AIR TRAFFIC CONTROL

NEWNES

PRACTICAL MECHANICS

9D.

EDITOR: F. J. CAMM

NOVEMBER 1946

AN AIRCRAFT MAKING A "BLIND" LANDING UNDER THE DIRECTION OF RADAR (See page 42)

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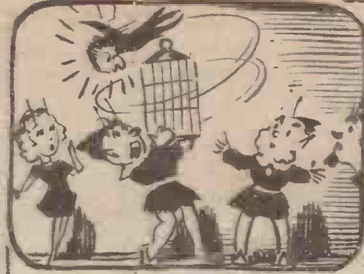

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PRACTICAL MECHANICS

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

Editor: F. J. CAMM

VOL. XIV NOVEMBER, 1946 No. 158

FAIR COMMENT——BY THE EDITOR

A Word With Querists

WE welcome queries on all subjects coming within the scope of this journal and at all times we endeavour to give complete and speedy answers to problems which are submitted to us. Some readers, however, are mistaking the nature of our query service and the function it is intended to fulfil. Some of the queries submitted would need the preparation of an illustrated textbook whilst others, involving the preparation of designs, would take days to answer. Clearly, such questions are unreasonable and we have to decline to answer them. We have already announced the discontinuation of our electrical and wireless query services owing to staff shortages, and in order to facilitate the rapid handling of queries we ask our readers to take careful note of the following advice.

Please write clearly, and on one side of the paper only. Leave a 1in. margin on each side of the note-paper and leave plenty of space between the lines. A considerable amount of time is spent in endeavouring to decipher bad handwriting and letters written in faint pencil.

Come to the point at once. It takes time to read letters and our experts are only interested in your problem and giving you a speedy answer. Many hundreds of letters of a technical nature are received by us each week and by saving a few minutes' reading time on each letter we are able to deal with more queries.

Consult Our Indexes

WHERE possible, consult the indexes of past volumes. We receive very many queries of a constantly recurring nature, and it is possible that the query you wish to ask is one of these. We issue indexes to each annual volume and they are provided for your convenience. Every item is indexed—even the published replies.

Be brief, without omitting essential details. Imagine when submitting it that you had the task of answering it. Be specific. Do not, for example, ask us to send you a method of bright plating. This really means nothing. We must know what kind of bright plating, whether nickel, chromium, silver, etc.

When you want a diagnosis of a trouble or a suggested remedy for a defect do please let us have all relevant circumstances connected with the case. Do not, for example, ask us to recommend a method of removing stains from a bath without informing us of the kind of bath which is stained. That is to say, whether it is of the painted, enamelled or porcelain variety. Do not ask us to give directions for removing ink-stains from fabrics without informing us whether the fabric is of wool, cotton, silk, etc.

Do not expect us to invent something for you or to design a machine tool. Such work should properly be placed in the hands of a consulting engineer who will make a charge for it.

Illegal or Dangerous Information

DO not write for information on matters which are illegal or dangerous. It *is* possible to purify methylated spirit and to manufacture high-grade alcohol at home, but such activities are highly illegal and we decline to answer questions concerning them.

Likewise, it is possible to prepare at home materials such as nitrogen chloride, nitrogen triodide, and fulminating gold, all of which materials are highly dangerous and their inexperienced preparation might very easily result in a fatality. We decline therefore to answer questions concerning explosives and this also applies to questions relating to the making of fireworks. We do not, also, give information involving the handling of highly dangerous poisons such as strychnine and atropine unless we have clear evidence of the status and credentials of the querist.

Do not ask us for detailed formulæ of proprietary products. By law all patent medicine formulæ must be printed on the bottle labels and the formulæ are thus readily available to all, but there are many non-medicinal proprietary products, and if you were a manufacturer of one of these you would not thank us for disclosing its formula to an inquirer. Hence do not ask us to send you the formula for So-and-So's household product.

Design of Special Mechanisms

DO not expect us to write a book or even a pamphlet about your query, nor can we reasonably be expected to produce drawings, scale diagrams, blueprints and other illustrated matter. After all we simply have not the time to sit down and design special mechanisms for individual querists. Some querists indeed ask for actual inventions, or at least for their basic idea to be elaborated and developed to workable proportions by us.

All such work we cannot undertake, nor can we give long and detailed descriptions of processes and methods which can be found with very little trouble in any modern textbook.

Our query service is designed for the purpose of giving short, practical, helpful, concise information, suggestions and recommendations on a very wide range of subjects. But for gaining an extensive knowledge of any given subject it cannot, nor is it intended to, take the place of a textbook.

Whilst we are glad to express experienced technical opinions as to the constitution and make-up of samples submitted to us, we cannot undertake the chemical or physical analysis of such samples. Readers have sometimes sent us samples of products and have asked for complete chemical analyses, the cost of which would be about 15 guineas! When, however, we are in the position to make chemical tests on materials submitted (which is not infrequently the case), we willingly do this, but we cannot guarantee this service on every occasion.

When sending in queries, please do not mix them. Do not write chemical queries on the same page as engineering queries. Do not mix botany with astronomy, or mathematics with model making. Write queries coming in different categories on different sheets of paper, and place your name and address on each of the different sheets. The various queries are thus dealt with at once, whereas an omnibus letter has to be sent round to the various contributors.

Royal Commission on Awards to Inventors

THE Royal Commission on Awards to Inventors has issued a pamphlet containing the relevant part of its terms of reference, the rules regulating the procedure before the Commission and general instructions for the guidance of intending claimants before the Commission. Copies can be obtained from H. M. Stationery Office, or any bookseller, price 2d., by post 3d.

The Commission will not begin its public hearings of claims before November 12th, 1946, and a further announcement of the times and dates of sittings will be made in due course. Details of cases to be heard will be published in the Daily Cause list.

The Royal Commission on Awards to Inventors set up in 1919 after the first European War issued a number of reports which have been summarised in a pamphlet first published in 1929 and entitled "Statement of the Principles of Assessment Governing Compensation adopted by the Royal Commission on Awards to Inventors." Reprints of this pamphlet can also be obtained from H. M. Stationery Office, or through any bookseller, price 6d., by post 7d.

Whilst in no way bound by the rulings and decisions of the 1919 Royal Commission, the present Commission will in general have regard to the principles and policy adopted by the 1919 Commission as summarised in this pamphlet.

Communications intended for the Commission should be addressed to the Secretary, Royal Commission on Awards to Inventors, Somerset House, Strand, W.C.2.

Air Traffic Control

A Demonstration of How Radar Will Aid Navigation for Civil Aviation

A twin-engined aircraft about to make a "blind" landing with the aid of the radar unit seen on the ground.

AS most readers know, we in this country are in the process of rebuilding our part of civil aviation, which has necessarily taken a back seat during the past seven years. In doing this, we have considered the navigational aids which are available to us, many of them developed for military purposes.

Their various advantages and disadvantages have been weighed against the problems of navigation and the regulation of air traffic which confront us now.

This problem was stated by the last P.I.C.A.O. Conference in Paris to be :

(i) Aircraft must be able to determine with accuracy and at any moment their positions in space.

(ii) They must be able to follow any tracks required by the pilots, or by Air Traffic Control.

(iii) Aircraft must be able to "hold" at any given point, at any specified time.

(iv) Aircraft on the same course must be able to follow parallel tracks at the same time, with a minimum of lateral and vertical separation.

(v) In the event of loss of communication with Air Traffic Control, aircraft must be able to proceed, without danger of mid-air collision, on their latest approved flight plans.

These are the recommendations of P.I.C.A.O., but at the opening of a recent demonstration the speaker said "I would go farther, and say that :

(i) Aircraft must be able to navigate to a position, and be in a suitable attitude from which they can make a straight-in approach on a blind approach aid.

(ii) The system must be incapable of saturation under any conditions which may materialise.

(iii) The system must be unaffected by precipitation static and any form of atmospheric interference."

There, then, is the standard set for us, which is certainly of a very high order.

Special Lattice System

In selecting the pulse hyperbolic lattice system for this demonstration, we considered that of all the many excellent navigational aids which are, or will be, available, we selected the one which most nearly fulfils those conditions.

Other reasons which had a bearing on our selection are :

First, the system, more widely known as Gee, has been proved over a considerable period of years to be reliable, and pilots of many nationalities who have used it will testify to its accuracy.

Second, and of major importance, is the fact that it is available for us to-day.

And third, the one set of equipment meets the requirements of both medium range and short range navigation.

In devising a system for the control of air traffic, there are several additional factors which we must also consider, and these are :

There is a limit to the capacity of an aerodrome. That limit may be governed by one, or by several factors—in fog, for example, the governing factor is more likely to be the difficulty of taxying than that of landing.

We must, therefore, allow a sufficient interval between aircraft for the runway to be cleared, in addition to the time interval necessary to attain one hundred per cent. certainty that aircraft are free from any possibility of collision. We must also make an allowance for an ever present possibility which we cannot as yet eliminate—the human error.

Two additional factors are: the saturation limit of the point of touch-down on a runway, and the saturation of the air space in a position leading to a runway.

It is therefore obvious that we must set a saturation figure for an aerodrome, based on the various limiting factors and taking into account the prescribed weather minima.

Having done this, schedules must in the future be so arranged that the saturation limit is not exceeded.

Then we must devise a system which will keep aircraft separated at all points by the required amount of time—a system which is sufficiently accurate to ensure that the aircraft will at all times be where they are required to be, and which is flexible enough to be suitably adjusted when aircraft are unable to maintain their flight plans because of unpredicted winds or other reasons.

Aircraft Landings

With these various factors—time, weather, errors, saturation, flexibility, and so on—in mind, we have considered that for civil air transport purposes the shortest interval which it is safe to permit between consecutive

Main flying control with computer, on right, for use in orbit meter in rapid landing scheme.

An officer demonstrating the " G " Box. This was used as a navigational aid in aircraft to enable them to pin-point themselves over any predetermined spot.

landing aircraft under all weather conditions is three minutes—or 20 aircraft landings per hour.

It is also possible to have the same number of take-offs during that period.

These figures—40 movements per hour, refer to a single runway. It is not proposed to complicate the issue by introducing contentious arguments on the respective merits of multi-runway aerodromes. The merits of the system can best be judged by restricting it at this stage to aerodromes at which only one runway will be available at a time.

Movements per Hour

It is not suggested that the figure of 40 movements per hour per runway is final. It is the figure we can attain to-day with the equipment available. I am satisfied that the figure can be increased by development and experience in the not too distant future—and the amount of development necessary to do so is minute compared with the results already achieved.

During the war Gee flying proved to be extremely accurate, and by its use an aircraft was able to pin-point its position at any given time during flight.

As the study of a Gee chart will show that there are almost limitless possibilities for separating aircraft or holding them on lattice lines outside the congested area and under Area Control, we are confining the demonstration to that area where we can expect a considerable amount of congestion, and where, if we are to ensure that the aerodrome is used to capacity, adjustments to landing times are to be made with an acceptable degree of accuracy.

The demonstration given was this :

(i) This aerodrome is situated at a spot we will call " X."

(ii) The area within a 50-mile circle, which is centred on the aerodrome, we will refer to, for convenience, as " Approach Control."

(iii) Outside the circle we will call " Area Control."

(iv) The runway in use is " A," landings in " B " direction.

(v) At a point on the approach beam we have a position which we call the " Gate." This is about eight nautical miles from the aerodrome, the distance being fixed as one convenient to the height of the aircraft in relation to the glide path of the SCS. 51.

(vi) Aircraft approach the " Gate " either direct or via one of those " Master Approach Lines " leading to the " Gate," as decided by the Controller.

We have imposed these conditions on the problem :

(i) All aircraft within Approach Control (the circle) will fly at the same height.

(ii) All aircraft would normally arrive at the " Gate " about the same time.

Lateral Separation

We have then to provide lateral separation and to adjust arrival times so that the aircraft land at three-minute intervals, plus or minus a given allowance for errors.

The procedure is simple :

An aircraft, some five minutes or so before entering Approach Control, gives its speed, its estimated time of arrival at and the position of crossing the circle, and its estimated time of arrival at the " Gate."

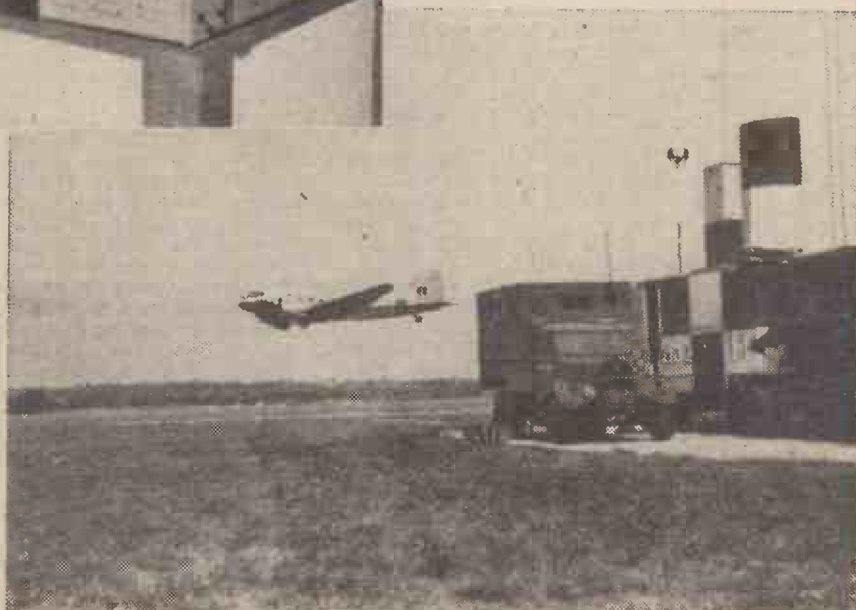
The Controller then decides whether the aircraft is free to proceed direct to the " Gate " and land, or has to be delayed by a required amount of time.

Normally, if the aerodrome is not being used to capacity, it will simply continue on its course to the " Gate," using Gee, change to the beam approach at that point, and proceed to land.

If time adjustment has to be effected in order to fit the aircraft accurately into the landing sequence, the Controller will instruct the aircraft to proceed to a point on a selected " Master Approach Line," which it then follows to the " Gate," and so down the approach beam to land. The position on the " Master Approach Line " is determined by a computer, which gives the course for the aircraft to steer from its position on the 50-mile circle to the appropriate point on the selected " Master Approach Line."

In other words, the aircraft, instead of flying a direct track which is the base of a triangle, flies the other two sides of the triangle. These sides are determined by the additional distance the aircraft has to travel, and take into account its speed, the delay required, and the wind speed and direction.

Since this theory was first produced, and our problem was put on paper, together with our proposals for solving it, we have found in practice that certain alterations were necessary, but these do not affect its fundamental principles.



The R.A.F. radar demonstration above shows the aircraft landing " blind " under the direction of the radar unit seen on the right.

The difficulties we encountered were these :

First, the pattern of lattice lines in the Bassingbourn area. The Gee chain we are using here was not designed with the requirements which we now have in mind. When we began to practise the system we found that the ideal lattice pattern for this problem was at some variance with that which exists. This, however, is not insuperable, even in the entirely fortuitous pattern existing, and can be easily avoided in the future.

The *second* difficulty was in solving our problem of computation on curved lattice lines which have no constant value in relation to one aerodrome or even to one runway. This can be solved in two ways :

By subtending from the " Gate " a tangent to the appropriate " Master Approach Line " and making the aircraft follow two computed courses, the second of which converges on the " Master Approach Line " some 25 miles from the " Gate." This simplifies the problem of computation, and gives the aircraft adequate time to settle on its final track prior to changing to the beam approach.

Or, and we have found this more satisfactory, by selecting "Master Approach Lines" which are either straight or only very slightly curved.

We found, *thirdly*, that there was usually some difference between the forecast wind on which our calculations were based and the actual wind at the particular time. However, over a period of time it has been satisfactorily proved that minor throttle adjustments in the region of plus or minus 10 knots are sufficient to eliminate this error.

Varying Speeds of Aircraft

Fourth, was the question of the varying speeds of aircraft and the different time intervals from the "Gate" to the actual point of touch-down. This, of course, is a simple matter of calculation. There is, however, one limitation which we must accept. As the distance from the "Gate" to the runway is eight nautical miles, a slow aircraft passing through the "Gate" three minutes after a fast one may be as much as five minutes behind it on landing. To some extent this can be minimised by arranging sequences of fast and slow aircraft alternately. In this way the larger time interval will only occur once in every second sequence. Thus, if the speed groupings are arranged in fours, our landing rate will be reduced by one aircraft per hour—the take-off rate will not be affected.

Fifth, we decided to omit from the demonstration the aircraft not equipped with Gee. We considered its inclusion inappropriate to the display, as its only purpose was to show the difference in landing rates between Gee fitted aircraft and aircraft equipped with only limited facilities.

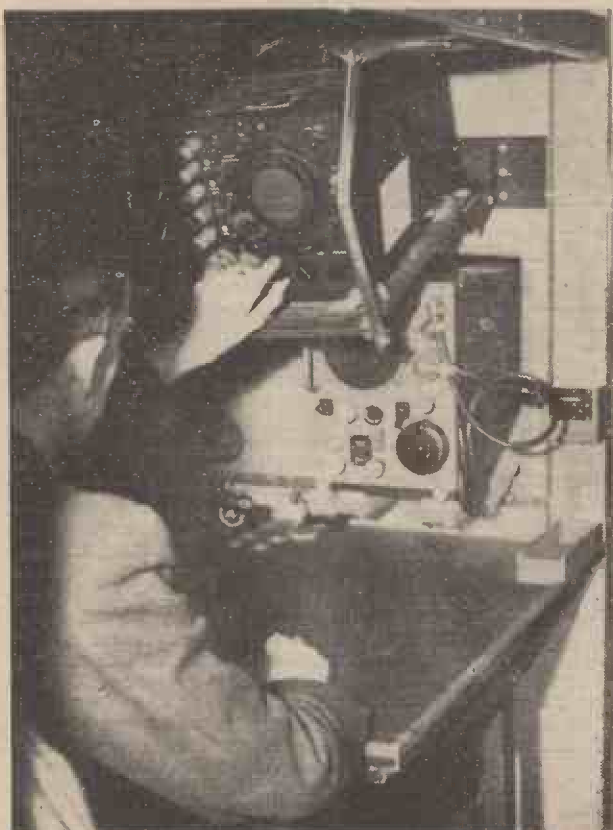
Sixth, we found that the holding pattern which we had proposed was too rigid, and in order to attain the necessary amount of flexibility in the system it was more satisfactory for all aircraft approaching while the runway was out of use to continue on their prescribed paths, overfly the aerodrome, and proceed by lattice line flying to patrol lines to the right or left of the aerodrome. When the aerodrome is again free, and as the approach sequence is continuing, one aircraft will already be in a suitable position for making its approach. Aircraft which have been prevented from landing will be fed back into the flow to the "Gate" at times appropriate to their speed and to their holding position. In the meantime, an interruption in the sequence will be made by Area Control holding aircraft beyond the 50 miles so that the number of aircraft under Approach Control will not be more than the aerodrome capacity over a given period.

The minimum delay we can impose on individual aircraft is about seven minutes for aircraft whose cruising speed is 200 knots, and up to 12 minutes for those at 120 knots. If this time interval has been caused by an aircraft overshooting, it need not be simply a blank space; it can all be taken up if required by continuing the normal flow at three-minute intervals. The overshooting aircraft will be given a new "Gate" time.

This emphasises one additional factor which must apply to any control system designed to give a maximum landing rate. Pilots are of varying ability. Even the efficiency of an individual pilot varies according to his degree of tiredness after a long flight, and to his mental state at the time. We cannot therefore guarantee that under very bad weather conditions all aircraft will make successful landings from their first approach. It follows that when we decide on the aerodrome capacity figure according to the system in use, we must make an allowance for "errors of judgment." This allowance will vary with the prescribed weather minima, but it is suggested it should be between five and 10 per cent.

Seventh, and last, we considered that W/T should be used in addition to R/T. The reasons for this were, first, the difficulty of communication at the required range, bearing in mind the height restriction which we imposed on the problem, and second, that with the amount of international flying which we have in this country, possibilities of misunderstandings and errors are greatly reduced by the use of the "Q" code.

These were the alterations to the initial plan.



An R.A.F. officer demonstrating the "Eureka" equipment. This is a device for homing aircraft to base, and worked in conjunction with a radar beacon at base which was picked up on the cathode-ray tube in the aircraft. Below it is a "G" Box—used as a navigational aid in aircraft, as mentioned on the preceding page.

Control Problem

With only a limited number of aircraft available for this demonstration, a control problem must be induced. If the aircraft were to approach without being given in advance their initial timings at the circle, we would almost certainly find that there existed no problem which required to be solved. We have, therefore, arranged the problem in the first instance so that all aircraft (which are flying at the same height) would normally arrive at the "Gate" more or less at the same time. This reflection on the efficiency of Area Control is made solely for the purposes of this demonstration. In practice the situation would never arise, but if we can show you that we can solve the impossible situation, you will have no doubt of the ability of the system to cope with the normal.

The fact that we have arranged the initial timings is, incidentally, in itself an accidental proof that the aircraft can, in fact, be at the allotted positions when they are required there in order to make the problem.

Height Separation

With one given height reserved for aircraft fitted with Gee, there is no alternative but to give, above the Gee level, height separation to aircraft not so equipped. I would point out here that this unhappy state is one of the main reasons why we insist that the answer to the air-traffic control problem must be such as will prevent aircraft being put at undesirable heights. For many months of the year the problem of icing in this country, as in many others, is acute.

Outgoing aircraft present no problem. There is such a wide variety of alternative tracks on the Gee system that they are simply allotted an unoccupied track to fly.

Another question is that of controlling aircraft approaching aerodromes which are in some proximity. There must, of course, be a centralised control in all such cases. In this system the Approach Controls would, in fact, be integral parts of the Area Control.

There are two solutions to this question:

First: The lattice pattern can be so arranged that the "Master Approach Lines" feeding the "Gates" to the different aerodromes are on non-conflicting and predetermined tracks.

Allotted Height

The *second*, and certainly a more simple solution, is to allot one given height to each aerodrome. We are faced with this problem in London, as no doubt some of you are faced with it in your own countries.

Our statistics show that an allowance of plus or minus 200ft. from a given height is adequate. With this system we can, therefore, control all our traffic in and out of the four main aerodromes of London between the heights of 1,500 and 3,000ft. (460 and 915 metres).

By way of development, we were limited only by time in providing Airfield Control Radar for this demonstration. With it incorporated in the system we would have immediate knowledge of any aircraft which was not following its allotted track with the required accuracy of time, and also of any aircraft in the traffic pattern which was not Gee equipped. It would also tell us with greater accuracy the exact time we had available to fit in take-offs.

Again, only time prevented us from making the computer simpler and easier to work. There is no difficulty in producing a computer into which the information is fed, say, on a series of dials, and out of which the answer comes instantaneously.

One necessity which is apparent for this control system is for Gee chains to be so sited in areas of congestion that the lattice pattern is as nearly as possible right-angled, and the hyperbolas as straight as can be achieved.

Then, in addition to A.C.R. giving the Controller an accurate knowledge of the happenings within his limited sphere, certainly one of the major requirements of Area Control is the provision of a display which will give a continuous presentation of the movement of every aircraft, irrespective of track, over the congested areas.

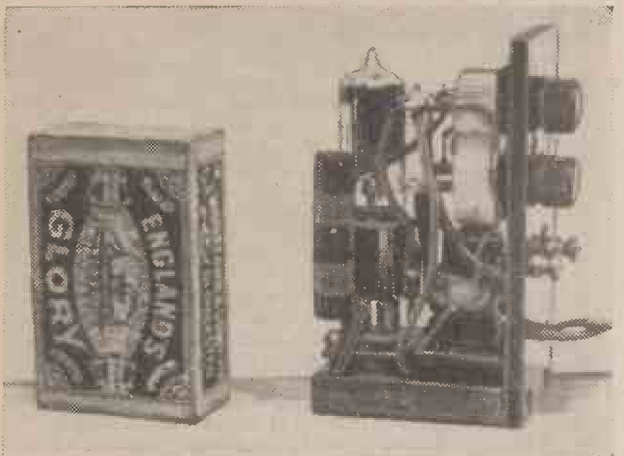
To this, a system of identification and of recording altitude would complete the Controller's dream, and such requirements are now well within our means to produce.

Finally, a major stage, and, I hope, an early one, in the development is the production of the airborne hyperbolic computer, by the use of which it is possible to set up the co-ordinates of any required position, and to fly to that point with a left/right meter indication and constant distance reading.

A Pocket One-valver

Constructional Details of a Simple Matchbox Receiver

By F. G. RAYER



The completed receiver, which is not much larger than a matchbox.

THE use of a twin trimmer for tuning and reaction purposes is largely responsible for the smallness of this receiver. A Hivac midget valve is also used to further reduce dimensions, and, in consequence, the receiver is very small, as reference to the diagrams will show.

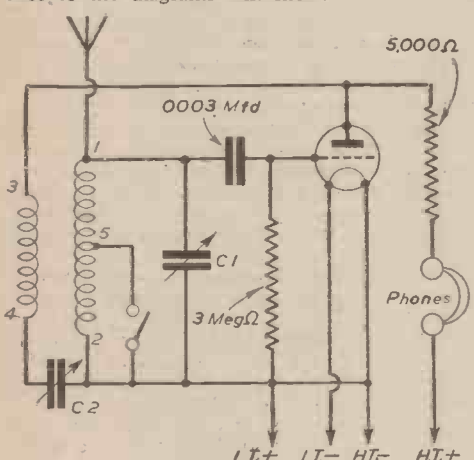


Fig. 1.—Theoretical circuit for the pocket receiver.

The circuit is shown in Fig. 1. The 5,000 ohm resistor is to smooth reaction and prevent the 'phone leads causing hand-capacity. The remainder of the circuit follows normal lines. The valve type is Hivac XL with 1.5 volt filament, so that a dry cell can be used for L.T. Condensers C1 and C2 are sections of the trimmer, and details of this will be given later.

Panel Layout

Fig. 4 shows the panel layout, and the location of the parts will be seen from Figs. 2 and 3. The panel is of ebonite, and the trimmer is secured to it by countersunk 6 B.A. bolts. The adjusting screws of the trimmer are removed and replaced with short lengths of screwed rod fitted with insulated terminal heads (such as those on the older type of S.G. valves), as shown in Fig. 3. This enables the set to be tuned by hand.

Below the trimmer two small terminals are fixed—one for the aerial and one for 'phone connection. The positive 'phone connection is taken directly to H.T. plus. No earth terminal is used, for if an earth is available it can be connected to H.T. minus at the battery.

All the connections except L.T. minus are shown in Fig. 2. L.T. minus is taken to the remaining filament socket, and Fig. 5 should be consulted for the connections to the valve-holder. The large socket is grid, and the three smaller ones are plate and filament as shown. Note that the connections are for the valve-holder and not the bottom of the valve.

The resistors and fixed condenser will need to be small components, the former being midget, or ¼ watt sizes. The parts are suspended in the wiring, and insulated sleeving should be put over the connections. Short lengths of thin flex are used for the battery connections, there being three only of these. There is no on/off switch, L.T. plus being disconnected to switch off.

Tuning Coil

The tuning coil fits around the valve, below the trimmer, and is not shown in position for clarity. Numbered connections for the coil will be seen in Figs. 1, 2 and 5. It is a small dual-range type, so that medium and long waves can be tuned for the reception of Light and Home programmes.

The twin trimmer was of the type having a capacity of .0005 mfd. each section, but, as the minimum capacity was rather high, some plates were removed, leaving four on the tuning section and three on the reaction section. The capacity used must, of course, be capable of tuning in the stations desired and also providing proper control of reaction. Because of this it is best to build the set temporarily with no regard for compactness, so that the trimmer may be modified with ease. When the correct capacity has been arrived at the set may then be rebuilt as shown.

The completed receiver pushes into a small cabinet made from 1/16in. thick ply. The wave-change switch is made from a small screw and brass strip, and is fixed to the case.

For L.T. a dry cell is needed, and a small one is suitable as the consumption is only .06 ampere. H.T. can be provided by a special battery or grid-bias batteries. About 24-30 volts is sufficient. If listening outside an earth may be provided by a metal skewer pushed in the ground. The aerial is about 15ft. of thin flex hung up as convenient.

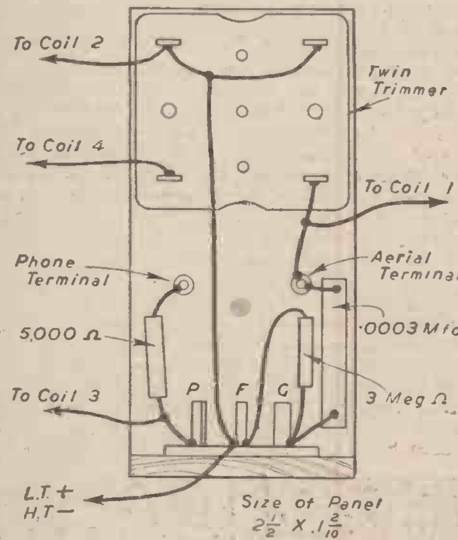


Fig. 2.—View of back of panel showing location of the parts.

With a higher H.T. voltage results are about equal to those from a normal one-valver. With the reduced H.T. results are still very good, and three or four stations can be received at good 'phone strength. After dark, numerous foreign stations can also be received.

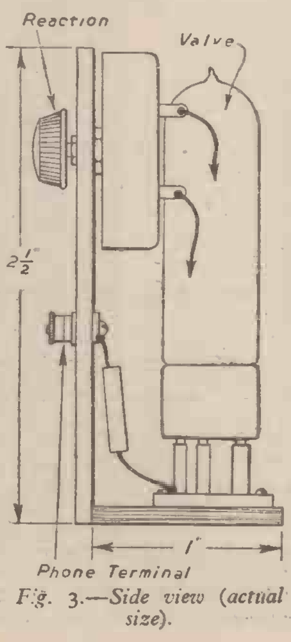
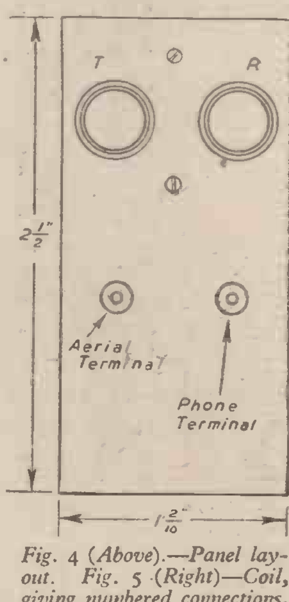


Fig. 3.—Side view (actual size).



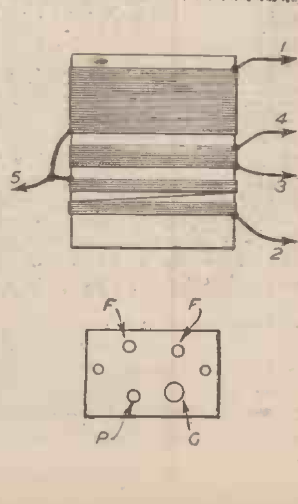


Fig. 4 (Above).—Panel layout. Fig. 5 (Right)—Coil, giving numbered connections, and the valve-holder.

Components

- **Twin trimmer.**
- **Valve: Hivac XL, and holder.**
- **5,000 ohm and 3 megohm small resistors.**
- **.0003 mfd. condenser.**
- **Small dual-range coil.**
- **Terminals, a few feet of flex, etc.**

F. J. Camm's Flash Steam Plant–II

The Valve Chest, Steam Generator, and Blow-lamp

(*Continued from page 7, October issue*)

By E. W. TWINING

THE exhaust cavity remains as before, and both this and the steam passage, together with the valve faces between them, make the same angle each with the other. These angles are figured in the right-hand drawing of Fig. 4.

As both the valve proportions and ports to the cylinders are the same as in the compressed air engine, the valve events will also be the same, and the reader is therefore referred to Fig. 6.

Metals to be Employed

With regard to the material from which the valve and parts of the engine, other than those already specified, should be made, it is recommended that the valve and its spindle be turned from mild steel, also the valve chest cover to which the steam-pipe union is attached. The "chest" itself may be of hard gunmetal, whilst the plate work of the crankcase, the crank, crankshaft and connecting rods are all to be of mild steel. Pipes from the valve chest to the cylinders are of copper with gunmetal flanges silver-soldered on. All screws will, of course, be of steel with either B.A. or Whitworth threads as preferred. The cylinder ends and the main bearing for the crankshaft are of gunmetal silver-soldered in place. The lapping of the cylinders should, of course, be done after the closed ends and the rings are fixed.

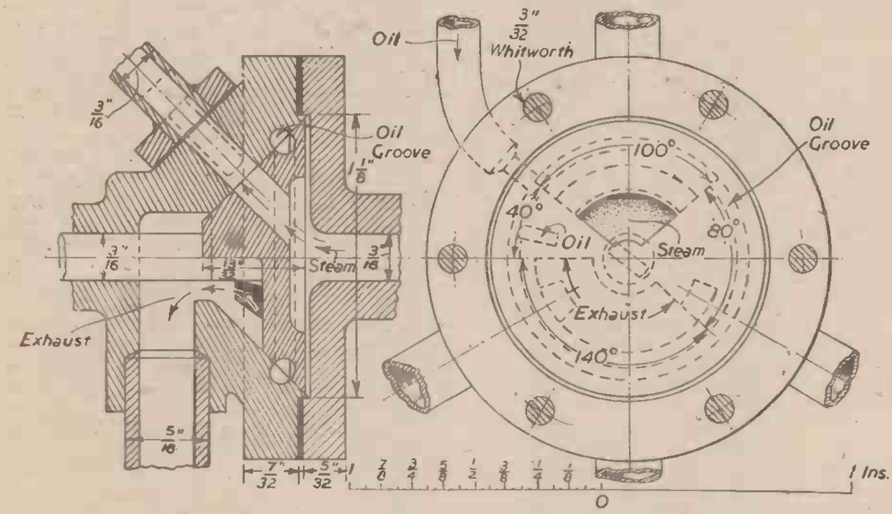


Fig. 4.—Section and exterior view of valve chest.

The Crank

In building up the crank with its shaft and crank-pin two alternative methods are available. Either the holes in the crank and the turned ends of the shaft and crank-pin may be a good driving fit together, further security being obtained by small cross-pins passing through the crank and shaft, and riveted over, or the shaft and crank-pin can be a fairly easy fit in the crank and fixed by silver-soldering. A combination of driving fit and silver-solder is not practicable, because one cannot be sure that the solder will flow into the joint, hence the reason for the easy fit if solder is adopted. Between the two methods there is not much to choose, but the writer is inclined to prefer driving and cross-pinning, especially as it is possible to further secure by slightly countersinking the holes in the crank and rivet over the ends of the crank-pin and the crankshaft.

The Steam Generator

The boiler, or, more correctly, steam generator, consists of two main parts, the shell and the flash coil. The principle on which these are used has been already explained, and it suffices to say that either of these could be used for steam supply to an engine separately, but on the one hand the shell boiler could only deliver steam at its working pressure, and the flash coil could only deliver steam which it had itself generated from water at a low temperature. Now the two, in combination, will have the effect of delivering to the engine steam at a pressure which will certainly be above that of the shell and that at a high degree of superheat, since the water when it enters the coil will already be in a state to be flashed into steam.

The Shell

For the barrel of the shell boiler a 7in. length of seamless copper tubing is required, $2\frac{1}{4}$in. diameter and about 3/64in. thick; the ends are beaten from sheet copper of the same thickness and silver-soldered into place.

The drawing, Fig. 5, shows the whole generator in longitudinal and cross sections; here it will be seen that a longitudinal stay with nuts at each end is taken through the centre of the boiler shell. This stay would be best made of 5/32in. diameter mild steel, and to prevent rusting it may be tinned from end to end over the threads after they are cut, a good thick coating of the solder being applied. After the stay is in place and the nuts screwed up, both they and the ends of the threads should be well covered with soft solder. Before this stay is put in, the two water tubes should be bent to shape, fitted by expanding them into the shell and silver-soldered.

The Flash Coil

This is to be of $\frac{1}{4}$in. diameter steel tubing of fairly stout gauge; about 1/32in. or slightly heavier. It should be bent around a tapered mandrel, turned to the correct diameters as figured in the drawing. The action of bending is bound to flatten the tubing slightly unless the mandrel is of cast iron spirally grooved to a depth nearly equal to the diameter of the tubing. The alternative is to use a wooden mandrel of, say, beech, covered with a layer of asbestos cardboard, but whatever material is used the tubing must be heated, and the best way to do this will be with a gas blow-pipe or paraffin blow-lamp, letting the flame play upon the pipe as bending proceeds. The pipe, at the point of bending, should be brought to a very dull red. Cold bending is liable to result in cracks, whilst if it is of bright red or nearly white heat it will flatten to an excessive amount.

The pipe leading from the bottom of the shell to the wheel valve can be of copper, as also the one to which the union is attached; both of these can be soft-soldered at the valve, but the end of the second pipe must be silver-soldered into the upper end of the steel flash coil.

The union which attaches the flash coil to the engine would be best made of steel, though a Bassett-Lowke brass union will stand up to the temperature and the work it has to do for a considerable time.

The Boiler Casing

The form of this, in cross section, is shown in Fig. 5. It will be best made of the thinnest sheet iron obtainable, tinned steel

Fig. 5.—Sectional views of the steam generator.

if preferred, having a thickness of about No. 30 on the standard wire gauge. It is to be lined very thickly with asbestos card, as shown in the cross-sectional view in Fig. 5, which card must be soaked in water to render it pliable, so that it can be shaped to fit the curvature of the plate. The tinned, or iron plate, cannot, for obvious reasons, be soldered at the necessary joints, but must be secured together with either rivets or small brass screws and nuts, the latter being, perhaps, the more convenient, because at some time it will become necessary to remove the boiler for cleaning or repairs.

In order to gain access to the union which couples up the engine to the flash coil, an opening will have to be provided in the casing; this may well be cut at the bottom, directly under the union, and will be fitted in with a cover plate secured with screws.

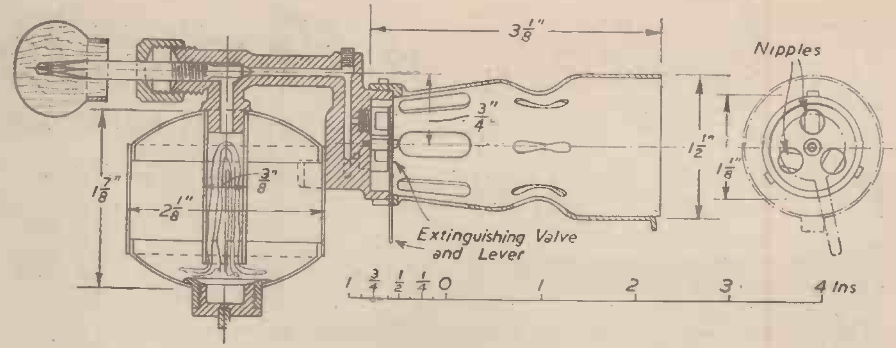


Fig. 6.—The blow-lamp and detail of nipples.

The Blow-lamp

The general arrangement drawing, Fig. 1, shows that the heat for evaporation of the water is provided by a blow-lamp of the self-vaporising type. This is shown in section in Fig. 6. Here it will be seen that it is fitted with three nipples of standard size, screwed into a gunmetal block, cast in one piece with the needle valve casing, and drilled out with ports leading from the valve to the nipples. These ports, three in number, are bored radially towards the centre, and to each of these a hole is bored from the face in which the nipples are screwed. The outer ends of the three radial ports are to be tapped and plugged with three grub screws driven tightly in. One of these screws is shown in Fig. 6.

The Valve

The valve, screwed as shown, is made from hard-drawn brass rod, filed square at the outer end and fitted with a fluted wooden knob to serve as a handle for revolving and adjusting the valve. The inner end of the rod is turned to a tapered point, having an angle of about 45 degress.

The Fuel Container

The container for the fuel, which is ordinary petrol, is made from either copper or brass, having a thickness of about 1/32in. The middle portion is a piece of seamless tubing, whilst the two ends are beaten or spun to shape and soldered in. The lower end must, before fixing, have a collar silver-soldered into a hole cut to receive it. This collar is screwed to take a plug fitted with a cross bar to serve as a filler cap. The upper end of the container is bored to receive a ⅛in. brass tube, which tube is brazed to the valve and nipple casting.

As may be seen from the drawings, the casting is attached at two points to the container: at the top, where the tube passes through the upper end, and by lugs cast on the nipple block. Attachment is made by well silver-soldering.

The Vaporising Tube

The mixing and vaporising tube may also be of either copper or brass. Its making will present perhaps the most difficult bit of work in the whole plant. Short of making a pattern and corebox and getting it cast in gunmetal, the only way in which it can be shaped is by spinning in the lathe on a hardwood or metal mandrel. If it is spun, the metal will need to be annealed before commencing to work it with the spinning tool, and again from time to time as the shaping proceeds.

A parallel tubular ring will, after spinning is completed, be silver-soldered on the smaller end. This ring will have three bayonet-socket notches cut in it to engage with three pins screwed into and projecting from the circular periphery of the nipple block. It will also have a gap cut in it wide enough to give the necessary semi-rotary movement to the extinguishing valve.

The Extinguishing Valve

This valve is a thin steel plate pivoted on a collar screwed into the centre of the nipple block. Its shape and action is clearly shown in Fig. 7. The three holes of the plate can be of any suitable diameter, say, 3/32in. They are required to be sufficiently large to allow the gas to pass freely from the nipples when the valve is in the open position, and yet not so large that they prevent the nipples being completely closed when gas is required to be shut off.

The large end of the vaporising tube passes through a circular opening in the boiler casing, and has a lip on its lower edge to engage with the casing plate. Other support will, of course, be required for the blow-lamp, but this has not been designed, since it will have to be incorporated in the aeroplane fuselage or framework.

For the initial heating up of the burners, and to ignite the first gas formed, either a pan will be required to hold a small quantity of methylated spirit or a wire frame, or rack, filled with asbestos wool which can be saturated with methylated spirit. The latter will doubtless be more convenient, since the spirit cannot be spilled. Such a rack can be formed of stout brass wire silver-soldered together and either made to hang by a loop from the nipple block, or be silver-soldered to the barrel of the container. The flame from the pan or asbestos wick must be arranged to play around the whole of the part containing the nipples and the inner end of the mixing tube.

To complete the lamp ready for use the tube leading up to the needle valve must be lightly packed with loose cotton or asbestos wick, the lower ends of this being spread out, as shown in Fig. 6.

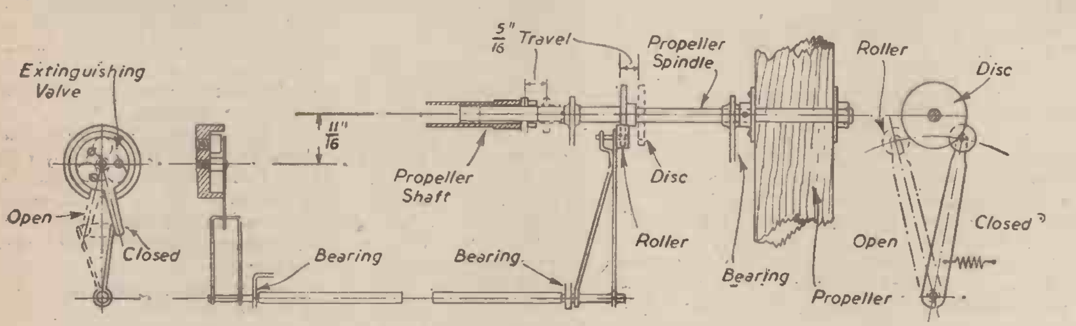


Fig. 7.—The automatic fire-extinguishing gear.

Automatic Extinguishing

The apparatus for automatically shutting off the flame when the water in the boiler is exhausted is shown in detail in the sectional illustration in Fig. 7. As the principle on which this operates has already been explained, and as all the parts in the drawings have written references against them, further description is rendered unnecessary.

Severn Road Bridge

General Description of the Construction of the Proposed Bridge Over the River Severn between Beachley and Aust

Proposed bridge over the River Severn.

THE bridge will be of the suspension type, as that readily lends itself to the large centre span required, namely, 3,000ft., and will be designed to carry a maximum load of 150 tons. In addition to the central span for shipping there will be two side spans of about 1,000ft. each. The vertical clearance provided for shipping will be 110ft. above high water near the towers, and about 120ft. in the centre.

The structure will be the largest suspension bridge in Europe, and the span of 3,000ft. compares with the following bridges in the United States :

Golden Gate	4,200ft.
George Washington ..	3,500ft.
Bronx-Whitestone ..	2,300ft.
San Francisco, Oakland ..	2,310ft.

The anchorages to take the pull of the main-cables will be each about 250ft. long by about 130ft. wide, and will be of concrete. They will be of massive and simple construction, relief being given by means of recessed vertical faces.

The piers will be about 200ft. long by about 60ft. wide, and are also of concrete with granite facing near the top.

Supporting Towers

The towers which support the main cables will be of steel and will rest on the above-mentioned piers. They will rise to a height of 450ft. above high-water. Each will consist of two legs about 30ft. by 30ft. braced by two panels at roadway level, at the top, and at about 70ft. above the roadway. In the centre of the panel above the roadway the arms of Wales will be picked out in bright colours on the English side, and the arms of England will be similarly depicted on the Welsh side. The remainder of the steelwork of the bridge will be painted light grey.

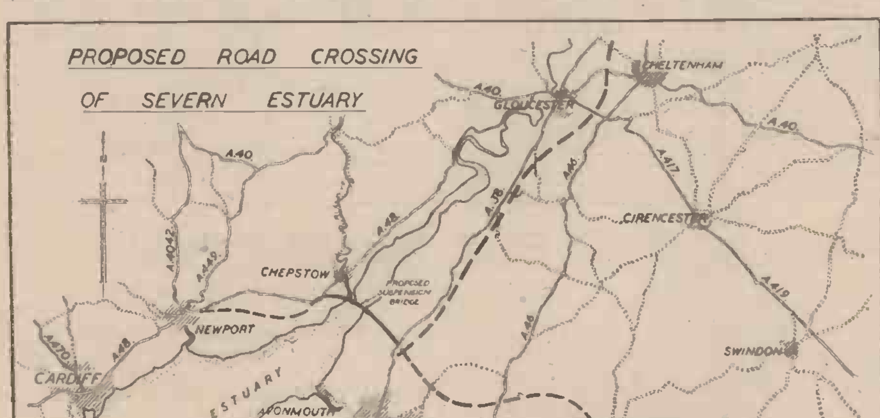
The bridge as a whole will rely for its effect on simplicity of design and good proportions.

The accommodation provided for road traffic will consist of two carriageways, each 22ft. in width, two cycle tracks, each 9ft. wide, and two footpaths, each 6ft. wide.

The total length of the bridge and of the approach roads on both sides of the Severn Estuary, including a bridge over the mouth of the Wye, will be about 8 miles and will cost about £7,500,000. The approach roads have been planned to connect the main road from Gloucester to Bristol (A.38) on the east side of the Estuary with the main road from Gloucester to South Wales (A.48) on the west side. The bridge will form an important link in the future road development of this area. The future new roads to Newport and London, also from Bristol to Gloucester and Birmingham, as indicated on the diagram of the Future Pattern of the Principal National Routes published in the Press following the Minister's statement in May last, are shown by broken lines on the accompanying key map.

The bridge over the Wye will have six spans of 150ft., two spans of 175ft., and a central span of 200ft. The central span is for navigation purposes and provides for a headway of 52ft. above high-water mark.

The Consulting Engineers are Messrs. Mott, Hay and Anderson, M.M.I.C.E., with whom are associated Messrs. Freeman, Fox and Partners, M.M.I.C.E. The Consulting Architect is Sir Percy Thomas, P.P.R.I.B.A.



Fractional Electric Motors

Constructional Details of an Efficient Motor with Tri-polar Armature

THERE is a well-known and widely-used class of electric motors to which one refers by the title of "Fractional Horsepower Motors." Their application to domestic and industrial uses is almost illimitable, and in the majority of cases they are designed and wound so that they may be connected direct to the high-voltage service mains. Their outputs range from the smallest sizes—that lend themselves to commercial mass production methods—of about a hundredth of a horse-power or so, up to anything less than one horse-power. Larger sizes than one horse-power cease to be "fractional" motors, while those smaller than one hundredth of a horse-power are hardly worth the serious attention of the firms who cater for large buyers, since the cost of production below a certain size becomes excessive in relation to its utility.

Such very small motors as these "micro-motors"—if one may coin the term—are generally left to the province of the amateur who has models to drive from low-voltage batteries, and who has seldom the special training required to wind them with the very fine gauges of wire required for operating on high voltages. A certain high standard of insulation is imperative for any motor to work satisfactorily from supply voltages of the order of 200 to 250 volts, whereas no such problem is encountered when dealing with voltages associated with a few dry batteries, or even a 12-volt accumulator. Small motors intended to work from the house service mains will usually necessitate enamel-covered windings of such extremely fine gauges as No. 40 to No. 44 S.W.G., and this needs a deal of experience to handle successfully. On the other hand, the same size of motor adapted to work on a low voltage battery or accumulator might not require windings of smaller gauges than No. 24 to No. 30 S.W.G., which is infinitely easier to handle, as well as greatly simplifying the standard of insulation requirements.

Model Requirements

The home worker will therefore be able to undertake his model motor with a much greater certainty of success if he begins by discarding any idea of winding it for high voltages; also by not insisting on standardising its output in horse-power, or its speed within too close a limit. The science of motor design is very highly developed even in fractional horse-power sizes, but there are too many disturbing factors when the size is still further reduced to what are actually little more than "gnat-power" motors. The slightest variation in frictional losses in the bearings, excessive spring pressure on the brushes, variations in the air-gap between pole faces and armature core, etc., may all be the cause of considerable discrepancies between the performances of two exactly similarly sized motors, and instead of worrying too much to account for the cause, it is far quicker and easier as a rule to add one or two more cells in order to get the results aimed at. The majority of micro-motors are usually required for the purpose of driving model railway locomotives, boats, etc., and if scale proportions are to be adhered to, the most difficult point to meet is the restriction of overall height sufficiently to enable the motor to go into the space permitted by the design of the model in question. As a rule, there is not so much difficulty in finding end room. A case in point arises when the motor has, for instance, to be incorporated in the boiler of a model locomotive, or carried in its tender, no part of it being visible externally. The electrical characteristics, too, must be such that the motor develops a high starting torque directly it is switched on, as one of the outstanding features of nearly all mechanical models is the static resistance to motion, far more power being required to start up the mechanism than to keep it in motion when once running. Such

Field-magnet Forms

If the variations in possible field-magnet form are studied, such as Overtype, Undertype, Manchester, Simplex, Ironclad, Edison, etc., it will be appreciated that the latter is the only one that really complies with the essential point of providing the largest possible diameter within any prescribed space limits. This is the type chosen, therefore, in the present design, the dimensions of which are indicated in the accompanying drawings, Figs. 1 and 2. The Part Number list gives the names of the various parts, and the number of each required.

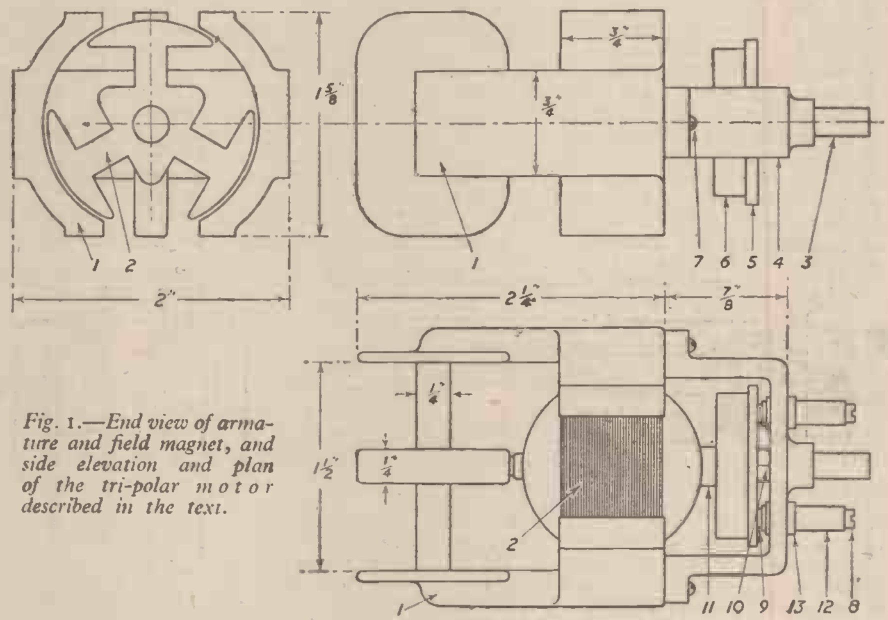


Fig. 1.—End view of armature and field magnet, and side elevation and plan of the tri-polar motor described in the text.

requirements can be best met by providing the motor with the largest possible armature permitted by top height, and giving it a "series" field winding. By this means the most powerful field is produced by the momentary rush of current that occurs when first switched on, before the armature has had time to develop its back E.M.F., due to actual rotation; in other words, the magnetic polarity of both fields and armature is at its greatest in a static condition. Another advantage of series-winding is that such motors are "universal" without any change of connections, in the sense of being able to operate on either direct or alternating current, although the power developed on A.C. will be rather less than on D.C., of the same voltage.

PART NUMBER LIST

No.	Description	Material	Qty.
1	Field magnet	Cast iron	1 off
2	Armature stampings	Lohys sheet	30 off
3	Shaft	Mild steel	1 off
4	Bearing bracket	Brass	1 off
5	Commutator ring	Hard brass	1 off
6	Commutator back	Fibre	1 off
7	Bracket screws	Mild steel	2 off
8	Clamp screws	Brass	2 off
9	Brushes	Copper-carbon	2 off
10	Commutator nut	Brass	1 off
11	Armature clamp nut	Steel	1 off
12	Brush holders	Brass	2 off
13	Insulation	Presspahn	2 off

Simplicity in design is the first essential for those who undertake motor construction with limited workshop equipment, and whose previous acquaintance with electrical instrument making does not extend very far. Fortunately, the winding of low-voltage motors such as these is free from many of the pitfalls that are present with the use of very fine gauges of wire, and the exacting nature of high-voltage insulation. Armature and commutator details, too, can be reduced to a very elementary form without appreciable detriment to the performance. Bearing all these points in mind, it is possible to produce a perfectly serviceable micro-motor on the lines of that illustrated in Fig. 1. The field magnet is a solid soft iron casting in one piece, the armature of the laminated tri-polar type, while the disc type commutator adopted is far easier to construct than any cylindrical multi-segment forms having a large number of segments which are necessary for satisfactory working on high voltage circuits. The disc type is suitable for all low voltages up to, say, 12 volts direct current, and can even be used when running from the secondary of an A.C. bell transformer.

Patterns

Two wood patterns will be required for the castings, one for the field magnet and one for the front end bearing bracket. Being small, these parts could, of course, be shaped out from solid metal if one has suitable workshop facilities, although this entails a good deal more work. The patterns are by no means difficult to make, contraction allowances are unnecessary, and the patterns themselves are an exact replica of the finished castings, except that the field magnet should have a core print left in for the armature tunnel, one eighth of an inch smaller than the finished size of the bore, to allow for machining. Both patterns should be divided along their horizontal diameter in two halves, and dowel pins inserted to keep them in register while they are moulded. A coat of waterproof varnish is also a good thing, as it prevents the moulding sand from sticking to the wood and leaves cleaner cast surfaces.

Machining operations on the castings should be carried out in the following sequence. First mount the field magnet in a 4-jaw independent chuck or by strapping to a face plate with the pole pieces outwards, and bore the armature tunnel to size. Before the casting is disturbed also face off the ends of the pole pieces and centre and bore the hole for the back journal bearing. All this work requires accuracy, as the bearings must be properly in line for the motor to run well, and the airgap between the armature and pole faces exactly equal all round.

Next rough out the steel shaft to size between lathe centres, after which the part receiving the stampings is finished to size and threaded for the clamping nut which holds them. Assemble a sufficient quantity of stampings to match the length of the armature tunnel, clamp them firmly with the nut, and then finish the remainder of the shaft to drawings, and then polish.

The next step is to drill the boss of the front bearing bracket one sixty-fourth of an inch under size, finishing out by hand with a fluted reamer. An ordinary twist drill seldom makes a good running fit. Mount the bracket on a steel mandrel, and then shape the feet in the lathe where they bed on the pole faces, so as to ensure their being exactly square with the bore.

Armature and Stampings

The armature can now be centred in its tunnel by wrapping a strip of presspahn firmly round the stampings until they just push tightly into the bore. This ensures an even airgap all round, a point which is very important in obtaining the best results. The smaller this airgap is within reason, the more powerful the motor, and a reasonable clearance is one fiftieth of an inch all round for armatures of this diameter.

Slip the bracket bearing over the front end of the shaft and notice whether the feet bed squarely against the pole faces. If not, they must be scraped or filed until they do, so that the holding screws, when tightened up, do not pinch the shaft. The latter should spin with perfect freedom, without any appreciable side shake, but with one thirty-second of an inch end play.

The Commutator

The disc commutator consists of a backing of horn fibre to which is secured a ring of hard brass by three countersunk brass screws and is held against the face of the nut which clamps the stampings by another locknut. This enables the commutator to be rotated to any position on the shaft, when setting the best brush position instead of providing a "rocker." Three narrow sawcuts divide the brass ring radially when all else has been turned to size and polished, forming the three segments of the commutator, each insulated from the others. Note that the brass ring projects slightly beyond the fibre disc and has a shallow cut in the end of each segment, for convenience in soldering the armature wires without getting in the way of the brushes. It is necessary that the flat face of the commutator runs perfectly true, otherwise steady contact with the brush faces at high speeds may be interrupted, causing sparking and unsatisfactory running.

Brush-holders

To make up the brush-holders two lengths of square brass tube are employed, fixed in the web of the front bearing bracket by grub-screws after first insulating them by a wrapping of 1/32in. fibre. If the brush tubes are cut as in the detail drawings, with one side left longer than the other three, the long side can be afterwards folded down squarely, closing the end of the tube, and forming a tab for attachment of the field wires under the head of a small screw. The brushes themselves are of copper-carbon mixture, known as "CM" grade, made an easy sliding fit in the holders. The brush springs are of No. 28 g. hard brass wire, adjusted to give the lightest possible pressure of the brushes on the commutator face, to avoid what would be otherwise a heavy braking effect. Ordinary hard black carbon is useless for the brushes of low-voltage motors such as these, since its contact resistance is far too high.

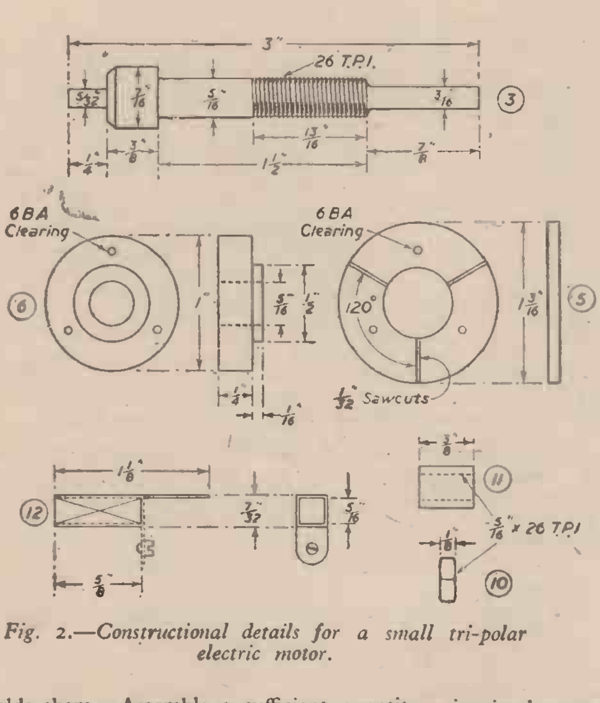


Fig. 2.—Constructional details for a small tri-polar electric motor.

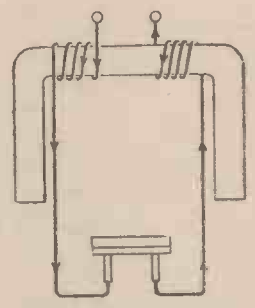


Fig. 3.—Diagram showing the direction of winding of field coils and connections to the brushes.

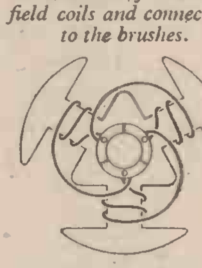


Fig. 4.—Winding diagram for the armature.

Volts	Armature	Field	Conn.
2	1½oz. No. 24	4oz. No. 20	Series
4	„ No. 26	„ No. 22	„
6	„ No. 27	„ No. 23	„
8	„ No. 28	„ No. 24	„
12	„ No. 30	„ No. 26	„

Winding table for different voltages.

Field Winding

Winding the motor is quite a simple job. Begin with the field magnet and first insulate the whole of the metal parts which come in contact with the coils with one layer of 8-mil presspahn or leatheroid sheet. This can be secured in position, until the coils hold it, by a touch of sealing wax or Chatterton's Compound. A diagram showing the direction in which the two halves of the field coils are wound, and their connections to the brushes, is given in Fig. 3. Enamel-covered wire is used because of the greater number of turns that can be got into the winding spaces. The utmost care is necessary to avoid damaging the covering. The last turn on each coil is held in position by tying it down with fine thread, which has been previously overwound by the last two or three turns of the outside layer. The start of the winding must be protected from leakage to the adjacent layers by a slip of thin presspahn where they cross it at the end of each coil.

Winding the Armature

A winding diagram for the armature is given in Fig. 4. All three sections of the armature coils are wound in the same direction, and when completed the finish of each one is connected to and twisted up with the start of the next coil, so that there will be three junctions formed, one of each being taken down and soldered to one of the commutator segments. A sufficient amount of slack should be given to these armature connections to allow of the commutator being rotated slightly either way on the shaft so that the best possible position can be found from trial to give the highest speed and least sparking when running.

The windings recommended for various battery voltages are to be found in the list on this page.

About the same weight of wire will be required for either of the above windings, namely, 1½oz. for the armature, and 4oz. for the field coils, to allow for a little unavoidable waste. Remember in winding that all parts in contact with the wire must first be protected with 8-mil presspahn insulation. Any damage to the covering must be scrupulously avoided and, finally, every additional turn that can be got into the available winding space will add to the performance of the motor.

Rocket Propulsion

This is the HWK 109-509A1, first bi-fuel rocket engine to be fitted in service aircraft. It was produced in large quantities at the Heinkel works during 1944, and drawings were subsequently acquired by Japan at a cost of 20,000,000 Reichmarks.

Details of Three Further Rocket-fighter Projects

By K. W. GATLAND

(Continued from page 13, October issue)

THE "Natter" was an altogether better solution, and it was *simplicity*, coupled with considerable *fire-power* in the shape of explosive rockets, that put Bachem points ahead of his competitors.

The "Julia," however, was a good runner-up, if only for the fact that it was designed to take off vertically.

On the ground and approaching from the side it would have been difficult to convince an observer that the "Julia" could climb at over 39,000ft. per minute, or, indeed, was anything more enterprising than a glider. A glider, of course, it was when the tanks had been drained, but with the HWK 109-509B Walter engine firing from the tail its *cruising speed* was nearly 500 miles per hour.

Design Features

Main identification features were the high wing location and the absence of a protruding cabin. The pilot was accommodated in a prone position at the extreme nose, and hence the line of the fuselage was unbroken save for two landing skids, one beneath the cockpit and another about half-way between nose and tail. The fuselage, nevertheless, was not so refined aerodynamically as the more normal high-performance fighters, and its design, as in most machines of its type, was obviously very much a compromise between capacity within and streamlining without. The propellant, comprising 1,550lb. T-stoff and 490lb. C-stoff, was contained in tanks grouped about the c.g., and the machine's weight after take-off was 4,040lb., the wing loading 67.6lb./sq. ft., reducing to 27.0lb./sq. ft.

The wing had a span of 15.1ft. and an area, including anhedral tips, of 77.5 sq. ft. The wing fixing was high and about mid-way along the 23ft. length of the fuselage.

Operational Aspects

Designed to take-off along a vertical ramp, the "Julia" was assisted into flight by four 1,100lb. thrust di-glycol powder rockets, the initial acceleration being slightly in excess of 2g, and the rate of climb during the early phase 39,400ft. per minute.

The speed fell off from about 620 miles per hour just after take-off to 560 miles per hour at 36,000ft.

In comparison with the "Natter" the fire power of this machine was remarkably small. Two 30mm. cannons only were carried, housed in blisters one on either side of the cockpit and having 60 rounds per gun.

It is true that in this machine it would have been difficult to house a battery of explosive rockets without causing a disastrous movement of the c.g., after they had been fired, but apart from suspending them from beneath the wings, there appeared to be no easy solution. Wing mounts were not very desirable because of the extra drag that they would involve, and no doubt this was the main reason for fitting the two cannons.

If the rapid-climbing rocket interceptor is to hold a place in future defence systems, however, it is obvious that its fire-power must be substantially improved, and consequently the explosive rocket may be expected to displace the cannon shell. This implies the development of expendable or semi-expendable types, and the trend is evidenced by a report that large numbers of fighters, following the general design of the "Natter," are being produced for the Russian Air Force. It is well known that a great deal of research has been conducted since the surrender at Peenemunde, where Russian and German technicians now work side by side.

Of further interest is the fact that the "Natter" (along with the Me. 163B) was found under construction in Japan, drawings having been dispatched from Germany by submarine. The manufacturing rights of the Walter 109-509A1 engine had been previously acquired in 1944 at a cost of 20,000,000 Reichmarks.

The two remaining rocket types were the EF-127 "Walli" (Fig. 80), a Junkers project, and the Messerschmitt 1104 (Fig. 81), both of which had normal flight characteristics, taking off on jettisonable wheels and landing on skids. They were each to be powered by the standard HWK 109-509B Walter engine.

The Me. 1104

This small fighter was another that might easily have been mistaken for a light glider. The fuselage, 18ft. in length, was almost cylindrical in section, rounded at the nose and slightly tapered towards the tail. A tall oblong fin and rudder emerged vertically from the centre-line of the rear fuselage, and the square-tipped plane was attached to the fin just above the root.

A well-faired cockpit was placed about a third from the nose with a shoulder wing fixing for the 20ft. 4in. span mainplane, which, like the tail surfaces, was square cut.

The all-up weight was 5,300lb. at take-off, including 1,980lb. T-stoff and 660lb. C-stoff, and the initial wing loading 75.5lb./sq. in.

Without resorting to auxiliary rockets, the take-off run was only 170 yds., the designed rate of climb being the same as that specified for the "Julia," 39,400ft. per minute. The initial acceleration was 1.45g., and, having climbed to 40,000ft., the machine was said to be capable of gliding a distance of over 50 miles, which was usually ample to reach a landing base. The difficulty, however, was that the glide range was appreciably less should the motor cut out at a lower altitude.

The armament was limited to *one* MK.108 30mm. cannon, with 100 rounds.

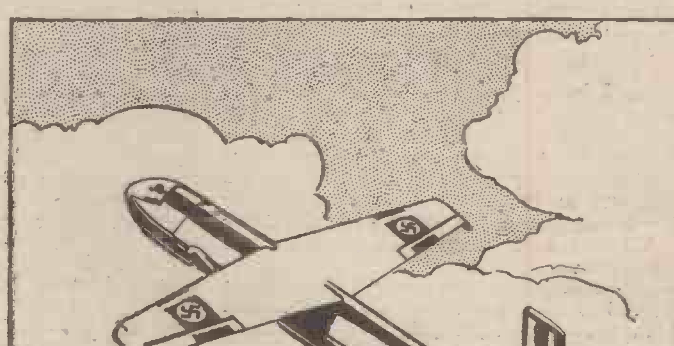


Fig. 79.—The Heinkel "Julia," in which the pilot occupied a prone position. Like the "Natter," it took-off along a vertical ramp.

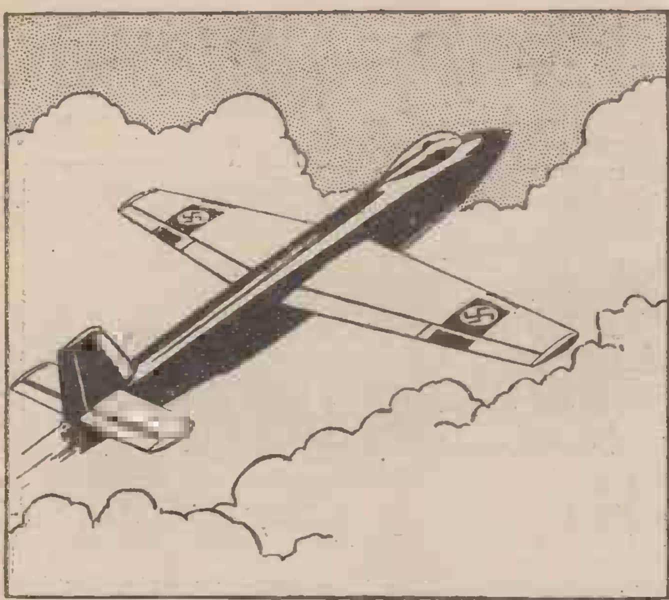


Fig. 80.—The Junkers "Walli." A better-looking aeroplane than its contemporaries, but lacking in many respects.

The "Walli"

There could be no excuse for mistaking the purpose of the "Walli." Its fuselage was cylindrical in section, pointed at the nose, narrowing towards the tail, and mounted high at the tail end was an oblong stabiliser with a single vertical fin and rudder. The short span wings were even more to the rear than in the previous designs, the root fixing being slightly below the fuselage centre-line.

As was the case in the Me. 163 and Ju. 8-263, a small wind-driven generator at the nose supplied the electrical services, whilst the pilot's cabin just aft of this was covered by a nicely designed "clear-view" hood.

Weighing 6,450lb. when fully fuelled, the machine was airborne within 370 yds. This was from a standing start, unaided by rockets or any other catapulting device, and rising from the ground at the rate of 26,000ft. per minute, the pilot experienced a maximum acceleration of only 0.67g.

The maximum speed achieved in level flight at sea-level was in the region of 630 miles per hour, but at 36,000ft. this figure had dropped to 560 miles per hour.

All other essential details, weights and dimensions, are as follow: propellant, T-stoff 2,400lb. and C-stoff 1,100lb.; weight (immediately following take-off), 6,140lb.; and weight (dry) 2,720lb. The wing loading at take-off was 68.0lb./sq. ft., reducing to 28.8lb./sq. ft. at the time of landing. The wing was only 20.7ft. in span with an area of 95.7 sq. ft.

It was intended to use two 1,100lb. thrust A.T.O. rockets acting for six seconds in the production version.

The armament was precisely the same as fitted in the "Julia," two Mk. 108 cannon firing 60 rounds per gun.

Summing Up

Despite many admirable points, it is obvious that these fast-climbing interceptors also embodied weaknesses, summarised as follow: (a) the limited duration of flight under power, (b) the need for a horizontal take-off run in the "Walli" and Me. 1104, (c) the small fire-power of all machines other than the "Natter," and (d) the increased liability to error in sighting due to the high speed of engagement.

Apart from (a) the semi-expendable "Natter" suffered none of the disadvantages, as obviously (d) did not apply as the machine was in essence a piloted missile—and a very effective one at that.

It was also obvious that to be fully effective these machines should take off from the precise spot from which they could rise directly in way of the attacking bombers as they formed for their "run in." Had it not been found possible to arrange vertical launching, special take-off strips would have had to be constructed and, of course, this was largely impossible within the suburbs of most cities. The only other alternative was to use the standard air-fields, most of which were placed on the outskirts of industrial areas, and whereas rocket fighters could be operated from these, their small-powered endurance did not permit them to cover all points of the compass. It thus became essential to disperse these interceptors more or less in a circle around the more vital potential targets, leaving the use of airfields to the jet and propeller fighters, which were less affected by their disposition at take-off.

Future Defence Methods

The exceptional climbing rate is, of course, the most favourable advantage, especially in view of the present trend towards jet-powered bombers, which should prove able to range abroad with almost the same fleetness as present patrol fighters.

Such high-speed invaders will not allow much time for even jet fighters to fly off and climb to interception height. It will therefore become increasingly more the job of the guided missile, and (though perhaps only as an interim measure) the expendable interceptor, to check the initial assault, leaving the rocket-boosted "jets" to engage where possible, but coming into full play as the bombers turn for home.

Eventually, with the further development of radar guiding technique, there is no doubt that the human element will be eliminated altogether, making obsolete the orthodox fighter; but then by the same token so also will the piloted bomber have become a weapon of the past. It is no secret—although only because rocket experiments are difficult to conceal—that technicians in each of the principal nations are pressing ahead with research to make the long-range rocket strategically accurate. Already, in fact, the establishment of a regular Atlantic rocket-mail service, England to America, is officially contemplated, not as a possibility of the remote future, but in terms of a few years' further development. The long-range mail rocket obviously is not far removed from the war rocket, with its more sinister cargo of plutonium explosive.

The significance here does not remain alone in terms of a weapon with better potentialities for destruction. From the political viewpoint we may find the rocket of infinitely greater value than a thousand Peace Conferences, for few nations, no matter how ambitious in outlook, would wish to enter into a war in which atomic bombs could be so simply exchanged on all sides.

Walter Units—Early Tests

These few details of German attempts at rocket interceptor design are sufficient to give some idea of the faith the German Air Ministry placed in the Walter engines, which, contrary to general belief, were not purely a wartime development.

It is, in fact, surprising to find that the first flight tests of a T-stoff rocket unit took place in the autumn of 1936; the 'plane a small primary trainer, the Heinkel 72 "Kadett."

This pioneer motor was exceptionally small, and very simple. The T-stoff (concentrated hydrogen peroxide) was fed by air pressure into a single combustion chamber which itself was filled with a paste catylist. Combustion was, of course, spontaneous, and although the thrust was virtually constant, a degree of control was afforded by an "on"-"off" lever which worked a cock in the compressed air line.

A thrust of 150kg. (330.7lb.) was obtained for a specific consumption of about 9g/kg/sec., the power lasting for some 45 seconds.

This was quite an achievement in those early days, but the D.V.L. pilots who carried out the tests were not that much overawed by the results. The thrust and power duration were reasonable, but these factors were greatly outweighed by the lack of control. This was apparent from the outset, and consequently no very extensive flight trials were made with this installation. Instead, research was directed towards perfecting a suitable *liquid* catylist, and eventually success was found in the use of Z-stoff, a saturate aqueous solution of calcium (or sodium) permanganate.

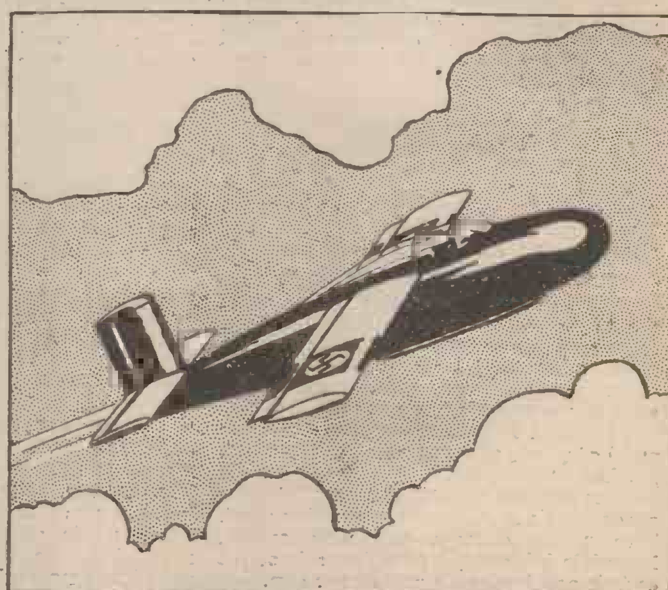


Fig. 81.—Another enterprising project, the Me.1104. Although strictly "utility" in appearance, it could climb at over 39,000 feet per minute. A great weakness was the fact that it carried only one cannon.

A new motor was then built, and after a series of bench tests was fitted in a F.W.56 "Stösser." The results of flight trials at Neuhardenberg in the summer of 1937 proved beyond all doubt the efficiency of the system, but it was somewhat surprising that again no attempt was made at varying the thrust. It was, however, an easy matter to throttle two liquids, and this further refinement was left to later development.

The Z-stoff was fed by air pressure in precisely the same manner as the peroxide, the two components coming together in the ratio of about 1 : 20 to yield 300kg. thrust for 30 seconds. A specific consumption of approximately 10g/kg/sec. was maintained throughout.

From this point on, progress was largely in the perfection of details, with Walter working at Keil mainly responsible for the fundamental research. Then, with the coming of war, another experimental factory was set up at Beerberg, in Silesia, where in 1942 Dr. I. N. Schmidt was put in charge of development. It was here that most of the prototype Walter engines were built and bench tested before being handed over to the Heinkel works at Jenbach for production. Flight tests were carried out at Peenemunde, Rechlin, Lechfeld and other airfields in the Beerberg area.

Among the first service aircraft to be fitted with controllable rocket boosters were the Messerschmidt 109E and the Junkers 88. Both of these installations were, however, experimental, and it was not until late 1943 that the rocket engine was sufficiently developed for operational use.

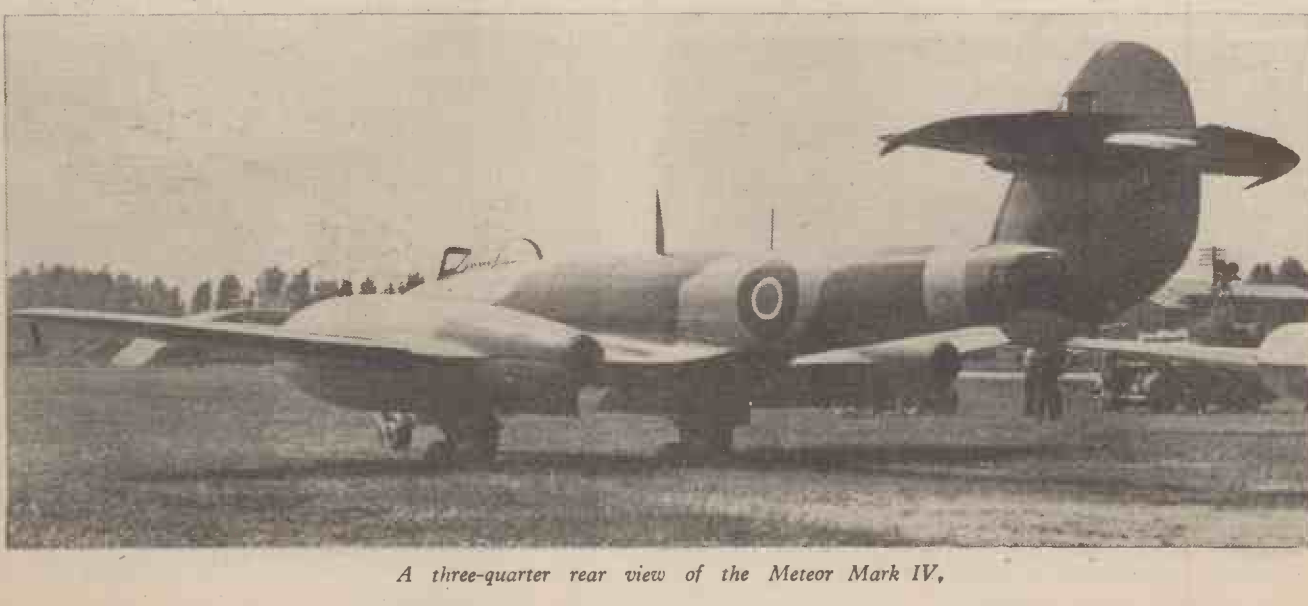
(To be continued)

The Air-speed Record

The Meteor Mark IV in flight, piloted by Group Captain E. M. Donaldson.

THE attempt to raise the air-speed record above the 606.25 miles an hour established on November 7th, 1945, was made on Saturday, September 7th this year, and a new record of 616 miles an hour was established over the three-kilometre course between Bognor Regis and Worthing. The speeds for the four laps flown by Group Captain Donaldson were 623, 610, 623 and 609 miles an hour, giving an average of 616 miles an hour. Squadron Leader Waterton averaged 614 miles an hour in four laps in a similar machine. The aircraft were similar to those used for the previous record, namely Gloster Meteor Mark IV fighters, powered by two Rolls-Royce Derwent Mark V jet-propulsion engines. The thrust of the Derwent V engine, as fitted in the standard service machine, is 3,500lb., but the jet-propulsion units used for the previous record were adjusted to give 3,600lb. thrust. For the latest record the thrust was given as 4,200lb.

Group Captain Donaldson checking up on the controls of the special Meteor IV.



A three-quarter rear view of the Meteor Mark IV.

The Marquis de Dion

The Passing of a Once Energetic, Creative and Pioneering Figure in the Motor Engineering World

DE DION is dead. Time has now taken from our pesent generation not only a pioneering personality, but a one-time veritable "king" of the world of motor engineering. The Marquis Albert de Dion, French pioneer of the car and motor-engine industry, whose death at the ripe old age of 90 took place in Switzerland on August 20th last, was one of the very few remaining originators of our present era of mechanised transport. Not only that, de Dion was a highly gifted and creative individual, a born engineer and mechanician who, without formal training in the mechanical arts, rose to the heights of industrial celebrity, and for many years actively spurred on the progress of the petrol engine.

There must be few older members of the engineering fraternity in this country who cannot cast their minds back to the days at the beginning of the present century when petrol engines and vehicles bearing the name "De Dion" enjoyed a popularity which was then second to none. Indeed, De Dion engines in those days were deservedly famous the world over, for they embodied some of the most "advanced" ideas in internal-combustion engine construction and their working efficiency was relatively high.

Each engine carried with it something of the spirit of its creator, the then Count Albert de Dion, French nobleman and one-time "gay Parisian" who had shaken off the conventional trammels of high society life and who, at an early age, had got down to creative and useful work in the sphere of engineering.

Jules Albert de Dion, son of the Marquis de Dion de Malfiance (who commanded a battalion during the Franco-Prussian war of 1870) was born on March 9th, 1856, at the famous Château de Maubreuil at Carquefou, not far from the town of Nantes. He came of a fighting and a war-like family, one of his ancestors having given a good account of himself in the Crusades of the early 13th century.

De Dion's grandmother was an Englishwoman, a Miss Bicknell, and he had other English relations as well. All through his long life, de Dion's sympathies were with the British cause, and it is said that he felt proud of the proportion of English blood which ran through his veins.

Passion for Things Mechanical

Right from his earliest years, the young Albert de Dion displayed something akin to a raging passion for anything mechanical. He revelled in the few mechanical toys which his parent occasionally purchased for him, and when he was unable to add to their numbers

The Marquis Albert de Dion (1856-1946).

owing to the obstinacy of his spartan father, he made them for himself. Throughout the progress of the conventional education and training which he received in France and in Germany, this prediliction for things mechanical asserted itself at every turn. De Dion made steam engine models, steam hammers, miniature bridges, railway and other working models at every turn.

It was a pity, his seniors thought, but, of course, when he got more sense, he would leave all these childish things.

It was about 1879 that the Count Albert de Dion entered Paris society. And he entered it with no small amount of gusto. Not content with being a reckless gambler, and with winning and losing tens of thousands of francs, he attained to some celebrity as a duellist, a confirmed theatre-goer, and an all-round sportsman. The Count was liked by all. He was clever, easy-going, rich and good-natured in the extreme.

But the Count avoided serious scandal, and in one way or another he managed to preserve his engineering interests.

Meeting with Bouton

Walking one day along the Boulevard des Italiens, Albert de Dion was attracted by a crowd which had assembled in front of a shop window. A working steam-engine model was on exhibition. At once the Count's interest became intense. He went into the shop and inquired the name of the maker of the machine. Two men had made the model, he was told, and they had a workroom somewhere in the East End of Paris.

Without more ado, off the Count went in intensive search of the model-makers. He found them some hours later in a small wooden building, outside the door of which was a brass plate inscribed *Bouton and Trepardoux*.

Bouton and Trepardoux, it transpired, were just two clever workmen who had got together a small workroom and who were endeavouring to make an honest living by constructing steam models, and by doing all sorts of odd jobs in experimental mechanism construction.

This was the manner in which the rich Count de Dion struck up an intimate friendship with his future partner, George Bouton, a friendship which lasted until Bouton's death at the age of 91 in 1938.

An idea which had long been latent in the Count's mind now came to maturity. He would enter the engineering industry professionally, buy out Bouton and Trepardoux, and take them into partnership in a small concern which he would establish for the purpose of making light steam-carriages.

Bouton and Trepardoux proved willing, and so Count de Dion's first industrial venture began.

The noble family of de Dion were very much concerned and, indeed, alarmed at the venture. The Marquis de Dion, hearing that his wayward son Albert had been popularly dubbed *Le Comte Mècanicien*, seeing in the Count's industrial adventure a profound loss of family dignity and fearing, perhaps, some

De Dion on a "Steam Carriage" (1887).

De Dion (farthest from camera) on his first steam carriage (1883).

loss of family funds, eventually obtained from the French courts a *conseil judicaire*, a legal document repudiating on the part of the father all responsibility for his son's debts.

Designing the Boiler

The chief obstacle in the way of constructing a suitable steam-driven carriage was the boiler. No small, compact boiler existed at that time. But the Count de Dion was quite undismayed by such a fact. He sat down and designed a small steam boiler having detachable tubes which could readily be removed in the case of repairs being needed. This boiler he patented in 1883, and a little later the first of the De Dion steam carriages was given its trial run in a quiet suburb of Paris. It was a steam-quadricycle driven by a leather belt, the vertical boiler being mounted over the front wheels and the rear wheels being used for steering purposes.

After this came a small steam tricycle weighing about 100lb. and constructed from an old English-made Rudge tandem tricycle.

It was only very gradually that de Dion and his partners were able to put any of their machines on the market. There was a popular fear of being "blown up" by anything in the nature of a steam boiler. Would-be purchasers had almost invariably to be assured that their speedy demise by sudden disintegration was decidedly not a likely consequence of their progress on a mechanised carriage.

And so, for the ensuing eight or nine years, the Count de Dion gave much of his time to the active supervision of his industrial venture. To some extent, also, the Count went in for the construction of steam engine units for the propulsion of river craft, but these were not successful. In fact, owing to the disturbance which the Count caused among the ordinary river craft, his licence was cancelled, thereby bringing to a close his experiments in this direction for several years.

Despite the many competitions and trials which the Count entered with his steam-propelled carriages and tricycles, he was never really able to popularise them. He found that although he was well able to prove their capabilities, he was never able to sell them easily. The public considered them to a large extent impracticable. The necessity of having to stoke-up a coke boiler at frequent intervals, and the dirt and trouble attendant on this requirement prejudiced all such vehicles in the public mind. For the average would-be user of a steam-propelled vehicle, the whole thing was too much trouble. A horse and carriage was far easier to run.

The problem came to a head during the Paris Exhibition of 1889. A few petrol-engined vehicles were displayed there, and although the firm of De Dion was awarded a silver medal for its steam-engine carriages, the main interest was undoubtedly in the direction of the coming petrol engines.

The Internal-combustion Engine

De Dion was quick to size-up the situation. He saw that to continue solely the production of steam carriages was akin to flogging a dead horse. Realising the undoubted convenience and superiority of the petrol-engined vehicle, he proposed to his partners that they might profitably turn their attentions in that direction.

George Bouton was agreeable to the Count's suggestions, but Trepardoux was against the proposal. In fact, he got quite ill-tempered, and averred that, after all the efforts of the firm during the past years it was disgraceful that the Count should be allowed to proceed with his "new fad."

A De Dion water-cooled engine made in 1899. It developed 3½ h.p.

In the following year (1889) the Count de Dion took out his first internal-combustion engine patent. It was for an "explosion motor." Another patent quickly followed. This was for a "detonating motor cooled by water."

The Count, indeed, became really "hot" on his "explosion motors." It was not long before he had designed and constructed a rotary engine—one with four and another with a dozen cylinders, both of which operated on the two-stroke principle. Such power-units, however, were before their day.

Trepardoux continued to remain adamant. His contention was that the petrol engine represented only a passing phase and that the steam-carriage would conquer in the end.

Nevertheless, de Dion persisted in his petrol engine designs. The matter came to a head formally on January 1st, 1894, when Trepardoux agreed to retire from the firm. He took up another partnership which was unsuccessful and he was little heard of again.

De Dion on one of his petrol-driven tricycles. A photograph taken towards the end of the last century.

Petrol-driven Vehicles

Freed from the objections and from the continual hindrance of Trepardoux, de Dion and Bouton formed a new company for the manufacture of petrol engines and vehicles. Whilst they made the heavier types of steam vehicles, such as steam buses, which were once popular in France, they realised that their chief successes must lie in the direction of the petrol-propelled vehicle.

In his little experimental workroom-laboratory at Puteaux, Paris, the Count de Dion worked night and day in 1895, on the production of a miniature yet reliable petrol engine. He produced a 4-stroke single cylinder engine which developed one-half horse-power. It had electric ignition, in contradistinction to the engines of other makers which were fired by the hot-tube method. De Dion's method of engine ignition comprised a coil and accumulator, a fallible device at the best in those days. But the method was persevered with until many of its weaknesses were eliminated.

The first product of the Puteaux factory of de Dion-Bouton was a motor-tricycle. It sold well, became fairly popular and attained a name for reliability. Other firms copied its details and legal battles resulted.

Next came motor bicycles, still utilising the De Dion miniature engine, and finally, in 1899, came the first of the de Dion-Bouton small cars, the engine of which was rated at 3½h.p. and was water-cooled.

Small Car Engines

It was the De Dion engine unit which made the small car possible. Between 1899 and 1901, three separate car engines were forthcoming, these being rated at 3, 3½ and 4½ h.p. respectively. They were all water-cooled and they were incorporated into light cars of the two and four-seater type.

In 1900 and even a few months before, a few de Dion cars were seen in England. The motor vehicle as a practical, everyday possibility had arrived.

The demand for the de Dion-Bouton engines and cars was enormously greater than the supply. The Puteaux factory operated continuously in order to modify such a demand, but the task was quite an impossible one. Other car makers arose, and the de Dion products had to enter into a sphere of severe competition from which, however, they emerged unscathed.

In after years quite a number of car makers utilised de Dion-Bouton power units, makers such as Louis Renault and Louis Delage being particularly well-known users of De Dion engines.

Family Inheritance

On the death of his father in 1901 Count de Dion inherited the family title of Marquis, several millions of francs and the large country estate known as the Château de Maubreuil, at which he was born. But such an inheritance made no difference to his industrial energies.

The De Dion engine had become famous. Even before the first of the de Dion cars, the early flying pioneer, Santos-Dumont, had, in 1898, used a de Dion engine in his dirigible balloon in which he circled the Eiffel Tower in Paris.

De Dion engines began to be copied by other makers. Even their name was illegally adopted. Eventually there arose a distinction between de Dion engines and *genuine* de Dion engines!

The majority of the first London taxis carried de Dion engines. De Dion engines began to be fitted into motor-boats. Thus it was that on land, on water and in the air the de Dion power unit proved on many occasions its efficacy and reliability.

As a man, the Marquis de Dion was a mixture of many types. His chief characteristic was complete indefatigability together with interests of the widest kinds. He conceived and founded the famous Automobile Club of France, an organisation which was responsible for many epoch-making trials and races on the Continent. He was also the founder of *L'Auto*, a very popular French motoring paper which appeared daily, and was devoted not only to the motor industry but to sports and pastimes as well.

In 1922 the Marquis founded and equipped a "School of Apprentices" in connection with the motor industry in France, its aim being to obtain and train competent recruits to the engineering trades.

Deputy and Senator

As far back as 1891 the Marquis de Dion had been elected *Deputy* (or M.P.) for the town of Nantes. He held this honour right up to 1923, when he was returned as a *Senator* in the French Parliament for the Department of Loire-Inférieure.

Even the French Aero Club acclaimed de Dion as its "parent." Ever interested in the mechanical problems of flight, he was President of the Club from 1898 (the year of its foundation) to 1905.

Known as the "Father of the French Motor Industry," the Marquis de Dion, throughout a long, crowded life, not only served his country but served humanity. He was a humanitarian first and an industrialist afterwards.

The aged Marquis, indeed, leaves behind him, at least in his own country, a tradition which, being essentially well founded, will linger long.

Notes and News

Lyons International Fair

THE next Lyons Fair takes place from April 12th-21st, 1947, under the Presidency of Mr. Edouard Herriot. This will be the second post-war opening, the first having taken place last April, only six months after the Exhibition buildings had been de-requisitioned.

Several improvements have been planned which will make the Lyons Fair of 1947 bigger and more attractive than any of its predecessors. There will be space for more than 5,000 exhibitors in the four storeys of the Grand Palais. The huge single span building of the Hall de la Mecanique is being enlarged by 10,000 square feet.

The 1947 Exhibition will be truly representative of French industry as a whole and many other countries will also be represented. The Swiss Government has taken a whole gallery of 21 stands for a group exhibit of the watchmaking industry.

Lyons Fair seeks the coveted first place in Continental European Fairs which in pre-war days was the indisputable prerogative of Leipzig.

G.B. 16mm. Film Library

FROM G. B. Equipments, Ltd., comes news that the G.B. 16mm. Film Library is preparing to return to London, after six years at Woodchester, home of the Library since November, 1940.

New and extensive premises have already been acquired at Perivale, Middlesex, where all 16mm. film distribution will be conducted. Easier access to railways and postal centres will result in an even speedier film service, a service which never failed even during the most difficult periods of the war.

This move by the G.B. Film Library, together with the proposed centralisation of all G.B. Equipments' Executives at new premises in Regent Street, London, is clearly in line with the vast new 16mm. distribution and manufacturing programme in both Home and Overseas markets.

Following on the recent agreement between J. Arthur Rank and the Bell Howell Co., manufacture in Britain of new 16mm. projectors of the latest design has already started. Major plans for 1946-47 film distribution have already been settled. They include many new feature films, some in 16mm. Technicolor, and much new material on exclusive subjects such as "Secrets of Life" and special children's films. A continuous flow of new subjects will take in many films—new in 16mm. to Britain—hitherto controlled only by the Bell Howell Company. G.B. Equipments will also handle the distribution of the many new G.B. Instructional Classroom films, some of which are well on the way to completion.

SPREAD THE GOOD NEWS

An increased paper ration has been announced, and commencing with the December issue of PRACTICAL MECHANICS *more copies will be available.*

For many years thousands of our readers have had to borrow from a friend and although the number of copies that may be printed is limited these readers now have a good chance of obtaining copies regularly from a newsagent provided an order is placed immediately.

Do not delay, as the extra quantity we shall be printing will soon be exhausted, so order now for the issued dated December.

The drive for export stands high on this great development programme. The demand for G.B. 16mm. film equipment abroad still exceeds present production capacity, but this in no way affects the far-reaching Overseas distribution plans now completed for both 16mm. equipment and films.

Watch Your Bath

HAVE you ever noticed the direction in which the water runs down your bath plughole as the stream begins to form its vortex? A most learned discussion has taken place on this subject: some people say that the direction of the whirl was decided by the movement of the earth on its axis. The point is open to debate, but if this theory were true, surely all the water in Australia would twirl one way, and all the water in England in the other. This is not so, and careful examination will show that the right- or left-hand turn is decided by the manner in which the water leaves the bath. It is the turn of the pipe, the grid, or the small piece of solder left behind which gives the initial push to the "river." There is, of course, a relevant question, as the lawyers say. Should rifles be rifled right hand or left hand, dependent on where they are to be used, or should the sights be altered accordingly? The twist of the Earth and the twist of the bullet work together to hold the projectile straight. It is an admissible subject for after-dinner discussion in the best families.

The Air Show at Radlett

AS part of a well considered export drive the Society of British Aircraft Manufacturers recently opened a two-day show of aircraft, motors and equipment at the Handley-Page airfield at Radlett, Herts. Fifty-five 'planes gave a display of Britain's newest aircraft, and about 3,000 overseas buyers and experts attended.

Newcomer as it is to aviation, jet propulsion influenced the entire exhibition. In the display hall were the latest types of gas turbines built by such firms as de Havillands, Rolls-Royce, Bristols and Vickers.

On the stands of other manufacturers were models of landplanes and flying-boats, some under construction, and some projected, which will be powered by jet engines.

Experimental Machines

On the airfield, lined up among other aircraft, were several experimental machines, pointers to the future.

Of particular interest was a Lancastrian—civil version of the Lancaster bomber—fitted with two Rolls-Royce Nene jets as outboard motors, with two ordinary Merlins retained at the inner positions. This is an entirely new combination, and during test flights the aircraft has flown on the two jets alone. The Lancastrian, however, is being used purely as a "flying test bed" in connection with experimental jet development.

America have also been carrying out experiments with a jet-propelled bomber, and carried out test flights early this summer. It was known as the Douglas XB 43 and resembled a glider in appearance, as its two jet motors were hidden inside the fuselage, leaving the wings clean. This machine is the successor to the XB 42, a piston-engined aeroplane of similar design which last December crossed America in five hours and afterwards crashed. The XB 43 was fitted with a pressurised cabin enabling it to reach a height of 38,000ft. without danger to the crew. Its cruising range was 1,400 miles.

Jet-propelled Machines

Much interest was shown in the Vickers-Armstrong 10-44 jet fighter and the de Havilland 108 jet-propelled experimental aircraft, designed for research into problems of high-speed flight. Both machines gave thrilling displays, flying low at speeds which brought them well within the compressibility barrier encountered near the speed of sound. The Gloster Meteor, which holds the world's speed record, gave a fine display of speed and manœuvrability.

Another interesting demonstration was of refuelling in the air. Two Lancasters took off almost together and, with a long pipe, one refuelled the other over the aerodrome.

Visitors also saw a Whitley bomber tow off the most revolutionary glider yet built in this country: the Armstrong-Whitworth 52 tail-less machine, which is the forerunner of larger power-driven tail-less air liners. After circling the aerodrome the bomber released its glider, which in free flight resembled a boomerang and showed surprising speed for an unpowered machine.

Mr. W. Humble, a Hawker test pilot, gave a brilliant display of aerobatics in a Sea Fury fighter.

British Aircraft at the Radlett Air Show

A head-on view of the "Hastings" four-engined multi-purpose transport 'plane in flight. The aircraft can carry Jeeps, 25-pounder guns, and 15 cwt. trucks.

General view of some of the 'planes lined up on show at the Handley Page airfield at Radlett, Herts. In the foreground is seen the D.H.108 jet propelled aircraft. It was while flying one of the latter machines that Mr. Geoffrey de Havilland lost his life over the Thames Estuary, last September.

An A. V. Roe Lancastrian with two gas turbines and two reciprocating engines (for landing) in flight at the show. Here all engines are in use.

(Above) The new Vickers Armstrong secret jet fighter, of which no further details are available.

(Below) The Handley Page "Hastings" Military Transport aircraft, powered by four Bristol Hercules 101 engines.

The Cunliffe Owen—Cierva W.9 Helicopter in flight at the show. This craft embodies jet reactive force for torque control, and is powered by a De Havilland Gipsy Six Series II engine.

Making a Spot Welder

Constructional Details of a Small Machine for Model Work and Light Shop Use

By "HOME MECHANIC"

MOST readers can soft solder and some can braze and weld, because these processes require little apparatus. Spot welding is entirely electrical, the two metals to be joined being brought to fusing temperature over a very small area, hence the term "spot." Briefly, the work is placed between two pointed electrodes, which are brought together with as much pressure as possible, and the current is then switched on for a fraction of a second. On examination, the metal is just joined over a pin spot. At the point of contact, the resistance is so high and the current so strong that the heat produced, C_2R, is enough to melt the metal. In practice, several spots can be placed side by side, but never one spot over another. Currents vary from 100 amps. upwards, and the voltages from 1.25 to 7.5 or slightly more. It must be understood that if these large currents are to flow at the low voltages mentioned, the resistance of the circuit must be very low. Hence, all leads are as short and as fat as possible, and the only material to use is copper of the best quality.

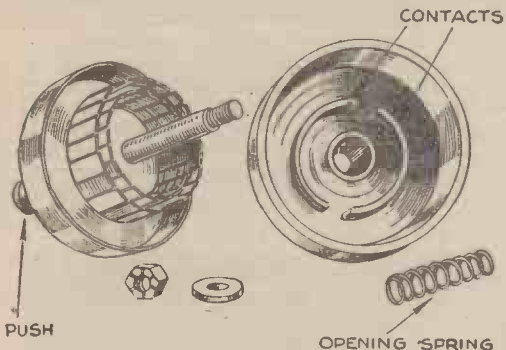


Fig. 1.—Details of the contact switch.

For Model Work.

In this article we only deal with a small machine for model work and light shop use. A spot welder can be used in almost any job that requires the quick, clean and sure joining of metals. Of course, a spot welder cannot make a watertight seam, and for this a special machine is required with revolving electrodes, etc. Since the advent of stainless steel, the welder has been very prominent in dentistry and other professions where fine wires require joining.

We cannot enumerate all the uses of the welder, but after one has been made and installed in the shop, it will be found as useful as the machine vice.

The two types of welder to be described are actually identical in detail, but the power supplies are different. The first is battery-operated, and the second draws its power from the mains through a transformer. Details for making a transformer will be given later. To supply the necessary current a six-volt high-capacity battery will be required. A car battery of the lead-acid type is quite good, especially if it can be trickle-charged from the mains. It must be a multi-plated cell of very low resistance and fitted with suitable and large terminal posts. The voltage to the electrodes is varied by changing the tappings on the battery. A suitable battery is one of the nickel-iron type. The big advantage of these cells is that they can be left for long periods without deteriorating in any way.

Simple Construction.

The actual construction of the welder is very simple and can be followed from the illustrations, Figs. 2 and 3. First obtain a good supply of copper rod, ½in. square; about 18in. will be required. The first welder, being battery operated, is actually mounted on one terminal post of the battery so as to do away with one lead.

The lower limb of the welder is 8in. long and is bolted to one terminal of the contact maker or switch. The pillar is 5in. long, and is fixed to the limb by a ¼in. copper bolt tapped into it. The two surfaces must be filled dead flat and the pillar must be at right angles to the limb. Screw up as tightly as possible, but remember copper is soft and will strip easily. When tight, soft solder must be flushed all round the pillar to make a good join, and, if possible, get it to run between the metals. The top arm is movable and hinged over the pillar. In order to make this arm free to move and yet obviate side play, i.e., so that the electrodes will meet when they are closed, the suspension bracket is made as wide as possible; in this case about 4in. The top arm is a little larger than the bottom and is drilled with a 5/16in. hole 2in. from one end. Through this hole a rod has to pass and is secured so that it does not make electrical contact with the arm. Reamer out the hole to a little over 5/16in. The supporting rod is of brass, ¼in. diameter, threaded any suitable number per inch. Study the various sketches to get a good idea of the general layout of the machine. Slip a length of thin-walled rubber tubing on to the rod and then push this into the arm. It should be a tight fit. Screw up the nut tightly, so that the arm is rigid (Fig. 5). Test on 6 volts and then on 230 volts, just to make certain. The bracket is of brass strip ½in. by ⅛in. bent to shape and fixed to the pillar with one screw and soft solder. It will be observed that the arm is insulated from the remainder of the machine. The upper arm is centred over the lower and held in place by two nuts on either end of the threaded rod.

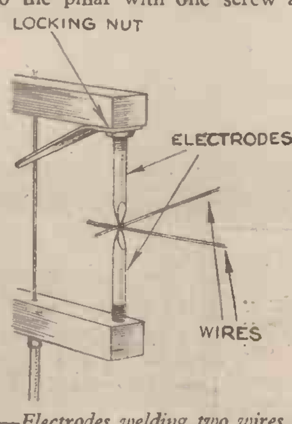


Fig. 2.—Electrodes welding two wires at right-angles.

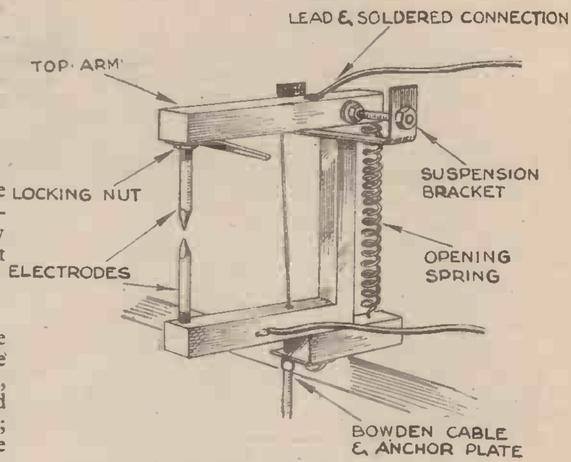


Fig. 3.—The complete welder.

Electrodes.

These are made from 3/16in. or ¼in. diameter hard copper rod to any shape desired. It is essential that the welding current, in order to get a spot, be concentrated to or over a small area, and therefore the electrodes are blunted to form a flat point of approximately 1/32in. diameter, depending, of course, on the material to be welded and the capacity of the machine. For thin steel plate of tin-plate gauge, a diameter less than 1/16in. should be used, the point to be quite flat and kept in this condition by an occasional touch with a fine file. The pointing of the electrodes can be easily accomplished with a file. Make the points fairly blunt, but do not have a long taper to them like a needle. The heat of the weld will soon soften the end, causing mushrooming, and faulty welding will result. The upper and the lower electrodes are both the same for simple plate welding and should be about 2in. in length. Each one is screwed into its respective arm and adjusted so that the points meet.

A Useful Tip.

A good plan is to make some electrodes larger than others so that the gap is not in the centre, but can be made higher or lower according to the electrodes used. This is an advantage when awkward slopes are being welded. The electrodes are threaded any convenient size and then fixed in holes in the arms. In order to lock them in the arms make small adjusting or locking nuts from strips of copper and tip them to fit the electrodes. A pair should be made for each pair of electrodes and must be fitted to them; this will save a lot of time when the pairs have to be changed. We will deal with

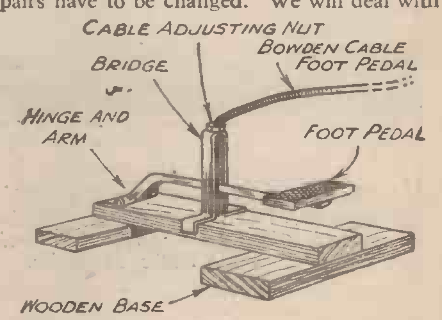


Fig. 4.—The foot control.

the types of electrode required before going on to discuss the method of using them for welding. In some cases it is necessary to weld on the outside of a cylinder, like the handle attachments on a tin can or "billy" can. A straight lower electrode cannot be used and a special swan-necked one is required. Make this from similar material as before, and turn up the end to just touch the upper one. The depth of the neck will depend on the distance along the tube that is required to weld, but if this is greater than 1in. or so, make the electrode from stouter material. A swan-neck is required for all work where the article is said to be undercut, such as rings and tubes of no great length, etc. (Fig. 6). Wires have frequently to be welded together at right angles and at a simple tap joint. In these cases, straight electrodes must be used with grooves in them to accommodate the wire. The depth of the groove must be just under half the diameter of the wire, as its function is to firmly hold the wire and get as big a current as possible. For right-angle welding, the grooves are at right angles, and in the same line for top joints (Figs. 2 and 7). Of course, they can be in any other intermediate position.

The Contact Switch.

In the original machine this was very successful and was a starting switch from a motor-car (Fig. 1). We advise readers to obtain a switch rather than to make one. A suitable one can usually be obtained cheaply from a "breaker's yard." Dismantle the switch and clean it, trim the contacts and make them true, and remove the powerful spring that normally works the switch, and fit a light one. If your switch is foot-operated, this is essential because it is hand-operated on the welder. It should be possible to make contact with one finger and yet the switch must open quickly.

Oil the sliding mechanical parts but not the electrical ones. The switch is bolted directly to the bottom arm of the welder by the contact screw on it. It is a good plan to make this contact to the frame of the switch so that both are firm mechanically and a good electrical join results. The other switch contact is connected to one pillar of the battery. To keep all leads as short as possible, it is necessary to have this contact welded to a battery terminal clamp; the usual battery clamp is ideal, but the weld must be a good heavy job. If the battery is fitted with screwed terminal posts as in traction batteries and crane batteries of the nickel-iron type, the switch is fixed directly on to the pillar by the terminal nut. This gives a good electrical contact.

Bringing the Electrodes Together.

Some device must be fitted to the machine for bringing the electrodes together, and the simplest is a coil spring between the arms. This must, of course, be insulated from the top arm, and if a spring is fitted a means for opening the contact is required. The best way of doing this is to fit another spring to keep the arms open and to close them to suit your own needs. This is done by using a Bowden cable and foot pedal (Fig. 4). A length of Bowden cable such as used on cycles is ideal. The method of connecting up is very simple. First make a small arm about 1in. long and fix this on the upper electrode arm supporting rod, using lock nuts, etc. The arm is made from sheet brass and is soldered or brazed to a nut to screw on the rod. The arm must not turn on the rod, and it has to be well made and quite strong as considerable pressure can be brought on it by the foot pedal. A small catch is fixed on the

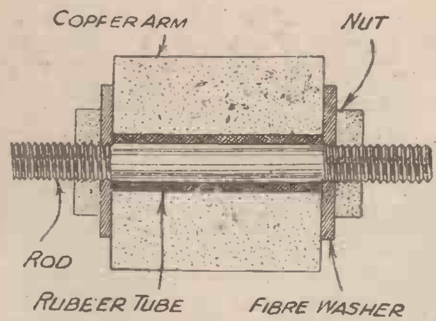
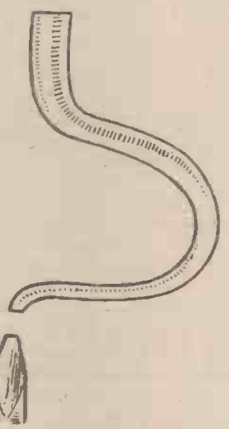


Fig. 5.—How the top arm is insulated from the supporting rod.

lower arm or pillar to which is anchored the outer cable.

The Foot Pedal.

The foot pedal is very simple to make, and can be just a board hinged to a fairly heavy base, the cable being anchored in the usual manner. The simple foot control shown is more robust, and is very simple to make and easy to handle (Fig. 4). It consists of a mild steel strip, $\frac{1}{2}$in. by $\frac{1}{4}$in., with a treadle, $1\frac{1}{2}$in. by 2in., welded on one end. The other end is welded to a simple wood hinge which is screwed to the baseboard. A bridge piece from $\frac{1}{2}$in. by $\frac{1}{2}$in. strip is bent over the arm and screwed into the base. A fine hole is drilled through the bridge to take the wire which passes through a hole in the pedal. At one end the wire should be easily adjustable so that, when necessary, any slack can be taken up. Grease the wire well so that the arm opens quickly when the foot is removed from the pedal. A connection made from a short length of cable, as flexible as possible, must be fitted to the top arm. For this make up your own sample, having first determined the minimum quantity required by trial with a length of stiff wire. Take about $\frac{1}{2}$lb. of No. 20 wire, anneal it dead soft and clean and straighten it out. Cut into lengths as required and twist them all together to give a firm yet flexible cable. Solder one end to the top spade terminal to make a good contact to the battery.



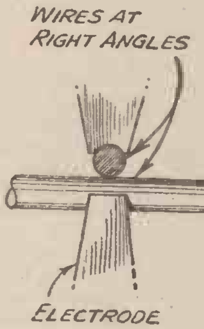


Fig. 6.—(left) Swan-neck electrodes.
Fig. 7.—Position of electrodes for wire welding.

Operation

Connect everything up. Place the battery and welder on a bench of suitable height, and connect the flexible lead to the lowest voltage say, 2 or 1.25. Place two thin pieces of steel plate between the electrodes and bring them together with moderate pressure. Close the circuit for 1/25 second (this may sound impossible, but it only requires a touch on the switch). The metal between the electrodes should not flow, because if it does so the weld has been too long. A little practice will soon produce good results.

For the benefit of readers interested in the subject of spot welding, a short article will be published in the next issue of PRACTICAL MECHANICS giving particulars of how the battery-operated spot welder described above can be adapted for use on A.C. mains. The chief additional component required is a transformer, and details of this will be given in the article.

Radio Frequency Crack Detector

THE accompanying illustration shows the G.E.C. Radio Frequency Crack Detector, M.914, which will indicate the presence of cracks and seams in ferrous or non-ferrous metal parts, and will also indicate depths from 0.001in. to 0.25in. Compared with other methods it is quick and certain, eliminating the variable accuracy that is an inherent weakness of visual inspection. It is direct reading, no interpretation being necessary, after setting it can be operated by unskilled labour, and it allows a rate of inspection that is suitable for rapid production-line testing work.

Operation depends on the facts that R.F. currents travel on the surface of materials and that any surface crack will interfere with the flow of current. The material to be tested is passed through a coil that forms part of a tuned circuit, and the alteration of the frequency of the circuit due to cracks operates frequency selective relays; these cause a lamp to light, and the depth of the crack is indicated on the dial of the instrument.

Applications.

There are applications for this crack detector wherever bar stock, wire or strip from 40 S.W.G. are to be tested, and also for the testing of round or hexagonal material, tubes, angles and channels within the same limits of size.

Radio Frequency Crack Detector.

New M.G.M. British Studios

Particulars of the Electrical Power Equipment and Other Studio Requirements

AT the present time the British film industry is much concerned with securing an international outlet for its productions. In particular, the aim is to sell in the American market. To achieve universal exhibition the productions must be inherently suitable; but the best films in the world ultimately depend for their success on the services of an international sales organisation that can guarantee release in those countries where a film is likely to have a popular appeal.

Among the companies making films in this country, M.G.M. British Studios, Ltd., have the advantage of operating a long established international sales organisation. It was this that ensured the success of M.G.M. British-made films in America and elsewhere.

M.G.M. production in this country started in 1937 with "A Yank at Oxford"—a film which had a notable reception in America. Subsequent M.G.M. productions enjoyed an equal success both in America and other countries. Films like "Good-bye, Mr. Chips," "The Citadel," and "Perfect Strangers," although typically British, were almost as widely acclaimed in America as in this country.

Because M.G.M. British Studios, Ltd., are in the happy position of being able to make films that are guaranteed general release in America and throughout the world, there is no need to restrict costs to a level that results in a falling short of the highest present-day standards.

The certainty of an international outlet, together with vast production resources at Culver City, California, which can be drawn upon for British production, means that M.G.M. can definitely ensure the quality of future output.

Expansion of Studios

Looking ahead during the war, M.G.M. decided to expand extensively their production schedule, and in 1944 acquired some new studio buildings at Boreham Wood, Elstree, Herts. Being at that time used for aircraft production, the buildings were very incomplete as studios. Construction had commenced in 1938, but was stopped by the war, and the site taken over by the Government. It was released some months ago, and now every effort is being made to have the studios in action by the latter part of 1946.

Building construction is being carried out by Sir Robert McAlpine and Sons, who were responsible for the original buildings.

Messrs. Guy Morgan and Partners are the Architects and Consulting Engineers for M.G.M. They are being advised technically by Mr. Sidney Moore—associated with M.G.M. of Culver City—who has come to this country to give the British technicians the benefit of his long and extensive experience of Hollywood practices.

When completed, these studios will be the most modern in Europe, if not in the world. The area of the site is about 105 acres.

The total stage capacity will be 80,000 sq. ft. distributed between four studios. At the present time three studios are being prepared. Each contains a stage having an area of 20,000 sq. ft., that is 100ft. by 200ft., with 45ft. head room. In two of the studios the whole area of the stage may be used for a set, or it can be divided into two separate stages of 8,000 sq. ft. and 12,000 sq. ft. respectively. Thus the total stage capacity of the three studios can be arranged to provide three, four or five areas to meet varying production requirements. Ultimately a fourth 20,000 sq. ft. divisible stage will become available, thus providing a final studio area of 80,000 sq. ft., and a maximum number of seven stages.

The activities of the studios have to be supported by administrative offices, workshops, projection theatres, sound recording rooms, "still" photographic studios, stores, dressing rooms, restaurant, and so forth.

To meet the heating, lighting and power requirements of the studios and ancillary buildings a large boiler house and a comprehensive electrical power plant are being installed.

Electricity is indispensable to the making of films. Not only is it the source of the vast amount of light needed to illuminate the sets, and for sound recording, but it is also essential for general utility lighting, power for compressors, pumps, workshop equipment, projectors, labatory apparatus, tabulating machines, and for a variety of both everyday and specialised applications.

With studios of this magnitude, the demand for electrical power is considerable. The greater part of the electrical demand is occasioned by the supplies to the studios themselves, where the major requirement is for lighting, especially as the production programme planned aims at using colour for most of the films. Colour photography needs an intensity of lighting of roughly three times that required for black-and-white photography.

Air-conditioning Plant

Another important use of electrical power is for the motors and equipment associated with the air-conditioning plant. To achieve the finest photographic results, it is essential that the studio atmosphere should be pure and dust free. Also, in this country every precaution must be taken against the entry of fog and mist. Production schedules are skilfully planned to achieve maximum output, and producers cannot afford to waste precious time by tolerating delays occasioned by misty studio atmospheres. To this end, the air-conditioning plants are designed on the Plenum system, whereby the studio interior is maintained always at a pressure slightly higher than that of the outside atmosphere, hence there is a permanent leakage of air from the studio at a pressure which prevents the ingress of the ambient air. The intake air is washed and conditioned by plants which are the most effective it is possible to devise. To guard against delays arising as the result of the accidental ingress of fog, extractors are available to restore rapidly the requisite internal atmospheric conditions.

The studios also make use of special effects machines, such as the huge fans developing artificial wind, the pumping plant required for producing rain, and the special lighting equipment to produce lightning effects. All these machines are operated electrically.

Well-equipped Workshops

For building the sets and constructing mechanical and electrical devices essential to production, well-equipped workshops are being provided. There will be a carpenter's shop, responsible for a high percentage of the set construction work; and a machine shop, primarily concerned with the production of the variety of mechanical devices needed for special cinematic effects, but also engaged in general studio and equipment maintenance. Both these shops will contain modern machinery, electrically driven, the whole installation being designed to meet urgent production requirements with the utmost speed.

Electrical power is required for the electrical machinery in the pattern shop, where the plaster work is carried out; the wardrobe, which uses electric sewing machines, electric clothes cleaning machines, and a large number of electric pressing irons. The make-up department employs a large number of electric hair dryers, tongs, and, in fact, all the elaborate electrical equipment of an expensive coiffure establishment.

In the "still" photographic studios, which turn out a vast number of prints, often at short notice, electricity is used for such apparatus as guillotines, rotary copiers, and mercury vapour lamps.

The electrical power requirements are to be met by providing a low voltage A.C. supply for general power and lighting, and a low voltage D.C. supply for stage lighting and equipment.

Electric Power Plant

Incoming supply is received from the North Metropolitan Electric Supply Co.'s 11 kV system, and for general power and lighting is stepped down to 400/220 volts by two 500 kVA transformers. These transformers, and associated switchgear, were already installed when work on the studios was recommenced, and were in use throughout the war for the aircraft production plant operating on the site.

For the D.C. supply to the studios a comprehensive scheme involving transformers, high voltage switchgear, motor generators, low voltage switchgear, and a specially designed aluminium-bar distribution network is required.

Messrs. Crompton Parkinson, Ltd. (Chelmsford, Guiseley, etc.), and their associate, The British Electric Transformer Co. Ltd., are supplying the equipment, and the whole scheme is being engineered and carried out by the Contract Department of Crompton Parkinson.

The scheme entails three B.E.T. 1,600 kVA 3-phase transformers for stepping down the incoming 11 kV supply to 3.3 kV for the input to A.C. motor-D.C. generator sets. The transformers will be of the ON outdoor type, connected delta/star, fitted with off-circuit tapping switch, anti-vibration pads, conservator, double float Buchholz relay, silica-gel breather, and 6in.-dial safe-load indicator.

For controlling the 3.3 kV side of the transformers, and the A.C. motors, Crompton Parkinson are supplying a 9-unit, 3.3 kV, air insulated, horizontal draw-out, truck type cubicle switchboard, having a certified breaking capacity of 75 MVA. The transformer circuit breakers are manually operated, but the motor feeder breakers are solenoid closed. Rectifier equipment for solenoid operation is being installed, together with a 30 volt tripping battery.

For A.C.—D.C. conversion, six Crompton Parkinson motor generator sets will be installed in a substation. Each set comprises a 3.3 kV auto-synchronous motor driving two 250 kW, 120 volt D.C. generators; giving an output of [illegible]00 kW, 240 volts, 3-wire D.C. The three machines are directly coupled, with the motor in the centre, on a common bedplate.

The auto-synchronous motors will be designed to operate at unity power factor at all loads from no load to full load, with fully automatic control.

The transformers and motor generators are designed for the overloads permitted by the relevant British Standard; but in addition, to meet special demands, they will be capable of carrying 100 per cent. overload for 15 minutes, under certain conditions.

The D.C. supply is essential because the greater part of the set illumination—particularly when making colour films—is derived from arc lamps which are required to function silently and without variations of light intensity. Arc lamps are very sensitive to a ripple in the supply, which causes them to develop a hum. This would be highly objectionable as it would be readily picked up by the microphones on the set, hence the generators are being specially designed for the minimum ripple. In addition, a smoothing system of laminated chokes, and condensers, will be installed in the outgoing D.C. feeders. These methods of minimising ripple will obviate the use of the costly and cumbersome portable chokes necessary in most of the studios throughout the world.

An elaborate 20-panel D.C. switchboard will control the output from the generators, and the outgoing feeders to the studios.

Three Circuits

The outgoing feeders will be 3-wire, and consist of aluminium bars. The feeders are to be carried overhead to the studios, hence the use of aluminium lessens the weight to be supported, and is economical. Inside the substation the conductors will be supported from the ceiling and will pass to the studios mounted between the truss members of the roof construction of a covered way. There will be three 240/120 volt feeders to a studio, and each will supply a separate distribution main made up of aluminium bars mounted at high level on brackets fixed to the grid steelwork above the stage.

Two of the circuits will each have a capacity of 15,000 amps, thus providing a total capacity of 30,000 amps for general stage lighting.

This capacity is to be provided in consequence of three of the four stages being divisional, and therefore available for shooting two colour sets at the same time. Also the feeders are to be designed with a view to extensions for future stages.

Each studio distribution main, or busbars, will encircle the entire stage at runway to feed eight distribution centres at various points of the stage. At each distribution centre there will be a 3-wire switchboard made up of a main 2,000-amp. air circuit breaker; four 400-amp. air circuit breakers, and three 400-amp. contactors controlling sub-feeders, together with two 30-amp. air circuit breakers for low current supply. The 400-amp. contactors are remote controlled from a portable panel on the stage floor, for the purpose of obtaining blackouts and other effects.

Special Effects Supply

The third stage circuit—quite separate from the other two—will have a capacity of 4,000 amps., and is to be used for "special effects" supply, such as lightning and dimming; and apparatus requiring special voltages. This circuit will be separately supplied from one of the generators through a set of busbars, distinct from the main bars, and to which a generator can be independently connected by means of a throw-over switch. The generator field will be remote controlled from the stage to enable the voltage on the circuit to be lowered for dimming shots. It will also be used for special effects where the large amount of current required might interfere with other shooting companies, or when lower or higher voltages are needed.

The aluminium bar mains are to be protected by a substantial perforated sheet metal cover. Expansion links consisting of foliated aluminium will be provided where necessary, to avoid any undue stress or distortion arising from expansion caused by the heating of conductors.

The whole of the substation and distribution equipment has been designed to meet the power requirements of the studios where production arrangements may necessitate the plant being heavily loaded for many hours a day.

We are indebted to Mr. Ben Goetz, Chairman and Managing Director of M.G.M British Studios, Ltd., for permission to publish this information, and to Mr. Sidney Moore, and Messrs. Crompton Parkinson Ltd., for its compilation.

Items of Interest

"Pumping Without A Pump"

THERE are many applications of pumping in industry, but it is not necessary to install a pump for intermittent use if compressed air is available. The automatic unit, shown in the accompanying diagram, shows how liquids can be pumped from one level to another by this method, using only the two containers necessary to hold the liquid.

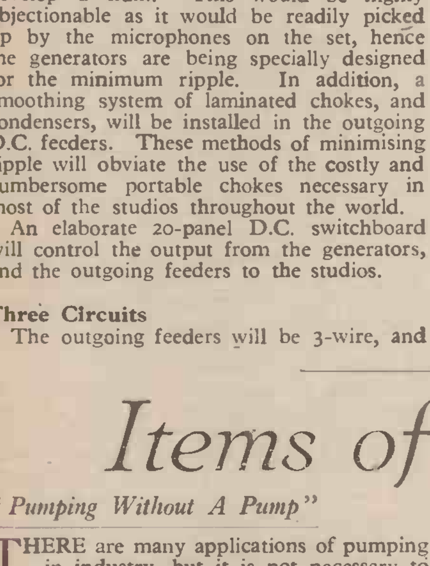


Diagram illustrating the working of the compressed-air pump.

The lower tank, which may, of course, be quite a considerable distance from the higher, must be designed to withstand the maximum air pressure necessary to force the liquid to the required height, and the fitting of a safety valve is a wise precaution. The lower tank can be filled either through a supply pipe or by means of a funnel as shown. When the necessary quantity of liquid has been passed into the tank, the filling valve is closed and compressed air is admitted to the surface of the liquid. This has the effect of forcing the latter into the internal pipe, and up the delivery main to the high level tank. If desirable, gauge glasses can be fitted to show the level of the liquid remaining in the lower tank.

The air pressure required can very easily be calculated. If water is the medium to be handled, the pressure is merely .434 × total lift, plus friction.

For any other liquid, specific gravity must, of course, be taken into account.

The time taken to empty a tank of given dimensions with a specified size of air compressor can also easily be calculated by using simple rules. Having decided upon the pressure which will be required, the volume of free air necessary to fill the lower tank at this pressure and so displace the liquid is very quickly arrived at.

Handling Acids

It will be realised that in chemical processes this method of handling acids and other corrosive liquids is very convenient. Any other type of pump would, of course, require to be manufactured of very special and expensive materials.

Another use for compressed air based on this principle of displacement is the emptying of barrels, drums and other small containers. In this case great care must be taken that the very low pressure required is not exceeded, as such small vessels are usually not designed to withstand more than a few pounds per square inch pressure. Naturally, a screwed fitting is required to prevent the escape of the compressed air.—"*Broomwade*" *News Bulletin*.

Reflectoscope Detects Flaws

ACCORDING to a recent announcement by Dr. Floyd A. Firestone, of the University of Michigan, supersonic soundwaves are being used by the newly devised "Reflectoscope" to detect flaws in solid materials.

The reflectoscope uses a quartz crystal to transmit short sound pulses into the material to be tested.

An Automatic Bottle Sealer

WE have just had the opportunity of inspecting an efficient bottle-sealing device which is being manufactured in Australia. As shown in the accompanying illustration, the detachable device is clipped round the neck of a bottle, and the spring-controlled handle, when pressed down, lifts up the sealing cap to allow the contents of the bottle to be poured out. The bottle shown in the illustration is of the crown type, but the new bottle sealer can be made to suit any type of bottle. The inventors of this automatic bottle sealer wish to dispose of the invention, either by direct purchase of the patent or on a royalty basis.

Any firm or reader interested should communicate with Messrs. Ings and Lakey, Rosemount Hotel, Fitzgerald Street, North Perth, Western Australia.

The automatic bottle sealing device.

Transformer Building

The Design and Construction of Small Static Transformers

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

FEW of the smaller electrical appliances within the scope of the amateur constructor offer a better return, and surer results, from his efforts than the transformer. Its design can be calculated and its working characteristics predetermined within close limits, while the constructional work it entails is of the very simplest.

Technically speaking, the term "transformer" can be used to describe apparatus widely differing in principle and operation; there are rotary transformers, static transformers, voltage transformers, current transformers, etc., with further variations in the way of auto-connections and independent windings. It is correct to speak of rotary transformers only for direct current operation, their purpose being to transform direct currents from one voltage to another. Static transformers are those which deal entirely with alternating currents or the transformation of one alternating voltage to another. Apparatus itself, from direct to alternating, or *vice versa*, comes under the description of converters, and should not be confused with transformers.

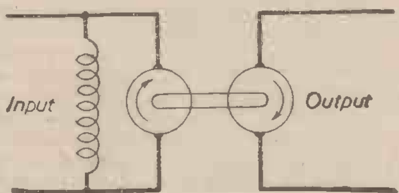


Fig. 1.—Diagram of a rotary transformer.

Rotary Transformer

The rotary transformer, shown in diagram in Fig. 1, is used for stepping up or stepping down direct currents from one voltage to another, and is a running appliance similar in construction to a direct-current electric motor but having two windings on its armature. One of these functions as a motor winding, the other as a generator winding, the latter being connected to a separate commutator and set of brushes. By this means an output voltage differing from the input volts can be obtained according to the ratio existing between the turns in the two armature windings. Machines such as these naturally involve a considerable amount of work and skill in fashioning the running parts; also, they are subject to wear and tear which is absent entirely from the static or A.C. transformer. The latter is an absolutely stationary device; there are no moving parts. But energy in some form must be supplied to it as an input before any output is possible. If connected to a D.C. circuit it will not function as a transformer at all. What, then, is the form of energy communicated to it when connected to an A.C. circuit?

There is no visible motion with which we are accustomed in the case of most electrical and mechanical devices. The answer to this lies in the fact that although motion is unquestionably present, it takes the invisible form of a rapidly oscillating magnetic flux in the molecules of the iron core, and these in their turn cause strong reactions in the stationary copper coils surrounding the core as the flux threads them first in one direction and then the other at a high rate of speed. In the rotary transformer it is the armature coils that move in a stationary magnetic field; in the static transformer it is the magnetic field or flux which moves through a system of stationary coils. The two ideas are expressed in Figs. 1 and 2.

Armature Windings

The D.C. rotary transformer in Fig. 1 shows two armature windings on one core, rotating together on one shaft, the motor commutator and brushes in connection with one set of windings, the generator commutator and brushes at the opposite end. The fields are excited by the input current which drives the armature also as a motor. Motion is represented by the curved arrow, and remains continuously in one direction. In Fig. 2, which is a conventional diagram of a static transformer, all the parts—namely, iron core, primary and secondary coils—are stationary and it is the magnetic flux that moves rapidly to and fro through them with every reversal of current in the primary coil, the rate of motion responding to the frequency of the supply, usually 50 cycles per second, or 3,000 cycles per minute. The flux speed is thus easily comparable with the rate of armature revolution in the D.C. type of transformer. If a static transformer were connected to a D.C. supply there would be no motion of the flux after the instant of switching on or off, hence there would be no reaction or transformer effect in the coils.

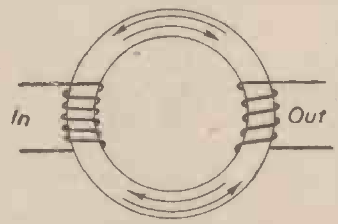


Fig. 2.—Conventional diagram of a static transformer.

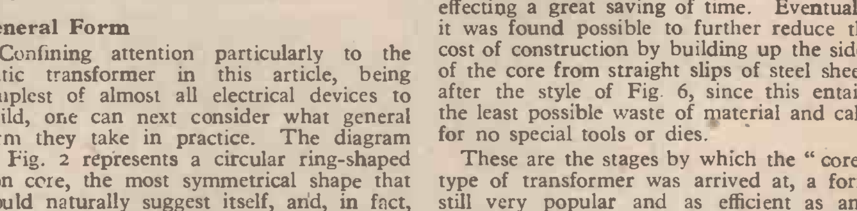
General Form

Confining attention particularly to the static transformer in this article, being simplest of almost all electrical devices to build, one can next consider what general form they take in practice. The diagram in Fig. 2 represents a circular ring-shaped iron core, the most symmetrical shape that would naturally suggest itself, and, in fact, the one adopted by early experimenters. It presents rather obvious disadvantages, however, from the maker's point of view when it comes to hand-winding a large number of turns of wire, all of which have to be threaded through the centre of the ring. This would take a long time, and inevitably lead to rather an untidy finished appearance as they could not lie closely on a curved surface. Practical considerations soon decided, therefore, that a plain straight core was necessary to accommodate the coils. Why not, therefore, a plain straight core like that of the induction or spark coil? This form proved easy enough to wind, but resulted in unexpected difficulties, the chief of which was excessive magnetic leakage owing to the great air-gap existing between its two ends. Every magnetic line generated in an iron core by reason of current flowing round an exciting coil has a complete circuit of its own. Fig. 3 illustrates this. Current from the battery flowing through a coil wound over the iron gives rise to a magnetic flux, one line of which is indicated. All lines leave the coil at one end and re-enter at the other. In completing their circuits they find an easy path through the iron, but a much more difficult one where they emerge into air, the result being to reduce greatly the number of lines set up by a given excitation. The same magnetising power of the coil can be used to far greater effect if the length traversed through air can be shortened. In other words, instead of an "open" magnetic circuit, a closed circuit should be aimed at, so that the lines encounter the least possible resistance. Since the circular form of closed core is open to objections already pointed out, the alternative is a core of rectangular shape, such as Fig. 4. Here the magnetic lines have an all-iron path and the exciting coil lies on a straight limb, making it easy to wind, so that two distinct advantages have been secured. But still the transformer would not be easy to wind if the core were made in one piece, owing to the necessity of threading the wire through the centre opening. The idea of building the core in separate parts was the next step forward, the result being a two-piece construction, as Fig. 5.

Independent Coil Winding

This allows of the coils being wound independently, insulated, and afterwards slipped over the straight limb of the core, thus effecting a great saving of time. Eventually it was found possible to further reduce the cost of construction by building up the sides of the core from straight slips of steel sheet, after the style of Fig. 6, since this entails the least possible waste of material and calls for no special tools or dies.

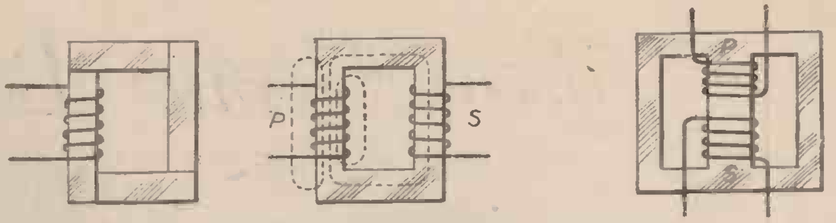
These are the stages by which the "core" type of transformer was arrived at, a form still very popular and as efficient as any. There is another form preferred by some, known as the "shell" type, Fig. 8. In this it is the centre limb that receives the coils and the magnetic flux after threading them divides up the right and left at the ends, returning by the yoke or outer shell. Since the shell thus carries only half the



Figs. 3, 4, and 5.—Diagrams indicating magnetic flux, and shape of transformer core.

total flux its sectional area can be reduced to half that of the centre limb. Stampings for these cores are obtainable in two forms, one a "TU" shape, the other an "EI" combination, Figs. 9 and 10.

The positioning of the two coils, primary and secondary, on any of the foregoing cores is a matter of some importance. In the shell type both coils naturally are wound on the centre limb, and there is no choice of position, but in the core type two arrangements are possible. For the sake of symmetry one would naturally incline towards putting the primary on the one limb and the secondary on the opposite one, but there are objections to this course, not at once apparent. If Fig. 7 is examined, where this method is illustrated, with the primary and secondary coils separated on opposite limbs, it will be clear that the magnetic lines generated by coil P will have a tendency, when heavily loaded, to leak away, as shown by the dotted lines, so that they do not wholly thread the other limb of the core, but leak away on shorter circuits without threading the secondary coil S. Any loss so entailed upsets the true voltage ratio between the two coils, and the "regulation" of the transformer suffers accordingly. The best practice, therefore, is to wind both the primary and the secondary coils on one and the same limb; this restricts the magnetic leakage effects to a minimum. With the same object in view the secondary coil should be wound next to the iron core, with the primary coil encircling it.

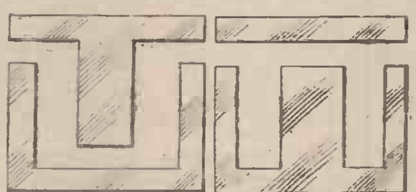


Figs. 6, 7 and 8.—Various types of transformer cores, and disposition of windings.

Laminated Construction

In all alternating current devices and transformers in particular, there is a reason for using thin stampings instead of solid bars or castings, as a laminated construction checks the formation of heavy cross currents in the substance of the core when it is subjected to an alternating magnetic flux. These, known as "eddy currents," would cause serious heat losses, and it would be impossible to keep the temperature of the whole transformer down to a reasonable figure without this precaution. Currents such as these circulate in a direction at right-angles to the flux in the core itself (see Fig. 11), and as they are generated at very low voltages a relatively small resistance in their path reduces them to a harmless extent. When the stampings are sufficiently thin, the natural scale or oxide on their surfaces forms almost sufficient resistance by itself, but in practice it is usual to give additional protection by coating one side of the stampings with very thin paper, or spraying them with a special insulating varnish.

Not only must the iron core be laminated, therefore, but the choice of material from which it is built is of importance. A definite magnetising force produces a much greater response in some grades of iron or steel than in others. Materials having a high "permeability" are, therefore, essential, and equally so is the ability of the iron to follow the rapid reversals of flux directions with as little lag as possible. Magnetic lag, or "hysteresis," means a loss of energy and lowers the overall efficiency as well as increasing the core temperature. Fig. 12 serves to illustrate both these points. An alternating magnetising force applied to the core first in the direction + H causes a response in the iron indicated by the curve


Figs. 9 and 10.—Two forms of transformer stampings.

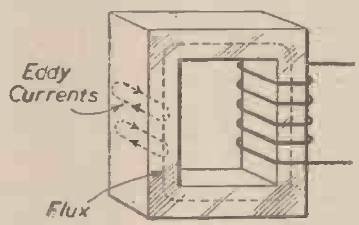


Fig. 11.—Showing the formation of "eddy currents" in a solid iron core.

a b. When the exciting current dies down again to zero before reversing, the magnetisation does not fall to zero, but remains at some value *c*, a little higher than the point *a* where it is started. This is due to a certain hardness or "retentivity" of the iron. A further magnetising current, *d*, therefore becomes necessary in the opposite direction, H –, before the iron can be brought to zero condition again. The same thing happens with the second half cycle of magnetisation, when current is reversed through the exciting coil. The results, if plotted out in the form of a complete curve, give a figure representing hysteresis loss in one complete cycle of magnetisation. The closeness or openness of this F-shaped curve represents magnetic friction, and is a measure of the suitability of the iron for its purpose. The smaller the area enclosed by the curve, the fewer watts will be wasted in iron losses and the higher the overall efficiency.

Material for Stampings

Although "Stalloy" may be regarded as a standard material for use in transformer cores, a good deal of interest centres round some of the newer alloys of nickel and aluminium with iron, such as "Permalloy," "Perminvar," "Mumetal," "Radiometal," etc. Some of these have extraordinarily high permeability values at the lower magnetising forces. Others possess an extremely small hysteresis loss, a feature which is highly important from the designer's point of view in connection with radio work. Here the frequencies are much higher than those met with in commercial transformers. Their use in such work also permits of a striking reduction in weight and dimensions. For instance, the drawing to scale in Fig. 13 shows the comparison between the sizes of stampings for two radio transformers of similar output capacity, the large one in ordinary silicon-steel and the other in special nickel-iron alloy. Their relative weights are as 24oz. to 0.64 oz.

Permeability

A curious feature of some of these alloys is the way in which they are affected by the presence of the element nickel in varying proportions. The permeability of pure iron, for instance, is gradually lowered by adding from 10 per cent. upwards of nickel until a point where the nickel content reaches 30 per cent., when the alloy becomes practically non-magnetic. Further additions of nickel, however, have the rather surprising result of again increasing the permeability until a mixture of 78 per cent. nickel with iron gives an alloy superior in magnetic qualities to almost any other known substance. A small addition of copper, too, appears to further improve performance and stabilise the properties generally. Special alloys like these, however, are expensive, and their utility lies more in the line of radio work, where low magnetising forces, audio-frequencies, and minimum possible dimensions count largely. For general industrial work, Stalloy, or silicon-steel, practically holds the field.

(*To be continued*)

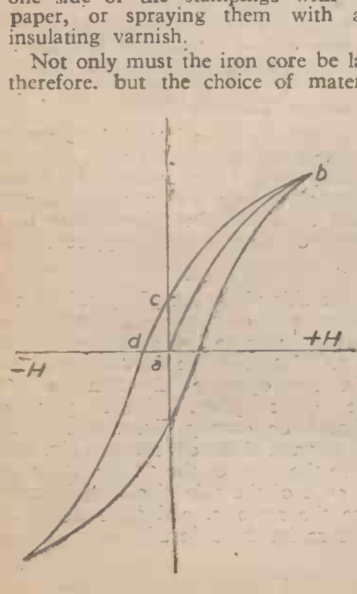


Fig. 12.—(Left) Diagram representing hysteresis loss.

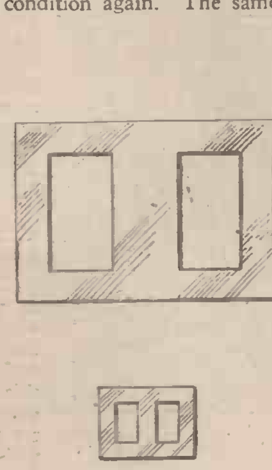


Fig. 13.—(Right) Comparison between the sizes of stampings for two radio transformers of equal capacity. The large one is of silicon steel, and the other of nickel-iron alloy.

Two Useful Ladders

Constructional Details of Handy Appliances for Household or Garden Use

By "HANDYMAN"

MANY uses can be found in the house and garden for the two small ladders shown in the accompanying illustrations, and which any handyman should not find difficult to construct.

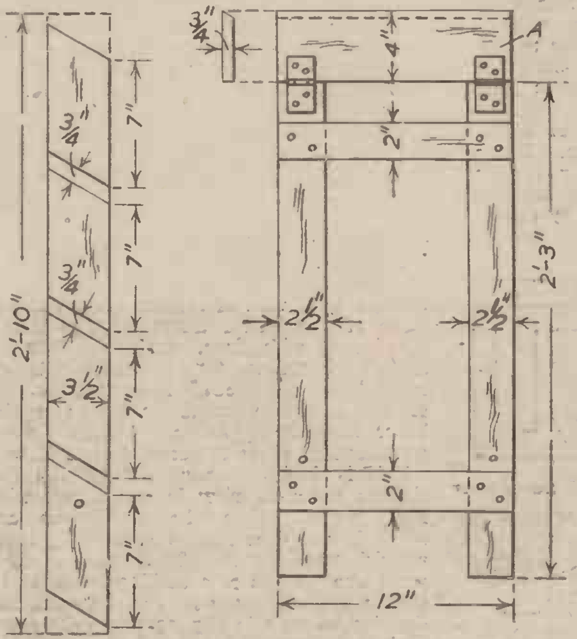


Fig. 2.—Details of sides, and hinged back support.

The light step ladder, shown in Fig. 1, is particularly handy for odd jobs in the house. There are three treads and a top board, and ordinary planed deal can be used throughout.

Marking Out the Sides

The first parts to take in hand are the two side pieces, Fig. 2, each of which is shaped from a 2ft. 10in. length of wood, 3½in. wide and ¾in. thick. On the side of one piece, mark out the slanting lines for the position of the treads. These lines, and those at the top and bottom ends, slope at an angle of 30 degrees, and they can be marked out with the aid of a set square.

With a tenon saw cut through the wood on the three pairs of sloping lines to a depth of ¼in., and, with a chisel, remove the wood between the saw-cuts to form recesses ¼in. deep. Saw off the top and bottom ends, and then mark out and finish the other side piece in the same way, except that the slanting lines must slope the opposite way across the wood.

The treads can be prepared next, and these are sawn from wood ¾in. thick to the dimensions given in Fig. 3. Fix the treads in place with two stout nails driven in through the side pieces, as indicated.

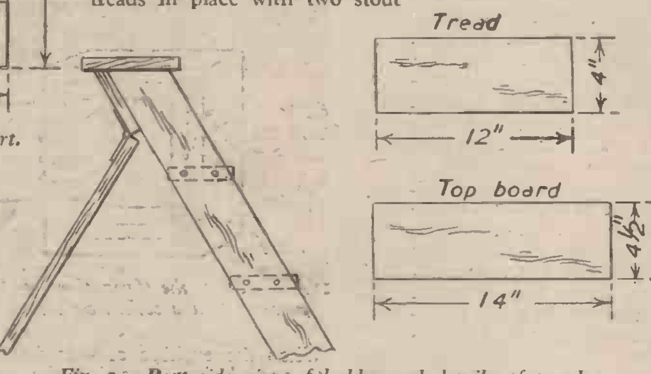


Fig. 3.—Part side view of ladder and details of treads and top board.

Hinged Back Support

For the back support of the steps (Fig. 2) two pieces of 2½in. by ¾in. wood will be required, each 2ft. 3in. long, and to these are screwed the two crosspieces which are 2in. wide and ½in. thick. Make a ½in. hole in each piece just above the lower crosspiece to allow a piece of rope to pass through.

The part A, which is nailed to the back of the side pieces at the top, is 12in. long and ¾in. thick, and to this part the back support is fixed by two iron hinges, which are screwed in position.

This back part must have the top edge planed to the same angle as the top of the side pieces.

Fig. 1.—The completed folding step-ladder.

For the top board (Fig. 3) use wood ¾in. thick, and nail this in position so that an equal amount overlaps on each side. To complete the ladder, fix two pieces of strong rope, each about 2ft. long, and knotted at the ends after passing through the holes in the sides, and back pieces.

The finished steps can either be painted or the wood can be left bare, as preferred.

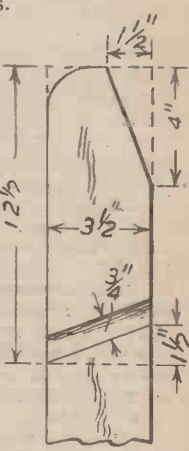


Fig. 6.—Top end of side piece for the longer ladder shown in Fig. 5.

Light Garden Ladder

This ladder, which is intended for garden use, can be made throughout with deal ⅞in. thick. Six treads are provided, and also a top cross-rail, which allows the ladder to be placed against the window frame of a greenhouse or other outbuilding, as shown in Fig. 4.

The two side pieces are 5ft. 9in. long and 3½in. wide, and each piece is marked out with sloping lines to the dimensions given in Fig. 5. Note that the lines on one piece slope in the opposite direction to that on the other piece. Each pair of lines should be exactly ⅞in. apart. With a tenon saw and chisel cut recesses ¼in. deep to receive the ends of the treads. Saw the bottom ends of the side pieces to the same angle as the recesses, and then shape the top ends as indicated in Fig. 6.

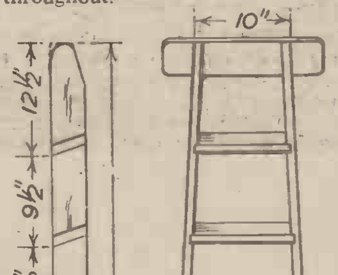


Fig. 5.—Side piece and front view of a 6-step ladder.

Fig. 4.—The ladder in use.

(Continued on page 67.)

THE WORLD OF MODELS

By "MOTILUS"

An Ingenious Model Railway System at Barnstaple : Model Making in Canada

The Mayor of Barnstaple (left) opens the Inglenook scale model railway on V.E. Day. Mr. A. M. Carpenter, the owner and builder, is on the right.

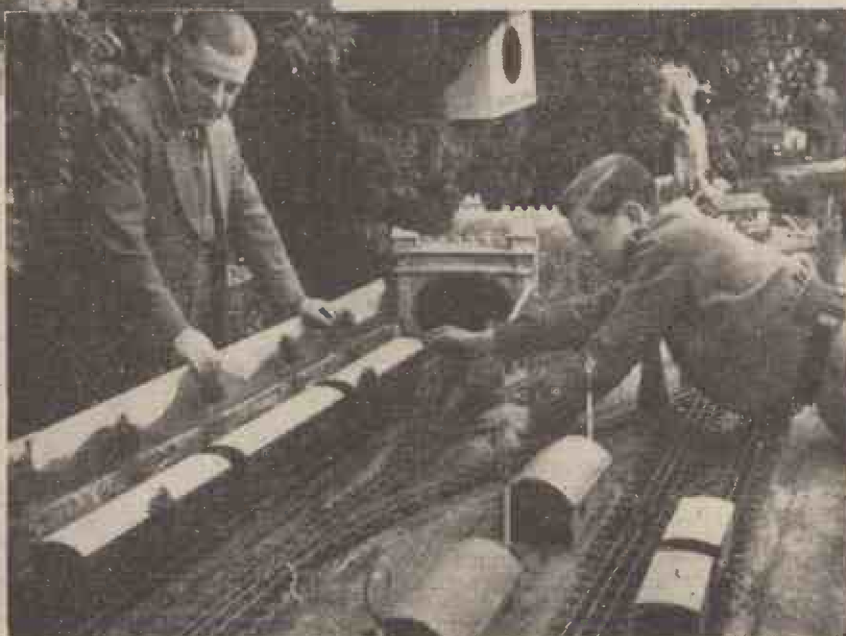
ALTHOUGH the town of Barnstaple has a population of only 14,000, it has the distinction of having more railway stations than any other town—per head of population—in the British Isles. It is served by the Great Western Railway and the Southern Railway, and the stations are Town (S.R.) and Junction (S.R.) and G.W.R.

This, however, is not the only feature that is interesting in Barnstaple, because, apart from being a very pleasant place indeed, famous for the manufacture of good furniture and pottery, it also boasts a most attractive gauge 1 model railway, and it is with this feature of Barnstaple that I propose to deal in this article.

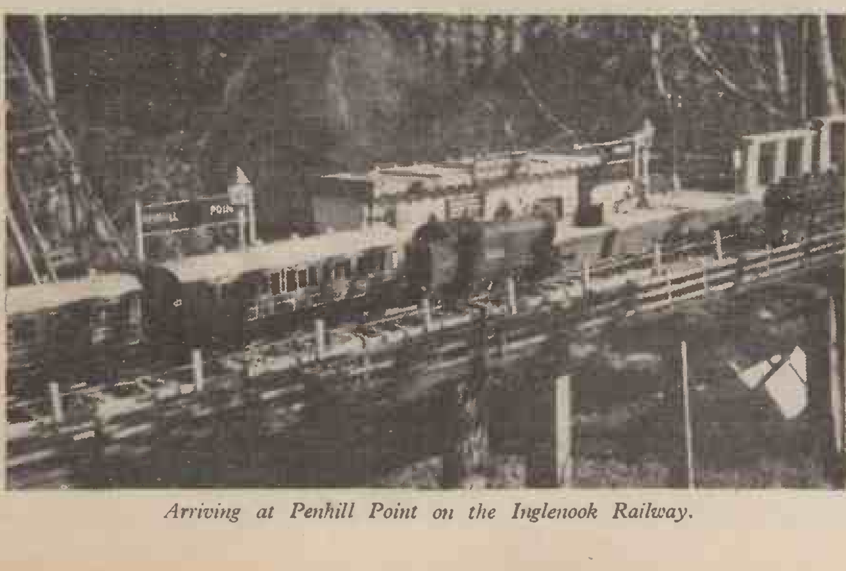
A Fine Model Railway System

To Mr. A. M. Carpenter, of "Inglenook," Park Lane, Barnstaple, goes the credit for a model railway system which is at once a triumph of ingenuity and a conquest of circumstances that presented great difficulties, the first big "circumstance" being the scarcity of engineering supplies in war-time. It has been during the war years that he has struggled with his idea, which primarily was an interest for the amusement of his only son, but now it is a genuine hobby for father!

From odd parts, pieces of scrap, and timber from butter and orange boxes, he has built his railway, and it now stands complete in a most picturesque setting—the garden at "Inglenook"—a system measuring no less than 220ft. in its entirety, with its Waterloo Station, goods sidings, engine sheds and accessories of every kind to delight and surprise the keenest of model railway enthusiasts.



Entrance to the Goods Yards from the tunnel on the Inglenook Railway.



Arriving at Penhill Point on the Inglenook Railway.

Hundreds of boys have already had the privilege of working this fascinating system, and the garden at "Inglenook" oft-times resembles a fairground with delighted youngsters of every age.

Mr. Carpenter is resident manager of the Barnstaple Gaumont Palace—a full-time job in itself—but he is full of enthusiasm for his railway, and rightly so, for it is an excellent effort, which earns him congratulations from the model engineering fraternity. He has, in addition, under his organisation one of the largest junior clubs in the south-west of England.

The gauge of the model railway is $1\frac{3}{4}$in.—gauge 1—and there are both steam and electric locomotives, with a complete mail train, every device being incorporated. The permanent way is ballasted in the professional manner, and the stations are peopled with realistic little figures.

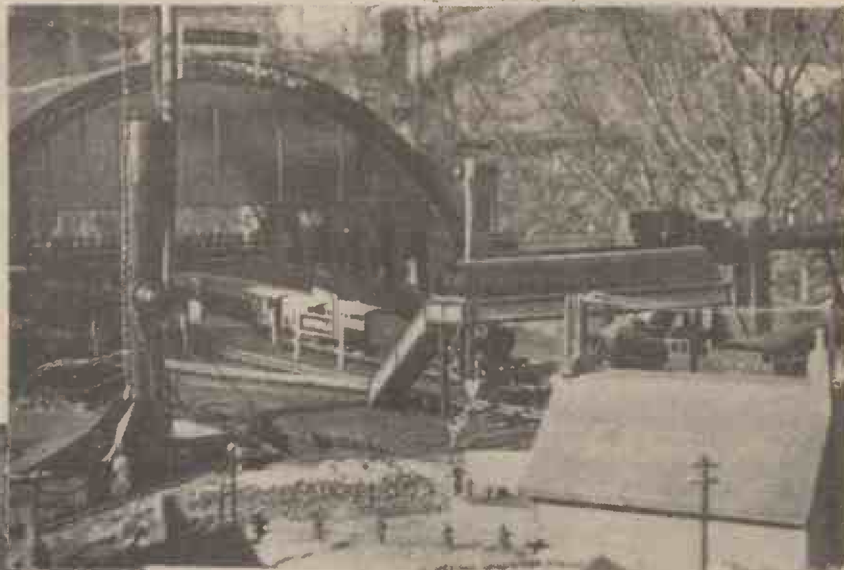
Rolling Stock

His rolling stock consists of six coaches—a complete L.N.E.R. train—and six coaches for a complete G.W.R. train, and also an L.M.S. mail van. Goods rolling stock comprises five wood brake vans and five tinplate brake vans, also three petrol and milk tanks and five wood super detail goods trucks. As for locomotives he has the Sir Sam Fay, electric, converted from clockwork, an Atlantic 2-6-0 in electric, a Great Central 4-4-4, electric converted from clockwork, and a Precursor tank locomotive, electric converted from clockwork. In addition there are two coal-fired L.N.E.R. locomotives.

The system contains the innovation of an airport, complete with runway and 'planes, and the central electric control panel is very creditably made and wired.

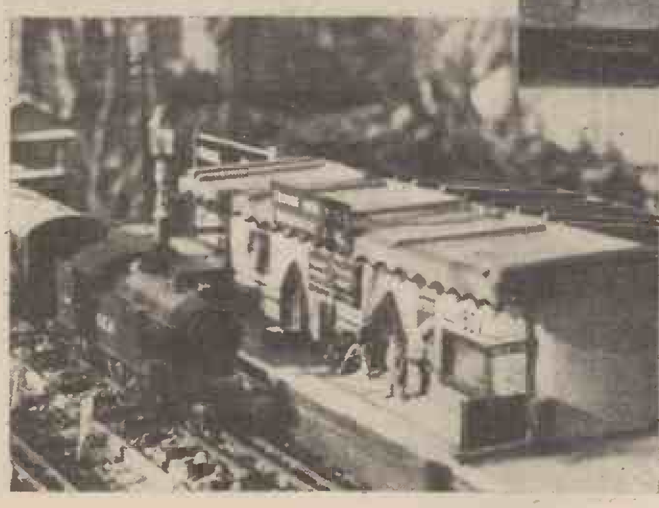
Mr. Carpenter has been good enough to supply me with an excellent plan which shows the distribution of the main buildings, the town of "Inglenook," with its bridge, church and market place, the large terminus station, and also the position of the airport, with its hangars, runways, flying control and outbuildings. From this plan (not reproduced) it can be seen that the railway is complete with telegraph poles and wires, bridges, tunnel, fencing, signals —even miniature wind sleeves.

Some of the accompanying photographs were taken on VE Day—the day on which the Mayor of Barnstaple officially opened Mr. Carpenter's railway on its completion. Over 4,000 people paid for admission, and the sum taken for charity during the afternoon amounted to over £35.



(Above) View showing Waterloo Station on this attractive out-of-doors railway.

(Left) View of the village of Inglenook.



Two other attractive views on the Inglenook railway, showing (above) one end of Waterloo Station, and (left) a local train entering Penhill Station.

Model Making in Canada

A Canadian "sidelight" on the model hobby comes from A. H. Jones, of Toronto, who writes: "While in England with the R.C.A.F. I became a reader of PRACTICAL MECHANICS. I have just received from a friend in Manchester some recent numbers (it is not obtainable over here), in which I notice with great interest on "Motilus's" page some photographs of models of war cars made by Bassett-Lowke. I am engaged on a similar job at Vincent De Vite Studios for our War Museum at Ottawa, and I enclose a photograph of the first I have completed. It is a Dodge, Chrysler 'Peep' of $\frac{3}{4}$ ton, 4 x 4, to $\frac{1}{8}$th scale. All details, even to the hoses of the windscreen wipers, are included. The tyres were my toughest job, and were eventually made out of wood and cardboard.

"These are boom times here in amateur model craft sales. Every boy seems to have the price for a gas-powered job. The little engines are made here in Toronto and sell for $18 to $40 each. Gas-powered cars are not as popular here as they are in the U.S.A.—possibly because of track facilities being lacking. Latest record for a miniature car is over 115 miles an hour!

"The model railroad fans are legion, but able to do little at present because of shortage of supplies. I am a member of a small gauge "0" club, and we cannot get any track at all. No locomotive kits are available, and only a few car kits at very high prices. Strikes in the U.S.A. and a copper and brass works strike here have hit us badly. There is a slight amount of H.O. gauge equipment available—at a price! I have catalogues from Mantua, Walthers, Varney and Lobaugh, but all marked "not available" at present. Walthers are featuring their polydrive locos. These have a worm drive to each driver axle, thus the side rods are "passengers." Several old-time locos and cars are advertised, and these seem to be quite popular. Live steamers don't do as much here as in England, possibly because their period of out-of-doors operation is so limited here. But I am imbued with an ambition to try L.B.S.C.'s plans when I can get a set. I brought a Bassett-Lowke Mogul home with me that I made while in the Service, and I think they will have quite a sale over here when available. Many Service men are anxious to add an English train to their roads after seeing the neatness and compactness of the English locomotive. Please excuse this long tale, but PRACTICAL MECHANICS reminded me of some happy times in England."

Mr. A. H. Jones, of Toronto, sent this picture of his model Dodge, Chrysler "Peep" or 3/4 ton 4 x 4—made to the scale of one-eighth.

No excuse needed, Mr. Jones, of Toronto. Your letter contains some very useful information.

Letters from Readers

Refrigerator Details Wanted

SIR,—After reading the article on the "Elements of Refrigeration" in the April issue it occurred to me to write and ask if any of your numerous readers in England had built themselves a small refrigerator for home use. If so I should be grateful if they would be good enough to let me have working sketches or drawings.

I made one from a design from a Melbourne paper; it was of the intermittent type and proved to be useless, and I have been trying to obtain a design of the continual type worked by a small lamp.—W. F. CLOSE (122, Truganini Road, Carnegie, S.E.9, Melbourne, Australia.)

"Photo-electric Cells"

SIR,—With regard to the article in the September issue of PRACTICAL MECHANICS on Photo-electric Cells, by P. Bousfield, I would refer to the statement that—"remember that the intensity of light at a said object is inversely proportional to the distance of the object from the source of light; or in plain language, if you go twice as far from the light it will be half as strong or intense."

Surely this should read: inversely proportional to the square of the distance . . . if you go twice as far from the light it will be one quarter as strong.

I bring up the matter in case some readers should be misled by a statement which would appear on the surface to be inaccurate.—PETER A. BUNCLE (Edinburgh).

SIR,—I am afraid that Mr. Buncle is right, and I regret my slip. I should certainly have noticed my omission when you sent me the proofs. Please accept my apologies.—P. BOUSFIELD (Witham).

An Appreciation: Back Issues for Disposal

SIR,—Recently I had to increase my cupboard space by disposing of my old copies of PRACTICAL MECHANICS, and on looking, somewhat regretfully, through these back numbers I was struck by the way the publication has "grown up." The majority of the articles nowadays show a much higher technical level than the earlier copies, and I wondered idly how many of the present subscribers are old readers. Your journal must have had a not inconsiderable influence on their educations to enable the present articles to be digested as a matter of course. May the quality continue.

Incidentally, I am removing cuttings from my old copies, but if the remainder of magazines are likely to be of use to other readers I should be pleased to forward them in preference to destroying them. If they would be willing to accept them "carriage forward" I should make no charge for them. —L. A. LEADBEATTER (155A, Tranmere Road, London, S.W.18.)

[*Any reader interested in Mr. Leadbeatter's offer is invited to get in touch with him at the address given above.*—ED.]

Wind-driven Charging Plant

SIR,—I have a direct wind-driven charging plant which works well, with one exception. I have tried various lengths and size of vane, but cannot keep the machine head-on to wind. Perhaps one of your readers may be able to give me some advice on the matter.

The propeller is 5ft. 6in. overall length, and the vane is mounted directly behind it. I am wondering whether it would be advantageous to off-set the vane slightly.—R. TATE (13, Boothferry Rd., Howden, Goole, Yorks.)

Radio-controlled Tractor

A SMALL firm of tractor manufacturers, working in co-operation with the Royal Aeronautical Establishment at Farnborough (Kent), recently gave a demonstration of a radio-controlled tractor at Knifton's farm, Bentley Heath, Hertfordshire.

The radio equipment and mechanical accessories were almost standard parts from early models of the Queen Bee apparatus for pilot-less aircraft.

Standing in a corner of the field, with a switch-box in his hand, the ploughman sent out various combinations of four radio signals, which caused the tractor to start and stop, turn left and right, and plough when directed. The transmitter used had a range up to 25 miles, but should the idea prove worth developing, a less powerful equipment can be designed with a range of up to one mile.

At the tractor end, crudely mounted on a platform above it, was a radio receiver and a relay box, which operated the various controls of a standard tractor by means of compressed air supplied by a cylinder, also mounted on the platform. A future development will be either a compressor attached to the tractor motor, or very low horse-power electrical motor, to produce the power for the mechanical operations.

Speeding-up Farming Operations

Mr. J. C. Reach, managing director of the company responsible for the experiment, who thought out the idea, believes it is capable of easing and speeding many of the operations in farming routine. It is suggested that one operator could control six tractors working in series.

This would be particularly useful on the large farm which, at present, uses the big caterpillar-type tractor, normally laid up while cultivation is in progress. The team of six radio-controlled tractors would serve the dual purpose of the big working unit for ploughing, discing, harrowing, etc., and when split up could perform cultivation processes.

The present equipment operates within the range of vision of the operator, and possibilities outside this range have not yet been considered. It is clear that the radio-controlled tractor would have most significance for the large-scale agricultural lands of the Empire and abroad, and then the consideration of a system which indicated the position of tractors to the operator will be essential. This should be possible in these days of Radar.

There are, of course, many fields which could use remote control equipment, and this experiment has shown how easily adaptable the equipment originally intended for aircraft is to a tractor.

TWO USEFUL LADDERS

(*Continued from page* 64)

Treads and Cross-rail

The treads, which are 4in. wide, have to be sawn to different lengths, the bottom one being 15in. long and the top one 10in. long. Each tread is 1in. shorter than the one immediately below it. They are fixed in position by stout nails driven in through the sides. Two nails for each end of the treads will be sufficient. The top and bottom treads should be fixed first.

For the top cross-rail cut a piece of wood 1ft. 6in. long and 4in. wide; round the corners, and screw it to the sloping top ends of the side pieces, as shown.

Plane the treads level with the back edges of the side pieces, and slightly round off the front edges of the treads.

To add to the rigidity of the ladder, screw on two strip iron struts between the ends of the side pieces and the bottom tread, as shown in Fig. 5. These struts are 11in. long, 1in. wide and ⅛in. thick.

QUERIES and ENQUIRIES

Fuse Wires : Immersion Heater

AM I correct in assuming that it is permissible to use a 10 amp. fuse wire in a 5 amp. fuse unit on a 5 amp. circuit, i.e., with cable size 1/0.044. It appears to me that fuse wires are rated at their approximate fusing current, as I find that with a 1kW. fire (230 volts) a 5 amp. fuse wire does not last long. What is the maximum size fuse for a circuit using 3/0.029 size cable ?

Is a 1kW. immersion heater sufficient to heat a 30-gallon tank ?—R. J. Barber (Lowestoft).

FUSE wires are usually rated on their current-carrying capacity, rather than on their melting current, although this practice is not invariable. In fact, the melting current of a given size of wire will depend to a certain extent on the construction of the carrier into which it is fitted.

A 1kW. electric fire on 230 volts will take 4.2 amps. and a fuse which melts at 5 amps. would not last many minutes, especially if the supply voltage, and consequently the current, happened to be a shade high. As a matter of fact, the initial current when switching on will exceed the above value, as the resistance of the element will be lower when this is cool.

Copper fuse wire tends to deteriorate slowly, and eventually melt prematurely, when used to carry a current which is much more than half the melting current. 1/0.044 cable is rated to carry 5 amps. and should be satisfactory for a 1kW. fire, whilst 3/0.029 cable is rated at 10 amps. For the average fuse-holder 34 or 35 s.w.g. tinned copper fuse wire, which will carry 5 amps. and melt at about 12 amps., is suggested for a 1kW. fire with 1/0.044 cable ; 30 s.w.g. being suggested for 3/0.029 cable.

Whilst a 1kW. immersion heater may be sufficient for a 30-gallon tank when the heater is thermostatically controlled, it would be rather small for a hand-controlled heater used to give an intermittent hot-water supply. The heater would give the required hot water, especially if the tank was lagged, but would be slow. In order to provide sufficient hot water for a bath within, say, one hour from cold, we would suggest a 3kW. heater if hand-controlled.

Emulsified Wax : Glass Bottle Makers

WILL you please answer the following queries ; First, what is emulsified wax—what is it made of, and how ?

Can you give me the name and address of a manufacturer of glass bottles, jars, etc. ?—F. Oard (Sutton).

AN emulsified wax is a wax which has been broken up into small particles by some chemical method, the wax particles being distributed throughout a suitable medium such as water. Emulsified waxes are not easy to make, but here, for your interest, is a formula for emulsifying ordinary paraffin wax :

Paraffin wax	12 parts
Stearic acid	5 „
Trigamine	3 „
Water	80 „

Melt the wax and the stearic acid together at a temperature of 65 deg. to 70 deg. C. Dissolve the trigamine in the water separately at the same temperature. Then add the resulting trigamine solution slowly to the molten wax with high-speed mechanical stirring. A white paste fluid of emulsified paraffin wax will result.

There are many other methods of wax emulsification, each wax having a particular method of its own. The above method applies only to paraffin wax.

Bottle and jar manufacturers suitable for your needs are :

Messrs. J. Kilner & Sons (1927), Ltd., Calder Vale Works, Wakefield, Yorks.

Messrs. Lax & Shaw, Ltd., Albert Glass Works, Hunslet, Leeds.

Messrs. Jackson Brothers (of Knottingley), Ltd., Knottingley, Yorks.

The International Bottle Co., Ltd., 48, Fore Street, London, E.C.2.

The United Glass Bottle Manufacturers, Ltd., 40-43, Norfolk Street, London, W.C.2.

Bromide Paper

I HAVE heard that it is possible to use bromide paper in a camera, converting the negative image thus obtained into a positive one (during development) by a method similar to the Dufaycolor process. Could you enlighten me as to the chemicals used in this process ?—R. Lane (Blackpool).

IT is quite true that a sheet of rapid bromide paper can be exposed in a camera and developed up afterwards, but the results are never satisfactory, since bromide papers do not respond well to such treatment. Neither is the chemical reversal of a bromide image satisfactory. Usually, the reversal is only semi-complete, and if it is " pushed " fogging or greying of the paper results.

However, you will find interest in experimenting in the matter. Use an ordinary two-solution metol-hydroquinone developer (or, alternatively, a one-solution M-Q developer).

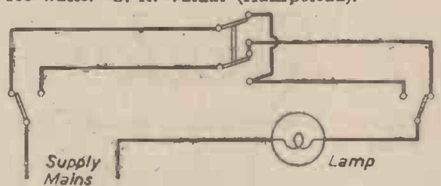
In the case of the two-solution developer mix equal parts of the solutions and one-half part of the following solution :

Phenyl-thiocarbamide	1 part
Water	2,000 parts

In the case of the one-solution M-Q developer, the same proportion of the phenyl-thiocarbamide solution must be kept. The developer must be restrained by the addition of a considerable amount of a ten per cent. solution of potassium bromide.

Triple Switching

I WISH to switch a light on or off from three different stations. Would you please inform me how this can be done ? The lamp is 230 volts 100 watts.—S. R. Valdar (Hampstead).



Circuit for switching a light on or off from three different stations. (S. R. Valdar.)

FOR your purpose you could use two single-pole two-way switches and a double-pole two-way switch connected as indicated in the diagram.

Depositing Copper on Glass : Ferro-prussiate Paper

(1) I SHALL be obliged if you will give me the formula for depositing a film of copper on glass.

(2) I am also interested in the formulas for the preparation of

1. Ferro-prussiate paper.

2. Ferro-gallic paper.

Would it be possible to coat sheets or plates of ground glass with one of the three formulas mentioned, after mixing with gelatine or some other suitable substance ? If so, what would be the formula for such sensitising solution, and the method for fixing and developing in the case of the glass plates and the three types of paper ?—F. G. Holmes (West Derby).

(1) THE following is the procedure for getting a lustrous copper mirror on glass.

First of all, thoroughly clean the glass surface which is to be coppered. Use for this purpose consecutively : hot soap solution, dilute nitric acid, dilute caustic soda solution, plain water, distilled water.

Now make up a solution of copper sulphate. The exact strength is immaterial, but it should have a bright blue colour. Add dilute caustic solution to it until there is no more precipitation of copper hydroxide. Let the precipitate settle. Wash it several times by decantation. Filter off the precipitated and washed copper hydroxide, and make a saturated solution of it in strong ammonia.

Now dissolve 1 part of phenylhydrazine in 2 parts of water. Heat till the solution is clear. To this add one-half of the solution's volume of the warm, saturated solution of copper hydroxide prepared as above. Finally, add hot 10 per cent. caustic soda solution with much stirring until a slight permanent precipitate is formed. The final liquid should be colourless or pale yellow.

To copper the glass, heat the cleaned glass in contact with the solution. Allow it to remain in contact with the warm solution for an hour. Tarry matter is formed and bubbles of nitrogen gas will be evolved during this time. After the coppering is complete, pour off the liquid and wash the coppered surface with plenty of water.

The liquid may be used over and over again after filtration.

(2) A simple formula for ferro-prussiate paper is :

(a)	Potassium ferricyanide	8 parts
	Water	50 „
(b)	Ammonium-citrate of iron (Green)	10 parts
	Water	50 „

The solutions are mixed in equal parts. In this state they will keep in the dark for about two weeks.

Paper which is coated with this solution prints white lines on a blue ground. After exposure the print is simply washed.

The paper should have been well sized by brushing it over with a 5 per cent. solution of gelatine (5 parts gelatine, 95 parts water) to prevent the sensitising solution from sinking too deeply into the fibres.

The ferro-gallic process produces black lines on a white ground. Four sensitising solutions are required, viz. :

(a)	Gum arabic	50 parts
	Water	500 „
(b)	Tartaric acid	50 „
	Water	200 „
(c)	Ferrous sulphate	30 „
	Water	200 „
(d)	Ferric-chloride	30 „
	Water	200 „

Mix solutions (b) and (c). Pour the mixture into solution (a), and then add solution (d).

Well-sized paper is brushed over with the mixed solutions and dried. The exposure is made in the usual manner. The exposed paper is developed by brushing over in the following solution :

Gallic acid	3 parts
Oxalic acid	1 „
Water	500 „

The print is finally washed with plenty of water.

A modification of this process utilises tannic acid in place of gallic acid in the developer. It is, therefore, known as the ferro-tannate process.

The above processes can be coated on to gelatine in the following manner :

Dissolve 5 or 6 parts of gelatine in 95 parts of water. Coat this solution (warm) on to glass and allow the gelatine film to set. Afterwards, immerse the coated glass for 5 minutes in a bath made up by adding 5c.cs. commercial formalin solution to 20c.cs. of water. If formalin cannot be obtained, a strong alum solution may be used. The plates are then well washed and allowed to dry, after which they may be coated with the sensitising solution. The result, however, will *not* be as good as that obtained by coating paper, for the printed lines will be somewhat blurred and the colours not as clear. The process of coating the solutions on to gelatined glass plates is hardly worth troubling about.

Cobblers Ink : Cleaning a Spring Well

I SHOULD be very much obliged if you could answer the following queries :

(1) How to make approximately 1 pint of cobblers ink or burnishing ink (black and brown).

(2) I have a spring well which supplies our drinking water. It is 25ft. deep, and during the summer months the water supply gets very low, but another well 50 yards away has plenty. The spring well has not been cleaned out for over 30 years (so I am told). Would this partly account for it, and how often should they be cleaned ?—F. Moody (Darlington).

(1) THE ink which you mention is made on an oil-resin basis and is difficult to manufacture in the absence of large-scale plant. The following is the best procedure to adopt :

Take a quantity of old boiled linseed oil. Place it in an iron pot and heat it until it gives off a vapour. This vapour will catch fire. Hence the heating should be done out of doors. When the vapour ignites, smother it by placing a lid over the iron pot. Then test the oil by stirring it with a wooden stick and by drawing it out into threads. When it is sufficiently thick, it will draw out into threads readily. If it does not, it must again be heated.

Into a pot containing 20 parts of this oil which has been thickened stir in about 2 or 3 parts of powdered resin and ½ part of shredded white soap. Heat the mixture again with continual stirring until it is homogeneous.

To make a brown ink, stir in a mixture of burnt amber and rose pink (in the proportion of 2 to 1) until the desired shade is obtained.

To make a black ink stir in lampblack mixed with about a tenth of its weight of indigo or prussian blue.

A little hard wax may also be incorporated into these inks to give them an additional gloss on rubbing.

(2) The question of the frequency of cleaning a well depends entirely upon the exact type of well and its mode of construction. A well which is fed with good, uncontaminated water does not usually require cleaning, and since the water which you obtain from your well is satisfactory in quality we think this ruling applies

in your case. The reason why the neighbouring well obtains more water than your well is very probably because there is an easier underground water-path to the former well than there is to yours. This being the case, you can do nothing about it, other than constructing a new well in, perhaps, a more favourable position, or, alternatively, by deepening your own well in the hope of collecting more water from the surrounding area than the neighbouring well.

But all these remarks must only be taken as probabilities—not certainties. For a diagnosis of the trouble, the well would have to be examined, and it is, of course, impossible for us to do this.

We do not think that cleansing or otherwise has anything to do with the lack of water in your well, since a well-founded well will supply ample water independently of being cleaned.

Silvering Mirrors

I SHALL be obliged if you will inform me of the method of silvering mirrors, and the chemicals required. I wish to silver a few small squares of plate glass for use as mirrors.—D. Large (Liverpool).

CHEMICAL silvering is not an easy job. It is apt to give rise to disappointment at first until experience and the necessary skill has been acquired. There are several different methods of silvering. One of the best for small work is the following:

Dissolve 60 grains of silver nitrate in 1 oz. of water. Pour this solution quickly into a gently boiling solution containing 48 grains of Rochelle salt in about 1 oz. of water. On cooling, filter the liquid and make up to 12 fluid ozs. with water.

Dissolve 60 grains of silver nitrate and add ammonia drop by drop to the solution until the precipitate which first forms almost completely dissolves, leaving a slightly milky or opalescent solution. Make this latter solution up to 12 fluid ozs. with water, as before.

For silvering, mix equal volumes of these liquids *immediately before* silvering, and pour the mixed liquid on to the glass surface to be silvered. Silvering will be complete in about four minutes, after which the spent liquid must be thrown away.

In the silvering process it is most important to have everything scrupulously clean and grease-free. The glass to be silvered must have been washed with soda, as must, also, the dish which contains it. It is advisable, also, to use only distilled water for making-up the solutions.

A useful tip is to dissolve 10 parts of stannous chloride in 90 parts of water and to flood this solution over the glass to be silvered immediately before silvering, washing off the solution from the glass with plenty of distilled water. This pre-treatment of the glass gives greater evenness of silvering and greater adherence of the silver film to the glass.

If the glass is not perfectly clean and grease-free, the silver film will either be patchy or else it will not adhere satisfactorily to the glass surface.

We must warn you, therefore, that silvering is a difficult job and that it is apt to give rise to much disappointment. However, it *can* be done at home, given the necessary skill and practice.

There are other methods of silvering, many of which are given in chemical textbooks and also in books of photographic reference, all of which should be in your local Reference Library.

Small Arc Welder

I WISH to make a small arc welder for use on, say, 20 S.W.G. (steel) sheets and 14 S.W.G. (aluminium) sheets. Could you please give details of striking voltages and approximate current densities? I am contemplating the use of car batteries, which could be connected in parallel for charging by a wind-driven generator.—F. R. Cannon (Coningsby).

FOR a normal design of welding plant we would advise a generator capable of giving about 70 to 80 volts on open circuit, with a current density of 75 to 150 amps. for ⅛in. carbon electrodes, 175 to 200 amps. for 3/16in., and 200 to 275 amps. for ¼in. electrodes.

Obviously such high powers are not practicable from accumulators, and we consider the latter source of supply to be suitable only for occasional light welding jobs. You might try using two 12-volt car accumulators in series with a copper-coated electrode of carbon about ¼in. diameter. We suggest you connect a resistance of about 0.25 ohm in circuit with the battery.

Distilled Water

WILL you please inform me of the best method, apparatus required, etc., for producing clean distilled water?—C. H. Miller (Hazel Grove).

YOU do not tell us of the quantity of distilled water which you wish to produce in any given time. This is a very important point. If you only want to produce laboratory amounts of distilled water, then any laboratory furnisher will supply you with a small still in glass or copper. In this instance, make inquiries of Messrs. J. W. Towers, Chapel Street (near Victoria Bridge), Salford, or, alternatively, Messrs. Philip Harris & Co., Ltd., Birmingham.

For larger-scale distilling plant, we must refer you to either Blairs, Ltd., Woodville Street, Govan, Glasgow, S.W.1, or Messrs. H. & T. Danks (Netherton), Ltd., Netherton, Dudley.

If the water is not intended to be used for drinking, but for some industrial process, it is possible that a non-distilled chemically treated water may suffice. In this event, Sofnol, Ltd., Greenwich, London, S.E., will be able to help you.

Soap Purification

COULD you please inform me how impure soap is purified, after it is made by heating caustic soda with a fat and salting out the soap? I find that this soap is difficult to dry. Also, are there any books on the manufacture of soap?—L. Green (Burnham).

PROVIDED that reasonably pure materials are used in the soap making, the soap itself should need little purification. In your case, the trouble about the soap being difficult to dry suggests that you have not removed all the glycerine from the soap after the latter has been salted out. What you need to do is to make up a strong brine solution by dissolving common salt in water until no more will dissolve. The salted-out soap, after collection, should be well washed with this brine solution to rid it of its glycerine, and finally the brine should be washed away by pouring a little cold water through the soap.

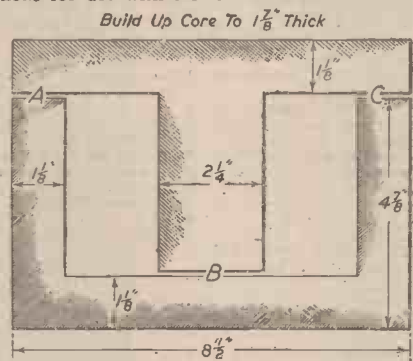
There are quite a number of good books on soap manufacture. Below, we give some modern works with their (pre-war) published prices appended in each case:

W. H. Simmons: "Soap—Its Composition, Manufacture and Properties" (3s.).
Simmons and Appleton: "Handbook of Soap Manufacture" (9s. 6d.).
E. T. Webb: "Soap and Glycerine Manufacture: A modern Treatise on the Production of Soaps of all kinds" (25s.).
G. H. Hurst: "Soaps—A Practical Manual on the Manufacture of Domestic, Toilet and Other Soaps" (21s.).
A. Watt: "Soap-making" (9s.).
J. H. Wigner: "Soap Manufacture" (10s.).

It is possible that you may be able to get one or more of these volumes secondhand from Messrs. W. & G. Foyle, Ltd., Charing Cross Road, London, W.C.2.

Transformer for Arc Welding

I HAVE constructed a transformer for arc-welding 18-gauge sheet and would be very obliged if you could supply details for a suitable hoke for use with this transformer.



Stampings for a transformer to be used for arc welding. (H. L. Holborow.)

The constructional data for the transformer (obtained from an old issue of your paper) are as follows:

Input: 230 volts A.C. Output: 80-100 volts, 25 amps.
Core area: 6 sq. in.
Primary: 260 turns 14 s.w.g. D.C.C.
Secondary: 122 turns 10 s.w.g. D.C.C. tapped at 98th turn for 80 volts.
Laminations used: Sankey Stalloy No. 41.

I understand that a choke is necessary for reducing the voltage after the arc has been struck, but I am not quite sure how this is accomplished. Is the choke permanently in series with the transformer secondary or is it connected by means of a switch immediately the arc has been struck?—H. L. Holborow (Harrogate).

WE suggest you build up a core of Stalloy stampings to the dimensions given in the accompanying diagram, the centre limb of the core being wound with 150 turns of 10 s.w.g. D.C.C. wire. When assembling the two halves of the core a gap approximately ⅛in. wide should be left at the points A, B and C, this being filled with wood, fibre, or other non-magnetic material, so that the core can be clamped up solid.

The choke coil should be permanently connected in series between the electrode and the secondary of the transformer. The choke coil is automatic in action, and the volt-drop across the coil depends on the current flowing through it. Until the arc is struck the full voltage will exist between the electrode and work, the choke volt-drop rising and the arc voltage falling when the arc is struck and current flows.

Plaster Casts

I DESIRE to make some plaster casts, and would appreciate any advice you could give me as to a mixture that would not crack upon drying. I should also like advice upon methods and materials for making moulds.—E. Matthewson (Whitley Bay).

THE usual material for the making of plaster casts is ordinary plaster of paris. The cast, after completion, is brushed over with a 10 per cent. solution of gelatine (10 parts of gelatine dissolved in 90 parts of water), which sizes it and gives it not only an increased strength, but also a non-absorbent surface on which to apply paints and enamels.

Alternatively, you can use 2 parts of the plaster and 1 part of powdered asbestos (obtainable from Turner Brothers Asbestos Co., Ltd., Rochdale, Lancs). The asbestos, being fibrous, gives additional strength to the plaster. Indeed, anything of a hairy, fibrous nature which you can incorporate with the plaster will impart additional strength to it.

Moulds may be of wood, metal or plastic. In each case they must be well greased internally with Vaseline or with a mixture of thick oil and soft soap, in order to prevent the sticking of the cast.

Stronger casts can be obtained by slaking calcined magnesite with a 40 per cent. solution of magnesium chloride, but, very unfortunately, calcined magnesite is quite unobtainable at the present time.

If the plaster of paris dries too quickly, add a little common alum to the slaking water, say 1 part of alum in 99 parts of water.

Preventing Pressed Flowers Fading

COULD you please inform me if there is any way of preventing pressed flowers from changing colour, mostly to purple and brown? Is it possible to treat them when freshly pressed; also is there any firm from whom I may purchase chemicals, etc., to be used in the treatment? Are there any books on this subject available?—P. Major (Gillingham).

YOU voice a problem which is centuries old. So far, however, no method has been discovered of preventing the slow fading and darkening of pressed flowers and leaves. There is no chemical way of treating them, although some experimenters have from time to time recommended that the leaves be varnished with a clear varnish or cellulose lacquer. However, in the long run, this makes no difference, the fresh green colour of the leaves disappearing and giving way to a succession of yellows, browns, purples and even blacks.

Advice as to the treatment of flower specimens is given in some botany textbooks, but the only book dealing exclusively with this subject which we know of is: "Wild Flower Preservation: A Collector's Guide," by M. Coley. This was published in 1913 by Messrs. T. Fisher Unwin and is now out of print. But you might possibly be able to obtain a copy from a good secondhand bookseller such as Messrs. W. & G. Foyle, Charing Cross Road, London, W.C.2.

Calcined Magnesite: Sawdust

CAN you enlighten me on the following questions?

(1) How calcined magnesite is sold; is it in lbs. or by the bushel? If in lbs. how many of these would equal a bushel? Is magnesium chloride only obtained in bulk or can I get small amounts of about 20lb.? Also, where can I obtain the above, and about how much per lb. does it cost?

(2) Can you tell me where I can get sawdust of the hard wood variety in small amounts of about 4 bushels? The purpose for the material is the repair of magnesium oxychloride composition floors in my house.—T. Ingersoll (Balham).

(1) CALCINED magnesite is sold in all but small quantities by the hundredweight. It is sold by the lb. up to 28lb.

Taking 1 bushel to constitute a dry measure of 8 gallons capacity, 1 bushel of calcined magnesite would weigh approximately 56lb., the exact weight depending upon the fineness of the particle size of the magnesite, its specific gravity (which varies), and its moisture content.

Magnesium chloride can be obtained at lb. rates up to about 14lb., its present cost being about 1/- per lb. It is, however, at present very scarce (as, also, is magnesite). Your best chance of obtaining it in relatively small amounts is from one of the large laboratory chemical concerns, such as:

Messrs. W. & J. George and Becker, Ltd., 17-29, Hatton Wall, London, E.C.1; Messrs. Griffen and Tatlock, Ltd., Kemble Street, London, W.C.2; Messrs. A. Gallenkamp & Co., Ltd., 17-29, Sun Street, Finsbury Square, London, E.C.2. You will only require the "technical" variety, not the pure crystalline grade of magnesium chloride.

(2) Sawdust is available (particularly in small amounts) from any working joiner, of which tradesmen there must be many in your district. For larger amounts apply to any of the big sawmills in and around the East End of London. Sawdust is generally considered to be outside the range of the stock of builders' merchants. If you are not able to obtain this commodity locally, send to Messrs. Page & Taylor, The Docks, Preston, Lancs, who will, we think, supply it in a minimum quantity of a sackful.

Bronzing Powders

I WISH to bronze plate some small ornaments at home. I believe there is a bronzing powder which is used with ammonia. Can you tell me if this is correct, and if so where I can obtain it?—H. Brooks (Edinburgh).

THE exact type of bronzing agent to use depends upon the nature of the articles in question, and this is just the necessary information which you do not give us in your inquiry. Neither do you tell us of the exact shade or colour which you desire to impart to your ornamental objects.

However, bronzing powders and media, after being unobtainable throughout the war, are now coming back into commerce. Your best plan, therefore, is to write to Messrs. William Canning & Co., Ltd., Great Hampton Street, Birmingham, 18, and to inquire for a small quantity of bronzing lacquer. State the nature of the ornaments to be bronzed, and also the approximate colour which you desire to obtain.

"See Britain by Cycle . . ."

1 CANTERBURY . . . The modern traveller to Canterbury-on-the-Stour uses vastly different methods of transport from Chaucer's 14th century pilgrims. The centre of historical and cultural interest in the city is the cathedral, in which Thomas à Becket was murdered in 1170. The magnificent architecture includes many varied styles, for tho' started in Norman times, the cathedral was not completed until the late fifteenth century.

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THE Cyclist

Editor: F. J. CAMM

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Phone: Temple Bar 4363

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Comments of the Month. By F. J. C.

Sending Cycles by Train

IN September the representatives of five railway companies (the G.W.R., the L.M.S., the L.N.E.R., the S.R., and the Cheshire Lines Committee), and also of the L.P.T.B., discussed the carriage and storage of bicycles by railway with the National Committee on Cycling. Major H. R. Watling, chairman of the National Committee, in introducing the deputation, stated that he also represented the Manufacturers' Union. The C.T.C. representative advanced the case urged by the International Touring Alliance, for a standard design of hooks from roofs of luggage vans for carrying bicycles, and of gutters alongside stairs and bridges to make it easier to wheel cycles in railway stations. The use of hooks is, of course, the standard practice in Switzerland, France, Belgium, and other countries, and we agree that it is time that Great Britain followed suit, for these hooks will be useful for carrying luggage other than bicycles. A great deal of the capacity of luggage vans is wasted in that it is only the floors of them which are used. The secretary of the National Committee submitted the result of an inquiry made into the accommodation for bicycles at London terminii. Only one station, Charing Cross, claims to have sufficient room for bicycles. He stated that in the bigger stations outside London, cyclists would welcome the sympathetic approach of the G.W.R., which had already undertaken to provide 793 additional stands at their railway stations.

Major Watling stated that the total damage done by the railways to bicycles amounted to hundreds of thousands of pounds a year. This should not happen, especially when there is great difficulty in providing replacement parts. Another representative stated that the carriage of bicycles in this country was the worst, and the price the highest, of any in Europe.

There is a limit of £5 on the value of any bicycle stolen from a railway station cloakroom. If the owner values the machine at more than that sum he gets nothing at all.

All cyclists are most concerned with the somewhat careless handling of their machines by the railways. Even new bicycles dispatched from the works to the various agents frequently arrive damaged and with parts missing. Pumps and other oddments are stolen in thousands every year. One of the representatives thought that the further education of railway employees on how to handle bicycles would be welcome. We do not think they are in need of this education. They know it already. It is crass carelessness which causes the damage. Unless a cyclist can prove deliberate damage he has little chance of succeeding with any claim and the railway employees know it.

Our contributor, Frank Urry, asks whether it would be practicable to install in railway stations a gallery by means of which bicycles may be moved up and down from the ground floor. Bicycles, he pointed out, were being paid for when carried by the railways. Luggage was not.

The chairman of the meeting, Mr. G. H. Aungle (L.N.E.R.), said that although he could not hold out any definite promise of what could be done in the future, those present would report back to their companies and draw attention to the suggestions made.

We agree with Major Watling's remark that railways ought to take time by the forelock, for these problems will increase in the future and the bicycle is going to play an even more important part in the future, than it had already done.

"Trouble in Holland"

ONE of our contemporaries recently printed an item dealing with a dispute between Dutch cycling champions and their Government. We recently received from official sources in Holland, some comment on this story, and an explanation of the position of the Dutch Government in the matter. The Dutch authorities had made an arrangement for the payment of fees to professional cyclists racing in the Netherlands. The Dutch Government, however, could only put foreign exchange at the disposal of foreign professional cyclists, to the same amount as the total of foreign exchange earned by Dutch professional cyclists in foreign countries. As far as the Dutch cyclists were concerned, this arrangement allowed for deduction of a reasonable amount for out-of-pocket expenses whilst staying in foreign countries.

The Dutch cyclists, however, did not keep to this arrangement. They spent their earnings in foreign countries on all kinds of personal expenses and purchases abroad. This was not only contrary to Dutch law, with regard to foreign exchange, but it also jeopardised the general arrangements referred to above. The Dutch authorities have called the attention of the professional organisation *Nederlandsche Wielren Unie* to the offence committed by their members and have pointed out the further consequences with regard to foreign cyclists performing in the Netherlands. Notwithstanding these difficulties, the Netherlands authorities agreed during the first months of the season to put certain amounts in foreign exchange at the disposal of foreign cyclists performing in the Netherlands. They believe that Dutch professional cyclists who will have to bear the consequence of their foreign exchange offences will in future conform more closely to their obligations under the foreign exchange regulations of their country. The purchase of racing materials from abroad is dependent upon an import licence.

Committee for 1947 Track Racing

AS we go to press we learn that a committee has been formed among those interested in the future well-being of track sport particularly in the London area. It is the intention to bring together all those who have something constructive to contribute towards this end. Next month we shall fully report upon this further breakaway movement from the N.C.U.

Tariff Against Britain

THE bicycle merchants of Bombay have united in a striking testimony to the British bicycle as against the native product of Indian manufacture.

In a memorandum to the Indian Tariff Board, Bombay, now examining the claim of the Indian cycle makers for protection against imports of British bicycles, the Bombay Cycle Merchants' Association declare that, apart from the fact that the Indian manufacturer can at present sell every bicycle he produces, the industry does not meet the test of being established and conducted on sound lines, entitling it to a tariff. They have come to that conclusion notwithstanding their desire for the "healthy growth of Indian indigenous industries and the rapid industrialisation and economic development of the country."

No Indian company, it is stated, manufactures a complete bicycle, but largely depends on imported components. In spite of this, these bicycles are "entirely unsatisfactory both from the point of view of durability and workmanship. The raw materials used are very inferior and the bicycles are worn out in a very short time.

"There is always the risk," it is added, "of the bicycle giving way en route. Indian labour cannot be considered efficient for the bicycle industry in view of the skill, precision and care necessary."

The merchants complain that the manufacturers have not attended to the defects pointed out to them, and consequently their members have had to cease handling these bicycles.

On the other hand, they declare, in the bicycles which are coming from the United Kingdom a "fully satisfactory, wholly reliable machine is made available to the public at a very reasonable price. The riders of English bicycles have not to go in constant dread of something going wrong and, moreover, have their money's worth and even something more. In our opinion, therefore, no protection is justified on complete bicycles or even components."

The merchants remark that American bicycles are not marketable in India "because of their parts being different and the landed cost likely to be very high."

Before the war India bought from Britain between 150,000 and 200,000 bicycles a year.

Tricycling Matron

DONCASTER is to lose its "tricycling matron," Miss M. E. Binnington, 65-year-old matron of the Nuttall Cottage Homes, who has for many years been a familiar sight in the town and district. She rode her tricycle with as much vigour as many women, far younger, ride their cycles, and now she is retiring to live in Bridlington, where, no doubt, she will become as familiar a figure as she has been in Doncaster.

Museum Piece

MR. J. BOSWORTH, of Kettering, who is 84 years old, and the town's oldest cycle trader, has promised to give to the municipal cycle collection at Coventry his 1890 Rudge pennyfarthing, a relic of his early days on the road. The machine will be sent to Coventry as soon as a building is ready to house the collection, which was removed for safety during the war. Mr. Bosworth, who is a founder member of Kettering Amateur Cycling Club, and did much racing in his early days, has been in business in Kettering for well over 50 years. When pneumatic tyres for cycles were introduced he worked out a method of repairing them when punctured, to avoid having to send them back to the makers, as was the usual practice in those days.

Too Audible Warning

THE club magazine has suggested to cyclists of the North London Group, Youth Hostels' Association that their habit of "continuous bell-ringing when passing pedestrians" is not a pleasant one and ought to be stopped.

Resisted Temptation

WHEN a respectable citizen got off the train at Huntingdon Station the other day he was presented by a porter with a brand new cycle, having a couple of brace of rabbits hanging from the handlebars. He was greatly tempted, but eventually plucked up sufficient strength of mind to tell the porter that he was not the lucky owner of the cycle and the rabbits. Even now he still wonders how he did it!

Service

A WISBECH (Cambs) constable was complimented by the Borough magistrates for catching a cycle thief a quarter of an hour after he had been notified of the loss of the machine. The thief considered that such efficiency was quite uncalled for.

Basic English

"I'M going for a copper," said a Leicester cyclist to a motorist after they had been involved in a minor accident. But by the time the cyclist had returned with the policeman the motorist had disappeared, and when he was subsequently charged at Leicester Magistrates' Court, he said he did not understand what the cyclist said. His solicitor remarked: "If the cyclist had said he was going to call a policeman, my client would have been waiting."

Pedal Dukw

A THREE-WHEELED, pedal-powered variation of the "Dukw"—which proved so useful during the war—has been evolved by Mr. Norman Sykes, of Sale, Cheshire. This novel vehicle has two large wheels at the rear and a smaller one for steering in the front and can be pedalled on land at a speed of up to 18 m.p.h. In water it is propelled at a slower speed, but is perfectly seaworthy, being built mainly of wood. There is plenty of room for two people who, if necessary, could park for the night and sleep on the floor with a fair degree of comfort.

Wise Suggestion

DURING the course of his speech, when he opened the Northamptonshire County Council Road Safety Committee's Exhibition at Kettering, Lord Henley, chairman of the County Council, remarked: "Magistrates are too lenient with road users who are involved in accidents because of alcoholic drink. They should be heavily penalised." He also added that blood tests for alcohol were made after accidents in the United States and Sweden, and said he wished this procedure could be instituted here.

Exit the Errand Boy

THE whistling errand boy, cycling madly along on his rounds, will soon be a thing of the past if the idea of a Nottingham man becomes popular. This man has obtained a commercial licence from the North Midland Regional Transport Commissioner for the use of his vehicles in Nottingham as an "errand boy pool service" upon which tradesmen who are short of errand boys can draw when necessary.

New Cycle Track

FOLLOWING a suggestion made by the Municipal Sports Advisory Committee, arrangements are being made to improve and relay the cycle track in Queen's Park, Chesterfield. The work is estimated to cost some £1,270.

Bailey Bridge for Bedford

BEDFORD Town Council are considering erecting a Bailey Bridge over the Ouse in the Queen's Park Recreation Ground, Bedford, for the use of cyclists and pedestrians. Residents of the town are pressing for the erection of the bridge as quickly as possible as it will save them making a long detour.

Still Short

AT the September meeting of Goole (Yorks) Chamber of Trade, the chairman complained about the difficult position regarding the purchase of new bicycles. He is a cycle agent himself and he told the members: "We can't even get nuts and bolts, never mind motor-cars and bicycles." Complaints had also been made that the town was not receiving its fair share of new cars.

Lincoln By-pass

CONFERENCES are in progress regarding the proposed new by-pass around Lincoln and the best route for the road to take. Lindsey County Council suggest that before any route is decided upon a terminal census of traffic using the existing roads converging upon Lincoln should be taken, to provide data upon which to work. The type of road, and how it is to be planned in relation to the proposed crossing of the Humber, are also matters which have not yet been settled.

Good Record

ACCORDING to the monthly road accident return of the Chief Constable of Huntingdonshire, there have been no fatal road accidents in the county since June. Of the 24 people injured on the roads during August, eight were cyclists.

Good Progress

AT the annual meeting of the Louth (Lincs) Wheelers' Cycling Club, held on September 24th, it was reported that the club had made good progress during the past year and its finances were in a healthy condition. A debt has been wiped out and there is now a balance in hand.

Derbyshire Road Collapse

SEPTEMBER'S abnormal rainfall caused a serious subsidence on the Derwent road at Ashopton, Derbyshire, extending over a considerable distance opposite the new Ladybower reservoir. It is believed that the rain caused a small underground stream to swell and undermine the foundations of the road. Repair work is estimated to cost several thousand pounds, but nothing can be done until the ground has settled down.

Good Advice

SOME 60 members of the cycling section of Nuneaton Youth Club provided an escort for Bishop Bright when he went to Nuneaton to perform a confirmation service at the Catholic Church. They escorted the bishop's car for some six miles from the parish boundary to the church, where the cyclists and their machines received the bishop's blessing. When he gave the blessing, the bishop pointed out that this did not relieve them of the responsibility of seeing that they had good brakes.

Into the Lion's Den

A LEICESTER man who was charged at the City Magistrates' Court with obtaining a bicycle by false pretences and fined £5 was stated to have obtained the machine from the police by "identifying" a cycle which he alleged was his wife's, and had been stolen previously. Unfortunately the cycle he "identified" and took away was later found by the police not to correspond with the particulars he had supplied of his wife's cycle.

Working Together

THE Hercules Cycle & Motor Co., Ltd., and Tube Investments, Ltd., controlling the Chesterfield Tube Co., Ltd., have come to a mutual arrangement which will lead to increased production. Considerable expansion of the Hercules cycle factories is also planned as a result of this arrangement.

For Cyclists Only

AS part of a special safety drive organised by the Doncaster Road Safety Committee, members of the Borough Police Traffic Section spent a week in checking up the behaviour on the road of the town's cyclists and pointing out anything which might lead to a cyclist being involved in an accident.

East Clandon, Surrey.
A delightful old world village lying just off the Leatherhead - Guildford road. The church dates from the 13th century.

Around the Wheelworld

By ICARUS

Wisecrack

IF national bodies will interfere in matters which are not their concern, trouble is bound to N.C.U. Got it?

The Stafford Police

A CURIOUS offshoot of the recent Brighton-Glasgow cycling marathon organised by the B.L.R.C. is the attitude of the Stafford police, and we are wondering why they were inspired to bring cases against four riders in that event after they had declined to co-operate as police throughout the rest of the route had done. Were they anti-B.L.R.C., we pertinently ask? Had they been specially selected to bring these prosecutions? Had any of the national bodies written to them? I am entitled to ask these queries in view of the letter-writing campaign against the B.L.R.C., which commenced round about the time of its formation.

No one will support a cyclist who breaks the law and I am not suggesting that the police had not a case. The four competitors were James Brown, of the Glasgow Wheelers; Morris Gough, of the Wolverhampton R.C.C.; Cyril Walker, of the West London R.C.; and H. Thurgar, of the East London R.C.C., who were charged with having failed to conform with certain traffic-signals at Grapes Corner, Stafford, on July 31st. The prosecuting solicitor stated that Walker started to wheel his cycle to the middle of the crossing when the lights were red. The three other riders passed the same lights in single file when they were red.

After a lengthy cross-examination of the police witnesses by the B.L.R.C. Counsel, briefed by Messrs. William Charles Crocker, some illuminating admissions were extracted. It was admitted that ample notice of the event had been given to the chief police constable, but that no attempt had been made to co-operate as in other towns. In the case of Brown it was admitted that he was not the one guilty of the offence charged against him, and the case against him was dismissed and the police were ordered to reimburse him for the cost of the fares, namely £3 8s. 2d. Although Walker was charged with riding his machine, he was actually wheeling it! The police were cross-examined as to reasons for delay in issuing the summonses. The other three charges were dismissed under the First Offenders Act with 25s. costs against each.

"Bouverie Street to Bowling Green Lane"

A. C. ARMSTRONG, ex-member of the Bath Road Club and formerly editor of the *Motor*, has just written *Bouverie Street to Bowling Green Lane*, setting forth the history of the publishing house of Temple Press, Ltd. The book is published at 20s. by Hodder and Stoughton, and consists of 224 quarto pages plus a very complete index. The firm was founded 55 years ago when Edmund Dangerfield launched his first journal on January 24th, 1891. The story is a fascinating one, especially for cyclists, for although the firm has entered other spheres of technical journalism, very naturally its early history is closely associated with the cycling sport and industry. The pneumatic tyre had only been marketed for 3 years when Dangerfield launched his first journal, which was printed in a ramshackle printing works owned by the Dangerfield brothers in Bouverie Street, London, E.C.4. Towards the end of 1895 the firm moved to Rosebery Avenue, and 44 years later to another new building in Bowling Green Lane. Throughout the early pages of this volume, which is profusely illustrated, names famous in the early days of the cycling boom are plentifully besprinkled. Sisley, Groves, H. O. Duncan, Lord Northcliffe (one-time editor of *Bicycling News*), R. J. Macready, George Lacy-Hillier, Harry J. Swindley, George Moore, A. J. Wilson, Henry Sturmey, H. H. Griffin (the only cycling historian), C. W. Nairn, Lord Berry, F. H. Noble, J. K. Starley, Percy Kemp, Frank Patterson (whose delightful sketches illustrate many pages of the book), T. M. R. Whitwell—these are but a few of the names which occupy the early stage of the firm's development. There is humour and romance in the book, which every one interested in cycling and motoring should read, for it tells the story not only of the firm's progress, but also of the progress of those industries and the pastimes associated with some of them. Naturally, I was mostly interested in the cycling pages, and as these occupy a considerable proportion of the book it must take its place amongst other books on cycling in my library. The illustrations are delightful. The various chapters deal with a Social Revolution, portraying life in the late-Victorian era; the New Journalism, Dangerfield and Sisley, Behind the Scenes, the Famous Quarrel Between the Dangerfield Brothers, the Formation of the New Company, Early Illustrators, Outside Printing Jobs, the Second Venture, Further Expansions, the Drive for First Place, Two More Journals, the Effects of the War, the Story of Sir Miles Thomas (originally a member of the Temple Press staff), the Early Twenties, Six New Journals, the Story of the Aeroplane told by C. G. Grey, the Second World War, Progress in Printing, Press Photography, the Law and the Press, and a concluding chapter giving advice to beginners in journalism. There are over 50 plates and numerous illustrations throughout the text.

Cycle Accommodation at Railway Stations

AN inquiry by the National Committee on Cycling, made this year, regarding the accommodation for bicycles at London termini, gave the following results:

Cannon Street: "Facilities for storing bicycles are limited, and are only adequate for normal purposes."

Charing Cross: "We have not an abundance of room, but sufficient for normal conditions."

Euston and St. Pancras: "Only limited accommodation, as the demand for storage of cycles at our stations is very heavy, and we can only accept cycles for storage when accommodation is available."

L.N.E.R.: "We have not got as much space as we would like to provide, although we do have racks in the cloakrooms."

London Bridge: "Owing to serious war damage, the storage space is very limited."

Paddington: "The lack of accommodation at Paddington precludes the acceptance in the cloakrooms of bicycles for storage purposes."

Victoria: "No storage room for cycles at present. On normal occasions we can take a few, but space is very limited."

At only one railway station (Charing Cross) is the accommodation believed to be sufficient.

Present building difficulties are appreciated. What the National Committee would welcome is an acceptance by the railways of the reasonableness of the claim for adequate accommodation, and an undertaking that it will be provided as soon as circumstances permit.

No recent facts are available regarding accommodation in railway stations outside London. In April, 1944, the Great Western Railway informed the National Committee that they had undertaken the provision of *additional* accommodation for cycles at stations to the extent of 793 *stands*, and that other schemes were under consideration.

The National Committee would welcome a similarly sympathetic approach to the situation by other railways, and would be glad to know whether any practical storage proposals are under consideration.

Cycle of the Future

AFTER all the fanfare of publicity concerning the cycle of the future, shown at the "Britain Can Make It" Exhibition, I was disappointed in it. The Press made some most stupid claims for this bicycle. One newspaper cutting says: "The bicycle will free-wheel 1,000 yards up a 1-10 gradient; the rider will be able to tune in to a miniature radio while he pedals; operate built-in lights in the mudguard by pulling a switch; signal his approach by pressing an electric bell button, and brake with a twist of the handlebars." I did not see this marvellous device which is going to propel cyclists up-hill. It was represented by a block of wood! In spite of all these additional pieces of equipment we are told that the machine is 15 per cent. lighter and that it will be much cheaper than the present-day bicycle. I do not think so. Nor do I think that Coventry or Birmingham will be greatly alarmed.

The following is an extract from the *Birmingham Mail*:

Birmingham is not very impressed by the revolutionary bicycle design produced by Mr. B. G. Bowden, the Leamington engineer, for the "Britain Can Make It" Exhibition.

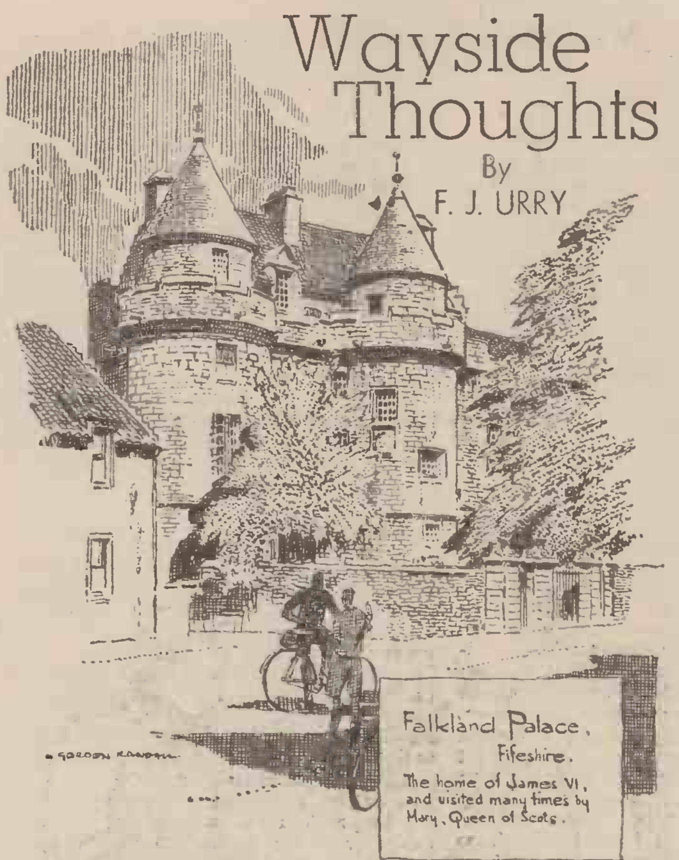
A director of the Hercules Cycle Company said: "We have had many similar designs offered us, and we are not interested. There may be a limited sale for this type of machine, but the big public demand will continue to be for bicycles of up-to-date but normal design.

"Export orders for bicycles of normal construction are overwhelming, including those from new post-war markets in the U.S.A. and on the Continent. At home manufacturers are satisfying only about 25 to 30 per cent. of the demands made by dealers. That being the case, we do not see anything in this new design at all.

"As regards streamlining, the bicycle of normal design is already as streamlined as any article could be. We invited streamlining experts to advise us on this matter, but they were unable to streamline the present design any more. We do not think this new design is likely to have any appreciable effect on sales."

Wayside Thoughts

By F. J. URRY



Falkland Palace, Fifeshire.
The home of James VI, and visited many times by Mary, Queen of Scots.

Catering Refusals

MY touring experience of accommodation during the vagrant summer of 1946 has not been of the happiest, although it is only fair to add that friends of mine report "no complaints" considering the circumstances of the times. I have not attempted a "straight tour," that is, moving on from place to place each day, which in my opinion is the finest method of roaming, but, except on one occasion, have fixed accommodation for a stay of several days and used such harbourage as a centre. Of the conduct of such hostels I have only one thing to say, that the meals were sometimes unnecessarily feeble when compared to those of the home, and there is really no reason why they should be since your ration-cards are taken, but the full value of them never seems to be returned. But my main criticism is directed to the caterers along the road, the folk who hold licences for the very purpose of feeding the traveller, and who so frequently refuse to do so. These refusals to get a rider lunch or tea have increased considerably during the summer, probably because more people are asking for such sustenance. Now, it seems to me that no one should hold a licence unless he is prepared to undertake its first duty, to provide food for the traveller, and unless we right this lapse in the licensing laws the highways and byways of Great Britain will become the most inhospitable in the world. The question is important, for this is a lovely land and ought to attract millions of foreign tourists and so provide a great and flourishing trade; but, candidly, I have not been able to detect those decent signs of hospitality that used to be a feature of the old-fashioned inn. Everything appears to be too much trouble for the majority of our modern Bonifaces, and as a casual caller I have been "fobbed off" with every variety of excuse from the lack of a fire to a houseful of guests and not sufficient food to meet their needs. And I have had doors slammed in my face when I have tried to persuade a cross-grained individual that the simplest of fare would meet my needs.

It is Important

SOMETHING similar occurred after World War I, but not, I think, on so wide a scale, and the neglect remained for a couple of years, leading to a considerable introduction of picnic parties, and the consequent loss of revenue to our caterers. Prior to 1914 no touring cyclist ever thought of carrying more than a bar of chocolate; he knew the next village would provide him with food and refreshment. Now, few of us ever take the road without iron rations, and as often as not they are more substantial than the fare offered to us—if we are fortunate. It seems to me that this slackness among caterers, and particularly the caterers holding licences, badly needs the attention of the Government—the Ministry of Food, the Ministry of Transport, the Home Office, and the Board of Trade—and I make the serious suggestion that all the touring interests should form a small working committee to press this question home to the only authorities that can bring our recalcitrant caterers to their senses. The freedom of the individual is a very fine thing to preserve, but when a man or woman undertakes a duty to the public, that duty should be carried out to the full, or the privilege that goes with it when such duty is refused should be cancelled and the opportunity placed in more capable hands. I know the remedy for uncivil treatment, or none at all, is with the traveller, but it is a cumbersome and onerous task involving loss of time and considerable expense, and few of us care or can afford to undertake it. Nor can the touring associations do much more than protect and remove from their lists the names of hostels which have refused reasonable service, for if they did otherwise they would be continually occupied with legal appearances against the renewal of licences to offending people—a thankless task, if in the last resort a necessary one. I imagine that concerted action by the Government authorities concerned with the need for reasonably good catering—which can be done even in these days of restriction—would have the desired effect and make such people realise the privilege they hold imposes a duty to the public which must be performed. Certain it is that to talk of attracting touring foreigners to Britain in increasing numbers is pure extravagance of speech until we make our roadhouses understand that reasonable demands at a reasonable price must be met, thus bringing the comfort and convenience of travel to every type of wanderer.

We Have the Best of It

MANY of my friends have loosed off their invective at the weather vagaries during this summer, and while they have had cause so to do, I am bound to admit this late strange season has never kept me in an hour, although it has hastily sent me, on occasion, to a shelter. I wouldn't give a button for a holiday of the sedate type, where everything must be just right to match the sunshine, and if that desirable condition does not materialise then the whole programme is upset, and you dive back to a lounge and look wistfully through rain-rilled windows. No doubt it suits some temperaments, but to me it would be a complete waste of time, and I'd rather be at work. My definition of a holiday is to move easily from place to place—to see, observe, look and listen, to mix with country folk and sample the avenue of life adown which they walk, and at the end of the day review its experiences with that measure of contentment following a good meal and the quiet leagues I have ridden. I do not want to be tied by the leg to any restricted area, for the habit of roaming is now too deeply planted to be uprooted by any incident short of the passage of time. That is why I think and feel that the cyclist, no less the elderly than the young, has altogether the best of it when the weather takes to tantrums and trails its storms across the supposedly sunny months of the year. I'd rather have it fine, and during warm afternoons seek the shade of an oak and browse; but it is as well to remember that in the worst of seasons—and this late one is among the records—it seldom rains all day and always gives to the roamer the marvellous compensation of glorious views. Remember how soon we get tired of long but hot spells and pray for rain; I never remember hearing or reading of a pulpit message praying for its surcease. It is well to take that into account, and by the same token persuade yourself that of the two conditions occasional rain would be your choice. The cyclist, I say, is better off in unsettled weather than any other holidaymaker; he can keep dry longer, see far more, nor need such conditions curtail his freedom and enjoyment. It is a phase of the game of which so many people are ignorant, and seeing a cyclist shurring over wet roads pity him. That is a wasted thought, for he is having the best of the fun.

The Old Story

I SPENT a week in the Lake District during our boisterous August, for such were the conditions four of us met and conquered. Never for an hour were we held up inside the hotel; true we sheltered from the fierce storms under rocks and walls and trees, but the weather did not prevent us visiting most of the lakes, crossing Honister (both ways), Newlands, Whinlater, Dunmail Raise and the rocky little track from Rosthwaite in Borrowdale to Watendlath. Nor were we a youth party, for the youngest was 45, and a couple of us were well over 60. Such is the mobility of a bicycle when riders are decently fit and a very lovely land is around them. Sometimes I feel that all the emphasis that cycling is a game for youth is overstressed; it is all that, but it is also much more, for in very truth it keeps the young fit and the old younger. The trouble is to persuade the over-forties to make cycling one of the main games of their lives, and thereby conserve their youth and undoubtedly preserve for themselves a healthy fitness far beyond that of the average sedentary individual of their own years. For the enjoyment of life does not lie in the contemplation of how much you possess, but how far happiness possesses you. We talk about freedom from want as a desirable condition of a new world order, and few would deny such a hope; but it seems to me there is another important thing in the scheme of living which should help to cure that reckless covetousness and ostentation one sees everywhere—freedom from wanting. Here is a simple form of travel embodying all desirable things for acquiring a holiday: health, activity, fresh air, deep breathing, freedom, scenery, bird-song, and last but not least silence, to heal the blows and bruises of industrial sound. It is within the reach of all men and women, so easy and so simple that its very ease and simplicity almost constitutes a handicap; "anybody can be a cyclist." Don't believe that yarn, for there is a wide difference between riding a bicycle and making that instrument the avenue to your enjoyment of life. I know, for I do both kinds of travel, the utility type daily to work and home, and the real cycling of which touring is the peak in enjoyment, just as often as opportunity occurs.

A Needed Component

I HAVE been using a pair of the new Chater-Lea pedals which retail at 30s. a pair. They are made for the rider who wants the very best for racing or touring, and though the price seems high the buyer is purchasing, in addition to the pedals, that slight increase in ease or speed which is in the gift of a component of this class. I should like to see C.-L. offer a rubbered block pattern in similar quality, but the rubbers supplanted with felt blocks, then such a combination would make the ideal pedal for my use. Rat-traps, which is the pattern of the new pedal, tend to give me slight vibration in the feet on a long journey, which is uncomfortable. The frame of this latest C.-L. product is of stainless steel, and the barrel is machined to form the cups, hardened and ground to give perfect alignment under every condition of load. The bearings are oil sealed as in aircraft practice, thus eliminating any necessity for adjustment, and though the pedal does not spin in the wonted manner of the cheap type with the sloppy bearings, under load it is as frictionless as accuracy in making and finishing can devise. I predict a long life and a steadily mounting demand for this article, for we have needed the aid of a first-class pedal for many years, and now we have one, though they will not be in great supply for some months.

A New Mac

A FRIEND of mine has made a mac out of plastic material and showed it to me recently. He said it was doing the job splendidly, did not crease or stick, and was as tough as leather, demonstrating the latter virtue by trying to rip up his property. I had always understood the difficulty with plastics was the sewing of the seams, the perforations weakening the fibre of the fabric to such an extent that it tore readily. He told me he had not experienced any such difficulty in the six months he had been carrying and using the garment, and invited me to try and separate the seams, which certainly seemed tough enough to resist the uneasy treatment most capes get. No doubt we shall hear more of this form of waterproofing in the near future, and maybe the new material will cure that fell disease of capes, leggings and sou'-westers—stickiness developing long before the articles are worn out. Perhaps our protection clothing manufacturers can give us some information—and hope—regarding the matter.

Just So!

AN old friend came to stay with me for a few days. He came in a car as most old friends do, but readily agreed to ride a bicycle with me at the week-end to visit some of his old haunts; he had lived in my area for more than twenty years. So we went out riding, not far, never more than forty miles at one session, and generally only half that distance during the evenings, and when the slimy weather of June would let us. So we went to his old haunts and I took him there by devious ways—and he was surprised. Surprised, because although he knew the direct ways, and would have sworn his knowledge of our Warwickshire lanes was complete, yet his discovery of minor ways and field paths, of which few motorists and not many cyclists are aware, gave him a little thrill and made him realise that there was a lot more in this cycling game than the mere rhythm of pedalling. Once he said; "Do you know, I've often wondered in the old days where that lane led, but always seemed to be in too much of a hurry to investigate. I begin to understand now why you love your cycling, finding in it that peace and contentment which seems so difficult to obtain in this noisy world. The bicycle does not "talk" to you; you are the complete master of it; it does not urge you to go on and on giving you that over-riding impress of impatience; it allows you to be more human, accepting and enjoying the limits of humanity; and finally it gives you the simple sense of personal ability. Yes, there's something in it, and I must make further experiments and discoveries." Just so; I probably should not have thought of the subject in just such terms; yet they are the right ones surely. There are still quite a lot of people who yet have to make experiments and discoveries, and I count myself as among those numbers. And there are still a few years left, I hope.

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CYCLORAMA

By
H. W. ELEY

In the lovely Thames Valley.
The sketch shows a distant view of Windsor Castle from just below Taplow village. Bucks.

And Now It is November

BUT it is wrong to associate this month with nothing but fogs and drear, damp days! Actually, I fancy that November is a maligned month, and I have been thinking of some of the *good* things one may find to say about it! Fog? I have been looking up some of my old cycling note-books, and find that most of my entries concerning fogs have been in February . . . and not November at all. That rather dog-eared old note-book shows that in the years gone by I enjoyed some fine rides in November. There is a record of a good ride, with a couple of friends, to the Lincolnshire coast . . . to Mablethorpe, Trusthorpe, and Chapel St. Leonards, hard by Skegness. Long, flat roads, vistas of the Lincolnshire fens, fine old churches; these are the features of that big county which seems to lure so few, but which is so rich in history and charm. But I could say much more about November . . . in defence of that little-loved month.

Newspapers and Cycling

TALKING the other day with one or two keen riders, and after passing round a copy of THE CYCLIST, the conversation turned to the little attention given by the average newspaper to cycling and matters connected with the pastime. Columns for the gardener . . . columns for the poultry-keeper, for the bee-keeper, the stamp collector . . . but precious little for the cyclist. That seemed to be the summary of our talk under a gnarled old tree, while the rain pattered down on an autumn afternoon. And I have often wondered why newspaper editors devote so little space to cycling: among their readership must be numbered thousands of riders, and it is no good excuse to say that the pastime has its own specialised press. Of course it has! But so have the poultry-keepers, and the apiarists, and the wielders of rake and hoe.

"Wheels of Fortune" Continue to Turn!

MY recent references to Sir Arthur du Cros's book have brought me one or two most interesting letters — from veterans who recall the early days of the pneumatic tyre, and who have vivid memories of the excitements and the litigation of those days. One correspondent recalls that some of the earliest officials of the Dunlop Company were famous track men. There was Herbert Synyer, for many years the Dunlop district manager at Nottingham. Herbert was a good man on the track in his earlier days, and always maintained a keen interest in cycling. And another writer mentions that C. A. Proctor, who quite recently retired from the onerous post of managing director of the Dunlop Company, was a noted rider in his youth. Good memories!

Nature Note

MANY of my cycling friends are keen nature lovers, and find never-failing interest in the countryside and its shy inhabitants. One of the shyest of all is "Brock," the badger. One may explore the countryside for many years, and keep a watchful eye on the banks and ditches where the badger has his haunts, but never see our wily friend. But quite recently, in the heart of Suffolk, I did see a badger . . . near to his "sett." It was almost dusk, and he came towards me through a tangled bit of bramble by the edge of a sandy bank. A big fellow, too . . . moving warily; but I got a good glimpse of him before he scuttled back to his home. I felt rather sorry that I had interrupted his evening forage, but I have no doubt that when I was well away from the spot he resumed his prowl for grubs and other delicacies.

Brealey of the B.S.A.

HE is a good fellow, is Brealey, who takes care of the advertising of the B.S.A. concern. I sat with him recently on a committee, and was struck, as I always am, by his shrewd sense, his knowledge of his job, and his intense enthusiasm for his company. And after all, he advertises a product to be proud of! That well-known trade mark of the piled guns must be one of the most famous in the world, and I am sure it stands, for every British cyclist, as a mark of high quality and fine craftsmanship.

"Cyclists Welcomed"

THAT was the friendly legend which I saw some few weeks ago on an inn in Wiltshire, and I thought it not merely an unusual legend, but one quite provocative. Why should cyclists *not* be welcomed? I was sufficiently intrigued to dismount and enter that inn, and make some inquiries . . . to find that the good landlord was a very keen rider himself, and he liked fellow cyclists to visit his establishment! He and I talked cycling for an hour or more. We talked of old-time meetings at Herne Hill; of riders of years ago; of bikes we had each owned; and I drank ale out of a battered tankard, and went on my way much refreshed. There is still a jolly fraternity of the road among men of the wheel.

Fireside Touring

NOT a bad idea, when the winter evenings come round, to light a pipe, take out some maps, and plan next year's tours. It is an old habit of mine, and I vouch for its fascination. When the "austerity" fire is burning brightly, and slippers are on, and the old briar we'll alight, then it is good to make plans for that Easter trip through Derbyshire dales, or over Yorkshire moors, or through the leafy lanes of Buckinghamshire. You'd be surprised how much joy there is in planning just where you will go, and what you will see. And if the winter wind is howling outside, and the rain beating on the window-pane, then all the better. Stir up the fire, take a sip from your glass . . . and "let the wind whistle as it will." And next Easter, when the spring sun is shining, and you ride serenely through that Yorkshire village in the dales, you will recall with infinite pleasure that winter's night when you mapped out your route, and did the ride in your dreams!

Bicycles in Plenty

I SAW them in one of the "big stores"—fine gleaming array of machines, and I felt a glow of satisfaction that in regard to one commodity at least, things seemed to be getting back to normal, and supplies on a scale somewhat commensurate with the demand. And, in that store, there was one feature of the cycle display which pleased me immensely: the assistant knew his subject, and knew a lot about bikes! I listened to his "sales talk" to a party of schoolboys, and was much impressed by what he told them. Later, I had a word with that salesman myself and, of course, found that he was a keen rider himself—owning two machines, very interested in touring, and very knowledgeable on subjects connected with the English countryside. It is not always that one meets the expert when one enters a cycle shop or departmental store!

Jubilees and Centenaries

IT was only in May that we celebrated the centenary of the bicycle and paid due homage at the shrine of Kirkpatrick Macmillan . . . and now we have had the jubilee of the motor industry, with a fine exhibition in the new and somewhat palatial premises of the Society of Motor Manufacturers and Traders . . . that historic building where once Disraeli lived and where Edwardian society was to be seen in all its splendour. And not only an exhibition, but banquets, cavalcades, and a Veterans' Car Club run to Brighton. It is good, I think, that the industry made so much of its centenary; good that the public should be made to realise what a great debt the nation owes to the pioneers who worked so hard in the old days . . . worked in the teeth of much stupid opposition and prejudice. If transport is the life-line of our national life, then the motor industry is truly one of the great links in that line!

Lullington Church.
Sussex.
One of Englands smallest churches. A lonely little building surrounded by trees off the main road from West Dean to Alfriston. Only the chancel remains of the original building which was destroyed centuries ago by fire.

My Point of View

By "WAYFARER"

"Go Thou . . ."

A RECENT obituary notice said: "After the outbreak of war in 1914 Lord Cavan's rise was rapid; at 49 years of age he was mentally and physically alert and inured to all forms of outdoor exercise." Everybody cannot indulge in "all forms of outdoor exercise," but we can take our pick of the lot, and I, personally, believe the best to be cycling. At any rate, a wise and sane indulgence in our pastime will help to keep one "mentally and physically alert." So my advice to all and sundry is: "Go thou and do likewise."

Luggage in Front

THERE is certainly something to be said in support of the plea which has been put forward with regard to the better distribution of the luggage we touring cyclists carry. The vast majority of us, it is to be supposed, stick the freight on the back of the bicycle, where, at least, it is out of sight (and out of mind)—and protected from the weather. There is also something to be said in favour of having everything in one place, so that no confusion exists when a map, or a toothbrush, or a hair-pin is required. But, as the back wheel has to carry the main weight of the rider, I am not sure that it is either fair, or wise, to penalise it with all one's luggage, including, perhaps, half a dozen maps. The point raised does seem worthy of some little thought.

Sub-standard Days

A WORD or two may fitly be said on the subject of sub-standard, or not-so-good, days. On a recent Saturday afternoon I set forth for my usual ride, rather discouraged by the general appearance of things. The whole aspect of the local world was a study in drab, and I saw that rain was not far away. In a very few minutes my cape was in position, and I was splashing through the juice. There was no thought of going back, for once I'm out, I'm out. The rain ceased, and I put my cape away—and then the rain started again! Not long afterwards, however, the wet desisted "for keeps" (as it turned out), the murk gradually removed itself, blue patches came into the sky, and the sun emerged from its lair. The temperature was low for the time of the year, but the impact of the wind on one's face gave a tonic effect.

The three cyclists who disposed of an excellent farm-house tea decided that they had been amply rewarded for turning out on a not-so-good day—they passed a vote of condolence with others who had stayed at home!—and that reward was accentuated in the evening, when conditions improved still further and the air was remarkable for its clarity. Such an experience is an inducement to "grasp the nettle" on sub-standard days, and hope for the best. And "the best," however unlikely it may seem to be, very often happens.

Psychology of Salesmanship

THANKS to the experiences sustained during the war years, I am seriously thinking of opening a school devoted to the psychology of salesmanship—a subject in regard to which a great many caterers know absolutely nothing. There is money in catering, but quite a number of the people engaged in the trade make a point of repelling their customers, and thus sending money elsewhere, by their very manner. It is obvious, of course, that rationing has set up serious difficulties for caterers, but they can surely be polite about their inability to provide a meal. When a cyclist has thrown at him the remark, "Nothing in the house," or "Can't manage any more," without any expression of regret (or even of interest), he remembers the episode, and the establishment is entered on his mental black-list. It costs nothing if the caterer briefly explains the position, making it known that rations have been exhausted, and saying how sorry she is not to be able to do anything. That, too, is remembered by the cyclist, who will probably try his luck again at the same place later on.

One day recently I called for lunch at a house where I have had one or two quite good feeds. In response to my request, the caterer said, bluntly: "You'll have to have an ordinary meal to-day!" That was precisely what I wanted: I expected nothing else, and I frankly accepted the position. Then, equally bluntly, she announced that she was trying to get lunch ready for one o'clock, to which statement I replied, very sweetly, that the arrangement would suit me admirably, and that *it was just five minutes past one!* Her method of dealing with customers was quite wrong, and, so far as I am concerned, she will have no further opportunity for practising it.

Without Sympathy

A CYCLING acquaintance told me over tea the other day that he had just been fined for failing to observe a "Halt" sign. He said that he had certainly slowed down, but had not come to a standstill, and a watchful policeman lurking in the neighbourhood had done the pouncing act, with unwelcome financial results. At the end of this brief recital my friend paused as though to give me a chance to express my sympathy—a chance which I spurned. On the other hand, I made it abundantly clear that I was certainly devoid of sympathy with anybody—cyclist or motorist—who ignored "Halt" signs, and that I would be very glad to see the police, generally, getting busy and "doing their stuff," in the interests of safety. Such action is bound to be initiated in the early future, when the police forces have been strengthened by the return of men from the Army. It therefore behoves us, one and all, to sit up and take notice. We shall find it cheaper to obey the injunction and come to a standstill when told to do so. No doubt a few of these "Halt" signs are unnecessary. Well, the remedy for that is not to flout them, but to organise opinion in favour of their removal.

Free Medical Advice

I EXTRACT the following from Dr. Halliday Sutherland's entertaining book entitled "Hebridean Journey." It has nothing to do with cycling, but, as a fragment of free medical advice, it may be of interest and use to some of my readers. The author was walking through Glen Sligachan, Isle of Skye, on a wet day. "There was no sense in trying to be dry-shod, because my raincoat, which might have withstood an April shower, was now permeated with rain, and from my panama hat water was trickling down my back. Indeed, at the end of this walk I was drenched to the skin, and on returning to Portree at 8 p.m. I went to bed in order that my clothes might be dried overnight in the hotel kitchen. Yet there is no risk to health from wet clothes, or even from sleeping out all night in wet clothes, provided the moisture does not evaporate too quickly. It is not the moisture but its evaporation that lowers the body temperature, produces a chill, and may produce pneumonia. Thus after the '45, when loyal Highlanders were driven to the mountains by the Duke of Cumberland's troops, it was their custom when sleeping in the open to soak their plaids in a burn or loch before using them as blankets. The wet plaid kept the body warm, and even to-day this is done by Highland shepherds when sleeping on the hills."

Elsewhere in the same book Dr. Sutherland says: "The best advice to those visiting the west of Scotland is to be prepared for rain. With a sou'-wester, light oilskins, and goloshes you can be out and about on wet days, and I once spent a pleasant holiday in Argyllshire although it rained for four weeks without stopping."

Tyre Technique

DESPITE the operations of the nice-minded people who like to strew our roads with broken glass, punctures are really few and far between. It occurs to me that readers may like to know something of my tyre technique when "troubles" are encountered, whether in the form of actual punctures or otherwise. Well, unless I know for certain that there is a definite perforation, I always test the valve, using water in an egg-cup or a wineglass or a narrow bottle. In the presence of negative results, I look round the cover for signs of an intruder. If found, I extract the foreign body, mark the spot, and (probably) proceed to take out only the immediate part of the inner tube. The repair is then effected in the usual way, namely, by cleaning the tube, applying a thin coat of rubber solution (which is allowed as long as possible to become "tacky"), pressing home the patch and dusting it over with French chalk, afterwards putting the tube back into position and replacing the cover. If it is necessary to apply the water test (and this, after all, is the best way of finding out what is wrong), then, of course, the whole of the tube must be unshipped. I put plenty of air into it, and then go round very carefully, stretching short pieces of the tube and watching for results. When found, I mark the spot with a cross, using a copying-ink pencil. It seems to me to be just as well to test the whole tube when one is on the job (it is a good plan to start from the valve and finish with the valve), and I take care to see that the air pressure is maintained throughout the process of examination. Otherwise results may not be readily observable. Soapy water is an advantage, making punctures more inclined to declare themselves, whilst in cold weather I like to have the chill taken off the water, thus reducing the temptation to scamp the job.

Other small points in my tyre technique are these: Owing to the escaping habits of rubber solution, I make a point of carrying a spare tube, unopened. The contents of a tube which has been used may get away, and you will be landed. With an unopened tube you have a good chance of finding what you want in an emergency. So always carry a spare. It occupies practically no space, and weighs next to nothing. Don't screw up the valve locking-nut too far; or, rather, don't give it an extra bit of attention every time you notice it. The danger is that, when you want to undo it you will have to use pliers—and you may not have a pair handy in the case of a roadside repair. If the insides of your rims are rusty, it is not a bad plan to apply a coat of thin paint. If the rim tape is the worse for wear, replace it. Rim tapes cost very little, and are easily fitted.

Two Points Arise

NOT for the first time—nor for the hundredth time—has a road fatality occurred owing to one unit of traffic crashing into another unit in the dark. The coroner, rightly characterising the accident as "most unfortunate and unnecessary," concluded that the stationary lorry, into the rear of which a motor-cyclist ran, had no efficient lighting system, the lights apparently working only while the engine was being accelerated. That is a pretty position in this year of grace 1946, after all the trouble which has been taken to see that road vehicles are fit for the purpose which engages them. The police superintendent is reported to have said that until the time of the accident nobody appeared to worry whether there were lights on the vehicle or not. That also reveals a pretty state of affairs—or was it nobody's concern? But, to get to fundamentals, is it not a fact that the motor-cyclist should have been depending entirely on his own lights, and not relying on those of other people? The unlighted lorry might have been an unlighted (and unlightable) straying horse or cow, or a fallen tree, or a collapsed wall, or a road subsidence—and the result would have been the same.

Ancient Voices

HERE are three reprints, summarised, from the *Birmingham Post* of about 50 years ago, with my comments: 11/9/1896. "It is only at the present moment that we are beginning to discover our mistake in having admitted the enemy within our gate in the shape of the hurried, fussy, breathless bicycle. We are severely punished for the outcry raised some time ago against the piano, and now we have to submit to a far more grievous domestic punishment in the adoption by our young lady population of the bicycle. The odious instrument, devoid of all grace or moral harmony in the purpose to which it is applied, has become the bugbear of every domestic circle." In 1896 the bicycle and the cyclist had emerged from the "cads on castors" stage, but there was still prejudice to be lived down, as witness the foregoing quotation from a responsible daily newspaper, circulated in an area which has since witnessed the manufacture of hundreds of thousands of these "odious instruments." Personally, I prefer the testimony of Arthur James (afterwards Lord) Balfour, voiced at about the same period: "There has not be a more civilising invention in the memory of the present generation than the invention of the bicycle."

Two days earlier the *Post* had spoken of the "curious embarrassment" which had arisen in Coventry "as a consequence of the cycle boom." Constant and well-paid employment was the order of the day, and workpeople were flocking to the city in order to participate in the "great and rapid development" of the industry. The housing accommodation was quite inadequate. Strange reading to-day, when the cycle trade is so firmly established in Birmingham, Coventry, Nottingham, and elsewhere, and has become an integral part of our national life!

A few days later (September 24th) the *Post* contained a reference to the fact that "at Smethwick Police Court, the second batch of offenders against the new county bye-law, requiring lights to be carried on all vehicles after sunset, appeared in answer to summonses." Some of the "criminals" pleaded that lamps were on order but had not been delivered, while one said that the shaking of his wagon put out the light, and he did not see how the bye-law could be complied with unless a specially designed lamp was invented. Another man pointed out that in Worcestershire, which was close to the boundary of Smethwick, they were not compelled to carry lights. Well, satisfactory lamps were provided—and the vehicles to which the bye-law applied have steadily disappeared from our roads, giving way to the internal combustion engine! But the main point here, to my mind, relates to the absurdity which then existed, whereby counties had power to legislate in this manner. Thus we had the ridiculous position of lights being required in one county and not required in the next county.

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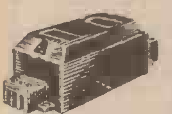

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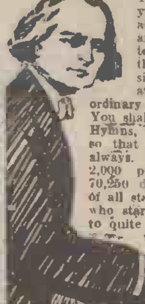

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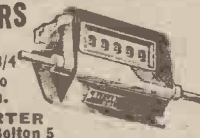

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