OUR AIRCRAFT CARRIERS

NEWNES

PRACTICAL MECHANICS

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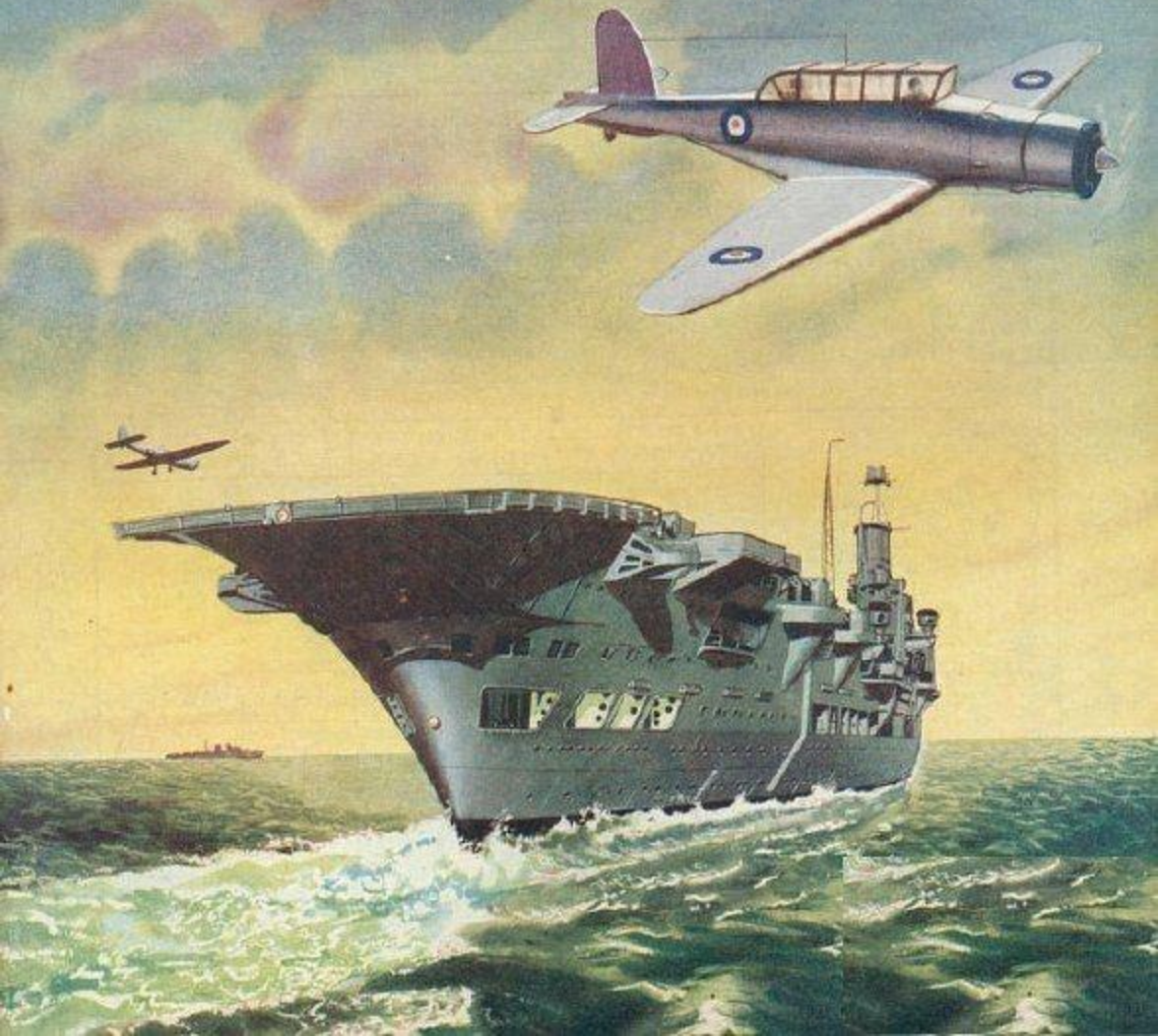
MARCH 1941



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PRACTICAL MECHANICS

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Editor: F. J. CAMM

VOL. VIII. MARCH, 1941 No. 90

FAIR COMMENT
By the Editor

Mobilising Man-Power

MR. CHURCHILL, in his last broadcast, the most brilliant he has ever made, ended on a note which has special significance for engineers and technicians. He said, referring to America, "Give us the tools and we will finish the job!" He had earlier indicated that he would not require the assistance of the American army this year, next year, nor as far as he could see, any year. In our companion journal, *Practical Engineering*, which is more directly concerned with engineering and engineers, I have constantly stressed the fact that this is a war of technicians and tanks, aircraft and arms, that it is not a war of large armies, and that therefore the late Government were lacking in vision, and indeed, living in the military atmosphere of the Battle of Waterloo, when they disrupted industry by calling tens of thousands of skilled men into the Army without making colateral arrangements to ensure the supply of equipment for them. The present Government is more alive to the situation as is evidenced by the broadcast remarks of Mr. Churchill. Somewhat belatedly, it may be felt, we are considering the mobilisation of man-power from a productive point of view. It is generally recognised that we do not want a particularly large army, for a thousand aeroplanes and a thousand tanks are more effective than half a million men.

Technical Knowledge

THESE are the days for the men with technical knowledge. Never before has technical knowledge and practical ability been in such great demand. So great indeed is the latter that there are not enough skilled men to go round, and training schemes have been introduced so that we can produce semi-skilled labour in adequate quantities. My comment on the trainee scheme is that it would be far better to take the trainees straight into the factories and teach them the work they are required to do, rather than to put them through some arbitrary course on subjects and operations they will not be called upon to understand and perform when they enter the factories. It is waste of time to teach a man to use a file if he will be put on a capstan lathe, waste of time to teach him how to operate a capstan lathe if he is expected to act as a viewer.

One of the causes of labour shortage has been the schedule of reserved occupations, under which a man is reserved according to his age, and not according to his ability or the work he is performing. There are many skilled men between the ages of 20 and 30 who have been called to the Army because their ages did not fall within the limit set by the schedule. There are tens of thousands of comparatively unskilled men reserved because of their age, and engaged in the manufacture of goods not concerned with the war effort.

Reserved Occupations

THAT system, under Mr. Bevin's new plan, is to go, and a man will be reserved according to the work he is doing and not according to his age. The skilled technicians are required in this war; they are, indeed, fighting the war. The Minister of Labour plans to utilise women wherever possible. This may be a useful move in unskilled and the lower grades of semi-skilled labour. We hope that the newspapers will refrain, however, from letting them bask in the artificial sunlight of public adulation, as they have done in the past. Illustrations appear in our daily newspapers with captions suggesting that in a few weeks women are able to replace skilled men. This is specious nonsense. Women cannot perform skilled work after a few weeks of training. With some experience of female labour in the last war, it is my view that they produced rather more scrap than they did perfect specimens. They doubtless were doing their best, and no one blames them because their limited skill prevents them from doing the work of a skilled man, but it is offensive, insulting and impertinent for anyone to suggest that women are doing the work of skilled men. The latter particularly resent it, for it suggests that they are labourers. Let us not lose our sense of proportion.

It must not be presumed that because a man is not engaged on the manufacture of munitions, he is not contributing to the war effort. The essential services, road transport, railways, and trams, the production of foodstuffs and clothing, the medical services, and the technical colleges are all as much a part of the war effort as the munition factories. It is as important for a worker to get from his business as to "go to it."

Price Increase

UNAVOIDABLY, your next issue of "Practical Mechanics" will cost you 9d. The very heavy increase in costs of periodical production have forced this move upon us. Not only have paper costs steadily risen since the outbreak of war, but costs in other directions have risen also. We preferred to increase the price by 1d. a month rather than to reduce the number of pages or diminish the quality of our editorial features—the only possible alternatives to price increase.

But at 9d., "Practical Mechanics" represents very high value indeed. It brings to you the services of the most expert contributors, draughtsmen and artists, a readers' query service without peer, up-to-date technical features, a technical news service, and a patent advisory service not obtainable elsewhere.

We know that our readers will appreciate our difficulties and appreciate that the extra penny represents only a proportion of the increased costs we have to meet.

Technical Books

WE have just issued a new 16-page catalogue giving details of our practical reference books for electrical engineers, radio mechanics, aero-engineers, mechanical engineers, motor mechanics, instructors, and students. Copies of this catalogue are available free to any reader addressing a postcard to the Publisher, Book Department, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2.

A new book which is finding favour is "Practical Leatherwork and Allied Crafts," selling at only 1s. It contains 96 pages, 179 illustrations, and the contents include: Leather; tools and materials; modelling and transferring designs; embossing, monograms, plating, weaving and piercing; tooling; lining thonging and sewing; a tooled handbag; applique; raffia work; wool rug making; painting on leather, fabrics and parchment; gesso decoration; batik dyeing; stencilling; beadwork, lampshades and candleshades.

Those engaged in the various services, as well as munition workers, are reminded of our recently published books:—"Diesel Vehicles: Operation, Maintenance and Repair," 5s., by post 5s. 6d.; "Motor Car Principles and Practice," 5s., by post 5s. 6d.; "Gears and Gear Cutting," 5s., by post 5s. 6d.; Newnes' "Engineers' Manual," 6s., by post 6s. 6d.; "Watches: Adjustment and Repair," 6s., by post 6s. 6d.; "The Flying Reference Book," 5s., by post 5s. 6d.; the new editions of "Workshop Calculations, Tables and Formulae," 5s., by post 5s. 6d.; and the "Pratical Mechanics' Handbook," 8s. 6d., by post 9s.; "The Dictionary of Metals and their Alloys," 5s., by post 5s. 6d.; "The Superhet Manual," 5s., by post 5s. 6d.; "Practical Wireless Service Manual," 7s. 6d., by post 8s.; "Wireless Transmission," 5s., by post 5s. 6d.; "Newnes' Short Wave Manual," 5s., by post 5s. 6d.; "Practical Wireless Circuits" (new edition), 5s., by post 5s. 6d.; "Practical Wireless Encyclopaedia" (new edition), 10s. 6d., by post 11s.; "Radio Training Manual," 5s., by post 5s. 6d.; and the "Radio Engineers' Vest Pocket Book," 3s. 6d., by post 3s. 9d.

The Care of Accumulators in

Various Types of Batteries, Charging and Upkeep, are

A. H. Avery,

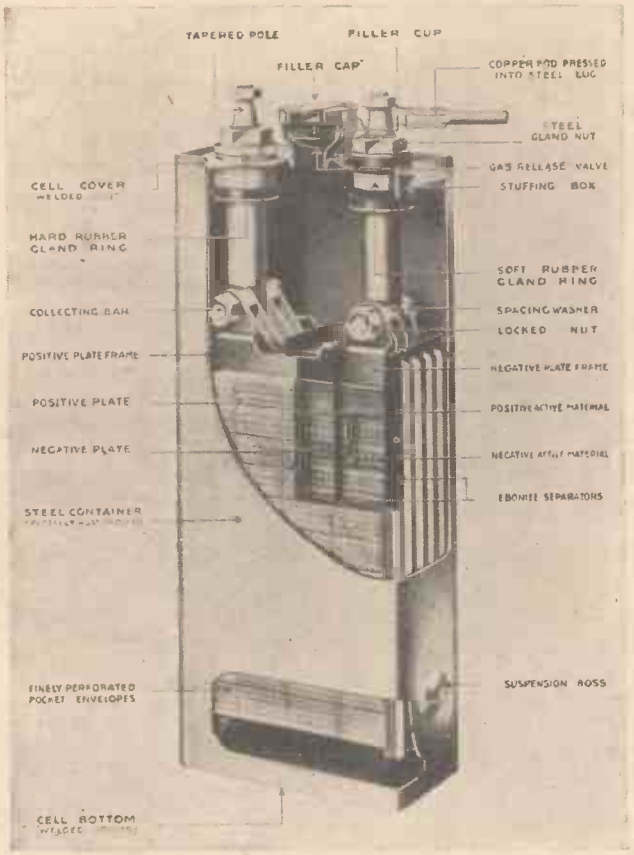


Fig. 2. A "Nife" nickel-iron cell with the casing partly broken away to show the plates, etc.

MANY of us in times like the present are viewing with some concern the condition of our car batteries, whose utility is either greatly restricted through petrol rationing, or maybe is completely put out of service for the time being. To keep accumulators in condition while disused, needs special precautions being taken, otherwise they will deteriorate to an extent that renders them of little service for further work. There is more than one type of accumulator in use, and first of all it is highly important to differentiate between them, since the treatment suitable for the one kind would entirely ruin the other.

The large majority of accumulators used for lighting and car starting are of the lead-acid type, consisting of lead plates in grid form filled with a paste of lead oxide immersed in a sulphuric acid electrolyte. The bugbear of such batteries when out of use is the ailment known as sulphation, that is, the formation of white patches on the grids of inert material which seriously deprives the battery of its ultimate output capacity. How to prevent this trouble, and how to restore a sulphated battery to its normal state again when once it has got into such condition is a matter well worth attention. Although mainly concerned with batteries of the car type at the moment, the treatment recommended will apply equally to most accumulators of the stationary type employed in private lighting installations as well as portable and ignition batteries. In the ordinary conditions of road work, we scarcely give a thought to the condition of our batteries, since they automatically take care of themselves beyond the occasional need for topping up any acid lost by evaporation: the car dynamo looks after the other requirements. But an idle accumulator with no work to do, either on charge or discharge, will soon develop trouble, and if the car has to be laid up for an indefinite period the accumulator should be detached and given special treatment.

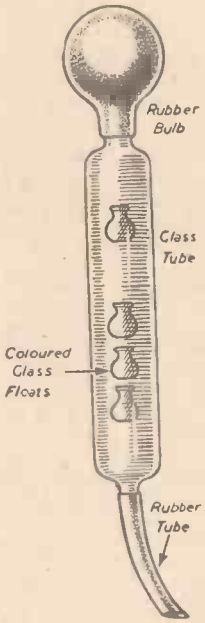


Fig. 5. A "bead" hydrometer

Lead-Acid Accumulator

A word of caution is here necessary. Beside the usual lead-acid type of cell there is another kind known as "Nife" batteries. These are entirely different in their construction as will be gathered by comparing the following description of their make-up and chemical action. In the lead-acid type the plate grids are filled with a paste of lead oxide, and after the initial "forming" process the positive plates consist of lead peroxide (PbO_2) and the negative plates spongy lead (Pb). Both sections are immersed in a solution of brimstone acid (H_2SO_4). When the accumulator is discharging, the negative plate combines with the sulphur and oxygen of the electrolyte forming sulphate of lead ($PbSO_4$), hydrogen (H_2) from the acid being liberated and given off in the form of minute bubbles of gas. Hydrogen is also evolved from the positive plates as well as oxygen, these two gases combining to form water (H_2O), thus diluting the solution of acid and lowering its specific gravity. The latter forms to some extent an indication of the charged or discharged condition of the battery, taken in conjunction with the voltage at the terminals. When discharged, both plates become $PbSO_4$, or sulphate of lead, a condition which must not remain too long without recharging, or the sulphate assumes an almost insoluble form, and by reducing the effective area of the plates seriously impairs the output capacity of the cell. Recharging by reversing the direction of current through the battery causes the positive plates to return to the condition of lead peroxide, sulphur being given up and entering into combination with the watery electrolyte. This increases its strength and raises the specific gravity once more. The negative plates, which had also been temporarily converted into lead sulphate when discharged, now give up their sulphur and oxygen molecules which by again combining with the acid solution further increase its density, the plates themselves returning to their spongy lead condition.

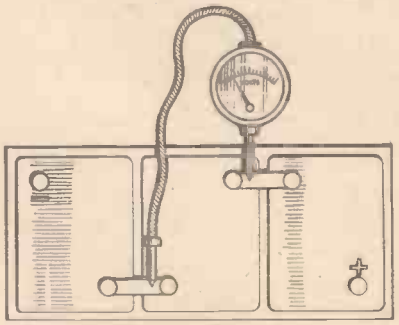


Fig. 4. Taking tests with a voltmeter.

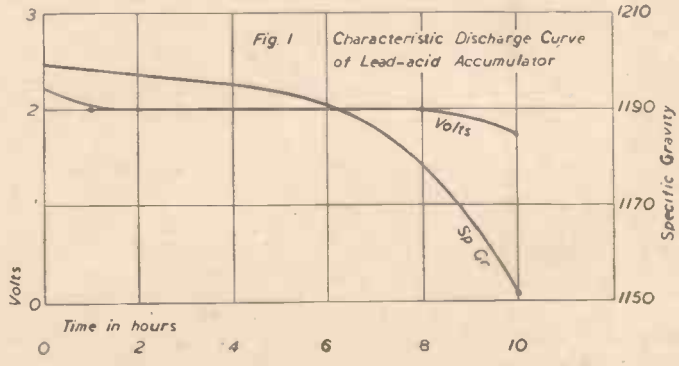


Fig. 1 *Characteristic discharge curve of lead-acid accumulator*

Wartime

Methods of Explained by A.M.I.E.E.

The lead-acid accumulator gives approximately 2 volts per cell when discharging during its useful life. When this figure has fallen to 1.8 volts per cell it is an indication that the battery is discharged to all intents and purposes, and it should not be further discharged until once again re-charged. The acid solution or electrolyte consisting of sulphuric or "Brimstone" acid should be of 1.200 specific gravity when first put into the battery. During the early stages of charging this usually falls to the region of 1.170, but rises as the charge proceeds, reaching 1.200 or 1.205 when charging is complete. In practice the state of charge or discharge can be estimated first by the voltage per cell, and secondly by the specific gravity of the acid, the two accompanying curves, Fig. 1, representing the changes which take place.

"Nife" Batteries

Turning now to the second type of accumulator of "Nife" batteries, the construction of a Nickel-Iron cell is clearly shown in Fig. 2, and must not be confused for a moment with the lead-acid cell, either in make-up or chemical action.

Those who have the charge and maintenance of accumulators need to be most careful in ascertaining which kind of battery they are dealing with, since to fill the cells with the wrong kind of electrolyte, for instance, would have disastrous results. The nickel-iron battery is different in every respect from the lead-acid accumulator. The illustration, Fig. 2, shows one of the products of Messrs. Nife Batteries, Ltd., of Redditch. In the positive plates, the active material consists chiefly of nickel hydrate, while the negatives contain a preparation of cadmium and iron oxides. Both sets of plates are identical in mechanical construction, the ingredients being first pressed into briquettes, and then enclosed within finely perforated envelopes securely fastened to a steel framework. Great mechanical strength results from this construction, while the whole assembly, being mounted in a plated steel container, makes an extremely robust and shock-proof unit. The electrolyte used in these cells is a solution of potassium hydrate in pure water, of 1.17 specific gravity. The chemical action is reversible, consisting of the transference of oxygen from one plate to the other. Thus on discharge the nickel hydroxide in the positive plate is reduced to a lower form, while the cadmium and iron in the negative plate becomes oxidised. The exact reverse takes place on charging, the metallic oxides being reduced to the pure metals once more. The electrolyte itself does not enter into chemical combination with the plates, and its specific gravity remains constant irrespective of the state of charge or discharge. The chief attraction of alkaline accumulators is their immunity to damage arising from long periods of idleness, short circuiting, and such occurrences as would be disastrous to the lead-acid type. On the other hand the voltage per cell is lower, more are needed for a given purpose, and the bulk is somewhat greater. Their average charge and discharge characteristics are given in the curves (see Fig. 3), and should be compared with those of the lead-acid type shown in Fig. 1. Greater immunity from damage through idleness is claimed for the alkaline accumulator as, of course, sulphation does not take place, but it is desirable to renew

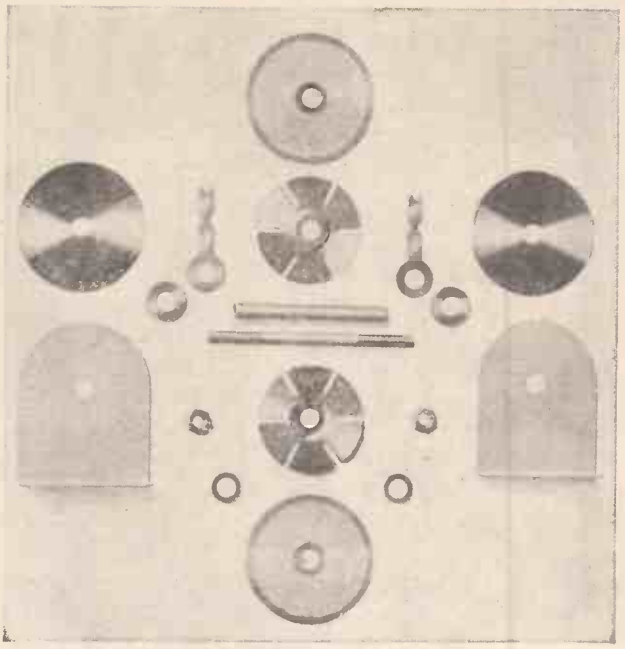


Fig. 6. *Component parts of a selenium rectifier.*

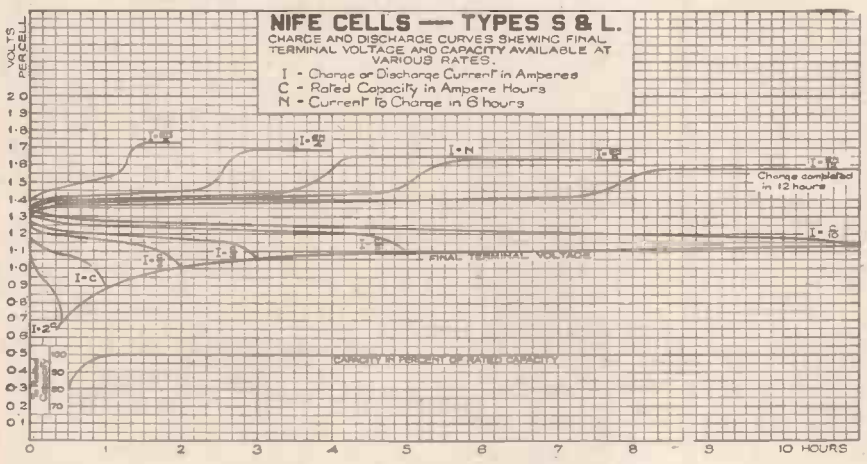


Fig. 3. *Charge and discharge curves of "Nife" cells.*

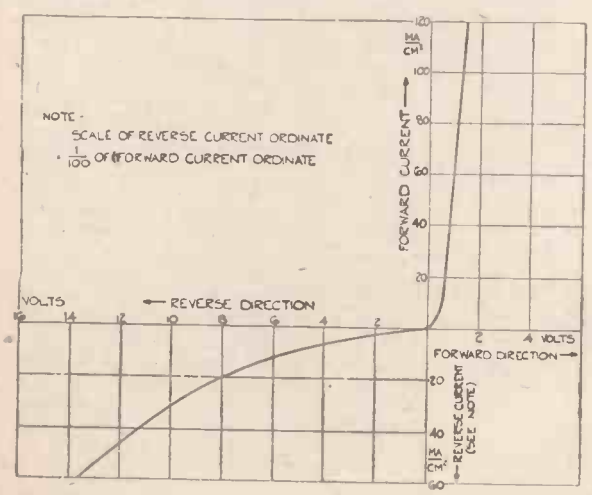
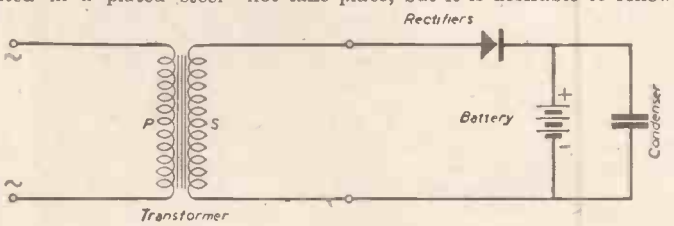


Fig. 7. (Left.) Static characteristic of a selenium rectifier disc, having effective surface area of 1 C M².



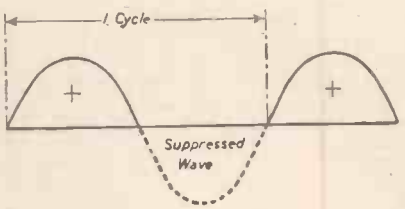


Fig. 8. (Right.) Theoretical circuit and curve of a half-wave rectifier.

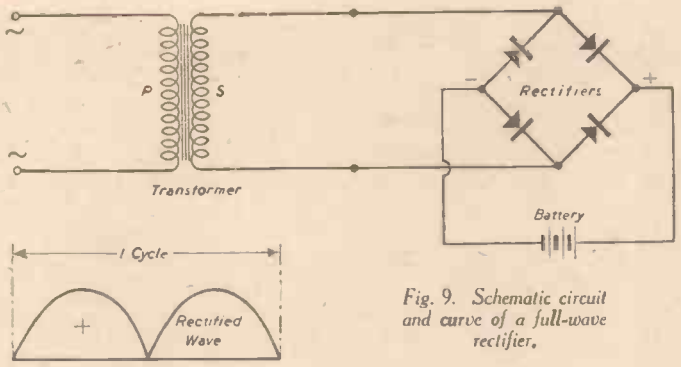


Fig. 9. Schematic circuit and curve of a full-wave rectifier.

the electrolyte completely once every twelve months. When entirely out of service the best way to keep alkaline cells is to store them in a half-charged state—the plates being well covered with electrolyte, the terminals well greased, and the vent plugs closed—in a clean and dry situation. When required for use again, nothing further should be required to restore them than an initial charge of double the normal length at the standard rate.

Car Batteries

Most car batteries of the lead-acid type are supplied in sealed-in boxes so that the internal condition cannot be ascertained by inspection. The only tests usually possible are the voltage across the terminals, and the condition of the acid taken by hydrometer method. These two tests will enable a fair estimate to be made as to its general condition, and its state of charge or discharge. They do not indicate, however, any loss of capacity or ability to discharge at a certain rate in amperes for a definite time, due to sulphation or other troubles. To check up on these points needs a definite rate of discharge in amperes being taken from the battery until the terminal voltage has fallen to 1.8 volts per cell, the time and the current multiplied together representing the discharge capacity in "Ampere-Hours."

In taking voltage tests, all cells should be tested separately, and not merely the whole voltage of the battery. Voltmeters with flexibles terminating in spikes are convenient for that purpose, applied to the opposite terminal lugs of any one cell in a sealed battery, as in Fig. 4. A freshly charged battery will indicate about 2¼ volts per cell, but directly any discharge is taken from it the voltage will fall to 2 volts and remain approximately level at that figure until the cell needs recharging, when a further drop of voltage rapidly sets in. No further discharge should be allowed after any cell has fallen to 1.8 volts, as a battery in this condition almost at once begins to suffer from sulphation and loss of capacity which will be difficult to restore. As already stated, the acid solution undergoes changes, both during charge and discharge, and is also useful in determining the state of charge remaining in a cell. Specific gravity tests, however, are not quite so simply carried out as voltage tests, as it is necessary to withdraw some of the acid for that purpose. One of the most convenient ways is by means of the "bead" hydrometer combined with a rubber bulb, similar to the sketch in Fig. 5. The outer gas tubes contain four coloured glass beads or floats, each one floating at some particular density of the liquid. A short rubber tube at the lower end enables it to be inserted through the vent plug of each cell, and by first squeezing and then releasing the rubber bulb at the top some of the acid is drawn up in which the beads float. After testing, the acid is returned to the cell. The coloured beads usually float at densities of 1150, 1170, 1190, and 1210 respectively, and to read the results the one which floats nearest to the centre of the tube is taken to indicate similar specific gravity with the acid surrounding it. Sometimes they all sink or all float, or one or more may sink and the others remain at the top, in which case the density of the liquid is at some figure intermediate to that of the two leads nearest to the centre. In a freshly made up battery the density of the acid when first put in is 1.200. This almost at once drops to about 1.150 before charging is started, and during the charge rises steadily and slowly until it reaches 1.200 or even 1.205. Progress of the charge can with a little experience be closely estimated when taking both voltage and specific gravity conditions into account. In all cases, however, it is wise to follow the exact instructions to be found on the labels attached to the accumulator, since there is sometimes a slight variation in acid densities with particular types of cell.

Sulphated Plates

When through disuse or neglect the battery plates have become badly sulphated there are three remedies that can be applied. The first is purely mechanical and consists of lifting out the affected sections and thoroughly scraping off the white deposit of insoluble sulphate of lead. This, of course, means opening up the cells, and in amateur hands this may be a little risky, leading to even worse troubles in reassembling and re-sealing, but it gives an opportunity of examining the condition of the plates, and this is an advantage, because grids that have lost a good deal of paste can never be wholly restored to their original ampere-hour capacity because of this loss of active material. Any such paste, whether in the form of pellets or "mud" found deposited at the bottom of the container, must be carefully washed out with clean water before reassembly.

When the plate sections are kept apart by wood separators there is usually little trouble from buckling of individual plates, but should this be present the opportunity should be taken of pressing all such defective plates flat once more by carefully squeezing them between slips of wood. Hammering is not permissible.

Fig. 10. A standard selenium-type rectifier as used for trickle charging.

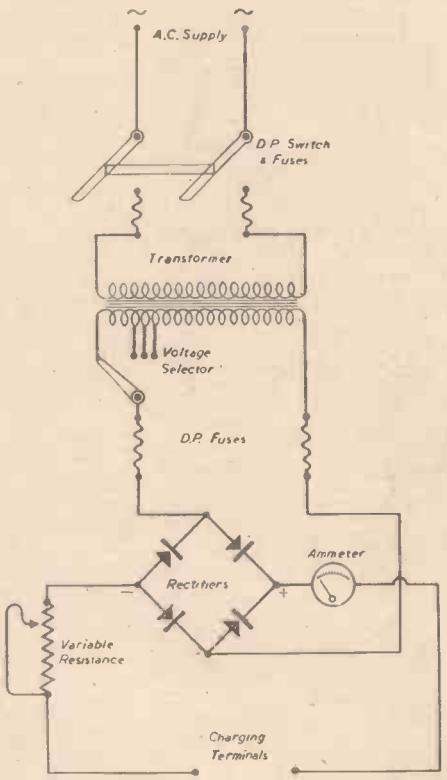


Fig. 11. Circuit diagram of a selenium-type rectifier.

The second method of treating a sulphated battery is a chemical process, and although easy to apply, is seldom successful if sulphation has gone too far. It consists simply of adding a small quantity of carbonate of soda to the electrolyte, dissolved in water, and relying upon the vigorous gassing which results in dislodging some at least of the sulphate. The cell must, of course, be washed out thoroughly with clean water afterwards, and filled with fresh acid, following immediately with a long slow charge.

"Normal" Rate of Charge

The third method, and the one usually most effective, is an electrical treatment, and is carried out by giving the battery a very prolonged charge at a quarter of the usual rate in amperes. This brings up the question as to what is a "normal" rate of charge? As a rule this can be answered best by consulting the label of instructions which should be attached to every accumulator. When, however, this is not available a safe rule is to charge at a rate equal to one-tenth the full ampere-hour discharge capacity of the battery.

(To be continued)

A Wind-driven Generating Plant

Constructional Details of an Efficient Home Constructed Unit

WHEN considering the construction of a wind-driven charging plant, I was doubtful of my ability to make a suitable propeller, and I therefore obtained one ready-made in the form of a wooden aeroplane propeller (a relic of the last war), 8 ft. 6 in. diameter, and with approximately 6 in. boss thickness. The angle of the blades is about 30 deg., and in view of the wind speeds normally attained, it seemed evident that a propeller speed of about 180 r.p.m. should be aimed at as a satisfactory charging speed.

Most car generators do not charge at less than 1,200 r.p.m., so that a speed increase of about 7 to 1 would seem essential.

Utilising Car Parts

Next, I visited a car-breaker's yard, and looked over his stock for a suitable car front axle (also dynamo and cut-out). Finally, I chose the front axle of an old 6-h.p. Peugeot, as this type of car did not have brake drums, and the hub was suitable for the mounting of slip-rings, and had a flange for bolting to the propeller.

Fortunately, I was in a position to have welding done cheaply, and therefore most of the alterations were carried out in this way. The king-pin at one end was welded solidly so that the hub carrying the propeller is kept always in line with the axle. (The welding at this point must be well carried out, as great strains are imposed by a varying wind.) The hub was cut from the other end and securely welded on to the bottom axle at the pad which had originally carried the springs (this weld also must be well made). This hub was now in a position about 12 in. behind the propeller position, and it will be seen that the adapted axle is now provided with a means of rotating into the wind.

Tail Piece

The tail piece was cut from $\frac{1}{8}$ in. sheet steel, as indicated in the illustration. It was welded solidly to the back end of the axle, and while this is thoroughly satisfactory in operation, there is no means of turning the propeller out of the wind for lubrication or examination purposes, except by hauling it out of the wind with a rope. Therefore, the sketch shows the tail-piece fitted with straps welded to the back end king-pin and, no doubt, some device could be arranged so that the tail-plate can be swung round through 90 deg. to move the propeller out of the wind. Most descriptions of chargers I have read seem to stress the importance of this arrangement to carry the propeller out of the wind when a gale is blowing, but this hardly seems to be necessary, as the generator in any case reaches a maximum charging rate, and does not exceed this, and it seems doubtful if any less strain would be put on the whole structure if the tail were swung round, than if the propeller were allowed to continue revolving. Provided that the guys are well anchored, there should be no difficulty in this respect.

Built-Up Driving Pulley

To obtain the required speed increase, a flat-face pulley was made of $\frac{3}{16}$ in. steel plate. First a circular piece $19\frac{5}{8}$ in. diam. was cut and as much metal as possible cut away (see Fig. 2). Then a rim of metal 2 in. wide by $\frac{1}{16}$ in. thick was rolled and tack-welded at intervals to the web of the pulley. (Tack-welding does not distort the metal so much as continuous welding would.) Four stiffening fillets were then

The completed wind-driven plant.

welded in to give strength and freedom from buckling. The rim was not machined as it was found fairly true. (A 21 in. diam. pulley would have been an improvement.)

The propeller had a central hole about 3 in. diam., and 8 $\frac{3}{8}$-in. clearance holes in the boss. These were used for bolting on the propeller, and the pulley and flange of the hub were drilled to suit. The propeller and pulley were affixed by means of $\frac{3}{8}$ in. M. steel studs with nuts and locknuts at each end.

Dynamo

The dynamo purchased was a 12-volt Lucas car dynamo of fairly recent type, with a bent steel bracket which enables the generator to be swung round for tensioning the belt. A slotted arm was also necessary to lock the generator at any required height. This was made of 1 in. by $\frac{3}{16}$ in. strip steel. The dynamo pulley was not of suitable size for the drive, therefore, a V-pulley of 3 in. pitch-circle diam., with bore to suit the dynamo shaft, together with an endless rubber V-rope 68 in. long by $\frac{1}{2}$ in. were purchased from James Dawson, Ltd., Lincona Works, Lincoln (total cost about 9s.).

To obtain the necessary height and support for the dynamo, a steel bar $1\frac{1}{2}$ in. wide, 1 in. thick, and 12 in. long was welded on top of the axle, just behind the king-pin. On top of this a piece of channel-iron 6 in. by 3 in. by 9 in. long was bolted, and on top of this the dynamo was mounted.

In the present case it was found that the direction of rotation of the propeller was counter-clockwise, and the rotation of the dynamo was clockwise. It was, therefore, necessary to alter the dynamo rotation. This was done by carefully dismantling it, and reversing the field connections, i.e. the field connection to the "third brush" (smallest one) was taken off, and connected to the field terminal, the connection from the field terminal being connected to the "third brush." This entailed the soldering on of longer connecting leads.

To make the generator thoroughly weatherproof, a sheet of $\frac{1}{16}$ in. thick cork sheeting was inserted under the brush inspection cover, and the whole dynamo was well painted.

Slip-rings

Some method of conveying the current generated from the movable axle to the stationary support was essential, and therefore two stationary slip-rings were mounted on the lower hub, and moving brushes fitted to an arm extending from the axle. The slip-ring construction was as follows. The hub was heated with a blowlamp, and then coated with shellac. A sheet of micanite was then heated to make it pliable, then shellacked and wrapped round the hub. It was kept in place until cold by binding with tape. Next two slip-rings were made of brass 4 in. diam. by $\frac{1}{4}$ in. wide The centre of each ring was machined out to a diameter which would almost enable it to slip over the insulated hub. Both rings

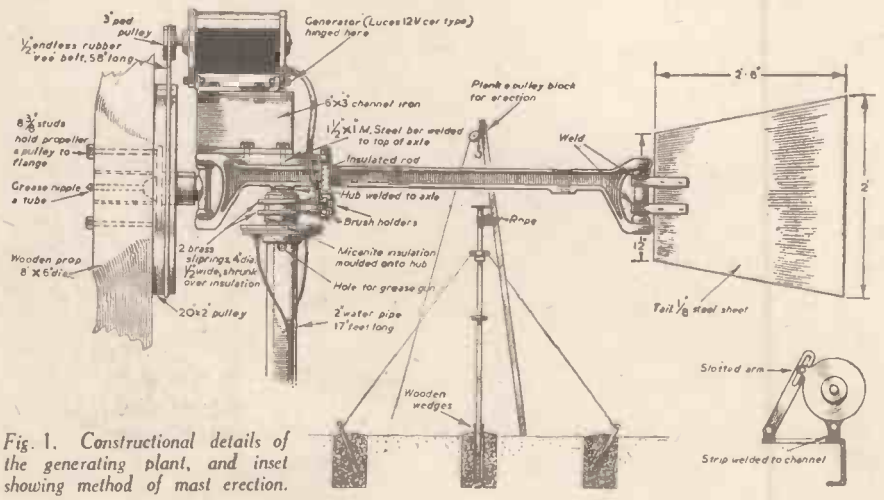


Fig. 1. Constructional details of the generating plant, and inset showing method of mast erection.

were then heated until bright red, and then slipped one at a time into their correct position on the hub. During this operation, have some thin strips of pure mica ready, and slip as many as possible in between the micanite and slip-ring so that when the ring is cold it will be rigidly held in position. It is advisable to make sure that one ring is properly in position before fitting the second.

Connecting Cables

Holes may be drilled through the side of the rings for the connecting cables. It will also be necessary to drill a large hole through the lower ring to allow the insulated cable to pass right through it to the upper ring in which a small hole is made for the conductor to enter, and be soldered in position.

The brush holders can be made of spring steel strip with a copper or carbon block for current collectors. If two brush-holders from an old motor (preferably a slip-ring motor) can be obtained, so much the better.

Steel Supporting Column

The supporting structure consists of two 8 ft. 6 in. lengths (or thereabouts, depending on location) of 2 in. mild steel water piping with flanged joints. The upper flange is drilled to suit the hub flange, and when all is completed the work of erection can commence. It will be evident that the structure is much too heavy to erect complete, and it must therefore be put together in stages. First a short length of pipe about 2 ft. long and large enough for the supporting pipe to slip into, is concreted into the ground where the generator is to stand. Also, four lengths of 2 in. angle-iron are cemented into concrete blocks at four equidistant points about 8 ft. from the centre. The angle-iron pieces are used for the guy wires, and should be drilled at the upper end before cementing.

When the concrete has set and is thoroughly hard, the supporting pipe may be dropped into the base pipe. Wooden wedges may be driven into the space between these pipes so that the supporting pipe is held solidly in position and perfectly vertical.

Previously prepared clamps (Fig. 3) are bolted on the support pipe, before erection, 4 ft. below the top. (This will enable the propeller to revolve in any position and still be clear of the guy wires.) Flexible steel guy

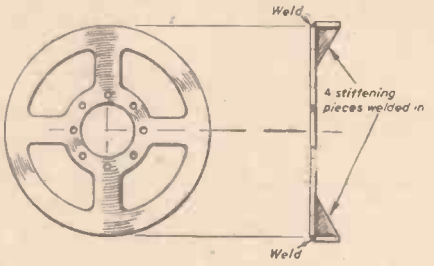


Fig. 2 Details of built-up driving pulley.

wires ¾ in. or ⅝ in. circumference are spliced and fixed to the clamps, and are attached to the angle-iron guy posts, preferably by means of bottle screws, but they can be pulled tight and spliced if these are not available. (A car breaker can usually supply

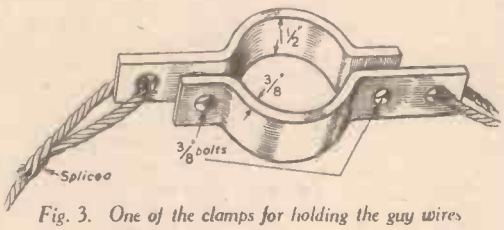


Fig. 3. One of the clamps for holding the guy wires

tightening devices taken from cable brakes.)

Method of Erection

The supporting pipe should now be quite rigid, and should enable a ladder to be placed against it so that erection can proceed. Next, take the axle (without propeller, pulley or dynamo), lift it into position, and bolt the lower hub on top of the supporting pipe. It will be found that this is a difficult operation, but it can be made much easier if a plank about 3 ft. longer than the pipe is placed against the pipe on the opposite side from the ladder, and lashed with rope to the pipe. A pulley block (borrowed from a car breaker) can then be tied with rope to the top of the plank. The axle can now be raised by someone on the ground who can take the weight while the axle is bolted in position.

The pulley and propeller can now be mounted (taking care to thread the V-rope in position first). Next the dynamo, and finally the brush gear and connections can be assembled.

If the battery and cut-out can be placed in a weatherproof housing at the foot of the supporting pipe, this will probably be the best place for them (remembering the danger of frost), but, alternatively, an overhead line may be run from the pole to the workshop or house, where this equipment may alternatively be installed.

Overhead Line

It will be appreciated that with a low-voltage generator, any appreciable voltage drop in the line may well result in its being impossible to charge a 12-volt battery, therefore, the leads and overhead line must all be of heavy-section copper (not less than 12 S.W.G.).

If the line is more than a few yards long it will probably be impracticable to increase the section of copper sufficiently and it is therefore suggested in such cases, that a 6-volt cut-out and battery should be installed instead of 12 volts. This will allow up to 6 volts drop, and the power available will still be sufficient for a few lights.

It can reasonably be anticipated, provided that the generator is installed in an exposed position, that the unit will charge at at least 4 amps. for an average of four hours per day. This is a very conservative estimate, and may well be improved upon.

Gauge "O" Model Railway Equipment

A New Bassett-Lowke, Ltd. Catalogue

DESPITE the war, Bassett-Lowke, Ltd., have cheered up the model world by producing (in addition to the publication of their Model Railway Handbook this season) a very fine 1941 catalogue on gauge "0" model railway equipment. The cover is to the same attractive design as last year, but it is printed on a special leather surface paper, which is particularly effective. Several pages have been added to the list, including one devoted entirely to finished accessories for the model railway builder, bogies, axle guards, buffers, ventilators, wheels and all the various "bits and pieces" that are the "life blood" of the model-making hobby. In looking carefully through the list the following really new items are at once noticed; a new 2-6-2 L.M.S. Tank (companion for the 2-6-4 model so popular since its introduction two years ago, and which this year has been re-designed); the long-promised new design L.M.S. wagons —open, covered and goods brake, which will be eagerly purchased by model owners whose rolling stock needs additions. For those who like their own permanent way, the new check rail chair with cast key should prove very useful in point work

We are pleased to see that tin-plate rail and points are again included. These make inexpensive and satisfactory track for those who require only a simple layout that can easily be assembled, and as easily taken to bits again. A full set of scale model signal parts, including upper quadrant frames, is now available, and a model signal cabin with an entirely new design of lever frame which has a bracket to hold the diagram and card will be welcomed, and the page devoted to the extremely popular gauge "0" Mogul parts in steam should make a great appeal. We are also pleased to see a full range of mechanisms included. The prices in this list contain all advances and revisions, but as the articles are replaced by new stocks this will mean an increase of from 15 per cent to 20 per cent., so model railway owners are advised to buy *now*.

The new gauge "O" signal cabin by Bassett-Lowke, Ltd.

NEW SERIES

Making a Success of Your Photography

What You Should Know About Stops, Lenses, Shutters, and View Finders

By JOHN J. CURTIS, A.R.P.S.

THE numbering or lettering of the "stops" differs on some cameras from those mentioned in our last issue; there is a series known as the Uniform System, hence the initials U.S. The numbers start with 1 and carry on as 2, 4, 8, 16, 32, etc., and their comparative light values must be allowed for as being the same as for the F series already referred to, that is to say, the next smallest is only half the value of the previous one. In actual use, therefore, if you stop down to 16 you will have to give twice the exposure time as 8, or if 4 is in use then give only half the time required for 8; this is a point which everyone must be quite sure about, otherwise mistakes are bound to occur. Before leaving this F and U.S. series of stops there arises in the minds of some the question as to whether there is any point at which the two series are comparable, and from the accompanying scale it will be seen that they do so at 16 and F.16.

F4	F5.6	F8	F11.3	F16	F22.6	=
1	2	4	8	16	32	of the U.S.

This scale is approximately accurate, and certainly near enough for all ordinary work, but there are other stops used in the F series which are of a between value of the previous and following numbers, and therefore not strictly following the rule of double or half values.

"Stops" on Cheap Cameras

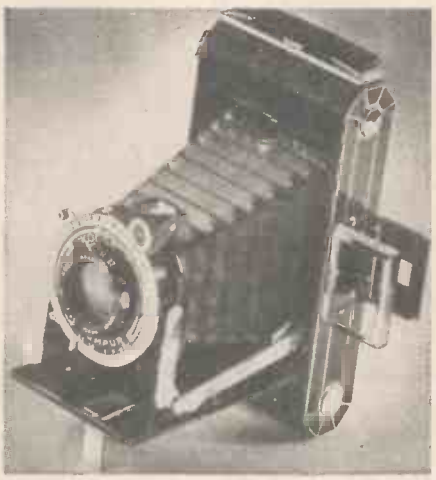
There are on the cheap type of cameras perhaps only two or three stops, or as the uninitiated sometimes prefer to call them "holes," and the instructions given in the booklet say that the largest is for use on dull days, or late in the day, and the smallest at midday, or when the sun is shining; this is, of course, right, and is another way of explaining the theory of the small stop being used to reduce or curtail the amount of light reaching the film, but it cannot be taken that the small stop is only half the value of the large one, as a much longer range of the stops is required for such calculation.

One frequently hears remarks about the speed of a lens, and possibly you have been able to realise from the foregoing that a speedy lens is one that is capable of working at a very large stop, and so allowing a large amount of light to pass through in a very short time, such as 1/100th or even a 1/1000th part of a second, but to do this accurately and without distorting the resulting image such a lens must be manufactured under very different rules and stricter scientific means than the cheap lens found on a camera only costing a guinea. The cheap type is usually that known as a "single" lens, although this may consist of more than one glass. The name given to these is Achromatic, and they are corrected only so far as chromatic aberration, and this means that the edges or fringe of the image thrown by the lens on to the film is free from colour, which would be in the case of the lens consisting of a piece of glass simply machined to fit the camera, and not tested and corrected.

Anastigmat Lenses

Let us now consider the medium priced camera, the lens of which will be an "anastigmat," or as they are sometimes called "R.R." lenses. These are carefully adjusted to give sharp definition, and to completely cover the edges of the film at the open aperture of F6.5, or whatever the largest stop may be. Now such a lens has been through quite a lot of careful testing and altering during the course of its manufacture. Very skilful people have handled it so that when it is ready to be fitted to the camera it is free from astigmatism, and possibly lineal curvature, which means that straight parallel lines will be rendered correctly. It will produce pin-point definition, and can be used with a fairly large aperture thereby making it moderately speedy.

Having considered the cheap and the medium lens there still remains the high-class series which are found on the expensive, or perhaps one ought to say the high-priced cameras, because, although the price is high, yet considering the workmanship and skill that are put into them they are worth the price that is charged. Some of these have many glasses or pairs of lenses included in their combination, and some of these pairs are capable of being used independently of the others. Each of the separate sections is most carefully and accurately tested and adjusted to be free from all faults and aberrations such as colour fringe, lineal distortion, curvature, astigmatism or loss of definition; the final result is a lens that can be used with a very large stop, such as F3.5, or even as big as F1.9, and yet give a clear, sharp, pin-point definition in the image. Such lenses will be found on the Reflex and similar cameras in use by the Press, commercial and scientific photographers because they know that it is possible with such instruments to obtain "movement" pictures without showing the least sign of movement and also to give minimum exposures because the large apertures will enable sufficient light to get through. Because these are the type of apparatus selected by specialists it does not follow that amateurs are barred from using them; on the contrary, there are many keen amateurs using such cameras, and if anyone can afford the price then he should avail himself, for undoubtedly he will then have the opportunity and the means of taking many subjects which are impossible with other types of cameras.



A popular type of folding camera, with anastigmat lens and Compur shutter. Note the direct-vision finder on the side, in addition to the small view finder on the camera front.

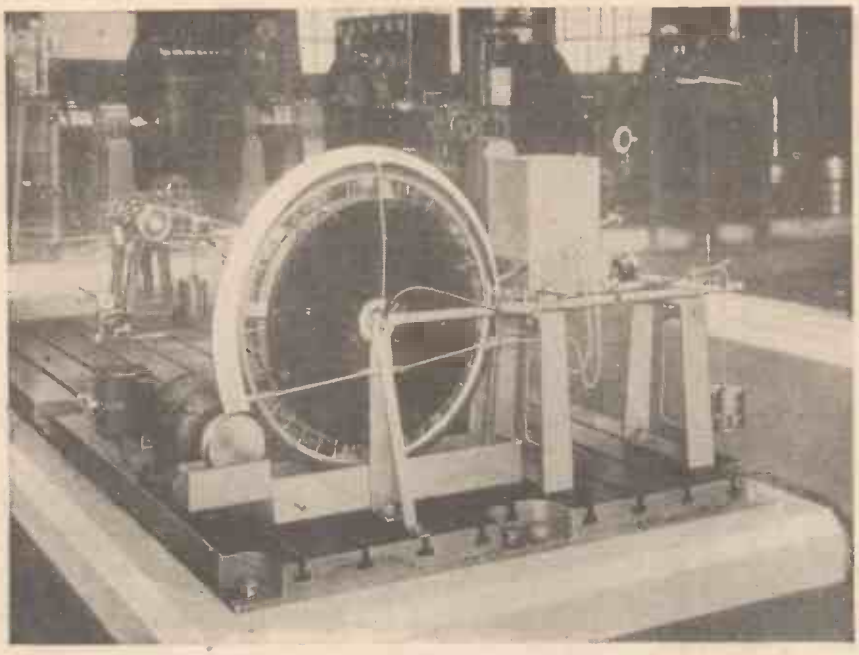
Shutters

In addition to stops there is another part which has to be known before the owner of a camera can be certain that everything is correct, and that part is the shutter. This is possibly the most important exposure control on the camera, for no matter how carefully the stop is selected, if the shutter is not functioning properly then over or under-exposure must result. It is, however, not an easy matter to test a shutter, but, fortunately, with the modern Compur shutter there is not a lot to go wrong, and if through an accident or because sand, dirt or even damp has caused a sticking, then rather than attempt to put it right it is best to take the camera back to your dealer and let him clean, repair and regulate it.

View-Finders

When taking a scene or portrait it is the usual custom with all hand cameras to "view" the subject in the view-finder, and those possessing folding cameras know that this little item is usually to be found on the side of the lens. It can be turned at a right angle for taking horizontal pictures.

It is very annoying to find when the film has been developed that half your friend's head or his feet have been cut off, and this frequently occurs when taking a close-up portrait. It may also happen that the top of a church spire is missing, but you feel quite certain that everything was all right when you saw the image in the view-finder. If that is so, then there must be something wrong, for the view-finder is not coinciding with the lens. The position of this part is such that it sometimes occurs when shutting the camera the part will catch against the side of the camera, and without noticing you may have forced it out of its correct position; it may be only a little out, but if it happens again, it will become a little more out of position. It may be that when you took the photograph the view-finder was not pushed back to its proper place, or, of course, it may simply want a little adjusting.



Pedal cycle brake block testing machine at the new Physical Research Laboratory of Messrs. Ferodo, Limited, Chapel-en-le-Frith.

THE MONTH OF SCIENCE

New British Warplanes

AN American aviation expert, who has recently been visiting this country has recently published in the United States details of the astonishing advances made in the development of new British warplanes, notably in four secret types. The Air Ministry is not prepared to confirm or refute the statements made in it. The following is the information that appears.

The Tornado is a new fighter that carries not only eight machine guns, but also three 20-millimetre cannon and can fly at 425 miles an hour. It has been designed by the designer of the Hawker Hurricane, and is aptly named.

Another new fighter recently mentioned by Lord Beaverbrook as having proved itself in action, is the Westland Whirlwind. This is a two-engined plane, and is believed to be fitted with a power-driven gun turret. This gun-turret enables it to fire broadsides at the enemy. It is designed to cope with the Me. 110, one of Germany's latest twin-engined fighters. Whirlwinds are to be built in the United States by the Packard Company.

The greatest bombing plane ever built is undoubtably the Short Stirling. It has four engines and is bigger and faster than America's "Flying Fortresses." It is built by Britain's outstanding flying-boat builders, Short Bros., designers of the Sunderland. It is based on plans they got out for a transatlantic plane. The prototype of the Stirling weighs over 31 tons, and its four engines are each of 1,380 h.p. of the Bristol Hercules type.

The fourth secret type is also a bomber, the Avro Manchester. It is a twin-engined plane with a speed of about 325 m.p.h., and for its weight of over 13 tons is an extremely fast machine.

Portable Pill-Box

A PORTABLE one-man "pill-box" has been invented that a soldier can carry about with him and set up wherever he needs shelter. The shelter, slightly adapted, may also be used for civilians against air attack. The invention is now receiving the attention of the War Office.

Anti-Submarine Craft

THE Canadian Department of Munitions and Supply announces that contracts have been placed for 20 anti-submarine craft of a new type, to be known as Fairmile patrol boats. Their hulls, of double-planed mahogany and each 112 ft. long, will be built in Canadian shipyards, and they will be equipped with petrol engines capable of giving a high speed.

New Type of Air Camera

THE United States army air corps have recently been carrying out experiments with a new type of wide-angle mapping camera. At a single exposure the camera can snap 36 square miles of territory from an altitude of four miles. Its magazine carries enough film for 249 such exposures, so that, allowing for the standard 60 per cent. overlap, about 3,600 square miles of landscape may be photographed on a single flight.

The new photographic aeroplane in which the camera is mounted, is a twin-engined Beechcraft powered with two 350 h.p. Pratt and Whitney engines. It is designed for landing and taking off in very small fields. Pilot, navigator and cameraman are in constant communication with one another by means of throat microphones, which pick up laryngeal vibrations and do not interfere with breathing the extra oxygen required at high altitudes. The machine has been flown in night aerial photography tests during which experiments have been made with the use of heavy flash bombs which trip the camera shutter by impulse from a photo-electric cell in the tail of the aircraft.

Wood Alcohol

TWO Swedish engineers, Asplund and Holst, have discovered a new method of producing wood alcohol. It is known as the "Defibrator method," and will shortly be tried out on a large industrial scale in Sweden. Under an agreement between the Swedish State and the Swedish timber producers, the Korsnas Company, the latter will erect a plant for making alcohol from wood sugar according to the new method. The plant will have a production capacity of 3,000,000 litres of 95 per cent. proof alcohol a year, which quantity will be required by the State.

A Milometer for Aircraft

MR. L. SWADLING, of Surrey, claims to have invented a device called a milometer, which will enable pilots to tell what ground mileage they have covered. Up to now aircraft are equipped only with air-speed indicators. The inventor has stated that in foggy weather the instrument will assist the R.A.F. in long-distance raids. If the milometer can do all that the inventor claims for it, then he has found some way of making allowance for wind drift which may have taken an aircraft some distance off its course. Mr. Swadling made his discovery while working on a wireless experiment.

Lubricating Oil from Vegetables

A CLAIM to have discovered a process of producing lubricating oil for aeroplane engines from vegetable matter is made by Dr. Y. Nagai, of the Tokio University Institute of Aeronautical Research. The discovery is said to be of "world significance."

Winner of Faraday Medal

DR. A. P. M. FLEMING, of Manchester, one of Britain's greatest electrical engineers and inventors, has been awarded the 1940 Faraday Medal—highest award of the Institute of Electrical Engineers. Dr. Fleming, who is 60 years of age, is a director of Metropolitan Vickers.

A Backwards-firing Gun

A BACKWARDS-FIRING Vickers' machine-gun worked with mirrors is the newest R.A.F. weapon. It is fitted under the nose of the new Bristol Blenheim Mark IV fighter-bomber, and is designed to protect the tail and cope with any attackers who come up from below. According to reports, the machine-gun is the first of its type in any air force, and is aimed and operated by the navigator through a series of mirrors. The new Blenheim is credited with a top speed of 295 miles an hour, a range of 1,900 miles, and a ceiling of 27,000 feet.

Cast-iron Propellers for Ships

IN their demand for the simplest possible cargo ships the Government have ordered that cast-iron propellers shall be fitted instead of bronze in all those of moderate speed. The reasons are not for economy, but that the constituent metals which are mixed to make up the bronze are badly needed for other branches of the war effort,

and that the cast-iron propeller can be made more speedily. Above a certain speed the bronze propeller has every advantage, but for slow ships there is very little difference in the initial efficiency. The difference shows in a few months' service, when the action of the water begins to make innumerable little pits on the surface of an iron propeller, greatly reducing its efficiency and finally endangering the whole blades.

Shortly before the war, enterprising shipbuilding interests in South Wale evolved a new cast-iron which promised all the advantages of the bronze propeller for slow-running cargo ships at a very much smaller cost.

Four-bladed Airscrew

A NEW four-bladed propeller has recently been introduced by Rotol Airscrews, a British company which was formed by collaboration between the Rolls-Royce and the Bristol companies. The pitch is adjusted to the speed of the engine by means of a hydraulically operated unit. Whatever the angle at which the aeroplane is flying, the blades will "fine off" or coarsen, to get a uniform rate for the engine while absorbing its full power.

Big Engineering Feat

ONE of the greatest engineering tasks ever undertaken in Australia—the building up of a sunken caisson, at Peat's Ferry Bridge—has been started. The old caisson, weighing 4,000 tons, sunk 53 ft. into the mud two seconds after it was placed into position twelve months ago. A 1,500-ton steel and concrete caisson, in the form of a punt, will be floated into the river, built up higher while at anchor, and then joined on to the top of the sunken caisson, 51 ft. below the surface.

A Robot Bomber

ACCORDING to two American reporters, a new robot aeroplane of an entirely revolutionary design is being tested by U.S. aviation officials at Hawaii and at Langley Field, Virginia. This pilotless aeroplane is operated by radio control and is the result of ten years of extensive work by experts. It has given excellent results during recent tests. A bomber takes off, discharges its bombs over a distant target, returns and lands untouched by human hand. The distance of the target is calculated in advance, and when the robot plane reaches it, a device automatically releases the bombs. The cruising range of the robot plane is limited only by fuel supply and wireless frequency range. Although more effective at short distances, the robot can be used for long-range bombing by "relay control" radio stations along the line of flight.

The James Watt Medal

THE James Watt International Medal of the Institution of Mechanical Engineers, an award founded in 1936 to commemorate the bicentenary of the Scottish engineer and presented every second year, has been awarded to Professor Aural Stodola, a native of Czecho-Slovakia, who has spent most of his active life in Switzerland. The medal is the highest distinction the Institution can confer, and it marks the recipient as "an engineer, inventor, designer, scientist, or teacher of established international reputation."

IN THE WORLD AND INVENTION

An "Invisible" Aeroplane

ACCORDING to reports reaching the German frontier, a new type of Junkers aeroplane made of a transparent material of mica composition, stated to be scarcely visible at a height of 2,400 ft., is being constructed at the big aircraft factories at Wiener and Neustadt, in Austria. The machines are said to be powered by engines of 1,140 horse-power, and have a speed of 390 miles an hour.

Producer-Gas Equipments

THE scarcity of imported liquid fuel has caused considerable consternation in the Swedish fishing industry, as the entire fishing fleet is dependent on internal combustion engines. In an effort to overcome this difficulty, producer-gas equipments have now been designed for the vessels. It is claimed that with tar fuel the engines will deliver about the same amount of power as before. There would not seem to be any other great objections. The exhaust is as clear as with oil, it is reported, because the greater part of the smoke-producing particles is consumed before the expansion of the gas.

New Fighter

A FIGHTER 'plane designed to attack bombers in the sub-stratosphere is now being built at a Long Island factory. The new 'plane, of which 1,000 have already been ordered, is the P 47, a single-seat craft with a 2,000 h.p. Pratt and Whitney radial engine and a secret turbo-charger. It is designed to reach 400 m.p.h. at between 25,000 ft. and 30,000 ft. The weight will be over 11,000 lb., nearly twice that of an ordinary pursuit 'plane, and it will carry at least ten heavy calibre machine-guns.

New "White Line" Machine Paints Kerbs

A "WHITE-LINE" machine has been invented which marks kerbs as well as roadways.

Paint is sprayed on the top and edge of kerbs in one operation, the regulation spacing of one foot being made automatically. Three miles of kerb-painting can be done in a day with one loading of paint, this is twelve times as quick as hand-painting. With the same machine, roads can be marked at a cost of £1 2s. 5d. per mile against a former cost of £12 a mile.

Usually, kerb-painting is confined to kerbs at inter-sections, but in view of the saving effected by the new method some authorities are having kerbs painted along their whole length.

Illuminated Helmets in Black-out

WHITE helmets, with illuminated signs reading "Police" on the front and "Stop" at the back, are being worn by Glasgow traffic police in the black-out.

Current is supplied by accumulators on the policemen's belts.

Glass Wings for Aircraft

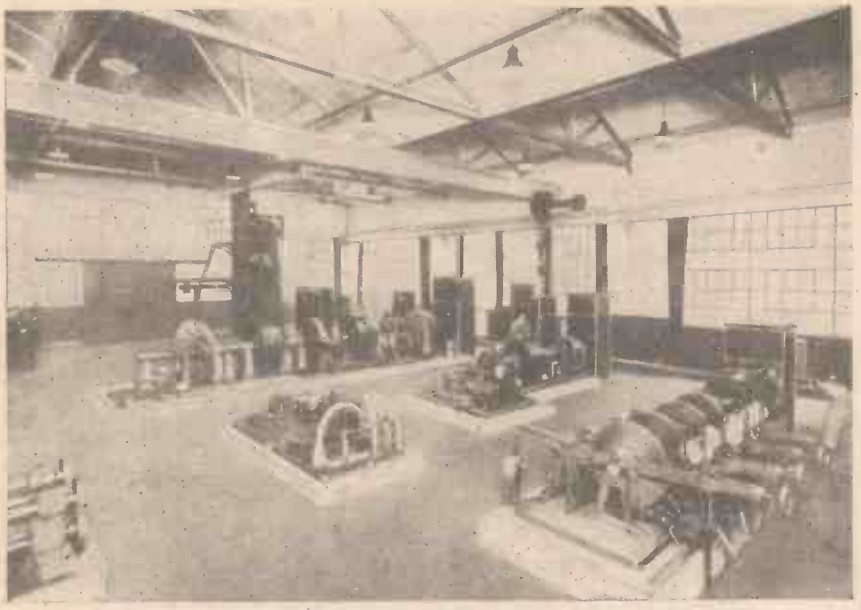
A 'plane with glass wings, so fire-resisting that a blazing torch produced only a smudge on the fabric, has been tested at Alliance (Ohio), and may open an entirely new field in aircraft production.

Yet to be approved by the American Government, it is thought that the new material would be better employed on 'planes of light horse-power, such as initial training craft, and for civilian training.

The glass wings are now undergoing a six months' weather test.

When in a professional film you see a shot in which the camera has obviously swooped about, you may be sure it was done with an elaborate and beautifully balanced piece of machinery called a camera crane. Here is the business end of one being got into position for a prison scene.

Testing Brakes for World's



General view of the new Physical Research Laboratory of Messrs. Ferodo, Ltd. at Chapel-en-le-Frith.

THE Ferodo Company was established some forty years ago solely to manufacture brake blocks for horse-drawn vehicles. These blocks were built up from laminations of cotton belting held together by nails and impregnated with a simple bituminous compound.

The intervening years have witnessed the rapid development of the automobile and every development of speed has demanded a corresponding development in deceleration. All these developments, together with other revolutionary developments in engineering technique, have created a demand for a highly specialised product, and today the company manufactures a wide range of friction materials well abreast of the searching requirements of modern high-speed mechanical transport and the widely varied needs of industry.

This progress has necessitated unremitting research throughout the whole period of development, and the provision of adequate facilities for research work has, therefore, always held a leading place in the policy of the company.

Testing Machinery

From the experience gained, it has been established that, for the correct solution of friction problems, it is essential that test machinery and test apparatus must be of sufficient capacity to reproduce actual working conditions as closely as possible. Attempts to economise by scaling down such apparatus lead to faulty conclusions, and clutches, brakes, brake drums and friction linings must themselves be tested under full-scale conditions of speeds, pressure and sizes, if test results are to be relied upon with confidence.

In full realisation of this fact, Ferodo Ltd., have from time to time increased the capacity of their testing plant, but in view of increasing speeds, rates of duty, etc., in present-day engineering practice, a careful survey was made of the industrial field as it exists to-day, and of possible future developments, with the result that it was decided to build a new Physical Testing Laboratory, equipped with test machines designed to cover the whole range of industrial braking and power transmission—from the testing of brakes on pedal cycles and motor vehicles, up to the conditions obtaining with the brakes of an express passenger train travelling at over 100 miles per hour.

These new test laboratories have now been completed and any type of brake, brake drum or clutch can be mounted on the test machines, so that complete assemblies can be tested under actual conditions of duty for which they were designed, and, at the same time, the most suitable type of brake or clutch lining for the particular application determined

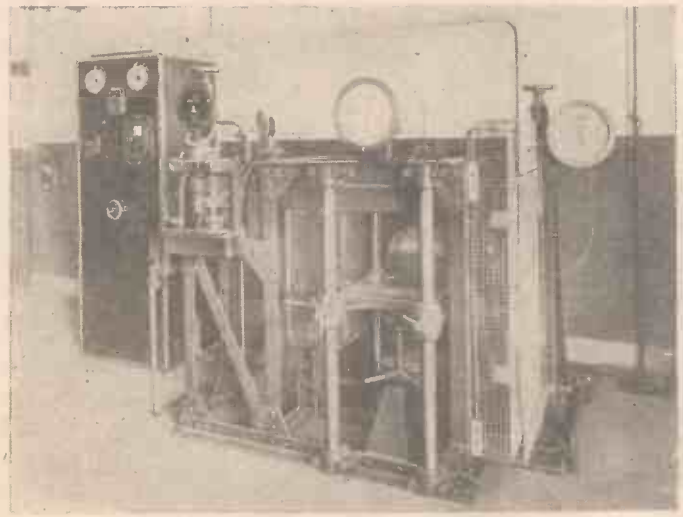
Brakes for Captain Eyston's "Thunderbolt"

One of the brake assemblies designed for Captain G. E. T. Eyston's racing car "Thunderbolt," on which he later established the world's land speed record of 357.50 m.p.h., in September, 1938, at Bonneville Salt Flats, Utah, U.S.A., was fitted with Ferodo brake linings, and subjected to a braking proof test at maximum braking speed in the Ferodo Test Laboratory before the complete brake equipment was assembled on the car. Similarly, the brakes and brake linings fitted to Mr. John Cobb's racing car "The Napier Railton," on which he set up the present world's land speed record of 370 m.p.h., in August, 1939, was subjected to full-scale tests before the car was despatched to the Bonneville Salt Flats. The pilot of a 7-ton aeroplane, landing at 70 m.p.h., and braking to rest, does so with confidence because its highly specialised brake design has previously been tested and proved under actual working conditions of speed, pressure and rate of duty.

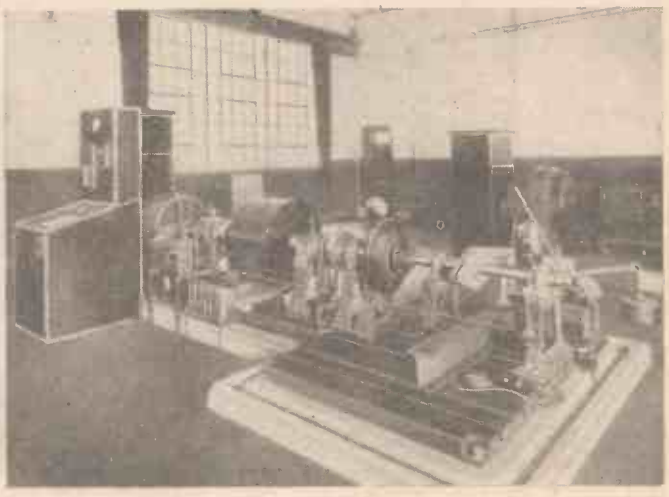
Following the introduction of Ferogrip Fan Belts, a complete range of which is manufactured by the company, test equipment has also been provided for the full-scale testing of these "V" belts

Laboratory Layout

The new Physical Research Laboratory comprises the main test room, which is 75 ft. long and 50 ft. wide, adjoining which is a fitting and machine shop 50 ft. long



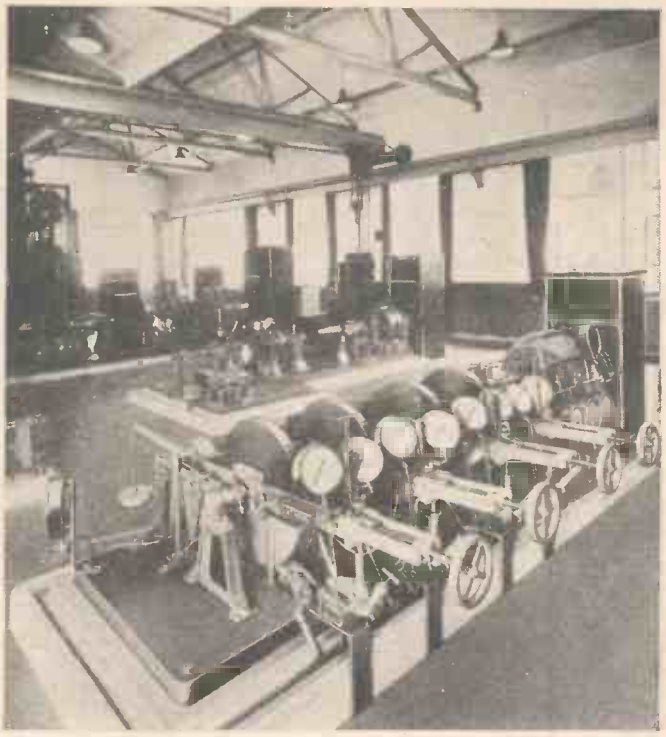
A small "V" belt-machine in the new laboratory.



Small inertia type test machine.

Fastest Cars

A Brief Account of the New Physical Research Laboratory of Ferodo Ltd., at Chapel-en-le-Frith



Standard continuous test machine at the New Ferodo Laboratory. This machine is used for routine control testing of the works' production of all types of Fero friction materials.

and 15 ft. wide, equipped with the necessary machine tools. There is also a conference room, so that the laboratory is a self-contained unit. All the testing equipment is of original design and incorporates all the accumulated experience of the Ferodo Company

Standard Continuous Test Machine

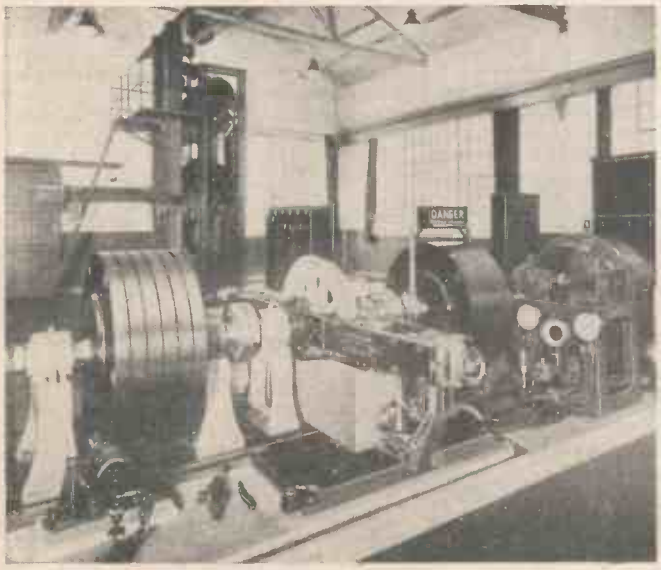
This machine is used for routine control testing of the works production of all types of Ferodo friction materials. From it are obtained specific wear values, together with a continuous record of the coefficient of friction of temperatures between 65 degs. Fahr. up to 550 degs. Fahr. The machine has four solid discs—one of high carbon steel, one of medium carbon steel, and two of special alloy cast iron—which are driven at a constant peripheral speed of 1,000 ft. per minute, and the samples, each of 10 square inches area, are fitted into the balanced torque arms. Load is applied to the samples under test hydraulically, and is adjusted to maintain a constant circumferential resistance of 330 lbs. at the surface of each drum so that each sample is thus loaded to absorb energy at the rate of 1 h.p. per square inch of its area. The conditions of test are such that, in a few hours, a correct indication can be obtained of the durability and friction characteristics of any given brake lining—the coefficient of friction being recorded on special chart recorders.

Small Inertia Type Test Machine

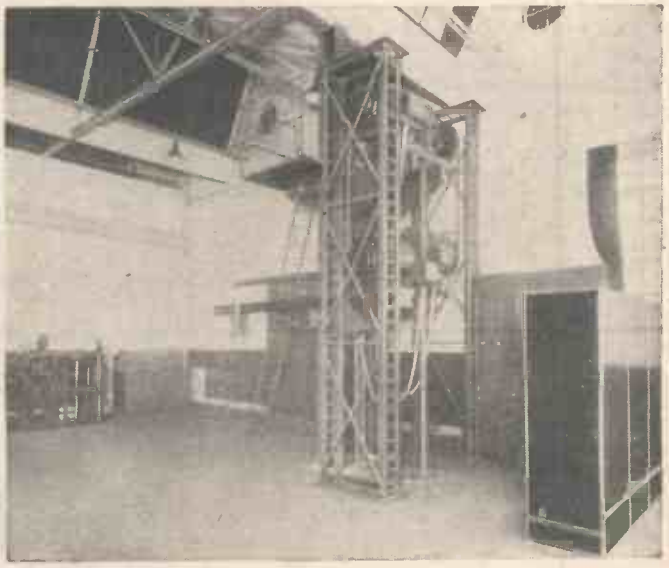
This machine is driven by a 25 h.p motor through a hydraulic infinitely variable speed-reducing gear. There are seven flywheels—any number of which can be made to rotate with the shaft, those not in use standing stationary with the shaft rotating within them. Complete brake or clutch assemblies can be mounted on the machine shaft, and the inertia or energy to be absorbed in a stop from a given speed is infinitely variable up to a maximum of 810,000 ft.-lbs., at 1 500 r.p.m. This machine is designed to test brakes and clutches of any capacity as fitted to a motor cycle up to a passenger car or light truck. The torque, pressure and electrical recording instruments are mounted together at the operator's control desk.

Large Inertia Test Machine

This machine is driven by a 100 h.p. electric motor at constant speeds ranging from 500 to 1,000 r.p.m., or the motor can be automatically tripped out at any given speed below 500 r.p.m. The twelve main flywheels (of a total weight of 8 tons) are arranged in two groups on each side of a standard railway rolling stock wheel, and any number of these flywheels may be made to rotate with the shaft—those not in use being held stationary, in the same way as those fitted to the small inertia machine previously described. The railway wheel is fitted with articulated torque arms designed to carry any type of railway brake blocks and heads—the load on the brake blocks being hydraulically applied and infinitely adjustable up to 35 tons per block. Braking torque is conveyed from the torque arm to indicating and recording instruments by means of hydraulic cylinders. Automatic time cycle mechanism is fitted, enabling repeated railway brake tests to be carried out at any speed up to 100 m.p.h. at 80 second intervals. Speeds, acceleration and deceleration rates are recorded electrically and automatically—all instruments being grouped at the operator's control desk. The railway wheel is mounted in a close-canopied water tank, so that tests can be carried out under wet or dry conditions. In addition to the arrangements for testing railway brake blocks, any design of brake or clutch can be fitted at the outboard end of the machine and stopping tests carried out in a manner similar to that described for the small type inertia machine. Correct



Close up of railway brake block testing machine



Large "V" belt testing machine.

speed and flywheel weight can be initially determined and the machine set to work entirely automatically on a series of stopping tests with any required interval between stopping and automatic restarting. The maximum energy available at 1,000 r.p.m. is 4,183,000 ft.-lbs., this being infinitely variable to reproduce any required condition for the testing of brakes and clutches as fitted to the heaviest and fastest type of vehicle likely to be produced.

Large " V " Belt Test Machine

The power unit of this machine is a 60 h.p. double-ended electric motor designed to run at constant speeds between 1,000 and 2,000 r.p.m., and at each end of the motor shaft a " V " belt pulley is fitted, with grooves to suit any standard section of industrial " V " belts. The motor is arranged to drive two electric generators by the " V " belts under test, each generator being fitted with a " V " belt pulley of similar design to those fitted to the driving motor. The electric generators are each mounted independently on two separate counterbalance swinging arms, and any desired running tension can be applied to the belts on test by sliding the balance weights along the swinging arms, also by raising or lowering either of the generators, complete with swinging arm, any length of belt can be tested within the total length capacity of the machine, namely, 27½ ft.

The electric generators have separately excited fields, so that the current generated can be fed back into the line, and are accurately calibrated throughout their speed range—thus the brake horse-power for any electrical output at every speed is known. This machine is used for determining the durability, slipping characteristics and apparent coefficient of friction for the various standard sections of any length up to the capacity of the machine, also for the routine control testing of works production of " V " belts.

Small " V " Belt Test Machine

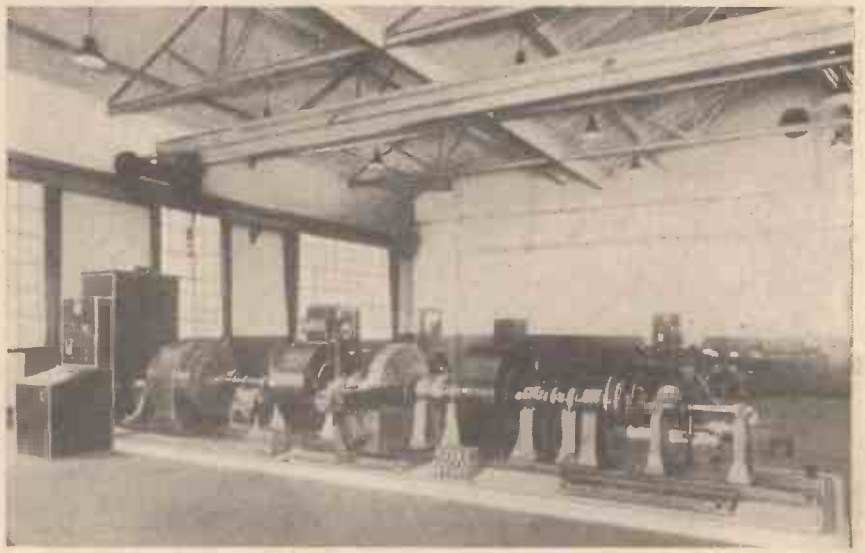
This is of the hydraulic dynamometer type and has been primarily designed for the testing of automotive fan belts. There are three shafts, each of which can be fitted with a " V " belt pulley, easily changed to suit the section of the belt under test. The lower shaft (representing the engine crankshaft on a motor vehicle) is driven by a 28 h.p. electric motor at any speed from 2,250 to 4,500 r.p.m. The upper shaft (representing the fan shaft) is coupled to a standard Heenan & Froude hydraulic dynamometer. The centre distance between upper and lower shafts is adjustable between 6 ins. and 24½ ins. by operating the gear fitted to the lower shaft. The third shaft (representing the generator drive on a vehicle) is mounted to the right of the vertical centre line of the crankshaft and fan pulleys. This shaft is adjustable sideways to give any horizontal centre distance from 0 to 19½ ins., and vertically to give the same centre distance range as that of the other two pulleys. It is thus possible to reproduce the actual pulley layout of any motor vehicle, and to run at the selected crankshaft speed and any desired loading. The tension applied to the belt during the test is indicated on statimeters, and the machine is equipped for measuring stretch and slip.

High-speed Destruction Testing Chamber

Incorporated in the basement is a strongly reinforced bursting chamber for high-speed destruction testing at speeds up to 9,000 r.p.m.

Fitting and Machine Shop

As the mounting of the various types of brakes and clutches on any of the test machines, or the making up of improvised rigs, entails a certain amount of fitting, and very often machining, facilities for these operations are provided in the workshop which adjoins the main test room. The equipment includes a lathe, with tool grinder, drilling machine, bandsaw, grinding machine and fitting bench. Ample storage lockers are also provided for the large assortment of spares and instruments, which necessarily form an important part of the equipment of a Physical Testing Laboratory.



A large inertia test machine.

This brief description of the testing facilities provided by Messrs. Ferodo Ltd., shows the extent to which the company has gone in order to maintain and further improve, by constant testing and research, the quality and reliability of its products.

All these test and research facilities are placed unreservedly at the disposal of any firm interested in the application of Ferodo friction materials or of " V " belt drives, in the development of new designs, or the solution of any friction problems.

Flying Without Wings

How Bomber Crews are Trained in the "Cubicle Trainer"

MAGIC lanterns and darkened rooms—a childhood thrill of an earlier generation—are used for the ground training of R.A.F. bomber crews in the "Cubicle Trainer." True, the lanterns are rather more magic than the simple contrivances of the nursery, but their purpose is the same—to throw a picture on a screen.

The screen is hung on one side of a large room. On the opposite side stands a row of half a dozen glass-fronted cubicles—hence the name. Each cubicle contains a pilot, a navigator, and a wireless operator. Outside the cubicle sits the instructor, who is in touch with the half a dozen crews by wireless only. By sending them on a " flight " to, say, Milan, he gives them an exercise in navigation. Sometimes they stay in their cubicles for six hours by the control clock, though they can emerge for the lunch interval. Or the clock may be speeded up, and a six-hour journey telescoped into a third of that time. Every few minutes a slide of an aerial photograph showing landmarks over which they would pass if in actual flight is thrown upon the screen. They see the slide through the glass front of their cubicles.

" Briefing " the Crews

Before entering the cubicles the crews are " briefed," just as bombing crews are " briefed " at an operational station before going on a real raid. They are given their objective, and the instructor decides the route which they are to follow. From the moment of " taking off " the navigators begin to plot their course on a chart.

Not all the pictures on the slides are easily recognised—in fact, the instructor may decide to show only pictures of ten-tenths cloud for many miles of the journey and the crews would soon be " lost " if the wireless operator were not there to pick up a bearing from the " ground "—that is, from the instructor outside. Sometimes slides of towns or landmarks which are just off the route are deliberately shown. If the navigator recognises them he will know from his maps just how far he has been carried by wind drift from his correct course. If he fails to recognise them he will again need the wireless operator to get a "fix" from the " ground " and to establish his position.

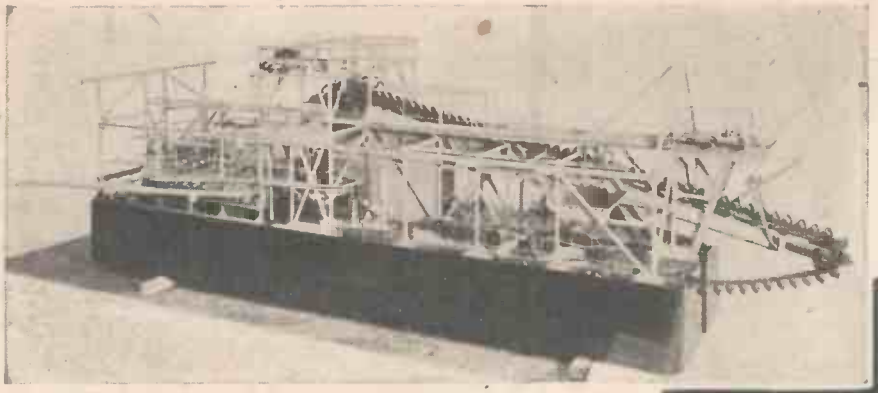
" Searchlights "

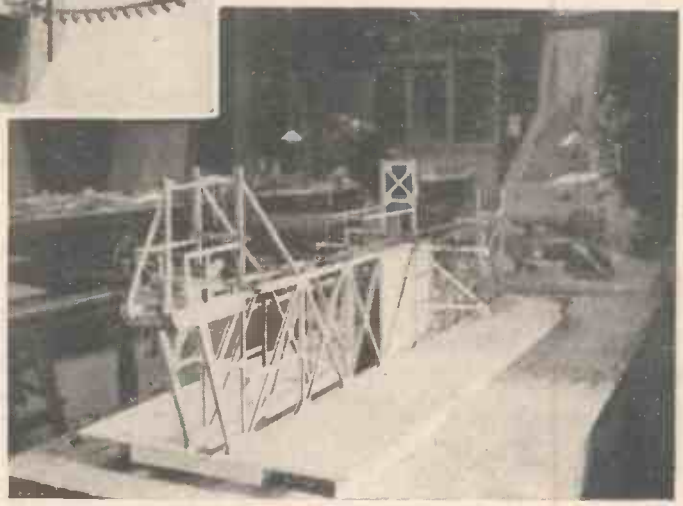
As the crews near the enemy coast bright lights gleaming from the bottom of the screen indicate searchlights, and a neat piece of mechanism throws hundreds of little flashes on the screen to denote the bursts of anti-aircraft shells. The navigator notes this " opposition " in his log.

Once over the coast the first excitement dies away, and except for occasional searchlights and perhaps a momentary burst of anti-aircraft fire the rest of the journey is mainly occupied with identifying the landmarks shown on the screen and keeping to course. At last the target appears; again the searchlights and the anti-aircraft fire are fierce. But this being only a navigational exercise, there is no simulated bombing, and no time is lost in starting back home.

The Work of a Tin Dredger

With Notes concerning a Remarkable Model.—By W. J. BASSETT-LOWKE.





(Above) The finished renovated model. (Right) The rebuilding of the superstructure on the special wooden deck

THE outbreak of war has made the mining of all types of metals a work of national importance, and all over the Empire there has been a speed-up in production.

In Burma there is alluvial tin in the mangrove swamps, and the alluvial tin deposits of Malaya are found in the flat land of the valleys or flood plains of the Peninsula, at depths varying from a few feet to 130 feet or more below surface level.

For obtaining these deposits under such conditions the bucket dredge is the most satisfactory apparatus. In the early stages of operation a dry dock is built, either by hand or mechanical means, of sufficient size to accommodate the hull or pontoon of the dredge. After this the paddock, as it is called, is flooded and the pontoon floated in preparation for the completion of the superstructure and the installation of the necessary plant and machinery, which, in most modern dredges, is electrically driven. The dredge, after starting up, proceeds to dig its way out of the dock, the ladder carrying the bucket band being gradually lowered until the full depth of the deposit is reached. The course of the dredge is then directed so as to cover, in time, the whole of the area to be worked. Being a floating dock, it can be moved with ease to follow the extension of the operations, and is thus kept in direct contact the whole time with the material to be treated.

Many readers have no doubt, in their lifetime, come across what looks like a heap of scrap—an article that has been neglected and allowed to go to ruin, or one that, unhappily, has been smashed up in transit and looks past repair.

A Remarkable Model

Here, then, is an example with a moral to it. The picture below shows the model tin dredger when it was first taken out of its case after being badly damaged, a pitiful and almost hopeless wreck. The second picture shows the reconstruction of the model in its early stages, and the first picture demonstrates the excellent job made by the model makers who recon. ditioned it to their clients' satisfaction.

The model was exhibited in the Malayan Section of the Empire Exhibition at Glasgow in 1938, and how it reached the state shown n the picture below is understood to have been in transit from another country, when the case containing it was broken.

On unpacking the "wreck" the model makers set to work to plan a scheme to bring this formerly attractive and educational model "back to life" again.

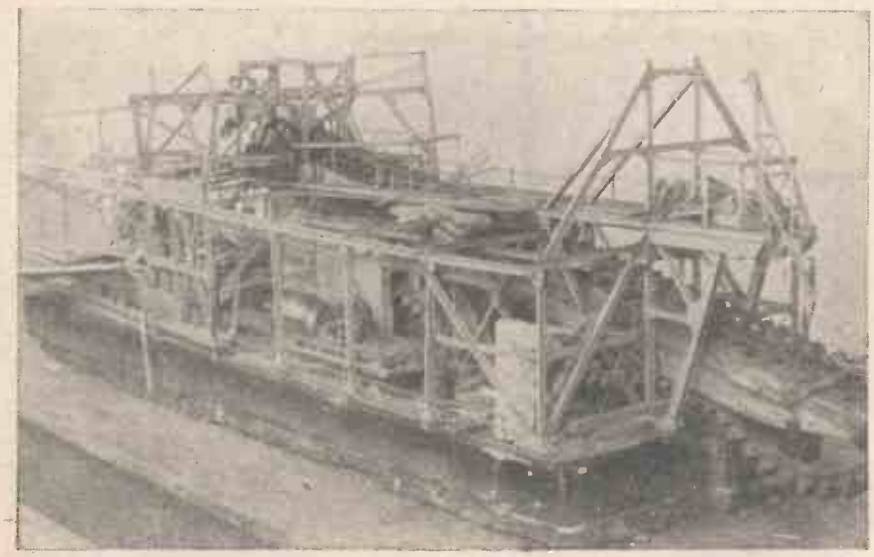
The only possible method was to take every part asunder and rebuild throughout. The old pontoon was merely a wooden structure. This was replaced by a new base made of planished sheet brass reinforced by half-inch brass angles. The whole structure was then weighted, and thepontoon so constructed to give two inches freeboard.

Superstructure

The superstructure was divided into three sections—port, starboard and centre—and was assembled bit by bit, remaking the old parts which were missing and those damaged beyond repair. Each section was then constructed separately and all three were collected together on a wooden deck.

The central section consisted of the central girder work carrying the bucket ladder, the gears which work it and the revolving drum. The port and starboard portions each comprised the strengthening girder framework carrying the primary jigs and the crane platform.

Also mounted on the deck were the moving winch and the ladder hoist winch, both of which were taken apart and rebuilt. The bucket ladder, made of heavy brass castings, was taken to pieces and renovated. The same task devolved on the model makers in connection with the two travelling cranes. One of these, it will be noticed.



A pitiful wreck—a view of the battered tin dredger when it arrived for renovation at the works of Bassett-Lowke Ltd.

lifts the gears and the other, which runs over the top of the moving winch and ladder hoist winch, was used to move parts for repairs.

All the primary jigs were reassembled and also the two electric motors, one of which operated the pump and the other the buckets. A new pump was fitted giving a flow of water through the revolving screens from the jigs.

The Work of a Dredger

The working of the real dredge is as follows :—

The bucket chain digs and elevates the ground, which contains normally about half a pound of tin ore per cubic yard (3,000 lbs.). The contents of the buckets are tipped into the revolving screen, where the material is treated by water jets and disintegrated. The coarse material and stone are rejected at the end of the screen and discharged behind the dredge by a stone chute, whilst the fine material, consisting of sands, clays and mineral ores, passes through the perforations in the screen to the primary jigs.

These primary jigs effect a part concentration of the tin-bearing materials by the action of gravity, the clays and lighter sands being carried off by side chutes to waste. The heavier enriched material sinks, and is drawn off from the spigots of the primary jigs and pumps up to the dewatering cones, through which it passes to the clean-up jigs for closer concentration. The concentrates from these jigs may contain from 20 per cent. to 40 per cent. of tin ore, which is collected and taken ashore to the tin dressing sheds for further treatment by washing, followed in many cases by magnetic separation. The final product—the clean tin ore free of all sand and, as far as possible, from other metallic impurities—contains from 72 per cent. to 75 per cent. of metallic tin.

It is now ready for the smelter, who converts it into the marketable product of Metallic Tin.

The reconditioned model, completed in best exhibition finish and in working order, has now been placed in the School of Mines Section of the South Kensington Museum, London.

Expanding Mandrels and Contracting Collets

Constructional Details of Some Useful Lathe Fitments

SOME simple forms of expanding mandrels and contracting collet chucks which are easily and quickly made and adjustable to cover a wide range of turning work, are shown in the accompanying illustrations.

For Work Turned Between Centres

Fig. 1 is an expanding mandrel for work most suitably turned between centres. The mandrel is tapered and, for a 4½ inch lathe, will be conveniently about 6 inches long. At its biggest end it is reduced to parallel about two thirds the diameter of the big end of the taper.

It is made of cast steel and the ends are hardened and tempered to an amber straw colour. Centre holes to correct lathe centre are drilled each end, with a parallel clearance at the end of the hole to ensure clearance for the point of the lathe centre and to afford a little reservoir for oil at the tailstock centre.

The taper should be about 5 degrees included. It could be made of mild (Bessemer) steel. In that case the ends should be case hardened before taking the final cut along the taper. The taper is best turned by setting over the tailstock of the lathe.

Expanding Collars

Upon this mandrel are fitted expanding collars which may be of various sizes to suit the run of work in the shop. They can be made of mild steel or plessplior bronze, and are turned to an interval taper out of the solid bar, cut off, and mounted on the taper mandrel and turned parallel outside. They are then slotted alternately from each end to a hole near the opposite end. The end view of the collar shows the slots. They are at right angles to each other. The side view shows how they alternate from either end.

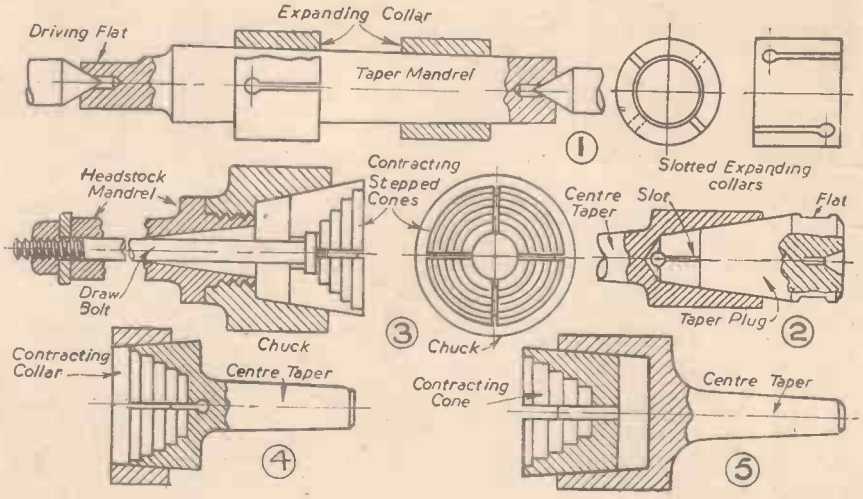
These collars will expand in the work and hold it tight in the mandrel when driven up the mandrel taper with the work in position on them. The collars can be made different outside and inside diameters and can be turned down if necessary for odd jobs.

A Stub Mandrel

A simpler form of expanding mandrel—a stub mandrel—is shown in Fig. 2. It has a standard tapered shank to fit the taper in the lathe headstock spindle or mandrel.

It is turned internally to a taper having an angle of about 10 degrees and is slotted across by a ⅛ in. slot ending in the transverse hole shown. It is parallel outside and is used to expand slotted collars as in Fig. 1, but with parallel holes. These collars are made from mild steel or bronze, and in various sizes.

The stub mandrel is expanded by the taper plug which is driven in. It has a case-hardened centre hole to take the back headstock centre and a couple of opposed flats by means of which it can be released by a spanner if tight in the mandrel.



Figs. 1 to 5. Details showing the construction of an Expanding Mandrel and Contracting Collets.

Collet Chuck

A contracting collet chuck to take several diameters is shown in Fig. 3, in section and end view. It is screwed internally to screw on the lathe mandrel nose, and is screwed up tight against the shoulder as shown.

Outside it is turned parallel, and inside taper. In this taper lie the four quarter cones which form the gripping members. The cone is turned as a solid, and has a central hole and a recess to take the draw bolt which passes through the hollow mandrel of the headstock, and is pulled up by a nut and washer at the rear end of the mandrel.

It is then stepped inside as shown while in its own chuck, and then is taken out and the four saw cuts made across it as shown in the end view.

This collet chuck can be made with one slot only but then the steps inside must be shallower.

The draw-bolt should have a hardened thread—it may be case hardened—and a hardened nut.

Modifications

Modifications of the contracting collet which are simpler, but do not combine the draw-bolt fixing, are shown in Figs. 4 and 5.

In Fig. 4 the chuck is made to fit in the tapered end of the lathe mandrel. It is turned from cast steel and recessed in the front and stepped to take different diameters of work as in the case of Fig. 3. It is slotted across, as shown, by a transverse slot sawn down it by a couple of hacksaw blades held together—side by side—in the saw frame. To contract it on to the work it is turned taper outside and a collar, having an internal taper of the same angle is driven along the chuck, so contracting it down on to the work.

In Fig. 5 we have the exactly opposite arrangement. Here the chuck body, with its taper to fit the taper of the lathe headstock mandrel, is recessed to a taper and the split-chuck with stepped interior, as in the other cases, is tapered outside to the same taper and driven in the female taper when it contracts on to the job, and holds it. It is probably a rather better method than that shown in Fig. 4,

Rain and its Reactions

Striking Facts Concerning the Earth's Rainfall and its Far-reaching Effects

The "Cheesering," near Callington, Cornwall, a well-known example of the eroding effects of rainstorms.

Another hard core of rock revealed by the natural action of rain. "Arthur's Seat," Liskeard, Cornwall.

RAIN is so universal and commonplace a meteorological phenomenon that, save in those relatively few instances in which it is spectacularly heightened in intensity or prolonged excessively in duration, we think nothing of it.

If we are townsmen or suburban dwellers we are generally inclined to take rain for a nuisance, forgetting, for the time being, the essential value of our country's rainfall for the well-being of the land, to say nothing of that of the populace, too.

How many of us pause to consider what our circumstances would be if, by some freakish operation of Nature, the world's rainfall ceased altogether? The results of such a permanent stoppage would be disastrous to most forms of life, since an earth without rain would become as dead a world as is our constant satellite, the moon.

The atmosphere, we all know, acts like a gigantic and invisible sponge in sopping up water from the earth. The air's moisture is mainly derived from the evaporation of the surface waters of the earth. Oceans, rivers, lakes, ponds, marshes all contribute regular amounts of water to the atmosphere. The hotter the atmosphere, the more water vapour it is able to absorb. At the same time, the more water vapour which the air holds, the more oppressive does it become to live and work in such an atmosphere, this being mainly on account of the fact that perspiration, which is a natural cooling mechanism of the body, becomes impeded in hot, moist atmospheres. There is little evaporation from the skin. Hence the body gets hotter and hotter, the individual more and more lethargic until, eventually, he becomes incapable of any sustained physical movement or even of clear thought.

In the Tropics

When people proceed from England to take up residence in the tropics, they find at first that they are unable to walk a couple of hundred yards without perspiring copiously. This perspiration evaporates but slowly, owing to the high water vapour content of the tropical atmosphere. Hence there is little cooling effect upon the skin. The individual, new to the tropics, therefore becomes "limp" and often listless. A certain amount of acclimatisation may be acquired, but, almost invariably, the intensely humid climate of most tropical regions will "get at" the individual, frequently rendering a return to England necessary.

If we leave water in a saucer, the water will slowly evaporate into the air. Consequently if there were no rainfall, and if the earth's atmosphere suddenly acquired an unlimited capacity for the absorption of water vapour, all the sources of water on the face of the globe, the vast oceans included, would quickly dwindle until our planet became entirely devoid of liquid water. Needless to say, long before such a stage had been reached the amount of water vapour in the air would have rendered life quite impossible. No one can live continually in the environment of even a mild and relatively cool Turkish bath. Yet an atmosphere which had absorbed all the liquid water from the face of the earth would render, in comparison, the steamy surroundings of even the most effective of Turkish baths a relatively dry and bracing locality.

A good example of the action of rain in washing away soil, and lighter stones, is to be seen in the case of any newly made road before paving, particularly after a heavy rainstorm.

Regarded in the above light, it will be seen that the phenomenon of rain is one of the great protective mechanisms of Nature for the guarding of animal and vegetable life upon our globe.

Causes of Rain

Despite such facts, however, there is still a good deal which even modern science has not yet discovered about rain, its mechanism and its causes. "Hath the rain a father?" exclaimed the prophet Job during his contemplations of the natural mysteries. Modern scientists essay the same meaning when they inquire into the essential causes of rainfall. The problem is one which is age-old, and it is not yet fully elucidated.

It is obvious, of course, that the water which falls from the clouds in the form of rain is derived from the evaporation of the large surface stretches of water which cover the face of the earth. Bulk for bulk, air saturated with water vapour is lighter than perfectly dry air. Hence when air takes up water vapour it tends to ascend. In rising, the humid air expands. Now, it is a universal law of nature that, when any gas expands, it becomes cooler, owing to the fact that it must have heat-energy to expand with and that it abstracts this heat energy from itself.

It has been found that, under average conditions, rising air becomes about 3 degs. Fahrenheit colder for every 1,000 feet of altitude.

Owing to this natural process of cooling, the water vapour in the rising air condenses. It forms tiny droplets, each averaging only about 1-125th of an inch, or even less, in diameter. Countless myriads of such agglomerated droplets coalesce to form clouds. If perfectly calm and tranquil conditions prevailed in the atmosphere, the clouds, light as they are, would slowly descend to earth. Since, however, there is always at least a gentle movement of winds above the earth, the clouds are buoyed up and they float about in the air much in the same manner as a cork or a light feather sails about on the gently agitated surface of a sheet of water.

Sometimes the moisture-laden air does not have time to form any long-lasting clouds. If, as in the case of an Atlantic wind blowing against a range of hills on the west coast of our country, the wind is very moisture-saturated, the air currents, which will be forced up to the tops of the mountain peaks and which will, in consequence, become cooler, will condense their moisture at once and rain will form heavily.

It is for the above reason that mountainous regions which are acted upon by moisture-laden winds are always rainy localities. The Lake District of England is such an example. So, also, is the region of Dartmoor.

Rain is also believed to be formed when a cool wind meets a warm one, the cold air condensing the absorbed water vapour of the warmer air, and so precipitating it in the form of rain.

It is further thought that much of the rain of our cities is actually caused by the

electrical condensation of water particles around minute specks of dust which invariably float high up over all manufacturing regions. Exactly how this condensation is brought about is yet an unsolved mystery.

The question is frequently asked as to whether it is possible for man to make or to stop rain. So far as we are aware with the present state of our knowledge, the answer to such interrogations is a simple negative one. Forces too stupendous for mankind to generate are concerned in the making of rain on a natural scale. Thus, for instance, it has been calculated that, in order to provide an average English rainfall about 330,000 horse-power of natural heat-derived energy must be expended for every square mile of surface rained upon.

The so-called "cycles" of wet and dry years, the one-time assumed connection between heavy rainfall and wireless waves, gunfire and other artificially produced disturbances are all problems of rainfall which have never been even partially elucidated. The interactions of air currents, variations of temperature, natural configurations of the land surface and a host of other factors are all so complicated that these are sufficient to account for even the most extraordinary variations of rainfall without having to ascribe such power to any artificial agency. Nevertheless, it is possible that rainfall could be produced by projecting vast amounts of electrical energy into the upper regions of the air, although precisely how this undertaking would be carried out remains to be seen.

Measurement of Rainfall

Rainfall is normally measured by means of a rain-gauge, which is a copper cylinder of prescribed dimensions fixed above the ground at a standard height. The gauge is inspected daily (usually at 9 a.m) and the water collected in it is measured in inches or millimetres. Under these conditions, if the layer of water in the gauge measures half an inch in depth, we assume that half an inch depth of water has fallen over the land in the immediate locality.

One inch of rain falling upon one acre of land is equivalent to a volume of water approximating to 22,600 gallons and weighing a little more than 100 tons. From this figure, some appreciation of the weight of water falling annually in any given district may, with a little trouble, be arrived at, if we knew the rainfall (in inches) of the district, and the approximate extent of the latter.

The annual rainfall varies greatly over the face of the earth. Some districts, such as the Egyptian deserts, hardly have any rainfall at all. In other places, as, for example, the islands immediately south of New Zealand ("Seven Sisters" islands) it rains almost continuously day and night throughout the year.

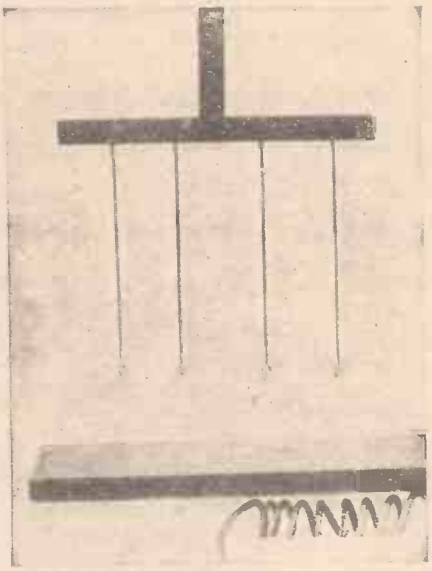
In the British Isles, the wettest places are those situated on high ground in the West. Probably the rainiest place in the British Isles is the Snowdon district, in North Wales. There, the average rainfall is about 247 inches. In various places in the Lake District, average annual rainfalls approaching 160 inches have been recorded, whilst at Bourne, in Lincolnshire, the annual rainfall is only about 20 inches.

Practically all England's rainfall is derived from the incoming Atlantic winds. Hence it is that as we proceed eastwards, our climate becomes drier and drier, most of the rain precipitating itself upon the western mountain ranges of our land.

In the London area, the average annual rainfall is about 24-5 inches, which relatively small rainfall makes possible the fresh and even exhilarating climate for which the Metropolis is noted.

Heavy Rainfalls

Normally, rain falls comparatively gently, but, occasionally very heavy rainfall intensities are experienced. To these is given the name "cloudbursts," and as such they are reported in the local Press. In nearly every case, such "cloudbursts" are nothing more than exceptionally heavy showers. There are, however, some occasions on which the rain seems to come down not in drops but in solid masses of water. These occasions represent actual cloudbursts. In such instances, local cloud conditions and variations of temperature, together with certain as yet unknown



A close-up of apparatus designed to study the formation of water drops under the influence of an electric field.

electrical conditions in the atmosphere, appear to effect the almost instantaneous condensation of the clouds' contents. When such conditions obtain, the water is thrown down to earth almost in the same solid sheet of liquid as is produced when a bucketful of water is suddenly inverted.

Rainwater, having come down to earth, disposes of itself by evaporation, by sinking into the ground (and therefore supplying the sources of springs and streams), and by running over the surface of the land into rivers and lakes, as well, of course, as by refilling the seas and oceans.

Heavy rains are less effective than steady ones in conserving the fertility of the land. Thus, in our country, an average annual rainfall of some 30 inches is all that we require for our agricultural and communal well-being. In those regions, however, in which the climate is warmed, rendering the loss of water by evaporation greater, an annual average rainfall of 30 inches would not be sufficient.

Eroding Influence

In the rainy seasons most rivers and streams are muddy and highly charged with sediment. This represents the "mechanical" work which the rain continually exerts in altering the face of the land. A good example of such a factor is to be seen in the condition of a newly made and unpaved road on a modern housing estate. Such a thoroughfare, after a rainstorm, becomes a veritable quagmire of muddy ruts and sodden channels, the rain washing out most of the lighter particles of soil and grit and carrying them away by means of the miniature streams which it brings into being.

Rain also acts chemically in dissolving out of the land certain readily soluble constituents. Falling over industrial districts, rain usually dissolves acidic constituents from the atmosphere, whilst even in country districts the action of lightning is to form oxides of nitrogen in the air, which gases produce nitric acid in traces sufficient in amount to render the rainwater slightly acidic.

Hence it is that rainwater flowing over the surface of the land possesses a chemical dissolving power as well as mechanical eroding influence.

The acids dissolved in the rainwater play a very great role in the natural weathering of the rocks. They dissolve the soft constituents (felspars) from rocky boulders, leaving only the hard granite behind. A notable example of such a natural action is the world-famous "Cheesewring," near Callington, Cornwall. Here, the continual rainstorms through the ages have dissolved and washed away large amounts of soft rock constituents, leaving a curiously shaped and perfectly balanced hard core of insoluble granite behind. Other examples of such action are to be found in nearly every mountainous region.

"Hard" River Water

The water of rivers is "hard" because of the chalk dissolved by the rainwater as it percolates through limestone and chalky districts. Thousands of tons of chalk are dissolved out of the land forming the Thames basin by the rain which falls in that area every year. That is why the domestic water supplied in the Metropolitan areas is so hard compared with water which comes from a non-limestone district.

It is the ceaseless mechanical and chemical action of rainwater which causes the underground caverns, "pot holes" and "grikes" which are well-known features of limestone districts. To such actions, also, is due to a large extent the natural configuration of the countryside as a whole. Even the mountain ranges themselves are slowly but surely changing their forms under the imperceptible but nevertheless irresistible action of rainwater.

As yet, we know too little about rain and rainfall to be able to exert any artificial control upon this aqueous precipitation. Perhaps, as some assert, we never shall have it in our power to control the rain. Nevertheless, we may study it closely, so as to increase our knowledge of the phenomenon, which, as previously indicated, is still considerably lacking in extent.

MASTERS OF MECHANICS

No. 64—A Master of Mechanical Flight: The Meteoric Activities of Alberto Santos-Dumont, Airship Designer and Builder of Aeroplanes

ON a Brazilian coffee plantation about the year 1880 a young lad of seven or eight years listened intently to a discussion which had been going on between two of the plantation workers. The subject was the possibility of man's mastery over the air. Both the men seemed to agree that mechanical flight would never be possible, but the boy, young as he was, expressed different views.

"Perhaps, some day," opined the lad, "men will invent a ship which will sail in the sky just as ships sail over the sea."

"No, my boy," one of the planters replied. "Man will never navigate a ship in the sky."

"But on St. John's Eve," insisted the boy, "when we all make bonfires, we also send up little tissue-paper balls with hot air in them. If we could make a paper ball big enough, why could not an engine be fastened to it which would drive it through the air just as a ship is driven through the water?"

"Boys talk foolishness," exclaimed the planter. It was the only reply that the wondering lad received to his query. In vain did the planter explain to him that since 1783 it had been possible for a man to ascend into the clouds in a balloon, but that no balloon could possibly be steered. The lad, who evidently cherished his own notion of things, insisted on the fact that it might one day be possible to fly by means of an engine attached to a balloon. But as the atmosphere of the plantation was too enervating to permit of prolonged argument, the boy was left to reflect upon his own strange notions undisturbed.

A curious lad was this. Barely eight years of age. Thin, wiry, and slender, with the face of a dreamer and eyes which seemed at times as if they were peering into futurity. His name was Alberto Santos-Dumont, and his father was a wealthy coffee-plantation owner, whose estate at Sao-Paulo, in Brazil, the world's chief coffee-producing country, extended to upwards of a score of square miles.

Early Work on Plantation

Alberto was born in 1873, at Sao-Paulo. During his earliest years he was allowed to run about wild, and because he was the "boss's son," he had things pretty well his own way. But Alberto did not grow up to be a spoiled or a pampered child. On the contrary, despite his slender stature, he tackled many of the rough jobs of the plantation and, at the tender age of seven years, he was actually driving a steam locomotive over the 60 miles of railway track which the plantation contained.

These locomotives, or "coffee engines," as they were termed, served the purpose of collecting the coffee berries from distant groves and transporting them to central sorting stations. They were essential to the smoothing running of the plantation and, despite the competition of the petrol car, some of these steam locomotives still exist at the present day.

The lad Alberto was a puzzle even to his parents. When they undertook periodical horseback trips to inspect other coffee plantations of the locality, the boy preferred to slip away to the mechanics' shop of the estate or to the large shed where the locomotives were housed. Undoubtedly, Santos-Dumont senior averred, the boy was a born mechanic, and, wisely, the indulgent father gave the lad much freedom in his bringing-up.

Young Santos-Dumont, as the years went by, proved himself to be an invaluable assistant on the "mechanical" side of the plantation, although he showed little interest

Alberto Santos-Dumont.

in the botanical aspects of coffee growing. He learned to repair the mechanical coffee-crushers, the rather complicated sieving machinery, and the other mechanical appliances of the plantation. In his spare time, particularly in the rainy seasons, he read the scientific romances of Jules Verne, and for hours pored over illustrated works on locomotive building and general mechanics. In the summer he went kite flying, although

Santos-Dumont completing his airship flight around the Eiffel Tower in Paris on 19th October, 1901.

he seems not to have had any spectacular successes in this avocation.

Alberto Santos-Dumont, the world's first successful airship builder, saw his first balloon in 1888 when he was 15 years of age. The balloon rose over the town of Sao-Paulo, and a parachutist descended from it. By this time Santos-Dumont was well versed in the history of ballooning, having made a detailed study of it from the books which he had available. The balloon ascent over Sao-Paulo appeared to be so easy, and so completely effortless, that on the spot all the latent ambitions of the growing youth to sail the skies in a balloon seemed at once to well up within him. From that time onwards Alberto determined that he would himself "go ballooning" and endeavour to construct a balloon that would drive itself through the air.

The decision was made far more easily than it could be carried out. For one thing, Santos-Dumont senior was a wealthy and an influential man, whereas a balloonist was at that time considered to be little more than a fifth-rate acrobat. For Alberto Santos-Dumont to "go ballooning," even over his own family plantation, would have been a veritable social sin.

Visits to Paris

Alberto had to wait until he got to Europe before the further developments of his ambitions took place. The Santos-Dumont family visited Paris in 1891, partly on business, partly for holiday purposes. Almost immediately after his arrival in Paris, Alberto Santos-Dumont sought out a professional aeronaut of whom he had heard. The latter individual expressed a willingness to take Alberto "up," but he surrounded his consent with so many conditions and formalities that Alberto gave up the idea of ballooning over Paris as useless. Instead, he bought a car, one of the earliest of the Peugeot 3½-h.p. models, and in the same year he returned to Brazil, taking his Peugeot model with him for the wonderment and amazement of the community at Sao-Paulo.

In 1892, Santos-Dumont, father and son, again made a trip to Paris. This time another attempt was made by the determined son to ascend in a balloon, but circumstances were still against him, and again his ambitions in this direction were doomed to failure.

Going to Paris for the third time in 1897, Alberto Santos-Dumont made the acquaintance of M. Lachambre, a balloon builder, who had attained much fame by his construction of the balloon in which the ill-fated aeronaut, Andrée, attempted to fly over the North Pole. Monsieur Lachambre was as enthusiastic on the subject of ballooning as Santos-Dumont himself. After their first meeting, it was arranged that, for a payment of 250 francs, Santos-Dumont should go for his first flight in a balloon on the next day. Lachambre was as good as his word, and Alberto himself was in high spirits. The latter turned up at the *Parc d'Aerostation* armed with a basket containing hard-boiled eggs, cold roast beef and chicken, cheese, ice cream, fruits and cakes, coffee, champagne, and green Chartreuse, for "nothing," wrote Alberto afterwards, "is more delicious than lunching like this

above the clouds in a balloon ! "

First Balloon Flight

Santos-Dumont's first flight in a balloon in the summer of 1897 only whetted his appetite for more. He promptly decided that he and Lachambre would build a balloon to his own ideas. This balloon, which was one of the ordinary spherical type, he named the *Brazil*. In order to get into training for his preliminary ascent in the *Brazil*, Santos-Dumont undertook two dozen or more ascents in one of Lachambre's balloons. The *Brazil* held about 4,000 cubic feet of hydrogen gas. It was constructed in the lightest possible manner and, fortunately, it was quite successful in use. In the *Brazil* Santos-Dumont gave several public exhibitions of ballooning. Public interest, however, in such spectacles was waning, and even Santos-Dumont's enthusiasm for the ordinary balloon was not quite what it was.

Something was wrong with the notion of the balloon, averred Santos-Dumont. A balloon which cannot be steered was, he insisted, a pretty useless thing. He resolved, therefore, to put the fantastic ideas of his not far distant boyhood to the test and to endeavour to devise a balloon which would drive itself through the air.

With this notion in mind he consulted Monsieur Lachambre. The latter worthy only laughed and said that the whole idea was impossible, that people had tried hitching engines to balloons in the past and had signally failed in their attempts—usually at the cost of their lives.

Santos-Dumont, however, was not to be denied. He almost commanded Lachambre at least to assist him in the practical construction of a steerable balloon of his own invention, for the driving of which he selected one of the new petrol motors which Paris was then producing in quantities.

The balloon was to be an elongated one, just large enough to raise one man's weight, together with the weight of the basket, engine and attachment ropes.

" Santos-Dumont No. 1 "

The construction of the airship was a prolonged one, but on September 18th, 1898, the *Santos-Dumont No.* 1 was ready for flight. Two days later this embryo airship rose for the first time from its moorings in the beautiful *Jardin d'Acclimation*, the new Zoological Gardens to the west of Paris. The machine, with its designer in it, skimmed the tree-tops gracefully and sailed away over the roofs of Paris. Then suddenly the balloon, which was more or less cylindrical in shape, began to fold in the middle like a pocket knife. The graceful flight of the *Santos-Dumont No.* 1 became a precipitate descent, from which the adventurous Alberto very fortunately escaped unhurt on landing. At once packing everything of value into a basket, he left the wrecked airship on the ground and returned to Paris in a cab.

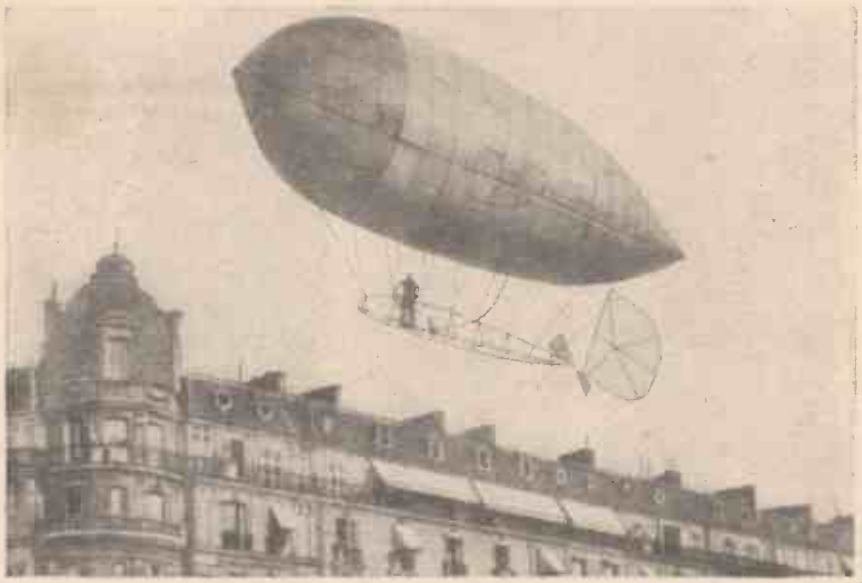
In the early spring of 1899, the *Santos Dumont No.* 2 was built. This had the same length as the *No.* 1 model, but its diameter was greater, and it held some 7,000 cubic feet of hydrogen gas. It was equipped with a miniature propeller and a small petrol motor, and it rose into the air for the first time from the Paris *Jardin d'Acclimatation* on May 11th, 1899. Sheer bad luck dogged this model, however. The day was a rainy one, and the wind lifted the rain-sodden envelope of the dirigible and hurled it against the trees, entirely putting it out of action.

Santos-Dumont No. 3 was then built. This made its maiden flight on November 13th, 1899, which flight, being entirely successful, confirmed Santos-Dumont in his opinion that a serviceable airship or dirigible balloon was a practical possibility.

Santos-Dumont's next plan was to establish an airship-building factory of his own, which task he accomplished at St. Cloud, near Paris, at the turn of the last century. Here, in 1901, he built his famous airship, *Santos-Dumont No.* 5, with which he attempted to win a prize for a circuitous flight around the Eiffel Tower. The endeavour failed, but with his next airship, the *Santos-Dumont No.* 6, which was 103 ft. in length and 22,000 cubic feet in capacity, the inventor succeeded in his attempt on October 19th, 1901. Following this achievement, he made a number of spectacular cross-country flights.

Epoch-making Flight

For his epoch-making flight round the Eiffel Tower, Santos-Dumont won a prize of 125,000 francs offered by a certain Monsieur Deutsch de la Meurthe, a member of the Paris Aéro Club. Of this sum, Santos-Dumont handed over 75,000 francs to the Prefect of Police of Paris for distribution among the poor. The remainder of the prize money he distributed among the workers in his own airship factory at St. Cloud, retaining none of the well-earned prize for himself.



The Santos-Dumont No. 9, one of the last of Santos-Dumont's airships. It is here seen cruising over the Paris roof tops.

Santos-Dumont's succeeding airships followed a line of progressive evolution. They become more powerfully engined, more stabilised, bigger, and yet more easily controllable.

Then came the era of the aeroplane, and in 1905 Santos-Dumont built his first heavier-than-air machine, which took the form of a mechanically propelled box-kite, which was built on the theories of one Lawrence Hargrave, a Greenwich-born man, who, at an early age, emigrated to Australia and contributed several important papers on man-lifting kites to the Australian scientific societies. Hargraves' work was little known, but Santos-Dumont saw value in it and put much of it into actual practice.

Santos-Dumont's First Aeroplane

The first aeroplane of Santos-Dumont was not a success, but with his second aeroplane (of a similar type to the first), which was fitted with a 50 h.p. petrol engine, he made a flight of 8 seconds' duration on September 14th, 1906, this attempt being followed by longer flights in the two succeeding months of the same year.

These were the first power-driven flights in a heavier-than-air machine to be made in Europe, and by them Santos-Dumont won the Aero Club of France's prizes for the first flights of 25 and 100 minutes' duration respectively.

In 1908 Santos-Dumont constructed what we may now term the world's first light aeroplane. This was his celebrated and now historic " Demoiselle " model, which, being fitted with a 30 h.p. engine, weighed only 290 lb. complete, and was capable of a speed of some 50 to 60 miles per hour. But the " Demoiselle " was before its time and it did not, despite its success achieve the popularity which its inventor and designer had anticipated.

Sudden Ending of Activities

In the following year, and for no apparent reason, Santos-Dumont's aeroplane and airship constructing activities came to a sudden end. The candle of his enthusiasm suddenly extinguished itself and Santos-Dumont, walking off the stage of public approbation and wonderment, left the further designing and development of air-craft to others. From that time until his death, which occurred, after a long illness, on July 24th, 1932, little further was heard of him.

There is no doubt of the fact that, despite the only semi-successful nature of his aircraft creations, Santos-Dumont occupies a high place in the annals of aircraft construction.

Santos-Dumont was a picturesque sort of a man. His personal courage in those daring and difficult early days of aircraft piloting was unexcelled, and his experiments in Europe were undoubtedly the ones which served to focus the attention of the public on the possibilities of flying.

For Santos-Dumont himself, of course, the later achievements of his career completely vindicated the dreams of his early boyhood. His were the hands which had first steered a balloon through the air. His were the brain and the muscles which had first controlled the flight of an aeroplane in Europe. Fulfilled ambitions and achieved ideals such as these, Alberto Santos-Dumont, " the little Brazilian," took away into retirement with him and, no doubt, they offered him comfort and satisfaction during those long years in which the world almost completely forgot his existence, let alone his pioneering flights of the past.

Our Busy Inventors

By "Dynamo"

Spades Are Trumps

"DIG for victory" is the slogan which is shouted at us by many a poster. In order to beat the enemy's blockade, while our soldiers carry arms, civilians are enjoined to shoulder spades. We must reinforce Home Guards with Home Gardeners, and every garden must be converted into a cornucopia.

Now, in addition to the "blitz," we have to contend with the blights. This moves me to mention an improved insect-destroying composition for which a patent in this country has been applied for. It is already known that mercurous chloride, otherwise termed calomel, is a powerful enemy of insects. Placed on the land under cultivation, this chemical prevents the hatching of eggs deposited by those insects which live near the ground, or whose adults lay eggs either on or immediately beneath the surface of the soil. The larvæ of these depredators cause extensive damage to both agricultural and horticultural crops. Among the victims of the pests are cabbages, cauliflowers, carrots and onions—vegetables, at this juncture, of more intrinsic value than emeralds.

The new composition is a mercurous insecticide mixed with a substance which absorbs water from the air and thereby maintains the insect-killer in a moist state.

So on the garden front we can destroy germs while our forces defeat Germans.

False Waistcoats

IN the Victorian era our forbears smugly recited Longfellow's "Psalm of Life," in which occurs the line :

"And things are not what they seem."

One of the hypocritical articles of those highly respectable times was the paper collar. This pioneered an imitation linen collar which the wearer cleaned with soap and water in the same way that he washed his face.

A lineal descendant of that Pharasaical neckwear is a paper waistcoat, which is the subject of an application to the British Patent Office. It is an irony of fate that the inventor's address is in Savile Row, London, the Mecca of sartorial devotees, from which one expects garments only of superfine cloth to emanate.

The idea consists of a waistcoat including a front portion made of paper, or paper-like material, arranged to be linked at its ends by detachable fastening means. The paper may be impressed to simulate a tailored vest having imitation stitches which also surround slits representing pockets.

The designer affirms that a white fancy waistcoat made of pliable linen-faced paper presents a front not so apt to crease as the material usually employed.

This vestment (I almost wrote "vest-meant") belongs to the family of paper serviettes, table mats, etc. But, in these troublous times, when paper is at a premium, the waistcoat in question will not readily come to the front.

Raising the Shoulders

MAKING the most of oneself is a pardonable trait in human nature. An important factor in the art of tailoring consists in magnifying the physique. Padding, sometimes known as "soldier's fat," is the usual means of clothes inflation. Many years ago, coats well built up and out were said to have "Yankee shoulders."

Improvised shoulder pad construction is the aim of a recent invention. The designer has particularly had in view the provision of padding in coats of the type that are unlined. Other objects of the inventor have been to furnish a new method of applying the shoulder pads to the lighter kind of garment; to provide a new form of pad; and to construct the shoulder padding simply, effectively and cheaply.

This improvement in the process of padding may be a boon to the ladies. According to the latest mode, the coats of the fair sex on the shoulders are moulded after a rectangular pattern. The new method should conveniently enable their garments to match modern architecture, which has more straight lines than curves.

Roof First

WHEN the foreign house demolishers of to-day have themselves been demolished, there will undoubtedly be in this country a considerable amount of rebuilding. As we sometimes experience in our island a lot of rain, wet days mean much interruption of work. This delays the erection of houses. If the builder happens to have borrowed money, the interest accumulates as rapidly as the rain falls.

A new type of anti-gas helmet which the Ministry of Home Security announce is to be issued shortly to persons who are unable to wear the ordinary type of gas mask.

In these circumstances, a suggestion which comes from Sweden is well worthy of consideration. An inventor in that happy neutral country seriously declares that, if you put up the roof of a house first, the workmen are protected from rain, and building operations are not interrupted by that fickle jade, the weather. This is not a mad idea from Laputa, the fictitious clime in which Gulliver discovered so many improbabilities; it is claimed to be a practical suggestion. The method involves the use of a motor which lifts the roof progressively as the walls are built. Platforms are suspended from the roof, by means of which the bricklayers erect the walls.

One wonders whether the same result could not be obtained by combining with the scaffolding a tent arrangement of an umbrella pattern which could be put down on sunny days.

Egg Elevator

THE price of an egg, though not yet "far above rubies," is abnormally high. This is the measure of its rarity. But I was at a breakfast table one morning lately when an egg cup was even a greater rarity. Then someone had a brain wave. On the table was a bottle of milk. Invention being still the offspring of necessity, the bottle was improvised as an egg cup. The mouth of the bottle exactly fitted the girth of the egg. And its height brought it conveniently near to the lips of the consumer, reducing to a minimum the danger of decorating his old school tie with a fragment of the golden yolk. Why not a lofty egg cup on a standard flanked with accommodation for salt and pepper? I offer this idea to the budding inventor.

Handy Eraser

"TO err is human." As regards writing, mistakes happen in the best regulated offices. When these are perpetrated in ink, erasure is the unpardonable sin. Before the advent of the typewriter all legal documents were engrossed by hand. One wonders how those industrious law-writers imperceptibly corrected the errors they must sometimes have made. The cautious scribe and the draughtsman sketch out their work first in pencil. Fortunately, the lead pencil does not leave a mark indelible like that which stained the hand of Lady Macbeth.

We are all familiar with the pencil which at the antipodes of its point has a small piece of india rubber. It is the symbol of the writer's fallibility. An inventor has come to the conclusion that this type of eraser is not without a disadvantage. In order that it may be brought into operation, the pencil has to be inverted. He has, therefore, devised a pencil, alongside the point of which is an eraser. One can slide this with the fingers without altering the writing position. And the pencil can be covered or uncovered as desired.

Light on the Key-Hole

THE roisterer who arrives home not long before the dawn was many years ago equipped with a latchkey fitted with an electric light bulb. This enabled his oscillating hand to insert the key in the elusive aperture.

To the same family of devices belongs a recently introduced electric torch, combined with which is a holder for receiving a key in such a way that, when not in use, the key lies against the torch-casing. But, if required, it is extended. A switch is provided so that the action of the extending key automatically turns on the light.

NOTES ON RIVETING

Practical Points to be Considered in Making Sound Joints

RIVETING is a simple and largely used method of joining two pieces of metal firmly together. But there are somevery interesting and important points about the process which must be understood if the best work is to be obtained.

Some practical examples of good and bad work are here illustrated to show what defects can arise through very slight causes, and how what should be a sound job can be made a very inefficient one.

In Fig. 1 is shown an ordinary round-head rivet. It will be noticed that there is a slight radius at X. Since all rivets should be a good parallel fit in their holes, it is obvious that a rivet cannot sit down with its head close to the plate being riveted when the hole is parallel from end to end and has a square corner at the top.

If a rivet with the rounding under the head is forced down by hammering, the rounding will act as a wedge and force the metal round the top of the hole sideways, and the metal will rise up to make room. This is shown in Fig. 2, greatly exaggerated to show the effect. The rising of the metal at A will prevent the rivet head sitting down tight on the surface of the plate.

Countersinking

To ensure against this defect the top edge of the hole should be slightly rounded or countersunk as at Fig. 3, and then the under surface of the rivet head will pull down, as it is intended to do when riveting up, close to the plate as shown in Fig. 4, to hold it fast.

Perhaps the greatest cause of weak and defective rivet work is in having the holes out of line with each other. For good accurate work holes should be drilled in the first case a little smaller than the rivet diameter, and reamed out together when the plates are assembled upon each other. Two, some distance apart, should first be reamed and then bolted together by bolts which exactly fit them, and then the other holes should be reamed to size while the plates are thus located, to fit the rivets.

When the holes do not line up we get the condition shown at Fig. 5. The rivet is forced sideways to take up a mean position in the axes of the two holes. Its head will not lie flat, but the corner at B will be taking the pull until the rivet is fully closed by the hammering, when the rivet will be distorted, as well as the contacting edges of the plate around the holes as shown in Fig. 6, where the rivet shown first entered and commenced to be compressed in Fig. 5 has been finally closed under the hammer blows; further hammering causes shoulders on the rivet each side as shown at X and Y, Fig. 7. These shoulders prevent the rivet holding the two parts tightly together; they only hold the rivet tight in each plate, but hammering will not draw the plates together.

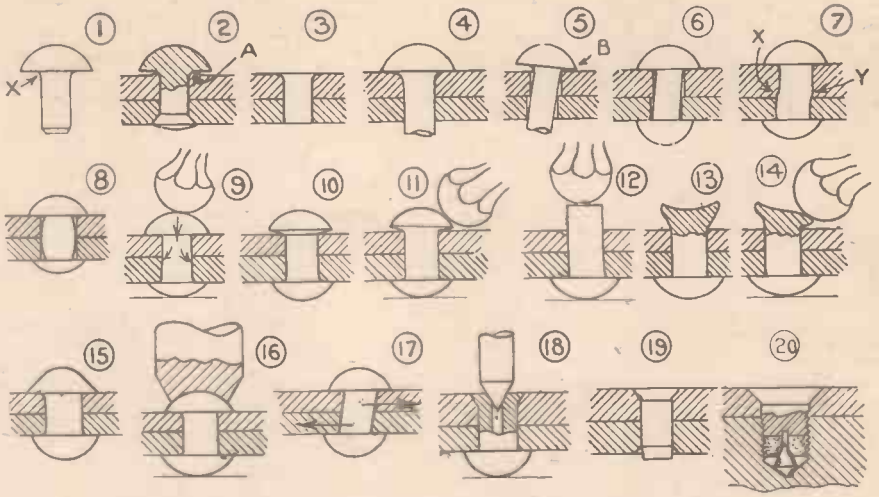
Rivets Too Small

If the rivet is smaller in diameter than the hole, then what happens when the rivet is finally hammered up is that it bulges in the middle as shown in Fig. 8. This will more or less locate the two holes axial with each other, but the fixing sideways will not be so good as if the whole length of the rivet fitted the hole closely.

When the rivet fits the hole the hammering spreads the shank tightly up against the walls of the hole, as indicated in Fig. 9, the arrows indicating the spread of the metal where the blows are directed at the centre of the rivet head, and in the line of its axis. But if the hammering is continued dead in the axial line, the edges of the head of the rivet will lose close contact with the surface of the plate being riveted. This is so slight as hardly to be noticed. It is shown exaggerated in Fig. 10. Therefore, after hammering down so that the shank swells by direct blows on the centre of the head, the blows must be directed all round the head at an angle as shown in Fig. 11 so as to close the periphery of the rivet head tight down.

Forming the Rivet Head

Given dead axial holes and rivets which exactly fit them, the procedure may be indicated as follows : Start by blows with the round-paned hammer dead in the centre of the flat end of the rivet, as shown in Fig. 12. This tends to swell the rivet in the plates. Continue till the edges bulge out and the end is saucer shaped as in Fig. 13. Then with blows on the edge knock down the edges all round, using the hammer as shown in Fig. 14. Continue till the more or less conical shape is produced as in Fig. 15. This spreads the shank, tightens the rivet over the corner of the hole, beds it down tight on the flat at the edges and, finally, compresses the head fully in all directions. (Fig. 15).



Figs. 1 to 20. Details illustrating various points in correct riveting.

Using a Punch

To give a neat finish to round-head rivets use a hardened punch with a semispherical head as in Fig. 16.

A bad joint is made when the holes for the rivets are not square with the surface of the plates. This is shown in Fig. 17. In riveting up, the tendency is to move the plates relatively to each other as indicated by the arrows because the blows on the rivet and the reaction of the blows at the holding up solid mass have the effect of driving the rivet sideways. Such a riveted joint could not have a good hold. One edge of the heads would be down as in Fig. 5, and closing them down by hammering would only have the effect of pushing the rivet and the plates sideways.

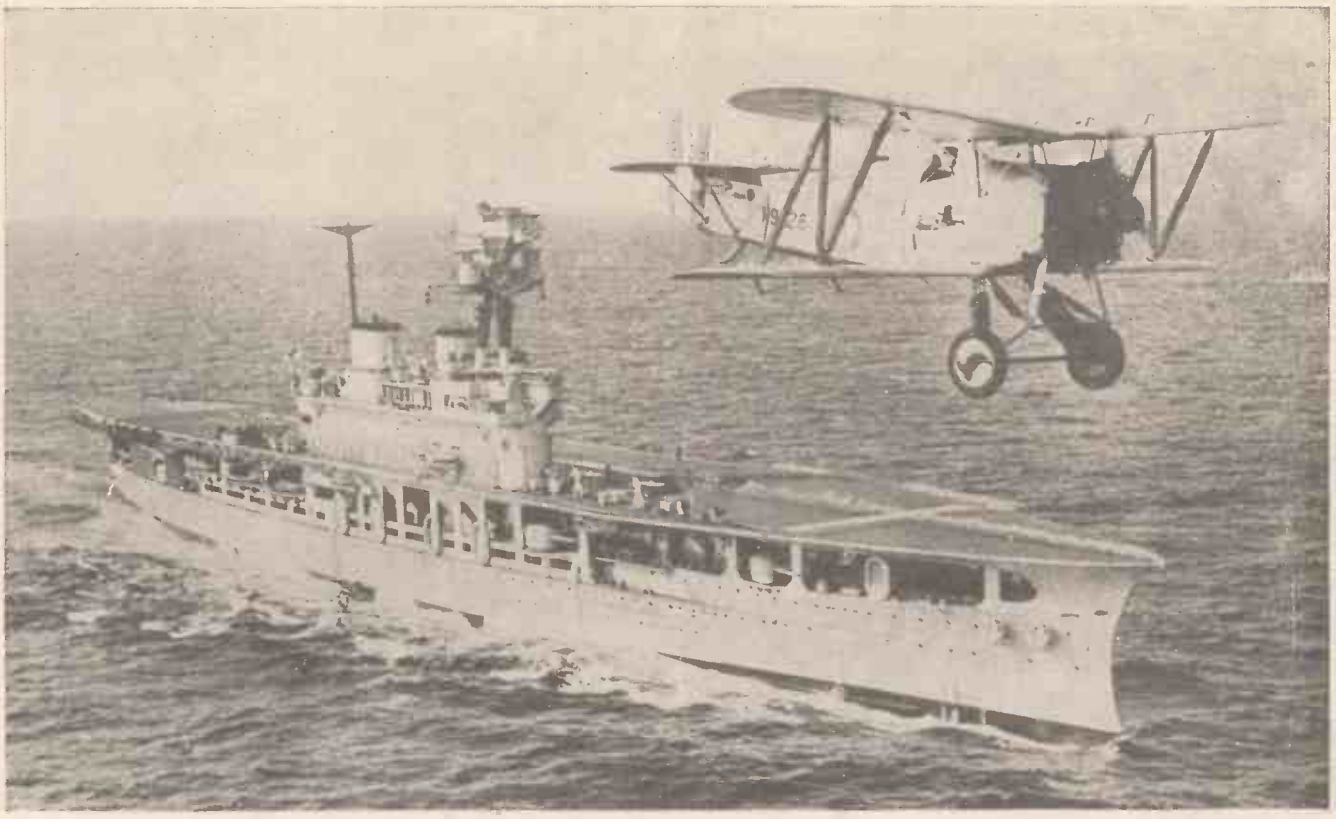
Expanding Rivets

A form of expanding rivet now more largely used than previously is shown in Fig. 18. It has an axial hole about halfway through the shank. The head is as usual or it can be sunk in a countersunk recess in the plate. The closing end of the hole is countersunk, and a hardened conical punch is used in the hole to spread the end of the rivet. The angle of the punch should be a little more obtuse than the angle of the countersink in the hole because the circumference of the countersink requires that the metal shall be spread out.

To enable a rivet to be driven in tight holes, it can be bevelled off slightly at the end. This gives it a lead, and often prevents the rivet being slightly bent when driving it a tight fit in a hole. If the end of the hole is countersunk as shown in Fig. 19, this rivet can be riveted up very tight and flush each side. In these flush rivets it is advisable to have the angle of the countersink a little more acute than is usual and a trifle deeper. It gives the rivet a better hold.

Screwed Rivets

When riveting a plate to a solid mass of metal the rivet may be screwed into the solid, and riveted over the plate as shown in Fig. 20. With a tap plug, thread the hole in the plate, and with dies screw the rivet end parallel to fit it. Drill a hole $\frac{1}{4}$ in. diameter of the rivet up its axis for a distance equal to its diameter, and saw cut it across for a distance equal to two-thirds of the length of the saw cut up the rivet Slightly taper the end of the hole in the rivet, and turn a taper cone to fit it. and project about $\frac{1}{8}$ in. Then screw the rivet in the hole tightly with heavy pipe grips. The cone will expand the rivet in the threads. Place the drilled plate over the rivet, and rivet up in the usual way. The hammer blows will consolidate the rivet in the hole and rivet its head over. Keep the blows axial at first; afterwards driving the head into the countersink.



A machine leaving the deck of an aircraft carrier

Our Aircraft Carriers

The Story of How the Fleet Air Arm Came into Existence

ALTHOUGH it was towards the end of May, 1939, that the Fleet Air Arm, administered entirely by the Admiralty, started its independent existence, it really came into being in the spring of 1924, when the Admiralty were given control of R.A.F. units for operational and disciplinary purposes while they were accommodated in aircraft carriers and other ships.

It was very early in the World War of 1914-18, however, that aircraft demonstrated their value as a means of guiding the conduct of a major naval operation. Although they were used solely for reconnaissance duties and not in an offensive capacity, their services were found to be invaluable. They suffered from serious limitations, however, in that, if a "land" plane was used, their useful range was greatly restricted, while if a seaplane was used, it was incapable of alighting with safety on anything but the calmest sea. Thus it is that a floating aerodrome is an obvious necessity, yet once that has been acquired there are many other important problems that have to be met. For example, the navigational problems involved in piloting an aircraft from an aircraft carrier require the most meticulous calculations. Then again, visibility at sea often extends over a range of many miles, but it also falls to only a few hundred yards almost without warning, and it is then no easy matter for a pilot to find his way home to a carrier after long reconnaissance flight, unless he has kept a very accurate record of his navigation during the flight. Thus we see that the organisation and equipment of a squadron of the Fleet Air Arm involves vastly more serious and complicated problems than in the case of a similar squadron operating from a land base.

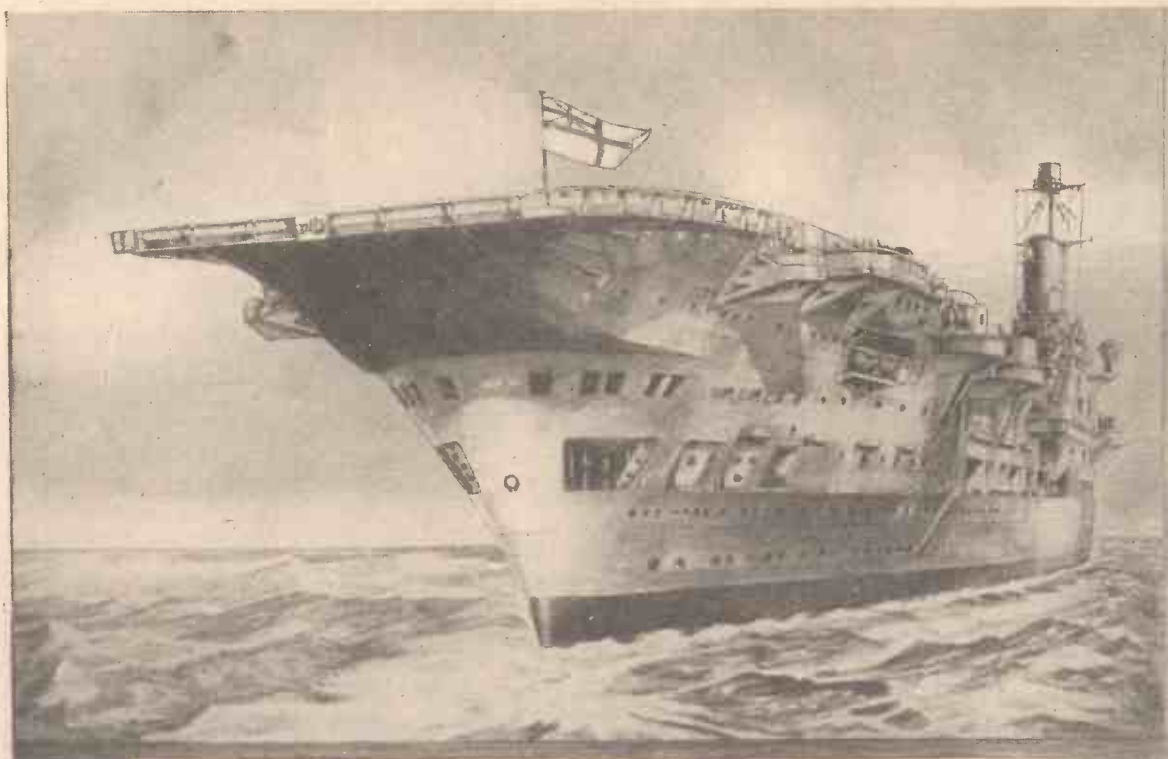
The First "Ark Royal"

Long before the construction of the first aircraft carrier was considered, the Admiralty had appreciated the value of aircraft in a naval engagement, and in the early months just before the war they had purchased a tramp steamer which was then in the course of construction, and had modified its design for use as an "aircraft tender." The vessel, which was named the *Ark Royal*, had a displacement of less than 7,000 tons and was far too small to permit of the construction of a deck for landing. Actually, a small flying-off deck was provided on the forward part of the ship and two cranes were installed for hoisting seaplanes on board. The *Ark Royal* was an invaluable vessel during the early years of the last war, but the impossibility of effecting a landing, or of even taking a seaplane on board in rough weather, was a serious limitation.

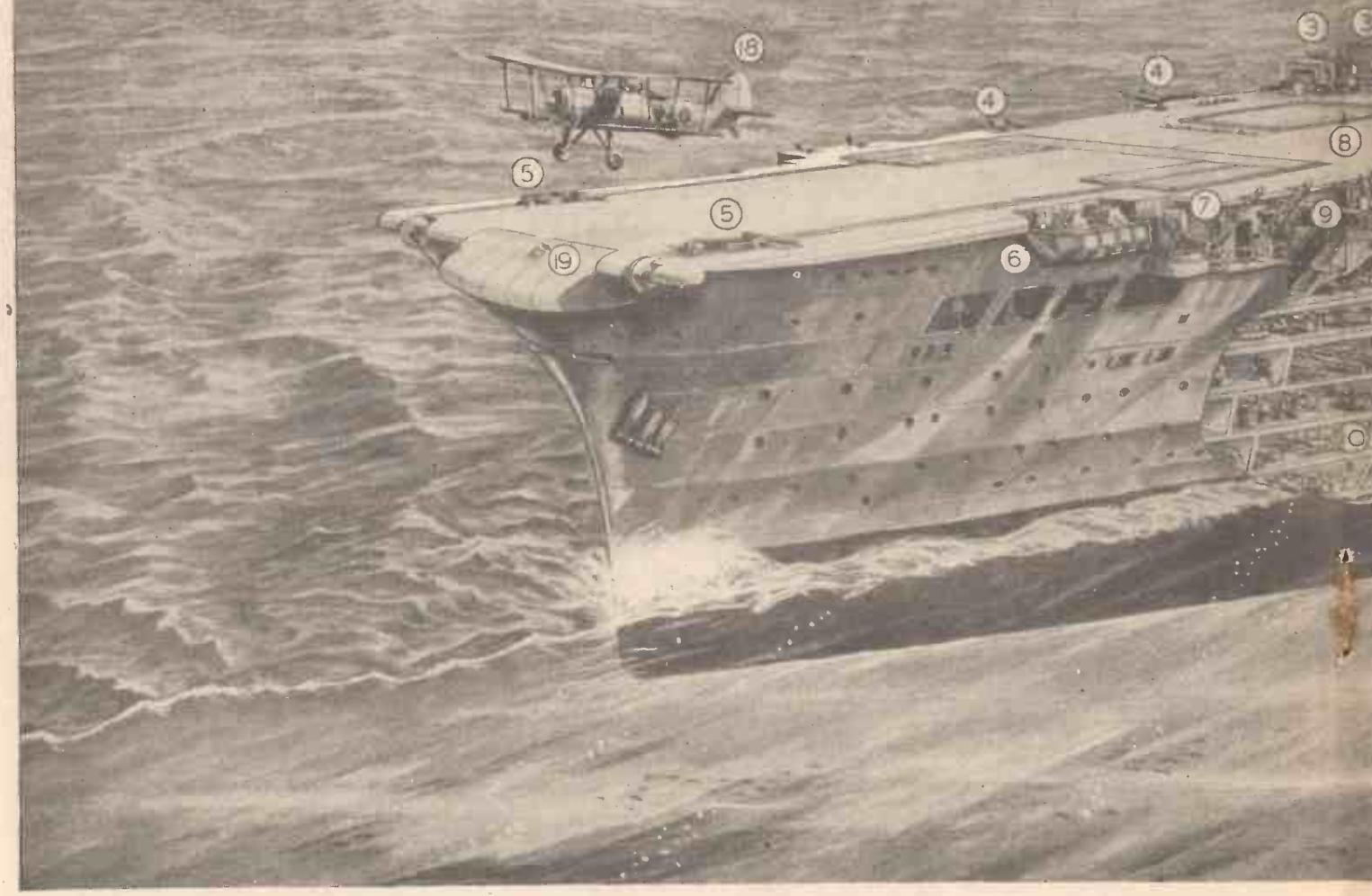
Three more small vessels were taken over by the Admiralty for service as aircraft tenders before the construction of the first real carrier. One was the *Campania*, a passenger liner which was completed in 1916, and this vessel was particularly interesting in that a flying-off deck was provided which was equipped with special wheeled trollies on which a seaplane could be mounted. These trollies enabled a normal seaplane to take off from the deck like an ordinary aeroplane, a feature which considerably increased the value of the vessel. The other two tenders were the *Riviera* and the *Engadine*, the latter being the only aircraft tender present at the battle of Jutland.

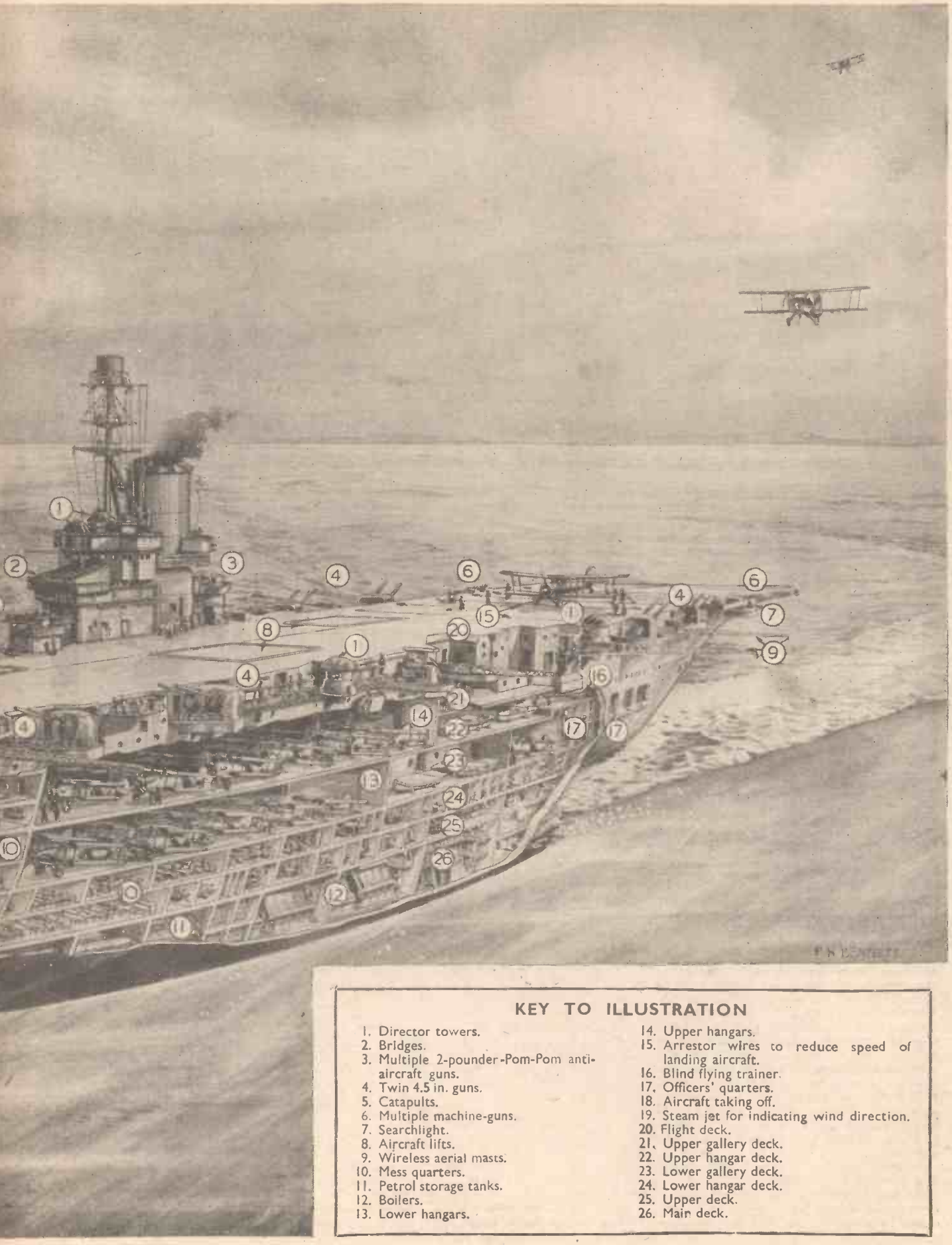
The First Aircraft Carrier

The first vessel to be constructed in the form of an aircraft carrier as we know them to-day, was the *Argus*, a vessel of nearly 15,000 tons which was originally designed as a passenger and cargo boat for Italian owners. Her construction had been commenced early in 1914 at Beardmore's yard, but on the declaration of war, all work on the ship was stopped and it was not until 1916 that the hull was purchased by the Admiralty and the design converted to a carrier. A complete flying deck was fitted which extended to practically the full length of the ship, and a larger hangar was constructed beneath the flying deck. A further revolutionary change was effected in the total abolition of funnels, and enormous horizontal flues were constructed to carry the boiler gases beneath the flying deck to discharge at the stern. The hangar was 350 ft. in length and nearly 70 ft. wide, and it could accommodate twenty aircraft of both land and sea types. Fully equipped workshops were installed capable of carrying out major overhauls and, so far as accommodation and equipment were concerned, the



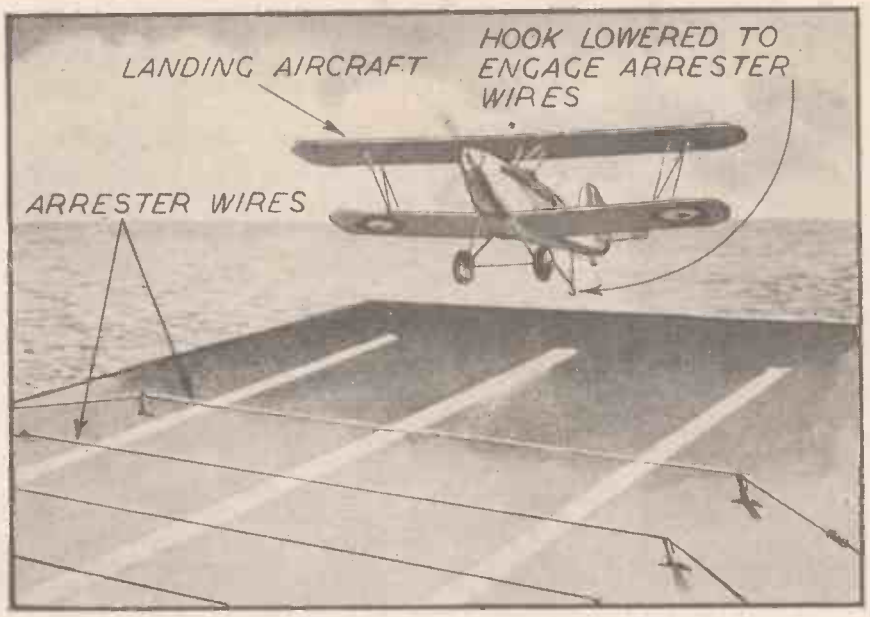
Stern view of the "Ark Royal," which was launched in 1937. Has sixteen 4.5 guns, and carries sixty planes Recently took part in the successful bombardment of Genoa.





KEY TO ILLUSTRATION

1. Director towers.
2. Bridges.
3. Multiple 2-pounder-Pom-Pom anti-aircraft guns.
4. Twin 4.5 in. guns.
5. Catapults.
6. Multiple machine-guns.
7. Searchlight.
8. Aircraft lifts.
9. Wireless aerial masts.
10. Mess quarters.
11. Petrol storage tanks.
12. Boilers.
13. Lower hangars.
14. Upper hangars.
15. Arrestor wires to reduce speed of landing aircraft.
16. Blind flying trainer.
17. Officers' quarters.
18. Aircraft taking off.
19. Steam jet for indicating wind direction.
20. Flight deck.
21. Upper gallery deck.
22. Upper hangar deck.
23. Lower gallery deck.
24. Lower hangar deck.
25. Upper deck.
26. Main deck.



Showing how the tail hook on the plane engages with the arrester wires thus enabling the 'plane to land with safety.

Argus was a complete floating aerodrome. Two electric lifts were provided for raising aircraft from the hangar to the flight deck, and the flight deck itself was equipped with wind-breaking palisades which could be simultaneously raised along the sides of the deck to give shelter to a machine on the deck.

With so many revolutionary features in her design, it would not have been surprising if the ship had not proved a success. In actual fact, however, the *Argus* was a most serviceable vessel; she was the first really successful aircraft carrier ever built, although the fact that she was not completed until September 1918, rendered her of no service during the War.

An Expensive Experiment

The demands of the Admiralty were not satisfied by the building of the *Argus*, and in 1917 it was decided to modify the design of a cruiser, the construction of which was being completed at Armstrong's yard. The vessel, which had been named the *Furious*, was destined to prove an expensive experiment. As originally constructed, she carried two 16 in. guns and was intended for service as a light cruiser. The first modification to her appearance was the removal of the front gun turret and the fitting of a flying-off deck with a hangar for seaplanes beneath. The next alteration was the removal of the rear gun turret and the building of a flying-on deck over the aft end of the vessel. This deck was not a success, however, on account of the air disturbance during landing due to the funnel gases and eddy currents. Once again the ship was reconstructed and she was finally completed in 1925; her funnels had been removed and a clear deck fitted, and her present appearance is very similar to that of the *Argus*, which largely served as the model upon which her final design was based. In spite of her chequered career, H.M.S. *Furious* has since proved a serviceable ship; she is capable of a speed of 31 knots and her clear deck expanse of 700 ft. in length and 80 ft. wide, makes landing a comparatively simple matter.

The Aircraft Carrier "Hermes"

So far, all the carriers constructed had been converted from designs originally produced for ships of quite different purposes, but about the same time as the *Furious* was appropriated for service as a carrier, the designs for the *Hermes* were drawn up. The *Hermes* was the first vessel to be designed and constructed specially as an aircraft carrier. She is a comparatively small ship, having a displacement of barely 11,000 tons, but she has the reputation of being a splendid sea boat with little tendency to roll in rough weather.

Her design includes one feature of fundamental importance. Unlike the *Argus* and the *Furious*, which were equipped with an unobstructed flying deck covering almost the entire vessel, the *Hermes* was built with a conventional funnel and control turret, but instead of being placed on the centre line of the vessel they were built on an island on the extreme starboard side at the widest part of the deck. In this position they offer little obstruction to the landing or taking off of aircraft, and although their presence inevitably causes some disturbance of the air to a landing aircraft, yet many pilots prefer their presence because they render the judgment of the height of a machine above the deck a much easier matter than is the case with the clear decks of the *Argus* and the *Furious*.

The "Eagle"

A few months after the *Hermes* was laid down, the Admiralty decided to appropriate and adapt yet another hull which had been lying half completed on the slips since 1914. This vessel was the *Almirante Cochrane*, which had been designed as a dreadnought for the Chilean Government. The hull was purchased late in 1917 and the design modified to that of an aircraft carrier, similar to the *Hermes*. The vessel which was re-named the *Eagle*, took no part in the Great War of 1914-18, as her trials only commenced in the spring of 1920, and she was not finally completed until 1923.

Two other carriers which were commenced in the early part of 1915, were the *Glorious* and the *Courageous*. The *Courageous*, however, was sunk in the early part of the present war through enemy action. Both of them were built as ordinary cruisers in the short time of twenty months.

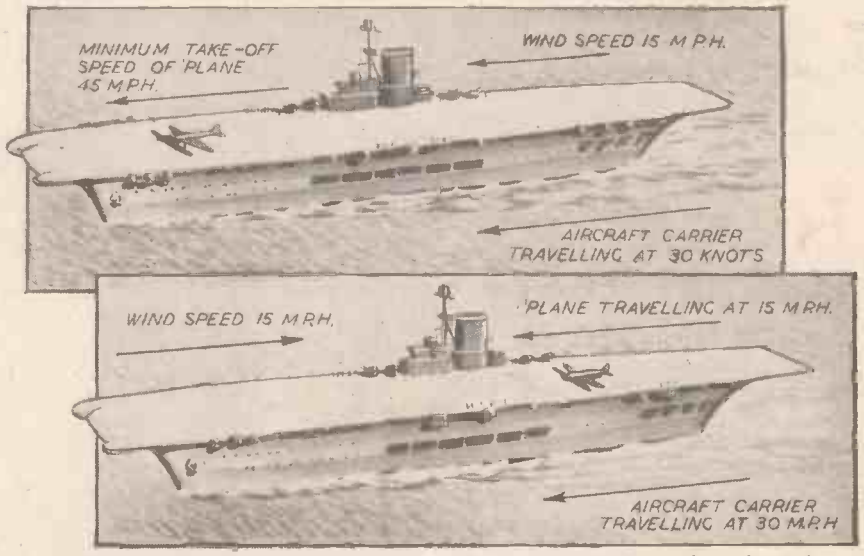
Modern Aircraft Carriers

We now come to aircraft carriers of the most modern type such as the *Ark Royal* and the *Illustrious*, to name but two. They are considered the last word in aircraft carrier construction. The *Ark Royal*, for instance, is 800 ft. in length, 94 ft. wide, has a flight deck height of over 70 ft. and a draught of 23 ft. It is capable of housing about 60 aircraft.

Space does not permit to give details of the types of plane operating with the Fleet Air Arm, but one of the most extensively used is the Blackburn Skua.

Finally we come to one of the most interesting problems of the Fleet Air Arm, and that is how the machine takes off from the deck of the carrier. The illustration on this page shows that the two main factors to enable the machine to take off from a small space are the speed of the aircraft carrier and the speed of the wind.

Despite their cumbersome appearance, aircraft carriers are very fast ships and are capable of a speed of over 30 knots. Therefore, if the aircraft is stationary on the carrier the wind will be moving past the wings of the plane at about 35 m.p.h. If the wind is blowing towards the carrier at 15 m.p.h. the wind moving past the plane will then be 50 m.p.h. even before it moves. Thus, as the minimum take-off speed of the plane is 45 m.p.h., the plane becomes airborne as soon as it is in motion.



Showing how the 'plane takes off from the deck of the aircraft carrier (see text for explanation).

A NEW SERIES

The Story of Chemical Discovery

No. 5.—Oxygen and Hydrogen Discovered. The Curious Dr. Priestley and the Eccentric Mr. Cavendish

DESPITE the falsity of the prevailing theory of "phlogiston" or the principle of fire, chemistry developed at a rapid rate during the eighteenth century. For the greater part, this development comprised the discovery of many new substances and materials, particularly gases. Yet, subsequently, great efforts were made by the growing number of experimenters to fit these discoveries into a systematic frame of scientific thought and, by means of them, to evolve not only a theory of chemical action, but also one which would satisfactorily explain the nature of chemical materials and of the everyday things around us.

One of the most brilliant chemical lights of the eighteenth-century period with which we are now dealing was the renowned Dr. Joseph Priestley, celebrated not only for his many discoveries in practical chemistry, but also for the remarkable career which he made for himself.

A Curious Fellow

A decidedly curious fellow was this Dr. Priestley. Of constitutionally gentle and amiable temperament, he nevertheless managed to get himself thoroughly disliked by his contemporaries, both scientific and lay, in England, so much so that he ended up his days as an exile in America.

Priestley was born near Leeds in 1733, the son of one Jonas Priestley, a cloth dresser of that neighbourhood. As a boy, he was delicate and this condition was by no means improved by the early death of his mother and his having to be brought up by a well-intentioned, although strict and spartan aunt. The lad was given a good education and, after studying for the Ministry at the Dissenters' Academy at Daventry, he obtained his first post, that of assistant to an aged Presbyterian minister in the little Suffolk village of Needham Market. The situation, however, did not suit Priestley, in consequence of which fact he set up, after some minor ups and downs, as a tutor in Warrington, in which town, also, he married a daughter of a Mr. Isaac Wilkinson, an ironmaster, of Wrexham, in Wales.

At Warrington, Priestley got to know Benjamin Franklin, the American philosopher, whose work influenced him greatly. Furthermore, in this town, he witnessed some electrical experiments, which resulted in his procuring sundry electrical apparatus and in his writing a History of Electricity.

"Fixed Air"

In 1767, Priestley removed to Leeds, where he ministered for six years to a "liberal, friendly, and harmonious congregation." Near Priestley's house in Leeds was a brewery which regularly discharged large quantities of carbonic acid gas into the atmosphere as a by-product of its treatment of malt liquors. Priestley became interested in this gas, which was then known technically as "fixed air." He found that it was soluble in water, and he made experiments on impregnating water with the gas under pressure.

Here, of course, Dr. Priestley shines as the very first discoverer of soda-water and of other aerated beverages. Quite unknowingly, by his few simple experiments on "fixed air," Priestley had founded a future industry. The Royal Society, however, appeared to recognise some practical value in Priestley's discovery, for that body awarded him the Copley Medal for this work, the Royal Society then being of the

Dr. Priestley, one of the most celebrated of 18th-century chemists.

opinion that "common water impregnated with this fluid (i.e. carbonic acid gas) alone might be used in medicine, particularly for sailors on long voyages for curing or preventing the sea scurvy."

Priestley, during his stay in Leeds, wrote a book on light and colours, which, however, was little more than a compilation of previous discoveries in this subject. His "special subject" was undoubtedly chemistry, and it was to this subject that the worthy doctor turned during his spare-time moments.

The principle of the "pneumatic trough" for collecting gases over water was discovered by Priestley.

In 1772 an offer came to Priestley of a position as librarian to Lord Shelbourne (afterwards Marquis of Lansdowne), who had a large mansion at Boxwood, in Wiltshire. The post held out the promise of abundant spare time for his many-sided interests, and, despite its low salary and his growing family, Priestley did not hesitate to accept it.

Discovery of Oxygen

It was during his employment as Lord Shelbourne's librarian that Priestley made the most celebrated discovery of his lifetime—that of oxygen. This was in 1774, in which year Priestley set himself to examine the effects of heat upon a large number of chemical substances. One of these materials which he examined was mercuric oxide, a brilliant red powder formed by heating mercury in air. By heating a small quantity of this powder by means of the sun's rays focused through a hand lens, Priestley observed that it gave off a kind of "air," which 'air" he carefully collected.

"What surprised me more than I can well express," wrote Priestley "was that a candle burned in this air with a remarkably vigorous flame."

Priestley found, also, that mice could live in his newly discovered "air," and since substances burned with great brilliancy in it, he concluded that it must be devoid of all "phlogiston" or fire-principle, and that during the process of burning, the fire-principle or "phlogiston" passed freely from the burning substance into the "air." Hence, this gas (which we now call "oxygen") was termed by its discoverer, Joseph Priestley, *dephlogisticated air*.

Joseph Priestley was also the individual who made the first use of rubber in this country. Having had a few balls of native rubber sent to him for examination from the West Indies, he cut them up into small blocks and observed that they could be used for erasing pencil marks from paper. Thus began another industry, which in modern times has attained truly giant proportions.

Religious Views

Despite his chemical discoveries—which, of course, appealed only to the very few—Priestley was, at this time, getting himself into great disrepute. His religious views were decidedly unorthodox. He wrote a book on the corruptions of Christianity, which brought him into trouble with the ecclesiastical authorities. Furthermore, he was in favour of the American Declaration of Independence and, at a later date, with the French revolutionists.

In point of fact, therefore, the gentle and amiable Dr. Priestley, brilliant scientist though he was, was regarded throughout this country as a veritable "fifth columnist" and as an individual whose views were calculated to undermine loyalty to the British Crown.

Lord Shelbourne severed his connection

with Priestley, and after the latter had been in charge of a dissenting chapel in Birmingham for some years, a local mob marched to the chapel where Priestley had preached in favour of the French revolutionists and burnt it down, after which act they proceeded to his house, which latter together with his laboratory and library of scientific books, shared a like conflagatory fate.

Priestley escaped to London, but in that city, also, he met with a bad reception. Even the Royal Society, which had previously awarded him its coveted medal, was hostile to him, so much so that he resigned from that body.

In 1794, Priestley emigrated to the town of Northumberland, on the bank of the Susquehanna River, in Pennsylvania, America, and here, at last, he found peace and quietude and the opportunity of carrying out further scientific work, which latter he continued almost up to the time of his death, in 1804.

" Pneumatic Chemistry "

Besides his discovery of oxygen, Priestley must be remembered as the " father of pneumatic chemistry," i.e. of the chemistry of gases. For the collection of gases, he devised the famous " pneumatic trough," well known in every school laboratory, by means of which gases are collected by displacement of water.

With his water-trough apparatus (which, for the collection of water-soluble gases he replaced by a mercury trough), Priestley collected and examined such gases as hydrochloric acid (which he first showed to be a true gas and not merely a solution), ammonia, sulphur dioxide, nitric oxide, carbon dioxide, and various other compounds, all of which he termed " airs," for, at that time, the name " gas " had not been introduced into chemical science.

To the end of his days, Priestley remained a convinced and even a pugnacious believer in the theory of Phlogiston or the so-called " principle of fire," scorning the endeavours of all who vainly endeavoured to convert him from this scientific obsession. Curiously enough, it was, in part, as a result of Priestley's very discoveries of oxygen and other gases that the Phlogiston doctrine had perforce to give way to our true theory of combustion and oxidation, yet, as we have just mentioned, Priestley could never be made to see that his hold on the false theory of Phlogiston was an absurd as well as an entirely unprofitable one.

Hon. Henry Cavendish

Living contemporaneously with Priestley was Cavendish—the Honourable Henry Cavendish—an English aristocrat of the 18th century, and an 100-per-cent. eccentric, if ever there was one.

Cavendish might be termed a personification of dehumanised humanity. Possessed of great wealth, which he received mainly through inheritance, he nevertheless lived the life of a recluse. He was without personal friends. He had a horror and a hatred of women, which revulsion was believed to be due to the failure of an early love affair. His life was entirely a passionless one, being devoid of love, friendship, ambition, good cheer, or even hate.

In his house, which stood on the confines of Clapham Common, to the south-west of London, the Honourable Henry Cavendish set up a laboratory and a library. Here he lived a strictly secluded life, writing out each day his orders for meals and laying the written paper in a prominent place so that it would be picked up by his housekeeper and would thereby prevent the necessity of any personal interview having to take place between himself and that essential personage.

Cavendish was shy, too. Upon the occasions on which he went to Royal Society meetings, he could very seldom be induced to talk, and even, indeed, when it was found possible to engage him in conversation, the flow of his words would instantly cease if Cavendish happened to notice any strange face in the group of Royal Society members which surrounded him.

Dr. Wollaston, himself a famous chemical discoverer, commented upon Cavendish's peculiarity and intractable shyness in his *Memoirs*. He said : " The best way to talk to Cavendish is never to look at him, but to talk as it were into vacancy, and then it is not unlikely but you may set him going."

To the bitter end, Cavendish maintained his pathological reserve and aloofness from his fellow creatures. As, aged and friendless, he lay on his deathbed, he commanded his man-servant to leave the room and not to return for an hour or two. The servant

Apparatus for the modern making of hydrogen in the laboratory by the action of dilute hydrochloric or sulphuric acid on zinc or iron.

obeyed his master's instructions. When, eventually, he returned, he found that his master had turned his face to the wall, as if in renunciation of all fellow-friendships, and had quietly breathed his last.

Discovery of Hydrogen

Of the physical discoveries of Henry Cavendish and his electrical researches, we cannot deal at the present juncture. Cavendish, however, was an experimental chemist of no mean order, and of his discoveries in the chemical realm, that of hydrogen is certainly his most fundamental one.

The action of acids, such as sulphuric acid, on iron, had long been known, but it was Henry Cavendish who was the first to study the " air " which is evolved in such reactions. We now know, of course, that this gas is hydrogen, the lightest of all elements. Cavendish, however, called it " inflammable air," in consequence of its combustible nature.

In hydrogen, most of the chemists of the period saw the long-sought-for pure Phlogiston, the principle of fire itself. Priestley particularly insisted upon this viewpoint, but Cavendish himself, a less fervent follower of the Phlogiston doctrine, assumed that his " inflammable air " (hydrogen) was " phlogisticated water."

In 1766, the year of his discovery of hydrogen, Cavendish proved that when this gas is exploded in a closed tube with oxygen, the result is water. He showed that when these two " airs " are mixed in the proportion of two volumes of " inflammable air " (hydrogen) and one volume of " dephlogisticated air " (oxygen), the whole of the mixed gases condensed to water after the passage of an electric spark through them.

He then proceeded to discover that when hydrogen is mixed with common air and exploded in a closed vessel, water is formed and a gas, which he called " phlogisticated air " (i.e. nitrogen) remains.

Composition of Water

Cavendish, clearly, is the discoverer of the composition of water, although it must be noted that James Watt, the so-called steam-engine discoverer, found grounds on which to claim this discovery as his own. That Watt and Cavendish were known to each other is certain, for on one occasion Cavendish visited Watt at his Birmingham foundry, in order to discuss technicalities concerning the production of water from oxygen and hydrogen. James Watt, however, was no more the discoverer of the composition of water than he was the originator, discoverer, or inventor of the steam engine.

Cavendish, in the years 1783-84, proved air to consist of two gases, and he also proved water to result from the chemical union of two distinct gases—oxygen and hydrogen.

He showed, also, that when a mixture of nitrogen and oxygen was confined in a tube over mercury, along with a solution of caustic potash, and the gases subjected to the influence of electric sparks, the oxygen combined with the nitrogen to form oxides of nitrogen, which were absorbed by the caustic potash. In every instance, however, a small proportion (about 1/120th part) of the nitrogen remained unabsorbed, and Cavendish, noting this seemingly trivial fact, raised the question as to whether the " phlogisticated air " (nitrogen) of the atmosphere is " entirely of one kind."

This observation and query of Cavendish's lay forgotten for more than a hundred years until 1894, in which year Lord Rayleigh and Professor Ramsay announced to the world the discovery of a new gas which they had found in atmospheric nitrogen. This was the unabsorbable portion of the oxygen-nitrogen mixture which Henry Cavendish had, in his days, drawn attention to. The new gas turned out to be an element. It was called "argon," and, as we all know, its discovery led to the founding of a new modern industry.

Cavendish, unlike Priestley, did not remain so obdurate over the matter of the false Phlogiston theory. Eventually, he subscribed to the new theory of combustion which was developed as a result of the work of the French chemist, Lavosier, whom the French revolutionists so mercilessly put to death.

Experimental Work

The volume of experimental work done by Cavendish was smaller than that performed by Priestley. Perhaps, however, of the two, Cavendish's work was the more thorough, the more painstaking, for Priestley, as we have seen, was a man of wide interests and had chemistry not happened to constitute one of them, some other science would undoubtedly have done so.

Priestley and Cavendish constitute two focal points around which many of the early scientific chemical discoveries centralised themselves in the 18th century.

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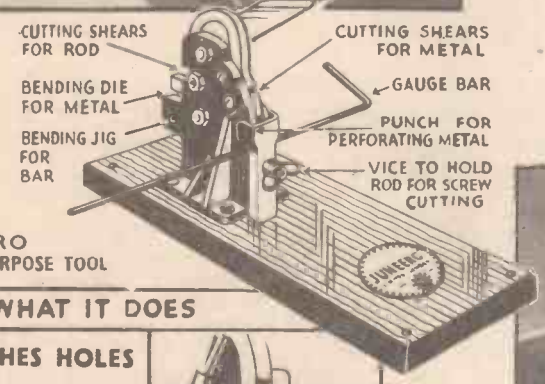

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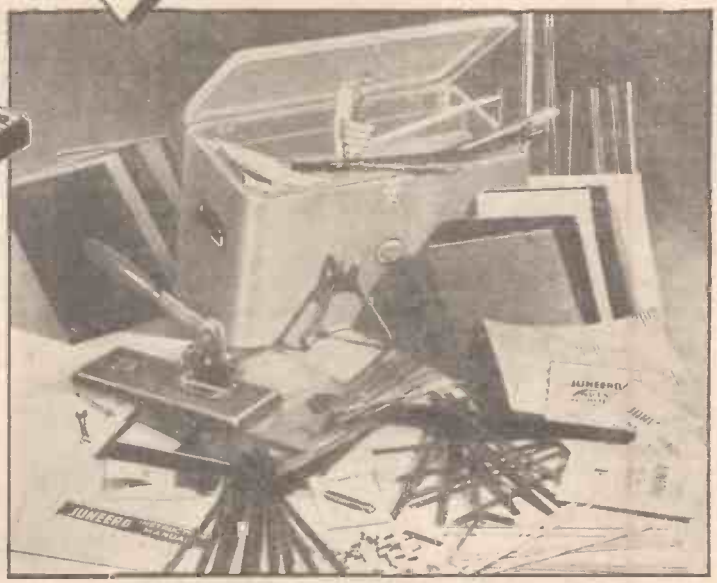

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SHEARS strips and rods to accurate lengths. (see left)

BENDS strips to accurate right angles or any other angles required. Also bends rods. (see right)

SUPPLIES: *The Juneero Engineers' Set is available from the Juneero dealer in your town, who also keeps stocks of spares and additional materials in 1/- packets ready for immediate demand. If, owing to war conditions, you have any difficulty in obtaining your set send remittance to us, adding 2/- towards packing and carriage (abroad 10/6 extra.)*

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Reversing Gear for Model Oscillating-Cylinder Steam Engines

By A. J. BUDD

In Response to Several Requests Particulars are Given of Two Simple Methods

MANY model steam engines which are driven by one or two single-acting oscillating cylinders are non-reversible, that is, they can run in only one direction. The general arrangement of a single cylinder, and its steam block, is as shown in Fig. 1, steam reaching the cylinder through one of the ports (A) in the steam block; (B), the other port; (C) being the exhaust port. The direction of rotation of the engine is clockwise, as indicated by the arrow. It will be seen that if the function of these ports could be reversed, and steam admitted through port (B), the direction of rotation of the engine would be reversed. This condition can be brought about by the addition of a reversing plate, in the manner illustrated in Fig. 2. A new steam block would also be necessary, in place of the existing block, the only difference being the additional steam port in the centre, and the trued-up back face against which the reversing plate works. If the old steam block is wide enough, the central port and side hole for the steam pipe can be drilled in it, and a new block would not be necessary.

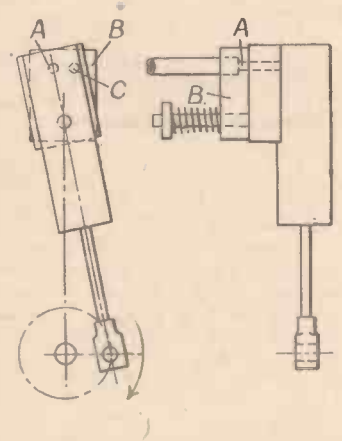


Fig. 1. General arrangement of a single-acting oscillating cylinder and steam block.

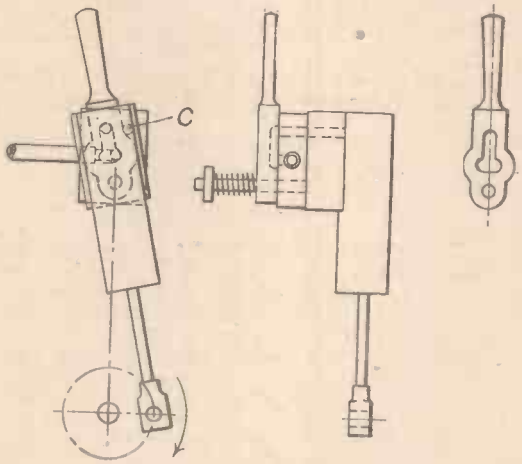


Fig. 2. Showing the addition of a reversing plate to an oscillating cylinder.

Shaping the Reversing Plate

The reversing plate can be roughly cut out with a hacksaw from a piece of sheet brass ⅛ in. thick, and filed to shape. The centre steam cavity, which can be drilled and chipped out with a small cold chisel, need not be more than half the thickness of the plate in depth.

It will be seen that when the reversing plate is in the position shown in Fig. 2, the engine will run in a clockwise direction, the cylinder exhausting through port (C), on the return stroke. When the plate is pushed over to the other position, steam is admitted to port (C), and the engine will rotate in the reverse direction, port (A) then becoming the exhaust port. Short stop pins, cut from $\frac{1}{32}$ in. iron wire, and soldered to the sides of the steam block, limit the movement of the reversing plate, and assure the correct registering of the steam cavity with either of the ports in the top of the steam block.

For Twin-Cylinder Engines

Model stationary engines or locomotives driven by two oscillating cylinders can be reversed in a similar manner by a simple reversing plate, which changes the cylinder steam ports to exhaust, and vice versa, as required. In the illustrations, Figs. 3 to 6, the arrangement is shown applied to a simple locomotive, and for a stationary engine the arrangement would be similar, the only difference being that in the latter case the cylinders would probably be wider apart, thus necessitating slightly longer connecting pipes.

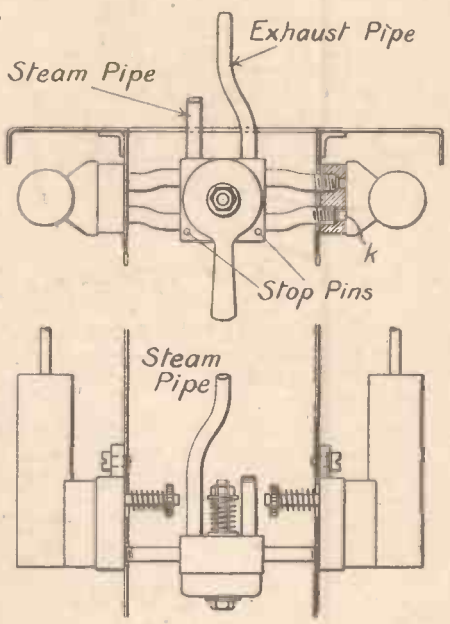


Fig. 3. Elevation and plan of a reversing arrangement fitted to a double-cylinder model engine.

A general arrangement of the cylinders and reversing plate, in elevation and plan, is given in Fig. 3, from which it will be seen that two pipes lead from each cylinder block to a central steam-distributing block, on the face of which the reversing plate works.

Steam Distributing Block

To make the steam distributing block, take a small block of brass and carefully file it up square to the dimensions given in Fig. 4. Scribe the two centre lines, and centre-punch the centre of the block, after which lightly scribe a circle of $\frac{3}{16}$ in. radius, and centre-punch the position of the four ports on the face of the block as shown. Mark the position of the holes for the steam pipes on one side of the block, and drill these carefully right through the block with a $\frac{5}{64}$ in. twist drill, afterwards enlarging the holes for a distance of $\frac{3}{16}$ in. with a $\frac{1}{8}$ in. drill to take the ends of the connecting pipes. The four holes in the face of the block can now be drilled, also with a $\frac{5}{64}$ in. drill—the two marked S, E, right through the block, and the other two to meet the holes already drilled through the sides.

The holes S, E, should be enlarged at the back of the block, and tapped out to take the screwed ends of the main steam and exhaust pipes. The centre hole to take the pivot-pin should be $\frac{3}{32}$ in. diameter, slightly counter-sunk on the face of the block.

The reversing plate and handle, R, can be filed to shape from a piece of brass $\frac{5}{32}$ in. thick, and the two grooves made in the face to the same radius as the holes in the block. Make the grooves the same depth as the diameter of the holes. The best way to form the grooves is to drill about five holes the required

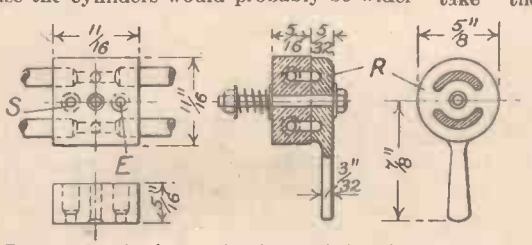


Fig. 4. Details of steam-distributing block and reversing plate.

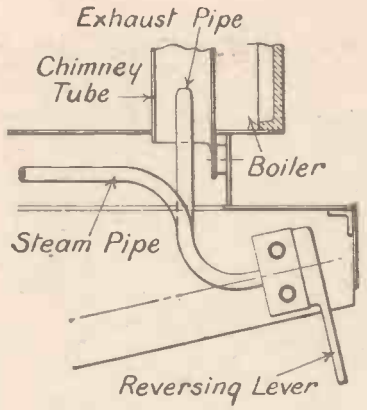


Fig. 5. Sectional view of the front part of a model locomotive, showing the position of the steam-distribution block and reversing plate

depth for each groove, and finish with a small chisel. Drill the centre hole $\frac{3}{32}$ in. diameter and slightly countersink on the face of the plate, as indicated.

The working faces of the steam block and reversing plate must be prepared by rubbing them down with pumice powder and oil on a piece of plate glass, or a small surface plate, after which clean out the holes to free them from any sediment.

For the pivot pin, a $\frac{3}{32}$ in. Whitworth bolt can be used which is screwed for $\frac{1}{4}$ in. at the end. The spring can be of steel, or hard brass wire, about No. 21 gauge, and this is tightened up with a nut and washer until the working faces of the block and reversing plate are pressed tightly together. To limit the movement of the reversing handle, two pins cut from No. 19 gauge steel wire are pressed into holes drilled near the bottom corners of the block, as indicated.

Cylinder Steam Blocks

With regard to the cylinder steam blocks already fitted to the engine, the exhaust ports have to be drilled out and tapped in the same manner as the other ports (see Fig. 3). For the connecting pipes cut four pieces of $\frac{1}{8}$ in. diameter brass tubing, one end of each piece being screwed for a distance of $\frac{1}{8}$ in. Anneal each piece of tubing by heating it in a gas flame, and plunging it into water, after which they can be screwed into the steam blocks.

Bend each pipe slightly so that the projecting ends can be pressed into the holes in the reversing block, as shown in Fig. 3, after which the pipes can be neatly sweated in place.

The reversing of the engine is brought about in the following manner : When the reversing handle is over to the right, as shown in Fig. 6, one recess in the valve connects the two top pipes with the steam inlet port, S, while the other recess puts the two bottom connecting pipes into communication with the exhaust port, E, This allows the engine to travel in one direction, but on pushing the handle over to the left, the top pipes will be connected to exhaust, and the bottom ones to the steam inlet, thus causing the engine to run in the reverse direction.

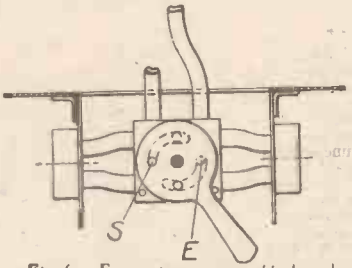


Fig. 6. Front view of steam block and connecting pipes, explaining the function of the reversing plate.

Angle of Steam-distributing Block

It will be noticed, with reference to Fig. 5, that the steam-distributing block is fixed in an inclined position. This is necessary in order to bring the face of the block square with the centre line of the cylinders and driving axle of the locomotive. In a model stationary engine the same angle must be maintained between the steam block and the centre line of motion.

The Rolling English Road

A Brief Resume of the Development of Our Highways

(*Continued from page 190, February Issue*)

The death penalty was imposed for such acts of violence, but still they continued—and the roads worsened in every respect. There were battles between the military and overwrought civilians. But things did not come to a head until there had broken out in South Wales a series of desperate riots amounting almost to civil war. The Welsh miners started it. Work was scarce, prices of necessities were high—and made higher by the toll-gate dues. The miners looked for a leader in this new crusade and found him in one who had the cause at heart. He was known to them as Rebecca, and under his leadership, and on horseback, they stormed the turnpikes over a large area and destroyed them. Apparently their violent efforts culminated in the seige of Carmarthen workhouse, in 1843, and ended —so far as activity was concerned—in their dispersal by a body of cavalry. The real end came in the setting up of a Royal Commission to enquire into the workings of the Turnpike Trusts. Unlike most Commissions, this one acted. And that was the beginning of the end of a system which had fattened the banking accounts of several hundreds of combines but had done nothing to put the management of our roads on a sane basis.

Thomas Telford

Contemporary with MacAdam, another great road-engineer did strenuous pioneering work. He was Thomas Telford, born in 1757—a year after MacAdam and, like him, a Scotsman. He drove roads through the Highlands and through parts of Wales hitherto cut off from the rest of Britain because of lack of highways. His name is equally honoured among bridge-builders. Unlike MacAdam, who let his road foundations look after themselves and relied on the deep surfacings, Telford paid great attention to foundations. He made these as solid as possible and topped them with stone blocks placed side by side binding these with stone chippings worked into the crevices between. But the MacAdam system prevailed.

These geniuses worked with poor tools, as we regard them now. They knew nothing of compressed air operated road drills, or steam navvies, or of the steel meshwork that we now lay upon our foundations and top with concrete. Such things as by-passes were yet to come—speedways of reinforced concrete with non-skid surface, and banked corners and bends, to take several lines of motor traffic. Belisha beacons, automatic traffic lights, centre white lines, roundabouts, these were all beyond even their dreams. Cycling and motoring organisations, coming long after the MacAdam-Telford era, set the way for many travel improvements. They likewise gave rise to infernal problems of dust in summer and mud-splashing in winter and aroused, unintentionally, enormous public enmity; against all of which they heroically and, in due course, successfully contended. And the heavy mulcting of motorists by way of taxation has swelled the coffers of the Exchequer and provided the wherewithal for the re-making of old roads, and the construction of new ones on a vast scale.

Modern Roads

The pioneers of cycling and motoring set a new fashion in many things concerned with our highways, including the setting up of signs and direction indicators, to replace the no longer serviceable signposts which are a relic of the coaching days when they had necessarily to be high so that they could be read from the coachman's elevated perch—so high that from the low driving seat of the motorist they can be read only with difficulty.

Even the best of the modern roads began to prove inadequate after the 1914-18 war, when motor traffic became specially heavy and congested. Then the big drive started to provide Britain with roads that should be worthy of their traffic. That drive has been temporarily interrupted by the present war. When that is over, great projects will again go ahead, such as the construction of a St. Albans by-pass, 23 miles long, at a cost of £2,000,000, and a Doncaster by-pass, of 10 miles, to cost £1,000,000.

Now, more than ever before, the laboratory scientist and practical engineer must walk hand in hand so that new problems, arising directly out of increasing and heavier traffic, may be solved. Research work of this sort is being done at Harmondsworth, Middlesex, by the Department of Scientific and Industrial Research with the advice of the Road Research Board; and experimental work on roads is being carried out by the Ministry of Transport with the advice of the Experimental Work on Highways (Technical) Committee.

When Peace Comes

When the nightly black-out is lifted from this land and motorists shall no longer be fined for showing too-bright lights (as they are fined for showing too-dim lights in the nights of Peace !) roadhouses that have arisen along the great new arterial and by-pass roads will come into their own again; and old inns, reminiscent of stage coach days and highwaymen, will put on new coats of paint and thrive anew.

HOME MOVIES

Notes by G. P. KENDALL, B.Sc.

NEWS AND COMMENTS

Timing Your Titles

THE rules have been given before, but the number of wrongly timed titles one still sees in amateur films suggests they might be repeated with benefit to all concerned!

Now, accuracy in timing is essential to good titles. If they are clipped too short the audience will be kept uncomfortably on the stretch, and so may miss the exact meaning. If they are left too long on the screen the result will be just as bad, for boredom will set in and people will start to talk while they wait for the next scene to appear. (And when it does they will probably miss the first few feet because their attention has wandered. Then they will ask their neighbours what it is all about, and upset *them* in turn. In short, the film will have scuttled itself.)

Timing is naturally reckoned in seconds on the screen, but the actual adjustment of the film strips to exact length is sometimes best done on a footage basis. Although the simplest method is to count off the running time of the camera when shooting the title, there are occasions when it may be necessary to make the title a little over the desired length and then trim it accurately with a foot rule.

To do so it is necessary to know the precise running time of the particular gauge of film, to which end the following figures may help. In either 9.5 or 16-mm. reckon 4½ inches of film per second at the standard silent speed of 16 f.p.s.; in 8-mm. take it as 2½ inches per second. (Not quite correct, but near enough for practical purposes.)

To estimate the proper time on the screen for a given title, the rules which follow will provide a sufficiently reliable guide in all normal cases. Begin by counting the words, and allowing half a second for each. Then to this basic time add a second for each unusual or unfamiliar word, and then another half-second for each word of more than two syllables.

Here is an example: "Down on the beach at Landewednack." Six words, so the basic allowance is 3 seconds. One word is decidedly unusual (like most Cornish place-names!), so we add another second for that, and then another half-second because it contains more than two syllables, arriving at a final figure of 4½ seconds. That may not seem very long, but if you try reading the example against a stop-watch you will find it is enough for an educated audience. (Don't be misled by the example of the professional film; the long, dragging title timings you will see therein are made necessary by the fact that public audiences contain a proportion of people who read slowly.)

The rule breaks down with very short titles. (It almost broke down over the Landewednack one.) Here one must add a further rule to the effect that however short the title the minimum screen time should be 4 seconds, or 3 if the caption is short and familiar, like "The End."

The Mains Load

IT is no uncommon thing for the owner of one of the more powerful projectors to find, on taking it round to the house of a friend, that it causes the lighting fuse to blow the moment it is switched on. At home, of course, the machine is probably run from a heavily fused power socket, where the question does not arise, but before such a projector is connected to a lighting point (with the usual 5-ampere fuse) a little simple arithmetic should be worked out.

The object is to discover what current the machine will take from the mains, and this may be done as follows. First, find out the wattage and working voltage of the bulb—this will be marked on either the cap or the glass bulb. Suppose the marking is "250w, 50v." This means 250 watts at 50 volts. To find the current in amperes, divide the watts by the volts.

In the example quoted, we discover that the current is 5 amperes, and when we add to this the small but not negligible current taken by the motor we see that the machine is almost sure to "blow" an ordinary 5-amp. lighting fuse.

If the bulb was marked "500w, 110v," we get a current figure of just over 4½ amps. for the bulb alone. With the addition of the motor current this comes up uncomfortably near the limit for a 5-amp. fuse, especially when it is remembered that on first switching on the cold filament there is a surge of current considerably larger than the normal consumption of the bulb when fully heated. This may suffice to blow the fuse.

That is the method to be adopted when the machine is run from a resistance. Note that the voltage of the mains does not enter into the calculation: it makes no difference to the current consumption.

When a projector is worked from a transformer the consumption of current from the mains is usually much reduced, and this time the mains voltage *does* come into effect.

In this case the method is as follows. Find the wattage of the bulb, add on 100 watts to make a rough allowance for the current taken by the motor, and divide this figure by the *mains* voltage. Thus, if the bulb is of 500 watts and the mains voltage is 200, we divide 600 by 200, and decide that the mains current is 3 amperes, which is a safe load on a circuit fused for 5 amps.

The case of talkie projectors is less simple, for here we have the unknown factor of the current consumption of the amplifier. Probably the best plan then is to write to the makers for the total consumption figure; it is a very useful thing to know.

QUESTIONS ANSWERED

Animating a Walk

I have been trying cartoon work this winter, but find great difficulty in getting proper timing for various movements. Can you give me the rules for, say, a walking figure?

There are no real rules for these things; it all depends on whether you want the movement to appear quick or slow of its kind. The only safe guide is to be found in a study of the same movement in real life. Thus, an excellent plan is to film a person actually walking, and to study the resulting strip frame by frame, noting the number of frames for each stride, and the amount of movement shown between each pair of positions. (In successive frames, that is.) With such a record as a guide it is easy to prepare the necessary key drawings for the work of "animation," varying matters a little as may be required to make the walk appear quicker or slower. As a rough guide it may be added that in a fairly brisk walk, one foot—the left, say—comes to the ground at one second intervals. For such an effect there should be 16 frames for each complete stride of either foot, or 8 frames for a "left, right."

Making a film with Kay Hughes and Eddie Nugent. Note the "tea cosy" type of blimp muffling the camera, and the reflector being used to put a little soft light into the shadows

Life of Over-run Bulbs

If I over-run the bulb of my projector to get a better light, shall I shorten its life in the same proportion?

Unfortunately, the price one has to pay for extra light obtained by over-running is much heavier than this. For example, if sufficient voltage is applied to obtain as little as 20 per cent. more light, the life of the bulb will be reduced by something of the order of 40 per cent. Thus, if its normal "expectation of life" were 100 hours, with this mild degree of over-running the expectation would come down to 60 hours. Even this assumes very adequate cooling; with cooling barely sufficient for normal conditions, the result of over-running will be still worse.

It is indeed better policy to use a bigger bulb than is strictly necessary, and *under*-run it. Under these conditions a comparatively trifling sacrifice of light is rewarded by a disproportionately great increase of life. For instance, a sacrifice of 10 per cent. of light may easily give an additional 40 per cent. of life.

Film for Title-making

It seems to be a very general thing to use pan film for titles. In view of its high cost, is this really a good plan? Would it not be just as good to use ortho and a little more light?

If only "a little more" light was required for ortho it would probably be used very generally, but the quantity actually required is more like four times that which suffices for pan; ortho film is very slow indeed when exposed by artificial light. It has, moreover, another drawback: it is very rarely provided with the anti-halation layer or backing which is so necessary when dealing with high-contrast subjects containing much fine detail.

Focussing Very Near Objects

I wish to film some small objects (growing crystals) at a distance of about 18 inches, and my lens is only scaled down to 3 feet. Can I use a supplementary, and if so how do I set the scale of the main lens?

Although of most use with fixed focus lenses, supplementaries can quite well be used with the focussing type. The only simple method is to set the lens scale to infinity, whereupon the usual rule applies as to the requisite focal length of the supplementary being equal to the intended working distance.

Ortho Film and Artificial Light

Why is it that the ortho film I have used so successfully out of doors gives such very poor results by artificial light?

Lacking fuller details, we surmise this must be another instance of the way one can be misled as to the speed of ortho materials. By daylight they may be quite fast, and yet by artificial lighting turn out to be so slow that severe under-exposure can only be avoided by the use of either an extremely wide aperture lens or a very large number of powerful lamps (or both!). This results quite naturally from the fact that ortho has very little sensitivity to red and orange, and these colours form the greater part of the light emitted by such light sources as are commonly employed by amateurs for indoor illumination. Hence, although there may be a considerable total quantity of light, the proportion thereof which is capable of affecting an ortho film is small, and so the material seems very slow. The extra cost of pan is never better justified than when one is working by artificial light.

Depth of Focus

If I want to get sharp focus from 10 feet to 20 feet, is it correct to set the lens for 15 feet? (Assuming the light is good enough to let me use a stop sufficiently small to cover such a range of distances.)

No, it is not correct to set the lens for the mid-point of the zone over which sharp focus is desired. The range of good definition always extends a little further *beyond* the point of exact focus than it does back towards the camera. Hence one should set the focus for a distance a little nearer than the middle of the zone to be covered. (In the example given, the correct distance to focus upon would be about 13 feet.)

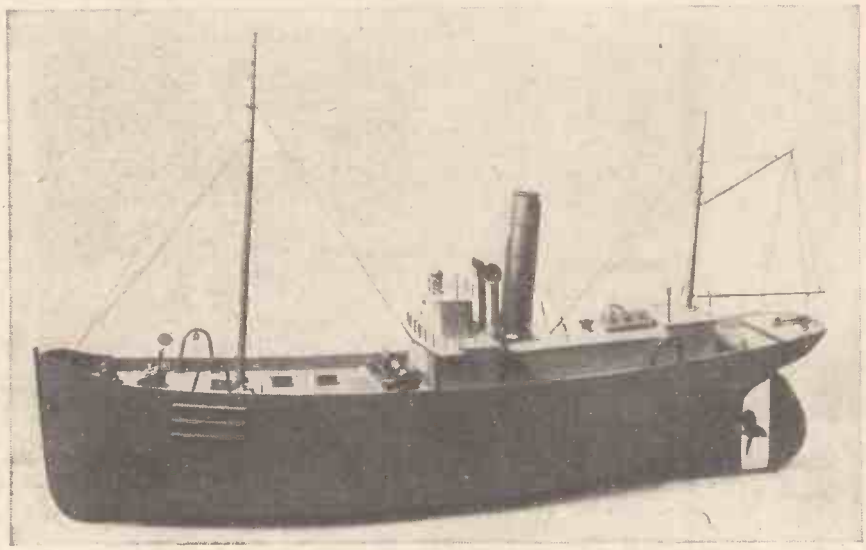
Using a Threading Light

I want to arrange a threading light on the stand alongside my projector, with a switch arrangement to change over, so that when the projector goes on the light goes off. Can I do this with a single switch? If so, what sort?

It is possible, the type of switch required being no more than the single-pole change-over which any electrical shop can supply. Simple as it is, we do not like the scheme, having tried it ourselves in our early enthusiasm for having everything very smart and automatic. There is one serious objection if the threading light cannot be "on" unless the projector is "off," you cannot watch the loop when the machine starts up, and so cannot spot the first signs of a threading error. It is really much more satisfactory to arrange the threading light so that it does not throw any light towards the audience, and have it on a separate switch. One can then turn the light on to check the behaviour of the machine during the actual running if one so desires.

"MOTILUS" PEEPS INTO

Some Interesting



This realistic scale model trawler was built from designs by Harold A. Underhill

READERS may remember some issues back in *PRACTICAL MECHANICS* the story of the "brass boat" of Mr. Ernest MacGowan, of Minneapolis. I have been hearing regularly from this keen American model maker, and he has recently sent me some photographs of his earlier efforts.

The Westinghouse type engine illustrated was his first attempt at model making and, "considering my lack of experience and proper equipment, it really is not as bad as it looks," he writes. "I gained lots of pleasure in making it, but because the slide-valve was far from what it should have been, it did not produce as much power as anticipated. This engine was the first one I installed in my "brass boat" I am now making a new slide valve of steel, and also a new eccentric rod and strap combined, as the first one, being of bronze, soon showed signs of wear."

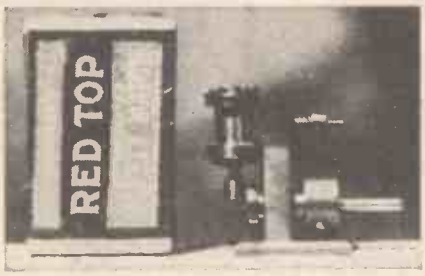
Model Engine in a Matchbox

The "engine to go in a matchbox" I started just to see if I could make so small an engine, and make it work. After I had started on it, I doubt if I would have continued the job to a conclusion, if my youngest son had not kept saying that "it would never go," so I had to finish it and have it run, just to prove him wrong!

For this engine I used no castings, just sheet and rod brass. The upright is both screwed and soldered to the base, and the valve face of the cylinder is soldered to the cylinder itself. The screws which hold the cylinder are too large in proportion, but were the only ones I had at the time."

A Fine Model of the L.M.S. "Royal Scot"

Models of exquisite detail are of interest not only to the model maker, but also to any person who loves fine craftsmanship. I am showing here a beautiful piece of work by Mr. Harold Thornton, of Paignton—a ¾-in. scale model of one of Britain's most popular types—the 4—6—0 three-cylinder L.M.S. "Royal Scot." The total length of the locomotive, which is 3½-inch gauge, is 4 ft. 1½ inches over buffers, and the approximate weight, unloaded, 100 lbs. The piston valves are inside steaming, with full Walschaerts valve gear, and the



This American enthusiast's miniature oscillating engine goes into a matchbox.

Belpaire firebox is fitted with hinge dropping grate. The engine has steam brakes on engine wheels, and steam and hand brakes on tender wheels, and vacuum brake for train wheels. The special fittings include mechanical lubricators, superheater tubes, water pick-up on tender, and live steam injector.

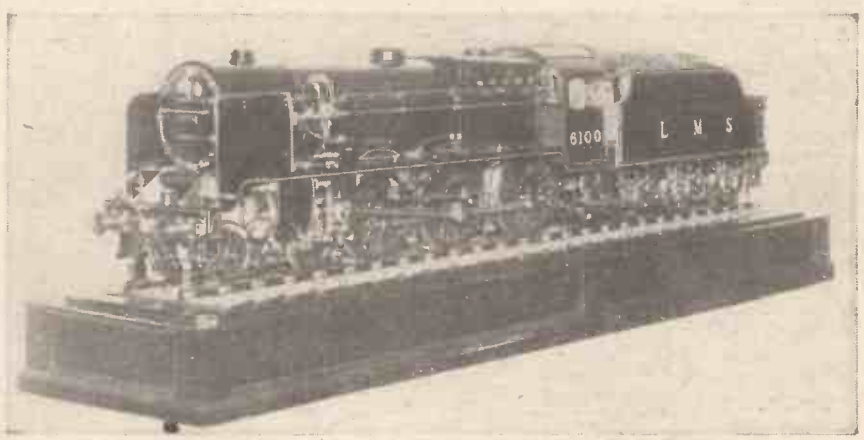
Mr. Thornton is now engaged on war work, but is anxious to dispose of the drawings and patterns he has made for this magnificent model. If any reader is interested, the editor of *PRACTICAL MECHANICS* will put him in touch with the maker.

An Interesting Model

Casting back my mind, I remember that, during the last war, the papers made a big splash about the laying of a foundation stone—that of the Bromborough Docks, Liverpool, I believe—from a distance. The ceremony was performed by King George V, and a special feature of it was that a model was also made to scale, and was actually laid with the real one. Looking at the picture of the model, I should say that, when the button was pressed, the hammer would be released and, making electrical contact with the solenoid under the model, set the miniature crane in motion, and the model stone would be laid, at the same time as the real stone was laid in the docks. This model was for a long time in the museum at Lever Bros., Ltd., Port Sunlight; for whom it was made, and it was there that His Majesty the King performed the stone-laying ceremony. With it was the famous Port Sunlight village model.

War-time Difficulties

Every manufacturer and producer not engaged on urgent government work finds great difficulty in obtaining goods or raw material. There is, firstly, the restriction on private production, except for export, to 25 per cent. of the usual output. Then there is the priority for raw materials for Government work, which means long delays in obtaining necessary supplies. Model manufacturers, owing to the variety and scope of their products, have always had a comprehensive stock of castings, fittings and materials, and this has served them and their customers in good stead during the past twelve months, but *stocks are now running low*. Apart from special castings,



A fine ¾-in. scale, 3½ in. gauge L.M.S. "Royal Scot" model—the work of Mr. Harold Thornton, of Paignton.

THE MODEL WORLD

Examples of the Model Makers' Craft

such as cylinders, wheels, chimneys, axle guards, domes and also engine parts where expensive patterns are necessary for making castings, it is advisable for model makers to try their local metal dealers for their supplies. Very often one can purchase odd sheet metal, rod or tube from local dealers when it would take weeks to come through from their usual dealer without having a priority certificate. Do not let your hobby suffer because you cannot obtain goods by return of post, as you did in the piping days of peace. This is a period when the ingenuity of the model maker is given full scope to adapt existing materials that are available to his model problems.

The latest pattern L.M.S. gauge "O" open wagon by Bassett-Lowke, Ltd.

A Model Goods Wagon

However, to strike a more cheerful note, despite present difficulties, Bassett-Lowke, Ltd., are still able, if not to make many new models, to revise and bring up to date their more popular lines, both as regards locomotives and rolling stock. Here is a great favourite among model railway owners, the L.M.S. open wagon. New prints have been made for B—L L.M.S. goods rolling stock, comprising latest pattern open wagon, covered wagon and goods brake van. You will see from the illustration the small neat lettering, and all the models are fitted with non-locking couplings and anti-friction wheels of correct pattern, but cast-iron wheels to scale can be fitted at an extra charge, if the customer prefers these.

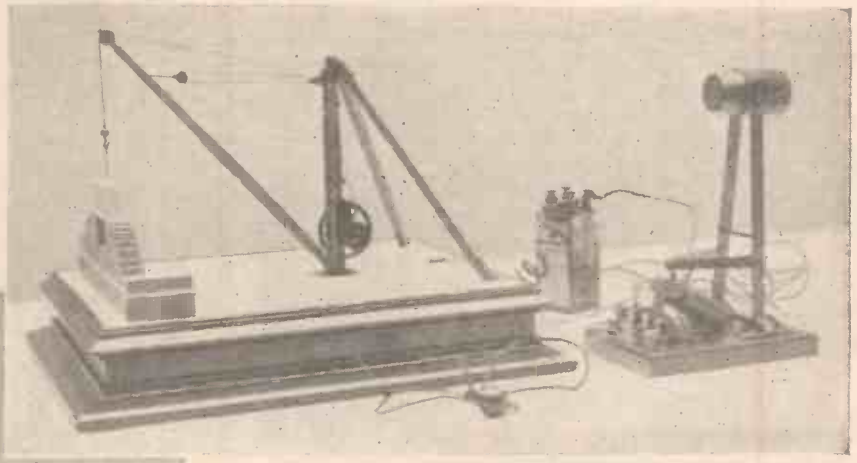
A Scale Model Trawler

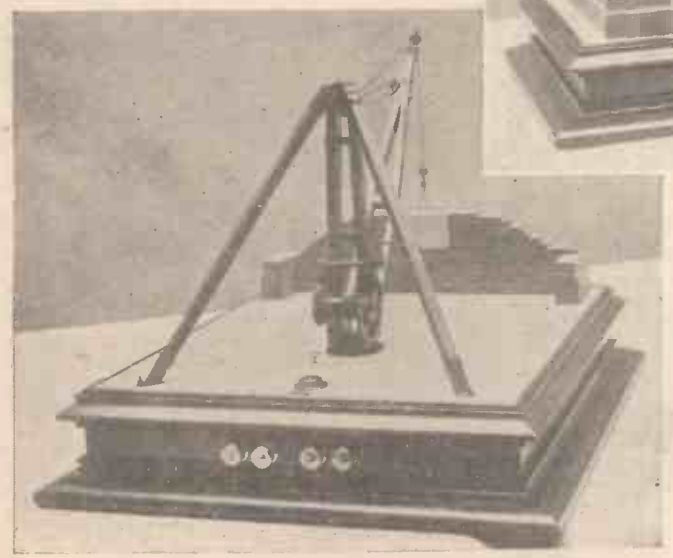
Now the longer days are approaching, ship lovers will want to build something new for the summer season. What about the latest type of trawler? The trawler is very much in the news in these days, whether converted for war work or doing its useful peace-time trade of fishing and bringing necessary food to our shores. The trawler model pictured on the previous page was built from drawings supplied by Bassett-Lowke, Ltd., to the design of Mr. H. A. Underhill. The prints available are: (1) Elevations, and Deck Plan. (2) Lines, (3) Full size Machinery Layout for 24-in. electrically driven model, (4) Full size Machinery Layout for 30-in. steam-driven model. The prints are priced at 2s. 6d. a sheet.

This model Westinghouse type engine, made from castings, is Mr. Ernest MacGowan's first effort at modelling.

Clockwork or Electric

The finished model is also available with clockwork or electric drive, and is a real trawler in miniature. Built for heavy weather, yet a picture of fine model shipbuilding to look at, and handsome enough to take a prominent place in any collection. The bridge, with its compass and bell, the gallows and winches for hauling the catch on board, ventilators, galley funnels, and so forth, all go to form the characteristic looks of this small but distinguished craft.





Two views of an interesting foundation stone model, built for Lever Bros., Ltd., of Port Sunlight, during the last war in connection with the laying of the foundation stone of Bromborough Docks, by His Majesty King George V

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.

Thermostat for Greenhouse

MY greenhouse, which is 9 ft. by 6 ft., and 7 ft. to the ridge, is heated by 4-in. pipes on three sides, open end expansion chamber, and sealed tank containing the heating element, which is a 2,000-watt unit on a 200-volt supply. The permanent thermostat is adjusted to shut off at approximately 80 to 110 degrees water heat. This was adjusted to give me a house temperature of between 40 nad 50 degrees, but this thermostat does not cut out when the house temperature is 50 or over.

Can you tell me if it is possible to make or buy a thermostat to work at the above air temperatures? If so, how and where?—R. A. J. Riches (Bexleyheath)

THERE is no reason why your thermostat should not cut out with reasonable accuracy. You do not say what type of thermostat you are using, but we presume, of course, that it is an electrical one of the opening and closing contact type. Very probably the contacts have been allowed to become dirty, or, alternatively, maladjusted. On the other hand the contacts may not meet squarely together, which fact would also take away from the accuracy of the instrument.

It is hardly possible for you to make a serviceable thermostat of the type you require unless you have special skill and experience in instrument making. You will, however, be able to obtain a satisfactory instrument from the Cambridge Instrument Co., Ltd., 13, Grosvenor Place, London, S.W.1. Electradix Radios, Ltd., 214, Upper Thames Street, London, E.C.4, may be able to supply you with a second-hand thermostat, whilst several of the larger horticultural supply firms also market greenhouse thermostats of suitable design.

Boiling Gas-impregnated Clothes

DURING a recent A.R.P. instructors' course, I was told that certain gases have boiling points as follow: Mustard gas, 423 F.; Lewisite gas, 374 F.; B.B.C. gas, 463 F. (bromo-benzyl-cyanide). Some of the non-persistent gases have, I understand, even a much higher "boiling point." We are told to decontaminate clothes by boiling in water, the boiling point of which is 212 F. Can you explain this, please?—W. Prosser (Abertillery).

THE solution of the apparent contradiction which you mention is to be sought in the fact that many of these organic compounds which serve as lethal "gases" are decomposed and rendered harmless by boiling water and, also, that some of them are volatile in steam.

Thus by boiling "gas-impregnated" clothes and other fabrics in water, a portion of the "gas" passes off in the steam (and is usually decomposed in so doing), whilst any remaining with the water is also decomposed and rendered comparatively harmless.

Nitrate of Silver

I HAVE been trying to make nitrate of silver by putting some old silver watch cases in a mixture of distilled water and nitric acid and I find that it becomes a blue liquid, which seems to suggest that there is a certain amount of copper in it. Is there any way possible to get the nitrate of silver out of the solution in a pure state, as I would like to use it to silver a telescope mirror?—W. E. Parkes (Sunderland).

IF you get a blue-green solution when you dissolve an old silver watch case in nitric acid, two inferences are to be made: either the case is not a silver one, but is made of nickel or nickel-alloy, or else the silver of the case is alloyed with copper or merely plated upon that metal.

In any case, however, it is a fairly easy matter to recover pure silver from your blue-coloured nitric acid solution of the watch-case metal. Evaporate the solution to dryness and then redissolve it in distilled water. Acidify the solution with hydrochloric acid. This will precipitate silver chloride. A few pieces of zinc are then added to the liquid. The acid will act on them, liberating hydrogen gas which will at once reduce the silver chloride to metallic silver. The latter is then filtered off as a black powder, washed, and dissolved in dilute nitric acid. The nitric acid solution is evaporated to dryness, and the residue of pure silver nitrate redissolved in distilled water.

Plastic Materials

COULD you tell me where I could obtain, or how to make, a plastic material for making brooches, etc., resembling bone or ivory, as sold by the multiple stores? Am I right in assuming the following to be a formulae for plastic wood: Nitrocellulose, 17 parts; ester gum, 6 parts; castor oil, 2 parts; wood flour, 20 parts; lacquer thinners?

Where could I obtain these materials?—J. Clough (Harrogate).

IT is quite impossible for you to make at home any of the artificial plastic materials which are now on the market, since these are usually moulded under hydraulic pressure. At the same time, you can purchase supplies of these plastic compounds from various firms, such as Imperial Chemical Industries, Ltd., Millbank, London, S.W.1, or from A.B.C. Plastic Moulded Products, Ltd., 61-63, Old Compton Street, London, S.W.1. The British Xylonite Co., Ltd., Hale End, London, E.4, may also be able to supply you with suitable materials for your work.

The formula which you give is not a correct one for plastic wood. Plastic wood is essentially a suspension of wood flour in an organic solution of celluloid. You can readily make plastic wood by dissolving scrap celluloid in a mixture of equal parts of acetone and amyl acetate so as to make a thick solution, and by kneading wood flour (i.e. very fine sawdust) into this. The addition of a few drops of castor oil to the celluloid solution will improve its qualities by rendering it less liable to brittleness when dry.

Such materials could very probably be obtained through your nearest branch of Boots, the chemists. Scrap celluloid, acetone, and amyl acetate may be obtained from Messrs. A. Boak, Roberts & Co., Ltd., Stratford, London, E., and wood flour is obtainable from Messrs. A. Reid, Elder and Co., Ltd., Peninsular House, 28, Monument Street, London, E.C.3, or from Messrs. J. H. Wiseman & Co., Suffolk House, 5, Lawrence Pountney Hill, London, E.C.4.

Special Adhesive

CAN you tell me how to make a permanently tacky adhesive similar to that used on motor-body painters' marking tape? I want to be able to make paper patterns, of any size up to 10 in. by 10 in., as required, to fix on glass, so that they will peel off after use, leaving no mark behind them. I shall, of course, use strong brown paper. They will not be subject to any heat while on the glass and will be used only once. Is it possible to make up this preparation and keep it in a bottle ready for use?—G. D. Williams (Plymstock).

THE adhesive which you seek is prepared by dissolving pure rubber latex in amyl acetate, acetone, spirit, or some other suitable organic solvents. Adhesives of this type have been used for some time in America, but are not yet common in this country.

It is quite possible to make up the preparation in small quantities and to keep it in a bottle. You will probably be able to obtain rubber latex from Messrs. Harrington Bros., Ltd., Oliver's Yard, City Road, London, E.C.1.

Rewinding Induction Motor

I HAVE a ¼ h.p. 230-volt, 50 cycles, 1,450 rev. squirrel-case induction motor, which is stripped of its windings, and I wish to rewind it for the same h.p. voltage and frequency. Would you please tell me the size of wire and number of turns I will have to put on for the starting and running coils respectively? The particulars of the stator are: Bore diameter, 2⅛ in.; depth of bore, 2¼ in.; number of slots, 24; depth of slots, ⅜ in.; width of slots, 5/16 in.; width of teeth, ⅛ in. What quantity of wire will be required to rewind this motor, and as the motor has oil ring bearings, would it be suitable for rewinding for a speed of 3,000 revs.?—W. Dunkley (Hornchurch).

REWINDING this motor as a 2-pole machine for a speed of 2,800 to 3,000 r.p.m. on 50 cycles will be considerably more difficult than a 4-pole winding for a speed of 1,400 to 1,500 r.p.m. A good deal more room is required in the end frames, and unless the radial depth of iron at the back of the slots is proportioned to suit the increased flux carried by a 2-pole distribution of coils, the result will not be at all efficient. Assuming the motor to be rewound therefore as a 4-pole stator, the following is the winding specification for 230 volts 50 cycles, to develop ¼ h.p. at 1,400 to 1,500 r.p.m. :—

Main running coils.—12 in number, each containing 54 turns of No. 21 s.w.g. d.s.c. copper. Concentric grouping, 3 coils per pole.

Starting winding.—12 coils, each with 45 turns of No. 27 s.w.g. d.s.c. copper, grouped as above, but with pole centres advanced half a pole-pitch.

No alteration will be required to the squirrel-cage rotor. The two sets of windings will be put in parallel for starting, and the starting coils cut out just below synchronous speed.

Time Lag for Relay

I AM desirous of lagging a relay to give a delay, if possible, of half a second. Would you please indicate how this may be done without resorting to mechanical means? If this is not practical, what mechanical method would serve?—R. Penwarden (Weston-super-Mare).

MECHANICAL means of obtaining the desired time-lag in the operation of the relay would probably prove more satisfactory and less costly, but it is difficult to advise on the few details given in your enquiry. Relays generally operate on exceedingly small current values, otherwise thermostatic control by means of a bi-metallic strip warping under the heating effect of the current in the relay coil would probably meet the case, but without further information as to the coil winding it is hardly possible to advise. Mechanical means of obtaining a time lag without reference to current values should be relatively simple. For instance, the armature of the relay might carry a light stem ending in a vane dipping into glycerine, the time element being controlled by the size of the vane. An air dashpot, with loosely fitting disc or short tube in a cylinder closed at one end would serve the same purpose, the speed of operation being controlled by an aperture of suitable size at the closed end of the cylinder.

Wind-driven Generator

WOULD you please give particulars of a miniature windmill to drive a ¼ h.p. dynamo in a normal wind of 25 to 30 m.p.h at 220 to 250 revs. per minute?—A Smithers (Burgess Hill).

A "MINIATURE windmill" to drive a ¼ h.p. dynamo is an impossibility. It would necessitate a mill with sweeps or vanes at least 8 ft. in diameter, and a dynamo of considerable dimensions, if required to generate at such a low speed as 250 r.p.m. In fact, only a machine with permanent-magnet fields, or laminated fields separately excited from an external battery would be the practical solution. The Lucas "Type A/900" car dynamo is one of the slowest running that will give any useful output, and even this requires a speed of 450 r.p.m. before it will cut in and start charging. Perhaps a better appreciation of the difficulty would be obtained by a study of the illustrated article entitled, "Wind-operated Lighting Sets," in *Practical Mechanics* for August, 1939.

Duplex Telegraphy

COULD you explain briefly the principle of the Duplex telegraph, by which two, or more, messages may be sent over the same line, at the same time, and in the same direction? Also, will you name any books to which I could refer for further details.—Frank Fensome (Worksop).

DUPLEX, diplex, and quadruplex telegraphy are carried out either on the "differential" method, involving the use of instruments wound with differential coils, or else by "bridge" methods. To explain fully would be very difficult in a short letter, as it involves many diagrams, and reference should be made to some text-book such as S. P. Thompson's *Elementary Lessons in Electricity and Magnetism* in the chapters dealing with submarine telegraphy. The diplex method of sending two messages at once through a wire in the same direction necessitates the employment of instruments which work only with currents in one direction in conjunction with polarised relays.

Magnetic Calculations

COULD you supply me with the following information:—

(a) A safe value of current flow per unit area between copper and mercury.

(b) A formula expressing the pull exerted by a solenoid on its core for given positions of the core, from right out to right inside? I have permeability and ampere-turns/inch curves available.—D. H. Goslin (Gt. Baddow).

A SAFE value of current density between copper and mercury in well-ventilated positions would be 400 amperes per square inch sectional area of contact. No single formula can be employed in calculating the pull of a solenoid for the whole traverse of its movable core, as each consecutive position of the core and consequent variation in the airgap affects the flux density and magnetic leakage. The only method is to calculate the actual values of the flux in a succession of positions of the core, and plot the curve resulting as the tractive effort. Knowing the ampere-turns of excitation and the permeability values of the iron employed, the value of ampere-turns needed to produce a flux of one line $=$

$$\frac{\text{Length of magnetic path (ins.)}}{\text{Area in square ins.} \times \text{permeability}} \times 0.3132,$$

the expression $L/A \times \mu$ representing the reluctance of the circuit for the stated dimensions of airgap. The actual tractive effort in lbs. with the two cores in actual contact will be :—

$$\text{Pull (lbs.)} = \frac{B^2 \times A \text{ (square inches)}}{72{,}134{,}000}$$

The articles on "Electromagnetic Devices," by A. H. Avery, in the April and May numbers of *The Model Engineer* for 1936 may be helpful.

GALPINS

ELECTRICAL STORES

Owing to war circumstances this Business is now transferred to

21, William St., Slough, Bucks.

Terms : Cash with Order

ELECTRIC LIGHT CHECK METERS, small, late type, well-known makers, in good condition, electrically guaranteed for 200/250 volts 50 cycles 1 phase A.C. mains. 5 amp. type, 6/-; 10 amp., 7/6; 20 amp., 9/- each. Post 1/- on all types.

D.C. ELECTRIC LIGHT CHECK METERS, 200/250 volts 5 and 10 amps., 5/6 each, post 1/- (in new condition).

PHILIPS HIGH VOLTAGE CONDENSERS. 1 mfd. at 4,000 volt working, 5/6 each, carriage 1/6.

REGULATORS, STARTERS AND LARGE DIMMER RESISTANCES. Stud Switch-arm type. State wants.

SWITCHBOARD VOLT- AND AMPMETERS, MOVING COIL AND MOVING IRON. All first-class makers. Please state requirements.

TEN LINE CORDLESS TELEPHONE PORTACLE EXCHANGE BOARD, complete with calling generator, in new condition, £6/10/-, carriage forward.

EX R.A.F. GLASS ACCUMULATOR TANKS, 5 x 5 x 8 in., new and unused, 3/6 each, post 1/-.

EX R.A.F. SWITCH PANEL, with case (new), fitted 6 small knife switches, leads, cords, and cleats, complete in wood case, 2/6 each, post 6d.

SMALL ELECTRIC ROTARY CONVERTOR, 110 volts D.C. input, 10 volts at 30 amps. output. Useful for garage charging, 55/-, carriage forward.

D.C. MOTOR BLOWERS, 2 in. inlet and outlet. Aluminium body, laminated field, ideal for dug-out ventilation. 100 volt, 25/-.

HIGH-VOLTAGE TRANSFORMERS, useful for all test work or television. Input 200/240 volts, output 5,000 and 7,000 volts, 7/6 each, post 1/-.

VOLTAGE CHANGING TRANSFORMERS (Auto-Wound), 100/110 to 200/240 v., or vice versa, fully guaranteed, 1,000 watts, 60/-; 2,500 watts, 110/-.

DUG-OUT LAMPS, ex R.A.F., solid brass construction, glass dome, complete with 12-volt bulb (any bulb can be fitted), wall fitting, 3/- each, post 6d.; Ditto, wing type, as new, 2/6, post 6d.

DUG-OUT LAMPS, ex R.A.F., porthole type, or can be bracket fitted, glass dome, three colour fitting, white, red or green, solid brass construction, 6 in dia., complete with bulb; any size bulb can be fitted. Price 5/-, post 6d.

1 kW. TRANSFORMER, 100 v. input at 100 cycles, output 10,000 volts, centre-tapped, price 30/-, carriage forward.

EX R.A.F. AUTOMATIC CHARGING CUT-OUTS AND VOLTAGE REGULATORS, to suit any dynamo up to 20 volts at 15 amps., fully adjustable, wiring instructions, complete in metal case. Price 3/6, post 9d.

DYNAMOS, all shunt wound and fully guaranteed, 50/75 v., 15 a., £6/10/-; 50 75 v., 25 a., £8/10/-; all carriage forward.

25 VOLT D.C. MOTOR, maker "Crompton," ½-h.p., ball-bearing, in perfect order, £3, carriage forward.

DITTO, on iron bedplate, but fitted with large reduction gear and rope drum, £5 carriage forward.

110-VOLT D.C. MOTOR, totally enclosed, rated at 8 amps., ball-bearing, in new condition, make good slow-speed dynamo, £2/5/-, carriage forward.

GUNMETAL PULLEYS, 7 in. diameter, to take 1 in. dia. rope, complete with rope guard and hook, 7/6 each, post 1/-.

PHILLIPS TRANSFORMERS, 220 v. input, output 2,000-0-2,000 volts, 200 m/a., and two L.T.s, 50/-, carriage forward.

2 kW. TRANSFORMER CORES for rewinding, sound windings but rating unknown, 20/- each, carriage forward.

STEEL CABINETS, suitable for large amplifiers, etc., size 42 in. by 24 in. by 16 in. Price 35/-, carriage forward.

¼ H.P. 110 v. D.C. MOTOR, in good working order, 25/-, carriage forward.

SLIDER RESISTANCE, 2,500 ohms at 200 m/a., worm and wheel control, 25/-, post free.

MILLIAMPMETERS, 2 in. dia. 0-30 m/a., 25/-; 2½ in. dia., 0-100 m/a., 22/6; 0-500 m/a., 22/6; all high grade moving coil.

AERO DYNAMOS, output 12 volts 12 amps., as new 15/-, carriage pass. train 2/6.

FLOOD LIGHTS, 12 in. dia., multi mirror type with 5 in. dia. mangin mirror centre, any lamp can be fitted, 15/- each.

EPOCH LOUD-SPEAKERS, 20 watt cinema type, 6 volt field, 50/-, carriage forward.

CHARGING DYNAMOS, all shunt wound, and in perfect working order, 12/18 volts 10 amps., 35/-; 100 v. 4 amps., 50/-; 20 v. 8 amps., 35/-; 50/75 v. 15 amps., £5/10/-, all carriage forward.

LAMPS, 110 v., 150 watt, half-watt gas-filled, Ediswan screw fitting, 2/6 each, 25/- per doz.

D.C. FAN MOTORS, large size, 110 or 220 v., 15/- each, carriage paid.

New 3-in. De-Luxe Double Disc White Celluloid

RAPID ANGLE INDICATORS

Each only **1/9** Post 3d.

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CASH or C.O.D. SATISFACTION GUARANTEED OR MONEY INSTANTLY returned without question.—Prompt delivery. Orders of 5/- or over sent C.O.D. without extra postal charges.

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110 volts, .8 amp. D.C., semi-enclosed, ball bearings, 1,850 revs. Weight 15 lbs. Size 6 in. by 5 in. No tax. Cheap. Carr. fwd. **10/6**

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30 SWG 7/-	34 SWG 9/6	40 SWG 18/-

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THE Cyclist
Editor : F. J. CAMM

VOL. IX MARCH, 1941 No. 229

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

'Phone : Temple Bar 4363

Telegrams : Newnes, Rand, London.

Comments of the Month

By F. J. C.

Bicycle Improvements

WE do not know, at the moment of going to press, whether the C.T.C. plaque will be awarded this year, for bicycle design has undoubtedly suffered a setback as the result of the war; yet, as a result of the war and the developments in metallurgy and other directions, the war period may yet play a large part in producing improved post-war bicycles. And we must admit that there are many directions in which the bicycle can still be improved. As most bicycle manufacturers will undoubtedly be considering, even during the war, their post-war programme, it might be wise for the C.T.C. Bicycle Improvements Committee to take the initiative and give a lead to design, by circularising manufacturers as to the directions in which improvement is necessary and indicating the type of improvement which would be worthy of their award. We still feel that there is room for a small direct current dynamo which would charge a small stand-by accumulator, and there are many other directions in which necessity is ahead of invention.

"Fighting Fit in the Factory"

WE are pleased that the Ministry of Labour and National Service has recognised the value of cycling by the publication of a booklet entitled *Fighting Fit in the Factory*. It deals with such subjects as proper food, relaxation, and there is an important contribution entitled "Take the Exercise you Enjoy." This is what it says under that heading : "Exercise is very important. People should get all the exercise they can, especially the sort they enjoy, and especially out of doors. Fresh air will refresh tired bodies, and a change of action will relieve tired muscles. For those who have to sit at their work, it s a good plan to take a brisk walk or a spin on the bicycle. For those who have been standing all day, walking and cycling are good, so long as you don't overdo it."

Dynamo Sets Tax-free

THE Customs and Excise authorities have relented. Having stated early in January that the purchase tax applied to dynamo lighting sets because such were portable, they received representations from the Trade, and it is now decided that dynamo lighting sets shall be exempt. All cycle lamps, other than dynamo lamps, pay Purchase Tax of 33⅓ per cent.

Reconditioned Cycles

IN other directions the purchase tax has furrowed the brow of many a cycle dealer. The problem of the tax in relation to repaired or reconditioned articles was by no means clear, but the Customs and Excise have now clarified that position. Manufacture is defined by Section 41 of the Finance (No. 2) Act, 1940, as "making goods or performing any process in the course of making goods. It does not, therefore, cover repairing or reconditioning an article, provided that the operations performed are not so extensive as to involve the making of what is virtually a fresh article. Manufacture would, however, take place if in an exceptional case a fresh cycle was built up, consisting mostly of new parts or parts taken from other vehicles."

Cycling Broadcasts

NOW that the B.B.C. is devoting a proportion of its valuable programme time to cycling, I suggest that it invites great cycling authorities such as Frank Urry, "Wayfarer," and men of similar calibre to broadcast. These men, who have grown up with the sport, know it from every angle, and have kept young in it, have the necessary wealth of knowledge and personal experience to talk with conviction and richness of anecdote. It is the pastime that must be broadcast, not the sport. The part can never be greater than the whole. We must consider the ten million and not the fifty thousand or so. Frank Urry, probably the greatest authority on the pastime, could put over some fascinating and interesting broadcasts. He has been a cyclist all his life for the sheer love of it—and his life extends beyond a few years or so. He speaks and writes from lengthy practical experience, and his reminiscences are quotations from his own cycling life story. That insatiable tourist "Wayfarer," could bring the very breath of the countryside to the microphone, too.

The Prospects

WITHIN a few weeks the road programme will be in full swing, for cycledom has recovered from the jitters inculcated in the early days of the war, when a lead was given to cycling clubs to abandon everything. Those who, indeed, were the first to adopt the policy of cancellation were those who are now loudest in their criticism of clubs who followed their advice. There was general criticism of a famous club because it cancelled its "100," but an examination of the programmes of most of the leading clubs indicates that the largest proportion of them cancelled their "100's." We think that they were wise in doing this at the time because clubs had reported some unhappy experiences; riders had been stopped for identity card inspection, their times had been reduced by convoys of military traffic, barricades had been erected unexpectedly and so on. Now that a degree of sanity and normality has returned, clubs are reinstating most of the events which they had cancelled last year. Readers will remember the classic case of high-handed action on the part of one club which, not satisfied with cancelling all its events, took the law into its own hands and "banned" its members from entering any opens promoted by other clubs. This, of course, they have no power to do, and we indicated to the members of the club the illegality of such a ban. No club has the power to prevent its members entering properly organised time trials. This particular incident was the more surprising because the club concerned, whilst not an old one, has yet been operating for ten years or so, and should know better. We cannot permit autocracy in the democratic sport of cycling.

It was not only time trials which were abandoned. Many clubs cancelled their committee meetings, whilst those which did hold them had difficulty in finding a quorum.

Notwithstanding wholesale cancellations, over 600 road events were held last year, and there will certainly be over that number this year—or as certain as one can be in these surprising times.

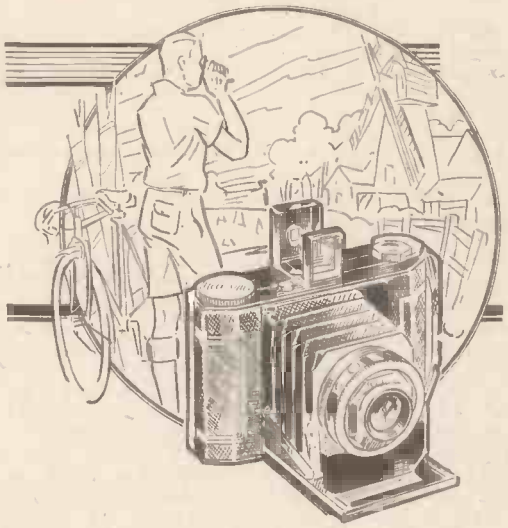
One of the difficulties which has cropped up concerns timekeepers. The B.H.I. have discontinued their tests of watches, and in order to meet the situation it is suggested that a panel of watch-testers, working at a standard charge, should take the rates of watches submitted to them. We do not like the scheme, for with a multiplicity of testers, there is multiplicity of risk of subterfuge. We must also remember that timekeepers with expensive watches may not agree to have their watches tested by some local tinker who happens to have been put forward by a District Council and approved by the National Council.

War History of Cycles and Cycling

THE management committee of the British Cycle and Motor Cycle Manufacturers' and Traders' Union have charged Major H. R. Watling, its director, with the duty of receiving and preparing material for a war history of the trade, the pastime, and the sport. This will undoubtedly be of considerable interest to future generations, and good propaganda for the bicycle itself. Record will be made of the doings of cyclists in relation to their military duties and their duties as members of the various Civil Defence services. We are co-operating with Major H. R. Watling in forwarding on material suitable for inclusion.

Death of George Lacey Hillier

THE Grand Old Man of cycling, George Lacey Hillier, died recently at the age of 84. He was not only a famous record-breaker, holding all records at all distances at one time, but a versatile man and a prolific writer. He was a founder member of the N.C.U., editor of cycling publications and annuals, regular contributor to the cycling Press, and author of a famous cycling novel entitled *The Potterer's Club*. We had arranged with him to serialise this in THE CYCLIST, and only a few months before his death he had read through the book and corrected it. He was free from the intrigue which seems to permeate the sport nowadays, and was revered by all. He was a member of the Fellowship of Old Time Cyclists. Another lion of the pastime goes to join Bidlake.



Paragrams

Cyclists in the Navy

ALTHOUGH many cyclists of note appear to express preference for the Royal Air Force, many famous riders still prefer the Senior Service, among these being Petty Officer J. Beaver (Bristol South C.C.), Reuben Firth, and George Logan.

Nurse Cyclist Fined

WHEN Nurse Susan McGinley was summoned at Barnet Police Court for riding a cycle without lights, she did not appear but wrote to the Justices as under: "As a nurse it was my duty to get to work at all costs to attend to Hitler's wounded and mutilated victims. With Herbert Morrison's words, 'Go To It' surging through my ears, I, unlike Florence Nightingale, the Lady with the Lamp, went to it without a lamp. I thus fell foul of the law in the honoured purpose of alleviating pain and helping my country to defeat Hitler's death-dealing blows." She was fined 10s.!

Cyclist Commended

AN A.R.P. messenger, Ronald ("Babe") Sanderson, has received the warmest commendation of the warden of his post. Although "only" a cyclist-messenger, "Babe" worked unremittingly for fourteen hours in an effort to rescue men from a bombed lodging house.

Club Secretary Resigns

GEORGE NEWMAN, Catford C.C., has had to resign from the honorary secretaryship of the London South District Council of the Road Time Trials Council. George Newman has left his "mark" on road affairs south of London, and his work will be carried on by his clubmate, J. E. Stephenson.

Veteran Cyclist in Home Guard

FEW who have the privilege of meeting Lieut.-Col. G. P. Mills, D.S.O., realise that he is now in his 74th year. Now serving with a section of the Home Guard, Mills' youthful appearance belies his years. It is 54 years since he made the first of his 19 National records which included the Groats jaunt six times. He still holds the "paced" tricycle record from End to End.

Film Star Rider in Tank Corps

HOLLYWOOD film star Richard Greene is serving in the Royal Tank Corps. Like many others in this mechanised unit, he is a keen rider.

An Old Clubman Passes Over

WELL known in Liverpool N.C.U. circles and a member of the Liverpool Century Road Club, Thomas Ashton has passed over. He was 76 years of age.

The Late Joseph Nicholl

STATED to have introduced the first "boneshaker" and Ordinary into Perth, Joseph S. Nicholl has died at his home, Glen Farg, Perthshire. He was in his 83rd year.

Clubman Hurt

RON WHITE, appreciated member of Highgate Cycling Club and hard-working official of the North Middlesex and Herts Cycling Association, is in hospital badly injured. A part-time member of the A.F.S., he sustained his injuries when tackling one of London's fiercest fires caused by enemy action.

Woman Secretary Marries Soldier

MISS PEARL TROUT, secretary of the Plymouth Corinthian C.C., was married recently to Sergt. T. Spry, a well-known pre-war time-trialist in the South-West. Spry has seen service in France.

Hostels Membership in Scotland

THE Scottish Youth Hostels Association finished the financial year 1940 with a membership of 15,873 against 18,720 in 1939. The Association is holding its tenth birthday celebrations this year, and will again issue its annual handbook.

Crack Kent Rider Joins Benedicts

THE crack Kent Road C.C. member, Harry Wheatley, has joined the Benedicts.

A Novel Collection

A BIRMINGHAM cyclist who has been awheel for over 60 years specialises in collecting pictures of pubs in which he has stopped!

Woman Club Secretary Takes Over

MISS K. E. BOND, Graig Park Circle, Malpas, Newport, Mon., is acting hon. sec. of the Newport and District Wheelers during the absence in the R.A.F. of the secretary. May success attend her efforts.

Treasurer Manages Club Affairs

CLUB affairs in general of the Doncaster Paragon are being handled for the time being by the treasurer, V. A. Greaves, 152 Cemetery Road, Doncaster. All the other officials are serving!

Scot Shocked by Cycling!

MR. WATT, of the Falkirk and Linlithgow Presbytery was shocked by the number of cyclists on the roads on Sundays in pre-war days, according to a recent press statement. He also thinks that the present physical types in Scotland do not compare with those of the days when porridge was the staple diet, and everyone knew the Shorter Catechism!

Road Sport in Scotland

AMONGST the leading Scots organisations which propose to promote open events this season are the West of Scotland T.T.A., the Mid-Scotland T.T.A., Glasgow Wheelers, Hamilton C.C., Douglas C.C., and the Nightingale C.C.

Taylor Clarion Champion Again

JACK TAYLOR, West of Scotland Clarion, has won the National Clarion C.C. championship for the fourth year, with a speed of 22.618 m.p.h. over 25, 50, and 100 miles.

Norwood Paragon Timekeeper

MR. F. J. CAMM has been re-appointed to the Norwood Paragon panel of timekeepers at its recent A.G.M.

Leslie in Air Force

TOM LESLIE, former championship secretary of the Scottish Amateur Cycling Association, is now serving with the R.A.F. "Somewhere in Wales."

Scots Records Safe

THE principal decision at the annual meeting of the Road Records Association of Scotland, held last month in Glasgow, was one to place the books of the Association in a safe place for the duration.

The records go back more than thirty years. Henry S. Bilbé was re-elected honorary president, with G. R. Herd, well-known Edinburgh timekeeper, as president and chairman, and John Macfarlane, 12 Aikenhead Road, Glasgow, S.2, as secretary.

Scots Speedman With the R.E.

WILL SCOTT, outstanding Scots speedman at short distances, is now Somewhere in Hampshire with the Royal Engineers. A Sanquhar miner, Scott broke a number of Scottish records in 1939.

Link With Tom Hughes

JOCK MILLER, noted Scottish cycling authority of Larkhill, is now living at Dagenham, Essex. He was closely connected with Tom Hughes's End-to-End record on three wheels in 1929.

Club Night

KINGSDALE C.C. hold their club "night" on Saturday afternoons in the Fishmonger's Arms, Wood Green.

Twins for Club Secretary

FORMER R.T.T.C. hon. sec., Ernie Stapley (Finsbury Park C.C.) has been presented by his wife with twins.

Annual Novices "25"

TWICKENHAM WHEELERS hope to hold their annual Novices "25" this year.

Yorkshire Speedman Wins Cup

JACK HOLMES, Yorkshire Road Club massed-start racing expert, has won a cup awarded to the best all-round athlete in his squadron.

Poly. Rider Joins Home Guard

"ANY previous military experience?" asked the Home Guard enrolment officer of Percy Curnew (Polytechnic C.C.), when Percy presented himself for enlistment. "Joined the Post Office Rifles in 1897 . ." began the applicant. Not unnaturally the enrolment officer was startled as he viewed Percy's youthful appearance.

A.F.S. Cyclists Wanted

THERE is a need for more messenger A.F.S. cyclists in Glasgow. Wages and conditions are good, and there is an additional allowance of 2s. 6d. each month for machines.

Hercules Rider in the R.A.

J. B. ("JOCK") WADLEY (Colchester Rovers), who was closely associated with the massed attempts on road records by the Hercules team in 1939, is now with the Royal Artillery.

Ladies' C.C. Annual Lunch

NEARLY 70 members and friends attended the recent annual lunch of the Rosslyn Ladies' C.C. over which Miss T. M. Biggs presided. For the first time in the club's 19 years of activities, "mere" man was admitted to the gathering.

Cycling Spook in Iceland

ON the road between Reykjavik and Hafnarfjorthur in Iceland there is a cycling spook. A man fell off his bicycle at a corner and was killed. Now he walks with his head tucked underneath his arm!

Clarion Meet at Easter

THE annual National Clarion C.C. Easter meet is likely to be held as usual, at Shrewsbury, in spite of war-time difficulties. The club is also to issue its annual handbook, although in a reduced form.

Strong Action Threatened

CYCLISTS in Northern Ireland are threatened with more severe punishment if there are further cases of riding without lights at night. It is stated that they do this instead of dimming their headlamps.

Stole Bicycle from Police Station

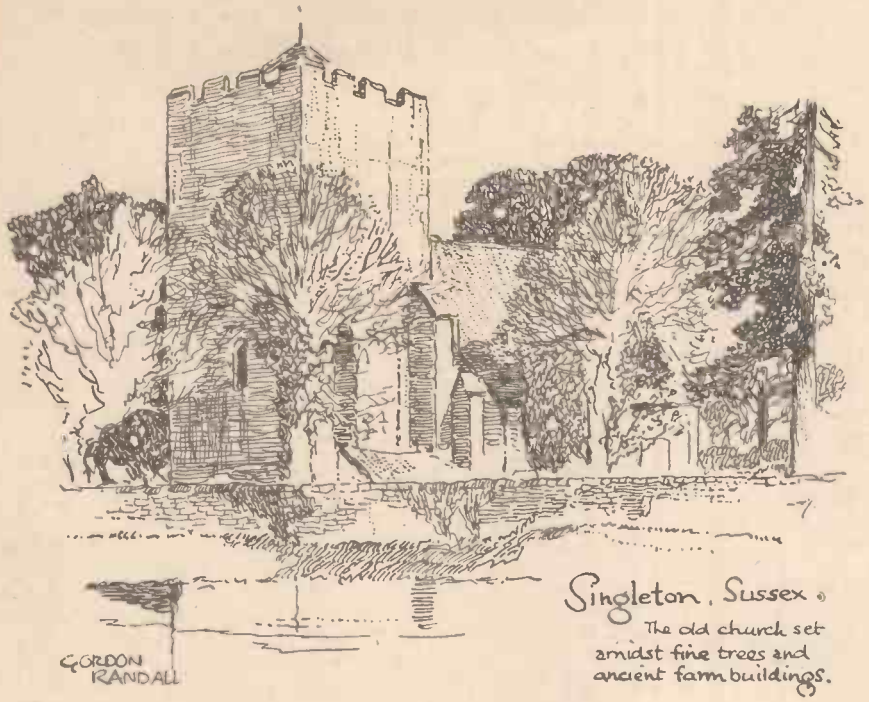
AN R.A.F. man, George Henry Price, was fined £3 by the Hitchin Bench last month on a charge of stealing a bicycle from outside the local police station!

Ealing Events

UNDER the active leadership of "Jimmy" Kain, the Ealing Cycling Club anticipate promotion of two open events this year. The club is going strong.

Cycling in Aberdeen

THE club movement is being maintained in Aberdeen, where the Aberdeen Wheelers have just opened a new clubroom at 3 Chapel Lane, Aberdeen.



AROUND THE WHEELWORLD—By Icarus

The Gentle Art of Timekeeping

IF you attend cycling meetings where the question of timekeepers is involved, you will reach the same conclusion as I that the sport seems to revolve around them. There are arguments about Kew "A" watches and B.H.I. tests. There are arguments as to who is and who is not a competent timekeeper, and you may, but mistakenly, reach the opinion that it is a heaven-sent gift to be able to press the button of a stopwatch or to count out five seconds before starting a rider. It is time that this hooey was debunked. For, of course, timekeeping does not require any special ability. It does, however, require a man of integrity, and a man of punctuality. It is a somewhat surprising thing that timekeepers with these accurate watches frequently arrive late at the start. Such has been the complaint for years. There have been other examples of timekeepers starting riders early, because they had incorrectly set their watches, instead of taking Greenwich Mean Time as the standard. There have been cases of timekeepers who adopt slovenly methods and have to sort out their results from odd scraps of paper. There have been cases where wrong times have been recorded. Unfortunately the riders have no redress. They must accept the timekeeper's reading of his watch, even though he has made a mistake—and no timekeeper admits that he has made a mistake. Anyone with the necessary watch can time a time trial or a record. Because cyclists could not afford the expense of a Kew "A" watch (it costs at least £5 to have a watch of suitable quality rated, and a further £3 for the test, apart from the £1 fee for the subsidiary test) the R.T.T.C. proposes to form a panel of watch-testers, and each District Council is asked to compile a list of those who can test a watch within the wide B.H.I. limits, and forward such names on to the National Committee for approval. They must agree to a standard charge, and I suppose that the British Watchmakers' Guild will have a meeting about it. Here again, extreme care will be necessary to appoint watch repairers of integrity, who will not hesitate to reject a watch even though it happens to belong to one of his friends or his customers. Such a system will, we think, lead to considerable subterfuge, and lower the standard of timekeeping. Members of this Watch Panel will merely have to record the rate in the pendant up and dial up position. They will not adjust the watch, except for a further fee. And so we slip back to the bad old days of road sport, when trials and records were timed with wrist-watches and alarm clocks.

In this connection it was somewhat amusing to hear a speaker at the recent unofficial R.T.T.C. meeting, held in January at the C.T.C. offices, make the suggestion that there should be a panel of timekeepers who were prepared to give their services free! There is a ring of timekeepers who vigorously resent anyone offering to time events free of charge, and who will use every endeavour to keep such timekeepers out of the game. I agree, of course, that those who are genuinely interested in the sport should not make anything out of it. Most of the paid timekeepers would cease to be interested in the sport if they did not draw their casual guinea—quite often from clubs who can ill afford it.

Yes, we must have people of integrity in the sport, and not only amongst timekeepers. We must have observers and marshals who will not sign false reports, or who are prepared to be careless with the truth.

Praise from the M.O.T.

THE British Cycle and Motor Cycle Manufacturers' and Traders' Union have just completed fifty years' work and they have been congratulated by Lieut.-Col. J. T. C. Moore-Brabazon.

"It has been a great story," he says, in congratulating the British cycle and motor-cycle manufacturers' Union upon the completion of fifty years' work.

"I have always considered," he writes to Mr. H. R. Watling, director of the Union, "that the fight which the British cycle trade put up against foreign importation at one time was quite extraordinary They beat everybody off our ground and became the great exporters of cycles all over the world, which was a tremendous thing to do and added to the credit of the trade.

"Then afterwards came the motor-cycle. Again we were attacked. At one time things looked bad but the same story was repeated of the excellence of our motor-cycles and they were acknowledged throughout the world. There was no record that they did not hold, no race not won, no reliability trial which was not almost automatically theirs.

"I congratulate the Union from the bottom of my heart, and hope that just as they are helping to-day in the prosecution of the war with great effect, so after the war they will continue to flourish as they so well deserve."

In a letter to the Minister, Mr. Watling states that the exports of cycle and motor-cycle products in the ten years from January 1, 1930, runs to £41,000,000.

The White Lines

THOSE helpful white lines, which guide cyclists as well as motorists, during blackout hours, have been allowed to fall into desuetude during the war—the very time when they would have been of most use! Men cannot be spared for the laborious process of maintaining the etiolated appearance of the lines. I am glad, however, that a system has been devised which will reduce the amount of labour involved, and enable the lines to be painted more speedily.

Hundreds of miles of white line are now being painted by contract instead of by local authority staffs—an innovation brought about by the war.

Council road surveyors in all parts of the country, faced with labour shortage, the risks of entrusting paint-spraying machines to unskilled hands, and the necessity for reducing white-line maintenance costs, have been responsible for this innovation. Another factor has been the need to free council employees for A.R.P. and demolition work.

Contracts cover road and kerb-marking, and the painting of white lines on trees, posts, post office constructions, fire alarms, and other obstacles to traffic movement. Fine weather is the time for the white-line "blitz." New lines appear and old ones are freshly whitened with magical speed by means of the new machinery introduced since the war.

This spring progress will be accelerated by the contract method, which allows a greater concentration of labour and machines.

Some Councils are saving as much as £10 per mile on their former costs.

Road Sport in 1941

ALL the portents are that a full programme of road sport will be run during 1941. The Bath Road "100" will be run, with an unrestricted time and their Jubilee "50" is also to be held. Certain scribes fanned themselves into a fine frenzy last year when the Bath Road "100" was cancelled, because it was thought that with the police stopping cyclists for their identity cards, the barricading of the roads, and military traffic, it would have been difficult to run the event. I do not know why the Bath Road Club became the cynosure of criticism on this matter, because I observe that nearly every other club cancelled its "100" last year. Now that the conditions have changed, the events are being reinstated. But who can say what the conditions on the roads of this country will be next August?

There were over 600 time trials run in this country last year, and over 30 are promised by the West London D.C.

N.C.U.—1,000,000 Membership?

THE suggestion has been made that the N.C.U. should aim at roping in at least one in ten of the cycling community, and thus provide itself with the enormous membership of 1,000,000. We do not think that this optimistic figure will ever be reached, for the very good reason that the majority of cyclists are utility users who could not, and do not want to be, converted either to the sport or the pastime.

We know from the past history of the sport that the articulate side of cycling is represented by approximately 100,000 cyclists, and as the law of average has held for so many years, I cannot believe that the proportion will change. All the same, I wish the N.C.U. luck in its endeavour. Since January 1, 1941, more than 3,000 Associates have joined the National Cyclists' Union, and these are only the direct renewals to headquarters, and do not include a very large number of persons being enrolled by the Union's expanding army of Associate Enrollers. Between 70 and 80 of these Enrollers are working in various parts of the country, and the figures are in advance of the corresponding period of 1940. This is indeed a useful sign.

N.S.F.A. Changes Its Name

IT has always struck me that the National Safety First Association was badly christened. It rather suggests that the public needs to be saved from itself. It is now known as the Royal Society for the Prevention of Accidents. I do not feel, however, that this association will succeed where the Ministry of Transport, and the police, and the cycling associations and the press, and the Advisory Committee, and the House of Lords Select Committee, have failed. A terrific lot of bunk is written about the causes of road accidents by those who do not use the roads sufficiently to keep their knowledge up-to-date, and whose minds still repose in the hoary past. The only way to have a point of view on road accidents, and especially during war-time, is to use the roads during the day, during the hours of darkness, and regularly. We must discount the views of critics who postulate from the comfortable depths of an armchair—having travelled home early to avoid the blackout.

Causes of Accidents

IN view of the illogical analysis of the causes of road accidents which many of these armchair critics have advanced, I drew the attention of the Minister of Transport to the matter, and pointed out what I considered to be the causes. I am pleased to see that he has acted on one of my suggestions, and had an analysis prepared of the types of vehicles involved. It was found, as I suggested, that a large number of the vehicles involved were military vehicles, as recently published statistics show.

I do not support the argument so constantly advanced by those who have not investigated the matter that the numbers of accidents are rising because motorists are criminally negligent, and that the standard of driving has deteriorated. I met one such critic the other day. He was one who had, in the latter half of the last century, broken a record—the only record he ever did break, at a time when anyone who rode a bicycle could break a record, were he minded to do so. He is of the type who for forty years has been unable to forget the fact, and for the same period he has posed as an expert on all cycling matters. Unfortunately, to-day the cycling movement contains a number of those who wish to pose as the successor to Bidlake. I understand there is keen competition amongst them for the right to be considered as the Greatest Living Authority on Cycling. They are, of course, mere dwarfs by comparison. Anyway, I completely floored this critic—another whose brain ceased to function, and became atrophied at a very early age. His views matched his Pickwicklan clothing, and still reposed in the nineties. Just another of those creatures who like the maggots in green cheese erect themselves to display some faint signs of life

WAYSIDE THOUGHTS

By F. J. URRY

The Vernal Season

THE days are almost here when the desire of man to be out of doors to welcome the spring will be insistent. March brings some perfect hours in its train, but it can also be rough and cutting with those eastern winds that occur to make even the sunshine brittle, and the draught of them searches the warmest clothes. Yet for all the handicap of fierce winds and sudden storm, what a joy it is to see the thickening hedgerows and the purple sheen of bud hanging like a gauze of beauty in the woods. This year the welcome will seem the greater against the background of the black-out, and we shall be foolish folk if we do not take the greatest possible advantage of the daylight hours of leisure that fall to our lot. They will not be too numerous in any case, for the call to work, long and hard, is still insistent, and will continue, I am afraid, all this fateful year. I have no delusions regarding the matter, remembering the 1914-1918 period; and, therefore, while retaining hopefulness as a sign and comfort, my welcome to spring will be in the light of gracious hours to relieve the grimness. Shall you do likewise? If you possess the real solace of a bicycle, I hope you will, for I know of nothing at once so charming and so healthy as a day's journeying under your own power when the gay flag of spring is partly unfurled. Let me admit at once, that after a week of heavy work, it sometimes takes considerable resolution to resist the ease of an armchair; but if you try the scheme of a quiet ride but once, I am certain as dawn follows night, the habit will grow on you, and the joy of health will give you power, and the beauty of the countryside mental energy. I have been doing that very thing for years, and shall go on doing it to the end of the active story, believing that yarn will be lengthened by very reason of its activity. A bicycle has always been among my most precious possessions, but to-day its value has been multiplied on many counts, but most of all because it stands ready to take me a precious holiday any sunny day when luck favours me with a trifle of leisure.

Get It In Order

NORMALLY this would be a time when we should be talking about new bicycles, and all the little improvements a year brings in its train even to such a common instrument of travel as the one under discussion. As matters stand to-day, new bicycles are not going to be easy to obtain, and the matter of improvement will have to await the ending of hostilities. For the time being that does not matter much, for the old machine will carry you comfortably during the passage of the next year or so; but if it wants attention, then for your comfort's sake, take it to your dealer and have it put in perfect running order. For you can take it as certain that a goodly portion of cycling enjoyment derives its pleasure from perfectly running machinery, ranging from proper lubrication to the truthful turning of the wheels. People are often careless about these things and as a result trouble is encountered which is annoying, and then they are apt to blame cycling and the bicycle rather than their own thoughtlessness. The equipment most essential to safety comprises brakes and tyres, and both those items are precisely the ones that seem to be most neglected. There is no need to draw the inference what such neglect may lead to; it is obvious to anyone who has ever ridden a bicycle. That is why I advise you who have a serviceable machine, which is under the handicap of trifling neglect, to take it to a good dealer and let him deal generously with it. Such action will pay you in convenience and pleasure, over and over again. If you can afford it, and your repairer can supply the goods, have a four-speed medium ratio gear fitted, and light open-sided tyres. Such equipment will revolutionise your ease of cycling, and give a tonic effect to your enthusiasm; and after all, that is the main reason why I am scribbling these notes. Far too many people say "this will do and that will do," without any real knowledge of the value in ease and delight they are cutting out of their cycling pleasures for the sake of saving the few extra shillings necessary to buy the best. The bicycle is so personal a thing that it is always worth while being generous with its equipment because you are merely treating yourself to a greater degree of comfort.

Some Personal Tips

MANY years ago it was a fashion among club riders and road racing men to fit "thorn-catchers" generally a piece of loose wire anchored to the front forks, and the rear seat stays, and trailing the thread of the tyre for the purpose of knocking away any foreign matter the cover may pick up off the road, before it has had time to penetrate and puncture the tube. In these days of glass-strewn city roads, the practice could be revived with consequent benefit to our tyres; for it must be confessed that enemy action has made puncture a much more prevalent occurrence of late. Although I ride thirteen miles a day over city roads, I confess I have been lucky, for only on two occasions have my tyres met with the small irritation that results from too close relationship with glass splinters; and I always use the lightest of wired-on tyres. The old "thorn-catcher" went out of fashion when the highways were carpeted with tarmac or similar compositions, and it was certainly redundant, and indeed is still so far as our country highways and byways are concerned, but it may be quite useful to the town rider and save him time and trouble. Another thing I have discovered on my daily journeyings is the fact that I want an extra five minutes in the mornings for my 6½ miles ride, if I am to arrive punctually. This is partly due to the greater traffic congestion, and partly to a wise exercise of care along those ways where debris is strewn. For the risk of puncture is more a matter of speed over glass-strewn surfaces than it is of steering, so if I cut time to the limit, I am in all probability likely to lose some of that measure of eternity by the handicap of puncture. This slower progress consciously employed has kept me, I believe, free of any great amount of roadside trouble, and I hand on the suggestion to you as a matter of experience. Another tip is that two pairs of lightweight gloves, the over gloves of the bag variety, are much warmer than one pair of heavy gloves. Indeed, all this last winter I have left my heavy gloves in the drawer, and used a pair of wash leathers as insides and woolly bag gloves as outsides.

On the open road

Keeping Fit

I WANT to revert to the season of the year and the call of the spring; I cannot help it, and I feel you ought not to be able to. Nor would you be, methinks, if you were as fit as I am to "spring lightly to the saddle," as the old chroniclers say, and roll up a few miles of countryside. The fit cycling folk are those who ride most days of the week, and so unconsciously absorb fitness into their mode of living and think nothing of it. That is the value of the cycling habit; one undertakes it as a matter of convenience, and probably has little knowledge how much it means to health and a healthy outlook of independence. But when it comes to a week-end awheel, what an enormous advantage it is to feel certain of the pleasure before you, and think nothing at all of the physical method of pursuing it. Well, we cannot all keep fit by the process of daily riding, circumstances of employment will not allow it; although it must be conceded that all sorts and conditions of employers are more broadminded on this question than was once the case. Perhaps, because the employer now comes in his car, he feels the cyclist is following the example of travel independence. But it is not necessary to be a daily rider in order to keep cycling fit. A journey a week will keep the average individual in condition to start on a long tour or an active week-end. But these weekly rides are not common practice among the ordinary run of cyclists during winter, and therefore it is wise to give yourself a chance to "train on" as it were, before going out to meet the spring a long way down the road. If you are lucky the lighter evenings will give you an opportunity for short rides this month and will act as an introduction to the beauty of the awakening copse and hedgerows, which will be showing their delicate loveliness by the time Easter is here—and that is not very far ahead. No one knows at this moment of writing what Easter may have in store for us, but if it so happens that a short break does occur, then you can be looking for nie where the hills rear their crests and the mad little torrents are frolicking.

A Personal Note

EARLY in this year of grace I shall be enjoying—and I say that deliberately—my sixty-second birthday. On my tenth I had the gift of a bicycle from an indulgent parent, since when I have never been without one—or more. I have sampled every other form of travel—except by air—known to man, though I readily admit my camel and elephant experiences have been zoologically limited. Motor cycling claimed me in its earliest days, as did the motor car, and I submit there was far more mechanical interest and personal excitement then than can be obtained from either of those travel conditions to-day. I tired of them because there was something missing that I badly wanted, the scent, and the quiet sight, and the bird song. With a bicycle I am free. I can stop and look and listen, staying awhile or passing by unobtrusively, and more silently than if I were walking. Yes, I use a car occasionally because I have to in the rush and hurry of this modern world; but if time is on my side, then I take my bicycle, even for business journeys, and my trade friends have grown quite used to what they are pleased to term my travel idiosyncrasies. When you have done a certain thing for over fifty years because you like it, even the folk who think it strange cannot but admit it must have some peculiar attraction. But this is the thing I want to say that seems to me worth while; during all those years I have never had a serious illness. It may be that had my habits been otherwise the luck of health would still have been mine; that I shall never know; but what I do know is the fact quoted above, and rightly or wrongly, I believe my great fortune of health is closely concerned with my cycling. That is a matter worth pondering to those among you who can look forward to many years of life, for the enjoyment thereof is just a question of health, activity and simplicity of outlook, and all these virtues are inherently part of the living splendour we call cycling.

Scotland's Oldest Repairer

JAMES BROWN, of Brandon Street, Motherwell, Lanarkshire, believed to be Scotland's oldest active cycle repairer, is to retire in May at the age of 73. He has been connected with the cycle trade for more than 50 years, and has dealt with the Dunlop Company since 1888.

Mr. Brown remembers the first pneumatic tyres in Scotland. Before going to Motherwell, he was in business at Longriggend and Airdrie. Until it became inactive some months ago, he was president of the Motherwell Roads C.C., which was founded in 1884, and was one of the oldest cycling clubs in Scotland.

My Point of View

BY "WAYFARER"

The Snow That Was

BY the time these lines appear, it will be possible to mention (without running grave risks of being sent to the Tower) that, in certain parts of a certain country lying off the coast of Europe, there has been a fall of snow. I shall not be more precise, as it is my desire to remain on friendly terms with the Censor, who, I understand, is a most particular young gentleman! On most of the days when the snow was lying about, gradually becoming more and more disreputable, it was my lot to be riding a bicycle. The process was not always an easy or a comfortable one, but it displayed marked advantages over travel by public transport—and the bicycle "got you there." A longish jaunt into the country provided me with some exciting moments, especially in connection with drifts. Speaking generally, what struck me specially on the occasions when I was cycling, was the consideration displayed by motorists—for whom, as a class (be it said), I have no particular love. Many of the ways I used were secondary main roads in which the traffic had beaten a single track. All the motorists I met reduced their already moderate speed and gave me as much room as possible, whilst it was worthy of note that those who came up behind me would hang back until a favourable opportunity for passing presented itself. There was no boring through, regardless. This attitude towards the "humble push-cyclist" provoked in me an even more reasonable state of mind than I normally display (advt.), and on several occasions I dismounted and drew aside, letting my bigger brethren pass in (relative) comfort. My experiences with motorists in the difficulties set up by snow—restricted space, glassy patches, hard ridges, slush, and all the rest of it—was a pleasant contrast to previous experiences. Even-keel cycling presented its problems during that trying period, but it was worth it.

Memorable Journey

ONE of my most sparkling cycle journeys in recent years was that which (a few months ago) carried me, of set purpose, over as many Thames bridges as possible. Starting at Maidenhead, I worked up the tortuous river until Lechlade was reached, and there, for the moment, the expedition came to an end, I having run out of time. In a week or two, however, the "task" was resumed (and practically completed) by my travelling down the Thames from its source as far, again, as Lechlade, where I cried "Content!" It is true that a few bridges below Maidenhead still await attention, but they can go on waiting. I reckon that all the bridges which really matter have been "bagged," and, as a cyclist, I have no particular desire to patronise such structures as those spanning the Thames at Hammersmith and Westminster, more especially as they are already familiar to me. (Don't ask me how many times I footslogged over Hammersmith Bridge during the last war, complete with all the freight a private soldier is invited to carry!) No! What seems much more important is the collection of bridges over other rivers, a process which has been interrupted by the coming of the present war—*interrupted* only, because a plan possessing such undeniable attractions cannot be permanently sidetracked. So, when the good days return, I hope to "set about" the Warwickshire Avon, the Yorkshire Ouse, the English-Welsh Severn, the Scottish Spey, the Irish Shannon, and others of our rivers. The idea of setting aside a day or two to cross every bridge spanning a particular stream is full of allurement, as readers will discover for themselves, if they will but sample the scheme, which, moreover, has its educational aspect—and its element of surprise.

Thin-Skinned Clubmen

IT is surprising—and somewhat disturbing—to note the number of thin-skinned merchants in the ranks of cycling clubs. This is how you make the discovery: the club publishes a monthly or quarterly magazine—generally called "the rag"—to which certain live members contribute something about their outlook on life . . . and on their fellow-members. We all possess our foibles, and these have the searchlight of publicity—kindly publicity, if frank—turned upon them. But alas! Blank dislikes those "rude remarks" about his stockings. Dash objects to his leg being extended concerning his bicycle, or his gardening habits. Asterisk tells the committee, solemnly, that if he is not left alone, he will resign from the club. This touchiness is all very paltry, revealing an absence of a sense of humour, in respect of which the thin-skinned gentry deserve one's sympathy. I don't know how many people have been peeved by my little efforts to brighten club life: how many names of "untouchables" have been placed on editorial black-lists. To my mind, it is tragic to contemplate the position of these otherwise good sportsmen who view themselves as sacrosanct. The nether limbs of their sacred persons must on no account be lengthened, even in the greatest good fellowship, and these people entirely fail to realise that lampooning is a tribute to their popularity. The pity of it!

I recall that a few years ago a supersensitive young friend of mine who was mildly pilloried in a club "rag," actually "went to law" about it. At any rate, he consulted his solicitor, who wrote to the editorial person and demanded an apology. I repeat: the pity of it!

Notes of a Highwayman

By Leonard Ellis

A Vanished Abbey

ALL the Cotswold towns are well worthy of inclusion in a tour. Some, like Chipping Campden and Burford, are world-famous for their charm and beauty and others like Northleach and Winchcombe, are loved by those who know them, but are not so well known. All these little towns are characterised by a mellow warmth of tone, due largely to the local stone of which they are built. Like Campden and Burford, Winchcombe is just a sleepy little country town, a mere shadow of its former great importance. At one time Winchcombe possessed a great monastery, possessing the rare privilege of fortification. This abbey was founded by Kenulf, although it is said that Offa founded a nunnery here even earlier. Kenulf was a king of Mercia in the eighth century. After the Danes had wreaked their vengeance upon it, the abbey was restored in the tenth century and in the twelfth century it was burnt down. For many years the Kings of Mercia resided in the town. Scarcely a trace now remains of the abbey buildings, although some attempt was made to excavate the site. The abbey was dedicated to Kenelm, son of Kenulf, a boy of seven years of age, who became King of Mercia. He was murdered at the instigation of his elder sister and legend says that his soul passed straight from his body to heaven in the form of a white dove. Winchcombe lies in a fold of the Cotswolds, under the shadow of Cleeve Cloud, and has many more attractions than its ancient history. At the old George Inn there is a Pilgrim's Gallery used by those who came to visit Kenelm's shrine. At the end of the village is a delightful old inn called the "Corner Cupboard," said to be so called on account of the number of corner cupboards in the house. The parish church was built in 1480 and possesses some very curious gargoyles. Near the town are the remains of the original Sudeley Castle, once the headquarters of King Charles I during the Civil War. The ruins left by the Parliamentary forces have been restored and the present buildings rank among the stately homes of England. Belas Knapp, said to be one of the most interesting long barrows in Europe, lies on the hills within walking distance. This is a prehistoric tomb complete with very fine dry-walling. It is said to be 5,000 years old and when opened some 80 years ago, was found to contain 38 skeletons. From the hills around a magnificent panorama is unfolded; the Malverns, the Welsh Hills, Tewkesbury, Gloucester and Cheltenham, all being visible on a clear day.

The Corner Cupboard Inn, Winchcombe

The Caves of The Gower

THE south coast of the Gower Peninsula is famous for its rugged rocks, and on such a coast it is to be expected that there will be caves as well. The tourist will not be disappointed and although the visits must be well-timed, there are caves in plenty to be explored. One of these, called Culver Hole, can be reached over the rocks from Port Eynon at low tide. It is not easy to find, but when tracked down will be voted unique. The cave occupies an immense fissure in the rocks and the whole of the front, except for a door and several windows, has been walled up. No one knows the reason, but it is supposed that the ancient smuggliers could have supplied the answer. A mile or two nearer Worm's Head are the Paviland Caves, even more difficult to find and more difficult to approach. They are two in number, about a hundred yards apart and situated under the spot called Yellow Top, on account of the mass of golden lichen growing there.

Notes on Cycle Brakes

How Cycle Brake Blocks for Present-day Machines Are Tested

IN common with all other means of transport, the cycle requires adequate brake power, and perhaps the only difference between this vehicle and other types on the road lies in the proportion which the rider's weight bears to that of the machine. Whereas in most other forms of passenger transport, the live load is small compared with that of the machine, in the case of the cycle, these conditions are reversed, and it is mainly the rider's own weight which dictates the need for satisfactory braking.

Historically, stopping devices on bicycles have ranged throughout practically all types of brake—starting with the brakeless machine, on which the rider depended on his own feet scraping along the ground. In the days of the solid tyre, and even after the advent of pneumatics, spoon brakes were applied directly to the tyre tread, frequently, in the case of the pneumatic tyres with disastrous results to the latter.

The Rim Brake

IT is rather strange that the spoon brake persisted as long as it did in view of the obvious improvement which could be effected by applying brake blocks to the steel rim. However, the rim brake was eventually adopted, and in one form or another has proved the most popular brake throughout the subsequent history of the cycle. It has a number of advantages over other types in that it is cheap to manufacture, easy to service, and exerts brake force at the greatest possible radius on each wheel, the latter feature resulting in an effective brake with light operating force.

On the other hand, it is not without disadvantages, as it is exposed to weather effects and requires reasonably true wheel rims to produce smooth braking. Its defunct competitors comprise mainly a variety of exposed band brakes, and an internal expanding band in the hub—which was known as a "coaster" hub. The latter was certainly quite popular for a time.

On present-day cycles the principal competitor of the rim brake is the internal expanding "shoe brake" (modelled on motor vehicle lines), which provides excellent braking.

Ferodo Cycle Brake-blocks

IN addition to supplying brake linings for the last-mentioned internal expanding shoe brake, Ferodo Limited have manufactured a high-class cycle-brake block for many years, and have been fully alive to the necessity for adequate means of measuring the effectiveness of this product under practical conditions. It might be thought sufficient to hand over sample brake-blocks to local enthusiastic cyclists, but it has been found that test reports resulting from this procedure are very decidedly influenced by individual preferences and prejudices.

In order to eliminate the human factor in this type of brake test, Ferodo Limited have installed a cycle brake block test machine in their testing laboratory, which gives scientifically accurate braking performance figures for any type of cycle brake block. The machine is based on the principle that such tests must be full-scale and duplicate, as near as possible, road conditions.

It therefore comprises a standard 26-inch wheel and tyre carried on its own ball bearings and spindle, and loaded with steel disc flywheels to duplicate the force represented by half the weight of an average rider and machine. The brake is a standard "Bowden" caliper, and the handlebar lever is operated by a dead weight and released by a cam. The wheel and flywheels are driven up to a speed of 21 m.p.h. by an electric motor fitted with a friction wheel, which engages the tyre tread. The machine is equipped with a standard cycle speedometer, and as soon as the wheel reaches test speed the friction wheel is disengaged and the energy in the flywheel dissipated by the brake—stopping time being recorded by the operator.

A water tank is also fitted to the machine—two small pipes leading water to the rim—and thus it is a simple matter to obtain accurate information of the respective brake block performances under wet and dry conditions. This test has proved invaluable, and has resulted in the production of Ferodo blocks giving smooth braking with light pressure, together with a high braking efficiency under both wet and dry conditions. An illustration of this testing machine is given on page 210 in this issue.

GLAND TREATMENT FOR CYCLISTS

By Frank Southall

HAVING read an article in a contemporary regarding, among other things, medical treatment for the Hercules record-breaking team, I feel entitled to comment, as I was manager to this team. The medical treatment mentioned was gland treatment. The team under my management had already secured 13 national records and were absolutely on the top of their form, and were not in the mood to submit to injections from a hypodermic needle twice a week for six weeks and then once a week for the rest of their racing career. Even admitting that the treatment was necessary and was really worth all that much more, it would not have been practical with a team ready to attack records from day to day, as the treatment would have prevented the cyclist from training on a cycle for six weeks. In other words, it meant the finish of records for them for that season. During an interview with the manufacturer of this gland serum, I asked him whether the treatment would make the riders ride faster, but he could not say that it would; but he assured me that it would make them think quicker. One of the riders, as an experiment, took an injection in the arm, but refused to continue the treatment. A few weeks after I noticed an article in the press stating that well-known racing cyclists were having gland treatment, but I want to make it quite clear that the Hercules team had nothing at all. The team refused the treatment and I advised against it.