H.T. COIL WINDING

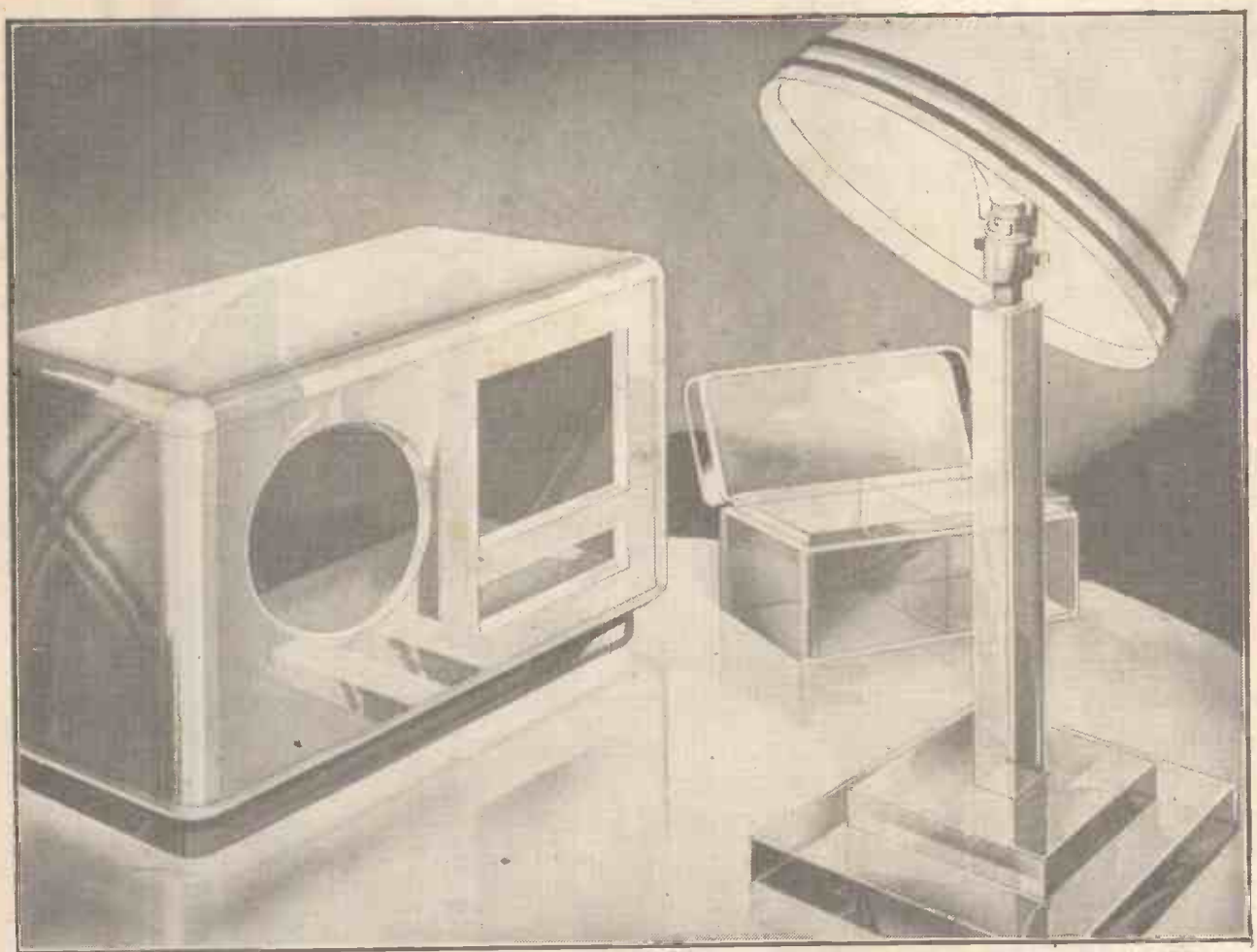
NEWNES

PRACTICAL MECHANICS

9D

EDITOR : F.J. CAMM

FEBRUARY 1949



ARTICLES FOR DOMESTIC USE MADE WITH PERSPEX (See page 136)

PRINCIPAL CONTENTS

YOU NEED CLIPS

TERRY'S MAKE CLIPS

in every shape and size — steel clips, bronze clips, stainless clips, etc., etc.
Here we show a tiny selection from the enormous range we have produced.
Our Research Department can design any clip to your own specification.
(93 years of clip-making experience is at your disposal.)

No. 81

Two popular types. In a range of sizes to grip from ¼" to 2". Delivery from Stock.

No. 80

No. 300

A drawing board clip. Plated finish, delivery from Stock. 4/- doz. plus P.T.

The most comprehensive and informative text book on springs yet published. 10/6 post free.

TERRY springs

Sole Makers:
HERBERT TERRY & SONS LTD. REDDITCH. *London · Birmingham · Manchester*

SUBSCRIPTION RATES
(including postage)
Inland - - - 10s. 6d. per annum.
Abroad - - - 10s. per annum.
Canada - - - 10s. per annum.
Editorial and Advertisement Office: "Practical Mechanics," George Newnes, Ltd.
Tower House, Southampton Street, Strand, W.C.2
'Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

PRACTICAL MECHANICS

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

Editor: F. J. CAMM

VOL. XVI FEBRUARY, 1949 No. 184

FAIR COMMENT

By THE EDITOR

Artificial Moon

THE reference in the report issued by Mr. Forrestal, the United States Defence Secretary, to the existence of an "Earth Satellite Vehicle Programme" came as a great surprise to the scientific world. I am certain, however, that it has given particular pleasure to one body of scientists, namely, The Interplanetary Society, and the associated astronautical societies.

The object, of course, behind the Earth Satellite is the creation of an artificial moon, but it is only the feasibility of such a programme that is admitted at present. Military scientists at present are considering design, the type of metals and alloys to use, and methods of launching.

We know that radar beams have already been transmitted to the moon and that they have bounced back again to us. The drawback to the use of the moon is that it cannot answer back. So it is thought that a small man-made moon could be equipped to send out radar beams and provide a fixed point for navigators of planes and ships.

It might also be used for controlling guided missiles so that they could bomb targets many miles away. Scientists have estimated that if this man-made moon could be rocketed into space a distance of about 200,000 miles it would reach a neutral point where it would be unaffected by the gravities of the moon and the earth. It is estimated also that such an artificial moon could be accomplished in from 10 to 20 years, but the possibility of launching it with a live crew and getting it back to earth again is at present very much in the realm of vaticination. There is, of course, nothing fantastic in this suggestion. The Astronautical Society and latterly the Interplanetary Society came to this conclusion many years before the war. Cleator wrote a book dealing with the possibilities, and in this journal I have published articles showing the suggested construction for such a space ship.

As with all sciences in their early days the idea of space ships has received only derisive attention at the hands of the Press, no doubt due to the stupid attempts of unscientific fiction writers to imitate the efforts of Jules Verne. Anyone who has read H. G. Wells' "First Men in the Moon" will realise once again how far ahead of his time H. G. Wells was. He forecast almost to the month the use of radioactivity in war, as long ago as 1895. He forecast aerial warfare. He was probably the only man of scientific qualifications who turned to fiction as a means of teaching science and entertaining the reader at the same time.

His "Time Machine" was a further example of scientific possibility, and it is feasible that in the not too remote future we shall be able to travel along the fourth dimension.

During the war German scientists investigated the practicability of producing ultra-long-range rockets which would end their flight at the perimeter of the earth's gravitational pull, and would continue to float at a fixed distance from the earth until directed back towards some target on the earth.

It is known that many in this country have investigated the problem and have made great strides in the direction of design. The project, however, it must be emphasised, is in its early stages, and several obstacles have yet to be overcome, not the least of which is that guided missiles travelling at high speed and at an altitude of 50 or 100 miles might disintegrate just as shooting stars do. The Ohio State University Scientists have developed a miniature motor which might carry projectiles beyond the earth's gravitational pull. It is operated by means of liquid hydrogen, but the drawback is that a temperature of 423 degrees below zero is needed to liquefy the hydrogen, and this is costly to produce. The motor already made emits a jet at a speed of 15,000 miles an hour, with a force strong enough to propel a small plane.

Unification of Screw Threads

THE need has long been felt for a standard screw thread series which could be used when it was desirable that products should be interchangeable in whatever country they were produced. As long as 40 years ago discussions were commenced between the British Standards Institution and its counterparts in the United States of America. In 1943, 1944 and 1945 a series of conferences took place between the United Kingdom, the U.S.A. and Canada, and at the 1945 conference at Ottawa considerable progress was made towards co-ordination. Agreement has now been reached between the three countries on the thread form and a series of diameters and pitches for bolts, nuts, and fastening threads for sizes ¼in. and above.

The three countries primarily concerned with the details are now preparing, for issue in their own countries, full particulars of the agreed standard and it is hoped that the other Commonwealth countries will be able to adopt the same standard.

The thread system is to be known in all three countries as the Unified Screw Thread system. The form of thread is one having a 60° angle. The bolt thread will have a rounded root with the alternatives of a rounded crest for use in the United Kingdom and flat crest for use in the U.S.A. The pitch diameter series will comprise a fine and a coarse series, and provision will be made in the standard for special design threads.

There are over 50 screw thread standards in use at the present time, and most of them are unnecessary. A glance at my Screw Thread Manual, for example, will indicate that many of the Standards are so close to one another that they do not perform any really useful function.

Perspex for the Amateur

Methods of Working This Popular Plastic

By J. C. REUSSNER

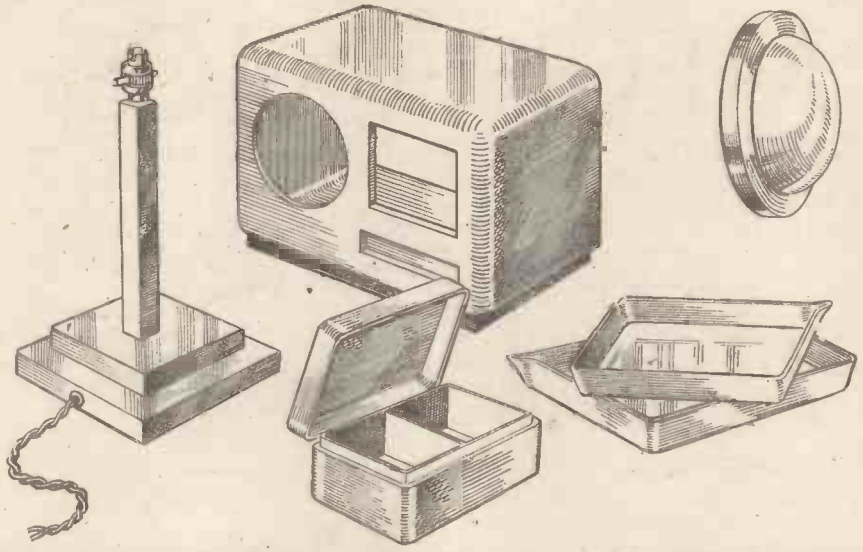


Fig. 4.—Various types of articles that can be made from Perspex. The table lamp and box are built up from flat sheets. The dishes can be built up or moulded. The wall lamp is blown without a mould. The top of the radio cabinet is cut from a part that was blown in a mould. The base is built up from flat sheets.

PERSPEX is a material that is in plentiful supply and which is particularly suitable for use by amateurs. It is very easy to work, and is one of the few materials than can be formed into complicated shapes without the use of elaborate equipment. Perspex can be obtained in the form of either sheets or block, both of which are available in a wide range of colours or as tinted, translucent or clear material. Many woodwork or modelling shops in large towns now stock this material, and there should be no difficulty in obtaining it from these, or from the many firms that advertise it for sale.

Perspex is already used by many people, but it is doubtful if they realise its full scope. It is hoped that this article will interest them in the more advanced uses of the material, as well as introduce newcomers to the possibilities of Perspex.

The material is very easy to work by hand. Most tools that are used for wood or metal can be used on Perspex. As the material, when it is cold, tends to be brittle, care should be taken to see that it is always well supported to avoid the danger of it cracking.

Protective Covering

Perspex sheet is supplied with a protective covering of paper on both its faces. This covering is held with a gelatine adhesive, and as much work as possible should be done before it is removed. The covering greatly assists marking out, which can be done with a sharp pencil, and it also protects the material from being scratched or splashed with solvents. When required, the covering can be removed by soaking the sheet in warm water and then peeling off the paper. The sheet should be washed down with warm water to remove all traces of gelatine and then dried with a soft cloth. On no account should the sheet be subjected to heat before all traces of the gelatine have been removed, as it badly marks the material when warmed.

Cutting and Drilling

Perspex can be cut with a hacksaw. A 10in. blade with 14 or 18 teeth per inch has been found to give the best results. If the blade is lubricated with water it considerably eases the cutting and prevents the blade from jamming due to the material softening. Thin sheets of Perspex, up to an eighth of an inch thick, can be cut by scribing a line about a quarter of the thickness of the sheet in depth and breaking along the line. The break should be started at one end and gradually worked along the line.

Holes can be drilled with ordinary metal twist drills. Care should be taken when breaking through on the under side of the sheet as the material is liable to crack round the edge of the hole. A drill with the end less pointed than is needed for metal will be found to have less tendency to crack the sheets, and will give the best results. Large holes can be cut with a tank or fly cutter.

Cements

There are several cements on the market for jointing Perspex. Perspex Cement No. 6 and Diakon Cement No. 2 are the most common. Chloroform and ethylene dichloride can also be used as cements, and give good results. Instructions for use are usually supplied with the commercial cements, but the following hints may be useful for using chloroform and ethylene dichloride. Absolute cleanliness is essential in making joints. Any dirt that gets into the joint will be cemented in and give the joint a bad appearance. The cement should be applied locally to the surfaces to be jointed, and should not be allowed to contact the surrounding material as it leaves a rough mark that spoils the surface. Speed is essential in making joints as the cement dries very quickly. All the surfaces should be prepared, and all the material be ready to hand before the cement is applied. If the cement becomes too dry before the surfaces are put together a satisfactory result will not be obtained. Joints should be allowed to harden for at least two hours before they are handled.

Types of Joints

Several of the types of joints that can be used are shown in Fig. 1. Straight butt joints are made by soaking the edges of the material in either chloroform or ethylene dichloride for about ten minutes and then pressing the edges together. Butt joints should only be used where the joint is lightly loaded. Where greater strength is required a strap joint should be made. The strap should be of the same material as the sheets and its width should be not less than six times the thickness. The cement should be applied to the surfaces to be jointed and the joint held under slight pressure for two hours. When the joint has hardened the 1/16in. gap is filled with either the Perspex cement or a solution of Perspex dissolved in chloroform. The lap joints shown in Fig. 1, although harder to make, give good results.

When making joints the area around the joints should be masked with gummed paper to prevent the cement from adhering to the surrounding material. When the joint is finished the paper can be washed off.

Removing Surface Marks

Where Perspex has been marked due to working or handling, the marks can be polished out. If the marks are deep they can be smoothed over with a fine file or sandpaper. If it is an edge that has to be cleaned up a wood plane will be found to give good results. Perspex Polish Number 1, which can be obtained from dealers, is next rubbed over the surface. The rubbing should be done with a circular motion and only light pressure used. The Perspex Number 1 polish is followed with Perspex Number 2, which is the finishing polish. If the proper polishes are not available, ordinary metal polish will be found to make a good substitute.

Methods of Shaping

By far the most interesting and useful property of Perspex is the ease with which

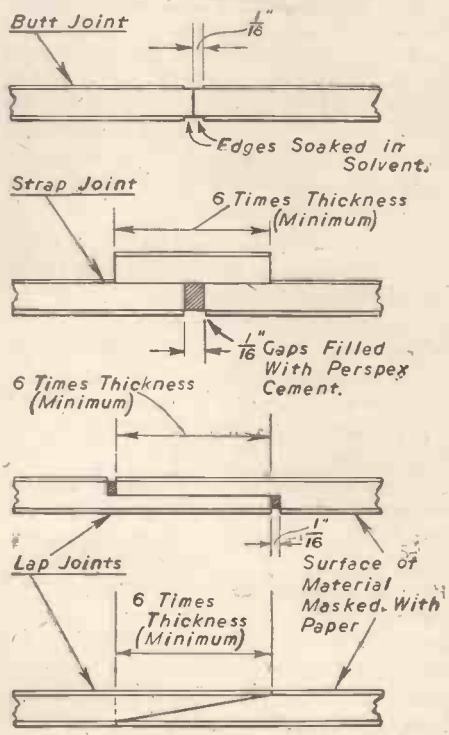


Fig. 1.—Various types of joint that can be used for joining Perspex sheet.

it can be formed into complicated shapes. The shaping is done when the Perspex is softened under heat.

Several methods of shaping are possible. Simple shapes can be obtained by heating the material and laying it over formers while it cools. More complicated shapes are obtained by blowing the material into moulds with compressed air. The apparatus required for doing this is described below.

Perspex softens at a temperature of between 110 degrees C. and 130 degrees C. The heating can be done in an ordinary household oven. Before heating, the paper covering must be removed from the sheets and all traces of the gelatine adhesive washed off. The sheets should be laid on soft cloth in the oven so that there is no danger of them being scratched. Care should be taken not to over heat as this causes small blisters to appear on the surface of the material. With a little practice the correct temperature can be judged by the feel of the sheets. When the material has reached the required temperature for shaping it can be picked up by the edges and will feel quite limp. The feel of the material should be checked at regular intervals during the heating process to see if it is ready for shaping.

A very useful property of Perspex is the ease with which it can be made to recover its original flat form after being shaped. If the material has been shaped and it is found that the result is not satisfactory it need only be re-softened in the oven and it will fall back to a flat sheet. This returning to the original flat state is complete, and a sheet that has been treated in this manner cannot be distinguished from a new piece of material.

Simple Formers

Perspex is formed into shapes involving single curvature by bending over simple formers. These formers may be made from wood, plaster or clay. They should have a smooth finish and better results will be obtained if they are covered with thin rubber or soft cloth. The Perspex is first heated in the oven and then laid over the former until it cools. If the bends on the former are such that the material does not follow the profile, it may be pressed into position with a soft pad. This pressure must be maintained until the material has hardened.

Compressed Air Apparatus

Double curvature shapes are best formed by blowing the material into moulds with compressed air. If a supply of compressed air is not available the apparatus shown in Fig. 2 will be found to give good results. This consists of a pressure tank and a pipe-line connecting it to the blowing board. A petrol tank from an old car will be found to make quite a good pressure vessel. A Schrader valve should be inserted in the tank. This is done by drilling a hole in the diameter of the valve and inserting the valve from the inside through the inspection panel in the tank. Rubber washers should be placed round the valve at each side of the tank to prevent air escaping. The petrol outlet union in the tank is a suitable place to connect the air pipe. The filler and air hole in the tank must, of course, be sealed. This can best be done by brazing a patch on to the tank, an operation that can be carried out at any garage. The tank is charged with a car pump; a pressure of thirty pounds per square inch can easily be obtained by this method.

As stated above, a pipe-line is led from the pressure tank to the blowing board. Some form of tap should be inserted in the tube, as shown, to stop the air. If the tube is of rubber and no tap is available, it can be kinked in the hand to stop the air.

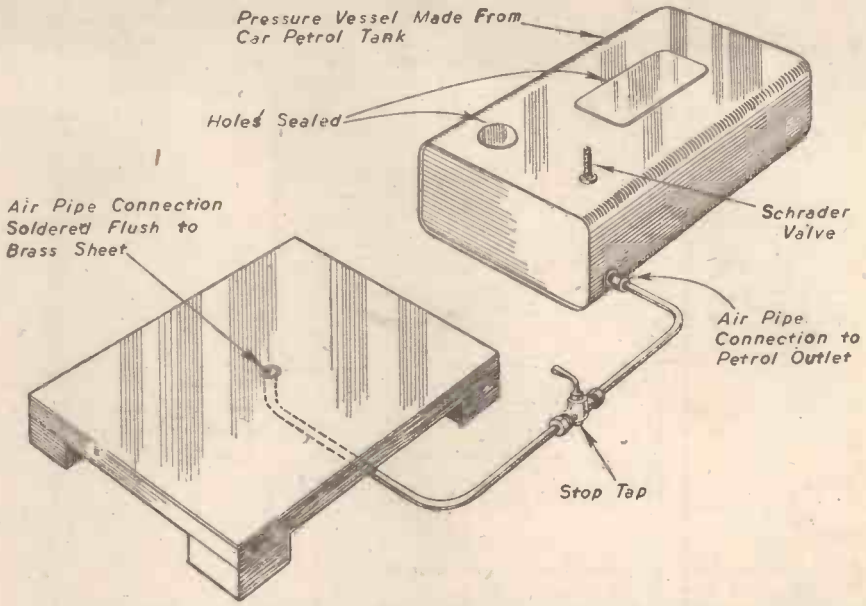


Fig. 2.—Apparatus required for blowing Perspex sheet.

Blowing Board

The blowing board consists of a flat piece of wood with a hole in the centre. The area of the board depends on the size of the sheet to be blown. The surface of board is covered with a thin sheet of brass and the end of the tube for the air supply should be soldered flush to the hole in the centre. The board should be mounted on blocks at each corner to give clearance for the air line.

The moulds for the blowing process are always female. If the shape to be moulded is comparatively simple the mould can be made in wood. It will, however, be found simpler, where a more complicated shape is involved, to first make a male pattern and then to cast a female mould from it in Plaster of Paris.

When making a mould or pattern, sharp corners should be avoided wherever possible. Shapes with large flowing curves will be found to give the best results and to be the easiest to blow. Where possible, lines rising vertically from the blowing board should be avoided and withdrawal angles of at least 10 degrees should be used.

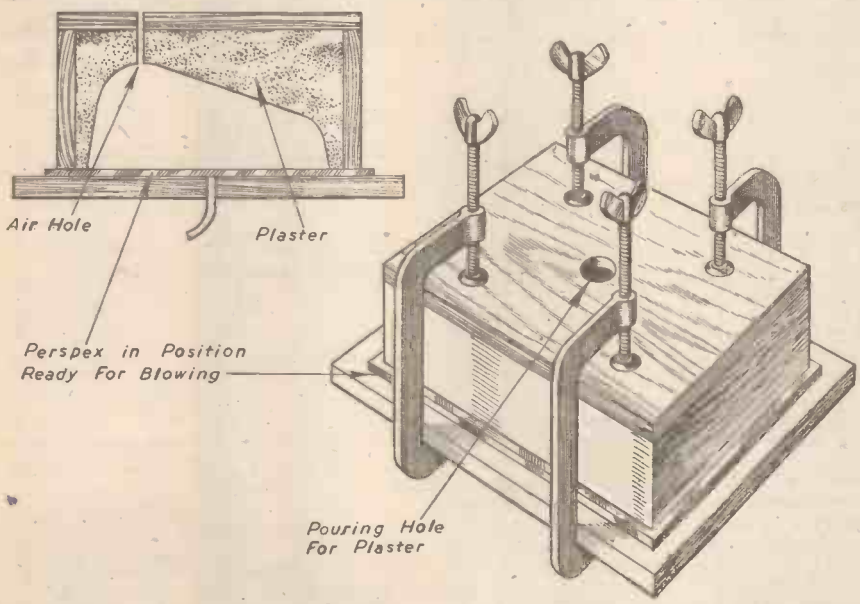


Fig. 3.—Showing mould box clamped in position on blowing board, and a section through mould box.

Casting Box

As the mould has to be clamped down on the base board, it is important to arrange wooden supports in it to take the pressure of the clamps. The simplest method of building the moulds is to have a casting box as shown in Fig. 3. This consists of a rectangular box with one face open and a pouring hole opposite the open face. The pattern is first greased to prevent the plaster sticking and then the casting box is placed over it and the plaster poured in. When the plaster has set the pattern is removed and small air holes drilled through the plaster at the top of the mould to allow the air at the top of the mould to escape during the blowing operation. The mould is then ready for use.

It is essential in the blowing operation that the mould is clamped solidly to the base board. Clamps of the type used by woodworkers are ideal for this purpose, but if they are not available, any method that will hold the mould firmly, and which can be applied quickly, may be used. It is important to realise that a considerable load is exerted

on the mould in the blowing process and the clamps should be strong enough to withstand it.

Blowing Operation

When the mould has been prepared, and everything is ready, the blowing operation can be started. First, a piece of clean cloth is laid over the blowing table. This prevents the Perspex from being scratched and also acts as a filter to stop any dirt that may be blown out of the air line. Next, the mould is warmed to a temperature at which it can just be handled without too great discomfort. When these are ready the material which has been softening in the oven is taken out and laid on the base board and the mould quickly clamped into position. The air is then turned on and the Perspex is blown up into the mould. The pressure is maintained for about ten minutes by which time the material should have hardened. The mould is then removed from the base board and the finished product taken out.

If there are any signs of an air leak in the blowing operation it is unlikely that good results will be obtained. Air leaks can usually be sealed by covering the edges of the mould that are in contact with the Perspex with thin rubber of the type that is sold in sheets for patching cycle inner tubes.

It is unlikely that perfect results will be obtained at the first attempt. This may be due to several causes. The material may not have been warmed sufficiently in the softening process, or it may have been locally cooled by the mould or the blowing board. In either case the solution is obvious.

If satisfactory results have not been obtained at the first attempt the material is reduced to a flat sheet by re-softening in the oven and the process repeated.

With a little practice the correct technique is soon obtained. There are many variations of the basic process described above. It is possible to blow shapes without a mould. In this case the Perspex is clamped down with a flat board in which a shaped hole has been cut. The material is blown up through this hole to the height required. The shape of the finished article is governed by the shape of the hole. Clear Perspex blown in this manner has perfect optical properties and it is by this method that the transparent covers for aircraft cockpits are formed.

There is plenty of scope for experimental work by amateurs in working Perspex. New methods can be evolved for special purposes, and the material can be applied to many new types of work. Great satisfaction can be gained from the fine finish and professional appearance of completed parts, and this will amply repay the time and effort put into the work.

Electric Door-chimes

A Simple Modification for Increasing the Volume of Sound

By E. S. BROWN

THE writer has received several requests from readers for particulars on increasing the volume of sound from the Electric Door-chimes as described in the May issue of PRACTICAL MECHANICS.

It should be made clear, however, that the chimes were primarily designed to give a soft, mellow, musical note, and any increase in the impact of the striker-rod may sacrifice this desirable quality. It is quite understandable, however, that under certain conditions a powerful sound emission may be required, and for those readers the writer has pleasure in presenting the following modification. This can be quite easily applied to the solenoid coil in a very few minutes without any dismantling, and will considerably increase the thrust on the striker-rod and the ultimate blow upon the chimes.

Soft Iron Pole-piece

A pole-piece, 1in. wide by 5½in. long by ⅛in. thick is constructed from a sheet of soft iron. A central hole, $\frac{5}{16}$in. diameter, is drilled ¾in. from one end, and a ¼in. diameter hole is drilled ¾in. from the other end. The pole-piece is then bent to the dimensions and shape as indicated in Fig. 1.

Leaving the solenoid coil *in situ* on the base, remove the brass bearing plates from the two end pieces, and on the interior of the thrust side of the coil carefully remove the cardboard former with a small knife for a distance of ¾in. Every care should be taken not to damage or displace the coil windings during this process.

The iron pole-piece should then be placed over the solenoid coil as shown in Fig. 2. The $\frac{5}{16}$in-hole-end should be placed over the return-spring-end of the solenoid, and the hole must be concentric with that of the solenoid. The pole-piece is secured in position by drilling and inserting two small screws in the solenoid end pieces. A soft iron tube ¾in. long by ¼in. external and $\frac{3}{16}$in. internal diameter is next required as a core-piece. This is pushed through the other end of the pole-piece and into the interior of the coil until it is flush with the surface of the pole-piece. It is essential that the iron core is a tight fit in the pole-piece in order to establish good magnetic contact.

The brass bearing plate on the return-spring-end of the solenoid is returned into its former position by drilling two small holes in the pole-piece, and screwing up. The other brass bearing plate may be discarded, as the core-piece will quite satisfactorily serve this purpose.

Free Movement Necessary

The striker-rod should now be inserted in the solenoid, and it must have complete free movement over the entire length of its travel. Should it bind slightly in the core-piece, it should be eased with emery paper until free. It must be emphasised that the slightest resistance offered to the striker-rod in its working stroke will detract from the satisfactory working of the chimes.

The return-spring-end of the pole-piece should be inspected to see that the sides of the hole under the brass bearing plate do not make contact with the striker-rod. Should this occur, the striker-rod will not operate due to the magnetic attraction of the pole-piece.

As the increased thrust of the striker-rod may cause undue swinging of the chimes, and eventually disarrange them from their correct position, it would be advisable to fit a slightly stronger return spring on the striker-rod.

The striker-rod and bearings should, of course, receive one or two drops of very light lubricating oil occasionally to minimise any friction.

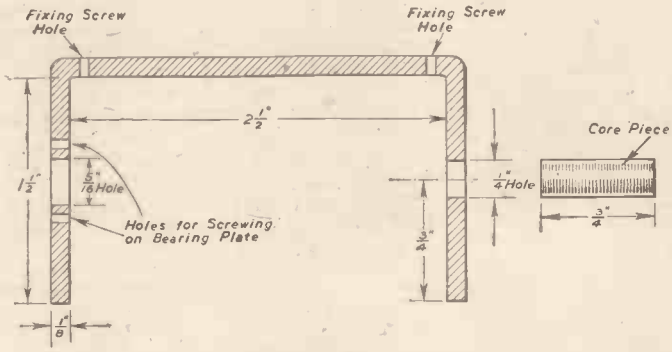


Fig. 1.—Section showing dimensions and arrangement of pole- and core-piece.

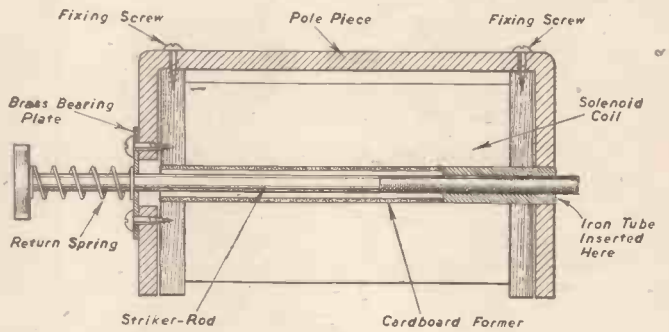


Fig. 2.—Sectional view of the complete solenoid and striker-rod.

Wind Tunnels—2

Technical and Operational Details.

By H. E. HUTTER, A.M.I.E.E.

(Continued from page 74, December issue.)

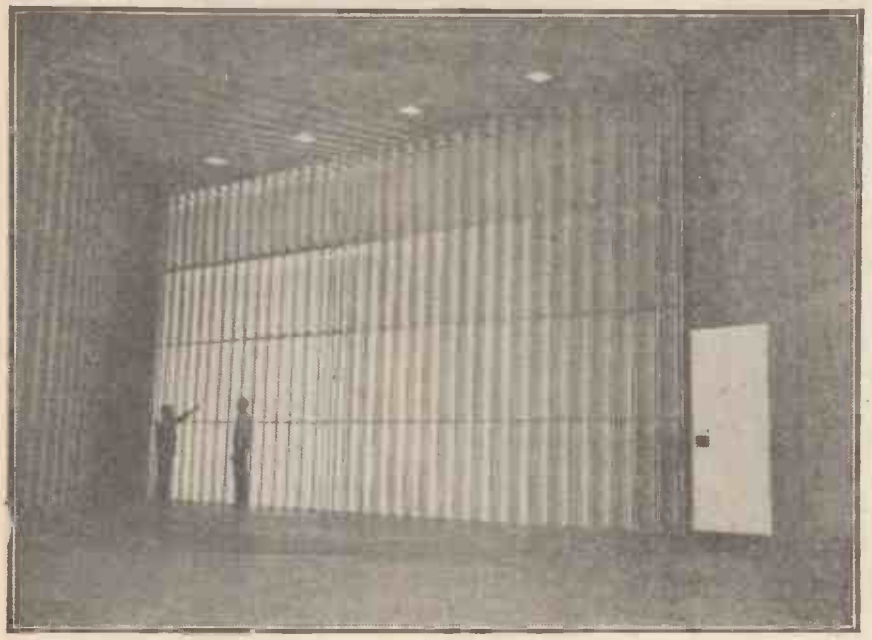


Fig. 7.—Turning vanes in the Convair wind tunnel at San Diego, California.

THE installation of the Convair tunnel is shown in Figure 7, there being 35 separate vanes at each position. This illustration also shows some of the access doors essential in a tunnel of this size, and the overhead lighting provided. One of the largest Eiffel open jet tunnels is at Chlais Meuden, and the leading dimensions are given in Figure 8, while shown in this view the long diffuser section is supported at two points only 110ft. apart at the point of entry into the testing house and into the suction chamber.

An unexpected feature of all these large tunnels is the limited number of people who are actually required to perform the testing operation. Naturally, in the case of a variable density tunnel there is an additional engineering staff dealing with the compressors and other associated equipment, but in the case of the tunnel itself as regards the conducting of a test very few people are required. As an example of a large tunnel the Southern Co-operative tunnel employs three operators only, one operator to attend to the power controls, one to operate the tunnel controls, and one in charge of the balance. They are provided with an observation window permitting viewing of the model during testing and work at a console 9ft. high by 16ft. long, which is provided with 587 indicating meters and signal lamps.

In some of the tunnels it is not at all easy to follow closely the performance of the model in the tunnel itself, and a scheme which is being seriously considered for some of the big tunnels in the United States is the installation of television apparatus with the camera viewing the model in the tunnel and the operators being provided with a separate screen in the control room. A typical control room is shown in Figure 9, which shows the Consolidated Vultee Aircraft Corporation tunnel.

The "Q" Balance

Measurement of air speed is naturally of considerable importance and various methods of measuring this are in use. In the case of the Convair tunnel airspeed in the tunnel is measured by a "Q" balance, consists of an electro-magnetic balance; an indicating meter with an accompanying range changer; a pair of Sylphon bellows opposing each other and enclosed in a common housing having a low heat-transfer coefficient; a balance beam with necessary flexures inter-connecting the electromagnetic balance, the bellows, and a weight pan; balancing weights; micrometer weights; and sensitivity adjustment. A set of weights, calibrated to various values of "Q," a power rectifier amplifier assembly, and a remote indicating meter and range changer complete the "Q" balance.

The "Q" balance is used in the following manner:—

(1) A weight, accurately calibrated to the "Q" desired, is placed on the weight pan; (2) this throws the balance beam out of the neutral position and causes current to flow through the electromagnetic balance until the restoring force in the balance is sufficient again to place the beam in equilibrium; (3) this current actuates the needle on the indicating meter and the reading multiplied by a suitable factor provides the value of "Q" corresponding to the pan weight; (4) the wind tunnel is started and as the speed increases the differential pressure in the bellows (which are connected to static rings in the wind tunnel) assists the electromagnetic balance in restoring the balance beam to equilibrium. This reduces the current required in the electromagnetic balance and correspondingly the "Q" indicated on the meter. The meter thus indicates the amount by which "Q" in the test section is off from the desired "Q"; (5) as the speed in the test section

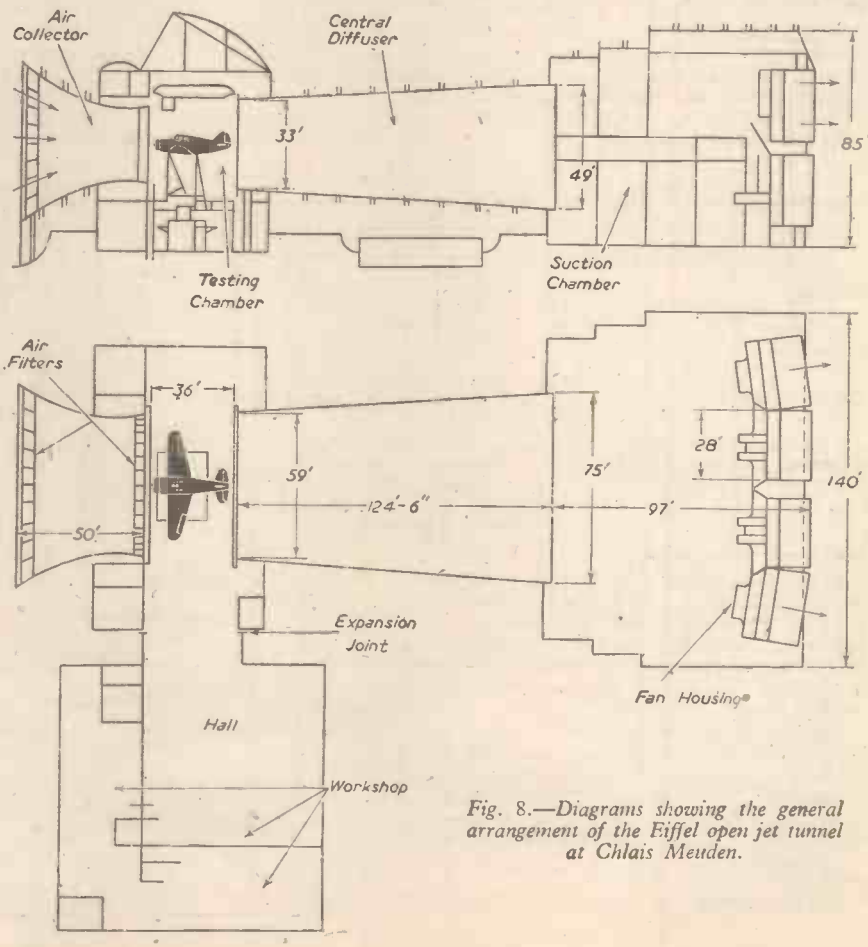


Fig. 8.—Diagrams showing the general arrangement of the Eiffel open jet tunnel at Chlais Meuden.

approaches that desired, the indicating meter reading approaches zero and the range changer is switched by the operator to lower and lower ranges on the meter to increase the accuracy of reading; (6) when the desired speed is reached, the operator then regulates the power output of the tunnel drive motor continuously as the test progresses to keep the "Q" meter indicating zero reading.

The propulsion of an airstream of such high velocity and of such high speed and large area calls for the dissipation of a substantial h.p. and requires a high degree of skill of the fan maker to design a unit which is capable of fully absorbing this power. The types of fan adopted for the return flow tunnels are either single or tandem types, fan blades being made of wood or forged aluminium alloy. According to the type of tunnel the motor may be inside directly connected to the fan or may be external to the tunnel driving through suitable seals, especially when variable density conditions are experienced.

The Boeing Tunnel

In the Boeing tunnel a 24ft. diameter fan having sixteen blades made of laminated spruce is driven at the maximum speed of 514 r.p.m. by means of an 18,000 h.p. motor. Due to the large size of this motor and the high power consumption which would be required when starting, an extra motor of 400 h.p. is provided to get it under way until a reasonable demand can be made on the supply.

An unusual feature of this installation is the employment of a magnetic coupling between fan and motor, this means that the motor can be running at one speed and actual adjustment of the fan speed can be made on the coupling. It is understood that in practice this has not proved the most desirable way and direct coupling of the motor and fan are the best. A further unusual feature is the fact that the motor is double-ended with a view to employing it in conjunction with a further tunnel that may be built later. The main coupling shaft between motor and coupling is 37ft. long, weighing 10 tons, and passes through the wall of the motorhouse and the tunnel.

In the case of the Southern Co-operative tunnel the difficult problem of trying to absorb 12,000 h.p. with a range of air densities of sixteen to one has been overcome by the use of a tandem fan installation. This consists of two separate stages duplicated through each other and running at a maximum speed of 595 r.p.m. The complete installation consists of two identical stages each consisting of a fan blade of the variable pitch type and twelve stationary pre-rotation vanes fitted with adjustable 30 per cent. trailing edge flaps. These two units are followed by a further set of flow straightening vanes located downstream in the tunnel.

The main fan hub diameter is 12ft. and the fans consist of eighteen blades each. Remote control is provided and simultaneous change of flaps and blade angle can be made by push-button operation during an actual run, or alternatively they can be changed in five groups whilst setting up for a test. The groups consists of (1) pre-rotation flaps of front stage; (2) blades 1 to 8 first stage; (3) blades 9 to 16 first stage; (4) pre-rotation flaps of second stage; (5) blades 1 to 16 second stage.

When operating under high pressure conditions of $1\frac{1}{2}$ to 4 atmospheres only, eight blades of the first stage are required, the other eight blades and the blades of the de-clutched second stage are set to a position of no thrust. For the range of $\frac{3}{4}$ to $1\frac{1}{2}$ all the blades of the first stage are used. For the lowest pressures both stages of the fan are required.

Fig. 9.—Control room of the Convair tunnel.

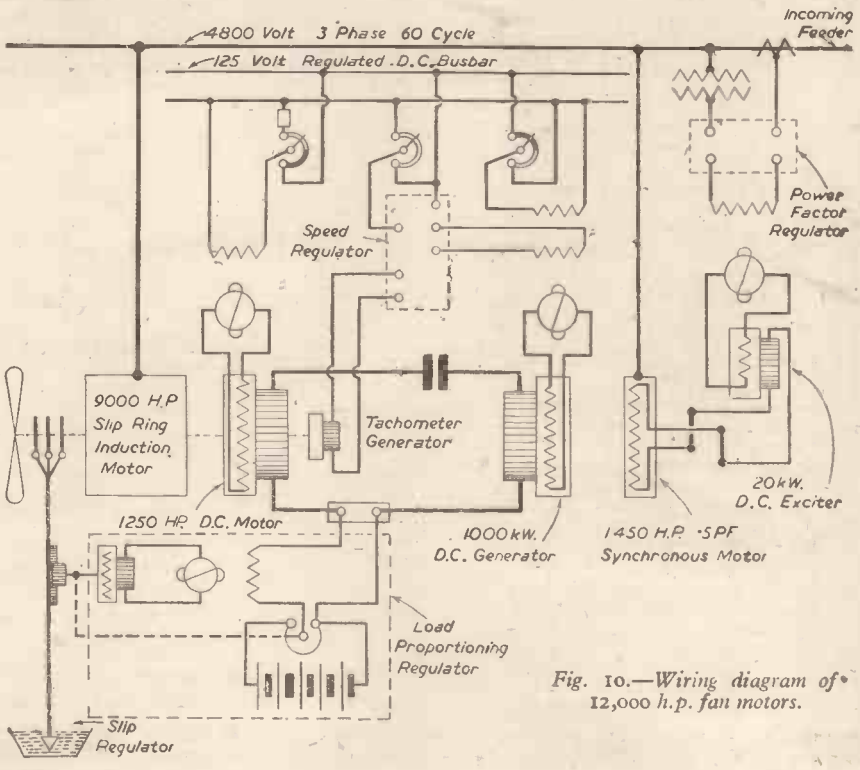


Fig. 10.—Wiring diagram of 12,000 h.p. fan motors.

Driving Motors

The driving motors for this equipment consist of an A.C. motor maximum rating 10,000 h.p. and a D.C. motor rated at 2,000 h.p., in conjunction with a motor generator set, the combination giving speed control and regulation of the Ward Leonard system at greatly reduced cost. An elementary wiring diagram is given in Figure 10.

Considerable application is naturally to be found in a fan of this nature when blades and vanes are adjustable, and as an example Figure 11 shows a cut-away view of the installation employed in the 12ft. variable density tunnel of the Cornell laboratory. An example of a motor mounted inside the tunnel is given in Figure 12, which shows the 2,250 h.p. motor of the Convair tunnel coupled to the 20ft. diameter fan. Cooling air for the motor is brought in through the two bottom streamlined struts from a blower underneath the floor, and is discharged out through the upper struts.

The obvious purpose of the tunnel being to test models, considerable thought has been given to means of entry to the interior and the mounting of the models themselves. In the plan of the Eiffel open jet type, shown in Figure 8, entrance to the main hall in which tests were made is allowed through airlocks. In the case of the R.A.E. tunnel, doors are provided to permit entrance, and these incidentally also pass through the outside return path. The actual size of the entrance is controlled greatly by the tunnel's size. In the Northrop tunnel the working space is constructed of wood and operated by motors; a view of this in the open position is shown in Figure 13.

The Convair tunnel is provided with a mono-rail track serving the model shop and bringing it to the tunnel, an overhead hatchway of 44 sq. ft. is provided for lowering the

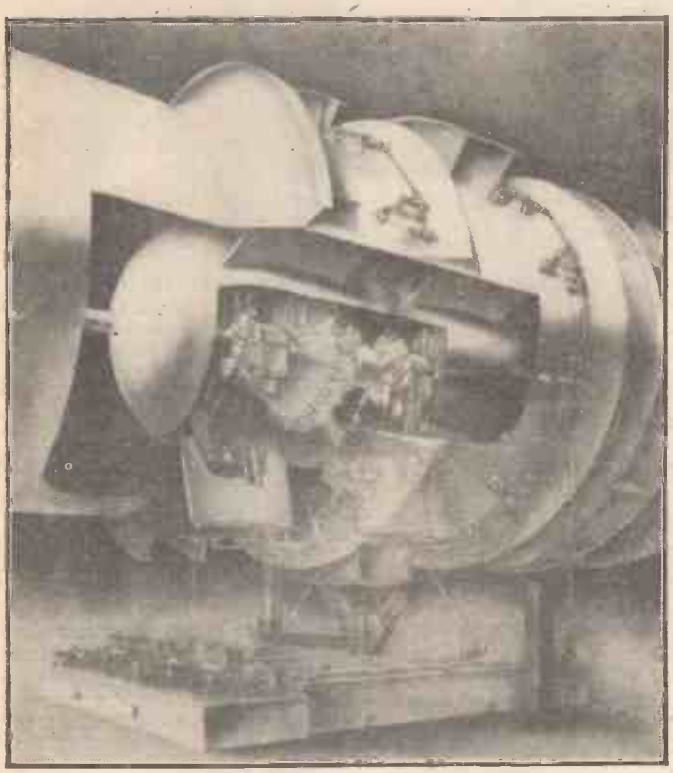


Fig. 11 (*above*).—*Fan blade and pitch control Convair fan.*

Fig. 12 (*right*).—*A* 2,250 *h.p. motor and* 20*ft. propeller* (*Convair*).

model, and for inspection during operation there are two windows each set 4ft. x 9in. constructed of 2in. thick bullet-proof glass. Due to the considerable danger which exists in operating such tunnels without all doors being closed, it is common to provide an electric interlock which prevents the main fan motor starting until all is sealed.

In the case of variable density tunnels the exhaustion or compression of the air may take as much as four hours to carry out. If the doors are opened to change the model it means that the internal air will return to atmospheric pressure and there will be a further delay of up to four hours before another test can be run. Various methods have been introduced to overcome this disadvantage, and the example to be shown utilises a decompression sphere which results in a loss of 10 per cent. of the air only; this means that the model can be changed and a further test run in a very short space of time. The sphere is shown in Figure 3 of Part 1 (December issue), and is the circular ring surrounding the working section. In both parts of the tunnel adjoining the working section a gate is provided and the tunnel itself is coupled to the sphere by means of a 24in. pipe and valve, and a further pipe with valve passes to the blow-off tower.

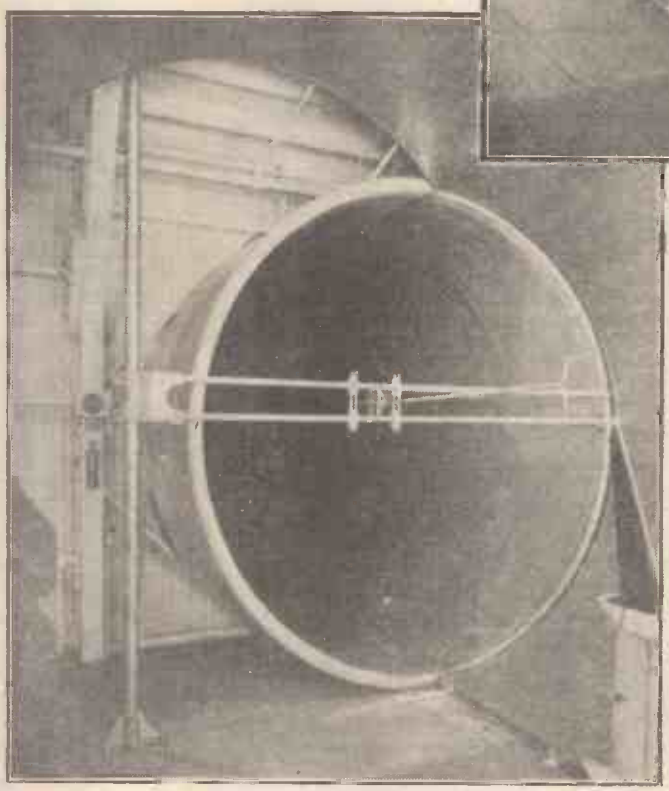


Fig. 13.—*Working section of the Northrop tunnel, shown in the open position.*

Method of Operation

The method of operation can best be described by an example. Supposing it is desired to run a number of tests at 45lb. per sq. in. in the tunnel, the following steps must be taken:

1. The tunnel must be pumped up to 45lb./sq. in. Three air compressors located in the power house can do this in about 3½ hours.
2. During the previous operation the upstream and downstream "gates" were left closed and the main door open, so that the model could be installed.
3. When ready for a test the main door is closed and sealed.
4. A 24in. valve V_1 is opened which equalises the pressure between the tunnel and the sphere.
5. The gates are lowered so that the "windows" come into position.
6. A run (or series of runs) can now be made after which it may be desirable to make similar runs with different fillets on the model.
7. The gates are closed (by raising) and sealed.
8. The air in the sphere is released to atmosphere through the blow-off tower by valve V_2. The blow-off tower contains sound-absorbing material to reduce the noise of the air-jet.
9. The main door then is opened to permit access to the model. All these operations are controlled from the console in the master control-room.

It should be noted that the valves V_1 and V_2 are used to equalise pressures between sphere and atmosphere or between sphere and tunnel as desired. The main door and two gates are always brought to position and sealed before being called upon to carry pressure.

(*To be continued*)

H.T. Coil Winding

Practical Details for Making and Testing Efficient Coils

By R. G. CHORLTON

MANY readers who have made miniature petrol engines and have tried to make small H.T. coils may have wondered why they were not successful.

Coil winding is a job where a little carelessness can ruin several hours of work. Concentration is required not for a few minutes but for the whole of the time that the coil is being wound. For instance, one turn overlapping another turn in the secondary winding will eventually burn out and produce an open-circuit reading upon an ohmmeter.

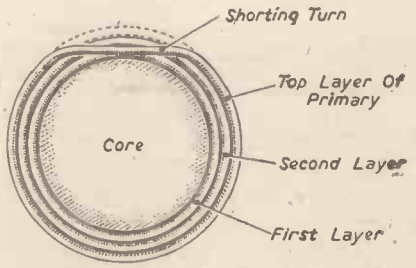


Fig. 1.—How a slipped turn can short out the primary.

No doubt many readers may have wondered why their coils failed, so here is the information for making a better job—an H.T. coil with a very high margin of insulation efficiency.

Winding the Primary

Between the primary and the core, which should be as large as possible, as it is the core which concentrates the magnetic flux, two or three layers of silk or empire cloth should be laid down. These layers of silk or empire cloth must be the full width of the coil.

The primary is wound to the full width of the coil on the first or bottom layer. The second, third and fourth layers turn back one or two turns before the end of the layer to prevent the last turn of each layer slipping down on to the lower layer, as in Fig. 1.

This should not be allowed to happen, as it will result in the cutting out of a layer of primary, thus raising the primary-secondary ratio unnecessarily high, and putting a heavy strain upon the inter-leaving papers of the secondary.

Fig. 2 shows the insulation of the primary whilst Fig. 3 shows how to trap the primary at the start and finish.

Between each layer of the primary an interleaving layer of silk or empire cloth should be put down, and the primary wound in pyramid fashion.

After the last layer of primary has been wound, the next step is two or four layers of empire cloth, mainly depending upon how much room there is left for the secondary.

If there is plenty of room, four layers of empire cloth will provide a very high insulation between the primary and secondary.

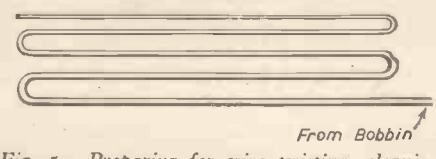


Fig. 5.—Preparing for wire twisting, cleaning and soldering for the secondary joint.

Most commercially-wound coils use from 24 to 30 s.w.g. for the primary windings. They are wound as described.

The silk and empire cloth used are from 5 to 8 mil. in thickness and are cut to the full width of the coil.

If the ends of the primary are to be brought out as in a flywheel magneto type coil, both ends should be sleeved in P.V.C. or similar sleeving.

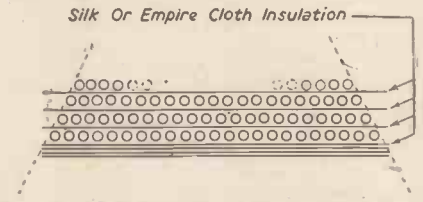


Fig. 2.—Primary winding in pyramid fashion.

The Secondary Joint

In making the secondary joint reference to Fig. 5 will show how to strengthen the wire.

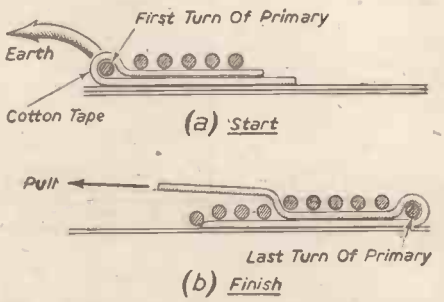


Fig. 3.—How to trap first and last turns of the primary.

Take a length of about 8 in., double backwards and forwards four or five times, twist and clean, and a good, strong joint is the result. This method of joining the two windings is preferable to using flex, which tends to show up under the secondary interleaving papers. Using flex often tears the paper, and also causes overlapping of the first half-dozen or so layers of the secondary.

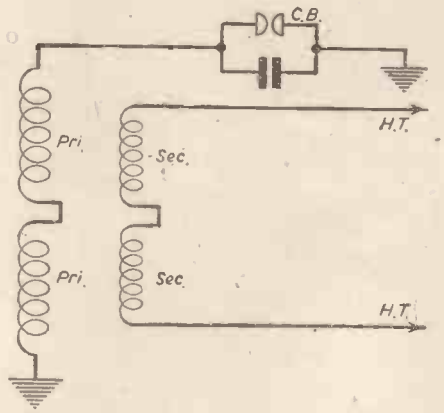


Fig. 6.—Coil without primary-secondary joint.

If the secondary is started off in 44 s.w.g. in a single strand, it often gets snapped by the empire cloth.

This joint is not common to some coils which are wound as shown in Figs. 6 and 7.

Another method used in starting secondary windings is to wind two layers of 34 s.w.g. to cope with the transient voltage moving into the secondary. The winding continues for some 12,000 turns of 44 s.w.g. The winding finally ends with another two layers of 34, although I have finished off with 35 and 36 s.w.g. (Fig. 8).

Cutting Interleaving Papers

When cutting the interleaving papers it is very important that they should be the full width of the coil. Otherwise, the coil stands a big chance of going down, especially near the upper layers (near and above 8,000 turns), especially if any of the layers are near the edge of the paper.

The best way for cutting the papers is to cut to the width first, a length being tried around the coil for length allowing about $\frac{1}{32}$in. for overlap. Then the rest of the papers are cut, increasing the length of each paper by 1/32in. in length.

As the layers are wound, the overlaps should be spaced out as in Fig. 15 for a round coil, and as in Fig. 16 for a rectangular coil. The rectangular coils are usually made up from soft iron strips.

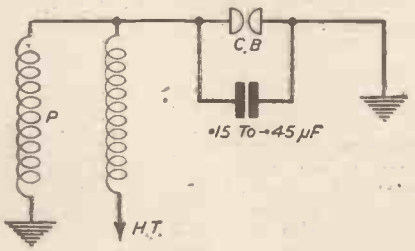


Fig. 4.—Conventional coil winding.

The idea is to build up a completely round coil, and in the case of Fig. 16 to gradually take the edges off; this is a cause of broken wires if too high a winding speed is used.

The more round a coil is, the better, and a higher speed of winding can be used with safety. Any breaks in the secondary will

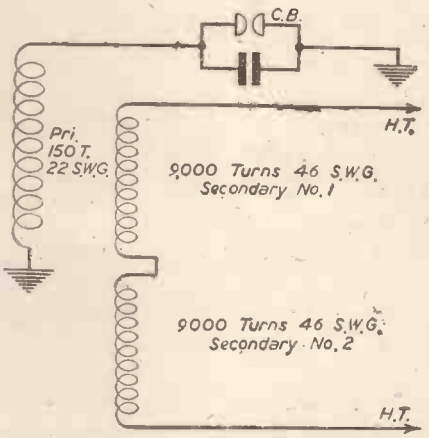


Fig. 7.—Twin-cylinder outboard motor coil giving 2 sparks per rev.

give a higher reading on the ohmmeter than is necessary. A useful figure to work to is from about 2,500 to 4,500 ohms, and this will give a good hot spark. Under 2,000 ohms and also above 8,000 ohms, usually gives a poor spark which cannot be relied upon.

On no account must the wire be allowed to overlap on a layer, as the crossed wires eventually burn out giving an open circuit.

If the overlaps are not removed, by winding the wire back on to the bobbin they will persist right through the coil, resulting in a loss of turns.

Whilst winding the secondary, make sure that no stray bits of 44's (or whatever gauge is used for the secondary) get on to the interleaving papers, as they cause a burn-out as soon as the primary is energised.

Every endeavour should be made to keep the papers as clean as possible; any grit getting on the papers will cause trouble in the way of overlaps.

To hold the interleaving papers down a

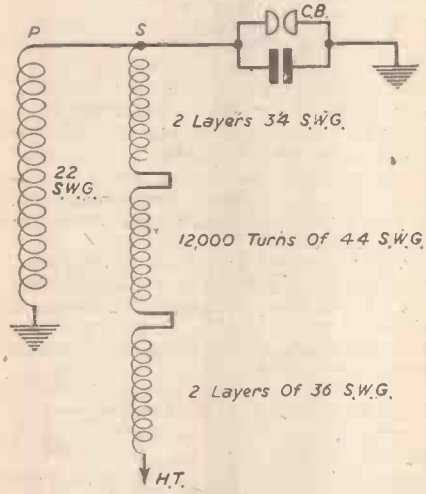


Fig. 8.—Another method of finishing secondary windings.

dab of thin shellac may be used, but not before it has been thoroughly sieved to remove any impurities that may be in it in order to prevent overlaps.

Another way to hold the interleaving papers down is by using a mixture of best quality beeswax, resin and methylated spirits. This is heated and made up into sticks of about 1in. in diameter and about 6in. or 6½in. long.

Each corner of the paper is given a smear

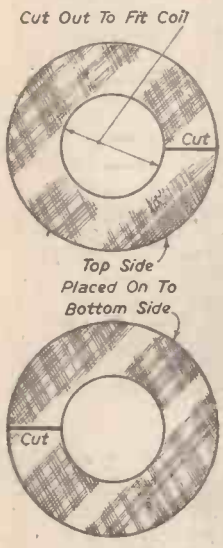


Fig. 11.—Silk sides. Cuts are spaced at 180 deg. apart to prevent spark jumping.

of this adhesive, and it holds the papers down very well. The result is a good, smooth layer of wire.

A useful check upon the layers of the secondary is to have a 60-watt lamp suspended about 6in. above the coil, but shaded so that the lamp does not shine on the eyes.

The light will show upon the surface of the layers, a series of colours as in Fig. 10. The centre band should be a bright red

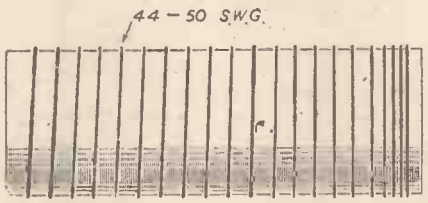


Fig. 9.—First layer of secondary well spaced out when using 44's-50's. Also last layer of secondary.

or brown, according to the colour of the enamel.

If any dark lines can be seen in the centre of the light band, then there is a slight overcrowding of the turns on the layer. Also the light picks out the overlaps better than by running a finger tip across the layer.

Any streaks of white or light brown denote spacing in the turns, and as the coil is built up, air spaces in the layers.

Insulation Details

Now for the insulation details of the secondary. If these details are closely adhered to your coil will give very good and long service with a good hot spark right on time.

Assuming that the secondary joint has

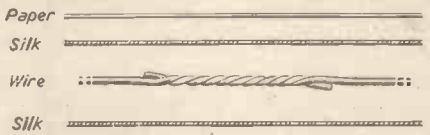


Fig. 14.—Preventing a soldered joint from doing any damage in a secondary winding.

been made, the next step is to wind on the first layer of the secondary. If it is intended to wind the coil wholly in 44 s.w.g., then the first layer should be spaced out at about ⅛in. between adjacent turns (Fig. 9). If the first and second layers are to be of 35 or 36 s.w.g., the winding can be put on in the normal manner, that is with no spacing.

This spacing acts as a safety valve for the transient surge rushing into the secondary. It will be found that this spacing shows

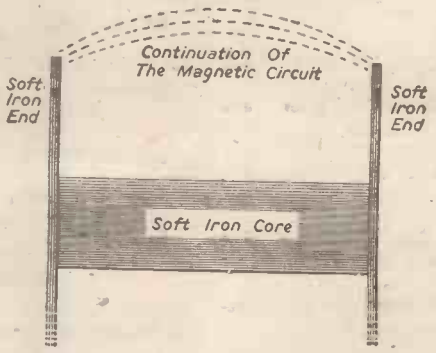


Fig. 12.—Coil core with soft iron ends.

through the first interleaving paper so two or three should be laid down so as to avoid upsetting the winding through overlaps.

For my first layer I wind up to 1/16in. from each edge of the paper.

This 1/16in. each side is carried on up to 2,000 turns, using one length of 2 mil. paper between each layer, except where the increase is given.

Fig. 10.—Checking the layers of the secondary during winding, with the aid of an electric lamp.

At 2,500 turns a double layer, i.e., 4 mils., of paper is put down, and the edge is increased to ¼in. each side. At 4,000 turns another double layer of paper is put down and the edge is further increased to ¼in. each side. Also, silk or empire cloth sides can be put on each end, cut out as in Fig. 11. Four sides will be wanted, so that the cuts can be spaced at 180 deg.

At 6,500 another double layer of paper is put down and the edge increased to 5/16in. each side. At 8,000 turns the layer of paper is doubled again and another four sides cut out and put on the ends of the coil, whilst the edge is increased up to ⅜in. on each side.

If it is the intention not to wind more than 8,000 turns, the double layers should be repeated every 1,500 turns. This is to cope with the excessive voltage raise from each layer that occurs in a coil with a low number of turns.

Another double layer of paper is used at 9,500 turns and the edge increased to ⅜in. At 10,500 the paper thickness is increased to 6 mils., with the edge increased to ⅝in.

It will be noticed that as the turns increase, so the edge of each layer of the secondary is taken further into the centre of the coil. This is to prevent a breakdown at the edges of the coil. The maximum increase of voltage is at the ends of each layer, so the most obvious thing to do is to wind the layers in a pyramid fashion as described (Fig. 13).

Many amateurs think that ¼in. from each edge is quite sufficient on any coil. Well, I have found out that if a ¼in. edge is

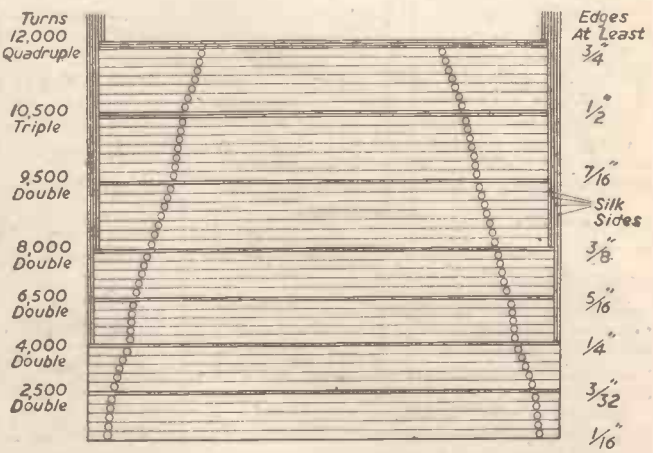


Fig. 13.—Winding in pyramid fashion to prevent spark jumping to primary. Silk sides are provided at 4, 8, 12,000 turns.

used, then the standard spark gap, 5.5 mm., must be reduced to under that size or else the coil fails. That is to say that the spark takes the easiest path which is down the ends of the coil and, in doing so, burns the papers in its travels.

If, for instance, a one-inch spark is wanted off a coil, the last five or six layers of that coil should be well over one inch from each edge, otherwise the spark will take the easiest way out, thus ruining a lot of work and wasting time.

To revert to the secondary winding again —over 10,500—a double layer of paper 4 mils. should be put down under each layer of wire. At 12,000 the paper thickness is increased 6 mils. and a further 4 silk ends put on (Fig. 11).

If the coil is having soft iron ends fitted, as in Fig. 12, the 4v. Bosch Ignition Coil used for marine purposes, silk ends will certainly be needed. At 12,000 turns the coil will give a really powerful spark, so that good strong insulation is very necessary to withstand the strain.

Testing

When testing a coil of 12,000 turns or more, please remember two things, keep your mind on the job or your fingers may stray near the H.T. (like mine did!) Also do not open the spark gap beyond $\frac{3}{8}$in.; this is necessary, until the coil has been impregnated with varnish.

In testing these H.T. coils the procedure after winding is to take an ohmmeter reading to get the resistance of the coil. I work to a given set of figures arrived at from experience in rewinding all types magneto and other H.T. coils. For the conventional winding as in Fig. 4, it is best to work to 2,500 to 5,000 ohms, but for Figs. 6 and 7, about 7,500 to 9,500 ohms, assuming Fig. 4 to be 44s and Figs. 6 and 7 to be 46s. Some Bosch coils, however, have a resistance winding to finish off with, giving a total resistance of over 8,500 to 9,500 ohms.

Varnishing

For the varnish treatment of coils, dry them out in a hot oven for about 8 hours, dip them in golden varnish for 4 hours, then bake for another 8 hours.

This treatment is very effective, and so far I have had less than 2 per cent. of my coils faulty through burning out. In some cases the spark has been too strong for the insulation.

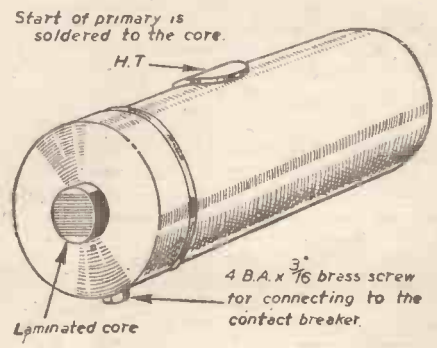


Fig. 17.—Villiers flywheel magneto coil.

So far, I have not mentioned breaks in the secondary winding. The fewer the breaks, the better, for they not only take up a lot of room but they raise the ohmmeter reading unnecessarily.

Assuming a break has occurred, make a twisted joint with the wires well cleaned and soldered, then place a strip of silk on the coil, full width of the coil, and long enough to cover the length of

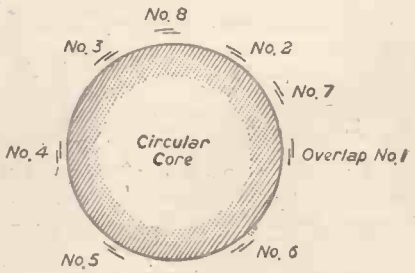


Fig. 15.— Overlaps in interleaving paper should be spaced out.

the joint. The next step is to wind the joint down on to the coil and cover the joint with a similar sized strip of silk, followed by a layer of interleaving paper to prevent the silk causing any overlaps. The idea is to prevent the solder biting into the enamel of the preceding and following layers of the coil. All the joints should be treated in this manner for safety (Fig. 14).

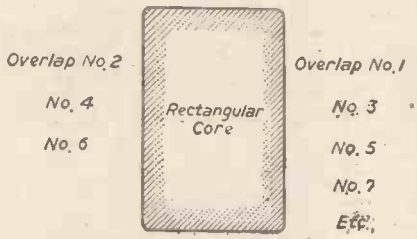


Fig. 16.— Overlaps on longest sides only to make coil circular for easier and quicker winding.

Condensers

A word about condensers. They should not be less than .15 mfd., and not more than .45 mfd. Less than .15 mfd. means insufficient capacity, and over .45 mfd. gives too much capacity.

Finishing

To finish off the coil, the safest way to take the spark away would, to my mind, be in the Villiers flywheel magneto coil method. For those who are not conversant with this coil, a sketch of it is given in Fig. 17.

Having decided to finish off the coil, the top layer must be spaced out in the same manner as the first layer, but spaced out much larger, about 3/16in. between turns.

The last turn should, if it is 44 or 46 SWG, be strengthened as in Fig. 5. Under the last turn, extra silk, cut about $\frac{1}{2}$in. to 1in. wide, should be laid down round the coil.

The completed coil can be slid into a length of Paxolin tubing, abut $1\frac{1}{2}$in. or $1\frac{5}{8}$in. diam. For the H.T. pick-up, I mark the centre of a length of Paxolin tubing (dependent upon length of coil), drill out 3/16in. and push into the hole one of those brass eyelets that you will find in your shoes and boots for the laces to pass through.

To hammer the inside level is very important, as the underside of the rivet must be absolutely smooth. If the coil comes up close, the ragged edges of the eyelet will tear the outside of the coil off. I use a 6in. length of 1in. diam. brass bar held firmly in the vice and hammer the top of the eyelet, not too hard, or else the hole will get closed up.

When the paint is taken off the eyelet takes the solder easily, and the H.T. cable is given a good, firm anchorage.

Having prepared the tube and the wire strengthened, cleaned up and soldered the next step is to put down three or four small sheets of silk (2in. by 2in. will be adequate), then a small sheet of mica 1in. by 1in. The idea of the mica is to protect the coil whilst the H.T. is being soldered up. Having done this, solder the wire to a $\frac{1}{2}$in. disc of copper strip, about .010in. thick, bent to the contour of the coil. The copper strip will solder nicely to the eyelet in the casing.

Now for a wrinkle. If you have completely finished a coil and, on taking an ohmmeter reading, an open circuit is obtained, dismantle and very carefully unwind the coil and a break will be found around where the first spaced turn is.

I used to completely rewind my coils until I tumbled to this wrinkle, which certainly saves a lot of time, material and also frayed tempers!

For the ends of the coils, sheet ebonite or Paxolin, about 3/16in. or $\frac{1}{4}$in. thick, can be used. A look through the advertisements in PRACTICAL MECHANICS will be of great help in obtaining Paxolin tubing, etc.

Another wrinkle that comes in very handy, especially upon laminated cores, is to guide the wire between the thumb and index finger. The lightest of pressure should be used or the wire is soon snapped.

When winding a laminated core the corners tend to jerk the wire, so, by guiding the wire, breaks and also overlaps are prevented.

When testing a coil, do not put more than 4 amps through the primary as this burns out the contacts in a short time. Also, remember to go very easy in testing until the coil has been given the varnish treatment.

If these notes are carefully followed I think that any one should be able to wind a really good coil at the first attempt.

The Elements of Mechanics and Mechanisms—16

The Hydrometer (Continued)

By F. J. CAMM

Viscosity

VISCOSITY relates to the stickiness or tenacity of a liquid. Treacle and oil are viscous, and so are waterglass and gum. The word, however, means something more than stickiness, because all liquids possess viscosity. It is only a matter of degree. Even water is viscous, although it is not sticky. Viscosity is a measure of the internal friction of a fluid, and it may be defined as its resistance to flow. Liquids, of course, lack rigidity, and because of this they assume the form of the vessels into which they are poured, although some, such as waterglass, for example, have a thick consistency and adapt themselves very slowly to the shape of the vessels, whilst water takes on the shape of the vessel immediately.

Every liquid possesses its own characteristic consistency, or viscosity, which is a measure of the liquid's internal molecular resistance. Thus, a solid has no viscosity, because it cannot flow. The solid has rigidity which is defined as the tendency of matter to resist change of form.

Solids can preserve their form whilst they remain solid. Liquid viscosity values greatly vary. For example, castor oil at ordinary temperature is about one thousand times as viscous as water, whilst pure alcohol has a viscosity equal to water. Mixtures of water and alcohol have greater viscosities than those of the component liquids taken separately.

Now the effect of heating a liquid is to increase the movement of its molecules, and when this molecular movement becomes intense the molecules fly off into the space above the liquid, which is then said to boil. Before the boiling point is reached the continuous addition of heat reduces the internal friction within the liquid, and it therefore follows that the higher the temperature of a liquid the less viscous it becomes. When a motor-car engine is cold it is difficult to crank because the cold oil is at maximum viscosity. When the oil is warm, however, that is, when the engine has been running for some time, the engine may be cranked quite easily.

Viscosity Values

A knowledge of viscosity values is of the utmost importance. It is necessary to know viscosity values when estimating the size of a pipe through which a particular liquid has to flow, and it is of equal importance in calculating the pressure needed to propel the liquid during its circuit of a pipeline system. The viscosity value is also a measure of the usefulness of an oil for lubricating purposes. The viscosity of paint is important, especially for spraying purposes, to avoid choking the jet.

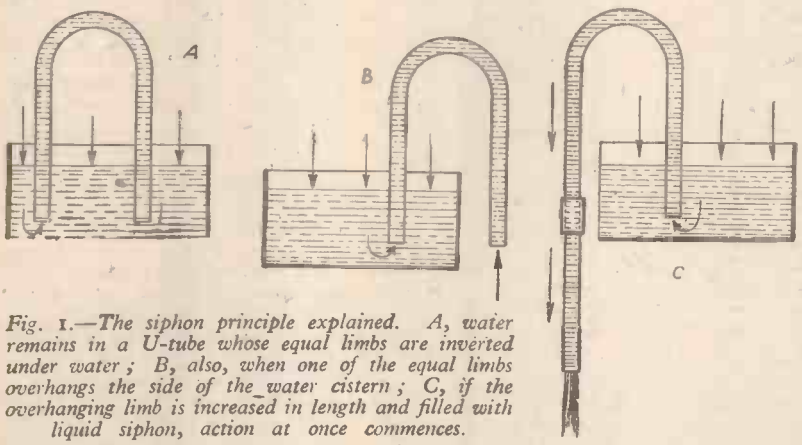


Fig. 1.—The siphon principle explained. A, water remains in a U-tube whose equal limbs are inverted under water; B, also, when one of the equal limbs overhangs the side of the water cistern; C, if the overhanging limb is increased in length and filled with liquid siphon, action at once commences.

Absolute Viscosity

The inherent viscosity of a liquid, or its absolute internal friction, consists of the force necessary to move a layer of the liquid of 1 square centimetre area over another liquid layer of equal dimensions and situated 1 centimetre distant, the first liquid layer moving over the second layer with a velocity of 1 centimetre per second. This gives the viscosity of a liquid in absolute units (C.G.S. units). It can be measured by estimating the rate of flow of the liquid through capillary tubes under constant pressure. The formula for viscosity is given by

$$n = \frac{\pi p r^4}{8 v l} t$$

where

p = the pressure (in grams per square centimetre) of the liquid

r = radius of the capillary tube

l = length of the capillary tube (in centimetres)

v = volume (in cubic centimetres) of the liquid which passed out in time *t* seconds

n = viscosity.

The real unit of viscosity, however, has yet to be decided, for physicists and physical chemists are in favour of absolute viscosity.

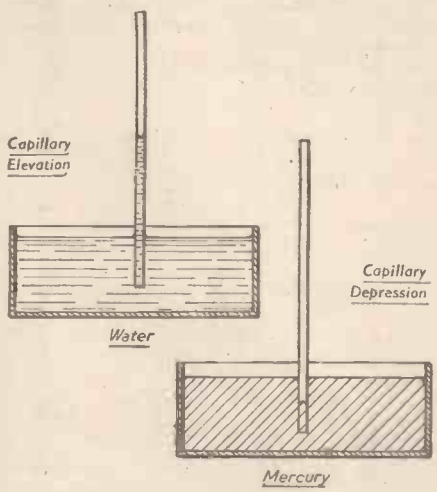


Fig. 2.—Illustrating "capillary elevation" and "capillary depressions." A narrow-bore tube dipped into water causes the water to rise with it. Dipped into mercury it causes a lowering of the mercury level with the tube.

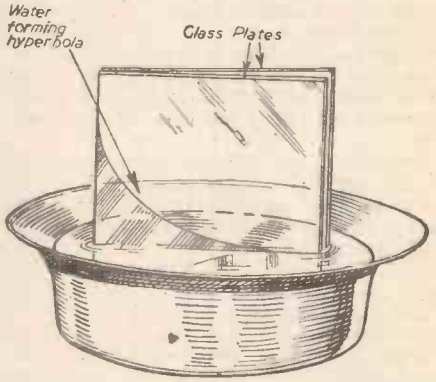


Fig. 3.—Showing the effect of capillarity produced by two glass plates plunged into a basin of water. The plates make contact at one side and are separated so as to form a slight angle. The water level within the plates forms a hyperbola, the water rising highest at the area of minimum separation of the plates.

Instruments for measuring viscosity vary in detail, but most of them follow the main principle—the measurement of the amount of fluid which will pass through a standard aperture or jet at a given temperature and in a given time; or, alternatively, the measurement of the time taken by a given quantity of liquid to fall through a given jet or aperture at a given temperature.

The Redwood Viscosimeter is popular in England, and it operates on the principle of estimating the time taken for a standard volume (50 c.c.) of a liquid at any given temperature to pass through an agate jet.

The Engler Viscosimeter makes use of a similar principle, and so does the Saybolt, which is largely used in America.

None of them, however, give any direct determination of the internal friction of a liquid or of the specific viscosity of the liquid. They are individual and non-comparative.

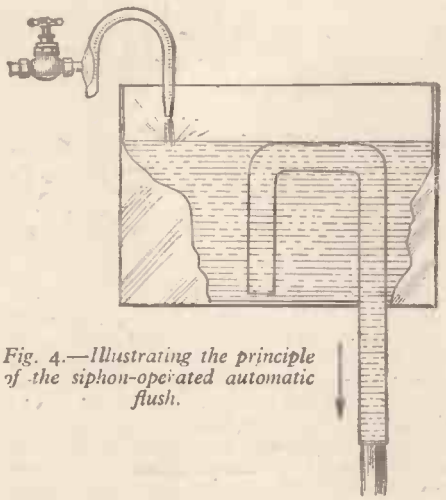


Fig. 4.—Illustrating the principle of the siphon-operated automatic flush.

Capillarity

The particles of a liquid exert an equal attraction on one another. It is also true that the particles of vapour which exist above the surface of a liquid exert a small degree of attraction upon the particles constituting the surface layer, but the greater proportion of the attractive forces brought to bear on the surface particles come from within the liquid. Hence, the surface particles are continually subjected to an internal pull which has the effect of making the liquid endeavour to present the smallest possible surface area.

This is known as surface tension. When a liquid is splashed on to a greasy surface the surface is not wetted, nor does the liquid spread uniformly over it. In fact, it tends to gather itself into separate drops or globules. When two or more such drops come into contact with one another they coalesce, and form one larger drop.

Water dripping from a receptacle descends in the form of small pear-shaped drops. They are never completely spherical due to the pull of gravity, and that is why raindrops are pear-shaped.

Normally a liquid at rest presents a flat surface, but if we confine the liquid within a narrow vessel it will be found that the surface of the liquid is not perfectly flat. It is slightly concave or saucer shaped, rising at the sides of the vessel higher than at the centre.

The narrower the vessel, the more pronounced is this effect. This saucering, due to surface tension, is known as the meniscus, and the phenomenon only exists in the cases of liquids which wet the sides of the vessels. Liquids which do not do so such as molten lead or mercury tend to withdraw themselves from the sides of the container, and they therefore present a slightly rounded or convex surface—an inverted meniscus.

The clinging effect of liquids which wet the sides of their vessels is due to surface tension. The attractive forces set up by the molecular particles in the surface layer of the container are sufficiently strong to cause a film of water to adhere to the vessel's sides and to draw some of the surface layer of water to them. When no such an attraction is present, as in the case of mercury or molten lead, the reverse effect is obtained.

Take a narrow tube and hold it vertically in contact with the surface of water in a vessel. The water will instantaneously rise up the tube to a level higher than the water level outside the tube, and the narrower the tube the more marked will this different level be. As a general rule a tube which has a bore of less than .05in. is known as a capillary tube, a word which is derived from Capillus, a hair. This effect is known as capillarity and it plays an important part in life. It is responsible for the distribution of moisture throughout the earth's surface, it causes the sap to rise in trees, and oil to rise in a lamp wick. All porous bodies will pick up moisture by capillarity. Rusted-up nuts may be loosened by penetrating oil which creeps between the two rusted-up surfaces by capillarity.

Now capillarity is not constant for all liquids, the lower the viscosity the greater the capillarity.

Next consider the case of mercury and similar liquids. If we repeat the above experiment and dip the end of a capillary tube into mercury it will be noted that the tube seems to form a dent in the surface of the mercury, and the mercury rises in the tube to a height lower than the surrounding mercury. This is known as *capillary depression.*

If glass capillary tubes are smeared with oil or grease water will not rise within them and capillary attraction ceases. In fact, capillary depression will occur.

Now the height to which a liquid will rise in a tube by capillarity depends upon the nature of the tube, its diameter, and the liquid. The height of the water level within the tube varies inversely as the radius of the tube.

Surface tension is not the same for all liquids. With the exception of mercury,

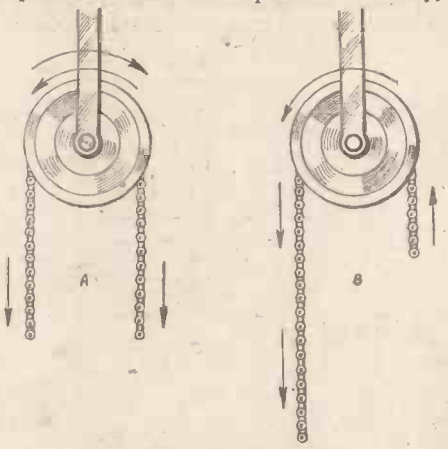


Fig. 5.—The chain analogy to siphon action. A chain placed equally around a pulley remains in position (A), but runs off when unequally positioned on the pulley (B).

the surface tension of pure water is higher than that of any other liquid. Scientifically, surface tension has been measured in dynes per square centimetre, and, on this basis, the surface tension of water (at 20 deg. C.) is found to be 72.70 dynes per sq. cm., while that of pure alcohol is only 21.7 dynes per sq. cm. Benzine, a well-known liquid, has a surface tension of 28.85 dynes per sq. cm. at the above temperature.

Mercury has a surface tension of 520 dynes per sq. centimetre.

The Siphon

If each limb of a U-tube is filled with water and then inverted so that its ends dip below the surface of water in a bowl, the water will not show any tendency to flow out of the tube. Again, if the U-tube filled with water is placed so that only one of its limbs dips below the surface of the water while the other hangs over the side the water will again remain stationary in the tube. This is because the upward pressure of the

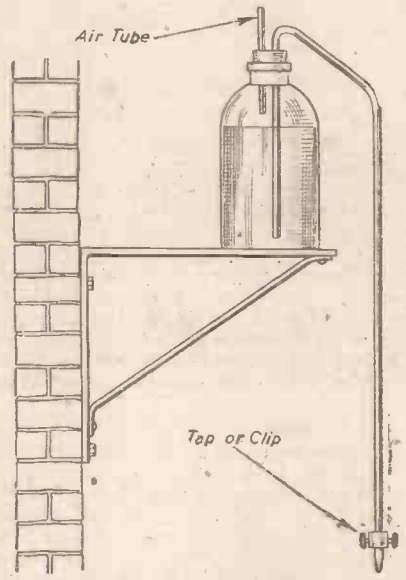


Fig. 6.—The siphon principle as a simple laboratory means of drawing small amounts of liquid from large bottles.

water in the bowl is equal at each limb in the first experiment, whilst in the second the upward pressure of the water against the submerged limb is counter-poised or counter-balanced by the upward pressure of the air.

If we increase the length of the overhanging limb and suck on the end of it, the water will commence to flow, and it will continue to flow until the liquid in the bowl has fallen below the level of the shorter limb.

The siphon has many applications. We are all familiar with the soda siphon, and with the automatic flush. A liquid cannot ascend higher in a liquid tube than it can in a barometer tube containing a similar liquid.

The average height of a mercury barometer is about 30in., therefore, mercury cannot round the bend of a siphon tube if the bend is more than approximately 30in. higher than the level of the liquid in the tank in which it is immersed.

(To be continued.)

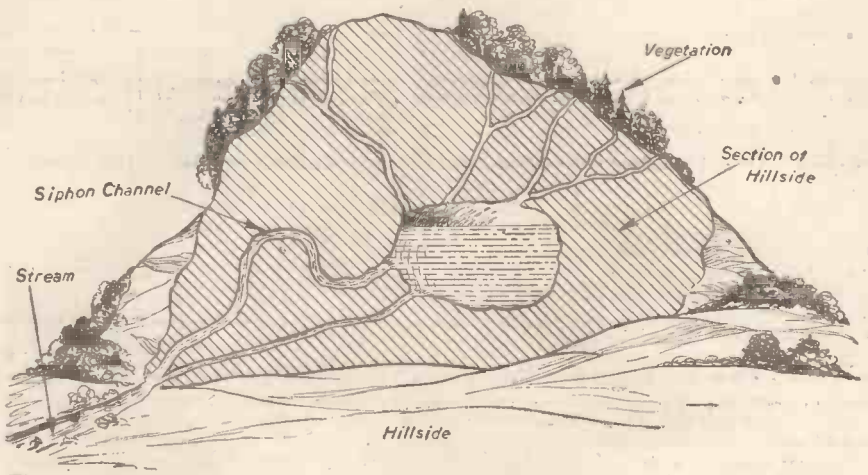
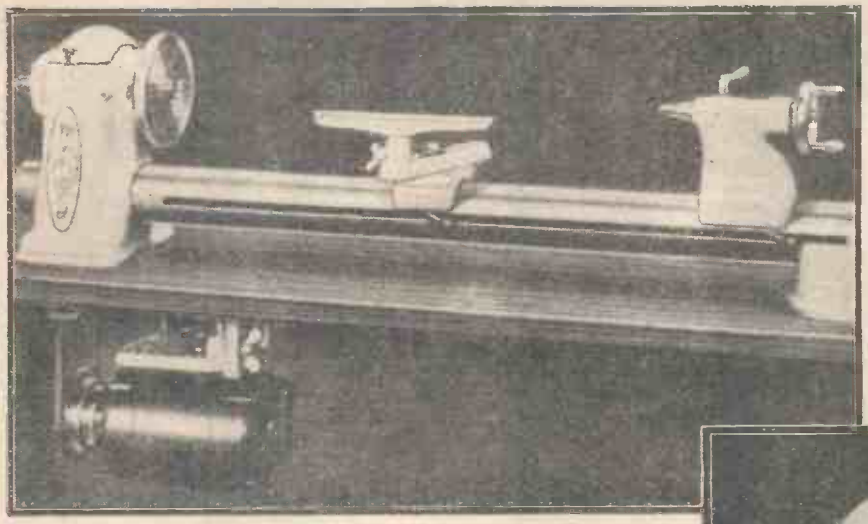


Fig. 7.—Nature's utilisation of the siphon. A hillside stream fed by siphon action.

Myford ML8 Woodworking Lathe

Details of a New Lathe With Several Special Features



A NEW woodworking lathe with several special features has been introduced by Myford Engineering Company, Ltd., of Beeston, Nottingham. Known as the Myford ML8, the new lathe is motorised and has a round, hollow-bar bed of seamless drawn steel. Distance between centres is 30in., and swing over the bed is 8in. A one-piece headstock unit is provided with totally enclosed drive, so that the driving belt is not visible above the bench. The motor is mounted on an adjustable bracket fixed to the underside of the bench immediately below the headstock, as shown in the illustration, Fig. 1. The motorising assembly is designed for the easy fitting of most ¼ and ½ h.p. motors. The mandrel runs in ball bearings, which are easily adjustable, and there are threads at each end of the mandrel for mounting chucks, faceplates, etc. Plunger indexing mechanism gives 24 fixed positions to the mandrel. The slides are controlled by single-action levers working in the side slot of the bed.

Fig. 1 (Above).—The new Myford ML8 woodworking lathe shown complete with motor.

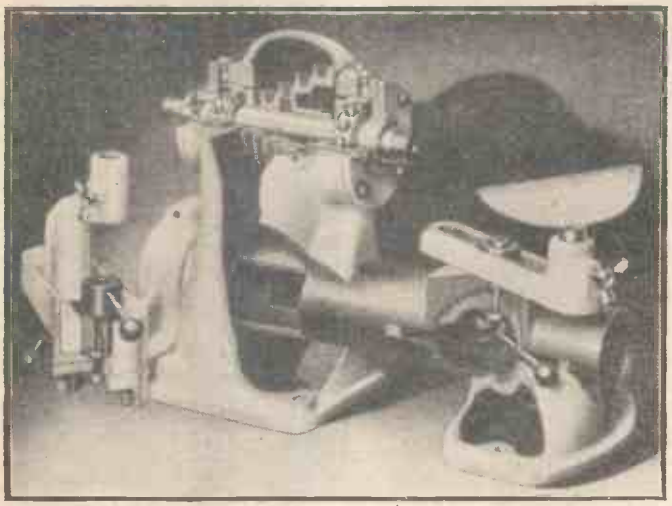


Fig. 2 (Left).—Sectional view of the lathe with short bed (note the ball bearings to mandrel).

Short-bed Lathe

The illustration Fig. 2 is a sectional view of the short-bed lathe, showing the totally enclosed pulleys, ball bearings and details of the lever control of the T-rest slide, and rear turning attachment, which is supplied complete with faceplate and hand-rest. Fig. 3 shows the swivel-arm support bracket of this attachment fixed to the bench. Quick-action clamp levers allow rapid positioning of the hand-rest.

Extension Beds

If required, extension beds of varying lengths can be supplied to special order. Short beds are available for bowl turning, as shown in Fig. 2.

To widen the scope of the ML8 lathe a compound slide has been added to the range of accessories. It embodies a generously proportioned boring table for the mounting of vertical slides and other fitments, enabling the machining of light metals and plastics.

Saw-table Attachment

The saw-table attachment (Fig. 4) meets all requirements as a well-designed powered unit. The tilting table is provided with rigid clamps, full guard protection and double locks to work fence. The heavy duty mandrel assembly in the headstock permits a free-end saw arbor to be used which allows a greater range of cutting depth and full freedom for table tilting. The size of the table is 14½in. by 12½in. Other accessories include handle tools for wood, linen polishing mop, mitre block for saw table and sander table, chuck backplates, and sander plate with disc. Further particulars and prices of this high-class tool, together with a neat illustrated folder, are obtainable from the Myford Engineering Company at the address given.

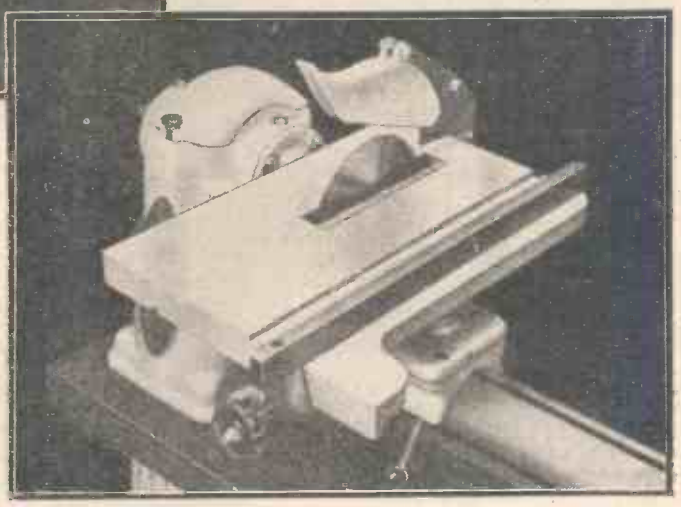


Fig. 4 (Above).—The saw-table attachment, with tilting table.

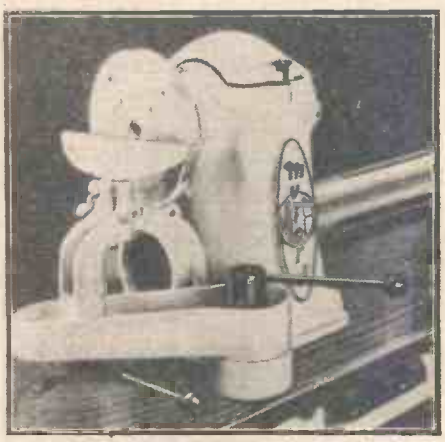


Fig. 3.—The rear turning attachment.

The Triumph of Tin

Its Properties and Peculiar Characteristics

All that remains of an old tin mine near Calstock, Cornwall. This Duchy now only produces about 1 per cent. of the world's tin output. The rest comes from overseas.

TIN is traditionally and peculiarly a British metal. Centuries before the time of the Romans Phœnician merchants from the lands of Tyre and Sidon and from the Mediterranean coasts sailed regularly up to Cornwall to load their ships with tin in exchange for products of the Near East.

Tin has, also, the distinction of being one of the first metals—if not *the* first—to be used by man. This is because its ore (oxide of tin) is so easily smelted to the metallic state by roasting it with charcoal.

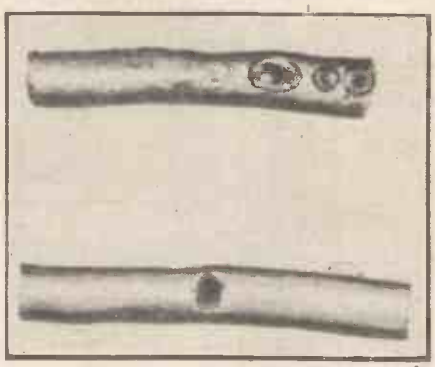
But the Cornish tin ores were not always pure. Sometimes they were admixed with copper, so that when they were smelted, instead of a white, silvery metal, a yellow alloy was obtained. Thus, bronze, which is essentially an alloy of tin and copper, came into being.

Bronze is harder than tin. It gives a better cutting edge. Bronze, therefore, gradually became a special manufacture, and its eventual utilisation introduced the Bronze Age, which preceded by many centuries the later Iron Age.

Tin, therefore, from an historical point of view, is one of the most fundamental of metals. In a way, it represents mankind's first metallurgical triumph over the mysteries of Nature, for by winning metallic tin (and later its alloy, bronze) from earthy ores our nowadays very remote ancestors first laid bare the long trail of trial and discovery which, in the course of time, has led ultimately to the seeming miracles of present-day metallurgy.

Articles of tin have been discovered in ancient Egyptian tombs. The Hebrews knew the metal and used it. So, also, did the Greeks. The Romans thought a great deal of it, but they confused it with lead and, apparently, they designated both tin and lead by the word "stannum," although Pliny, the Roman naturalist and historian, uses the word "*cassiteron*" to refer to the metal which came from "Cassiterides, in the Atlantic Ocean," Cassiterides, of course, meaning the British Isles, which to the Romans were remote islands on the edge of beyond.

Considerations such as the above go to prove that tin was always a popular and a prized metal. Yet, strangely enough, in our own days, it has somehow or other acquired the reputation of cheapness and shoddiness. The "tin can" is universally despised as an inferior product. To say that a piece of metal is "only tin" is, in the popular mind, equivalent to its being valueless.



"Tin Pest," a once dreaded disease. Our photograph depicts two tin tubes which have contracted "tin disease." Note the ulcerous active growths which spread throughout the metal, reducing it to powder.

In Demand

Nothing, however, could be further from the truth. Tin is more in demand to-day than ever it has been in its long and honourable history. The Cornish deposits of tin have for many years been unable to cope with the world's demands on the metal. Nowadays, Cornwall supplies only about 1 per cent. of the annual world tin output. Most of our present-day tin comes from British Malaya. Other tin-producing areas are Bolivia, Siam, China, Nigeria, Belgian Congo, Burma, Australia and even (formerly) Japan. In or about the year 1800, approximately 9,000 tons of tin were produced in Cornwall. This constituted the world's supply of the metal for that year. In 1900 the world's tin output figured at 75,000 tons. In 1940 it had leapt up to 238,000 tons.

And tin consumption is still on the increase. That is why the metal is not becoming any commoner, and why its price is still stiffening. That is the underlying reason of all the compulsory economies which have been made in the technological applications of metallic tin the world over.

Such is the triumph of tin. Indispensable, no doubt, to those dim civilisations which lie beyond the limits of recorded history, tin is even more indispensable in our modern times. So far as its supply position is concerned, it has not yet let us down. Nevertheless, it is not a cheap metal, nor is it one to be despised and relegated to the categories of shoddy, substitute and inferior materials.

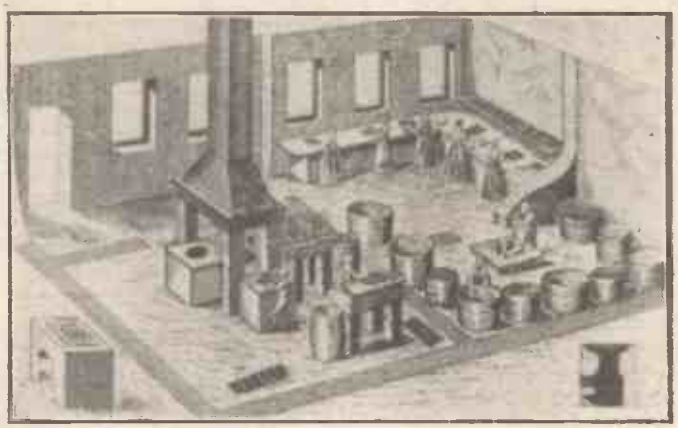
Jupiter's Metal

There are a lot of curious things about tin, quite apart from its historical and economic aspects. The old alchemists of medieval times likened it in appearance to the planet Jupiter, and they gave to it the recognised symbol of that planet. Tin was, to them, the readily fusible metal which could be made to "run" like mercury and which could be persuaded to "combine" with other metals. From these usually meaningless meanderings of the alchemists there arose at least one useful discovery in relation to tin. That was the method of making pewter, an alloy which, in the days of our country forefathers, usually consisted of three parts of tin to one part of lead.

Pewter had a thousand uses in rural England. It was the "poor man's silver," used alike for the making of his dinner plates and for the fashioning of his beer mugs and shaving bowls. Nowadays, pewter (of different composition) is still being made for decorative purposes, whilst the genuine old pewter articles soar ever and ever higher in price at our fashionable antique shops.

Britannia metal was another useful alloy of tin. It was a Victorian product, a sort of "improved pewter." Its average composition was tin 84 parts, antimony 10 parts, copper 4 parts, bismuth 2 parts. It was harder than pewter, had a higher melting-point, could be more readily moulded and had better wearing qualities.

Common solder was originally a mixture



Making tinplate in 1714. The earliest illustration of the dipping process of tinplate manufacture.

A modern tin mine in Cornwall.

of equal parts of tin and lead. Nowadays, solders of innumerable proportions are on the market. The various babbitt metals, bronzes, gun metals, bell metals, to say nothing of the many fusible metals, such as Wood's metal and Rose's alloy, are all tin alloys. Even the British Mint is a habitual tin consumer, our copper coins being an alloy of copper 95 parts, zinc 1 part, tin 4 parts.

The Metal with a "Voice"

But to return to some of the more curious properties of this metal. Has it ever struck you that tin is the only metal which has a "voice"? The phenomenon of "tin cry" has been known for a very long time, yet it has never been quite satisfactorily explained.

If you take a bar of pure tin and slowly bend it, holding it up to your ear at the same time, the metal will emit a distinct grinding or crackling noise. Almost a noise of complaint, one might imagine. This is the celebrated "tin cry." No other metal is "vocal" in this respect, and it is assumed that the make-up of pure tin is so inherently crystalline that the rubbing of crystal faces one on the other when the tin bar is bent is responsible for the "cry." It is a sort of molecular friction.

The fact that pure tin is inherently crystalline in nature can very easily be seen. Make up a quantity of *aqua regia* by mixing two volumes of strong hydrochloric acid and one volume of strong nitric acid. Dilute one part of this mixture with three parts of water. Warm the diluted *aqua regia* and then pour it over a sheet of tin. The metal will immediately assume a rather beautiful and characteristic crystalline surface appearance, something like a pane of frosted glass in wintertime.

Ordinary tinplate will give rise to this effect, but it will not "cry" when bent.

Crystals of Tin

Actual crystals of metallic tin are easily prepared by melting tin in an iron spoon or ladle. Allow the mass of molten metal to solidify partially. Then suddenly pour out the remaining molten portion. The ladle will afterwards be seen to be lined with long tin crystals, many of which will be almost perfect in form and which can be detached and preserved as interesting specimens of pure metal crystals.

Tin melts at a temperature of 232 deg. C. It is, therefore, a fairly low temperature melting metal. Despite this, however, it takes a temperature of 2,275 deg. C. actually to boil the molten metal, and this boiling can only be effected properly in the absence of air or oxygen because round about 1,200 deg. C. mark the molten tin gives off a combustible vapour which soon catches fire and burns with a rather strange white flame, emitting clouds of white tin oxide.

Even when tin is retained in the molten condition at a temperature just above melting-point it soon becomes covered over with a whitish scum. This, too, is tin oxide, identical in composition to the material forming the "white smoke" of burning tin.

When pure a sheet of tin is white and lustrous, but it possesses a tinge of bluishness which is very characteristic of the metal. You can cut tin with a knife, for, although it is harder than lead, it is not as hard as zinc. Tin is malleable. It can be beaten into tinfoil of considerable thinness, and the metal is also very ductile. But, here again, a rather curious property of the metal asserts itself. As you increase the temperature of tin to 100 deg. C. (the temperature of boiling water) it becomes more and more ductile, more and more able to be drawn out into wire. But beyond this temperature the metal loses its ductility with increasing temperature and at 200 deg. C. the metal becomes actually brittle enough to be crushed into a fine powder.

A Dreaded Disease

Perhaps the most remarkable property of tin is its liability to be attacked by a peculiar form of active disease which, like a malignant cancer in human flesh, can actually grow through the mass of metal and completely disintegrate it.

Such is the "tin pest" or "tin disease" which has been well recognised for nearly a century.

What happens is this: A tin object, be it a pipe, tube, bar, rod or some other component of tin, is on examination found to be in a completely brittle condition, so much so that it powders up at a very slight touch. This, of course, represents a very bad case of "tin pest." Most cases are of much slower growth. In such instances a sort of warty excresence develops on the surface of the metal, The diseased area has the appearance of an ulcer—that is, if one can imagine what an actual ulcer in metal would be like. The patch grows in extent and, also, deeper into the metal. If a piece of sound tin touches the diseased part, it, also, stands a risk of contracting the "pest." If a portion of the diseased area crumbles away and falls on a sound part the latter becomes infected. Ultimately, of course, the whole component becomes useless.

During the present century a lot of scientific work has been put into efforts to discover the underlying cause of this very strange metallurgical phenomenon. The work has been successful and the basic causes of the trouble are now well understood.

It had always been noticed that "tin pest" only manifested itself during very cold winters. There were very hard winters in Russia during the last century, when large quantities of tin pipes crumbled up in their then very mysterious fashion. In cold, unheated churches, organ pipes of pure tin were at times wont to fall to powder. Even beer pipes in breweries and public-houses have been known to be attacked by the same "pest."

The Two Tins

As we have above remarked there is nowadays no mystery about this tin trouble. In fact, its cause is surprisingly simple. All it happens to be is that there are two kinds of tin, a white tin and a grey tin. White tin is the ordinary metallic tin as we know and use it. Grey tin is a powdery variety of the same metal, equally as pure from a chemical standpoint, but entirely different in physical make-up.

Provided it is not cooled down below a certain "transition temperature," white tin is stable enough, but once below this critical temperature it becomes unstable and it then tends to become automatically converted into grey tin. So that "tin pest," after all, is not a disease, a corrosion of the tin; it is merely a case of a metal undergoing a change from one variety into another.

The transition temperature of white tin into grey tin is, according to the latest determinations, about 13.2 deg. C. Now, since our average room temperature in this country is about 15 deg. C., it follows that we have only to cool down a mass of tin a degree or two for it to attain the unstable (or "metastable," as it is called) condition for it to become liable—and ready—to undergo this peculiar physical and disintegrating change. Usually, the change does not occur at the stated "transition temperatures" because there are a number of factors which tend to delay it. That is why one can often cool down tin a long way below its transition temperature and get away with it quite successfully. But if conditions are favourable, the tin, at these lowered temperatures, will react badly. The "disease" or the "pest" will become active and the metal will disintegrate in consequence.

The change of white tin into grey tin can be inhibited by alloying small amounts of certain metals with the tin. For instance, 0.5 per cent. of antimony or bismuth will keep the change at bay for a long time. One per cent. of lead will inhibit the change; so, also, will 2 per cent. of cadmium. A very small trace of gold has a similar effect.

On the other hand, there are metals which,

High-power water jet being used in Nigeria to dislodge tin bearing ores from the rock face in a quarry.

when alloyed with tin, actually render it more liable to undergo this change. As little as 0.01 per cent. of zinc or aluminium, cobalt, manganese or tellurium speed up the tin change very considerably.

The Tinplate Trades

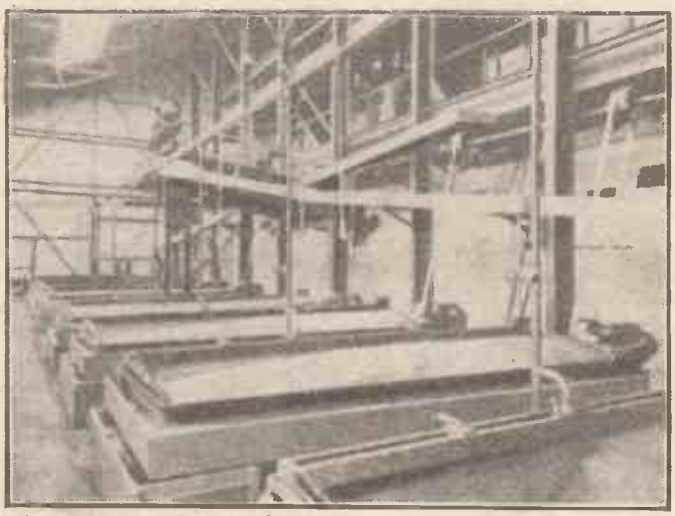
The industry which makes the greatest use of tin is, of course, the tinplate trade. Tinplate has been made for about two centuries by dipping the base metal (sheet iron or mild steel) in a bath of molten tin, and in modern times very great refinements in the technique of this method have been made possible. Hence our modern "tin" containers comprise merely sheet iron or mild steel, which has been superficially coated with protective tin. The actual weight of tin on these articles is not more than about 1½ per cent. of the whole container.

Recently it has been found possible to make tinplate by spraying the molten metal on to the prepared iron or steel sheets, whilst, as a still alternative method of tinplate production, there is the electrolytic method by virtue of which tin is electrolytically deposited on mild steel in specially designed, continually working vats.

Electro-tinning saves a good deal of tin because the electro-deposited coat of the metal is far more uniform in thickness than any mechanically laid-on coating can hope to be. Yet it is very questionable whether the electro-deposited tinplates are the equal of the hot-dipped tinplates. They are found not to be as protective as the hot-dipped plates, the reason apparently being that the electroplates are surfaced with tin metal in an extremely pure condition and that the hot-dipped tinplates have a layer of tin containing traces of impurities which are found to exert an inhibiting effect on corrosional influences. Yet how far these considerations will ultimately affect the industrial balance between hot-dipped and electro-deposited tinplate material remains to be seen.

What is commonly called "silver paper" is, in reality, a form of tinplate, comprising, as it does, a thin sheet of lead coated on both sides with a very thin film of tin.

Quite apart from the multifarious uses of tin metal and tin alloys, tin is employed in quite a large measure in the form of its compounds. Tin oxide, for example, white, powdery material, has been used for a couple of centuries at least as an opacifying material in the glazing of pottery. It is used similarly in white vitreous enamels.



Equipment at a Cornish tin mine by which the heavy tinstone grit is concentrated or separated from the lighter particles of dross mineral matter. The process is automatic.

Tin chloride, perhaps the commonest industrial compound of tin, finds extensive use in dyeing processes, particularly in silk dyeing. It is also employed as a "weighting" material in the manufacture of artificial silk stockings and as a medium which is capable of imparting a characteristic and desirable "rustle" to these articles of feminine dressware!

"Tin Smoke"

Finally, in wartime, tin chloride is brought in to act as a component in smoke-producing units for aircraft and other uses.

The main source of tin is the mineral "tinstone" or *cassiterite*, which is essentially tin oxide, SnO^2. Its composition is about the same, no matter whether it is of Cornish or Malayan or other origin. One or two ores of tin with sulphur, notably *stannite*, are utilised for the metal production, mainly in Bolivia. But these ores contain some silver in addition to tin, and it is therefore to some extent the silver no less than the tin which constitutes the ingredient of value in them.

No one would call tin a "decorative" metal. It is not a very resistant metal, either, being attacked readily by the common acids and alkalis. But tin is a good mixer among metals. It alloys readily. It resists atmospheric tarnishing. Its various compounds are all of industrial use, many of which are almost traditional in their antiquity. Its popular demand has lasted for at least three thousand years. Maybe, therefore, it can look forward confidently to a similar period of future renown and popularity.

Atomic Energy Research

PART of the work at the New Research Establishment at Harwell consists of the production of radioactive isotopes by means of the atomic pile.

One of these piles, known as GLEEP (Graphite Low Energy Experimental Pile), is a simple unit designed to develop about 100 kilowatts of heat, and was completed in August, 1947. It is being used for the measurement of the properties of atomic nuclei, and for testing the nuclear properties of materials used in the construction of piles.

In the accompanying illustration a sample has been taken after irradiation in the pile, the face of which is seen in the background.

The sample is in an aluminium container, which during irradiation is placed in one of the holes in the graphite blocks (bottom right), and the latter are pushed manually in and out of the pile through a hole in the concrete shield. The operator is protected from radiation from the material which has been in the pile by the lead tunnel (shown with handles), through which the samples are taken with long-handled tongs.

The samples will be placed in the lead pots (centre) for transport. Cans with new samples awaiting irradiation are in the stand in the foreground. An instrument for measuring the amount of radiation is on the left.

The Research Establishment is already producing separated isotopes of oxygen and carbon, and a large electro-magnetic separator capable of separating the isotopes of any element is being erected in one of the buildings.

Taking a sample of radioactive isotopes from an atomic pile. (*Crown copyright reserved.*)

Twenty Years from Now

Will Men and Women Have Changed?

By Prof. A. M. LOW

(*Continued from page 26, October issue*)

TWENTY years from now the average man and woman will be perhaps a little taller and weigh more. That prediction requires no great skill, for we can see the improved physique due to better diet and housing conditions already. The average man will perhaps have an expectation of life that is two or three years greater. Many germ diseases are already on the way to being completely conquered. New chemicals and treatments promise to remove yet more common causes of premature death.

All this does not mean we shall have more tall men and women and more centenarians. It simply implies that the "normal" height will be a little increased and that far more men and women will live to the three score years and ten which is the traditional span of life. We now have in Britain an important research school into the causes of ageing. Russian scientists have been performing dramatic experiments in prolonging the span of life and say that man's normal age at death should be nearer 150 years than 70. But I do not think this work can bear much practical fruit in 20 years. In any case, in Britain scientists are looking for means of postponing senility rather than death, of enabling people to enjoy a healthy and vigorous old age rather than avoid dying.

Social Changes

These physical changes will have great social, economic and political results. The social changes are obvious. Many of us can remember the time when a woman was expected to occupy a chair by the fire and do nothing active immediately she became a grandmother. To-day you can find grandmothers in the factories—and enjoying it. The idea that a man should retire from work as soon as he can afford to do so will disappear. Already we can see that the pre-war encouragement towards early retirement has given way to a campaign to keep people working even when they become entitled to an old age pension.

The longer average span of life will raise acute economic and political difficulties. The problem was put in a nutshell by a witty friend who had just read of some new drug that cured a high mortality disease. "Another half-dozen drugs like penicillin," he commented, "and we shall get a shilling on the income tax to pay for old age pensions." What he was pointing out is the fact that old age pensions have to be paid for and they can only be paid for by the younger, working population. If in the future we greatly increase the proportion of old people—and that is almost certain—we shall either have to increase the pension age, reduce the amount of the pensions or make our young people work a great deal harder. Neither of the first two steps would be politically popular. To pay for penicillin, so to speak, young people will have to produce more. Very probably we shall have to make much more scientific use of our manpower so that our older people are able to continue working.

This is an interesting example of the far-reaching social and economic effects of scientific discovery and a warning to politicians to look ahead before making promises.

Physical Changes

Permanent physical changes in the human body take place in centuries, and many thousands of years, rather than two decades. But 20 years hence changes now taking place may be much more obvious. Probably not one person in 10 will have normal eyesight, although the general adoption of "contact lenses" may make the spectacle wearer rare except amongst the over sixties. Our sense of hearing will probably be further atrophied in an attempt to combat the harmful effects of noise. Millions of people will have had 30 years of listening to music on the wireless and will hardly be capable of hearing the full range of "real" music. Wireless completely cuts out the reproduction of sound frequencies above 5,000 cycles and custom will have made the limited reproduced sound seem more "natural" than the "real" sound!

The Ace "Concord" console player desk with a table-model radio receiver, by Ace Radio, Limited. The cabinets are of Australian walnut and Finnish birch. This attractive outfit represents the latest trend in radiograms.

One big change will be beneficial. The "reaction time" of the average man and woman will have been greatly speeded up and accidents with machinery reduced as a result. The present heavy toll of the road is partly due to our dealing with twentieth-century machines with eighteenth-century nervous systems. The chief victims are the very young, who have not yet learned, and the very old, who cannot learn. In 20 years a very much larger percentage of the population will have been brought up in 60 m.p.h. conditions. They will be naturally as much more skilled in judging the speed and direction of machines as the average city dweller of to-day is compared with a native from the wilds.

Women's Work

The biggest changes in the next 20 years will be those affecting women. In fact, many of the changes are now taking place, but it will take years to make them apparent. The real "winners" in the war have been women, and everyone seems to be busy making the world a more comfortable place for women to live in. When we talk about "labour-saving devices" we always refer to devices that save women labour. All the ingenuity of inventors and output of manufacturers is devoted to reducing "women's work." Men have got left behind in this struggle to be free from work—we get plenty of vacuum cleaners, washing machines and automatic irons, but no one troubles to market a cheap automatic shoe-cleaning machine because the shoe cleaning is considered man's work!

With the Government providing meals for her children at school, her husband eating at restaurants, and the local authorities providing "home helps," the housewife of 20 years hence looks like carrying the title in a purely honorary capacity. The fact that women will no longer be content to be cheap domestic drudges will be very plain. The best houses of 20 years hence will require about one hour's work a day, and canned, quick frozen and other labour-saving foods will enable the housewife to have a 20-hour working week.

Many people suggest that the increasing relief of parents of their "responsibilities" to their children will result in the break up of marriage and the family. On the contrary, I suggest that 20 years hence the family may be a much firmer unit as a result. Instead of harassed parents being so busy with the mere business of feeding and clothing their children that they have no time to understand them, they will have the means and time, if they wish, to become their real companions. The knitting together of the family will not be simply a legal one, with the parents tolerated as old bores simply because they are necessary to provide food and shelter. It will be based on real understanding and sharing of interests. Freedom from drudgery offers women great opportunities and will, in course of time, profoundly affect their psychology and social relations.

So with marriage. If you project the "graph" of rising divorces for the past few years, it could be forecast that in 20 years there will be more divorces than marriages! But this will not be the case. The present urge for divorce is not due to divorce being made "easier," but to abnormal war conditions accompanied by a social morality that in some ways is 50 years out of date. In 20 years time divorces may be even "easier" in the sense that if both sides

desire it, they will not be debarred from it by lack of money, or the need to go through with the pantomime of cruelty or infidelity that the law now demands. But it is probable that marriage will be a very great deal more difficult. We are seeing the absurdity of making unhappy people wait years for a divorce. We are beginning to see the absurdity of letting anyone who has a few shillings in their pocket get married in five minutes. If couples had to go to court to prove why they should be married, as they now have to prove why they should be divorced—with the King's Proctor ready to intervene if he feels the marriage is doomed to failure — we should have far fewer divorces.

Effect of Education

It is an old saying that "human nature doesn't change." That is absurd, as anyone who tries to behave like a caveman or even Henry VIII to-day quickly discovers. Fundamentally, we may still be ruled by the same primitive appetites, but the whole business of controlling them which we call civilisation changes quite rapidly. In 20 years I believe that men and women will be much more straightforward in their social intercourse. The need for demonstrating their "freedom" which led to absurdities and excesses 20 years ago will have gone. Fear which has ruled human beings for centuries will be much less. We are no longer terrified, like savages, by fear of lightning, famine and disease, but we still have some fear of modern but no less superstitious bogies, like unemployment and war. In 20 years' time the effect of education should be apparent, and the average man will realise then that unemployment, war and the other ills of civilisation are not bogies to be propitiated by certain rites and the uttering of magic words, but diseases to be scientifically studied.

Club News

Sutton-in-Ashfield and District Society of Model Engineers

ON behalf of the members of the above club I should like to thank the Myford Engineering Co., Beeston, for the courtesy and kindness shown to us on our visit to their works on Saturday, December 11th, also to Mr. C. Moore and his colleague for the very thorough way in which our visit was conducted and the manufacture of the well-known Myford lathes and accessories explained to us at every stage. We also wish to thank them for the excellent tea provided which completed a most interesting visit and which was very much appreciated by all members who attended. —Hon. Sec., J. Corbett, Corbett's (Lathes), Stanton Hill, Mansfield.

Staines Society of Model Engineers

THE above society held their third annual exhibition in the Town Hall, Staines, on September 18, and as will be noticed this again was only a one-day show. Nevertheless about 1,500 people passed through the doors between 10.30 a.m. and 9 p.m. Inside the hall over a hundred models were attractively displayed, and as at former exhibitions the "model engineers" workshop has proved such a popular feature that this was again staged and manned by members during the day, the lathe being in constant operation.

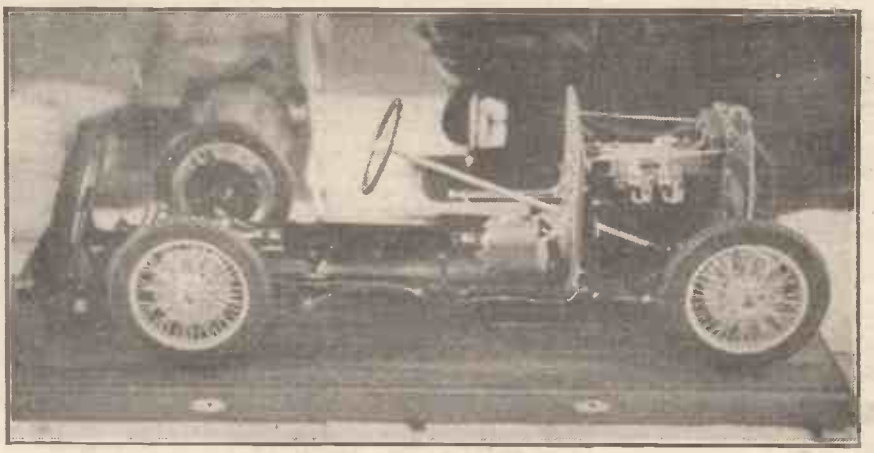
In another corner models were running under compressed air, the model stealing the show (and the air) being an old pumping type engine fitted with the scotch crank. This model has only just been presented to the society in memory of a late member, Mr. Len Wilson, so little is known of its origin or age.

Among the many sideshows around the hall the most interesting proved to be a display by Mr. Hasling (member) in 0 gauge locos of the advance in locomotive building dating from locomotion No. 1 of the Stockton and Darlington Railway. All these locos were attractively displayed on a special showboard built for the occasion, with dates and particulars prominently displayed.

Another interesting display was by Vickers, of Weybridge Model Engineering Society, with the various stages of yacht building, from the bare boards to the finished article.

Of the models exhibited one table was devoted entirely to competition entries, and these reached a remarkably high standard. The judges awarded the medals to the following: Loco section, Mr. J. C. Walker (Weybridge Society), for his 1in. scale G.W.R. King George V bogie, a beautiful piece of work. Aircraft section: Mr. L. Sharp (Bushy Park Flying Club), for his control-line biplane. Mr. Hodges (Staines Society) for his cutter frame for lathe slide rest, in the workshop section. Boat section: Mr R. J. Collins, for an amazing model of a 50-gun ship of the 1732 period. The fine detail in this model was highly commented on. General section: M. F. H. Buckley, for a ⅛ scale P class M.G. chassis, another beautiful job, complete with gearbox, steering gear, in fact, everything that was on the original.

The "Len Wilson" Memorial Cup, which has been presented to the Society by his father for annual competition amongst the members only, was won by Mr. Quinsee for his "Heilan Lassie" chassis.

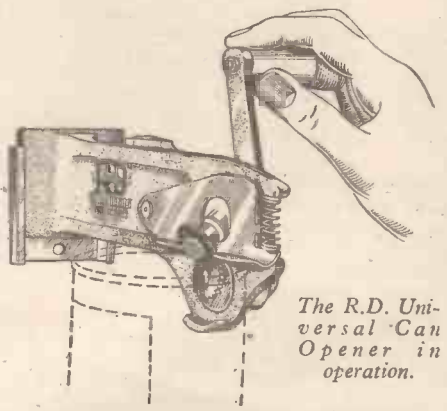


Mr. F. H. Buckley's ⅛ scale M.G. chassis.

Trade Notes

The R.D. Can Opener

THE new R.D. Universal Can Opener opens any size and type of can safely and with little effort. It operates by the simple turning of a handle and cuts away the top of the can neatly while compressing the outer rim to avoid the danger of an exposed sharp edge. When in use the can opener fits in a small bracket screwed to the wall of a kitchen, as shown in the accompanying sketch. The appliance is strongly constructed, and has a specially hardened cutting-wheel. When not in use the can opener can be quickly slipped from its holding-bracket and put out of sight.



The R.D. Universal Can Opener in operation.

Further particulars can be obtained from the manufacturers, Rudman Darlington and Company, Ltd., Wednesfield, Wolverhampton.

Books Received

Build Your Own Projector. By W. G. Rowell. Published by Cineluxe, Ltd. 124 pages. Price 12s. 6d.

THIS book, which is intended for the cine-amateur, contains much useful information, hitherto unavailable in book form, for assisting the experimenter in the construction of a sound-projector or any associated apparatus. No attempt has been made to describe fully the building of any particular projector owing to the difficulty of obtaining standard components; sufficient detail has, however, been given to enable the constructor to lay out a machine to suit his requirements. The book is well illustrated with line drawings and half-tones.

Trigonometry Made Plain. By G. P. Rawlings, M.A. Published by Percival Marshall and Co., Ltd. 176 pages. Price 7s. 6d. net.

THE object of this book is to make the application of trigonometry to his work possible to the general reader who is already able to add, subtract, multiply and divide. As lucidly explained by the author in this entertaining and instructive book, trigonometry is extremely simple to understand and to apply to various trades, arts, crafts and professions in which it is to-day essential.

THE WORLD OF MODELS

Some Interesting Ship Models : Model Pumping Station : Beam Engines at Leicester

By "MOTILUS"

IT is now just over ten years since this feature was introduced into the pages of PRACTICAL MECHANICS as a regular contribution. The writer sincerely hopes that his varied notes on activities in both amateur and professional model-making circles have during that time been an interesting record for all those who like to follow progress in "the model world." For the future, he hopes to continue to bring you news and comments on the many developments and applications of modelling in all its phases.

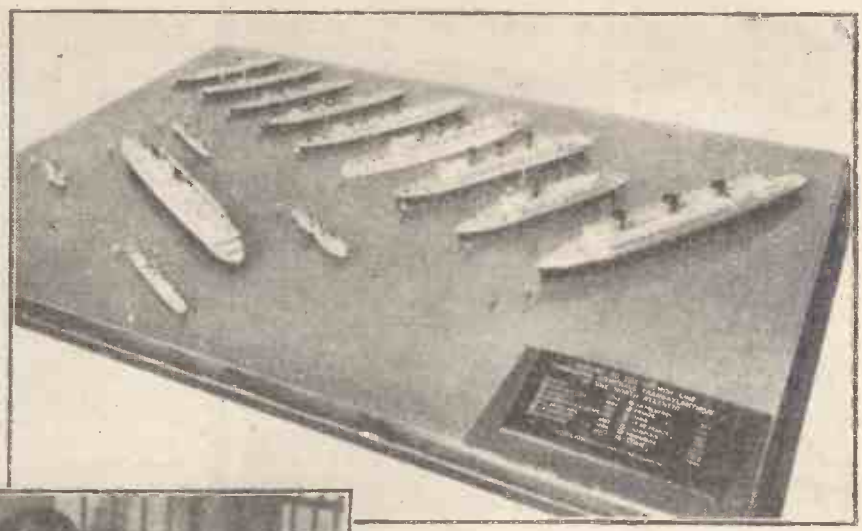


Fig. 1.—The group of waterline ship models constructed to show the history of the French Line in the North Atlantic.

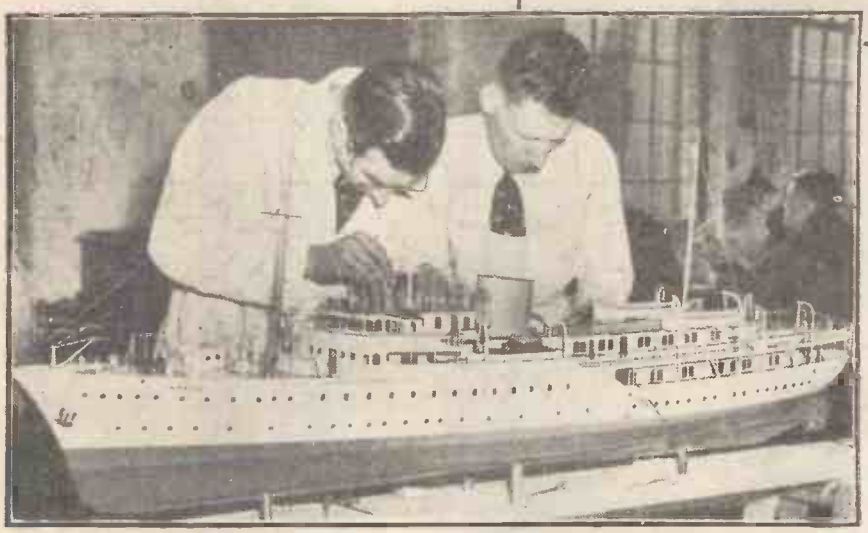


Fig. 2.—Final details being added to the full-hull model of the motor yacht "Norge," built to the order of Messrs. Camper and Nicholson, Ltd., who built the original ship.

Waterline Ship Models

Among the countless inevitable disasters of warfare in our times are the shipping losses sustained by merchant fleets. During the last war many fine ships were sunk and others were rendered obsolete as a result of intensified research work, so that nowadays ship-lovers follow with interest the efforts of the various shipping companies to replace lost vessels or modernise old ones. The French Line (Compagnie Générale Transatlantique), were singularly unfortunate in their percentage of losses as compared with those of other companies ; these losses included some of their largest and finest ships, among them the magnificent *Normandie*, then one of the largest ships in the world, and the smaller but modern *Champlain*. As yet, no new large ships have been added to this company's fleet, but the post-war reparation programme gave them possession of that famous and fastest German liner, the Nord Deutsche Lloyd *Europa*. She is now at St. Nazaire, being reconditioned and redecorated, and it is hoped that this year will see her in the Havre, Southampton, New York service under the French flag and the new name of *Liberté*.

French Line publicity schemes have frequently made good use of ship models. The accompanying illustration (Fig. 1) shows a set of waterline models to a scale of 41ft. to the inch (1/500th actual size), built to illustrate the history of French Line ships in the North Atlantic service. The first of their ships on the Western Ocean was the *Paris*, which made her maiden voyage in 1856 ; she can be seen at the extreme left-hand edge of the group. The *Normandie*, latest and finest French-built ship, is on the far right-hand side ; she met a tragic fate in New York harbour whilst in the hands of the U.S. military authorities, having been converted into a troopship. The new liner *Liberté* is to the left, surrounded by four small, earlier ships. The full set of models displayed in their glass case is now to be found in the French Line offices near Trafalgar Square, London.

Motor Yacht "*Norge*" in Miniature

While on the subject of ships, many of you will already know that the people of Norway have presented their King, Haakon VII. on the occasion of his seventy-fifth birthday, with a very fine motor yacht, the *Norge*. This famous yacht, originally known as *Philante*, was designed by Mr. Charles E. Nicholson, R.D.I., for Messrs. Camper & Nicholson, Ltd., of Southampton, who built her for Mr. T. O. M. Sopwith, the well-known yachtsman. During the war the *Philante* was requisitioned by the Admiralty for their own use, and afterwards she was reconditioned by the builders and renamed the *Norge*, ready for the presentation. I think readers will be interested to see the illustration (Fig. 2) of the third model to be made of this ship by Messrs. Bassett-Lowke, Ltd. Built to a scale of ¼in. to 1ft. (1/48th actual size), this particular model was displayed in London last autumn at the Design at Work Exhibition held at Burlington House, showing outstanding examples of the work of the Royal Designers for Industry. Later the model itself was also presented to King Haakon.

Model Pumping Station

Despite the large number of models that are made for commercial purposes nowadays one seldom sees a working model of such a large engineering undertaking as a modern

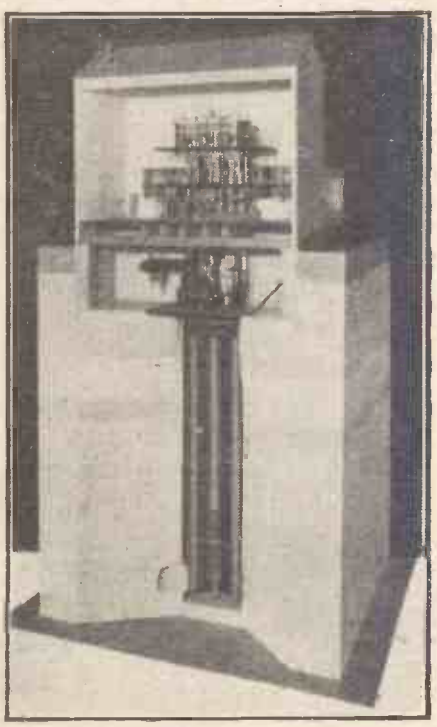


Fig. 3.—General view of the model of Kingston-upon-Hull pumping station, to a scale of ⅜in. to 1ft. The model is sectional and operated by electricity.

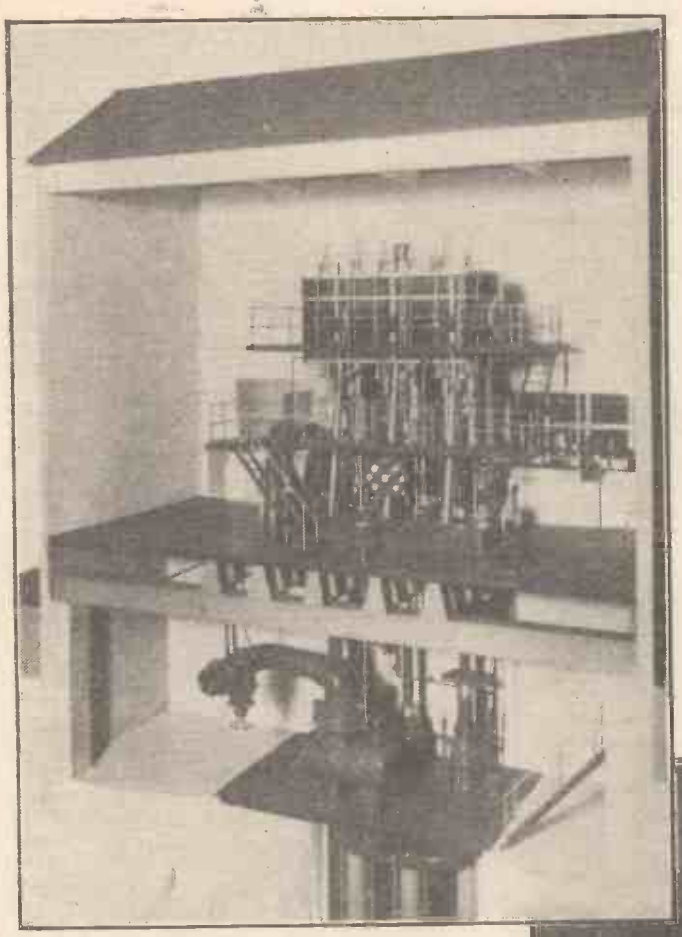


Fig. 4.—Close-up view of the pumping plant in the sectional model made for Kingston-upon-Hull Corporation, showing all external details of the Worthington-Simpson triple expansion steam engine.

pumping station. The model illustrated this month (Figs. 3 and 4) was made to the order of the Kingston-upon-Hull Corporation for purposes of reference and general information for the public. It is to a scale of $\frac{1}{8}$in. to 1ft., measuring 2ft. 6in. square and 3ft. 6in. high, and is electrically operated. Part of the model is sectional, showing the strata of earth through which the bore is made for the well, the adit and three rising mains. Above ground level the model shows the pumping plant, the Worthington-Simpson triple expansion steam engine and the boiler house, the latter having glazed windows so that the spectator has a view of the interior, with the Lancashire-type boiler, complete with all external fittings and details. The scale model exterior brickwork of this model gives it a good, finished appearance, the "bricks" being embossed with the white pointing clearly shown.

Fig. 5.—A well-finished model of a refuse disposal lorry, scale 1/10th actual size, built to the order of Messrs. Shelvoke and Drewry, Ltd., of Letchworth. The model has several remarkable features.

Model Refuse-disposal Lorry

The idea of making a model of a dust cart may evoke a smile even among those accustomed to weird and unusual prototypes. The modern "dust cart," however, is a far cry from the old-fashioned horse-drawn cart which differed from the farmer's open wagon only in design. Nowadays most up-to-date towns and cities apply scientific methods to their refuse collecting and disposal and use motor vehicles that are often as smart in their appearance as a public omnibus. Our illustration (Fig. 5) confirms this: it shows a model of a refuse-disposal lorry made by Messrs. Shelvoke and Drewry, Ltd., of Letchworth. It was built by Mr. E. H. Clifton, a skilled model-maker, and is to a scale of 1/10th actual size.

Many notable features of the original are demonstrated by the model, such as the locking of the front wheels in a given position, the tipping of the body, as shown in the illustration, for unloading purposes, and the opening and closing of the shutters covering the refuse and also the doors at the rear. In addition, the cab roof on the model lifts right off for inspection of the interior equipment in the cab, which is all shown in exact detail: the front of the radiator can also be removed, to reveal the model engine. In the lorry itself the engine can be extracted as a complete unit for overhaul and repairs, or for the fitting of an entirely new engine. This model is certainly a fascinating miniature of a very handsome, mechanical counterpart of the "dust cart" of our fathers' and grandfathers' times.

Beam Engines at Leicester

My last item for comment this month is not really news from the world of models, but purely from the world of engineering. Beam engines are always interesting, but to most of us they represent early steam engine history. It is not generally realised that for some purposes they were ideal, and in fact reached a high standard of efficiency in comparatively recent years.

Fig. 6.—A "close-up" of the Leicester Corporation beam engine cylinders. The link connecting cylinder to beam, which is 5ft. 6in. long, will give an indication of the massive proportions of the plant.

At Leicester last month I had an opportunity to inspect the sewage plant which will shortly be re-engined with diesel units, to replace four massive beam engines that were installed in 1892. I am indebted to the City Engineer and Surveyor of Leicester for the facilities he placed at my disposal, and for permission to write about these engines in the present article.

The period in which the engines were constructed was probably the greatest in the history of engineering, for at that time there was a blending of decorative design and perfection of craftsmanship that resulted in

attractive appearance and sturdy, well-made machinery. The Leicester plant may certainly be included in this category.

The 30ft.-long beams of the four engines (which are operated in pairs), weigh about 15 tons each and are supported on entablatures consisting of moulded cast iron girders mounted on massive ornamental columns.

The flywheels, weighing nearly 21 tons each, were built of cast iron segments planed and bolted together and are 21ft. in diameter. The engines are the compound condensing type, the high-pressure cylinders being 2ft. 6in. bore by 5ft. 9½in. stroke and the low-pressure cylinders 4ft. bore by 8ft. 6in. stroke. Two enormous pumps for the sewage, 2ft. 3¼in. bore by 5ft. 9½in. stroke, are connected to each pump, one at each end of the beam. An unusual feature is that the pump on the cylinder end of the beam is connected directly to the high-pressure piston rod, which is carried down through the cylinder head for this purpose. The four engines are driven by eight double-flued Lancashire boilers, each 30ft. long by 7ft. diameter, fitted with seven conical cross tubes in each flue. The working pressure is 80lb. per square inch.

A report of the trials conducted when the plant was first installed makes fascinating reading. During eight days each engine was tested twice to ensure that the net quantity of sewage pumped *per revolution* and *per hour* was in accordance with specifications. At frequent intervals coal and water consumption was checked and even the ashes weighed to determine the net combustible in the coal.

The remarkable thoroughness of the tests was justified in the eventual performance of the engines, for they are still in sound working order to this day. It is not age alone that is the cause of their removal. The enormous advance in the development of the internal combustion engine has proved the value of the diesel unit for this particular duty. Thus, in due course, the four beautiful beam engines will make way for the modern power plant which, being totally enclosed, will conceal the movements of its parts from view.

As I watched the beam engines at work with a slow, pulsating rhythm and observed the cleanliness and orderliness of the engine room, which enhanced the brilliance of the bright steelwork, I felt that there are moments when one regrets the march of time.

Letters from Readers

"Vanishing Chinaman"

SIR,—Thank you for prize received in connection with the above puzzle.

I am glad to see you intend to publish further puzzles, and I am sure readers of all ages will welcome them.

The correspondence columns of your periodicals show how the stock problems keep cropping up, mainly mathematical ones, but there must be many puzzles and paradoxes, not too "mathy," which would provide welcome relaxation and interest.

Liquid Pressure.

With reference to the article "Elements of Mechanics," in the December issue, it might interest your younger readers to consider a practical application of Fig. 1. If such a machine were built, having, say, 12 pistons around the circumference and one on top, then an operator could close 12 rivets, or press on 12 spring caps, or hold together 12 assemblies of parts for gluing or soldering—all for the expenditure of the same force required to do one only.

Therefore you get out 12 times as much as you put in—or do you?—E. W. BAIGENT (High Wycombe).

Electric Door-chimes

SIR,—It gives me great pleasure to acknowledge your gift prize in connection with the "Vanishing Chinaman" problem.

Also, I would like to take this opportunity of letting you know how much I appreciate PRACTICAL MECHANICS in general.

I constructed the door-chimes and they have been quite successful. I have noted in the December issue constructional details for a double-action push switch.

Since the door-chimes appeared I have been trying to work out a scheme whereby I could operate these chimes on the alarm principle from an ordinary eight-day clock. At present I am still using the old discarded trembler-type door-bell for that purpose.

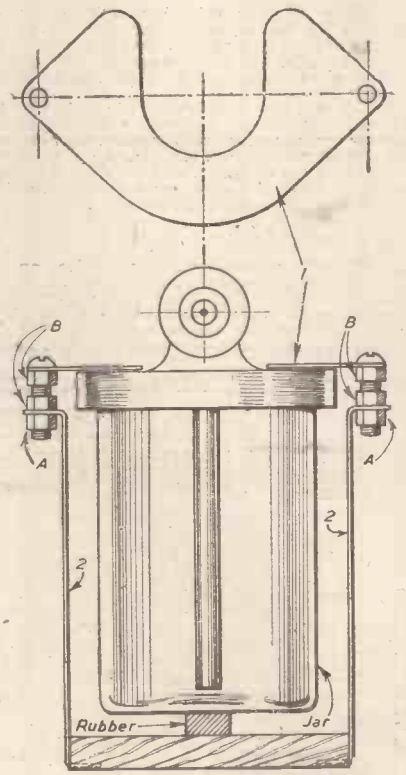
I am experimenting in the hope that by substituting a mechanical make-and-break operated electrically I could make the time lag sufficient to operate the chimes normally.

When the hand of the clock makes contact I have thought of utilising the pendulum motion to make and break the circuit, and thereby give a "sound picture" of the chimes at pendulum swing time; alternatively, to construct a balanced light wire cage, with a ball enclosed, operated by the solenoid. When the cage is swung on its pivot by the motion of the plunger the ball would provide the time lag by its gravitational run back and forward, operating a pivoted switch. These and other methods are the subject of my experiments just now, and I am sure there are many more of your readers besides myself who would prefer to be wakened by the dulcet tones of the chimes rather than the harsh, dictatorial clangour of the old type electric bell.

I realise there are snags and objections to these projects, which I will probably find experimentally, but I hope the subject is also of interest to other readers.—J. DUNN (Glasgow).

Adaptor for Spray-gun Jars

SIR,—Owners of the suction-cleaner-operated spray find that the replacement of the glass jars is an expensive business. The adaptor shown in the accompanying sketch takes about one hour to make and enables an ordinary 1lb. jam-jar to be used. It has the additional advantage of making the gun less liable to be knocked over.



A novel adaptor for a spray-gun jar.

The materials required are as follow:

Sheet of 18 gauge aluminium or 20 gauge dural. or mild steel.

Piece of wood 4in. by 4in. by ½in.

Piece of rubber ½in. cube approx.

2 x 2 BA bolts with 6 nuts.

From the sheet of metal cut the top plate and the side strips (items 1 and 2). Cut a piece of wood to the required size and recess it to take the turned-up ends of the side strips. Attach the rubber cube in the centre of the top of the wood with rubber solution.

Choose a 1lb. jam-jar with an undamaged, level top and assemble. Tighten nuts "A" until the whole assembly is firmly clamped together and then tighten locknuts "B."

To remove the jar, stand the spray gun on its base, spring out the side strips and lift the spray gun from its jar.—P. DURMAN (Hook).

Hot-air Engines

SIR,—I was greatly interested in the compact "hot-air" engine illustrated in the August, 1948, issue. Ericsson's original engine, however, was fitted with a "regenerator" which absorbed the heat from the hot air as it emerged from the working cylinder. The cold air for the next stroke then successively passed through the heated "regenerator" on its way to the working cylinder, thus conserving the heat.

The "regenerator" consisted of a sieve of finely divided wire net placed in layers to a thickness of twelve inches.

In Ericsson's engine the working cylinder was placed directly in the furnace, and air was supplied through the medium of a supply cylinder of approximately half the capacity of the working cylinder.

The efficiency of a "Stirling" engine fitted with a "regenerator" in comparison with a steam engine supplied with dry saturated steam working between the same limits of pressure is as 53 per cent. for the "Stirling" against 17 per cent. for the steam engine.—G. E. HICKS (Kyrenia, Cyprus).

Space Flight

SIR,—Having read with much interest and appreciation your correspondents' letters concerning space flight, there would appear to be one very serious obstacle to its successful accomplishement, namely, the danger of collision with meteorites in their flight through space. Probably the number seen as they burn themselves out is small compared with the number undetected. Possibly radar might give timely warning of the danger of collision. It would be interesting to know whether this danger, imaginary or practical, can be overcome by those conversant with the conditions and problems presented by space flight. — G. P. MCWILLIAM (Cowdenbeath).

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 40 (THE CYCLIST), 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.

Contact-breaker for Coil

I WISH to make a high dispersion triangular prism by filling a hollow prism made from pieces of old photographic plates with some liquid of high dispersive power, such as carbon disulphide. Could you inform me of any liquid of higher dispersive power than CS_2, and also some cement to join the pieces of glass which is quite impervious to the liquid used ?

(2) I have an induction coil which gives a 5in. spark with a primary voltage of about 12 volts. Can you tell me how to make an efficient automatic make-and-break mechanism ? The present contacts are of tungsten, and about 1/16in. diameter, but rather excessive sparking occurs, in spite of the usual high-capacity condenser in parallel. Do you think that contacts with a larger area would be more suitable ?—E. A. Whitaker (London, E.).

TAKING the refractive index of carbon disulphide of reasonable purity as being 1.627, liquids having greater refractive indices than this are as under :—

Liquid	Refractive Index (Dispersive power)
Alpha-bromnaphthalene	1.627
Methylene iodide	1.740
Methylene iodide saturated with sulphur	1.770
Phosphorus dissolved in methylene iodide to saturation	1.929

The above liquids can be obtained from British Drughouses, Ltd., Poole, Dorset.

Cements proof against liquids such as the above are made specially for microscope slide makers, and may be obtained in 1oz. bottles from Messrs. Flatters & Garnet, Ltd., Oxford Road, Manchester.

On the other hand, a good cement for this purpose is one consisting of a bakelite resin "accelerated" with an acid, the acid affecting the resin so that the latter becomes hard and insoluble within a few hours. These cements are being developed by Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1.

Another type of cement can be made by mixing two parts (by volume) of water and five parts of glycerine. Six parts of this liquid are then added to 40 parts of finely ground litharge. The mass hardens within ten minutes. If slower setting is desired, use more water in the glycerine mixture.

It is possible, also, that ordinary cellulose cement (sold in tubes) will resist the above liquids, but we are not sure whether this cement will be equally resistant to all of them.

(2) The ordinary "Nieff hammer" contact-breaker of your induction coil should be quite serviceable and satisfactory with contacts of approximately 1/16in. diameter, although it would be better if these contacts were of platinum. The excessive sparking will probably be due to an irregular wear of the contacts and/or to their not contacting perfectly squarely. On the other hand, the condenser in parallel may have broken down. Have you tried the effect of a new condenser ?

Another type of interrupter which is occasionally used with large induction coils is the mercury make-and-break. It is superior to the hammer-break type of interrupter, and its construction is described in most text books of practical electricity. The older types of mercury interrupter consisted of needles or blades (hand or motor driven) which dipped rapidly into a jar of mercury. Improved patterns took the form of a rotating segment or blade at the end of an inclined shaft, the blade dipping under the mercury surface at one point and rising from it at others. The mercury was kept covered with a layer of alcohol or paraffin to prevent oxidation.

Cleaning Red Sandstone

COULD you please advise me as to the best method to clean red sandstone ? The front of my house is rough-hewn sandstone, and in parts is coloured green with a mould from dampness. I have seen it being cleaned with a wire brush, but I wondered if there was another method.—J. Hoggans (Ayr).

YOU could make a good job of cleaning your red sandstone by taking a bucket of water and by dissolving half a pound of caustic soda or soda ash in it and by scrubbing this solution on to the stone, subsequently swilling it away. Many people use this method, but the method is a dangerous one, for the reason that sandstone is a porous material and that it will absorb a portion of the caustic salt. Now, when porous stones absorb chemical salts, they are only expelled from the stonework with great difficulty, and whilst in the stone they tend to bring about its slow decay. Many of the types of stone decay which one sees in public buildings and stonework of various kinds are due to retention by the stone of absorbed salts.

The safest method which you can adopt is the wire brush and plain hot water, plus, of course, plenty of elbow-grease and an abundance of patience ! This method will give good results, and it will not damage the stone.

If, however, you do decide to adopt the caustic soda method, apply it in rainy weather so that the rain will have a chance to drive out all absorbed matter from the stonework.

The bright green mould to which you refer is most probably a growth of "protococcus." This is not a mould but a form of primitive plant life known as "algae." It can be ridded from the stone surface by swilling it with scalding hot water, which kills the algae. Another method is to brush over it a mixture of 1 part carbolic acid, water 10 parts. Still another method is to scrub wet sand over it.

Anti-fouling Paint

CAN you please provide me with the formulae for the preparation of red, white, blue and green marine anti-fouling paints—A. W. Atkins (Dover).

COPPER salts are always toxic to marine organisms, and, of these, the modern favourite for anti-fouling compositions is copper naphthenate, which may be obtained, price about 3s. 6d. lb., from Messrs. Thomas Tyrer & Co., Ltd., Stratford, London, E.15. Twenty parts of this should be dissolved in 80 parts of white spirit. The resulting green solution should be stirred into the paint, using it as a thinner. Get as much of the naphthenate solution into the paint as possible without altering the colour or the flow of the paint. If necessary, you can use an even stronger solution of the copper naphthenate than the 20 per cent. solution first mentioned.

To make a thorough job of things, it would be advisable to brush any woodwork over with the plain naphthenate solution and to let this dry prior to applying the naphthenated paint. Indeed, many individuals merely treat the woodwork with the plain naphthenate solution and then give one or two coatings of an ordinary paint, preferably a red oxide paint.

Readers are asked to note that we have discontinued our electrical query service. Replies that appear in these pages from time to time are old ones, and are published as being of general interest. Will readers requiring information on other subjects please be as brief as possible with their enquiries.

Translucent Lantern Screen

I WOULD appreciate your advice on the following problem. I am desirous of making a translucent screen to enable me to use rear projection in my lantern lecture work. What would you consider the best material for this, taking into account availability and cost as well as suitability for the job ? Where can it be obtained ?

At the moment I am using a standard "Optiscope" lantern with a 2½in. focus lens and a 500-watt pre-focus bulb. Do you consider this suitable for rear projection ?—K. A. Elias (Bolton).

TRANSLUCENT lantern screens function very well in sizes up to 10ft. square, but not beyond this size. Various materials may be used for the screen making. The very thin rubber sheet known as "dental rubber" is sometimes excellent, but it is costly and apt to perish. Ordinary engineers' tracing paper (white) can be used with good results, or, alternatively, any type of good quality white smooth drawing paper which has been given a coating of an oil varnish and allowed to dry. All such screens should be stretched on a strong wooden frame.

For a rollable translucent screen, use a varnished silk or varnished cotton cloth which has been given a surface coating of a flat oil varnish.

You should be able to get all the above materials locally. If not, try Messrs. Haldane & Co., Ltd., Albert Square, Manchester.

The lantern system as you describe it will be quite suitable for rear projection, although, in a small room, you may find the illuminant too intense.

Polishing a Cork-tiled Floor

CAN you give me details of the best method of polishing a cork-tiled floor ?

The tiles are new, being Eldorado cork, approximately 1ft. square and ⅛in. thick.—R. Willis (Belfast).

DISSOLVE about 1 part of shellac in 1½ parts of methylated spirit, and paint the resulting solution on to the cork surface of your flooring tiles. If the solution is much absorbed, allow it to dry, and then repeat the process.

You will now have a firm, waterproof base on which to build up an enduring layer of wax polish. When the tiles have dried out, apply any good wax floor polish, and repeat the application at intervals of a week, until a good wax layer has been built up.

You can, if you desire, brush a thin coating of shellac solution over the wax surface, but we do not think that this will be required.

The surface may also be varnished with a synthetic varnish, but this will give a glossy appearance, unsuitable for a flooring, for which reason we think you should be well advised to keep to the regular use of an ordinary wax polish.

Tank for Sodium Hypochlorite

I HAVE a galvanised tank in which I wish to put sodium hypochlorite. I understand the galvanised surface won't last or stand this chemical solution. Can you tell me of any paint or coating I could paint or spray the tank with ? Is there a make of tank called "Everite," which, I think, is like glazed asbestos ; if so, would this be suitable ? I wish to mix about 100 gallons at a time.—J. Cone (Chester).

SODIUM hypochlorite solutions are powerful oxidising agents, and there are no paint or enamel coatings which will stand up to them permanently. Two or three coats of a cheap bituminous paint will withstand the action of these solutions for a few months, but *not* permanently.

Ordinary metal will not withstand these solutions, either. The material which you mention is, we think, a stainless steel, but even this material will not resist strong hypochlorite solutions indefinitely. The best metallic material for this purpose is Monel metal, which is an alloy of copper and nickel, and is obtain-

able in sheet form from The Mond Nickel Co., Ltd., London, S.W.1.

An asbestos composition would not be suitable for your purpose for the solution would find its way into the asbestos fibres and would soften it.

Best of all for your use would be an all-glass tank, or a slate tank. Wooden tanks, slate or glass lined can be very serviceable when carefully made. So, also, can be leaden tanks, similarly treated. Vitreous enamelled tanks are satisfactory—as long as the enamel remains intact. But in the case of strong hypochlorite solutions, this is not long, for the solution quickly "gets at" the enamel and, seeping underneath, completes the destruction of the tank in a relatively short time.

If you could make an earthenware tank from earthenware bricks or tiles joined with a silica cement, this might be the cheapest answer to your problem.

Achromatic Lens Construction

I WISH to construct a 3in. astronomical telescope of the refracting type, as I have just finished a 5in. mirror type instrument and wish to try my hand at making a 3in. achromatic objective. I shall be glad if you will inform me what focus to make each lens so that when both the crown and flint glass are together they focus at 50 in. Could you please show me the curvatures by means of a diagram. I should also like to know of any books that I could obtain dealing with grinding and polishing of lenses, and where I could obtain them.—W. H. Brealey (Stoke-on-Trent).

IT is quite impossible for us to give you all the detailed information which you require within the space available. You will have to seek the aid of treatises on the subject, and such, unfortunately, are no longer in print. As regards lens grinding and polishing, together with optical computing, we can only refer you to a good secondhand scientific bookseller, such as Messrs. H. K. Lewis and Co., Ltd., 136, Gower Street, London, W.C.1, or Messrs. Wm. Bryce, Ltd., 54, Lothian Street, Edinburgh, in the hope that you may be able to obtain a helpful book on this subject.

As regards the construction of a 3in. achromatic objective having a focal length of 50in., the front or convex lens should be of crown glass and the rear and bi-concave lens should be of flint glass, the dispersive powers of flint and crown glass being as .052 to .033. The rear lens should not be so concave as the front lens is convex, so that the action of the front lens is predominantly refractive, whilst the rear lens acts more energetically as regards dispersion, its main function being to correct the chromatic aberration of the front lens. A good and well-made lens of this type will have its spherical aberration corrected as well as its chromatic aberration, so that the image of a star will form a nearly colourless point at its focus.

If two lenses are placed at a distance apart, the combination is "equivalent" to a single lens differing in power and thickness from either of them. The rule is that the equivalent combination of lenses will have a power equal to that which the two would have when close together, less an amount equal to the product got by multiplying together the powers of the two lenses and the distance between them expressed in decimals of a metre.

Thus, $P_1 P_2 - P_1 P_2 w$ = Power of combination, where P_1 and P_2 are the powers of the two lenses and w the distance between them.

However, this information will not get you far as regards your proposed curvature computation, testing and grinding. This is a very lengthy procedure which cannot be explained in a few paragraphs. Hence, if you go on with the matter, it will be absolutely essential for you to consult the few treatises which have been published on the subject. Your local library or your country library may be able to assist you in this matter of text books.

Methylated Spirit

I WOULD be obliged if you would inform me what is the exact difference between commercial methylated spirit and industrial methylated spirit ?

Does commercial methylated spirit contain any resin ? Also, is there any other grade of methylated spirit apart from the above two ?—J. N. Bridgwater (Newcastle).

OFFICIALLY, there is no such thing as "commercial" methylated spirit. Under existing Regulations, there are three types of methylated spirit, viz.:

(a) Industrial Methylated Spirit.

This the purest form, comprises 95 per cent. by volume of ethyl alcohol, plus 5 per cent. wood naphtha.

(b) Industrial Methylated Spirit (Pyridinised).

Composition as above, but with the addition of from 0.5 to 1.0 part of crude pyridine to each 100 parts by volume of the mixture.

(c) Mineralised Methylated Spirit.

This represents your "commercial" methylated spirit. It comprises 90 parts by volume of ethyl alcohol, 9.5 parts of wood naphtha and 0.5 part of crude pyridine. In addition, to every 100 gallons, three-eighths to one gallon of mineral naphtha (petroleum distillate) is incorporated together with not less than one fortieth of one ounce by weight of aniline dye (methyl violet).

For fuller details, you should consult "The Methylated Spirits Regulations," a pamphlet which is to be had from your local office of H.M. Stationery Office.

No variety of methylated spirit contains any resin.

Windings for Small Motors

I HAVE two sets of armature stampings, etc. (one as "A") and (one as "B"), in the accompanying diagram, and I wish to build them up into small electric motors.

Could you tell me the gauge of wire, and the number of turns required to operate under 12 volts D.C., using permanent magnets. Also, what is the gauge of wire and the number of turns required to operate under 14 volts A.C. and what would be the gauge and number of turns required for the field coils ?

Would you please give the information for both sets of armature stampings.—J. H. Billington (Northampton).

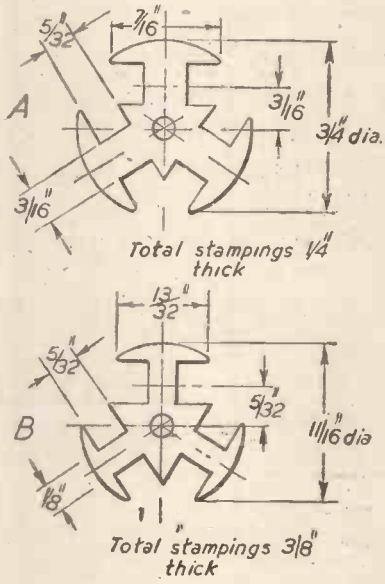
THE design of windings for such small motors is somewhat experimental, and also depends to some degree on the dimensions of the field system. We suggest you try the following :—

DESIGN A.—Each armature pole—800 turns of 39 s.w.g. enamelled wire for 12 volts D.C. and 14 volts A.C.

Series field coil for 14 volts A.C. 100 turns 33 s.w.g.

DESIGN B.—Each armature pole to have 700 turns of 37 s.w.g. for 12 volts D.C. or 14 volts A.C.

Series field coil for 14 volts A.C., 100 turns of 29 s.w.g.



Dimensions of stampings for small electric motors. (J. H. Billington.)

Removing Ink Stains

COULD you please answer the following queries: How can I remove ink stains from the polished surface of a mahogany table ? Also, what is the best kind of stain to use with mahogany ?—G. Webster (Glass Houghton, Yorks).

WE assume that the stains are those of ordinary writing ink, in which case proceed in the following manner.

Scrub the entire table top gently with soap and water to which a little ammonia has been added. If this does not remove the whole of the oil, grease or wax, repeat the process.

Next, make a thin cream of chloride of lime and water. Dab this on the affected area, following it up by dabs of a mixture of equal parts of water and acetic acid. Bleaching will take place rapidly. When the ink stain has gone, quickly wash away the applied chemicals and allow the table top to dry. It is more than likely that the treated area will require a little judicious re-staining. This is done by dissolving mahogany stain (obtainable from any paint store) in methylated spirit and by gently brushing it over the area. The re-staining should be done very carefully so as to match up with the remaining portions of the woodwork. After the applied stain has dried out, repolish the area with linseed oil (raw) or with a wax polish.

If the table top has been french polished (i.e., with spirit polish), omit the first washing with ammonia, and apply the bleaching liquor direct. There is a chance that the ink stains may not have penetrated the shellac polish. If, however, they have done so, the affected area will require shellac polishing to match up with the unaffected areas.

Either "spirit red," with a trace of "bismarck brown," or one of the proprietary "mahogany" stains makes the best spirit stain for general mahogany staining. These dyes should be dissolved in methylated spirit, not in water.

Developing Panchromatic Film

WILL you please explain the process for developing films with Velox developer ? The timing factors are the most important. With a panchromatic film is it an advantage to have a complete dark room without a red light ? Is a red light suitable for all other films ?—J. Turnbull (York).

WHEN developing panchromatic film it is not merely an advantage to avoid red light—it is an absolute necessity ! Panchromatic films are highly sensitive to red light. Consequently, if you attempt to develop such a film in a red light, the result would be the same as endeavouring to develop an ordinary film or plate in white light—complete and utter fogging, and, indeed, rapid blackening of the film all over.

You must, therefore, develop your panchromatic films either in total darkness (using the tank and time method) or else in the very dim illumination of a special dark-green safelight.

If, prior to developing, you desensitise the film by immersion in a solution of a desensitiser (such as "Desensitol," supplied by Ilford, Ltd.), you may then develop the film in a very bright green illumination, but not in a red light.

The dark and the bright green safelights above-mentioned may be obtained from any photographic dealer, or direct from Ilford, Ltd., Ilford.

A bright red light is not suitable for all non-panchromatic films. For example, such an illumination will tend to fog any of the modern super-speed films or plates. For such purposes, you must use a dull red safelight, but for all films up to and including a speed rating of 450 H. and D., the brighter red illumination is quite safe.

If you make up a Velox developer at full strength for use with gaslight paper and then dilute it with an equal bulk of water, it will be quite suitable for film development.

Leather Dust Flooring Material

I HAVE unlimited quantities of leather dust available and wish to make use of it as a floor covering. I believe a kind of composition could be made by mixing with a synthetic resin and would like to have your advice on choice of resin and method of mixing. I would prefer to lay the composition on a canvas backing rather than in situ. What method of laying would you recommend ?—A. T. Burnell (Armley).

YOUR proposed method of incorporating leather dust into flooring material has promise, but it has never been worked out to its fullest extent, mainly on account of the cost of the leather dust and the uncertainty of its supply. You could, however, mix the leather dust with a bakelite resin dissolved in a suitable solvent, and, after laying the mix evenly on a canvas backing you could apply to it an acid "accelerator" which would insolubilise the resin within a few hours, or, alternatively, you could mix the "accelerator" with the resin direct and previous to working in the leather dust.

You can obtain several types of resin dissolved in a solvent for the above purpose from Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1, and you will, we think, get some very good results from your experiments. Your main difficulty, however, will be the cost factor, and this, we are inclined to think, will severely curtail the applications which you can make of your method.

The leather dust may, of course, be mixed with sawdust in order to cheapen the mix.

Another method would be to mix about equal quantities of leather dust, sawdust and calcined magnesite. Then slake the resulting mixture to mortar consistency with a 40 per cent. solution of magnesium chloride made by dissolving 40 parts of the latter salt in 60 parts of water. This composition sets hard within 36 hours, and was much used as a basis of the well-known "magnesite" or "composition" floors. Magnesium materials are hard to get hold of in quantity at the present time, but you might be able to obtain experimental quantities from a firm of chemical dealers such as Messrs. Reynolds and Branson, Ltd., of Leeds.

Aneroid Capsules : Ink for Barograph Charts

WILL you please inform me if the air in aneroid capsules as used in barometers is at atmospheric pressure, or is it pumped out and then the capsule sealed, thus forming a vacuum ?

(2) Also, I should like to know the address of a firm that supply the charts for graph barometers, and the kind of inks that are used in the pens of these instruments.

(3) What is the postal address of Messrs. Wilson, Warden and Co., Ltd., London, who, I believe, make these instruments ?—S. H. Scragg (Ashton-under-Lyne).

IN the aneroid barometer the metal capsule is always vacuous, for if this were not the case the diaphragm would not respond to the variations in atmosphere pressure. The more perfect the degree of vacuum within the capsule, the more sensitive is its response to atmospheric pressure changes.

(2) There are two main types of inks used for barograph purposes, viz., an aqueous ink and an oil-based ink. The aqueous ink is the easiest to make, the following comprising a representative composition :

Methyl violet	..	3 parts
Water	..	15 parts
Meth. spirit	..	15 parts
Glycerine	..	15 parts.

(3) The address which you ask for is : Messrs. Wilson, Warden and Co., Ltd., 28 and 30, Pear Tree Street, Goswell Road, London, E.C.1, and also, Pine Grove, Tollington Park, London, N.4.

You should be able to obtain barograph charts from the above firm. Also, from Messrs. Philip Harris and Co., Ltd., Birmingham ; Messrs. Haldane and Co., Ltd., Albert Square, Manchester ; or from any firm of dealers in scientific apparatus, such as Messrs. J. W. Towers, Ltd., Victoria House, Widnes.

THE Cyclist
Editor: F. J. CAMM

VOL. XVII FEBRUARY, 1949 No. 323

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

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

Comments of the Month

By F. J. C.

Dopes

THE use of dopes by riders in international events is a matter which is being discussed in racing circles. It is not, of course, a new problem. Just before the war a well-known team manager refused to administer dopes to the professionals under his care. The argument in favour of their use seems to be that if dope produces the desired results the end justifies the means, and that it is no more wrong to use a dope which gives a temporary burst of energy than it is to adopt a special diet or to take a couple of aspirins before a ride to cure the toothache.

It can be argued, of course, that a man may not win a race if he has the toothache, and that the taking of the aspirins which, after all, are a drug, really gained him the victory. The question, however, is rather more serious than is accounted for by this simple analogy. It is the effect of certain dope upon the system which must be taken into consideration, and in every case this effect is harmful. It cannot be said that anyone is likely to suffer ill-effects from a carefully-planned diet. It is perfectly proper for an individual to select such diet as will provide him with the maximum amount of energy and staying power, and if this is artificially induced by means of a drug such a competitor is taking an unfair advantage.

Even in the case of a man who is taken ill before a race, the use of a drug cannot be justified, and it is better for him to swallow his disappointment and withdraw from the race rather than to run the risk of seriously injuring his health.

A dope is but a means of hiding the illness or the weakness for the time being, and it will return with increased intensity as soon as the effects of the drug have passed. They buoy up for the time, but drug taking induces chronic meloncholia and depression. The victim thus must take further doses and so he forms the habit of drug taking.

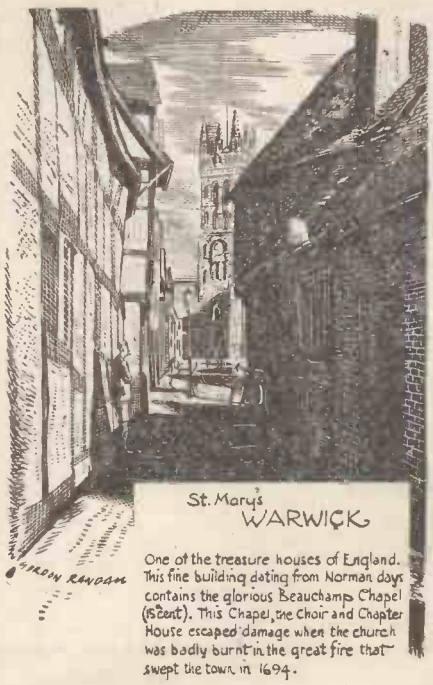
In the very early days of cycle racing the doping of riders was common practice, but the attitude of the cycling promoters caused it to be abandoned as a set part of the sport. I do not think that the use of ordinary stimulants of the type which the rider finds effective in providing the extra amount of vigour required, say, for a 24, will be objected to since alcohol in mild quantities can have no harmful after-effects even if it has no beneficial ones, although most of our well-known riders are not teetotallers, and speak highly of the beneficial effects of champagne both before and after a ride.

There are those who feel that dopes if administered under proper medical supervision should be permitted. We are, however, in disagreement, for a race would become not a test of one man's skill against another, but a test of one man's dope against another. It would indeed be a battle of the dopes. Let us keep the sport clean.

The "Honorary" Official

A SPEAKER at the annual dinner of the W.R.R.A. severely criticised those honorary officials who pay lip service to the necessity for preserving strict amateurism, yet who devote a considerable amount of their time to writing articles and broadcasting, and to such an extent that they neglect the duties they have undertaken in an honorary capacity. In other words, they are merely using their honorary position to obtain news and information which they can later translate into cash by means of an article, a lecture, or a broadcast.

The cycling movement has not produced a crop of first-class writers. In fact, the really first-class writers on cycling could be counted on the fingers of both hands. They have created imitators, however, and much of the material such submit for publication is just a thinly disguised imitation of the styles of well-known writers. This also applies to artists who submit touring sketches. Because a well-known artist usually draws a cyclist in his sketches, clothed in plus-fours and about 12ft. high if the bicycle can be taken as an indication of scale, every would-be artist introduces a bicycle and a disproportionate cyclist clothed in plus-fours.



One of the treasure houses of England. This fine building dating from Norman days contains the glorious Beauchamp Chapel (15cent). This Chapel, the Choir and Chapter House escaped damage when the church was badly burnt in the great fire that swept the town in 1694.

We are, however, in agreement with the speaker we have quoted. We feel that honorary officials should work for the good of the sport, and whilst they are members of clubs operating under the flag of amateurism, they should not take cash for work they do which is associated with the sport. They should be expelled from their clubs or proclaimed professionals.

There is a general tendency in cycling journalism to publish articles without investigating the qualifications of the contributors. Not so long ago one of our contemporaries unwittingly published a number of articles which had been copied word for word from this journal by a contributor who received payment for them. Most amateurs seem unacquainted with the law of copyright and presume that they can lift material from one journal and sell it to another.

In another case a journal secured credit for a photograph which is the Crown copyright of the Imperial Science Museum. A few months ago we went to a considerable amount of trouble and research in connection with the history of the Cycle Show. We observed that some of our contemporaries freely helped themselves to the results of our efforts without the usual courtesy of acknowledging the source. We have no objection to use being made of our copyright material if permission is first asked, and the source is acknowledged.

Unrest in the B.L.R.C.

THE correspondence we continue to receive from the various sections of the B.L.R.C. shows that members are by no means satisfied with their national executive. As one of them put it, "We agree with your criticisms but we are helpless to put matters right." Why? The B.L.R.C. holds an annual general meeting, although it is true that on at least one occasion it was a travesty of normal procedure. Like another A.G.M., it merely went through the motions of an A.G.M. The League is losing support and sympathisers as a result of some of the actions of the London section which seems to regard itself as the proprietor of the League. We have warned League members on a number of occasions that it is high time to purge its ranks, and we hope that it will now see the wisdom of doing so, otherwise it will go the same way as the N.C.U. and the old Road Racing Council.

A new feeling of accord is required in the cycling movement, but this cannot occur until some of the dead wood has been lopped off and some of the splenetic oldsters, who are bound in the movement, have been placed on the retired list. No longer cyclists, they are quite out of touch with modern cycling thought.

Paragrams

Evenlode E. Worcestershire

GOUPON COPYRIGHT

The little church of St. Edward. (containing part Norman work and a fine late 14th cent pulpit.). The village lies 3 miles N.E. of Stow-on-the-Wold in the valley of the same name.

Thought

"AS is the case with everything else in life, the true appreciation of travel lies in the contrasts which it constantly provides."—From "Narrow Boat," by L. T. C. Rolt.

Riding on Nylon

EXPERIMENTS in the use of nylon plastic as wheel bearings have been carried out by the Du Pont Company in America, and satisfactory results are reported to have been obtained. Nylon bearings were first tested in perambulator wheels, and after the wheels had turned for an equivalent of 1,190 miles the bearings were inspected and were found to be in perfect condition. With light loads at high speeds, these bearings need no lubricant, nor do they need lubricating for medium loads at low speeds. Further experiments using nylon bearings for cycle wheels are being made and are expected to be successful.

Road Safety at Grimsby

THE Road Safety Organiser for Grimsby has reported to the local Road Safety Committee that the recently introduced scheme for the inspection of cycles ridden by schoolchildren is showing good results. He described the reaction of parents to the scheme as "very satisfactory," and the committee hope that very soon there will not be one child in the town whose cycle is not completely roadworthy.

Strange Accident

AT the inquest at Retford, Notts, on an 18-year-old cyclist who was found dead in a ditch not far from his home, still astride his cycle, a verdict of death by misadventure was recorded. A postmortem examination revealed that the youth died from a broken neck, but how the injury was sustained remains a mystery. The doctor who carried out the post-mortem suggested that a sudden jolt might have caused the injury.

Bit of a Muddle

A SUGGESTION from Hunts County Council, following complaints made by the warden of Houghton Mill Hostel, that cyclists ought to be made to walk through a passage at the Mill, was rejected by the local parish council. Members said they were against the proposal that the passage should be obstructed so as to force cyclists to dismount, or that notices should be placed there prohibiting them from riding through the Mill. One member said the passage had been used by cyclists right back to the old penny-farthing days, as long as he could remember, and he did not like newcomers telling the local people what they ought to do. He said: "A lot of people who have come here recently are spivs and drones, and think the villagers are a lot of fools!"

Silver Jubilee Celebrations

AT the 25th birthday celebrations of the Bedfordshire Road C.C., held at Gamlingay, Beds, 75 members were present, including five of the 12 founder members of the club. There was a special birthday cake, complete with 25 candles, which was cut by the club president's wife, Mrs. W. Haylock. The early days of the club and various trials and tribulations were recalled by the president and other speakers.

Side By Side

VISITORS to Rockaway Beach, New York, are forsaking their glittering glasshouse cars for cycles; but cycles with a difference. The cycles, all ladies' models, are joined side by side by means of four 3ft. lengths of piping. On the inner fork of each machine an extension piece is welded, to which is attached a connecting rod to enable the two machines to be steered in unison. The double cycle is particularly useful for learners while for others it enables a child or some light luggage to be carried on the struts joining the machines.

Road Safety Hint!

WHAT to do when one meets a full-grown lion on the road as one is cycling along is explained by Archdeacon A. B. Lloyd, a former missionary in Uganda and now living at Leamington Spa, in a recent book about his work. He says that shortly after he went to Uganda he was riding downhill on an old-fashioned fixed-wheel bicycle, with his feet comfortably on the front forks, when he suddenly saw a full-grown lion in the middle of the road. He says: "I could do nothing but shout my loudest and ring my bell and then I flew down the hill at a good 30 miles an hour, straight for the lion." The lion had evidently received some training in road safety for it leaped for the side of the road and Archdeacon Lloyd missed it by the hairs on its tail.

More Tramlines Vanishing

CYCLISTS visiting Leicester will have one death-trap less to trouble them soon, for the City Council have already made a start on the removal of the city's tramlines. The making good of the roads after the removal of the lines will, however, be a very expensive matter, and in the west end of the city alone the cost is likely to be round about £250,000. Certain underground works will be done at the time the roads are resurfaced, in the hope that there will be no need for any further work for about 20 years.

First and Third

THREE cyclists who had to finish their journey by rail found, on arriving at a main line station, that the guard's van was too full even to enable cycles to be crammed inside in the usual railway fashion. However, the guard proved to be a resourceful man, so he told the cyclists to put their machines inside an empty first-class compartment, which he locked. The cyclists then walked along the train and found seats in a third-class compartment.

Asking for It

A MOTHER who, having a small child in a carrier at the back of her cycle, propped the machine against a lamp-post and left it and the child while she went into a shop, evidently believed in looking for trouble rather than waiting for trouble to look for her. One unexpected wriggle by the child, and it and the cycle would have been under the cars and lorries which were passing in a continuous stream.

By-Passes—Sometime

THE Highways Committee for the Kesteven division of Lincolnshire has submitted to the Ministry of Transport provisional plans for building 12 by-passes in their area to avoid danger spots on the Great North Road and other main roads carrying heavy traffic. Unfortunately, it is likely to be a considerable number of years before the scheme can be carried into effect.

Trees Damage Roads

THE cyclist who suddenly crashes into an unseen pot-hole on the road should not, when he recovers his breath, curse heavy motor traffic, for it may have been an innocent-looking roadside tree that has done the damage. A comprehensive survey recently carried out by the Road Research Laboratory of the Department of Scientific and Industrial Research into the possible effects of tree growth on road surfaces shows that trees are likely to damage roads where the subsoil is clay by extracting the water from the clay and causing shrinkage. Poplars and elms are great offenders in this respect, particularly during periods of drought, but other fast-growing trees, such as alder and aspen, can also cause damage. The survey showed that no damage appears to be done to road surfaces where the subsoil is loamy or sandy.

Cycle Valves „Save Cigarettes

LEICESTERSHIRE miners in the Ibstock district have found a way of saving cigarettes by using the upper portion of an ordinary bicycle valve. They smoke their cigarettes as far as possible and then insert them in the portion of the valve, which enables them to continue smoking a cigarette until there is practically nothing left but ash. The miners claim that by this method they can save one packet of cigarettes in every five.

Dirty Roads

MANY country roads at this time of the year look more like cart tracks than tarmac roads, due to tractors and other farm machinery covering them with a layer of mud and slime, but little seems to be done to obviate the nuisance, in spite of the potential danger to cyclists and other road-users. Local authorities have power to prosecute for this offence and there is a maximum penalty of £2. Some farmers in the area covered by the Isle of Ely County Council have been asked personally to keep the roads clear of mud and clods of earth, and a number of complaints have been brought to the notice of the County Council. Legal action is being considered by the council if the trouble continues.

Poetic Justice

A 15-YEAR-OLD Grimsby boy, charged at the local Juvenile Court with the theft of a cycle, heard his father tell the magistrates that he had been saving up to buy the boy a new cycle, unknown to him. The boy was put on probation for one year and was ordered to pay 15s. costs and also £3 10s. for damage done to the stolen bicycle. His father told the Court he would pay the money out of what he had saved towards the new bicycle.

Going Up

A CONSIDERABLE increase in interest in cycling is apparent in Yorkshire, and a number of clubs are reporting gains in membership. The latest figures for the past year, reported at the annual meeting, come from Thorne Paragon. This club is thriving and making good progress, and has increased its membership to 90. Next season it is hoped that the number of members will be well into three figures.

Visibility—Poor!

ME and my dog, lost in a fog, weren't in it with cycling and running members of the Boston Cycling and Athletic Club, who held their annual cross-country scramble in a thick fog. There were 23 competitors taking part, two more than last year, and the course was over wet and muddy fields and cart tracks. Nimble feet beat wheels, and nine runners had finished the course before the first cyclist came in sight. The winning cyclist got off course very early in the event and got so muddled that he had to return to the starting post and begin again. The next cyclist home carried a back wheel in one hand and the rest of his machine in the other hand. Another cyclist fell in thick mud and lost both shoes; two collided early in the race; two more had to walk home because of mechanical breakdowns, and yet another buckled his back wheel. The only casualty among the runners was a bad attack of "stitch," but on the whole a good time was had by all. The first cyclist home was Ray Popple, who also headed the cyclists last year.

Comparative Values

AT a pre-Christmas auction in a country sale-room, the auctioneer could not get a bid above 9s. for a second-hand cycle, and it had to be sold at this price. A child's tricycle, also second-hand, went for £2 15s.

Polish Offenders

"IS there not some way by which Poles can be informed of the laws of this country?" asked the chairman of Melton Mowbray (Leics) magistrates, speaking to a Polish interpreter during the hearing of cycling charges against a number of Poles. He was referring particularly to one defendant who had committed five offences while cycling. The man was fined 40s. and the other Poles were fined sums of 20s. or 10s.

The Old Brigade

MR. A. DIXON, of Broxholme Lane, Doncaster, who has just celebrated his 80th birthday, is one of the few men who learned to cycle on a bone-shaker and is still riding, but on a more comfortable mount. His first machine was of heavy iron construction, with a wooden seat, but in those days he had more surplus energy. During the summer he often cycles 10 or 12 miles after tea and even now that the bad weather has set in he can be seen riding in the centre of Doncaster, in spite of the heavy traffic. May he be spared for many more years yet to enjoy his favourite hobby.

Around the Wheelworld

By ICARUS

A Neigh from the Pegasus

YOU will remember that your scribe Icarus in Greek mythology was the venturesome soul who flew too near to the sun so that the wings attached to his body with wax by his father Daedalus, fleeing from the wrath of King Minos, fell off, and he dropped into the Icarian Sea. According to Mr. A. Missen, the honorary secretary of the Pegasus Road Club, which is affiliated to the British League of Racing Cyclists, I, too, have been venturesome in daring to criticise the London section, and suggesting that not only were changes necessary but desirable and likely to happen.

He thinks that I am carrying the torch for the ex-honorary secretary, and thinks that my side wind blows from Disraeli Road. He evidently is able to say in advance that there will be no changes at the A.G.M. This is, indeed, a surprising statement, and it is the first time that I have heard of the result of an A.G.M. being known in advance except when "rigged."

I declined an invitation to attend the annual dinner of the London section, either as a friend or as a Pressman, feeling that it would be ungracious to accept the hospitality of a body with whose policy I disagree. I think Mr. Missen should check his facts before writing imprudent letters, or someone less understanding than myself may take a strong line with him one of these days. It seems a pity that some League officials have cultivated the art of writing offensive letters to those whose view does not coincide with theirs. It is doing the League a lot of harm and it is alienating the sympathies of its friends. For, of course, I have no connection whatever with the ex-honorary secretary, and the side winds which carry information to me with the speed of a bush telegraph blows from a somewhat higher quarter than Disraeli Road. I do not, either, carry the torch for anybody. I am only interested in decent sport, decent sportsmen, and I am interested in the League, not intrigue.

The underground methods which I have so severely criticised in connection with members of the N.C.U. seem to have permeated the League, and I am wondering how many *agents provocateur* are within the League.

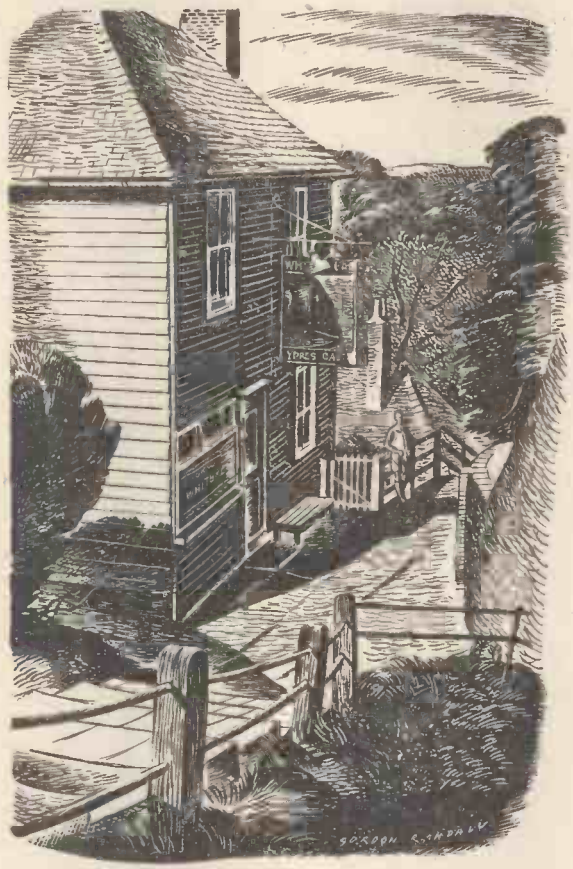
I conducted my plebiscite without reference to any League official, present or past, and was guided in my action purely as a result of a conversation with a Government official.

Mr. Missen, who himself seems anxious to carry a torch, says that the President of the League did not make to Mr. Lintern, of the Ministry of Transport, the statements I have imputed to him. It is significant that no denial has been forthcoming from the President, nor has he replied to my letter inviting him to do so. I therefore am prepared to join him in a visit to Mr. Lintern and his assistant, who was present, when Mr. Lintern will reaffirm that the statements I have reported were made to those two gentlemen by Mr. Durman.

I am sorry to have to report unpleasant facts, but in view of my plebiscite I am concerned to see that the League executive carries out the wishes of its members and that the members are kept informed of what is going on behind the scenes.

Pedestrian Crossings

THE decision of the Minister of Transport to hold a National Pedestrian Crossing week in April draws attention to the need for general consideration as to how the use and observance of these crossings can best be improved. The ideal, as the Royal Society for the Prevention of Accidents points out, is to combine real security for the pedestrian with free-flow of traffic, but it seems to me that these two ideals are unobtainable.



Rye, Sussex. A picturesque little weatherbound inn overlooking the marshes near the Ypres Tower.

At crossings uncontrolled by police or light signals how can drivers anticipate the movement of pedestrians, and how can the latter know when it is really safe to cross? Even at simple light-controlled crossings it is no solution to say that the pedestrian should obey the lights, says the Society, but with them I profoundly disagree. I maintain that pedestrians should be made to conform with traffic lights, and should be considered as vehicles. A man in charge of a car, or a cyclist riding a bicycle, is in exactly the same category as a pedestrian in charge of his legs. All are subject to movement, and to sudden stopping. It is monstrous that jay-walking should be permitted, and that pedestrians should cause so many accidents outside of those in which they are personally involved.

I have seen many accidents caused by careless pedestrians in which the pedestrian escaped scot-free. We only hear of the accidents in which they suffer death or personal injury.

At complicated junctions or where filtration or early release of a stream of traffic takes place the difficulty increases, and only where an all-red phase is possible can the pedestrian be sure of a safe passage as things are at the moment.

The present regulations were described in a recent House of Lords case as ill-drafted and ill-conditioned. With this view I concur. Perhaps those who drafted them listened too much to the bleatings of the Pedestrian's Association, and perhaps just a little too much notice was taken of the cycling organisations, who concocted their own view without reference to their memberships.

It must be borne in mind that cycling organisations represent only a few thousand cyclists out of a total of several millions. They do not represent even that small number in the strict sense of the term because they do not have a referendum of their membership on important topics.

The associations have become proprietorial, and when you join them you have little chance of changing the views of head office. You must become anti-cycle track, anti-rearlight, and anti-motorist-minded. You will be howled down if you dare to suggest that the executives are wrong. Perhaps as a new generation comes along and occupies these executive positions they will cut adrift from the campaign of hatred which has permeated their ill-considered doctrines for so many years.

A good case could be made out for abolishing pedestrian crossings altogether. Few pedestrians use them, preferring to cross the road wherever they may be rather than to look out for one of the permanent memorials erected by Hore-Belisha to himself as a guide to where the crossings are. You will remember that pedestrians have absolute right of way on a pedestrian crossing, and if you knock one of them down on one of those crossings you have no defence—not even that of contributory negligence, a position which should have been challenged years ago. A pedestrian cannot commit an offence on the highway not even of jay walking. Cyclists talk glibly of the lethal machine of the motorist unmindful of the fact that a cycle can also be a lethal weapon. All road users should be brought within the jurisdiction of the Road Traffic Act, and the highway code itself incorporated or abolished, for it has not at present the force of an Act of Parliament.

"The Origin of the Show"

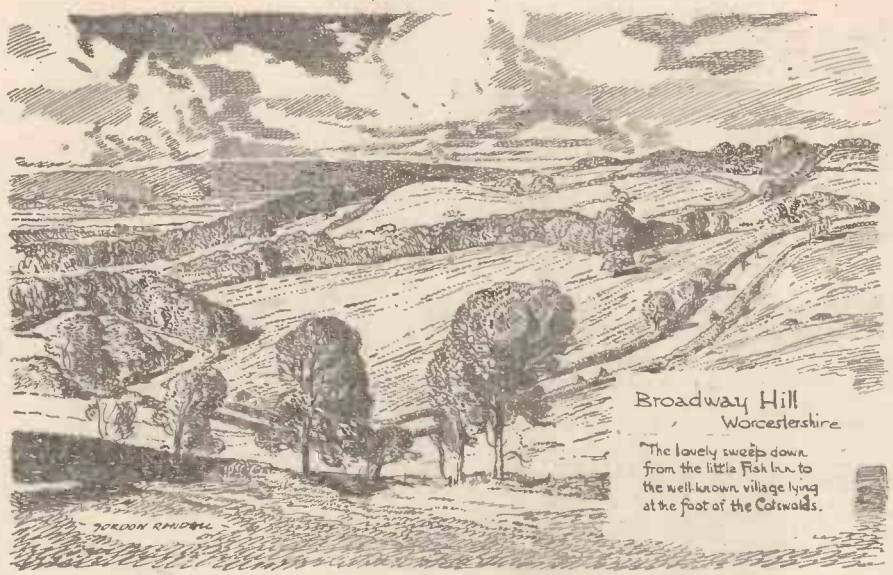
I AM glad to note that several contemporary cycling publications made use of the information recently published in this journal on the origin of the Cycle Show. I went to a considerable amount of research work in connection with this article, and it seems a pity that our contemporaries, in freely helping themselves to my services and my articles in this connection, did not have the courtesy to give a line of acknowledgment.

Safety Cycling for Children

OVER 37,000 children have joined the "Cycling Safety League" promoted by the Royal Society for the Prevention of Accidents since they inaugurated the scheme. Of this number 2,387 have passed the cycling efficiency test. This test was promoted in conjunction with the cycling organisations to combat the heavy road casualty rate among child cyclists, of whom 200 are killed and 7,000 are injured on the roads every year.

Wayside Thoughts

By F. J. URRY



Praise

IT is the time of year when one begins to think about cycling in the terms of high pleasure, of sport along the road, of touring, of the light evening when the glow of spring has lifted earthly beauty to a higher plane, and of all we can do with the summer to come. We do not often give voice to these innate feelings, for I find that so many of my cycling friends are a trifle shy at expressing themselves in terms of joyousness when in non-cycling company, sometimes for fear they may be rebuked for an out-of-date method of travel. That is the way of the world, for it speaks too often in the terms of the latest fashion and all its ostentation, and completely overlooks the valué of simplicity, the very foundation of human happiness. As a matter of fact, cycling will never be out of date, for it is much too marvellous a method of travel to ever lag superfluous. There never has been anything to equal it in the world of simple things, and as far as I can see there never will be. Most riders who read these notes will agree with that dictum; but I would like them to go further than mere agreement—I want them to become articulate advocates of the sport and pastime, to air their views on the subject in any company, positive of the fact that they cannot say anything too complimentary about the game. That may sound a large order, but if you consider your own experiences along the road, analyse them in the terms of complete enjoyment, of exercise, fresh air, health and beauty and freedom, is there anything else can give you such a catalogue of desirable things at one and the same time? I do not think so, and the testing period of 60 years of riding, covering all phases of the game is but a pleasant confirmation of all the theories that moved the early pioneers to proclaim that the great emancipation of the people would be found in the pleasant and serviceable value residing in the possession of a bicycle.

Do Not be Shy

I BELIEVE that sincerely, so do thousands of others. Then let them say so to all and sundry; let us talk intelligently on this subject of cycling, tell of our pleasures along the road, of our fitness, health and the excitements of the chase, where the only assistance you get other than your muscular power is the aid of that miracle of machinery we call a bicycle. And in our moments of tranquility let us tell of the tours we have enjoyed, the adventures that have happened to us, and even of the arduous crossing of the ranges when we have gone delving into the remotest countryside. These things are the very breath of cycling, the good, clean air that blows through us when we remember these things; you and I know how good they are, but thousands of others are ignorant, and do not believe that a bicycle has the magic in its make-up to transmute everyday life into a fairyland open to every roamer. To them, so very many of them, a bicycle is just an implement to accelerate walking, a cheap implement suitable for the working man or woman to increase speed. It is all that, I agree, but how much more? The story of the last four words will never be fully told, but each of us can do something towards the creation of a greater happiness and health in our fellow men by spreading the values we have found and used in this greatest of all pastimes. It seems to me it is our bounden duty to do it even at the risk of being called obsessionists, for the ignorance of the great G.P. on matters of cycling is truly colossal, and in need of teaching. Who better can do this job, and a worthy job, than the men and women who know, who have found happiness. joy, excitement, adventure, health and contentment in the pursuit of the pastime? I have been trying to do it for years, and I want your help, for my belief in the efficacy of cycling grows stronger with the years.

The Lost Legions

EVERY morning of the week as I go to work I think on these things. The cars pass by me in the early miles and often enough I am with them again when the main roads converge and all the goods traffic joins in the parade. I often wonder if the motor vehicle, even as a conserver of time, is not defeating its own ends; but even if that is so the owners would never consent to use their legs for going on their lawful occasions. Why should it be *infra dig.* for a man to propel himself? The question can be posed, but its only real answer is an excuse, palpably thin and hedged about by the pale luminescence of ostentation. The habit has been formed, and there you are, tied to a vehicle that can never keep you healthy or reasonably fit. But my friends in their cars are not the type of people I really feel sorry about; they at least have made a choice and would not alter it. It is the folk who herd at the tram and bus stops, standing in the cold rain with the water dripping from their hats, bored to annoyance when the public vehicle is jammed tightly, and qualifying for a chill. I go serenely by in my macks, loping along at eight to 10 miles an hour, alert, comfortable and completely free from the trammels of a time-table. These folk, especially the younger element among them, I cannot understand, for my own everyday bicycle, plastered with mud over its nether parts but running silkily by reason of its lubrication, just takes me there and home again, and the exercise and the deep breathing in the freshest of the city air, is good for me. Moreover, I am alert, my senses are awake. I know my road and from it obtain the greatest human interest by comparing the citizens who use it. All I lack is the speed of the car—everything else is in my favour; and I have all the speed I need for my journey, and all the freedom from the irritations of the swifter traveller. Small wonder that I remain a utility cyclist, a preface as it were to the pleasant journeys at the week-ends and the touring times.

The Value of Attention

YOU will remember that some little while ago I had something to say regarding the care, and especially the care in adjustment, of hub gears. Since then I have had several communications from users of the four-speed hub acknowledging the information given and saying in a complimentary manner that its application has cured the little troubles they were experiencing. It is a reminder, surely, of the wisdom to carefully read the maker's instructions sent out with the hubs, or to ask for those printed instructions from the dealer if they are not in the saddle bag. It is a pity that some people seem to think machinery needs no attention, and curiously enough that remark applies with full force to bicycles, the neglect of which by their owners is really appalling, and it says much for the modern machine that it stands up so triumphantly to the daily toil without attention. But it should be the duty of all of us who use speed gears—and to-day that is the majority—to give this delicate machinery a modicum of attention in the way of lubrication and correct adjustment. Hours of trouble and disappointment would be saved to owners, dealers and makers, and the matter is so simple that I am frequently amazed that such slight neglect can lead to so much damage. I have seen hubs and derailleurs ruined by careless people who too frequently are prone to blame the maker instead of themselves, and I have heard dealers use terrible language when they have shown me a repair job made necessary by the omission of a little lubricant. I can only repeat that I have six hub gears and two derailleurs in regular use, and one derailleur and two hub gears are of pre-war vintage, and yet apart from oiling and adjustment I've never had the slightest trouble, and I'm still riding 8,000 miles a year. To know something about the machine you ride is to add confidence to your cycling, and that is always worth while.

Part of This Freedom

I RODE home a few nights ago rather late in the evening into the heaviest rain of the winter. The roads were deserted, for it was beyond the time of the traffic pressure, and the reflections of the gold of the street lamps ran down the road in quivering streams as the rain swept the shiny way. It was a trifle eerie, for beyond an odd individual, mainly policemen, here and there, the lights and the distant noise of a train, the world seemed deserted, and the familiar scenes transmuted to a city forsaken. Why are people afraid of the rain? "You are not going to ride home on a bicycle to-night?" queried my friends. They would have persuaded me to wait half an hour for a bus and walk the better part of a mile to join it, and after leaving it. "You'll be drowned," they said. I just slipped into macks, donned an old cap back to front, let the rain beat upon my face, and slid home in complete comfort in less than an hour. In the minds of my friends I was a brave fellow or a foolish one, according to point of view; in my own estimation merely wise to use a form of travel that waits for no man, that gives me exercise and a rhythm of movement that never fails to delight, and lands me on my own doorstep with no more than the toe caps of my shoes dampened. And all for nothing! You add a deeper breath to your body, a tingle to your skin where the rain impinges, and a satisfaction to your mental outlook. I would not give this cycling up for anything in the world, and as for the rain and the wind, what in Heaven's name should we do without them?

Your Own Picture Show

THE other Sunday morning I was out amid our Warwickshire lanes looking at a countryside aglow with sunshine. It was one of those days of early winter that bejewel the land and all that grows thereon, when every tiny pool and stream is transmuted to gold and every tree radiated with the splendour of light. The wind was warm, the ways almost dry, and I went bowling along with a song in my heart which came bubbling forth once the inhabited area had been left behind. This was the kind of day a cyclist can steal from the gloomy season, can steal it on the instant as it were, and almost wonder at his temerity. Near Temple Balsall is a beech hedge that holds its bronze beauty until the young buds unship the golden flags of its leaves, and with the sun full on it and the stream beyond, 'twas a picture to make a man gasp. Hard by the little pool was alive with coots that cut a hurried wake for the rushes when I leaned over the railings to watch the sun stab golden daggers through the rifts in the solemn pines. There were still a few leaves aflutter on the oaks, hanging by a hair's thread which another storm would break; and the old track running through the wood was a carpet of colour no human artifice could match. It was really good to be alive, to take it all in and revel in it; and finally to wonder how severe would be my limitations if I were not a cyclist. For no other form of travel could have given me three such charming hours of intimacy with the day and the way. A car would have been far too urgent, and walking much too slow; here was the intermediate that will never fail a man who loves the country, but leave with him the glow of health and mental comfort that makes of the world a better place than seemed possible yesterday.

Chancy Weather

SPRING is round the corner, and that is a happy thought whatever may be awaiting us before its advent. In mid-December the birds were singing to me in the mornings and the sticky buds on the chestnut trees were showing a delicate tint; it almost seemed then as if winter had forgotten to arrive. But there were storms, fierce little gales that sprang from nowhere and had you almost wet through before you could climb into a cape, and then having done so a glint of watery sunshine smiled and challenged you to pack the wretched things into the bag and go on your way rejoicing. And if you accepted the challenge, ten to one you regretted it inside a quarter of an hour, and were fumbling for protection again. Far better to carry the cape on the bar when such weather comes sweeping in from the south-west, flutters the clouds into flying storms and laughs as it passes over. Such a mixture of the elements may keep you guessing most of the day, but it's a good deal more pleasant than the steady downpour and the hard air of an east wind. To be out and about in such weather gives the wanderer some wonderful visions, long visions running to wide horizons, beyond which, as always, the most delectable valleys lie, where we imagine it is always spring and the best and oldest inns in the world are waiting to welcome us. As a fact it is, of course, the projection of the thought in mind that a few more weeks and, what a metamorphosis, the almond will fly its flag of pink, and the blackthorn remember another March is nearly here. These simple things make up the quiet joy of cycling, and they are very precious.

CYCLORAMA

By H. W. ELEY

Educating the Young

I FANCY that most national advertisers are alive to the advantages of educating the rising generation to a knowledge and appreciation of their wares and products, but not all of them exploit ideas to the best advantage. I have just seen a little booklet issued by the Dunlop Company, written, obviously, for the "very young." It tells, in simple but arresting language, the story of John Boyd Dunlop's son "Johnny" and his tricycle, and the boy's father's ever-memorable experiments which led to the manufacture of the famous pneumatic tyre. The booklet is illustrated, and I understand that it is being issued to schools. A very sound idea . . . it is important that the coming generation should know something of the romance and origin of our manufactures and of the beginnings of great industries.

"February Filldyke"

THE old country name for the second month of the year comes back to me as I think of gurgling brooks and squelching lawns, and the drip of rain from the trees in my favourite wood. A goodly month, this February, I always think—and rain should never deter the ardent cyclist from a ride out into the countryside where each month in turn Mother Nature unfolds some of her glories and gives us glimpses of the beauty to come. My somewhat tattered note-books remind me that in years gone by I have had some really entrancing tours in February. I turn over the leaves as I sit by my fireside and recall a long ride through Central Wales when the February rains teemed down in the Elan Valley and I sought shelter, one squally night, in a cottage not far from Llanidloes in fair Montgomeryshire. There is an entry in my note-book which tells me that "I found it all most enjoyable, and the rain a wondrous tonic and refreshment to my tired mind and body." I was much younger when I wrote that note . . . but I still feel that rain is refreshing, and I still love the feel of it upon my cheeks as I ride down some English lane . . . or Welsh lane, too, for that matter. . . .

The Oldest Cycle Dealer is Shy!

IN a recent article, you may remember, I invited correspondence from the oldest cycle dealer in the country, fondly believing that I should have quite a big "mail"—and that I should glean some really interesting information about the early days of cycle dealing and repairing. Alas! to date I have not received one solitary letter! I am mortified. I yearn for a letter from some revered dealer whose business was established in the days when the Hyde free-wheel was unknown and when rude small boys, seeing one cycle down the street, would yell out "Hi! Mister! Your wheels are going round." It was the super-joke of the street-urchins of the period. Maybe this lament will induce *one* dealer at any rate to write me about his early experiences.

Time Well Spent

YES!—when it is an hour or so spent on giving the old bike an overhaul—making everything O.K. for the times when the rains will come and the roads be muddy. I hate a mount that is not really weather-proof, and I commend a bit of overhauling to any rider who, loving the roads in winter, wants to be sure that tyres are in sound condition, nuts tight, and all in order for the rides when the winds blow and the rain beats down, and the smooth, dry track of summer days has become the rutted route of the winter ride. Go to it!

The Gentle Art of Selling

IT is always rather a puzzle to me why so many cycle dealers do not make the most of opportunities of salesmanship. I often go into dealers' shops, and a customer comes in . . . asks for some trifling "gadget"—say a tube of solution, a pair of handlebar grips or an outfit—and the dealer, with shelves quite well stocked with other and more highly-prized goods, never seems to dream of *suggesting* another need or requirement. Now, it is easy to hand over just what the customer asks for; but growing businesses are not built up by just that amount of effort. There should be an *effort* to sell something additional. I have frequently heard this theory expounded at sales conferences of manufacturers by experts in the art of selling, and I do think that there is much in the idea for the individual retailer. Why not think it over?

February Nature-note

NOT yet is the sun really warm on the back as one rides out into the countryside, but, nevertheless, there are welcome little signs of spring. The gurgling rain in the ditches is the magic which will make a million little plants shoot out their greenery; and in the big meadow, where the red-and-white cows graze so placidly in the lush grass, there are one or two coltsfoot blossoms to herald the springtime—when the cowslips will deck the fields and the violets be found, shy and modest, in the bank of the tangled lane. And . . . do not let us forget that February is the month of good Saint Valentine—the patron saint of all lovers. And February is the month when whips and tops emerge from their winter hiding and boys again begin to play the ancient and honourable game of marbles. Above all, February is the prelude to the real spring. . . . the time of the singing birds and of flowerets in field and hedgerow.

Christmas Cards

CHRISTMAS brought me a shoal of cards from friends in the cycle and kindred businesses, and these reminders of long friendships were very welcome. Good to hear from old friends like D. D. MacLachlan of Hercules, Brealey of the B.S.A. Company, Harold Goodman of Avon Tyres . . . these good men I have known this long number of years, and I treasure their greetings at Yuletide. Ours is a friendly business . . . which, maybe, accounts for much of its success! And . . . thinking of Christmas . . . I loved to see the hard frost over the countryside in Essex where I spent the holiday; as the old stockman from the farm said to me, "Seasonable weather, sir!" Yes . . . and that frost will work its magic in the good Essex soil and benefit the crops of spring and summer.

Dover's Ancient Lighthouse

THE oldest building in Dover and, it is said, the oldest standing erect in England, is the Pharos, at the end of St. Mary's church, within the castle precincts. It is generally accepted as having been a lighthouse in Roman times, and although less than 40ft. high to-day it was originally much higher. Experts regard it as having been built about the year A.D. 46. It is of octagonal shape yet square inside. St. Mary's church (St. Mary in Castro) is a very old building. At one time it was said to be Roman but later theories go to prove that it is of much later period, although much of the material is Roman. There are many other points of interest within the castle and it will be seen that the walls of the Norman Keep are 20ft. thick. Queen Elizabeth's Pocket Pistol, a 24ft. bronze cannon, was presented to her Majesty by the Dutch States.

Gateway to Dartmoor

DOVER is not the only place to which one can apply the word "gateway," and I often think that Moreton Hampstead in Devon is the real gateway to Dartmoor. The moor has really few approaches, so that any town on its fringe can be so regarded. Moreton always seems to be a delightful place in which to stay a night. Although tiny and with not many attractions, there are some good hotels and, what is more, Dartmoor is within a hop, skip and a jump on the following morning. No tourist, however, will go away without seeing the very fine row of almshouses in the main street, in fact he will be quite unable to miss them, they constitute the most attractive feature of the whole town.

Cycling Literature

Some Interesting Books for the Collector

By R. L. JEFFERSON

SINCE last writing on the subject of cycling literature over eight years ago much additional material has turned up. A complete bibliography of cycling literature is badly needed, and I have set myself the task of compiling this. The number of books that are not in the C.T.C. Jubilee volume is now quite large.

For years now I have haunted book and junk shops and badgered all and sundry for cycling books, and results have been quite good. The only way to get a really good collection together is to keep pegging away.

"The Green Bicycle Case"

Coming now to the titles, my first find was "The Green Bicycle Case" by H. R. Wakefield; first published in 1930 the book is a factual account of the trial and acquittal of Ronald Light. The case created almost as great a sensation as the Ronald True affair; the late Sir Edward Marshall Hall won a notable victory in his case for the defence. A green B.S.A. bicycle figures prominently throughout the case. Bella Wright was murdered by being shot through the head with a Service revolver. Light threw his bicycle and Service revolver in a canal, and he had been seen in her company only one half hour before the crime. The bullets found in the canal were the same calibre as the one that killed Bella Wright. Light also admitted it was his bicycle, and he had been seen on it in company with Miss Wright. The evidence for the prosecution was entirely circumstantial, and Light was set free. The book, which is illustrated with photographs of the accused, the victim and the rival counsel, is now out of print, but is well worth searching for.

"Bates and His Bicycle" carries a sub-title, the record of an interrupted cruise upon wheels, with disquisitions on cycling, photography, dogs, love and other delights; a highly amusing book published in 1898.

"Dusty Diamonds"

R. M. Ballantyne was the author of a great number of books, mostly highly coloured adventures. His "Dusty Diamonds" contains a chapter on the perils of scorching on Ordinaries; the frontispiece has an excellent steel engraving of a rider "going over the top" in a really classic pile-up. The book was published in 1883; as it ran into over eight thousand copies it should be possible, with diligence, to find one.

The author of "Three Men in a Boat" wrote one of the funniest books on cycling in "Three Men on the Bummel." This book has been long out of print but is still fairly easily picked up.

Arthur Sketchley was much admired for his series of books dealing with the adventures of a certain Mrs. Brown. The one for the cyclist is "Mrs. Brown's Visit To Paris"; the book has a pictorial cover in colour depicting Mrs. Brown riding an early lever-drive tricycle.

In the Punch library of humour appears "Mr. Punch Awheel." The editor of the series remarks: "designed to provide in a series of volumes each complete in itself the cream of our national humour." The book in question certainly does this, and the humour is, of course, somewhat dated by now; it was published about 1905.

There have been a great many books published on cycle repairing. I possess most of them, and it was therefore with considerable interest that I found one I had not heard of before. This is "Practical Cycle Repairing," reprinted from the journal "Ironmongery," published in 1899. The book deals with the overhaul and repair of cycles of that period.

American Books

Four American books are worthy of mention. The late "Major" Taylor wrote one called "The Fastest Bicycle Rider in the World." Whilst not in agreement with the author's choice of title, I found the contents most interesting; the personalities he raced against were certainly colourful, and not always scrupulous.

"Fifty Years of Schwinn-built Bicycles" is the history of a firm whom I think have done more for the sport in America than any other. The book is a very fine publication, illustrated in colour, and it contains several pictures of Letourner, the man who clocked over 108 m.p.h. for the measured mile; his gear was 252, and he was paced by a Studebaker car.

"Wheels in His Head" is the story of A. J. Musselman by his son, "M. M." The father was the reputed inventor of the coaster brake, and, among other things, he made a contraption called Rock-a-Baby which electrified a whole town and nearly electrocuted his own baby; incidently, he is also credited with the low-pressure aeroplane tyre.

"Cycling Handbook" is published by the League of American Wheelmen. I have loaned this book to a number of friends and all have expressed surprise at the contents; they had no idea that the Americans took cycling so seriously.

I have enumerated just a few of my additional finds and hope that they will whet the appetite of other collectors to keep pegging away. I understand that Icarus did not have a very good response to his appeal in THE CYCLIST for suggestions on forming a collectors' club. This is a pity, as all of us can gain in knowledge by the swapping of ideas. Before me as I write is a long-sought book containing a chapter on cycling; the description of a hobby-horse antedates the 1820 Draisnene by no less than fifty years. What is even more remarkable is that the actual machine is reputed to be still in existence. Its discovery would be a sensation indeed, but that's another story.

Paragrams

(*Continued from page 34*).

Busy Hooligans

LOCAL hooligans, with an urge for destruction, are blamed for a fire which has caused considerable damage to an old North Lincolnshire landmark. It is Maw's windmill, which stands on a hill at Epworth. The fire destroyed the first and second floors of the mill and added very considerably to its state of dilapidation. It is a number of years since the mill was in use.

Speedway Cyclists

THE Council of the London borough of Tottenham have agreed to allow a number of boy cyclists to use a piece of waste ground as a speedway track on condition that spectators are admitted free of charge and that there is no gambling of any kind. The land is on the edge of Tottenham Marshes and will be a better track for the boys than the bombed sites which they have been using for some months past.

Give Helping Hand

AT the silver jubilee dinner and prize distribution of the Grantham Road Club, held at the Angel Hotel, Grantham, the Mayor of Grantham, Coun. G. E. Mills, said it was up to members of registered clubs to set a good example for other younger cyclists by always riding roadworthy machines and training their younger and less-experienced colleagues in road sense. The club president, Mr. F. Bates, referred in a short speech to the fact that their membership had risen to the record figure of 104. Further progress is hoped for in the coming months.

Come On, Girls!

FIGURES for the first year of proficiency cycling tests for schoolchildren in Leicester show that out of 73 boy entrants, 68 passed and obtained their proficiency certificates. Strange to say not one girl has ever entered for the tests. There are schoolgirl cyclists in Leicester, but perhaps they are supremely confident of their skill on the roads and do not feel the need for tests. In this age, it surely cannot be that they are shy.

Death to Rust

A GERMAN professor working in Sweden claims to have produced a chemical, which he calls "corrosan," which will make a rusty piece of iron or steel completely free from rust within a few hours. The treatment does not damage the metal in any way and can be used in a spray to cover large surfaces. But unfortunately the day has not yet come when "corrosan" is available to we all-weather cyclists who, to our shame, have a habit of neglecting rust spots!

Hitching Post

HOLYWELL CROSS, Chesterfield, had quite a Wild Western appearance the other day when some ingenious person used one of the "No Waiting" signs as a hitching post for a donkey. The donkey stood patiently waiting while its owner was away on some important business, and the local constabulary kept themselves well in the background. The sight of a policeman trying to move on an obstinate donkey might probably have made the Law a laughing stock in the eyes of the local citizens.

Accidents or Antiques?

"IT is nice to know that 'Ye Olde Towne' of St. Ives is waking up at last," commented a member of the local Trades Council during a discussion on the recently formed Road Safety Committee for St. Ives, Hunts. He went on to add: "I hope our representative suggests that they do away with that old bridge." This excited the chairman, who retorted: "You can't do away with that. It's historic!" He was told that the bridge may be historic, but it is awkward and very dangerous both for pedestrians and traffic.

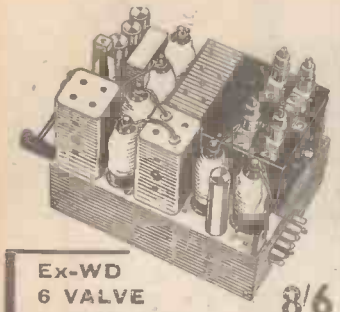
Those Officials

SPEAKERS at a meeting of Daventry and District Road Safety Committee commented rather acidly on the fact that the Ministry of Transport has asked committees to intensify general measures for securing road safety. The secretary said the area had no pedestrian crossings and the Town Council had just rejected the committee's recommendation that crossings should be laid down, so he considered the Ministry's appeal rather ironical.

New Club Magazine

THE Falcon Road Club, Loughborough, has just produced the first number of its new magazine of club activities, "The Last Mile," and copies were presented to members and their friends at the club's first annual dinner. Good progress has been made by the club since its formation 12 months ago, and further ideas are simmering to secure increased membership.

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



Ex-WD 6 VALVE SUPERHET 8/6

Complete, less valves and crystal. Can be adapted for 4-station push-button Receiver, or Car Radio. Above set can be supplied with valves. Post free. Data Book 1/6 extra. Plus 1/6 postage 32/-

TRIPODS. 3ft. high erected. Brass thread and cap, web sling. Wood or metal. Reduced price. 8/6

★ BARGAIN PARCEL

for the Model Maker!

definitely for this month only!

Consisting of the following items:
1 Solid Brass Liquid Pump
1 Sealed Thermostatic Switch
3 Assorted Relays (Magnetic)
3 Assorted Switches
1 Pr. Binocular Type Prisms
3 Gross Model Maker's Nuts, Bolts & Washers. Post Free

19/- ONLY

EX-RAF CLOCK UNIT

This set can be modified for use as Clock or automatic timing device. Packed in CASKET of strong bakelite or solid oak with sponge padding. Size of actual motor—diameter 3¼in. x 1in. deep. Casket 6in. x 6in. x 5in.

12/6 *Post Free*

NO C.O.D. UNDER £1. Write **(Dept. K)**

INSTRUMENT CO.
244, HARROW ROAD, LONDON, W.2

ADANA PRINTING MACHINES

Print in the odd hours with an Adana—still the most absorbing of crafts. **No. 1 H/S Machine £4.10.0. No. 2 H/S Machine £9.15.0. Will pay** for itself in a month or two. Send for illustrated folder to Dept. P.M. 19.

Adana (Printing Machines), Ltd.
15/18, Church St., Twickenham, Mdx.

TECHNICAL TRAINING

The Institute of Practical Radio Engineers have available Home Study Courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade. Enrolments limited. Fees moderate. The Syllabus of Instructional Text may be obtained, post free, from the **Secretary, I.P.R.E., Fairfield House, 20, Fairfield Road, Crouch End, London, N.8.**

"PIGMY"

GAUGE "00" 6 to 12 volt Permanent Magnet (Tunnel Type) Motors, fitted with 30 to 1 worm gear, reversible, 39/6. Permanent Magnets "00," 7/6. Armature 3-pole stampings, ¼in. diam., 2/6 per set. Worm Gears, 10-1, 5/9. 40-1, 5/9. 10-1 in case, 8/-. Ex-Govt. Motors. A.C./D.C., 12/24 v., 3¼in. x 2¼in., 15/-. Stamp Leaflet (write plainly). Satisfaction guaranteed. **E. M. Co., 120, Torrington Avenue, Coventry.**

Electric bed warmer. Warms the whole bed evenly, Safe, healthy, luxurious. 17/6 inc. tax. "Reveille" Clock-Radio. "Wake the Easy Way," £12/12/0, plus tax.

Battery Charger, 2-12 volts 1 amp., with ammeter, 37/-.

Valves, 807, 10/-; 12SJ7, 5/6; V960 rect. (2,500 volts 60 mA.), 5/-. Thermocouple meters, 350 mA., 5/-.

Thames Valley Products, 28, Camden Avenue, Feltham.

TRANSFORMERS

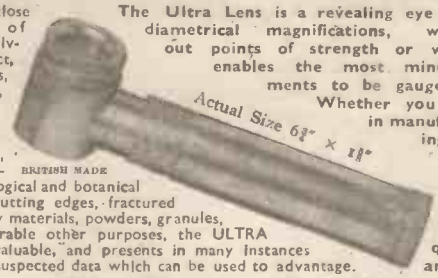
Thompson Transformers of various outputs to suit your requirements. Special Sizes for Trains and Motors.
12 v. or 20 v. 1½ amps. 20/-
12 v. or 20 v. 2½ amps. 25/-
6 v. 7 amp. Ground Heater ... 25/-
Step-up or Down 60 watts ... 21/-
Rectifiers from 12/6.

Stamp for List and quotation.

T. W. THOMPSON & CO., 176, Greenwich High Road, Greenwich, S.E.10.

NO MAN CAN KNOW TOO MUCH OF HIS PRODUCT

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



The Ultra Lens is a revealing eye of six actual diametrical magnifications, which brings out points of strength or weakness, and enables the most minute measurements to be gauged accurately. Whether you are engaged in manufacturing, buying or selling, it is an ally of real value. No instrument you can buy will more quickly justify and pay for itself.

FULL PARTICULARS ON REQUEST

THE ULTRA LENS COMPANY,
75, Finsbury Court, Finsbury Pavement, London, E.C.2.

MODEL ENGINEERS

FOR THE TURNER:

Lathes, 3¾ and 4½ S.S. Bench Millers. Drilling Machines. Hand Bench Shaping Machines.

FOR THE WOODWORKER:

Wood Turning Lathes, 2½" and 5½" centres. 4in. Planers. Saw Benches. Sanders. Spindle Moulders.

Pedestal Jig and Fret Saws.

Perspex — All sizes and colours in stock.

NUTTALL'S (LATHES) LIMITED,
MANSFIELD, NOTTS.

BOOKS:

ABC's L.M.R., W.R., E.R., S.R., each	2/-
"Stanier Pacifics of L.M.S." ...	3/6
"British Pass. Locos."	3/-
"Canals"	3/6
"Three Rail Control"	4/6
"How to Build Good 00 Loco." ...	5/6
"Min. Building Construction" ...	3/6
"Rly. Modelling in Miniature" ...	10/6

Sample L.M.S. or G.W.R. Train Postcard & List 7d.

USEFUL PARTS	00	0
1 Round Spring Buffers ...	7d.	9d.
Disc Wheels (Pr. on Axle.) ...	9d.	1/9
Teleg. Poles per ½ doz. ...	2/-	—
Scale Station Figures	4d.	7½d.
Ex-R.A.F. 16-Switch Panels	NOW 2/6	
Min. Pea Lamps on Base, 2.5v. ...		6d.

Postage extra. "55" or "0" Parts List 3d. per post.

TYLDESLEY & HOLBROOK (M.E.T.A.)
109, DEANSGATE, MANCHESTER, 3

I WILL MAKE YOU A BRILLIANT PIANIST

I do not say I may, but I say positively that I WILL, if I accept you as my pupil. My class is seldom less than 2,000 pupils. I have taught over 77,000, of all ages, occupations and degrees of proficiency, to play the piano brilliantly. I **CAN TEACH YOU,** even if to-day you do not know a note, to read and play at sight any standard musical composition. I grade lessons personally to suit your individual needs, using ordinary musical notation, no freakish methods. SEND P.C. for free book and advice. Say Moderate, Elementary or Beginner.

Mr. H. BECKER, (Dept. 858), 69 Fleet Street, London.

CRAFTSMEN'S AIDS

(Known and used from John o' Groats to Singapore)

Fast clean cutting of plastics (and wood to 5/8in.) is now possible with an easily constructed miniature **CIRCULAR SAW** bench. Clear drawings and instructions, 3/6.
Other sets at 2/6, (1) **JOINTER** and **SHAPER,** (2) **SANDER** and **POLISHER,** (3) Heavy-duty **FOOT MOTOR.** All four sets, 10/-.
Also stocked, limited quantity "Speedicut" circular saw blades for wood and perspex. 6in. x 1in. hole, 22/7, post 1/-. 3in. x 5/16in. hole (for min. bench), 9/3, post 8d.
6in. Polishing Mops, 6/8, post 6d.
"White Gloss" Polishing Compound, 2/6 per 1½lb. bar, post 9d.
"Be Clever With Plastics" (C. W. Read), fully illustrated, 2/6, by post 2/8½.
Full Refund if Dissatisfied.

T. SINCLAIR,
5, BUSS CRAIG ROAD, EYEMOUTH BERWICKSHIRE

GENUINE BARGAIN SALE

New, perfect goods only: Collaro A.C. var. spd. gram. motors with 12in. t.t., £5; ditto, with pick-up and autostop, £8/19/6. Plessey Mixed A.C. Autochangers, w. pick-up, £18. 4-watt A.C. amplifiers, feedback, tone control, gram. and tuner inputs, £5/19/6. Complete All-dry Battery Superhet Kits, L., M. and S. wave, less cabinet, £7/15/-. Exhaustive instructional manual enabling even beginners to build a 5-valve 3-wave superhet of exceptional power and range, A.C. or Universal model, 5/-. New valves, 8/-, 22/6 for 3: EF39, EF36, EL32, 6K8, 6K7, 6Q7, 6V6, 524, 6SN7, 6J7, KT33C, MU14, 5U4, FW4/500, EF50. Bargain List, 2½d. C.W.O. or C.O.D. **N. R. S., 102, Parkhill Rd., London, N.W.3. GULliver 1453.**

RATCHET & REVOLUTION COUNTERS

Ask for Leaflet No. 18/5

Speed up to 6,000 r.p.m.
B. & F. CARTER & Co., Ltd., Bolton 5

NICKEL PLATING

Complete Equipment, including Nickel Anode, Plating Salt, etc. Full instructions for Plating Ornaments, Car Fittings, and all Metal Parts. Flash-lamp battery only required.

Price 15/-, post free.

HOLBOROW & CO., 71, Weymouth Bay Avenue, Weymouth.

For your Bungalow, Caravan Workshop or Radio
BUILD YOUR OWN
WIND-CHARGER

with (1) Slow running Propeller,
(2) Geared 3½ to 1 Shaft Drive to
(3) Car dynamo at ground level.

Every part accessible. NO sliding contacts or excessive top weight. Ample speed for ANY Car dynamo. SET OF CLEAR DIAGRAMS AND INSTRUCTIONS for building same complete from easily and readily obtainable parts ONLY. PRICE 3/6.

P. M. BARHAM
BRIDGE AVENUE
ST. SAMPSONS
GUERNSEY, C.I.

SPARK'S DATA SHEETS

Provide detailed Instructions with Clear, Full-size Constructional Prints of Tested and Guaranteed Designs.

THE "POCKET PAK." All-dry Pocket 1-valver. Self-contained med. wave aerial. Good 'phone sigs. on 'local' stations. Greater range with rod aerial. Size 7x3¾x1¼in., 2/9.

THE "CONQUEST." An Efficient **A.C./D.C. ALL-WAVE SUPERHET.** Five Valves, 3 Wave Bands. A.V.C. 4 Watts Output. P.U. Connections 2/9

RADIO UNIT TWO. H.F. Plus Detector Batt. operation, M/L waves. For use in front of an amplifier 2/9

THE "JUNIOR." A fine little 1-valver for use with short aerial. M/L waves. All-dry Batts. Good 'phone sigs. 2/6

THE "CRUISER" All-dry T.R.F. 3-Valver for use with short aerial, 2/6

THE "CUB." A.C./D.C. 2-Valver Plus Rect. Fine results on M/L waves. 2/6

THE "CADET." A.C./D.C. 4 Watt Amplifier. 2 Valves, plus Rect. ... 2/6

THE "OLD FOLK'S TWO." An A.C./D.C. 2-Valver, plus Rect., having Station Selection by Switch. ... 2/9

THE "CHALLENGER." An Outstanding A.C./D.C. Portable for use in any room without aerial or earth; 3-Valve T.R.F. circuit, plus Rect. 2/9

A.C. TWO-VALVER (Plus Rect.), M/L Waves. Fine Power and Tone. 2/6

A.C. THREE-VALVER (Plus Rect.), T.R.F. Circuit. M/L Waves... ... 2/9

A.C. SUPERHET. 3 Valves plus Rect. All-wave. 4 Watts Output. 2/6

A.C. 8 WATT QUALITY RADIOGRAM. A.C. M/waves only. Quality rather than range. P.P. Neg. F/Bk. 3/6

BATTERY ALL-DRY PORTABLES. Tiny Two. Med. waves. Local Station on 2½in. Speaker. 2/6

THREE-VALVE PORTABLE. M/L Waves. A very popular set ... 2/6

THE PORTABLE FOUR. Med. waves only. T.R.F. Circuit ... 2/6

MANY OTHER DESIGNS. Stamp for List and with order. Components supplied.

L. ORMOND SPARKS (M),
9, Phoebeth Road, Brockley, S.E.4
(Nearest Station: Ladywell S.R.)
('Phone: Lee Green 0220.)

WEBLEY AIR PISTOLS

Marvellously accurate for target practice.

No licence required to purchase.

Senior Mark I
Junior Webley Air Rifle

Write for List. WEBLEY & SCOTT LTD., 106, Weaman Street, Birmingham, Eng.

INSULATED COPPER WIRE.

Enamel, silk or cotton covered, all gauges 13 S.W.G. to 44 S.W.G. Leatheroid insulation, Empire cloth, armature sleeving, commutators, etc.

SPECIAL OFFER.—A.C. Single Phase Electric Motors. All new. ¼ h.p. £5. ½ h.p. £6 10s. ¾ h.p. £7 12s.

Send S.A.E. for List.

L. C. NORTHALL, 16, Holly Road, Quinton, Birmingham, 32.
'Phone: WOO 3166.

ALUMINIUM?

S.A.E. for LEAFLET.

No order is too small—so don't be shy!

BULLANCO,
66, Queen's Road, S.E.15.
(New X 1092)

CATALIN

Large stocks of the wonder cast resin. Profiles, rods, sheets, cylinders, etc., in glorious colours. Worked as easily as wood. S.A.E. Lists.
Table Lamp Parcel, 9/-, post free.

TOWN BOOK SHOP ENFIELD, MIDDX.
ENF. 4943

Try our plastic glue. Sticks anything. Heatproof. 3/6, post free.
Really large Perspex offcuts, 5/4 per lb.

SILVER PLATING SETS

as supplied to Electroplaters, but in miniature, for parts, etc., instructive small sets, 22/- inc. post. Send 3d. stamp for printed folder. A profitable hobby, materials the standard Cyanide type for use with low v. electric current. Suitable for silvering motor headlamp reflectors, model parts, and radio components.

ARGENTA PRODUCTS (Dept. C), 40, Harrogate Road, LONDON, E.9.

Free Guide – "Success in Engineering"

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

ENGINEERING, AERO, ETC.

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

GENERAL

Matriculation—College of Preceptors—Chartered Institute of Secretaries—Aircraft Apprentice.

MUNICIPAL SERVICE

School Attendance Officer—Handicraft Teacher—Registrar—Housing Manager—Sanitary Inspector—Weights and Measures Inspector—Inst. of Mun. and Cy. Engineers—A.R.I.C.S.

"PRACTICAL ENGINEERING" said—

We recommend all readers interested in improving their position to apply for a copy of this valuable book. "Success in Engineering" is not a pamphlet. It is a 132-page book, containing valuable and vital information on all branches of engineering. . . . There are many engaged in engineering who owe their success to The National Institute of Engineering.

The FREE GUIDE explains:

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

Write now for your copy of this remarkable publication.

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

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

THE BUILDING BOOM— SECURE YOUR SHARE!

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

BECOME A DRAUGHTSMAN QUALIFY AT HOME AND EARN BIG MONEY

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

NATIONAL INSTITUTE OF ENGINEERING

(Dept. 29)

148, HOLBORN, LONDON, E.C.1

●

OVER SIXTY YEARS OF CONTINUOUS SUCCESS

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

FOUNDED 1885—FOREMOST TODAY—OVER 100,000 SUCCESSES

THE ACID TEST OF TUTORIAL EFFICIENCY

SUCCESS—OR NO FEE

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

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

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

PROMPT TUTORIAL SERVICE GUARANTEED

FREE COUPON

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

Please Forward your Free Guide to

NAME.....

ADDRESS.....

.....

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

The subject or examination in which I am especially interested is

.....

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