A VERTICAL ENLARGER

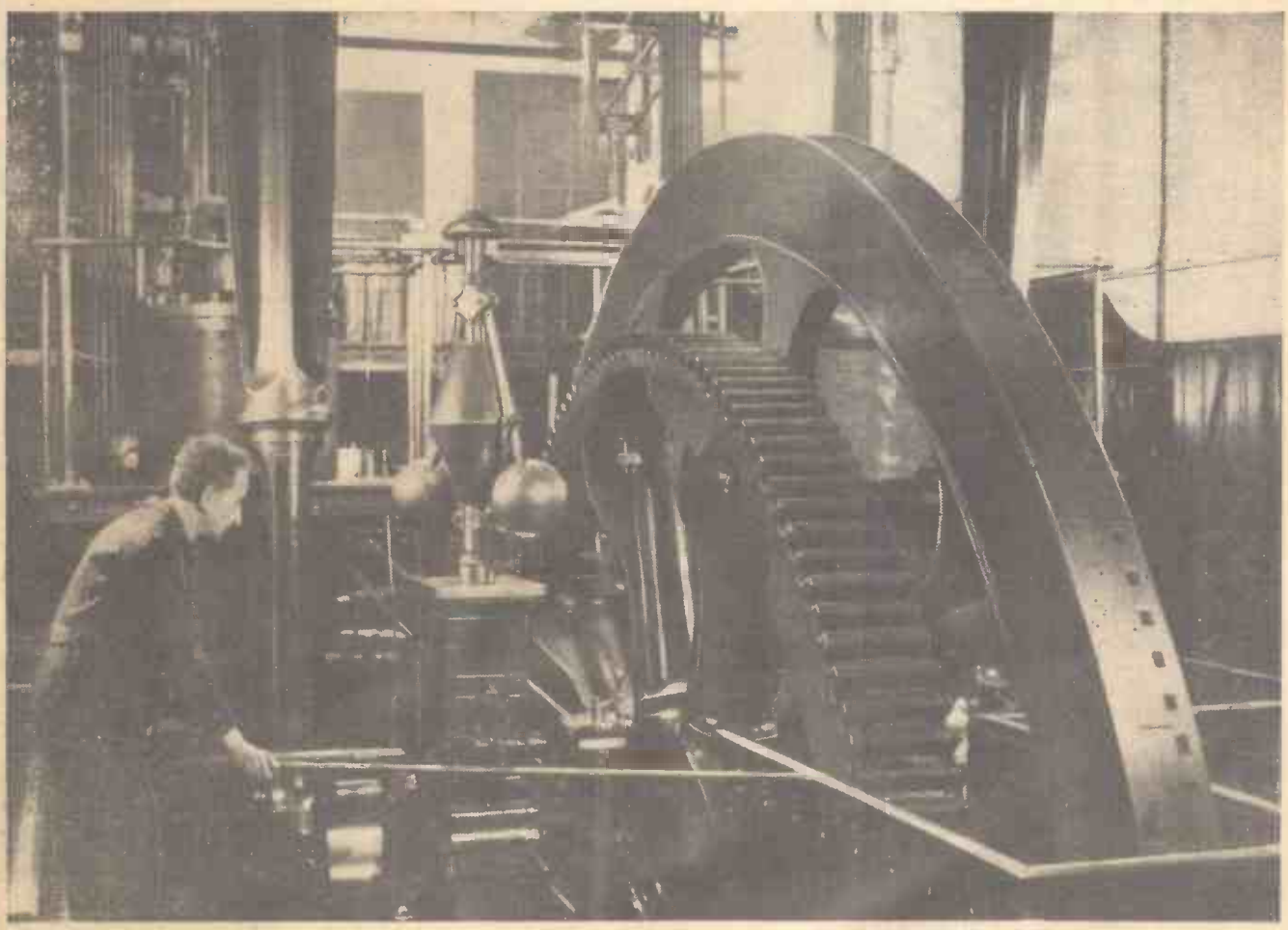
NEWNES

PRACTICAL MECHANICS

9D.

EDITOR: F. J. CAMM

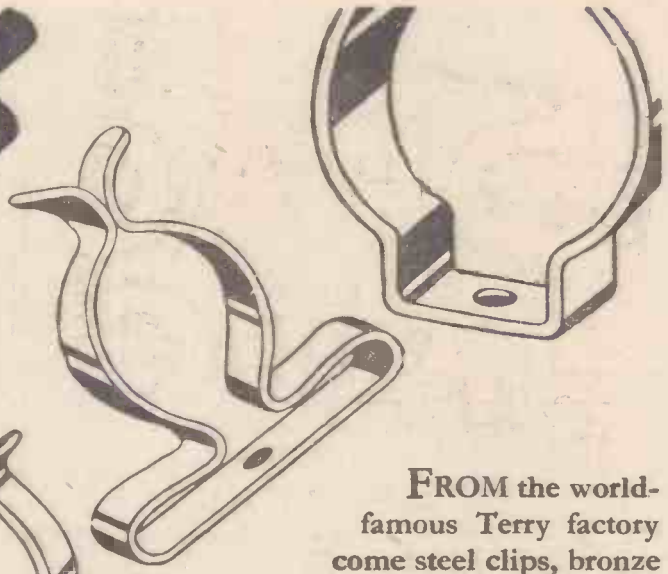
MARCH 1947



THIS TWIN-BEAM ENGINE, BUILT IN 1861, STILL PROVIDES POWER FOR A LARGE FACTORY. (See page 211)

PRINCIPAL CONTENTS

CLIPS
CLIPS
CLIPS
CLIPS



FROM the world-famous Terry factory come steel clips, bronze clips, stainless clips, big clips, little clips, wide clips, narrow clips — in fact clips in every conceivable shape and size.

Illustrated here are two of our stock patterns, 80 and 81, made in a range of sizes to grip from ¼ in. to 1½ in.

Maybe a clip of special shape would be necessary for the job you have in mind. Well, we can help you because we make clips for hundreds of uses. We can make to print or specification, or our Research Department will design for you.

Our knowledge of clips has advanced side by side with our 91 years' spring-making experience.

Sole Makers: **HERBERT TERRY & SONS LTD., REDDITCH**
LONDON *MANCHESTER* *BIRMINGHAM*

CLIPS
by TERRY SPRINGS

Established 1855

★ *and just a few special shapes we have made to order.*

T.C.4

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. XIV MARCH, 1947 No. 162

FAIR COMMENT — BY THE EDITOR

The Engineering Advisory Council

THE Minister of Supply recently announced the appointment of an Engineering Advisory Council to provide a means of consultation with employers and workers in the industry on matters of general concern. Matters normally handled by the Joint Organisation of Employers and Trade Unions in connection with wages and conditions of employment are excluded.

The Engineering Industries for this purpose will comprise mechanical, electrical and radio engineering, but not shipbuilding or the iron and steel industries, which fall within the purview of the Iron and Steel Board.

The Council will consist of equal numbers of Trade Union and Employer members with the Minister as chairman.

It is hoped that the Council will provide regular machinery for consultation with a wide cross-section of the leaders of the engineering industry on both sides; those who can speak with authority and who between them represent the views of at least the main groups.

There will naturally be speculation as to the subjects which this new body will discuss. There will certainly be no lack of material. One subject of great concern to the engineering industry is the shortages of certain raw materials such as steel. Employers and workers are very concerned as to how supplies are allotted. The Council will serve as a two-way channel for the exchange of views and of information between the Government and industry, and it is hoped that it will lead to a clearer appreciation by the Government and of the industry of their respective problems.

It is difficult to see, however, what this new Council will perform which could not be even more satisfactorily performed by existing organisations. If the Government wishes to know anything about industry it has the Trade Unions, the Masters Federations, the learned societies, the Joint Production Committees, and it has also that valuable source of information, the technical press, which fairly reflects the views of all sides of a problem.

In a multitude of counsellors there is not necessarily wisdom, for too many cooks spoil the broth! We cannot see that any useful purpose is served, especially in these days of labour shortage, by this duplication of effort.

The Government is surely sufficiently advised by its own permanent civil servants. We are, therefore, not hopeful that this new Council will perform useful work nor function as it was designed to do.

International Management Conference

THE Eighth International Management Conference is to be held in Stockholm this year from July 3rd to July 8th, under the auspices of International Scientific Management. Previous Congresses took place in Washington in 1938; in London in 1935; and on five preceding occasions.

New management experience and more widespread applications of established principles come fast in wartime, and the Congress will provide the first post-war opportunity for many people in this country to secure a swift appraisal of the principal trends and managements abroad since 1939.

The three plenary sessions of the Congress will be devoted to the philosophy and application of Scientific Management, the regional local planning in modern society, and industrial relations and the responsibilities of Management and Labour.

We are astonished that so much attention is being devoted to these altruistic things at a time when the world requires output of raw materials. Far too much attention is being devoted to welfare schemes, shorter working weeks, music while you work, social clubs, and converting work into play. What we require are some Congresses to increase output, for without output there will be no work. All money comes from industry, and without industry there will be no money and no revenue with which to pay for these grandiose schemes for a modern Utopia.

Electrical Queries

AGAIN it is necessary for us to remind readers that we have suspended our electrical query service. Readers continue to send in questions relating to the rewiring or the conversion of dynamos, and because of staff shortage we are unable to deal with these for the present.

Similarly, we do not undertake to reply to questions relating to explosives, nor to undertake chemical analyses. Nor do we undertake to give details concerning commercial products. In most cases licences are required which are only granted to recognised manufacturers, or else they are quite unsuitable for production in a small way. Also we do not undertake to design special apparatus for readers. One reader wrote saying that he had accepted a contract to make 20,000 of a particular article. Would we please design the press tools for him and tell him what plant he would require? These are questions which should be addressed to a consulting engineer. Our Query Service is open within the above limits to any reader in his private capacity. We do not act as industrial consultants for those who will make a considerable profit from the advice.

Britain Can Make It Exhibition

THE Government sponsored "Britain Can Make It" Exhibition, did not run at a profit. In the 14 weeks of its life 1,432,369 people visited the exhibition, and this represented a loss of 3s. per visitor. We did not think that the exhibition was particularly brilliant as representing a true cross-section of British industry. There were far too many nebulous ideas, such as the absurd bicycle of the future, which we venture to suggest will never be made, and the claims for which could not be justified.

We think the Selection Committees were in error in permitting publicity stunts of this sort, for it might give the impression abroad that Britain Can Fake It, as well as make it. Evidently Britain can lose it, if it cost the country about £250,000. The exhibition was organised by the Council of Industrial Design, but we do not think that they can take credit to themselves for anything beyond staging a public entertainment. Things were exhibited which should not have been exhibited and important articles were not exhibited which should have been shown to the world.

We think that such exhibitions in future should be staged by those with long experience in the planning of exhibitions and with running them at a profit. Anyone can run an exhibition at a loss. It must have been particularly aggravating to the British public to view British-made goods which they could not buy in this country but which are being supplied to liberated countries coupon-free.

Radio Controlled Models Society

ON December 21st, 1946, a meeting of persons interested in the radio control of models was held in the Y.M.C.A., Manchester. This was the first meeting of its kind to be held on this subject and it was called for the purpose of arranging closer co-operation between radio control enthusiasts.

Interested enthusiasts from various parts of the country, representing all parts of the model movement, were present. It was eventually decided that a permanent body be set up for the discussion, guidance and development of the radio control of models. This body will in future be known as the Radio Controlled Models Society and for the time being meetings will be held monthly in Manchester.

Acting Secretary of the society, Mr. R. Lawton, 10, Dalton Avenue, Whitefield, near Manchester.

Armature Winding

Practical Notes Dealing With Armatures Suitable for Fractional Horse-power Motors

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

(Reprinted at the request of many readers from an issue now out of print.)

AS many readers may have discovered for themselves, there are a number of pitfalls lying in wait for those who attempt the repair and rewinding of small armatures for the first time. First there is the specification itself to consider, that is, the number of turns to give to each coil and the correct gauge of wire; then comes the matter of insulation, the actual manipulation of the coils, the number of slots they should span, and, lastly, what pitch to be given when connecting them up to the commutator.

It is necessary in the present instance to limit the discussion to such sizes of armature as would be employed for "fractional horse-power" machines, since the procedure for dealing with larger armatures wound with copper strip or bar instead of small wire of circular section is generally along totally different lines of treatment, and outside the scope of the small winding shop.

Winding Specification

Concerning the winding specification itself, this belongs to the province of design rather than of repair, and for that reason one must assume it to be already known; there are many handbooks dealing with this aspect of the subject to which the reader can refer if interested. Where repairs and rewinds are in hand, too, the specification is already

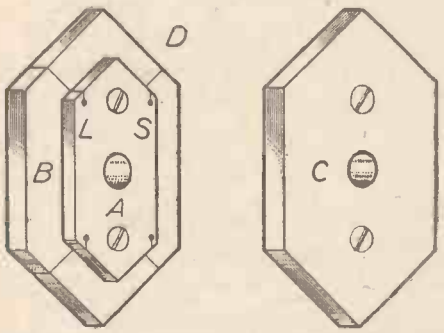


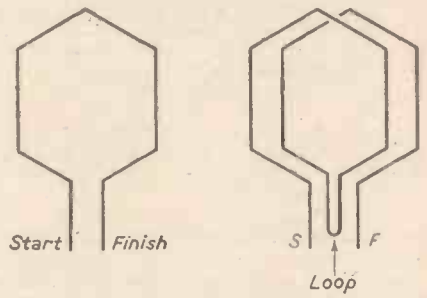
Fig. 6.—A suitable former for small armatures.

available from an examination and count of the turns and gauge of wire already existing on the damaged armature, if it is not too badly burned out. Generally it is possible to lift one complete coil out of the armature slots, and either unwind it carefully, counting the turns, or, if this cannot be done owing to its condition, the coil can be cut across the end winding, the individual wires then being spread out and counted.

Admittedly this may prove tedious work if the gauge of wire is very fine, but it forms a much more definite guide to a correct rewind than merely making a rough estimate and guessing at the turns and gauge. In particular it is necessary to be careful in measuring up the gauge. A short length of wire should be extracted from an old coil and the covering removed by carefully passing it through a piece of folded glass-paper of finest grade until the bare metal shows. Stretching must be rigorously avoided, nor is it the slightest use to gauge over the old covering. When the wire is very fine the safest way is to pass a length of it through the flame of a spirit lamp or bunsen burner until it is just reddened; the covering usually then rubs off with very slight friction.

Burnt-out Coil

To discriminate between the different



Figs. 1 and 2. — One- and two-coil-per-slot grouping.

kinds of insulating covering is also not too easy on a coil that has been burnt. It may be generally taken, however, that plain enamel coverings are employed on wires finer than No. 40 s.w.g.; enamel and single silk or double silk coverings on gauges between No. 32 and 38 s.w.g.; and double cotton coverings, 6 mils thick, for wires of No. 24 to 30 s.w.g. Coarser gauges than No. 22 have generally thicker double cotton coverings ranging between 10 and 15 mils in thickness.

The importance of choosing a suitable covering for the wires is not always fully appreciated. It greatly affects the "space factor" of the windings and often makes all the difference between an easy winding and one that is impossibly tight in the slots. For instance, an armature slot having a winding space equivalent to ¼ sq. in. would accommodate a maximum of 1,110 turns of No. 33 s.w.g. wire covered with 6-mil cotton; but by the use of double silk covering instead 1,600 turns of the same gauge would go into the same space, while no fewer than 1,975 turns of the wire could be accommodated if the covering were of enamel only. Tables giving the number of turns per square inch for various gauges of wire and for various coverings can always be consulted when there is any difficulty with "tight" windings.

Turns Per Coil

The number of turns per coil being known, together with the gauge of wire and nature of its insulating covering, the next thing is to decide how many coils are required, also how many armature slots each coil should span. The answer to the first question is determined by reference to the commutator. Every armature must have the same number of armature coils as there are bars in the commutator. Even when there is a discrepancy between the number of armature slots and the number of commutator bars this rule still holds good, as such conditions are met by "grouping" two or more coils in each slot instead of one. It is quite a common thing to find a 24-part commutator, for instance, on an armature having only 12 slots in the core, in which case 24 coils would be wound off and two put into each slot instead of only one. Similarly a 16-part core and 48-part commutator would have its 48 coils grouped three per slot, and so on. Nearly all armatures are "former-wound," by which is meant that the coils are all wound on a separate "former" or wood block of suitable shape and all to the same size. The ends are then taped up and the coils packed into the armature slots separately afterwards, instead of being wound on direct in position one at a time. It is only in cases where heavy gauges of wire are called for, such as are associated with very low voltages, that

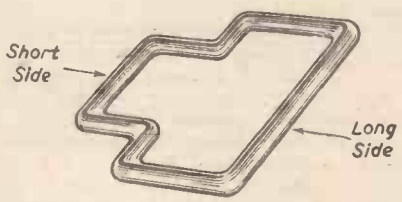


Fig. 7.—The appearance of the formed coil.

Fig. 8.—An armature with semi-enclosed slots.

the wire is hand-wound direct into the slots of the core. The great advantage of former winding is that not only can the fine wire coils be run off at a comparatively high speed in the winding machine, but that each coil can now be separately insulated before assembly, giving invaluable protection thus to the most vulnerable points. Also since the coils are all of the same shape and length their individual weights and resistances are identical, the winding becomes symmetrical

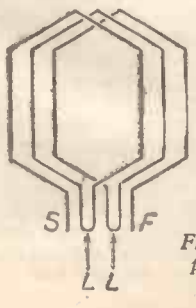
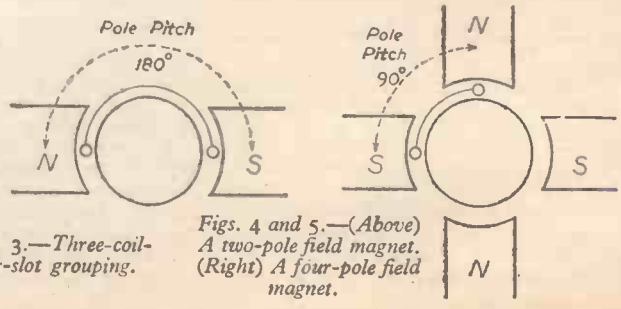
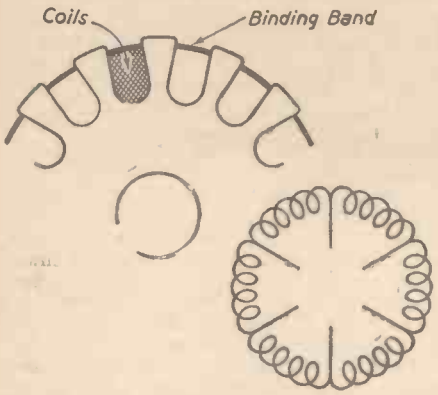


Fig. 3.—Three-coil-per-slot grouping.



Figs. 4 and 5.—(Above) A two-pole field magnet. (Right) A four-pole field magnet.



Figs. 9 and 10.—(Above) An armature with open type slots. (Right) Windings forming a continuous succession of loops.

and better balanced for running at high speeds, and there is consequently less tendency towards sparking at the brushes. With hand windings there is often a considerable difference between lengths, weights and resistances of the first and last coil put on the core, which leads to vibration troubles and bad commutation. Moreover, should the insulation give way the fault nearly always happens in one of the earlier coils to be put on, making it necessary to unwind the greater part of the armature to rectify it. But in the case of former windings one side of the coils can be lifted out of the slots and the defective coil removed bodily without destroying the others.

Former Winding

If it were necessary to still further stress the advantages of former winding it is that the method lends itself particularly well to grouping two or three coils per slot and saving considerable trouble with their interconnections. For example, the typical shape of any former-wound coil is seen in Fig. 1. This is a single coil, but if they are to be grouped two per slot, instead of cutting the wire when the required number of turns have been wound for the first coil, a loop is taken out long enough to reach the commutator as at Fig. 2, and the second coil continued until complete. The interconnections between coil 1 and coil 2 are thus automatically made, and since the ends of the double coil can be taped up as though it were one coil it becomes much easier to assemble in the armature slots than if wound as two separate and independent coils, besides saving work in connecting up later on.

Similarly, if a three-coil-per-slot grouping were called for, as would be the case if the commutator had three times the number of bars as the armature core had slots, the winding would take the form shown in Fig. 3. In these figures for sake of simplicity only one turn per coil has been indicated to avoid confusion. In practice there would generally be a large number of turns in each coil between each starting and finishing point.

Before the former or shape can be made up for winding the coils, it is necessary to decide what shall be their span in the armature slots. This is determined by the number of poles in the field magnet. Theoretically the coil span should be the same as the pole pitch, that is, the distance between the centre lines of poles of opposite polarity. In a two-pole field magnet, for instance, the armature coils should span slots diametrically opposite, that is, 180 degrees apart, as Fig. 4. And in a four-pole field magnet the span of the coils would be one-quarter of the circumference, or 90 degrees, Fig. 5. It is usual, however, to shorten the span by about one slot, as this makes the coils easier to assemble, especially in two-pole windings, as they do not then bunch up so much at the ends, while electrically they are almost identical in effect.

Armature Slots

When the number of armature slots is not exactly divisible by two or four, the practice is to make the coil span the nearest smaller whole number. A 13-slot armature, for instance, running in two-pole fields, obviously could not have a coil span of 1 to 7½ (= 180 degrees) and would therefore be given a span of 1 to 7.

After settling the number of turns, the gauge of wire, and the span of the coils, comes the question of a suitable former for winding them. For small armatures these are generally lozenge shaped and built up on the lines shown in Fig. 6. The centre block A is of hard wood or fibre, of a thickness slightly less than the width of the armature slots. Two separate flanges larger in all ways than the centre block by the radial depth of the coils are then made up, B being permanently fixed to A, and C made detachable by means of a couple of wood screws. Sawcuts are made where shown at D, the purpose of which is to enable thread to be passed through from side to side underneath the coils after they are wound on each of the four short ends, tying this firmly to prevent the coil from collapsing when taken off the former. The two sides L and S of the centre block determine the length of the active part of the coil which lies in the slots. S is made about ⅛in. longer than the actual

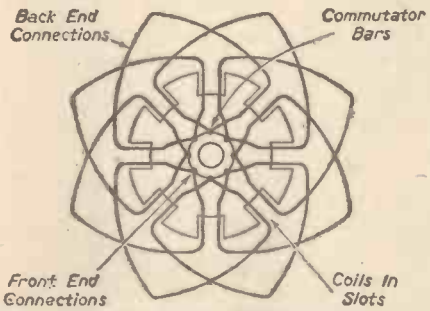


Fig. 11.—A simplified diagram showing the method of winding an armature.

core length, and L is longer than S by twice the radial depth of the wound coil. One or two modifications will no doubt be found necessary after trial to finally settle upon the best dimensions.

The end windings make an angle of about 90 degrees with one another, and 45 degrees with the sides of the coil.

Preparing the Coils

In preparing the coils the procedure is first to wind off a complete set, tying them at the corners temporarily. They are then made hot in the oven to dry out any moisture and immersed bodily in good insulating varnish such as "Armacell" until all air bubbles cease to escape. They are then drained off, again warmed until the varnish is well set, but not baked out hard, as they must remain flexible until placed in position in the slots. After taping the ends with thinnest cotton tape each coil has its short side laid in one of the armature slots, and when the bottom halves of all coils are inserted the long sides are brought down one by one into the top of the remaining slot spaces, giving them the correct span at the same time. When the coils are of fine wire and quite pliable no preliminary "forming" is necessary, but if they are stiff they may need a twist given to the lozenge-shaped ends in order that the inner and outer sides may pass one another more easily in crossing at the ends of the armature, so that they pack together symmetrically. The appearance of the formed coil when shaped thus will be seen from Fig. 7.

Armature coils are not generally taped all the way round but at the ends only, in order to keep them in shape during assembly. It also assists by providing extra insulation in those parts of the winding which are at the greatest potential difference. In open-slot armatures the coil is sometimes taped all over, but with semi-enclosed slots end taping only is possible, since in order to insert the sides of the coils in the narrow slot openings the wires have to be separated and fed in a few at a time, which is impossible when taped all round.

Coil Taping

Although coil taping serves a very useful purpose in separating parts liable to insulation breakdown, neither the taping nor the wire coverings by themselves can be relied upon to provide sufficient protection between the live wire and the iron of the core, without further precautions. Slot linings of presspahn, leatheroid, or empire cloth are always necessary before final assembly of the coils, the thickness of these slot linings depending upon the voltage to which the windings will be subjected. One layer of leatheroid 10 mils thick is sufficient for the slot linings of most small armatures working up to 250 volts, or two thicknesses for 500 volts, but if these have to withstand a flash test they should be reinforced by a further thickness of 10-mil empire cloth. The more insulation there is in the slots the less will be the room for actual wire, so that one is obliged to keep a close watch on this point and provide only the minimum thickness of insulation compatible with safety from breakdown, otherwise the quantity of active wire, and consequently the final output obtainable from any armature, will be seriously restricted.

When an armature core has semi-enclosed slots as in Fig. 8 the coils are secured from flying out under centrifugal stresses by thick leatheroid strips inserted under the hook of the teeth. If, however, the armature has open-type slots as Fig. 9 the coils have to be held down by binding wire bands of tinned copper wire sunk flush with the surface of the core, strips of leatheroid or mica being laid along each slot previously to protect the coils when the band is being soldered up.

The actual interconnection from coil to coil of a small lap-connected armature, although apparently a complicated matter, is in reality simplicity itself if the fact is borne in mind that the object in connecting up is only to join the end of one coil to the beginning of the next all the way round the armature in regular sequence so that all the coils are in series with one another until the starting point is reached again, when the winding closes upon itself, making an endless circuit. Every junction formed

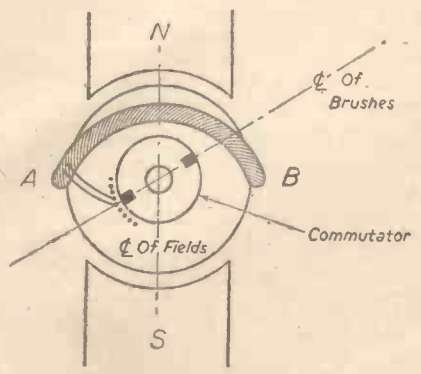


Fig. 12.—A single armature coil shown in position.

where one coil meets the next is made a connection to one commutator bar. The choice as to which one will be explained later, but in effect the windings form a continuous succession of loops as indicated by the diagram in Fig. 10. This diagram shows only six coils, but is typical of the method whatever the actual number of coils may be.

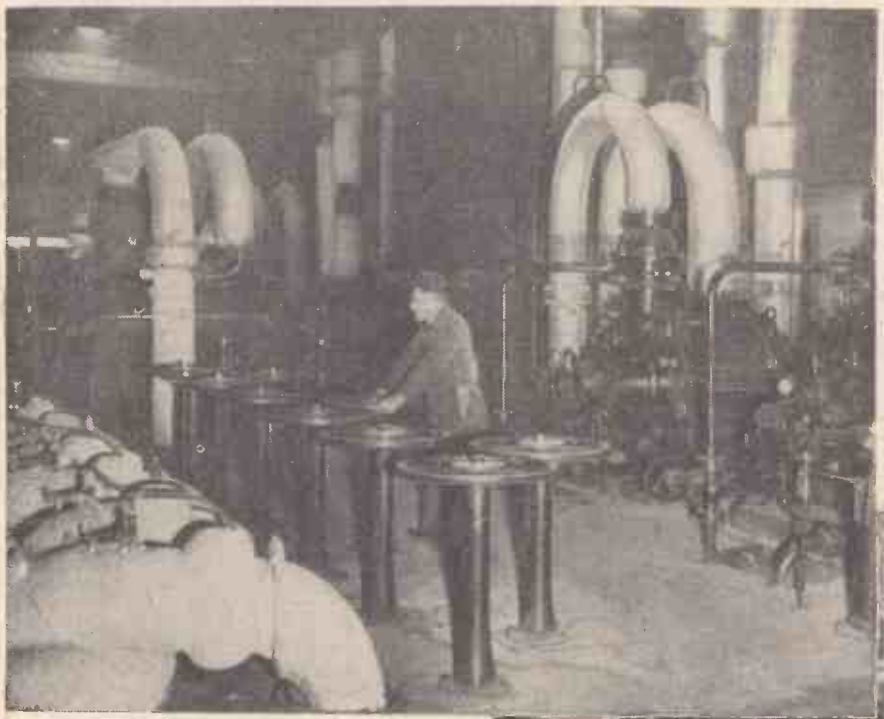
Armature Connections

Armature connection diagrams are apt to look complicated even when one turn only per coil is shown, and the least confusing way of showing these is represented by the "radial" diagram, such as Fig. 11. However many turns per coil there may be, it is only the start and finish that matter for connecting purposes. In this figure the two active sides of the coil are represented by the radial lines, the commutator bars by the central segments, and the front and back end connections by the curved lines linking together the active wires.

The last remaining point that has to be settled when connecting up the armature coils to the commutator is what pitch, if any, to give to the junctions between coils before soldering them to the commutator bars. This is very important, because no armature, even if its coils are correctly interconnected and otherwise free from faults can work properly unless connected to the commutator with the proper relation between pole centres and brush centre line. In other words, the act of commutation must be arranged to take place while the coil is in its "neutral" position. This may best be explained by inspecting the accompanying Fig. 12. Here a single armature coil AB is shown in a position such that its sides are "sliding" momentarily along the lines of force which proceed from the magnet poles N and S instead of "cutting" them. This is the neutral position in which little or no E.M.F. is generated in the coils and is the best position for the current flowing round them to be "commuted" or changed in its direction. Consequently the starting and finishing ends of this coil must be brought down to those two adjacent commutator bars which lie on either side of a centre line drawn through the brushes, wherever they may happen to be situated. Sometimes the brush line coincides with the centres of the field magnet poles, more often it lies at right angles to the poles, since this leaves more room for the brush holders between the field coils. Occasionally they are placed at some intermediate angle for structural reasons, but no matter where they may be it is always essential that the armature-to-commutator connections should be planned out so that they follow the brush centre line position, when the coil itself is in its neutral position in relation to the field magnet poles.

London's Largest Electricity Plant

Where a Large Part of London's Electricity is Generated



VERY topical, in view of the Fuel Minister's recent warning to the public, are these photographs recently taken at Fulham Power Station, largest electricity generating plant in London, and the largest municipal undertaking of its kind in the whole country.

It produces 6½ million units per day from five 50,000 kW turbo-generators, and consumes several hundred tons of coal per day.

When it is necessary to "shed the load," it is from this station that a large part of London's electricity supply is reduced, or cut off.

Working in connection with the power station is a well-equipped laboratory for the control and testing of water, coal, lubricating and insulating oils, etc., and the investigation of all chemical problems associated with power station operation.

(Above) A corner in the Fulham Power Station showing the feed pumps which supply water to the boilers at the rate of 6,300 gallons per hour per pump.

(Right) One of the five switch houses for operating the network of the S.E. grid. The Metropolitan-Vickers 66,000-volt switches, or oil current breakers, have a rupturing capacity of 1½ million kilo-volt-amps. Each switch weighs 20 tons, including 3½ tons of oil.

A Turret for a Small Lathe

Constructional Details of a Useful Accessory for the Home Mechanic

By W. BADDELEY

DURING the war I had occasion to produce a considerable number of small turned parts on my 3in. lathe, and decided it would be worth while to make a simple turret for slide rest fixing before commencing the work. This turret proved to be very satisfactory, and I give the following details of its construction, which may be of use to other readers.

Fig. 1 shows the complete turret, and in Fig. 2 the details of each part are given. As shown in Fig. 2, part (A) is the rotating toolholder, and is drilled to take six tools made from 5/16in. diam. steel rod. They are held in position by six ¼in. Whit. bolts. This part can also be made to take four tools, in which case there must be four locating holes to suit.

Fig. 1. The turret mounted on the cross-slide of a lathe.

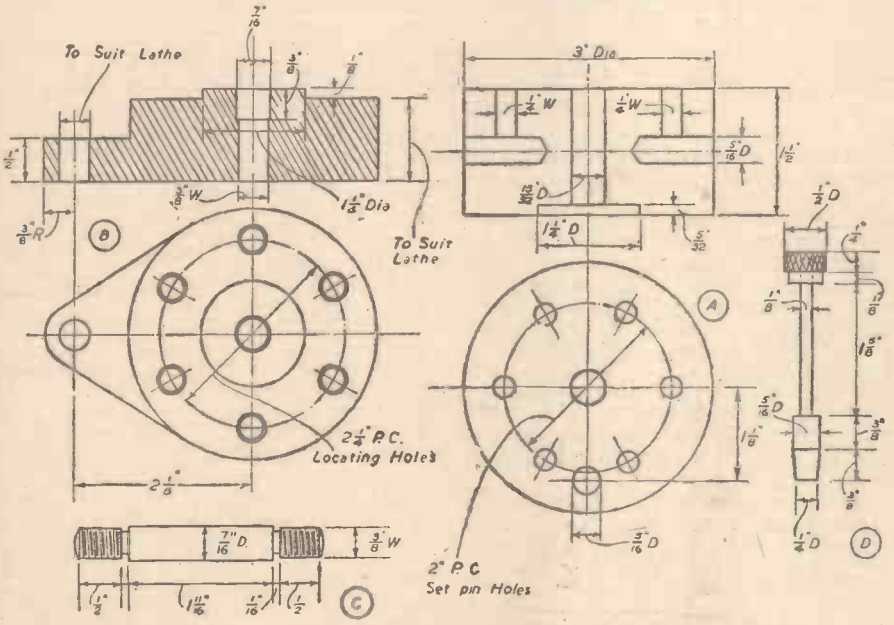


Fig. 2. Details of the component parts for a small turret.

A cast-iron casting is used to form this piece and is machined all over to the dimensions given, particular care being taken with the diam. of the recess, as this has to be a good fit over the spigot on the base, part (B). The 5/16in. diam. hole which accommodates the locating plunger and spring can now be drilled. To obtain a good finish in this hole it is advisable to drill to 9/32in. diam. first, and then finish off with a 5/16in. drill.

Machining the Base

Cast iron is also used for the base, part (B), which is machined on top and bottom only, the 1¼in. spigot now being fitted carefully to the recess in part (A). A pointed tool can be used to mark in the pitch circle of the locating holes, thus ensuring that they shall be concentric with the spigot. The locating holes can then be spaced out and drilled ¼in. diam. The internal thread in this part should be cut in the lathe and then cleared 7/16in. diam. and ⅛in. deep to accommodate the centre spindle (C).

In Fig. 2 the centre spindle is shown in detail.

It is turned from ½in. M.S. bar to the dimensions given, the thread being formed on the lathe.

The arrangement of the locating plunger, part (D), is also shown in Fig. 2. The various parts are turned from M.S. bar, the plunger being a sliding fit in the hole. The plunger and rod are turned from the solid and the knurled top is screwed on.

The correct taper of the locating holes is obtained by the use of a simply made tool. It is made from a piece of 5/16in. diam. silver steel, about 3in. long, turned to the correct taper at one end.

Small flutes can then be cut on the tapered end and the tool suitably hardened and used in the same manner as a tapered reamer. It is advisable at this stage to turn the plunger, using the same top slide setting to turn the taper. This ensures that both tapers are alike.

The reamer tool is used through the plunger hole in part (A) to widen out the six locating holes in part (B), and the parts (A), (B) and (C) should be assembled for this operation.

Holes for Cutting Tools

The locating plunger can now be fitted, and the job is now complete except for the holes in part (A) to receive the cutting tools. To drill these the turret is bolted on to the slide rest and a 5/16in. diam hole drilled in part (A) for each position of the plunger.

It now remains to drill and tap the six holes for the tool clamping bolts in part (A).

This particular turret was designed to bolt on to a slide rest provided with a table which has slots for fixing bolts. It should be stated, of course, that to fix the turret in position the top slide has to be removed. If the reader's lathe does not possess these slots an alternative method of fixing will easily be found.

The photograph (Fig 1) shows the turret in position on the lathe. It will be noted that the fixing bolts are of various types, this being due to the shortage of bolts about 1941, when the turret was finished.

British Commonwealth Scientific Conference

THE establishment of a British Commonwealth Scientific Office in London is one of the main recommendations to Governments disclosed in the Report of Proceedings of the British Commonwealth Scientific Official Conference. (Published by H.M. Stationery Office, Kingsway, London, W.C.2, price 1s. 3d.)

The Official Scientific Conference followed on the Royal Society's Empire Scientific Conference last July. Its primary concern was to discuss scientific collaboration, which had grown up in the Commonwealth during the war, and to devise means of ensuring its continuance and improvement.

Broadly, the proposal to set up a British Commonwealth Scientific Office (B.C.S.O.) in London is that the various Dominion Scientific Missions and Liaison Officers in London should occupy adjoining offices in the same building. While retaining full autonomy and responsibility to their Governments they would be able to co-operate more easily in matters of common interest. Thus specialist knowledge which might at any time be available among the staff of one mission would be available to the other missions. The work would be carried out more rapidly and economically by the provision of certain common services such as library, typing, duplicating, abstracting, indexing and microfilming. It is suggested that the Department of Scientific and Industrial Research should be responsible for these common services, and that the B.C.S.O., London, should at first be housed in the same building as D.S.I.R.

Radio Research

There was extensive exchange of information on Radio Research. Twenty-three ionospheric recording stations are likely to continue in operation, and recommendations were made for the exploration of the possibilities of stations at Nairobi and in Graham Land. The future of stations at Cape York, in Australia, Suva and Kodai Kanal were also discussed.

Rocket Propulsion

Early German Transonic Research : 1,500 m.p.h.-plus Project Aircraft from Bell and Douglas

By K. W. GATLAND

(*Continued from page 158, February issue.*)

Chalmers H. Goodlin, Bell's twenty-three year old chief test-pilot, hopes to fly a developed XS-1 at 1,700 m.p.h. over 15 miles up.

FOR obtaining data at transonic flow speeds, the wind-tunnel is little more than useless. There is considerable interference in the working-section between the walls and from the model supports; and hence the reason for what in comparison with the static model is a costly item of equipment, the unmanned free-flight research aircraft.

First German Experiments

First of these special types was the "Feuerlilie," developed by German aerodynamicists. Actually, this did not signify a specific machine but was a group designation which covered at least three distinct models. They were originally intended as ground-to-air missiles, and all three, the Hechte, the F.25 and the F.55, were designed by Rheinmetall-Borsig and developed at the Hermann Göring Research Institute, sunk deep below ground in the forest of Volkenrode, near Brunswick.

F.25

Driven by powder fuel, the F.25 appears to have commanded most attention and some twenty models were launched between 1941 and 1943.

The drawing (Fig. 92, top) shows the external layout and it will be seen that swept-back wings, with tip fins, were mounted mid-depth of its slim and nose-pointed fuselage. They were of section N.A.C.A. 0009, swept back at 40 degrees and set at zero incidence to the body axis. The tail assembly was rather unusual in that a separate fin and rudder extended both above and below the rear fuselage. Each carried a tail-plane, the upper one having movable elevators adjustable for each flight. The machine was roll stabilised by a gyro-servo mechanism, working through electro-magnets which moved ailerons at the wing tips.

The rocket motor, which could be either a 109-505 or 109-563 di-glycol type, delivered a thrust of 1,100lb. for six seconds. With its aid, the model was launched from a ramp set at 60 to 80 degrees and could reach a maximum speed of 720ft. per second.

Leading particulars for the F.25 are as follows: length, 6.56ft.; fuselage diameter, 9.85in.; span, 2.95ft.; wing area, 3.84 sq. ft., and the all-up weight, 264lb.

Design of the F.55

The F.55 (Fig. 92, bottom) was a larger machine and tailless, weighing 1,040lb. Its wings, tipped by large square-cut fins, swept back at 50 degrees and were 8.20ft. in span with an area of 26.2 sq. ft. The fuselage, 21.6in. in diameter, had an overall length of 15.75ft.

First tests were made using a booster rocket, jettisonable as a first stage, in addition to its driving charge—both di-glycol burning. The booster section, thrusting at 4,400lb. for six seconds, was first embodied as a fixture on the rear fuselage, but this brought trouble straight away, for unless a vertical or near vertical ascent was adopted, the missile became unstable immediately after leaving its launching ramp. The obvious remedy was to split the large boost rocket into smaller units, mounting them as close to the aircraft's c.g. as possible, and this was done, using four 1,100lb. thrust rockets with satisfactory results. One such model, in fact, having risen to 15,700ft. from a launch at 70 degrees, flew for 4.66 miles. Its final speed (at the time of impact) was M=1.25.

Later flights were planned in which a liquid-fuelled power plant displaced the second stage powder rocket and using 90 kg. of oxygen and 50 kg. of alcohol, it was found that a thrust of approximately 1,100lb. could be maintained for 25 seconds. A di-glycol boost rocket contributed 6,600lb. thrust for the first two seconds of flight, whereupon it automatically released and dropped off. The bi-fuel unit then, thrusting on its own account, would take over and the machine flying under the control of its auto-pilot usually remained stable throughout its complete run. Any rolling tendency was continually and automatically corrected by deflection of the ailerons. Fore and aft stability was said to be particularly good.

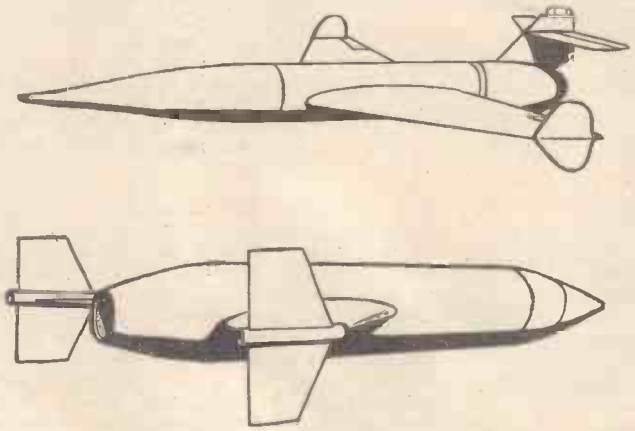


Fig. 92.—Two models of the "Feuerlilie" series, the F.25 (top) and the F.55. Flares, fitted on the fin or wing tips, were sighting aids for ciné-theodolite operators.

Hechte

Hechte was actually the first of the "Feuerlilie" series and it might well have taken its place in the Rheinland defence system had its development not been guided into other channels. The ground-to-air weapons that followed the early "Feuerlilie" models, however, embodied many of the features proven in the Hechte and F.25, and much of the data found its way into the hands of the full-scale aircraft designer.

The Hechte and the F.25 appear to have been almost identical in both size and shape, the only main difference being the power unit. Here again a bi-fuel propellant was the integral driving force, though not as in the F.55. The Hechte used a "cold" system operating on T-stoff and Z-stoff (80 per cent. solution, H_2O_2 and calcium or sodium permanganate), which gave 132lb. thrust for from 20 to 25 seconds. The maximum speed attainable was about 920ft. per second, and as with the F.25 and F.55, roll stabilisation was effected by ailerons through a gyro link.

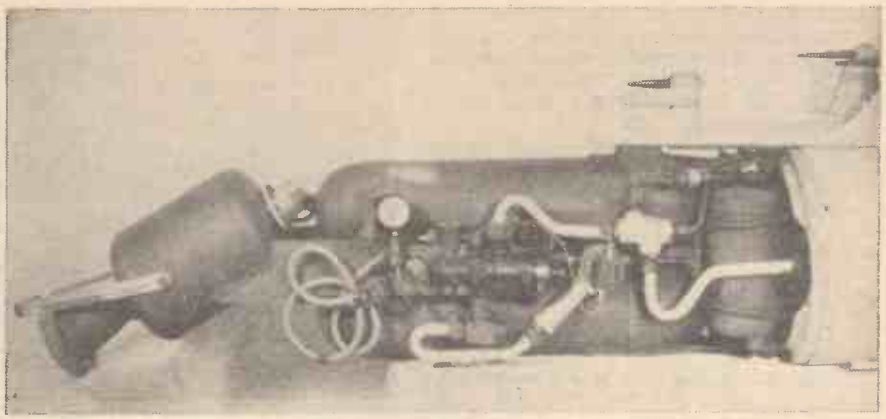
Some General Particulars

Work on the larger model (the F.55) had only just commenced when Germany collapsed, and there is no evidence of the liquid-fuelled version having flown, though several were almost completed. The solid-fuelled model was further advanced, and there are several complete examples. One of these, tested by technicians of the U.S. Army shortly after the occupation, is said to have risen successfully and to have remained stable and on course up to its maximum Mach number of 1.25, despite the conventional wing-section (again N.A.C.A. 0009) and normal type ailerons. This particular model weighed 1,000lb., and its di-glycol rocket, fitted internally, developed fully 13,000lb. thrust. From a comparison of these figures and those given earlier, it would seem that there were several size charges specified for this type.

A ciné-theodolite was employed to follow the course of these midget research missiles, though this system seldom proved reliable. The plotting involved a double differentiation which, despite the greatest care by both operator and calculator, was a very inaccurate process, and although the German technicians strove to improve the mathematics of the problem, by analytic differentiation and the fitting of high-degree polynominals to the trajectory curve, they still could not

better their results. The ideal solution, that of transmitting data from the model "air-to-ground," was not practicable at the time of the experiments although research was proceeding at the D.V.L. (Deuteches Versuchsanstalt für Laftfahrt) in an attempt to perfect a radio transmitter for this and similar projects.

Since the war's ending, Allied technicians have perfected the "telemeter" with which it is possible to check with unparalleled accuracy, and at long range, the performance of pilotless missiles and aircraft. Each Vickers-Armstrong transonic model embodies one of these units capable of transmitting six instrument readings *simultaneously*. The data thus obtained has no comparison with that recorded in Germany during the war years and there is much to be expected from its further use in manned aircraft. This will be all the more apparent when full details of the Bell transonic experiments can be published.



Forerunner of the bi-fuel rocket engines used in the "Feuerlilie" models was the T-stoff and Z-stoff motor of the Henschel H.S. 293 "glider bomb." It developed 1,500lb. thrust for 12 seconds.

XS-1, First Tests

Latest news of the Bell XS-1 supersonic research aircraft is that a first flight under power has already been made. Others, in fact, may have already taken place by the time these words are in print.

Taken up beneath a specially adapted B.29 "Super-Fortress," the machine was cast off at 25,000ft., and then releasing propellant to *one* of the four combustion chambers, the pilot succeeded in reaching a maximum level speed of 550 m.p.h.

In announcing this Major E. J. Huber, of the Headquarters Army Air Forces, gives the designed top speed as 1,700 m.p.h. at an altitude of 80,000ft., with the maximum thrust available from the four-unit bi-fuel rocket engine, 6,000lb.—1,500lb. each chamber.

Design Features

Like the Miles M.52 project, the XS-1 has a ballistic-shaped fuselage and no wing sweep-back. Basically, the difference between these two designs is not great, though, naturally, as one was "jet" and the other is "rocket," the similarity remains only in the exterior shape. Actually, the fuselage of the Bell machine is rather more plump looking than its British counterpart, which is due to the need to provide tankage for the rocket propellant, 8,177lb. of liquid oxygen and alcohol.

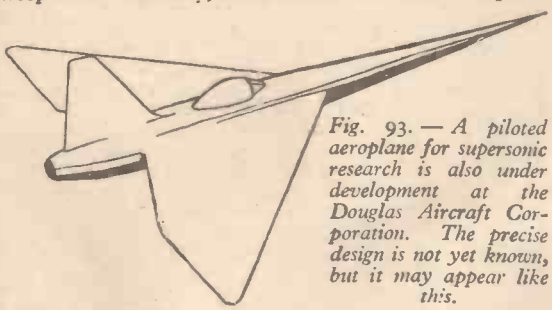


Fig. 93. — A piloted aeroplane for supersonic research is also under development at the Douglas Aircraft Corporation. The precise design is not yet known, but it may appear like this.

The overall weight of the prototype (fully fuelled, all test equipment installed and with pilot) is 13,069lb. For all that, it is not a big aeroplane, as will be observed from the photographs; the length of the first test machine is 31ft.; its span 28ft., and the height (from ground to fin tip) 10ft. 10in.

There are apparently to be at least two of these research aeroplanes, the first a "flying test-bed" for the second. The earlier version, moreover, will not be capable of reaching the speed for which it was designed because of the substitution of an alternative power unit.

A Gas-charged Engine

Originally, the engine for the prototype was to incorporate a fuel system similar to those employed in the Walter bi-fuel units, in which the propellant would be forced for combustion by a turbine driven pump. A series of design problems has unfortunately delayed the development of this particular item, and as it was obvious that the machine would be complete in all other respects long before the pump and ancillaries became available, it was decided to install an entirely different system. The method adopted was "gas charging," an arrangement reminiscent of the early German "Mirak" and "Repulsor" experiments, in which gaseous nitrogen, contained under high pressure, is used to force both fuel and oxygen from their tanks into the combustion chambers.

The gas pressurised system is naturally inferior in many respects to the mechanically actuated feed. In the prototype machine, the motor is limited to a duration of only 2.5 minutes when operating at full thrust, whereas with the turbo-pump, its maximum power could be maintained for 4.2 minutes. Coupled with this, the top speed attainable with the alternative power plant is estimated to be 1,000 m.p.h., at 60,000ft., instead of the 1,700 m.p.h. velocity at 80,000ft., as originally specified. In addition, the rate of climb claimed for the machine when fitted with a turbo-pump, 45,000ft. per minute, falls off to 28,000ft. per minute when the pressurised engine is substituted.

An 8g Pullout

When Bell Aircraft Corporation first undertook the contract for a supersonic research aeroplane—and that was in the spring of 1945—the following minimum performance requirements were specified. First, an 8g pullout at an indicated air-speed not exceeding 500 m.p.h.; then, an 8g pullout at minimum speed; a proof of the specified endurance at rated thrust, and take-off (from the ground) and climb to 35,000ft. under its own power. Finally, the machine must respond satisfactorily to control at Mach = .80.

These characteristics are now being proved. Afterwards, the 'plane will be accelerated by stages into the transonic speed zone and then, if everything goes well, the throttle will be opened wide in an attempt to confirm the designer's most ambitious estimate. This does not necessarily imply that the same basic design as recently tested will remain unaltered at transonic and supersonic speeds. The probability is that several modifications (principally in wing form) will be embodied as fresh data is brought in from each successive test flight.

The pilot's task under transonic flight conditions—when his attention must be one hundred per cent. on his controls—is considerably relieved by the telemeter, which transmits readings of air-speed, acceleration, aileron position and elevator position to a ground station throughout the entire duration of the test.

Control and the Strength Factor

An interesting feature of the control system is that the setting of the tail-plane can be adjusted during flight, and as this might normally prove hazardous at transonic speed, special flutter dampers have been designed to minimise the danger from this source. The movement is brought about by a powerful mechanical actuator. For the rest of the controls, they are apparently orthodox.

During the early phase of testing, the XS-1 will be checked comprehensively by officers of the National Committee for Aeronautics. One of their instruments is an oscillograph with which they will be able to determine the strains sustained by structural members of the wing and tail. The normal pre-flight inspections, too, will be carried out with infinite care, for there can be no room for oversight of the slightest defect. At the speeds this machine will fly, nothing can be left to chance and the ground personnel have a great responsibility.

The XS-1 has been designed to withstand 18g. (or an acceleration of 18 times the force of gravity), and clearly becomes the strongest craft ever to fly. The wings, for example, have a skin *machined* from aluminium alloy, having a root thickness greater than ½in., tapering off to about ⅛in. at the tips. Its limitations, in fact, are much more in the make-up of the pilot than in the structure of the machine.

The Pilot

The man whom it seems will be the first to outfly sound is Chalmers "Slick" Goodlin, Bell's twenty-three year old chief test-pilot. He succeeds Jack Woolams who was killed on August 30th, 1946, when a special P.39 racing 'plane which he was grooming for an air race crashed out of control into Lake Ontario. The reason for this most unfortunate mishap is given as tail failure.

Goodlin, a native of Greensburg, Pa., learned to fly at the early age of sixteen, later serving with the R.C.A.F. and the R.A.F. from February, 1941, before his transfer to the U.S. Navy in December, 1942. After his honourable discharge from the Service, he joined Bell Aircraft Corporation, and has been test flying since January, 1944.

A Douglas Project

News of progress with the XS-1 is followed by rumours of another research aeroplane,

similar in purpose but very different in design, a project by the Douglas Aircraft Corporation. The machine is said to be rocket powered and as nearly a "flying-wing" as it is possible to obtain in a small high-performance type.

Actually, the need for containing comparatively large proportions of rocket propellant makes some form of fuselage essential in these thin-wing research aircraft; and then there is always the installation of pilot and controls to be considered. The Douglas project, in all events, is mainly wing, but with a slim pencil-like fuselage which projects for some distance beyond the root leading edge, tapering away to a point at the nose. The body form is naturally less slim toward the rear where the pilot is accommodated, presumably along with the main tanks and rocket motor. A single vertical fin and rudder emerges conventionally from the rear fuselage and there is no tail-plane.

The above few particulars of what promises to be an interesting aeroplane are indicated pictorially in Fig. 93. The drawing is not intended as an accurate impression of the design, but rather to illustrate the likely arrangement of such a machine as the one described.

The reason for the length of fuselage forward of the wing can be explained quite simply. At trans-sonic speeds, the highly refined nose will have the effect of breaking down the shock "front" so that the air accruing in the conical bow wave thrown off from that region hits the leading edge of the wing at considerably reduced velocity. The reduction in flow speed is further assisted by the pronounced sweepback of the wings with the result that the overall drag is greatly decreased and the lift suffers not so drastic a drop. Stability also derives a benefit in that change in trim during travel from one speed zone into another is not so marked. At least, that is the theory!

The prototype Bell XS-1 with which it is hoped soon to reach 1,000 m.p.h. at 60,000ft. Its engine comprises four separate combustion chambers—each capable of 1,500lb. thrust— d operating on only one, the machine has already flown at 550 m.p.h.

The "needle-sharp" nosing on a sweptback layout should prove effective in countering at least some of the more major problems which will arise when pilots come fully to grips with sound. It will be interesting to learn more of this Douglas venture and also to discover the truth of a report that most of the main U.S. aircraft builders are actively preparing programmes of research which call for "faster-than-sound" piloted aircraft.

(To be continued)

Glues, Cements, and Adhesives—2

Cold Glues, Pastes, Gums and Their Uses

By "HANDYMAN"

(Continued from page 120, January issue)

BY the word adhesive I refer to all such "sticky stuffs" as employed for uniting paper, cardboard, leather and smaller wooden objects to each other, and, naturally, the liquid and other cold glues which ordinarily would have been considered in the last article may be classified with the adhesives: the gums, the liquid fish-glues and starch pastes.

Liquid Glues

There is nothing much to say about the making of these glues, except that they are derived from bones and offal of fishes, and that the edible isinglass is a highly refined product made from selected parts of the fish, bearing much the same place in relation to common fish-glue that gelatine does to animal-glue. Isinglass, however, is sometimes used for the finer cements, and is therefore not an adhesive in the ordinary sense of the word, except where it is used in the making of "court plaster," an adhesive silk for cut fingers. Liquid fish-glues are supplied in collapsible tubes in all sizes and qualities and under various trade names. Seccotine is the forerunner of this most convenient form of adhesive, and a small tube is obtainable for a few pence.

The liquid glue is known under the name of "Croid," and is a quality of cold glue which, besides having a general utility, is to be recommended for small joinery and other woodwork where a small quantity of the agglutinant is required at a time. It is excellent for model-making purposes.

Using Liquid Glues

As in the case of hot glues (carpenter's hide glues) the minimum amount of cold glue should be used in making a joint, and perfect contact between the two parts is essential to the strength of the job. Rubbing the objects together to exclude the superfluous adhesive is therefore recommended. If there is bad contact between the united parts, the area of the exposed glue is considerable and dampness in the atmosphere can more easily penetrate and weaken the joint. This may not be quite so serious a matter with glues of the nature of "Croid" or "Seccotine" as with carpenter's glue, which is most susceptible to atmospheric changes, but there is bound to be some detrimental action on the adhesive if the joint is not a close one. Grease is an enemy of all adhesives, and therefore surfaces which are to be attached to each other should be free even from the natural oils which are present on the fingers. In winter, cold glues are more viscous—even hard—and if, when the tube is squeezed, the adhesive comes out in a sort of crystallised form, it should not be used without slightly heating. In a cold room, or on a winter's day, it is best to place the tube of adhesive in a cup of hot water for a few minutes before using. Seccotine tubes are usually supplied with a metal peg with a looped handle end, which is replaced in the nozzle after use. This is the simplest and best device to prevent loss of glue and to ensure a ready flow when the glue is required to be used again. Where this sort of stopper is not provided, as in the cheaper qualities and sizes, a small nail or a stout household pin will serve the same purpose.

Pastes

These are usually made from one of the flours or starch and there are innumerable recipes in common use. Dextrine is a manufactured substance which is almost identical with starch and is sometimes termed "British Gum." The granules in starch and flours are insoluble in cold water, but when heated with water of a temperature of about 75 deg. Fahr. these granules split up and adhesive "glutens" and "albumen" are formed. Both these substances possess powerful adhesive qualities, and the paste is of a double tenacity when they are both liberated. Decomposition of flour and starch pastes is due to the fermentation of the cereal constituents, and therefore preservatives are necessary. Pastes made from farina (potato starch) are not so strong as wheat or rye flour pastes, and sometimes the addition of one of the glues is resorted to. With the hide glues such a paste is more liable to putrefaction. The mixing of pastes with silicate of soda (common "water-glass" or "preservatives") can be tried, but the difficulties of keeping them are increased. Such pastes tend to liquefy when they are put into closed retainers.

The preservatives for pastes are carbolic acid, oil of cloves, camphor and other essential oils. In using that powerful disinfectant, "Lysol," as a preservative in home-made flour paste, I found that it destroyed the adhesive value of the paste—especially if the quantity was overdone—and turned the paste quite brown. I now use nitro-benzine. This is a chemical strongly smelling of almonds and is an admixture to many brands of office pastes.

Cold-water Paste

Liquid ammonia and other alkalies have the power of causing such separation, and wheat, flour or potato starch can be converted into a mass of stiff paste, which will dry up. The resultant horn-like mass will not decompose and can be ground up into a powder. This powder, usually sold as "cold-water paste," can then be mixed with water into a paste as required. The only drawback to this stuff is that the presence of the strong alkali may cause the paste to adversely affect coloured objects.

(To be continued)

Electrical Engineering Developments

An Interesting Account of the Progress Made by the British Thomson-Houston Company in the Reconversion from War to Peacetime Production

AS the year in which the British Thomson-Houston Company, Ltd., celebrated its jubilee, 1946 has been a memorable one in the history of the company, which has had its large manufacturing capacity fully occupied in the execution of orders for all kinds of electrical plant for service at home and overseas.

Orders ranged from large power station and industrial plant to Mazda lamps of all types, and the various domestic appliances required for the extensive housing programmes now under way in this country. Many large lighting installations have been completed, and street lighting with "Warm-white" fluorescent lamps has been an outstanding development.

Power Station Plant

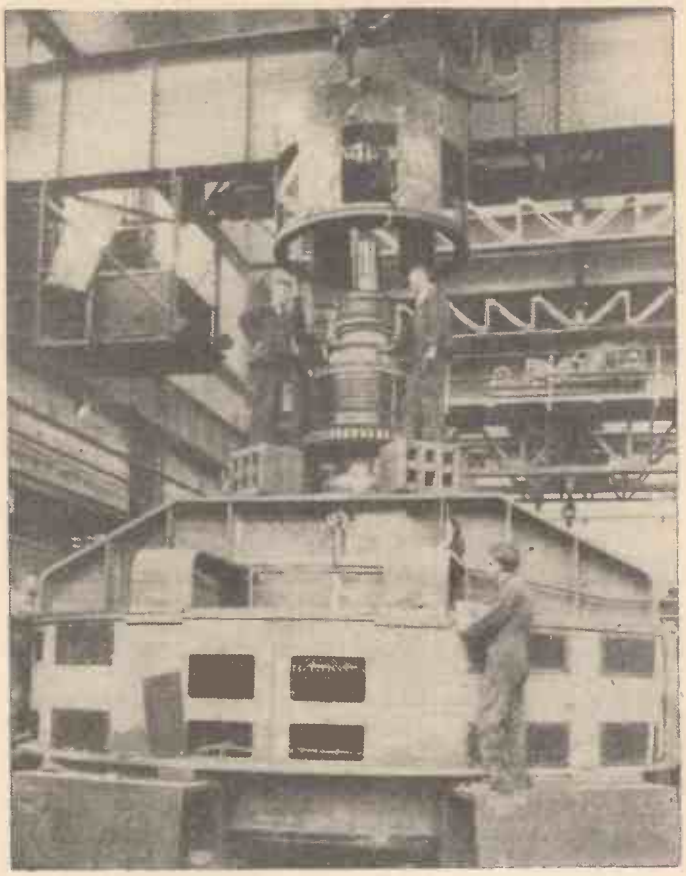
The Central Electricity Board's programme of additions to generating plant has produced a number of orders for large turbo-alternators, including three 75,000 kW three cylinder 1,500 r.p.m. machines of the new Barking "C" (County of London E.S. Co., Ltd) power station, and two 60,000 kW two cylinder 3,000 r.p.m. units for Balfour Beatty and Co., Ltd. Several orders for 50,000 and 30,000 kW machines, duplicating units already in hand, are a welcome recognition of the importance in present circumstances of repetition of existing design and construction. Several 30,000 kW units are in course of erection and a 200,000 kW set for the Scottish Central Electric Power Company's Bonnybridge station was put into service during the year. The hydro-electric and engine-driven alternator departments have also received important orders.

Increasing interest is being shown in gas turbines, and schemes for a variety of applications for power station, industrial, marine and traction requirements are under consideration.

Mechanical rectifiers and control for precipitation plant, unified control for the stokers and fans of boiler, soot-blower and temperature alarm equipments are other products for which there has been an active demand.

Engine-driven Alternators

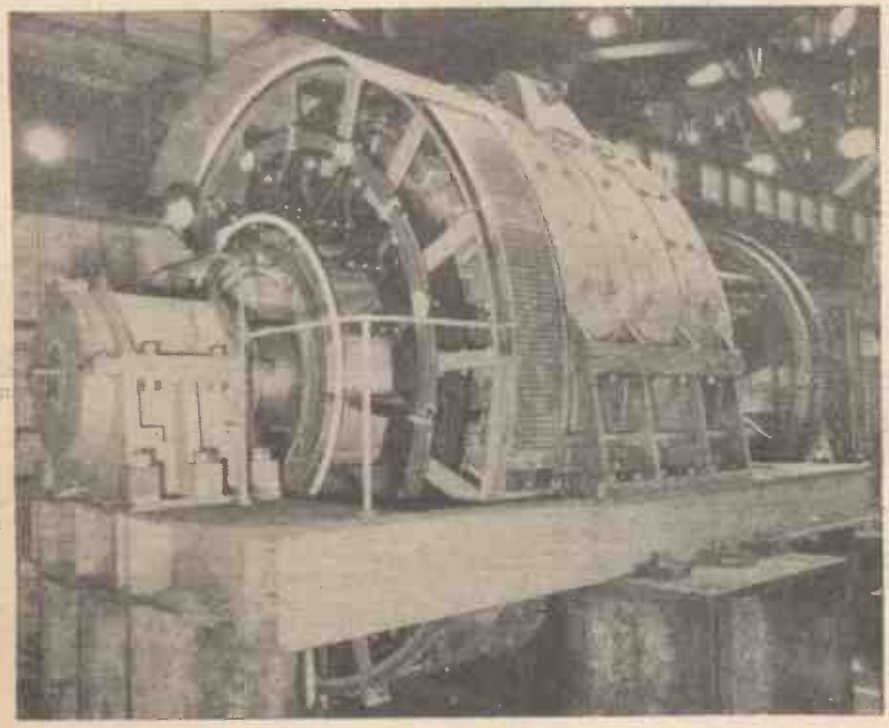
A fourth 3,000 kVA flywheel-type engine-driven alternator was completed for a Jerusalem public utility company and repeat orders were received for two more. Two 3,500 kW flywheel, type 185 r.p.m. alternators were ordered for a station which already contains six 2,500 units of this type.



B.T.H. 3,500 kW water-turbine-driven vertical alternator for a hydro-electric scheme in India.

Transformers

Large transformers, ranging from 45 mVA downwards, include a number fitted with on-load tap changing equipment for the C.E.B. and for the North Eastern E.S. Co. Among the overseas orders from India, Australia and South Africa are two 40 mVA banks (10.5/88 kV), with station and auxiliary transformers for the Orlando (Johannesburg) power station, and three 37.5 mVA 11/66 kV units which are being supplied to the Victorian State Electricity Commission.



B.T.H. 4,850 h.p. motor for 32in. reversing mill, on test at Rugby works.

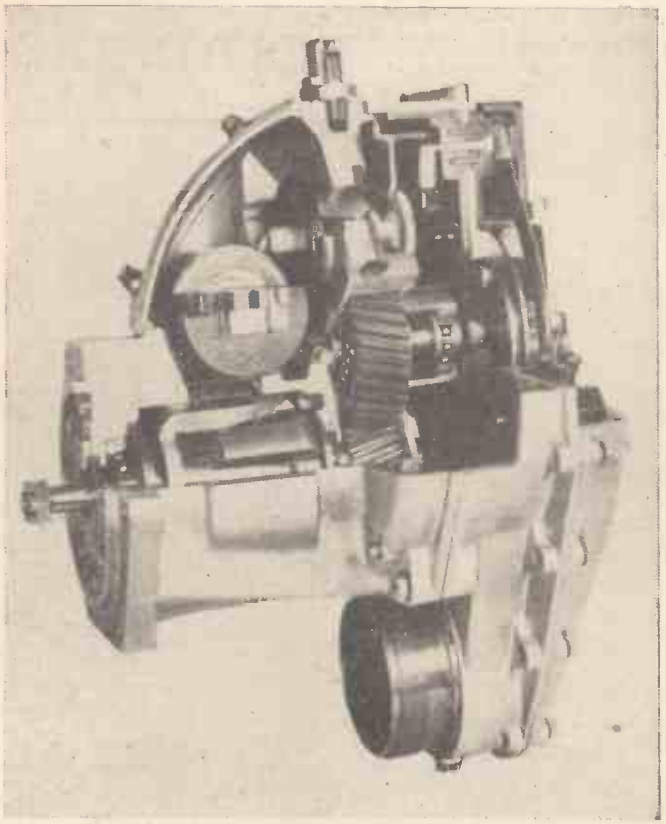
Switchgear

Perhaps the most interesting item in the activities of the switchgear department was the installation of six 132 kV "Aerojet" 1,500 mVA circuit breakers in the C.E.B. substation at Andover. An "Aerojet" breaker for 110 kV fitted with a new design of "all porcelain" blast head and incorporating a simplified contact arrangement, has been developed for the Madras Government. A new design of high speed oil circuit breaker for 2,500 mVA duty, which incorporates resistance switching and is capable of operating in 3 cycles, has been manufactured.

A new design of type V-L air circuit breaker, incorporating an improved form of arc chute is now available for 100 and 150 mVA breaking capacity at 3.3 kV. A large order for Class AL truck-type switchgear with type V-L air circuit breakers has been completed.

Marine Department

Special interest is added to an order now in hand for the first four-engine diesel-electric tanker using A.C. by the fact that a combustion turbine is now under manufacture at the Rugby Works which will be



Section of type C18/A self-boosted aircraft magneto, showing position of the pump gears.

substituted eventually for one of the diesel alternator sets; this is the first British mercantile marine application of the gas turbine to be announced. The experience to be gained from this installation will be most valuable when more ambitious arrangements, in which the gas turbine will form the main or the only power producing unit, are developed. Another interesting marine installation is the electric cable-laying machinery—the first of its kind—in the cable ship *Monarch*, which completed very successful trials in the early part of the year.

Traction

This department is busy with a large number of trolley bus equipments, recent orders including 52 for Wolverhampton, 15 for Derby, and 12 for Mexborough. For the London Passenger Transport Board an order has been received for 225 PCM control equipments which will be generally similar to the 855 equipments supplied for the 1938 Tube stock, but will incorporate improvements in the layout and design of the individual parts to facilitate servicing and replacement with the equipment in position. The electrical side of the power plant of a diesel-electric locomotive for mixed traffic is to be supplied to the L.M.S. Railway. This will have two 2-axle bogies, with all four axles motored. The new battery vehicle control equipment developed in 1945 is now in full production; orders for 500, including motors, have been received, and further large orders are expected.

Mining Plant

The supply and installation of a number of equipments has been proceeding. For oversea mines two winder equipments of more than 2,500 h.p. are being manufactured, and three of at least 3,000 h.p. are about to be installed. In order to handle large loads at low speeds and thereby to attain maximum efficiency a 2,000 h.p. 37 r.p.m. D.G. Ward Leonard controlled skip winder motor has been ordered by a Nottinghamshire colliery to replace a 1,500 h.p. 49.5 r.p.m. machine. An example of the alternative method of using large mine cars is the medium horse-power A.C. winder fitted with the B.T.H. patent speed compensated braking control, which is being manufactured for a colliery in Derbyshire, where the car capacity has been raised to 4½ tons and the rope speed reduced to 14.4ft. per second.

A number of schemes for the replacement of subsidiary rope haulages by conveyor installations, as recommended in the Reid Report, have been prepared. A typical equipment, now being installed at a Midland colliery, comprises a 140 h.p. 3,300v. flameproof squirrel cage motor, which drives through hydraulic coupling. It is started direct-on-line by flameproof contactor gear; the control circuit being interlocked with other conveyors by a belt-driven centrifugal device, with a Thrustor-operated brake to prevent run-back. There are five 75 h.p. conveyors in the same scheme.

Rolling and Tube Mills

A number of new drives for a variety of rolling mills have been placed in commission. These include a 4,850 h.p. drive for a 32in. reversing structural mill with amplidyne control; two aluminium mill installations; and a small reversing cold strip mill for special alloy steel. Amplidyne control is giving very satisfactory results in mill operation. A 1,000 h.p. induction motor drive for a 3-high roughing mill has recently been shipped to Southern Rhodesia. Other important orders for mill plant and auxiliaries are in hand.

Paper Mills

Orders from home and overseas for paper mill equipment include a large contract from a South American company for A.C. sectional drives and auxiliary machinery; additional motors and control equipment have been added to the order during the year. The B.T.H. Company is supplying a number of A.C. variable speed commutator motors ranging up to 200 h.p. for individual drive of smaller paper machines; where extra long speed ranges are required an electronic speed regulator is being fitted.

These equipments include one for an Indian paper mill. One of the latest B.T.H. design of selsyn tie-in sectional drives for operating a cellulose film-making machine is now in production.

Lifts and Escalators

Additions to the lift installations at the Rugby works will give greater variety to the types of lift motors available for demonstration to visitors. Variable voltage sets for high speed lifts are in hand for London and for Canada. A variable speed A.C. drive for a L.P.T.B. escalator represents a new departure, employing a type CHT motor with three-speed selector switch, enabling the escalator speed to be changed automatically; eventually, five speeds will be available for larger installations.

Fractional H.P. Motors

A section of a B.T.H. factory at Newcastle-under-Lyme has been devoted to the manufacture of fractional horse-power motors to supplement the other works engaged in producing these machines. A comprehensive range of fractional h.p. flameproof motors, covered by Buxton Certificate

A modern shirt factory lighted with Mazda 80-watt fluorescent lamps.

for use in Group II gases (of which petrol vapour is a typical example), is intended primarily for use in kerbside petrol pumps; orders have been received for many thousands for this and other applications. The varied requirements of the several main users have been met by the production of one basic design.

Small special motors for the film industry (three-phase slipring machines, of which a number will operate in mutual synchronism when connected to a common distributor unit); and a small shaded pole motor (type BP. 1304), available for outputs of 3, 5 and 7 watts, and intended for driving table or window fans, condenser cooling equipment on refrigerators and general air conditioning plant, are among other recent developments in this field.

Industrial Heating

The standard screw type immersion heater has been used in steam generators, with working pressure up to 30lb. sq. in.; for higher pressures flange-mounted heaters have been supplied. A scheme has recently been developed for feeding a lead melting furnace, the molten metal being pumped through an electrically heated tap to the metal mould or to the processing machine.

Reclaiming of vitreous enamelled sheet steel parts has been achieved by treatment in special caustic baths heated by Pyrobar immersion heaters. To prevent damage to cable connections Pyrobar oil immersion heaters for tempering baths have been designed, with their terminals extended away from the hot bath.

Electronics Engineering

In addition to the Government work still in hand, much development has been carried out on improved and simplified forms of the controls shown at the Symposium and Exhibition held at Rugby in July. It is anticipated that marine radar equipments will be in production in 1947. Active development has taken place in sound reproduction, 35 mm. and 16 mm. sound film projection equipments, and carrier frequency wire broadcasting—the first relay installation of this type was inaugurated at Rugby in November.

Aircraft Equipment

Tests of a B.T.H. turbo-starter of the "Cartridge" type on a gas turbine aero engine were very successful, and prototypes are now being made. In the ignition equipment for the new 330 h.p. supercharged Gipsy Queen series 70 De Havilland aero engine, "rotating magnet" type magnetos are used in place of the earlier "rotating armature" type. The new self-boosting magneto which has the distributor brush holder gear enclosed to form a pump, produces 7.6 kV. at 34,000 ft., and with the aid of the pump, 6 kV at over 50,000ft. The first thousand of these magnetos are now being made by the B.T.H. Company.

Lamps and Lighting

The Mazda 40 watt fluorescent lamp has achieved almost as much popularity as its older 80 watt counterpart. The efficiency of "Daylight" lamps has been greatly improved and it is hoped that the improvement will shortly be extended to "Warm-white" lamps.

The range of compact elongated Mazdalux lamp auxiliaries has been extended, and made it possible to develop a complete uniform range of 40 watt and 80 watt single and two-lamp fittings.

Industrial Lighting

Many large-scale installations have been completed, and it is becoming increasingly evident that architects and consulting engineers are realising the necessity of giving serious consideration to lighting in the early stages of planning.

Commercial Lighting

A new fitting of B.T.H. design for a 40-watt fluorescent lamp was selected by the Council of Industrial Design for inclusion in the "Britain Can Make It" exhibition. This fitting is one of a new family of 80-watt and 40-watt fluorescent lamp fittings already in demand for offices and business premises.

Street Lighting

The most outstanding development has been the introduction of a Mazdalux lantern accommodating three standard Mazda 80-watt "Warm-white" fluorescent lamps. The first experimental installation was made in High Street, Rugby, closely followed by an installation in Old Bond Street, London. Many inquiries have already been received from public lighting engineers.

A range of 16 side-entry lanterns, all of the same basic design, has been developed for the accommodation of every type of vertically operated street lighting lamp.

Another new lantern is that designed for the lighting of Group A roads with 250-watt or 400-watt standard Mercra lamps in a horizontal burning position.

School Lighting

During the year many local education authorities have sought the advice of B.T.H. lighting engineers on lighting plans for future schools.

Mines Lighting

Experimental fluorescent lighting installations have been completed in the Binley and Birch Coppice Collieries, proving that there is a great future for fluorescent lighting in underground roadways. Further experiments to extend the field of application are under way.

Infra-red

A new type of lamp with an internal reflector which does not require cleaning or polishing has been introduced. It is hoped that production of this lamp in the company's works will soon be started.

The Sawyer "Viewmaster"

THIS new instrument embodies the scientifically applied principle of the stereoscope, redesigned on modern lines and with the added attraction of three-dimensional pictures in full colour Kodachrome.

It is slightly bigger than the average pair of opera glasses, beautifully made in durable plastic and equipped with perfect, accurately ground lenses—specially adjusted for stereoscopic effect and fully guaranteed for a year after purchase.

"Viewmaster" pictures, photographed by special colour-photo process, are mounted on easily changed reels . . . minutely adjusted for correct focus and ready to use; a flick of the finger changes the picture. Apart from its uses as an educational and entertainment medium its applications in the world of business are very numerous. For instance, it has great value as a saleman's aid—especially for those products where samples and details of manufacture cannot possibly be taken to a client's desk. The representative can show his prospective customer full-colour three-dimensional pictures of products, application, processes, colour ranges, textiles, installations in far parts of the world, etc.

The "Viewmaster" and reels—there are over 200 subjects to choose from—are obtainable from photographic dealers. The price of the "Viewmaster" is 15s., plus purchase tax, and that of the reels, 2s. each. New releases will be available shortly and will include reels of English scenes and life, Switzerland, The Holy Land and, especially for the childen, their favourite fairy stories—all in three-dimensional full-colour Kodachrome.

The Sawyer "Viewmaster," is made in England for the sole distributors, Messrs. Victor Animatograph Corpn. (London), Ltd., of 9, Cavendish Square, London, W.1.

The "Viewmaster" in use, and (left) enlarged view showing the front open and the reel of Kodachrome pictures.

Trace Elements

A Modern Chemical Enigma Outlined

By J. F. STIRLING

FOR the healthy growth and development of both animals and plants certain basic elements are required to enter into their nutrition. Such elements are nitrogen, potassium, calcium, phosphorus and, to some extent, iron. Additionally, of course, animals need oxygen for respiration, and the animal machine also needs very small but regular amounts of certain complex organic substances which we call vitamins for it to work smoothly and efficiently.

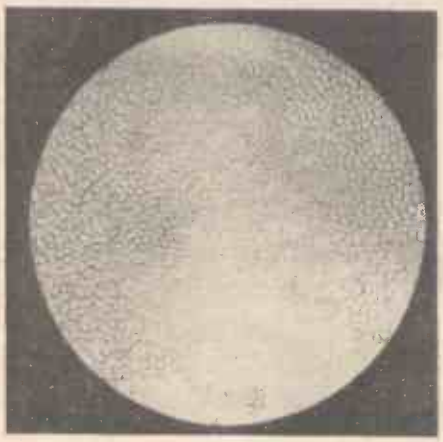
But increasingly during the last few years it has become recognised that the above list does not comprise the whole of the essentials of healthy plant or animal life. There has now entered into the picture of Life's processes the conception of what, for want of a more accurate term, is known as the "trace element," that is to say of an element whose presence in the merest traces seems to be more or less essential for the well-being of the plant or animal.

You may think of a "trace element" as a mineral vitamin, if you like, although the analogy is not a perfectly exact one, for the vitamin seems to function in an altogether different manner from the trace element.

It was the agriculturists and the biologists—not the chemical scientists—who first stumbled on the conception of the trace element. They were puzzled, for example, as to why two areas of land having similar soils and similar climatic conditions should produce entirely different crop yields, one of the experimental lands giving bumper cereal crops, the other giving poor, miserable results. They were perplexed, also, as to why sheep grazing on certain lands thrived exceedingly well and why other identical breeds of sheep feeding on similar pastures should be poorly nourished and even diseased.

It was from considerations such as these that the idea of the trace element gradually arose. Clearly, it seemed, the successful pasture lands and the soils which produced the prolific crops were the ones which contained something which the other lands did not possess. Yet, in their average routine chemical analysis, such soils were identical.

So, one by one, agricultural scientists set to work in order to ferret out the underlying reason of these observed differences.



A drop of human blood highly magnified, rendering the red hæmoglobin corpuscles clearly visible. Lack of manganese traces in the body is supposed to inhibit the formation of these corpuscles and to bring on a condition of anæmia.

In various laboratories throughout the world the work proceeded quietly and patiently. Ultimately, the results began to come through little by little. It began to be proved that there exist elements whose presence in the

Healthy, well-grown barley. Absence from the soil of copper, zinc and manganese as trace elements renders such cereal crops weak, improperly formed, stunted, and liable to disease attacks of mildew.

soil in minute amounts is absolutely essential to the good growth of crops which are grown in such soils. Only traces of such elements in the soil were shown to be necessary, amounts not exceeding a few parts per million in the soil. Indeed, some of the trace elements, such as, for instance, copper, are actually poisonous when present in substantial amounts. Nevertheless, in these minute traces, they seem to be essential.

Active Investigations

Not very much is known about agricultural and biological trace elements at the present time. But more and more laboratories are taking up the investigation of these mysterious elements and are actively endeavouring to ascertain the underlying mechanisms of their now indisputable effects on plants and animals.

So far as we know at present, the trace elements concerned with the well-being of the plant are four in number, viz., boron, manganese, copper and zinc. To this quartet of elements may be added another suspected trace element in the form of the rare metal molybdenum.

Boron is the most important of the agricultural trace elements. As long ago as 1910, it was shown that the presence of certain amounts of boron compounds in the soil is required for the healthy growth of a number of plants, but the essential character of this element was not demonstrated until some fifteen years afterwards when the agricultural scientists at Rothamsted experimental station proved conclusively that at least twenty diseases of plants could be traced to the complete absence of boron in the soil.

A highly theoretical piece of research, you might think, and one without very much practical import. But not so, because one of these boron-deficiency diseases happened to be the then troublesome "heart rot" or "crown rot" of the sugar beet, which in a good degree opposed our efforts to establish a successful sugar beet industry in this country. Hence it was that the discovery of the essential nature of boron in a soil gave us the weapon we wanted to combat an agricultural disease which might ultimately have been the ruination of a very necessary industry.

In a similar way, it was shown that the "raan" or "brown heart" disease of turnips and swedes was due to lack of boron in the soil.

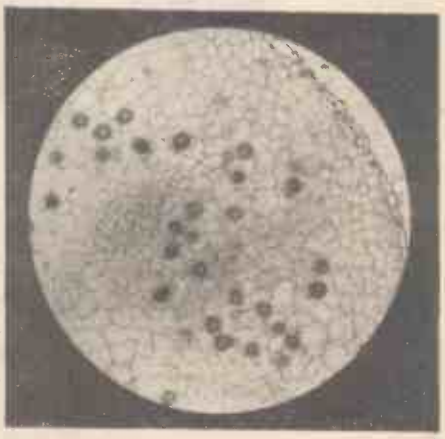
Indispensable Boron

Boron, indeed, seems to be a very indispensable element in the growth mechanism of plants. Root crops are the most sensitive to its absence. Without it, the fibres of these roots cannot form themselves properly. The root becomes stunted. It is unable to extract sufficient nourishment from the soil. Hence the plant languishes and ultimately dies.

Why this should be so is unknown at present. But the fact remains and continues to present a subject for the most interesting research to the modern agricultural chemist.

Quite a lot of varying plant diseases can be traced to lack of boron in the soil. The "browning" disease of cauliflowers, and the "cracked stem" trouble of celery are both due to boron deficiency. So, too, is the "internal cork" disease of certain apple trees, whilst that peculiar disease known as "topsiekte," which withers the leaves of the tobacco plant, has the same cause.

And what is boron? It is a non-metallic element which is related to aluminium. Its



"Cabbage Rust." A highly magnified view of a section of a diseased cabbage leaf affected by "rust," showing the invasion of the leaf cells by destructive fungoid bodies, which feed on the living cells of the leaf and destroy them. Such a disease is often symptomatic of trace-element deficiency in the soil.

compounds are plentiful, particularly in volcanic regions, and for a long time most of our borax and boric acid came from the waters of these regions. Yet, owing to the difficulty of its extraction, boron itself is seldom seen, and there are practically no uses for it.

Nevertheless, its action on plants is positive enough. Apply boric acid or borax to a "deficiency" soil and the plant diseases due to its absence gradually vanish. Even the mere spraying of the crops with a borax solution will sometimes cure the disease. In a word, the application of about 10lb. of borax to the acre of land is an almost sovereign remedy for troubles caused by the lack of this element.

Copper, as we have already seen, is another trace element. Its complete absence from the soil is responsible for various diseases of fruit trees not only in England, but in many parts of the world. An instance of copper deficiency is to be seen in the

The mysterious molybdenum. Whether it behaves as a trace element or otherwise has not yet been settled. Nevertheless, in view of its rarity in the metallic state, a strip of it as shown here is seldom seen.

"exanthema" or "die-back" disease of plums, apples, pears, prunes and citrus fruits. Put copper into the soil at the rate of about 2lb of copper sulphate per acre and you cure the trouble. But exceed this amount appreciably and you run the risk of killing the trees, for copper in more than the most minute traces is a well-known toxic agent.

The same applies to zinc. Without a minute trace of zinc in the soil, crops languish and become liable to be attacked by mildews of various descriptions.

Then there is manganese, another metallic trace element whose presence in soil is indispensable to a healthy plant life. Remove assimilable manganese from the soil and the plants become, as it were, chronically anæmic. It is thought that the presence of manganese in the soil acts by assisting in the mechanism of iron-uptake by the plant, but the chemical process has by no means been worked out yet.

Animal Trace Elements

In the animal organism, trace elements are equally as essential as they are to plant life, and the complete absence of them brings about cessation or, at least, disorganisation of life's forces. Animal trace elements are at least five in number—copper, cobalt, manganese, zinc and iodine—but there are probably considerably more awaiting recognition.

Of the above named, the last one—iodine—is the best understood as regards its physiological mechanism, for it applies to our own bodies as well as to those of the lower animals.

A minute intake of iodine is essential for animals and man. From it the body builds up the very necessary organic compound known as *thyroxine*. This is a complex iodine compound which regulates the general mechanism of the body. Without a sufficient iodine supply we run the risk of goitre and various other troubles.

Manganese is indispensable to the animal organism (and probably, also, to our own bodies) because, as previously mentioned, it seems to be concerned in the mechanism of hæmoglobin formation, hæmoglobin being, of course, the red active principle of the blood. If, therefore, without the as yet mysterious catalytic effect of traces of manganese you cannot assimilate sufficient iron to produce the necessary blood hæmoglobin, the effect of this lack can readily be imagined. The same applies also to various breeds of cattle and other land animals.

Cobalt Deficiency

Cobalt is a trace element which seems to be indispensable to animals but not to plants. Probably it acts in a similar manner to manganese, because in experimental rats, its presence in the food has been shown to result in an increase in the number of blood cells.

In Australia, cobalt deficiency has been shown to be the cause of various wasting diseases of sheep. What is known as "Coast disease" in Australia has been cured by feeding minute amounts of soluble cobalt compounds to cattle. So, also, has the important "bush sickness" of cattle in New Zealand. The disease of sheep known in this country as "pine" seems also to be a case of cobalt deficiency. It has been experimentally cured by the addition of from 2 to 20lb. of cobalt chloride per acre to Scottish soils.

Then there is molybdenum, the rare metal which has been used considerably in the construction of radio transmitting valves, and in other high-power electrical vacuum tubes. Molybdenum has been shown to be the cause of the cattle disease known as "teart" in certain Worcestershire and Somersetshire pastures. Yet there is some evidence to show that its entire absence from the soil is injurious to the well-being of animals, if not of plants. But in the case of this rare metal the verdict is, as yet, one of "not proven."

An enlarged section of a human tooth showing the sensitive "pulp" or inner tooth material and the hard external enamel layer around it. Whilst the enamel always contains fluorine in minute quantities, excess of this active element in the body destroys the enamel and causes it to crumble.

Fluorine

There is another element which seems to be essential to animal economy. This is fluorine, the most active member of the "halogen" family, of which chlorine, bromine and iodine are other members.

In minute quantities, fluorine is found in the teeth of humans and animals. Hence, it must be assumed that certain traces of this element are necessary. Yet if man or animals drink water having a high fluorine content, the normal processes of tooth and of bone formation are at once upset. There is brought about the well-known "fluorine mottling" of the teeth and a softening of the bones. When rock phosphate is fed to animals, these symptoms may come on if, as is sometimes the case, the phosphate is

Highly-magnified view of a portion of a section of a wheat stem, showing parasitic fungus growing on the surface of the stem. The individual plant cells of the wheat stem are plainly seen, and also the gradual penetrations of the fungus "roots" into them. A condition such as this is often due to lack of trace elements—notably copper and zinc—in the soil.

rich in fluorine. Indeed, in extreme cases of this "fluorinisation," general emaciation, thickened joints, and even a form of rickets may all come on. Yet, strange to say, in minute amounts, fluorine, as we have observed, seems to be essential to tooth formation.

As regards zinc, which is essential to certain forms of plant life, no known case of cattle and farm animal disease has yet been ascribed to zinc deficiency. On the other hand, experimental rats which were fed on a perfectly zinc-free diet for several months were found to have developed anæmia and wasting diseases, due, apparently, to poor nutrition. Hence, even in the biological world, zinc seems to function in some ways as a vital trace element.

The metal magnesium can hardly be regarded as a trace element in the world of plants, for just as iron is an indispensable constituent of the red hæmoglobin of animal and human blood, so, too, is magnesium a component of the green chlorophyl of plants. But it has been noticed in the case of sheep and other animals that deficiencies of magnesium have been associated with the onset of convulsions. What is known as "grass tetany" or "grass staggers" in sheep has been shown to be due to low magnesium values in the blood and may be cured by dosing the animal with magnesium salts or by providing it (as recommended by the Ministry of Agriculture) with a daily mineral lick containing 10 per cent. of magnesium oxide.

Concerning Copper

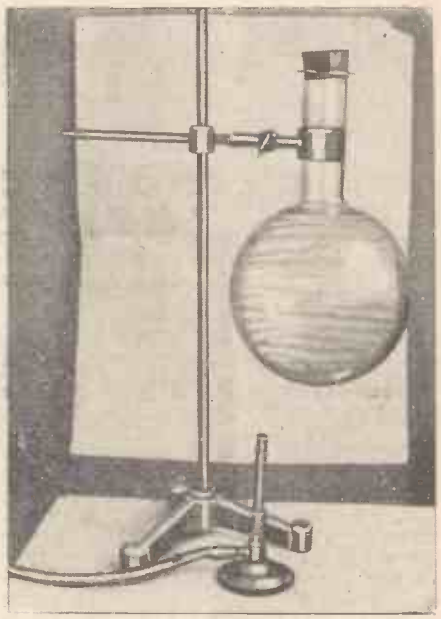
Copper as a trace element is just as essential for animals as it is for plants, although in both instances an excess of

it acts the other way and becomes highly poisonous. In Holland, in Australia and in New Zealand a disease of young lambs known as "swayback," which was first associated with lead poisoning, has been shown really to be due to a copper deficiency in the body. Animals which have died of this disease show cavities in the brain mass and an almost complete absence of all traces of copper in the blood. Whether the observed deterioration of the brain matter is due to the copper deficiency has not yet been proved. If, however, it is shown to be the case, it must then appear that traces of copper are essential to the working of the animal and, no doubt, to the human brain. Here again, however, very little is yet known of this interesting subject.

Instances could be multiplied of animal diseases being proved to be due to certain element deficiencies in the body, but to extend such examples would serve very little purpose.

We have, however, sufficient evidence before us to show that what are called "trace elements" (and sometimes "minor elements") do in actual fact perform a very important function in both the plant and the animal economy. But what mechanism they involve or create is very much a matter for the research scientist of the present time.

Whether the action of these trace elements in the human body is similar to their effect in the animal body is not certain in all cases. True it is that deficiencies of iodine,



The deep purple or violet vapour of iodine contained in a flask. This element is highly important to animal life, its absence bringing on various physical and even mental trouble.

fluorine, manganese and probably copper have broadly similar effects in both animal and human organisms, but whether the chemical mechanism is the same in both instances we do not know.

Agricultural Geology

Trace elements in the soil are derived from the various rocks of the neighbourhood. There is being set on foot at the present time a number of modern geological studies which seek to estimate the amount and variety of trace elements in the soil of any given neighbourhood from a consideration of its geological surroundings and environment. "Agricultural geology" is the name which has been proposed for this new branch of applied science.

The modern study of the trace elements, although it has only just begun in real earnest, shows us at once how complex and still intrinsically mysterious are the basic mechanics of animal and vegetable life. The general balance between health and disease, between well-being and deterioration, is finely poised. Not only is well-balanced general nutrition required for plant and animal life, but fine control of the life forces which are generated by such nutrition is also indispensable.

In this complex and still inexorably mysterious business the vitamins are concerned, but the trace elements play no less important a part. It is, therefore, the business of modern science to endeavour to discover not only how each trace element plays its allotted part, but also how they are all related in their actions one to the other.

The Model Aircraft Exhibition

A Brief Review of Some of the Fine Model Aircraft and Miniature Engines Seen at Dorland Hall

By the MARQUIS of DONEGALL

A flying model of the Sandringham Flying Boat.

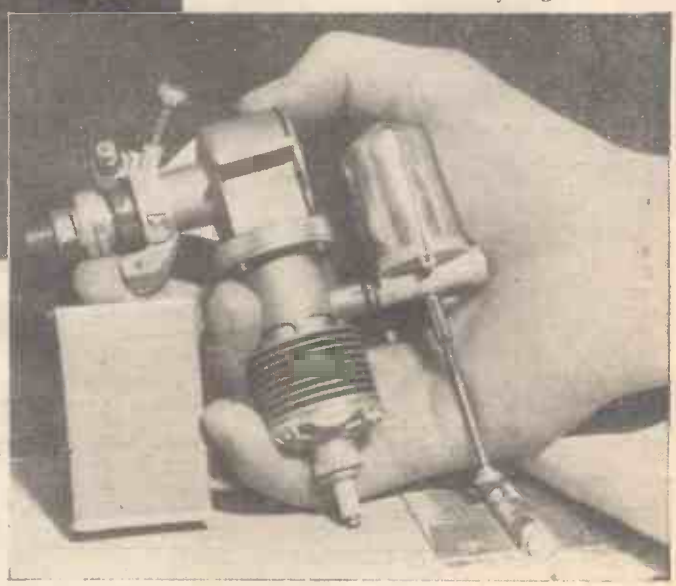
MANY years ago I learned to take people who build and fly model aircraft—aeromodellers, they call themselves—very seriously. I had just acquired a Gypsy-Moth and was in that first flush of swollen-headedness through which all A Licence pilots have at one time passed. At this point a friend of mine, whose hobby of throwing things into the air on the end of a twisted piece of elastic I had been inclined to belittle, won the Wakefield Cup and received a good measure of encouraging publicity in the Press. On the same day I dented my Gypsy-Moth and received a quite unmerited measure of unkind publicity in the Press. Ever since that unfortunate coincidence I have had a greater regard for aeromodellers: they are at least on a comparatively safe wicket.

I only mention this great respect in which I hold aeromodellers in order that you should understand the better how profoundly shocked I was at a certain incident during my tour of Dorland Hall, where the Third National Model Aircraft Exhibition was being held.

I was inspecting one of the booths at which components for this science are sold. An argument was in progress.

"But, madam, you will need two rubber tyres, not one."

"I tell you I want one rubber tyre, and if you really want to know the reason it is because I want it for my dog."



A miniature aero engine seen beside a matchbox. With a bore of .75in. and a stroke of .815in., this tiny engine is capable of 5-6,000 revs. per minute.

Dorland Hall shook to its foundations, and I only wished that H. M. Bateman himself had been present.

We must now do a tour of the exhibition but before we start I would like to say that Dorland Hall is particularly well suited to an exhibition of this kind.

For instance, at the Model Engineer Exhibition in the New Horticultural Hall everything was, so to speak, laid out on a platter for you in a large expanse, with the effect that there was too much on view to distract from the exhibit under consideration at the moment.

At Dorland Hall the exhibits are arranged in corridors on the ground floor and on part of the first floor. Thus you progress logically from the time you enter one door in Lower Regent Street and come out at another next door to it.

Prize-winning Models

On entering we have in a showcase on the left the prize exhibits sent in for competition from all over the country.

First a Flying Wing in scarlet and natural wood by A. H. W. McBain, of Bedford. This model is powered by an American Minijet.

Another first prize is the Scylla tailless glider by A. J. Cockle, of Northampton,

A flying model of the Vickers Viking.

who also got a special prize with a beautiful model of a Fairchild amphibian with a wing-span of about 5ft.

In the same showcase Sgt. A. Welsberg shows a model of his native Polish R.W.D.5. It is powered by a 1/10th h.p. two-stroke engine, and the hand-beaten cowling is something that has to be seen to be believed.

Another first prize, by R. H. Smith, of Wolverhampton, is a Mercury petrol model with a wing-span of about 6ft. It is a dark blue and yellow high-wing monoplane. There is a modified Jersey Javelin with a 48in. wing-span. According to my information it has a vertical corkscrew climb and anti-spin fins. Anyway, it looks a very fine model, and I hope one day to see it do its "corkscrew."

I must explain that there are 12 different competitions, which embrace almost every category of model from tailless to seaplanes and flying boats, and a competition for model aircraft research equipment. One learns, for instance, that in these days wind tunnels are as important in designing models as in designing full-scale aircraft.

Non-flying Models

Passing by some delightful model aircraft engines, including a model of a Rolls-Royce Derwent I, we come round a corner to the solid scale models, i.e., non-flying models. Among these I pick out a Mustang, a Boeing Fortress, a D.H. 108 in silver, by H. F. Freeman, of Gillingham. L. G. Temple, of Colchester, gets a well-deserved first prize with his Messerschmidt 163B. And I think that my favourite in the non-flying category is the Mustang, by H. Marsden, of Gravesend. It is complete with rockets under the wings and has its engine bared for inspection.

Again we come to more flying models: the flying boats of A. Webb, of Eltham—a Spencer-Dawson amphibian — and the Sundaleena, which got a first prize for Mr. H. G. Bedness, of New Cross.

Flying Demonstrations

Now we go up a staircase into a large hall where there are three flying demonstrations. At the end where we enter there is a control tower, and roped off are three circular wooden runways on which the models take off and land after their tethered round-a-pole flights. They are controlled electrically from the control tower. It is almost uncanny at first how the voice from the control tower booms out through the loudspeaker what a given model is about to do, and to see that particular model manœuvre instantaneously.

Thus, "Now a demonstration of the Vickers Viking . . . the engines now start . . . warming up . . . taxis round the runway . . . taking off on full throttle . . . undercarriage comes up . . . in normal flight . . . throttles back for the glide to come in . . . a little burst . . . undercarriage comes down . . . she is back on the runway."

I need hardly remind readers that this Viking is the one that attracted great crowds at the Paris Aero Show.

Talking to the man in the control tower, I discovered that the mechanism which retracts the undercarriage so convincingly relies on a small unit which played its part in timing the German V.2. I asked the expert how these timing mechanisms were obtained, because, as far as I knew, only two V.2s had failed to explode. His reply was: "After all, they are only the size of a Leica film, and I imagine that they mostly came back from Germany in men's pockets as souvenirs."

The other interesting thing about the Viking is that, as you will recall, its big brothers have been selected for the King's flight, and will be used on his South African tour. The model is powered by two motors that weigh only 9oz., and each develop 1/10th h.p.

Altogether five model aircraft were being flown round these three runways, but I only propose to deal with those that I saw in flight. We come to the De Havilland Vampire jet-propelled fighter 'plane. Much research has been given by Squadron-leader Peter Hunt, technical editor of the *Aero-modeller*, to the production of this remarkable model. It is, of course, the only jet-propelled flying model. The jet-blower weighs 3oz.; you can carry on from there on my well-known non-technical Brontosaurus principle.

Lest you think that I am leading you up more garden paths than usual, I must

A jet-propelled model of the D.H. Vampire.

make it clear that the Vampire at the exhibition was electrically powered—which must be obvious even to the woman who bought a model rubber tyre for her dog.

The third flying model was the Dorland high-wing cabin 'plane with tricycle undercarriage. As I understand it, the Dorland was put out for competition to aeromodellers, but the one which I saw in flight was an expert's job from a research department.

Model Flying Boat

Having satisfied ourselves about the three runways and what flies round and round them, we move 10ft. and look to our left down into a large pond on the lower floor. A gentleman in gum-boots is just putting a model of a Sandringham flying boat on to a floating catapult mechanism. It seems that, clever as these aeromodellers are, they can't get one of their dwarfs off water without assistance. So Mr. E. J. Riding's ¼in. to the foot flying boat has to admit the fact that Nature has provided water with a so far impenetrable drag, and it therefore has to plumb the depth of unreality by being catapulted.

It fairly throws itself into the air, buzzes round the tether-pole and makes a perfect landing on the water.

It would be difficult to be fair to all the stands, considering that there are 17 of them, varying from Diesel Corner, displaying model diesel engines of less than 1 c.c., to the well-known firm of Atlas Motors, whose superb little engines have delighted me almost from undergraduate days. We also have "Frog" and its plastic non-flying stuff, which goes under the name of "Penguine." These are the products of International Model Aircraft, Ltd. It is claimed for the "Penguine" models that they are the Rolls-Royce of non-flying models.

If I go on much longer I shall have to mention all the stand-holders, which is impossible. So I will content myself with saying that there were many interesting and new things for aeromodellers, and that I was pleased and surprised to find how many necessities had reappeared on the market.

A Vertical Enlarger

Details of a Small, Inexpensive Apparatus Specially Designed for Enlarging 9.5 mm. Negatives to ¼-plate Dimensions

By R. J. CHAMBERLAIN

ALTHOUGH primarily designed for dealing with 9.5 mm. (about ⅜in. by ¼in.) cine film, the enlarger about to be described can be used for making enlargements from most miniature sizes of negative, or small portions of regular sizes of negative. It makes ¼-plate-size pictures (4¼in. by 3¼in.) which, incidentally, is a size selected because the dimensions are neither too small nor too large for most purposes.

The amount of enlarging possible is not confined to ¼-plate limits. If, for example, ½-plate enlargements are desirable, one has only to include a longer upright support rod to provide sufficient extension for the lamp house and its negative carrier and make a 6½in. by 4¾in. print holder.

It is rather unlikely that enlargements beyond ½-plate dimensions will be wanted. If so, the reader will have to extend the lamp house base arm and bracket and also make a larger baseboard. The main idea behind the print holders, of course, is that these give a neat white edge to the prints, and the main idea behind the enlarger, if built to the dimensions stated, is the creation of pictures which can be conveniently mounted in an album.

Cine Film Enlargements

The enlarger makes excellent "stills" from 9.5 mm. cine film. Assuming, then, that you have in the past indulged in the hobby of home cinematography and possess 9.5 mm. Pathéscope film showing pictures of movie stars you wish to enlarge and preserve in an album, or, alternatively, pictures of members of the family taken on Kodak film with a cine camera, this can be easily done, even though you might not possess the negative films.

On the other hand, you may want "stills" from standard size cinematograph film. In this case, however, you will only be able to deal with portions of the film picture, this also applying to most other miniature sizes of film. Any size over V.P. (2¼in. by 1½in.) means that only very small portions can be dealt with, unless the images, such as heads, etc., are fairly minute, in which case it might be possible to make portraits.

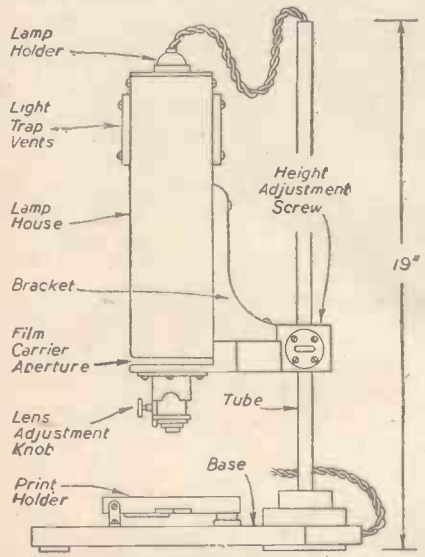
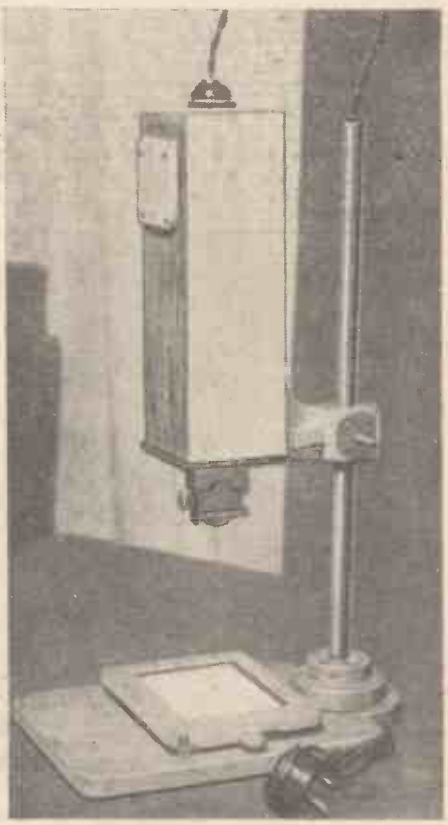


Fig. 1.—Side elevation of the enlarger, giving names of the various parts.



The completed enlarger.

It must now be explained that the enlarger differs vastly from conventional types. It makes enlargements at comparatively short distances. If a strip of 9.5 mm. cine film were projected on a screen by an ordinary enlarger, the resultant magnification, at about 6ft., would be extremely small in comparison with a 6ft. projection with the small, home-made vertical type illustrated.

The Lens Used

Now a word about the most important item of the enlarger—its lens. Knowing the difficulty there is nowadays in buying lenses of any description, the writer experimented with the bi-convex magnifying lens in the view-finder of a ¼-plate stand camera. This lens measured 1in. square and nearly ⅛in. thick. Under test, it gave excellent magnification of small negative pictures, but only truly in the centre, the outer edges being somewhat distorted and tending to converge.

This, however, was not surprising, since the lens is not a proper anastigmat. Indeed, a single plano-convex lens, having a small focal length, would project better pictures. A lens of this sort is to be found in cheap box cameras; the focal length, however, is usually about 5in. or thereabouts, whereas, to suit the enlarger, as designed, a 1in. diam. lens, having a ½in. focal length, would be best.

You will be wise to make use of a view-finder lens. If you own a ¼-plate stand camera, you could "borrow" the lens from its view-finder. The latter is seldom used, although handy for outdoor snaps. Another plan is to try to pick up an old folding camera view-finder, or even the lens from a box camera view-finder. The lens must be obtained before proceeding with the construction of the enlarger, and while the size should be 1in. square, other sizes, such as ⅞in. square or ¾in. square, can be utilised.

The Lamp House

The side elevation in Fig. 1 gives a clear idea of the home-made enlarger. The apparatus is very simply made up. Chief requirements are some ½in. deal, ⅛in. and ¼in. plywood, a length of ½in. diameter tubular metal curtain rod and a few other odds and ends. No condensing lens is needed nor an opalising screen. The bulb of the electric lamp—an opal type—is large enough to cover the negative aperture completely with white illumination, thus dispensing with the need for a screen.

The lamp house can be made first. The front and back pieces are cut from (preferably) ⅛in. plywood, the side pieces being cut from ¼in. stuff. Fretwood (plain thin wood) can be employed, of course, but unless this is well seasoned the heat from the lamp may cause a shrinkage. See Fig. 2 for shape and sizes.

The front and back shapes are attached on the side pieces to be flush, using glue and thin panel pins. Having done that, the lamp house base is cut to size and shape (see Fig. 3) from ½in. wood 7⅛in. by 3in. This, when fitted neatly to the bottom end of the housing, is affixed with glue and nails. Prior to following this procedure, note the small slot cut in the arm end, and the dotted lines running from it to the metal rod hole. The slot is for a nut (belonging to the adjustment screw) and a hole is drilled through centrally for the stem of the adjustment screw. This, in the writer's case, was part of the thumb-screw on a 2in. fretwork cramp.

The Film Carrier

The film carrier and its packing piece (Fig. 3) are cut from ¼in. plywood. Glue

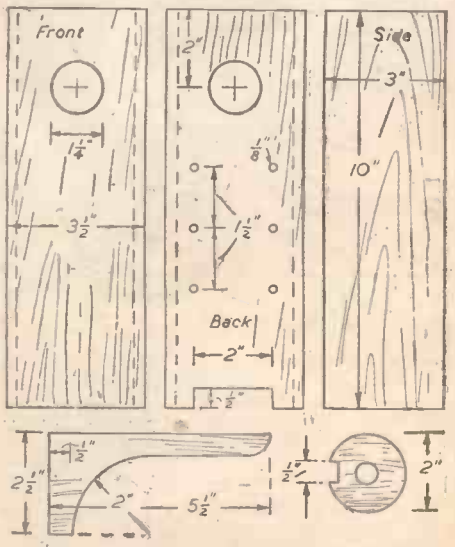


Fig 2.—Details of the lamp house parts.

and nail the packing piece to the underside of the lamp house base arm, then attach the carrier piece.

The length of metal curtain rod should be inserted through the arm holes to pull the pieces true during the assembly. Before withdrawing it, cut out (from ½in. wood) the bracket and washer shown in Fig. 2. Glue on the washer, then attach the bracket, the lower end of the latter engaging with the notch cut in the former.

As soon as the glue dries, the work is trimmed and glasspapered, then the height adjustment screw fitted. The nut is held in its recess by a sheet metal disc which is bent to shape and screwed on over it centrally, as seen in the enlarged detail.

The Top and Vent Covers

The lamp house top consists of a piece of ⅛in. plywood and ¼in. deal attached together, as depicted in Fig. 5. The hole in the ⅛in. piece is 1⅛in. in diam. A standard pendant lamp-fitting fits into this hole, being secured by its collar ring.

The top, when fitted, is attached temporarily with a couple of ⅛in. by 6 roundhead screws, one being driven in at each side, preferably at the back and front. If the plywood has a tendency to warp, use four screws.

The vent cover pieces (M and N) are cut from ⅛in. plywood. Piece M screws over piece N, and the screws should be ¼in. by 6 roundheads, these being long enough to hold the vents over the ventilation holes in the lamp house front and back.

Lens Holder and Sleeve

The lens holder and sleeve parts are all cut from ⅛in. plywood. Great accuracy is needed in cutting the parts to their various shapes and sizes. A fretsaw handframe, or fretmachine, is definitely wanted, and a fine blade should be fitted, more especially if plain ⅛in. fretwood is used.

The lens holder is made up from parts A, B, C, D, E and F (Fig. 4). When neatly cut out, including repeats of A and B, the A pieces are glued to the B pieces, then inserted, unglued, upon piece C. The tenons of the A pieces, of course, engage with the mortises cut in C. The latter helps to hold the work square until the glue sets.

Meanwhile, prepare the sleeve parts G, H, J and K. You want a repeat of piece K only. Glue the J and H pieces to K pieces, then attach the lot to piece G, using

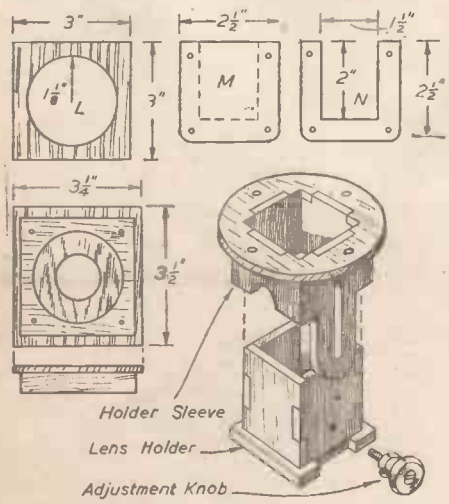


Fig. 5.—Perspective view of lens holder and sleeve, with details of lamp house top and vent covers.

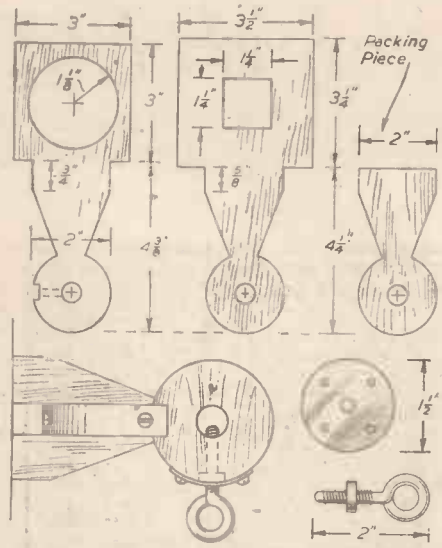


Fig. 3.—Lamp house base, support and packing piece, with details of adjustment screw.

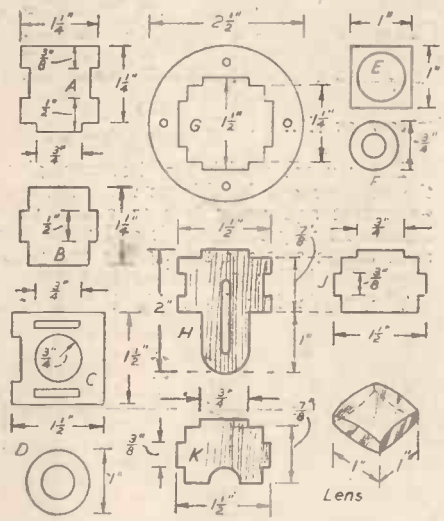


Fig. 4.—Lens holder and sleeve parts with details of lens used.

glue. When the glue sets, clean up the sleeving by glasspapering. The inside of the sleeve may need truing with a flat file to remove spots of excess glue.

The lens holder piece C is removed and the square tube fitted into the sleeve. If too tight a fit, reduce by glasspapering. A glasspapering cork, plus No. 1½ grade glasspaper, is advised for this purpose. When made a neat, smooth fit, glue piece C to the holder tubing, test again in the sleeve, then withdraw to set. When set, the top of C is glasspapered to level the tenons, then disc D glued on centrally, with disc F added on D. Piece E is for packing the lens in the holder and two pieces should be cut out; these pieces should be a fairly tight fit.

Lens Adjustment Knob

A helpful view of the completed lens holder and its sleeving is provided in Fig. 5. The lens holder is adjusted by means of a small milled knob which drives into a hole drilled in one side of the holder. Almost any small size of knob can be employed, provided the threaded shank is not more than ⅜in. in length and ⅛in. thick. A suitable knob could be easily made from discs of ⅛in. plywood and a ¾in. long machine screw, the nut serving to "bind" the discs to the screw.

The interior of the sleeve and lens holder should be darkened by applying black drawing ink with a pencil brush. This is advised to reduce opaque "reflection" and the lower end of the lamp house could also be similarly stained, including the negative carrier.

The lens holder sleeving is affixed directly beneath the negative carrier to be central with its aperture. In fact, the top end of the lens holder will penetrate into the carrier aperture by about ¼in. Consequently, the sleeve is best fixed in position by pushing the holder fully into it to project for centring the sleeve flange adequately beneath the carrier.

The lens, which is shown in Fig. 4, is cleaned and pushed into its holder. The pieces E fit down on top; these, too, should be stained black. If using a ¾in. square lens—which may be unlikely—you should cut out a 1in. square from ¼in. plywood, with an inner ¾in. square hole for the lens; this will prevent the lens from moving sideways. Another idea is to "line" the bottom interior sides of the lens holder with ¼in. by ⅛in. strips of wood to surround the lens.

This will also apply if testing a ¾in. diameter plano-convex lens. In many old cameras, the lens consists of three different types, one being plano-convex. The other two are invariably cemented together with, possibly, Canada balsam. These lenses could be separated for test purposes in the enlarger, but such interference is not advised if it is desired to use the lenses again for camera work.

The Negative Carrier

It is at this stage you will need the negative carrier in order to test the various lenses that may come your way. The carrier is made from a cleaned negative plate of ¼-plate size and a piece of ⅛in. plywood the same size, as seen in Fig. 6.

Remove the emulsion from an old plate by steeping it in hot, soapy water, then scrubbing with a nail brush, finally rinsing and drying the glass. Unless the sharpness is removed from the sheet of glass, fingers are liable to be cut. Edges can be easily dulled by rubbing with an oilstone slip.

A neat film "frame" aperture is cut in the ⅛in. plywood as shown. The edges of the wood should be rounded over at the front and sides only. The sheet of glass and wood is hinged together with a piece of insulation tape or other adhesive tape. It might be advisable to "dust" the tape afterwards with

(*Continued on page 211*)

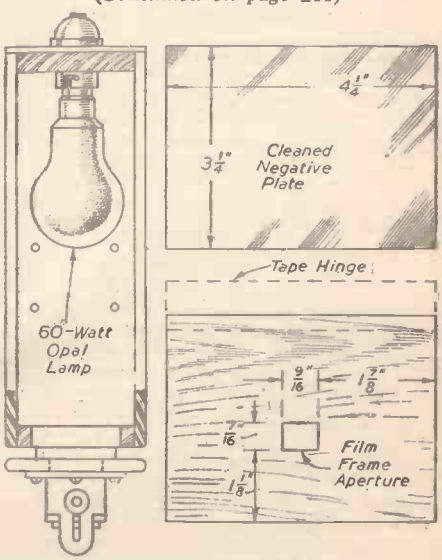


Fig. 6.—Part sectional view of lamp house with front removed to show interior, with negative carrier parts.

A Remote-controlled 1in. Scale Model Tank

The model tank travelling over an obstacle.

Constructional Details of a Scale Model "Churchill" Tank

By PHILLIP F. DODD

(*Concluded from page* 168, *February issue*)

IN order to solve the chain-drive problem, the designer endeavoured to discover a manufacturer who produced half-inch pitch, straight-sided links, and eventually decided to sweat small brass strips, each ¼in. high and ½in. long, on to the side of each link so that the bogie wheels would run smoothly over them instead of the chain links. There would have been 376 pieces each to be cut ¼in. high and ½in. long, rough corners smoothed, stepped so as to clear its overlapping neighbour and sweated to the hard steel pivots of the bicycle chain. This was abandoned as being very tedious and not altogether satisfactory. The ideal method was to design a track link which would resemble as closely as possible those employed on the prototype. A pattern was cut in ebonite, Fig. 8, and many weeks were spent in attempting to procure someone to cast 250 of these links. One firm would make not less than 10,000 for £40, which was reasonable enough for that quantity, but when only 250 were required this appeared to be rather expensive. Finally it was decided to manufacture them at home. A mould was built up of mild steel sheet and plates of varying thicknesses, Fig. 9, and scrap silicon aluminium headers and risers were purchased from a foundry. This alloy is easy to melt, flows readily, and does not show an easy tendency to oxidise in the molten state. It is comparatively strong and quite strong enough for the job in hand. After casting, the headers were removed, and each link was drilled, filed and pinned to its neighbour. A considerable amount of filing was necessary owing to the primitive mould. The track pins were made from nails with the heads removed and cut to length. They were bent slightly before inserting into the link holes, and were thus held rigidly in place. From casting to finishing each link took 15 minutes; there are 94 links per track. The mould was made in five days and casting took a fortnight. Again, time was well spent, and the track "looks right."

It is hoped to build another model with two motors, each motor driving one track, and steering being effected by the difference in speed of the motors, which will be controlled through two rheostats.

The present model has, however, given the designer and his friends many hours of enjoyment and never fails to amuse as it threads its way round chair and table legs, as it creeps across a 10in. gorge and negotiates 3½in. high vertical obstacles.

The whole is painted khaki green and finished with squadron, divisional and recognition markings in the correct colours. Its official "W.D. number" is T13745, this being the day, month and year in which it was completed.

Operating Notes

The case in which the model is transported is divided into two compartments. The larger and right-hand one houses the model itself; the smaller and left-hand one contains the control panel, the trickle charger and its lead to the mains, and the seven-core cable complete with seven-pin plug. (Fig. 10.) A short length of flex carries a three-pin plug at one end and a pair of alligator clips at the other.

After unlocking and opening the right-hand lid and removing the spare parts tray, the model is lifted out and placed on the floor, making sure that the bogie wheels are running correctly on the tracks. Do not attempt to push the model along by hand, and it is recommended that the surface on which the model is operated is hard and smooth, such as linoleum or a thin carpet.

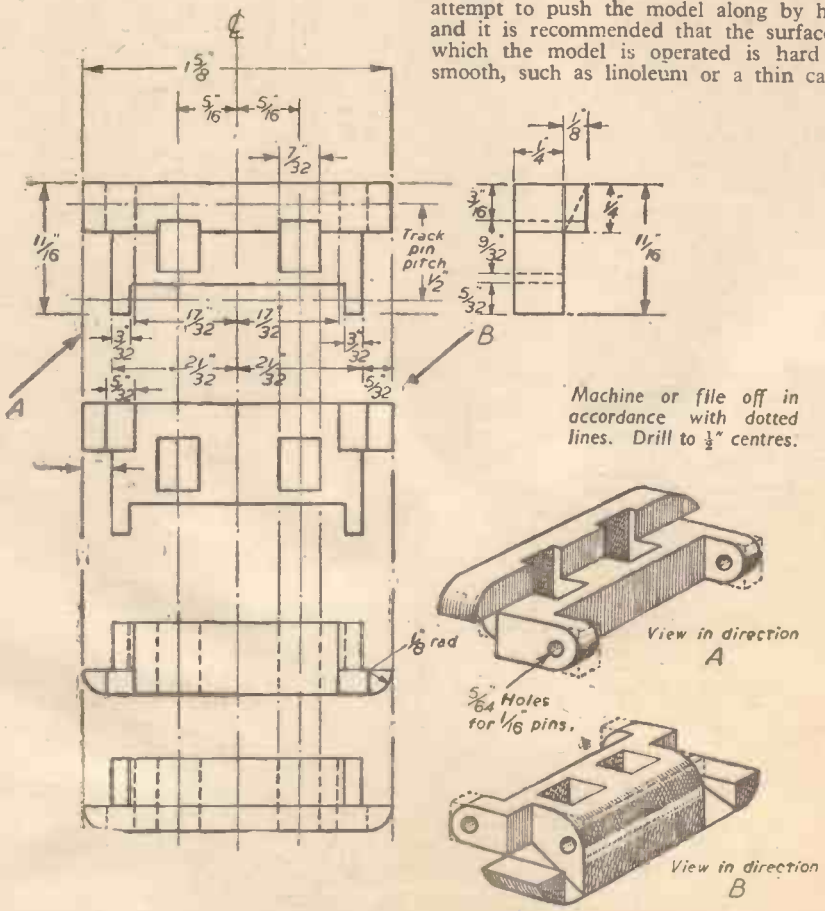


Fig. 8.—Details of the track links.

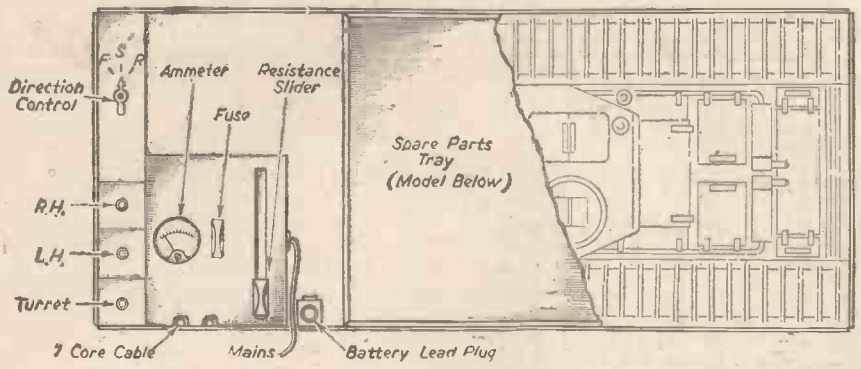


Fig. 10.—The case for transporting the model tank; showing the control panel, etc.

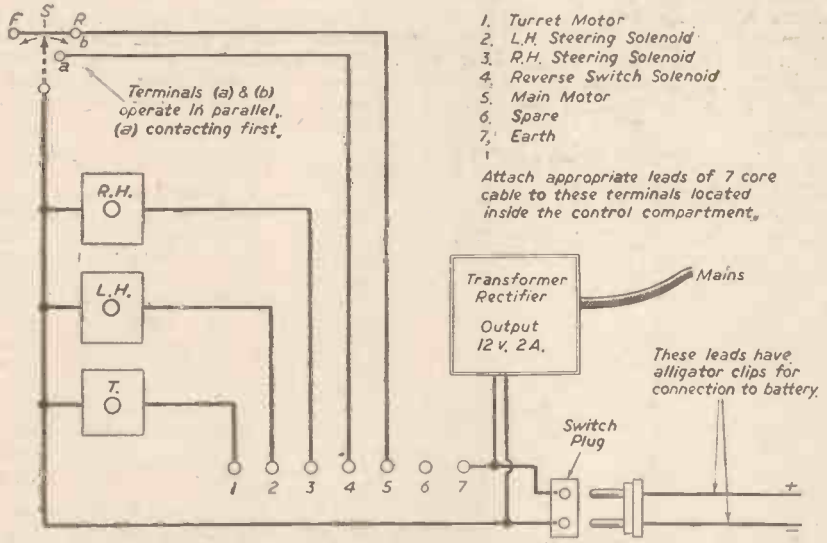


Fig. 11.—Diagram of connections for the control panel.

A carpet which has a thick pile is inclined to catch the ends of the track links, with serious results to both carpet and track.

Uncoil the seven-core cable and attach the seven-pin plug to the near-side of the model, the offset pin in the plug being towards the rear of the model. Before the next operation make certain that the direction control lever is opposite the letter "S" (stop). Take the short length of flex and insert the three-pin plug into the switch-plug, seeing that this switch is down, i.e., off; the negative and positive marked clips at the other end of the flex should then be attached to the *appropriate* terminals on a 12v. battery. *This is very important.* The slider on the trickle charger must now be moved until it is as near as possible to the front of the box. Take the trickle charger lead and plug into the mains. Switch on. A humming sound should issue from the charger. Switch on the battery by moving the switch on the switch-plug to the up position. This switch is provided solely for the purpose of switching the battery on and off. Move the slider until the ammeter is showing a charge of *not more than 2 amps.*

The model is now ready for operation. The direction control lever is moved to "F" (forwards) or to "R" (reverse) according to the direction in which it is desired that the model should travel. A click will be heard in the model when the control lever is moved to "R."; this is an indication that the reverse switch solenoid is operating. *The model must be allowed to come to rest before changing from "F" to "R" or vice versa, otherwise damage to the motor may result.*

Steering and Turret Traverse

To steer the model . . . utilise the two white press-buttons marked "left steering" and "right steering." A click will be heard from the model when either of these is pressed. This is an indication that the steering solenoid is working. Continually tap at the press-button if no click is heard.

To traverse the turret . . . switch off the battery and move the trickle charger slider towards the front of the box. Press the button marked "turret traverse." The turret will revolve slowly. To increase the rate of traverse move the slider on the trickle charger. (The turret may be traversed when the model is moving, without switching off the battery.) Before switching on the battery again, return the slider to the front of the box . . . switch on the battery . . . and then move slider until the ammeter reads a 2-amp. charge. *On no account must the model be operated direct from the trickle charger, that is, when the battery is switched off.* Spare fuse wire (5 amp.) is carried in the spare parts tray. Note.—The model may be operated from the battery alone.

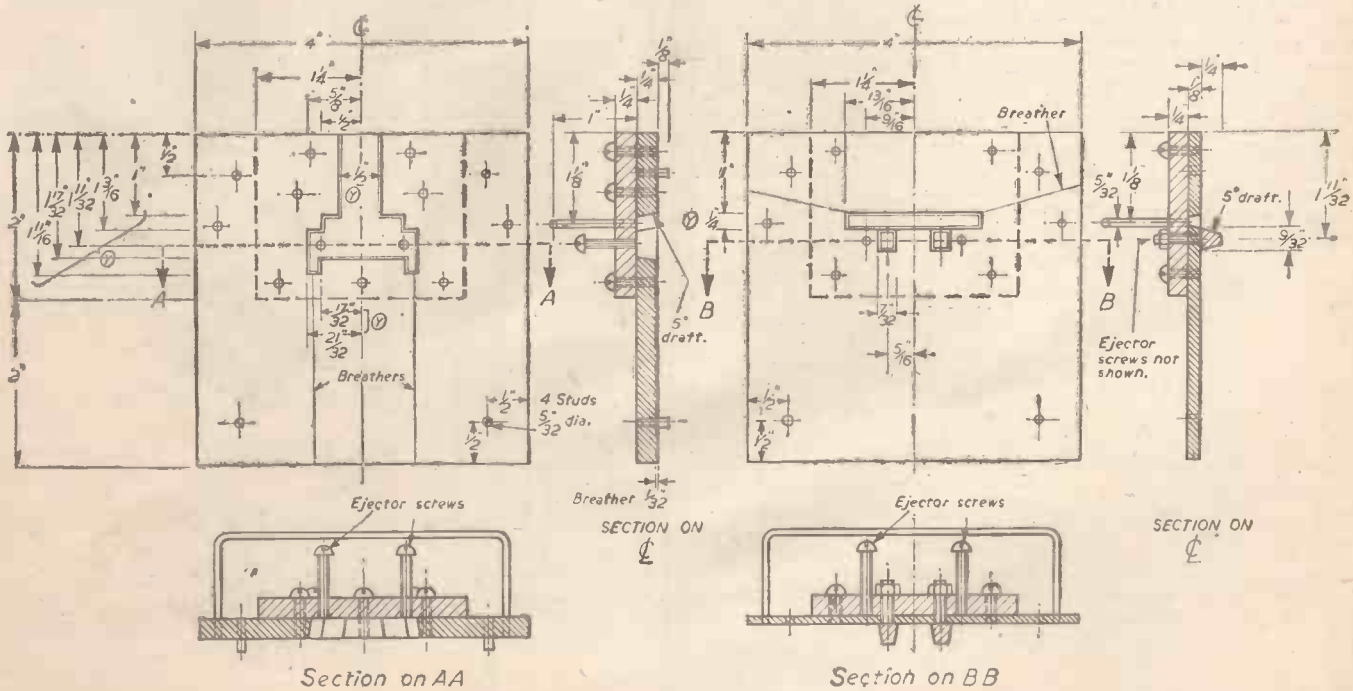


Fig. 9.—Details of the sheet steel track link mould and die plate. Brass screws are used and all threads are 5/32in. Whit.

Observations

Interesting Facts About Everyday Topics

By Prof. A. M. LOW

Black Diamonds

EVERYONE knows, which means that no one bothers, that Nature took one little subatomic particle and made everything. Including you. And the wonderful thing is that all these substances have taken millions of years to manufacture. Not that time may mean anything, any more than a dream. Oil, for instance, was made millions of years ago from fish, vegetation, anything, and it does not even take very long to turn it into the product useful for the roadster or the aircraft tank.

But the queer point I want to make is that these substances do not all combine unless they have somebody or something to "marry" them. These marrying "people" are called catalysts, being substances which produce chemical changes in others, but do not themselves alter. Like a parson who presumably alters the participants, but is not, we trust, changed in himself.

Take, shall we say, a piece of coal which burns in air. If this coal is dried or desiccated very thoroughly it can be made red hot without burning at all. Allow in the faintest trace of water and the coal flashes off into flame. Now this is not a true catalystic action, because the water turns into steam and the coal might absorb some of this oxygen leaving hydrogen to run a gas engine, as in a producer plant. Or the coal might partly burn and leave carbon monoxide, as happens in many of the gas generators which we have been using on the back of our cars in England to save petrol.

Fancy having to take the gas works with you! No wonder the driver is called a chauffeur. Examples of catalysts are some of the nickels and their compounds which are used when adding hydrogen to oil to make hydrogenated oil. Another is the platinum wire which, when placed in a gas jet, becomes so hot that the gas ignites.

This principle was used to indicate an escape of gas in submarines, or mines, and at one time was replacing the canaries and white mice which gave the first signs long before they could be detected by men in the same atmosphere.

These detectors were clever. To prevent heat affecting them as well as gas, the platinum wire was stretched against a glass wire which expands at the same rate. Only a *difference* in temperature between platinum and glass could sound the alarm.

Dirty Diamonds

Some will have wondered why I seem to interchange the word "coal" with that of "diamond." There is a good reason. Unless the coal contains hundreds of medicaments and, like the sea, practically everything in the world from which we now get our civilised blessings, it is no more than pure carbon. Charcoal is another form. And so is the diamond, which happens to be crystallised carbon.

Nature made these diamonds by great heat and pressure. If you take a piece of steel containing carbon, melt it in an arc, and allow the drops to fall into a basin of water, a very mild imitation of nature is given. Upon dissolving the solidified drops, tiny diamonds remain behind. They are, in fact, allotropic modifications of carbon, but my duty is to warn you that it costs far more to make them in this fashion than to dig them up. Nor are they big enough to be of service.

I cannot help feeling, although I hate to point a moral, that many things, such as coal and steel, are in truth more important than gold and diamonds. It is only *my* opinion! Which would the world be best without?

The Dog's Warning

As you drive home at night, you will have noticed on a wet day that reflected lights travel up house walls in front of you. It always puzzled me until I noticed that it was the shortening angle between headlights and water on the road. But what I like are the glowing eyes of animals, which seem better than most rear lights on the road.

This is due to a high degree of reflection at the back of the curtain of the dog's eye. Human beings have an iris diaphragm which opens and shuts to regulate the amount of light which passes through to the sensitive retina. When this action is not very quick you suffer from lack of accommodation, hence you must get used to light, and it is often a good plan to shut one eye when passing a car. If the other man's car is stationary, winking in this way may, however, be misconstrued if seen!

The dog has its frontal lens so shaped as to throw back the light from the coloured part into your eyes and the colour is merely due to the fact that all other colours given out by your headlamps are absorbed, with the exception of the colour you see.

Cheap spectacles are always being introduced and when they are very bad they are like compound lenses manufactured most poorly. Look through a simple lens and you will see coloured rings round the edge, rather like the refracted colours you will observe from a chandelier or the edge of a bevelled looking-glass.

The edge of the mirror is like a section of a lens. It breaks up the light into its component colours. Now, our eyes have bad lenses, but we have learned to correct the effect in our brain. Camera makers have to use achromatic lenses if they do not want trouble, simply because each colour has its own wavelength, and they do not therefore come to a focus together. It has been found that nearly every creature in the world that can see has some form of correction, so we should not be too proud of our skill. Even a moth can see by lights invisible to us, and many species can be attracted by invisible light. Half the work of science is in providing ourselves with means of observation better than that of our unaided senses.

Did You Drop It

So many people were interested to know why cigarettes fell with the ash uppermost that I think it my duty to take up the much more important question of bread and butter. Does it, in fact, always fall butter side down?

Some years ago a large number of experiments were made on amusing things of this kind, and it was discovered that butter, being heavier than the remaining part of the slice, acted like a weight tied to a piece of paper. The butter on the average fell downwards. You can make another amusing little experiment for yourselves in this way by putting a small piece of tissue paper on top of a coin and dropping it on the table coin downwards. The paper and the coin hit earth together simply because all bodies fall at the same speed, and it is only air resistance which normally prevents the paper from falling as fast as a piece of lead. When put together the coin breaks the way and the slight vacuum at its back holds the paper firmly in position.

The Meco Moore Mechanical Coal Cutter and Loader enables six men to do the work of 20, and can cut a ton of coal a minute. Under favourable conditions the machine will cut, break and deliver on an endless-band conveyor up to 500 tons in one seven-hour shift. Twenty of these "Iron Men" are at work in the pit of the Clipstone Colliery, Chesterfield, and many other collieries await delivery. These machines will play a big part in solving the manpower problem of the mines. The illustration shows one of the Meco Moore machines being operated in the pit of the Clipstone Colliery, Chesterfield.

The Volkswagen—The People's Car

The Much-discussed German Small Car

By "TECHNICUS"

WHAT is the people's car, or Volkswagen, of Germany, so much debated in Great Britain, and over which questions are being raised in official circles? There is nothing unusual in its history, for the German Government asked for a cheap, small car to be designed a few years before the war. The Volkswagen was the result. Its development was typically German. A very large sum was voted the country's leading automobile designer to undertake intensive research in design and manufacture, so that a small car could be made available to the pockets of the working classes in Germany.

A suitable design having been decided upon, the site for mass production was selected, at Wolfsburg, near Brunswick. But the war interrupted the project just when the works was to go into production, and it was left to the Allies, when they entered the Reich, to rehabilitate the already-damaged works and to produce the first batch of Volkswagen.

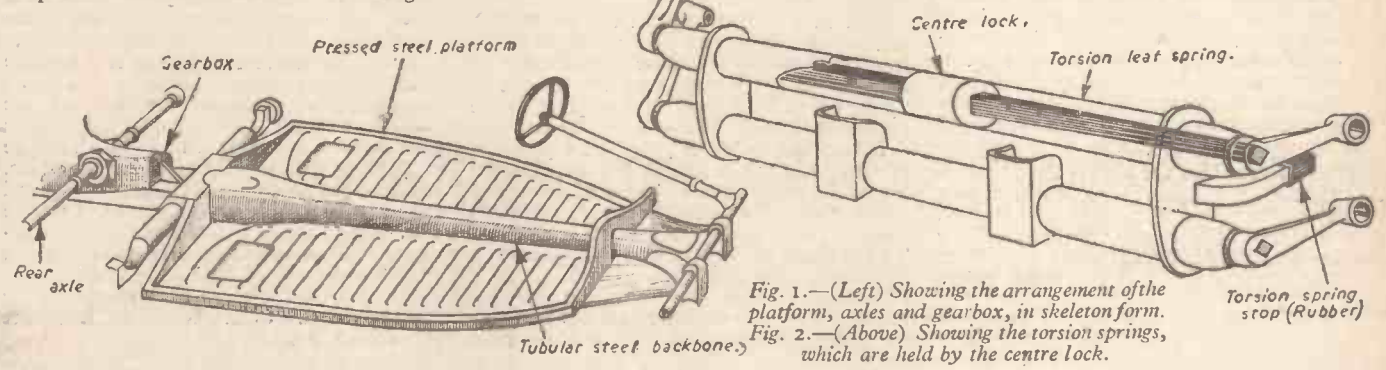


Fig. 1.—(Left) Showing the arrangement of the platform, axles and gearbox, in skeleton form. Fig. 2.—(Above) Showing the torsion springs, which are held by the centre lock.

It is interesting to note that production at present, with only part of the works repaired, is over 2,000 cars a month.

Fresh Ideas

It would be doing car manufacturers in various countries of the world an injustice to suggest that the Volkswagen is revolutionary or embodies new ideas. What it does unquestionably reveal is a fresh outlook on car construction, with originality applied at every turn. The somewhat hidebound notions of the British manufacturer have been dispensed with and a fresh start made, from the wheel nuts to the windscreen wipers. The multitude of bits and pieces which spread over British cars like a rash are conspicuously absent, giving a clean appearance both inside and out.

In discussing this small car it is essential not to lose sight of the fact that it was designed with a very low price in view, the selling price reported to be about £40. That may have been possible, but the intervening rise in the cost of living has taken the cost of manufacture up to almost twice that value. The low selling price made it necessary for the designer and his staff to plan the car not only in relation to the owner's needs but also with an eye to production, both cheaply and on a very large scale.

General Construction

A feature of the Volkswagen is the use throughout of pressed steel and welding. The body rests on a pressed steel platform, and is therefore unstressed. A tubular backbone is forked at the rear to carry the engine. Wheels are independently sprung, those in the front using torsional leaf springs, while the rear wheels employ torsion rods. Hydraulic shock absorbers are also incorporated, single-acting type on the front wheels and rear, to prevent rebound.

The arrangement of the platform referred to above, axles and gearbox, is shown in skeleton form in Fig. 1. The body is bolted to the platform and mounted on rubber. The design of the body gives full room for four adults, with luggage room for two average suitcases behind the back seat. Wheels are pressed steel, as are the transmission and gear housings, and, wherever possible, bolts have been dispensed with in favour of welding.

Headlamps are integral with the front wings, while the bonnet cover is in one pressing, being hinged along the line of the windscreen. There are two side windows, entry to the car being through one door of generous size, on each side. An unusual point is the heating of the interior, and of the windscreen, from hot air ducts, heat being derived from the exhaust manifold. Here again pressing and welding are used exclusively, the hot air ducts for the windscreen being small louvres situated in the bottom corners of the windscreen.

Engine

An air-cooled, four-cylinder horizontally opposed engine is mounted in the rear, on a three-point rubber mounting. There is one cylinder head for two cylinders, the pistons being of light alloy. The crankshaft is of the four-bearing type, possessing high rigidity owing to its short length. Cooling is effected by means of a fan, which delivers air over the finned cylinder castings at 500 litres a second. The fan is driven by a belt from the generator pulley, and serves also to cool the engine oil, which is circulated through a radiator-type cooler.

Push-rod overhead valves are mounted on the light-alloy cylinder castings, fuel being fed from a single carburettor of standard design. Force-feed oil lubrication is assisted when the oil is cold and viscous by a valve which bypasses the oil cooler during a cold start. An indicator lamp on the dashboard lights up when the oil pressure has fallen below a safe minimum, due to a defect in the feed. A simple strainer in the sump is considered to be sufficient to keep the engine oil clean, while a small air filter on the carburettor intake ensures that dust does not pass into the cylinders with the air.

The following are details of the engine:

Rating: 25 b.h.p. at 3,300 r.p.m.
Compression: 5.8 : 1.
Bore: 75 mm.
Stroke: 64 mm.
Capacity: 1,131 c.c.
Firing order: 1-4-3-2.
Valve clearance: cold—inlet: .006in. outlet: .008in.
Carburettor: downdraft.
Battery: 6 volt, 75 amp.-hr.
Coil ignition.
Fuel consumption: 35-40 m.p.g.
Fuel tank capacity: 9½ gals.
Crankcase capacity: ½ gal.

Although a four-stroke engine, its normal running sound inclines one to the view that it is a two-stroke, and it is not so quiet as the modern orthodox four-cylinder engine.

Miscellaneous Features

The lifting jack is fitted, when required, into a tube permanently fitted to the chassis platform, and is operated with the wheel wrench, thus economising in one tool. The rear axle is of the half-axle pattern, while the front axle is made up of a twin-beam assembly, the fore end of the tubular backbone being carried between the beams. Through the latter, which are hollow steel tubes, run the torsion spring leaves held by centre locks, as shown in Fig. 2.

The silencer is arranged parallel to the rear axle, instead of the more usual practice of the silencer running lengthways. This makes for compactness, and enables all of the power unit and accessories to be sited behind the rear seat.

As might be anticipated in a rear-engined vehicle, the gearbox is operated through a shaft which runs through the tubular backbone. Gearbox and universal are housed next to one another, under the luggage compartment referred to above. The petrol tank is situated under the front bonnet, together with the spare wheel, holding sufficient for about 350 miles, a spare tank being incorporated. There are two rear lights, and headlamps can be dipped by means of the usual foot switch.

Performance

If several interesting ideas have been incorporated in the Volkswagen, no attempt has been made by the designer to give the car a super performance. Indeed, as it was expressly designed as an all-purpose people's car, it is unlikely that a freak performance would have been sought.

The following are the recommended speeds in the various gears:

1st speed (crash): 13 m.p.h. (ratio, 1 : 3.60);
2nd speed (crash): 24 m.p.h. (ratio, 1 : 2.07);
3rd speed (silent): 40 m.p.h. (ratio, 1 : 1.25);
4th speed (silent): 62 m.p.h. (ratio, 1 : 0.8).

The mechanical brakes, hand and foot, will pull up the vehicle in approximately 34ft.

at 25 m.p.h. on a dry surface. The high ratio of the 1st gear, coupled with a final drive ratio of 1 : 4.43, gives this little car good hill-climbing ability, it being able to negotiate gradients up to 1 in 3.

The length of 13ft. 4in. is accompanied by a turning circle of 33ft. The ground clearance is 8¾in., and overall width 5ft. 1in., with a height of 5ft. 1in. also. The unladen weight of the people's car is 1,600lb., indicating that it is truly a light car.

General Criterion

The vehicle handles well on the road and is easy to drive over long distances. There are no frills and furbelows, and for driver and passenger comfort is adequately provided without the many touches given to higher-priced cars as selling points. It is competent in performance, has pleasing if somewhat dumpy lines, as will be seen in Fig. 3, and would be well worth £100, for which price it could be retailed in Britain, were production costs normal and material supplies up to pre-war standard.

In considering the Volkswagen one must remember that it is being made from limited materials of inferior quality. Thus, castings, where employed, are not up to standard on quality. Soft metals used in the front axle assembly lead to an increased rate of wear. Cylinder block castings being of distinctly wartime quality cannot be expected to stand up to the high speeds demanded of the car, the autobahns helping in this direction. In effect, one is confronted in this little vehicle with the combined disadvantages of low price and low quality materials.

If one remembers the above, the performance of the Volkswagen, in relation to its cost, is very good. There is much to learn from it, and it would be interesting to imagine how British small cars would stand up to its competition, given normal material supplies. Another factor which militates against it is that it has not received a trial at the hands of owner-drivers. To any experienced motorist it is evident that a car in any driver's hands cannot be expected to yield the life of that which is owner-driven. At present opinion is derived mainly from the experience of a large number of non-owner-drivers, some of whose object is to get from one place to the other as quickly, or as relentlessly, as possible.

Fig. 3.—The pleasing appearance of the Volkswagen.

It would be unfair to judge the capabilities of this little car before it has been in the hands of a large number of owner-drivers, and before reasonable-quality materials are again available in Germany for mass production. The author of this article has driven a Volkswagen for three thousand miles, and is of the opinion that, given adequate care, the car should prove a useful addition to the small car market. Above all, its value will have been proved if British car manufacturers can graft some of the novel ideas of this German car on to the good quality of British small cars.

It will be interesting to see if "expense of dies," "the pressure of export demands" and other explanations will prevent the adoption of some of the people's-car-notions in Britain. A real people's car, which can be made for modest pockets, is long overdue. It need have no chromium plate, gadgets and the many superfluities that go to put up the cost, albeit against the will of the manufacturer. A simple pressed-steel frame and body, an ingenious use of modern synthetic resins and a little courage are the ingredients for this much-wanted car. Which manufacturer will show the way?

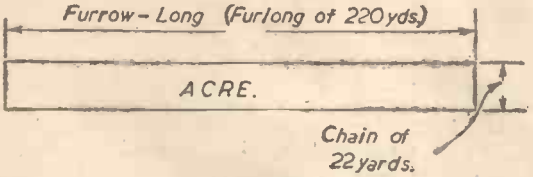
Mathematics as a Pastime—3

Measuring Lengths and Surfaces

By W. J. WESTON

YOU remember how—Horatius having kept the bridge in the brave days of old—the City Fathers gave him, of the cornland, "as much as ten strong oxen can plough from morn to night." Very likely your own forefather had his land allotted in like manner. He drove his oxen a furrow-long (or furlong) as many times as he could from dawn to dusk; and, being a stout-hearted worker, he managed a width of about one-tenth of the furrow-long. There was his field, his acre (to use the word that we still find in "God's acre," and in place-names like "Long Acre"). Later, when we became familiar with the Roman miles (millia, or thousands of double paces), the furlong became standardised into one-eighth of a mile; and the yard-stick, to ensure fairness, came into being. These miles varied, and still vary. In the British Empire and the United States, however, the legal mile is now one of 1,760 yards. [For the nautical mile (which sailors call a "knot"), though calculated equal to one minute of a great circle of the earth, the British Admiralty fixes the length of 6,080 feet.] Twenty-two lengths of the yard-stick extended along the base of the ploughed land; and this length developed into our cricket-pitch. A chain of 22 yards set out this base, and a pole of 5½ yards also became a convenient device for setting it out. The modern chain for land-surveying has its 100 links, so that each link is almost 8 inches.

The acre became our unit for comparing medium surfaces: "Now would I give a thousand furlongs of sea for an acre of barren ground," declared a tempest-tossed and poor sailor. The square mile for larger surfaces, the square yard for smaller, takes the place of the acre.



Dimensions of an acre.

Like the furlong, once varying with man and ox and soil, the fathom, the length of the outstretched arms, is now standardised into two yards; the foot, no longer changing with the Chancellor's, is standardised into one-third of the yard. The inch was always a twelfth part, and we restrict it now to the twelfth part of a foot.

This English method of measuring lengths and surfaces is less logical—and less useful, too—than the Metric System. But it reminds you of a deal of our history.

You get a great circle of the earth whenever you slice sheer through the centre of the earth: the Equator is one of an infinite number of such great circles. Any other slicing gives an ever diminishing circle. The navigator seeks, whenever possible, to sail along this great circle. Thereby he covers the shortest distance beween two points.

Think, for instance, of the ancient quip, recurring ever in varied guise. You, perhaps, like so many of us, were deluded at first. Here is the modern version. *The United States has, or will have, a watching post at the North Pole: a patrol from the post goes four miles due south, then five miles due east: the patrol then returns to the post by the shortest route. How long is the route?* Of course, there are only four miles on the great circle from the post; for, however far east or west the patrol goes, it remains at constant distance from its base.

(To be continued)

THE WORLD OF MODELS

Models at the Shipwrights' Exhibition: A Fine Scale Model of a Modern Distillery

By "MOTILUS"

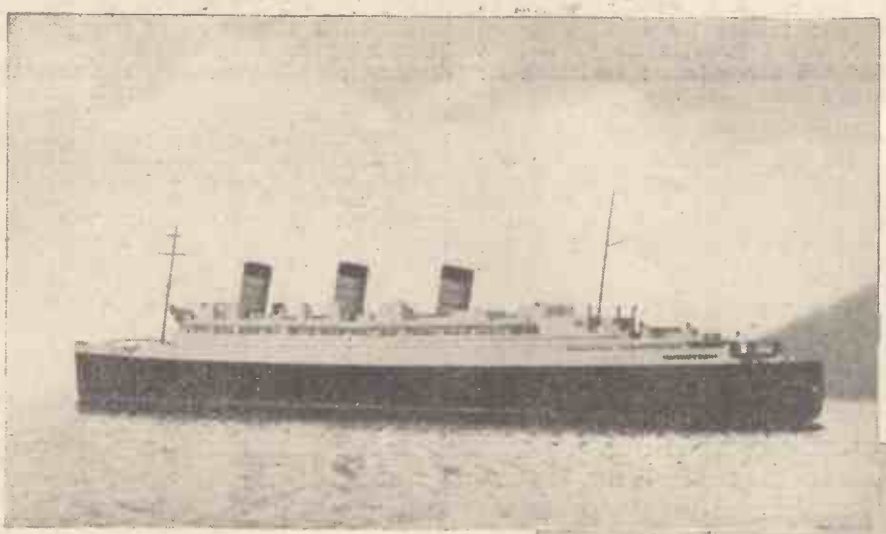


Fig. 1.—A fine model of the "Queen Mary" built to a scale of 50ft. to 1in. (Photo by the Cheltenham Photographic Company, Ltd.)

I HAVE no doubt that many of our readers, especially those interested in high-class ship modelling, paid a visit to the Shipwrights' Exhibition, organised by the Worshipful Company of Shipwrights, and held at the two Royal Horticultural Society's Halls, Westminster, from January 28th to February 8th.

Quite a number of the models displayed were made by Messrs. Bassett-Lowke, Ltd., Northampton, and as I had the opportunity of seeing some of these models before they left the works, I can say that they were typical of the splendid workmanship for which this firm has been famous for many years.

Over a period of more than 12 months, skilled craftsmen have been busily engaged on a series of waterline models for the firm of Messrs. Wm. Harvie and Co., Ltd., whose navigation lights have been famous throughout the shipping world for many years. This collection, all made to a scale of 50ft. to 1in., or 1/600th actual size, represents a selection of ships, both British and foreign, which have been fitted with the Harvie navigation lights. Such a wide range of waterline models naturally attracted great attention.

Wigham Richardson, Ltd., as examples of their warship construction for the Admiralty.

Messrs. Bassett-Lowke, Ltd., had a small exhibit from their Ships Models Department, which included a model tug boat, one of the new working models they are placing on the market. This model tug boat, which was on view at the Britain Can Make It Exhibition, is an up-to-date design of the steam tug, electrically operated, the motor being their standard "Marine" type. The

Fig. 2.—Model tugboat by Bassett-Lowke, Ltd. It is 25in. long and is driven by a small electric motor. A dry battery or accumulator provides the current.

Of the traditional type of scale models of ships, that is the full hull glass case model, there were two very excellent pieces of workmanship in H.M.S. *Vindex* and H.M.S. *Anson*. Both these models were made to the order of Messrs. Swan, Hunter and

whole of the superstructure can be removed to gain access to the electric motor, which is driven by standard flashlamp batteries or an accumulator. This model, if available, should be very popular during the coming summer.

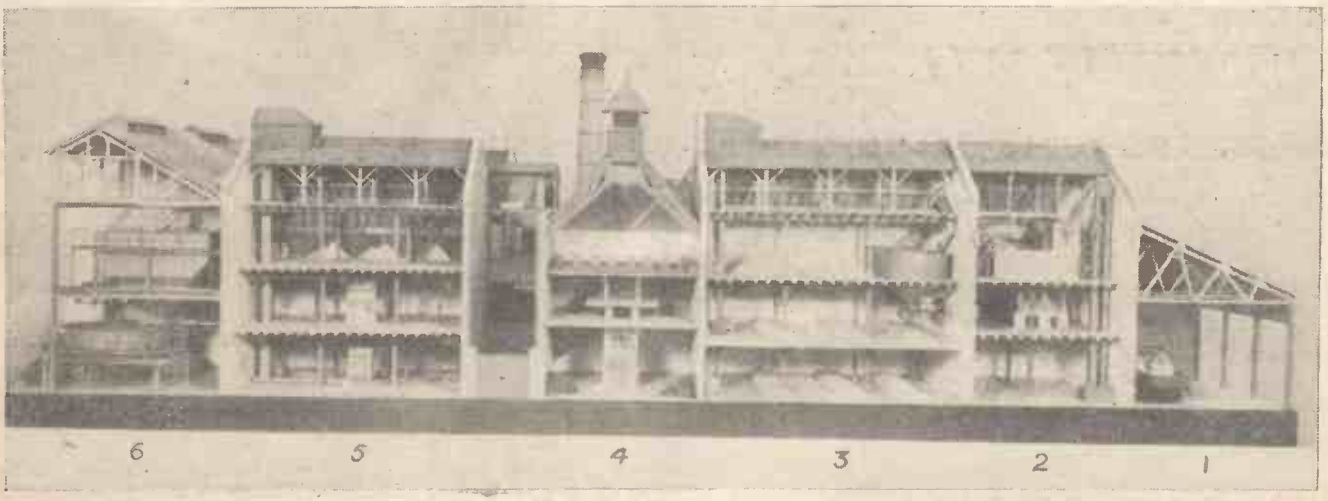


Fig. 3.—Part of sectional model of a Scotch Whisky Distillery, built by Bassett-Lowke, Ltd., to the order of the Scotch Whisky Association. The illustration shows, from right to left: (1) The lean-to Barley Arrival Shed; (2) The cleaning plant; (3) Maltings; (4) Kiln; (5) The Mill Room; (6) Mash House.

Altogether, the Shipwrights' Exhibition was an outstanding innovation in exhibitions in this country, and was a survey of all productions relating to the nautical world, covering sectional models of war and commercial marine craft, turbine, steam and oil machinery, auxiliary machinery, etc. In addition to the usual exhibits, there was a special feature in the form of a series of papers and films which dealt with all aspects of ships, their design, construction and operation. Other papers dealing with various subjects relative to the shipbuilding and marine engineering professions were of great interest to the younger generation, as they dealt comprehensively with the opportunities of careers presented by the industry.

Northampton Society of Model Engineers

By the way, I hear that the Northampton Society of Model Engineers, under the able secretaryship of Mr. W. A. Wells, of the Guest House, Moulton, Northampton, are becoming increasingly active, and plans are being discussed for a "get-together," with a view to increasing the membership, and also to discuss the prospects of holding an exhibition of members' work in the autumn of 1947. In a town so well known for model making, there should be room for a very active model society, especially as I understand that three Model Engineer Exhibition Cups are held by amateur model makers in Northampton. Model making is now entering into the "arts and crafts" societies of various Northampton firms, and at a recent exhibition of work done by employees of Messrs. Padmore and Barnes, the well-known shoe manufacturers, a prize was won by Mr. C. Robinson for his model of a ship in a bottle. As all model makers know, this was a favourite pastime of seamen in their short leisure hours on the old "windjammers," when they could always find a ready purchaser at their ports of call. Although there are many experts with this clever idea, which has been explained in many publications, it is still a problem to some who practise the hobby of model making, and I am sure the "ship in a bottle" will always have a fascination for those who love a novelty.

Model of a Modern Distillery

In the December issue, reference was made to a scenic scale model of a Scotch malt whisky distillery, and an illustration was given of the typical Highland setting in Scotland of a modern distillery. I am now able to give some illustrations and particulars of a detailed model showing the whole of the processes of whisky distillation. This model, representing months of skilled craftsmanship, was made specially to the order of the Scotch Whisky Association so that the general public could visualise the processes which have to be gone through before the famous and popular spirit is ready for sale. Covering about 14 different departments, and made to a scale of $\frac{1}{8}$in. to 1ft., the model measures approximately 7ft. 6in. by 4ft.

The model shows clearly how the barley is first brought by lorries to be processed, and at the right-hand side of the first picture (Fig. 3) the lean-to "Barley Arrival" shed is seen. The second department, the Cleaning Room, is where the dust is extracted before it is passed into the maltings. In this department the barley is kept at a certain temperature, is partially "grown" for seven days, being continually turned over to aid the process, and then is passed to the kiln, where it is dried. In Room No. 5, the Mill Room, the barley is ground up to what is known as "Draff." The draff is then passed into the next room, which is the Mash House. This department, which is shown at the extreme left in Fig. 3, and at the right-hand side of Fig. 4, is where liquid is first added to the ground barley, and in the next room, the Draff Drying House, the liquor is separated from the draff. The draff, a by-product of the whisky, is then dried and taken back to the farms, where it is used on the land as a fertiliser.

The liquor, which is now whisky in a very rough state, is passed on to Room No. 8, the "Tun Room," where it is again fermented. Next, the liquor is passed on to the Still House. The illustration, Fig. 5, shows two stills. At the first distillation the liquor is passed through the condensers on the left-hand side of the picture, after which it is cooled, tested for strength, and passed back through further distillation processes to purify. From that time, that is after it leaves the stills, it is under Excise lock and key, and under the supervision of the Resident Excise Officer. After leaving the stills, it goes to the warehouse, where it is put into casks for storage.

The whole model shows clearly that the handling of the grain right through to the final production of the whisky is by automatic conveyor and pumping systems, and is not touched by hand at all, except in the maltings.

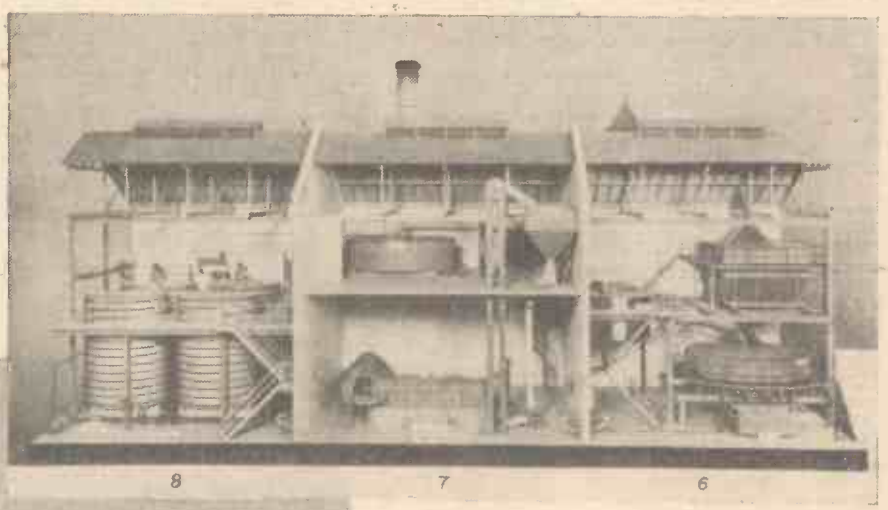


Fig. 4.—The second portion of the Scotch Whisky Distillery model, showing: (6) The Mash House; (7) The Draff Drying House, and (8) Tun Room.

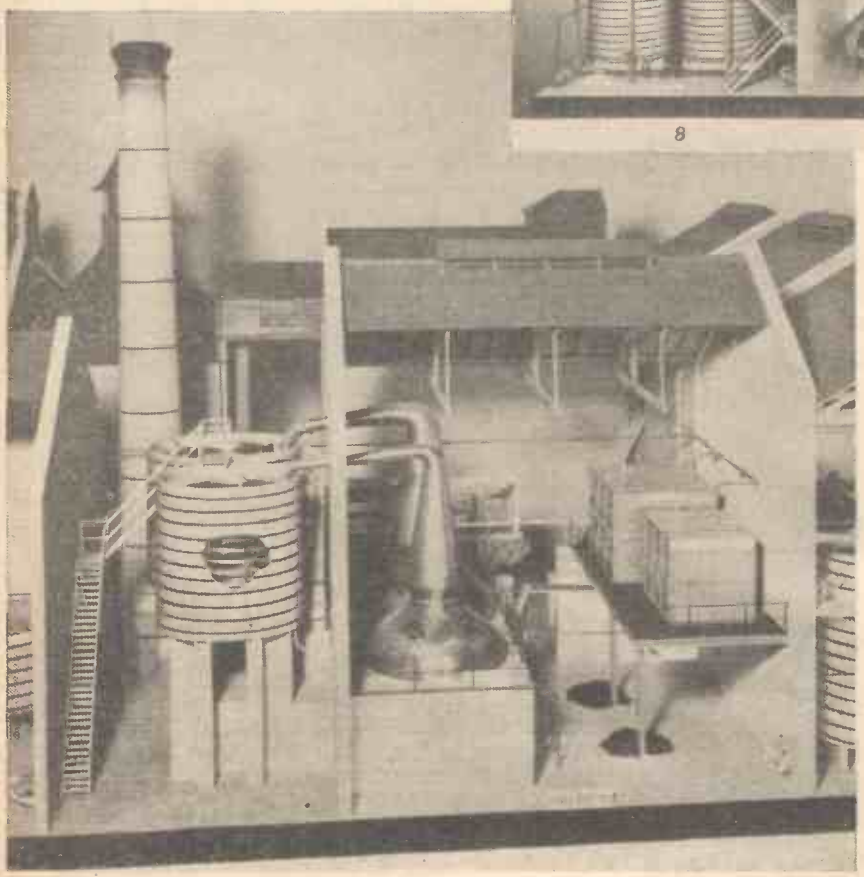


Fig. 5.—The Still House, showing the beautifully detailed craftsmanship of the whole of the model distillery.

On View in Edinburgh

Specially transported by road to Scotland, this wonderful model is now in the Royal Scottish Museum at Edinburgh. After it has been in Edinburgh for some time, the whisky distillery model will be used for exhibitions in different parts of England. It will probably then be sent overseas to bring to the notice of the world the complicated processes involved in the production of one of Britain's most famous, and valuable, exports—Scotch whisky

Letters from Readers

"Are You Wrong?"

SIR,—In the January issue of PRACTICAL MECHANICS, Prof. A. M. Low states in his "Science Notes": "The sun does not put out the fire but makes it more difficult for you to see," etc. I do not quite agree. The sun gives heat and heat causes expansion. This expansion of the air surrounding a fire causes the oxygen to become rarefied and as the fire is dependent on the oxygen to support its combustion it consequently burns slower. —THOMAS A. MEADE (Cavan, Eire).

[*Utter nonsense!*—ED.]

Electric Flash Light

SIR,—I noted the answer to Mr. Newman's query re the door bell and lamp in the January issue. In the same issue, there was an advertisement for Varley Thermal Delay Switches, and it occurred to me that a simpler solution to the problem could be found by using one of these, or something based on that principle. I therefore enclose two possible circuits which might be of some use.

The lamp in each case is connected across the bell magnets with the bell adjusted to give a slow beat.

A. A circuit for a thermal switch with the contacts normally closed. The contacts on opening would break the relay circuit.

B. A circuit for a thermal switch with the contacts normally open.

A small resistance or a flash-lamp bulb is placed in series with the relay. The thermal switch contacts on closing bypass the relay, the resistance or bulb preventing a short-circuit.

If the circuit was fed from a transformer, the connection marked X could be taken to a higher tapping if necessary.—B. TOON (Stamford).

A Tip for Motorists

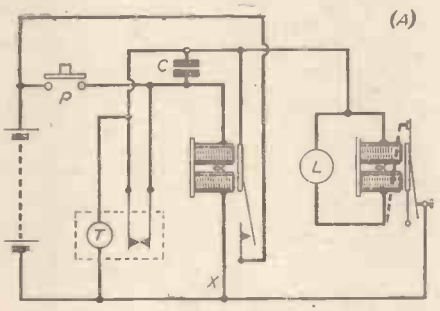
SIR,—I am sure many readers will be interested in the method which I have adopted for keeping the road springs on my car working in a clean mixture of oil and grease.

I obtained two rolls of plastic tape—I believe it actually came from P. B. Cow and Co., of Berkeley Square, London, and proceeded as follows:

(1) The road springs were completely cleaned off and were then covered with old engine oil, the oil being well brushed in between the leaves.

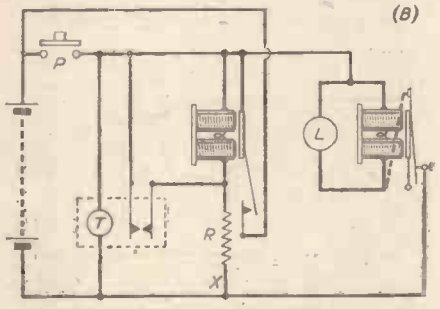
(2) An ordinary lubricating castrol grease was then generously applied all over.

(3) The spring was then bound with the plastic tape, as follows:



Thermo Switch Normally Closed

P – Bell Push. C – Small Condenser.
T – Thermo Switch Heater & Contacts.



Thermo Switch Normally Open
R – Resistance or Flashlamp Bulb.

Circuit diagrams for a flash-light system, using a thermal delay switch. (B. Toon.)

(a) Cover the U-bolts bandage fashion first;

(b) Then proceed to cover the spring, working from the centre outwards;

(c) Slight tension should be applied when binding as this in turn exerts a slight pressure on the spring and gives a completely water-tight joint;

(d) To finish off slit the tape through the centre for a few inches, knot, and tie as you would a bandage.

I tried this idea out many months ago and my local garage suggested that some rusting would occur. Inasmuch as the plastic tape is completely impervious to the action of oils or moisture, I was not convinced that this was so, but feeling there may be some reason for the suggestion last week-end I stripped the covering with a sharp knife, and, as I expected, found the springs in perfect condition. There was no sign of water penetration or rust, and the clean grease was still around the spring. —E. N. CRUMP (London, S.W.).

Register of Model Engineering Societies

SIR,—With reference to the letter from Mr. Pinnock, of the S.M.E.E., which appeared in a recent issue of your journal, concerning the compilation of a register of club data for the whole of the country, I would like to draw the attention of your readers to the fact that information relating to clubs in the north can be furnished by myself, as secretary of the governing body for the north of England.

The data at present available is being extended to embrace all non-affiliated clubs, as it is considered that the association will be better able to be of service to model engineers generally, and particularly those who will be visiting the forthcoming exhibition in Manchester.—A. F. DUCKITT, Hon. Secretary, The Northern Association of Model Engineers, 145, Bowring Park Avenue, Liverpool, 16.

Waterproofing Processes

SIR,—We have received a large number of inquiries in regard to the reproofing, rubberising or otherwise making waterproof ex-service flying suits, the writers of which, in most cases, refer to your paper, NEWNES PRACTICAL MECHANICS, as being the source from which they have obtained our name and address as a firm capable of carrying out this work.

Kindly note that we are quite unable to carry out this work, as we have already informed many people.—GREENGATE AND IRWELL RUBBER CO., LTD. (Manchester).

Club Note

Whitefield and District Model and Engineering Society

LAST month the club had two well attended meetings. On February 7th a mock auction was held, and on February 21st a talk on "Model Diesel Engines" was given by Mr. Johnson.

On March 7th Mr. Priestley will give a talk on "Constructing a Jig Saw."—Hon. Sec., A. F. Stevenson, 2, Newlands Drive, Prestwich.

OUR COVER SUBJECT

THE beam engine, shown on the front cover this month, was built in 1861 and is still providing power for the Fielding Johnson Worsted Spinning Mills at Leicester. It is believed to be the only one of its kind still functioning, and is known as Juno and Jupiter. It has twin beams with cranks placed at the unusual angle of 90 deg. to one another, has cylinders 36in. diameter and was originally fed with steam at a pressure of 30lb. to the square inch, but with modifications, etc., it now developed 900 h.p. The flywheel is cast in sections, keyed to a boss on the shaft by its arms, which also serves to hold the gear wheel which drives the secondary shaft, which, in turn, drives an upright shaft through six floors, each floor being bevel-gear driven from the main shaft.

The engine is now on its last lease of life as some time this year the entire mill is being motorised, and it will then be classed as redundant.

NEW BOOK

"Ships and Men." By W. J. Bassett-Lowke, and George Holland. Published by George G. Harrap and Co., Ltd. 316 pages. Price 15/- net.

HERE is a book which has a strong appeal to all lovers of ships and the sea. Written in a most entertaining style, the book is a unique and exciting record of the men that "go down to the sea in ships" from the days of the coracle to the present era of ocean giants, such as the *Queen Mary* and *Queen Elizabeth*.

Advances in ship design are traced in detail, together with the social and economic reactions brought about by the increases in range, speed and capacity.

The many excellent illustrations in the text give effective point to the surveys of progress in maritime construction.

A VERTICAL ENLARGER

(*Continued from page* 203)

talcum powder or french chalk to remove any stickiness.

It is imperative that the sheet of glass and plywood lie flat together. The film negatives go between the glass and wood and any curls or kinks in the film must be pressed flat. If you cannot obtain a flat piece of plywood, use another ¼-plate or piece of plain glass (about 15oz. stuff) 4¼in. by 3¼in.

The underside of the sheet of glass is covered with a thin card in which the film frame aperture is carefully cut with a penknife. When this card has been adhered to the glass, it is painted black with ink.

The Electric Lamp

The best kind of lamp to use is a 60-watt opal type, or one of higher wattage. Frosted lamps could be tried, but these give a ball of light that is not altogether evenly distributed in places on the bulb end. Plain lamps could be used in conjunction with a piece of 3in. square opal sheet glass, this resting within the lamp house, at the bottom. However, the opal glass tends to dull the light, unless the lamp is fairly close to it, which means that the opal screen becomes rather hot and, being close to the film, the heat emitted may cause the film to crinkle.

(*To be concluded.*)

QUERIES and ENQUIRIES

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

Cementing Glass Panels in an Aquarium

I HAVE an aquarium, and have broken one of the glass panels. Can you please inform me of a suitable fixative to use when replacing the panel? The framework is of sheet iron, with five glass panels forming the bottom and four sides.—G. Smith (Birmingham).

THE following formula provides a good medium for cementing glass panels in an aquarium:

Litharge	10 parts (by weight)
Plaster of Paris	10 parts (by weight)
Powdered resin	1 part (by weight)
Dry, white sand	10 parts (by weight)
Boiled linseed oil	Quantity sufficient

Mix all the dry ingredients together. Powder very finely. Then make into a stiff putty with the linseed oil when and as required.

Do not fill the aquarium for three days after cementing.

This cement hardens under water. It will stick to wood, stone, brick, metal and glass. It will resist the action of sea water, so that it is useful in the making of marine aquaria.

A small amount of a cobalt "drier" liquid can be added to the linseed oil, if required, in order to speed up the hardening rate of the putty, but this addition is by no means essential and, in reality, the slow-drying boiled linseed oil gives a rather better seal without the addition of a drier.

Removing "Fur" from Boilers

WOULD you please let me have particulars for cleaning the inside of hot-water boilers?—E. Smith (London, W.).

THERE are several materials which can be dissolved in small amount in the water of a heating circuit in order to remove gradually the inner deposit and "fur" caused by the use of hard water. Perhaps the best of these is sodium metaphosphate which, under the name of "Calgon," is sold by Messrs. Kieth, Piercy, Ltd., Oldbury, Birmingham. If you will write to this firm they will, no doubt, let you have a copy of their literature on "Calgon" which, we think, will interest you very greatly.

Alternatively, you might write to Sofnol, Ltd., Greenwich, S.E., for their literature concerning "fur" removal from boilers and heating circuits.

The best treatment which you can apply consists in adding a small amount of sodium metaphosphate to the water supply at regular weekly intervals. As a result, the boiler deposit will gradually be removed.

Non-acetone Plastic Wood

(1) WOULD you please supply the formula for a plastic wood of a non-acetone type, which will not take too long to harden?

(2) Also, please acquaint me with the constituents of cellulose paint, and the means of obtaining the colours maroon, dark blue and black. I require this to touch up my car, and so will have to match the existing paintwork.—G. K. Dinsdale (Liverpool).

(1) A non-acetone type of plastic wood can be made up according to the following formula:

Casein	50 parts (by weight)
Slaked lime	8 parts (by weight)
Trisodium phosphate	3 parts (by weight)
Sodium fluoride	3 parts (by weight)
Naphtha	2 parts (by weight)
Fine sawdust	34 parts (by weight)

Mix with water to a consistency suitable for tubes.

Another type of non-acetone plastic wood is made up on the following lines:

Base	30 parts (by weight)
Wood flour or fine sawdust	45 parts (by weight)
China clay	15 parts (by weight)

The "base" above-mentioned has the composition:

Manila gum	175 parts (by weight)
Methyl alcohol	300 parts (by weight)
Benzol	30 parts (by weight)

(2) All the commercial cellulose paints are of more or less secret composition. Hence it will be necessary for you to experiment until you get the right admixture of ingredients. These paints can be made by grinding suitable pigments into various cellulose solutions—that is to say, solutions of nitrocotton, cellulose acetate or even celluloid itself.

For instance, you can dissolve scrap celluloid in a mixture of approximately equal parts of acetone and amyl (or butyl) acetate. The solution should process until a varnish-like liquid has been obtained. Then grind pigment into this until you have obtained the colour and shade required.

For black paint use drop-black or lampblack pigment, plus a little ultramarine blue. For maroon shades use "rose pink." For dark blue, use indigo. All these pigments (and many others) are usually obtainable at large paint and materials stores.

Sparking Plug Tester

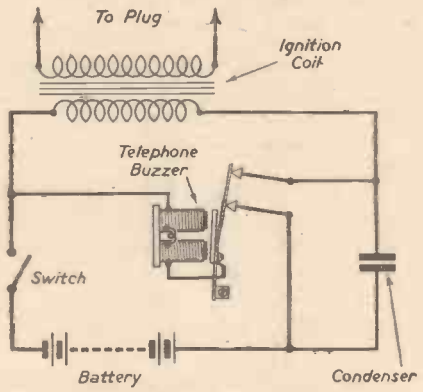
I AM building a sparking plug tester, automobile type, to take six sparking plugs in a row at one time. I have completed the compression chamber, which it is proposed to take up to 150lb. per sq. in., but am not quite sure of myself in respect of the ignition side.

Could you supply me with a wiring diagram, and a list of the various parts needed?

I would like a push-button to set the flow of current to each particular sparking plug, and also some arrangement whereby a seventh push-button would set the whole six sparking plugs sparking.

Also, I would like to run the tester off a 12-volt battery, and at a later date be able to incorporate a transformer in order to run the tester off the mains.—H. J. Sweet (Aylesbury).

THERE are certain difficulties in carrying out the push-button control scheme. In the first place the push-buttons would have to deal with switching on the high voltage side, or else separate high voltage generators would be required for each plug. Also if



Circuit diagram for a sparking plug tester.—(H. J. Sweet)

the six plugs are to be tested in parallel the current capacity of the ignition apparatus will have to be considerable, or some sort of a rotary distributor used to connect to each plug in turn.

We think the best plan would be to concentrate on a single plug tester; this could be made to accommodate the six plugs if required, and the test current transferred from one plug to the other by means of a flexible lead and connecting clip. The high voltage could be supplied from a hand driven magneto or from an ignition coil fed from a battery. A make and break should be connected in the primary circuit of the ignition coil. This could consist of a telephone type buzzer having an additional fixed contact connected as shown in the accompanying diagram.

Treating Gun Barrels

I AM a practical gunsmith and, although I have a process by which I black gun barrels, I am wondering if you can give me any further information, as my method is not 100 per cent. efficient.

Also, what is the method used to obtain the brown effect on "Damascus" barrels?—J. H. Walker (Guildford).

A GOOD way to blue-black gun barrels is by means of heated charcoal. This necessitates the employment of long shallow trays in which the barrels can be placed.

The barrel must be cleaned, degreased and very highly polished. It is laid in the heated charcoal until the required colour has developed. It is then removed immediately, allowed to cool and is well oiled.

Another way is to grind flowers of sulphur into turpentine (genuine) so as to produce a thin "milk." This is then rubbed on to the clean barrel, which latter is then held in a luminous gas flame until dry. The process is repeated until an even colouration has been obtained. Then the barrel is rubbed well with oil.

This process gives a black rather than a blue-black colouration.

An effective "wet" method of bluing gun barrels is as follows: Mercuric chloride, 4 parts (by weight); potassium chlorate, 3 parts; alcohol (surgical spirit), 8 parts; water, 8.5 parts. This solution must be made up in a non-metallic vessel. Mercuric chloride (corrosive sublimate) is a Schedule I poison and may only be obtained from your pharmacist if you are known to him.

The solution is raised to just under the boiling point. By means of a clean cloth tied to the end of a wooden stick, it is swabbed liberally over the gun barrel until the required blue-black shade is obtained. The gun barrel is then well rinsed and dried. Whilst still hot, linseed oil (raw) is rubbed into it.

The final blue-black colouration depends in shade on the exact type of steel used for the making of the barrel.

The brown effect which you desire is obtained on gun barrels by means of the following solution: Ferric chloride, 2 parts (by weight); mercuric nitrate, 2 parts; hydrochloric acid, 8 parts; alcohol (surgical spirit), 8 parts; water, 8 parts. This solution must be made up and used in a non-metallic vessel.

It is used hot and is swabbed over the gun barrel by means of a cloth tied to the end of a wooden stick or pole. The gun barrel is then hung up to dry for about 10 hours. Afterwards the process is repeated. The gun barrel is then rinsed with water, allowed to dry and rubbed lightly with steel wool. Finally it is rubbed down with a soft cloth charged with raw linseed oil.

Removing Stains on Water Colours

I HAVE in my possession two original water colours and, due to age, they have brown stains on them, possibly due to damp. I shall be glad if you can tell me whether there is any method of removing these stains without damaging the water colours.—H. W. Ongley (Malton).

YOU do not say whether the brown "foxing" spots on your water colours are in prominent positions or otherwise and, also, whether they are numerous.

However, with care and patience they can be removed. The method is to select a few of the spots (never more than three or four at a time) and to paint them over with strong hydrogen peroxide. Apply the peroxide with the tip of a camel-hair brush, taking great care that the peroxide does not flow on to the surrounding area. If possible, apply the peroxide in strong sunlight, since the action of the sunlight is to heighten the effect of the bleaching agent. Allow the peroxide to dry off and, if the spots are still present, apply the treatment a second time. If the spots have not entirely vanished after two or three applications of the peroxide, paint the remains of the spots with a warm solution of oxalic acid (Schedule I poison) of strength, say, 1 part of the oxalic acid in 3 parts of water. The brown colour of the spots is due to iron, and the oxalic acid solution will discharge the colour. Afterwards the treated areas should be carefully wetted with warm water and dried by means of white blotting paper in order to remove as much as possible of the oxalic acid from the paper. Do this several times.

If the spots defy this treatment, they can be bleached away by a mere touch of a solution of sodium hypochlorite (the proprietary liquid "Milton" will suffice), but after this treatment the bleached areas must be most thoroughly "spot-washed" in the above-described manner in order to remove every trace of the hypochlorite solution, which would otherwise slowly rot the paper.

Treatment of the spots will leave white marks on the paper indicating where the spots have been. These must be very carefully touched in with a fine camel-hair brush charged with water colour. Carefully done, this touching-up will be indistinguishable from the rest of the picture.

Fixative for Pastel Drawings

CAN you give me a formula for preparing a fixative spray for charcoal and pastel drawings? It is I think Juniper gum and spirit. What is "commercial spirit"?—J. M. Douglas (Peterhead).

A GOOD fixative solution based on gelatine may be easily made according to the following formula:

Gelatine	.. ..	4 parts (by weight)
Alum	.. .. ..	½ part (by weight)
Soap	.. .. ..	¼ part (by weight)

Dissolve the gelatine and the soap in warm water. Then add the alum, and stir well. Filter the liquid hot through filter or blotting paper.

If the solution has to be kept for any length of time, stir into it a few drops of carbolic acid to prevent it from developing mould growths.

The above solution will set to a jelly when cold. It must, therefore, be used warm.

Another solution for fixative work can be made by dissolving scrap clear celluloid in a mixture of about equal amounts of acetone and amyl acetate. This solution is inflammable. It must not be too thick, otherwise it will congeal in the spray.

A solution of gum juniper or, better still, gum dammar, in rectified spirit, is also effective.

"Commercial spirit" is the name sometimes given to certain grades of industrial alcohol. It is not obtainable by the ordinary public. Industrial alcohol is alcohol which has been treated so as to render it unsuitable for drinking. It is supplied duty-free to certain licensed industrial concerns.

Small Single-phase Motors

I WOULD be glad if you would explain the running (including starting) of the different kinds of single-phase small A.C. motors. Also fault-finding with an ordinary megger.

I have a one-horse motor with condenser starting and I cannot understand how to trace faults because I always get a zero reading even though the motor is running all right.

Could you also inform me where I could buy resistance wire, about 30 or 32 gauge? How much current will resistance wire of this gauge safely pass?—C. W. Haig (Warrington).

A FULL explanation of the running and starting of all types of single-phase small motors would involve a very lengthy reply. The commutator types of motor are the series, repulsion, and repulsion starting-induction motors. Line current passed through the armature of the series motor reacts on the magnetic field created by the line current in the field windings to create a torque; a small motor may be started up by switching direct on to the mains, but a larger motor requires a graduated resistance in series to limit the starting current. The speed varies considerably with the load. The operation of the repulsion motor is similar to that of the series motor, but in this motor the brushes are short circuited together and are not insulated. The armature is not connected to the supply but acts as the secondary winding of a transformer of which the field is the primary and receives its current by induction. The speed varies considerably with the load. The repulsion start induction motor is similar to the repulsion machine but has a centrifugal device which short circuits the commutator when the motor reaches a certain critical speed during starting, and also frequently lifts the brushes from the commutator. The short circuited rotor is then similar to the squirrel cage of an induction motor and the motor runs at a fairly constant speed on varying load.

There are many types of single-phase induction motor. These differ mainly in the methods employed for giving a directional torque to the rotor. Most small motors are of the squirrel cage type with short circuited rotor conductors which receive their current by induction from the mains fed stator windings. The rotor current reacts on the stator magnetic flux to create the torque, and the motor runs at a fairly constant speed on varying load. The shaded pole motor, used in small sizes only, has one section of each pole face encircled by a copper band which acts as a secondary winding and causes the cycle of magnetic flux in the encircled portion of the pole face to lag behind that in the other portion so the rotor moves in a direction from the plain to the encircled portion.

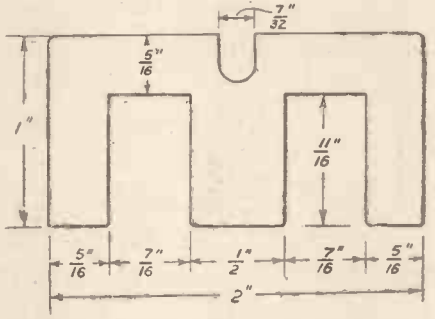
The stator windings of the split phase induction motor have a running winding and an auxiliary or starting winding. The auxiliary or starting winding may be designed to carry current continuously or may be intended to carry current only during starting. In the former case the motor can be started by switching direct on to the mains. Many motors are of the latter type, however, and the starting winding may burn out if left in circuit. To avoid this the starting winding may be switched out by a centrifugal device in the motor which acts at a certain speed or may have to be switched out by hand. The magnetic flux created by the starting must be displaced both in space and time from that created by the running winding to create a directional torque. The former is obtained by fitting the starting coils midway between the running coils, whilst the latter is obtained by connecting a resistance, choke coil, or condenser in circuit with the starting winding. In some capacitor motors a condenser is connected in circuit with both windings.

It should be realised that only a limited degree of testing is possible by means of a megger. The principal test is an insulation test with the megger connected between the windings and motor case. In our opinion a minimum satisfactory result for this test is 0.1 megohm, although motors have run for years with a much lower figure. The zero test mentioned may indicate merely weak insulation or an actual failure. The latter may be verified by connecting one pole of the supply (the live pole) to a mains voltage lamp, the other end of the lamp being connected to the motor terminals, whilst the frame of the motor is connected to the other pole of the supply. If the lamp lights the insulation has failed. You may also be able to test with the megger between the starting and the running windings if these can be separated. If the frame of the motor is not connected to earth it may run even with a definite earth fault, although we do not advise such use. When testing do not turn the megger at full speed if a low reading is obtained or you may break down the insulation. The shock experienced may be due to charge held by the condenser after switching off. The condenser may be discharged by connecting a small mains voltage lamp across the condenser terminals for a few minutes.

You may be able to obtain resistance wire from Messrs. Henry Wiggin and Co., Ltd., of Grosvenor House, Park Lane, London, W.1. As an example a straight length of 30 s.w.g. Ferry resistance wire in open air will attain 100 deg. C. with 1.4 amps, 200 deg. C. with 2 amps, and 300 deg. C with 2.3 amps. 32 s.w.g. Ferry wire will reach 100 deg. with 1.2 amps, 200 deg. with 1.64 amps, and 300 deg. with 1.94 amps. Higher temperatures will be reached if the wires are coiled or enclosed so that free ventilation is impossible. Other types of wire give different results.

Transformer Windings

I WISH to construct a transformer to the following requirements: Output, 120 volts with tappings at 110 v., 100 v., 90 v., 0.020 amperes; input, 12 volts; frequency, 50; efficiency, 80 per cent. Calculating the weight of core, I find that it has to be 0.25 lb. (4 oz.). By calculation I find that the primary current is 0.25 amperes. The wire to carry this current is 26 s.w.g. The



Dimensions of transformer stampings.—(E. Rawnsley.)

resistance of the primary is 3.85 ohms (approximately 4).

I have been informed that the windings should obey Ohm's law. Now if I apply Ohm's law with the above conditions I find that the primary current is 3 amperes $-I = \frac{E}{R} = \frac{12}{4} = 3$**. Consequently, with wire that only takes .25 amperes it will burn out. A similar problem presents itself in the case of the secondary.**

I would be very grateful if you could enlighten me on the subject.—E. Rawnsley (Leeds).

ASSUMING the core is to be built up to ½in. thick, you could wind the primary with 360 turns of 28 s.w.g. enamelled wire (1,500 amps. per sq. in. of conductor) and the secondary with 3,840 turns of 44 s.w.g. enamelled wire, having tappings at 3,520, 3,200 and 2,880 turns. A layer of thin paper should be wound on after each two layers of wire.

The current passing through each winding is only partly controlled by the resistance of the winding; the reactance also has an influence. The reactance voltage is proportional to the strength of the magnetic field linked with the winding considered, to the number of turns of wire which are linked with the magnetic field, and to the rate at which the magnetic field changes. The reactance is the principal factor in controlling the primary magnetising current, the reactance volt drop being almost equal to the supply voltage. The secondary current will be limited partly by the reactance volt drop of the secondary and partly by the resistance of the *whole* secondary circuit, not merely the resistance of the secondary winding. It follows that the secondary may overheat if it is overloaded, i.e., if the resistance of the secondary load circuit is too low. In order to minimise the secondary reactance volt drop the primary and secondary windings should be wound as closely together as possible in order to minimise leakage magnetism.

Hectograph Composition

(1) COULD you give me details of a simple duplicator: (*a*) is it made of wax or a gelatine solution? (*b*) Can it be used with ordinary writing paper and ink?

(2) I am also interested in making a model fire range fitted with electric elements for heating. Would ordinary cement be too brittle or heavy? How could I fix the tiles on the range?—F. Foster (Nelson).

(1) THE following formula makes a good hectograph mass for duplicating work:

Glue	.. .. ..	100 parts (by weight)
Glycerine	.. ..	500 „ „
China clay or whiting		25 „ „
Water	.. .. ..	375 „ „

Soak the glue in the water overnight, during which period it will swell up. Then add the gelatine and heat the liquid gently until the glue has dissolved. Add the China clay. Stir well and squeeze through fine-mesh cloth into shallow trays in which the mass will set and then be ready for duplicating.

The mixture of China clay or whiting is not absolutely essential but it is advisable, since it gives capacity and additional firmness to the hectograph composition.

Ordinary inks do not work well with hectographs. A suitable ink for this use can be made as follows:

Methyl violet	.. ..	2 parts (by weight)
Methylated spirit	..	2 „ „
Sugar	.. .. ..	1 „ „
Glycerine	.. ..	4 „ „
Water	.. .. ..	20 „ „

Any other dye can be substituted for methyl violet.

(2) If ordinary cement were mixed with 2 per cent. of its weight of powdered asbestos, it would probably serve your small-scale purpose. So, also, would ordinary cement slaked with waterglass solution. The following formula also makes a good heat-resisting cement.

Powdered pumice	.. 9 parts
Powdered asbestos	.. 2 „

Mix to required consistency with waterglass solution (i.e., 1 part ordinary waterglass and 1 part water).

These cements would also fix the tiles on the range.

Powdered asbestos can be obtained from Turner Brothers, Asbestos Co., Ltd., Rochdale, or, no doubt, from a local builder's merchant or paint stores, such as Messrs. Whittaker and Clegg, Ltd., Hammerton Street, Burnley.

Making Cork Slabs

CAN you please inform me what bond is used in making up slab cork, 1½in. to 2in. thick, 3 to 4ft. square?

The slabs are of loose construction and are used for heat insulation, not for carrying loads as when used for noise insulation of machinery.—B. H. Eartham (Preston).

USUALLY no bonding agent at all is used for making cork slabs. The material is hydraulically compressed in steel dies to a pressure of about 1¾ tons per square inch

Sometimes a thick boiled linseed oil (to the extent of about 4 per cent.) is mixed with the cork for bonding purposes. At other times China clay is used, and sometimes even a glue solution. Hydraulic compression is always necessary.

If a suitable press is not available, we would suggest that a mix of cork grain and glue solution is trowled into well-greased metal frames and allowed to set. After hardening, the glue constituent can be insolubilised by spraying or painting both sides of the cork slab with commercial formalin solution. This solution renders the glue insoluble immediately, besides hardening it and toughening it considerably.

This latter process would seem to constitute your way out of the difficulty in the event of your not being able to get a suitable hydraulic press. The exact proportion of glue depends on the particle size of the cork used. A few experiments in this direction, however, will soon put you right.

You might be able to hire a hydraulic press from Messrs. T. Ward's, of Preston Docks.

White Glue

COULD you please give me some information as to the ingredients for making white glue, as used in violin making? By the look of some I have seen I imagine it may contain isinglass.—J. G. Monteith (Ilford).

THE following is a formula for a white glue:

Good quality hide glue	..	10 parts (by weight)
Zinc Oxide	.. .. ..	5 parts (by weight)
Water	.. ..	10 parts (by weight)

Allow the glue to stand overnight in contact with the water. Then gradually bring it into solution by heating the water. Finally, stir in the zinc oxide. This type of glue sets dead hard and is very strong.

Alternatively, you might use a casein glue. This is difficult to make up, but it may be obtained fairly cheaply through any good paint stores, such as Messrs. James Beard and Co., Ltd., Great Ancoats Street, Manchester.

Curing Rabbit Skins

WOULD you please tell me how to cure rabbit skins so that they remain soft and pliable, as I wish to make gloves from them? Is it necessary for them to be dried by sunlight, or will any heat dry them?—D. W. M. Latimer (Liverpool).

IN order to cure rabbit skins, stir 1 part (by measure) of bran into 3 parts of boiling water. In every gallon of liquor so prepared dissolve 1 lb. of common alum and ¼ lb. common salt. Clean the skins as thoroughly as possible, removing flesh and fat. Then soak them in the above liquor at ordinary temperature for 24 hours. Allow the skins to dry (in the shade). Then stretch them and rub them well together. Repeat the process twice more, repeating the stretching and rubbing. This latter procedure is most important. The more rubbing the skins get, the softer and more pliable do they become. If the rubbing has been efficient, the skins, after the third immersion in the bran liquor, should be as soft as chamois leather. It is a good plan finally to rub a very little neatsfoot oil into the skin in order to assist and preserve its pliability.

The skins should not be dried by sunlight; nor should heat be applied for drying them. Slow drying in a cool place is the best.

GALPINS

ELECTRICAL STORES

408 HIGH ST., LEWISHAM, LONDON, S.E.13. *Telephone : Lee Green 0309. Near Lewisham Hospital.*

TERMS : CASH WITH ORDER. REGRET NO C.O.D.

ELECTRIC LIGHT CHECK METERS, K.W.H. type, for A.C. only. 200/250 volts 50 cycle, 1 phase, 5 amp. load, 12/6 each ; 10 amp, 15/- ; 15 amp., 20/- ; 20 amp, 25/- ; 30 amp, 30/- ; 50 amp, 40/- ; 100 amp, 50/-. Carriage 1/6 extra on each, all guaranteed.

USEFUL PANELS, consisting of chokes, resistances, mod. transformers, condensers, calibrated to decibels, and various other components, all mounted on metal baseplate, size 19 x 5 x 5, 10/- each, post 2/6 ; 19 x 8 x 5, 15/- each. post 2/6; 19 x 12 x 5, 20/- each, carriage 3/6. All components as new. Makers Standard Telephone.

EX-G.P.O. PRE-UNISELECTORS, 3 ohm automatic relay operating a 4-way Yaxley switch, fitted with 2 condensers .01, 1½ M.F., new, boxed, 5/- each. G.P.O. Polarised Telegraph Sounders in new condition, 15/- each. G.P.O. Polarised Relays, operating on 10/20 m/amps. coil resistance, 230 ohms, 15/- each, as new.

SHUNT WOUND D.C. 110 volt motors, 1,500 r.p.m., approx. ⅛ h.p., condition as new, 17/6 each, post 2/-.

LARGE SIZE 1 MFD. CONDENSERS, at 4,000 v. wkg., 10/- each, carriage 2/6. "Selenium Rectifiers," output 200 volts at 1 amp., half-wave type, 27/6 each. Instrument Rectifiers, 5 m/a., and 10 m/a., 4/6 each. Ex-G.P.O. Multi-Contact Relays, 5/- each.

EX-G.P.O. HANDSETS. The latest type (black bakelite), 10/6 each, post 1/-. Single earphones, low resistance, with headbands, 4/6 each. Ditto, 2,000 ohms, 7/6 each. Bell Boxes, standard pattern, 6/6 each. Ballast lamps, 125 volts 30 watts or 100 ohms resistance, E.S. holder, 6/- per dozen.

EVERETT EDGCUMBE 2½in. METERS, 0 to 5 volts AC/DC, incorporating Westinghouse Rectifier, 47/6. Ditto, calibrated in decibels +3—10, with rectifier, 65/-. Another reading 15-0-15 m/amps., 35/-. Ditto, 30-0-30 m/amps., 35/-. These meters are all first grade moving coil instruments.

VARIABLE RESISTANCES, worm wheel-drive, 2,000 ohms, to carry 250 m/amps, 35/- each. Electrolytic Condensers, 2,500 mf., 25 w. wkg., 25/- each ; 250 mf. 250 v. wkg., 15/- each.

MAINS TRANSFORMER, 200/250 v. Primary, 500/0/500 v. at 150 m/a., 4 v. 4 a., 5 v. 3 a. and 6 v. 5 amps., 55/-. Ditto, 350/0/350 volts at 100/120 m/amps, 4 v. 4 a., 5 v. 2, 6 v. 4 amps., price 32/6, post 1/6.

EX - G.P.O. VERTICAL TYPE GALVANOMETERS, centre zero reading 30/0/30, 7/6 each, post 1/-. Mallory 12 volt vibrators, new and unused, 7/6 each. Electrolytic condensers, 80 mf. 350 volt wkg., 5/6 each, post 9d.

WESTON MOVING COIL METERS, edge type with knife edge pointers, 2½in. scale, all 2 m/a. F.S.D., 0 to 300 m/a., 30/- ; 0 to 2 amps., 27/6 ; 0 to 60 volts, 27/6 ; 0 to 150 volts, 27/6 ; ditto, 0 to 1 volt 1 m/a. 1,000 ohm per volt, 35/- ; another 301 model 0 to 3 m/a., 35/- ; 0 to 50 m/a., 30/- ; 0 to 200 m/a., 32/6 ; another 501 model 0 to 50 m/a., 27/6 ; 0 to 10 m/a., 27/6.

EX-GOVT. ROTARY CONVERTERS, input 12 to 18 volts D.C. at 3½ amps., output 450 volts 60 m/amps., fitted with automatic switching and smoothing, 32/6 each, 2/6 carriage. Also a few only to clear, as above, but without brushes or brush caps, at 20/- each, post 2/6.

ERNEST TURNER, moving coil m/amp. meters, 2in. scale 0 to 10 m/a., 0 to 20 m/a., 0 to 50 m/a., 27/6 each ; all fully guaranteed. Standard Telephone 3in. scale m/coil meters, calibrated to read 0 to 25, 100 volts movement, 1 m/a., incorporating metal rectifier, 45/- each.

D.C. MOTORS, approx. ¼ h.p., either 110 v. or 230 volt, D.C. mains, series wound, 20/- each, post 1/6. Mostly with laminated fields.

EVERETT EDGCUMBE 3 READING VOLT-METERS, 0 to 5, 25, and 250 volts, 4in. scale, complete in teak wooden carrying case, 50/- each. One only, Ship's Sextant (Makers, H. Hughes), condition as new, £8/10/-.

SMALL ELECTRIC MOTORS for A.C. or D.C., 80/100 volts, useful for sewing machines, Pathe Cine's, etc., double ended shaft, 30/- each.

VOLTAGE CHANGER TRANSFORMERS, auto wound, fully guaranteed, immediate delivery, all tapped 0, 110, 200, 220, 240 volts 250 watts, 45/- ; 350 watts, 55/- ; 500 watts, 70/- ; 1,000 watts, £5/15/0 ; 2,000 watts, £8/15/0.

MODEL ENGINEERS

FOR THE TURNER :

Lathes, 3¾ and 4¼ S.S. Bench Millers. Drilling Machines.

FOR THE WOODWORKER :

Wood Turning Lathes, 2¼" and 5¼" centres. 4in. Planers. Saw Benches. Sanders. Spindle Moulders.

Sets of Castings and Blueprints for Circular-saw Bench and Power Hacksaw.

Every known Small Tool in Stock. Electric Motors available.

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

Copper wires. Cotton-covered ¼lb. reels, 18, 20g., 1/6 ; 22, 24g., 1/9 ; 26, 28g., 2/- ; 30, 32g., 2/3 ; 34g., 2/6. Enamelled do., same prices, including 36g., 2/6 ; 38, 40g., 2/9. Silk-covered 2oz. reels, 24, 26g., 1/6 ; 28, 30g., 1/9 ; 32, 34g., 2/- ; 36, 38g., 2/3 ; 40, 42g., 2/6 ; 44, 45g., 1oz., 2/- ; 18g., 1lb., 7/- ; 22g., 1lb., 2/6. Laminated Bakelite panels, ¼in. thick. 6in. x 4in., 1/6 ; 6in. x 6in., 2/- ; 8in. x 6in., 2/6 ; 10in. x 6in., 3/- ; 10in. x 8in., 3/9 ; 12in. x 8in., 4/6. Ditto, 1/16in. thick, same sizes, 1/-, 1/4, 1/8, 2/-, 2/6, 3/-. Polished Ebonite panels, 3/16in. thick, sizes as above, 2/-, 3/-, 3/9, 5/-, 6/6, 7/6, respectively. B.A. screws, gross useful sizes, 2/6, do., nuts, 2/6 gr. ; assorted gross screws and nuts, 2/6 gr. ; brass washers, 1/6 gr. ; fibre washers, 1/6 gr. ; assorted soldering tags, 2/- gr. ; assorted small eyelets and rivets, 1/3 gr. New ex-G.P.O. hand telephones with microphone, switch and cords, 12/6. Rubber-covered stranded copper wire, 1½d., 2½d. yd. Tinned copper connecting wire, 20ft., 6d. ; do., rubber-covered, 10ft., 6d. Finest quality stranded and single push-back wire, 12 yds., 2/3. Resin-cored solder, ½lb., 1/-. New "Lucerne" permanent crystal detector, 2/- ; semi-perm. perikon detector, 2/6. "Lucerne" crystal set coil with wiring instructions, 3/6 ; glass tube crystal detectors, complete, 2/6. Reconditioned headphones, 4,000 ohms, complete, 12/6. Used ex-R.A.F. low resistance earphone with switch, bargain, 2/6. All postage extra. Trade supplied.

POST RADIO SUPPLIES,
33, Bourne Gardens, London, E.4.

"OSMOR"
RADIO HEART

Comprises :—Chassis. IFs. Pre-set. V. Holders. S.M. Drum, Drive, etc. Coil Pack (3-wave). Choke. Dropper. 2-gang. 8-16 mfd. Dial. Pointer. Knobs. All Cons. and Resistors.

Fitted ready for wiring up. **£6 12s.** incl. 3 drawings.

Foundation of a Quality Superhet. 8in. P.M. Matched Speaker 30/-. Attractive Cabinet £3 10s.

Write for Literature.

MORGAN OSBORNE & Co., Ltd.,
South View Road, Warlingham, Surrey.

Homecrafts

PERFECT PASTIMES FOR PLEASURE AND PROFIT

Plastics, Models, Toys, Lampshade frames—patterns—covering materials, Leather Punches and Leather Fittings, Raffia, Erinoid, Plastic Handicraft Wire, etc.

Send 3d. for price lists, or 11d. for specimen copy of

CRAFTWORK MAGAZINE
(which includes price list)

Dept. 2, Homecrafts, The Broadway, Broadstairs, Kent.

BOOKS

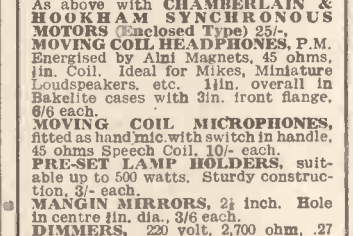
"Toys from Scrap for Pleasure or Profit," 3/6, by W. Lee.
"The Art of Scale Model Aircraft Building," 4/11, by V. J. G. Woodason.
"How I Toured the World on Nothing," 1/6, by W. Buchler.
"Publishing for Pleasure and Profit" (How to start and run a publishing business), 3/6.
"Money in Exports" (Trading in 41 different markets), 10/6.

USEFUL PUBLICATIONS,
37, Aldwych, London, W.C.2.

SANGAMO SYNCHRONOUS MOTORS,
self-starting, exceptionally good torque; rotor speed 200 r.p.m., 200-250 v. A.C., 50 ∿c. Consumption 2½ watts. Size, 2¼ x 2. Geared 1 rev. 60 min., can be reset to zero by friction drive from front or back. Shaft ¼in. x 1/10 to run clockwise ; ideal movements for making electric clocks, time switches, etc. Nickel-plated finish. Price, 22/6 each. 12 to 1 Dial Trains to fit above spindle, per set, 2/6.
As above with **CHAMBERLAIN & HOOKHAM SYNCHRONOUS MOTORS (Enclosed Type) 25/-.**
MOVING COIL HEADPHONES, P.M. Energised by Alni Magnets, 45 ohms, ¼in. Coil. Ideal for Mikes, Miniature Loudspeakers, etc. 1¼in. overall in Bakelite cases with 3in. front flange. 6/6 each.
MOVING COIL MICROPHONES, fitted as hand mic. with switch in handle, 45 ohms Speech Coil. 10/- each.
PRE-SET LAMP HOLDERS, suitable up to 500 watts. Sturdy construction. 3/- each.
MANGIN MIRRORS, 2½ inch. Hole in centre ¼in. dia., 3/6 each.
DIMMERS, 220 volt, 2,700 ohm, .27 amps. Stud Control. In brass cases, 7 x 7 x 4, 30/- each.

CASH WITH ORDER, POST PAID ON ALL ABOVE GOODS
TO CALLERS ONLY. A comprehensive stock of scientific instruments, meters, gears, relays, etc.

H. FRANKS, Scientific Stores,
58 New Oxford Street, London, W.C.1
TEL. : MUSeum 9594



The Hallam "Nipper" Aero Petrol Engine

EASILY MADE FROM OUR CASTINGS.
J. HALLAM & SON
UPTON, POOLE, DORSET.
MINIATURE PETROL ENGINES for Aeroplanes and Speed Boats.
Send 3d. for new list.

RADIO CIRCUITS AND COMPONENTS
"DORSET" SERIES

NEW BATTERY SUPERHET 4-VALVE ALL DRY 3-WAVE
A.C. 5-VALVE 3-WAVE SUPERHET
A.C./D.C. 5-VALVE 3-WAVE SUPERHET
A.C./D.C. AMPLIFIER, 6-8 WATTS
A.C./D.C. 4-VALVE T.R.F. MEDIUM WAVE WITH L.W. CONVERSION

Manuscripts containing 5 or 6 pages of drawings, point to point wiring instructions, etc., 5/- each, post free. Theoretical circuit of superhets with parts price list, 2½d. each.

WELDONA RADIO ACCESSORIES, LTD., SWANAGE

THIS MONTH'S SPECIAL—Plans to make a 36in. model of the "Vosper Motor Torpedo Boat." Two sheets giving every detail. Can be driven by petrol or electric. A splendid job. 12/10 post paid.
Plans to make a 36in. model of a "Cargo-Passenger Liner." Two sheets giving every detail for building a beautiful merchant vessel. Can be powered by steam or electric. 12/10 post paid.
List of kits and plans, two penny stamps. Write name and address very clearly.
T. FITTON (Model Specialist),
4, Ann Terrace, Norwich Rd., E. Dereham, Norfolk.

WHY WORRY?

WORRY uses an immense amount of vital force. People who worry not only use up their energy during the day by worrying, but they rob themselves of that greatest of all restoratives, sleep. People who worry can't sleep. They lose their appetite. They often end up by getting really ill. How often have you heard it said, "I am worried to death"?

What do you suppose would happen if a person who was putting himself into mental, moral, and physical bankruptcy by worrying, were to convert all this worry energy into constructive action? In no time at all he would have accomplished so much that he would have nothing to worry about.

Nothing is more discouraging to a worrying person than to have someone say, "Oh, don't worry, it will all come out right"!

This is not reassuring at all. The worrying one can't see how it is going to come out all right. But if the men and women who worry could be shown how to overcome the troubles and difficulties that cause worry, they soon would cease wasting their very life-blood in worrying. Instead, they would begin devoting their energies to a constructive effort that would gain them freedom from worry for the rest of their lives.

You say that sounds plausible, but can it be done?

H.M. FORCES

All serving and ex-service members are now entitled to receive the complete Pelman Course, with full tuition and guidance, at

One-Half Usual Fee.

Immediate application should be made for Special Enrolment Form (Services).

It can be done, and is being done, by Pelmanism every day in the year. This is all the more remarkable because to-day the whole world is in an upset condition and people are worrying to an unusual extent. Yet, every mail brings letters to the Pelman Institute from grateful Pelmanists who have ceased to worry.

People to-day are all too prone to complain that they just have to worry. But once they become Pelmanists they cease this negative form of thought.

Remember—Everything you do is preceded by your attitude of mind

The Pelman Course is fully described in a book entitled "*The Science of Success.*" The Course is simple and interesting, and takes up very little time; you can enrol on the most convenient terms. The book will be sent you, gratis and post free, on application to :—

Pelman Institute

(Established over 50 years)

130, Norfolk Mansions, Wigmore Street, London, W.1.

Callers welcomed.

PELMAN (OVERSEAS) INSTITUTES: PARIS: 176, Boulevard Haussmann. AMSTERDAM: Damrak, 68. NEW YORK: 271 North Avenue, New Rochelle. MELBOURNE: 396 Flinders Lane. JOHANNESBURG: P.O.Box 4928. DURBAN: Natal Bank Chambers (P.O. Box 1489). DELHI: 10 Alipore Road. CALCUTTA: 102 Clive Street.

THE Cyclist
Editor: F. J. CAMM

VOL. XV MARCH, 1947 No. 301

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.

Cycle Show Postponed

THE announcement that there was to be a Cycle Show this year gave rise to pleasurable anticipation among the industry and cyclists, who felt that this would be one step towards relegating the war to the limbo of forgotten things. It was with some astonishment, therefore, that a later announcement gave the depressing news that the Council of the British Cycle and Motor Cycle Manufacturers' and Traders' Union, Limited, had met and decided that after all there would not be a Cycle Show this year.

They were forced to this decision after considering the important changes which have taken place in the industrial situation following a further restriction in the supplies of steel and other vital materials by the Ministry of Supply, and the shortage of other materials necessary to this industry such as chromic-acid.

These difficulties, added to the restrictions on the deliveries of fuel, have placed the bicycle industry, one of the leading export industries, in a peculiarly difficult position.

In these circumstances, and bearing in mind that the industry must concentrate as far as possible on its production problems, the Council decided by a majority that the time and energy which would be required to organise a thoroughly representative Cycle Show could only be secured at the expense of production, and they have decided, therefore, not to proceed further with the arrangements which they had in hand for the organisation of a 1947 show. They still hope to organise a show in the autumn of 1948, nine years after the commencement of the last war!

Nine years is a long time in the life of any individual. The allotted span is three score years and ten. Nearly 16 years of that time have been spent in wars. We are still urged to go on saving for the future, when the future has arrived, and is passing.

The Cycle Show is one of our best ambassadors, but in view of the tragic circumstances which now surround British industry we think the decision of the Council is a right one. Manufacturers are beset by incredible difficulties. They are controlled, badgered, pestered for figures, worried by form filling, shortage of coal, shortage of labour, and shortage of materials. There is little point, therefore, in staging an exhibition which would merely encourage a commodity demand for goods which the industry could not supply to the home market.

Indeed, it is doubtful whether during the present year they will be able to supply all of their overseas commitments. Such is one of the tragedies of this post-war era, and such are the fruits of victory.

Exhibitions provide one opportunity during the year for the trade, its customers and its users to meet, when cyclists may under one roof inspect the products of all the firms which comprise the industry. We are to be denied that pleasure for at least another year.

"Calling All Sportsmen"

THERE are many who pay lip service to the cleanliness of cycling sport and sportsmen. We therefore appeal to them to exercise their sportsmanship and to refrain from attacking branches of the sport with which they may disagree. Each of us is entitled to our views, and we may not agree with the other man. We should, however, be particularly careful not to endeavour to force our views on others.

These comments are encouraged by a broadcast under the title "Calling All Sportsmen," in which a known antagonist of massed start racing gave his views on it. There was no one present in the debate representing the B.L.R.C. and thus the public had a one-sided view of the problem presented to them.

We should like to ask the B.B.C. and those responsible for planning this particular broadcast the following questions:

(1) Who was responsible for framing the questions?

(2) Who was responsible for selecting those taking part in the debate?

(3) Who selected the subject of massed start racing?

(4) What steps did the B.B.C. take to make quite sure that the questions submitted were not inspired questions sent in by members, say, of the N.C.U., which is, of course, anti-massed start?

(5) Will it give the B.L.R.C. an equal chance of putting its case?

(6) Why did not the person responsible for the broadcast, and knowing the questions which were to be put, go to the only source which could satisfactorily answer them, namely, the B.L.R.C.?

(7) Why were only anti-massed starters invited to take part in the debate?

(8) Is the B.B.C. aware of the League Memorandum to the Ministry on this subject, and is the B.B.C. aware of the fact that if this form of racing were illegal it would have been stopped a long time ago?

(9) Is the B.B.C. aware that massed start racing takes place on the Continent?

Motor Roads

MR. BARNES, Minister of Transport, recently stated that it is proposed, subject to the approval of Parliament, to put in hand during the later stage of the ten-year plan a number of motor roads linking some of the main centres of population. The exclusion of slow-moving traffic from these selected routes would involve a drastic departure in highway legislation, but it would be to the benefit not only of fast motor traffic but also of pedestrian, cyclist and local motor traffic, which would be able, as a result, to use the existing roads with increased comfort and safety.

"During the next two years priority is to be given to the improvement of the roads at points which accident records have revealed as being 'black spots.' The programme will include the improvement and provision of footways and other measures designed to promote pedestrian safety. Traffic signs will also be modernised, and other measures taken which will contribute to greater road safety. The human factor cannot be eliminated from road accidents, but its effects can be reduced, and everything that can be done to ensure that failure of judgment does not necessarily result in an accident must be done.

"We are already carrying out a large programme of re-surfacing of existing highways in order to reduce wartime arrears and to rectify the damage caused by military operations. This programme will be continued, and we intend to make the fullest possible use of modern plant in carrying out this work. Special attention is being given to the provision of non-skid surfaces and, what is equally important, uniformity of surface conditions.

"I am very glad to know that although your federation may hold different views on the question of transport nationalisation, you are entirely in accord with the Government on the general plan of road developments. I believe that this exhibition will demonstrate to the public that the expenditure now contemplated will be a sound investment and will be more than offset by the saving in lives, in time and tempers, and in wear and tear of vehicles. For this reason and in this hope I wish the Highways Exhibition every success."

French Study British Games

AT the invitation of the Central Council of Physical Recreation and the British Council, a party of French medical specialists has arrived in England to study British methods of physical recreation with a view to their possible adoption in France.

Led by Dr. C. Churche, who proposed the visit after attending one of the Central Council training courses in 1945, the party includes 25 doctors and medical students who attended a course this week at Uppingham College and 6 doctors who attended a similar course at Bisham Abbey, Berks, the national recreation centre of the Central Council of Physical Recreation.

Dr. Jean Martin, consulting physician in Paris to leading sports organisations, summing up his impressions of the course at Bisham Abbey, said: "The chief difference I have already noticed is that the method of training followed by the Central Council of Physical Recreation is less military in character than that of France.

"The emphasis seems to be more on rhythmic movement and simple games than on formal physical training.

"I was particularly impressed by the importance that is given to dancing, which tends in France to be regarded simply as a means of enjoyment, so that its value in training is apt to be overlooked."

PARAGRAMS

See When

IN order that road users and pedestrians can see when the "Stop-Go" signal is about to change, an American inventor has produced a sign with the words "Stop" and "Go" in illuminated letters. In a semi-circle round the top of the sign is a series of holes which are illuminated one by one as the mechanism lights up "Stop" and darkens "Go," and vice versa. It is possible to see at a glance what period will be left before the signal changes.

Snow-cycle

A 74-YEAR-OLD villager who lives at Schwandi, in Switzerland, and has a paralysed right leg and only one arm, has designed and built several "Schneevelos" or snow-cycles for his friends. The frame, of the orthodox cycle pattern, is built of wood and instead of wheels, hand-carved wooden runners are fitted at the front and rear. These snow-cycles are propelled by the feet on the level, but on a slope it is a matter of holding tight and hoping for the best. The local children are finding them very useful, and the fact that no brakes are fitted does not worry them in the least.

Keep it Safe!

THE cycles of all schoolchildren at Great Yarmouth are to be regularly checked by the local police, and at the end of each year the school whose pupils are found to have kept their machines most roadworthy and safe, will be presented with a new cycle.

Enthusiasts

WEARING leather jerkins and shorts, Mr. C. Smith, of the Kettering and Yeovil Cycling Clubs, and Mr. A. G. Young, of Yeovil Cycling Club, rode over 160 miles in bitter wintry weather to attend the first post-war prize-giving and luncheon held by Kettering Amateur Cycling Club. On the day following, they cycled back to Yeovil. About midnight on their first day's journey from Yeovil they reached Brackley, Northants, and spent the rest of that night by a blazing fire at the local gasworks. A few hours after setting off again they were at Kettering, where they were met by a car which took them the remaining few miles to the Sondes Arms, at Rockingham, where the luncheon was being held.

Scunthorpe Polytechnic Club

IN the course of his annual report at the dinner and prize-giving of Scunthorpe Polytechnic Cycling Club, the hon. secretary, Mr. J. R. Pulling, referred to the activities of the club which were planned for 1947. He said the club had plans for an open sports meeting to be held in connection with Scunthorpe United Football Club in the summer, and he hoped the meeting would be very successful. Scunthorpe has had no sports meeting for many years, although at one time its sports meeting was one of the best in the country. The club has at present over 70 affiliated members, and its finances are sound.

Lucky Children

LINDSEY County Education Committee has decided to spend £300 on the purchase of cycles for the use of children in their area of North Lincolnshire who have to travel more than two miles to school. Up to now the children have had to get to school as best they could, either walking or getting a lift now and again. The committee has set aside £50 for allowances to those children who already cycle to school. If there should be a suitable bus service the children would, of course, have to use it instead of cycling, but in the majority of cases there is no service.

Gad, Sir, What Cads!

MRS. BRACE, of Grantham, Lincs, who arranged the decorations for the Belvoir Hunt Ball, held at Buckminster Hall, borrowed 22 bicycle lamps and used them to provide a special lighting effect. After the ball was over, as the old song goes, she went to collect up the lamps and found that all but four had been stolen. Mrs. Brace says she will have to pay for the missing lamps herself, and she has suggested that the people who took them should send some "conscience money" to the Belvoir Hunt funds.

Mixing the Colours

CONFUSION was caused at Grantham, Lincs, when the town's new street lighting system, with its mercury vapour lamps, was switched on. The blue lighting of the lamps made yellow lights appear green. This caused particular trouble on the stretch of railway line just outside Grantham Station. As soon as the lights were switched on the engine drivers began to come into the station at speed, instead of observing the yellow caution-signal lamps. When they were asked the reason they all said they had seen green lights. Screens are to be fitted to the offending street lamps.

Badge Wanted

A KEEN collector of military badges has written to the Ramsey (Hunts) branch of the British Legion, offering a donation to the Legion funds in exchange for one of the cap badges of the old Huntingdonshire Cyclists' Battalion.

Cycle Company's Ball

SOME 300 guests were present at the annual ball organised by the Elswick Hopper Cycle Co., Ltd., Barton-on-Humber, Lincs. Local charities benefit by sums raised by these events and this year over £10 was obtained for charitable purposes.

Wise Girl

WHEN two Land Army girls gave evidence at Newport Pagnell Police Court on the hearing of a summons against a lorry driver for failing to report the accident in which one of the girls had been knocked from her cycle, which was completely smashed, they were asked about the identification of the lorry. The girl whose cycle was not damaged told the magistrates that immediately after the accident she scratched the lorry's registration number on the frame of her cycle. The driver was fined £1 and ordered to pay 14s. costs.

Going Too Far!

A MAN who appeared before Leicester City Magistrates on a charge of cycle stealing, admitted to the Bench that altogether he had stolen 14 machines. He was, however, rather annoyed to see that he had been charged with stealing two cycles in one day. He said he had never taken more than one cycle in any one day and there must be "a clerical error."

Wot! No Pedals!

JOFFRE PLOWE, one of the younger members of the Grantham Road Club, was the winner of the club's free-wheeling contest by travelling just about 2½ miles without pedalling. He said the two large bricks, which he carried in his saddle-bag, helped him considerably downhill but rather held him back on the level run. All the competitors removed their chains before the start of the race, just in case instinct got the better of them.

Barton Club to Re-form

THE re-forming of the Barton Wheelers' Cycling Club was decided upon at the first post-war general meeting of the club, which was held at Barton, Lincs. The name of the club will be changed to the Barton and District Wheelers' Cycling Club and members will be accepted from the villages around Barton. The club chairman is Mr. H. Dent; secretary, Mr. A. Drury; treasurer, Mr. S. Coulam; racing secretary, Mr. G. H. Ebbatson; and captain, Mr. N. Ebbatson. The members of the committee are Messrs. Haddock, Turner, Cammock and Mrs. Crowther.

Suggested Good Resolution

LEICESTER cyclists are hoping that the City Transport Department have made at least one good resolution for 1947, and that is to do a spot of repair work to the roadway adjoining the tram lines. The lines themselves are treacherous enough and in addition, mainly due to wartime neglect, the surrounding road surface is so worn and uneven that a cyclist has to be extremely careful to avoid being thrown from his machine, particularly at night.

Starting Them Right

TWO Peterborough children, a girl aged 8 and a boy aged 6, holders of "Lucky Tickets" at the Savoy Cinema, Peterborough, were thrilled when they found that their tickets entitled each of them to a brand new cycle. When the manager of the cinema handed over the machines he presented each child with a copy of the Highway Code and asked them to understand it before they ventured out on the road.

Don't We Know It!

THE monthly road safety and accident review issued by the Chief Constable of Lincolnshire, after giving details of road accidents during November, says: "The use of fog lights and undipped headlights appears very prevalent. They are not focused properly and considerable inconvenience is caused to approaching drivers." Perhaps one of these days such ill-manners on the part of motorists will be a matter for a police prosecution, having regard to the increased risk of an accident when a driver is dazzled.

My Point of View

By "WAYFARER"

Declining Band

I VERY much fear that we who use acetylene gas lamps for our serious night cycling are (like exponents of the fixed gear) a declining band. My fear arises solely from the circumstance that the demand for gas lamps is bound to be reflected in the factories, and already I hear that there is nothing doing in the way of such lamps, since suspension of manufacture during the war period. Personally, with a "fleet" of four gas lamps—enough to last out my cycling career—I need not worry, but some of my cycling companions who share my preference for acetylene are inclined to be a bit het-up as regards the future. Fortunately, there must be hundreds of discarded lamps scattered about the land, and these could be brought back into use if and when the need for them occurred.

Not Far-fetched

THE story told by a motorist who charged into a house is not so far-fetched as would superficially appear. He said that he swerved to avoid a shadow which he thought might be a pedestrian. On more than one occasion, when cycling at night, I have been startled by hurrying shadows induced by the lights of overtaking motor-cars. It can be very alarming. And so I believe that the house-rammer above-mentioned may well have been telling the truth.

Modified Praise

FROM a leading article in *The Times*: "The bicycle offers perhaps the best facilities for seeing the countryside, but there is much to be said for the top of a bus." Amended to omit the word "perhaps" and all words after "countryside," the dictum can be accepted by cyclists. In its present condition this praise of the bicycle is very modified.

Local Colour

LEADING a draught horse along a busy city street, a man improved the shining hour by whistling that well-known marching song, "The Road to the Isles." Visions of Lochaber and Arisaig and Mallaig and the Five Sisters of Kintail and the Kyle of Lochalsh! On a hoarding round the corner I came across an auctioneer's announcement of the impending sale, at the familiar Blossoms Hotel, Chester, of the even more familiar Swallow Falls Hotel, near Bettws-y-coed. More local colour swam before my eyes. Later in the day, when reading my newspaper, I found a note about the death of Viscountess Powerscourt, at Powerscourt, Enniskerry, which invoked memories of my first Irish tour, while an advertisement sponsored by the Scottish Tourist Board inviting all and sundry to spend Christmas in the Land o' Cakes (there to enjoy good fires, exhilarating air, and first-class food) set me a-longing for a trip to Caledonia, stern and wild. Thus can a stray word bring sunshine—local colour—to the gloom of a wintry day, if you are a cyclist!

Competition in Lateness

ONE sometimes wonders whether there is a sort of competition amongst clubmen to be the last to pay their dues to the organisation of which they are members. In this possibility may be found a reason for the reluctance of many people to take on honorary jobs—though sheer laziness may be a much more likely reason! I feel, however, that clubmen who regularly enter this competition in lateness in the matter of forking out their subscriptions might advantageously give a moment's thought to the result of their slackness. Do they realise the amount of extra work which they impose on the long-suffering treasurer? Here is an example: One who keeps the money-bags of a large cycling organisation told me the other day that, as last year was drawing to a close, he had to sit down and prepare (and despatch) no fewer than 128 reminders to members who had not paid the subs. due nearly 12 months earlier. Think of the unnecessary labour thus imposed on the luckless official, oh! ye laggards, think of the cost of the postage.

Some clubs have a salutary rule, seldom enforced, of lapsing membership when subscriptions are not paid by a certain date. Such a rule should not be necessary in a sporting organisation, it seeming to me to be the very negation of the things for which a cycling club stands. Perhaps, however, this "word in season" may cause the bad payers to realise their obligations, and it may be that, in future years, hon. treasurers will be overwhelmed with a spate of subscriptions from members who are anxious to be the first, rather than the last, to discharge their obligations! That would be a pleasant change, and one in regard to which, I imagine, no club official would complain!

Nose-bag Meals

WHATEVER may be said in favour of nose-bag meals in the summer loses some of its force during the winter, when the climatic conditions, usually, are not (shall we say?) quite so pleasant. On an austere winter Sunday two of my friends put into a familiar guest-house in the hope of obtaining a pot of tea to consume with their sandwiches, and were refused on the grounds of busy-ness. A second and third call produced exactly the same result, and, in the end, my pals adjourned to a church porch and ensconced themselves on the usual stone seat, there disposing of their nose-bag meal and doing without a drink. This sort of experience may be all right in the "cycling season" proper (my preference then, and at all times, is for a knife and fork function), but it does leave something to be desired on a less genial day in mid-winter.

Mouth-watering

IN connection with a recent newspaper discussion concerning the use of Rannoch Moor as a military training area, an interesting sidelight on the nature of the terrain is provided by one who is "in the know." The moor contains a large number of extensive and dangerous bogs. Nearly sixty years ago, when the West Highland Railway was constructed across Rannoch Moor, part of the line had to be "floated" on brushwood and, where the embankment did not permit of this form of construction, enormous quantities of ashes were brought from the steel works in the Glasgow neighbourhood and dumped into the bog to form the embankment. I never see that railway over Rannoch Moor without feeling a strong urge to use it—just as I would love to traverse the line from Fort William to Mallaig. They are both mouth-watering routes. So far, in each case, the road has been good enough for me, but it would indeed be a thrill to do the railway journey as a change. And, one of these days—please the pigs!—it shall be done.

Around the Wheelworld

By ICARUS

"Calling All Sportsmen"

I WAS considerably astonished in listening to the programme under the above title during the evening of Friday, January 31st, to hear a discussion on massed-start racing. I considered that this debate was particularly unfair in that there was no one representing the British League of Racing Cyclists in the studio to put their case. It seemed to me that the questions were badly framed, and they were answered by those who either did not know anything about massed-start racing or else were known to be hostile to it. I think it wrong policy on the part of the B.B.C. to allow controversial topics of this sort to be debated unless both sides of the case are put at the same time. I was not in the least surprised, therefore, to learn that the speakers were against massed-start racing, and I have accordingly written a letter of protest to the B.B.C. asking that the League case should be given equal prominence in a similar programme. I have also sent Raymond Glendenning, and also the Director of Programmes of the B.B.C., a copy of the memorandum on massed-start racing which I prepared for the League, and which was submitted to the Ministry of Transport.

It would appear that the antagonists of this new, wanted and most popular form of cycle sport intend to leave no stone unturned in their efforts to get it suppressed—but they will be unsuccessful. In view of this broadcast was not its title a misnomer?

James Kain has sent a letter of protest to the B.B.C.:

"Last evening and throughout today I have received several 'phone calls from listeners to the above programme, who complain most strongly of that part of a discussion dealing with cycle road racing."

I would add that I have also sent for a copy of this broadcast and shall comment on it in a later issue. In the meantime, I advise the B.B.C. not to rush in where angels fear to tread.

Cycle Tyres of Leather

DURING the rubber crisis Dunlops experimented with tyres made of leather, but they were never put into general use. Dunlops' production of cycle tyres reached a total of 85,000 a week, but the bulk of these were used on munition workers cycles and for paratroopers folding cycles. A smaller proportion were dropped by parachute to the French Underground Forces.

A. R. Haine's Appointment

THE N.C.U. has appointed A. R. Haine as professional promoter at Herne Hill Track. The Committee for 1947 Track Sport were kept fully informed of the offer made to him by the N.C.U. and the committee were unanimous in their desire that he should accept the post. He has therefore resigned as secretary of the committee and the new secretary is Mr. C. S. I. Scott, 19b, Clifton Gardens, London, W.9.

The committee are still of the opinion that the best interests of the sport would be served by the setting up of the N.C.U. of a completely separate organisation on the lines of the scheme they have already laid down, and which has been published in this journal. The committee has, however, performed a very valuable task. They have shaken the N.C.U. from its lethargic and torpid slumbers and forced them to do what the committee itself proposes to do. The committee will retain its separate entity for 1947, for the purpose of mobilising public opinion in support of improvements at Herne Hill and for the purpose of directing public attention to the methods by which such improvements can be carried out.

The Tricycle Association

DURING 1946 the Tricycle Association ran five road events attracting 88 entrants. The "50" attracted 35 entries. The interest in the three-wheeler appears to be increasing, judging from the increase in demand for them. The North Midland Region has been formed, catering for tricyclists in the counties of Yorkshire, Nottingham, Derbyshire, etc. For the present season the "25" will be held in Cheshire, the "50" on Merseyside, the "100" in Yorkshire, and the "12" in conjunction with the Manchester Wheelers. C. E. Green was again elected chairman.

The Half Century Club

FIVE new members of Raleigh's Half Century Club have been presented with silver tankards and cheques by Sir Harold Bowden, Bart., the Raleigh chairman, in recognition of 50 years' service. The veterans are:

Mr. Ernest Cooke (service department), who joined the company in 1897, and originally taught Sir Harold how to "key up" cranks on bottom bracket axles; Mr. Bill Spray (bracket shop), who started with Raleigh in 1895; Mr. Walter Bourne (Sturmey-Archer repairs), who also started in 1895; Mr. H. Hopcroft (reconditioning), who started in 1891 and who retired from the company's service in July, 1946, and Mr. T. Bradshaw (3-speed machine), who commenced work with the company in 1891 and retired in December, 1946.

There are now 18 members of the club, all of them with at least 50 years' service. In making the presentations Sir Harold mentioned that he himself was within two years of becoming a member.

Cycling is Such Fun

UNDER his pen-name of "Ragged Staff," Rex Coley's lighthearted yet instructive writings are well known in both the British Isles and the U.S.A. His cycling adventures cover a space of twenty years, during which time he has cycled in every county in Britain and Ireland.

In whatever company Ragged Staff finds himself, laughable complications invariably occur, and the reader will here get full enjoyment from these amusing reminiscences. There is a foreword by F. J. Camm.

With 31 illustrations by A. J. Charles, the book is published by Skeffington and Son, Ltd., 55, Pont Street, London, S.W.1

More Leisure: More Cycling

SPEAKING recently at the first annual dinner of the local branch of the National Association of Cycle Traders, the Lord Mayor of Birmingham said that thousands of people, given more leisure by the introduction of the five-day working week, would take to the Open Road, and he suggested that it was the duty of traders not only to sell cycles but to co-operate in the provision of information about week-end accommodation in the country. The speaker added that there would be a shortage of motor-cars and motor-cycles for a considerable time to come, and that the existing army of cyclists would be joined by thousands released for long week-ends by the shorter working week.

May it be so! The extra leisure provided by the five-day week will be justified if a goodly proportion of the people concerned decide to devote their play-time to cycling, which is such an admirable and profitable method of using one's leisure, and, moreover, is a method within the reach of practically everybody.

Aire Valley Cycling Club

A NEW club has been formed in Bradford and district called "The Aire Valley Cycling Club" (affiliated to the B.L.R.C.). Regular runs have been arranged, and we will welcome all intending members and friends.

The Secretary is: G. Mason, 2, Arncliffe Terrace, Lidget Green, Bradford.

Cycling Characters

Some Interesting People I Have Met

By R. L. JEFFERSON

THE cycle trade and pastime includes as many—if not more—cranks and eccentrics as any sport I know. It is perhaps only natural, as ours is such a unique pastime; it is travel and sport combined, and has a history of well over a century.

It was my very great pleasure before the war to travel daily by bicycle and call on all the people connected with the trade in London and the Home Counties.

Back in the 'Eighties

One wet and miserable day I cycled through Blackwall Tunnel and entered the maze of streets which make up London's East End. My last call was in a street which at one time had been of some importance, and the cycle shop was old, the proprietor seemed, if anything, even older; he kept the door on a chain, and on answering my knock he inquired my business. Inviting me in, he apologised for the light—a candle in a bottle—and explained that he had had a disagreement with the gas company and they had cut off the gas. "Of course," he said, "a young fellow like you wouldn't know any of the old timers like I do." I mentioned Sparrow and Timberlake and a few others, and he brightened up considerably. He explained that he had at one time back in the 'eighties been one of the largest cycle manufacturers in London. He asked me to follow him into the basement; this extended right under the road, and there were very large racks full of castings covered with dust. There must have been several tons of these parts, all of them were for solid-tyred safeties and tricycles. There were also one or two complete solid-tyred tricycles, a couple of ordinaries and a few safeties, and one of these latter I bought from him.

A Racing Veteran

In another part of London I was wheeling along a main road when I noticed a name over a garage. The name was familiar to me as that of a famous racing man of a few decades ago; I found him under a Lagonda and introduced myself. He climbed out and we started to yarn; he had certainly aged since I last saw him, but his memory was still good. We appeared to be talking a language quite foreign to the several mechanics in the shop. Presently he led me outside and across the road, through an alley, where we entered an old stable, and there on the wall was the frame of the cycle he rode years ago with such success abroad. It was his firm belief that that machine had travelled faster unpaced than any other machine had ever done. On the floor of the barn was a watering can, and he told me quite simply that it was his custom to water the frame from time to time. In this way, he argued, it would eventually disintegrate, and he would be sure that no other person would ever ride it.

The "Euclidia"

In one of the Medway towns of Kent I called one afternoon on a very old-established dealer. A traveller was engaged with the proprietor, so I waited. Strolling through the yard at the back, I saw, hanging up, a very well preserved "boneshaker"; I noticed it was a "Beck," of Lister Works, Holloway, one of the oldest makers in England. There were also several ordinaries, and a solid-tyred safety, which latter was the unique "Euclidia," the frame of which defies description.

Presently the dealer came out and we had a long chat. I told him of my interest in the history of the wheel, and he sold me a few early cycling books and catalogues. He told me that his own hobby was collecting old newspapers, and he took me up to his flat over the shop and showed me his collection. He had No. 1 of *The Times*, *Telegraph*, *Spectator*, etc., and all were in beautiful condition. Some of his papers were well over three hundred years old, and yet they looked as if they had just come off the press. At a later date I was able to send him a few very old papers, and we corresponded on our respective hobbies.

A Trip on a Tandem

Just after the 1914-18 war, when cycles and accessories were even scarcer than they are to-day, a friend and I decided to buy a second-hand tandem. A new one was out of the question; they just weren't being made.

We scanned the columns of the cycling papers week by week, and eventually what appeared to be a suitable machine turned up. I took a day off from work and cycled over to Walthamstow to inspect the tandem. It was a path racer and very light, it had 26in. wood rims for wired-on tyres, and only one brake, a short pull-up to the front wheel. The machine had ⅛in transmission and was unique in several respects. The seat pins were held in place by expander bolts, the left-hand cranks and axles were in one piece and the chain wheels and right-hand cranks splined on to the axles. It weighed only 42lb., which was certainly very light; there were three spare chain wheels and a number of accessories. The price was £15, a lot of money in those days. However, I took a chance and bought it. I rode the tandem with one hand and trailed my single home with the other. I lived in Bayswater then, and it seemed quite a long way. I found out later that the gear of the tandem was 108.

In the evening I rode over on it to my friend's house; he seemed very pleased, and complimented me on my capture. We adjusted the rear seat and tried out the machine round the outer circle of Hyde Park. Returning home, we made some more adjustments and put the machine in thorough order. We then decided to go to Dover and back on the following Sunday for a real test.

A Good Start

Bill was waiting for me when I turned up at 8 a.m. that Sunday morning; we got going, and soon left the suburbs behind. The Dover Road was not as smooth as it is to-day, and some of the surface was rough macadam. As we approached the top of Wrotham Hill I warned Bill of the gradient and the surface. The road then used to go right through Wrotham village, and there was a dead left angle turn in the village which had to be negotiated at walking pace. I told Bill about this, but he didn't take much notice; he looked over my shoulder and saw the village over a mile away. "Let her rip, we can easily pull up before we get there," he said. Like a fool, I took his advice and soon we were flying down the hill. Presently we reached our pedalling limit on the 108 fixed gear, and goodness knows what speed we were doing. It must have been well over 40 m.p.h.

A Nasty Spill

Suddenly I heard a crack and felt the handlebars go "limp"; I realised the steering column had broken. I told Bill as calmly as I could, and putting his hands on my shoulders he started to tread back that terrible gear. I had to try to counteract his swaying as best I could. Luckily the forks were well raked, and this kept us going. Bill managed to slow the machine down to about 'evens," when suddenly we snaked. That's all I remember until being picked up. My injuries were two broken ribs, a torn instep and numerous cuts and bruises. Poor Bill lost the sight of his right eye and had more than his share of bruises and road burns.

Weeks later, when we had recovered and were examining the tandem, we discovered that the steering column was 20 gauge plain steel; how it had stood up at all was a mystery to me. I took the forks to my local maker and he brazed a butted tandem column into the crown. We reassembled the tandem and sold it cheaply.

Shortly after, Bill blossomed out on a brand new A to Z French welded cycle, and went into serious training for the first "50" of the season. He wore glasses, and his right eye was replaced with a glass one. We rode to the event at a sedate pace, and Bill changed by the roadside. I proceeded to my appointed place to hand up drinks. Bill did quite a respectable time for those days, and was very pleased with himself, as he was placed second in the handicap.

Continued Bad Luck

I turned his wheel round for the low gear and we started for home. When we reached Chiswick it was afternoon, and there was plenty of traffic. The buses then had open tops and solid tyres, and someone on one of the bus tops threw a large apple core overboard. It struck Bill's glasses; he lost the sight of his other eye—a cruel bit of bad luck.

But Bill wasn't done with cycling yet. I borrowed a tandem and we took many a week-end trip on it. He had an uncanny way of telling me where we were; he always knew when we had passed Barnet Church and were approaching the "Old Man's," a popular cyclists' resort.

Recompense

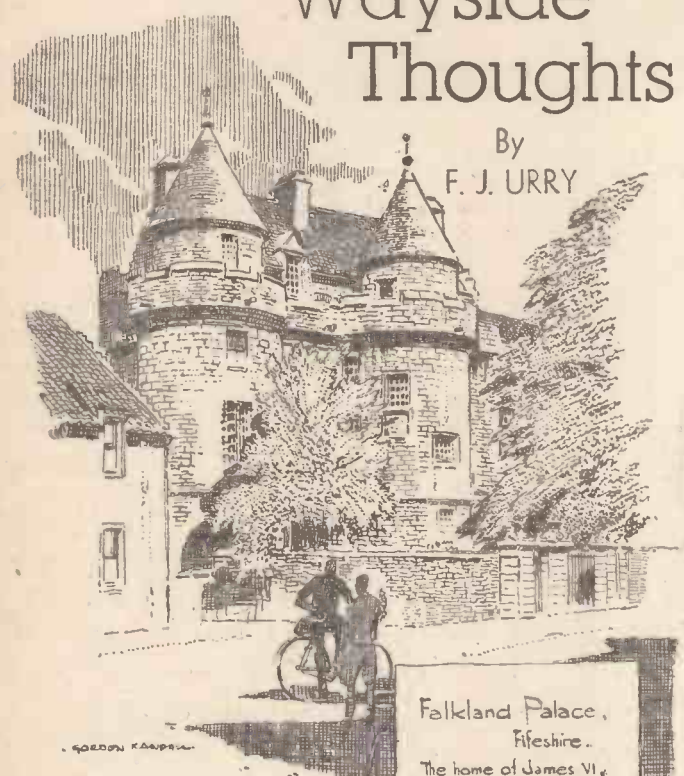
Some few years later I went abroad for nine years; when I returned I naturally looked up Bill, and found him a successful French polisher, employing twenty men. It would seem that when we are deprived of one of our faculties, Nature intensifies those remaining.

Just before this last war a friend of mine, knowing I had a "nose" for finding difficult things, asked me if I would get him a bottom bracket axle for his "Centaur Featherweight." This machine had not been made for over twenty years then. I went to a dealer I knew in S.W. London and asked him for the axle. Opening a drawer, he produced one straight away, and added that he could supply axles and parts for Rovers, Sparkbrooks, Raglans, etc., all, of course, long obsolete, yet he had very little up-to-date stock. It seems he managed to make a living supplying parts and repairing obsolete cycles.

It is people like the above and hosts of others I have met that add so much to the interest and enjoyment of the pastime, and they help in their way to make cycling the grandest of all games.

Wayside Thoughts

By F. J. URRY



It is Badly Needed

I WAS glad to read a leader in a technical journal criticising the present type of battery lamp, front and rear. The plaint was timely, for the rubbish offered at a big figure of cost seems to me an imposition in so far that you cannot buy anything better. Cycle lighting has gone backward as far as the battery lamps are concerned, and personally I get a bigger load of trouble in illumination than any other component concerning the equipment of the bicycle. And there is no need for this worry if we were offered the right type of casing for our batteries instead of the cheapest and flimsiest form of thing possible to make. A stout brass case with proper contacts to lamp and battery will overcome all the many defects we are now made to suffer. Of course, designers (who do not ride bicycles) tell me I've a bee in my bonnet on the question; but then they have had no experience of the first battery lamps of about 30 years ago, made from sheet brass with sturdy contacts and retailed at 8s. 6d. each. They lasted many winters and were most reliable. Now most of us who ride daily use new lamps every season, and even then, if they are subjected to stormy trips and caked with mud, they often refuse to function and require a lot of persuasion to make them carry out their duties. At the moment, battery lamps are the worst equipment on a bicycle, and it is not possible to buy anything better. "Go over to the dynamo," I can hear someone say. While I can buy my light I do not intend to work for it; and besides, even dynamos are difficult to obtain, for the supply is strictly rationed to the dealers. Give us a really good battery lamp and many of our lighting troubles will disappear.

The Price Question

WE are now becoming used to the reign of new prices and do not exclaim quite so violently as was the case a year ago. Then many of us expected the cost of things we desired would drop; the war was over and it merely needed the swing of our factories to peacetime production for the shortages to be made good, at a lower retail figure and of a better quality than the products we had to use during hostilities and actually were then thankful to get. But it didn't work out like that. Excessive overtime had appeared, and the standard rate of wages had only been maintained during the war because of overtime and the payment of generous peacetime rates. So wages went up and, as wages are the main charge in bicycle building, bicycles, replacements and equipment went up. And the shortages were not replaced; indeed, the situation in that respect has been worse, due in a large measure to the export drive—that urgent call for bicycles from countries far worse off than we were and are, in the matter of supplies, to say nothing of the national need for obtaining credits abroad. In that respect the cycle trade has done, and is doing, a fine job of work, even though it may be a little difficult for some of us to reconcile ourselves to the conditions imposing on us such limited purchasing facilities. The point at issue in this paragraph is: what will be the price of bicycles? I have been asked that question in many quarters, and it is a difficult one to answer because the industry itself is not at all certain of the future of supplies or the stability of wages. The labour force is also a factor, the present shortage militating against the highest output, and that condition has a very big bearing on the costs. My own impression is that the price of the basic bicycle (£3 19s. 9d. pre-war) will remain between £10 and £11, including purchase tax, and that a good class machine, according to specification and equipment, will vary between £16 and £25.

We Are Fortunate

IT seems a big price to pay for a bicycle; yet, and mark this, we are merely reverting to the prices ruling during the mid-nineties, when the cheapest machine cost 14 guineas, and in 1896 I paid £26 for an Osmond, and that just a frame and wheels, no hub gear, brakes or mudguards. And there was no purchase tax then, which to-day accounts for approximately 24 per cent. on what would otherwise be the retail figure. However, it is useless comparing present-day costs with those of 50 years ago, for at best they are only a matter of interest. What we should be doing is to realise that the bicycle is one of the few articles in wide use that has only doubled its cost. In the better type of machine the comparisons between pre-war and to-day's figures are certainly in favour of the buyer, for one could not expect very much for £8 in 1939, and £12 10s. was not an outside figure for the best type of machine. So taking it all round I think we cyclists are fairly fortunate and have little enough to criticise on the cost question. It is the good goods we want, for it is demonstrated that the real value to any and every type of rider is in the better bicycle. I have known this for years, and remember I am a utility cyclist riding over 3,000 miles a year to and from work. This year of 1947 we shall see a change I hope, and some of the promises made by the industry during the war will be implemented, for the trade must get going if a successful show is to be held in the fall of the year. Personally, I hope that will occur—both the supply of high-class goods and the show—for the former will prove my contention that cycling is very much alive in the minds of men, and the latter will spur forward the production of those many improvements in machines and their equipment, which I know are awaiting the opportunity of coming on the market.

The Urgency of Roads

I THINK every regular road user agrees that the major transport problem now is the lack of road space in certain areas, and this trouble will increase considerably in the very near future. Authority will be obliged to meet it soon, and the longer the work is delayed the less likely it is that proper planning will give us the necessary road room, and also preserve the amenities. Personally I should hate to see some of our main roads rendered to motorways pure and simple, and to think that the curly lanes of Devon or Warwickshire would be redesigned for the use of fast traffic is unbelievable. Surely we do not need to sacrifice everything to speed and impose a drear prospect on all travellers because a comparatively small proportion of them are in a hurry? We have proved we can make big arterial roads tidy, often at the expense of their one-time loveliness, but I think no countryman or townsman with a sense of country love and lore will agree that such routes preserve the dignified beauty of these lovely islands. They are a means to an end, necessary perhaps in these days of urgency, but certainly an invasion of the old time amenities of our island home. So we come back to the old question of motorways, not the translation of our present roads to speed tracks, but the actual building of motor highways for the service of fast traffic. It will be the system sooner or later, and would be better tackled now before the destruction of beauty of our roads and lanes is sacrified to pressure of speed. We hear little about the matter in these days, for the simple reason, I suppose, that labour and material are in such short supply that the projects in the minds of the M.O.T. are of the long term variety; but I do think that important Ministry should give to road users an outline of the schemes they favour for the purposes of debate and criticism, for I believe the huge majority of people want beauty first, even though they recognise the need for road room.

Headlights

I DO not like the dazzling headlights, and far too many motorists who dip as an act of courtesy would greatly improve the value of that gesture if they would see that their headlights were correctly adjusted, not merely for their own convenience but for that of the oncoming traveller. I say these things as the result of recent experience, yet I do not want to put the blame too heavily on the car owner because I think he is very much the victim of the lighting equipment manufacturer. That is where the criticism should arrive, for we are too apt to blame the driver who after all (and provided his lights are properly adjusted) is only using the equipment of the car. The serious effects of dazzle have not been eliminated to the extent we had hoped; indeed, the more powerful beam of modern lamps, even when dipped, are an annoyance if not a danger to oncoming travellers. Motorists themselves say little about it in public places, but if you listen to their private complaints you will find they are at a greater disadvantage than we cyclists, due of course to higher speed and windscreen reflection. In the aggregate they want an improvement in head lighting for the purpose of overcoming dazzle as much as we do—or so they say—and I think it is up to them to air their grievances in such a way that the lighting equipment manufacturers must take notice; for I will not believe the present disabilities cannot be reduced, if not completely eliminated. I have found, when meeting a particularly bad specimen of dazzle, that by shutting an eye for the short period of discomfort, and opening it when the glare has gone, relieves that black-out patch of nothingness into which you wobble on such occasions. Dazzle won't stop me night-riding, but it does add to the journeys that unnecessary sense of irritation.

My Daily Journey

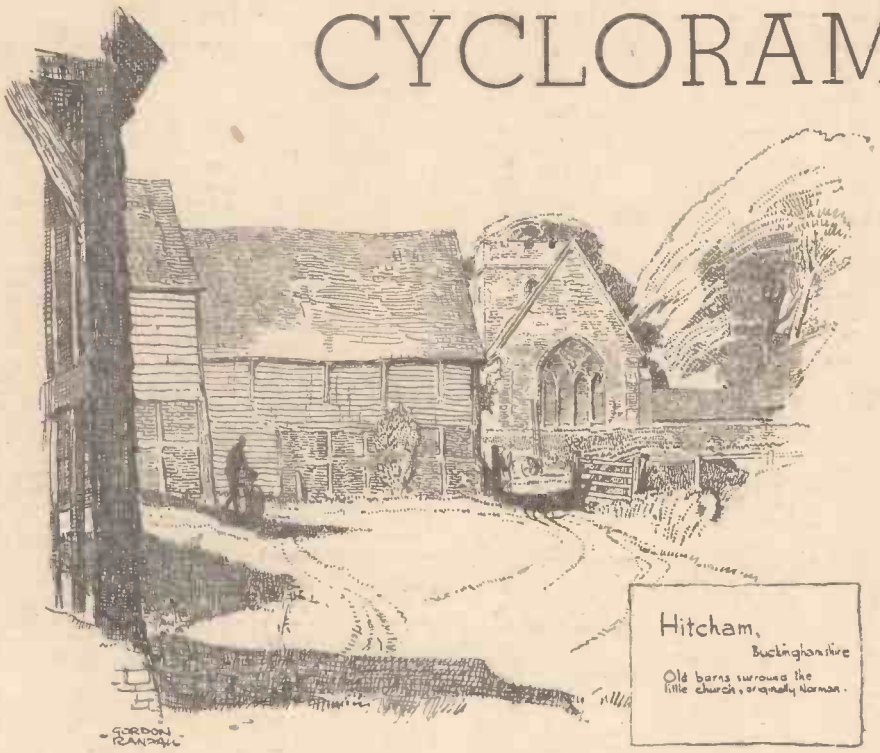
THE daily journeys come and go and have their little adventures, for 15 miles of town and suburbia are bound to bring one in contact with the varying manners of many people. I get along quite well, and not being in any haste never seem to be in any danger. It is, I am certain, the fast folk who cause trouble, fast that is in their degree, for not only motorists but cyclists and pedestrians become affected with the desire to hurry and thereby break the rules and are often a danger to themselves and other people. Only a few hours before writing this paragraph, a youngster on a bicycle crept between my rear wheel and the verge without my knowledge, and when the green light came up tried to jump me for the corner. I could not move outwards because a car was alongside, and as there was no room for two of us abreast I gently elbowed (an old riding trick) the young man on to the pavement and then stopped in an endeavour to correct his conduct for future use. But he was not "wearing me" as a monitor on manners, and told me with adjectival emphasis that I was the type of old idiot who ought never to be allowed out, etc. Such specimens of riders are almost bound to come to grief sooner or later, and it is a pity some kind of gentle corrective cannot be applied to them while they are still whole and hearty. That is the only case of really bad cycling I have witnessed up to this winter day, so I do not think the general conduct of the wheeling folk is nearly so bad as some motorists declare. On the other hand, the car drivers too are mainly decent; it is the young man at the wheel whose impatience is apt to twist his manners; he cuts in, pulls up sharply immediately after passing (a bus drivers' trick, too) and frequently gives you less elbow room than he could. I am used to such occurrences and prepared for them; but I can quite understand that the nervous cyclist abjures town riding whenever possible. But, generally speaking, I think road conduct is slowly improving, for the process seems discernible in the accident returns. Yet we have a long way to go before the "manners maketh the man" is firmly in the mind of every individual who takes to the road.

This is the Truth

OFTEN enough people who have not seen me for a few weeks ask how it is I look so well. I suppose the tan of the weather sticks and the outdoor hours leave their mark, for I'm not conscious of feeling well because that surely should be the common lot of all decent people. When I say that my travel method is the main reason for my fitness I suppose most of these friends, even if they believe it in part, feel it to be an exaggeration in total. Well, I don't. I am of the opinion that the health value of cycling is not merely underrated, it is almost unknown. Medical men do not ride in these days, and therefore have no first-hand knowledge of the exercise, with the result that their opinions are given—if at all—in a vague and uncertain manner. I am not blaming them, being busy men with little leisure to burn; but it does seem to me a pity that a simple thing like cycling should not be quoted as a means of acquiring and retaining health, and that condition of bodily and mental fitness which preserves a youthful outlook. The fact is, I suppose, that cycling is not fashionable and the priggishness in our make-up suggests a preference for the medicine bottle rather than the exercise. But what delight people miss. To feel fit and well is a magnificent thing; to acquire and retain that condition as the result of a pleasant pursuit is idealistic, and here in cycling is the offer and the certain result. I have no doubt about it, for the pastime is not merely the background of my enjoyment of life, it is the healthiness of life itself. My own theories on this question of cycling and health are based on constant experience, and if I made them public property I have no doubt medical friends would laugh and write me down as a crank and fanatic. Nor would my ignorance allow me to debate the matter with the professionals, for I presume they would quickly count me out in the details I have no intention of disclosing. I only know for certain that I'm fit and healthy, and a jolly happy human, and that the combination is mainly the direct result of regular cycling.

CYCLORAMA

By H. W. ELEY



The "Half-century Club"

THIS is an organisation connected with the Raleigh Company, and five new members have just been presented with silver tankards by Sir Harold Bowden, Bart., the company's chairman, in recognition of 50 years service. I understand that there are now 18 members of the club, all of them with at least 50 years service with the company. This is a great and remarkable record, and it is good to see such length of service so suitably recognised. In making the presentations, Sir Harold mentioned that he himself was within two years of qualifying as a member of the club.

The Cycle Show Comes Back!

I EXPECT that, like myself, quite a number of people connected with the cycle trade experienced a thrill when they read that we were to have a cycle show again; what memories that announcement conjured up! Veterans recalled the old Stanley Show . . . and I myself had thoughts of many shows, of the hectic and exciting work of getting everything ready for the official opening . . . and nobody who has not had charge of an exhibition can realise the snags, the last-minute difficulties, with which the job is surrounded. But, in my experience at least, everything is always O.K. "on the night," and when October rolls round and we have to tackle the old familiar job again, I expect that all will again turn out well. . . . And I trust that we shall stage a show worthy of our great industry, and show the world just how virile, and ingenious, the British cycle industry is. The venue will again be Earls Court and the actual date of opening will be announced later.

"Tiny" Holmes Returns to Dunlop

AFTER long and very strenuous work with Tyre Control, H. J. Holmes has rejoined his old company, Dunlop, and takes up the post of regional manager for the west region, succeeding "Archie" Cochrane, retired after over forty years good service with the company. "Tiny" is the son of H. E. Holmes, who spent long years with Dunlop, and who is well remembered (and with affection) by a host of friends. "H. E." is living in retirement at Eastbourne, and is fit and well. The son is no stranger to the West Country, and in Bristol will be on very familiar sales ground.

Spring is On the Way

THERE is always a first moment when we suddenly realise that the long winter is passing, and that spring is round the corner. It came for me this year as I travelled up by train from Southampton. The sun streamed through the carriage windows; in the fields some lambs skipped joyously by their dams; and there was that indefinable "something" in the air . . . that "something" which makes the errand boy whistle even more vigorously than usual, and which causes even the tired business man to admit that life is worth while. The blackbirds are vocal each morning, the daffodils are piled on the barrows of the street traders, and altogether we may know, and rejoice, that the queen of spring is about to ascend her green throne, and depose the grim king of winter, who has reigned too long.

Road Safety Teaching

MANY of the councils, and many of the educational authorities, are doing excellent work in connection with road safety . . . in making known the Highway Code, and in inculcating the right ideas into the minds of the young. But there is still much to be done. I am still rather appalled at the carelessness of children with cycles; needless accidents happen every day, and I feel that more intensive propaganda is wanted among the schools. From talks with teachers, I have formed the conclusion that not all of them are aware of the urgency or the vital character of the problem.

"Beeropolis"—and Ancient Days

BURTON-ON-TRENT is an ancient and famous town. Is it not the home of our national beverage? Do not its casks go forth to the far ends of the earth? But it is a town steeped in English history, and I was intrigued to read the other day of a splendid gift to the town by the Marquis of Anglesey. He has given a collection of most valuable documents relating to the ancient abbey, which include the Charter of King Ethelred the Unready, dated 1004, the will of Wulfric Spot, Earl of Mercia, various documents relating to the old rights of the borough, some papal bulls, and Henry the Eighth's grant to Sir William Paget of the abbey possessions. My old native town will be proud of these historic possessions. Alongside the modern breweries there are still the crumbling ruins of the abbey walls.

Cycling Club Secretaries are Busy

SPRING and summer runs ahead—functions to organise—dilatory members to be rallied to the club standard—and all kinds of arrangements to be made for the happiness and welfare of the club members during the coming sessions. I have been talking to some of the hard-worked secretaries lately, and, as ever, I greatly admire their continuing enthusiasm, their desire that the members should be catered for properly, and have good times. Members do not always appreciate the work of a secretary. He is often a "back-room" boy; but he does yeoman work in keeping the club flags flying.

A Joy to Come

THIS summer I plan to have a cycling trip in those delightful counties of Radnor and Montgomery . . . those unspoiled, fascinating counties where, before the war, I had such enjoyable tours and made such good friends. I remember that I took train to Llanidloes, in Montgomery . . . and from there did some delightful rides through magical country. Little Welsh farms, where folk spoke the Welsh language; the hillsides, covered in September with rowan-trees gorgeous with blood-red berries; mushroom gathering in the misty early mornings; and little inns where, at night, the riding over, one could sip ale and talk of the ancient glory of Wales, and the deeds of her ancient chieftains in the days of grim and sanguinary border raids.

There's Always the Bike

DURING those worrying days when it seemed possible that we might have to endure another "General Strike," as in 1926, I heard many conversations about ways and means of transport to work should the 'buses, trams and trains fail. And, of course, the great solution was the bike! "Oh! I shall just ride the old cycle down, starting early, and I guess it will be quite good fun." That was typical of the comments I heard in offices and warehouses and shops. And how good to know, that, in the event of the old 8.15 not running, there is the bike waiting to convey us to our desk, or bench! And as to "good fun"—well, those who have been lucky enough to be able to ride to work over the years know how good and exhilarating the exercise can be. Yes, there's always the bike!

A Day in Coventry

IT is difficult not to think of bicycles when in Coventry, and recently I spent a day in that brave and blitzed city. It was a cold and chilly day, and the keen wind blew across those tragic bombed areas . . . but I sensed a great and brave spirit in Coventry: it is a city which, over the years, has weathered many storms, and seen many changes. Its cathedral, when rebuilt, will be a focal point for all kinds of activities and endeavour, and when Coventry's scars are healed I predict that she will add new glory to her rich past . . . and one may be sure that the cycle will continue to figure as one of the products which send the name of Coventry around the world.

Shorthand in 24 hours?

Impossible!' thought Mr. J. A. E. Goss, 51 High St., Brecon, South Wales.

Then he learned the complete theory of Dutton Shorthand by post, in just under 2 hours' study!

Before I attempted Dutton's', writes Mr. Goss, "I had unsuccessfully tried to learn shorthand and am amazed at the ease in which I have picked up the principles of the Dutton system, since I had really given up all hope of learning shorthand. At first the timing on each lesson looked impossible to me, but I have seen that shorthand really can be learned in 24 hours or less."

Original letter, Student Record Card and many similar letters available for inspection.

All the rules of Dutton Shorthand, the system designed for ease of learning, are mastered by a person of average intelligence in twelve 2-hour postal lessons. There is then nothing new to learn, but practice is necessary to reach dictation speeds.

Many people, doubtful of their ability to learn shorthand, have succeeded with the Dutton system and become fast and accurate writers.

For fuller details and a free trial lesson without obligation, tear out and send this advertisement, with your name and address, to:—

Dutton One-Week Shorthand

Dept. PM3, 92-3 Great Russell Street, London, W.C.1

HIGHSTONE UTILITIES

CRYSTAL SETS

Our latest Model is a REAL RADIO RECEIVER, which is fitted with a PERMANENT CRYSTAL DETECTOR. WHY NOT HAVE A SET IN YOUR OWN ROOM OR AS A STAND-BY? —2/6, post 6d. PERMANENT DETECTORS, 2/6, post 3d.

.0003 Pre-set Condensers, 2/-, post 3d

Headphones, brand new, leading makes 15/-, 22/- and super-sensitive 30/- a pair, postage 6d. Single Earpiece (new) 4/6 each, postage 6d.

MICROPHONES

Just the thing for impromptu concerts, room to room communication, etc. Bakelite table model, 7/3; Suspension type, 8/6. Post 6d. Super Model on stand, 12/6. Fitting instructions included. Mike buttons, 2/6. Transformers, 6/6. Public Address Transverse current Mike, 37/6, post 1/-. All microphones have transformer incorporated.

MORSE KEYS AND BUZZERS

Standard size keys wired to work Buzzer or Lamp. Chromium plated, 7/6. W.O. Key, heavy brass bar, with an additional front bracket, 9/6. Chromium plated, 10/6, post 6d. No. 2 Single Coil Buzzer, 2/6. No. 3 Heavy Duty Double Coil, 4/9, post 3d.

BELL TRANSFORMERS

These guaranteed transformers work from any A.C. Mains, giving 3, 5 or 8 volts output at 1 amp., operate bulb, buzzer or bell. Will supply light in bedroom or larder, etc. PRICE 7/-. Post 6d.

SOLDERING IRONS

Adjustable Bit, all parts replaceable and fully guaranteed. 200/250 v., 60 watts, 8/6; 150 watts, 12/6, post 6d. Small Soldering Irons, for use on gas, 1/M. Post 4d.

Twin flex, for lighting, 6d. yard. Power, 9d. yard and postage. Toggle Switches, can be used for Vacuum Cleaners, radio sets, table standards, etc. 2/3, post 3d.

SEND 1d. S.A.E. FOR ILLUSTRATED LIST B.P. OF USEFUL ELECTRICAL ACCESSORIES. Money refunded if not completely satisfied. Letters only. Please include postage any excess will be refunded.

Wholesale and Export Departments.

HIGHSTONE UTILITIES,
58, New Wanstead, London, E.11

MAKE MONEY IN YOUR WORKSHOP

SETS of CLEAR CONSTRUCTIONAL DIAGRAMS and instructions for

BUILDING YOUR OWN

(1) **TOY, MODEL or WOOD-WORKER'S LATHE, 3/6.**
(2) Power or foot treadle drive **FRET JIG SAW MACHINE, 3/6.**
(3) Ball bearing Table Model **CIRCULAR SAW, 2/6.**
(or 9/- for the three.)

ALL these well tested, simple machines can be built **EASILY** from **READILY OBTAINABLE PARTS AND MATERIALS ONLY** and will turn out 101 Saleable articles for the shops and market. Prompt posting. Parts stocked.

P. M. BARHAM, Les Buttes, Torteval, Guernsey, C.I.

(Publishing shortly—Six profitable side-lines to make in the workshop.)

ELECTRIC ENGRAVERS.—Powerful instruments in cylindrical case, on stand with spring attachment and switch. Suitable for dog collars, tool marking, etc., 4-6 volt model, price 55/-; A.C. Mains model, 200-240 volts, 75/-, postage 1/-.

TELEPHONE SETS, comprising 2 G.P.O. hand phones, 2 bells, 2 pushes and 80ft. twin wire. Price 65/-, post free. Single instrument, 25/6.

WIRELESS HEADPHONES, 12/6 pr.

BATTERY CHARGERS FOR A.C. MAINS. FOR CHARGING 2-volt accumulators at ½ amp. Parts with diagram, 12/6. Complete, 21/6. Postage 10d.

FOR TRICKLE CHARGING CAR CELLS, parts with diagram. Output 1½ amps. for 6v. cells, 30/- set. For 12v. cells, 32/6 set. 6v. 6-8 amp. set, 55/10.

SWITCHBOARD METERS, A.C.-D.C. N.P. cases, 1½" dial. Any readings up to 0-25 volts, 0-25 amps. Price 15/6 each.

BOAT MOTORS, low centre, wound field, high-speed, weight 18oz. Size 5in. x 1¼in. x 2in. Well made—No Rubbish. Price 26/-, post paid.

ECONOMIC ELECTRIC CO.,

64, London Road, Twickenham, Middlesex. *Tel.: POPesgrove 1318.*

MATRICULATION

The Key to Opportunity

Unless you have matriculated, you cannot even be considered for many of the really interesting and profitable appointments. Why needlessly handicap yourself and go through life watching other people winning success and security? Whatever your age, you can now prepare for the all-important Matriculation Examination at home, on **"NO PASS—NO FEE"** terms. Write now for our valuable **"GUIDE TO MATRICULATION,"** which explains the easiest and quickest way to Matriculate—**FREE** and without obligation. B.T.I. (Dept. 160), 356, Oxford Street, London, W.1.

"SCALEMOBILE"

Blue Prints for 4in. Scale Authentic Model Racing Cars. Engineers Job. Not a Toy. 2 sheets, 22in. x 14in. Fully detailed and dimensioned. Chassis, Axles, Body, etc.

E.R.A. British Sprint Champion.
AUSTIN o.h.v. Racing Seven.
GARDNER-MG 1946 Record Breaker
DELAGE and **MERCEDES** Grand Prix. 5/- each. Packing 1½d.

H. PRATLEY, 72, Walpole Road, London, E.18.

ARMATURE RE-WINDING

We re-wind all types of armatures and field coils, or if you wish to do your own re-winding we supply a complete set of materials for any specified job.

New ball races and commutators included if required.

Send particulars of your requirements at once to:

JOHN F. KNELL, "Sherwood," Merry-End, Middleton-on-Sea, Sussex.

"The last word in Radio Kits."

Really detailed Instructional Manuscript how to build best type of 4 valve A.C./D.C. wireless, 2/6d. Absolutely complete Kit of Parts, including all valves, speaker and super cabinet, £8 carr. pd. Send postage (Dept. P.M.) for current Bargain List.

Northern Radio Services, 66, Parkhill Road, London, N.W.3. Tel. Gulliver 1453.

FOR THE MUSIC LOVER AND HOME CONSTRUCTOR

SUPERBLY REALISTIC REPRODUCTION of **RADIO** and **RECORDS,** enable the **THRILLING REALISM** of the **CONCERT HALL** to be obtained in your own home. Amplifiers, incorporating technical advances not hitherto made available for home construction, 3 or 7 watt models, and a Superhet-T.R.F. Unit designed for high quality reproduction. Blueprints for these units, giving full circuit details and constructional data, 2/6 each. S.A.E. for catalogue, including details of high quality Pick-ups, speakers and baffles available.

All equipment demonstrated at our showrooms.

CHARLES AMPLIFIERS, LTD.

1E, PALACE GATE, KENSINGTON, W.8.

'Phone: Western 3350.

(One minute from the Albert Hall.)

PERSPEX

Perspex coloured and clear, Perspex Cement and Polish. Tools, Plans. Instruction books, etc.

Send 3d. and long S.A.E. for booklet "Plastic Handicrafts" and full price lists to:

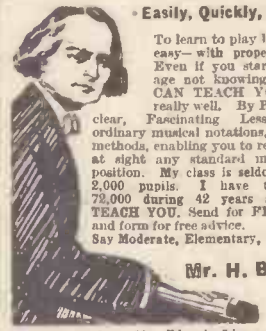
PLASTICS-HOBBIES & MODELCRAFT
(Dept. 2)
West Laith Gate
DONCASTER

PURCHASE OF SUPPLY CO.'S WATT-HOUR METERS. Comprise 230 volt disc motor on frictionless self centring bearings. 6 dial precision gear trains giving ratios up to 100,000 to 1. Electro-magnets on laminated cores wound 1,200 yards enamelled copper. Powerful permanent magnets, vernier adjustments, etc. A beautifully made instrument ready for use to check power consumption or for its invaluable components. 10/-, plus 9d. postage under money back guarantee.

W. & S., 11, Hawley Crescent, London, N.W.1. No Callers.

Master the Piano

Easily, Quickly, Enjoyably



To learn to play beautifully is easy—with proper teaching! Even if you start at middle age not knowing a note. I CAN TEACH YOU to play really well. By POST. Sunclear, Fascinating Lessons, using ordinary musical notations, no freakish methods, enabling you to read and play at sight any standard musical composition. My class is seldom less than 2,000 pupils. I have taught over 72,000 during 42 years and I CAN TEACH YOU. Send for FREE BOOK and form for free advice.

Say Moderate, Elementary, or Beginner.

Mr. H. BECKER

Dept. 958), 69, Fleet Street, E.C.4.

BOOKS		
A B C "G.W.R."		1/6
G.W.R. "Titans" or L.N.E.R., S.R. ...		1/6
L.M.S. "Titans"		2/-
L.N.E.R. "Renumbering"		2/6
Postage 2½d. extra.		
Working Model Railways		2/6
L.T. & S.R. Locomotives		4/6
Loco Valves and Valve Gears		5/-
Modern Loco Classes		6/-
Postage 3d. extra.		
British Loco Types (drawings), per post.	8/-	8/6
PARTS	00	0
Wagon Wheels (on one axle) ...	9d.	10d.
Coach Bogies, per pair	8/3	18/6

TYLDESLEY & HOLBROOK
109, DEANSGATE, MANCHESTER, 3.

ELECTRIC motors, reversible, A.C./D.C., 4/24v. (state current supply). 10 ozs. 2½in. x 2½in. x 1½in. Designed for models. 25/8.—Emco, 118, Foleshill Road, Coventry.

NEW Machinery.—Electric Motors, Band Saws, Drilling Machine, Pumps, Grinders, Welders, etc.—John P. Steel, Bingley.

ELECTRIC Metal Engraving Pens, run off battery, 10/6 post free.—Bulls, (P/M), 246, High St., Harlesden, N.W.10.

SPARKS' DATA SHEETS

Provide full constructional details, and full-size black and white prints of Tested and Guaranteed Designs.

ANOTHER NEW CIRCUIT

THE UNIVERSAL FOUR. A 3-valve plus Rect. T.R.F. A.C./D.C. Set. M/L waves, fine volume and quality. Compact and very efficient.

THE TINY TWO PORTABLE. Med. waves. 5½ x 5½ x 5½in. Self-contained Aerial, Speaker and All-dry Batts.; local stations on speaker for "Individual Listening."

ALL-DRY 3-VALVE PORTABLE. M/L waves, Self-contained Aerial, Speaker and Batts. Size 9 x 6 x 4in.; powerful signals.

MIDGET 1-VALVE PORTABLE. All-dry Batts., M/L waves, 9 volts H.T. Good 'phone signals.

MIDGET 2-VALVER. All-dry Batts., Med. waves, 9 volts H.T., good range.

A.C./D.C. MIDGET PORTABLE. M/L waves, 3-valves, plus Rect.

COMPACT TWO. M/L waves. (Batt.)

COMPACT "STRAIGHT" 3-VALVER. (Batt.) Med.-waves.

THREE-VALVE T.R.F. SET. (Batt.) M/L waves. Good range and strength.

FOUR-VALVE T.R.F. SET. (Batt.) As above but with Push-pull Output.

A.C. QUALITY 2-VALVER. M/L waves, 3½ watt output. A popular set.

A.C. THREE-VALVER. (Plus Rect.) T.R.F. Circuit. Range and Quality.

A.C. SUPERHET. 3 Valves, plus Rect., S., M., and Long waves.

A.C. 3½ WATT AMPLIFIER. Ideal for P.U. 2 Valves, plus Rect.

A.C. 8-WATT AMPLIFIER. Neg. Feed-back, P.P. Output, 5 Valves.

TWO-VALVE AMPLIFIER. (Batt.)

THREE-VALVE Ditto (P.P. Output.)

All the above 2/6 each, plus stamp.

A.C. QUALITY RADIOGRAM. Designed for Quality rather than range. 8 Watts, P.P. Output. Neg. F. B., 3/6.

A.C./D.C. PORTABLE AMPLIFIER. 6-8 Watts, P.P. Output. Neg. F.B. 3/6.

IMPORTANT

In addition to offering the Finest Constructors' Data Sheet Service in the British Isles, I can now offer an Additional Service in the form of Speedy Supply of all Parts, Valves, Coils and Speakers for all my Data Sheet Designs. Service 100% Plus.

Many other Data Sheets available. Stamp with order or for list.

L. ORMOND SPARKS (M), 9, Phoebeth Road, Brockley, S.E.4. (Lee Green 0220.)

Introducing Ourselves—
and our First Product

SAILOR SAM'S SECRET

SHIPS IN BOTTLES

The latest Constructional Ship Kits

THE CUTTY SARK 5/6

Others available shortly

Ask your Dealer for these Kits

Obtainable from high-class Model, Sports and Toy Stores

COOPER-CRAFT LTD.

WHOLESALE ONLY

NORWICH . ENGLAND

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.

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

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—P.A.S.I.

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

"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.A.E., A.F.R.Ae.S., A.M.I.S.E., M.R.San.I., London B.Sc., Degrees.

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

THE ACID TEST OF TUTORIAL EFFICIENCY

SUCCESS—OR NO FEE

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

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

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

PROMPT TUTORIAL SERVICE GUARANTEED.

FREE COUPON

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

Please forward your FREE Guide to

NAME.....

ADDRESS .....

.....

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

The subject or examination in which I am especially interested is

.....

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

"Practical Mechanics" Advice Bureau. **COUPON**

This coupon is available until March 31st, 1947, and must be attached to all letters containing queries, together with 3 penny stamps. *A stamped, addressed envelope must also be enclosed.*

Practical Mechanics. March, 1947

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.