SYNCHRONOUS ELECTRIC CLOCK

NEWNES

PRACTICAL MECHANICS

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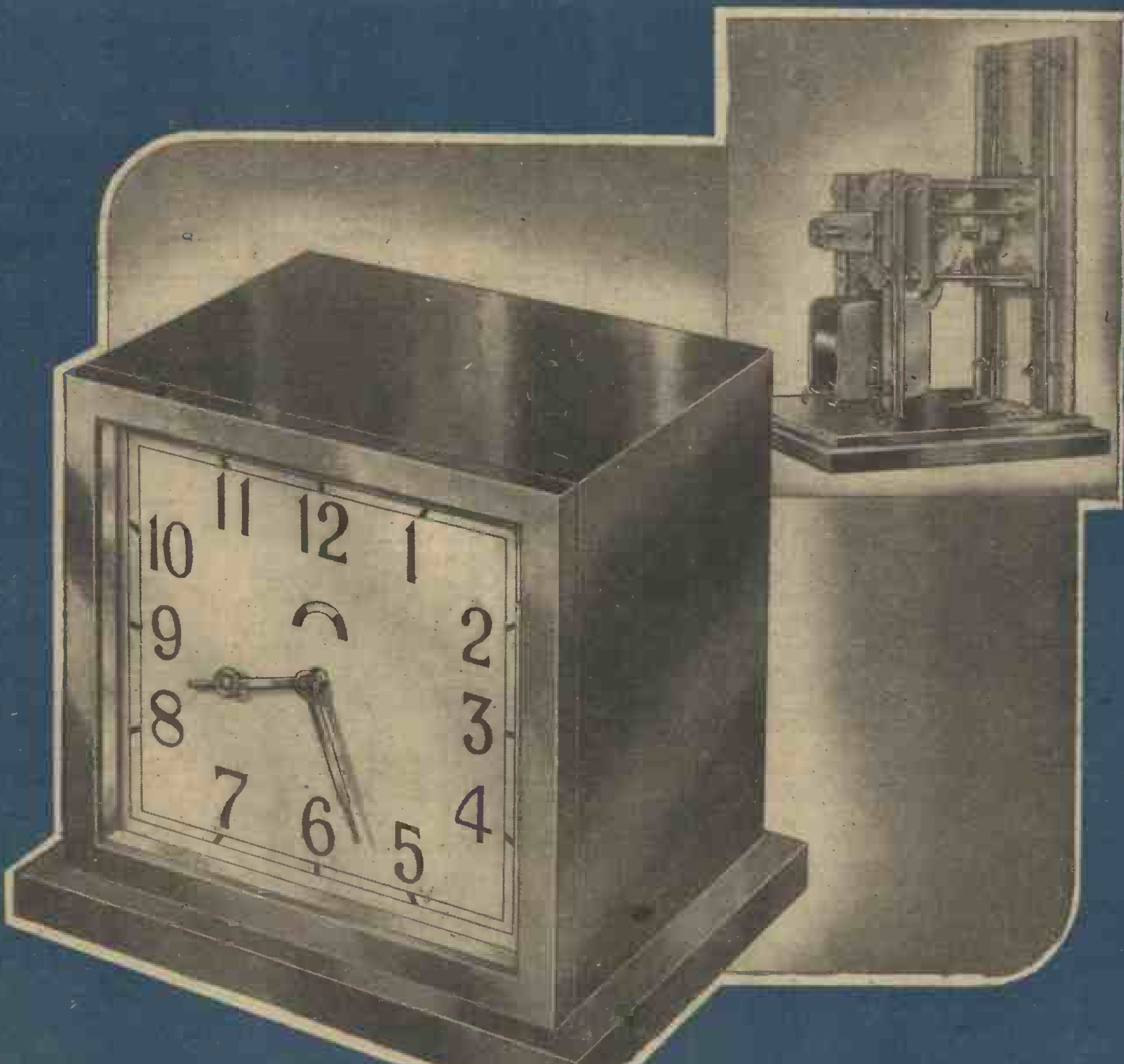
MARCH 1944



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Editor: F. J. CAMM

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FAIR COMMENT—BY THE EDITOR

Post-war Technical Education

I AM glad to notice that provisions are to be made in the new Education Bill for technical education, but details are not given. It was recently stated in Parliament that technical education in this country was far below that of any other industrial nation. If this is true, the Government accuses itself. Free education in this country was launched with a great fanfare of trumpets in 1888, when Gladstone introduced his famous Education Act, which made it compulsory for parents to send their children to school from the age of five until the age of 14.

Strange though it may sound, the very people who pressed for free education—namely those who would benefit by it—were the first to oppose it. They wanted free education of the sort where they could go when they wanted to—turn up when they liked. No system of education could possibly succeed on those lines, and so education was made compulsory, with school hours and holiday periods laid down by statute. It is perhaps one of our national defects that things have to be made compulsory, because the voluntary system in anything has always failed. People have to be dragooned into doing things for their own benefit. However, the system worked well, and the early school curriculum was mainly concerned with teaching scholars the rudiments of the three R's—reading, writing and arithmetic.

Before that time those who could afford education sent their children to a kindergarten (a nice, snobbish German word, which enabled the pseudo intelligentsia of the period to lead their neighbours to believe that it was an academic establishment), or to a ragged school, or if they wanted to be really snobbish, to one of the schools where the scholars paid 1s. a week. For the next ten years the school curriculum was gradually improved to include such subjects as mathematics, music, religion, physical training, physiology, health, and later proceeded to the school clinics, where the child's health was subject to periodical inspection. Then, of course, came various trade slumps, and Chancellors of the Exchequer lopped considerable lumps off the Government grant for education, so that the curriculum had to be cut.

During this process of reduction, science was leaping ahead in other directions. Radio, the aeroplane, bicycles, the motor car, the pneumatic tyre, and many other inventions were being developed by the pioneers. So whilst our heritage of knowledge was being enriched and increased, the reply of the Government was to cut down the training and the education which would enable one to absorb it.

Other nations had more foresight, and in Germany particularly the Government of the day saw that the key to their national aspiration was to create a highly intelligent race of capable, trained technicians, and it is beyond all doubt that Germany did achieve this object. This country and others lapsed behind and bought goods from abroad which could not be made here because we had not trained the people to make them, or to design and produce the machinery which could make them.

The cinema, the dance hall, the theatre, and the inordinate national importance attached to football, have provided counter-attractions which took away from the individual the time he would normally spend in studying, until to-day large numbers of people understand only reading, writing, and rhythm! The nation must become scientifically minded in view of all the new developments which are bound to take place after the war. We must live down the gibe that we are a nation of shopkeepers selling other peoples' goods.

Technical Study

IN an attempt to provide opportunities for technical studying, monotechnics, polytechnics, and evening classes were commenced, but these have not been largely successful because, after a day's work it is found that the brain is not particularly receptive to instruction. Now the proposition is to teach it in the schools, and to train the scholar in the particular field for which he shows a natural aptitude. We must confess that at the moment we do not see how this plan can be carried out. Certainly the normal school curriculum in the academic branches of education must be absorbed by the student before he receives a technical education. This will certainly occupy him up to the age of 14, and apparently for the next two years after his natural aptitude has been discovered he will be passed over to a specialist instructor to receive elementary training in his chosen career. Attached to each school, therefore, must be a large number of specialists in particular branches of technology, and existing schools have neither the capacity, the accommodation, nor the equipment to handle such a scheme.

Practically every school will have to be rebuilt, or considerably augmented. Additionally, we have not sufficient teachers of the right type to handle such a scheme. It takes time to train teachers, and the salaries they are offered are not particularly attractive. So that aspect of the new Education Bill cannot reach fruition for a number of years.

Evening Classes

THE Government has reached the conclusion that segregated technical education such as is obtained by voluntary attendance at evening classes or technical colleges does not quite fill the bill, and we are inclined to agree that it is unreasonable to expect a man to work eight hours a day and spend three or four at evening classes and at homework. The move, however, is a sound one, and whatever the snags, the plan must be carried out. What is really wanted is a Minister of Education, and a Ministry of Education, not a fictitious Board of Education which never meets. Education has always been the Cinderella of the Budget. If we have wanted to save money we have always cut education. We agree that in some directions the school curriculum and the basis of examinations are in need of overhaul and drastic revision. Really capable people fail to pass exams. on unimportant subjects like history and geography, yet are good at science and mathematics, whilst precocious nitwits collect the glory and the degree because they can remember a few textbook postulates. When they enter industry they are nearly always found to be lacking in energy, enthusiasm, and practical knowledge. They cannot apply their book knowledge. Some of those examinations need to be abolished. The absurd examination for Matriculation or General School Certificate, and the almost equally monstrous examination for B.Sc. degree does not provide the individual with the knowledge or the dignity such examinations should provide.

Nine-tenths of the academical side of our education could be cut away, and the individual left to learn it after he has been trained to be a useful citizen. During his school years his mind should be crowded with useful knowledge, not academic knowledge.

We are glad to notice that in the post-war period greater use is to be made of films for teaching purposes.

"Dictionary of Metals and Alloys"

THE Third Edition of the "Dictionary of Metals and Alloys" has just been published at 10s. 6d., or, by post, at 11s. It has been completely revised, and over 150 new definitions have been added. It is obtainable from George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Building a Synchronous Electric Clock

The Construction of This Clock is Simple, and it is Built Without the Aid of a Lathe or Special Tools

Fig. 1.—The finished clock.

WHEN the amateur model-maker looks around for new subjects on which to exercise his skill, the building of an apparently intricate piece of apparatus, such as an electric clock, is passed over on the score of requiring special tools, such as a lathe, gear-cutting appliances and other apparatus not usually possessed by amateurs. It will be found possible, however, to construct a highly satisfactory electric timepiece with perfect timekeeping capabilities, literally "on the kitchen table."

Unlike the spring-driven clock, an electric clock of the synchronous variety does not depend for its accuracy on escapement of pendulum action. It is driven by a very small electric motor, having a minute consumption of power, controlled for speed by the frequency of the A.C. electric mains to which it is connected.

Now that the grid scheme is in operation, practically every power station in the country is synchronised from Greenwich, to deliver power at exactly 50 cycles per second, and, as the speed of the motor is entirely dependent on the frequency, the clock is, virtually, controlled from Greenwich.

The motor is not self-starting and has to be rotated by hand until it is running at the speed at which it is designed to run.

The Rotor

In the timepiece, as illustrated, the rotating part of the motor, generally called the "rotor," consists of a toothed iron disc which rotates in an alternating magnetic field, set up by a winding, between the poles of a specially shaped iron magnet system, hereafter called the "stator." Fig. 6 shows the shape of the rotor and stator, and gives their dimensions.

The rotor speed, in revs. per minute, is determined from the formula $\frac{2\ f\ 60}{n}$ where f is frequency in cycles per second, sometimes called periods, and n is the number of teeth on the rotor. In this instance, the mains frequency was 50 c.p.s. and the rotor teeth 16 in number, giving a speed of 375 r.p.m or 22,500 per hour. To reduce this speed to 1 per hour calls for a reduction gear 22,500 to 1. This seemingly huge reduction is obtained, very simply, in four steps of 3 to 1, 3 to 1, 50 to 1, and 50 to 1, by employing gear wheels.

It is to be noted that the clock is rather larger than is usual with purchased ones. The overall size, including the case, is approximately 8in. square by 6in. back to front. These dimensions are occasioned by the size of the gear wheels employed. The large size is not considered a disadvantage as the more usual 3½in. dial is rather small to be read at a distance.

Materials

Commence construction by gathering together the material required as detailed in the list of parts. The gears, sprocket wheels, collars, plated washer, axle rod, perforated plate and grub screws can be obtained ready made. The Swedish iron plates and iron strip are obtainable from any good blacksmith or metal merchant. If Swedish iron is not readily obtainable, mild steel will do quite well. A good radio dealer will supply the D.S.C. wire, 2 B.A. screwed rods, nuts, washers, 4 B.A. and 6 B.A. screws, ebonite and transformer stampings.

Take the wider of the two iron plates and having polished off any rust and scale which may be adhering to it, scribe the line A-B 1½in. down from the long edge. (See Fig. 6.) On the line A B mark off hole 1 and drill with a 5/32in. drill.

Drilling Operations

Drive a pin, cut from the axle rod, into this hole and use the pin to position the perforated plate which will guide the drill for drilling hole 2. Secure the plate firmly to hole 2, in a similar manner, and using it as a template, drill out holes 4, 5, 6 and 7. With the plate still in position, use the 5/32in. drill to indent the centre of hole 3. Do not drill this hole right through at this stage.

Remove the template and using the indent for hole 3 as centre, scribe, with compasses, a circle of 1¼in. radius. At the same time scribe a second circle of 1 17/64in. radius. By bisection, divide the circumference of the smaller circle into 16 equal parts, and with a centre punch, mark each point of intersection. Using a drill of 1/16in. diameter, drill pilot holes for the 16 holes on the circumference of the circle. Hole 3 may now be drilled out 5/32in. diameter. Great care must be taken to make these holes exactly in the correct position and dead square with the surface of the plate.

Before proceeding to enlarge the holes already drilled to their finished sizes, the narrower plate should be cleaned up and, with the aid of the perforated plate, holes to correspond to 1 and 2 drilled. These holes will permit the narrow plate to be secured to the back of the wide one. The wide plate now becomes a template, and drilling is continued until all holes but one are present in both plates. The exception is hole 3, which should only be indented, as it is used as a centre for scribing the finished size of the rotor, i.e., 1 15/64in. radius.

Having drilled out all the pilot holes in both plates, attention should be turned to the rear rotor bearing strip, which is of brass 4½in. × ¾in. × 1/16in. (approx.).

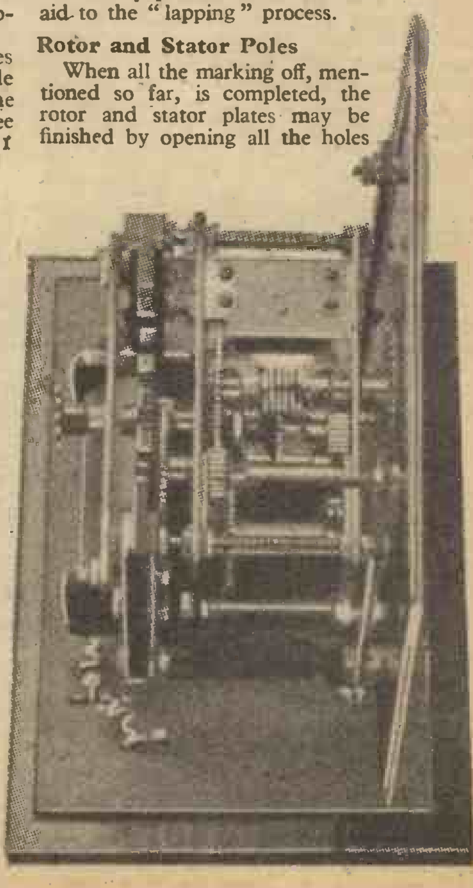
It is essential that this bearing strip and the gear plates be of brass or other non-magnetic metal. If iron were used for them they would short circuit the field between the stator poles.

The centres for the bearing and support holes can be marked off from the partly completed stator plate. The rear gear plate can be marked off in the same way. By adhering to this procedure of marking off all the parts from the stator plate, perfect alignment of the holes is assured.

Holes that are to be a bearing fit for the rod are best drilled out with the 5/32in. drill and then "lapped" out with the aid of a small piece of the rod, tapered slightly to enter the hole, used as a lap in the hand drill. This procedure actually improves the bearings as the lap hardens and polishes the wearing surface. The hole in the centre of the rotor will require a little fine emery powder and oil as an aid to the "lapping" process.

Rotor and Stator Poles

When all the marking off, mentioned so far, is completed, the rotor and stator plates may be finished by opening all the holes



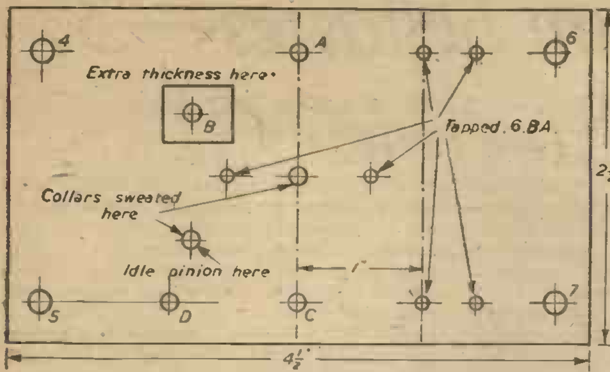


Fig. 3.—Details of the template for positioning the holes.

out to their final sizes. (See Fig. 6.) With a hacksaw, cut out the rotor and stator pole pieces as near as possible to their finished shape, finishing them down to the dimensions given with files, taking care to keep the edges square and the concave faces of the pole pieces as true as possible. The shaping of the rotor demands especial care. It must be truly round. Any lumps on its circumference will necessitate increasing the gap between stator and rotor to prevent fouling as the rotor revolves. The gap should not exceed 1/32in.

The rotor is completed by having a ½in. diameter, ¼in. face pinion sweated to it with the boss outwards. A short length of axle rod will hold the parts concentric during the sweating operation.

Care must be taken to prevent solder creeping between the teeth of the pinion.

If desired, the iron parts can be given a coat of quick-drying black enamel.

The next step is to fashion the stator pole supports, or legs, from the ½in. × ⅛in. iron strip. It is only necessary for the rearmost pair of strips to be bent to form feet. The strips which support the dial form the front pair of feet.

The Transformer Stampings

From the transformer stampings cut sufficient strips, 4½in. long by at least ½in. wide, the exact width is not critical, to equal in thickness the stator pole pieces. Also cut two pieces of the ½ by ⅛ iron 3½in. long. The transformer iron strips and the 3½in. pieces, together, form the yoke over which is wound the winding for energising the motor. It is not recommended that this yoke be made from solid metal, as its use in magnetic circuits introduces a loss of energy which has to be made good by increased consumption from the mains.

Having completed the iron work for the motor, attention can now be given to finishing the rear bearing strip. To provide a greater length of bearing for the rotor spindle, a collar is sweated to it. A short length of axle rod will facilitate the sweating process if it is used as suggested for sweating the pinion to the rotor. The collars, as purchased, have two tapped holes, but only one grub screw. The extra tapped hole will serve as an oil hole if it is positioned vertically and oil will not run out of the bearing if the screw is left in place. It must not, of course, be tightened up or it will grip the rotating spindle.

The drawing of the rear gear plate, Fig. 3, gives the position of all the bearing holes for the gear wheel spindles and their sizes. All the dimensions are not given, as, in some cases, greater accuracy in meshing the various wheels can be obtained by following the procedure outlined below. The front gear plate is almost identical with the rear one, and it can be drilled out, with a minimum of labour, by using the rear plate as a template. Immediately above the hole for the rotor bearing (a collar is sweated to this hole when the plate is finished, as with the rear bearing strip), drill hole A with a 5/32in. drill, lapping out the hole to axle size, as detailed earlier. The exact distance from the rotor hole to hole A may be fixed by employing the perforated plate as a template. On temporary spindles, mount a ½in. pinion in the rotor hole and a similar pinion in hole A. Place a 1½in. gear wheel in mesh with both of these pinions, so that its centre takes up a position corresponding to hole B, and indent the centre of hole B. If a strip of thin writing paper, crimped between two pinions, temporarily mounted on the perforated plate for the purpose of crimping, is inserted between the teeth of the three wheels, prior to marking hole B, sufficient clearance will be automatically allowed for any irregularities in the meshing of the wheel teeth. These same crimped between two pinions, temporarily any wheels whose centres are not marked off from the perforated metal plate.

Hole B is the bearing for the first reduction gear spindle, which runs at one-third rotor speed, and it is advised that it be increased in length by sweating a small

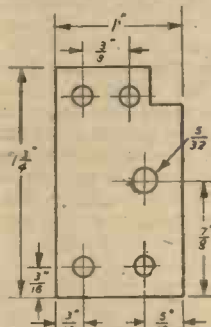


Fig. 4.—Horizontal bearing plates.

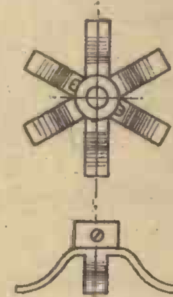


Fig. 5.—The six-arm star piece for adjusting the hands.

square of brass over it, and the corresponding hole in the front plate, afterwards drilling right through the two thicknesses.

Angle Pieces

The next step is to cut off and clean up ⅜in. pieces of brass angle strip. Each of these is drilled and tapped, using a No. 44 drill and 6 B.A. taper tap, to have two holes in each face, symmetrically placed, with ⅜in. between centres. These angle pieces are employed to carry horizontal brass plates, 1in. wide by 1¾in. long, between the front and rear gear plates. The horizontal plates are drilled with one hole each for a vertical spindle upon which is mounted a 50-tooth wheel and a worm. The position of the spindle holes is indicated in Fig. 4. A ¼in. square is taken out of the corner of each plate to clear certain gear wheels. The cutting of these small squares is best left until the assembly is partly completed, when their purpose and position will be obvious. Each horizontal plate has, also, four 5/32 in. holes through which 6 B.A. by ¼in. round-headed brass screws are inserted to secure the plates to the angle pieces. These holes are deliberately made much larger in diameter, i.e., 5/32in., than is necessary. By so doing, and employing washers under the screw heads, the plates are given a fair amount of play which allows for adjustment of the meshing of a worm on the spindle in hole A and the 50-tooth wheel on the vertical spindle. The screws are, of course, tightened down after the meshing is satisfactory.

The position of the screw holes on the gear plates to which the brass angle pieces are secured is indicated in Fig. 3. They, also, are drilled 5/32in.

LIST OF PARTS

- 1 piece of Swedish iron 4½in. × 3½in. × 5/32in. thick.
- 1 piece of Swedish iron, 4½in. × 3in. × 5/32in. thick.
- 1 strip of brass, 14in. × 2¼in. × 1/16in. thick.
- 1 length of angle brass, 6in. × ⅜in. × ⅜in. × ⅛in. thick.
- 1 length of iron strip, 3ft. × ½in. × ⅛in. thick.
- 1 piece of ebonite 4in. × 2in. × 3/16in. thick.
- 8 ozs. of 36 S.W.G. double-silk-covered copper wire.
- 2 12in. lengths of 2 B.A. screwed brass rod.
- 38 2 B.A. brass lock nuts and washers.
- 4 4 B.A. × ⅜in. cs. brass screws and hex. nuts.
- 18 6 B.A. × ¼in. round head brass screws and washers.
- A few transformer core stampings. (See text.)
- 4 19-tooth pinions, ½in. dia. × ¼in. face.
- 2 25-tooth pinions, ⅝in. dia. × ¼in. face.
- 4 50-tooth gear wheels, 1¼in. dia.
- 3 57-tooth gear wheels, 1½in. dia.
- 2 worm drives.
- 6 metal collars.
- 24 plated washers.
- 15 5/32in. grub screws.
- 2 11½in. axle rods.
- 1 sprocket wheel, 1½in. dia.
- 1 sprocket wheel, ⅞in. dia.
- 1 perforated flanged plate, 5½in. × 2½in. (Used as a template for drilling the holes.)
- Black enamel, celluloid lacquer, cardboard for dial, glass for case, etc.

(To be continued.)

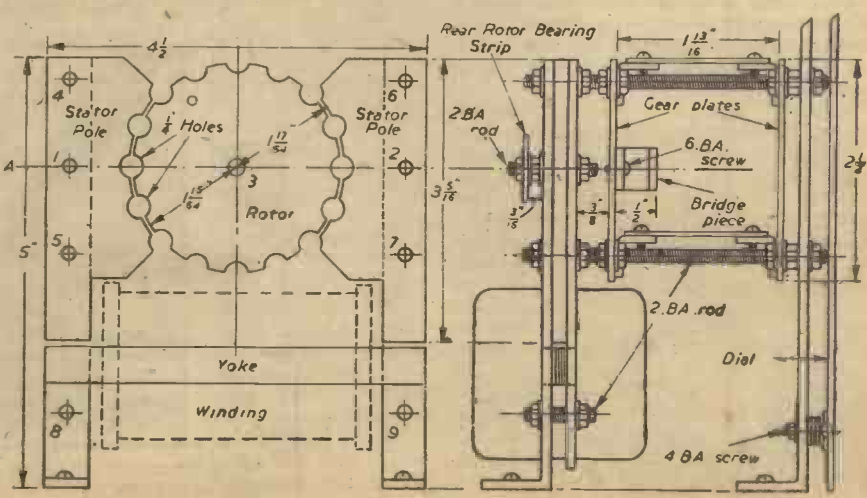


Fig. 6.—Showing the construction of the stator and rotor.

Small Wind-power Plants—3

Constructional Details of a Serviceable Unit.

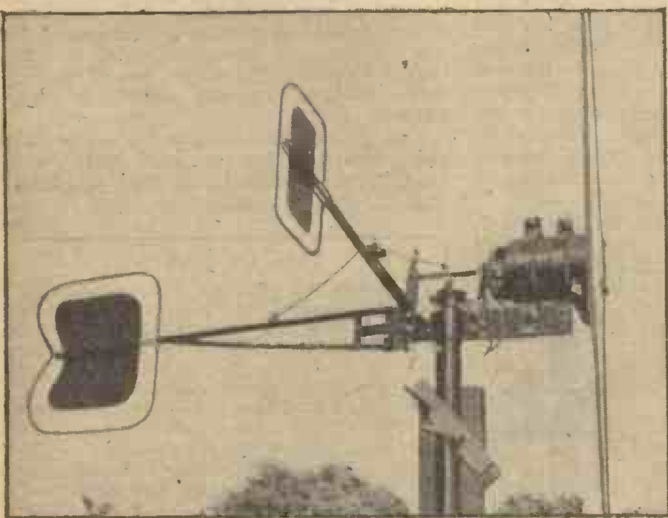
By W. H. SUTHERLAND

(*Continued from page 154, February issue.*)

LAST month we described how to rewind a Lucas A900C dynamo to make it charge at low speeds for wind-charger use. In this article, instructions are given for building a good wind-charger with this particular dynamo.

Turntable and Slip Ring

The turntable is built on the lines suggested in the first article of the series. Two iron pipes (1) and (2), Fig. 1, about 2in. and 2½in. diameter and 3ft. long, fit closely together in one another. The cross-arm, which carries the dynamo and tail, is made from two flat iron bars (32), Figs. 2 and 3, bent at the local forge, and bolted around the inside pipe. In the photographic illustrations these bars are 3in. x ½in., but something lighter would do quite well, although they should be wide enough to take four ½in. bolts to secure them to the pipe. The bars lie flat against each other on the side that holds the dynamo, but a space of ¼in. is allowed on the short side for tightening purposes. The bottom of the outside pipe is closed by a wooden block (4), 3in. or 4in. long, driven tightly into the pipe. A length of copper or brass tube (3) fits tightly in this block and passes up through the turntable to carry the control rope (35) through the oil reservoir (7). This is filled through the opening (8) with heavy motor oil when the whole machine is finally mounted on its pole.



General view of the windcharger described in the text.

The filler (8) is made by tapping a wander-plug socket into a ⅜in. slanting hole. The oil is poured through a piece of rubber tube joining the filler to a funnel laced to the side of the windcharger on a calm day. The copper pipe also carries the positive connection from the slip-ring (6) to the cable (9). This slip-ring is made of brass. The case from an old headphone earpiece, with the bottom cut off, will generally do for the purpose. It is driven on to the wooden block (5), which also serves as a support to centre the top of the copper pipe. If it is available, a short piece of pipe (not shown), which fits closely outside the copper pipe, is hammered into the hole in block (5) to act as a "bearing" for the copper pipe, and to prevent enlargement of the hole in the block. If necessary, slip-ring and wooden blocks are all secured by countersunk wood screws, but they should all fit so that considerable force is necessary to drive them home. A piece of brass acts as a soldering tag for the slip-ring.

The brush ring (15) is taken from a Ford self-starter, and contains four heavy copper brushes. The two insulated ones are removed, leaving the two diametrically opposite earthed brushes. It is attached by any convenient method to the copper pipe. In the illustration it is soldered by four small brass brackets to a clip, made from sheet brass, which bolts around the copper pipe. Alternately, the slip ring may be attached to the copper pipe, and the brushes bolted to the two pieces of angle-iron which hold the rope pulley-drum. They must, in this case, be insulated from the angle-iron, and connected together by rubber covered cable. Two connecting clips (10) and (11), made from ½in. wide copper strip, are bolted in position before the pipes receive their first coat of enamel. The dynamo is fixed on the turntable by two iron rings (21) (22). Here, again, the assistance of the nearest blacksmith is needed.

Braking System

In building a home-made windcharger, the braking system presents the greatest problem in the whole design. Commercial units follow three systems: (I) an internal expanding friction brake working on a drum at the front of the dynamo. (II) A dynamo mounting which tilts up to a vertical position. (III) A swinging tail-vane shut off. The first type is very efficient and simple, but does not lend itself to home construction. An internal brake drum on this dynamo would be awkwardly large, whereas an external brake element usually burns out in the first storm. Besides, the problem of governing would not be helped in any way by this system.

Type II is very simple in theory, but drastically weakens a vital point in the construction of the unit. A dynamo held to the turntable by a single bearing will sooner or later vibrate itself off. The only hope of survival in a home-made plant lies in exceptionally strong construction.

The "framework" of this unit will stand up to any gale that our climate can produce—more than can be said for most of the fancy home-made outfits with ball-bearing turntables and the dynamo mounted with its centre of gravity directly above the pole, and the propeller tips consequently passing the pole with a clearance of about 1in.

Type III is really the only brake that can be used easily on a home-made plant, and it also solves the question of governing. The main tail is held by a hinge (12), bolted to the cross-arm. The writer was doubtful about the strength of such an arrangement, but it has proved quite efficient. A good hinge, with at least four "bearings," is needed.

The tail is held in position by a rubber band (30), cut from a strong motor tube, and stretched between two large cotton spools. A rubber band is easier to mount, and works more efficiently than a steel spring. The arm (29), which carries one cotton spool, also acts as a stop to limit the position of the tail, which is variable by changing the spacing nuts (27) (28).

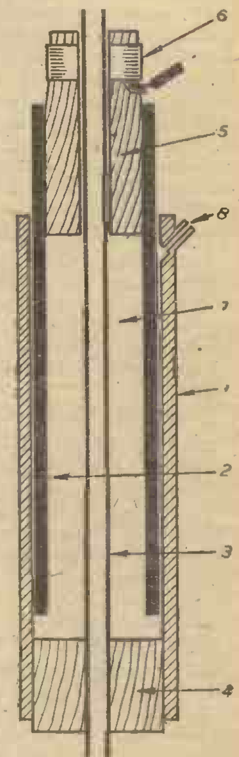
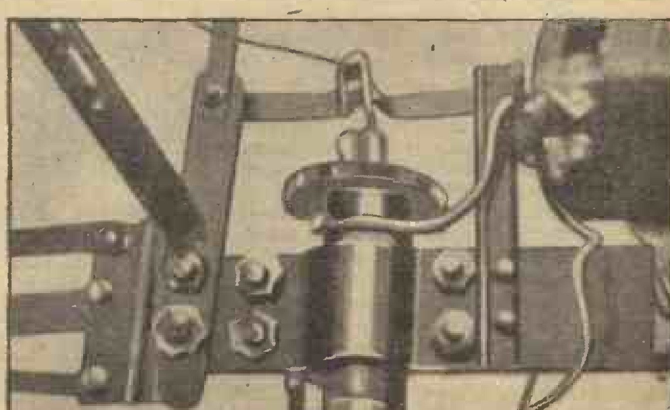


Fig. 1. — Section through turntable and supporting tube.

To shut off the windcharger, the tail is pulled to one side by the rope, turning the dynamo and propeller out of the wind. A great advantage of this type of brake is that the machine may be shut off to any extent required, so that it acts as a "trickle-charger" to maintain the batteries in a full condition. During winter months, it is well to make a habit of half-shutting off the wind-charger last thing at



Enlarged detail of the turntable and fittings.

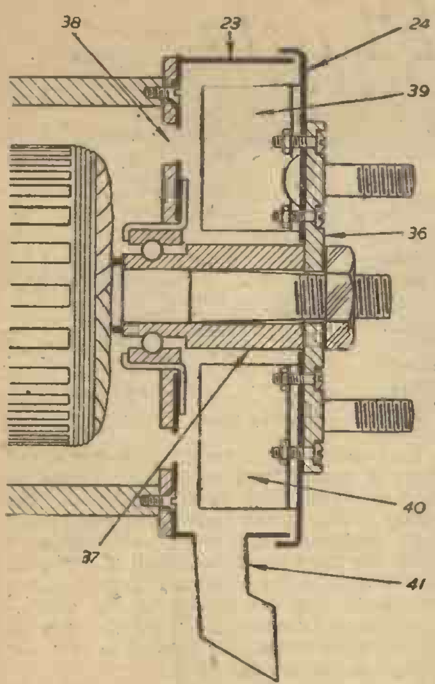


Fig. 4.—Section through the fan casing.

night in case of sudden storms.

The pulley (18) is made from an empty wire spool, mounted on the axle of a bicycle wheel between two pieces of angle iron. These 1¼in. or 1½in. angle irons (13) (17) are slightly opened and closed in a vice to give the slope necessary for the pulley-drum, and are mounted on opposite sides of the turntable to bring the drum into position above the copper tube. This necessitates cutting away a piece of the upright (13) as shown in Fig. 2. A more efficient and durable pulley is obtained by mounting a complete bicycle rear hub instead of the wooden spool. The upright (13) also carries the bracket (14) which holds the rain cover in position.

The second pulley (26) is bolted to a right-angle bracket (34) held by the bolts which secure the hinge. Two pieces of aluminium are bent around this pulley to form guards for keeping the rope in the pulley-groove. The pulley should be at least 12in. from the turntable. Remember that wire cannot be used instead of rope, since it would short-circuit the dynamo.

Action of Governor

The bracket that holds the second pulley-wheel also has attached to it a length of light 1in. angle iron or circular tube with the governing vane on its end. The operation of this governor is extremely simple. When the wind pressure on the side vane becomes sufficiently great to stretch the rubber, the side vane closes up with the main tail, turning the dynamo and propeller to one side. When the wind falls, the rubber pulls the dynamo into the normal position again. The main tail is so large that it acts as an "anchor" in space against which the side-tail and the rubber exert opposing forces. The length and area of the side tail is best found by trial while "running in" the finished windcharger on a small experimental pole erected temporarily in a windy spot. Three feet is a suitable length to try, with a vane about 12in. square.

There is a very important point to be observed in the construction of this governor. The line drawings and photographs were made on an anti-clockwise windcharger, so that for a clockwise dynamo the side-tail would have to be on the other side from that illustrated. The reason for this distinction would take too much space to explain but will be obvious to many readers. If built on the wrong side, the side-tail will refuse to work. The side-tail needs to be strengthened by a length of wire stretched from its end to the clamping ring (22). The vane must also be reinforced by several light bars bolted along its rear side. The tension in the rubber band is made adjustable by attaching the second spool to a long bolt whose head has been removed, passing the bolt through a hole in a small bracket, and screwing the nut to any position required. The main-tail is displaced a few degrees by reducing the spacing nuts (28) to balance the permanent pressure against the side-tail.

If a side governor is used, the tail vane should not be less than 20in. square. Never use a flat iron bar to hold a windcharger tail. It can vibrate in one direction, and soon breaks off at the "node" of this vibration. Angle iron, or tubing, is rigid in all directions. The rain cover (19) is made from tin, soldered at the edges, and with a "porch" at one side for the rope. It is held by the band (20) and the bracket (14), and adds greatly to the appearance of the finished unit.

Cooling Fan

Those who wish may add a forced draught cooling fan to the front of this dynamo. As well as increasing the permissible charging current, it completely protects the front bearing from rain. Even if no fan blades are fitted, it is worth while to add the casing for this latter purpose alone. A small cake tin (23), with a diameter the same as that of the front plate of the dynamo, is held in position by the screws that hold the front plate. The screw heads will force the tin to the shape of the countersunk holes. Six ⅛in. holes (38) are drilled through the tin and front plate. Two intake "scoops" (41) Figs. 2 and 4, are shaped and soldered to the bottom of the cake tin, where they will pick up the least rain. One of these can be seen in the first illustration on page 186.

The plate which holds the propeller to the axle (36) is spaced as far as possible from the dynamo by the piece of pipe (37) which presses against the inside race of the dynamo bearing. To the back of this plate is attached a lid (24) of a second cake tin slightly larger than the first tin, so that it overlaps the first by ½in. A loop of wire is soldered to act as a rim for the first tin, where it has been cut short, so that no water will make its way between the two tins when the machine is shut off on a rainy day.

Six aluminium fan blades are bolted symmetrically around the plate by 6 B.A. bolts, countersunk on the front of the plate. These blades are bent to an angle of 45 degrees. The top one (39) is bent upwards over the head of the propeller bolt, which it then holds in position, and the bottom one is bent downwards, also over the head of the other propeller bolt. The air draught emerges through the brush inspection holes and the gap (25) Fig. 2. A strong plate, 6in. by 4½in., is used as a "washer" between the front of the propeller blade and the two nuts that hold it, since large local strains in the timber cause it to split at high speeds. A single 1 mfd. condenser is connected across the brushes, to prevent radio interference. The method of mounting the turntable on a wooden pole is clear from the photographs.

(*To be continued*)

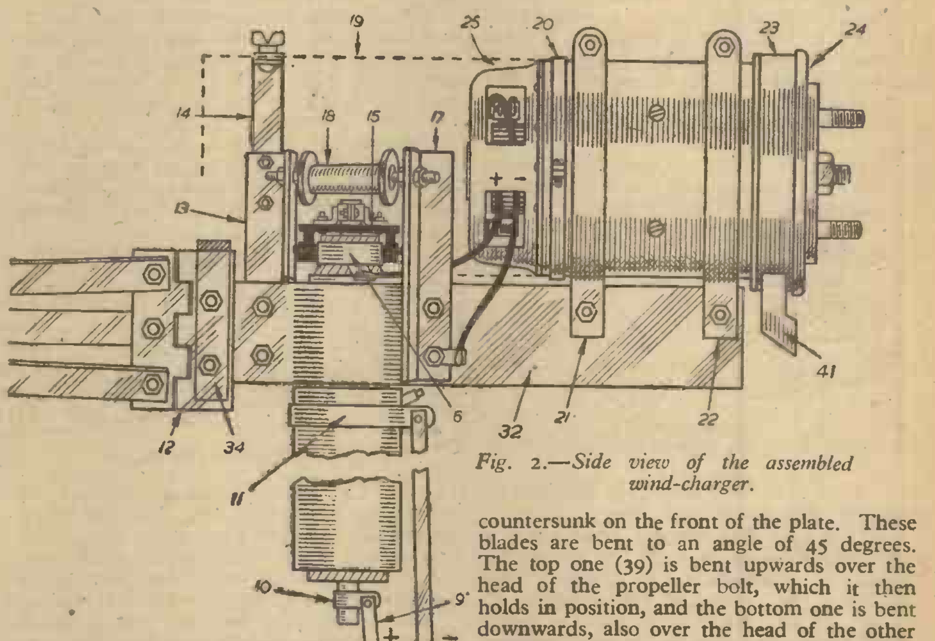


Fig. 2.—Side view of the assembled wind-charger.

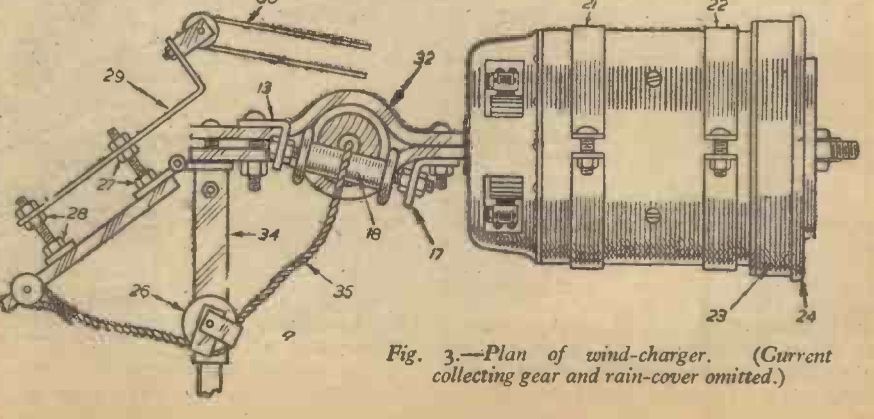


Fig. 3.—Plan of wind-charger. (Current collecting gear and rain-cover omitted.)

Aircraft Flying Controls

Their Positioning and Functions

By T. E. G. BOWDEN, Grad.R.Ae.S., M.I.E.T.

To allow an aircraft to be controlled during flight it is necessary to incorporate flying controls. These are similar in their method of functioning in the majority of aircraft and only the detail design varies. The controls fall into two main categories, i.e., fixed and movable. There are three directions of stability for which the controls have to be effective. Firstly, longitudinal stability; secondly, lateral stability; and thirdly, directional stability. The methods of control around these axes (see Fig. 1) now follow.

Longitudinal Stability

Due to the fact that the centre of pressure (the point at which the resultant lift of an aerofoil is assumed to act) of a wing varies according to the angle of incidence, a wing by itself is unstable. By increasing the angle of incidence, i.e., raising the leading edge, the C.P. moves forward, and consequently the incidence angle is still further increased. In the same manner, when the incidence is reduced, so the C.P. moves towards the trailing edge, thus depressing the leading edge. From the above it will be seen that a correcting control is required to overcome this instability.

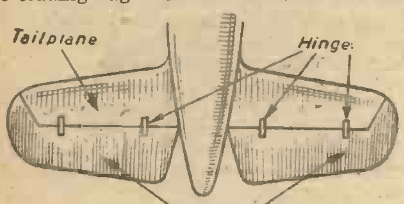


Fig. 2.—Elevators.

The usual method adopted is to attach a fixed horizontal surface at the rear end of the fuselage, and this control is known as the tailplane. The method of functioning is as follows. When the aircraft nose is raised the airflow passing over the tailplane creates an upward lifting force, consequently tending to cause the nose to drop to its original position. For normal flight the airflow does not create any lift, as the centre line of the tailplane section is usually approximately in line with the airflow. On certain aircraft the tailplane is designed to give an upward or downward lift at normal flying positions. As the airflow, when it has travelled over the wing, is deflected downwards, the angle of incidence of the tailplane has to be adjusted to suit this angle of downwash, as it is termed.

In order that the pilot may depress or raise the nose of the aircraft, in addition to being longitudinally stable, movable control surfaces are required. These form the rear portion of the tailplane and are known as elevators. Normally, as shown in Fig. 2, the elevators form a continuous aerofoil section, usually of the symmetrical type. When the elevators are depressed the lifting force is increased, due to the increase in camber. This causes the tail to rise and consequently depresses the nose. When the elevators are raised, the resulting lift acts in a downwards direction, thus depressing the tail and raising the nose.

If the aircraft does not require any operation of the elevator control for normal flight, it is said to be longitudinally stable, but if it requires correction by use of the elevator, it is unstable. If a disturbance occurs in a stable aircraft the oscillations will gradually die out, or vice versa for an unstable design.

To obtain satisfactory longitudinal stability the wing section should have as small a C.P. movement as possible, and a high aspect ratio tailplane of reasonable size is required.

Lateral Stability

The stability about the longitudinal axis is termed lateral stability. This movement about the axis is termed rolling, i.e., one wing tip rises and the other falls.

The controls fitted to govern this movement are known as the ailerons, and their position is indicated in Fig. 3. As in the case of the elevators, they are movable, but with the difference that when one is raised the other is lowered.

The manner in which the ailerons function is as follows. If a roll or bank to port is required for a left-hand turn, the starboard aileron is lowered and the port aileron raised. The lowered aileron increases the lift on the starboard wing, and the raised aileron decreases the port wing's lift. Thus a bank will result in the required direction. The opposite result will take place if the ailerons are moved in the reverse directions.

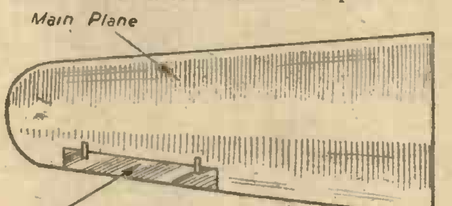


Fig. 3.—Main plane and aileron.

The angles that the port and starboard ailerons move through usually vary, i.e., the upwards moving control travels through a greater angle than the lowered one. This differential action is to decrease the drag of the raised wing and increase that of the lowered wing. If this were not done the drag tends to turn the aircraft to the right instead of to the left. Approximate angular movements are 20 deg., and 15 deg. down.

Ailerons are sometimes connected with the movable slats fitted in the leading edge. In this case, when the aileron is depressed, the slat moves away and forms a slot in the usual manner, thus increasing the control at stalling angles.

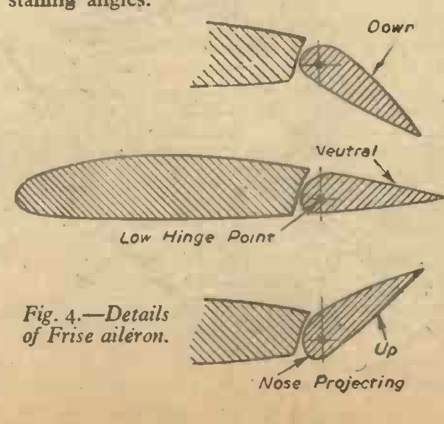


Fig. 4.—Details of Frise aileron.

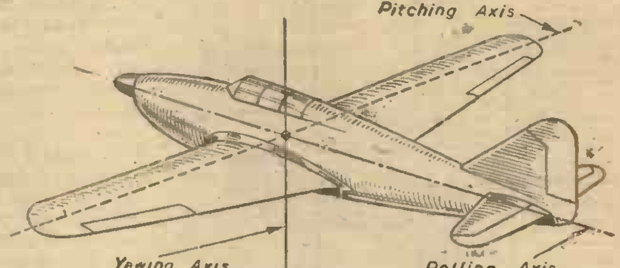


Fig. 1.—Reference axes.

To combat the increased drag mentioned above a special type of aileron known as Frise ailerons have been developed. As shown in Fig. 4, the hinge point and profile is so arranged that when the aileron is raised the nose projects outside the profile, but when it is depressed the contour is not disturbed. By this movement the drag is increased on the lowered wing and decreased on the raised wing, i.e., tending to turn the aircraft in the correct direction.

Dihedral

To achieve lateral stability without having to continually operate the ailerons the wing is usually given an upward tilt, as shown in Fig. 5. The angle between horizontal and the wing is known as the dihedral angle.

When a wing drops and the aircraft sideslips, the dihedral angle causes the effective angle of incidence of that wing to be increased and vice versa for the rising wing. Thus the lift is increased on the lowered wing, tending to revert the aircraft to its original position. The dihedral angle varies, but an approximate figure is 5 degrees.

Sweepback

An additional aid to rolling stability is to sweep the wings backward so that in plan they form a V-shape. By this means the effective aspect ratio of the lowered wing in a sideslip is increased, thus increasing its efficiency and helping to restore the aircraft to the horizontal position.

Other factors affecting rolling stability are the side areas of the fuselage, fin, etc. It is obvious that when a sideslip occurs the fin will tend to right the aircraft as the area is above the centre of gravity, but if floats are fitted the roll is increased.

Directional Stability

An alternative name for directional stability is weathercock stability, and the second title is more explicit. If an aircraft yaws, i.e., changes direction about the normal axis, it is said to possess directional stability if it returns to its original direction of flight.

Stability is obtained by the fin, i.e., the fixed control surface mounted at the rear of the fuselage at right angles to the tailplane. When the aircraft is deflected by a gust from its original direction, the pressure of the air on the fin will turn the aircraft's nose to the original direction. The action is similar to the tail-planes', and, as in their case, a movable control surface is hinged to the rear of the fixed surface.

The movable portion is known as the rudder, and allows the pilot to turn his aircraft either to port or starboard about the normal axis. To turn to port the rudder is moved to the left, which gives a lifting force, turning the tail to starboard, giving the required movement. It should also be noted that the rudder acts as a continuation of the fin when in the neutral position.

Balanced Controls

To reduce the operating loads required to deflect the control surfaces, they are always balanced. In the case of aircraft flying long distances the operating loads must be reduced to a minimum, otherwise the pilot will be fatigued. The controls are therefore balanced, either aerodynamically or statically.

Fig. 7 (a) illustrates an aerodynamically balanced control surface. As will be seen,

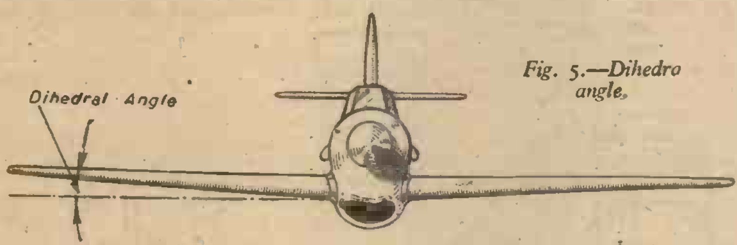


Fig. 5.—Dihedro angle.

the hinge line is so arranged that there is a considerable portion of the control forward of the hinge. When the control surface is turned, the forward position juts out into the airflow. Thus the air striking this portion helps to rotate the control in the direction required. All the controls, i.e., rudder, ailerons or elevators, may be balanced by this method.

An alternative aerodynamical method is the Servo system. In this design an auxiliary smaller control is mounted behind the main control. It is connected up and hinged so that when the main control moves, say, to the right, the servo tab moves in the opposite direction, i.e., to the left. The airflow striking the tab assists the pilot in the movement of the control.

Static balancing is illustrated in Fig. 6 (b) and entails the addition of weights, either internal or external, so that the centre of gravity of the control coincides approximately with the hinge line. This reduces the operating loads by a considerable amount. The weights are usually fitted in the control leading edge.

The static balancing also assists in the avoidance of flutter, and is commonly carried out for all high-speed aircraft. By balancing so that the products of inertia are zero, the possibility of flutter occurring is reduced. Flutter, if allowed to increase, may ultimately lead to loss of a wing or control, and is caused by interaction between structural and aerodynamic forces.

The amount of balancing carried out on the controls depends on the type of aircraft and its duties. A fighter aircraft requires to be more responsive on the controls, and also the pilot should be able to "feel" the controls, thus overbalancing must be avoided. The same reasoning applies to the stability of an aircraft as a whole, i.e., it is possible to make an aircraft too stable. If it possesses great stability, the force required to operate the controls to perform manœuvres is increased.

Trimming Tabs

Trimming tabs, adjustable in flight by the pilot, are usually fitted to the elevators and rudders. The ailerons are as a rule fitted with tabs adjustable only on the ground and usually fitted to one aileron only.

The function of the trimming tabs is to allow the aircraft to be flown without continual pressure by the pilot on the controls. It is very rare for the centre of gravity of an aircraft to remain stationary during a flight of any great duration. Consumption of petrol, dropping of bombs, movement of passengers, etc., cause the centre of gravity to change its position. If the tail became light, it is obvious that the pilot will have to pull the control column back towards him and thus bring the tail down. This means that he has to exert a continual pressure in order to maintain the aircraft in its normal position.

By fitting trimming tabs, the camber of the control surfaces may be altered, thus either increasing or decreasing the lift. In the case mentioned in the previous paragraph, i.e., tail tending to move upwards, the pilot would operate his elevator trimming tab control so that the tab moves downwards. This causes the elevator to move slightly upwards, giving a resultant lift downwards, pulling the tail down to its original position.

Trimming tabs are sometimes also fitted so that they act in a similar manner to the servo control mentioned previously. In this case they are connected up so that they move in the opposite direction to the control to assist in its operation.

Control Profiles

The profile of the controls is important, and as a general rule it has been found that those with a high aspect ratio are the most efficient. By a high aspect ratio it is meant that the span is great compared with the

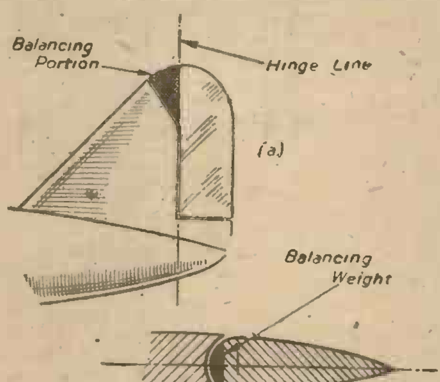


Fig. 6.—Balanced controls.

chord, i.e., the length-width ratio is fairly high.

The actual profiles adopted vary, and each aircraft firm appears to favour its own development: in many cases it is possible to identify an aircraft by the shape of its tail unit.

The positioning of the controls is also important, as the farther away they are from the aircraft's centre of gravity the greater their effect. If the fuselage is short and stubby, then large areas are required, or if it is a long, slim aircraft then the control surfaces may be reduced in size.

During a spin the rudder control is often blanked off by the tailplane and elevators, thus making it ineffective. Consequently, on some aircraft the fin and rudder or the tailplane and elevator are moved forward or aft to avoid this trouble.

The total areas of the controls vary, but approximate figures are as follows: Ailerons, 10 per cent. of the wing area, tailplane and elevator 15 per cent., and fin and rudder 8 per cent.

Auto-Rotation

An interesting occurrence which happens when rolling with the angle of incidence at or near the stalling angle is auto-rotation. Normally, when a wing drops, the increased lift tends to right the aircraft. However, when the critical angle is exceeded the lifting force is not increased, but is decreased. This results in the roll being increased instead of being damped out. Consequently, unless the pilot takes action, a constant rotation will develop which is termed auto-rotation. The rate of rotation can actually be calculated mathematically.

Control Construction

The movable controls are all constructed on similar lines as a general rule. A single tubular spar to which the ribs are attached and finally a fabric covering, is the usual practice. The ribs may either be built up or made from pressings. Diagonal bracing members are frequently added.

As an alternative to tubular spars, which are usually steel, built-up light alloy sections have been utilised.

Welding has been applied for control construction, but it is not used to any great extent, although it is quite satisfactory from the strength point of view. As regards weight, it has been found possible to produce lighter controls by welding than is possible by the usual methods.

The fixed portions of the controls, i.e., tailplanes and fins, follow the usual wing methods of construction.

Control Operation

The elevators, ailerons and rudder are operated by the pilot by means of two controls, i.e., the control column and the rudder bar. The control column is vertical in the neutral position and controls both the ailerons and elevators. Forward and aft movement causes the elevators to move downwards and upwards respectively, thus lowering or raising the nose of the aircraft.

Sideways movement of the control column operates the ailerons. A movement to the right causes the right wing to drop by raising the starboard aileron and depressing the port aileron.

The rudder bar, operated by the pilot's feet, moves the rudder over to the right, when a right-hand turn is required, and the rudder is moved to the left by the pilot pushing the left-hand side of the bar forward.

A typical control system for the elevators is illustrated in Fig. 7, the other controls being operated in a similar manner. In this case cables are shown, but push-pull rods are often utilised. Cables are comparatively cheap, but tubes have the advantage that they do not stretch and only require one length instead of the two lengths of cable needd to transmit loads to raise or lower the controls. Turnbuckles are required for adjustment of the cables to take up the slack.

From the diagram it will be seen that the control column transmits its movement via a connecting rod to a vertical lever. The cables are attached to this lever and pass to the control lever on the elevator. It will be noted that the wires are crossed so as to give movement of the elvator in the correct direction.

Pulleys and fairleads are used to guide the cable round any obstruction.

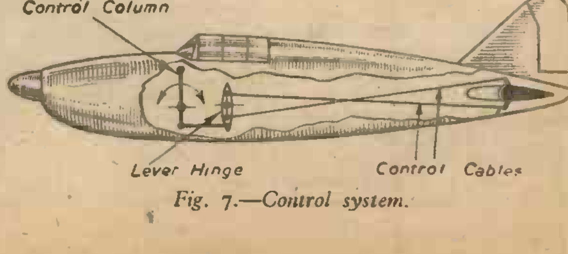


Fig. 7.—Control system.

The "Volkswagen"

The German Light Aid Detachment Vehicle, Which is Based on the German People's Car

(*Continued from page 152, February issue*)

THE connecting rods are made from steel stampings, a thick layer of bearing metal being run direct into the big end. The bolts securing the connecting rod caps have hexagon socket-type fittings on the heads.

The aluminium crankcase is made in two halves, and is split on the vertical centre line through the main bearings; the halves are secured together by means of bolts and studs. An oil sump is formed integral with the crankcase; the underside is generously finned. In addition, the casing serves as a mounting for the various accessories, such as the dynamo, oil cooler, blower equipment, etc.

A single camshaft driven at half engine speed by single helical gears from the crankshaft runs direct in the aluminium crankcase, and actuates the overhead valves through push rods, each cam operating two rods. The whole of the valve gear is pressure lubricated.

The distributor is mounted on top of the crankcase, and is driven by spiral gears from the rear end of the crankshaft. The driven shaft consists of the spindle, and gear and cam for operating a petrol pump, and is made from a steel stamping, which is hardened and ground. It is supported at both ends, and runs directly in the crankcase, the gear end thrust also acting against the crankcase facing.

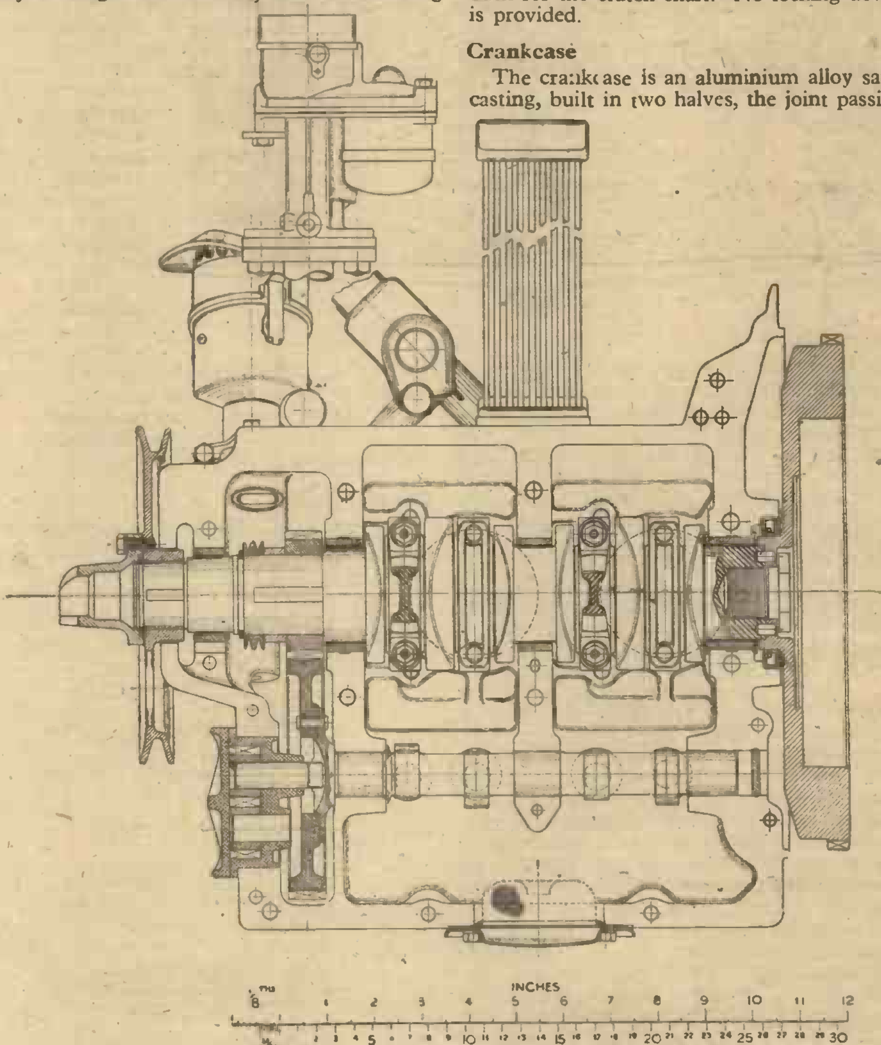
The petrol pump is an A.C. diaphragm type, mechanically operated, mounted on the left hand of the crankcase, on a neat moulding which also houses the operating rod. A single downdraught "Solex" carburettor is fitted. This is connected to the cylinder head by an extremely small-bore inlet pipe, which has a central hot spot. The latter is obtained as the result of pressure pulsation which causes the exhaust gases to flow past the hot spot.

The crankcase has an extension which provides a saddle mounting for the dynamo and also forms a convenient oil filler orifice on account of its hollow construction. The dynamo is driven by means of a "V"-shape belt, adjustment being provided.

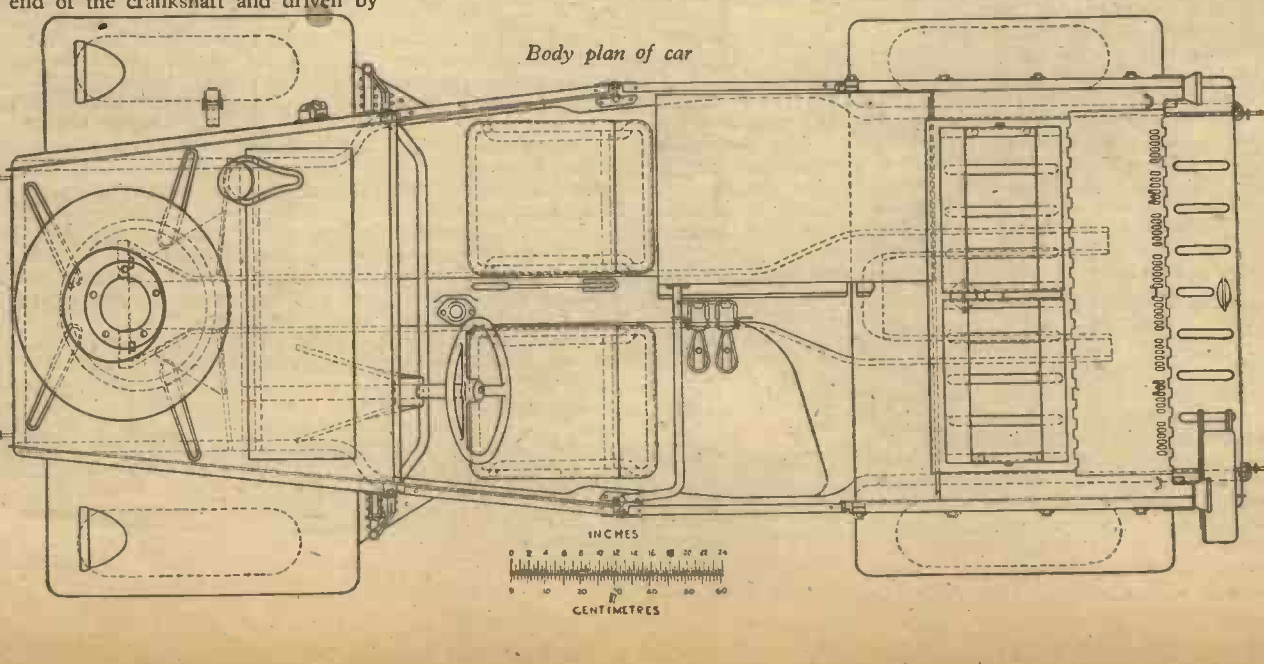
The flywheel is a steel stamping with integral starting gear teeth, and is spigoted to the end of the crankshaft and driven by four dowels. It is secured to the crankshaft by a single centre bolt, the latter being hollow so as to include a self-lubricating bush for the clutch shaft. No locking device is provided.

Crankcase

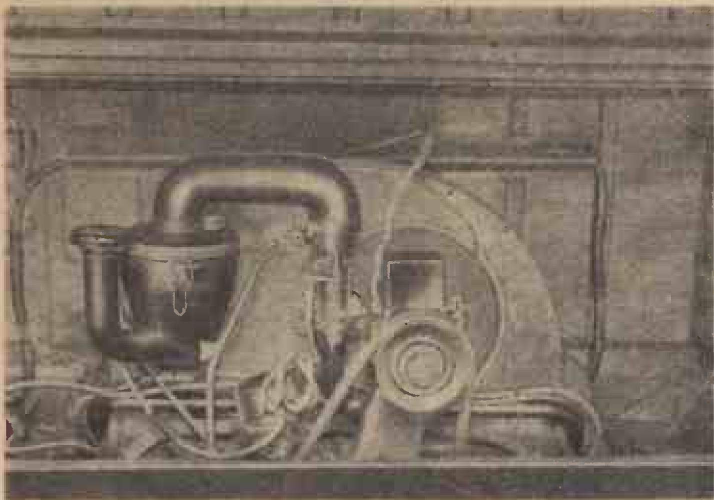
The crankcase is an aluminium alloy sand casting, built in two halves, the joint passing



Longitudinal section of engine.



Body plan of car

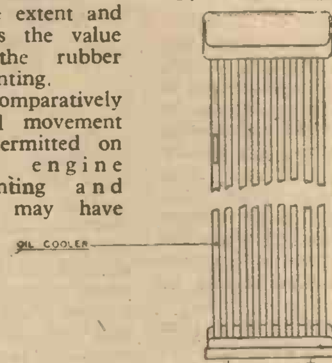


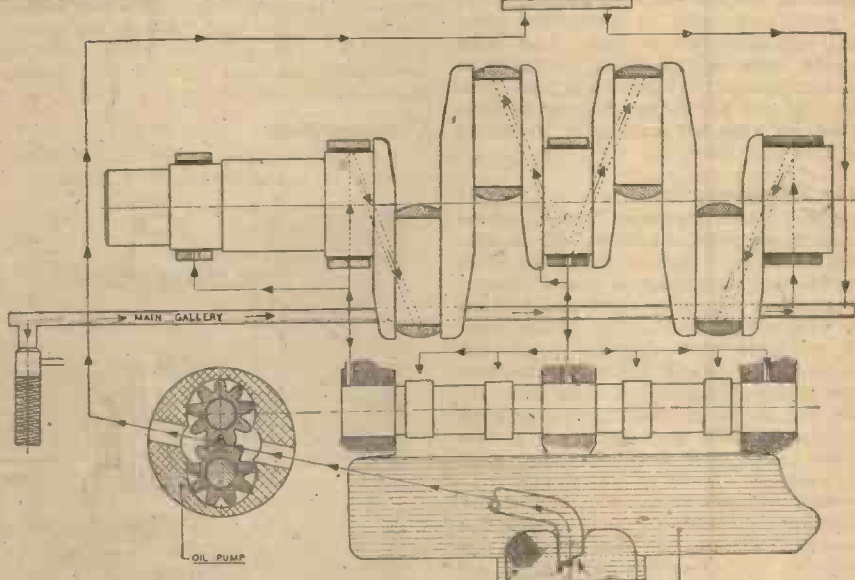
vertically through the centre lines of both the main bearings and the camshaft bearing —the camshaft itself running directly in the crankcase. An oil sump is formed integral with the crankcase, of fairly wide and shallow proportions so as to afford maximum ground clearance, fins being cast in a longitudinal direction on the underside. (Provision is made for a detachable gauze filter which is centrally mounted on the base of the sump.) A large diameter flange formed at the flywheel end is utilised as an engine mounting face with spigot fitting. Lubrication is through drilled oil ways in the crankcase. Platforms on top of the crankcase carry the oil cooler, dynamo and blower equipment.

Engine Unit Mounting

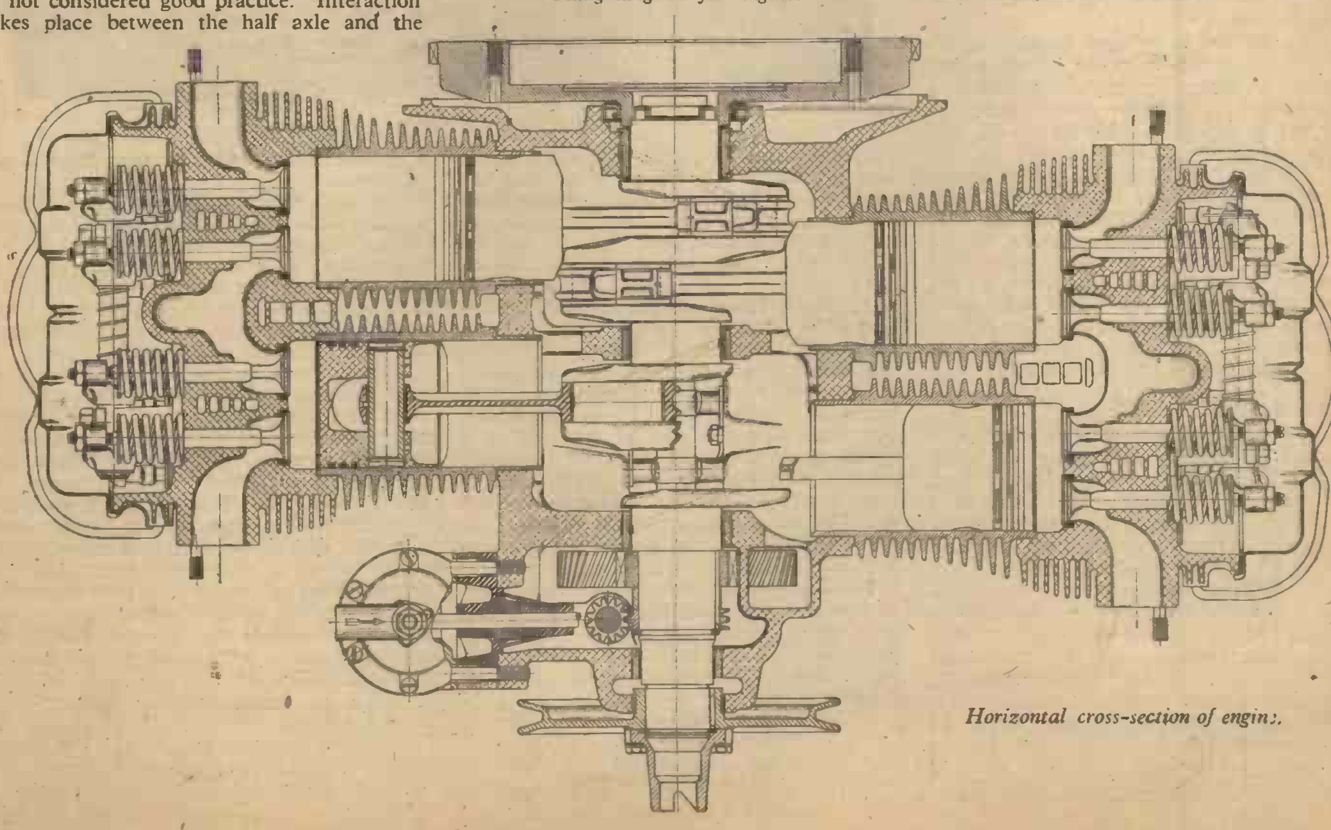
The engine unit, including the gearbox and axle differential, is suspended on rubber mountings arranged to permit a small rotational movement of the unit about an axis passing through its centre of gravity and coinciding with the centre-line of the vehicle in plan. This is arranged to absorb the torque reactions, but owing to the half-swing axle type of suspension employed, it is not considered good practice. Interaction takes place between the half axle and the engine due to wheel movement or roll and engine reaction; consequently the engine movement is restrained to some extent and limits the value of the rubber mounting.

Comparatively small movement is permitted on the engine mounting and this may have been purposely designed, having regard to the interaction. The tension on the rubber mounting is adjustable. The engine mountings consist of two rubbers vulcanised on a steel bracket bolted to the prongs at the rear end of the backbone fork which, in turn, supports the engine around the portion of the crankcase adjacent to the flywheel. This forms the main support for the engine unit on the backbone, one other point of attachment being situated at the forward end (or nose) of the unit. A rubber ring type mounting is fitted, acting principally as a location for the unit. It is housed inside a casting at the centre of the tubular cross member.





Oiling diagram for engine.



Horizontal cross-section of engine.

Making a Success of Your Photography

Better Prints from Your Negatives. By JOHN J. CURTIS, A.R.P.S.

AT this season of the year some of the most popular lectures of photographic societies are those relating to the making of better prints, the improvement of faulty negatives, wrinkles and dodges in printing, and similar talks by those who have had much experience, and are willing to pass it on to their fellow members. The work is such that it can be done quite easily at any time, but most of us relegate it to the long, dark evenings and when the camera is not so much in use, taking new subjects and adding to our collections of negatives.

He is, indeed, a fortunate amateur who can claim to get 100 per cent. good results; it is not always easy to accurately judge correct exposure, and mistakes have been known to occur in calculating development times, but the careful worker will note these results, and will put the negatives on one side until he has time for some after treatment to be given to them.

"After Treatment"

It is this "after treatment" which forms the basis of the popular lectures and demonstrations, and it is mostly concerned with intensification and reduction of the image; there are, of course, other ways of obtaining better prints, such as the use of the right grade or surface of printing paper for obtaining special effects, but as this involves the purchase and stocking of more than one variety, and as it is so difficult to obtain even one grade, we must not consider it at this time, but rather leave it till the happy days return when we can get all we require.

Let us therefore give some thought to the treatment of our faulty negatives by chemical means; the processes are such that we can all do them quite successfully without any previous experience and, fortunately, the chemicals are obtainable even in these days of restrictions.

Intensification, as its name implies, means increasing or building up the image so that it becomes rather denser, and produces a more defined image in the positive print. It must not be thought by this that in the case of an under-exposed film you will be able to "introduce" by intensifying some details of the subjects that are absent as the result of wrong exposure. The image in any negative is the direct action of light on the silver contained in the emulsion and reacted upon by the developing solution; if this action and reaction have been sufficiently powerful to produce an image, even a faint one, then it is possible to add to, or coat over, that image and so make it denser.

Re-developing

The process known as re-developing is probably the best for illustrating the building up of the image; it is a two-bath method, and first the negative is immersed in a bleaching bath where the image almost vanishes. As a matter of fact a chemical reaction takes place which changes the image into a compound salt of silver and chromium. After washing, the negative is transferred to a clean working developer such as any metol-quinol formula, and this causes the image to reappear in its "black" stage, and with added depth. If, on printing, it is found that further intensification would be advantageous, then the process, both bleaching and redeveloping, can be repeated without risk or damage being incurred.

The bleaching bath is made as follows:—

"A"	Potassium bichromate	240 grains
	Water	10 ounces
"B"	Hydrochloric acid (pure)	1 ounce
	Water to make	10 ounces

These two stock solutions will keep indefinitely, but do not mix "A" and "B" until you are ready to use as the mixture quickly deteriorates. It must be noted that intensification, or rather the degree of intensification, is considerably influenced by altering the proportions of "A" and "B" when preparing the bleaching bath. For normal work take one part each of "A" and "B" and add six parts of water; for very thin negatives requiring much intensification, mix one part "A" to one quarter part "B" and six parts water. For re-developing the film any of the standard metol-quinol formulæ may be used.

Uranium Bath

The process which appeals to a very large number of amateurs chiefly because of its simplicity and its great efficiency is the uranium bath. Its action is to coat the whole of the film with a deep orange tint; it would appear to have a selective action, for it seems to deposit more heavily on the actual image than on those parts which have little or no silver image to be intensified. There is a very decided advantage to be gained by the use of the uranium bath. If for any reason you desire to remove the orange tint, place the negative in a bowl of water, and in a very short while it will be found to have regained its original colour. For some purposes, such as enlarging on a special grade of paper to secure a particular effect, a thin negative is required, but that same negative would be useless for contact printing on say, some gaslight papers; you will therefore see how useful the uranium bath can be for such negatives.

I will give you the formula as mentioned in one of our leading text-books, but I find it is more economical to buy a bottle of Johnson's Uranium Intensifier; it keeps well and is sufficient for quite a number of films. The formula is:—

"A"	Uranium nitrate	50 grains
	Water to make	5 ounces
"B"	Potass. ferricyanide	50 grains
	Water to make	5 ounces

For use take four parts each "A" and "B" and add one part acid acetic. Wash in still water.

Reduction

So much for improving negatives that are too thin. We must now give some thought to those that are too dense, or thick, and require some of the image or silver deposit to be cut away, or reduced. For our purpose we will consider two types of negatives which require reduction, and let us bear in mind that this process is for reducing the time of printing and also to improve the gradation of the negative.

For negatives which give prints that are too "hard," due to under-exposure and over development, the best bath is that known as the Persulphate Reducer; this solution acts first on the heavy high-light densities, such as the sky or solid whites, before it starts reducing the shadow details. You will therefore recognise that this selective action reduces not only the deposit but also the excessive contrast. Take 50 grains ammon. persulphate, dissolve this in 4 ounces water and add two drops acid sulphuric.

A print from an intensified negative.

This bath will only function when freshly made. Wash the negative well, then pour the solution over it, and rock the dish the whole time. In a short while a milky deposit will appear in the solution—this indicates it is working—continue rocking for about half a minute for slight reduction, increasing the time if further reduction is desired.

Should the milky deposit not appear in two or three minutes throw the solution away and make fresh, if very considerable reduction is wanted make a fresh bath when the one becomes opalescent. When the negative is sufficiently reduced rinse it quickly and place it in a weak hypo bath (½ ounce to 10 ounces water) for just one minute, and then wash it thoroughly.

For negatives which give prints that are too flat, showing considerable over exposure, a bath that will increase contrast and at the same time reduce the general density is necessary and so we use the process known as Howard Farmers.

Make the following two solutions:—

"A"	Hypo	2½ ounces
	Water to make	20 ounces
"B"	Potass. ferricyanide	1 ounce
	Water to make	10 ounces

These two solutions keep indefinitely but must only be mixed just when you are going to use the bath.

To each 3 ounces of "A" add ¼ ounce of "B" (more of "B" can be added if quick reduction is wanted). Use this at once, for the solution becomes useless in a few minutes. It is of a lemon-yellow colour and as soon as it becomes a blue-green it is useless. Reduction takes place very rapidly so that it is necessary to watch the effect frequently during the course of the first two or three minutes.

After sufficient reduction has taken place wash the negative in running water for 10 to 15 minutes, and stand it to dry.

Importance of Cleanliness

With these two intensifiers and two reducers there is no reason why you should not considerably improve the majority of those negatives which give poor prints; the work is quite simple and very interesting, and a knowledge of the processes will be found helpful to you as you progress with the hobby. There are, however, certain rules which apply equally to all these after treatment processes. Cleanliness is of great importance, and both dishes and measures must be made clean after using, and the negatives well soaked before commencing the work. Soak all negatives in clear water for at least an hour beforehand as this will serve two purposes; it will free any hypo which may be present, and it will ensure even action over the whole of the film's surface by the chemical solution. Uneven action will perhaps spoil the negative rather than improve it. Finally, do not overwork the solutions; it is cheaper to use a fresh bath than to spoil one film.

Aero-engine Fuels

Their Essential Characteristics Explained.

By D. J. H. DAY, B.Sc.(Eng.).

IT is not generally realised that the fuel used in the high performance engines of the R.A.F. differs vastly from that sold at the petrol filling stations for use in the family car. There are many points of difference between the fuels, the main differences being in octane number and volatility. Other points which must be carefully watched in aircraft fuels are their freezing points, specific gravities, and percentages of gum and free sulphur. It is not within the scope of this article to deal with these latter points, so we will confine ourselves to the main differences.

Octane Rating

The first and probably the best known property of a fuel is its anti-knock or octane rating. The octane rating of the fuel indicates its resistance to detonation, and, indirectly, therefore, the possible power output of the engine concerned. Detonation is shown by a knocking sound like that produced by a sharp ringing blow upon the metal of the cylinder. This is caused after the ignition point by a wave of high pressure travelling at a great speed through the compressed gas and impinging with intense local force upon the metal of the cylinder wall. The same noise is produced under similar conditions by the sudden and high local pressure produced under a hammer as it strikes an anvil. This high pressure wave travelling through the burning gases is generated when the rate of burning of the fresh gases becomes enormously accelerated and becomes virtually spontaneous instead of being comparatively gradual. The physical causes of detonation have not yet been finally established, and are outside the scope of this article. It may be said, however, that detonation is affected by the fuel employed, the compression ratio and the design of the combustion chamber. Since the design of the combustion chamber is bound up with the design of the engine, we may say that the compression ratio determines the point of detonation for any particular fuel, and also that the higher the anti-detonation or octane rating of the fuel, the higher the compression ratio that may be employed.

In an aero-engine prolonged detonation, however slight, must be avoided, as it causes piston-ring sticking, with its resultant loss of compression, and eventually it will result in burning of the piston crown and consequent complete failure of the engine. It is essential, therefore, that the engine manufacturer should know the octane number of the fuel to be used in the engine in order that the boost pressure and compression ratio may be determined to ensure that the maximum power may be developed without fear of detonation.

Volatility

The second requirement of aero-engine fuel is that it should be of a high volatility. Volatility, or the ability of the fuel to evaporate, is determined by distillation of a sample of the fuel under standardised conditions. This volatility of the fuel is important for a number of reasons, including ease of starting, good distribution of mixture and prevention of carburettor icing. Aero-engines are usually more difficult to start than motor-car engines since, owing to their size, they are difficult to turn rapidly, consequently a great deal of heat is lost during the compression stroke, when the major part of the evaporation and mixture of the fuel with the air under starting conditions takes place. Further, on account of size, the induction pipes are necessarily long, which permits condensation of the fuel from the mixture until the engine is warmed up. It will be clear, therefore, that the more volatile the fuel, the better the evaporation at low temperatures, and consequently the easier the starting.

In a multi-cylinder engine it is fairly easy to ensure that each cylinder receives the same weight of mixture, but it is more important that each cylinder should receive the same amount of fuel. It has been found that the distribution is largely dependent upon the amount of vaporisation that takes place in the carburettor. With a very wet mixture the chances of bad distribution are very greatly due to the fact that the supercharger, acting as a centrifugal separator, throws more liquid fuel to one side of the volute than the other.

The volatility has an important bearing on the icing up of the carburettor; in a petrol engine the fuel is evaporated partly in the choke tubes and partly in the induction system, a proportion of the necessary heat to cause vaporisation of the fuel is supplied by the air entering the carburettor and, generally speaking, the temperature of the air drops in proportion to the amount of fuel evaporated. It will be seen, therefore, that if a large amount of fuel is evaporated in the carburettor, a big temperature drop will take place, and the water in the humid atmosphere will separate out in the form of ice. Consequently, a high volatility fuel which requires less heat to cause vaporisation will materially assist in keeping the choke tubes free from ice.

Specific Gravity

For all normal purposes the specific gravity of the fuel has very little influence on the performance of the aircraft, since the work done by the engine is dependent on the amount of heat obtained from the fuel, as opposed to the weight of fuel burnt. In the case of aircraft designed for long-range operation it would be advantageous to use a low gravity fuel, owing to the greater number of heat units per unit weight of low specific gravity fuel. This saving in weight may represent a considerable increase in the bomb load which can be carried, or an improvement in the take-off. On the other hand, where it is desired to obtain the maximum range from an aircraft without alteration to the volumetric capacity of the fuel tanks, it will be found advantageous to use a fuel having a high specific gravity in order to accommodate the greatest number of heat units per unit volume. In a case of this sort the load increase caused by the use of the high specific gravity fuel will have very little effect on the performance of the aircraft.

Vapour Pressure

When fuel is heated, it tends to form vapour, the volume of which depends on the nature of the fuel. If the aircraft fuel system is imperfectly designed, so that the fuel pipe becomes excessively hot, or if the fuel is sucked up to a considerable height in the fuel pipe so that the pressure in the pipe is low, the fuel in the pipe may start to evaporate. This tendency is greatly increased by the lowered boiling point of the fuel at altitudes under rarefied atmospheric conditions. The vapour thus generated may accumulate at a bend in the fuel line or at a filter and thus interrupt the flow of the fuel. Fuels having a low vapour pressure are therefore required to prevent these troubles in high-altitude aircraft.

Calorific Value and Latent Heat

The calorific value of a fuel is the heat energy obtained when a unit quantity is burnt freely in the air, and consequently it is a measure of the power output of the fuel; the greater the calorific value the less the weight of fuel required for a given power output. In view of the fact that there is not a wide variation in the calorific values of the hydrocarbons used in aero-engine fuels, this feature is relatively unimportant. Since liquid fuels are evaporated before they are burnt in the combustion chamber, the latent heat of evaporation has a slight bearing on the characteristics of the fuel. The latent heat modifies the nett calorific value of the fuel, since the latent heat of the water found by condensation after combustion must be subtracted from the calorific value of the fuel used. Another effect of the latent heat is that it cools the fuel-air mixture as it enters the cylinder. The volumetric efficiency is thus improved, since, by cooling the charge in this manner, a greater weight may be induced into the cylinder with the consequent result of increased power per stroke.

Thus we see that the fuel used in modern aero-engines must be very carefully blended and chosen for its particular characteristics according to the engines in which it has to be used, and that a very strict watch must be kept on the specification of the fuel during its manufacture if it may be used without detriment to the engine.

An Electric Alarm Clock

Details of a Simple Conversion, Using an Ordinary Spring-driven Clock

DOES your alarm clock fail to wake you? If you are one of the unlucky people who cannot wake up, or one of those who slip off to sleep again after the alarm has wound down, then why not convert your alarm into an electric one? By these means you cannot fail to wake as a much louder ringing tone keeps on until the battery is exhausted, or until you get out of bed and switch it off; or one can fit a pear switch and operate it whilst in bed, but if you're apt to drop off to sleep again then dispense with this idea.

A general view of the converted clock is shown in Fig. 1. A small electric bell is installed, but increased sound can be obtained by using a wireless grid bias battery; this will last about seven to eight months. A light is also fitted so that when the alarm goes off the light goes on, and the time can be readily ascertained whilst in bed.

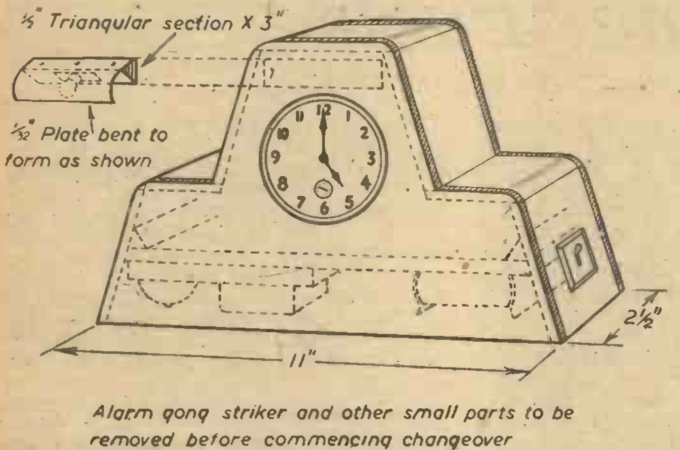


Fig. 1.—General view of clock, showing bulb mounting and case assembly.

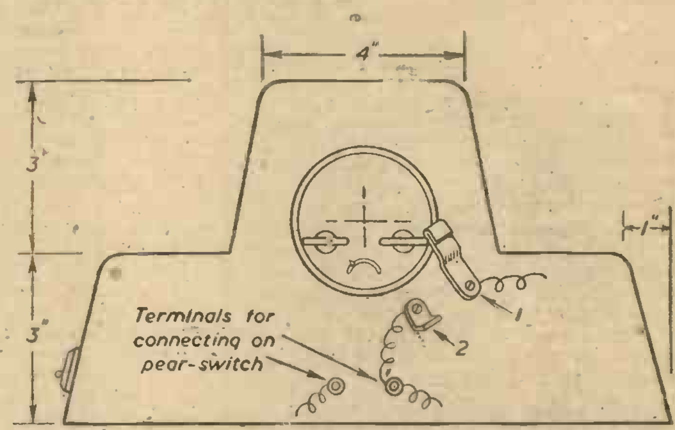


Fig. 2.—Rear view of clock, showing arrangement of contact brackets.

The Clockcase

Although the dimensions of the clock-case will suit most clocks, you might have to make slight alterations for the round apertures back and front, also in the width of the case. The making of the case is indicated in Fig. 1; the aperture in the front panel must be a tight fit for the clock. All nails showing can be sunk by using a fine centre punch and filled in with plastic wood, the work being finally glasspapered. The bell and battery support board is then fixed to two triangular blocks which have been glued into correct position and then screwed and glued to the sides of the casing. Most alarm clocks have hinged keys, and these can be readily made rigid by inserting part of a match-stick, for it is on this key that the contact will rest before being released when the alarm goes off, or when the key starts to unwind.

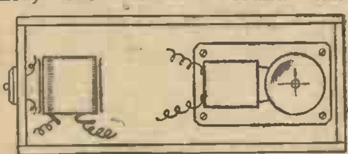


Fig. 3.—View of underside, showing bell and battery positions.

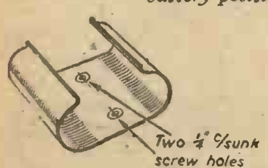


Fig. 4.—Details of battery clip.

Electrical Parts

The contact bracket (1), made from brass and seen in position in Fig. 2, must be an easy fit on clock-case. The clock is fitted in the case and contacts judged to get correct working position. After marking the positions, the clock is removed and contacts screwed on, using about ½in. brass wood screws. The battery clip is shown clearly in Fig. 4, and is made from 1/16in. spring steel.

The circuit diagram is shown in Fig. 5; if desired, the bulb can be omitted.

Testing

To test the alarm, set the hands to about 3.55, give about two turns on the alarm key, then in five minutes' time the mechanism will operate, causing the key to free contact bracket (1), which completes the circuit by dropping on to contact (2), thus causing bell to ring and light to go on.

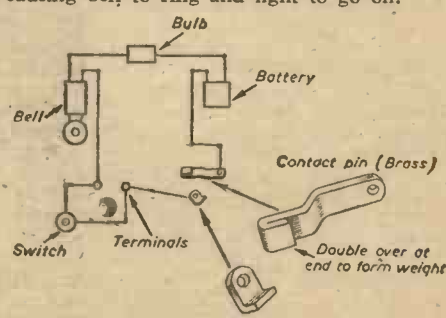


Fig. 5.—Diagram of electrical connections.

Books Received

Aircraft of the Fighting Powers. By H. J. Cooper and O. G. Thetford. Published by The Harborough Publishing Co., Ltd. 78 pages of text, and several single and double page illustrations. Price 21s. net.

THIS work, which is Vol. IV of the series "Aircraft of the Fighting Powers," must be used in conjunction with the others if a complete record is to be kept of all the military aircraft used in the present war. The present volume deals with the aircraft used by Great Britain, United States of America, Germany, Japan and the Union of Soviet Socialist Republics. Each aircraft described is illustrated with one or more half tones and either a full page or double page line drawing, which make the book extremely useful to designers, students, and aero-modellers. The book is remarkable for that accuracy of detail which makes it invaluable to both the "spotter" and air-conscious layman.

Beautifully produced on art paper, the book may be recommended as an authoritative work of reference on a subject of extreme importance at the present time.

Fleet Air Arm. Published by H.M. Stationery Office, London. 128 pages. Price 1s. 6d. net.

Here is a book which tells of the rise of Britain's Naval Air Power in a very interesting manner. Prepared for the Admiralty by the Ministry of Information, the book gives a lucid account of the various types of aircraft used by the Fleet Air Arm, its aircraft carriers, and some of the notable actions of the present war in which they have taken part. Graphic accounts are given of the attack by Swordfish in Bomba Bay, Libya: Spotting for the Fleet: the Second Battle of Narvik: The Triumph at Taranto: The Battle of Matapan: Protecting the Convoys, and African Operations. The story is told of the tracking down and the sinking of the *Bismarck*, and the fine work of the Desert Squadrons in the Middle East. Naval aircraft have shown their ability to work with the Merchant Navy across the seas of the world, and with the R.A.F. in Great Britain, Malta and North Africa. They have also fulfilled another function for which they were not originally intended—co-operation with military forces on land. How Naval Aircraft supported the Norwegian Expeditionary Force, and co-operated in the Madagascar campaign, is also vividly described in the book. The text is illustrated with many striking photographs.

The Story of Chemical Discovery

Advent of the Alkali Trade

An Early Chapter in Industrial Chemistry

THE use of alkalis dates back to pre-Christian times, to the era of the Egyptians in which a substance called "nether" was employed for washing purposes and, also, for making glass.

The Arabians, too, cultivated a certain type of seashore plant, the burnt ashes of which, when dissolved in hot water, gave a white substance to which the name *kali*, or

James Muspratt (1793–1886).

al-kali was applied. The ashes of seaweeds were discovered to be productive of this *kali*, also, and gradually, as the centuries wore on, the process of collecting and burning seaweed and lixiviating or extracting its ashes with boiling water rose to the importance of a veritable industry.

Almost to the end of the eighteenth century (the period which coincided with the rise of modern scientific chemistry) the world's alkalis were obtained solely from such plant or vegetable sources. The main alkali of that period was potash, which alkaline agent was obtained by the evaporation of water in which wood ashes (pot ashes) had been vigorously boiled. The early chemical workers seemed hardly to recognise any difference between their "potash" (potassium carbonate) and the analogous substance which we nowadays call "soda" (sodium carbonate). There was, indeed, no scientific foundation for alkali manufacture. The alchemists, of course, knew nothing concerning the true nature of alkaline substances, and even the early chemists experienced the greatest possible difficulty in understanding the essential differences between the various alkaline substances. They failed to appreciate the fact that the alkali from plant ashes (potash) was different from the alkali obtained from seaweeds (soda).

"Fixed" and "Volatile" Alkalis

The early chemists satisfied themselves by distinguishing between "fixed alkalis" (potash and soda) and "volatile alkalis" (ammonia and ammonium carbonate). They also used the term *vegetable alkali* for the potash which they extracted from the ashes of land plants and *mineral alkali* for the soda which they obtained from seaweed. The former term has come down to our own times, but it is, of course, a wholly unscientific one.

Into the complex narrative concerned with the scientific unravelling of the alkali composition question we cannot very well enter at the present time. Suffice it, however, to note that during the years when this once-vexed question was being fought out by investigators in England and on the Continent, the demand of alkalis was growing by leaps and bounds. New industries were coming into being. Older ones were being overhauled in the light of the then modern knowledge. Novel processes and technical methods were being designed. Numberless new products were being placed on the industrial markets. All such activities, technical and industrial, necessitated the supply of alkalis in one form or another. Indeed, it is a truism to state that the industries of the world, or, at any rate, a large

Manufacture of "salt cake" (sodium sulphate). Common salt being charged into the "salt cake pot."

number of them, have been reared not only on iron and steel and engineering knowledge, but on alkalis as well, for without a plentiful supply of the ubitiquous soda there are whole masses of industry (paper-making, dyeing, bleaching, chemical, glass, soap, porcelain and dyestuff industries—to mention but a few) which would be unable to carry on at all.

The problem of alkali production was one of the pressing matters which beset the early industrialists in this country and on the Continent during the second half of the eighteenth century. There was a theory—prevalent, particularly, among the French chemists—that common salt contained some element or principle in common with some of the then known alkalis. Now, ordinary salt was a very abundant material, so that eventually some of the more "advanced" thinkers in the early chemistry of the period began to wonder whether it might be possible to convert the almost universally plentiful mineral salt into soda and, therefore, immediately, to satisfy the increasing demands which were being made on the latter commodity.

Salt into Soda

The notion of converting salt into soda grew apace. It appealed to the minds of the technical people of the period, so much so that in the year 1775 we find the famous French Academy of Sciences offering a prize of 2,400 livres (approximately £100 in modern money) for a practicable means of obtaining soda from common salt.

At this time there lived in the employ of the celebrated Duke of Orleans a private surgeon and medical man named Nicholas Leblanc. Leblanc happened to be a rather brilliant and original-minded individual. Although only 22 years of age, he had made something of a name for himself as a surgeon, and he possessed, also, a very great enthusiasm for chemistry, a subject in which the Duc d'Orleans himself was pleased to dabble.

Nicholas Leblanc was the son of a blacksmith. He was born at Ivoy-le-Pré, France, in 1742. In some way or other he gained admission to the famous School of Surgery in Paris. Eventually he passed out as Master of Surgery, and he practised as a medical man for some time before entering the service of the Duc d'Orleans.

The Leblanc Process

Leblanc, in the Duc d'Orleans' laboratory, experimented for three years before he at last hit upon the famous soda-making process which was to bring him scientific celebrity—and, alas, social ruin!

He stated off by treating common salt with sulphuric acid, a process which had

William Gossage (1799–1877).

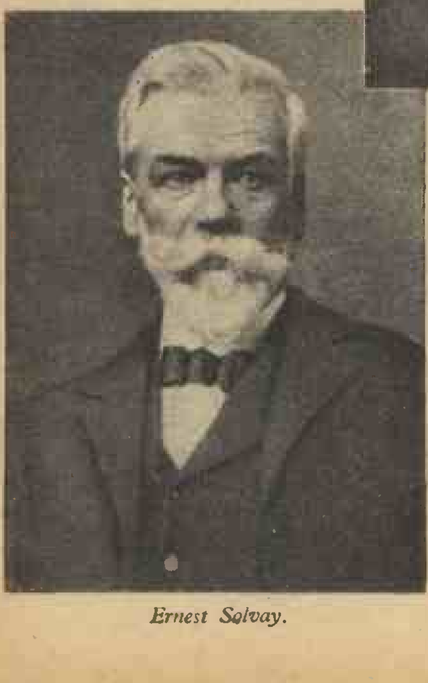
been known previously. The common salt (sodium chloride) was thereby converted into sodium sulphate, and, at the same time, hydrochloric acid gas was abundantly liberated. The resulting mass of sodium sulphate ("salt-cake," as it was afterwards technically termed) was mixed with charcoal and chalk and then strongly heated. This process gave a crude mixture of sodium carbonate and calcium sulphide, which, on account of its colour, came subsequently to be known as "black ash." The black ash was then extracted with water, and the sodium carbonate in that manner dissolved out and finally purified by recrystallisation.

Such, in its essence, was Nicholas Leblanc's soda-making process. But it never gained for him the Prize of the French Academy of Sciences, for the year of its introduction (1789) was also the one which witnessed the beginning of the French Revolution. However, in September, 1791, the revolutionary "National Assembly" in France granted Leblanc a patent for 15 years for his soda process, and, with the aid of a few interested individuals (including the Duc d'Orleans), he established a factory—the world's first soda factory.

Before long the Leblanc works were in full activity, and were turning out sodium carbonate from common salt at the rate of about five hundredweights per day.

For a couple of years or so Leblanc progressed fairly satisfactorily with his project, although his factory was never free from technical trouble. Social troubles arose, too. The acid fumes which poured out from the soda works polluted the neighbourhood and gave rise to much dissention. But, worst of all, the French Revolution rose to its height and set the nation into a ferment.

After the establishment of the French Republic, Leblanc, in 1794, was ordered to resign his factory to the nation for the general benefit thereof. It was an early example of State control, that supposed panacea which, in our days, so many ill-formed minds so desperately hanker after. Nicholas Leblanc found himself (to use a modern expression) a "directed" man. His factory was taken from him, and he received the miserable compensatory sum of £160 for it. It is true that, some half-dozen years later, when more settled conditions returned to the country, his factory was given back to him, but bad treatment, ill-health and poverty had completely broken his spirit, and in the early morning of January 16th, 1806, he chose to end his increasing cares by means of a pistol bullet.



Ernest Solvay.

Alkali-making in England

The individuals who took up Leblanc's process in England were more fortunate than Leblanc himself, although even for them the industrial enterprise proved anything but a straightforward one.

James Muspratt, a Dubliner, was the first to set up alkali-making in England, on account of which fact he has been dubbed the "Father of the Alkali Trade." A very small amount of soda had previously been made on the Clyde, but the industry had not been successful. Muspratt, however, in 1823, erected a factory in Liverpool to manufacture alkali by the Leblanc process. Then the trouble started. No sooner had Muspratt got fairly going than almost the whole of Liverpool rose up in seething opposition to his activities.

The reader will recollect that when sulphuric acid is heated with common salt at the commencement of the Leblanc process hydrochloric acid gas is liberated. It was this hydrochloric acid gas which caused the trouble. From Muspratt's factory chimney it spread over Liverpool like a white, corroding blanket. Ultimately the Corporation of that city compelled Muspratt to close down his process and to seek a fresh site for it, which site he eventually found at Newton-le-Willows, not far away.

Another pioneer of the British chemical industry had a similar experience. He was William Gossage, a Lincolnshire man, who, starting as a druggist's assistant, came eventually to be one of Britain's foremost chemical manufacturers. Gossage was a more inventive individual than Muspratt. Consequently he endeavoured to abate the nuisance consequent upon the discharge of free hydrochloric acid gas into the atmosphere, and the means by which he effected this took the form of a long vertical tower packed with coke, down which a steady stream of water was allowed to trickle. The ascending hydrochloric acid gas came into contact with the water and dissolved in it, forming the valuable industrial commodity which we now know as "hydrochloric acid."

Sacks of soda crystals awaiting transport from an alkali factory.

Gossage's Towers

Muspratt, when he heard of Gossage's invention, was sceptical. "Not all the water in the falls of Ballyshannon would condense the gas from my works," he is reputed to have exclaimed. Nevertheless, so effective became the "Gossage Towers" that, in the Alkali Act, which was introduced at a later date, soda manufacturers were rightly compelled to equip their factories with similar absorption devices.

William Gossage laboured incessantly to find a method of reclaiming sulphur from the "alkali waste" which was a by-product of the Leblanc soda process. The alkali waste, consisting, as it did, of impure calcium (lime) sulphide, presented a perennial problem to the alkali manufacturer. It was a foul, stinking stuff, which was produced in large quantities and which rapidly accumulated in enormous dumps around the alkali works.

Henry Deacon (1822–1876).

Although Gossage never completely solved the problem, he came very near to doing so, and his continual researches formed the basis of the more successful sulphur-recovery process which was introduced after his time.

Henry Deacon

Henry Deacon, born in London in 1822, was another of Britain's foremost soda makers. After a strenuous early career, Deacon found himself installed as manager of Pilkington's glass works at St. Helens, Lancashire. Finally, in association with others, he branched out as an independent chemical manufacturer at Widnes, the early home of English chemical industry. Deacon manufactured soda, but he was not content to consider that the troublesome Leblanc process was the last word which had been said on the subject. He experimented with other possible methods of alkali production, notably with a method of converting salt into soda by means of ammonia gas. Unfortunately, however, success failed to come Deacon's way in this particular respect.

Until the year 1872 Leblanc's process of soda manufacture reigned triumphant. No other process was able to compete with it in any way at all. But in that year there was introduced a new soda-making method, one which, within a few years, rendered the Leblanc process almost obsolete. It was a process due to a young Belgian chemist named Ernest Solvay.

The Ammonia-soda Process

Solvay's new process was based upon earlier-known facts—facts, indeed, which Henry Deacon in his experiments had made use of. To convert salt into soda, Solvay made a strong solution of salt which he saturated with ammonia gas. He then treated the ammoniated salt solution (brine) with carbon dioxide ("carbonic acid gas") under pressure. A mixture of ammonium chloride (sal-ammoniac) and bicarbonate of soda was formed in the resultant liquor. The less soluble bicarbonate crystallised out, leaving the more soluble ammonium chloride in solution and thus permitting a simple and easy separation of the two salts.

Relatively speaking, Solvay's "ammonia-soda" process was a perfectly clean one. It gave rise to no obnoxious acid vapours and to no alkali waste. It gave a soda product of high purity. Moreover, it was a process which could be worked continuously and without frequent intermission.

The ammonia-soda process was first established in England by the late Dr. Ludwig Mond, who, towards the end of 1872, set up a factory to operate it at Northwich, Cheshire, directly above the Cheshire salt deposits. In partnership with a certain John Brunner (who was formerly an accounts clerk in an alkali works) he created the famous "Brunner-Monds," which, together with the United Alkali Co., Ltd., and several other prominent chemical manufacturing concerns, ultimately became fused together as the nowadays celebrated and world-prosperous Imperial Chemical Industries, Ltd.

As for Ernest Solvay himself, the inception of his process and the technical failures and difficulties which he encountered, nearly ruined him. But he lived in more settled and prosperous times than those of the ill-fated Nicholas Leblanc. With dogged determination he overcame difficulty after difficulty. Ultimately he accumulated great wealth and lived "to sit above the salt" and to witness the fame and prosperity of his process the world over.

The Cheapening of Alkalis

At the end of the eighteenth century, soda crystals, obtained from seaweed (the so-called "mineral alkali") were sold for £60 per ton. The introduction of the Leblanc process into England by James Muspratt in 1823 lowered the price of alkali soda to £18 per ton. At the beginning of the present century, soda, manufactured by Solvay's process, sold at about £3 10s. per ton, and the following years saw an even lower price still.

Growth of the Alkali Industry

Soda, one of the first essentials of a thousand industries, thus became, during the course of a century, one of the cheapest of manufactured materials. The British alkali industry, based on soda made from salt, rose during the same period to the position of one of the foremost trades in the country.

Such was the eventual result of chemical skill, scientific experiment, individual effort and persistent application. The rise of the alkali trade is, indeed, a veritable industrial romance, but, unfortunately, the story of its difficult yet successful career has not often been related.

Science Notes of the Month

Frost Predictor

AN ingenious instrument known as a "Frost Predictor" is likely to prove a great help to fruit growers and nurserymen in the event of a spring frost. Invented by Sir Henry Cunynghame, the instrument resembles a garden thermometer, but is provided with two tubes, one to measure temperature, and the other the humidity of the atmosphere. If at sundown the "wet" bulb reading falls below the "dry," a coming frost is predicted. Over a long period of trial warnings were given correctly 23 times out of 24. While the war lasts orchard heaters must not be used, but the predictor will enable fruit growers and nurserymen to take the necessary precautions in time to prevent damage to their crops.

Britain's New Transport 'Plane

PARTICULARS of the Avro York, the only passenger and transport aircraft Britain has built since the war began, have now been released by the Ministry of Aircraft Production. The Avro York was conceived by Mr. R. H. Dobson, managing director of A. V. Roe and Co., Ltd., Mr. R. Chadwick, their chief designer, and his assistants.

Engines, wings, tailplane, fins and rudders are identical with the Lancaster. The fuselage is entirely different, being large and square, to accommodate bulky freight. A central fin has been added.

With a wing span of 102ft. and a length of 78ft. the York, fully loaded, weighs 30 tons. Top speed with four Rolls-Royce Merlin engines is claimed to be 300 m.p.h., the economical cruising speed 220 m.p.h., and maximum range over 3,000 miles.

Such is the capacity of the fuselage that four jeeps can be driven in under their own power. The size of the interior of the fuselage offers opportunities for the most comfortable furnishing, and the space available provides seating capacity for 24 passengers in two big cabins, with wash-rooms, lavatories and a buffet-kitchen.

"Mars" Maiden Trip

THE huge flying-boat "Mars" entered the U.S. Naval Service last month by completing her inaugural flight from San Francisco to Hawaii in a little over 13 hours. "Mars" did the trip with a record cargo, including 13,000 pounds of mail and war materials. She carried 20 passengers and a crew of 15, and is powered by four 2,200 h.p. engines. U.S. Navy authorities, when announcing the flight, stated that 20 more flying-boats of the same type are being built.

Greenwich Observatory to Move

IT is reported that Greenwich Observatory, the home of the "right time," is likely to be moved. The chief reason for this is increasing smoke in the locality which makes the Observatory's sunshine recording inaccurate. Already much of the work of the Observatory is done elsewhere, partly because of bomb damage, and partly for security reasons. The magnetic work was transferred to the Surrey Hills some years ago, because of the electrification of the railway.

Fast Victory Ships

THE first of the Victory ships—successors to the mass-produced Liberty ships—was launched at Portland, Oregon, U.S.A., last month. The ship, named *United Victory*, will probably be in service shortly. Victory ships carry the same weight of cargo as the 10,000-ton Liberty vessels, but are faster—15 knots as against 11.

Rocket Target

ACCORDING to a recent report from America, the U.S. Army are using a rocket-propelled target, which travels with the speed of a fast 'plane, for training A.A. gunners at a camp in North Carolina. The target, which is about 5ft. long, is launched from a tower, and has an initial speed of 450 miles an hour and a range of about 2,200 yards.

Camp officers said that practice with the new target improved to a marked degree the accuracy of gunners, who fire at the target with machine-guns and cannon.

Transmitting Speech by Light Ray

THE German Army has in use a field telephone instrument which utilises a light ray as the transmitting agent for speech. It is claimed that the use of light transmission avoids the disadvantages of wires as used for the normal field telephone, and of radiation to the enemy of messages sent by radio. By the use of filters, visible light rays are stopped at night, and the apparatus can be used in foggy weather. A light beam of constantly varying intensity is sent out and picked up by a receiver equipped with a telescope and photo-electric cell.

The new Avro York transport 'plane, particulars of which are given above.

Inventions of Interest

By "Dynamo"

Glass Cloth Bags

IN these days when it is illegal for a tradesman to wrap up certain goods in paper a capacious bag or basket is an indispensable article of the housewife's shopping equipment. It is therefore fitting that two ladies should be included among the applicants for a patent in this country for a bag of glass cloth.

The idea is not unprecedented, since it has previously been proposed to make sandbags from glass cloth and to manufacture translucent containers of glass fibres.

The invention in question is a flexible bag, the walls of which are of glass cloth and are interconnected by stitching by means of a vitreous thread. The interconnection, if preferred, may be effected by fusion or by affixing by fusion patches to the glass cloth.

When the bag is to be furnished with a handle, there may be attached to it by lacing through eyelets, cords or ropes composed of glass fibre strands fashioned similarly to cords or ropes of vegetable fibre.

The fabric of these bags may be treated in such a manner that they have the appearance of natural vegetation. The glass cloth may be coloured either on the surface or by incorporation in the glass of colouring materials. If desired, it can also be coated or impregnated with proofing medium; for example, a quick-drying oil, such as linseed oil.

It is affirmed that this bag is impervious to moisture, non-inflammable, and proof against rot, bacteria, fungus and vermin. And it is adapted to serve a purpose for which the use of textile fabric bags has not previously been contemplated; it may act as a container for corrosive materials.

Ideal Bricks

AFTER the war the brave new world which we all hope will materialise will undoubtedly include a vast number of new houses, if not ideal homes. This makes appropriate any really useful idea in relation to building.

With a view to provide effective building construction, an inventor has designed a new building material. His object has been to devise a product reasonably light in weight, porous and one which is a good insulator against sound penetration and variations of temperature.

A further object has been to produce a material which is non-inflammable and vermin and white ant proof.

Additional characteristics aimed at are strength, flexibility and a substance which can be sawn and into which nails and screws can be inserted.

The inventor maintains that it is also desirable that such a material should not shrink unduly in setting nor expand or contract to any great extent owing to changes in temperature. It should also take plaster well, and finally, the material should be readily moulded into shape.

The originator of this new building material believes that his device realises the above-mentioned desiderata.

His invention consists of a lightweight material which comprises a vegetable or animal long staple fibrous substance, such as coir, hemp, jute, wool, hair and other long staple fibre normally used in industry, or in the textile trade. This is impregnated with sulphate of aluminium and one of the following: sodium carbonate, zinc oxide or calcium carbonate, and it is caused to adhere and form a compact mass by means of Portland cement or other cementing material.

The information on this page is specially supplied to "Practical Mechanics" by Messrs. Hughes & Young, Patent Agents, of 7, Stone Buildings, Lincoln's Inn, London, W.C.2, who will be pleased to send free to readers mentioning this paper a copy of their handbook, "How to Patent an Invention."

Paper-making Process

A NEW process and apparatus for the manufacture of paper are the subjects of an accepted application for a patent in this country. The primary aim of the inventor has been not only to obtain an improved product but also to effect a saving of time and expense in the handling and treatment.

The inventor points out that hitherto in the manufacture of paper, raw materials have been placed in a mixer containing fibrous materials, such as cellulose wood pulp, rags, waste paper, etc. There have also been added ingredients such as glue, alum, colours and some others in the proportions chosen in each case and mixed with the fibres while the fibres were being beaten and hydrated.

This process, however, it is stated, has the disadvantage that, although fibres of different kinds are mixed, all of them receive the same treatment in equal degree and during the same time. A more satisfactory result is said to be attainable by treating each kind of fibre independently. And this is the method adopted according to the invention which it is desired to patent.

In the case of the new process, the different fibres are individually treated to hydrate and refine them. Quantities of the pulps that are to form the constituents are introduced into a measuring tank having means whereby the quantity of each pulp can be measured.

The pulps are then intimately mixed together with sizing material prior to being fed directly, or after refining, to the feed tank of a paper-making machine.

Down in the depths at the County Hall is installed one of the finest air-conditioning plants in the world. Huge pipes start their journey to supply clean, warm and fresh air to the council chamber.

Magazine for 'Planes

MILITARY aircraft obviously need accommodation for ammunition. As space in an aeroplane is strictly limited, the storage must necessarily be as compact as possible. This point has been borne in mind by an inventor who has designed an ammunition box or magazine for the machine-guns mounted in a 'plane.

His idea is a box located close alongside the guns so as to extend practically parallel with the gun barrel. This will house a number of superposed lines of cartridges arranged in belt or flexibly linked-up form extending backwards and forwards within the box.

A longitudinal shallow channel extends along the upper part of the box, forming an outlet guide. Along this the line of cartridges is adapted to be fed from the box to the gun.

Besides being appropriate for aircraft, the invention is suitable for other purposes in which it is imperative to minimise space for ammunition, or to operate guns from remote control. It is, however, particularly applicable for use where a number of machine-guns are mounted close together side by side in the wings or other convenient parts of an aeroplane.

Seaweed Extraction

The Promise of a New Industry

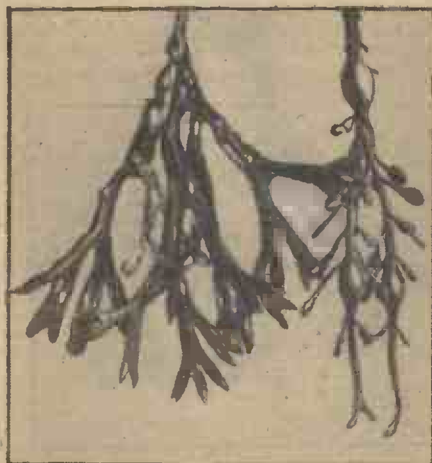
SEAWEED constitutes one of the few present-day raw materials which are freely available for the taking. Quite apart from the large masses of this material which are washed up annually around the coasts of the British Isles, the oceans of the world must, in the aggregate, contain colossal amounts of the various seaweed species. Yet among the raw materials of modern civilisation, seaweed, the universal and international harvest of the marine depths, is a veritable Cinderella. After nearly a century of some economic importance as an important iodine source, seaweed, apart from having a few minor and localised uses, is, at present, a neglected material, a substance which has been little exploited in respect of modern demands and developments.

Seaweed is really a highly interesting and, in many ways, a remarkable and unique material. It is interesting in regard to the number of useful substances which can be extracted from it; it is unique in consequence of its property of absorbing iodine from seawater and concentrating this valuable element within its own tissues.

During the stormy spring months, great quantities of deep-sea weed are driven up on to the western coasts of France, Ireland, and Scotland. For years, local workers have collected the weed and have burned it in heaps at as low a temperature as possible, the ash being termed "kelp" in Britain, and "varech" in France.

During the eighteenth century, burnt seaweed or "kelp" was the only source of alkali in Great Britain. Kelp production, therefore, in those days, was an important occupation. When, however, the mass-production "chemical" methods of alkali production came into operation about 1840, kelp ceased at once to be of any importance for alkali manufacture, but, for a number of years, it was used as a source of iodine. Nowadays, of course, all the iodine supplies normally come from the vast nitrate deposits in Chile, the iodine therefrom being derived in the form of sodium iodate.

During the progress of the last century, therefore, the seaweed industry, in consequence of the loss of its alkali and its iodine markets, has dwindled away almost to nothing. In spite of this, however, it would seem that the industry has not been killed, but that it is, at present, merely in a dormant condition, awaiting a resurrection to a new lease of life.



Common seaweed found everywhere around the British coasts suffices for many interesting experiments in seaweed extraction.

Seaweed Iodine

Before considering such possibilities of revival, some information relating to the occurrence of iodine in seaweed may be of interest. Iodine is present in seawater to the extent of about 0.001 per cent. It is present in seaweed, however, particularly in the deep-sea weed, to the extent of 0.5 per cent. In some way, therefore, all species of seaweed possess the remarkable property of being able to filter out the iodine from the seawater. How they effect this operation is totally unknown at present, although future research may reveal the chemical mechanism of the process.

Cleaning the seaweed prior to laboratory processing.

Crude alginic acid; a thick, gelatinous product obtained from common seaweed.

Iodine is obtained from "kelp"—the ash of seaweed—by extracting it with boiling water. The iodides, carbonates, chlorides and sulphates of potash, sodium and magnesium go into solution, and by subsequent careful crystallisation it is possible to remove the majority of the carbonates, chlorides and sulphates, leaving the much more soluble iodides in the remaining "mother-liquor." This latter is then concentrated down to fairly small bulk. Concentrated sulphuric acid is added to it, together with some manganese dioxide, and the mixture is carefully distilled. Violet fumes of iodine arise, and these are condensed in a cooled receiver. Approximately 10-12lb. of iodine is obtained from a ton of carefully-burnt kelp by this process.

The process is capable of being imitated on the small scale in the laboratory, yet it is seldom successful on such a scale. The seaweed must be ashed at the lowest possible temperature and in closed vessels in order to prevent the escape of the very volatile iodine. Furthermore, a large amount of the kelp has to be extracted in order to obtain sufficient "mother-liquor" from which to obtain the free iodine by the sulphuric acid-manganese dioxide distillation process.

In view of the almost unlimited deposits of sodium iodate in Chile nitrate deposits, the extraction of iodine in any shape or form from seaweed will hardly ever become a commercial proposition again, unless, of course, some much simplified mode of obtaining the element from the weed could be devised.

Iodine is by no means the only valuable product which can be obtained from all classes of seaweeds. A certain type of weed is found on the west coast of Ireland. It is known as "carrageen moss." When this material is boiled with water, it resolves almost completely into a thick jelly. This "Irish Moss," as it is often called, still has its commercial uses in pharmacy, and as a thickener for colours in the calico-printing industry. In some parts of Ireland it is rather extensively used as a food, although recent scientific tests have demonstrated that it possesses no food value worth speaking about.

A curious thing about this extract of Irish Moss is that it tends to prevent the clotting of blood. Its chemical composition is unknown, but it has been shown to contain a complex sugar—raffinose—together with an ethereal sulphate of undetermined character.

Alginic Acid

One of the most interesting substances which are obtainable from seaweed is alginic acid. This is a very viscous, sticky substance, which has already found some commercial uses, and which holds out promise of many more.

It is not a difficult proposition to obtain a quantity of this substance on the small, experimental scale. The best procedure to adopt is the following:

Gather any of the usual varieties of British seaweed and wash the weed well in *cold* water. Then cut it up into convenient-sized pieces and gently boil the material with water for about 15-20 minutes. This process will extract from the weed a brownish, viscous substance which is termed *fucoidin*. The fucoidin extract can be concentrated by further boiling, if desired, until the impure fucoidin is obtained as a reddish-brown sticky mass, which is completely soluble in hot water.

The extracted seaweed is then allowed to steep for 24 hours in a dilute solution of hydrochloric acid (spirit of salts), say one part of the acid in five parts of water. During this immersion, the weed will change to a sage-green colour. It is then removed from the dilute acid (which may be used again and again for this operation) and rinsed well in *cold* water in order to get rid of every trace of the acid.

The next operation is to soak the acid-treated seaweed in fairly strong ammonia solution (two parts strong ammonia to one part of water) for a further 24 hours, the weed being frequently stirred. Use just as much of the ammonia as will cover the weed in the vessel. If too great a quantity of ammonia is used, the excess will merely be wasted.

Ammonia Treatment

The ammonia treatment will result in the sage-green seaweed turning a dark brown and partially dissolving into a thick, brownish liquid. After 24 hours, the entire mass is strained by squeezing it through a coarse cloth. The brownish liquid which results is a solution, more or less impure, of ammonium alginate.

In order to obtain the free alginic acid, the ammonium alginate solution is carefully acidified with strong hydrochloric, which is added a drop or two at a time. At one stage of this operation a gelatinous precipitate will form in the liquid. This is the free alginic acid. It should be filtered off, dried and preserved for further experiment. It is insoluble in water, but is freely soluble in weak (5 per cent.) sodium carbonate (washing soda) solution, or in weak ammonia.

When to a solution of alginic acid in sodium carbonate solution, a solution of copper sulphate is added a thick gelatinous precipitate of copper alginate is obtained. By using solutions of zinc of aluminium sulphate, the corresponding zinc and aluminum alginates can be obtained.

Forcing crude alginic acid through a cloth bag in order to free it from remaining tissue.

These metallic alginates are quite insoluble in water, and, having that character, they are capable of forming excellent waterproofing substances. They still await technical and commercial development in this and in other directions, although sodium alginate solution (the solution obtained by dis-

Another common type of marine weed which is suitable for the experiments described in this article.

solving alginic acid in sodium carbonate solution) has been used as a cloth dressing in the textile industry.

Absorbed into wood, solutions of metallic alginates in organic solvents, such as naphtha, would not only render the material water-

Cutting up the seaweed into small pieces for extraction with sodium carbonate solution.

resistant and rot-proof, but would also give it protection against mildew, mould, dry rot, and boring-beetle attacks.

An alternative way of making alginic acid is to soak the washed seaweed directly in 5 per cent. sodium carbonate solution (5 parts sodium carbonate in 95 parts of water). This gives an almost black solution from which impure alginic acid can be precipitated by the cautious addition of hydrochloric or sulphuric acid.

The chemical composition of this curious substance, alginic acid, is yet unknown. It contains carbon, hydrogen and oxygen, the proportions of which correspond to the formula, $C_6H_8O_6$, but it is almost certain that the acid is very much more complex in make-up than this, and that, in actual fact, it is composed of a large assembly of these $C_6H_8O_6$ units, all strung up together like beads on a thread.

Fucoidin, the boiling water extract of seaweed, is an interesting material of unknown composition. It is highly gelatinous, and, as such, may be combined with various resins to make bonding materials. All such uses, however, have been but little investigated, and, at present, are purely experimental.

Laminarin

Another interesting product of seaweed growth is laminarin. This can be obtained from the broad, ribbon-like seaweeds by brushing the fronds of these weeds with dilute hydrochloric acid for four or five days in succession. After this time, laminarin will be formed as a white deposit on the surface of the fronds, which deposit can then be scraped away and the underlying surface of the weed again treated for further quantities of this substance.

Laminarin has been given the chemical formula $(C_6H_{10}O_5)_x$, the "x" designating an unknown number. In actual fact, laminarin is a sugar of complex composition. It is one of the rarer sugars. When it is boiled with a little dilute hydrochloric acid, it becomes converted completely into glucose, $C_6H_{12}O_6$, one of the simplest of the natural sugars.

These same ribbon-like seaweeds are usually an abundant source of the mucilage-like substance called fucoidin, for when they are chopped on a board they exude it profusely. Fucoidin is supposed to be a very complex sugar-like compound containing calcium and sulphur. It should surely find at least a few uses in the fast-developing world of commercial chemistry.

Mannitol is also present in the majority of seaweeds, although its extraction is difficult. Mannitol is a complex alcohol. When pure, it is a colourless solid, having a sweet taste. It is readily soluble in water and, when oxidised, it becomes converted into sugars. Whether mannitol will ever be commercially extracted in the future from any varieties of marine weeds is a difficult question to pronounce on. Nevertheless, this useful material is certainly present in seaweed, and probably the discovery of a practical process for its extraction will render it an important product in the chemical economics of the future.

Plastic from Seaweed

Seaweed, when thrown into ditches or left to lie in the open, gradually rots away. The fucoidin and the laminarin, the alginic acid and other products are slowly broken down by natural oxidising agencies. This rotted product is not without its uses. By steeping the rotted weed for a few days in dilute hydrochloric acid, all remaining traces of alginic acid are precipitated, and any mineral salts are extracted. The residual weedy material is then well washed in cold water and boiled with sodium carbonate (washing soda) solution of about 25 per cent. strength (25 parts of soda in 75 parts of water). This treatment of the weed gives a dark-brown or almost black horny material which can be taken up on a trowel and placed into moulds, in which latter it will dry and set into a hard, impervious material. The latter can be cut and sawn like wood, and, like wood, also, it will take a screw securely. Furthermore, it can be planed, painted, varnished, and processed in other directions. Surely, then, a use will crop up for this curious marine weed product, or for some combination of it with resin, pitch, tar, bitumen, or with one or more of the more modern synthetic plastics?

If ordinary seaweed is treated with 25 per cent. sodium carbonate solution by being allowed to soak in this solution for a week, and if, then, the solution is concentrated and mixed with a little formalin and tannic acid (or a soluble tan-bark extract), a highly viscous mass is obtained. This mass contains alginates and other complex compounds or, rather, their interaction products with formalin and tannic acid. The important point, however, is that, when mixed with products such as glue, shellac, resins, rubber latex, bitumens, etc., it is capable of being converted into board-hard waterproof material which is suitable for impregnating into fabrics, felts and other absorbent materials. It can, also, be used for the backing of linoleum and for compounding various water-repellant plastic and moulding materials.

Here, again, however, little work has been done in this direction, so that this "sea-weed plastic" still awaits the investigator who will develop it thoroughly.

Various authorities have asserted that good cellulose-substitutes are obtainable from marine weed. Such is quite possibly the case, although the question has never been prosecuted to its full practical extent. It does seem certain, however, that alginic acid, as obtained from seaweed, is capable of forming a thread. Here, therefore, probably lies the germ of some future synthetic thread application, for there should be no greater difficulty with the production of an alginic thread or of one composed of a metallic alginate than there was originally with many of the present-day synthetic or artificial fibres.

Seaweed Soda

The only mineral constituent of seaweed which is of any interest is soda. This can be obtained in the form of its salts by the simple hot-water extraction of seaweed ash or "kelp." But, of course, in these days, the commercial soda producers have far more abundant resources of their important and indispensible commodity than that provided by the humble yet ever-present weed of the ocean.

In connection with the well-known iodine content of marine weeds, it should not be imagined that the iodine occurs in the free or uncombined state in seaweed. Quite a lot of modern research on the iodine content of marine organisms has been conducted in recent years, and it now transpires that the seaweeds, the sponges and the corals all store up iodine in their tissues, the corals excelling in this activity, since they all contain approximately 8 per cent. of the valuable element.

It has been proved that the iodine compound existing in coral is very similar to, if not identical with, the iodine secretion of the human thyroid gland, which vital gland, as is well known, functions as the controller of the bodily processes.

The precise nature of the iodine compound or compounds in seaweed has not yet been ascertained, but it seems likely to be similar to that occurring in coral and, therefore, related to the iodine compound of the thyroid secretion.

It is highly probable, also, that there exist in at least some species of marine weeds and other vegetation, other compounds and substances of great interest which only await discovery, extraction and elucidation. For a worker skilled in the methods and technique of organic chemistry, the subject of seaweed and its scientific extraction and processing forms one of much promise both theoretically and practically. It is a field of chemical research in which there is, at present, little, if any, competition.

Probes and Problems

More Mental Nuts for You to Crack

(*Solutions are given on page* 206.)

Four Men from the Provinces

Mr. York, Mr. Bristol, Mr. Dover and Mr. Cambridge live (not necessarily respectively) in the four towns of the same name.

Mr. Dover lives in the town with the same name as that of the man who lives in York. The man who lives in Dover has the same name as the town in which Mr. Cambridge lives.

Only one of these four men lives in a town with the same name as his own. Who is he?

Down Our Street

Four houses in our street are named Whitefield, Blackfriars, Brownleaves and Greystones. They are painted white, black, brown and grey; and their occupants are Messrs. White, Black, Brown and Gray.

Only one man lives in a house the name of which suggests his own name, and only one house (not the same one) has a name that suggests its colour.

The name of Mr. White's house suggests the name of the occupant of the house painted black. The name of the grey house suggests the name of the occupant of Greystones. Brownleaves is painted white.

Who lives at Whitefield?

Phoney 'Phones

"You are aware," said Professor Crackbrayne, that my telephone is on the Livingstone exchange. I have just discovered that in dialling my own number, if I reckon the three letter LIV according to their numbers on the dial, that is, as 548, then the seven-figure number produced is a perfect square."

"By a remarkable coincidence," said his friend, Professor Nitwit, "my telephone number is the same as yours, although on a different exchange within the London ten-mile radius; and by reckoning the dialling letters as numbers I too arrive at a perfect square in the same way."

I want to telephone to Professor Nitwit, but have forgotten his number. Can any reader work it out for me?

Energy on the Escalator

The escalator at my Underground station is 88yds. long, and it travels at the rate of 2 miles per hour. I myself can run up an ordinary stairway at the rate of 3 miles an hour.

Being a little late for my train yesterday morning, I ran up the moving escalator. How much time did I save by doing so?

Services Dinner Party

"We had a little Services dinner party last night," said my friend Adams, stroking his beard. "Six of us dined together at a round table. As you know, I come from Liverpool," he continued. "I sat next to Evans, and the sailor was facing me. The warden, sitting on the left of the fire-watcher, was opposite Clark, who sat between Brown and the soldier. Frazer was between Davis and the man from Glasgow, who sat opposite the Home Guard. The Mancunian was opposite the Leeds man, who sat on the right of a fellow from Birmingham. Clark is an airman."

Who was the only Londoner present, and what does he do in the war?

Lady Bountiful's School Treat

"Lady Bountiful paid the whole cost of our Sunday School outing," said the vicar. "She hired a bus to take the children to Winklesea, and gave them a really sumptuous tea."

"Very generous," I commented. "Did it cost her much?"

"I couldn't say how much," the vicar replied. "All I know is that the organisers charged so much a head—there being no fractions of a penny—and when her Ladyship settled the bill she paid out a Bank of England note and a penny besides. Perhaps you can work it out from that," he added with a smile.

How many children attended the school treat?

Sympathy and Antipathy

"Sympathy and Antipathy" is a simple gambling game, in which the dealer detaches two cards from the top of the pack and the punter (of course without seeing them) bets a level stake on sympathy or antipathy—sympathy meaning that the two cards are of the same colour, and antipathy that there will be one red and one black card.

It did not take my friend Cleverleigh long to realise that the odds in this game are slightly in favour of antipathy, so he sat down the other day intending to back antipathy steadily with a level stake of a shilling each deal.

Coming back a few minutes later, before the pack was exhausted, I asked Cleverleigh how he was getting on.

"Very badly," he replied. "As ill-luck would have it, sympathy has turned up every time."

"Dear me," I said. "Are you going to continue with your system?"

"It doesn't matter whether I do or not," answered Cleverleigh, "because the chances are now exactly level."

How much had Cleverleigh lost?

Grinding and Crushing Machinery

The Construction and Operation of Various Types of Crushers Chiefly Used in the Chemical Industry

By H. BOULTON

GENERALLY speaking, materials when purchased or produced for the manufacture of such things as paints, explosives, pottery-clay, glazes, and even some types of foodstuffs, are very coarse, and are often formed into hard lumps and masses. It is necessary to grind these materials down into powders or a smaller crystalline size, before further refining can be done.

As grinding is usually the first process carried out in the production of certain commodities, it is very important, for all following treatment given to the materials is dependent on the efficiency of the first. The design of machines capable of doing this work properly presents a number of difficulties not met with in any other type of engineering design. Chief among these problems is the considerable difference in characteristics of different materials. Some can only be ground dry, so that the machine must be fitted with dust-hoods, and all bearing surfaces have to be fitted with oil-seals and adequate casings to protect them from the dust. Certain types of material can only be ground when in liquid form, and to maintain this state have to be kept hot, in special hot-water or steam-jacketed mills. Others should not come in contact with any form of iron, and the grinding mills consequently have to be lined with porcelain or silex linings. Almost every material has its own peculiar characteristics which call for special consideration. However, the following is a brief description of some of the grinding machines used in the chemical industry. Attention is paid more to specific types rather than to the considerations which must be embodied in a machine for a particular chemical or material. The commonest, and perhaps the one of greatest importance, is the ball mill, a typical example being shown in Fig. 1.

The Ball Mill

The tides' effect on pebbles and rock on the seashore is ultimately to reduce them down to grains of sand. The process is, of course, extremely slow, but is, nevertheless, a natural wearing or grinding action caused by the ceaseless turning over and smashing together of pieces of rock, broken off from the shores by the pounding of the sea.

This principle is used by the ball mill, the only difference being that the action is very much quicker, the desired degree of fineness being controlled by the length of time which the machine is allowed to run. The material to be ground is loaded into the mill cylinder with a quantity of pebbles, or porcelain balls. The "grinding media," as these are called, are usually of the same material as that with which the mill is lined. Thus a porcelain-lined mill requires porcelain balls, a steel-lined mill requiring forged-steel balls, and so on. As explained above, the type of lining used is determined by the material to be ground.

The mill cylinder, having been loaded, is rotated mechanically at such a speed as will cause the balls to climb part way up the cylinder wall and then fall back through an angle of about 45 degrees. Obviously, the balls when going through this "cascading" action (Fig. 2) will smash and wear the softer material present in the mill down to an impalpable powder.

Probably the greatest disadvantage of this method of grinding is the fact that this machine can only deal with materials in batches, that is, it has to be stopped to allow discharging and loading. To avoid this, the tube mill can in some cases be adopted.

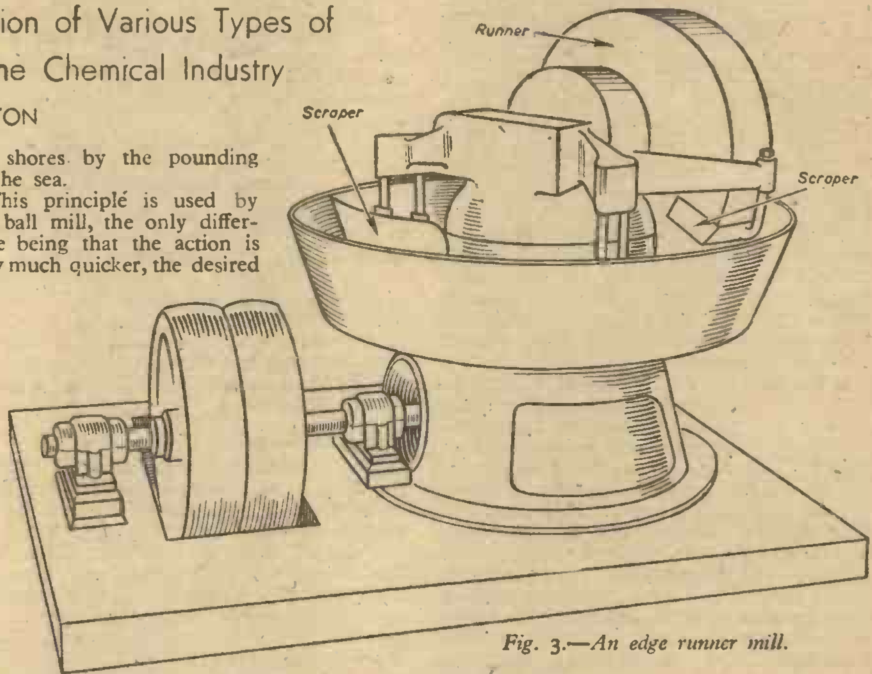


Fig. 3.—An edge runner mill.

The Tube Mill

This is identical in its main principle to the machine just described, but its method of charging and discharging is continuous. The cylinder barrel is supported on hollow trunnions or shafts, so that material may be fed through one of these by a screw conveyor, and discharged through the other end after passing down the length of the mill. Thus chemicals can be ground in a continuous flow, and the labour necessary in charging and discharging is consequently eliminated. It is interesting to note that this method of grinding, used in the ball and tube mills, is also an efficient method of mixing. The materials are ground and mixed simultaneously.

Laboratory Ball Mill

This is a machine used for grinding small quantities of chemical compounds, and is used extensively in some laboratories. Its principle is the same as that of the ball mill; grinding is done, however, in small porcelain drums, about one foot in diameter, which are held and rotated at the correct speed in frames fitted with suitable quick-detachable fastenings.

These machines are often designed to accommodate up to 12 porcelain drums, and thus the machine is capable of grinding 12 different materials or samples simultaneously, one sample, of course, in each drum. When grinding is complete, the drums may be removed, and replaced with others; and whilst the machine is dealing with a second set of samples, the first lot can be tested and inspected.

We will now consider some of the other types of grinding machinery, which are basically different from the ball-mill class.

The Edge Runner Mill

The edge runner mill relies for its grinding action on the crushing action of a heavy roller or runner, revolving round the inside of a large pan in which the material to be ground has been loaded. The principle is merely the obvious one of crushing the material between the pan bottom on which the roller rests and the heavy roller itself. In the type shown in Fig. 3 the pan is

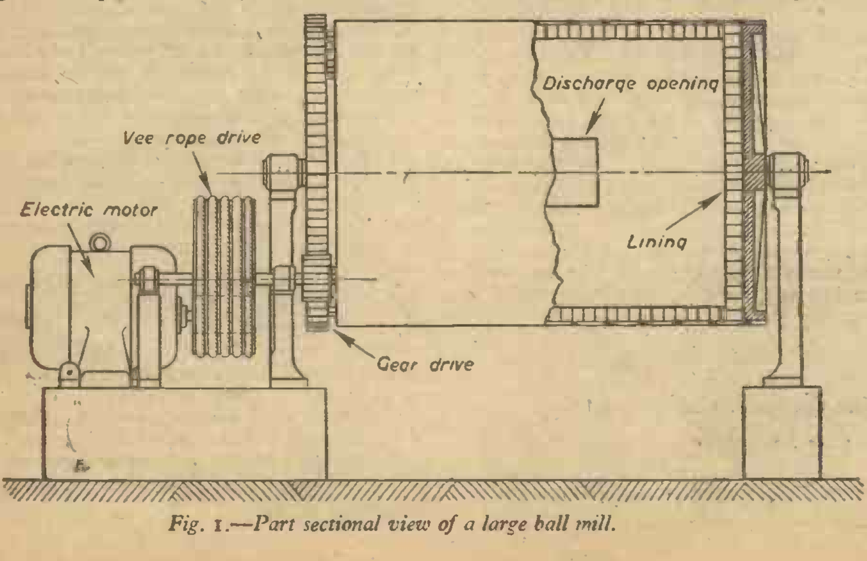


Fig. 1.—Part sectional view of a large ball mill.

stationary, and the whole runner assembly is rotated by a bevel gear drive from belt pulleys. Two scrapers are fitted to this assembly, designed to scrape the sides and part of the pan bottom, guiding material thus collected into the path of the runner, so that none of it can remain uncrushed. A further scraper is arranged to prevent adhesion to the roller. The machine can discharge its contents, whilst in motion, quite automatically. A sliding door in the bottom of the pan is opened by hand, and through this the material is discharged, assisted by the scrapers which push and guide it to the outlet.

It will be understood that an edge runner mill of this description, would hardly be

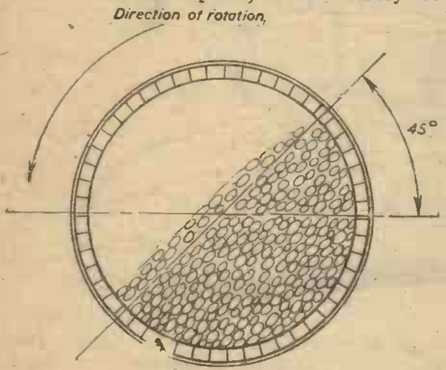


Fig. 2.—Diagram illustrating the cascading action of a ball mill.

suitable for grinding dry and dusty compositions, for the amount of dust generated would be such as to cause most unhealthy and uncomfortable conditions for persons working near, or attending to the machine. A further disadvantage would be the appreciable amount of material lost.

Some machines intended for dry grinding are constructed as follows:

Two runners of equal diameter are arranged diametrically opposite each other resting on the bottom of a revolving pan containing the dry composition to be ground. In the bottom of the pan a "track" of cast-steel plates is fitted, and it is between this "track" and the rollers that the crushing is done. The rollers spread the ground material on to a set of perforated plates, and if it is ground sufficiently, it passes through these into a stationary container from which it is discharged. Should the material not be ground fine enough to pass through the perforated plates, it is passed under the rollers again by scrapers. A dust casing is fitted over the pan and runners of machines dealing with dangerous or extremely dusty chemicals.

The Jaw Crusher

As the name suggests, this machine consists principally of two hardened steel "jaws" which are made with vee grooves running down their full length, looking remarkably like long, shallow teeth. Actually when the machine is working these grooves really do have the effect of teeth. One of the jaws is fixed stationary, and the other is given a reciprocating motion by a heavily constructed eccentric coupled to either one or two flywheels, depending on the design. In this way the space between the jaws increases and decreases as the eccentric rotates. Obviously any material present between the jaws, when they close, is crushed by the great forces applied. Thus the machine virtually devours the materials fed to it, and it is most useful for breaking stone, flint, and any other fairly brittle chemical compound which can be smashed by impact. The jaw crusher may also be used with success for breaking up crystalline chemical compounds which are apt to form into hard lumps, after becoming damp during transport or storage.

The Disintegrator

Unlike any of the previously mentioned machines, which depend upon a rubbing or crushing action, the disintegrator performs its task by percussion, or, in other words, by the forcible striking and collision of high speed rotor-arms and the material being ground or "disintegrated." The ball mill, of course, certainly makes use of this principle of percussion, but as it is essentially a slow speed machine the effect is very small and may be ignored. The disintegrator, however, running at a speed between 3,000 and 5,000 revs. per minute, depends entirely upon this force for its efficiency as a grinding machine.

Referring to Fig. 4, it can be seen that the disintegrator is in appearance quite similar to some kinds of water turbine. The rotor, having arms set like cutters, is installed inside a lined housing and is rotated at a high speed by a belt drive to the pulley shown. The material to be ground is then fed into the housing, and there meets the blades of the rotor, which beat it against the sides and top of the housing linings until it is fine enough to pass through screens, situated above the receiving casing. The grinding and discharging actions are both continuous.

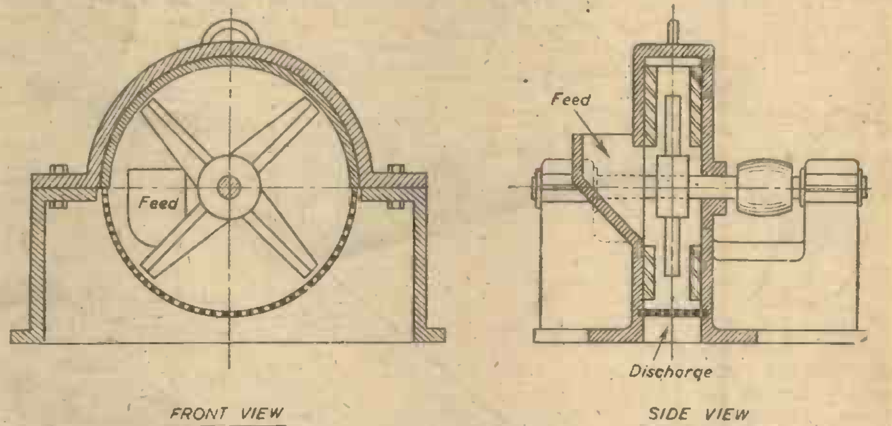


Fig. 4.—Sections of a disintegrator.

The foregoing is intended to cover only the commonest and most important types of grinding and crushing machinery met with in what may be broadly called the "chemical industry."

There are some other machines which have not been included. Examples are the "Stone Mill"; similar to the edge runner mill, but employing four heavy Blue-Welsh or Derbyshire-Chert stones, in place of rollers, which are "skidded" round the inside of a pan by four wooden arms, one arm to each stone. This is probably the most ancient method of grinding.

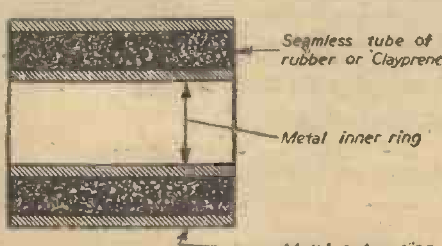
Flexible Bearings and Bushings

With the exception of the special types of machinery whose main function is of a vibratory nature, such as pertains in shakers and certain types of crushers, the presence of vibration and noise is unwelcome, and any expedient that will eliminate the evil is of paramount importance to engineers.

The introduction of the "Clayflex" flexible bearings and bushings has brought a solution to many of the problems arising from the transmission of vibration and the suppression of noise in machinery; the "Clayflex" flexible bearings and bushings, which are manufactured by Clayflex, Ltd., Tiddington Road, Stratford-on-Avon, consist essentially of a seamless tube composed of natural rubber compound which is pre-stretched between an inner and outer metal tube as shown in the sketch.

On account of the method adopted in pre-stretching the rubber compound between the inner and outer metal tubes, the rubber continually seeks to conform to its original shape, with the result that the constant force exerted within the rubber ensures a high capacity bond between the rubber and metal: the strength of this bond is such that it will only break down after the imposition of a considerably higher overload than that for which the bearing has been designed.

The load-carrying capacity of the "Clayflex" bearings and bushings varies, of course, in accordance with the particular application for which they are required, and since the capacity depends upon the class of rubber compound, its length and thickness, in addition to the length and relative diameters of the inner and outer metal tubes, it is not practical to give a general formula for determining the load-carrying capacity of the full range of bearings and bushings; an average figure, however, for the types and sizes in the greatest demand at the present time is a radial load of approximately 600lb. per square inch.



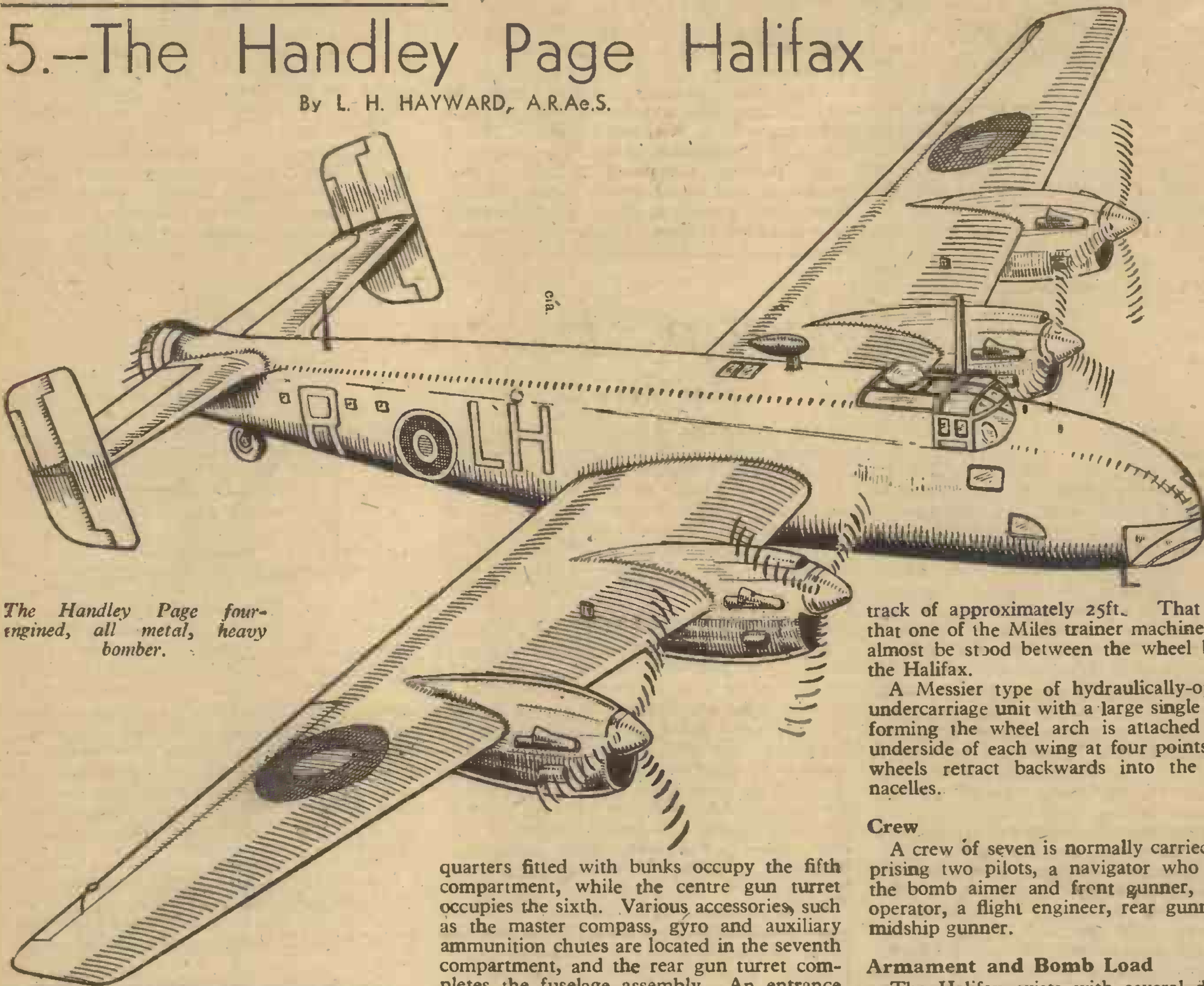
Section of "Clayflex" flexible bearing.

Where the bearings or bushings are liable to come in contact with oil or high percentages of ozone, a special material marketed under the trade name of "Clayprene" is recommended in place of the natural rubber compounds, and in order to cater for the requirements of bearings and bushings that must be of a self-oiling nature the "Clayflex" types can be supplied with the inner tube or bush made in brass or graphited bronze.

AIRCRAFT ON ACTIVE SERVICE

5.—The Handley Page Halifax

By L. H. HAYWARD, A.R.Ae.S.



The Handley Page four-engined, all metal, heavy bomber.

THE Handley Page Halifax heavy bomber, officially described as a four-engined, all-metal, mid wing, cantilever monoplane with stressed skin construction, is manufactured by the parent firm, many large "shadow" firms, and by a large number of sub-contractors. Many types of Halifax are now in service with Bomber Command, the table below gives the general leading particulars.

Construction

The fuselage is a light alloy, monocoque structure with flush riveted stressed skin. The main body is divided into eight major compartments. The nose compartment houses the front gun turret, when fitted, and the navigator who is also the bomb aimer. The second compartment is divided across the middle. It houses the radio operator and his equipment in the bottom half and the two pilots, who sit side by side, in the top half. The third or flight engineer's compartment has an astral dome with a bullet-proof glass panel, enabling firing operations to be directed by a control officer when the aircraft is attacked by enemy fighters. The first three compartments are all forward of the leading edge of the aircraft wings and protection is afforded to the crew from rearward attacks by armour-plated bulkheads.

The crew's quarters are heated by trapping a quantity of the air which has become warm in passing over the engine cylinders and led away through ducts to the fuselage compartments. Observation windows are fitted all along the sides of the fuselage. Rest quarters fitted with bunks occupy the fifth compartment, while the centre gun turret occupies the sixth. Various accessories, such as the master compass, gyro and auxiliary ammunition chutes are located in the seventh compartment, and the rear gun turret completes the fuselage assembly. An entrance door, with a ladder which can be retracted into the left hand side of the fuselage when the machine is in flight, provides entry for the crew. All crew stations are connected by a walk-way extending the complete length of the fuselage.

Wings

Each tapered, swept back wing is built up from six main sections and seven smaller ones. Twelve self-sealing fuel tanks are installed in the wings, and on early Halifax aircraft three large emergency fuel jettison pipes were fitted in the trailing edge of each wing. Two engines are mounted in each wing, one at the outer end of the centre section and at the inner end of the main span. The ailerons are formed from light alloy sheet and are fabric-covered. Special Handley Page trailing edge flaps to assist take-off are fitted between the ailerons and fuselage. The flaps enable the huge heavily-loaded Halifax to take off from normal service aerodromes. A dinghy for use in an emergency is stowed in the rear of the left hand centre section. A bomb compartment is housed in the centre section of the wings.

Undercarriage

The massive undercarriage necessary to support the fully-loaded bomber has a wheel track of approximately 25ft. That means that one of the Miles trainer machines could almost be stood between the wheel base of the Halifax.

A Messier type of hydraulically-operated undercarriage unit with a large single casting forming the wheel arch is attached to the underside of each wing at four points. The wheels retract backwards into the engine nacelles.

Crew

A crew of seven is normally carried, comprising two pilots, a navigator who is also the bomb aimer and front gunner, a radio operator, a flight engineer, rear gunner and midship gunner.

Armament and Bomb Load

The Halifax exists with several different types of armament. Early versions carried a two-gun nose turret, four-gun tail turret and four beam guns. The beam guns were replaced by fitting a dorsal turret with two machine-guns. Enemy night fighters usually attacked from the rear and the nose turret was eventually discarded.

To try to improve performance the dorsal turret was then removed, but most of the Halifax machines now operating have a power-operated four-gun midships turret, a four-gun rear turret and a single hand-operated nose gun. These various modifications have meant several changes in the design of the nose and three or four types may be seen flying at the present time.

Eight hydraulically-operated doors enclose the 22ft. long main bomb compartment capable of housing incendiary, 250lb. or 500lb. and 2,000lb. bombs. In addition, the centre section of the wings is formed into six extra compartments for housing 500lb. bombs. The maximum bomb load that is carried by a Halifax is between 5 and 6 tons.

Engines

Four Rolls-Royce Merlin XX or Merlin XXII liquid-cooled, twelve-cylinder, 60 deg. "V" type motors, operating three-bladed, constant speed, fully feathering airscrews are installed in the leading edge of the wings.

Span	Length	Height	Weight Max. Load	Max. Speed	Range	Bomb Load	Motor Type	Motor Power
99ft. 0in.	70ft. 0in.	22ft. 0in.	60,000 lb.	300 m.p.h.	3,000 m.	5-6 tons.	Rolls-Royce Merlin	1,175 b.p.

The motors, renowned throughout the world for their reliability, are built to allow each of maintenance and accessibility and are entirely self-contained units, including the coolant radiator and oil cooler. The Halifax can fly on two engines only.

An extremely large amount of research and development work has been carried out by Messrs. Rolls-Royce so that the exhaust flames could be effectively damped out, and many types of shields and muffs may be seen fitted over the Halifax exhaust stubs.

A great tribute to the co-operation and standardisation between Messrs. Rolls-Royce and Handley Page is the fact that one engine can be taken out of the airframe and a new one fitted in a little over six hours.

In Service

The first operational flight made by Halifax machines was during March, 1941, the targets being Kiel and Le Harve. Since this time the number of machines in service with Bomber Command has been ever increasing and to-day almost every bombing report on Germany or the occupied countries mentions the Halifax as having taken part.

The distinction of being the first four-engined British bomber on active service overseas belongs to this machine. Squadrons of Halifax bombers badly dislocated the German communication and defence systems during the victorious advance of the Eighth Army in Libya, and they were also engaged in the invasion of Italy.

One of the most outstanding four-engined aircraft to-day, it is expected that the Halifax will still be "on active service" in a modified form in the civil air-lines now being planned to operate at the cessation of hostilities.

Masters of Mechanics—94

Oliver Evans

America's Pioneer Steam Engine Inventor

NOT infrequently, Oliver Evans is dubbed "the James Watt of America," the title purporting to embody a compliment to the inventive achievements of this American steam-power pioneer.

In reality, however, the cognomen is one of more than doubtful honour. For whilst Oliver Evans was, at least, a life-long advocate of high-pressure steam, Watt, the Scotch instrument-maker, proved himself to be wholly a bigoted, crafty and confirmed opponent of it. The honour which an official and unthinking history has bestowed on James Watt is aneything but justified. Consequently, to credit an inventor in another country with being Watt's "opposite number" is, however well-intended the appellation may be, hardly expressive of the true state of affairs.

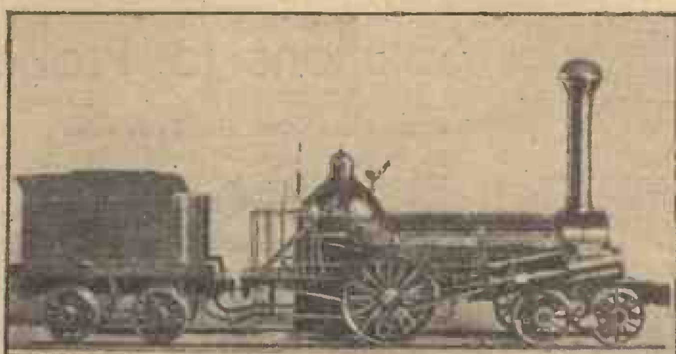
In the industrial history of his own nation, Oliver Evans has risen pretty much to the status of a national hero. Indeed, some of his countrymen claim for him the origination of the use of high-pressure steam and, also, the construction of the world's first locomotive. Such claims, however, do not bear investigation, for Evans, brilliant though he was, undoubtedly took his cue in the invention of steam engines from the pioneer Englishmen who were his contemporaries.

Oliver Evans was born in 1755. The place of his birth was the then diminutive town of Newport, Delaware, although in some historical accounts it is given as Philadelphia. Apparently, he came of humble yet capable parents. With his brothers, he was imbued with innate mechanical capabilities, and, during his early 'teens, he was apprenticed to a wheelwright, an occupation which he took to with great gusto, and in which he found every opportunity of exercising his own inborn creative bent.

The "Steam Cannon"

When Evans had arrived at manhood, news concerning the then novel and experimental applications of steam-power began to trickle through from England. It was such news which turned Evans' fancy to the subject of constructing a machine which would propel itself without the aid of horses. Evans knew something about the practical aspects of the expansive force of steam. A favourite experiment of his (and a somewhat sensational one, in the bargain !) was to fill a small iron cannon with water, to plug it up tightly and then to place the water-filled cannon on the fire of his blacksmith's forge. Evans would then operate the forge bellows until the small cannon exploded with some violence.

It was this type of experiment which originally turned the mind of young Evans to the subject of steam power, and to the effective utilisation of the expansive force of water vapour. He studied Newcomen's "atmospheric" engine principle, a principle in virtue of which, as the reader will, no doubt, recollect, steam was allowed access to the underside of a large piston. The subsequent condensation of the steam created a vacuum under the piston, which latter was then driven down by the external force of the atmosphere on its upper side. Newcomen's engine was not a steam pressure contrivance, for, in it, the only purpose of the steam was to enable an under-piston vacuum to be created with ease and readiness. Like his English confrères, Evans came to the conclusion that motive power could only effectively be obtained from the application of steam by dint of making use of steam's constant and ever-present pressure. In other words, Evans made himself the apostle of steam pressure in his own country, and even of high pressure steam, for, during his subsequent career, he advocated high pressures in contradistinction to the then almost universal low steam engine pressures.



An early American locomotive.

His first invention of which there exists a definite record was made when he was 22 years of age. It comprised a machine for making the metal "card" teeth which were used in the construction of "combing" machines for wool and cotton. The invention was successful although Evans himself appears to have got little out of it.

Mechanised Milling

About the year 1780, Evans entered into partnership with his two brothers who were practical flour millers. During the ensuing 15 years in which he was in close contact with his industry, he almost completely revolutionised its methods. Numerous inventions connected with the mechanical aspects of milling machinery were made by Oliver Evans during the period 1780-1795. He published a description of them in a book which he composed in 1795, and which was entitled *The Young Miller and Miller's Grist*. Patents for milling machinery were granted to Evans in the American States of Maryland, Delaware and Pennsylvania in 1787, and, also, by the United States Government in 1790 and in 1808.

Evans' invention simply mechanised the process of flour milling which, previously, had been very much of a hand operated job. He practically eliminated all manual labour from the milling process. From the time the crude grain entered Evans' mills until it was collected in clean sacks, the material was untouched by hand. Evans not only speeded up the milling process; he also cheapened it and enabled a cleaner, and a much-improved product to be obtained.

It was during the course of these milling interests and inventions that Oliver Evans developed his early ideas on the subject of steam power. Steam power, to him, was an important achievement, for not only would it enable him to drive his flour mills faster, more cheaply and with greater economy, but, also, it would be the means of allowing him to devise other objects of its employment, particularly the "self-propelling carriage" which Evans had pondered over in his active imagination ever since his earliest wheelwright days.

Evans was an earnest man, and had the courage of his convictions, so much so that, in due course, his plans came to be regarded at least as not unfeasible.

High-pressure Steam

In general, Evans planned a steam engine operating at high steam pressure. Many of his present-day countrymen state that Oliver Evans *originated* the employment of high-pressure steam, and they point to the fact that, in 1787 (and, also, in 1795) he sent plans of his high-pressure steam engine over to England.

Now, in England, the Cornishman, Richard Trevithick, is usually considered to be the originator of the high-pressure engine, which he brought out and developed in the face of the bitterest opposition on the part of James Watt and his party. The Americans say that Trevithick had sight of Evans' plans, and that the former took his ideas from the latter. It is impossible with any degree of certainty to deny or to assert such a happening, although all the available and accredited evidence favours the British contention that Richard Trevithick, the Cornishman, was the true originator of the high-pressure steam engine.

High-pressure steam engines were constructed independently by Evans and by Trevithick about the year 1800. Both inventors subsequently applied their engines to propel road carriages, but, in this connection, it is quite certain that to Richard Trevithick belongs the honour of having been the first man to make practical use of steam power on a railway.

Locomotive Projects

Although Oliver Evans did not succeed in constructing a serviceable locomotive engine before the dawn of the nineteenth century, his connection with the subject of locomotive trains goes back to 1787, for in that year he actually obtained from the State of Maryland an exclusive right to construct a steam train "that would run on a level with the swiftest horse." Later, he was granted the right (without opposition) to provide steam carriages that would "run at the rate of 15 miles an hour on good, level railways."

Perhaps it was the ineradicable streak of the visionary in his character which was responsible for Evans dying a comparatively poor man. He seemed to lack the ability to prosecute his designs in concrete form, as one might put it, to the bitter end. For all that, Evans possessed tremendous enthusiasm, which was of an infective nature. It was Evans, without any doubt, who laid the trail of the "steam engine fever" in the United States of America at the conclusion of the eighteenth and the beginning of the nineteenth centuries.

There is little doubt that Evans experienced opposition to his locomotive schemes. Such opposition was only made the stronger by his not having a locomotive ready to place on a railway or on the road. It is said that an American engineer who was acquainted with Evans' project for a railway wrote a semi-official report in which he stated that it would be materially impossible to run a vehicle on four wheels by the means of steam!

Stone-sawing Machine

By way, perhaps, of a change from his steam locomotive designs, Evans, in 1803, constructed a stone-sawing machine which was operated by a high-pressure stationary steam engine. The engine, so the record states, drove "12 saws in heavy frames, sawing at the rate of 100ft. of marble in 12 hours."

In his steam engines, Evans used a cylindrical boiler having a cylindrical flue inside it, the fire being placed within the flue. Such a construction formed the origin of the present-day well-known Cornish boiler. Richard Trevithick used a similar type of boiler, and it seems likely that both these inventors designed their boilers entirely independently of each other.

The "Puffing Amphibian"

In 1804, the year following his successful "stone-sawing machine," Evans determined to build for himself a steamboat. Previously, in 1801, he had made some attempts at the same project, but they had never come to anything. In 1804, however, the steamboat was completed. In order to get it from his workshop to the river, Evans had to provide the vessel with four under-wheels. It was a curious contraption, and its inventor and constructor saddled it with a still more curious name. Evans called his somewhat fantastical boat-car the *Eructor Amphibolis* or the "Puffing Amphibian."

The available accounts of Evans' "Puffing Amphibian" vary. Some say that the boat-car was successfully driven along the streets of Philadelphia to the river and then equally successfully launched therein. Other accounts, and probably the more reliable ones, state that before the vessel was finally completed, it underwent total destruction as the result of a disastrous fire which occurred in Evans' workshop. The incident is supposed to have played so much on the mind and the health of the inventor that, after this disaster, he relinquished the greater number of his more "advanced" projects of which he had formerly been so fond.

It is certain that from about this date he sank gradually into an obscurity from which he never again arose. It is true that, as one of his last public acts, he planned a railway between New York and Philadelphia, but nothing ever came of this project. Unfortunately, Evans, at this period of his life, had neither the ability nor the means to carry out such a formidable and revolutionary plan. He returned, therefore, to his flour milling, an occupation from which he eventually retired when enfeebled by ill-health.

Evans died in New York on April 16th, 1819, his death being very little noticed at the time.

The trial of Trevithick's first locomotive. (From a contemporary print.)

For a century or more, Oliver Evans and his pioneering work have been entirely forgotten by his posterity. It is only within comparatively recent times that his memory has been resurrected. It would not be true to state that Oliver Evans was in any sense a great inventor. Furthermore, he lacked the ability to concentrate on a job and to see it through to its ultimate satisfactory culmination.

Yet in spite of all his constitutional faults and defects, Oliver Evans functions as a landmark in American industrial, engineering and economic life, and, to a certain extent, in the wider narrative of the world's engineering activity.

Evans found the way of the pioneer and the man with a creative vision to be a hard one. Let us therefore take advantage of the historical perspective in which we are now placed, and, in consequence, endeavour to realise the precise impact which Evans' inventive energies made upon the course of steam engine development. That it was, on the whole, a favourable one and, in some respects, even a memorable and distinctive one is the verdict which history has now pronounced.

Solutions to Probes and Problems

(*See page* 201)

Four Men from the Provinces

Mr. Bristol.

Mr. Dover lives in Cambridge, Mr. Cambridge in York, and Mr. York in Dover.

Down Our Street

Mr. Black lives at Whitefield.

The complete solution is as follows:

Name of House	*Colour*	*Occupant*
Greystones	brown	White
Blackfriars	black	Gray
Brownleaves	white	Brown
Whitefield	grey	Black

Phoney 'Phones

POPesgrove 0281.

Energy on the Escalator

54 seconds.

Services Dinner Party

Clark, the airman, must have been the Londoner.

Numbering the seats clockwise, and putting Adams at No. 1, the party was arranged as under:

No.	*Name*	*Home town*	*Service*
1	Adams	Liverpool	Home Guard
2	Evans	Manchester	Soldier
3	Clark	London	Airman
4	Brown	Glasgow	Sailor
5	Frazer	Leeds	Fire-watcher
6	Davis	Birmingham	Warden

A second solution, with a different set of diners, is possible according to the terms of the puzzle. In that arrangement, however, Adams would be the soldier. Since he "stroked his beard" and beards are not permitted in the Army, this second solution must be rejected.

Lady Bountiful's School Treat

There were 49 children, and the outing cost 4s. 1d. per head.

Lady Bountiful could not have paid 10s. 1d., since that would have meant 11 children at 11d. per head, and one could not have a bus ride and a "sumptuous tea" for as little as 11d. 241 pence (£1 0s. 1d.) and 1,201 pence (£5 0s. 1d.) have no factors, whereas sums over £20 would require too many children for a bus-load or too high a cost for the outing.

She must therefore have spent £10 0s. 1d. (2,401 pence). She would not have hired a bus for as few as seven children, and one bus could not have accommodated 343 of them. Therefore there must have been 49 children.

Sympathy and Antipathy

18s. It can be proved that for the chances to be even, the number of cards left must be a square number, and (since sympathy has turned up every time) an even square.

Experiment shows that the only possible number of cards remaining is 16, so that 36 cards have gone and there have been 18 deals. Thus Cleverleigh must have lost 18s.

Relics of "Long John Silver"

Many Interesting Additions to be Seen at "The Look Out," Gravesend

By W. J. BASSETT-LOWKE, M.I.Loco.E.

I UNDERSTAND that considerable interest was taken in the article I contributed to the January, 1939, issue of this journal on "Long John Silver's" collection of ships' relics at "The Look Out" on the Waterfront at Gravesend. During last summer this collection was open to the public for the first time, for the benefit of the Merchant Navy Comforts Service, and a short while later I again had the pleasure of visiting this "Valhalla-by-the-Thames," as it is sometimes called. I found that since my last visit there had been many important additions to this unique collection. There are now over 600 relics and souvenirs—an amazingly large number for a private collection—and the realisation that each one has either a romantic history attached to it, or is the only example of its kind in existence, must make a lover of the sea and ships feel almost reverent, and most certainly awe-inspired, upon entering. I welcome the opportunity of being able to tell you about some of the new figureheads and models, and about some of the older ones I was not able to mention in my last article.

Fig. 1.—(right). "Long John Silver"—from the painting in oils by his artist friend.

Fig. 2.—The Forecastle—or "Model Room."

The "Model Room"

I dealt mainly with the bridge last time; this time I shall devote myself to the Forecastle and Valhalla. The Forecastle is the "Model Room." Nearly all the models have been made by men of the sea, quite often during the long and tedious voyages of the "square rigger" days, and one can feel the love and care that went into their making—nothing impersonal or "landlubberish" about *these* models. In my first view of the Forecastle (Fig. 2), the model under the *Eagle* is of an old Blackwall frigate —the *Renown*—modelled by her bos'n. Next to her is the *Loch Torridon*, the sails of which are made entirely of tobacco tins. A rather interesting "relic" can be seen on the extreme right of this picture. It is a carved Viking drinking horn which Capt. Silver found in an old farmhouse in Iceland about 40 years ago. The mountings are, of course, modern. Next to the horn is a particularly fine model of Forwood Bros.' s.s. *Orotava*.

An historically interesting model is set between the two figureheads to the left of Fig. 3—it is of the last English-owned square rigger (four-mast barque), the *Garthpool*. In the centre of this same photograph—immediately under the figurehead *Sophie Kirk*—is a model of the *Gull*. It was made by her ship's carpenter, and all the sails are of wood. I was not surprised to learn from "the Cap'n" that this is considered to be one of the best examples of carving in any model. Another model is of the oldest craft in commission—the *Ellen*. She is at least 140 years old.

The "Queen Mary"

In the third photograph of the Forecastle (Fig. 4) will be seen a "modern" touch—a model of the *Queen Mary*, made by one of her crew. She seems almost to be trespassing in this place, where time has been arrested and "the past" is still "the present" . . . where the "good old days" still hold sway. Above her, on the wall, are two builders' half-models. "Valhalla" is the *real* "home" for "Long John's" figureheads, but his collection is now so large (it is the largest private collection of merchant ships' figureheads in existence) that some have, of necessity, had to "overflow" into the Model Room. To save confusion I will deal with these before "entering" Valhalla. On the extreme left of Fig. 3 is a fine figurehead of the *Sovereign*, an old brig. The right arm is detachable, and, upon inquiring why, I was told they used to "unship 'em at sea"! A chance photograph revealed the identity of the next figurehead as being from the Aberdeen Line s.s. *Thermopylæ*. For many years it had been one of the few "unknowns" in Capt. Silver's collection. Next, with arm outstretched, is *Zenobia*, an old Salcombe

Fig. 3.—The Forecastle again—note "Elizabeth Fry" in the corner.

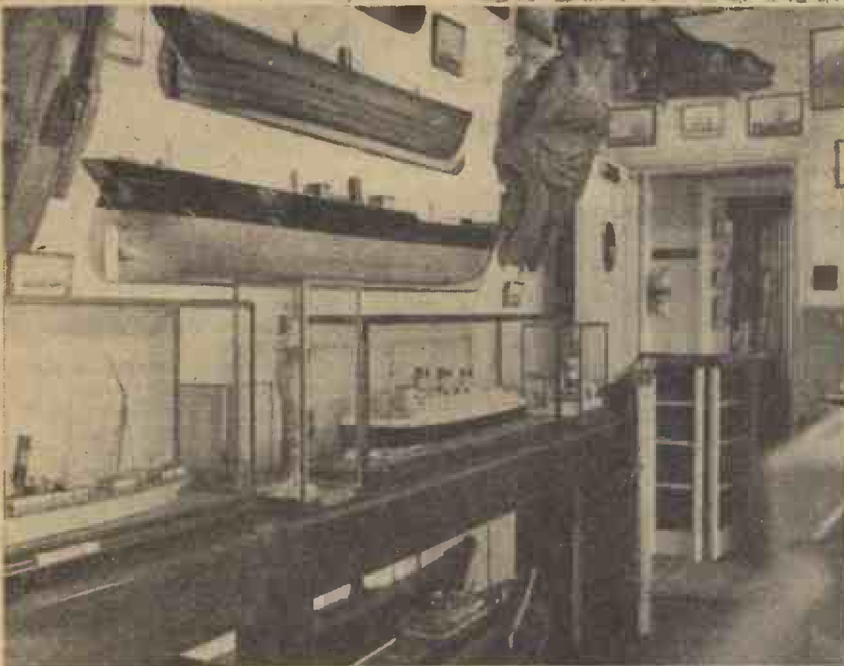


Fig. 4.—The view of the Forecastle showing the "Queen Mary."

"fruiter"—one of the last of a long line of these famous craft.

To many, history is "dull and uninteresting," but everyone remembers the little human stories which every so often creep into the history books. One of them is about Elizabeth Fry—remember how she used to hold services on the convict ships before they sailed with transportation prisoners? What more fitting than that she should "adorn" a ship's bows? And there she is in the corner, with her prayer book in her hand.

Although figures of human beings were by far the most popular as figureheads, birds and animals *were* used, and a superb example is the *Eagle* on the extreme right of this picture, from the full-rigged ship of that name (1856). Although the days when she "proudly sailed the seas" are long since gone, this ship is still doing useful service—as a coal hulk in Gibraltar Bay.

The dog over the door in Fig. 4 has a very definite claim to "fame." He is from the quarter galleries of the *Sirius*—the first British steamer to cross the Atlantic under her own steam. You may be interested to know that the figurehead of this ship can be seen in the Hull Municipal Museum.

The two most recently acquired figureheads have been "coveted" by "Long John" since he was eight years old—truly a perfect example of "patience rewarded"! One of them can be seen to the left of the dog, and the bottom of the other is just visible to the right of Fig. 2. This latter is of a man of the early nineteenth century—possibly from the *Lord Beaconsfield*—but there is, unfortunately, no trace of the other. Both ships were sunk off Ramsgate—one on the Broadstairs Knoll Banks and the other on the Goodwins—and the figureheads stood in the sheds in Beeching Moses' shipyard on the west side of Ramsgate Harbour for many years (it was here that Capt. Silver used to gaze at and long for them). When the yard was dismantled they were removed to a shipwright's store, and it was from here, after long negotiations, that they at last "came into their own" and entered the sanctuary of "The Look Out," to be cared for by "Long John."

Fig. 5.—(above) "Valhalla."

Fig. 6.—(right) The seascape from the bridge with stuffed gull on davit.

"Valhalla"

And now "Valhalla"—full of so many memories of "gallant merchantmen" proudly battling against the whims and fancies of that great force, "the ever-changing but unchanged sea"—still untamed even to-day, despite the great strides that are being made in land, sea and air power. The very beautiful piece of carving at the top to the left of the picture is thought to be from the *Helene*, one of the Bordes "White Ships." On her right is *Old Goody*, a 174 tons brigantine built in 1865. *William Wilberforce* (1868)—famous as the emancipator of slaves—comes next, then *Maud*, from a 1,108 tons barque built in 1878, which became an isolation hulk at Plymouth before being broken up. *Cleopatra* will easily be recognised. Next to her, with scroll in hand, is *Havelock*, from an 1859 barque. *The Bride*, from a 292 tons iron screw steamer built in 1863, is, unfortunately, almost hidden by the ship's bell in the foreground, but her "history" is an interesting one, as she was named after Queen Alexandra, who came to England that year as the bride of King Edward VII. Tradition has it that she actually landed on a pier facing the lawns outside "The Look Out." Last of all is *Abraham Lincoln*, from a 688 tons wooden barque, built in 1865.

But the most precious of all Capt. Silver's wonderful collection of figureheads, and worthy of special mention, is the *Golden Cherubs* (1663), which overhangs *Cleopatra* and *Havelock*. This is the oldest and rarest figurehead known to exist. It is reputed to have been carved by Grinling Gibbons, and once adorned the bows of John Jacobs' frigate. Jacobs was the most notorious smuggler and plunderer of his day, and his portrait in oils is one of the most interesting, to an outsider, of "Long John's" collection of photographs and pictures, most of which are more of personal interest to their owner than famous. Apparently the feature of this figurehead which makes it so rare is that it is of the "billet" or "fiddle" variety. From the little information I have been able to give you here you will not be surprised to learn that the *Golden Cherubs* has a long and romantic history—one day I hope to make this figurehead the subject of another article.

(*Continued on page 210*)

Letters from Readers

A CYCLE LIGHTING UNIT

SIR,—The "blackout" hours usually renew the cyclists' headache over the question of lamps and batteries.

The following particulars are of a scheme, which, during the "blitz," I found most satisfactory—one Ever-Ready 2-cell battery (used 20 minutes nightly) lasting the *whole of last winter* !

The basis of the idea is to run one's front and rear lamps *in series* from the same battery, thereby doubling its life and reducing the power of each lamp.

The screw-type switch on an ordinary headlamp is removed, and an ordinary radio socket (insulated from the lamp casing) is inserted. The circuit is completed by inserting a plug connected to the centre contact on the back lamp via a length of flex (see sketch below). Earth return via the frame is unsatisfactory, and can be improved by a direct soldered connection between the lamp cases. Ordinary lamps suffer from the defect of rust and dirt interrupting the electrical circuit through the various parts of the casing.

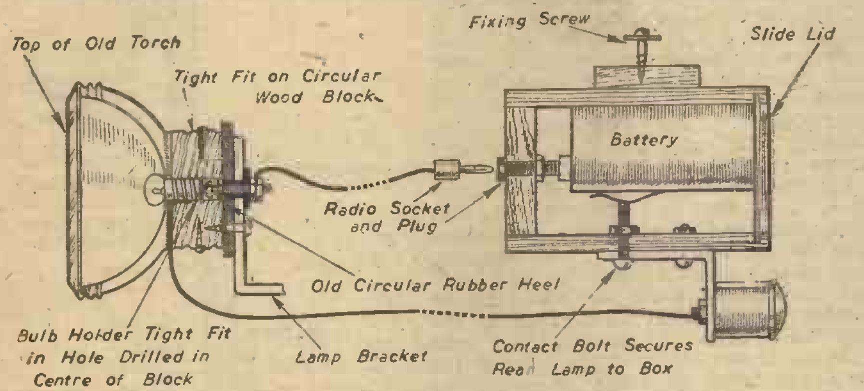
Construction

In the scheme illustrated above the top of an old focusing-type torch was wedged on to a circular block of wood through which a hole had been drilled to accommodate the bulb-holder, the bottom contact of which had been replaced by a long bolt, insulated all round.

This bolt passes through a discarded rubber heel, and secures the lamp holder to the cycle lamp-bracket by means of an insulated nut.

The wood block with torch top attached is slid over the bulb holder, and secured by a screw and washer through the back of the lamp bracket. The wooden battery box was built round an ordinary 2-cell battery to ensure a good fit and obviate any tendency for the battery to rattle about (one cause of their early deterioration).

This box has a sliding lid at the rear or bottom end and a radio socket at the other, which makes contact with the top strip on the battery. The side strip on the battery faces downwards and contacts a bolt which secures the rear lamp beneath the battery box, which is finally secured beneath the carrier by means of two screws.



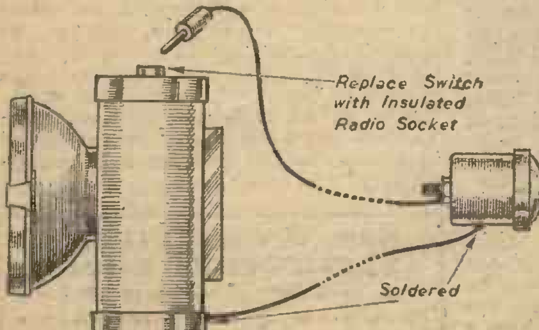
Details of a front and rear cycle lighting arrangement.

The centre contact of the rear lamp bulb is connected to the case of the front lamp bulb holder, the centre contact of the latter being connected via a plug to the socket in the battery box.

Details will depend on materials to hand, but providing the parts are solidly constructed, and proper attention given to insulation, no difficulty should arise.

This latter method is thoroughly recommended as the battery has far better protection from the rain and damp, especially if the carrier is of the "solid" top variety, and the mudguard adequate.

S. H. THOMAS (London, S.W.16).



Method of converting an ordinary lighting set.

ELECTRIC CLOCK CONVERSION

SIR,—Wishing to dispense with batteries, I decided to experiment with some parts from an old radio set which had a Westinghouse rectification.

As the clock was functioning quite satisfactorily on batteries, I did not wish to make any alteration to the electrical system other than the method of supply, therefore transforming the current alone would no suffice. I then tried a portion of 1-bar of the Westinghouse rectifier, fitting a brass clip to slide along the copper oxide rod, which I found served two purposes: (1) Rectification, (2) Voltage reduction. I then put the two 4v. windings on transformer in series, and adjusted the clip on the rectifier to give me the voltage that the clock was using on battery, namely 4½, and found that by using in addition the mains condenser across the circuit, that the clock would function quite satisfactorily. Another advantage of not interfering with the battery operation is that a relay can be arranged from C.T. on transformer to work on 2v. A.C., and operate a battery in the case of mains breakdown.

My clock has been working for about six months now, as described above, and with a 15lb. pendulum weight I get 52 swings per impulse on mains, as against 35 on battery operation.

The unit here described has the advantage of simplicity and reliability, and constructors of the "P.M." Battery Master Clock with A.C. mains at their disposal will find it worth the trouble of assembly.

The parts required, if not already at hand, are usually obtained from the local junk shop, an old radio set with "Westinghouse" rectification will supply all the parts that are not easily made, and the coil for the relay (if fitted) can be taken from an ordinary domestic bell.

When the components have been collected, it will be necessary to arrange them to find the size of baseboard required; the writer found 8in. by 6in. would be sufficient and thus enabled the unit to be fitted to a small cabinet to form the base of the clock; although this is not essential, it is well to remember that mains voltage enters the unit and therefore precaution should be exercised.

Another point to bear in mind is that it is not the voltage that works the clock; the current or amperage supplied by the unit will be found to exceed that of a battery and it is on this fact that the success of the unit depends.

You will observe from the illustration (Fig. 1) that only *one* bar of the rectifier is used, the reason being that the Westinghouse rectifier in a radio set is designed to work on high voltage and we require it to operate on a low or transformed current, and the clip C is fitted to enable adjustment to be made.

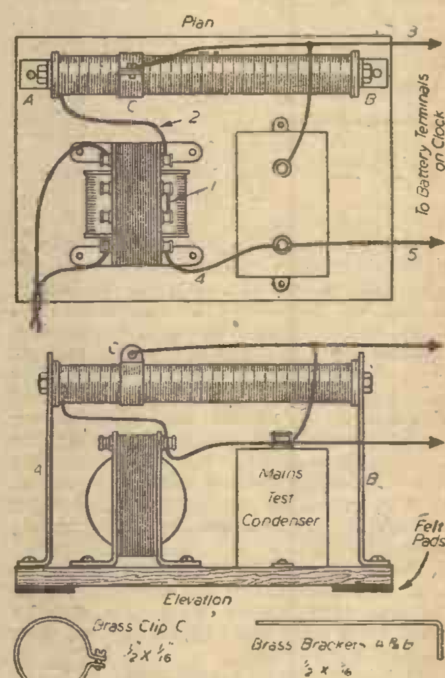


Fig. 1.—Plan and elevation of the A.C. mains unit, and details of clip and brackets.

It is advisable to raise the rectifier above the rest of the unit, as shown, by brackets A and B as a certain amount of heat will be dissipated, and a few holes bored in the back of the cabinet just behind the rectifier will ensure adequate ventilation.

Now turning to the transformer, first see that input on mains side corresponds to the supply in use; a length of 5 amp. lighting flex will be quite sufficient to carry the load, and this should be kept as short as possible and connected to its own plug, as obviously it will be switched on all the time the clock is in use.

Looking at the low voltage side of the transformer it will be seen that there are at least two sets of terminals (or tappings) generally marked 4 volts, and also one in the centre marked C.T. (centre tap). This will be referred to later. Each of these tappings if connected in series will increase the voltage by the amount shown on the terminals, so therefore connect the inside of the first pair to the outside of the second, and so on, which will leave the outside terminals vacant to carry the wires, 2 and 4, to the rectifier and clock, the condenser being a safety measure, is put across the circuit—that is each wire is connected to one side of the condenser.

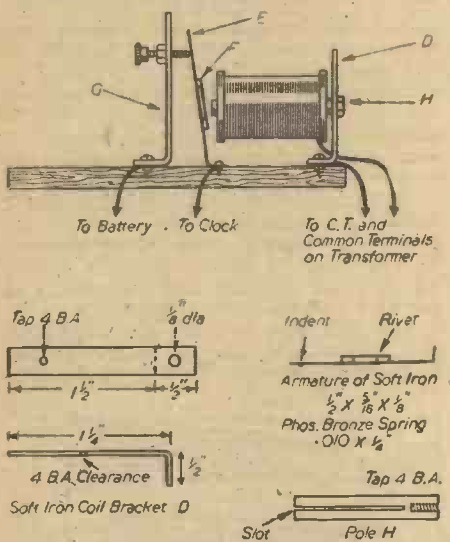


Fig. 2.—The complete relay and details of the parts.

The wire marked (3) taken from clip C and wire 5 from the condenser form the two leads to take the place of the battery in use, the only other wire is taken from clip C to the opposite side of the condenser.

When the wiring has been completed and checked the rectifier can be adjusted by sliding along clip C, which should be moved to the right as far as good performance allows, the further along the better the rectification, and the lower the voltage, but it will be found that the number of swings of the pendulum per impulse has been substantially inproved for the corresponding battery voltage.

The unit to drive the clock is now complete whilst the mains are working, but by the use of a simple relay and standby battery it is quite easy to guard against these occasional annoyances.

This is where the two outer terminals on the transformer come in; a wire from those, as indicated in the top sketch (Fig. 1) will supply 2 volts A.C., which will be found quite sufficient to energise a relay which, in the event of mains breakdown, switches on the battery.

The illustration (Fig. 2) explains itself, but perhaps a few remarks on running a bell coil on A.C. will be helpful.

In order to reduce hum caused by the use of alternating current, it is wise to slot the pole piece, as shown at H; an ordinary hacksaw cut will suffice.

A further point to be observed is to see that when armature and pole piece are in contact, they are well "bedded," and to assist in this it is advisable to arrange that the contact spring is at right angles to the pole-piece when in contact. Bend slightly back and screw the adjusting contact on G to suit, and a small indent made with a centre punch will assist in battery contact, and a battery of the same power as formerly used is, of course, necessary.

The connections to the switch, or relay, are: G to battery, E to clock and, of course, the other wire from battery directly to clock.

Finally, see that the transformer clamping screws are tight; fix a strip of felt or similar material under the baseboard, and there should be no perceptible hum.

F. W. KEYWOOD (Leicester).

SPACE ROCKETS

SIR,—I note in the January issue that a reader has been asking about space rockets, and feel that I may be able to help a little. Some time ago, whilst studying special fuels, I read a book by the British Interplanetary Society, and whilst I cannot now remember the name of the book, the following facts may be of interest to your correspondent. They are quoted from memory, but are, I think, reasonably accurate:

(1) In the German "Mirak" rockets, using first petrol and liquid oxygen, and later alcohol and liquid oxygen, the combustion chamber was of copper, but burnt out, then given a ceramic lining, but still burnt out, and, finally, water was added to the alcohol to reduce the temperature in the chamber until the fuel amounted to a light beer for alcohol content. The fuel was fed by carbon dioxide pressure behind it, and the oxygen by evaporation. (The oxygen container had to be fitted with a safety valve.)

(2) To leave the earth's gravitational field a speed of 600 miles per second was calculated to be necessary.

(3) Nothing was stated as to method of ignition, but it will obviously be necessary to apply considerable heat to such a fuel as the above to ignite it.

(4) Solid fuel rockets were stigmatised as being very much more dangerous than liquid, being responsible for most of the deaths, so far, Oberth, Opel, etc.

(5) Stress was laid in the book on the great cost of experimenting, together with the, up to then, relatively small results obtained.

J. SCANLON (Leeds).

SIR,—I was extremely interested in Mr. Boggio's query on rockets, in the January issue of PRACTICAL MECHANICS, and in your answers.

With regard to the British Interplanetary Society, this is in hibernation for the duration of the war, but the furthering of the science of astronautics is being carried on by the Manchester Astronautical Association and the Astronautical Development Society. These two societies are working in close co-operation, and if any of your readers are interested, further information may be obtained from either Mr. K. W. Gatland, 17, Southcote Avenue, Tolworth, Surbiton, Surrey (A.D.S.), or Mr. E. Burgess, 2, Hillview Road, Denton, Manchester (M.A.A.).

The only two books in English on the subject that are likely to be obtainable at the present are *Rockets Through Space*, by P. E. Cleator, published in 1936 by G. Allen and Unwin, Ltd., at 7s. 6d., and *Stratosphere and Rocket Flight*, by C. G. Philp, published by Sir Isaac Pitman and Sons in 1935 at 3s. 6d.

J. HUMPHRIES (Farnborough).

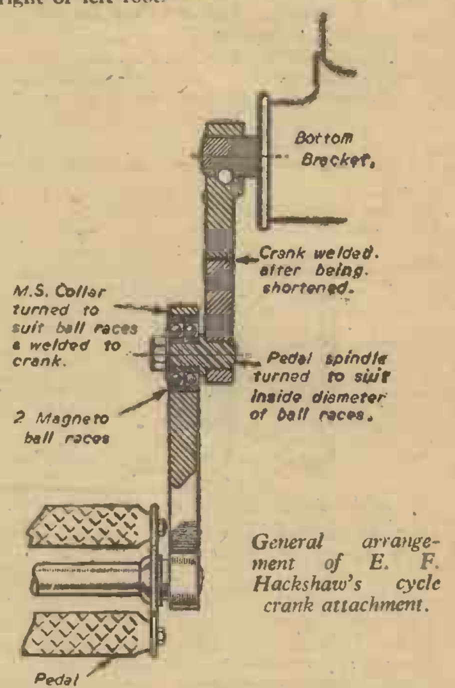
CYCLE CRANK ATTACHMENT

SIR,—Noticing H. H. Valentine's article, "Cycle Crank Attachment," in the October, 1943, issue, I thought perhaps he would be interested in how I overcame the same difficulty with a difference. I have a *straight* leg, the only movement being obtained from the *ankle*.

I may say that at week-ends I have covered as much as 60 miles in a day. My attachment has two distinct advantages:

(1) Quickly and easily detachable (by removing cotter pin).

(2) No friction, and it is also adaptable to right or left foot.



General arrangement of E. F. Hackshaw's cycle crank attachment.

The materials required are: two cranks, two magneto ballraces, one pedal spindle and one piece of mild steel for making the ball-race housing. The complete assembly is shown in the accompanying sketch.

E. F. HACKSHAW (Twyford).

RELICS OF "LONG JOHN SILVER"

(*Continued from page* 208.)

A Realistic Setting

On this last visit I took a photograph "looking seawards from a portion of the bridge," and I think you will agree that, with the seagull perched on the top of the davit, the effect is quite amazingly realistic. A lot of the credit for this "illusion" must go to the artist friend of "Long John" who painted the surrounding seascape (he was also, incidentally, the modeller of the *Queen Mary* in the Forecastle). This artist friend has painted an excellent portrait in colour of "Long John" himself, and I am happy to be able to reproduce a photograph I took of this picture. If, therefore, any readers are sufficiently interested to want to visit this fascinating "seaman's paradise," they will easily recognise the owner when he welcomes them at the foot of the "Gangway"! One word of warning, however. "Long John" is a busy man, and can only visit his waterfront residence at odd times in the spring and summer. A visit must, therefore, be made by appointment, and he has especially asked me to say, "Please *don't* make this journey to Gravesend, either direct or via Tilbury (which includes a ferry across the Thames), unless you are genuinely interested in the romance and history of ships through the ages."

QUERIES and ENQUIRIES

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

Heating Small Aquariums

HAVING taken an interest in tropical fish breeding I would be pleased to know of methods of heating and airing aquariums.—H. Collis (Beckenham).

IN order to heat a tropical or sub-tropical aquarium you require an immersion heater, which comprises merely a specially-wound electric element placed in an insulative case. Such articles can be obtained from any dealer in aquaria requisites, as, for example, Mr. B. T. Child, 113-121, Pentonville Road, N.1, Messrs. L. Cura & Sons, Bath Court, Warner Street, Mount Pleasant, E.C.1, or The Waterloo Goldfishery Co., 47, Great Guildford Street, Borough, S.E.1. The same firms will also be able to supply various devices for aerating aquaria. These consist usually of small motor-pumps which project a miniature jet of water, fountain-wise, above the surface of the water in the aquarium. Quite a good and a simple device for "airing" an aquarium consists merely of a narrow glass tube positioned about a foot above the water surface in the aquarium and connected to the main water supply. On allowing a slow stream of water to flow through the tube it breaks up into a series of drops which fall into the water, each drop carrying a little air with it. This system, however, necessitates the provision of an overflow to the aquarium and some type of effective screen to prevent the inmates of the aquarium from disappearing via the said overflow! If, however, you approach any of the above-mentioned firms they will be very ready to give you practical advice concerning your needs.

Making Ventilators for Model Launch

I WISH to make some small ventilators to fit on to a model motor launch. I have heard that these could be made by copper depositing on lead castings, afterwards running the lead out.

I shall be glad if you can give me any information on this subject.—A. S. Boyes (Birmingham).

YOU can deposit a substantial shell of metallic copper on a lead model by making the latter the negative electrode of the following plating bath, the positive electrode comprising a rod or a strip of copper, or, better still, a cylinder of copper sheet, which is curved around the negative electrode.

Copper sulphate, 28 ozs.; sulphuric acid (conc.), 4 ozs.; water, 1 gallon. Operate the bath at a temperature of 70 deg. to 75 deg. F. Voltage, 1–1.5, preferably from an accumulator.

After a shell of copper has been built up on the lead model the connecting wire can be pulled away. The model is then heated, and the lead allowed to run out through the hole made by the removal of the wire.

As an alternative method, you can cast your model in wax, and then dust the wax over with fine graphite powder. The graphited model can then be plated in the above manner, and the wax finally removed by melting.

Chemicals from Sea-water

I DESIRE some information regarding the "Isolation of New Chemicals from Sea-water"—new in the sense that they are not usually obtained from this source, e.g., gold, bromine, magnesium, etc. Could you please tell me of any books or references where I might obtain some information on the subject?—A. W. Cleland (Pumpherston).

THERE are no books of reference relating to the obtaining of chemical substances from sea-water, important though this interesting subject undoubtedly is. The Germans, particularly Dr. Haber, tried hard to obtain gold from sea-water, but they gave it up as an impracticable proposition. It has also been proposed to obtain copper from sea-water, but this project, too, is apparently impracticable.

The only successful sea-water process is that which is being worked on the eastern coast of America for the recovery of bromine from the sea. Essentially this consists in the treatment of sea-water with chlorine, which liberates the free bromine. Practical details are not available, being maintained more or less secret. By electrolytical methods it is considered practically possible to extract magnesium from sea-water, and of course it would be possible to obtain metallic sodium from this source, merely by evaporating the water and electrolysing the fused salt.

We are afraid that if you want any more detailed information on this subject, particularly on the subject of bromine extraction, you will have to write to the American Bureau of Standards, Chemical Division, Washington, U.S.A., and inquire whether they have any literature available. Some papers on sea-water chemicals were, about 10 years ago, published in one or two of the German scientific journals, but these are now quite unavailable.

If you consult a good modern textbook on inorganic chemistry, such as J. W. Mellor's "Comprehensive Inorganic Chemistry," you will come across several references to the presence of various substances in sea-water and the possibilities of their extraction, but you are only likely to find the above many-volume monumental work on the shelves of a large or important technical reference library.

Chemistry Course: Silver-plating

I WOULD be pleased if you will kindly answer the following queries:

(1) I wish to take a degree in chemistry, and I am studying a course on Matric. chemistry. Can you suggest what books to follow on from the course and where could I obtain them?

(2) I have one or two small articles that I wish to silver-plate in my spare time; can you tell me how this is done, and what chemicals will be required?

(3) I would also like to know a firm where I can obtain leather work tools and leather.—K. Hargreaves (Rochdale).

1. YOU do not state your age, but we assume that you are still at school and that you have not yet passed Matriculation. Before you can study for a degree or a professional diploma in chemistry you must have passed Matriculation, or an examination which will exempt therefrom. For particulars of all such courses of study you would, we think, be best advised to apply to your local technical institute, or, alternatively, to one of the day "continuation schools" in your district.

Having obtained your Matriculation or exempting examination, it would be quite impossible for you to prepare for a degree or a diploma in chemistry merely by studying textbooks. Much practical work is necessary, and this extends over as much as six years. For this and other reasons it would be useless for us even to attempt to give you a list of books which you might require for your future course of studies. That matter can only be decided on when the particular course of study commences.

Your best immediate courses of action are: (a) Consult your local technical school. (b) Consult the Principal of the Manchester (or Salford) College of Technology. (c) Write to the Registrar, Royal Institute of Chemistry, 30, Russell Square, London, W.C.1, requesting particulars of the "Studentship" of the Royal Institute, and also for a copy of a publication entitled "The Profession of Chemistry," which will help you enormously in your final choice of your future career.

(2) The best silver-plating is done with the use of a silver cyanide bath, which is excessively poisonous. You can, if you wish, obtain silver-plating salt ready made up from Messrs. S. Canning and Co., Electroplaters, Birmingham, but you will probably find the following formula suitable for small articles, since it gives a silver deposit without electrical means: Silver nitrate, 11 parts; sodium hyposulphite, 20 parts; sal ammoniac, 12 parts; whitening, 20 parts; distilled water, 200 parts.

The articles are cleaned well and immersed in this solution for a few minutes. Silver nitrate can be obtained from Messrs. J. W. Towers, Chapel Street, Salford.

(3) Leather work tools can be obtained from the "Leatherwork Shop," Bridge Street, Deansgate, Manchester, or from Messrs. G. W. Russell, Hitchin, Herts.

Copper-plating

I WISH to make a small number of miniature boats by copper-plating. I can manage the pattern, and the making of a moulding box in plaster of Paris, but what I want to know is what material should be used for the actual mould, and how to proceed to plate it?—D. Halliday (Halifax).

SO far as we interpret your inquiry, you wish to make miniature ship models comprising a hollow shell of copper, the latter being formed by electro-deposition. In this instance the mode of procedure is as follows.

Using a plaster mould, cast the model of the ship in wax, preferably in a hard wax. Then remove the wax from the mould and secure a copper wire to the moulded wax. Using a camel's-hair brush, dust the wax model over with fine graphite powder, making quite sure that the graphite adheres to every part of the wax model and also that the graphite makes effective electrical contact with the copper wire.

Now immerse the graphited wax in the following plating bath so that it forms the negative electrode (cathode), the positive electrode (anode) being a rod or strip of copper: Copper sulphate, 28 ozs.; conc. sulphuric acid, 4 ozs.; water, 1 gallon.

Operate the bath at a temperature of 70 deg. to 75 deg. F. Use a current voltage of 1–1.5, preferably from an accumulator.

After about half an hour a fairly substantial shell of metallic copper will have been deposited on the wax model. This can now be removed. A small hole is then drilled in the model at some inconspicuous position. The model is carefully heated to enable the wax to liquefy and run through the hole.

It will, in all cases, as a final operation, be advisable to give the finished copper model a coating of a transparent varnish in order to preserve it from tarnishing.

The above process is not quite as easy as it seems. It demands care and some experience. If you run into any difficulties with it, consult a book in your local library on electrotyping.

Water-softening Material

I HAVE installed a domestic water-softener, and apparently the previous owner had neglected to regenerate according to instructions, with the result that the softener has now lost its properties. I would be glad, therefore, if you would furnish me with the address of anyone who could supply the necessary softening materials and also the quantity required.

I would add for your information that the softener in question requires regeneration after 192 gallons of water at 25 deg. Clarke's hardness have passed through it.—J. Winstanley (Maghull).

IT is possible that the makers of your water-softener may be in a position to supply you with a small quantity of the necessary active softening material. If not, write to the Permutit Co., Ltd., Gunnersbury Avenue, London, stating the type of your water-softener and inquiring whether the material used in their "Deminrolit" process (which produces a water of zero hardness) will suffice for your requirements. You might also write to Sofnol, Ltd., Greenwich, S.E.10, and to Alfloc, Ltd., Bush House, Aldwych, London, W.C.2, making similar inquiries.

The precise amount of active material which you will require depends entirely upon the nature of the material. If you give the suppliers information relating to the capacity of your water-softener they will be able to advise you of the exact amount required.

Damp Detectors

CAN you please inform me what actuating material is used in the construction of the small cheap dial-type damp detectors which are on sale at about 3s. 6d.? I have one, but the small piece of actuating material is broken.

What material can be used to actuate a fairly sensitive hygrometer? I have made one, on the lever principle, using brown paper as the actuating medium, but it is rather large and I would like to make a smaller dial-type one. Can you give me rough details as to construction?

What is the actuating medium in the Swiss type of damp detector, in which small dolls go in and out of a house, and what is the method of construction?—J. Dimond (Bournemouth).

THE actuating material of the usual damp detectors is generally a hempen cord which has been immersed in a solution of gelatine and glycerine in water.

Dissolve 1 part powdered gelatine in 10 parts water, and then add 6 parts glycerine, together with a few drops of carbolic acid to act as a preservative. Soak the cord in this material for a few hours, then allow it to drain and to dry. Cardboard, string, silk, wool, etc., may all be impregnated with the above moisture-attracting solution. The Swiss-type damp detector usually operates by virtue of a cord which twists and untwists under the influence of varying degrees of atmospheric humidity.

None of these instruments, even the dial type, is reliably sensitive, since the actuating line, string or other material takes up a greater amount of moisture than it readily parts with, in consequence of which fact the surroundings of the instrument are always damper than the instrument indicates them to be. You can make a dial-type detector by using one or two twisted hempen lines, but we would advise you to make a "chemical hygrometer" which utilises the moisture-attracting properties of sulphuric acid, and which is, in consequence, a scientific, albeit not a portable, instrument. For details of this instrument see any textbook of practical physics, as, for instance, E. S. A. Robson: "Practical Exercises in Heat" (Macmillan).

"Sealing Liquids"

WILL you please tell me the composition of any "sealing liquid" which can be applied over paint and enamel to make effective crystalline lacquer?

Having purchased a number of brands of crystal-forming lacquer, I fine in use that they are not suitable for application over pre-painted surfaces, perhaps because of inter-penetration. Incidentally, the brands of coloured crystal lacquer purchased do not work on absorbent materials. Since a sealing coat seems the required thing, any information you can give will be appreciated.—H. Ball (Leicester).

COMMERCIAL "sealing liquids" have various compositions which are kept secret by their makers. Usually, however, these preparations are made up on a basis of a solution of a metallic stearate, such as aluminium stearate, in a solvent. You could, for instance, dissolve aluminium stearate in benzine or naphtha so as to make about a 25 per cent. solution. This could then be incorporated to the extent of, say, 15 per cent. with an ordinary lacquer, and it would cause the lacquer to dry out with a "crystallised" effect.

Alternatively, you can give the porous or painted surface a coating of the stearate solution before you apply the commercial crystallising lacquer. Apply to Messrs. A. Boake, Roberts and Co., Ltd., Buckhurst Hill, Essex, for a copy of their leaflet concerning the use of aluminium stearate in the paint trade.

Freezing Mixtures

COULD you please publish a list of freezing mixtures, for making at home small quantities of ice-cream, etc.? The type of thing I have in mind is the mixture used in the small commercially made ice-cream freezers which were sold before the war. I think that the mixture which I used in one of these freezers was two parts of nitrate of ammonia and one part of common washing soda mixed together in a small quantity of water.

Perhaps you could suggest some other simple chemical mixtures which are not too expensive, and which would suffice to freeze, say, a pint of mixture in a reasonably short time.—C. F. Mander (Stoke-on-Trent).

WE can tell you quite frankly that none of the many chemical freezing mixtures will serve your purpose satisfactorily. It is not that they do not, in most cases, get down to the low temperature required, but rather that they are very expensive to make up and also that their effect is of only short duration. Hence, in our opinion, any attempt to make ice-cream by means of a chemical freezing mixture is doomed to disappointment, if only in view of the cost entailed.

A good chemical freezing mixture is the following:

Saltpetre, 2½ lbs.
Sal ammoniac, 2½ lbs.
Sodium sulphate, 4 lbs.
Water, 8-9 pints.

The pre-war success of the modern ice-cream industry which sent out its products in tricycle vehicles was entirely dependent upon the use of solid carbon dioxide gas which was marketed (industrially) by Imperial Chemical Industries, Ltd., under the name of "Dricold." This material was cheap, water-free, and it produced a very great degree of cold over a long period. It formed the only really practical way of making ice-cream and other products without the use of ice.

We suggest that you write to British Oxygen Co., Ltd., Wembley (or to your nearest branch of this company), and inquire whether they are prepared to supply solid carbon dioxide gas. Alternatively, you could use liquid air, which the above company supplies (or did supply) in hired containers. A quarter of liquid air (costing about 5s.) would remain at an extremely low temperature for three to four days, and it would be amply sufficient to freeze a large amount of ice-cream material, its only objection being that it would lower the temperature of the cream mixture too far, and thus necessitate the material being warmed up by the surrounding atmosphere before it could be eaten. It would be highly dangerous to eat ice-cream material at the temperature of liquid air.

Acetylene Gas Cycle Lighting

I WISH to construct an acetylene gas lighting system for my cycle so that gas will not be wasted on short runs and the system will work automatically. I propose to make a generator in which the water supply to the carbide is regulated by the pressure of the gas generated, and all gas produced after the lamps are put out is to be stored under pressure in a small reservoir about the size of a small autovac off a car (about 8in. × 3½in. diameter), the lamps being supplied through a reducing valve. I am aware that acetylene under pressure is unstable, so propose to make a dissolved acetylene system for the reservoir. I was thinking of using a pressure of about 10-15lb. per sq. in. for normal operation, though this would be exceeded by the accumulated gas produced after the lamps are put out. Can you tell me at what pressure acetylene gas becomes unstable, and how to prepare the material with which the dissolved acetylene reservoir should be packed? Also, what is the method for estimating the volume of acetylene stored in the reservoir for a given gas pressure?—P. Chatterley (Cosford).

ACETYLENE gas is stored by being dissolved under pressure in a paste composed of pure acetone and kieselguhr, both of which materials are nowadays absolutely unobtainable except for uses of No. 1 priority. We fear, therefore, that you will not be able to employ this method of storing acetylene gas, and since the gas is not merely unstable but is definitely liable to explode with the greatest violence when stored at pressures of more than 30lb. per sq. in., we are afraid that you would not be justified in constructing any pressure-storage system for this illuminant. Even under atmospheric pressure, the gas should not be stored in metallic holders, since it is always liable to form "acetylides," or compounds with copper and iron, which compounds are powerful detonators.

One volume of acetone dissolves about 24 volumes of acetylene, hence this substance is the ideal solvent for the gas. We suggest that you might write to either British Industrial Solvents, Ltd., Hull, or General Chemical and Metallurgical, Ltd., Moorgate, London, and inquire whether supplies are available of any acetone-like solvent which could be used as a substitute for acetone in the above respect. Your prospects of obtaining any such compound are rather remote.

There is no direct method of estimating the amount of acetylene gas stored in solution form in a container. Probably the British Oxygen Co., Ltd., Wembley, might let you have tables of acetylene pressures, showing the amount of gas corresponding to a given pressure, but any such tables would naturally be applicable only to the standard pressure containers owned by this company.

Leaf Skeletonising

I HAVE seen leaf skeletons, that is leaves with the soft parts removed, leaving only the veins.

Can you tell me the necessary chemicals, or method of obtaining this?—F. E. Taylor (Edinburgh).

THE usual leaf-skeletonising formula prescribes a strong solution of chloride of lime (bleaching powder) in which milky solution the leaf is soaked until the softer parts are destroyed. The remaining skeleton is then carefully removed, washed and dried. This process, however, is never satisfactory, for the reason that, after a time, the skeleton itself begins to deteriorate owing to the delayed action of the lime solution.

A better way to prepare these skeletons is as follows: Dissolve 20 parts of caustic soda (or "black ash") in 80 parts of water. Immerse the leaf in this for three or four days. Preferably the leaf should be a dead or a dying one, that is to say, its brown colours should be well evident. The caustic soda will dissolve out all the brown and other colouring matters, leaving a thin, semi-transparent skin in which the "skeleton" can be seen clearly. The next process is to immerse the leaf in strong vinegar, or, better still, in a fairly strong solution of acetic acid (say, 30 parts acetic acid to 70 parts of water). This immersion should proceed for two or three weeks until the transparent skin surrounding the skeleton is almost invisible. On washing the leaf with warm water the skin will finally disintegrate, leaving the bared skeleton, which can then be mounted on glass.

Most workers do not proceed so far as this stage, which leaves the leaf skeleton in an exceedingly fragile condition. They stop short at the stage at which the leaf is rendered transparent, and they mount the skeleton on glass at this stage, this mounting operation being able to be carried out with very much less risk of the delicate leaf structure being torn or mutilated.

Semi-matt Varnish

I SHOULD be glad if you could give me a recipe for making up flat or eggshell finish varnish to cover oil paints.—T. A. Bedford (Portsmouth).

TO make a flat varnish which will dry with a semi-matt or eggshell surface mix together equal parts of aluminium stearate (or zinc stearate) and magnesium carbonate, and work this mixture into any clear oil or synthetic varnish, employing about 1 part of the mixture to, say, 8-10 parts of the varnish.

These materials can be obtained from Messrs. A. Boake, Roberts & Co., Ltd., Buckhurst Hill, Essex, or from any large firm of wholesale chemists and laboratory furnishers.

Asbestos Cement

WILL you please inform me if it is possible to make asbestos cement at home? If so, what are the ingredients, and where can I purchase same?

Also, what type of mould should I need to mould it into various shapes?—C. A. Penny (Forest Hill).

QUITE a good cement of this nature can be made by mixing equal parts of Portland cement and asbestos powder, and then by mixing 1 part of fine sand with 2 parts of the cement-asbestos mixture. This is slaked with water and used in the ordinary manner. Asbestos is difficult to obtain nowadays except for really essential purposes. We would advise you to apply for supplies to Turners Asbestos Company, Ltd., Rochdale, Lancs.

You can use an ordinary wooden or metal mould for your purpose, giving the inner sides and outer edges of the mould a good smearing over with a thin layer of a thick grease. Pressure is not essential for moulding cement articles, but often a slight pressure is an advantage.

The following (according to U.S. Patent No. 1,985,764) is said to provide an excellent "asbestos moulded plastic":

Asbestos flour	40 parts
Wood flour	60 "
Slaked lime	10-15 "

Sufficient water must be added to the above mixture to convert it into a very thick pasty mass. This can then be rolled or worked as required. Articles which have been moulded from this material must be stiffened by a few days' immersion in a solution of sodium silicate.

Preparing Acetyl Chloride

CAN you give me any information on how to prepare acetyl chloride CH_3COCl also metaldehyde $(C_2H_4O_3)$.—H. A. Petterd (Victoria, Australia).

YOU will find details of the preparation of both acetyl chloride and metaldehyde in a textbook of practical organic chemistry, and in such a book you will find greater detail than we can possibly give you within the space of a short reply.

However, to prepare acetyl chloride, CH_3COCl, mix glacial acetic acid with half its volume of phosphorus trichloride. The mixing must be done very slowly, since a considerable amount of heat is evolved. After a time, the mixture separates into two layers, the top layer comprising a mixture of acetyl chloride and unchanged phosphorus trichloride, the lower layer being made up of a solution of phosphorus acid in acetic acid. In order to purify the acetyl chloride, the upper layer of liquid is separated and distilled. The portion of the liquid distilling at 50–58 deg. C. consists of fairly pure acetyl chloride. It can be further purified by redistillation.

Metaldehyde ($C_2H_4O_3$), is a white solid substance which sublimes when heated to about 115 deg. to 120 deg. C. It is readily prepared by adding one or two drops (not more) of concentrated sulphuric acid to ordinary formalin (formaldehyde), great care being taken to cool the formalin to a temperature below 0 deg. C. If the temperature of the formalin is allowed to rise above 0 deg. C, another substance, paraldehyde, will be formed.

Pottery Making

I SHALL be glad of your help in connection with making pottery of various types, as a school activity. The chief difficulty is the firing of the clay model, and if you could inform me as to the cheapest and easiest method of doing this—apart from providing an elaborate kiln—I should be greatly obliged.

Assistance would also be welcomed in choosing suitable glazes, assuming reasonably low temperature baking. Would borax be an efficient glaze?

I should be glad also to have information as to where to obtain the best materials for this purpose—clay, colours, glazes, etc.—H. Woodcock (Doncaster).

WE are afraid that it is utterly impossible for us to give you the vital and necessary details concerning the glazing of school-made pottery within the space of an ordinary reply.

We suggest, however, that you approach the subject as a whole by procuring either of the undermentioned volumes and perusing them carefully:

H. & D. Wren: "Handbook of Pottery for Workshop and School." (12s. 6d. net).

C. F. Binns: "The Potter's Craft: A Practical Guide for Studio and Workshop." (14s. 6d.) These prices are pre-war ones.

In order to effect a satisfactory glaze, the material must be fired at a temperature of at least 950 deg. C. This necessitates a furnace the temperature of which can be carefully controlled. An ordinary fire is more than useless for the purpose. Previous to the war, a number of scientific instrument firms, such as Messrs. Philip Harris & Co., Ltd., of Birmingham, used to supply suitable gas furnaces at a cost of about £8, but whether these are now obtainable we are unable to say. We should advise you to write to Messrs. Philip Harris, or to Messrs. J. W. Towers, of Victoria House, Widnes, or, again, to Messrs. Reynold & Branson, Ltd., of Leeds.

Regarding glazes, ordinary borax used alone does not make a very satisfactory glaze, although it can be employed for this purpose. Modern glazes are much more complicated things. For example, the following is a typical formula for the making of a white glaze:

"FRIT"

Stone	6 parts
Saltpetre	2 "
Borax	12 "
Flint	4 "
Pearl ash	2 "

Grind the following to an impalpable powder:

Frit (made as above)	24 parts
Stone	15 "
Flint	6 "
White lead	31 "

Pottery clays and colours may be obtained from Messrs. Cowan Brothers, Ltd., Stratford, London, E., and it is possible that British Colour and Mining, Ltd., Coleford, Glos., may also be able to help you.

We think, however, that by far your best plan is to refer to either (or both) of the above-mentioned books before proceeding any further with your projects.

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Comments of the Month By F. J. C.

Sir William Rootes, K.B.E., on Road Problems

NEARLY 100 members and guests sat down to lunch at the Roadfarers' Club luncheon, held at the Waldorf on January 21st, under the chairmanship of Major H. R. Watling, O.B.E., J.P., in the absence, due to illness, of the president, Lord Brabazon. There were many distinguished members and visitors present, including Mr. H. G. Wells, Professor A. M. Low, Gilbert Smith (president of the Manufacturers Union), Sydney Camm, C.B.E., Harold Eley, Sir Harold Moore, A. Percy Bradley, Mrs. Kay Petrie, etc.

Sir William said: "As a man of Kent, when I speak of roadfarers I am naturally reminded of the pilgrims winding their way through the dells and over the downs of the countryside. The first thing that appealed to me was the old pilgrims and the way they travelled in those days. Travels as they were in the past were bad, and we to-day know very little about them. Nevertheless, I was encouraged by the thought that if the right mentality of approach could be made to the subject there is great scope for us to be able to improve the roadfarer's lot in the future. I am sure that if the roads in this country are tackled in a bold and aggressive way, we can bring into the life of future roadfarers much more of the peace than he had in the past when the pilgrims of Kent used those roads.

"The need for motor roads is one that I do not think I have to stress before this assembly, but I do feel that it is one that the Government authorities should tackle in the boldest way both from the point of view of safety, speed and the alleviation of congestion, which undoubtedly will be a problem of the post-war era. I feel, also, that no stone must be left unturned at the appropriate moment to bring about the reconstruction—and the rapid reconstruction—of the roads. I am sometimes nervous that anything in the way of a compromise is likely to fail and not receive the full appreciation of the public as a whole; what we fear is that we may get some half-baked proposals that would not bring us very far and will lose a great deal of time.

"Our Prime Minister has collected around him what I believe he termed 'A broad based Government' comprising, as it does, many shades of political opinion. It is a united Government and the burdens that that Government and the nation will have to bear now that we are about to face the greatest conflict of our life will be very serious ones, and in those circumstances we can well imagine that those whose task it is to pursue the present war work will be fully engaged, but, on the other hand, there are those who serve with forward planning, and I feel to those we should appeal that they may make the greatest possible headway so that when the time for reconstruction approaches, we can be given a bold and forward policy without further delay.

Passenger and Goods Transport

"IF one speaks in terms of passenger and goods transport, then it is right to advocate that a new and progressive opinion must be taken if we are to make the most of our opportunity. It might be asked, what are our opportunities? In the first instance I believe that the use of automobiles and trucks in this country can, and should be, vastly increased. If you look up the figures of 1938, you will see there were 2,490,000 cars and commercial vehicles in use in this country. This represents 1 in 23 of our population, whereas in California it was 1 in 3.6, and even in our Dominions, for instance, take New Zealand, it was 1 in 6, and in Australia 1 in 9. I think that these figures indicate that there should be a fuller use made of wheeled vehicles whether for industrial or domestic purposes, as they are essential to the efficient conduct of our new national life.

"For goods carrying vehicles, particularly for economic hauls, I hold the view, and I hope my friend, Mr. Birtchnell, of the Ministry of Transport, who is here to-day, agrees, we must make more use of commercial vehicles. In the past we have permitted one of our greatest potential assets to be hindered and given a back place in our international life. Successive Governments have allowed an obsolete method of taxation to hinder and to hamper the United Kingdom in the production of cars and light commercial vehicles of the type that were in demand by the great majority of users throughout the world. In addition to this, they have also taxed the road users at such a prodigious rate that transport generally has been thwarted and not allowed to expand at the rate it should have done.

"Sir John Anderson's statement in the House this week is therefore all the more welcome, and it is to be hoped that he and his colleagues will encourage the traveller in reviewing this matter by taking the broadest possible view of the subject they can. I should also like to see, as far as both the Ministry of Transport and the Board of Trade are concerned with this problem, that Mr. Birtchnell will not fail, when he is next back at the Ministry of Transport, to appreciate that viewpoint also.

"Commercial vehicles, to my mind, must be freed from some of the shackles they have around them to-day, shackles which have been imposed on them with a distinct intention of holding them in bondage. Gentlemen, I think we have to appreciate in road transport that when it comes to road haulage, motors are definitely handicapped, and if this hardship is not removed it is impossible for them to be efficient in the postwar era.

"In the past it was thought that railways could not be successful if other forms of transport were not robbed of their rightful place in a progressive world.

"I hold the view, and I am sure you will agree, that railways must be successful and that it is the duty of every citizen in this country to see they are successful. I believe they can be, but I unhesitatingly say that if the public are to be asked to use stations that are cold, bleak, untidy and unfit to use, and trains that are out of date in appearance and lacking in modern comforts, then the railways will need to continue the policy they have been pursuing during the past few years, which is, to endeavour to handicap other forms of transport which are of a more modern type.

Postwar Rail Traffic

"ON the other hand, if the railways are given the opportunity of modernising their equipment, then I am convinced that industry and the public will use them to even a greater extent for post-war goods and passenger traffic. From a national point of view, I think we should be agreed that we need to see that all forms of transport are efficient and prosperous, and I hope that Mr. Birtchnell, from the few remarks I have made, will realise that, in the motor industry in particular, we are not in any way opposed to the railways. We are all looking forward to the opportunity being given by both the Government and the railways of sitting around tables and collaborating and endeavouring to work out a future which will be of benefit to the people of this country.

"Gentlemen, it is to be hoped that our Government will take a realistic view of the whole of this problem, and that when we start again we shall not commit the errors of the past.

"One of the major tasks we are confronted with is the re-establishment and advancement of our trade in general, particularly in respect to our overseas and export trade. Under the new economic conditions we will have to face, this will be one of the vital planks in our future policy.

"By heavily taxing private passenger cars, public conveyances and transport vehicles in general, I am convinced that the Government have imposed a recurrent burden on every phase of trade and industry, including agriculture. A burden like that, if allowed to remain, will be a handicap in building up our industrial effort and our overseas markets. Nobody to-day can have a greater influence over those matters than the Minister of Transport, and when I say the Minister of Transport I also mean those who are around him. They are in a unique position because they not only control roads, they control road and rail traffic, they control shipping and the canals, and, I presume, if we have a correct grouping of transport, in the future they will also have a big say in matters concerned with the air.

"Upon Lord Leathers's shoulders, there-

(*Continued on page* 48.)

PARAGRAMS

Neidpath Castle, on the Tweed, Scotland.

Regional Record

WITH a total of 5,879 bednights during the year ending September 30th, 1943, Winchester Y.H.A. set up a new regional record. The London Region's total for the corresponding period was 5,600 in excess to 1942.

Povey at Portsmouth

ERIC POVEY, Marlborough A.C. and North Road C.C., stationed with the Royal Navy on the south coast, is a keen attender of Gosport C.C. fixtures.

Ridley C.C. News

LARRY PHILLPOTTS, Ridley C.C., serving with the R.A.F. in Southern Rhodesia, has been promoted to pilot officer.

Home from Africa

THOMAS MARK, Barras Road Club, is home after many months' service in North Africa. He met several of his club-mates while abroad.

"Early Bird" Pathfinder

SERGEANT JOHN WALKER, Early Bird C.C., is now on duty with an R.A.F. Pathfinder squadron.

Barnesbury C.C. Record

EIGHTY members of the Barnesbury Road Club are serving with the various armed Services; three have lost their lives at sea. A corresponding number of members are prisoners of war and another, William Toddie, has been "missing" since June, 1940.

Died in Italy

A MEMBER of Glasgow Lancia C.C., Gordon Stewart, has died in a hospital in Italy. He was serving with the Royal Engineers.

The Sergeant's Return

OGMORE Valley Wheelers, a Welsh club, recently welcomed home from service in the Middle East, Palestine, Syria and India, Lance-Sergeant W. J. Jones, Royal Artillery, one of the club's founder members.

Barnet a Mixed Club

BY resolution passed at the annual general meeting, the noted Barnet C.C. has decided to admit ladies to membership.

Chichester Reunion

AFTER being with the Eighth Army throughout its long campaign, Sergeant Leslie Osborne, Chichester C.C., has been home on leave, as has his club-mate William Long (Fleet Air Arm), who has been stationed in Gibraltar.

Wally Reynolds Killed

WHILE on his final flight before taking a commission, Flight Sergeant Pilot Wally Reynolds, Swindon Wheelers, was killed while engaged in operations over Germany. He was very well known to West Country club-folk.

A Cycling President

ARTHUR ROGERSON, Spen Valley Wheelers president, takes a very active part in his club's riding activities.

Frank Tillman Decorated

FORMER treasurer of the Finsbury Park C.C., Frank Tillman has been awarded the Polish Cross and bar for his part in shooting down two Ju. 88s. He has also been promoted to pilot officer.

Clubman's Promotion

FORMER member of the Crouch Hill C.C., and later of the Finsbury Park C.C., Robert Lasham has been promoted to pilot officer. He has taken part in many operational sorties.

Alex Hendry's Haul

ALEX HENDRY, Glasgow Wheelers, closed last time-trial season with a total of 45 road prizes. In addition, he won numerous track awards.

New Scottish Officials

FOLLOWING the retirement of Alex Urquhart (Glasgow Wheelers) and A. McArthur from the chairmanship and secretaryship respectively of West of Scotland T.T.A.—positions each has occupied since the outbreak of the war—Harold Briercliffe and Frank Huggins have been elected to fill the respective offices.

A "Twelve" for Scotland

DOUGLAS C.C. (Scotland) anticipate promoting a 12-hour event this year.

Notts Castle B.C. Revival?

A MOVE is afoot to resuscitate the famous Notts Castle B.C. which, two decades ago, provided open events attracting the cream of competitive riders.

Pickersgill in Uniform

H. H. PICKERSGILL, Veg.C. and A.C., is among the latest famous cyclists to join the Forces.

Tom Hughes's Mileage

THE famous Wigan "evergreen" rider, Tom Hughes, covered over 11,000 miles in 1943. Since he passed his 60th birthday he has recorded over 170,000 miles and has ridden in almost every European country. He has been riding regularly since 1887.

Romford Wheelers Talk Business

ROMFORD Wheelers' annual general meeting revealed that from the five members who were left after the general mobilisation of the club's youth, membership had grown to 53.

Charles Davey Honoured

CHARLES DAVEY, famous record breaker and one-time Olympic rider, has been elected life member of the Addiscombe C.C., of which he is president.

Met in Africa

HUBERT WHITEHURST, Wolverhampton City C.C., has met in North Africa "Clarry" Hopkins, Crewe Wheelers, against whom he frequently raced.

Fred Willett Presumed Lost

NOTIFICATION has been received from the Air Ministry that the death on active service must be presumed of Fred Willett, popular Norwood Paragon rider, who has been missing for the past eight months. He was an R.A.F. Sergeant-Observer.

Allondon Road Club

THE Allondon Road Club, which formerly contributed many notable riders to the sport, has been resuscitated.

Manufacturers' President

C. GILBERT SMITH has been elected president of the Manufacturers' Union for the fourth consecutive year. George Wilson, O.B.E., A.F.C., J.P., and A. E. Dovey have been elected vice-presidents.

Forest C.C.

DESPITE the fact that 75 per cent. of its members are in the Forces, the Forest C.C. is being revived. It promoted classic open events before the war.

Albert Watson Remembered

FRIENDS are opening a fund to commemorate the memory of Albert Watson, famous Scottish rider and tricycle record holder, who died in Canada while serving with the R.A.F.

Scots Awards

AWARDS won in the Scottish championship last season were presented at the Douglas C.C.'s prizegiving in Glasgow, when Alex. Hendry, Glasgow Wheelers, took most of the prizes.

Ben Nevis Railway?

FORT WILLIAM Town Council has proposed that a mountain railway be run up Ben Nevis, the highest peak in Britain, 4,406 feet.

Canal Closing

AT one time regarded as the shortest, straightest, and deepest canal in England, the mile-and-a-quarter-long Ulverston Canal, in North Lancashire, is to close.

No Change

ALTHOUGH attempts were made to increase charges, the annual council meeting of the Scottish Y.H.A. decided to continue the present charges for membership and overnight stays.

Situations Vacant

APPLICATIONS are invited for the post of part-time Secretary to the Road Time Trials Council. (Women must be exempt from National Service.) Applications, stating experience of road sport, qualifications for administrative post of this nature, time available, and salary required, should be sent to S. R. Forrest, 1, Glenwood Road, Stoneleigh, Epsom, Surrey.

Club Notes

Maxfield Missing

FLIGHT LIEUT. W. W. MAXFIELD, 1939 sprint champion of England, is reported missing from an Atlantic operational flight.

Lonsdale in Midlands

FRANK LONSDALE, the Douglas C.C. star, has been training with the Navy in the North Midlands and has met such outstanding racing men as Douglas Hartley, C. Cartwright, and C. Gorman.

Death of Bill Pinder

"BILL" PINDER has lost his life while serving with the R.A.F. as a Flight Engineer. He was a Yorkshire Vegetarian C.C. official, as well as an enthusiastic Clarion member.

More for Oldham

THE Oldham and District Cyclists' Union is now stronger than at any previous part of its history. Most of the leading Manchester and South Lancashire clubs are affiliated, a recent recruit being the Cheshire Roads Club.

Mid-Scotland Opens

TEN opens will be run this season in Mid-Scotland, as well as a women's "25" and two hill climbs. This is a longer programme than in 1943.

Clarion Opens

THE West of Scotland Clarion will run open events at 25, 50, and 100 miles this season, as well as the "Tour de Trossachs" hill-climbing time trial.

Open to All

THE Barnet C.C. has opened its ranks to women riders. Formerly this noted North London body was confined to men.

"Twelve" for Clydeside

THE West of Scotland T.T.A. will be running an open "12-hour" this season for the first time since the war. Additionally, the Association is entering a new field by promoting a "25" for women.

Addiscombe "30"

THE Addiscombe C.C. will be running its open "30" again during the coming season.

Around the Wheelworld

By ICARUS

What is a Real Cyclist?

I WAS interested to read a short time ago a definition of what the writer of the article considered to be a "real" cyclist. According to him, a real cyclist is one who cycles in all weathers, every day of the year and on every possible occasion, who thinks of nothing but cycling, who is for ever advancing the cause of cyclists, and more or less lives on his bicycle. Now this sort of nonsense has been written and spoken so many times during the past 30 years that it is time it was debunked. The most reprehensible type of cyclist is that defined above. Fortunately, however, I doubt whether there is such a cyclist in existence. A cyclist who states that he enjoys riding in the rain is a liar. A cyclist who elects to start on a cycling journey in the rain (provided, of course, he has not an appointment to keep which cannot be postponed) is a fool, and one who makes a fetish of riding a bicycle every day to provide himself with a boast about the number of miles he has covered (and thereby, when walking, takes the permanent attitude of one riding a bicycle, shoulders bent forward) is a candidate for an asylum. To promote this sort of insincere belief is to do the greatest possible disservice to cyclists. Godwin rode every day the whole year round as hard as he could, and he told me he was not anxious to repeat the experience.

Of course, the contributor omitted to say that a "real" cyclist must have a hatred of motorists, that he must not use cycle paths under any consideration, and that he must oppose all forms of legislation. Additionally, when visiting the wayside teashops he should conduct himself as a hooligan, parking chewing gum on the furniture, creating a din, and possibly breaking up the crockery. He should, of course, regard teashops as places where you go to borrow a cup and saucer, a plate, knife and fork, by means of which you can drink the liquid in your flask and eat the sandwiches which you have brought. He must, of course, join every cycling organisation.

A Definition

I WILL give you my definition of a "real" cyclist. It is one who cycles for pleasure when the mood fits him. He does not necessarily wear plus-fours, because Scottish artists always draw cyclists in plus-fours. He does not wear plus-fours when he is not riding his bicycle, as so many do to proclaim the fact that they are cyclists. He does not wear half a dozen club badges in his lapel. He is not anxious to pile up miles, but pleasure. He does not ride through the rain unnecessarily. It is bad for the machine, anyway, and possibly for the health. He does not necessarily belong to an organisation, for this is not a *sine qua non*. He does not hate motorists, and if it is more pleasant to use a cycle path, he will use it. He will be reasonable in arguments, and not oppose things for the sake of opposing them. He will not wear colourful and fantastic clothing, nor imitate the racing attitude of a cyclist. He will not necessarily want to cycle amongst mobs, and he will be of clean appearance.

Now there are hundreds of thousands of such cyclists amongst the millions on the roads; they do not belong to the noisy minority and so their praises go unsung. They do not spend a large part of their cycling time arguing cycling politics; and they have their own views, not the views mass-produced *ad nauseum* by national bodies. They do not oppose things just for the sake of opposing or because they were opposed in 1888. I know a few real cyclists of the right sort who have been cycling for over 30 years; they do not belong to a cycling organisation. Of course, a clubman is chiefly interested in racing, and there are, of course, those who like riding in company, but there are far more who prefer to ride alone.

Let us hear less nonsense, or rather tripe, about "real" cyclists, or "really" cyclists, and less about touring with half a comb and a toothbrush, borrowing or stealing the hotel soap! I challenge the writer of the paragraph to show me a real cyclist who fits his definition. I can show him thousands who fit mine.

Road Accidents—December, 1943

THE number of deaths resulting from road accidents in December, 1943, was 690—the highest monthly total of the year. In addition, 11,537 persons were injured, 3,150 seriously. These figures compare with 780 killed, and 12,859 injured in December, 1942.

More than half the accidents occurred during darkness, and among adult pedestrians the proportion killed at night was as high as three out of four. On the other hand, accidents to children, most of which occurred in daylight, caused fewer deaths than in any month since the previous January. The total was 77, of which 68 were pedestrians.

As daylight lengthens, accidents to children tend to increase, and the Ministry of War Transport reminds all parents and road users of the need for taking the greatest possible precautions, including the regular training of children in kerb drill.

The figures for December bring the total number of road deaths in 1943 to 5,796. Although this total is the lowest for many years, the number of children killed, 1,124, is well above the pre-war level. The total number of injured of all ages during the year was 116,740. The following is a table showing the total of road deaths for the years 1938-43 inclusive, together with those for child pedestrians and child cyclists.

	1938	1939	1910	1941	1942	1943
All persons...	6,648	8,272	8,609	9,169	6,926	5,796
Child pedestrians	870 (app.)	850	972	1,231	1,112	993
Child cyclists	205 (app.)	184	205	231	203	131

Lt.-Col. Chas. Jarrott, O.B.E.

THE passing of Lt.-Col. Charles Jarrott, O.B.E., is a great loss to the Royal Society of St. George (of which he was secretary for several years), the Roadfarers' Club and several other clubs and societies. He was a founder member of that pioneer body, the Nineteenth Century Circle of Motorists. He was also a member of the Fellowship of Old-time Cyclists. To me his death came as a great shock, for we were friends of over forty years standing. In those far-off days, when the motor industry was almost entirely in the hands of Continental firms, and its development in this country was retarded by repressive legislation, Charles Jarrott was one of that band of hardy pioneers who helped to bring England to the fore, for he competed with success in the big road races abroad against the giants of that period. But he will best be remembered for his activities in connection with the Automobile Association. Before its foundation, when motorists had to submit to considerable persecution by the police, he conceived and carried out the idea of engaging a squad of boys, each wearing an armlet as a mark of identity, to stand at the danger spots on the roads and warn motorists of the proximity of police traps.

From this modest beginning, due largely to the vision and abounding energy of Jarrott, grew the vast organisation we know to-day. The Automobile Association, of which he was chairman for several years, is an enduring monument to his memory.

To-day we mourn the loss of an ardent Roadfarer, a great sportsman, and a man of very lovable personality.—E. Coles Webb.

Fountain C.C. 1944 Officials

Gen. Sec., G. T. Avis, 44, Badminton Road, S.W.12; Treasurer, Miss E. Butler, 17, Eckington Gardens, S.E.14. Racing Sec., H. Patman, 113, Tivoli Road, S.E.27. Runs Captain, S. Chalmers, 63, Loughborough Park, S.W.9.

H. Patman is dealing with inquiries, entry forms, etc., for the Balham R.R. 25, which the Fountain C.C. are promoting shortly. The usual Kent and Surrey lanes course is to be used on the usual week in late February, and offers to marshal this difficult course will be much appreciated.

The annual dinner and dance, held on February 26th, was very successful.

The Road Time Trials Council

MR. A. E. ARMSTRONG, chairman of the Road Time Trials Council, was also elected chairman of the National Committee at a meeting held on Sunday, January 23rd.

The main business of the meeting was the consideration of matters arising from the decisions reached at the National Council meeting.

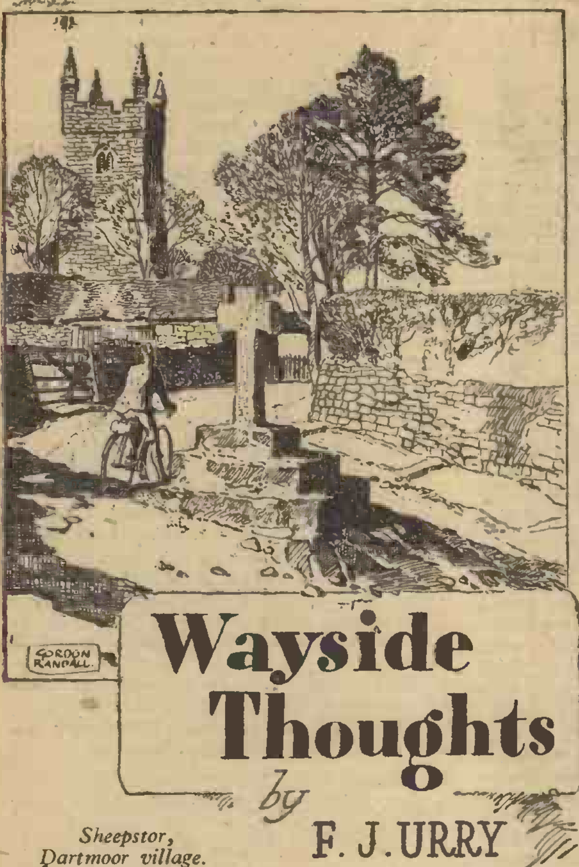
National championships will be held in 1944 at the following distances: 25, 50, 100 miles, 12 hours and hill climb. One event at each distance will be allocated to district councils in different parts of the country, and a district council to whom an event is allocated may delegate the promotion to a club in its area. Full details concerning the promotion of the championship events will be given shortly, but the main provisions will be that the events must be timed on split-second watches holding current Kew "A" certificates; entries will be limited to 100 riders; both an individual and team championship will be decided at each distance, but the riders will be selected on individual merit, without regard to team representation.

The national best all-rounder competition will be based on average speeds at 25, 50 and 100 miles. The events to be included in the competition are under consideration, and a further statement will be made as soon as possible. Not necessarily all the events to be promoted in 1944 will be included in the competition. It may be decided to limit the competition to a certain number of events at each distance. It was decided not to include the 12 hours distance while war conditions prevail.

The amount of the levy on each rider in open and association events has been fixed at 3d. for each event This amount is to be added to the entrance fee and forwarded by the responsible official of the promoting club to the district council treasurer.

Cycling Instructors

SPECIAL instructors of cycling, as of cricket, football and boxing, have been suggested by the National Committee on Cycling to the Board of Education.



Wayside Thoughts

by

F. J. URRY

Sheepstor, Dartmoor village.

New Owners

NUMEROUS amalgamations have lately taken place in the cycle trade, led by the absorption of Rudge-Whitworth by the Raleigh interests, soon after which the B.S.A. Co., Ltd., bought the New Hudson and have since acquired Sunbeam; and J. A. Phillips and Co., Ltd., have purchased Armstrong Cycles, Ltd. These are facts; but rumour is busy with many well-known names, and I understand various other amalgamations are likely to take place in the near future. It is not surprising that with the end of the war in sight, great firms are busily planning the output for their extended factories, nor do I think the changes will be other than beneficial to cycling interests. I am told on good authority that these absorptions will not affect the specialities of the machines for which the absorbed firms were responsible, but that the amalgamations will enable the widest possible field of demand to be covered. If this works out in practice, then certainly we can be sure the result will mean the high probability of a fine range of better class bicycles. Think of the old Rudge. I once owned one weighing 28½ lbs., a very beautiful bicycle, that carried me thousands of happy miles in the early part of this century; and I still own and ride a little Sunbeam, now in its twenty-third year, and still making the daily winter journey without complaint. Only a few years ago I gave a New Hudson away that had outside liners to the main tubes, an introduction to lightness, strength and rigidity that was first used by the late F. J. Osmond on his famous machines. One hopes these things will be remembered by the new owners of those famous names, not for the purpose of reversion to type so much as the modernising of the bicycle to be a worthy successor to those that built a great and remembered reputation. There is still much room for improvement, and one hopes this object is in the minds of the new owners of the old names.

The Constant Joy

I BELIEVE there will be a big demand for the good type of bicycle in the post-war days, firstly because we are all rather tired of the dead level of quality imposed by war conditions, and secondly for the simple reason that economy in travel will be essential and many of us who could just afford to run a car in 1939 will now find that financial burden impossible, and so will be looking for the very best the cycling world can supply. To the fit and active this limitation will be a fine thing, since it will replace the car as a purveyor of fresh air and scene, and add that inestimable advantage of exercise and the feeling of complete freedom that is only to be found in self propelled travel. Given the right bicycle and the correct way of riding it, the ordinarily active individual ought to be as happy as the day is long, and gather to himself a good deal more personal satisfaction at the end of it. People say it is all very well for me to talk like that; I am used to it, and that makes a difference. Of course it does, but I had to get used to it once, and so can they. It is merely a question of overcoming that silly notion that there is something the matter with the man who rides a bicycle, and that matter is mainly because it is felt he can't afford anything better! And the worst cases of this kind of snobbery are among the people to whom the limitations are true. Get rid of that feeling, for the only thing in it is worry and a condition of covetousness that is worse. A good bicycle and the ability to ride it easily is the greatest health and happiness asset I know, and I am prepared to say so in any company and under the most virulent form of criticism. The cycle trade and the cyclists have never said it half seriously enough, perhaps *because* it is the truth, which too often is taken for granted. There is much more constant joy to be extracted from cycling than any other game I know.

The Easy Rider

THE comfort of riding to work instead of waiting in the rain in the bus queue has to be experienced to be believed. Anyhow that is how I feel as far as this provincial city of Birmingham goes, and what happens here in the way of traffic is probably no better or no worse than in most cities. I know the caped cyclist sliding past the waiting crowd seems to many of them an object of pity because I have heard such remarks passed on numerous occasions; but as far as I am concerned the pity is all for the other fellow whose journeying is nearly always uncomfortable, and for ever at the dictates of time. Mine is when I like, and as for the rain, it just makes the difference of a pair of leggings and a cape, and nothing else. I know, too, that many riders give up their daily journeys when the weather turns rough, for they do not stop to measure the loss of regular convenience against the occasional struggle against wind and rain; if they did I think they would absorb my philosophy, and be the better in health and temper for the experience. The only conditions that deter me from my daily journeyings are more than an inch of snow and that glazed frost condition of the roads when the slightest deviation from a straight course means skidding, and that is particularly dangerous because the car ahead or behind you is in the same jeopardy and may "bump you off" without the application of carelessness. Taken all round my daily rides are an enormous saving of time and a tremendous convenience, to say nothing of the value of regular exercise and the economy. If offices had parking places for bicycles I believe their regular use would be enormously increased, and we ought to agitate for them in the same way we are now agitating for cycle storage room in the houses to be built after the war. We have a fine servant in the bicycle, but we have not given it the best chance to prove its highest value.

Registration Racket

THE police voluntary registration of bicycles goes on apace, but what good it will do to stop the thief has not yet been told to us. When the experiment was first launched—by the Portsmouth Chief Constable, I believe—we were told the cases of theft fell away enormously. Natural enough, for the professional thief just waited awhile to see what effect this voluntary registration would have on his business. Now I understand—though not officially—that with the lapse of time sufficient to show the thief he has nothing to fear from this "check-up," the number of stolen bicycles has gone back to normal. One would expect that to happen, for the registration of anything will not prevent it being stolen. If only cyclists would take the little trouble to preserve the maker's number stamped on their machines, ready to hand to the police, together with a description of its latest equipment, in case they are unfortunate enough to have it stolen, that would be far more valuable than registration—voluntary or otherwise—for it would save the police much clerical work (which in most cases would be out of date) and the owner would be in a position to hand to authority an up-to-the-minute description of his property. That obviously is the right method of check-up in case of loss. If this voluntary registration business is allowed to "get away" with the story, you can take it as a certainty that compulsion will follow, and that definitely means some form of taxation, and once a registration fee is imposed, who shall say where the impost will stop? Remember, for many years motoring interests have voiced the opinion that all cyclists should be taxed and made to carry a number plate! Do you think such opinions will be quieted by any form of voluntary registration? I don't.

Answer to the Cycle Thief

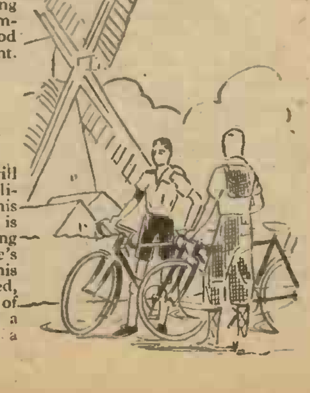
ACTUALLY the best thing for the prevention of cycle theft is a built-in locking device, and the neatest thing I have seen in this way will be marketed by the B.S.A. Co., Ltd., immediately after the war. The company would not be waiting for the cessation of hostilities if they could obtain the materials and the labour to operate their patent device now, for they realise how important the question is, and the fact that they possess a complete answer to the cycle thief, which cannot now be marketed, is galling. Actually, I have one of these locks fitted to a machine I own, and guarantee you would not readily discover its position, for it is remarkably unobtrusive and neat. The lock is fitted in the crown fork and operates a bolt in the steering column by the turning of a small Yale key when the front wheel is at a slight angle. It is positive in action and cannot be tampered with except by dismantling. Only when the lock is in operation can the key be withdrawn, a safeguard against the loss of the key when the machine is doing its rightful service. The weight of the whole device I should imagine is not more than a couple of ounces, so that the fitment is suitable for every type of bicycle, and is as simple to operate as it is neat and sure. This is the sort of "extra" regular cyclists have been looking forward to purchase ever since cycle thieving became a profession, and, in my opinion, it justifies the description of a complete reply to registration and that curse of dishonesty, the cycle thief. Some years must elapse before its use becomes universal for, as at present designed, it is a built-in job; but the fact that the answer to all this registration nonsense is ready to market with the ending of the war, is one of the satisfactory things in cycle design and improvement we are waiting for.

Waiting For It

THE war news is such that it gives one hope that the European theatre will "close down" before another winter is on us. We all hope and desire that fact, for the relief from all our present daily troubles will be tremendous. What will happen thereafter is a speculation agitating the minds of most thinking men. For myself, I imagine cycling will go forward in a wonderful way, not merely as a result of its own intrinsic value, but because the economic position of most of us will be such that will suggest the use of the cheapest form of transport, but not, I hope, the cheapest type of bicycle. Surely we have had enough of the latter during the war when the manufacturing firms did their best, but were by no means proud of their products. What we shall need when peace comes to us is lighter and brighter bicycles, multi-speed geared, well saddled, and replete with stainless rims; bicycles to be proud of, and to ride with the conscious certainty that we possess a piece of marvellous machinery giving us a wide freedom and a way of health at a cost within the easy reach of millions. Personally, I have no doubts about the matter; my only trouble is to find the power to put over the story to those same millions who languish their leisure in dull places, and know not of the beauty and splendour a bicycle—and particularly a good bicycle—can give them. No doubt, even when peace comes to us, things will be difficult in the early days. We shall have to wait a while longer for the best in bicycles: our caterers will need to get into their strides again before that ultimate glory of cycling, the holiday tour, can be considered completely comfortable; but the start of peace will, I think, be the beginning of a wheeling epoch the like of which has never been seen. Yes, I believe in cycling because I know cycling, and to know it intimately is to love it intensely as a giver of joy.

Repeating History

AMONG the numerous letters I receive from interested readers many contain suggestions for the improvement of cycle design, and it is remarkable to observe that a high percentage of them tabulate notions that were tried out long ago and found wanting, or, at any rate, the then wheeling public would not have them. There is no point in enumerating the ideas propounded, for that would merely be waste of space; but it is interesting to note that successive generations of riders have found their inventive minds directed to similar things. Personally, I do not think we have reached limitation of design in bicycles, for there are many avenues open to welcome improvement, but I do think we are unlikely to see any major alteration commensurate with the Dunlop tyre or the original S.A. 3-speed hub. I have lived in the world of wheels long enough to remember the coming of the Dunlop and the sensation it made, and to now realize that event was "a once in a lifetime" happening, for even the S.A. gear and the Bowden wire cable did not stir imagination and trade as did the pneumatic. Several of my corresponding inventors are keen on lengthening the throw of the crank in its forward movement, and reducing the travel of the back stroke, and if it gives them any satisfaction, that has been the aim of thousands of people. It can be done, but only under handicaps of weight and very considerably increased cost, and it is doubtful if the gain in power, even if obtained in a very simple form, is worth the additional cost, or—more important to me—the upsetting of the easy rhythm of the pedalling action as we now know it. If there is any compensation in growing old, then some of it resides in watching history repeat itself and discovering that mankind stumbles on most good things by accident.

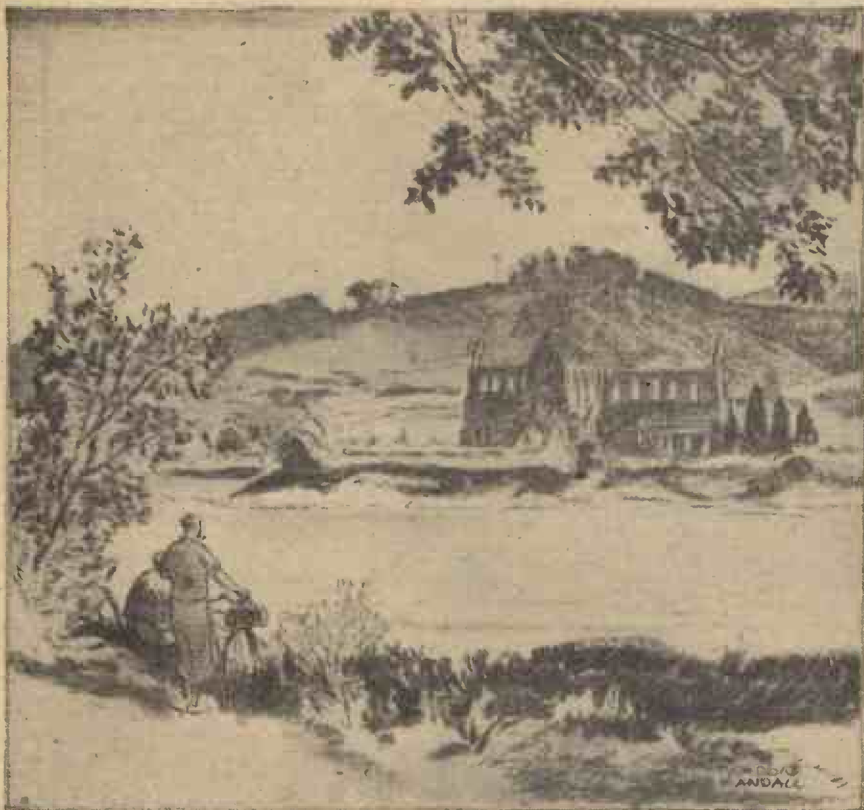


"Holidays at Home"

Many of us will be spending "holidays at home" this year. There is nothing like going right away on one's vacation, but if this cannot be managed, then a daily ride of anything up to a 100 miles, makes a good substitute.

CYCLORAMA

By H. W. ELEY



A glimpse of Tintern Abbey, Monmouthshire.

Synthetic Rubber Tyres

EVER since the loss of the Malayan Rubber Plantations and the need for rubber economy, we have heard a good deal about "Synthetic." It has always been surrounded by a certain amount of mystery, this question of the "substitute" for natural rubber, but I am glad to see that tyre-users are being given some hints about the use of tyres which contain some proportion of synthetic. And, what we have to do, apparently, is to see that such tyres are inflated *hard*, and kept *hard*. Simple enough advice, and really nothing different from that which tyre manufacturers have always given us . . . but we have so often neglected it! Well, I am told that it is just imperative to keep tyres hard when they have been made partly from synthetic . . . the penalty is—greatly reduced mileage! So wise cyclists now know what to do and will do it.

Cycling Parsons

MY recent comments about an aged Derbyshire rector who bought a new cycle, and took good care to buy a good one, so that it would last, have brought me one or two letters from cycling parsons of advanced age. It appears that country parsons live long, and that they are keen cyclists . . . and I doubt not that the cycling habit has had much to do with their longevity! But when one comes to think of it, it is obvious that the country parson has a job which renders possession of a bicycle a sheer necessity; what better mode of transport for "doing the rounds of the parish" than a bike? It would be interesting to know of the very oldest cycling parson!

Lure of the Dart-board

CAME, on a moonlight night, to a village in Hertfordshire where there is a good and ancient inn. And inside it there is a little low-ceilinged room sacred to the game of darts. And I can never resist the lure of a dart-board, so I sought a game . . . and how good it was to play this fine old game with some old village worthies who, despite the fact that they worked and lived quite near to London, nevertheless were true countrymen . . . speaking the country dialect, thinking country thoughts, and looking upon life through the eyes of the land, the cow-byre, the rick-yard, and the green meadows. And what worthy exponents of the game they were! If a townsman, fancying himself an adept at this old English game, ever thinks that he is necessarily superior to the countryman, let him enter some inn in a hamlet and try his skill against the "locals." He will very likely get a great surprise! After our games, I sat and smoked, and sipped ale with two of the villagers, and found them up to date in agricultural politics and full of optimism about the future of the English farm. And I cycled towards Mother London happy and optimistic too. . . .

The Cotswolds in Spring

FEBRUARY! And although it may still be winter, I find myself thinking of spring, and wondering whether I can steal away for a day, and go to my beloved Cotswolds, and look for snowdrops! I love those little virginal blossoms which seem to herald the arrival of all the floral hosts to come . . and I used to know just the dell, nestling in the very heart of the Cotswolds, where I could always be sure of finding them . . . and in February, too. Not very far from Stanway and Stanton Court . . . and if you know those delightful Cotswold places you will know why I long to visit them again. . . .

The Last Cycle Show

LOOKING over some business photographs the other day I came across a collection of pictures taken at the last Cycle Show to be held prior to the outbreak of war. What memories they brought back! Hard, urgent, unremitting toil to get a "stand" ready for the opening! Problems of display, memories of crowds touring the exhibition, of speeches about the cycle industry. . . . I found myself wishing that I was again in the thick of "show preparations" and longing for that good day when it will all be possible again. May it come soon!

Literary Chatter

A LOVE of cycling is often allied with a love of literature, I find, and just lately I exchanged "literary chatter" with a cycling friend, and found that both of us had been indulging in a sort of "course" of the classics. Both of us had grown a little tired of "thrillers" (though I confess to an abiding love for them!), and, curiously enough, both of us had turned to the same old book for quiet joy and instruction; Cobbett's *Rural Rides*. I commend it to all who would know more of their England, and who love to read of the English scene and character. At the moment I am dipping once again into *Pickwick* and finding, as every Dickensian ever does, that it is inexhaustible in its allure, and unsurpassed in its power to charm and entertain. Oh, for those spacious Pickwickian days, when tables groaned 'neath the weight of boiled fowls, and gargantuan pies, and mounds of cheese, and bottles of claret, and port and bottled beer! Oh, for the inns of Pickwick's day, when landlords greeted the applicant for a bed with beaming smiles, and straw-chewing ostlers sprang from the dim corners of stable yards to take one's horse and give it "good stabling." The days are gone . . . but Pickwick remains, and we can journey and laugh with him still.

Road Accidents

THE death-on-the-road figures are still tragic. Many factors account for the still far-too-high figures, but I wonder sometimes whether parents are as thoughtful and wise as they might be in connection with the use of the roads by small children. The child on a toy cycle can be, and often is, a real menace to other traffic, and I have seen many children riding who have no control of their small machines, and who are quite unfitted to be allowed on a modern road. And when one meets groups of these kiddies, cycling happily but carelessly to school, one feels that legislation should take a hand and forbid them the road. Now, no wails about "freedom," please! There is no freedom in folly!

Brighter Shops!

MOST of our shops—and I include cycle shops—need a coat of paint; they are getting shabby after over four years of war! But I know the difficulties, and so just sigh for the day when we shall be able to smarten up our shops, and put in colourful window displays, and say good-bye to this dreary drabness which is not the least of the bad things which Hitler has brought upon us. Meanwhile, I think that traders do their best, and I have seen some quite ingenious efforts at window display . . . "home-made" efforts which show that the zeal and the enterprise of our retailers is not dead . . . merely sleeping an involuntary sleep!

AWHEEL . . . IN SAFETY

When you obey the 'call of the open road' be sure that you can rely on your brakes. Wet or fine, on steep hill, dangerous cross-roads or treacherous curve you can rely on Ferodo All-weather Brake Blocks. In all emergencies they grip firmly and noiselessly giving confidence and safety along every mile you ride. Be sure to fit

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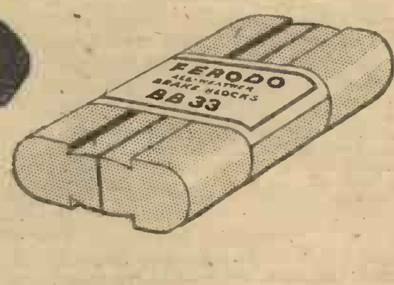

ALL-WEATHER BRAKE BLOCKS

REGD. TRADE MARK FERODO

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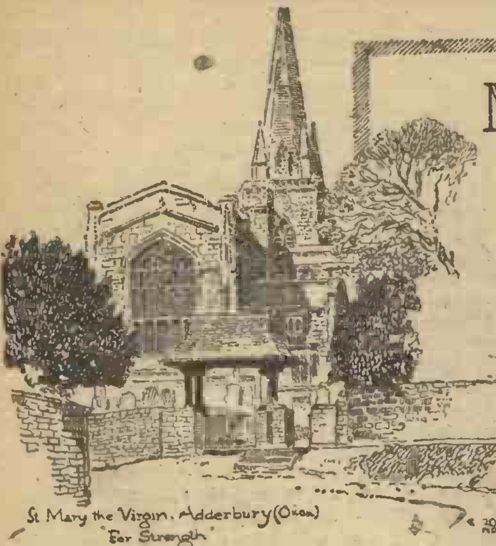


My Point of View

BY "WAYFARER"

Dazzle, and Deep Waters

IN that part of the world which I call "mine" (without implying ownership!), the weather on the penultimate Sunday of January was a mixture. It followed what the sailor-men speak of as a dirty night, but it departed from pattern—for a time. On the Saturday evening, ignoring the darkness and the rain, I had deliberately done a 30-mile journey, when two-thirds of that distance would have carried me home. On the Sunday morning—I hate to say it!—the sun, low in the heavens and shining on wet roads, was something of a nuisance, dazzling to the eyes in a mildly painful manner. One does not complain of sunshine in January, of all months, and it was really delightful to behold the liquid gold.

I picked up an old friend at lunch, and thereafter we set forth for a village three miles away in order to obtain tea. As, however, the journey occupied two hours, it is obvious that we did not seek the shortest route. In other words, we "made a ride of it." We were interested in noting the effect of the over-night rain. The little rivers were brimming, their attendant willows standing knee-deep (as it were) in the flood, and angry, tumultuous waters hurried across the fields and under the bridges. Here and there a new stream had come into being, flinging itself downhill or over the road, in a most reckless, irresponsible fashion, and making the most of its brief life.

The morning dazzle had long since departed, and a grey sky reigned supreme. When we turned into the bitter, searching wind, life was not so easy, but there came a lucid moment at sundown when the sky momentarily cleared and displayed a riot of colours in the west, giving us also a glimpse of distant hills. The house aimed at for tea turned us down owing to illness, and we went forward to the cottage which had provided our midday meal, there eating hot buttered toast and absorbing many cups of tea in an atmosphere of warmth and joviality, and forgetting the ordeal through which we had passed.

Afterwards we lived again the strenuous life, battling with a fierce cross-wind, which ultimately developed into a head-wind, accompanied by cold rain. Despite difficulties and discomforts—and remembering the joy of the morning sunshine—we wrote down the day as a good one. It was a day of acceptable adversity—a day to recall with pleasure—and the process of jotting the figure "70" in my diary (representative of my mileage) crystallised the delight of an experience in which dazzle and deep waters played very definite parts. Of the ultimate glory of the night sky of black velvet, pricked by a million brilliants, one can only say that it added a fitting crown to a good day.

"It Never Rains . . ."

THE recent experience of one of my cycling friends seems to show that there is some truth in the old tag that "it never rains but it pours"—as some of us know from the incidence of punctures. This man keeps three bicycles in commission. The front forks of one collapsed the other day. Almost immediately afterwards a horse knocked over and trampled on a second bicycle, necessitating extensive repairs. Up to the moment of going to press, the third machine is intact and in use, and it is to be hoped that the "rain" has stopped. Two such incidents all at once, in these days of scanty (and second-grade) repairing material, are a trifle unfortunate for a keen cyclist who, living on an isolated farm, must rely on bicycles for transport to and from business in an adjacent city.

Deaf Ears

IT is well known that if you tell the man in the street a thing often enough he will come to believe it. Hence the success of 101 quack remedies for pains in the back, bad legs, spots in front of the eyes, and so on and so forth. But when the man—or woman—in the street does not hear what is said, or see what is written, where are you? Just nowhere! We who travel on wheels have had impressed on us for some time past the urgency of proper inflation of tyres, but those words of wisdom have fallen on much stony ground and there is no harvest in certain directions.

One day recently, at a Shropshire haunt, I fell into conversation with two middle-aged ladies who were having tea, and when the meal was over I had a look at their bicycles. One was five years old and in good condition; the other was at least four times the age, and in shocking condition. But there was little to choose between the two machines so far as the state of the tyres was concerned. Having secured the consent of the ladies, I got busy with my pump (a real one!) and did the needful. "There!" I said. "Now you'll be able to ride in comfort and with efficiency, and you'll prolong the life of your tyres, which are in very short supply nowadays." The ladies thanked me—but I could not help wondering whether I had not been "wasting my sweetness on the desert air."

Quick Decisions

ONE of the most important things, as a cyclist, is to know what to do in an emergency—and then to do it. Two of us were traversing a narrow, and (as we thought) a deserted, lane, riding "all over the road"—a policy suggested by the seclusion, and dictated by the broken surface. Suddenly, round a bend, came two other cyclists, travelling in like manner. The total speed was considerable, and instant action was necessary if collisions were to be avoided. As it happened, all four cyclists did the right thing. The two inner men of each party accelerated; the two outer men reduced speed and each got in behind his companion. Thus nothing untoward occurred. But it was an occasion for quick decision, and there was no time for mental fumbling. This is a worth-while lesson which can be gathered up only in the hard school of experience, where one learns to do the *safe* thing.

On another recent occasion two of us, emerging from a lane into a secondary road on which traffic was not expected, saw a hurrying motor-car approaching. There would probably have been time for us to cross over in front of the vehicle and take up our rightful position on the road, but instinct said "No! Stop!" and we both pulled up. This was the safer plan.

"Some" Detour

I WAS interested to read in my newspaper the other day that General Eisenhower, on his way to this country from North Africa (or thereabouts) called in at Washington and had an interview with President Roosevelt. Evidently the Supreme Boss of the Second Front is a man after my own heart, though my detours are very "small potatoes" in comparison with his. As a cyclist, however, I am all for roundabout routes from one place to another.

Jest

A WAR correspondent in Italy reports that a local cyclist threw a bomb at a lorry full of Germans, killing the lot. Perhaps, thereby, not improving the general reputation of cyclists!

Notes of a Highwayman

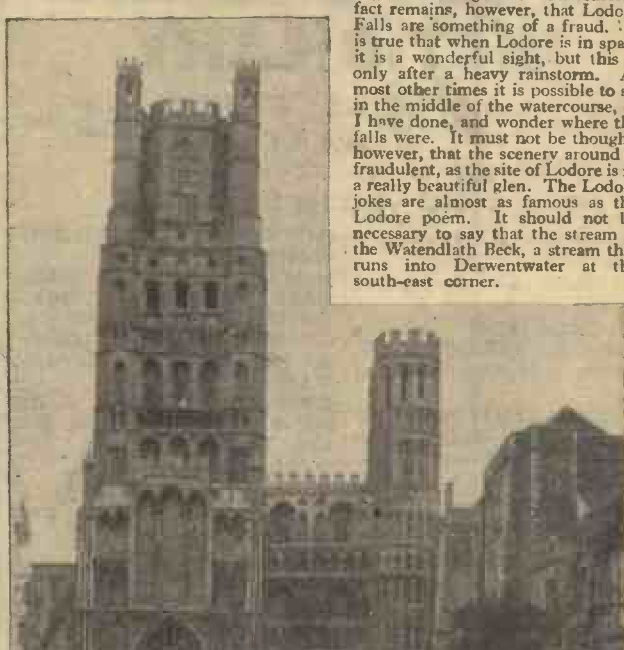
By LEONARD ELLIS

A Fenland Gem

THE Isle of Ely is one of those so-called islands—one that just comes within the definition, because it was at one time surrounded by water. There are many such inland islands in this country, relics of the days when the Fens were not so well drained as they are to-day. History tells us that owing to its position, surrounded by fens and marshes, it was once a place of refuge. Ely is a somewhat little town, standing on one of the comparatively high spots in Fenland and is often called the capital of Northern Cambridgeshire. The county is not one that draws cyclists by the hundred to visit its charms, but in Ely at least there is a glorious attraction in its superlative cathedral. Although, perhaps, it is not considered one of the finest of our beautiful churches, it is certainly unique in its design. Its towers can be seen from Peterborough Cathedral, 35 miles away, and from nearer view points it bulks on the skyline, appearing so huge that one can imagine that one sees a mirage. The nave is Norman, and one of the outstanding features of the exterior is the fourteenth century Octagon. Many parts of the church have collapsed in its 800 years and have been rebuilt and restored, without, however, destroying its beauty. It was the collapse of the tower that led to the building of the Octagon, a feature that is not to be found in any other English cathedral. It is said that it was built owing to an error of judgment on the part of the architect. He realised almost too late that the span was too great for a stone dome and consequently he built it of oak. After searching the country for eight oak trees, free from fault and big enough for the task, they were cut from Chicksands in Bedfordshire. Like Wells, Ely has something to be said in its favour from a photographer's point of view. It can be seen and photographed from a distance without a wide-angle lens, and without the necessity of tilting the camera. Although sleepy the town itself is far from uninteresting, and is a real haven of peace.

A Lakeland Fraud

FROM the low-lying country of the Fens we travel swiftly to the highlands of Cumberland, England's lake country. Here we can see another feature, this time a natural one, that is world famous. The Lodore Falls are perhaps as well known as any falls in England, and this is probably due to the publicity given to them by the poet Sourhey, who wrote a magnificent and thrilling poem extolling the dashing falls. The curious fact remains, however, that Lodore Falls are something of a fraud. It is true that when Lodore is in spate it is a wonderful sight, but this is only after a heavy rainstorm. At most other times it is possible to sit in the middle of the watercourse, as I have done, and wonder where the falls were. It must not be thought, however, that the scenery around is fraudulent, as the site of Lodore is in a really beautiful glen. The Lodore jokes are almost as famous as the Lodore poem. It should not be necessary to say that the stream is the Watendlath Beck, a stream that runs into Derwentwater at the south-east corner.



Elv Cathedral.

SIR WILLIAM ROOTES, K.B.E., on Road Problems—(*Continued from page* 41.)

fore, more than anyone else, rests a great responsibility—a responsibility for bringing about a new state of affairs to the benefit not only of employment, but of the country as a whole. I am sure that Lord Leathers will not let this opportunity pass, because it is an opportunity. We have always been told in pre-war days, that we cannot change it, that we cannot start again, that this and that cannot be done, but no Government has had such an opportunity presented to it like ours to-day, where they have expert planning, where they have a world receptive for new ideas, where they have a determined courage, where there will be a great change, and this country will gain in prosperity and, as an empire, will be able to hold its own in matters of commerce.

"I also feel that the Government can be certain of one thing, and that is that, as time goes on, there will be a growing volume of public opinion in this country that the citizen should have as much freedom as is reasonable for rebuilding our national effort and giving scope and initiative for enterprises without which, to my mind, we cannot become competitive and successful.

"I hope that these few remarks which I have made at random will appeal to you all. You as Roadfarers must obviously be looking forward to what is to come, and I feel at any time that transport, whether rail or road, requires a greater volume of support, it will be forthcoming."

Professor A. M. Low, in proposing the toast of "The Visitors and the Press," accentuated the remarks of Sir William Rootes, but thought that there should be a move for more silence on the roads. In replying, Mr. H. G. Wells said: I will do my aged best to respond to the very flattering reception the Roadfarers' Club has accorded me. Nowadays I am a Roadfarer in spirit rather than in fact. I don't get on the road very much; gout (richly deserved, thank Heaven!) and a patriotic disinclination to use petrol (which also I can't get, anyhow) keep me in London. Such ways as I follow nowadays are sea-ways and air-ways. If I travel much in future, it will, I hope, be by Brabazon No. 1, for your president, the Lord of Tara, is also no longer a Roadfarer. Like all the rest of us here I *profess* nomadism. I am by habit and nature a nomad. I hated my home as a child and rejoiced to leave it. I admit it was not a model home. Mostly I lived in an underground kitchen, or in an attic that let in the wet, and I spent as much of my time as possible in the streets of Bromley. *Home, Sweet Home* meant nothing to me. But does it mean much more to any of us Roadfarers? *Home, Sweet Home* is a sentimentalist's dream. Suitable for singing abroad. As far abroad as we can get. Then nostalgia ceases to be a vice and becomes a pleasure. But people who really want to live at home for good and all—well, it seems to me that the proper penalty for them is to put them in a Home—for good and all.

All this talk that is being bandied about, about putting men back in the places to which they belonged before the war, fills me with protesting doubts. Only the other day I was publishing a letter from an admirable British soldier, in hospital in the Middle East, a Zulu namd Hlope. His one passionate desire was that he should never be sent back to servitude and inferiority in South Africa, and I believe there are hundreds of thousands of British soldiers who will be of the same mind. Back to the old round? No fear! They won't want to be put back. We haven't fought this war to be put back.

Never in all my life have I wanted to stay put. Directly bicycles became available for me I got one and went off on it. Directly I could get a car I got a car and went off in it, driving dangerously, I admit, but anyhow getting away. I believe you are all with me to-day in a unanimous detestation of being rooted to the soil. I am a man, not a tree.

Here on my right hand I find Sir William Rootes, and I am happy to say he has belied his name and pulled himself up to join us Roadfarers. On comparing notes we find we both belong to that great nation, that star upon the front of England, Kent, which still to this day sustains the equestrian tradition, the Roadfaring traditions of Hengist and Horsa. Those two came to England by sea. Yes! but they didn't call themselves seamen. They were riders, and they must have ridden a long, long way before they reached Jutland and jumped the narrow seas to Kent.

Well, you will be wanting to hear what Sir William has to tell you, so I will end this little Hymn to Movement.

I have lived in a great variety of places, I have built several houses, but always I have shaken them off, given them away, thrown them away, with infinite relief and the happy expectation of new and refreshing experiences.

At present I am interned in a house upon Regent's Park. I can die very comfortably there if need be, but I am just as willing for my ashes to enrich the soil of China or Peru or South Africa.

So let us move on to the next speaker. Move on, says the Great Policeman. Get a move on. That, I take it, is what this Club exists to assert, and which I have done my best to underline.

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