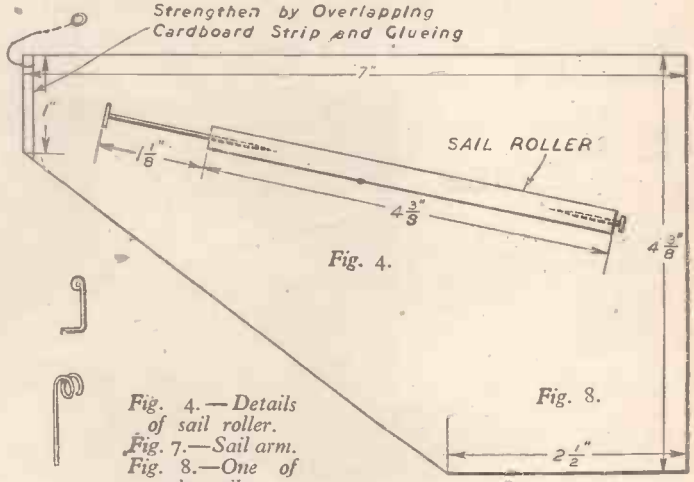


Fig. 4.

Fig. 8.

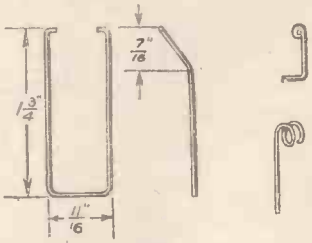


Fig. 6.—Parachute carrier and striker bar stop-hook.

Fig. 4.—Details of sail roller.
Fig. 7.—Sail arm.
Fig. 8.—One of the sails.

and have two small brass rings ready. Pull out the sails with the thread through the ring at the end of the sail arm and tie to a ring at just the right length so that it engages on the nearest pin of the U-piece on the striker bar. Do the same with the opposite sail. When the striker bar is pushed back the sail threads are released and the tensioned roller will fold the sails up tightly. A parachute carrier can be fitted, if desired, and this is hinged in the holes just forward of the centre piece, being held up by the striker bar stop hook when the striker bar is in the forward position. The runner stop is made with a disc of stiff tin or similar metal about 1½in. diameter with a hole in the centre to take a piece of ¼in. brass or copper tube. Solder the disc near one end of the tube.

To Operate

The kite string is threaded through the runner stop from the disc end, and is held about 3 or 4 yds. from the kite by plugging the string in the tube with a matchstick.

When the kite is flying steady, put the "Skyway Runner" on the string. Pull the striker bar forward. Take the two sail rings and, pulling them to the centre, hook them on the releasing points on the striker bar.

Push the runner up the kite string a few yards and the air currents will start it running up towards the kite.

When it reaches the stop the striker bar will release the sail cords, allowing the sails to be furled. The runner will then return down the string. When a parachute is put in the hinged holder it is dropped when the striker bar is pushed back on reaching the stop. It will be noticed that the runner attains a good speed on its return journey and, unless checked, is likely to give the hand holding the kite string a nasty knock; but if the string is given a circular action of just a few inches when the runner is about five yards away it will be braked.

Optical Mirrors

Methods Used in Forming Large Optical Surfaces Required in Telescopes and Image Forming Instruments of High Power

By G. HOLE

FOR the purposes of a telescope of any size larger than 2in. to 3in. diameter, surfaces are required on the image-forming device which exceed in accuracy that standard which is satisfactory in smaller instruments, cameras, etc. This is because the image formed by either the object glass or mirror, itself enlarged, has to be again enlarged by a secondary magnifier, the eyepiece. An error producing a negligible effect in the primary image will be enlarged by the eyepiece and become visible and of importance.

The surfaces employed in the larger class of telescope should approach very close to perfection, the excellence of the performance being directly dependent on this. The permissible tolerance for object glasses is at least twice that of a mirror doing the same work, being due to the doubling of angles on reflection. It will therefore be seen that the surface of a reflecting telescope mirror should be as close to perfection as can be attained.

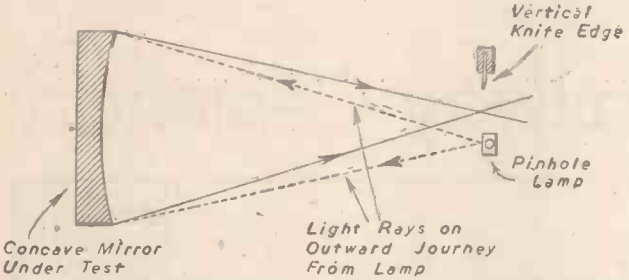


Fig. 1.—Foucault's test at the centre of curvature.

Polishing Technique

The fabrication of these surfaces on a mass production basis is not feasible for the large classes, as the tolerances are measured in millionth parts of an inch. Therefore, these methods differ from the factory methods recently described in this journal, and approach to laboratory work. Temperature control is necessary, as the expansion of the mirror during the polishing is enough to distort the surface, unless the mirror is of a substance with a low expansion figure, such as Pyrex or quartz. For this reason, among others, polishing proceeds slowly, from 30 to 75 strokes per minute in spells of half an hour each. The thickness of the mirror is important, as anything thinner than one-eighth of the diameter may sag under its own weight enough to destroy the image. Also, it may flex during polishing and thus receive a distorted figure. Shaping and trueing follow normal procedure, the difference coming in with the later stages of polishing. A movement of translation of mirror across tool, or vice versa, is all that is permissible, the rotation of mirror and tool being controlled to ensure that no two strokes follow exactly the same diameter. The following speeds are used by the writer on work up to 18½in. diameter. Stroke, 60 per minute, tool rotates 1½ times per minute, mirror 2½ times per minute. Smaller mirrors may be run faster, but above 90 strokes per minute produce a rolled-back edge, known as turned edge. Obviously, these motions may be obtained by a machine, and above 12in. diameter the use of one is advisable owing to the weight of the mirror and the length of the polishing. By hand a properly ground 10in. surface will polish up in about 10 hours; by machine the same surface may take double the time, owing to the absence of pressure, which is an advantage. Indeed, it is sometimes necessary to counterpoise the polisher. Machines score on temperature grounds also, as the heat of the hands is absent. A handle cemented to the back of a mirror for hand work, and held for 30 minutes at a time, passes hand heat through the glass to the surface being polished and expands same into a hill. This hill promptly gets polished off, and, when cool, the mirror has a hollow. These and kindred troubles are absent when a machine is used.

Polishing is effected on a pitch surface, formed in facets of approximately 1½in. square, coated with a thin beeswax film. This may be formed on the grinding tool by pouring on strained pitch, moulding to shape with the mirror and channeling with a knife. The surface is then waxed and the mirror left on the warm tool to settle into contact, using plenty of rouge and water to prevent sticking. This cold pressing is essential to obtain contact. The rouge is carefully washed before use, and strokes of quarter to one-third of the diameter, varied every 15 minutes, together with a variable side throw, are used. After several hours the abrasive marks are eliminated and polish is complete.

Testing

The main work now commences, and a word on testing is needed. Commercial lenses are worked to fit accurately made test plates of opposite curvature to the piece being tested, these test plates being made in the laboratory. The test consists of placing the piece in contact with the test plate and reading the interference fringes formed between the surfaces. This test is delicate, but not suitable for large surfaces, for which more rigorous tests are used. They nearly all function on the principle of reflection from a concave mirror. If this mirror is set on edge and an illuminated pinhole placed at its radius of curve (found from $\frac{r^2 + D^2}{2D}$ where r = half diameter and D = depth of curve), an image of the pinhole is formed on the pinhole. A movement of the lighted pinhole to one side will move the image of same a corresponding distance to the other side, and it can then be examined with an eyepiece. This will settle any question of turned edge, as the expanded cone of light inside the focus will have a

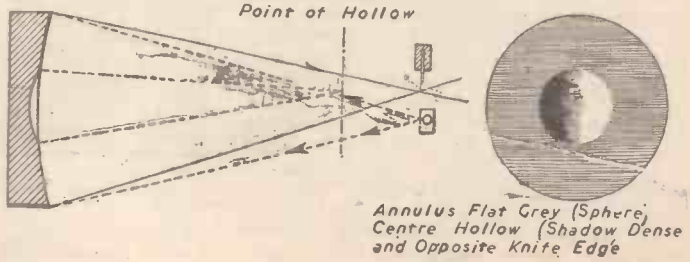


Fig. 2.—Section of cone and appearance of mirror with central hollow.

hairy edge if turned edge exists on the mirror. The remedy is to shorten the stroke and/or trim the edge of the polisher, and polish until the defect disappears. The eyepiece is then removed and the returning cone of light received direct into the eye. The glass under test appears full of light just like a full moon. A vertical knife edge is now slid in front of the eye, its edge just cutting into the cone. Its shadow will be seen to cross the mirror. Now, if the knife edge is inside the mirror focus, the shadow will travel across the same way as the knife edge. If it is outside the focus, the shadow will travel in a direction opposite to knife edge feed. When it is at the focus, the mirror, if spherical (all parts of same radius), will darken evenly (see Fig. 1).

The mirror will, however, not be spherical in all parts. It may possess a central hollow (region of shorter focus). The shadow on this region would be confined to the opposite side to the knife edge, and the remainder of mirror, if spherical, would be grey (see Fig. 2). Should any departure from the sphere exist, it will show as a variation in position and depth of shadow, and the expansion of the glass, caused by placing the finger-tips on it for five seconds, is plainly visible as a hill where each finger rested. This gives some idea of the delicacy of this test.

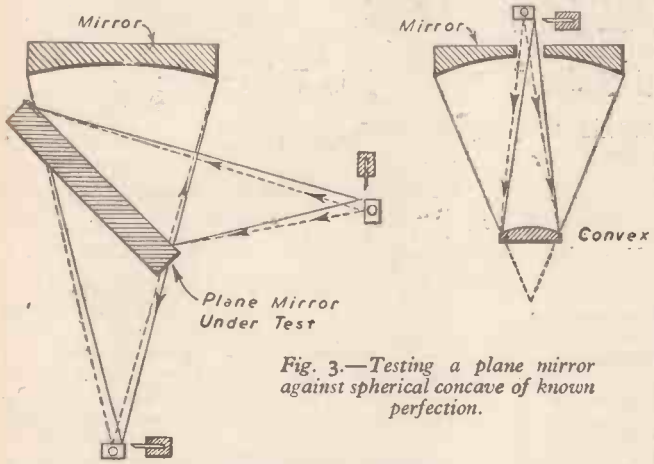


Fig. 3.—Testing a plane mirror against spherical concave of known perfection.

The mirror for use as a reflecting telescope must not be spherical, but must be of shorter focus at the centre. Therefore the curve must be deepened towards the centre by increased polishing. This may be done in a variety of ways, the safest being to trim the polisher facets from full size in the centre down to nothing at the edge. This will leave the full-area polishing in the centre, while the edge is not being polished so much, according to the amount of trimming. Polishing with the mirror on top and off centre on the tool will also deepen the centre, but is likely to turn the edge, as is a longer stroke. This deepening must be perfectly regular, from nothing at the edge to the full amount at the centre of the mirror. The difference in focal length of the edge and centre, when masked off and measured, should be $\frac{r^2}{R}$ (where r = half diameter and R = radius of curve), and when this difference is reached the mirror is a paraboloid. If it is regular, has no turned edge and the above-mentioned difference in focal length exists, it is finished and ready for silvering. Various methods exist, the best being Brashear's process, details of which can be found anywhere. Silvering may in future be displaced by coating with a film of aluminium deposited *in vacuo*, and this service is available from various commercial houses. It has the advantage of being more permanent than silver, and gives better reflection in the ultra violet.

Plane Mirrors

Surfaces of comparable accuracy are required on plane mirrors as used in Coelostats and Heliostats, on the surfaces of certain prisms, etc. These can be tested by placing them in the cone of rays coming from a perfect spherical mirror. It has been seen that a spherical mirror appears evenly grey under test from centre of curvature, if perfect. It also gives a perfect pinhole image in this position only. Obviously, if a perfect plane surface is placed so as to reflect the rays from the sphere, it cannot alter them at all if the plane is perfect. It can only divert the whole beam (see Fig. 3). If, however, the plane is not perfect, the previous beauty of the sphere's image will be lost and irregularities of the plane will be seen in elliptical outline, apparently on the surface of the sphere. They will be doubled owing to the two contacts with the faulty surface, and should be treated by figuring, as in the case of the mirror previously described, until the even shadow is obtained and the pinhole image of the sphere is equally good, with or without the plane. When this condition obtains with freedom from local irregularities and turned edge, the surface is plane and finished. This means that should the surface be imagined enlarged to one mile in diameter no hills would exist higher than $\frac{1}{4}$in., and no hollows deeper than same. Such is the level of perfection required in these large optical units.

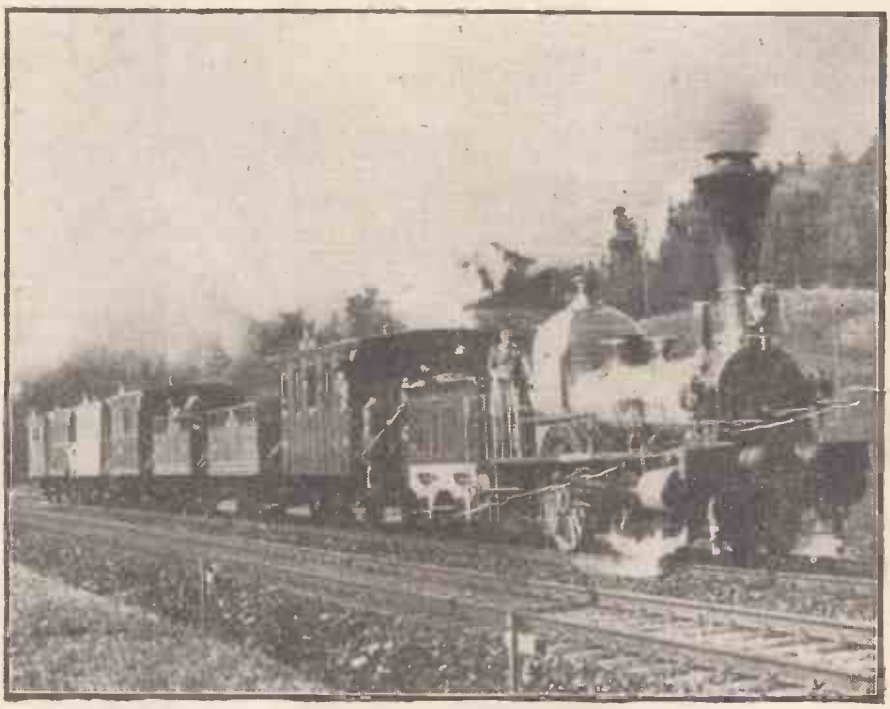
Convex Mirrors

One more type of mirror remains, the convex. This surface is not an image former, as reflection forms a divergent cone with no focal point available. It requires a larger, more powerful convergent cone of known perfection to test with, obtained from a spherical mirror of short radius. If the convex be placed so as to reflect this cone of rays it will modify its angle but not destroy its perfection of image, provided the convex is perfect. Figuring should be worked until this end is obtained. The test is one of the doubly rigorous type, as the light from the testing pinhole contacts the surface under test twice, on its outward and return journey.

The various types of surfaces are used in telescopes of both refracting and reflecting type. The lenses of refractors need spheres and planes, and in some the plane is replaced by a concave. The great mirror of a reflector of one of the three normal types must be a paraboloid, and the cone of rays from this may be modified by any of the three curves—convex, as in the Cassagrain, plain, as in the Newtonain, and concave, as in the Gregorain.

This survey cannot be detailed and still remain within the limits of a short article, but enough has been written to show the reader the road to follow in order to produce surfaces of the ultimate accuracy obtainable by human effort.

Swiss Railway Centenary



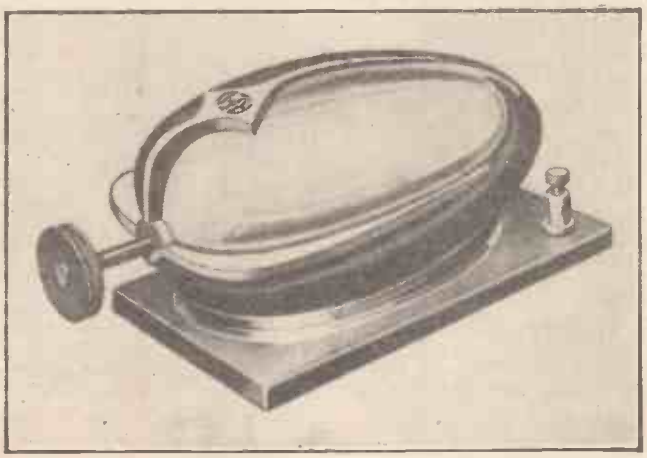
A hundred years ago—on August 19th, 1847—the first railway journey was made from Zurich to Baden. To celebrate the centenary, an exact replica of the locomotive that made the journey has been constructed. With officials dressed in uniforms of the period, it is to tour the Swiss Federal Railways as part of the centenary celebrations. Our illustration shows the replica of the 100-year-old train on a trial trip.

A New Type of Electric Motor

Details of Construction and Operation of the Rev Electrotor

DETAILS are now available of a new small power electric motor known as the Rev Electrotor, which employs an electro-magnetic phenomenon new to electric motor design. The motors are built on completely unorthodox lines; they have no commutator and no soldered joints.

The extreme simplicity of construction ensures complete freedom from faults and high efficiency.



(Above) Two tiny Electrotors, and (Left) an Electrotor in a special mounting.

Description

As will be seen from the "exploded" view, Fig. 1, the Rev Electrotor consists essentially of:

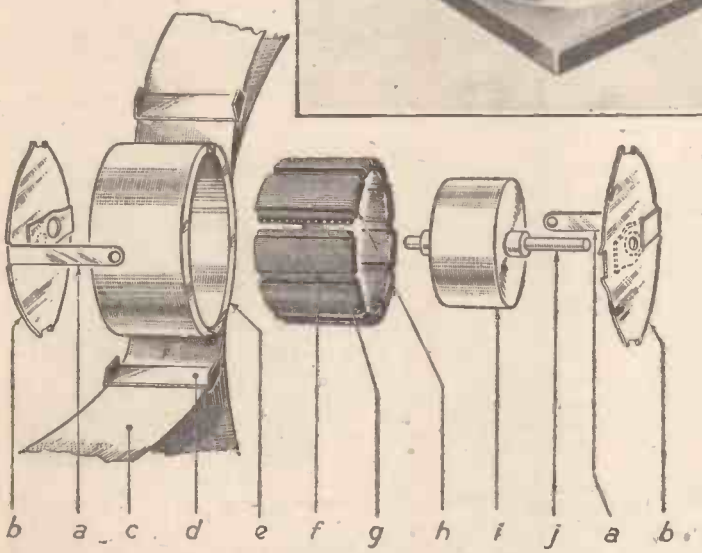


Fig. 1. "Exploded" view of the Rev Electrotor

A permanent ring magnet (e). A gap-ring armature winding (f) mounted on a bobbin (i) and spindle (j). Two end plates (b) with contacts (a). Cover tape (c). Two securing clips (d). (See also Fig. 7.)

The edges of the winding (f) are bared and the contacts (a) bear directly upon these edges.

The winding (f) has a core of iron wires (g) of high permeability, cased in an insulating coat, upon which several layers of double nylon covered copper wire (h) are wound in such a way that current flowing between the contacts energises all the layers.

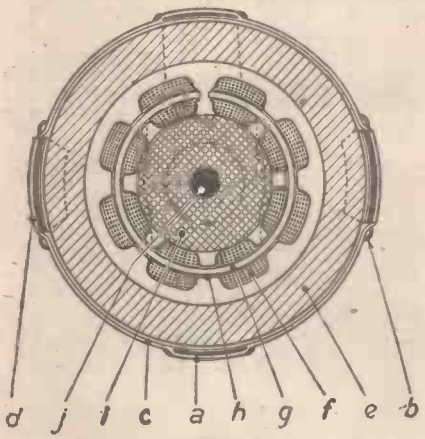


Fig. 7. Section through armature and permanent ring magnet. (Reference letters indicate same parts as in Fig. 1.)

Theory of Operation

Consider first the condition which obtains when no current is flowing, and the gap in a winding is adjacent to the S. pole of the permanent magnet (Fig. 2). Both ends of the armature core have induced N. polarity and the peripheral centre of the core (which is adjacent to the N. pole of the magnet) has induced S. polarity.

When the current is applied (Fig. 3) the winding becomes, in effect, a horseshoe electro-magnet with polarity between the points of contact of the contacts and the ends of the core (but with concentrated polarity at its ends), the end nearest the + contact being a strengthened N. pole, and that nearest the − contact a S. pole of reduced strength. Consequently, the N. pole is attracted to, and the S. pole repelled by, the S. pole of the magnet, and rotation ensues, the effective torque depending upon the width of the gap.

It will be obvious that this width is vitally important and years of painstaking research have been devoted to the establishment of the exact dimensions necessary to give the required torque, consumption, and efficiency.

As rotation continues (Fig. 4) the flux density of the N. pole of the winding loses its end concentration and becomes more evenly distributed between the end and the contact point, and eventually has concentration at the contact point; conversely, the flux density of the S. pole of the winding becomes progressively

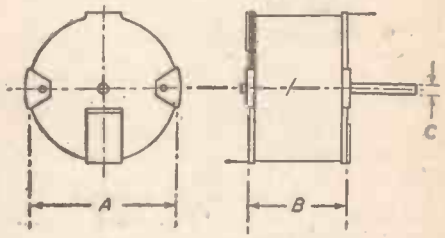
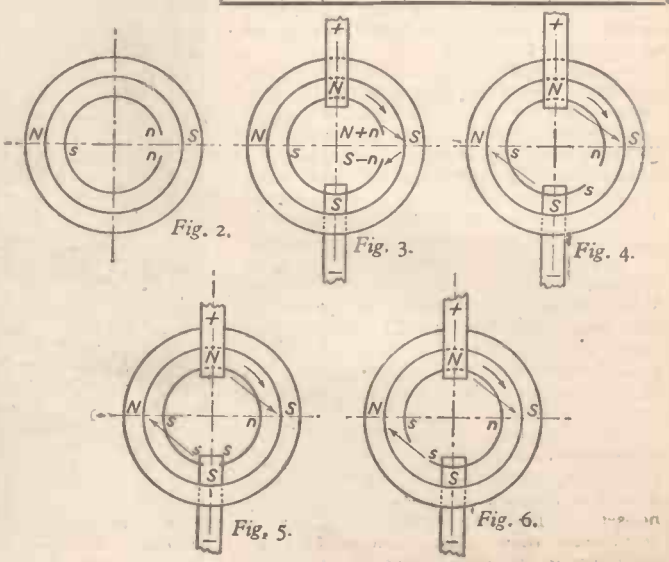


Fig. 8. End and side views.

Type No.	A mm.	B mm.	C mm.	Volts	Consumption	Speed r.p.m.	Weight Grms.
001	5	5	0.8	1.5	In accordance with torque required	7,000	1
240	22	14	1.6	3 to 4		5,000	21
320	30	19	3.2	6 to 12		4,000	84
440	38	35	3.2	6 to 24		4,000	161



Figs. 2 to 6. Diagrams explaining the theory of operation.

concentrated at the end of the core. There is, consequently, strong attraction to the poles of the magnet, with resulting high torque.

The next stage to be considered obtains when both ends of the gap are under the — contact (Fig. 5) and have therefore strong S. polarity. The peripheral centre of the core (which is under the + contact) is similarly strong N. polarity. Rotation therefore continues.

The final stage occurs immediately after the gap has passed the — contact (Fig. 6). The N. pole of the armature is now concentrated under the + contact, the terminal energised polarity being cancelled by the S. polarity induced by the magnet. Consequently, the point of flux concentration is attracted to the S. pole of the magnet. The following end of the armature (i.e., that under the — contact) has strong S. polar concentration, and is therefore strongly attracted to the N. pole of the magnet.

From the foregoing notes, it will be seen that at two stages in the cycle, flux concentration at one or other of the ends of the winding is utilised to give an additional surge of power, and the whole cycle is balanced by the constant variation in the distribution of flux density.

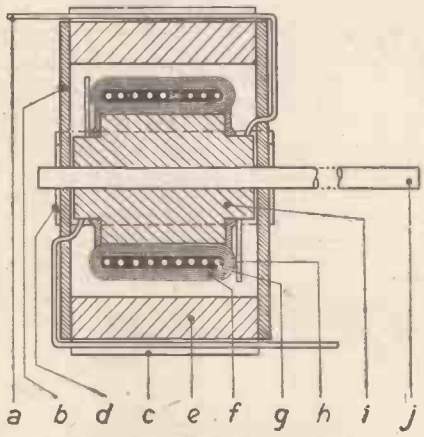


Fig. 8.—Longitudinal section. (Reference letters indicate same parts as in Fig. 1.)

Sizes

Electrotors are at present made in four sizes:

(*a*) Type No. 001, the smallest, is a triumph of design and workmanship and is only 3-16th in. diameter and 3-16th in. wide. It is used for special highly sensitive scientific instruments, requires 1½ volts, and has a speed of 7,000 r.p.m. It is undoubtedly the smallest electric motor ever made, and weighs under 1 gramme.

(*b*) Type 240 is 9-16th in. wide and ⅞in. diameter. This is the most popular size, and is used largely for toys, models, pocket fans, electric razors, etc. It requires 3-4½ volts, consumes less than a flashlamp bulb, and weighs only ¾oz.

(*c*) Type 300 is 1½in. diameter and ¾in. wide, used largely for bigger toys and models. It requires 4½-6 volts and weighs 3oz.

(*d*) Type 440 is 1⅝in. diameter and 1½in. wide. This range includes Electrotors suitable for voltages varying from 6 to 24. Although these are used for the driving of large models, they have been designed primarily for industrial use, and power windscreen wipers, ciné cameras, projectors, hair-clippers, air-conditioning units, etc. More powerful fractional horsepower motors, AC/DC motors, synchronous motors, and another unique development in electric motor engineering, still secret, are all in the development stage.

The manufacturers of Electrotors are Rev Motors, Ltd., Knowsley House, Bolton.

Science on View

Some Notable Exhibits Which Were Seen at the Recent Ideal Home Exhibition.

By the MARQUIS of DONEGALL

AT least it was a relief from the "Britain Can Make It" Exhibition that the great majority of the exhibits at the *Daily Mail* exhibition which came broadly under the heading of scientific were to be available within a reasonable time and actually function.

"Cooking by Radio"

The only example of something that did not work as well as it might at the Ideal Home Exhibition was E.M.I.'s "cooking by radio." Two young ladies were demonstrating this cooking with what looked to me a bit of turbot. Sure enough, in a few seconds the fish and sliced potatoes emerged cooked.

"That's all very well," I said, "but what happens if I want some Brussels sprouts with my fish?"

It appears that I can't have them unless I boil them in the ordinary way, and in that case I can't see the point of buying a machine costing two hundred and something pounds to cook the fish and potatoes in a few seconds if I've got to wait for it to get cold while the vegetables cook.

What happens in this "cooking by radio" is that house current is transformed into radio-frequency current and, as it is focused directly on the food, no heat is wasted. There is apparently a larger model which will cook a family joint in five minutes.

Another thing that is claimed for it is that a fishmonger can de-freeze a selected portion in a few moments.

Magnesium

In my last article I touched on the demonstration of magnesium as the lightest metal for use in the home. This demonstration of magnesium from sea-water was organised by F. A. Hughes and Co., Ltd. A child can lift a five-gallon dairy can with one finger, and a scales had been rigged up on which a chair—similar to the usual tubular chair—exactly balances against a glass of water.

Owing to the fact that magnesium heats quicker than other metals, it is excellent for griddle-plates and heating elements similar to those on view.

The manufacturer of nylon had a demonstration stand in which the Ministry of Supply had a hand. I suspect that the Ministry's contribution was the Horsa glider tow-rope, worth £5 a foot, and equivalent to 17,000 pairs of nylon stockings; also the parachute cords. We saw how chemical compounds of coal and air go in one end and come out as nylon threads at the other end. Perhaps the most rare nylon exhibit as far as the ladies were concerned was a pair of British-made nylon stockings.

Airscrew, Ltd., Jicwood, Ltd., and the Ministry of Supply showed various uses of wood-stronger-than-steel that was first developed in quantity for the Mosquito aircraft, propeller blades, and for the Human Torpedo.

Synthetic Resins

There was a Human Torpedo on show

A display of domestic gas appliances seen at the Ideal Home Exhibition.

(on a reduced scale). For the purposes of this product timber is cut into thin veneer and joined with plastic cement and synthetic resins. The chief uses at present are artistically bent or twisted forms of woodwork which imitate the wood-carver's art for such household uses as furniture boiseries. It is said that machine gears made from this substance are silent and less subject to temperature expansion and contraction than metal.

Another point is that, when you consider that it takes a lifetime to grow a large tree for timber, a process which enables broad planks to be made from small trees is something of a revolution in the forestry industry.

Cheap Watches

I mentioned some popular cheap watches in my last article. The pocket watch will be on sale shortly at 30s. and the wrist watch is on sale now at £2 5s. Farther along this stand they were demonstrating and selling a new design of household door lock.

That thoroughly antiquated vested interest, the making of recordings on shellac, or "wax," as it is popularly called, was beautifully demonstrated in detail by H.M.V. The fact that all our records would have been on film-strip or wire years ago if so many interests were not involved does not detract from the way the show was produced. It did, however, seem a shame that all the artists worth hearing have been tied up by people whose profit lies in saddling us with cumbersome, scratchable, breakable and symphony-dividing disc records, when far more efficient methods have been available for years. Incidentally, I wonder why we were ever allowed to take the small step from the old Edison cylinder to the even less-portable disc?

Working Wind Tunnel

Anybody interested in knowing why an aeroplane goes up—we will leave the accident investigation people to find out why they come down — could find out by looking at an ingenious showcase containing a 12ft. working wind tunnel where you could see the air stream, made visible by smoke, on a streamlined aircraft wing. It is claimed that architects have also benefited by watching the effects of the slip-stream produced by a gale on jutting-out pieces of houses. Just to round this whole thing off we found out that the same principle will turn 27,000 herrings into kippers in 24 hours. If they have a better flavour, which is claimed for these smoke-wind kilns, it is obviously more efficient than the old method of hanging to smoke over a peat fire.

A gas cooker made of Perspex, to demonstrate the correct packing of a cooker oven, at the Ideal Home Exhibition.

"Cooking by radio." In this cooker house current is transformed into radio-frequency current and focused directly upon the food. No heat is wasted, and the cooker remains cold.

Intercom. in the Home

The only snag I saw to the "intercom in the home" is that in my small experience one of the things that make the housewife's household chores less dreary is the two or three minutes gossip with the milkman, butcher, baker or itinerant vendor as and when these worthies present themselves and their wares.

The "intercom in the home" consists of a small gadget which the housewife carries about and plugs into the mains in any room where she happens to be. A caller approaching the front door automatically causes the bell to ring. She switches on and inquires the nature of his business, her voice coming through a loud speaker outside the front door. If he has goods to deliver, she presses a button and a hatch-way opens while he puts the deliveries into it. She can tell little Willie to behave himself in another room or leave a recorded message for her husband to play back when he comes in.

Our old Home Guard friends the "sticky bombs" have given up their moulds for making plastic sprays for shower baths. The transparent noses of aeroplanes have become cigarette boxes and plastic machine belting yields attractive belts for women. Some of the plastics were non-inflammable. We were, in fact, invited to put our cigarettes out on them to prove that they are undamageable. Others were luminous and such things as door handles, key-hole plates and light switches were shown in a darkened cupboard. The organisers of this Plastic Section were Messrs. De la Rue.

Invisible Heat-ray

To me the most novel demonstration was of seeing in the dark. You looked through a slit in a wall and saw nothing but pitch black; then you looked through eye-pieces similar to opera glasses and saw in a sort of greenish light a night nursery quite distinctly enough to tell if all was well without disturbing the child in the cot. This phenomenon was achieved by invisible heat-ray and was a demonstration of top-secret war appliances by the Ministry of Supply.

The chair covers and curtains of glass by Messrs. Fiberglass were not only attractive but are said to be untearable, unburnable, unrustable and moth proof. It was also stated that one glass marble weighing ¾oz. and ½in. in diameter would be the equivalent of 102 miles of the glass thread used in combination with plastics.

The last demonstration in the Science Section attempted to explain what atomic energy is all about. I have no doubt that you, dear readers, would immediately find the whole thing crystal clear. As for myself I shall take the wise course of fading gracefully away rather than show you that the atom remains to me, even after the demonstration, a highly mysterious and more than unpleasant subject.

Experiments with Ozone

What Ozone Is—Its Peculiar Properties—How to Make Ozone from Air

EVERY amateur experimenter, when working with electrical apparatus in which sparks are produced, must, at times, have noticed a peculiar smell in the vicinity of the apparatus, an odour which is not unpleasant, despite its being somewhat pungent.

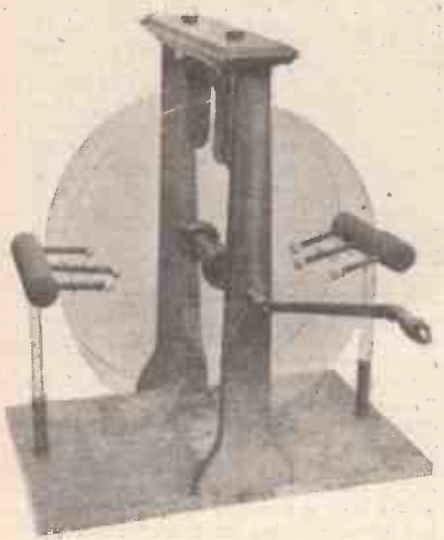
For years this "electrical smell," as it was once termed, was observed and commented on by various electrical and chemical workers, but it was not until a little more than a century ago—in 1840, to be precise—that a Swiss experimenter, one Christian Friedrich Schönbein, discovered that the electrical odour was due to the presence of a gas, to which he gave the name "ozone," from the Greek *ozo*, "I smell."

One of our countrymen, too, John Benjamin Dancer, a now almost forgotten Manchester optician, instrument-maker and photography pioneer, was struck by the peculiar and characteristic smell surrounding working electrical instruments, and he, also, gave some attention to discovering the cause of it. It is very probable that Dancer identified ozone as a separate substance before Schönbein did. Nevertheless, the latter worker published his discovery in a better form, and is nowadays generally given the credit of having discovered ozone.

The nature of ozone was a great mystery to Schönbein and to the other experimenters of the day. At first it was thought to be a new element, an element belonging to the well-known "halogen" family, of which chlorine, bromine and iodine are members. Then the view was put forward that it might consist of a new form of water, a new compound of oxygen and hydrogen. Finally the real composition of ozone was discovered, and it was found to consist of nothing other than oxygen in a peculiarly condensed form.

Condensed Oxygen

Chemical science, as, no doubt, the reader will be well aware, terms the smallest particle of a substance which can exist as such, a *molecule*. Now, in the ordinary way, a molecule of oxygen consists of two oxygen atoms linked together by an attractive force existing between them.



An old frictional electric machine. This, when working, acts as an ozone generator.

We may visualise an oxygen molecule as:

O = O

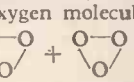
Ozone, however, contains three atoms of oxygen in each of its molecules. Consequently, a molecule of ozone is represented as:

two ordinary oxygen molecules having been condensed together to form the special kind of contracted molecule containing three oxygen atoms.

We may, for the sake of greater clarity, write down the condensation process of oxygen into ozone in the following manner:

O = O + O = O + O = O

(Three oxygen molecules.)



(Two ozone molecules.)

This curious condensation of oxygen into ozone may be effected in several different ways. In many chemical reactions small amounts of ozone are generated, but for all experimental purposes by far the best method of generating ozone is by means of the "ozone tube," a simple device which can be made by any electrical or chemical worker.

Christian Friedrich Schönbein (1799-1868), the Swiss discoverer of ozone. (From an old silverprint photograph.)

Ozone Tube

To make an ozone tube, obtain a narrow glass tube of about ¼in. bore and approximately 12in. long. Insert into the tube a length of thin bare copper wire, the far end reaching to about an inch off the end of the tube, the other end of the wire being brought out of the tube and secured in position by means of a little blob of sealing wax or some other plastic material placed at its point of emergence from the tube.

A second length of copper wire (bare or D.D.C.) is then coiled round the outside of the tube, the length of the coil being about an inch shorter than the length of the wire inside the tube. This coil of wire is also secured in position by suitably placed blobs of sealing wax or by some other convenient means.

We now require an induction or spark coil. Quite a small one will suffice, one capable of giving, say, a quarter-inch spark, and it need only be actuated by a two- or four-volt battery or accumulator. To the secondary terminals of the induction coil the two electrodes of the ozone tube are connected. The ozone tube itself is suitably mounted either by means of clamps or on a wooden base. A supply tube is attached to it at one end and a delivery tube at the other end.

The supply tube may consist of a length of ordinary rubber tubing, but the delivery tube should be made of glass and attached to the ozone tube by only a short link of rubber tubing, since ozone rapidly attacks rubber.

We may now connect up the supply tube to a bicycle pump and in that manner cause a slow current of air to be blown through the ozone tube, or, better still, we may attach to the supply tube a large hard-glass test-tube containing a mixture of three parts of powdered potassium chlorate and one part of manganese dioxide. This mixture, when heated, will give off oxygen abundantly, and the oxygen will perforce have to pass through the ozone tube on its way to the external air.

During the time at which oxygen or ordinary air is being slowly passed through the ozone tube, the induction coil should be brought into operation. A silent electric discharge will thus pass around the tube and a considerable percentage of the air or oxygen flowing through the tube will undergo its peculiar condensation into ozone. If pure oxygen is sent through the tube, about 8 per cent. of it will be changed into ozone. If only air is passed through the tube, the proportion of ozone will be less and it will be likely to be contaminated by traces of oxide of nitrogen.

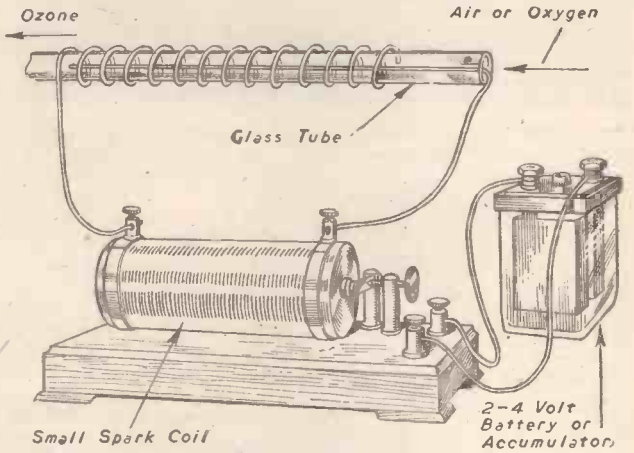


Diagram showing the construction and layout of a simple electrical ozoniser.

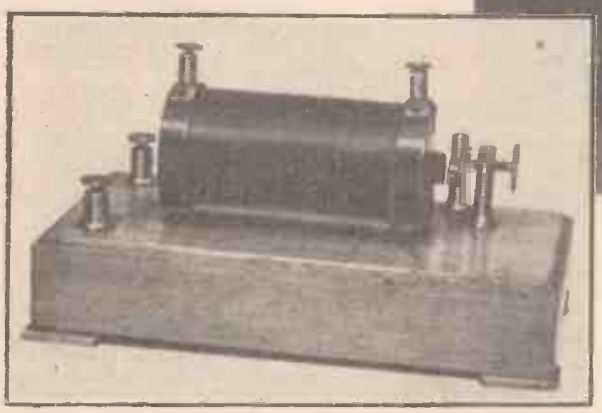
Chemical Method

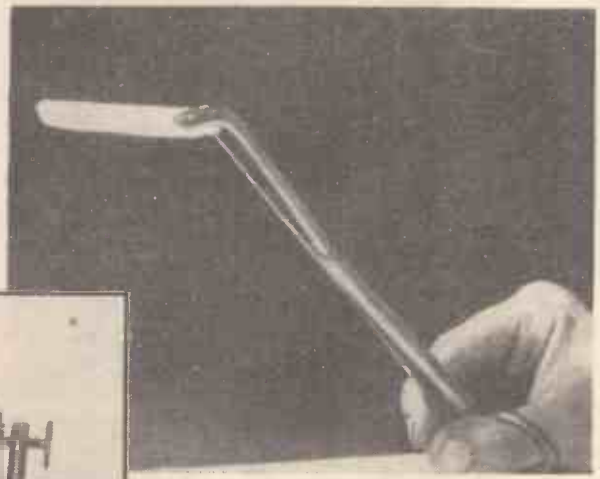
Another way of making ozone is to pass air very slowly through two or three flasks containing sticks of phosphorus half submerged in water. The slow current of air issuing from these flasks is finally passed through a wash-bottle flask containing a little water to dissolve out phosphorus oxides and the traces of hydrogen peroxide which are also formed by the oxidation of the phosphorus.

The phosphorus employed must be the yellow variety of this element—not red phosphorus.

Even a single stick of phosphorus placed at the bottom of a bottle and half covered with water will charge the air in the flask with ozone in about five or ten minutes' time. If this time is exceeded, the ozone formed in the bottle will begin to act on the phosphorus itself and will therefore become diminished in amount.

The powerful smell of ozone is very characteristic. It is pleasant, yet pungent, and too much of the gas may possibly set up a transient throat irritation.





(Above) A chemical ozone producer. A stick of yellow phosphorus glowing in the dark. By its slow oxidation, ozone is generated. (Left) A small induction coil giving a ½in. spark. An instrument of this size is well-suited for ozone production.

The sense of smell, however, is by no means the most delicate test for ozone. If we make up a little ordinary starch solution and dissolve in it a small quantity of potassium iodide and afterwards impregnate a number of pieces of white blotting paper with this solution, subsequently allowing the impregnated paper to dry, we shall have prepared "starch-iodide" paper which is exceedingly sensitive to the presence of ozone in the atmosphere. These "ozone papers" should be preserved in a well-stoppered bottle.

In order to detect traces of ozone with them, all we need do is to moisten them with water and then to hold them in the situation in which the presence of ozone is suspected. If the slightest trace of ozone is anywhere in the neighbourhood the ozone paper will turn blue. This colouration arises from the fact that ozone has the power of liberating free iodine from potassium iodide and that the iodine thus freed from its compound combines with the starch to form a vivid blue substance.

Ozone is fairly soluble in water and also in turpentine. Consequently, when the delivery tube of the ozone apparatus is allowed to dip beneath the surface of either of these liquids contained in a small vessel the liquid will smell strongly of ozone.

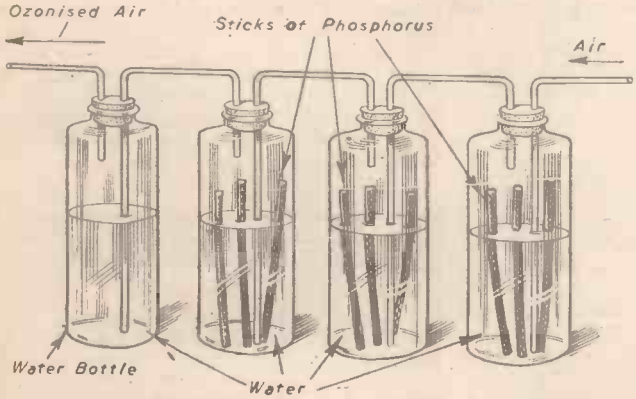
Powerful Oxidising Agent

Ozone is a very powerful oxidising agent since the additional amount of oxygen which it contains is very easily given up by it. It is for this reason that ozone is one of the best disinfectants known. It destroys germs rapidly, and when passed in small amounts into water it sterilises the latter very effectively.

Ozone, too, in consequence of its oxidising powers, can be used as an effective bleaching agent. If, for instance, we allow the delivery tube of our home-made ozoniser to dip below the surface of water coloured with a little indigo or cochineal extract or aniline dye solution, the liquid will become decolourised.

In view of its bleaching properties, therefore, it is not advisable to conduct ozone experiments in any room containing valuable oil paintings or water-colours which, although fast enough to light, may be sensitive to the action of traces of ozone.

When carrying out experiments with ozone it is also inadvisable to breathe too great a quantity of the gas, in spite of its containing nothing but oxygen. High concentrations of ozone give many people lasting headaches. Small amounts of ozone in a room, however, impart to it a delightful freshness and a faint, "clean" odour.



Apparatus for the chemical production of ozone by means of the slow oxidation of yellow phosphorus.

Whenever lightning strikes through the atmosphere, great quantities of ozone are formed in its path. It is for this reason that the atmosphere, after a severe thunderstorm, usually becomes very refreshing to breathe. The slow evaporation of seawater and, also, the action of sunlight on large masses of wet seaweed is productive of considerable quantities of ozone. Hence it is that the seaside air has often a peculiar freshness and tang which is absent from country air.

Action on Mercury

Ozone has an extraordinary action on mercury or quicksilver. If, by means of our ozone tube, we collect a jarful of ozonised oxygen or air and introduce into it a globule of mercury, afterwards shaking the mercury globule about within the jar, the mercury will quickly lose its mobility and lustre and will spread itself in the form of a grey film on the sides of the jar. The mercury, however, may afterwards be restored to its original condition by shaking it up with water. In view of this curious effect, ozone preparation should not be carried out in rooms containing mercury barometers or other mercury-containing instruments in which the mercury is exposed to the air.

If a piece of silver foil—*real* silver paper—is heated and then held in a jar of ozone, the silver will immediately be blackened owing to the formation of an oxide film on its surface.

Ozone, too, will oxidise black lead sulphide and convert it into white lead sulphate. This is a particularly useful reaction to remember, for if we have any white lead paint which has yellowed during the course of time we have only to wash it over with water in which ozone has been dissolved in order to freshen it up very considerably and, indeed, in some instances, to restore it to its original whiteness, the ozone oxidising the traces of lead sulphide to whose increasing presence the gradual yellowing of the white lead paint has been due.

A photograph of lightning—Nature's own ozoniser.

Liquid Ozone

By strongly compressing ozone and by cooling it to the temperature of liquid air, the gas condenses to a deep blue liquid which boils at a temperature of minus 119 deg. C. The liquid prepared in this way is never pure. It contains greater or less amounts of condensed oxygen, and it is only by careful fractionation of the liquid that fairly pure ozone can be obtained.

In the liquefied condition, ozone is a rather dangerous substance. It is explosive, and it has been suggested that liquid ozone might be used as an effective blasting agent in coal mines and other underground situations, since the products of its explosion can only consist of pure oxygen. Unfortunately, however, liquid ozone in its pure state seems to be too uncontrollable an explosive for this use.

Ozone Into Oxygen

As we have already observed, it is not a difficult matter to change oxygen into ozone. It is, however, a still easier task to change ozone back again into oxygen. All we have to do for this purpose is to fill loosely a short length of glass tubing with granular copper oxide and to attach it to the delivery tube of the ozone apparatus. All the ozonised air or oxygen which passes through the copper oxide tube will be completely de-ozonised and the air or oxygen which escapes from the end of the copper oxide tube will not have any effect on ozone paper.

Even heat alone will break down ozone into oxygen. Heated to a temperature of 250 deg. C. this breakdown of ozone is complete. Hence if ozone is sent through a glass tube heated by means of a Bunsen flame, the ozone will be reconverted back again into oxygen.

A high-pressure spark generator in action. Any apparatus of this type is productive of large amounts of ozonised air.

Atmospheric Ozone

Town air contains little or no ozone. Country air, however, contains about one volume of ozone to every 700,000 volumes of air, whilst the percentage of ozone present in seaside air is still greater.

Small as these atmosphere traces of ozone may be, they are sufficient, it is thought, to hold the world of micro-organisms in some considerable check, for were the atmosphere entirely devoid of ozone it is probable that micro-organisms would multiply extensively and that the world would quickly become a place of continual disease and pestilence.

Ozone, therefore, is one of Nature's most powerful disinfectants. By means of it the Earth's atmosphere is kept reasonably pure and all living creatures are to some extent protected against one of their greatest enemies, the disease-giving germ.

The germ-ridding properties of ozone are, of course, well recognised, the various commercial ozonisers testifying to this fact. Such instruments consist merely of a device wherein a high-tension electric discharge is passed across a space through which air is made to pass. The issuing air then contains appreciable amounts of ozone.

The household ozoniser may not yet be a common device, but the industrial ozonising apparatus for the purification of air in factories, workshops, hospitals, underground workings, theatres, cinemas and the like was, previous to the war, becoming a very common and effective aid to air conditioning.

Science Notes

By Prof. A. M. LOW

Coloured Fire

NOT so long ago I happened to witness a number of fires all round me.

It is interesting to think that by touring London at such a time with an instrument consisting of little more than a prism made from an old-fashioned chandelier or a cheap lens, one could estimate the nature of all the materials on fire.

I was amazed, as the headlines say, to find that every fire had a distinctive colour. Due in some cases to dust or moisture in the atmosphere, but usually, I think, to the materials concerned. Perhaps they were of interest to another world where peculiar people are saying, "They are lucky to have so much carbon in such convenient form."

I feel that the early savages who made fires by rubbing sticks together, a most trying business which seems to warm the person concerned more than the sticks, must have noticed the many colours achieved by their fires. Built on sand these fires may have shown the yellow of sodium; built on rock perhaps the green of copper. Every district must have had its own local characteristics.

No Wonder We Breathe

BREATHING is a habit. A very good one, I imagine, but here is a very interesting thing, and this is about air. Of course it makes the green fields we breathe it and it is pleasant. But it is so much more than just "air." Aeroplanes fly in it, but without some of the queer substances it contains their manufacture might be slowed down by about 30 per cent.

Air is mainly a mixture of 21 parts oxygen and 79 nitrogen. It was this nitrogen that saved Germany from a nitrate shortage in 1914 that might have slowed up production of explosives and fertilisers. To-day the separation of air into its various component gases has enabled almost every form of industrial and manufacturing process to be vastly speeded up.

Oxygen is a great "speeder up." There was a time when it was just used occasionally in hospitals to help sick lungs and hearts and to heal wounds. Now oxygen is one of the most vital tools known to the engineer. It welds, it cuts, builds gun mountings and salvages ships in a miraculous fashion.

Nitrogen, too, is almost as important. Unlike oxygen, it is a very lazy gas which never wants to join with anything else. So it can be used for preserving food. Just think what would happen in tinned foodstuffs if they were sealed up with air—rust, fermentation and waste. Not so when nitrogen is all around. Nitrogen, in a sense, feeds the world in more ways than one, for, given good canning and dehydration, famines can be abolished.

Atmosphere also contains minute quantities of other gases such as neon—you see its effect in modern lighting—and argon, a valuable gas used to prevent electric light bulb filaments from wastage at high temperature. All these materials are made from air by apparatus which, in itself, is a romantic story. Queerly enough, the microscopic quantities of rare gases in air help to keep us healthy!

Thinking Up a Pot of Jam

YOU will have noticed from the Press, and therefore you will have known that it is true, that the energy in atoms must have been "put there," as it were, by the sun in its heat and at its birth. Star dust is made more romantic by a little knowledge, and not less so, as has been said by people who do not grasp, fortunately, that scientists are as ignorant as anyone else.

We know, it seems, that matter can be converted into energy by a bomb, and we also know that in the preparation of the uranium family we can seemingly create a new element from "bricks" of which it is basically constructed. Call them electric particles if you prefer.

Now, if matter is energy at partial rest, and if energy can go through the ether, why not, in the vastly distant future, transfer material things by radio? The betatron may be a beginning. An Atlantic flight was represented by a two-yard hop only yesterday in the realms of time.

More exciting still is it that thought also is energy. It even produces ether waves. I remarked long ago that I felt very small indeed beside the man of the few million, million years hence who might look positively frightful with atrophied legs, artificial aids to everything, no hair and no teeth. But supposing he could *think* a pot of raspberry jam across the Atlantic, that would be far more interesting than the best of bodies! As far as I am concerned at the moment it would be an extraordinarily desirable accomplishment.

The Design and Operation of D.C. Machines

The D.C. Dynamo.

By W. H. SUTHERLAND, B.Sc.

THE armature, or rotating part, of a dynamo consists of an iron cylinder with a number of deep slots lengthwise along its periphery. In these slots are laid the active portions of the insulated copper conductors which form the winding. The minimum number is usually two conductors in each slot. In the following article "conductor" may refer to a single copper bar, or to all the turns in one side of a multi-turn coil. As the armature rotates each conductor passes through intense magnetic fields the directions of which are shown dotted in Fig. 1, which is a cross-section through the armature and field system of a typical 4-pole machine. By making the armature in this way the magnetic flux travels through iron for practically its whole journey, and, since it is about 1,000 times easier to establish a flux through iron than through air, the necessary flux is thus obtained with the minimum expenditure of energy in the magnetising coils. The small double air-gap in each flux path is inevitable, but can be reduced to a minimum by accurate construction.

Flow of Induced Current

As a conductor cuts the lines of magnetic force four times in each revolution a small E.M.F. is induced in it, the direction of the resulting current flow being obtained readily by the application of Fleming's Right-Hand Rule (Fig. 2):

Hold the thumb and first finger of the right hand as fully extended as possible, and bend the second finger at right angles to the palm. If the first finger represents the direction of the magnetic field and the thumb denotes the direction of motion of the wire, then the second finger shows the direction in which the induced current tends to flow.

As an aid in remembering this useful rule, associate the "f" in first finger with the "f" in field, and the "m" of thumb with the "m" of motion. If the left hand is used, the rule shows the direction of motion (thumb) of a current-carrying wire (second finger) when placed in a magnetic field (first finger), and is useful in the case of electric motors.

When this rule is applied to Fig. 1 it will be seen that current flows up out of the plane of the paper in the conductors marked 7, 8, 9, 10, 17, 18, 19, 20, and down into the paper in those marked 1, 2, 3, 4, 13, 14. The remaining conductors are in positions of zero or negligible induced E.M.F. at the instant shown in the diagram.

The conductors are connected in series to

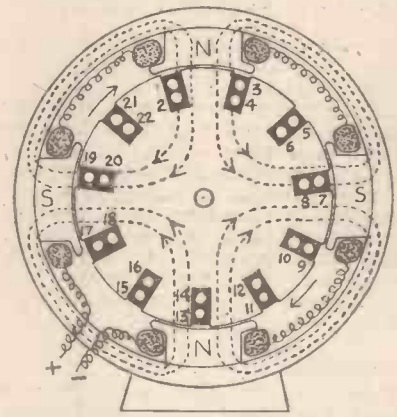


Fig. 1.—Section through armature and field system of typical 4-pole D.C. dynamo carrying 22 armature conductors in 11 slots.

form a continuous closed path, which may be considered at any instant to commence at one brush and end at the other brush. The elementary condition which must be satisfied by the winding scheme is that current shall be driven in the same direction all

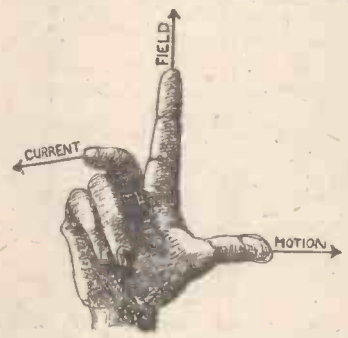


Fig. 2.—Illustrating Fleming's Right-hand Rule, used to determine the direction of current flow in a conductor moving through a magnetic field.

through a conducting path by the separate induced voltages of the individual conductors forming that path. A conductor carrying a "down" current must therefore be connected across to one carrying an "up" current and so on around the circuit. In this way the current receives a "push" from the induced voltage in each wire as it passes through the generating portions of the winding on its way from one brush to the other. Of course, the wires used to form these end-connections do not generate but serve merely to link up the active portions lying in the armature slots.

Armature Windings

If we start to trace a path through the winding of Fig. 1 from the conductor marked 1, we could satisfy the above condition about current direction by joining the far end of 1 to the far end of any one of the conductors marked 7, 8, 9, 10, 17, 18, 19, 20, all of which are carrying "up" currents. In practice the choice is limited by two important conditions. *First, it is customary to connect top-layer conductors to bottom-layer conductors, and vice versa.* This is purely a mechanical point leading to a more symmetrical winding, and permitting the use of "former-wound" armature coils. In fact, in very small hand-wound armatures the exact opposite condition usually holds. We shall assume former winding for the present discussion. *Secondly, conductors which are joined together at either end of the armature must be separated by approximately the same "pitch" (=angle) as adjacent field poles.* This is necessary in the interests of efficient commutation, and will be justified presently. The pitch in the present case is 90 degs. With these points in mind conductor 1 could be connected, at the far end, either to 8 or to 18. There is nothing to choose between these two alternatives, and, in practice, if 1 is joined to 8, then 2 will be joined to 17 (not to 18, since 2 is in the bottom layer). Alternatively, if 1 is joined to 18, then 2 would be connected to 7. In the present instance 1 is shown joined to 8, and this defines the pitch to be used for all end-connections at the far end of the armature. Conductor 3 is therefore joined to 10, 5 to 12, and so on, each end-connection "spanning" seven intermediate armature conductors.

We have traced the current down through 1, across and up through 8 to the near end of conductor 8. From here the path may go in either of two directions, producing the two different kinds of armature winding. *The near end of 8 may be joined back to the near end of 3, or it may go forward to the near end of 13.* These two possibilities are illustrated in Fig. 3 and Fig. 4 respectively, where, for simplicity of representation, the conductors are drawn radially, the inner ends indicating "front" or near ends of Fig. 1. In either case, the pitch of the front end-connection is seen to be 5. It is usual for the front and back pitches to differ numerically by 2 in this way, each being of necessity an odd number, when top-layer conductors are joined to those in the bottom layer.

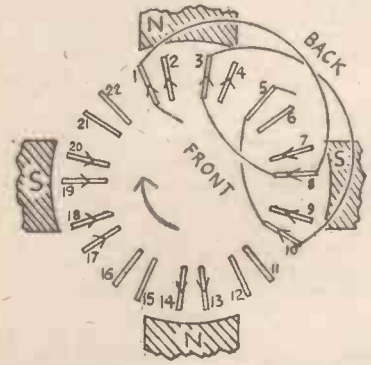


Fig. 3.—The beginning of a lap-wind of the armature of the machine shown in Fig. 1.

Fig. 4.—The beginning of a wave-wind of the armature of the machine shown in Fig. 1.

Fig. 3 is a lap winding. After a succession of the fundamental "laps" or "loops" described, the winding eventually returns to the starting point at the near end of 1, thus forming a complete closed circuit containing all the 22 conductors in series. Fig. 4 is a wave winding of the same armature. Each fundamental "wave" encircles the armature once, and after a number of such waves the winding again returns to the starting point. These windings are shown fully developed in Fig. 5 and Fig. 6. These may seem complicated at first sight, but are really nothing more than a succession of the simple elemental "lap" or "wave" of Fig. 3 and Fig. 4. The centre point of each front end-connection is joined to the nearest commutator segment.

Path of Current Through Armature

The condition that current should flow in the same direction throughout a complete brush-to-brush path cannot be made to apply simultaneously to the whole winding. On tracing around the lap winding of Fig. 5 it will be found that the direction of the current reverses suddenly at four points in the winding, but remains constant from any one of these points to the next. In other words, *the winding divides naturally into four separate conducting paths*, with currents alternately in opposite directions. These paths are shown dotted and full-line in Fig. 5, and the junction of each two indicates a correct position for a brush on the commutator. The arrow heads which indicate the direction of the current-flow are seen to meet at segments (e) and (j), so that current will flow from the armature into the external circuit from positive brushes placed in contact with these segments. Similarly, current tends to enter the armature at segment (b) and segments (g) and (h), and the negative, or return end, of the external circuit is therefore brought to brushes in these positions. The current, returning to the armature after passing through the external circuit, will divide into two parts, half entering the winding through segment (b) and the other half through segments (g) and (h). The current which enters at (b) will divide again, one quarter flowing through the full-line path to the positive brush at (e) and thence back into the external circuit, and the other quarter flowing through the dotted circuit to re-enter the external circuit at segment (j). Of the other half of the current, one quarter will pass through the dotted path from segment (g) to (e) and the other quarter through the full-line path from (h) to (j). Between the terminals of a four-pole, lap-wound armature there are thus four separate generating circuits, all in parallel with the external circuit. The terminal voltage of the machine is that generated in any one of these paths, that is, *in one quarter of the whole winding*. On the other hand, the possible current output is high, since any conductor carries only one quarter of the total armature current. In general, a lap-wound armature is divided into as many parallel paths as there are field poles, and since the junction of any two paths must be supplied with a brush the number of brushes is also equal to the number of poles. Brushes of similar sign are joined together externally. Multipole lap windings are therefore suitable for low voltage, high current machines such as those used for carrying out large-scale electrolytic processes.

In Fig. 6 only two parallel paths can be found, each commencing at segment (e) and passing by dotted or full lines to segment (b). Wave-wound armatures have never more than two parallel paths *no matter how many poles are used*, and the number of brushes need never exceed two. Moreover, the terminal voltage is always that generated

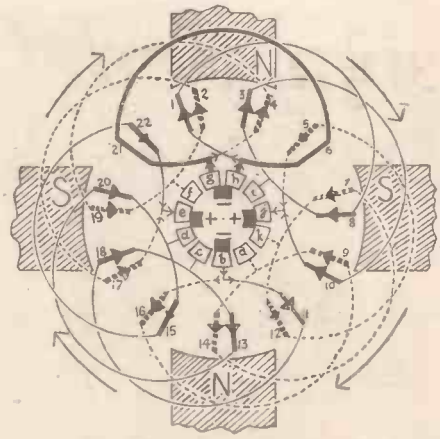


Fig. 5.—Developed diagram of the lap winding shown in Fig. 3.

in half the total number of conductors, irrespective of the number of poles. This type of winding is more suitable for machines supplying normal loads at higher voltages. It should be noted, in passing, that a lap-wound two-pole machine would have two parallel paths, and would therefore be identical in every respect to a wave-wound, two-pole machine of similar design. However, the two-pole construction is rarely used.

Commutation

When any conductor in an armature winding has travelled from one field pole to the next the current passing through it has completely reversed, as a glance at the arrow-heads in Fig. 5 or Fig. 6 will show.

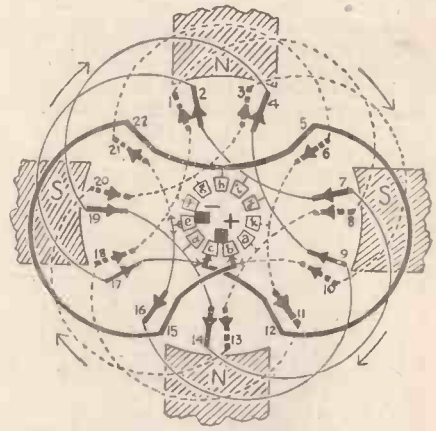


Fig. 6.—Developed diagram of the wave winding shown in Fig. 4.

Approximately half-way between any two poles each conductor transfers from one parallel path to the next, as the segment to which it is joined passes from one side of the brush to the other. While it forms part of any particular armature path, a conductor must be carrying the full current of that path. Hence, during the transfer, an orderly sequence of current changes must occur. First, the current must decrease to zero, after which it must increase *in the reverse direction* to the full value of the current in that path which the conductor is about to enter. *Not until the current has reached this full reverse value can contact with the brush be broken and the conductor completely introduced into the fresh path.* Any deviation from this condition will result in sparking at the brushes. For example, suppose a conductor is suddenly introduced into a fresh armature path at a moment when the current flowing through it is in the correct direction but only half as large as the current in the fresh path; as soon as the conductor in question leaves the brush and becomes part of the fresh circuit the full current of that path will flow through it. At the instant of transfer the current must therefore jump from half to the full value for the fresh path, and, since all armature windings are highly inductive, this sudden forced change of current will lead to the production of large local-induced voltages which will cause sparking at the brush. The process by which this regulated reversal of current is achieved is called *commutation*, and may be effected in two distinct ways, or, in practice, by a combination of these two ways.

Resistance Commutation

For this, carbon brushes are required at least as wide as a single commutator segment, so that pairs of adjacent segments are short-circuited for a moment while bridged by the brush. This causes the short-circuiting in turn of each elemental lap or wave, just at the moment when the induced E.M.F. in the lap or wave has dropped to zero as the conductors pass through the region of zero flux in the centres of the interpole gaps. The lap or wave which is thus momentarily shorted and undergoing commutation is shown in heavy line in Figs. 5 and 6, the absence of arrow-heads indicating that the current has fallen to zero at the instant shown in the diagram.

Mere short-circuiting of a loop for a moment would not cause the sequence of current changes outlined above. The orderly reversal of current in the commutated loop depends on the important fact that *the contact resistance between a carbon brush and a commutator segment is inversely proportional to the area of contact.* That is to say, the resistance is low when the segment is directly opposite to the brush, but increases rapidly as the area of contact between the two becomes less as the segment moves away from the brush. The effect of this phenomenon is detailed in Fig. 7, which shows a section of the lap winding of Fig. 5 drawn in simplified form. The resistance commutation of loop 21/6 (i.e., the loop shown in heavy line in Fig. 5) as it moves to the right across the negative brush is shown. In (A) the two parallel armature paths meet at segment (h), and the current is conveyed to the winding from the brush through this segment. When segment (g) comes into contact with the brush the current flowing from the brush into the full-line path finds a shorter route through segment (g), but since the contact resistance at (g) is very large at first, due to the small area of contact, the current prefers still to follow the longer path through segment (h) and around loop 21/6. Thus, *the shorting of loop 21/6 by the brush does not immediately lead to a sudden decrease in the current around the loop*, as would occur, for example, if copper brushes were used. As the area of contact with (h) decreases, and that with (g) increases, more and more of the full-line current takes the direct route through (g), so that the current passing *via* the shorted loop drops progressively, until, at (B), half of the full-line current is passing through each of the shorted segments. By the time the brush has symmetrically bridged the two segments, at (C), all of the full-line current is passing through the direct route by segment (g), and the current around loop 21/6 has dropped to zero. This is the condition of the loop at the instant shown in Fig. 5. As the contact resistance to segment (h) increases still more, *some of the dotted line current begins to find an easier route into the winding through segment (g) and around loop 21/6, so that current commences to flow*

in the reverse direction around the short-circuited loop. At (D) half of the broken-line current is passing through the loop and half is passing through segment (h). Just before segment (h) leaves the brush, *all* of the broken-line current has transferred to loop 21/6, so that when contact with segment (h) is finally severed and the commutated loop becomes part of the broken-line circuit, it is already carrying the full reverse current and no sudden change in the value of the loop current occurs. A moment later commutation of loop 19/4 commences, and so on.

Cause of Brush Sparking

In the foregoing notes we have dealt with the routes taken by the main armature load current. If the loop 21/6 is not in the position of zero induced E.M.F. (i.e., in the centre of the interpole gaps) during the period of short-circuit, *an additional circulating current* is set up in one or other direction around the shorted loop by the E.M.F. induced in the loop by its movement through the field. When the trailing edge of the brush breaks contact with segment (h), this circulating current is suddenly interrupted, a self-induced E.M.F. rapidly builds up in the inductive loop, and a spark jumps to the brush from the segment before the gap has widened sufficiently to prevent it. To avoid this, *each brush must be placed so that it bridges those commutator segments which are joined to conductors passing through the region of zero flux, midway between the poles. This is the primary consideration governing the placing of brushes in all D.C. machines.* It explains also why the winding pitch should be kept as close as possible to the pole pitch, so that *both* sides of any loop may be situated in the centre of the interpole gaps at the same instant.

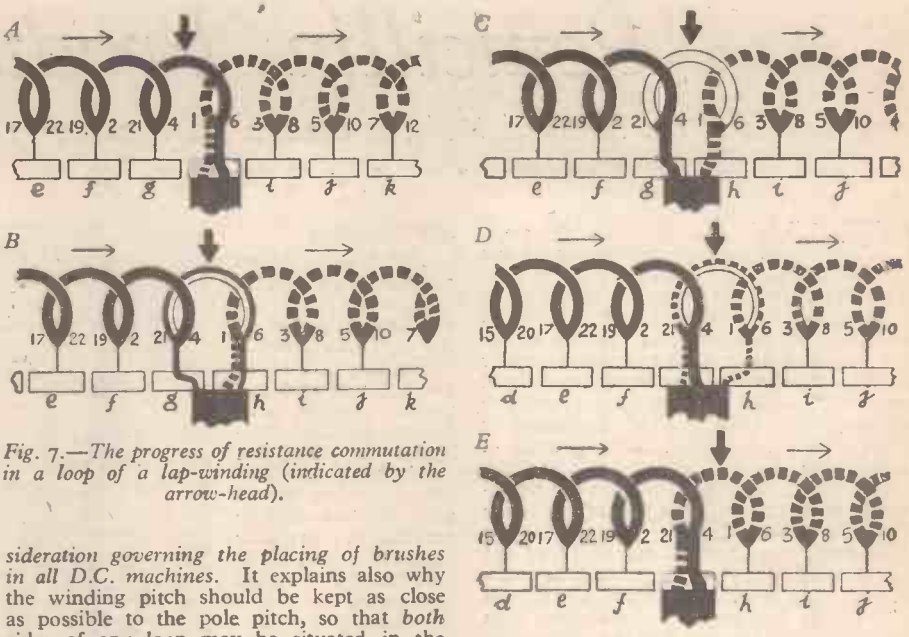
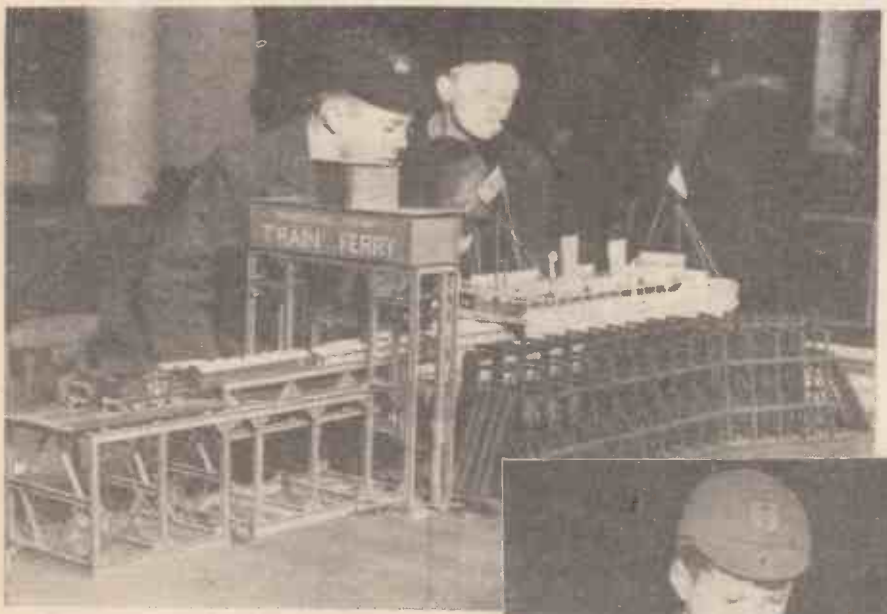


Fig. 7.—The progress of resistance commutation in a loop of a lap-winding (indicated by the arrow-head).

As an examination of the winding diagrams will show, the placing of the brushes which best satisfies this vital condition brings them also in contact with the points in the winding at which parallel paths meet, so that no sacrifice of available E.M.F. need be made to secure sparkless commutation. Unfortunately, the problem of sparkless commutation is complicated in practice by several other factors to be discussed in detail next month.

(To be continued)

The Model Railway Exhibition



The illustration above shows two young enthusiasts having a pre-view of an attractive exhibit—a scale model ferry train. On the right is a 1in. scale Atlantic type locomotive and tender.

THE Model Railway Exhibition, recently held at the Central Hall, Westminster, was the first exhibition to be held by the Model Railway Club since 1939. As with previous shows of this kind, the organisers staged a very attractive display of model locomotives, rolling stock and accessories. The accompanying illustrations give a good idea of the high-class workmanship noticeable in many of the exhibits. Model railway layouts in various scales were much in evidence, particularly in "OO" and "O" gauges.

Judging by the fine attendance at the show, the war years have not dimmed the enthusiasm of young and old for the fine hobby of model railway construction and operation.

Penicillin Production

Details of the Plant and Methods Used in the Manufacture of This Remarkable Drug

By A. E. WILLIAMS, F.C.S.

PENICILLIN, a very useful drug developed largely during the recent war and now made by large-scale fermentation processes, requires special types of plant for its efficient production. To obtain 4lb. of penicillin over 30 tons of the raw material have to be handled under strictly controlled and exacting conditions. Because penicillin is an extremely sensitive substance the technique of producing it differs widely from other methods used in manufacture.

The flow sheet, Fig. 1, outlines the procedure adopted for penicillin production at the Speke (Liverpool) factory operated by the Distillers Company, Ltd., on behalf of the Ministry of Supply. In this plant the materials for the fermentation vessels are sterilised by heating in the steriliser, then passed through a cooler into the fermenters, wherein the mould to induce fermentation is added. Compressed air is blown upwards through these vessels to assist fermentation. The fermented batch is next filtered, and from the clear liquid the penicillin is extracted, being next combined with either sodium or calcium to give a stable penicillin salt. In this form the penicillin goes forward through sterilising, testing and special drying plant.

In processing, the liquid is first sterilised by the use of superheated steam at a pressure of about 150lb. per sq. in.; the type of fermenting vessel used being seen in Fig. 2, which shows some 5,000 gallon vessels of Glaxo Laboratories, Ltd. Fermenters may be of mild steel, welded or riveted, with pipes arranged at intervals up the side of the vessel for the drawing off, when necessary, of the various portions of the batch. In such a building, not only steam pipes are lagged, but those carrying the process liquids are also similarly protected to maintain the desired temperature while they move through the pipes. To maintain a vigorous fermentation in the vessels a strong current of air has to be blown through the tons of liquid in each vessel. This is done by compressors drawing from atmosphere via an elaborate system of air-purifiers, since the air passing through the compressors must be perfectly sterile.

Air Cleaning

The installation of air purifiers, or scrubbers, at the Speke factory is seen in Fig. 3. Air is sucked in at the top of the towers by compressors and passes through different chemical reagents to eliminate atmospheric impurities. It is then filtered and washed before proceeding, under pressure from the compressors, to the fermenters.

Normally, the different forms of impurity in the average atmosphere may be classed as solid, liquid, gaseous and bacterial, the different proportions of these varying widely according to district. Visible particles, which we commonly call dust, are larger than 0.0002in., and these are easily collected from the air by the use of suitable filters; while the smaller, invisible particles can also be eliminated by suitable washing methods. These invisible particles may, in fact, be arrested at the same time as the liquid and gaseous impurities by chemical and washing treatment. The amount of solid impurities in an average atmosphere ranges from 1 to about 10 grains in every 1,000 cubic feet of air; but in congested industrial areas this concentration of impurity may be greatly exceeded. It is not difficult to estimate, therefore, the amount of solid dirt alone which will be collected by air-purifiers handling thousands of cubic feet of air per minute.

In the case of fermentation processes the elimination of bacteria and sterilisation of the air to be passed through the vessels is of paramount importance; because air, even though freed from other types of impurities, that contains even a low concentration of bacteria may quickly spoil a fermentation process. To create sterile air quickly and in large quantities is no easy matter. Extensive use has been made of glycerine as a collecting medium for bacterial impurities, and one plant for this purpose consists essentially of a series of revolving drums, partly submerged in a bath of glycerine. The air to be cleaned is passed through the upper section of each drum and thus contacts the glycerine-coated surface of the drum. As the drum is slowly revolving a fresh contact surface is continuously presented to the air.

Fig. 2.—Penicillin Glaxo 5,000 gallon fermenters.

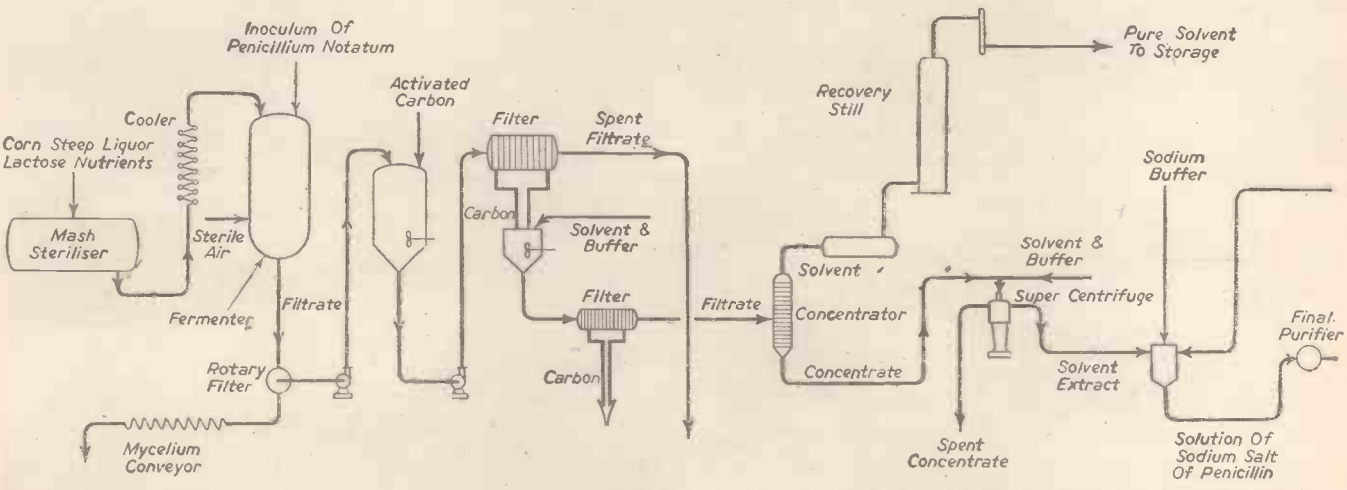


Fig. 1.—Flow sheet outlining the process adopted for penicillin production

Rotary Filters

After fermentation it is necessary to remove the solids (mycelium) from the liquid containing the penicillin, and this is done by rotary filters. Fig. 4 shows a filter of this type in action at the Speke factory. The mycelium is removed in a continuous layer, and the plant operates under vacuum created by Pearn pumps. In operation, the liquid from the fermenters is fed in a constant stream to the vessel in which the filter rotates, and gradually a layer of mycelium forms on the surface of the filter by reason of the reduced pressure inside the drum created by the pump. The layer of mycelium is removed continuously as it is formed on the filter surface.

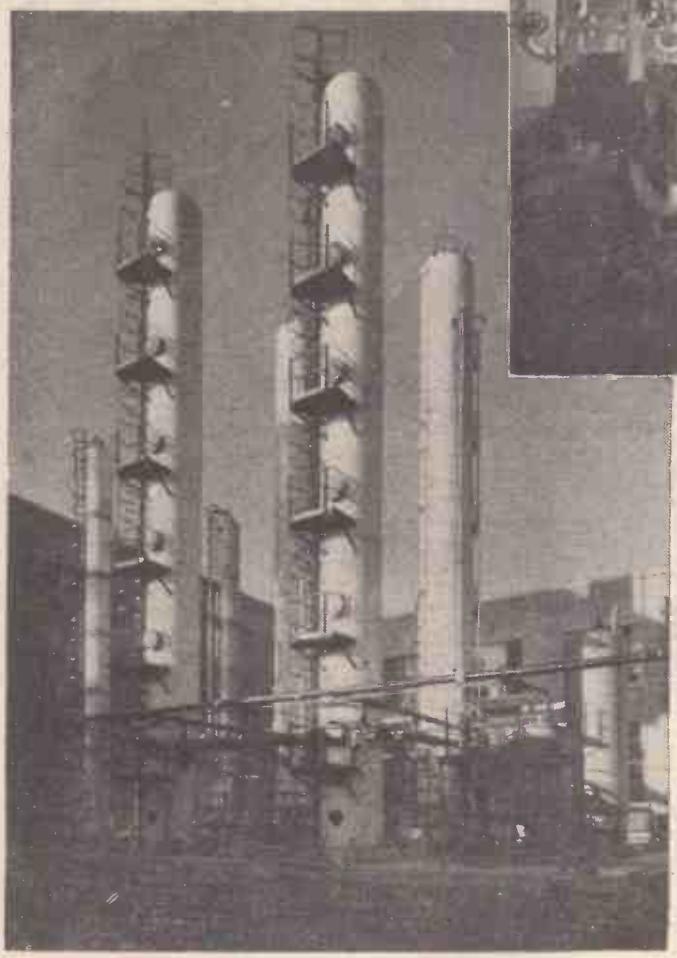


Fig. 3.—Air scrubbers at the Speke factory.

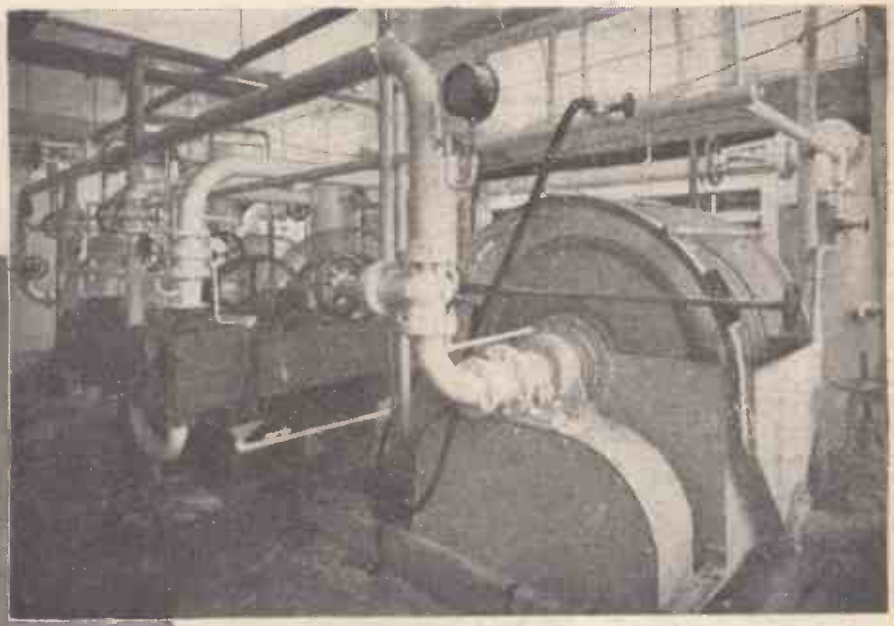


Fig. 4.—Rotary filters at Speke.

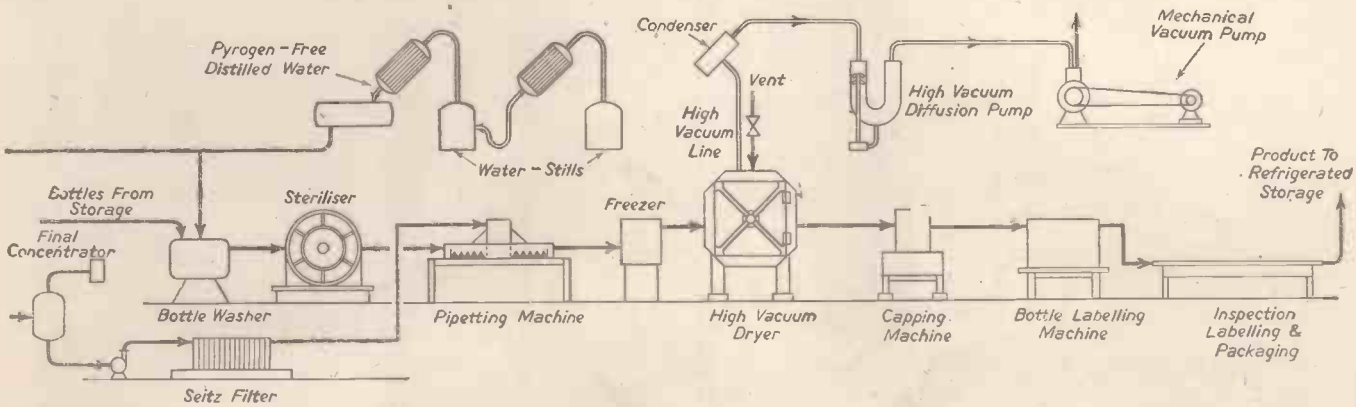
A typical rotary filter consists of a drum revolving in an open tank, which latter may be constructed of cast iron, mild steel, stainless steel, or other metal having a high resistant action to the material passing through it. The object of having a non-corrosive metal for the construction of this tank is not only to prolong the life of the tank, but also to avoid metallic contamination of the batches passing through it. The drum shell has an inner surface which is impervious to liquids or gases, and this carries a grating to support an outer surface which is porous and forms the filtering medium. Different compartments are built into the space between the two surfaces by the provision of metal strips running parallel to the axis of the drum, the compartments being entirely separate from each other and are connected by a series of pipes to an automatic valve at the end of the shaft. In this type of valve the seat is bolted to the drum trunnion and the two revolve together, while the valve chamber is fixed.

When in operation, the liquid that has to be filtered is fed at an appropriate speed to the tank, and as the drum revolves in the liquid, a cake or layer of solids from the liquid gradually forms on the porous filter surface by reason of the suction inside the drum. The clear liquid which has passed through the porous material is collected by a series of pipes inside the drum and passed through the automatic valve to the outside. As the cake emerges from the liquid a current of water is sprayed on it; the vacuum serving to clear quickly the excess water. At a point just before the layer, or cake, meets the scraper to remove it, the vacuum may be replaced by compressed air, which loosens the cake for easy removal by the scraper. The clear, porous surface then enters the liquid in the tank again and the next cycle commences.

The clear liquid from the filters passes on to a large, stainless steel tank fitted with high-speed agitators.

Recovery of Penicillin

At this stage a small proportion of finely divided activated carbon may be added to the liquid, the amount depending on the actual concentration of penicillin present. The penicillin is rapidly absorbed by the



at the Speke (Liverpool) factory of the Distillers Co., Ltd.

carbon and after passing through filter presses the clear liquid is thrown away. The next step is to recover the penicillin from the carbon and to purify the crude penicillin by a series of operations using organic solvents. For this purpose the carbon may be transferred to another stainless steel vessel and stirred up with a solvent, which dissolves the penicillin from the carbon.

The penicillin is later passed through a series of alkali extractors, Fig. 5, which shows some of these vessels in the Speke factory, whereby a solution of either the sodium or calcium salt of penicillin is obtained. These vessels are of stainless steel, glass lined, each vessel carrying stirring gear operated by its own individual motor, with variable speed gear. The method of stirring materials, as depicted in Fig. 5, wherein each vessel has its own individual stirrer and prime mover, is a vast improvement on what was, until recently, almost standard practice. This was to stir a whole series of vessels in a row by means of line shafting and a belt operating each stirrer through simple gearing; the stirrers each having a fast and loose pulley. With the old method it frequently happened that the necessarily high-powered motor employed to drive the line shaft had to be kept running merely to stir one vessel in the series.

So that in order to stir one small vessel a motor far too big for the job had to be used, and in using it the belts on all the unoccupied vessels had to be kept moving, running on the loose pulleys, thus creating unnecessary wear and tear. Another great drawback to the older method of stirring is that if the big motor breaks down, all the stirrers operating from that line shaft are immediately out of action, but with the individual stirring method, if one motor stops only one stirrer is out of action.

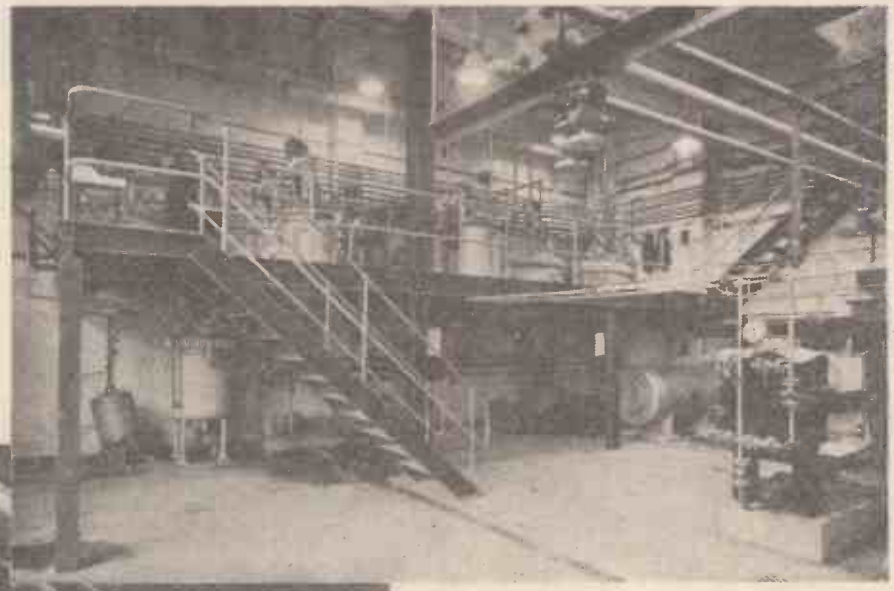


Fig. 5.—Reaction vessels for penicillin sodium salt.

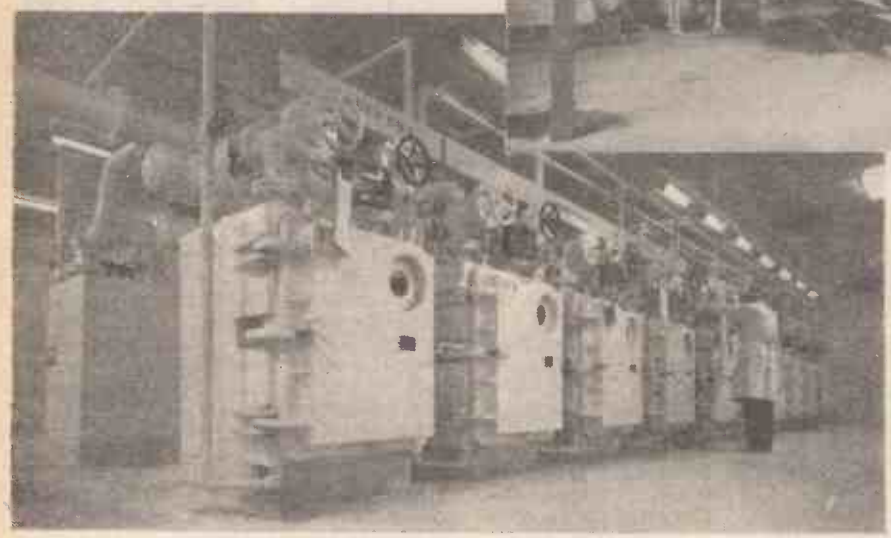


Fig. 6.—Vacuum dryers for dehydrating penicillin.

Drying

After further purification and concentration, the penicillin is transferred to bottles, which are filled at a rate of 3,000 per hour. Trays containing the filled bottles are covered and placed in dry-freezing machines which reduce the temperature of the solution to 70 below zero C., thus freezing the solution to a block of ice. The bottles are then transferred at high speed to vacuum ovens and vacuum is applied. In solution, penicillin is so unstable to heat that dehydration must be accomplished in the freezing state and the ice is, therefore, evaporated directly without going through the liquid phase. This is assisted by the use of high vacuum diffusion pumps.

Drying equipment at the Speke factory consists of two batteries of vacuum ovens, seen in Fig. 6. The massive construction of these units is necessary, for when in operation under high vacuum there is a pressure of about ten tons on the outside of the oven doors. These doors are constructed of special cast iron, while the body of the drier is of welded steel construction. Around the rim of the door is a composition gasket to give an airtight joint quickly when the door is closed.

The diffusion pumps operating on these driers are seen in Fig. 7. Eleven sets of these pumps handle the two batteries of driers. The pumps are 4in. diameter units, of multi-jet design, in welded steel. The operating medium is chlorinated hydrocarbons, which have a lower vapour pressure even than that of mercury. In operation, the hydrocarbons are continually vaporised and condensed again on the cooled sides of the pump. A vacuum higher than 10^{-6} mm. Hg. is obtainable with these diffusion pumps.

After the trays of uncovered bottles are placed in the ovens, the system is evacuated down to about 300 microns within five

(*Continued on page 319.*)

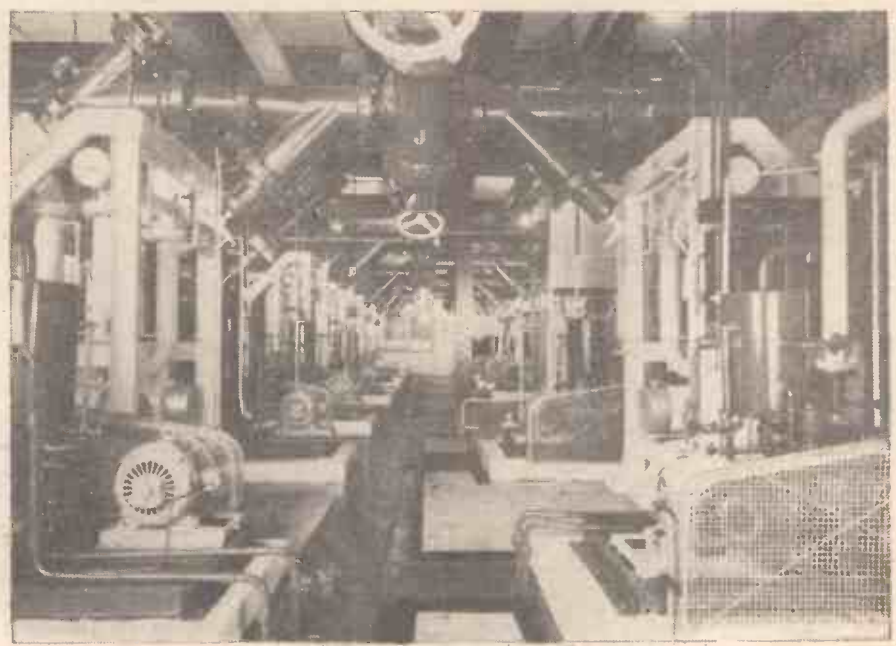


Fig. 7.—A battery of diffusion pumps at Speke.

The British Industries Fair

Some Afterthoughts: A Glance at the Trinity

By the MARQUIS of DONEGALL

THERE was little in common between the three divisions of the B.I.F. (Olympia, Earl's Court and Castle Bromwich) except such things as good catering, courtesy and efficiency for dealing with overseas buyers' language requirements.

There was, however, one important angle common to all that struck me particularly, having visited this year's fair at Basle. That was that it was obvious, as was the case at Basle, that an architect, or team of architects, must have been employed in the design of each section.

These architects had a difficult task because, just at the time that their designs were ready to be materialised, the sundry shortages, and especially the fuel shortage, set them furiously thinking out substitutes and improvisations.

I am not sure that the result was not to the good. All flamboyance had to be omitted, and in consequence, instead of the fair having a "Wonderland" effect, it just about reflected reality without being in any sense makeshift.

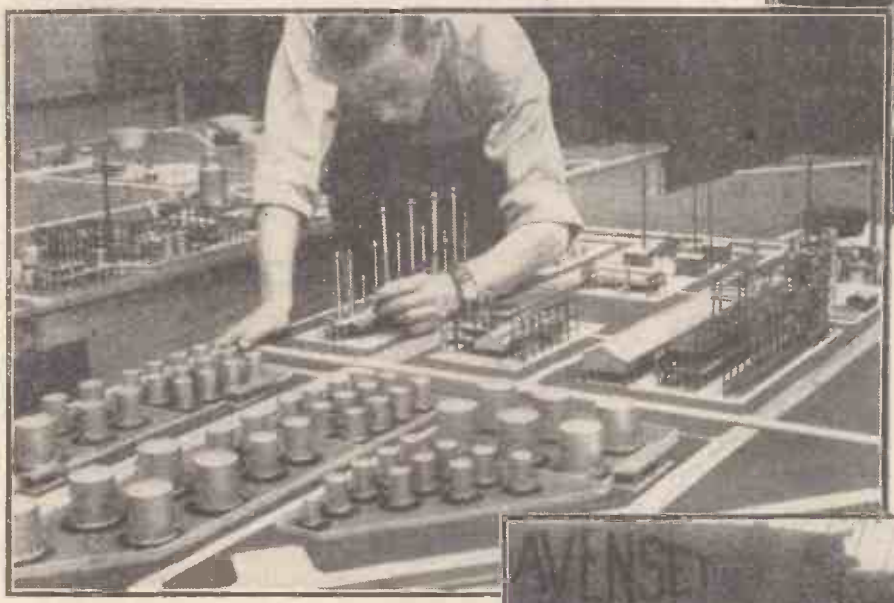
It has been suggested by critics that the letting of floor-space by square-footage must in some way be revised. The argument is that one stand is thus enabled to over-balance another and thus upset the design of the whole. Not being an architect, I must say that I did not find this effect thrust upon me, and that throughout the general impression was restful and pleasing to the eye.

Earl's Court

Earl's Court was the largest of the three sections, and consisted mainly of the textile exhibits which included a great many articles depending on processes developed during the war. Particularly I would mention fireproofing and sponge-down qualities. If we could only get hold of the things in this country it might make the dry-cleaners think again when they airily tell us that we won't get the curtains back for three months, if lucky.

Perhaps I was only particularly impressed by the bed-linen and the Witney blankets, because everything tolerable in this department has been out of the shops for so many years. The shades in which all these things come, including the quilting, were certainly pleasing, even if one had seen them long ago.

An ultra-lightweight exhibit at the British Industries Fair (Olympia section) was this "OWAT" 5 c.c. compression ignition diesel engine for model aeroplanes, cars and boats. Its all-up weight is only 10½oz., its fuel tank, holding 1½oz., is sufficient for 5 minutes' run.



A model of the Shell plant, costing several million pounds, that is being erected at Thornton-le-Moors, Cheshire, for the manufacture of chemicals from petroleum. Picture taken at the Olympia section of the B.I.F.

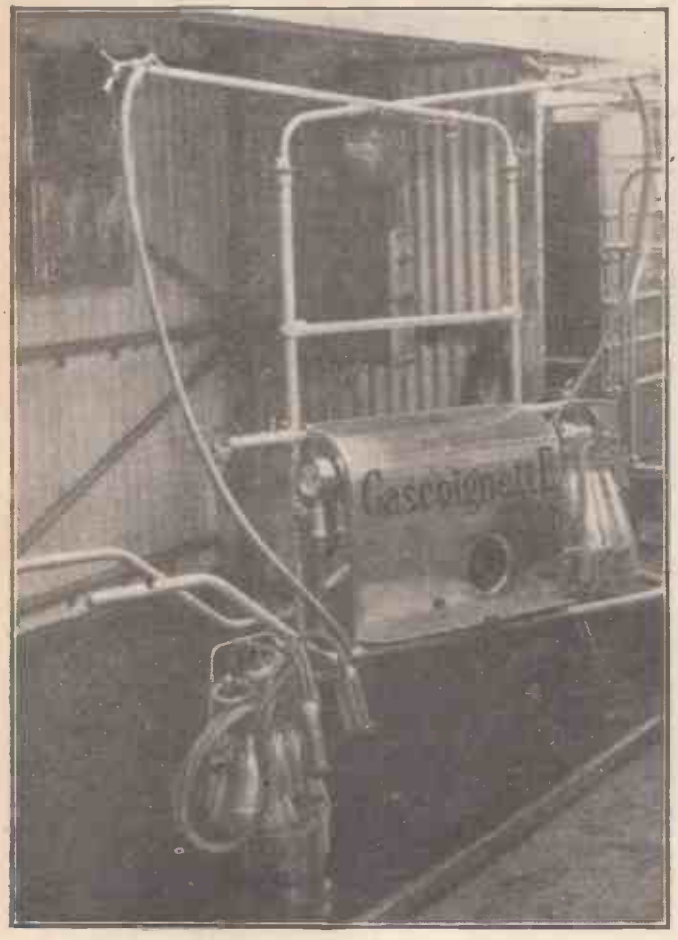
To go on with Earl's Court, I had goggled in Switzerland in January, 1946, and again only a few weeks ago, at the leather goods from handbags to suitcases. Many of the identical models turned up at Earl's Court,

A Wilson electric vehicle chassis on Partridge, Wilson and Co.'s stand at the Birmingham section of the Fair.

and one realised that their counterparts in Switzerland were British.

The Movie-doll

To go less serious for a moment, one of the unexpected riots of the Olympia section was the movie-doll, of which, in its present various forms, I submit a picture. The fact that it is modelled on Disney-esque lines, is cheap, washable, unbreakable and will retain any grotesque position that you twist it into, apparently caught the imagination of overseas buyers. Also it was for immediate delivery. Anyway, South Africa ordered a million, and America was only a little behind with the Dominions. You will be able to see this popular monstrosity because a large Oxford Street store has bought the entire Olympia stand to transplant lock, stock and barrel. (I was not able to ascertain whether it has also purchased the British and American film stars who swarmed round the Olympia stand.) One of the reasons that I have picked out this particular product to be the only one that I shall mention by name is that it is made entirely by ex-Servicemen, 50 per cent. are disabled—with a proportion of one-armed and some in wheeled-chairs.



A portable milking machine on the stand of G. H. Gascoigne Co., Ltd., at the Birmingham section of the fair.

Precision Instruments

It is rather interesting to recall that there were over 3,000 exhibitors at the first post-war B.I.F. as against just over 2,000 at the last one in 1939. Undoubtedly at Olympia a main attraction was what I would call the Precision Instruments Section. This department—hardly by chance, I feel, was situated immediately through the main entrance of Olympia. Quite apart from the "British Leica," which I mentioned in my former article, there were such things as binoculars, microscopes, optical measuring machines, instruments fitted with plastic precision lenses, etc.

Plastic Lenses

All these things we manufactured before the war — including plastic lenses—better than anybody in the world. I happen to know about the plastic lenses, because I am original shareholder in a company which spent seven years on research working out the variation of refraction between glass, quort and "Perspex" for every known prescription of spectacles.

It takes you back a bit to remember that King George V wore a pair of our plastic spectacles for the last two years of his life. As may well be imagined, the art that we had developed was put to good use in the war, but, not being a technician on submarine periscopes, I will not go further than to say that I believe we were able to eliminate what would correspond in a motor-car to the "blind spot" provided by the supporting limb between roof and chassis.

As an instance of the optical apparatus there was the equipment made to replace that which was removed from a Norwegian lighthouse by the Nazis. This was such a landmark that it corresponded as a meeting-place to the famous clock at Lord's Cricket Ground. When installed this apparatus will give a triple flash per minute of 4,000,000 candle power, which, in good conditions, should be able to warn ships as much as 40 miles away. Also among the scientific instruments there was one which records the behaviour of cosmic rays and another by the aid of which "vets" can detect a piece of metal that your dog has swallowed. This instrument was on the same principle as the wartime land-mine detector.

Then we have instruments that are capable of measuring such things as the speed of a camera-shutter within one-millionth of a second.

Also there was a machine that will indicate to the "backroom boys" any weakness in the design of an aircraft before the prototype takes off on its first test flight.

The movie-doll stand at the Olympia section of the fair.

Watches and Jewellery

As far as watches and chronometers are concerned, we have always made the best in the world since Harrison lived and died at a ripe old age in the eighteenth century to give the world the marine chronometer. We got slack about this virtual British monopoly towards the end of the last century.

Frankly, the watches were not very startling to one who has glued his face to watch-shops in Switzerland, but it was good to see the chronometers and equally satisfactory to note that someone had taken the trouble to set them right.

I was particularly interested in the telecommunication show of high-speed transmitters and receivers, as fitted in one of the trains for the Royal tour of South Africa. On the television side, the full-size van for outside broadcasts was interesting and, although not new to readers of this magazine, I saw for the first time a television set employing only one wavelength for sound and vision.

It would be impossible to give any idea of the multiple uses of plastics. It went from allegedly unbreakable doll's furniture to a full-size kitchen display of gaily coloured Perspex.

Whatever the arguments may be for or against the holding of the fair, it is certain that the British craftsman has not lost his skill—nay, has indeed taken full advantage of wartime scientific advance—even though he may not have the tools or the material to make in the quantities that we would all like to see.

Napier's Bones

Suggestions for the Construction of a Strip Calculator of this Type

By A. MILNER

MANY minds have been intrigued by these ingenious devices, and in view of the recent articles in this magazine the writer feels that some of the ideas and methods outlined below may prove of interest and use. From the point of view of present day requirements, the "Bones" are hardly in usable form. The inconvenience of arranging the separate sticks for each multiplicand, together with the mental resistance to adding numbers arranged diagonally, and the carrying forward detract considerably from the usefulness as a practical calculator.

Strip Calculator

Anyone desirous of constructing a calculator of this type, but without the inconvenience of the separate sticks, may do so on the following lines. Take 10 sheets from a pad of ¼in. squared paper and, as shown in the illustration (Fig. 1), use each sheet to contain a number of vertical columns for sets of the tables for each multiplier. By cutting carefully between the columns, but leaving all sheets fastened at the top, it is possible by turning up the strips to obtain a table for the desired arrangement of numbers.

The centre row of figures is in distinctively coloured ink, and the figures indicate each of the multipliers 1-9. The use of diagonal lines is avoided, and the figures which it is necessary to add together are shown between the strip centre multiplier columns.

Simple Method

As the mental effort required to effect the additions and the carry forward figures causes appreciable delay and as the multiplication table up to 12×12 is well known, attention was directed to performing the multiplication mentally and leaving the additions to a separate step. The following method allows for products to be written down without tables or strain, and the separate addition of the two lines is easier to perform than in the usual carry forward method.

Multi-add 1

Example 1

8×6732

4824
5616
53856

Example 2

9654×3276

9654
3 2715
. 1812
2 1810
. 1208
7 6335
. 4228
6 5430
. 3624
31626504

For multiplication by two or more figures squared or lined paper is advisable, and the separate products for each multiplier are written down on alternate lines as before. The product of such as 3×2 should be shown as 06 to maintain alignment.

Multi-add 2

If a table of boxes of products for each of the numbers 1-99 is constructed as shown on page 316, the multiplication of any number by a two figure multiplier is obvious. It will, however, be seen that by performing one linking step on similar lines to that required with the strip calculator, the use of the table permits easy multiplication of any number by four figures.

Example 3

9×5758. Read as 513-51822 using boxes 57 and 58.

Example 4

9×5778. Read as 513-52002 using boxes 57 and 78.

Example 5

95×523. Read as 45-4707 using boxes 5 and 23.

25- 2615
49685

Markers or pointers to indicate the required boxes should be used. Where it is required to use boxes for an odd number of places the box for a single place should be used first, as shown in Example 5.

Long division is facilitated as the table allows the factor and its product to be quickly ascertained.

M.A.3 and M.A.4

While the M.A.2 is normally sufficient and is convenient on account of being on a single sheet, there are advantages which in the writer's opinion would warrant tables being constructed for three-place and four-place numbers. As an example of the M.A.3, boxes are shown in the table on the following page for numbers 365, 366, 634 and 635. The M.A.3 allows for six figure multipliers to be dealt with conveniently.

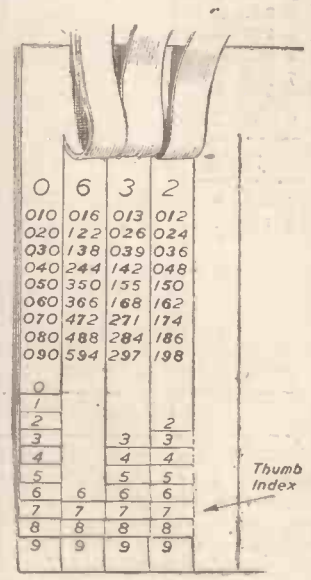


Fig. 1. A simple strip calculator. Alternatively the heavy figures can be replaced by red figures with vertical lines on each side.

Complementary Division

The difficulty in long division, apart from the multiplication of the divisor, is the necessity of subtraction which is not usually an easy mental process. We can replace subtraction by addition if we arrange M.A.3 and M.A.4 tables in such a way that next to the box for a given number is to be found the box for its complement.

Example 6.

8365426÷365 using M.A.3 table.

0365)08365426(22918 remainder 356
1270
¥1065
12704
¥3354
5715
¢0692
0635
¥3276
5080
¥356

By inspection of the box for 365 we see that the first figure of the answer is 2, and we then add the product of 2×635 which is the complementary number and is found in the adjacent box, and so on. The first figure of each of the additions is crossed off to form part of the answer, and the rest is the remainder.

The method will be clear when it is seen that for example:

562 − 365 = 197 is equivalent to 1197 i.e., 562+635 − 1000 = 197 365+635

Alternatively a slide rule can be used to ascertain the next few figures of the quotient, and only the table for the products of the complement of the number is then required.

Log Charts

As the name of Napier is so much associated with logarithms, one is tempted to see if any similar economies in this field can be effected. In this connection the writer has found that logarithmic scales constructed in sections on squared paper can often be used more conveniently than the usual four figure tables. These charts can be used in much the same way as a slide rule, by noting the number of complete lines of sections of the single log scale; and as regards portions of lines, by marking off the lengths on a strip of paper. In this way it is easy to have the service equivalent of a slide rule 100 cms. or 1,000 cms. long, but which naturally does not compete with the standard 10in. rule for convenience for the usual engineering requirements. These sections of a logarithmic scale are on similar lines to those used in Cooper's slide rule, and on account of being prepared on suitably selected squared paper the mantissae can easily be read when necessary without the mantissae values being shown. Suitable layouts are 1,000 cms. divided into 50 lengths of 20 cms., and 100 cms. divided into 10 lengths of 10 cms. In the scales prepared by the writer it was found convenient to indicate on the left-hand side the mantissa value at the commencement of each line and on the right-hand side the number of the line.

In these days of strict economy the devices outlined may form a useful utility model calculating machine.

A Modification of "Napier's Bones"

A Practical Calculation Aid which Permits of Easy Multiplication of any Number by a Four Figure Multiplier

365	635
1 0365	1 0635
2 0730	2 1270
3 1095	3 1905
4 1460	4 2540
5 1825	5 3175
6 2190	6 3810
7 2555	7 4445
8 2920	8 5080
9 3285	9 5715

366	634
1 0366	1 0634
2 0732	2 1268
3 1098	3 1902
4 1464	4 2536
5 1830	5 3170
6 2196	6 3804
7 2562	7 4438
8 2928	8 5072
9 3294	9 5706

MULTI-ADD TWO-PLACE TABLE

01	02	03	04	05	06	07	08	09	10
1 001	1 002	1 003	1 004	1 005	1 006	1 007	1 008	1 009	1 010
2 002	2 004	2 006	2 008	2 010	2 012	2 014	2 016	2 018	2 020
3 003	3 006	3 009	3 012	3 015	3 018	3 021	3 024	3 027	3 030
4 004	4 008	4 012	4 016	4 020	4 024	4 028	4 032	4 036	4 040
5 005	5 010	5 015	5 020	5 025	5 030	5 035	5 040	5 045	5 050
6 006	6 012	6 018	6 024	6 030	6 036	6 042	6 048	6 054	6 060
7 007	7 014	7 021	7 028	7 035	7 042	7 049	7 056	7 063	7 070
8 008	8 016	8 024	8 032	8 040	8 048	8 056	8 064	8 072	8 080
9 009	9 018	9 027	9 036	9 045	9 054	9 063	9 072	9 081	9 090

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1 011	1 012	1 013	1 014	1 015	1 016	1 017	1 018	1 019	1 020	1 021	1 022	1 023	1 024	1 025	1 026	1 027	1 028
2 022	2 024	2 026	2 028	2 030	2 032	2 034	2 036	2 038	2 040	2 042	2 044	2 046	2 048	2 050	2 052	2 054	2 056
3 033	3 036	3 039	3 042	3 045	3 048	3 051	3 054	3 057	3 060	3 063	3 066	3 069	3 072	3 075	3 078	3 081	3 084
4 044	4 048	4 052	4 056	4 060	4 064	4 068	4 072	4 076	4 080	4 084	4 088	4 092	4 096	4 100	4 104	4 108	4 112
5 055	5 060	5 065	5 070	5 075	5 080	5 085	5 090	5 095	5 100	5 105	5 110	5 115	5 120	5 125	5 130	5 135	5 140
6 066	6 072	6 078	6 084	6 090	6 096	6 102	6 108	6 114	6 120	6 126	6 132	6 138	6 144	6 150	6 156	6 162	6 168
7 077	7 084	7 091	7 098	7 105	7 112	7 119	7 126	7 133	7 140	7 147	7 154	7 161	7 168	7 175	7 182	7 189	7 196
8 088	8 096	8 104	8 112	8 120	8 128	8 136	8 144	8 152	8 160	8 168	8 176	8 184	8 192	8 200	8 208	8 216	8 224
9 099	9 108	9 117	9 126	9 135	9 144	9 153	9 162	9 171	9 180	9 189	9 198	9 207	9 216	9 225	9 234	9 243	9 252

29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
1 029	1 030	1 031	1 032	1 033	1 034	1 035	1 036	1 037	1 038	1 039	1 040	1 041	1 042	1 043	1 044	1 045	1 046
2 058	2 060	2 062	2 064	2 066	2 068	2 070	2 072	2 074	2 076	2 078	2 080	2 082	2 084	2 086	2 088	2 090	2 092
3 087	3 090	3 093	3 096	3 099	3 102	3 105	3 108	3 111	3 114	3 117	3 120	3 123	3 126	3 129	3 132	3 135	3 138
4 116	4 120	4 124	4 128	4 132	4 136	4 140	4 144	4 148	4 152	4 156	4 160	4 164	4 168	4 172	4 176	4 180	4 184
5 145	5 150	5 155	5 160	5 165	5 170	5 175	5 180	5 185	5 190	5 195	5 200	5 205	5 210	5 215	5 220	5 225	5 230
6 174	6 180	6 186	6 192	6 198	6 204	6 210	6 216	6 222	6 228	6 234	6 240	6 246	6 252	6 258	6 264	6 270	6 276
7 203	7 210	7 217	7 224	7 231	7 238	7 245	7 252	7 259	7 266	7 273	7 280	7 287	7 294	7 301	7 308	7 315	7 322
8 232	8 240	8 248	8 256	8 264	8 272	8 280	8 288	8 296	8 304	8 312	8 320	8 328	8 336	8 344	8 352	8 360	8 368
9 261	9 270	9 279	9 288	9 297	9 306	9 315	9 324	9 333	9 342	9 351	9 360	9 369	9 378	9 387	9 396	9 405	9 414

47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
1 047	1 048	1 049	1 050	1 051	1 052	1 053	1 054	1 055	1 056	1 057	1 058	1 059	1 060	1 061	1 062	1 063	1 064
2 094	2 096	2 098	2 100	2 102	2 104	2 106	2 108	2 110	2 112	2 114	2 116	2 118	2 120	2 122	2 124	2 126	2 128
3 141	3 144	3 147	3 150	3 153	3 156	3 159	3 162	3 165	3 168	3 171	3 174	3 177	3 180	3 183	3 186	3 189	3 192
4 188	4 192	4 196	4 200	4 204	4 208	4 212	4 216	4 220	4 224	4 228	4 232	4 236	4 240	4 244	4 248	4 252	4 256
5 235	5 240	5 245	5 250	5 255	5 260	5 265	5 270	5 275	5 280	5 285	5 290	5 295	5 300	5 305	5 310	5 315	5 320
6 282	6 288	6 294	6 300	6 306	6 312	6 318	6 324	6 330	6 336	6 342	6 348	6 354	6 360	6 366	6 372	6 378	6 384
7 329	7 336	7 343	7 350	7 357	7 364	7 371	7 378	7 385	7 392	7 399	7 406	7 413	7 420	7 427	7 434	7 441	7 448
8 376	8 384	8 392	8 400	8 408	8 416	8 424	8 432	8 440	8 448	8 456	8 464	8 472	8 480	8 488	8 496	8 504	8 512
9 423	9 432	9 441	9 450	9 459	9 468	9 477	9 486	9 495	9 504	9 513	9 522	9 531	9 540	9 549	9 558	9 567	9 576

65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
1 065	1 066	1 067	1 068	1 069	1 070	1 071	1 072	1 073	1 074	1 075	1 076	1 077	1 078	1 079	1 080	1 081	1 082
2 130	2 132	2 134	2 136	2 138	2 140	2 142	2 144	2 146	2 148	2 150	2 152	2 154	2 156	2 158	2 160	2 162	2 164
3 195	3 198	3 201	3 204	3 207	3 210	3 213	3 216	3 219	3 222	3 225	3 228	3 231	3 234	3 237	3 240	3 243	3 246
4 260	4 264	4 268	4 272	4 276	4 280	4 284	4 288	4 292	4 296	4 300	4 304	4 308	4 312	4 316	4 320	4 324	4 328
5 325	5 330	5 335	5 340	5 345	5 350	5 355	5 360	5 365	5 370	5 375	5 380	5 385	5 390	5 395	5 400	5 405	5 410
6 390	6 396	6 402	6 408	6 414	6 420	6 426	6 432	6 438	6 444	6 450	6 456	6 462	6 468	6 474	6 480	6 486	6 492
7 455	7 462	7 469	7 476	7 483	7 490	7 497	7 504	7 511	7 518	7 525	7 532	7 539	7 546	7 553	7 560	7 567	7 574
8 520	8 528	8 536	8 544	8 552	8 560	8 568	8 576	8 584	8 592	8 600	8 608	8 616	8 624	8 632	8 640	8 648	8 656
9 585	9 594	9 603	9 612	9 621	9 630	9 639	9 648	9 657	9 666	9 675	9 684	9 693	9 702	9 711	9 720	9 729	9 738

83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1 083	1 084	1 085	1 086	1 087	1 088	1 089	1 090	1 091	1 092	1 093	1 094	1 095	1 096	1 097	1 098	1 099	1 100
2 166	2 168	2 170	2 172	2 174	2 176	2 178	2 180	2 182	2 184	2 186	2 188	2 190	2 192	2 194	2 196	2 198	2 200
3 249	3 252	3 255	3 258	3 261	3 264	3 267	3 270	3 273	3 276	3 279	3 282	3 285	3 288	3 291	3 294	3 297	3 300
4 332	4 336	4 340	4 344	4 348	4 352	4 356	4 360	4 364	4 368	4 372	4 376	4 380	4 384	4 388	4 392	4 396	4 400
5 415	5 420	5 425	5 430	5 435	5 440	5 445	5 450	5 455	5 460	5 465	5 470	5 475	5 480	5 485	5 490	5 495	5 500
6 498	6 504	6 510	6 516	6 522	6 528	6 534	6 540	6 546	6 552	6 558	6 564	6 570	6 576	6 582	6 588	6 594	6 600
7 581	7 588	7 595	7 602	7 609	7 616	7 623	7 630	7 637	7 644	7 651	7 658	7 665	7 672	7 679	7 686	7 693	7 700
8 664	8 672	8 680	8 688	8 696	8 704	8 712	8 720	8 728	8 736	8 744	8 752	8 760	8 768	8 776	8 784	8 792	8 800
9 747	9 756	9 765	9 774	9 783	9 792	9 801	9 810	9 819	9 828	9 837	9 846	9 855	9 864	9 873	9 882	9 891	9 900

THE WORLD OF MODELS

Model Railway Activity in Germany : Northampton Society of Model Engineers : Model Yachting in Kensington Gardens

By "MOTILUS"

EVEN in times of great distress and suffering it is extraordinary to learn that model activities still find a place in the lives of those interested in the hobby. Since Postal Regulations have been somewhat lifted, I have had news from friends in various parts of devastated Europe, and have recently received a long and informative letter from JNG. Dr. Phil. Walter Strauss, of Ulm, Württemberg, Germany. As some readers may remember, Dr. Strauss is the author of that very comprehensive and famous book entitled "Lilliputbahnen, which was published in Germany in 1938. Unfortunately, owing to the outbreak of war, the English edition was never published. This book dealt not only with model locomotives and model railways in Germany, but also included illustrations of model railways all over the world, and was considered by many authorities to be a classic of its kind. Writing on the subject of his last railway book, "Lilliputlokomotiven," Dr. Strauss says: "This book, which deals with miniature passenger-carrying railways, was stamped in and scrapped by order of the Nazi regime, a book of ten years intensive international work, which showed my sympathy towards your country. . . ." Yet the invincible spirit still spurs him onwards and he admits that as soon as paper and printing are available he will start work on a counterpiece to "Lilliputbahnen," which will deal with indoor electric railways, especially of gauge 00.

Fig. 1.—Dr. Phil. Walter Strauss, with Mr. G. P. Keen (right), President of the Model Railway Club. Taken about 20 years ago, when Dr. Strauss visited England.

Fig. 2 (Above)—Mr. Victor Harrison and Alderman W. J. Bassett-Lowke examine a Trail Blazer Hydroplane model designed and built by Mr. A. M. Welter.

Fig. 3 (Right)—A prominent group at the recent "get-together" of the Northampton Society of Model Engineers. From left to right are Mr. Albert Welter, Mrs. Welter, His Worship The Mayor of Northampton, Councillor P. C. Williams, Mr. R. Ward (Chairman), Mrs. Ward, Mr. Victor Harrison (Guest Speaker) and Mr. W. A. Wells (Hon. Secretary).

2,300 Feet Above Sea-level

At the beginning of the war, in order not to take part in anything connected with the taking of life, Dr. Strauss took the post of teacher in a private high school placed in the romantic buildings of a former Benedictine monastery in a picturesque valley of the Alb Mountains, alongside the line Ulm - Signaringen. During this time he had occasion to develop his 00 Marklin railway to an expermental plant for the 120 schoolboys in his care. So with their help he erected a layout nearly 100 m. with a central station having eight branch lines for the traffic of four trains controlling themselves. Unfortunately, towards the last days of the Nazi regime, the head of the Gestapo in Württemberg selected the school as a place of concealment for himself and his Gestapo guardsmen, and after that, as the school was required for French vacation children, Dr. Strauss had to live for nearly a year in the chemistry class-room among glass tubes, retorts, poison bottles, burners, etc. However, better times were in store, and eventually Dr. Strauss was appointed school leader of the Stubersheim Elementary School in the U.S.A. Zone. Now, living in the country on the summit of the Alb Mountain (some 2,300 feet above sea-level) he is re-erecting his 00 gauge railway. This is surely a true example of the love of the hobby, although the German enthusiasts know nothing of the developments which have taken place in other parts of Europe during recent years, as they have been so totally separated from the rest of the world. Dr. Strauss says—"so the world of model life is all wherein we try to forget the terror of the last years of suffering, as we had a Jewish name."

In the name of his school he has asked that any reader who has some picture postcards which he could use as lantern slides in the epidiascope to illustrate his lectures about London and Great Britain would be greatly assisting him. Even used postcards will help him, he says, to show the beauties of our country to the German children. Let me pass on to you a message from Dr. Strauss—he would be most interested to hear from any model railway enthusiast who would care to write to him; his address being (14a) Stubersheim Kreis Ulm, Württemberg, Germany.

After receiving this letter, I looked through my store of photographs of long ago, and was lucky enough to find one which I had taken on my return from Germany some 20 years ago (Fig. 1). I had been visiting well-known model makers in Germany in company with Mr. G. P. Keen (chairman of the Model Railway Club), and we met Dr. Strauss near Hanover. We found that we had much of mutual interest to dis-

Fig. 4.—A summer scene on the Round Pond, Kensington Gardens.

cuss on that occasion—and from the letter recently received from Dr. Strauss it seems that this would still apply.

Northampton Society of Model Engineers

Every week I have news of another model society resuming its activities after an interval of several years or more, and exhibitions and social functions are being organised to bring together those interested in the hobby. At the first post-war "get together" of the Northampton Society of Model Engineers held recently, nearly 100 members and friends were present. Several prominent citizens, including His Worship the Mayor of Northampton, Councillor P. C. Williams, Alderman W. J. Bassett-Lowke, Councillor J. V. Collier, managing director of the Northampton Machinery Co., and Dr. S. Rowlands, former Northampton Medical Officer of Health, were amongst the guests (Fig. 3). In the opening speech, Mr. Ronald Ward, chairman of the society, spoke of the aims and objects of the club, and gave a short history of its progress since it was formed in October, 1945. Mr. Ward said that the club was a good example of the wide appeal that model making has, as amongst its members it has a doctor, a hotel keeper, an industrial chemist, a transport contractor and a clicker. His opinion is that there is no one who is such a "good neighbour" as a model engineer—he's always in demand up and down the road for repairs to lawn mowers, grinding scissors and mending toys of all sorts. Some of the members had brought along specimens of their work, and Mr. A. N. Welter (the vice-chairman), who is a Swiss engaged on shoe design, showed a model cabin cruiser in which he plans to instal a receiver for radio control. He has built this model to his own plans, and it is 4ft. 6in. in length and is to a scale of ¾in. to the foot. Motive power is of a 6-volt motor-cycle battery driving the main motor and three Servo motors as well as relays. He plans to have a transmitter on a one valve circuit while the receiver is to be on a two valve circuit—control being achieved by a fully automatic push button.

Mr. Victor Harrison (Fig. 2), the well-known figure in the model railway and model shipping world, was the guest speaker, who expressed the strange fascination which the hobby had on boys of all ages—from eight to 80. Mr. Harrison's very extensive outdoor railway at Bishop's Stortford was the subject of one of the cine-films shown during the evening.

Using a model aircraft weighing only one-twentieth of an ounce and capable of flying to 80ft., a demonstration of indoor flying was given by Mr. E. W. Evans, of the Northampton Flying Club. Three cups, won in London model engineering exhibitions by members of the society, were displayed, thus showing that this comparatively young society certainly has amongst its members some most enthusiastic and talented model makers.

Model Yachting Activity

Summertime at the Round Pond, Kensington Gardens, is always a hive of activity for owners and enthusiastic friends who (with or without waders) can be seen with their yachts, power-driven boats, scale models, etc. The photograph (Fig. 4) shows a typical scene with the usual fun and interest taken in the craft on this excellent pool in London. In the foreground is a working model of the C.P.R. liner *Empress of Britain*, the prototype of which was unfortunately lost during the war.

When in London the other day, I was very pleased to see at the High Holborn branch of Bassett-Lowke, Ltd., a display of the Alexandra Bermuda rig sailing yachts (Fig. 5). They had three sizes in stock, and on examination these appeared to be quite equal to the pre-war productions. In addition to yachts I also observed quite a range of yacht fittings and ship parts—a sight which proves that, although the return to full production is slow, it is sure.

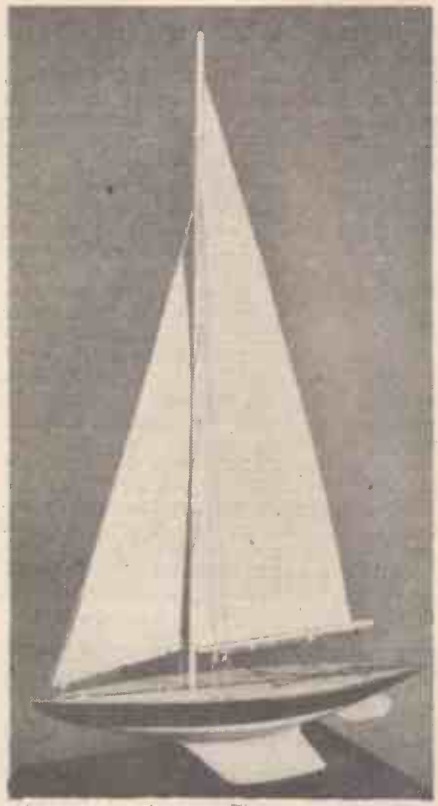
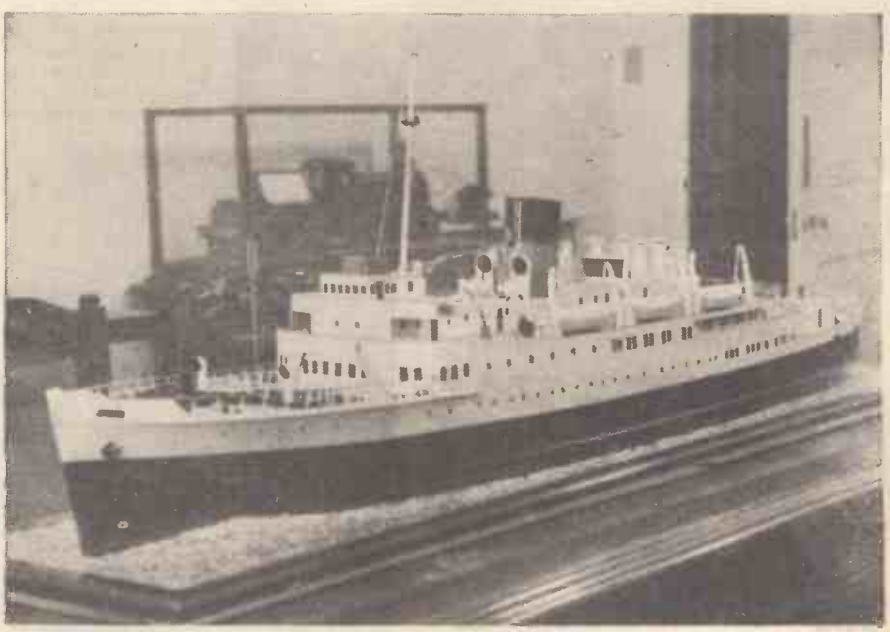


Fig. 5.—A Bermuda rig "Alexandra" yacht.



To demonstrate how the Great Western Railway's post-war plans for improved travel facilities are now materialising, a display of models was recently arranged at Paddington Station. Our illustration shows one of the Company's new luxury cross-channel ships which is now in service.

Letters from Readers

Lubricating Car Springs

SIR,—I was interested to read in the March issue a letter from motorist E. N. Crump (London), re keeping the road springs on his car working, and could not help remarking to myself that I sincerely hope other readers will *not* adopt his spring oiling method, with all kind respects to Mr. Crump!

Considering that the essential requirements of road springs are to suspend the vehicle's weight and *to resist major road shocks*, I wonder if it has occurred to motorists that to freely lubricate the spring leaves will greatly increase the flexing and unflexing action and result in broken leaves, besides imposing greater stresses on shock absorbers?

I maintain that road springs should not be "mollycoddled" and wrapped up in oil and grease, but on vehicle overhaul they should be stripped and cleaned and coated with a graphite mixture. Concentrate more on shackle lubrication. Rarely do spring leaves squeak, but shackles and bushes—yes!—H. H. (Gravesend).

Porcelain Elements for Electric Fires

SIR,—We observe in the February issue of PRACTICAL MECHANICS that one of your correspondents, R. J. Marr, Portsmouth, is inquiring about the ingredients necessary for making porcelain elements for electric fires, and we are taking the liberty of writing you as we have had considerable experience on this subject during the past few years.

The method that is being used very successfully at the moment is to mix one part of powdered ball clay with one part of powdered china clay and one part of Molychite, which is a ground calcined china clay. This is fired at a temperature of about 1,200 deg. C., and the firing should take place over not less than 48 hours; the firing schedule should be arranged so that there is a gradual increase from cold to a good red heat, and therefore the contraction will be regular. The actual contraction of the mix mentioned is 8 to 9 per cent. of the die size, of which 2 per cent. occurs during the drying and the remainder during firing. From these figures you will realise that it would be necessary to add about 1/11th to the dimensions of the finished article in order to produce a die of the required size.

With reference to the mixing of the dry materials, it is essential that they be mixed very intimately, and between 15 and 17 per cent. of a mixture of five parts water to one part of soluble oil, to be added very carefully, and again thoroughly mixed. The soluble oil, we believe, can be purchased from Marston Lubricant, Ltd., St. Paul's Road, Rock Ferry, Birkenhead.—For English Clays Lovering Pochin and Co., Ltd., H. E. FARROW (St. Austell, Cornwall).

Trade Notes

Waterproofing Compound

THE waterproofing compound known as "Nev" has striking properties inasmuch as it makes any article of clothing, or any fabric, wool, cotton, rayon, etc., completely water repellent very simply in the user's own home. The appearance and "handle" are not affected in any way, and what is very important, the material remains just as permeable to air as it was before treatment.

In this climate of ours it is undoubtedly a very great benefit to anyone if their clothing and they themselves can remain completely dry if they are compelled to go out during rainy weather. A woman's head scarf, for example, if simply dipped and pressed, will keep hair absolutely dry during the heaviest shower.

This waterproofing compound has been sold in bulk to the textile industry for many years, and is a most efficient product of its kind made in this country. There is a Government standard test called the Bundesman test, which brings water repellency of fabrics down to actual figures, and we have not found anything which even closely approaches "Nev" in efficiency.

The manufacturers of "Nev" are Peel and Campden, Ltd., 183/9, Queensway, Bayswater, London, W.2, and the compound is obtainable from most of the large stores.

Club Notes

Plymouth and District Society of Model and Experimental Engineers

AN exhibition of models by the above society was held in the showrooms kindly loaned by the directors of Barton Motor Company, Limited, from April 21st to May 3rd. The official opening was performed by the Earl of Mount Edgcumbe at 3 p.m. on the first day.

An interesting collection of models was brought together to add to the members' exhibits, from industrial firms, kindred societies and private individuals. There was a demonstration of "round-the-pole flying" and of hydrofin boats on a circular water tank. A group of stationary engines was shown working, and Mr. W. R. Dunn exhibited his London and North Eastern 2½in. gauge electric locomotive working on a section of track.—W. J. Moyse, Hon. Secretary, 3, Evelyn Place, Plymouth.

The Staines and District Society of Model Engineers and Craftsmen

THE second annual exhibition of the above society will be held at Staines Town Hall on Saturday, July 5th, open to the public from 10 a.m. onwards.

This will cover all branches of model engineering and allied crafts, and prizes will be awarded for the best exhibits in open competition. Entry forms and details available to club secretaries and lone hands on request, and loan of models would also be appreciated.

Closing date for entries is June 30th.—Hon. Sec., R. F. SLADE, 166, Kingston Road, Staines, Middx.

Books Received

"How Secrets Work." By Prof. A. M. Low. Published by Peter Davies. 224 pages. Price, 10s. 6d. net.

IN this very informative book Professor Low explains, in simple terms, the many intricate new devices brought into operation by the war. His own wartime employment kept him in close touch with many new scientific and mechanical developments, and he is now able to reveal a great many facts which have hitherto remained secret. Among the inventions and developments which this book sets out to explore are radar, jet propulsion and atomic energy.

"The Amateur's Workshop." By Ian Bradley. Published by Percival Marshall and Co., Ltd. 244 pages. Price, 7s. 6d. net.

THE special requirements of the amateur, both in fitting out a home workshop and in making the best use of tools, are the main theme of this useful book. Lathes, various light machine tools, metal-working hand tools, and many aids to accurate workmanship are dealt with in a practical way by the author, who is well known as a model engineer. The book is profusely illustrated with line drawings and half-tones.

"Petrol-engined Model Aircraft." By C. E. Bowden. Published by Percival Marshall and Co., Ltd. 230 pages. Price, 7s. 6d. net.

THE fascinating subject of power-driven model aircraft is fully dealt with in this interesting book. Starting with a brief history of the petrol-engined model aircraft, the author traces the development of the ideas in design and construction which have led to the high performance models of today. Amongst the many subjects dealt with in detail are the ignition system, control of flight duration, automatic stability and design, and the action and pitch of propellers. A special chapter deals with radio control of model aircraft. The book is well illustrated with line drawings and photographs.

PENICILLIN PRODUCTION

(*Continued from page* 312.)

minutes by means of single-stage mechanical pumps of the oil-sealed rotary type. These mechanical pumps are connected by a common manifold to all the drying ovens. After this rough evacuation, the ovens are connected to the high vacuum manifold serving the diffusion pumps. Vapours leaving the high vacuum manifold go through a pair of cold traps or low-temperature condensers in parallel. These are jacketed steel cylindrical chambers set at an angle, provided with revolving scrapers and refrigerated with ammonia. Ice that collects on the walls is scraped off and falls into an ice receiver at the same temperature. These condensers relieve the strain on the diffusion pumps. An important feature of the mechanical pumps which back the diffusion pumps is the oil-purification system that continuously recirculates all sealing oil to remove condensed water and other impurities. Otherwise such impurities would flash back into the system and raise the pressure to a point where the diffusion pumps could not operate.

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.

Dyeing a Sheepskin Rug

I SHALL be glad if you will assist me in the following matter. I wish to dye in a deeper colour a sheepskin rug which is badly stained, and require to know what solution would be safe to use.—A. M. Shaw (Forest Gate)

FIRST of all, wash the sheepskin rug gently with warm water and soap. Rinse it well and hang it out to dry.

Before the wool has completely dried, dissolve 5 parts of alum in 95 parts of water and immerse the rug in this solution in the cold, allowing it to remain therein for two or three hours. As it is only necessary to immerse the wool of the rug, strips of wood can be placed along the alum bath to prevent the skin from sinking.

You must now obtain the necessary dye, which should be of the "basic" variety. The following is the composition of the dye bath:

Dye	5 parts	(by weight)
Soap	2 "	"
Sodium sulphate	3 "	"
Water	90 "	"

Again, there is no necessity to dye the skin. Hence the above method of floating the rug on strips should be adopted. Immerse the wool in the cold dye bath. Then gradually bring the bath up to nearly boiling point. Keep it at that temperature for about ten minutes. The rug will now have been dyed. It should then be removed from the bath, washed well and allowed to dry slowly.

There are other methods of "vegetable dyeing" of rugs which give very fast colours. The following is an example of the method of dyeing a rug a "vegetable" brown:

Dissolve ½lb. of copper sulphate in a gallon of water. This is the "fixing" bath for the vegetable dye. The rug is immersed in this in the cold for two hours. It is then removed, drained (but not rinsed) and dyed in a bath made by dissolving 1lb. catechu in 1 gallon of water. A good brown colour will result. If logwood is substituted for catechu a black will result. If these colours are not intense enough, the fixing and dyeing process can be repeated.

Dusting of Concrete Floors

I HAVE a concrete floor in my workshop. Can you advise the use of any preparation to keep down dust?—R. G. Griffiths (Llandrindod Wells).

THE dusting of concrete floors is a perennial problem. There is no certain cure for it. However, two methods of approach are open to you, viz.:

(a) Surface treatment with a colloidal wax solution. For this purpose, use "Autogloss," manufactured by British Asphalt and Bitumen, Ltd., The Docks, Preston, Lancs.

(b) Surface treatment with a silicon ester which binds the loose floor particles together. Silicon ester is manufactured by Messrs. Albright and Wilson, Ltd., Oldbury.

Neither of the above materials is cheap, but there is no other way of dealing with the floor dusting problem—apart, of course, from removing the floor and substituting one of another type.

Bronzing Lacquer

WILL you please give me details of the plating process which gives a "bronze" finish to steel objects such as wood screws, small door catches, etc.?—C. Dundas (Newcastle-on-Tyne).

THE bronzing of small articles is not usually done by any process of plating. It is often effected by means of a bronzing lacquer, such as can be obtained from Messrs. Wm. Canning and Co., Ltd., Great Hampton Street, Birmingham, or, if the screws happen to be of brass, by immersing them for a short time in a dilute solution (1 part in 600) of sodium or ammonium sulphide.

For steel screws, etc., you can apply what is termed a Florentine bronze by rubbing over them a paste composed of about equal parts of red oxide or iron and black lead mixed with water. The paste is then allowed to dry on the screws at 100 deg. C for half an hour, after which it is brushed away with a stiff brush.

Steel articles which have been previously copper plated may also undergo this treatment, and, in such instances, very pleasing dark, reddish-brown colours are obtainable.

Distemper for Concrete Floor

I AM anxious to know where to obtain a supply of red paint or colouring matter suitable for application to a concrete floor. Where can I obtain the necessary substance?—E. A. Lee (Evesham).

THERE is no paint suitable for concrete floor treatment, since traffic on the floor quickly wears away the gloss of an ordinary oil paint, resulting in very unsightly patches. Your best plan is to treat the floor with a thin wash of a casein-bound distemper. Such material may be obtained from the Walpamur Co., Ltd., Darwen, Lancs.

Alternatively, a suggested treatment is that you very lightly colourwash the floor and then, after drying out, you treat the floor with a good silicon ester preparation, such as Kexacrete, obtainable from Kautex Plastics, Ltd., Elstree, Herts. This impregnates the floor with a liquid which sets to a hard, stone-like mass, binding the surface particles of the floor together and the particles of colourwash with them.

Silicon ester material may also be obtained from Messrs. Albright and Wilson, Ltd., 49, Park Lane, London, W.1.

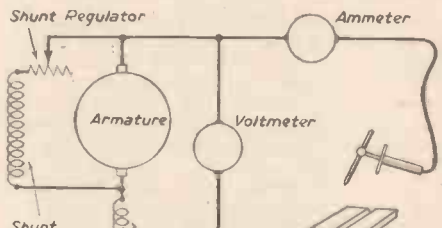
Portable Welding Outfit

I WISH to make a heavy duty (at least 300 amps.) portable welding outfit to fit on a traller. I would like to know what type of dynamo I need, and where I could buy same, either new or second-hand. Would it be possible to work a 110-volt D.C. electric hand tool from the dynamo on occasion, without lowering the efficiency of the welder, by having a 110-volt dynamo?

I would also like a rough circuit diagram and list of other components necessary.

What firms do you recommend as suppliers of welding equipment and electrodes, etc.?—G. R. Moore (Mirfield).

FOR arc welding you require a compound generator capable of giving about 70 volts on open circuit and about 30 volts on full load. This characteristic may be obtained by using a machine having suitable series field windings which act in opposition to the shunt field windings; or by using a machine which is specially designed with split poles and which gives a reduced voltage on load by altering the magnetic distribution through the poles. The dynamo may either have self-excited shunt field windings or these



Circuit diagram of a self-excited welding generator.—(G. R. Moore.)

windings may be separately excited and supplied by an auxiliary dynamo. Messrs. Murex Welding Processes, Ltd., of Hertford Road, Waltham Cross, Herts, supply new welding generators and all equipment for welding; or you may be able to obtain a suitable second hand welding plant through the advertisement columns of any popular engineering perlodical.

It would not be practicable to use a 110-volt hand tool from the generator without designing this specially and rendering the machine rather inefficient. If, however, the generator is to be separately excited it would be possible to arrange for the field windings and exciter to be wound for 110 volts and for the exciter to be large enough to supply the tool as well as the field windings.

The diagram shows the theoretical circuit of a self-excited welding generator. Accessories used with welding plant, in addition to the shunt regulator, voltmeter and ammeter on the plant proper, are flexible cable, electrode holder, hand screens, helmets, goggles, gloves, aprons and sleeves; although all of these are not essential.

Designs in Gold on Glass

I WISH to make designs in gold on glass, such as you see on shop windows, house numbers, etc. I would be glad if you will name the materials required and methods of applying. The effect I want is just like a mirror, but gold not silver. Sometimes you see it with a crackled effect.—A. H. Leggette (Doncaster).

WE are not clear as to the type of effect which you desire to produce, but if you refer to the so-called "gold mirror" these are usually silvered mirrors of tinted glass. You can obtain a formula for silvering glass from any book of workshop or photographic formulæ.

Occasionally, pure gold leaf is used to produce the mirror effect, but since this process is nowadays exceedingly expensive we hardiy think that you will wish to work the process.

The "crackled" effect on glass is due to the use of a bronze powder made up into a suitable paint. You can obtain bronze powders in various shades of gold from Messrs. John and Bloy, Ltd., Metana House, Hind Court, Fleet Street, London, E.C.4. As a medium for this paint, you can use a 4 per cent. solution of gelatine (made by dissolving 4 parts of gelatine in 96 parts of water) or, alternatively, you can use a cellulose solution which may be made by dissolving scrap celluloid in a mixture of about equal proportions of acetone and amyl acetate. If you cannot obtain these two liquids, use a thin cellulose varnish which may be obtainable from a good paint shop in your city.

Ventilation for a Caravan

COULD you advise me of a suitable and cheap way to ventilate and insulate a caravan. The outside is of aluminium and the inside of wallboard. There is a space of 2in. Would wood-shavings be satisfactory and would holes drilled in the floor between the outer and inner wall give sufficient ventilation?—C. V. Jones (Torquay).

WE do not favour your scheme for ventilating your caravan by means of holes drilled in the floor, for although such a scheme might be effective the interior of the caravan would be more or less continually draughty. A better plan, we think, is to bore a series of, say, half a dozen holes in opposite sides of the caravan walls, one series of holes to be bored near to the roof, the other an inch or two from the floor. Do not bore more than six holes to start with, for if the results are not sufficiently effective the number of holes can always be increased. The holes should not be bored directly opposite each other. They should face diagonally across the caravan.

For insulating the interior of the caravan you require some fibrous material which will break up the space into little air cells or air pockets. Any fibrous material will serve this purpose. Glass wool, loosely packed, is excellent, for it is fireproof, clean and hygienic. Coarse wood-shavings are quite good. So, also, is hair or coarse asbestos fibre. Perhaps you might be able to obtain some waste asbestos for this purpose cheaply from Turner Brothers Asbestos Co., Ltd., Rochdale, Lancs.

Dental "Porcelain" Filling

COULD you please give me the formula used by dental mechanics for making imitation ivory for teeth and "filling" material? Also, I should like to know how the different shades of white are made for the above.—T. Caenor (Liverpool).

THE exact composition of modern dental "porcelain" filling materials is maintained a close secret by the few firms which manufacture them. Even individual dentists are unaware of the precise composition of such materials. The material of artificial teeth is different from the white or "porcelain" filling material. This consists of a hard silica base which has been fired in a furnace to a high gloss. Variations in colour are produced by blending minute amounts of stable colouring materials.

You can make an approximation to a dental white filling material by moistening powdered zinc oxide with a strong solution of zinc chloride. This will set to a hard, insoluble mass.

Enamel for Instrument Wire

CAN you please tell me where I can purchase the enamel which is used to coat copper wire as used for dynamo winding, etc., or can the same substance be made up from ingredients ? Would ordinary cellulose paint be suitable ?—H. R. Bartolozzi (Ely).

THE usual enamel of instrument wires is a stove enamel varnish which, after painting or spraying, requires stoving at about 300 deg. F. for several hours. This is a very difficult process for the average individual, since it needs the services of a carefully regulated oven. However, for your information, such stove enamels may be obtained from the United Paint Co., Ltd., 73, Bishopsgate, London, E.C.2.

New types of instrument enamels of an incombustible nature based on the new "silicone" compounds may be obtained from Messrs. Albright & Wilson, Ltd. (Silicone Department), 49 Park Lane, London, W.1.

An ordinary hard-drying cellulose paint would make quite a good insulating enamel, but its dielectric powers would not be very high. A hard asphaltum varnish would be better in this respect. It can be made by dissolving medium-hard asphaltum in benzene or naphtha, and it can be obtained ready made from Messrs. Flatters & Garnet, Ltd., 313, Oxford Road, Manchester.

Shellac varnish, made by dissolving shellac in methylated spirit, can also be used as an insulating varnish with good results, although it is inclined to be rather soft and liable to damage through rough usage.

Magnesium Chloride : Portland Cement

COULD you assist me with the following problems ?

(1) I want to employ the properties of the two chemicals magnesium chloride and sodium silicate unitedly, but do not know what catalyst would efficiently combine these two without causing precipitation of one by the other. How would the catalyst be removed afterwards ?

(2) How is white Portland cement made ; and how does it compare with the grey Portland cement ?—F. P. G. Oosterlaak (Pretoria, S.A.).

(1) THERE is no means of bringing magnesium chloride and sodium silicate (presumably in solution form) together without causing the precipitation of insoluble magnesium silicate. Catalysts do not inhibit chemical reactions ; they promote them. Hence catalytic bodies would be quite useless to prevent the interaction of these two substances.

(2) White Portland cement is merely prepared from purer materials than the ordinary grey cement and is, therefore, more expensive. It is considered to be less enduring than the grey cement, for which reason the latter material is given preference in the construction of members whose strength is to be their main feature. The white cement has a different micro-crystalline make-up from the grey cement.

Modifying a Three-phase Motor

I HAVE a ½ h.p. 3-phase 220 volt motor. Could you tell me how this could be modified to run on a single-phase circuit ?

I should not object to a slight reduction in power, if this should be inevitable.—W. M. Smith (Derby).

THE motor could be used without modification from a 230-volt single-phase supply by merely supplying two of the three stator terminals from the mains, provided you are prepared to start the motor by hand, say by winding a cord round the shaft and pulling this to start. The best way, however, would be to rewind the motor to give about two-thirds of its present power, or slightly higher if the motor can be designed to run at a higher speed than at present.

Photo Engraving

I HAVE read with considerable interest the article in the November, 1945, issue of "Practical Mechanics," on Photo Engraving. It seems to me that a similar, but much simpler, process could be used to engrave sketches and pen and ink drawings. Could you let me know if the process must be altered in any way ? Could the plates be etched merely in a bath of acid, and must the remains of the glue be removed from the plate before sending it to the printer ?—J. A. Boskwell (Guildford).

THE photo-engraving process to which you refer could be simplified to reproduce line drawings (pen and ink) only. You would find full working details of such a process in any dictionary of photographic and photo-mechanical processes. Briefly, the mode of procedure is this :

Polished zinc is thinly coated with a solution containing 5 parts gelatine, 3 parts ammonium bichromate and 92 parts of water. This solution must not be exposed to strong light. After the bichromated gelatine film has set the plate is exposed to sunlight or to an arc lamp under a negative. The strong light has the effect of rendering the gelatine coating insoluble, whilst the unexposed parts remain soluble in water. After sufficient exposure the zinc plate is steeped in warm water, wherein the soluble parts dissolve away. The plate is then carefully dried and immersed in dilute nitric acid. This attacks the parts of the plate which have been laid bare by the dissolving away of the soluble film of gelatine. After the etching effect has gone far enough the plate is rinsed in water and the whole of the insoluble gelatine which has formed a "resist" against the acid attack is cleaned off. The block is then mounted on wood.

The making of even this simple type of block is not an easy matter. It calls for patience, skill and experience. You should read the subject up in detail before commencing work, but, given the necessary knowledge, there is no reason why you should not be successful at the work.

Water Turbine

I AM thinking of using a waterfall to produce electricity. The flow of water varies between 60 and 1,000 gallons per minute and the drop is 12ft.

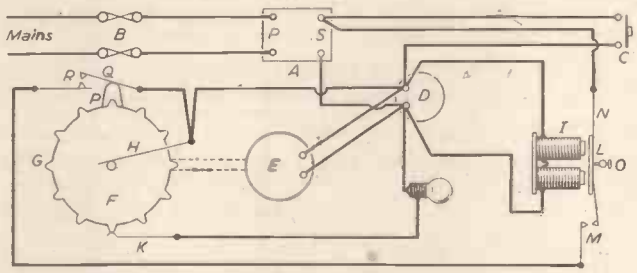
What would be the most efficient way of using this power, and how much current could I generate ? As the generator would run continuously could I do without storage batteries ?—G. R. Kendrick (Bewdley).

WE do not anticipate that you would be able to generate more than about 60 watts with the available water supply. If you do not use a battery you may have difficulty in maintaining a fairly constant voltage, particularly on a varying load. You could dispense with a battery if you can fit a governor which will cause the dynamo to run at a practically constant speed. A water turbine would probably be the most effective power unit for the conditions specified.

Electric Flash Light

I WAS very interested in the "Electric Flash Light," on page 141, January issue, but unfortunately I do not quite understand the circuit diagram. Can this be operated from the mains via a transformer ? Also, would you please explain this circuit by a practical diagram ?—T. Leggat (Alwoodley).

IN the accompanying diagram A is a small transformer having its primary terminals P connected to the mains through fuses B in a switch, socket or distribution fuse box. The secondary or low voltage terminals S are connected as indicated, one terminal being connected to one terminal of the push button C at the door, D represents an electric bell (A.C. type), whilst E represents a low voltage series motor suitable for operation on A.C. This motor drives the brass disc F through suitable gearing so the disc revolves slowly, say, about 1 r.p.m. On the edge of the disc are projections G, 12 or more in number. K is a thin strip of hard



Circuit diagram of a flash-light device for use with a door bell.—(T. Leggat).

brass or phosphor bronze, which just touches the tips of the projections. H is another strip which makes contact with the shaft of the disc or with the centre face of the disc. P is another projection mounted at the back of the disc or on the same shaft. Q is a strip of phosphor bronze which is lifted by P to open the contacts R. I represents the coils of a relay, similar to an ordinary trembler electric bell movement. The contacts M are arranged so that when the armature L is attracted to the coils the contacts are closed in the same manner as an ordinary bell. O is an adjusting screw by means of which the air gap between L and the coil poles can be set. The iron strip armature L is suspended by a flexible metal strip N. For use on A.C., the poles of the relay should be sawn down the centre about 3/32in. deep. Into each slot is pressed a strand of bare 20 s.w.g. copper wire, which is turned back so that it encircles half of the pole face, and is then soldered to form a short-circuited band.

On pressing the push button C current flows through the bell D and the motor E, so the latter slowly turns the disc F. Each time a projection G touches K the lamp J will flash. It is assumed that, by the time the push button is released, the disc will have moved far enough to allow the contacts R to close. Instead of the current flowing through the push button it will then pass through the contacts M, which have been closed by current in the coils I attracting the armature L, and through the contacts R. The bell will thus continue to ring and the bulb to flash, whilst the motor will continue to drive the disc F. When the disc has completed one revolution, however, the projection P will have moved round again and will then open the contacts R and will switch everything off until the push button C is again pressed.

Porous Oak Timbers

THE gables of my house have old Tudor oak timbers incorporated in the brickwork. Some of the timbers are of 7in. by 5in. section and the outside surfaces have become spongy or porous to a depth of about 1in., which absorbs driving rain and renders the surrounding brickwork damp.

Can you suggest any way of filling the porous surface of the oak to make it more weatherproof ? —J. R. Worthington (Purley).

YOU do not state whether the sponginess of your timber ends is due to rot or to wood beetle attack —or to both.

The only permanent way of dealing with the matter is to remove the affected areas completely and to replace them. We realise, however, that this may be quite impossible at the present time, for which reason we advise that the areas be thoroughly saturated and impregnated with a good bituminous paint applied *hot*. The woodwork will thus absorb the bitumen and will retain it permanently, thereby rendering the area immune from moisture and damp. The average bituminous paint, however, is a glossy black. This may spoil the appearance of the woodwork, in which case we advise that you use one of the brown bituminous paints, such as brown "Mariolene," which is manufactured by British Asphalt & Bitumen, Ltd., The Docks, Preston, Lancs. Such paints are very much cheaper than ordinary oil paints, costing about 6s. per gallon.

If you could get a local asphalting firm to surface up the spongy and decayed timber ends with a brown asphalt mastic (*after* the paint impregnation) a fairly permanent job lasting many years would be effected at a very minimum price, and we imagine that the colour of the brown asphalt would match up with that of the adjacent timbers.

Removing Oil-bound Distemper

CAN you tell me the best way to remove two or three coats of oil-bound distemper which has, in places, begun to flake off my kitchen wall ? —R. Bradshaw (Pinner).

DISSOLVE ½lb. of caustic soda or soda ash in a bucket of water. Mop this solution on to the distemper, allow it to soak a little and then scrape the softened distemper away with a knife. Some prefer to use a caustic soda solution of half the above strength and to make it into a paste with slaked lime. This solution will, of course, quickly remove paint. Hence it should be kept away from all woodwork. Needless to say, it must be well washed away from the wall after the distemper has been removed.

Transferring Photos to Glass

I SHALL be glad if you will give me any information on the method of transferring photos on to glasses, etc. Also how do I treat a photograph as in crystoleum painting ?—J. W. Ramsdale (Bootle).

TO transfer photographic prints to glass, the prints must be made on bromide "stripping paper" such as is manufactured by Ilford, Ltd., Ilford, London. Following the instructions issued by the makers of this paper, the complete prints are pressed down on to the prepared glass surface, allowed to dry and the upper paper stripped off, leaving the photograph on the glass. We are not, however, sure whether this paper is yet available to the public.

The crystoleum process, once exceedingly popular in photographic circles, has now become completely obsolete and we doubt whether there is now a photographer living who could produce such prints. There is a long and detailed *practical* account of this process in Bernard E. Jones' "Cyclopaedia of Photography" (Waverley Book Co., 1911), which may be obtainable at your local reference library and to which we must refer you for working details. In short, the process consists in pasting the print face downwards to convex or plain glass and, after removing the paper support of the print, in applying oil colour to its rear. The original picture carries all the fine shading, the effect being heightened by the subsequent colouring. Various imitations of the original crystoleum process have from time to time appeared, but none of them has been successful.

THE Cyclist
Editor: F. J. CAMM

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Comments of the Month

By F. J. C.

The Paris-London Race

THE Paris-London race has been run with great success, without hitch, without accident and without incident and is therefore a complete answer to those quondam critics who were more fearful of the prestige of their own particular organisations than they were the questions of road safety, which is always the bogey they erect when someone does something in the cycling world which they do not themselves promote. All credit, therefore, is due to W. J. Mills, who conceived the race and was largely responsible for its organisation, to the *News-Chronicle*, which sponsored it, and to all the helpers and officials who contributed so generously of their time in order to make the race the success it undoubtedly was.

Face Saving

There is no need for us to give the results since they have already been reported in the daily Press. The important thing about this race is that it is a complete answer to elderly armchair critics who, grimly holding on to the memories of their salad days, are opposed to any progressive movement, and want the sport run on the lines of the 'nineties.

Now that the R.T.T.C. has climbed down with a face saving arrangement with the promoters, we hope there will be more of these races, and that the R.T.T.C. and the N.C.U. (the latter were, of course, in favour of the race, whilst their uneasy bed-partner, the R.T.T.C., opposed it originally!) will themselves bring their ideas up-to-date and run events in accord with the wishes of the present generation. This may need a change in their rules, but other times, other manners. A racing cyclist clad in black tights is not supposed to attract attention because he is "inconspicuously attired." We mention this fact (only one of many which we could cite) to indicate how antediluvian are the bodies which control the various branches of road sport.

The M.O.T. Has Second Thoughts

THE Minister of Transport has changed his mind, for as a result of the strong representations made by Major H. R. Watling, of the British Cycle and Motor Cycle Manufacturers' and Traders' Union, Ltd. (incidentally, isn't it high time that this lengthy and high-sounding title became abbreviated, especially in these days of labour shortage?). He has decided that those provisions of the Road Transport Lighting (Cycles) Act, 1945, which would compel cyclists to carry a white patch and reflector as well as a red light, are not to be brought into operation this winter. "The information which has been given to the Minister of Transport," says Mr. H. R. Watling, the Union director, "clearly indicates that it would be futile to attempt to enforce the law in this respect for some time yet as none of the materials which are required to equip the 12,000,000 bicycles in use are available to the industry and, indeed, the industry is very embarrassed by the recent decision of the Minister of Supply to reduce the quantity of steel for the manufacture of replacement parts for bicycles. In these circumstances, it is hopeless for the Ministry to consider the provision of additional equipment such as would be required by the Act. The position will be further examined in the autumn."

Misleading Statements

WE are amassing evidence that representatives of the N.C.U. are making public statements couched in such terms as may lead the public to believe that they are reflecting Government views. Even in a recent broadcast one of the speakers in a Sports Talk based a considerable part of his argument against B.L.R.C. activities upon the statement that Parliament had made a law, which it has not yet even discussed, and as far as we have been able to check does not even contemplate. The officials of this body, it would seem, are putting up a barrage against these activities because they now realise that the B.L.R.C. will undoubtedly be recognised by the U.C.I. at its 75th Congress, to be held in Paris next July.

Another instance of the campaign against the League relates to the Circuit of Urmston Road Race, which was organised by the Manchester Couriers on April 20th. The chairman of the Urmston Road Safety Committee is reported as having referred to an anonymous letter he received about the matter, and this was included on the Committee's agenda. At this meeting it seemed somewhat strange that a member of the N.C.U. was present by invitation, and in referring to massed start racing he made the irresponsible assertion that "this type of racing is dangerous." He also added the sweeping statement "that on the Continent the roads were closed to all traffic except officials and those taking part in the race." On such evidence the Committee passed a resolution asking the Minister of Transport to take action and introduce legislation to stop it.

Fortunately the Minister of Transport will not take notice of such irresponsible resolutions, based on biased evidence. We, as impartial arbiters on this matter, are keeping the Ministry fully informed of all sides of the question, and our readers may take it that he will not act upon the advice of the N.C.U., which is merely jealous of the success of the new body.

The Urmston race was held according to the law, with police co-operation, and the public turned out in thousands to witness the race. The Urmston Road Safety Committee held a further meeting after the race, and forwarded a further request to the M.O.T. for the banning of all road racing. The organiser of the race was refused admission to the meeting, so that the Committee was without the advantage of the League point of view. It is, therefore, relevant to recall that on December 8th, 1943, when government officials, representing the Home Office and Ministry of War Transport, met a deputation (F. J. Camm, W. J. Mills and J. Kain) representing the League case, Mr. F. J. Camm asked the following questions of Mr. H. R. Lintern, representing the M.O.W.T.:

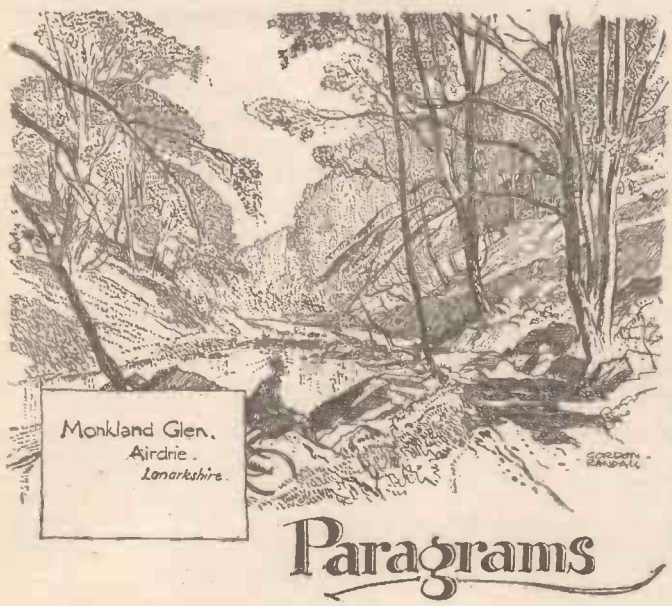
a. Had any complaints concerning League activities come from members of the general public? . . . Answer, *no.*
b. Had the Police reported any complaint? . . . Answer, *no.*
c. What, then, had induced the Home Secretary to issue a circular deprecating League activities? . . . No reply.
d. Mr. Camm then pressed, "Was it right to state that the only complaints concerning League activities had come from rival organisations, the National Cyclists Union, and the Road Time Trials Council?" . . . Reply, "The answer is in the affirmative."

Although full publicity was given to the foregoing conversation in THE CYCLIST at the time, no denial has been forthcoming.

As we have pointed out so many times, comprehensive laws already exist in this country covering such offences as dangerous driving, causing obstruction, etc., and that the League has never yet been guilty of infringing any of the laws. It is, itself, a disciplinary body, and would take action against any of its members who transgressed the law. The N.C.U. might just as well suggest that the Lord Mayor's Show or the Boat Race are dangerous because they cause congestion and traffic jams. In fact, they cause the gravest confusion. A cycle race, however, does not interfere with any other form of traffic. The success of the B.L.R.C.'s efforts can be measured by the rising tempo of the N.C.U. opposition, and the methods it is adopting in order abortively to get this form of racing stopped. For years they preached the gospel that massed start racing is illegal. It was this journal which took the matter up and nailed that statement once and for all. Now the danger bogey bobs up in its place. The N.C.U. has only itself to blame for the unhappy and weak position in which it now finds itself.

Encouraging Sport

WITH the object of encouraging more people to take an active part in games and sport, the National Sports Development Fund was inaugurated at a banquet given by the Lord Mayor at the Mansion House in April. The Fund has been launched by the Central Council of Physical Recreation, which is made up of 160 of the principal bodies in Britain concerned with sports. The Fund will be used for the creation of National Recreation Centres, for recreation within industry, and for exchanging sports ideas and personnel with the Empire and other countries. The target is £100,000.



Too Much Speed

"MORE people will have to be killed on the Watling Street at Towcester before we get a reduced speed limit," said a member of Towcester (Northants) Parish Council when consideration was given to the dangerous nature of the road through the town. The Ministry of Transport suggest that a reduced speed limit through Towcester is not necessary, but motorists, according to statements made at the meeting, take no notice of the existing 30 m.p.h. limit.

Cycle-wheeled Car

FOUR ordinary cycle wheels on a light platform are the main components of a sand car which some lucky holidaymakers have been using on the sands at Daytona Beach, Florida. Power is provided by a small electric motor which uses two six-volt accumulators. Two passengers can be carried, and as that object usually missing from the English scene—the sun—operates regularly above Daytona Beach a sun-top is also provided for the car.

No Short Cut

A ST. NEOTS (Hunts) cyclist, who decided that the floods in the town and district would make it necessary for him to travel by train, had to travel 18 miles from his home on the outskirts of the town to reach the railway station. Normally, the journey would take only a few minutes.

Cavendish Bridge Collapse

ONE of the casualties of the great floods which followed our Arctic winter was the Cavendish Bridge, the only link between Leicestershire and Derbyshire for a distance of some 10 miles, which was swept away by the swollen river. The bridge was built in 1758, at a cost of about £3,000, but an expert suggests that a new bridge to take its place will cost something like £500,000. When the bridge collapsed plans were at once made to use a Bailey bridge to connect up north and south once again over the River Trent.

Derbyshire Landslide

FOLLOWING a landslide which smashed a gap in the road at Little Bolehill, Wirksworth, Derbyshire, the whole of the nearby hillside was seen to be moving slowly downwards as a result of the frost and snow and subsequent rapid thaw. A number of houses were endangered by the landslide and arrangements had to be made for the evacuation of the tenants. The road which was cut is the road to Belper and normally carries a good deal of traffic.

After Seven Centuries

SOME time before the year 1274, a new bridge was built at Billing, Northants, between the parishes of Billing on one side of the river and Little Houghton and Brafield on the other side. It was a queer bridge, with a bend in the middle, and the parishes on either side of the river were responsible for their half of the bridge up to the centre arch. There were various squabbles over the repair of the bridge and maybe the centre portion of the bridge got neglected, for the floods of 1947 have proved too much for it and the whole middle portion has collapsed. At one time Billing Bridge carried a considerable amount of traffic to and from London, in spite of its awkward shape.

Forty-nine Cycles Missing!

ADVERTISING in a Derbyshire newspaper, a man stated that he was in urgent need of "an electric record player, 240 volts, 50 cycles, A.C." Shortly after the advertisement appeared, a woman wrote to him, saying: "Have seen your advert. and can offer you one gent's cycle, with 3 speed, in good condition."

Dunlop Representative

MR. C. R. DAVIES will now represent Dunlop at all cycle and motor-cycle events throughout Great Britain and on the continent, including, of course, the Isle of Man T.T. Races. He will be assisted by Mr. J. M. Whitelaw, son of Mr. John Whitelaw, secretary of the Dunlop Rim and Wheel Company, Foleshill, Coventry. Mr. J. M. Whitelaw was a Flight-Lieutenant in the war and received the D.F.M. before he was commissioned.

East Norfolk Road Improvement

NORFOLK County Council have given their provisional approval to a tender of £62,425 for the construction of a new bridge over the River Yare, at Reedham, which it is stated will prove of great advantage to traffic going into East Norfolk.

Road Safety!

IN the interests of road safety, the authorities at Huntingdon have painted a white line down the centre of St. Germaine Street, Huntingdon. But the scheme is rather spoiled by the fact that the road is so narrow that about the only two vehicles that can pass each other are two cycles. Only one car could possibly get through at one time.

Barton to Sunderland

MR. J. A. WALKER, works manager for the past four years with the Elswick-Hopper Cycle Co., Ltd., Brigg Road, Barton-on-Humber, Lincs, has left to take up another post at Sunderland. As a mark of appreciation on his departure, he was presented by members of the executive and technical staff with a case of pipes and pouch, and by the works office staff with a cigarette lighter and case.

Schoolchildren's "Driving Licences"

IN order to promote road sense among child cyclists, a scheme has come into force at Saffron Walden, Essex, for the issue of "driving licences" to schoolchildren who have proved themselves proficient and safe cyclists. Invitations are now being sent to all schools in mid-Essex to join in the scheme, which it is hoped will mean a sharp decline in the number of accidents to child riders.

Invented Electric Cycle

MR. JOHN PIDCOCK, of 99, Crown Street, Peterborough, who has just retired after nearly 42 years at the Westwood Engineering Works, Peterborough, of Messrs. Baker Perkins, Ltd., carried his love of engineering into his home. During the war he evolved a bicycle driven by a small electric motor and batteries which proved most successful. He rode it regularly about Peterborough until recently, when he purchased a small car.

Prompt Identification

AS two Boston police officers were driving along the Kirton road outside the town they met a cyclist, speeding in the opposite direction, whom they recognised as an absconding Borstal boy from the nearby institution. They turned the car round and gave chase and after catching the boy the driver asked: "And where did you get that bike?" But there was no need for him to answer as the driver's detective companion replied, for him: "It's my wife's bike!"

Stamford Club Revives

ALTHOUGH there were less than a dozen enthusiasts present at a meeting held to consider the revival of the Stamford Cycling Club, which came to an end during the war, it was agreed that steps ought to be taken to bring the club to life again. A Stamford section of the Peterborough Cycling Club has now been formed and until enough supporters come forward to warrant the formation of a separate club this scheme will save much expense and administrative work. Full details of the scheme were explained at the meeting by Mr. R. J. Seamer, the chairman of the Peterborough Cycling Club.

Cycling Comes Cheaper!

ALL through last winter's extreme weather, Mrs. Barthorpe, of Wellingley, Yorkshire, rode her husband's cycle to the nearest school, at Tickhill, two miles away, with her five and a half years old son on the crossbar. The road is bad and very uneven and Mrs. Barthorpe has told the Doncaster West Riding Education Committee that some other means of transport must be found for the boy until he is old enough to travel to school alone. The authorities admit they are legally responsible for getting the child to school, but the only alternative means of transport they have found so far is a taxi and driver, twice daily, at a cost of £2 per week.

At the recent Manchester Wheelers Internationa Meeting at M.A.C. ground, Fallowfield. The illustration shows A. Bannister of M/C Wheelers, who won his heat in the 550yds. Open Scratch Race is waiting his time to beat E. Sorenson of Denmark.

Around the Wheelworld

By ICARUS

Extract

HEREWITH a quotation from *The Cycle* for 1895: "The National Cyclists' Union we are told, is the controlling body of cycling sport in England. The National Cyclists' Union has its critics—and their name is Legion. What I have never discovered in all my peregrinations is the man who is not an N.C.U. critic, and a violently abusive one too. When I do discover such a man I shall have no hesitation in standing him a drink, for it would be a pleasure to talk to him. But, somehow, everybody I have met seems to have engendered a hearty dislike to the N.C.U. Everybody says it is all wrong. Everybody says that everything it does is all wrong. Nobody seems to have a good word for it, until at length I began to look upon the N.C.U. in much the same light as I should look upon the London County Council, were fickle fortune to smile upon me and I became a music-hall manager. Diligent inquiries revealed to me a glimmering of the constitution of this wondrous body. It was indeed a complex one."

Brighton Parking Place

CONGRATULATIONS to the Brighton Corporation Entertainment Department for opening a covered parking place for cyclists which is provided with racks, and where cyclists are now able to park their machines for the day for a charge of 1s. The makers of the fittings state that this is the only provision of its kind in the country.

The "Trader" Handbook, 1947

THE "Trader" Handbook: A Legal, Technical and Buying Guide for the Motor, Motor-cycle and Cycle Trades. 41st edition. Published on May 15th, 1947, at 12s. 6d. post free, overseas 14s. 6d., by The Trader Publishing Company, Limited. Size, demy 8vo, 5½in. (wide) by 8in.; 396 pages. Bound paper boards.

All the regular features of the Handbook have been retained and many new features have been added. The legal guide has been much enlarged and now covers points of the law governing normal trading conditions. Authentic information is clearly set out on the law of hire purchase, merchandise marks and patents, price control, purchase tax, trade number plates, warranty, to mention only a few of the points on which traders are continuously seeking advice. The principal trade and professional organisations are given in alphabetical order. Motor vehicles servicing data, providing tables of measurements, now covers 1939-46 models.

The garage equipment section has been reintroduced in classified form under more than 200 headings, giving the names of firms specialising in the manufacture or supply of garage and workshop equipment for use of motor vehicle manufacturers and repairers. Other new features include British tractor specifications, technical data, such as international standard screw threads, metric and decimal equivalents, etc., a table showing traffic area headquarters and the newly appointed driving tests supervising examiners, a list of Regional Petroleum Officers and a full table of vehicle licence fees.

For ease of reference the various sections are printed on distinctively tinted paper.

"Cycling Record"

AGAIN congratulations to the B.L.R.C. on the production of No. 3 of its official journal, *Cycling Record*, which costs 6d. a month. The acting Editor is James Kain, 24, Disraeli Road, Ealing, London, W.5. The journal is of newspaper format, is brightly illustrated and well edited.

Tyre Valves

DUNLOP announce that they have reverted to the pre-war practice of fitting road racing (high pressure) cycle tubes with Presta valves, and the valve holes on new rim production are being reduced to suit this type of valve.

As there will be a number of rims already in use which have been drilled for the Woods valve, the tubes fitted with Presta valves are now supplied with a leather washer under the rim nut to ensure a good join in such cases. On the other hand, in fitting a Woods valve tube to a rim drilled for the Presta type valve, the rider is advised to widen the hole to 11/32in. diameter and remove rough edges with emery paper.

Bicycles in Luggage Vans

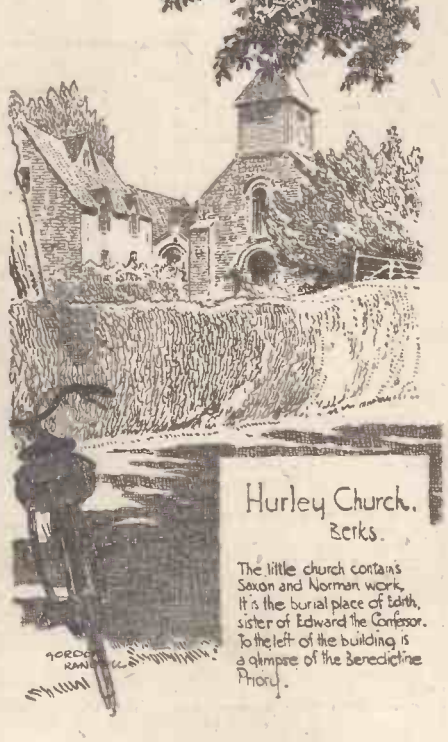
THE following letter has been circulated by Major H. R. Watling, chairman of the National Committee on Cycling:

"The Minister of Transport states that British railways do not consider they would be justified in providing hooks for hanging up bicycles in luggage vans.

"The idea, as Mr. John Parker, M.P., told the Minister, has already been adopted in France and Belgium, and the International Touring Alliance asks that all European countries should follow suit. The need for the device will be obvious. At present, bicycles are so jammed into luggage vans that the damage done to them runs into thousands of pounds a year.

"That fact was not denied by representatives of all the British railways with whom the National Committee on Cycling discussed the question last September; nor could they deny that the carriage of bicycles by passenger train in Great Britain is the worst, and its cost the highest, of any country in Europe.

"The railways may feel that they are 'justified' in continuing to damage the property of cyclists. But this is more than a cyclists' grievance; damaged bicycles must be repaired and the wanton waste of replacement parts, at present in short supply, is not defensible. Nor should the question of attracting touring cyclists from Europe be ignored. The numbers of them have never been impressive even compared with the flow from this country to the continent before the war; and, should they now be persuaded to come to Britain, they will certainly not come back when they find their bicycles treated like old iron."



New B.L.R.C. Section

A NEW B.L.R.C. club has been formed in the Streatham Vale area, and full details are available from A. J. Tilly, 3, Broadview Road, Streatham Vale, S.W.16.

Swiss Industries Fair

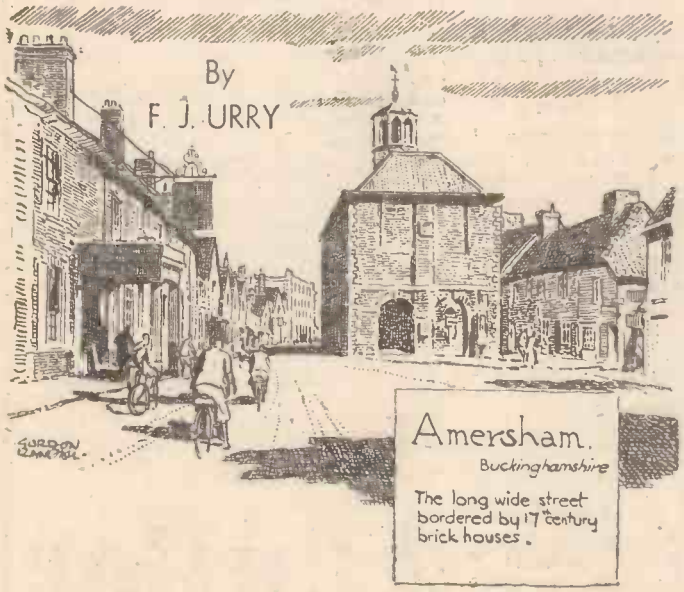
IN the cycle sections, as elsewhere, the great difference between this year's Swiss Industries Fair and any that we have had here since the war is that the exhibitors were there to sell, not merely to exhibit. Switzerland is once more a buyers' market now that stocks and production are again approaching pre-war levels, and this produces (for the unfortunate Briton, at least) a tonic atmosphere that is intensified in the Fair itself. The thousands of stands bear goods that are there for one purpose: the taking of orders. Not just to show what the manufacturer could do if he was allowed, but to show what he has in stock right now . . . and he has a form ready with that good old dotted line right there for the buyer to sign on.

The bicycle section of Hall IX was crowded, owing to the very attractive exhibits of some 20 firms. The most attractive exhibit was an animated display of three stuffed bears riding cycles, and the most striking machine in the section was probably the "Aero-Stella," by Camille Piquerez, S.A. This greatly resembled the "bicycle of the future" seen at the B.C.M.I. Exhibition, but like everything else at the Swiss Fair it was in production and for sale. With curved top tube and rear forks, this was a light and handsome machine, a streamlined unit under the handlebars incorporating a clock, speedometer and built-in lamp. The biggest crowd, however, was always around an exhibit tucked away by itself in another hall (and apparently not in the catalogue), the Rapid cycle made by Theodor Saxer, of Rorschach. Of conventional design as far as the frame goes, this has two-wheel drive—a normal pedal drive to the rear wheel and a front-wheel drive from the handlebars, operated by depressing and pulling back each grip alternately. This is a freewheel drive, and the bars can be locked solid when it is not in use; apparently the additional motive power of the arms (normally wasted, after all) does give incredible results in speed, hill-climbing and long-distance riding without fatigue. The actuating mechanism is enclosed, small and streamlined.

Amongst the many sports models in Hall IX it is interesting to note how (as in all sports activities) English terms are used; to such an extent, indeed, that many of these models are called after well-known English cars.

Both in the transport and sports sections a very notable point about the cycle sections (as in the commercial vehicle section) was the number of trailers shown. The cycle trailer is a feature of Swiss life that strikes the visitor immediately; every type of small tradesman uses them for deliveries, and many private cyclists own them and find them very useful.

Wayside Thoughts



A Further Wait

AT the moment of writing the cycle trade is in a state of chaos. Nobody knows how much steel it will be given for this season, and the shortages of little things, spokes, balls, nuts and bolts, chain wheel sets, etc., are growing worse. It is a doleful tale and it means the postponement of the full return of the better bicycle for at least a year. And that is a pity, because I firmly believe the best type of cycling is the foundation of the sport and pastime, and that the suspension of its coming is a bitter disappointment to hundreds of thousands of people. It is easy enough to say that there is very little difference between one bicycle and another; and it is true as far as appearance goes, but I tell you that the comfort of the good bicycle is astonishing when compared with the quality of the basic type of machine. It is the old, old story that quality and the care in the making of the article gives character to the machine and satisfaction to the owner. The fellows in the trade who still ride bicycles are fully aware of this, and if you will examine such mounts you will discover the fact very quickly. Yet we shall have to wait a little longer for the best of things in bicycles and their equipment, for it follows automatically that scarcity of supplies will mean that the great utility market must be kept supplied. I have never been able to understand why, during the war period, the basic bicycle was not raised to a medium valued machine, with concentration on this particular quality, for its manufacture would have used rather less material, kept the skilled worker more interested in his job, and, most importantly, have made the cycling public more alive to the values of the better bicycle. I know how good cycling can be when the bicycle is right for the rider, and I have a firm belief that such facts only need a wider discrimination among all kinds of people to greatly increase the number of users. The war-time bicycle was the chance to prove this contention, and I'm sorry it was not taken at a time when the opportunity occurred.

Shortage and Vexation

WE can't make enough steel to expand our industries; such is the position as I write after discussing the question with various manufacturers of bicycles and cycle equipment. It is the shortage of steel to expand that is the trouble. Most users, as far as I can discover, will get a percentage of the quota of material allocated to them in 1946. But they need more, far more, and the present limitations cannot meet the demand. The result is easily foreseeable; there are shortages of everything and production programmes have to be cut at a time when we need every bicycle that can be made. Some of the frustrations are comic, or would be if they were not seriously holding up production. For instance, spokes are a trouble and ball bearings, and thousands of bicycles are actually waiting for such trifles to complete assembly. As is ever the case in matters of this kind, makers are doing their best to help each other out of the dilemma and I know of one case where American contacts in this connection have been quite useful. Naturally, such shortages militate against the quick return to the market of the first-class goods; but I'm glad to say there are some signs that the industry is very much alive to the growing strength of this market. I am promised delivery of an all stainless steel machine shortly, the first stainless bicycle made as far as I am aware. Later, I will let you know something more about it. At the end of last year I had the first pair of Sprite covers the Dunlop factories have made since 1940. This tyre is the open-sided type, lightly but toughly fabricated, and it looks, smells and feels good. I am saving these covers to complete the ensemble of the stainless machine. I understand the Sprite tyre will probably not be on the market until the early summer, and then only to manufacturers. The delay trouble in this instance is the woven fabric, for the cotton business is still more than a quarter of a million hands short, and there seems no immediate prospect of improvement.

Whose Duty?

YET, with all these disappointments, cycling, both as a game, a pastime, and a utility means of travel, goes ahead. It is not surprising, for here is geared walking, tripling the two-foot speed, and sitting down to the effort of comfortably moving the individual from place to place. Hard work it may be to the people who refuse or neglect to learn to ride, the splay-footed, arms akimbo, body-swaying cyclists, without style, grace, or deportment, who traduce cycling to that low degree in the scheme of things comparable only to sloppy walking—and proper parents teach their children to avoid that. I have always felt the proper parents of cycling are the manufacturers, but how little they care for the well-being of their customers is measured by the neglect in telling and teaching them how to ride. Go and watch a rider who has learned the art of cycling, note his or her progress, the ease of it, the poise of the body between the linked wheels, the perfection of the human pedal action overcoming dead centre by the flexing of ankles and feet; the very grace of it all from position to performance, and you may realise what I mean. Then cycling is a joy, a poised and balanced exercise as near to flight as the human body can achieve through its own exertions; and this I feel is what a great industry ought to teach the public, this—which means the ease and joy and comfort of cycling—and that other galaxy of pleasure awaiting the exploration of the real rider with many leagues in his legs to change his habitat any day of leisure, and know his country and his country compatriots more intimately and sympathetically than any other type of traveller. Do I exaggerate? If so, my own experience belies the joy I have gathered from life as the result of cycling for more than fifty years. I am glad indeed to be fit and healthy, to see life whole and find it good even in these unsettled times, and thinking on the subject quietly, when all the emotions and satisfactions have become tranquillised, I candidly believe my cycling has presented to me these virtues in very full measure.

New Record

IT gave me quite a thrill to learn that the Roads Record Association—after some 13 years of "staying put"—have added the London-Pembroke route to the list of recognised rides. This due east to west journey is over a romantic road full of historical pictures illustrating our Island story, for it traverses Oxford, Gloucester, Carmarthen, and finishes on the sea verge at Pembroke Castle, where the Earls of that name played so great a part in English history. The lads who scurry over this route will not be greatly concerned with its story; their interest will be more closely allied to the gradients and the wind direction. Many times have I passed over the Welsh portion of this road where the milestones tell the wanderer how far yet to go to Hobb's Point. These stones were erected at the time when the fleet was centred at Pembroke Docks, and the men who manned our wooden walls tramped back to their ships when their leave had expired. There were few stage coaches, no railways, and alas, no bicycles in those times, and the jolly old tars had a long and weary walk over a road that even to-day is not thickly inhabited. Personally I would imagine the west to east will be the favoured way, not only because of wind prevalence, but I seem to remember the climbs going east are on the whole easier in grade. The mileage is computed at 246, and I wonder how long it will take before some top class performer with the luck of the gale, breaks twelve hours. But I like to think of that road which led me to a bonnie beach on the Pembroke coast, where for many years we ran a family camp at August, and from our bivouac learned much of the majesty of that seaboard, and the quaint hinterland of a remote area. The longest slope of the route is a couple of miles west of St. Clears, the famed Red Roses rise, three and a half miles of steady grind up which I have pinted on numerous occasions with a south-wester swinging into my lap, half frightened to walk a stretch for fear of not mounting again before winning the summit. But the whole way is good, and I doubt if any other 246 miles of main road between point and point can exceed it in fairness. The view of the Brecon Beacons beyond Three Cocks Junction, and the long rise from that town with the river Usk gleaming far below; and then the swerving road after Trecastle running to the Towy Valley at Llandovery; these sights are reserved for the tourist, and one hopes that the record breakers, when their urgent days have ended, will visit the scenes of their triumphs and stay awhile to gaze on the glories they once passed so hurriedly by. Certainly we want more of the young sporting lads to grow old at the game and take from it then the beauty they missed during their youthful years.

No Help

THE National Committee on Cycling has worked hard to improve the conditions under which bicycles are transported by rail, but the success of their efforts is very slight and amounts to little more than a vague hope mentioned by the railway officials that care in the handling of cyclists' property will improve. And that leaves us nowhere. The suggestion of the N.C. on C. to the railway officials was to the effect that if luggage vans were provided with hooks fixed high on the walls, and properly protected with rubber or leather sheaths, machines could be suspended therefrom, secured by a rope or strap, and so travel in comparative safety as they do on many of the Continental railway systems. The Minister of Transport, in reply to a question on the subject in the House, said the railway companies had considered the matter of the provision of such special, fittings but do not believe they would be justified. So for the time being, that's that, and I many of us who like to enlist rail aid the more quickly to reach our touring centres, will have to risk damage to our machines. And that risk is a very real one, the incidence of which seldom reaches the claims department of the railway companies, for who among us troubles to seek amends for broken spokes, fractured guards, bent cranks, or even the loss of lamp or pump? The claim trouble is not worth the time; but nevertheless we have to pay for righting the damage or loss in addition to the heavy carriage costs, the highest charged by any railway system in the world. No doubt the N.C. on C. will raise this important cycling question again after the railways have been nationalised, for once they are public property surely a considerable part of the community—the cyclists—can press home more vigorously than ever the elimination or the reduction of the risk of damage in transit of their delicate property, by the introduction of so simple a fitment as that already outlined. In the meantime, keep your eye on your bicycle when taking train aid, and have lamp, pump and bag with you in the carriage.

New Lincolnshire Club?

ALTHOUGH there has been no cycling club at Stamford, Lincs, for many years, keen riders now have plans for forming a new club, which would either be independent or associated with the Peterborough Club. One of the prime movers in the scheme is Mr. R. J. Seamer, of 5, All Saints Place, Stamford, who is at present chairman of the Peterborough Cycling Club and of the Fenland Road Riding Club and was the Peterborough Club's first member when it was formed some 23 years ago.

Hercules Racer Models have a great tradition be hind them—the breaking of 20 official Road Record in five months. Added t this are the new eye arresting colour scheme and the finest finishes. As your Local Hercule Dealer about these models

H.R.11

Hercules

The Finest Bicycle Built To-day

THE HERCULES CYCLE & MOTOR CO. LTD · ASTON · BIRMINGHAM

CYCLORAMA

By H. W. ELEY

Wooton Creek.. Isle of Wight:

A quiet backwater between Ryde & Cowes. The bridge carries the narrow Ryde to Newport road.

The Whitsun Break

I ALWAYS think that the short "break" which comes to us at Whitsuntide is the best of all the year. Often Easter can be cool and chill, and sometimes, when Easter is early, there is little greenery in the countryside; but at Whitsun most of the trees are in full splendour, the gardens are gay with flowers, and we feel that Queen Summer is really on her throne. The festival is a week away as I write, and I have no doubt that in town and city and hamlet keen cyclists were busy getting their machines in good trim for the on-the-road holiday. For myself I journeyed into unknown Essex . . . that little-known county so near to London and yet so derided as a place of scenic beauty. But there are some who know the charms of Essex . . . her good thatched cottages, her lonely farms, her little villages where time seems to have stood still. And it is an easy trip . . . just slip out on the train to Chelmsford, and from that ancient place one may "do" a little tour of surprising beauty not so many miles from town.

An Ardent Propagandist

I SEE that my old friend D. D. MacLachlan, of the Hercules Company, has been urging the Government to supplement its general campaign to the public on the subject of "Work or Want" by an intensive campaign directed to the men and women in the factories. "Mac" knows what he is talking about when he speaks about "internal factory propaganda," for during the war years he did an amazing amount of such work in the Hercules factories, covering such subjects as production, National Savings, salvage, safety first, etc., and I am not surprised, knowing his abundant energy, to see him anxious that the national needs should be made more clear to the men and women at the factory bench. I believe that they will put in the extra effort if they are told the facts . . . and that is what "Mac" is suggesting. Good luck to his effort!

A Town on Cycles

RECENTLY I had occasion to journey into the Eastern Counties . . . touching the old town of Huntingdon, and then visiting Cambridge and Bedford. They all have this in common . . . they are the homes of cycles! Bikes abound everywhere, and I imagine that there are no districts in England where more "town riding" is done. Women shopping . . . on bikes; boys and girls . . . going to and returning from school on bikes; factory workers using bikes to convey them from home to bench. I should think that East Anglia must be one of the most profitable "sales areas" for cycle manufacturers—and tyre and accessory manufacturers, too. And for many years I have known that the manufacturers are well served in this area by old-established and enterprising dealers.

The Farmer Carries On

JUST how seriously the farming community was hit by the frost, snow and floods of recent months, only farmers know . . . the urban dweller has but faint conception of the extent of damage suffered and of the setback to sowing. But the British farmer, ever a realist, is tackling the crisis with typical energy and optimism . . . and he will win through, just as he won through during the war years. But cycling in Lincolnshire the other week, on a little investigation about tractor tyres and equipment, I was almost appalled at the size and seriousness of the probelm . . . and, passing the fair and colourful bulb fields, I realised just how vital is the farmer to the rest of the community, and we do not always give him his due!

Boys, Badges and Banners

HOW fond are our schoolboys of decking their bikes with banners, badges and all kinds of "gadgets"! I passed a large school the other day just as the boys were arriving, and there were scores of them on bikes . . . bikes bedecked with the most ingenious gadgets and badges. Some were connected with speedway racing, some with football clubs, others were evidently gadgets presented with those lurid periodicals which boys still read with such avidity . . . adventure yarns, "Westerns," detective tales along the lines of Sexton Blake of immortal memory, and "comics." The gadgets certainly made the bikes very colourful, but unduly decorative, I thought . . . but then boys love to adorn a machine with every possible device, and I remembered my own schooldays, when it was the fashion to wear little badges depicting the generals of the South African War—and, watching those noisy, happy boys, I remembered the names of the heroes of South Africa . . . Methuen, Baden-Powell, Gatacre, Kelly-Kenny, Buller and the immortal "Fighting Mac." What curious little things will send memory racing back over the long years!

Cruelty to Cycle Tyres

WHY is it so difficult to persuade cyclists to give their tyres an adequate supply of air? All the tyre makers, over many years, have preached the wise gospel that "the air carries the load"—and have stressed the importance of pumping up tyres hard. But there is still gross neglect of this simple admonition! For my own part I can never feel comfortable unless my tyres are well inflated . . . and as a tyre man I know full well what potential mileage is sacrificed by the rider who will not give his tyres a full supply of air. But there it is . . . I almost despair of success in this particular field of propaganda. . . .

William Hume

YES, the original and only William Hume, not passed on, but the man who won that historic cycle race at the Queen's Park Sports, Belfast, in May, 1889—when, in the presence of John Boyd Dunlop and the du Cros family, the superiority of the pneumatic tyre was so clearly and positively demonstrated. My friend married a daughter of William Hume, and we had a most interesting chat about the early days of the pneumatic tyre . . . those hectic days when there were cycle booms and company floatations galore . . . days when history was made and the beginnings of the transport revolution. Good, sometimes, to look back and muse upon the pioneers!

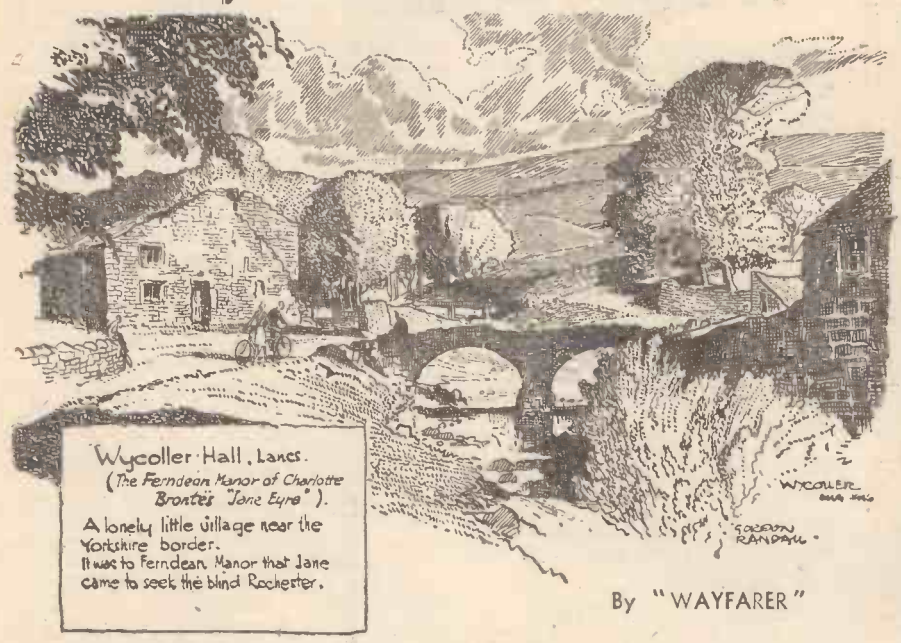
The Lure of Colour

WHETHER in the wide realm of Nature or in a range of manufactured articles, colour is a powerful factor, and never fails to attract. In bikes, we now have quite dazzling colours, and I have been particularly struck of late by the good colour combinations on a popular range of bikes . . . all kinds of pleasing shades are available, and, looking at the machines of a club the other day while out for a spin, I could not help thinking how far we have travelled in this direction of "brighter bikes." It is all to the good, and I welcome the bright greens and blues and reds and oranges. A war-weary world should welcome every contribution to cheerfulness!

Long-wearing Cycle Tyres

NOTWITHSTANDING the fact that for most of the war years cycle tyres were of the synthetic variety, they give wonderful service. I saw the other day a bike bought in the summer of 1940 and ridden regularly ever since . . . and the original covers were in fine condition. I must not mention the "make" . . . but it is a well-known one! And I happen to know that this particular machine has been ridden over very indifferent roads. The builders of our cycle tyres deserve a bouquet . . . and I gladly present it!

My Point of View



By "WAYFARER"

"Where's the Bike?"

WHEN walking through a busy city street the other morning my ears were suddenly assailed by a question, heartily expressed by a man who appeared to be a complete stranger: "Where's the bike?" What it is to be a convinced and enthusiastic cyclist!

Reputation

THE foregoing incident reminds me of a little thing I heard a few days earlier, when on a visit to the north of England, where one of my lectures was to be given. A successful ticket-seller told me that one of the people he approached responded thus to his importunities: "'Wayfarer'? That's the bloke who wants everybody to ride bicycles, ain't it?" How true!

Hopeless Dawn

A MOTOR-CAR with a flat front tyre stood outside a bank. I assumed that the owner was interviewing the manager with regard to the more frequent dusting of his overdraft, and had no idea of the trouble which was awaiting him when he emerged. Momentarily it is something of a hopeless dawn for either motorist or cyclist to discover an empty tyre. The motorist changes his wheel and is away in a few minutes; the cyclist has to "get down to it" and make a repair. How hopeless is the dawn depends on the circumstances surrounding the trouble, and on the amenities available. I, personally, would not welcome a puncture in a busy city street, though my remedy would be to find a cycle shop and get the job done for me; nor do I exactly delight in being held up in this manner on a country road. Nevertheless, the task of making a repair is not a serious one. What galls me is the delay—and the legacy of dirty hands which constitutes the normal harvest of puncture repairing. The real hopeless dawn in connection with tyre troubles is, of course, to be found on a dark and stormy night when one is alone, and "miles from anywhere."

My Gospel, Too

THE wording of a pictorial advertisement which I recently noticed in one of the daily newspapers intrigued me. It ran thus: "Henry Ford was the first man to make a lightweight motor-car. He didn't see the use of pushing a lot of unnecessary weight around." That second sentence represents what I have been saying for years and years with regard to bicycles. Nothing is gained, speaking generally, when cyclists propel several pounds of metal more than is necessary. It is they—i.e., the cyclists—who have to provide the motive power, and, while I am always ready to admit that it is one thing to carry a heavy weight and another to roll it along the road, the fact remains that the latter process calls for a certain amount of extra effort. Certainly lightness in our bicycles is to be aimed at, and we shall all be the gainers if we keep down the weight as much as possible. None of my present stud of bicycles weighs much more than 25lb.—and that is quite enough to push about the countryside when touring equipment is added.

The Dog Problem

IT is interesting to note that the Canine Defence League is arranging classes in London to teach dog-owners how to train their dogs to behave in traffic, and we are told that if the scheme is successful it may be extended to the provinces. We are further told that nearly one-quarter of the road accidents are caused by dogs not under control, a circumstance which results in car drivers swerving. Evidently the people comprising the League are optimists. They may, indeed, be successful in training dogs up to a certain point, but it appears to me that no power on earth, except physical control, will prevent our canine friends from dashing into the middle of a traffic-laden street. I view with some concern the grim possibilities in connection with wandering dogs, in the case of cyclists, and I say again that there is no room for uncontrolled dogs on our modern roads. It is deplorable to see one of our canine friends killed or injured through getting mixed up with traffic; it is much more deplorable that we cyclists should be endangered in life or limb through this cause.

History

FIFTY years ago it was announced in the House of Commons that the use of cycles by the post office had just been extended to the telegraph service, messengers in 22 provincial towns having been supplied with machines. The charge for the delivery of telegrams outside the three-mile limit was at once reduced from 1s. to 4d. a mile. The spokesman in Parliament mentioned that "for many years" it had been the practice to establish cycle posts in rural districts where the conditions were suitable. "Only those rural posts were adapted for cycles where the roads were tolerably flat, and where the postman had not to cross fields and follow by-roads." One wonders whether the same conditions are still observed. I doubt it. Anyhow, it is interesting to know that the utility of the bicycle was recognised so long ago. The handiest vehicle in the world has grown greatly in popularity since 1897, not only as a beast of burden but as an instrument of pleasure also.

Registering Surprise

IN the course of business, one day last autumn, it was necessary for me to interview a daily newspaper magnate, with whom I had secured a "date," as the saying is. The experience happened to be a very pleasant one, made much more so by the manner of its ending. When our business had been discussed, I harked back to the days of my youth when his Lordship (he was then a plain "mister") ran a weekly cycling journal of which I was an avid reader. The Big Noise had evidently been armed with a little information about me, for he said: "You're an enthusiastic cyclist, I believe." Admitting the soft impeachment, I added that on a recent Sunday, which happened to be my sixty-ninth birthday, I had cycled 69 miles. His Lordship was obviously astonished, and wrote the figure on his blotting-pad. I then went on: "And last Sunday, my Lord, I did 79 miles." Commonplace to me, it was a revelation to him, and he wrote the new figure on his pad. He thought it was marvellous, and ended by congratulating me on my vitality and my prowess at twirling pedals—and wishing he could do the same.

Of course, a great many people could make quite a decent show at cycling if only they tried. It requires a little practice, which in itself is a pleasant thing, and it is a definite advantage to stick to the game as the years pile up.

Tyre Puzzle

I DO not profess to know the secret of this tyre mystery, and would welcome elucidation. After a recent week-end ride, I found the front tyre of my No. 1 bicycle dead flat. I pumped up and went for a 40-mile trip without experiencing any further trouble. Ten days later the tyre was still hard enough to be ridable (though my views on air pressure impelled me to apply the pump), and it is still behaving itself. My son-in-law, who is in the tyre business, suggests that a patch might have lifted and afterwards gone back home. That suggestion might contain the explanation but for the fact that the tube is fairly new and has not been punctured. So the puzzle remains.

Staggering

WHEN the staggering of work hours was being discussed recently, it was interesting to note the suggestion of one of the big Unions that firms should shut down for two days each week on a rota system, with the result that a proportion of industry would be working on Saturdays and Sundays. Thus—so to speak—week-ends would be staggered. This arrangement, if widely adopted, would have far-reaching effects on cycling programmes. It might almost destroy organised club-runs, while it certainly would be an advantage to catering establishments in that it would spread business over the whole week, instead of concentrating it into two days. Our present system provides "one demnition rush" at week-ends and relative slackness on the remaining five days of the week.

Shifting the Responsibility

THE practice followed by certain folk of hanging out a notice "Caution—Private Drive" near the entrance to their premises tends to make me see red. The practice suggests a shifting of responsibility, but this is just one of those things that cannot be done. The need to take extra care rests on the person who is emerging from private grounds on to the public highway, and the notice in question thus becomes totally unnecessary.

Cycling Flavour

I WHILED away a recent six-hour railway journey by reading a curiously named book: "If I Laugh," the words being derived from Byron's "Don Juan." The author, Rupert Downing, took part in the great exodus from Paris in June, 1940, accompanied by his girl-friend, "Dee," and most of the 600-mile journey to the Spanish frontier was done on bicycles. There was one machine to start with. It was a 700fr. bicycle bought from a slightly drunk French officer for 3,000fr., and Downing made and attached a "Heath Robinson" carrier. The bicycle was then loaded up and with "D" on the cross-bar a start was made. Nor was it long before the pair crashed. Fortunately they were able to buy a second bicycle, which was obtained for 150fr., and then, with the luggage rearranged, a new start was effected. The trip does not appear to have been very comfortable, the weather being grossly unkind at intervals, and some of the roads abominable, but the two bicycles stood the racket all right, which was just as well, seeing that there were no spares and that the tools consisted of "one spanner, one screwdriver, a two-blade pocket knife, and a pair of nail-clippers."

The author throws off this bit of wisdom, which is a variant of what I have said for years: "Hills, like questions, have two sides to them." That is a point which we might all bear in mind. We are prone to complain of hills, forgetting there are downs as well as ups. On another page he remarks, humorously, that he is not an authority on cycling, "but, speaking from my own limited experiences, I do maintain that bicycles have a funny effect on the winds of heaven. On foot I have been blown backwards, forwards, and sideways; on a bicycle the only wind I have ever known has been one blowing in the opposite direction to the one I am going." Many of us have sustained the same impression—but it is not quite based on the truth! In another place the author, speaking of the country of the Landes, says that this "is a cyclist's dream—as flat as your hand, and with excellent roads." The latter may well constitute "a cyclist's dream," but, so far as I am concerned, flatness is not an attraction. Give me hills and undulations, and anybody can have the pancake type of country.

Two Letters

LET me share with you two interesting letters which have recently come to hand. The first is from a prominent member of a wealthy Midlands family, who, well provided for as regards this world's goods, nevertheless remains intensely loyal to the "humble" (*sic*) bicycle. Inflicted at the time of writing with an attack of arthritis, he bemoaned his fate, saying that he was "just existing" until he could get out on his bicycle and work off an accumulation of rheumatism. A few days later I happened to meet this friend. He was walking painfully, but he again assured me of his conviction—based on experience—that a return to cycling would quickly put him right.

The second of the two letters referred to comes from that cycling friend who shared with me my first cycle tour in Ireland, as long ago as 1923. Since then he has become a world traveller and has been located in India for several years. Home on leave, he decided that he must return to "the ould sod," taking his wife with him. Writing from Dublin he says: "I can hardly believe that we arrived only yesterday. One seems to drop into the 'atmosphere' and friendliness of the place so quickly that we seem to have been here ages already. . . . Everybody is so delightfully friendly and chatty, especially when they know you're from 'over the water.'" Later my friend went on to Killarney, where he and his wife received what he calls "a lovely welcome." All this is but what I, with a long experience of holiday-making in Ireland, would expect. It's a grand touring country.

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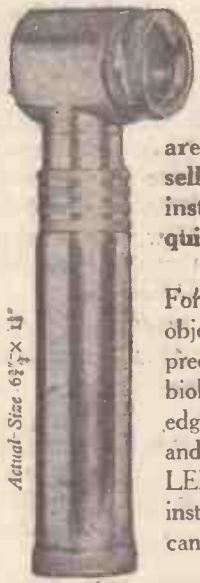

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