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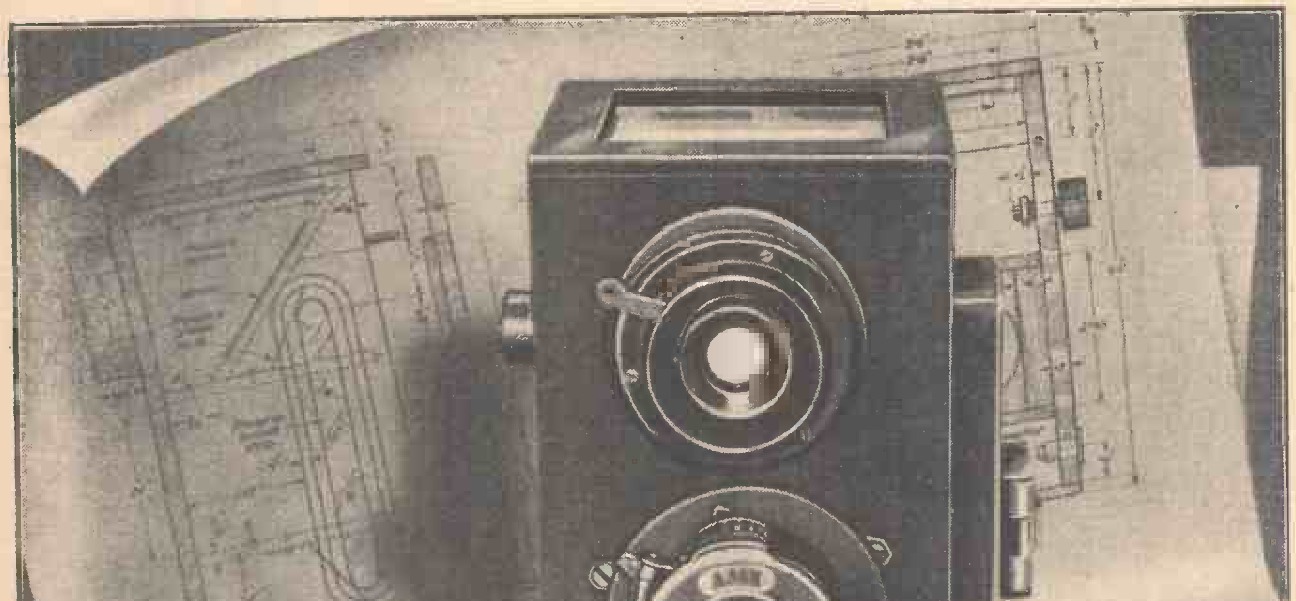
EDITOR: F. J. CAMM

DECEMBER 1951



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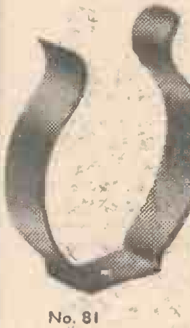

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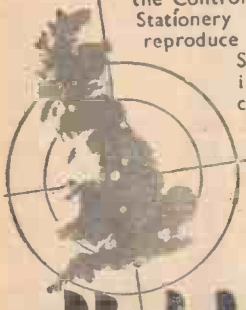

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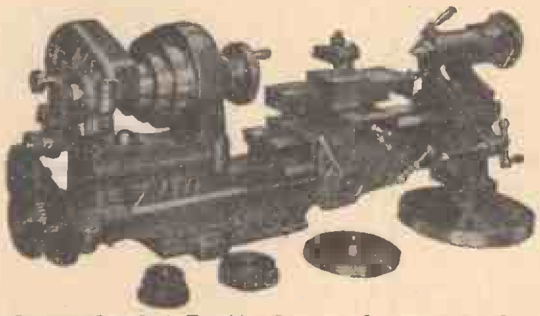

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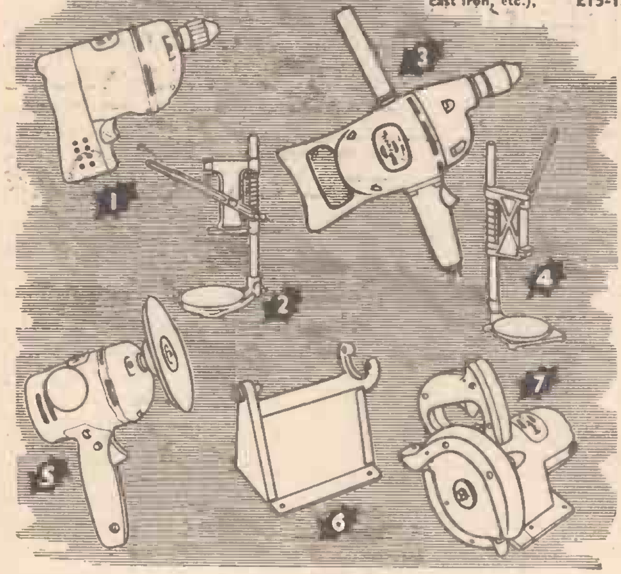

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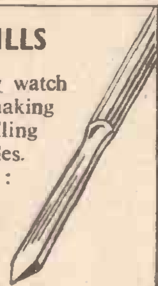

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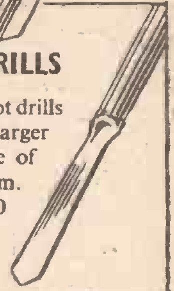

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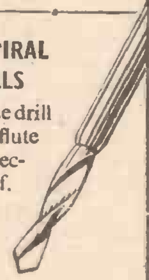

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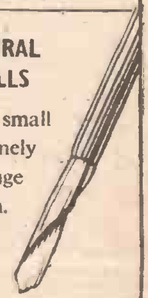

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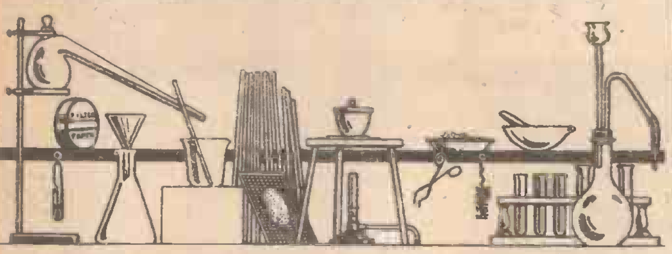

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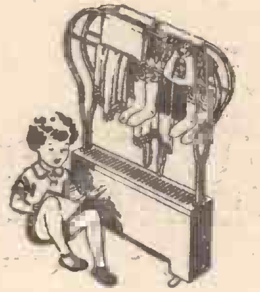

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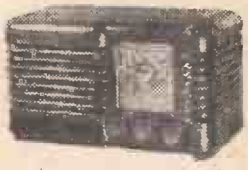

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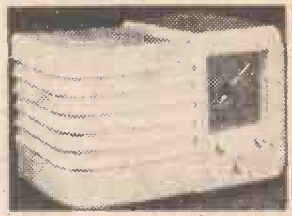

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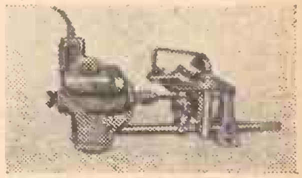

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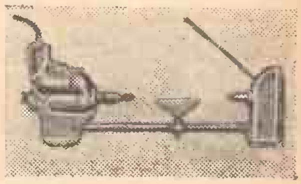

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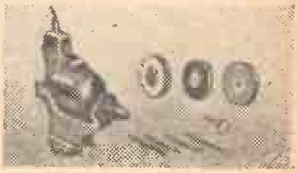

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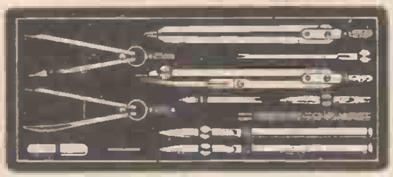

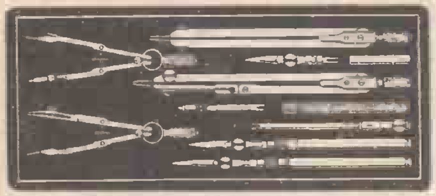

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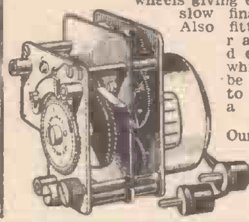

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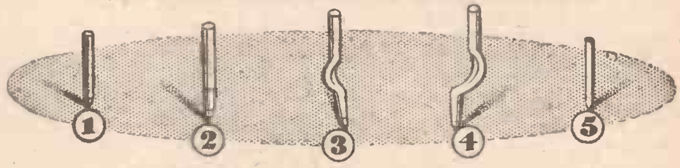

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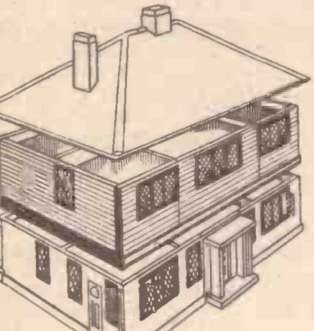

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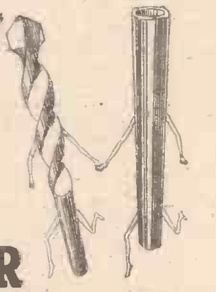

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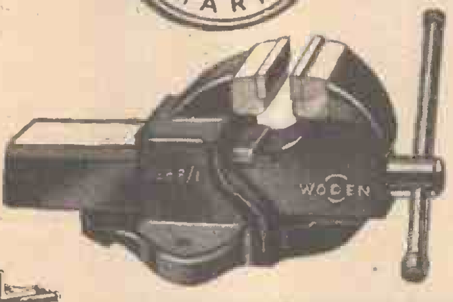

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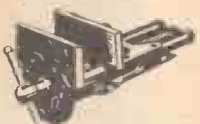

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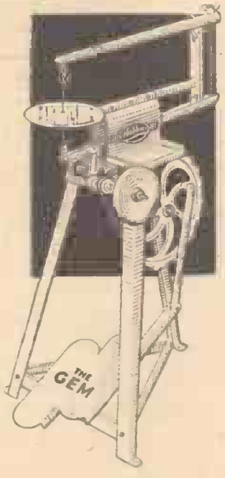

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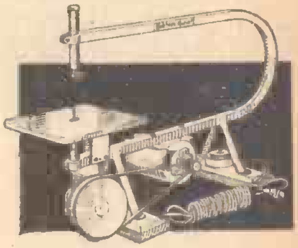

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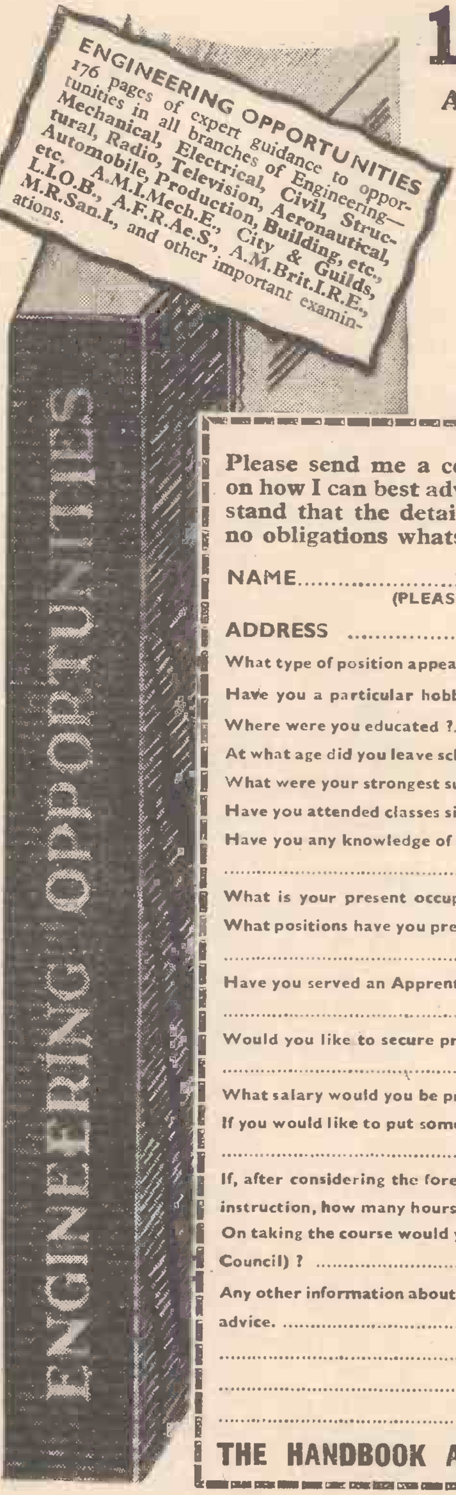

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PRACTICAL MECHANICS

EDITOR F. J. CAMM

DECEMBER, 1951
VOL. XIX. No. 216

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

FAIR COMMENT

By The Editor

Tribute to a Pioneer

IT was in 1926 that I witnessed in Soho the first demonstration of television by the late John Logie Baird. I am glad to note that his pioneer work has been commemorated by the unveiling of a plaque outside the building, 22, Frith Street, Soho, where his attic laboratory was located. It was unveiled in October by the President of the Television Society, of which Baird was an Honorary Fellow, and which was founded in 1927 by a band of pioneers with vision who saw it could only be a matter of time before real television arrived.

Baird did more than any other man to draw public attention to the undoubted possibilities of television. He was born in Scotland, and educated at the Royal Technical College, Glasgow. Later he came south to Hastings, and the house in Queen's Avenue where he lived bears a plaque which records the experiments he conducted there in 1924.

On January 26th, 1926, he carried out the world's first demonstration of television before an audience of 40 members of the Royal Institution. It is true that the demonstration was of a transmission from one room to another, but it demonstrated beyond all doubt that the idea of scanning and translating the dissected picture into electrical impulses which could be radiated through the ether and reassembled at the receiving end was entirely practicable.

It can be said that television was launched on a commercial scale before it was ready, and that the early televisors were likely to give the public a poor impression. Certainly the public at that time did not readily respond to the new scientific entertainment. That was partly because the B.B.C. was cheese-paring in its programme time, and did not extend the technical co-operation which the new science deserved. Baird was not deterred by these setbacks, and lived to see his idea reach fruition and to spread to the Continent and America.

Television as we know it to-day differs enormously from the early Baird system. The pictures had a frequency of 30 lines, all too coarse for clear definition. It made use of a scanning disc with spirally arranged holes, giving a picture 1½in. x 2¼in. This system was originally demonstrated by Paul Nipkow in Germany as long ago as 1884, but he did not pursue experiments. Baird commenced where he left off.

In the comparatively short space of 27 years we have seen television grow in this country to the point where nearly 1,000,000 people own television licences, and the number increases daily. Within the next 20 years it is beyond all doubt that a network of stations will provide a nationwide service, and that sound broadcasting will take a secondary place. There are more viewers in America than in this country, and the Continent is running us fairly close.

One of the difficulties yet to be solved is that of satisfactorily "canning" the programmes. It may be done at present by means of telecine but this is not altogether satisfactory. What is wanted is some system similar to a wire or tape recorder upon which lengthy programmes such as plays can be recorded for repeat performances. At present a play has to be actually performed each time it is repeated.

When our companion journal, *Practical Television*, was launched just over a year ago, there were 250,000 viewers. Nearly 750,000 have been added to the number since that date. Many thousands of people are now building their own television receivers, and television clubs are being formed all over the country, thus following the early course of radio.

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CHOICE OF A CAREER

ONE of the questions I regularly receive from eager and ambitious youths at each end of term is: What career shall I choose? I do not care to advise on this subject unless I have personal knowledge of the individual concerned. I therefore usually ask the reader in question to call for an interview. As might be expected, in nearly every case the reader shows a strong mechanical inclination, and in almost every case I am compelled to advise him to take up engineering, which in my view offers better opportunities to-day than ever before, and will continue to do so for many years to come.

Those who feel, however, that they can evade the rough work they will be given when they first enter an engineering works by going straight into the drawing office should dismiss such a career from their minds. No one can become a competent engineer unless he has been through the rigours of an apprenticeship, preferably a student-apprenticeship, for at least five years, and has worked most of the machines, seen how things are made, served in most of the departments, studied in his spare time for an engineering degree, and kept his knowledge up to date by studying the latest technical literature.

As Editor of *Practical Engineering* I am in some cases able to give those who aspire to engineering as a career a personal introduction to factories within easy travelling distance of their domiciles.

Entrance to the drawing office should only be via the factory with the ultimate object of becoming a chief designer. Those who prefer to remain in the shop may work their way up to be tool designers, planning engineers, works managers, or cost accountants. The intermediary grades, too, are well paid. Remembering that engineering is the basis of all other industries it must continue to be the basic English industry.

From time to time in *Practical Engineering* specimen examination papers with model answers are given. I shall always be pleased to advise readers or their parents on careers.—F. J. C.

Making a Twin-lens Camera

Constructional Details of an Efficient and Inexpensive Instrument

By W. J. HARRIS

A TWIN-LENS camera offers three main advantages over a folding camera: (1) the absence of bellows gives maximum rigidity and ensures that the film always lies in the focal plane of the taking lens; (2) the provision of a view finder giving an image of the same dimensions as the photograph allows careful composition to be carried out before the subject is photographed; and (3) sharply-focused photographs are ensured. Two disadvantages can be advanced against the twin-lens camera: (1) the camera is more expensive, and (2) more bulky than a folding camera.

General Details

The camera described here has certainly overcome the disadvantage of expense, for the approximate cost, excluding lenses and direct vision finder, was 2s. 6d. The photographing lens and the direct-vision finder were taken from a folding camera which lacked the rigidity necessary to give consistently sharp negatives. The lens (*f*7.7) employs front cell focusing from infinity down to 6 feet. Copying and close-up photography have been made possible by fixing this lens in an extension tube. The viewing lens (*f*6.8) was found amongst some junk, but a similar second-hand lens would not be expensive as no shutter is required.

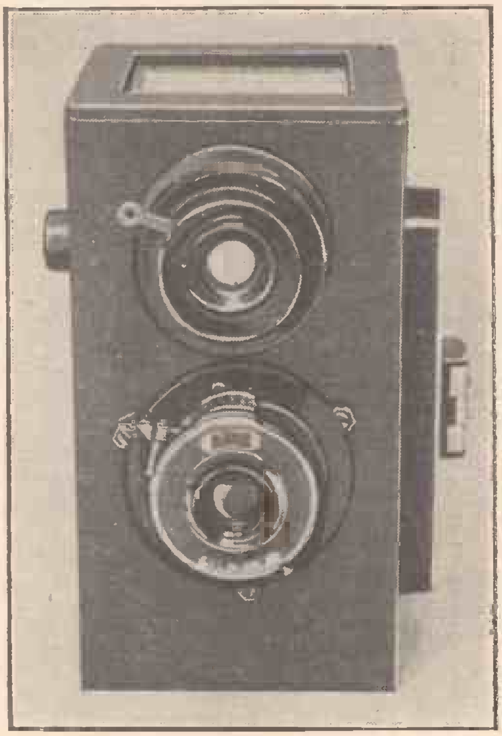
The camera construction involves the use of only common tools. Certain parts of the camera were turned on a lathe by a friend, but the cost would have been small if the turning had been carried out in a commercial workshop. Suggestions are made in the last paragraph of easy ways to eliminate this lathe work if so desired. Three novel features are employed in the camera: (1) the film traverse takes place over highly polished plywood surfaces; (2) the back is not hinged but quickly detachable; and (3) a floating pressure plate is used.

Construction of Camera Body

The body is made throughout of plywood, the various parts being initially tacked together with panel pins, carefully squared up, and good-quality carpenter's glue run into the joints. A copious application of glue to the joints prevents any leakage of light through them. The parts of the body were very carefully squared before assembly was commenced and each joint was tested for squareness as the work proceeded. All holes were drilled and cut prior to assembly.

The Photographic Compartment

This compartment is formed by the fixing of the two horizontal pieces of 3/16in. plywood A and B (Figs. 1 and 2). The rear edges of A and B are cut, as shown, so as to accommodate the detachable back and to serve both as film guides and as location points for the floating pressure plate (Fig. 3). Parts A and B are tacked and glued to the sides and also to the front panel, for it is, of course, essential that there is no light leakage from the viewing compartment. The front panel has a 2.1in. diameter hole cut in to accommodate the extension tube.



The completed twin-lens camera.

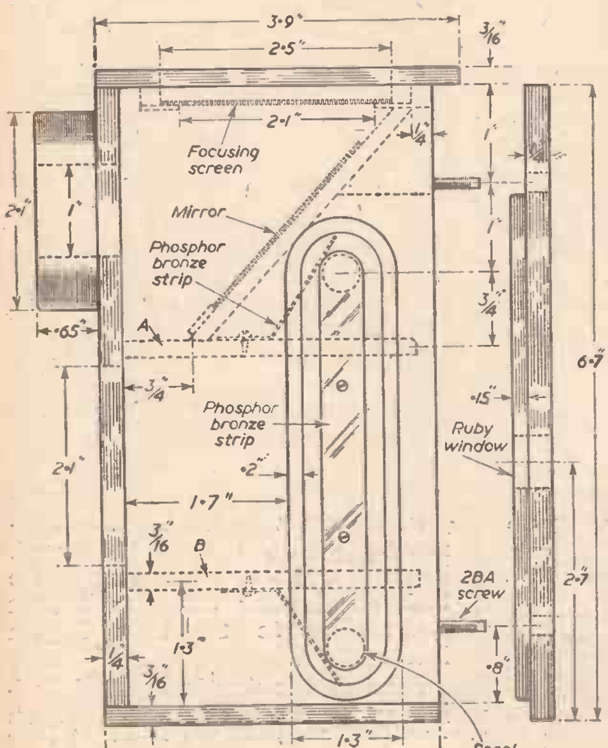


Fig.—1. Side view of body and detachable back.

The Extension Tube

This is formed from a 1.1in. length of 2in. outside diameter brass of 1/16in. wall thickness (Fig. 4). To one end of this was sweated a suitable brass ring which was then turned down to the same inside diameter as the tube and to an outside diameter of 2.1in. to form a rim (M) about 1/10in. wide. The other end of the tube is closed by a circular metal plate which has a 1in. diameter central hole to accommodate the lens and shutter. A ring of tinplate (N), inside diameter 1.8in. and outside diameter 2.4in., is soldered to the front end of the tube. The tube works inside a 0.45in.-wide brass ring let into the 2.1in. diameter hole in the front panel. This ring, of 2.25in. outside diameter and 2.0in. inside diameter, is turned down to 2.1in. outside diameter for 0.35in. of its length. Three fixing brackets are soldered to the rim which is left. For ordinary photography the tube is pushed right in and N serves both as a stop and as a mask to prevent any possible light leakage. For close-up photography (15in.) the tube is pulled fully forward, when M serves as a stop and mask.

The Viewing Compartment

The viewing lens is attached by means of its mount to a ring of 0.65in.-thick plywood of inside and outside diameter 1.0in. and 2.1in. respectively, which is glued to the front panel. A piece of ⅛in. thick plywood is fixed at an inclination of 45 deg. to accommodate the reflecting mirror. A suitable mirror about 1/16in. thick is easily and cheaply obtained and, if necessary, cut to the required size. The mirror is fixed to its support by means of clips (not shown in diagram). The method of accommodating the focusing screen will be clear from the diagram. A suitable screen can be easily made from a portion of photographic plate stripped of emulsion and cut to size. The glass is then frosted by rubbing with fine carborundum or pumice powder. A fine finish will give much more satisfactory and accurate focusing than a coarse one. The finished screen is mounted with the frosted face downwards and the top is fixed to the sides by four wood-screws.

The Film Chamber

The three spool pivots are formed from 0.6in. lengths of 5/16in. diameter brass. Each has about 0.1in. of the length from one end turned down to 3/16in. diameter so as to fit in the hole at the end of the spool. The other end of each pivot on the direct-vision finder side has a 1/16in.-thick piece of 7/16in. diameter brass soldered to it, whilst a 1/16in.-thick piece of 5/8in. diameter brass is soldered to the end of the third pivot. The two pivots on the direct-vision finder side have a piece of phosphor bronze or beaten brass fixed over them so that they spring back against the camera body when the spools are in position. Although this arrangement allows no light to get through the pivot holes, the direct-vision finder mounting was so designed to give added security and a neater appearance. The third pivot is securely fixed by means of two screws through the flange. The film winder is formed from a 1in. length of 3/8in. diameter brass rod, with 1/10in. of the length from one end turned down to 0.2in. diameter. A slot is cut across the diameter and a 3/8in. length of brass is soldered into the slot to form the key. The other end is also turned down to 0.2in. diameter for a distance of 0.8in. to form the key shaft. Springs are fitted, as shown, to facilitate loading. A suitable knob is either soldered or fixed by means of a screw to the shaft.

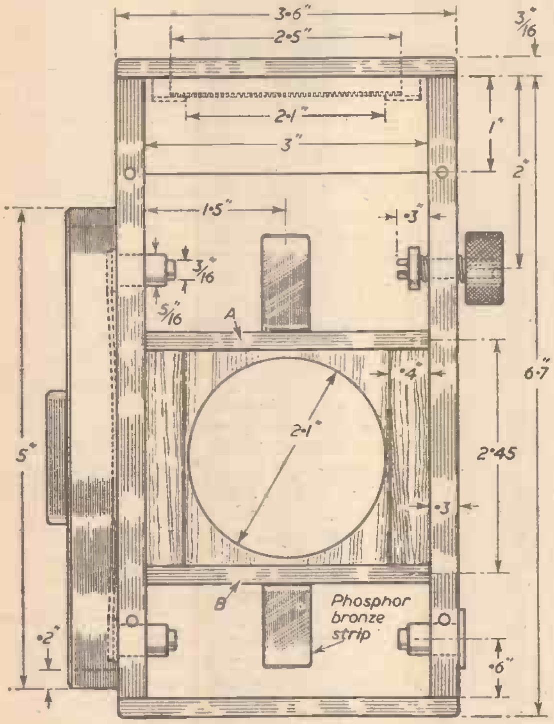


Fig. 2.—Rear view of body.

The film chamber is completed by the detachable back. The construction of this and the way that the rear edges of A and B are cut to accommodate it will be clear from Figs. 1 and 2. Four 2BA clearance holes in the back allow the latter to slide over the four 2BA brass screws let into the rear edges of the two side panels. The back is retained in position by means of four knurled brass nuts such as those found on certain types of dry batteries. Birch plywood was used for the side panels, and this was sufficiently hard to be tapped with a standard 2BA tap. The screws were then screwed into the holes, cemented in position, and the heads removed.

Method of Operation

Since the lenses are not identical, coupling would not be a simple matter. This was found to be no serious drawback. The viewing lens employs helical focusing and is fitted with a distance scale. When taking a photograph the two lenses can be set at the same required distance setting and the camera moved until the image is sharp on the focusing screen. Alternatively, the subject can be focused on the screen and the photographing lens then set to the same distance setting as the viewing lens. Parallax is not troublesome with distances down to 6ft. When the extension tube is pulled fully out, subjects as close as 15in. may be photographed. It is proposed to fix an anti-parallax device for close-up work, but best close-up results with any camera are obtained by focusing with a ground-glass screen in the film or plate position. Providing a dark room is available for loading, cut film or plates can conveniently be used with this camera as the pressure plate will keep the sensitised material firmly in position.

Finishing Details

Upon completion of the assembly all sharp corners were removed and the camera body was sandpapered to give a smooth finish. The inside was given a thorough black matt finish with optical dead-black (Indian ink is quite satisfactory as an alternative). The top rear edge of part A and the bottom rear edge of part B were rounded and smoothed to a very high degree with the finest glasspaper and then thoroughly polished by repeated applications of french chalk. An exceptionally smooth finish can be obtained and maintained in this way, and in no instance has evidence of a scratched negative been obtained, although enlargements up to six times have been made. It is important to do this polishing after the blackening has been done, for this latter process will raise the grain of the wood. The outside of the camera body was simply given a coat of black cellulose as it is intended to fit further attachments later, but it can easily be covered with leatherette to give a very attractive finish.

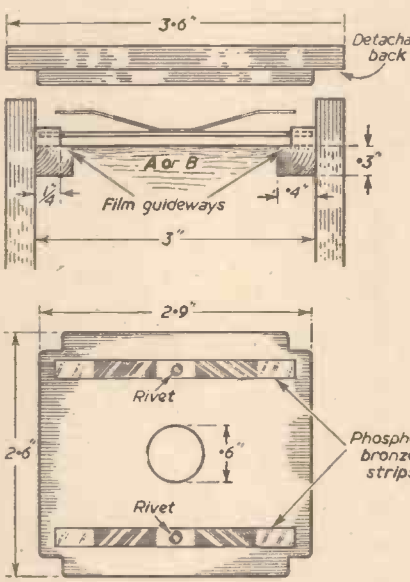


Fig. 3.—Details of pressure plate and film guideways.

Final Suggestions

It will be necessary to determine the focal length of the two lenses available before the various dimensions can be determined and construction commenced. The two lenses must be mounted in the same plane in order to avoid parallax. The preparation of the various parts and the assembling of them must be carried out with very great care and accuracy, for the quality of the photographic results depends entirely upon the quality of the workmanship. Assembly is facilitated if it is carried out in this order: (1) Horizontal members A and B to the sides; (2) front panel; (3) phosphor bronze strips bearing on the spools; (4) mirror and its plywood mount; (5) the bottom; (6) the top, together with the focusing screen; (7) the mounting for the direct-vision view finder; (8) the four 2BA screws. The viewing system must be carefully adjusted so that sharp focus is obtained for objects at the various distances indicated on the distance scale. A scale should be fitted if the lens is not equipped with one. The photographing lens must also be carefully adjusted so that objects at infinity are sharply focused in the image plane when the extension tube is pushed fully in.

Eliminating Turning

Turning of the various items described may be eliminated as follows: The ends of the spool pivots can be satisfactorily reduced by careful filing. The film wind can be constructed by using an 0BA cheese-headed brass screw as the key shaft. Brass telescopic tubing can be used for the extension tube and suitable "stop" rims made by soldering on rings of stout brass or copper wire. An alternative method of fixing the 2BA screws for the back is to solder the screws to conveniently sized wood-screws, screw the units firmly into the sides, and then remove the heads of the 2BA screws.

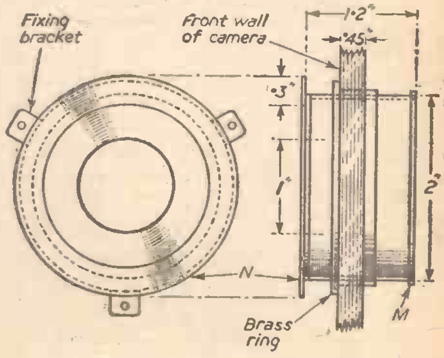


Fig. 4.—Front and side views of extension tube.

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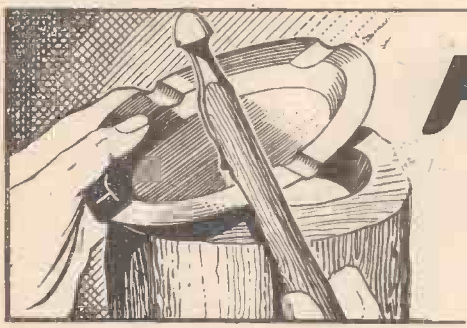


HAMMERED METALWORK

With Notes on the Various Tools Used

By H. C. PIGGIN

THE methods employed by the coppersmith are worthy of the attention of the engineer who may require to produce shallow bowl-shapes in metal for such things as light reflectors, pressure-tank ends, floats, etc. Although it is true that mechanical production methods by spinning and stamping have superseded the slower and more arduous hand-methods of producing hollow-ware, yet, when only a few samples of a shape are required, or on intricate non-repetitive work in kitchens, workshops, breweries, etc., the old hand-methods are certainly not despised.

Annealing

Almost any sheet-metal can be easily "hollowed" to a fair depth by the method to be outlined in this article—even mild-steel up to 16 gauge—providing the work can be suitably annealed. All metals tend to harden when under the hammer or otherwise subjected to stress, and if work is continued without relieving the internal strains set up, splitting and cracking will inevitably result. Naturally, the harder the metal, the more difficult it will be to hollow.

The most usual "development," or flat-pattern, for bowl shapes is the disc. The size of such a disc required for a bowl of given depth and diameter may be approximated to within a fair degree of accuracy by adding the greatest depth to the greatest diameter of the shape required. For example, a bowl to be 6in. diameter and 3in. deep could be worked from a disc of metal 9in. diameter. Alternatively, where economy is the governing factor, an even more accurate assessment may be made by measuring around the contour of a full-size drawing of the job in hand, using a wire or string. In any case, one need never fear finishing under-size on simple shapes, for the metal will stretch considerably as it is worked.

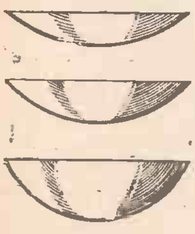


Fig. 2.—Showing how the metal deepens after each course on the doming-block.

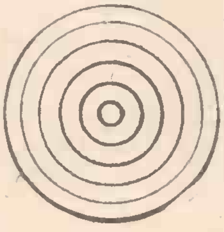


Fig. 3.—The work ringed ready for planishing.

Fig. 1.—Using the bossing mallet on an improvised doming-block.

The disc should be annealed and then scrubbed clean, using a scouring powder. Copper and brass may need immersing in a dilute sulphuric or nitric acid pickle, especially if a high-polish finish is required.

The cleaned metal is now held over the depression in the doming-block and beaten down into it with the bossing-mallet. (See Fig. 1.) Beating should be started at the outer edge, the disc being rotated slowly after each blow, so that the resulting dents move inwards as a spiral until all the work has been covered. The result should be a shallow "saucer" of metal.

This may be farther deepened by repeating the malleting process until the depth required is obtained. After two such "courses" on the doming-block, the work will need annealing again, but when the final shape is reached, it should, of course, be left hard. During the final "course" some attention must be paid to eliminating any bumps in the work which may interfere with the smoothness of the required contour.

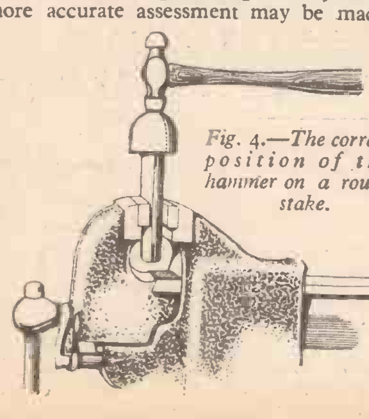


Fig. 4.—The correct position of the hammer on a round stake.

Planishing

If a finer smooth surface suitable for high polishing is required, the work will need to be planished. If suitable stakes are not available, the ball of a large ballpeen hammer will suffice, and any flat-face hammer, about 6-8oz. weight, may be used. One stipulation, however; the working faces of both stake and hammer must be polished to mirror brightness, as any slight marks on either will be reproduced on the work and spoil the surface. It is as well to keep such hammers, etc., especially for the job of planishing, and not use them for any other purpose once a good face has been obtained.

Concentric pencil-circles, about $\frac{1}{4}$in. spacing, scribed on the work before planishing will assist in the tricky job of keeping it round and of even contour. Hold the work flat upon the stake (which should be of approximately the same shape, although, of course, smaller), and strike gently at the centre, moving the hammer slightly until a solid "ring" is heard. Now always strike on that spot on the stake, but slowly rotate the work so that an even row of hammer marks, each touching its neighbours, is obtained. Continue the next row outwards from the first, again keeping all marks touching. The hammer blows should fall evenly of the same weight, and until some practice is obtained the operation should be "slow but sure." Try not to allow the hammer to fall obliquely on the work or the edge will dig in, and the resulting nicks are sure to be difficult to remove.

The surface obtained by planishing, as described above, is essentially a hammered surface, covered with little "facets," each reflecting light independently. This may look very well on certain types of work, but if a more even surface is required a little extra attention must be given. The planishing should be done very lightly indeed, using a hammer with an absolutely flat face so as to get very small facets very close together.

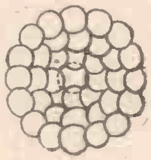


Fig. 6. — The formation of a planished surface.

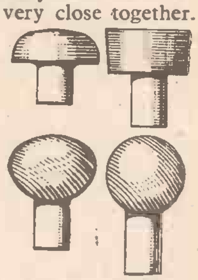


Fig. 7.—Some useful shapes for stake-heads.

Smooth emery may be used to rub down any blemishes which remain after the fine planishing, but when some skill has been gained in this kind of work, this will be unnecessary on most jobs. In any case, final polishing is best done on a power-buff, using

(*Continued on page* 88)

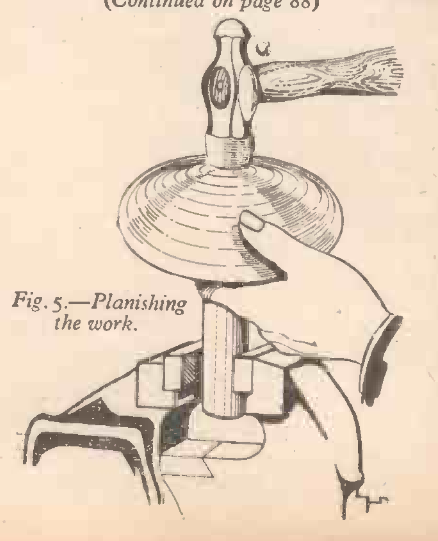
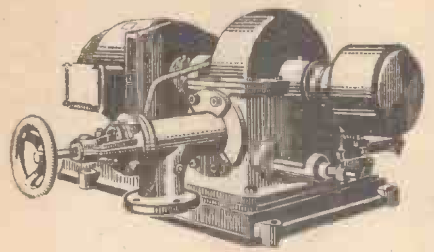


Fig. 5.—Planishing the work.



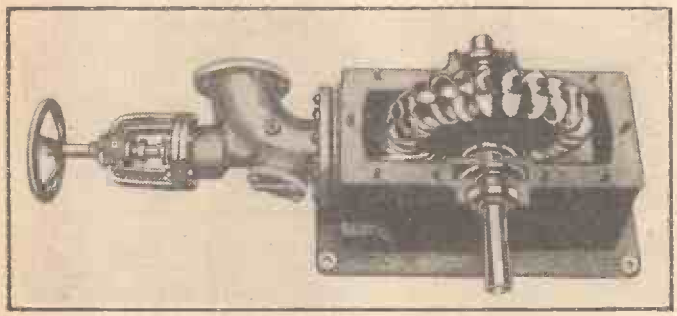
Small WATER-POWER PLANTS

Notes on Installations Suitable for High Falls

By J. H. RAPLEY

(Continued from page 59, November issue)

WITH an alternator the speed must be governed closely to keep the frequency steady, but the modern tendency on small D.C. plants is to dispense with the governor and use an automatic voltage regulator or constant voltage generator. This offers a valuable saving in cost and avoids the careful maintenance called for by a governor. For some applications, where there is always a steady flow of water, a magnetic brake governor is used. This simply absorbs the proportion of the output that is not being used, but is expensive and not generally applicable. Providing some variation in voltage can be tolerated, a small plant can be quite successfully used without any governing if it is arranged that some piece of apparatus, for example, a fire or immersion heater, can be switched on when the power is not wanted for other purposes. If the load is allowed to fall too low there will be a big rise in voltage, and this method is not generally recommended. In the same way, a suitable field regulator can be adjusted by hand to regulate the voltage, this having a resistance about the same as that of the shunt field coils of the generator.



Impulse Turbine

There is a patented form of impulse turbine made by Messrs. Gilbert Gilkes and Gordon, Ltd., of Kendal, known as a " Turgo Impulse Wheel," in which the jet enters the wheel from one side only, as shown in Fig. 4. By careful design it has been found that the ratio of wheel mean diameter to jet diameter can be reduced to about 4.5 without affecting the efficiency, which means that on a given head and flow a smaller diameter and higher speed is possible, resulting in a more economical design. The T. I. Wheel can thus be used on low heads where the Pelton Wheel becomes uneconomically large and slow. Frequent attempts have been made in the past to overcome this difficulty by adding more jets to a Pelton Wheel, but this adds complications and has not proved very satisfactory.

The machine to be driven by the turbine can be either coupled direct through a flexible coupling, which allows for slight errors in alignment, or by a vee-belt drive which is very satisfactory where the two machines run at different speeds. Flat belts are not normally to be recommended as they require a lot of attention, and the greater tension necessary results in bearing wear and friction losses. Direct coupling makes the neatest and most satisfactory job.

Generator Selection

In selecting a generator there are many points to consider. The choice between D.C. and A.C. is mainly a matter of personal preference, but it may be said that, in general, for a small plant D.C. is technically simpler, more efficient, and allows the turbine governor to be dispensed with. There are few domestic appliances which cannot be obtained for D.C., and it allows the use of a storage battery to smooth out load peaks and give a useful degree of storage under dry weather conditions. An A.C. plant requires a governed turbine, an automatic voltage regulator or compensated alternator, a D.C. supply for excitation, resulting in a lower efficiency, and where inductive loads are concerned power factor problems arise. Running in parallel with other machines is also more complicated. On the other hand, fluorescent lamps and thermostatic appliances, which are not entirely satisfactory on D.C., can be used. In cases where the supply is taken direct from the turbine, use of a standard 240-volt output allows appliances to be bought " off the shelf," though lower voltages are possibly safer and allow higher efficiency in the lamps.

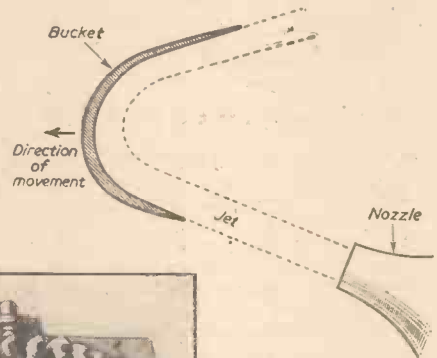
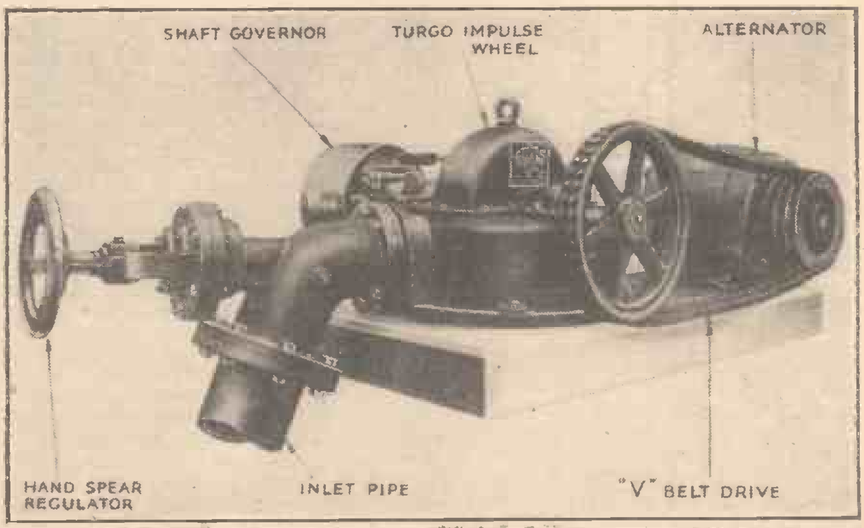


Fig. 4. (Above) The Turgo impulse wheel principle.

(Left) Pelton wheel (cover removed) with hand spear regulator.

(Note. All photographic illustrations by courtesy of Messrs. Gilbert Gilkes and Gordon, Ltd.)

The generator should have ball or roller bearings and be of the correct size for the job, as an oversize machine tends to be inefficient without being more reliable. A totally enclosed machine is less likely to be affected by dirt or damp, but is slightly less efficient than a ventilated machine of the same rating. Soft, self-lubricating brushes, kept at the right pressure, reduce commutator wear, and care should be taken while the plant is under construction to prevent abrasive dust entering the generator or turbine. On D.C., where an automatic voltage regulator is used, either a shunt or compound machine is suitable. A heavily over-compounded machine will reduce the voltage variation between no load and full load, simplifying the work of the automatic regulator, or, if some variation in voltage is acceptable, the latter can be dispensed with altogether. Alternatively, a constant voltage generator of the Macfarlane " Magnicon " type can be used. For battery charging a shunt machine is essential. There are so many types of alternators that it is impossible to discuss them here, but in general machines with small D.C. exciters require more attention than the self-excited type. Machines of the " Magnicon " type or Mawdsley's " Compensated " type allow the automatic regulator to be dispensed with, but are more expensive than a plain alternator without automatic regulator. The carbon pile type of automatic voltage regulator is very satisfactory, but on D.C. machines covering a wide speed range



A Gilkes Turgo impulse wheel with shaft governor and spear regulator driving an alternator.

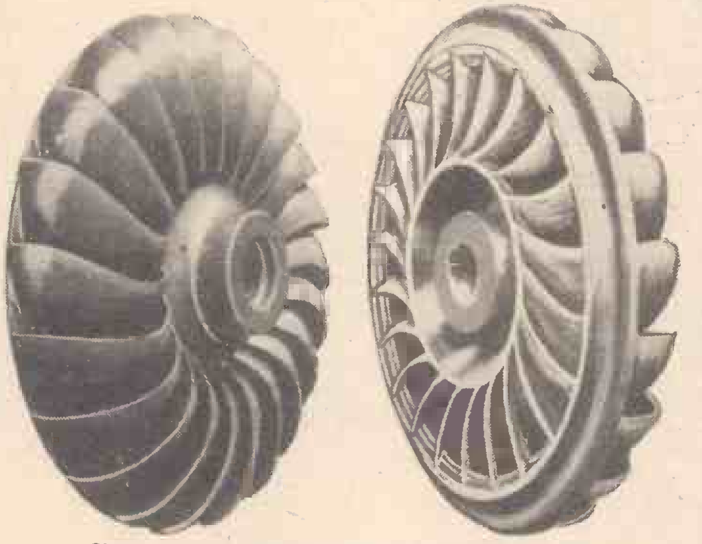
the vibrating contact type may give better results. It requires more maintenance and is more liable to cause radio interference.

Choice of Voltage

Keeping the supply going in dry weather calls for consideration. The simplest solution is to manage without, but for very small plants a large-capacity battery trickle charged by a relatively small generator is probably best. For a single house 50 volts gives a satisfactory supply, and allows the use of all except the heavier heating appliances. 110 volts is preferable for a farm or group of houses where greater distances are involved. By keeping the number of cells small and the voltage low, maintenance is simplified and the initial cost reduced compared with a higher voltage battery of the same total capacity. On sites where the flow falls are too small to work the plant at all, an engine-driven plant as a stand-by is the best solution. If only occasional use is made of it, the higher fuel cost of a petrol/paraffin engine can be set off against its lower first cost compared with a Diesel, but in general a Diesel engine is always to be preferred.

Water Storage

The alternative solution is water storage, but this is governed mainly by the lie of the land, which must allow a large volume of water to be stored by a relatively small dam to make the scheme economic. On a small stream even a slight leakage can be serious, so the foundations of the dam should be on an impervious strata and the inside facing at least must be watertight. For a stone gravity dam, a ratio of width at base to height of at least 2-3 must be maintained, but under these conditions all parts of the dam are under compression, and providing the stones are well bedded together no mortar is necessary except for watertightness. Whether a dam or weir is built, screens should be provided



Showing the two sides of a Turgo impulse wheel runner.

to exclude stones and drifting rubbish from the pipeline. Old quarry screens of about ¼in. mesh are cheap and satisfactory for this job. They should be so arranged that any debris can be easily cleared away, and the whole screen should be removable for cleaning. To benefit from water storage it is necessary to reduce the flow during light load periods, or to shut down completely, and for this purpose an automatic water economiser can be fitted to the spear valve, opening or closing the nozzle according to variations in load. This allows water to be stored during light load, while the reservoir can be drawn on during periods of heavy load. In conjunction with this, an electrical control can be arranged to start or stop the plant from a distance.

Survey is Essential

This, then, is a brief description of the various parts of a water-power plant as applied to the supply of electricity to private premises. When properly designed and installed it is an extremely reliable and cheap source of power, but it is a matter that should not be approached in too optimistic a spirit lest disappointment should result. There are many possible sites, but few ideal ones, and a careful survey is essential, for any hearsay evidence regarding flow is usually unreliable, if not useless. But, to those living in isolated places, it offers power at a price with which no public supply could compete.

Who Should Own the Patent?

Points Concerning the Patents Law as Applied to the Employer and Worker

By W. J. WESTON

"THE first and true inventor" is, doubtless, an answer to the question posed. That fits such a patent as Sidney Gilchrist Thomas took out in 1877 for making steel out of phosphoric iron. His vocation at the time was strangely aloof from a noisy steel works; he was a clerk at the Thames Police Court; he studied metallurgy at South Kensington, and he experimented in a backyard.

The answer does not fit all patents. In particular this question may present itself. "If, in the course of my work in the engineering shop I make an invention, am I or is my employer entitled to take out a patent?" The answer is not obvious. If, unluckily, contention arises and litigation follows, the Court's answer will vary with the varying conditions of employment.

Consider the question awhile. You can't patent an idea; you can only patent the "manner of new manufacture" in which the idea is made manifest to the public. For all that, the idea is the essence of the matter. The idea may seem an inspiration. The worker intent on the operation of his job or the employer brooding over problems of management is "stung by the splendour of a sudden thought." Or the idea may be, and usually is, a sequel to long and persistent wrestling with a particular problem.

Practical Application

Whatever the birth of the idea our patent law takes adequate notice of its importance. For one thing, there is recognition that acute theoretical knowledge may be present and practical skill may be absent; the theorist needs the practical man as his complement. An employer has an idea that, being workable, would effect enormous saving in time and in labour. He instructs a competent engineer to devise a way of giving the idea a practical application. The engineer, using his accumulated skill in mechanical operations, does devise the way. The employer it is that applies for the patent; the worker is obliged to be content with the employer's approval and a handsome gift at Christmas.

The invention may, however, result from study and experiment away from the works. It then belongs wholly to the worker; even though the invention concerns (as in all but the rarest instances it must do) the worker's employment, the employer can claim no share in it. The worker may have stipulated for full-time service with the employer. But "full-time service" has a narrow interpretation and does not include service during leisure hours. The worker may, indeed, assign a share in the patent to his employer; and perhaps, capital being needed to exploit the patent, it is expedient to do so.

The patent law of some countries—Holland and Switzerland among them—is solicitous lest the worker should be despoiled of an adequate reward for his invention. In this country no special protection extends to the worker-inventor. But the melodramatic tales of his being tricked, of his Esau-like selling his right for a mess of pottage, are probably little mirrored in real life.

Between these two extremes are intermediate positions. Co-operation in one form or another between employer and employed may be present. A worker may be engaged for the purpose of research. The ownership of any patents that are sequels of such research is usually provided for in the service agreement, and obviously this is desirable.

Joint Ownership

The agreement may stipulate for joint ownership. For the law recognises an ownership shared by two or more; the Comptroller has power to grant a patent "to any person, British subject or not, if that person is either the true and first inventor, or if he applies jointly with the true and first inventor (or inventors)."

It should be noted that this joint ownership of a patent lacks a characteristic feature of joint ownership; there is no right of survivorship. On the death of one joint owner of a patent, his share devolves not on the survivor but on his personal representative as part of his personal estate.

When no provision is made in the research-worker's agreement about patents that may possibly result, the employer becomes entitled to the grant of patent. If need be, the worker can be enjoined to assent to the making of a joint application. This rule is analogous to the rule whereby a newspaper becomes owner of the report that its reporter was engaged to write.

Moreover, the essential idea underlying the invention may well be a joint product. Often enough an animated discussion causes a new, maybe startling, idea to spring into light, and we find a difficulty in pointing to the originator of the idea. Without the co-operation of employer and employed the idea would still be latent. Equity demands that, when the idea fructifies into a valuable patent neither co-operator shall be forgotten. And our own patent law sees no absurdity in the notion of a multiplicity of inventors of the one invention.

Making a POTTER'S WHEEL

Constructional Details of a Simple but Necessary Adjunct for Handicraft Pottery and Clay-modelling Work

By "HANDYMAN"

SURPRISING as it may seem, the traditional wheel of the potter is one of mankind's first primitive mechanical inventions. To this day, after an uninterrupted spell of thousands of years in all the nations of the world, the potter's wheel still remains basically unchanged in principle. It comprises a disc of wood, stone, metal or other material which is mounted on the top of an upright shaft and is caused to rotate at varying speeds thereon.

Many—but not all—of the wheels of the trade or professional potter are nowadays motor-driven, and, as such, it is possible to actuate them by a foot, a knee or by some other form of control much in the same way as a domestic sewing machine or the dentist's drill is operated. The traditional potting wheel, however, is foot powered. It is known as the "kick wheel" in consequence of its being revolved by kicking or otherwise moving a bar or beam backwards and forwards in a horizontal plane. In this respect it differs merely from an up-and-down treadle by being restricted in its movements to one horizontal plane only.

For all amateurs and even for the half-amateur, half-professional work of the handicraft potter and the clay or plastic modeller, to say nothing of the teacher and instructor of such craft occupations, the foot-driven wheel is by far the best. There are numerous ways of contriving a wheel rotating at the upper end of a vertical spindle. Many of these have been tried, perhaps in attempts to get away from tradition, but the old hands at the potting and modelling game have invariably preferred the orthodox form of "kick" wheel, mainly because of its essential controllability and its simplicity and reliability of operation.

The contrivance is, in principle, a really very simple and straightforward device, and it can be constructed by any individual having some mechanical aptitude.

The Table

First of all, it is necessary to construct a stout table framework for the wheel. This may be of the three- or four-legged variety, the former being preferable, as we shall see later; but it is essential that the table should be strong, heavy and well-braced in its underframe so as to resist vibrational tendencies from the backwards and forwards movement of the foot-board or treadle and the rotation of the heavy flywheel. A table which is light and rickety will never allow good modelling work to be produced.

The illustration (Fig. 1) indicates the general appearance of the wheel. Build the table in the best wood you can procure, giving it, if possible, stout legs of 4in. x 4in. section. Brace into the upper part of the table (just under the top) a stout beam to carry the upper end of the vertical shaft, and fit a corresponding beam at the bottom to take the lower end of the shaft.

The shaft itself may consist of a ¾in. iron rod. It must be bent and formed into a crank near its lower end (Fig. 2). This is really a blacksmith's job, because, in order to give steady running of the wheel, the crank requires to be made accurately. The lower part of the shaft fits into a hole made in the bottom cross-bar of the table, or, alternatively, it may fit into a metal flange (Fig. 3) screwed firmly down thereto. The only other support of the vertical shaft is at the top where it passes through a hole drilled through the upper cross-bar or beam.

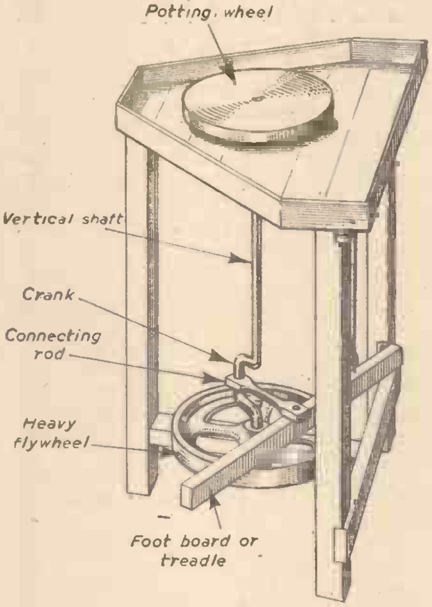


Fig. 1.—A general view of the potter's wheel and stand.

Forming the Crank

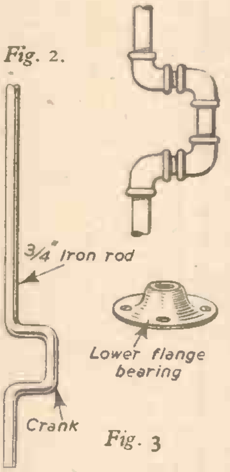
If facilities are not available for forming a crank on the iron rod, an alternative method is to make the entire shaft in ½in. standard iron pipe and to use four elbows and a short length of piping to make the actual crank in the manner shown (Fig. 3). This necessitates cutting and threading the connecting parts. Make all the joints a very tight fit and pack the threads with white- or red-lead paste to ensure adequate tightness and permanence.

The wheel, which is mounted at the top of the shaft and about an inch or two above the surface of the table-top, may comprise a wooden disc about 1in. thick and anything from 6in. upwards in diameter. For ordinary modelling work, a 10in. wheel (gramophone record size) is usually ample. The wheel may be metal faced or it may even be cast in concrete and made really heavy. For a first-class job it is always best to make the upper wheel or disc on which the actual modelling is done interchangeable with others of its type, but of varying diameters and surfaces to suit the needs of individual workers.

The flywheel is an essential part of the job. It should be of solid, heavy construction and well secured to the vertical shaft by keying or by any other suitable method. Within limits, the heavier the flywheel, the steadier and the more easily the potter's wheel, as a whole, will work, because the heavy flywheel supplies momentum and keeps the upper wheel or disc rotating steadily and regularly. The actual diameter of the flywheel is of little consequence provided that it is not too small for the crank to operate satisfactorily. The actual weight of the flywheel is the more important factor. Any type of wheel may be used for its construction. An old iron pulley is admirable for the purpose; so also is an old truck wheel or even a wheel specially cast in concrete.

The flywheel is rotated by means of a connecting-rod attached to the crank formed on the vertical shaft. This connecting-rod need not necessarily be made of metal; it may be cut out of a heavy piece of timber.

The operating "treadle," lever, foot-board (call it what you will) to which the metal or wooden connecting-rod is attached is made out of a length of stout timber which is pivoted at one end to the underframe of the table. It is held up by means of a thin iron rod (stout wire will suffice), which latter is loosely attached at its upper end to the table underframe, as shown in Fig. 1.



Figs. 2 and 3.—Two methods of making the crankshaft.

Bearings

It is a great convenience to provide lower and upper bearings of some sort to the ver-

A professionally made potter's wheel for handicraft potting and modelling, as supplied by Dryad Handicrafts, Ltd., Leicester.

tical shaft and also to the connecting-rod at its attachment to the crank. Plain pieces of brass or phosphor-bronze will make rough-and-ready bearings, but the orthodox white-metal bearings will give much easier working. Whilst it may be borne in mind that the early potters' wheels had no bearings at all, the fitting of any spare ball-bearings which may be available will make a first-class job of the whole assembly and construction.

The table size may conveniently be about 2ft. 6in. by 1ft. 6in., and its height should be about 2ft. 6in. from the ground, although a worker of smaller stature than average may prefer a somewhat lower table level. It is a good plan to finish the whole job by screwing or otherwise attaching 6in. boards all round the edge of the table, so that the wheel revolves in a sort of shallow well like the turntable of a cabinet gramophone or radiogram. Here again this requirement is not essential, but it is useful for easing the work of the clay modeller or handicraft potter and for preventing loose clay or other modelling material from being flung about by the revolving wheel.

"Triangular" Table

Notice that the three-legged or "triangular" table (Fig. 1) is so designed that the modeller can sit most conveniently at one end of the table, placing his legs on opposite sides of the single table leg. This convenience of sitting and operating position is a great advantage and it is best attained by the use of a three-legged table, despite the fact that a four-legged table would be stronger. The wheel is operated by pushing the foot-board or "treadle" backwards and forwards in the horizontal direction only and *not* up and down.

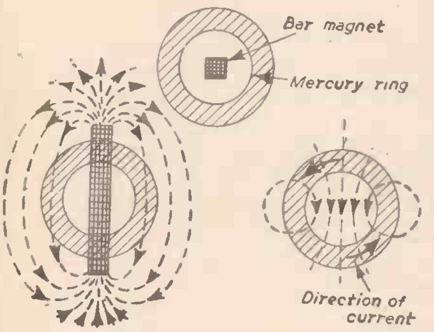
For easy operation, the crank on the vertical shaft should have a fairly deep bend, one, say, of 4in. or 5in. The wheel is started by rotating it by hand in an anti-clockwise direction and then by pushing (or "kicking") the foot-board with a quick, steady thrust. It will not then be difficult to achieve a steady, rhythmical foot-stroke, after which the wheel, as it gathers momentum, will almost "move by itself." The steadiness of the wheel and its ease of rotation are essentially matters resulting from its careful mounting and the provision of adequate bearings, all of which refinements must be left to the judgment of the individual mechanic and builder.

A wheel of this type should provide controllable rotational speeds varying from 80 r.p.m. up to as much as 500 r.p.m., which is the usual speed-range required for most handicraft potting and clay-modelling operations.

An Aspect of Perpetual Motion

By D. A. BELL

THIS aspect of perpetual motion may not be classed in the same category as those given in the September, 1951, issue of PRACTICAL MECHANICS, but it is indeed justifiable and practical.



Diagrams showing the position of the bar magnet in the mercury ring, and the magnetic field due to the flow of current in the mercury ring.

The idea is based on two fundamental facts:

(1) There is a temperature at which the resistance in a substance to the passage of an electric current is zero.

(2) Faraday's Laws of Induction.

At a certain temperature mercury has no resistance. If we arrange a ring of mercury as in Fig. 1, and insert a bar magnet through the central hole we shall have the necessary starting apparatus. The temperature is then lowered until it is below the temperature at which mercury has no resistance. If the bar magnet is quickly drawn away from the mercury the change in flux through the ring will cause an electric current to be set up in the ring, and there being no resistance in the mercury the current will continue to flow without decrease. This will be true so long as the temperature is kept below the invertion temperature of mercury.

While this idea would be of no use practically it is possible to set up a working model.

The first actual impulse is the taking away of the bar magnet. The work done in this is converted into magnet energy and then into electrical energy. The current in the mercury ring does no work, so that the energy will remain constant, i.e., that at which it started. Thus an electric current will always flow in the mercury ring and perpetual motion would be achieved.

Detecting Flaws in Tyres by Ultrasonic Waves

SOUND waves of so high a pitch that they cannot be heard by the human ear are now being used to examine tyres for flaws which can be neither seen, felt, nor detected by X-rays.

Passed through water, these ultrasonic waves, as they are called, will detect in a tyre an air film as thin as one fifteen-thousandth of an inch. Research workers at the Dunlop Research Centre and the General Electric Company have therefore jointly designed an instrument which generates ultrasonic waves under water by quartz crystals coupled to a source of high-frequency electrical impulses. A quartz crystal generator is placed within the arc of a tyre cover slowly turning round with the lower part under water, and the waves pass through the cover in all directions. If there is the slightest lack of adhesion between the seventy or eighty pieces from which the tyre may be built an air film will be present, and the waves will pin-point the flaw on a dial.

The new technique should prove a valuable addition to existing inspection methods, and will be particularly useful in dealing with covers returned from service to be re-treaded. The first of the new instruments has been installed at Fort Dunlop, and will be used for a wide range of covers from 14 to 24in. in rim diameter, $4\frac{1}{2}$ to 17in. in width, and up to 300lb. in weight.

HAMMERED METALWORK

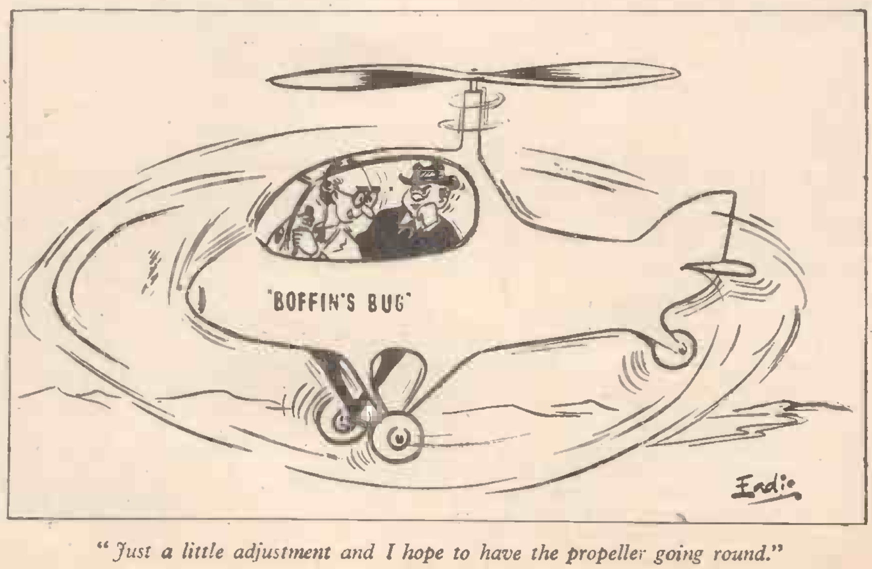
(*Continued from page* 84.)

Tripoli compound and jewellers' rouge.

Choice of Tools

It may be appropriate to give here a few notes of guidance on the subject of the tools necessary for small coppersmithing jobs. Purchase of most tools is to-day a very expensive business, and it is therefore very desirable to improvise whenever possible. A set of small stakes, such as those shapes illustrated in Fig. 7, is a valuable asset in any workshop, and they are easily turned up out of scrap-iron, a suitable holder being made from a piece of iron-pipe about 6in. long. A useful diameter for the heads is $1\frac{1}{2}$in. Old hammer-heads come in very handy, as do the knob-ends of worn-out pokers, etc.

Hammers for planishing have already been mentioned. Incidentally, on very hard metals, a ballpeen may give quicker results than a bossing-mallet on the doming-block. This latter item can be easily made from a short length of tree stump, with suitable depressions gouged and hammered into the ends. It should be cut square across the grain so as to stand level.



"Just a little adjustment and I hope to have the propeller going round."

A Passenger-hauling Model Locomotive

Constructional Details of the Tender

By E. W. TWINING

THE locomotive, not being a tank engine, is not complete without a tender for carrying water and fuel. A quite normal design for this is given in side elevation in Fig. 13 and in front and back elevation on the left hand side of Fig. 15.

Fig. 14 is a longitudinal section and the right-hand side of Fig. 15 is a cross-section through the sump, the water filling hole, and through one axlebox and spring.

The wheels are 3in. in diameter and for these I have selected from the catalogue of Bassett-Lowke, Ltd. their 12-spoked wheel casting, No. X208, in cast iron.

(*Continued from page 57, November issue*)

Constructional Details

Returning to the tender, the whole of the details of construction will be more or less obvious from the drawings and I will merely mention briefly a few points which may need emphasis or explanation. The frames are of steel plate as are also the front and rear buffer beams. For the body of the tender and all parts with which water makes contact sheet brass or copper is advisable. If tin plate is used it should be of stout gauge and be heavily tinned; even so the inside of the tank should be painted with at least two coats of Brunswick Black to prevent rusting.

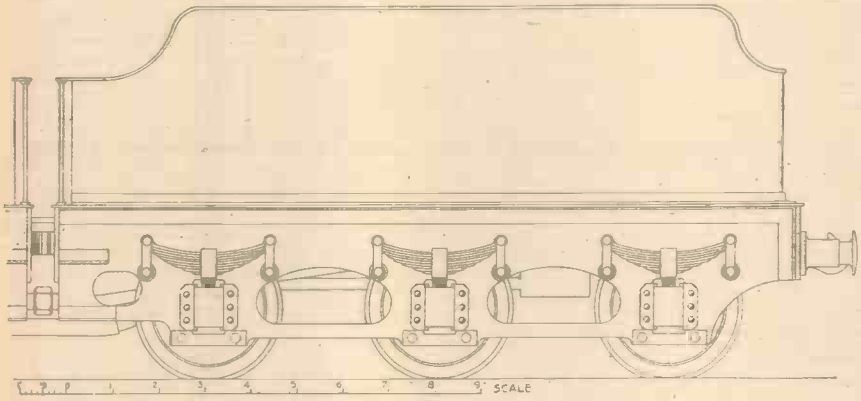


Fig. 13.—Side elevation of the tender.

It may not be out of place to mention here that this 0-6-0 locomotive was designed, and all the drawings illustrating these articles were made, about the middle of year 1949 and that, unknown to me, Messrs. Bassett-Lowke Ltd. were preparing to put on the market sets of castings for building a 3½in. gauge engine of the same size and wheel arrangement. This engine is a tank and not a tender engine, but the coincidence is that the coupled wheels are of the same diameter and the bore of the cylinders the same, the stroke being 1⅝in. instead of the 1¾in. which I have shown. It follows, therefore, that the reader who builds from my drawings can obtain his driving and coupled wheel castings ready made and, if he prefers cast cylinders to those built up as I have described, he may get these also. I find, from Bassett-Lowke's latest (winter, 1949-50) catalogue, that the code reference to the six driving wheel castings is CT/1 and the gunmetal cylinder castings CT/2.

In the cast cylinders the slide valves are flat with outside admission whereas in my drawing Fig. 6 the built up cylinders with piston valves are arranged for inside admission. It follows, therefore, that if the cast flat valves are adopted an alteration must be made in the valve gear. This will involve nothing more than making the return crank longer, so that the eccentric pin is on the opposite side of the axle centre from where it is shown in Fig. 1; in other words, the return crank will have a length between centres of 1¼in. instead of the present ½in.

The top of the tank is made movable by being screwed down to an angle brass all around. The sump from which the feed water is drawn should be made from thin brass or copper tubing. Between the tender and the engine are two water pipes; one of these on the right-hand side leads, through a flexible piece of rubber tubing, from the sump to the axle-driven pump and the other, from the tender hand-pump direct to the left-hand check valve on the boiler, being subjected to pressure exceeding that in the boiler, must be provided with a union for connecting up. Such union, unlike the rubber on the other pipe, makes a rigid joint and, since flexibility between an engine and its tender is essential, provision is made for this, by means of a large oblong loop in the water pipe between the union and the point where the pipe passes through and is soldered to the tender bottom plate.

The hand pump—as is also the engine axle-driven pump—is a Bassett-Lowke fitting, the code number of which is given in Fig. 14.

The springs are of steel wire, as shown in Fig. 15, where one axlebox is in section. The spiral wire working springs are freely socketed in imitation laminated pattern springs, the buckles being drilled to form the sockets. The whole of the imitation laminated spring is cast in gunmetal in one piece with the hangers, and is secured to the frames with either bolts or rivets through eyes in the lower ends of the hangers.

Stoking When Running

With a tender engine as large as ¾in. to the foot scale it is almost impossible to reach the firebox, for firing with solid fuel, when on a continuous run, and the scheme to render this possible was devised by the writer many years ago. Details of the device are shown in Fig. 16. It is simply a bent plate fitting in the firehole at the front end (the normal firehole door being left open when the plate is in use) and resting on the tender at the back end.

Used in conjunction with the plate are two firing, or stoking, tools; a rake made from a length of steel rod and a "coal pusher" which, besides being used for transferring the coal from the tender, down the chute and into the firebox, serves as a stop for closing the firehole; in other words, as a portable door. To prevent this door from falling through the hole a small cranked lug is riveted on the top edge as shown in the section, and also in the small perspective view.

When the small pieces of coal are pushed into the firebox they naturally fall, for the

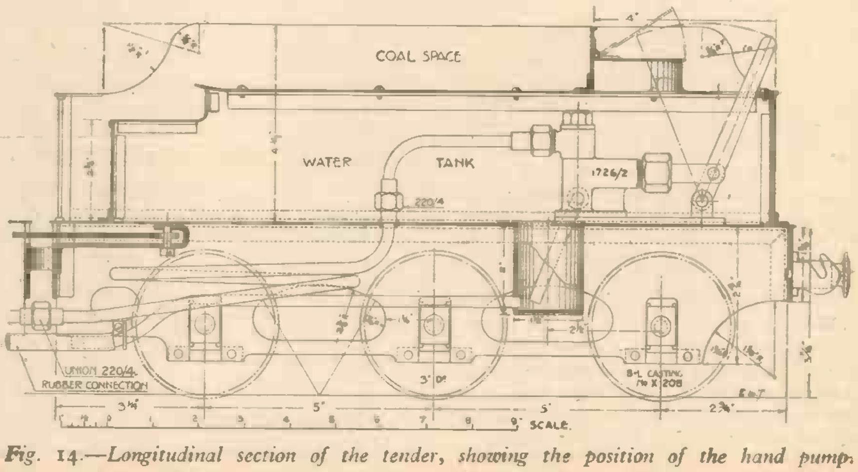


Fig. 14.—Longitudinal section of the tender, showing the position of the hand pump.

greater part at the back, underneath the fire-hole; the rake is then used to distribute them so as to maintain an equal thickness of fuel all over the firebars.

Hauling Power

In conclusion, I would say a few words regarding the hauling power of this engine. Given a good track and passenger trucks, which are carefully made and with good long journals in the axleboxes, at least four adult persons should be pulled with ease. I notice that the Bassett-Lowke 3½in. gauge tank has a boiler which works at 100lb. per sq. in., whereas the boiler shown in my drawings is intended for 60lb. pressure. The Bassett-Lowke engine, although ⅛in. shorter in the cylinder stroke, should pull a slightly greater load because of this greater pressure. Now the question arises: should we put the pressure up in our boiler? Well, the thickness of the copper shell of the boiler—5/64in.—will carry the 100lb., but the answer to the question lies in the workmanship put into its construction. If all the seams are lapped sufficiently, riveted and silver-soldered throughout then it will be quite safe to work at 100lb., assuming that it is worth while. Personally I should prefer a little lower pressure and put all the journals of the trucks in ball bearings; by so doing seven or eight adults could be hauled. That means, of course, the making of seven or eight trucks; I can hear someone saying: three or four trucks will be enough for me to make so we will stick to 60lb. pressure.

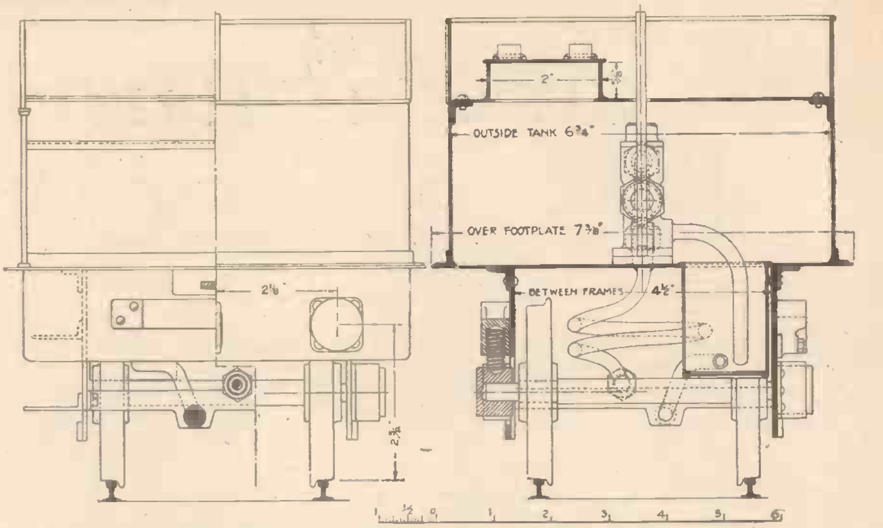


Fig. 15.—Front and rear half elevations, and cross-section of the tender.

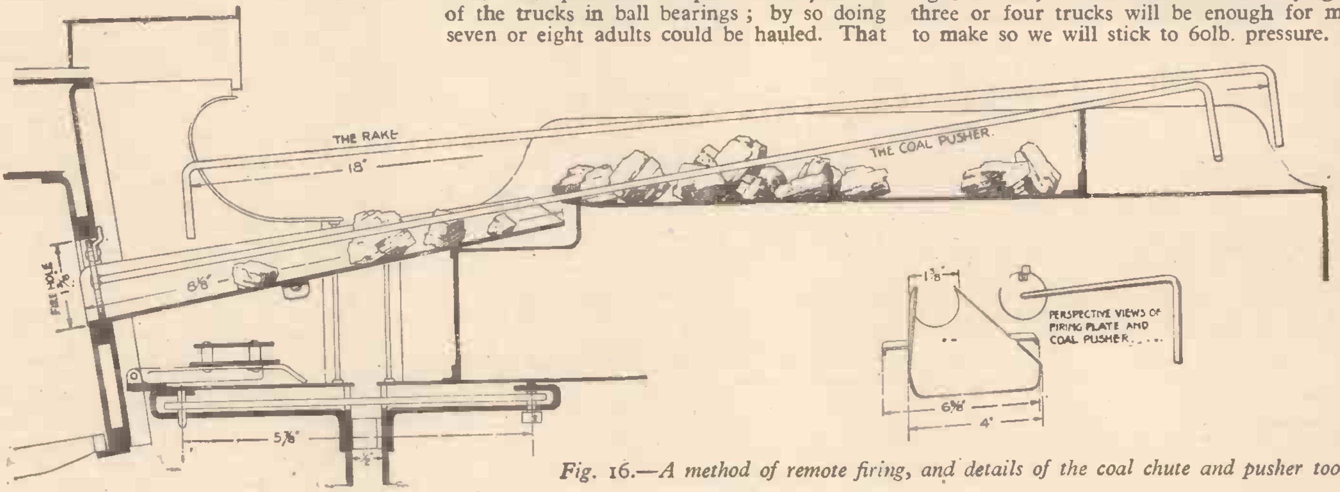


Fig. 16.—A method of remote firing, and details of the coal chute and pusher tool.

A Chemical Exhibition

The History of the Electric Storage Battery Depicted

AN impressive Chemical Exhibition, staged by eight large industrial companies in the north-west, was held in Manchester's Civic Centre on September 27th, to mark this year's Dalton Lecture of the Royal Institute of Chemistry. The exhibition was based on the same theme as this "festival" lecture. Delivered by Lord McGowan, K.B.E., it was entitled "One Hundred Years of Chemistry."

Among the various exhibits depicting the history of the science in various fields was one prepared by Chloride Batteries, Ltd., following the development of the lead-acid storage battery.

This display traced the course of progress from Volta's famous Pile constructed at the beginning of the nineteenth century to the large scale production to-day of highly efficient electric storage batteries for a variety of specialised duties. The successive stages in this long history were illustrated by models or actual examples of typical plates and cells from each period.

Among the exhibits were a Daniell and a Leclanché cell typifying the early types of primary battery built before the principle of reversibility was recognised, and a Plante cell of about 1880 marking the first successful attempt in applying the principle. Subsequent research which led to great improvements in efficiency was indicated by a group of cell plates developed by Henry Tudor, Elieson and Rhodin. Rhodin, who was the Chloride Company's chemist at the time, introduced his famous positive plate in 1895. This section of the display was completed by a large Plante type positive in use to-day.

The "Pasted" Plate

The history of the "pasted" plate, first introduced by Camille Fauré in 1881 and turned into a commercial proposition largely as a result of the company's research, was similarly treated. Its progress was shown leading up from small beginnings to the development of the now standard Exide grid and the well known Exide-Ironclad tubular positive plate. Methods of separation which have been used at one time or another were also illustrated.

The story told by the exhibit finished with a display of batteries of various types and capacities from the vast range produced by the company for every conceivable type of duty. Constructed in the very latest materials and incorporating all the refinements in design and construction dealt with in the historical display, the selection included typical stationary, train-lighting and submarine cells and batteries for aircraft, road transport, radio and meteorological balloons.

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Columbium Metal

Sidelights of Interest on This Unique Metal

By J. F. STIRLING

TAKE a glance, in your imagination, at Mr. John Winthrop the Younger as he goes for one of his constitutional strolls near his home at New London, Connecticut, in or about the year 1650.

Mr. Winthrop is a keen, energetic individual, a man of many abilities. Apart from being the first Governor of the new American State of Connecticut, he has functioned as a naturalist, a chemist, a physician and as the founder of the chemical industry in America. He is, too, a man of many hobbies, and that in which he is most keenly interested at this period of his life is the collecting of minerals. In short, John Winthrop is America's first mineralogist.

Not far from his New London home, Mr. Winthrop kicks his foot against a large fragment of blackish-looking rock bordering a natural freshwater spring. He does this, and a new metal comes to the knowledge of mankind. Not immediately, of course, for the process of the metal's birth takes at least one hundred and fifty years. Nevertheless, it is to this seemingly trivial incident that the discovery of columbium, a metal of many striking possibilities, may be traced.

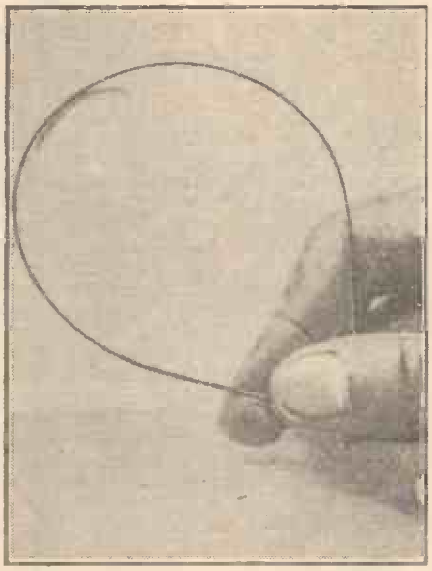
Winthrop took a portion of the black rock back to his home laboratory. It was an extraordinarily heavy rock specimen, he noted, and although he performed many chemical tests on it, he was not able to classify it. The rock sample was relegated to Winthrop's museum collections, and there it remained for the rest of his life.

Fifty years later, Winthrop's grandson sent the black rock specimen as an American mineralogical sample to Sir Hans Sloane, in England, who was a famous collector of natural curiosities. Sloane ultimately handed it over to the British Museum, and there it remained for approximately another hundred years until it was examined in 1801 by a certain Charles Hatchett.

Coachbuilder Chemist

Hatchett was a rather curious individual. His father was a wealthy coachbuilder of Long Acre, London, but, having ample funds, he attended but little to the family business and passed his time dabbling in the arts and sciences. It was only for a brief ten years that chemical studies seem to have attracted Charles Hatchett, yet in that time he was able to rise to the heights of eminence as an analytical chemist in his home laboratory at Roehampton, and to become one of the founders of the Animal Chemistry Club which, in its day, numbered among its members many of the scientific *élite* of London.

It happened that Hatchett was called in to rearrange the mineralogical collections at the British Museum, and coming across the old rock specimen labelled "from Mr. Winthrop of Massachusetts," he took a portion of it home and began to analyse it. The analysis resulted in a paper entitled "An Analysis of a Mineral Substance from North America Containing a Metal Hitherto Unknown" which Hatchett read before a meeting of the Royal Society on 26th November, 1801, and in which he showed clearly that the mineral contained a new metal to which he proposed to give the name *columbium* in honour of the country of its origin.



A loop of columbium steel, an acid-resisting alloy of high quality.

Note, however, that Hatchett did not actually isolate metallic columbium from his mineral specimen. The trail of the new metal now became more confused, because in the following year (1802), one Anders E. Ekeberg found a somewhat similar element in a number of minerals from Finland. To this particular element Ekeberg gave the name "tantalum," and there the matter rested for a further forty-two years.

Then came Heinrich Rose, German pharmacist and mineralogist, who worked with tantalum-bearing minerals and found what he thought to be still another new element in them. He called his new element "niobium" in allusion to the mythological Niobe who was the daughter of Tantalus. Rose was not able to obtain either tantalum salts or niobium salts in a pure condition, for the metals were so much alike that it seemed quite impossible to separate their compounds.

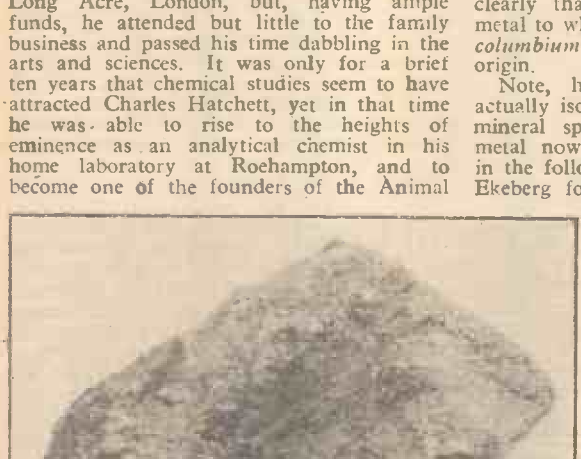
However, in 1865 the French chemist Marignac found that by converting the impure metals into their fluorides he was able to separate the two elements, and so, for the first time, was prepared pure tantalum and pure niobium—both in the form of a greyish powder.

Columbium or Niobium ?

It was quite evident at this time that the niobium of Rose and Marignac was identical with the original columbium of Charles Hatchett. Hence, if priority of naming had anything to do with the matter, Hatchett's appellation of columbium ought to have been retained. The mid-nineteenth-century German influence in chemistry militated against this, so that right down to our own days the two names "niobium" and "columbium" have been used to denote the same metal. It is now, fortunately, being recognised that by right of priority and by rightful historical association, *columbium* is the true name for this curious, steely-grey metal, so that the term "niobium" is rapidly going into disuse.

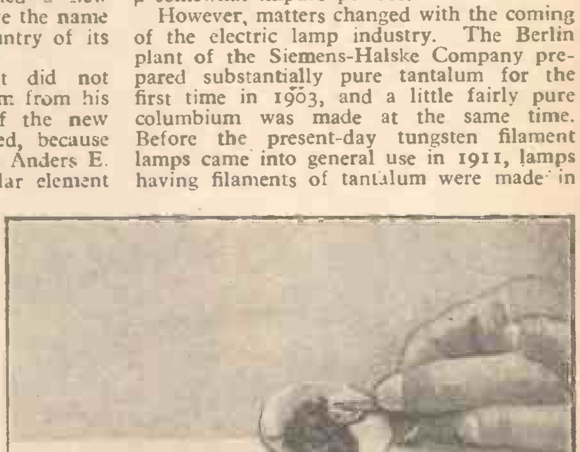
Up to the beginning of the present century columbium (then called "niobium") had no uses whatever. Nor were there any suggested uses for it. It was so rare, so difficult to obtain, and, in point of fact, had never been prepared except in the form of a somewhat impure powder.

However, matters changed with the coming of the electric lamp industry. The Berlin plant of the Siemens-Halske Company prepared substantially pure tantalum for the first time in 1903, and a little fairly pure columbium was made at the same time. Before the present-day tungsten filament lamps came into general use in 1911, lamps having filaments of tantalum were made in



(Left) Columbite, an American mineral source of columbium metal which has nowadays an interesting historical significance.

(Right) Columbium oxide, a modern source of columbium's manufacture.



their thousands. Columbium was tried as a lamp-filament metal, but its melting-point was found to be lower than that of tantalum. Consequently a columbium filament could not be raised to as high a temperature as a filament of tantalum, and for this reason alone an all-columbium lamp, although it would undoubtedly have been "America's Pride," could not be brought into being.

For close upon another quarter century columbium suffered a further eclipse. It still remained a laboratory curiosity, a metal which even few scientists had ever set eyes upon. Indeed, only a few grammes of the metal had ever been prepared in the really pure state.

The long-prevailing situation, however, was entirely changed when, for the first time in scientific history, a number of 16-inch bars of pure columbium metal were displayed at the Exposition of Chemical Industries in New York in 1929.

Columbium at Columbia

The individual finally responsible for putting the American metal on the map was Frederick Mark Becket, an American

The type of early metal filament lamp in which columbium was first tried out.

metallurgist who was, appropriately enough, a graduate of the Columbia College, U.S.A. Becket had long been a stainless-steel man, and it was he who showed that the very detrimental inter-granular corrosion which used to occur in this steel, to the almost complete ruination of its properties, could be controlled completely by the alloying of a small percentage of columbium with the steel. A new interest in the American metal at once arose. "Columbium steels" were called for on all sides. But where was the columbium?

There is a traditional truth in scientific matters, a saying to the effect that if a thing is wanted badly enough it will ultimately be forthcoming. The truth well confirmed itself in the case of columbium.

The tantalum industry, first arising in Germany, had, after World War One, made rapid strides in the U.S.A. and because commercial columbium compounds had always been a sort of by-product of tantalum winning and all tantalum processes, it was in this direction that chemists turned in search of the now needed columbium.

Before long, metallic columbium was being prepared in commercial quantities and at a fairly economic figure. The process was to prepare a double fluoride of potassium and columbium (potassium columbium oxy-fluoride) from the residues of tantalum extraction processes, and, after purifying this compound and dehydrating it, to electrolyse it when in a fused condition. An electrolytic metallic powder was obtained, which was subsequently pressed and sintered into coherent metallic bars.

More recently, however, an alternative method of columbium production has been devised. Columbium oxide is prepared in a state of high purity. It is mixed with pure carbon and heated at a very high temperature in an electric furnace so that a well-defined mixture of columbium carbide and columbium oxide is produced. This is cooled down, repowdered, pressed into bars or rods and heated in a resistor tube in a vacuum furnace. At a temperature of above 1,800 deg. C. carbon monoxide gas is evolved from the mixture. When the evolution of this gas begins, the temperature of the mass is raised still higher. A steely-grey columbium metal is thereby obtained.

For its final purification, the metal thus prepared is reduced to powder, pressed and sintered at a high temperature in a vacuum furnace. It was in this manner that a quantity of extremely pure columbium metal for use in World War Two was manufactured.

In many respects, columbium is akin to tantalum in its physical and chemical properties. The appearance of the two metals is the same. Their reactions are similar, too.

Industrially, the applications of columbium have necessarily been restricted on account of its scarcity, and because it has not hitherto been obtainable in a very pure condition. However, columbium is not intrinsically a very scarce metal; it occurs in many minerals apart from those of the tantalum group, although, in such instances, production problems arise from lack of methods of extracting it economically from such low-content minerals. If columbium can ultimately be obtained in quantity from such supply sources it will, undoubtedly, be found to be a metal of many unique uses.

A Surgical Metal

Consider, for instance, the fact that columbium metal, like tantalum, is "biologically acceptable." By this term is meant the fact that columbium is completely non-irritating to living flesh and tissue. If you get a fragment of iron or lead under your skin it acts as a foreign body and usually sets up an irritation. Not so columbium. The bodily tissues and the flesh actually adhere to the metal and grow over it in much the same way as ivy clings to and grows over a supporting wall. By using columbium gauze, flesh cells will grow *through* the mass of metal without the slightest irritation being set up.

Here, therefore, is a new and a valuable adjunct to repair-surgery. Injuries to the skull can now be repaired by means of plates of tantalum or columbium. Columbium foil can be used for permanently binding up nerve-repairs. Columbium and tantalum gauzes can be used as "bridges" in areas in which large amounts of flesh have had to be removed, the tissue afterwards growing back over the reinforcing gauze which remains, without detriment, in position for the remainder of the individual's lifetime. There seems, indeed, to be no limit to the utility of columbium as a repair metal for the modern surgeon's use.

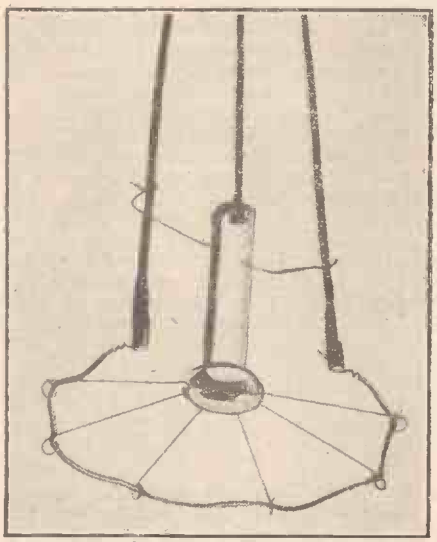
Columbium carbide is one of the hardest of known materials. With or without associated tantalum carbide it can be used for the machining of hard steel. Even dies and special wear-resisting parts for industrial purposes have been produced in America from columbium carbide.

The subject of the columbium and related carbides is still under active investigation both in America and in this country, and developments are to be expected as soon as the empirical knowledge of their behaviour has been finally reduced to a sound theoretical basis.

In another direction—that of the aluminium industry—it has been found that columbium may be used as a very active grain refiner for aluminium alloys, thereby enabling tough and very enduring alloys to be produced.

Acid Resistant

Like tantalum, columbium is a very acid-resistant metal. This property it is capable of communicating to other metals with which



The filament assembly of a modern electric lamp. Will a columbium alloy or a columbium carbide ever be able to oust the present supremacy of the tungsten coiled filament, as shown in this illustration?

it is alloyed, a case in point being a peculiar species of acid-resisting steel wire which was produced for war purposes. It is particularly useful in resisting hydrofluoric acid, a liquid so potent that it will dissolve glass and porcelain, and which few other metals, apart from platinum, are capable of withstanding.

Further Applications

There is also talk of introducing columbium metal into wireless valves, electrical tubes and similar devices, in view of its general toughness and resistance to physical attack at elevated temperatures. All such applications, however, belong to the future and not to the present. Indeed, columbium stands, so far as its possible general usages are concerned, more as a metal of the future than of the present.

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New Crystal Valve Receiver

Particulars of the G.E.C. Radio Receiver Giving Loudspeaker Output and Using Germanium Crystal Triodes

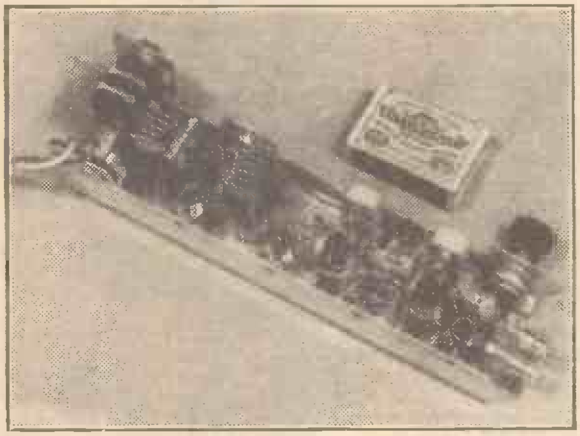


Fig. 1.—The G.E.C. experimental crystal valve midget receiver. Comparison with the matchbox gives a good idea of its size.

THE G.E.C. has built a simple experimental radio receiver which gives acceptable loudspeaker output using germanium triodes instead of the usual thermionic valves.

Germanium triodes are a development of the crystal detectors used in the early days of radio, and have the same essential feature of a metallic crystal to which contact is made by means of points. The early crystal detectors were very unstable and erratic and have been completely superseded by the development of germanium crystal diodes, which the G.E.C. produces for television receivers, modern crystal receivers and other technical applications.

Experimental work in connection with these diodes has led to the development of the G.E.C. germanium triode, and it is now possible to design a radio receiver which is stable, capable of withstanding severe mechanical shock and at the same time able to produce loudspeaker output with a low power consumption.

Important Points

Three points must, however, be borne in mind in connection with the present receiver: (1) It is only experimental and the industrial production of such a set is unlikely for some time; (2) although no filament heating power is required for the set it is not independent of electrical supplies, and it still needs an H.T. battery (or an equivalent mains unit, which may utilise germanium diodes as rectifiers); (3) the crystal triode is not likely to replace the existing thermionic valves of an ordinary radio receiver at present. Nevertheless, the germanium triode is an important development in the field of electronics, and it seems likely that the first applications will include electronic computing machines and lightweight radio sets.

To the question, "What is the advantage of a crystal triode if an H.T. battery is still necessary?" there is a fourfold answer: There is no filament or cathode to be heated; the unit is extremely robust; it is very compact and also very long-lived. Filament or cathode heating may not seem of great importance to the layman, but in some receivers, for instance portables, the necessary equipment for it can add appreciably to the weight of the set. In apparatus where thousands of valves are employed, e.g., computing machines, the amount of power required for filament heating and the corresponding amount of useless heat developed may be very substantial.

A battery is necessary in an "all-crystal" receiver because it is impossible (at least in the realm of science) to obtain "something for nothing." If power, in the form of a large volume of sound, is to be obtained from the loudspeaker, at least an equal amount of power must be supplied to the apparatus. In practice more must always be supplied on account of internal losses, but this wastage, because there is no filament to heat, is relatively low.

Technical Notes

The experimental receiver (see Fig. 1) is of comparatively simple design and uses a two-circuit tuner to obtain reasonable selectivity, and five G.E.C. germanium triodes in the R.F. amplifying, detector and push-pull A.F. output stages, which results in a receiver of sensitivity suitable for local station reception, and an audio output of about 50 milliwatts. A more sensitive and selective receiver can, of course, be made by using more germanium triodes, for example, in a superheterodyne circuit, where a germanium triode oscillator would be employed.

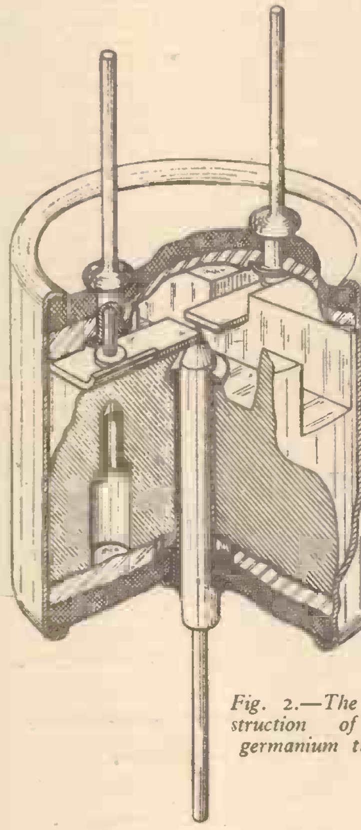


Fig. 2.—The construction of the germanium triode.

The total power consumption of the present receiver is about 10 mA at 50 volts, from which it will be seen that about 10 per cent. of the total power input is utilised as loudspeaker output.

The design of the germanium triode is illustrated in Fig. 2, and is of a form which can be manufactured relatively easily. It consists of two phosphor-bronze blades 0.003in. thick and 0.04in. wide, supported in a moulded insulator. The gap between the blades is very critical and is obtained by means of a manufacturing technique which involves mounting a single strip across a channel in the moulding and subsequently shearing a gap a few thousandths of an inch wide with a specially designed cutter. The germanium is soldered to the tip of a metal stub and is ground to a point, with an angle of 60 degrees. Then, by inserting the apex of the resulting cone into the gap between the blades, the essential two-point contact is made with the germanium and with a spacing which can be very accurately controlled. The three electrodes are then the two blades and the stub.

Operation

In simple terms, the electrical operation of the triode depends on the fact that if a negative potential is applied to one of the blades (called the "collector") then the current to it can be varied by altering the positive voltage applied to the other blade (called the "emitter"), see Fig. 3. The "emitter" draws appreciable current when positive voltages are applied to it, in contrast to the thermionic valve in which grid *voltage* is the important factor controlling the anode current. In the germanium triode the "emitter" *current* controls the "collector" current, i.e., it is a current-operated device rather than a voltage-operated one.

The characteristics of the germanium triode result in a device of low input impedance (of the order of 500 ohms) and of relatively high output impedance (of the order of 30,000 ohms), and, of course, the associated circuits have to be designed with this in mind.

For an amplifier, a typical operating condition would be: Collector, 1.5 mA at -30 volts, emitter 0.5 mA at $+\frac{1}{4}$ volt, and with proper impedance matching such an amplifier stage will give a power gain of 20-30 db.

Power Output

Due to the limited safe collector current, the power output of a single germanium triode of the present design is about 20 milliwatts, for a tolerable degree of distortion. Oscillators, however, may be made with outputs up to about 100 milliwatts. There is an inherent upper frequency limit for operating the germanium triode, which arises from transit time effects in the germanium. At present this limit is about 10 Mc/s.

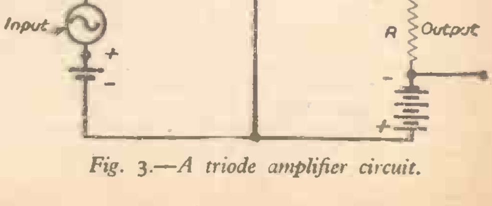


Fig. 3.—A triode amplifier circuit.

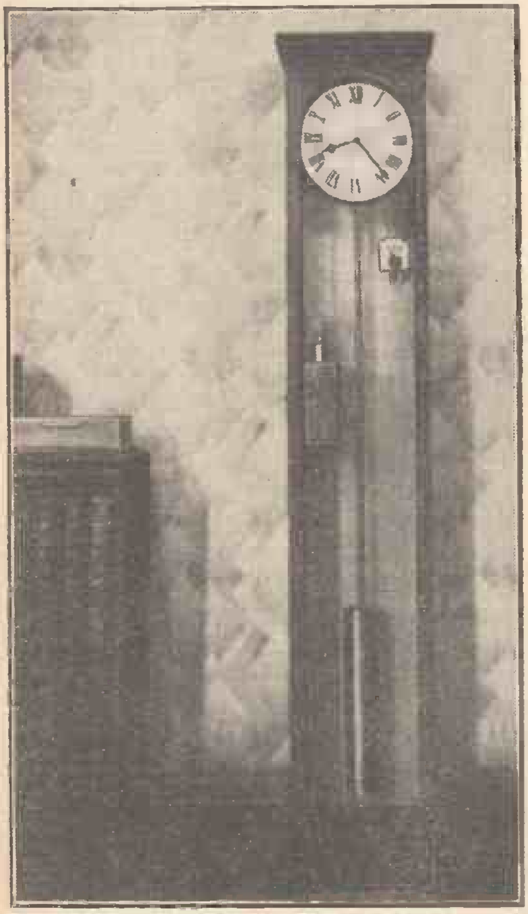
A "Free"-pendul

Constructional Details of a Novel Electric-T

IN the following description of a free pendulum clock, the writer assumes that those who may wish to make it have some rudimentary knowledge of the theory and behaviour of pendulums, though this is not essential.

The ideal pendulum is one that is entirely "free," that is to say, apart from the suspension spring, the pendulum touches nothing during the whole of its oscillation. There are, of course, other considerations which even though the pendulum is free, affect its time-keeping to a very small degree, e.g., circular error—to be truly isochronous, a pendulum should swing in a cycloidal path and not a circular one—but we need not consider these here.

In attaining a free pendulum, the problem is, of course, to keep the pendulum swinging without interfering with it. Also, if the pendulum is required to operate a visual dial, to obtain this mechanical operation without touching the pendulum. It is a fascinating problem and one which, at first sight, appears to be impossible of solution.



The completed clock in its position against a wall.

The following description indicates one way of obtaining a pendulum which does not touch, nor is it touched by, any part of the operating mechanism, and one which will operate an electric impulse dial.

The method of imparting an electric impulse at the lower end of the pendulum is, admittedly, not ideal, but it was the object of the writer to construct a pendulum which was *entirely* untouched at any time. It is possible to adapt the mechanism to be described so that the pendulum is impulsed by a gentle push higher up the pendulum rod at half-minute intervals—the period of the electric impulse—but here we have problems of friction arising which it was desired to eliminate.

The principle of driving the pendulum lies in the use of a photo-electric selenium barrier cell which generates a current when light falls upon its plate. By using the current so generated, an electro-magnetic contacting device, to be described, can be operated to deliver impulses to the pendulum at frequent intervals, thereby maintaining its arc.

General Layout

The general layout of the components is shown in Fig. 1.

A back-board (1), 4ft. 7in. by 8¾in. by ¾in., is screwed to a wall at its top, centre and bottom, and has a base-board (2), 8¾in. by 6in. by ½in., screwed to it at its lower extremity, this in turn being screwed to the floor. A seconds pendulum (3), with a weight bob of 15 lbs., is suspended from the back-board by means of a bracket (4), and has at its lower extremity, an iron armature (5). Secured to the base-board is an electro-magnet (6), over the poles of which the armature (5) swings.

Attached to the back-board on the left-hand side of the pendulum is a wooden box (7) containing a selenium-barrier photo-electric cell (8) fixed horizontally, and a micro-ammeter movement (9) below, adapted so that the needle forms a moving contact. Projecting through the top of the box is a short brass tube (10), in which a 12-volt, 6-watt lamp (11), held vertically in the tube, projects a ray of light on to the photo-cell plate through an aperture in the closed lower end of the tube.

Attached to the pendulum is a brass arm (12), having a small horizontal brass plate or "shutter" (13) at its free end. The arm projects through the side of the box so that the shutter is free to swing to and fro across the aperture in the bottom of the brass tube (10).

A Siemens high-speed relay (14) is fixed to the back-board in any convenient position, e.g., as shown in Fig. 1, and, above this, is impulse relay (15), comprising a revolving contact which completes an electric circuit through the magnet (6) at half-minute intervals.

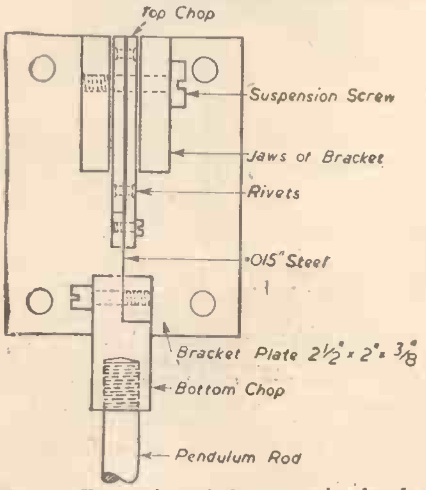


Fig. 3.—Front view of the suspension bracket.

The whole system of relays is operated when light falls upon the photo-cell plate and is released when the source of light is interrupted. In general, therefore, it will be seen that the pendulum itself, and hence the shutter, is the means by which these operations are caused when it is set swinging but without any mechanical contact being made by the pendulum.

The Pendulum

The pendulum (3), is of second's length, i.e., it is 39.125in. from its point of suspension to the *centre* of the weight bob. The pendulum rod consists of mild steel, 5/16in. diameter and 47½in. overall length. It is threaded at its lower end for a distance of 4in. to take a

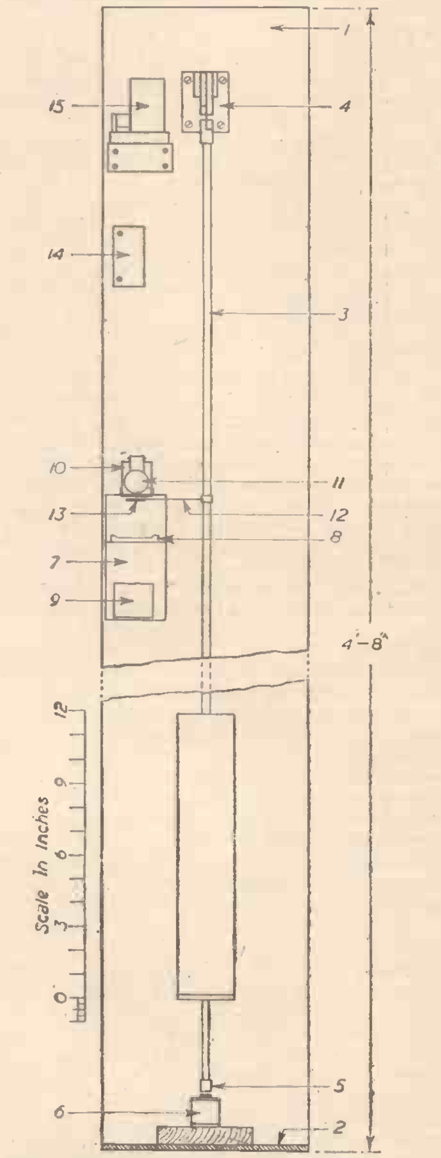


Fig. 1.—General layout of the components of the clock.

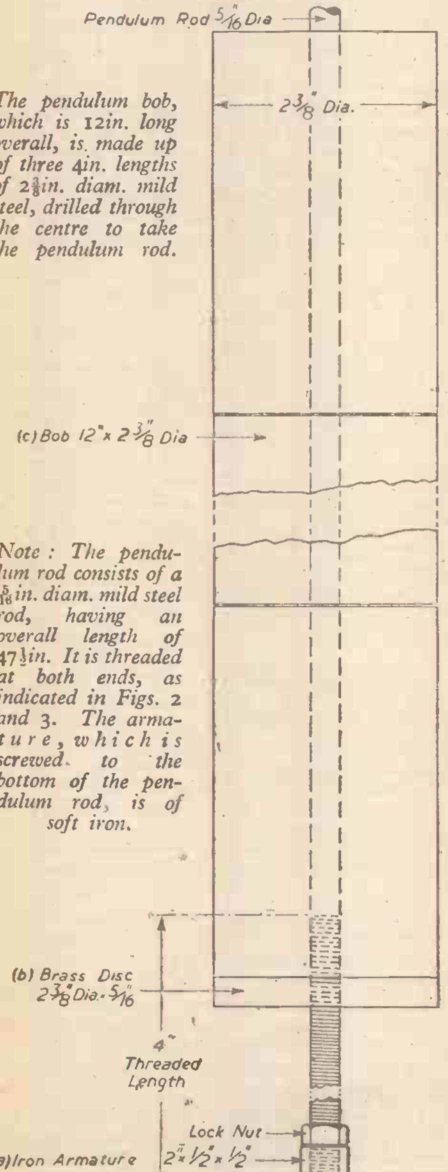
m Electric Clock

ece

By J. M. AUST

soft iron armature, 2in. long by ½in. by ½in., and a brass disc turned to the same diameter as the bob and 5/16in. thick (see Fig. 2). The latter is used to "rate" the pendulum when the clock is going.

The weight bob (c), Fig. 2, is made of mild steel in three sections, each section being turned to a diameter of 2⅜in. and with a 5/16in. hole through its centre. The reason for making the bob in three sections is that it is easier to drill the 5/16in. hole through each length of 4in. than through one length of 12in., the total length of the bob. Further, it is advisable to drill the holes first and then turn each section to the required diameter. This should ensure that the surface of the bob is concentric with the hole. The total weight of the bob is approximately 15lb.



The pendulum bob, which is 12in. long overall, is made up of three 4in. lengths of 2⅜in. diam. mild steel, drilled through the centre to take the pendulum rod.

Note: The pendulum rod consists of a 5/16in. diam. mild steel rod, having an overall length of 47½in. It is threaded at both ends, as indicated in Figs. 2 and 3. The armature, which is screwed to the bottom of the pendulum rod, is of soft iron.

Fig. 2.—Details of the pendulum bob.

The pendulum is suspended at its upper end by a piece of steel spring, .015in. thick, ½in. wide and about 1½in. long. This is held firmly in two clamps, or chops, one of which is screwed to the top of the pendulum rod and the other held firmly between the jaws of a steel bracket screwed to the back-board. The length of steel spring between the clamps is ½in. The horizontal distance from the back-board to the centre of the rod is 2in. It should be noted that the clamp which is held by the bracket should be free to move in a plane at *right-angles* to the back-board so that the pendulum is free to find its plumb-line in that plane. There must, however, be no sideways movement of this clamp.

The method adopted is shown in Fig. 3. No sizes are given as these can be adjusted to suit available materials.

The Impulse Magnet

This is illustrated in Fig. 4, and comprises a double-pole "horseshoe" electro-magnet fixed to a wood base, measuring 4in. × 3in. × ¾in., which has two holes, 5/16in. diameter, to take round head brass screws for fixing the magnet to the base of the clock underneath the pendulum armature; the holes being large enough to allow lateral adjustment of the base. The bobbins are wound with No. 28 s.w.g. enamelled copper wire, the ends of which are taken to two terminals on the base.

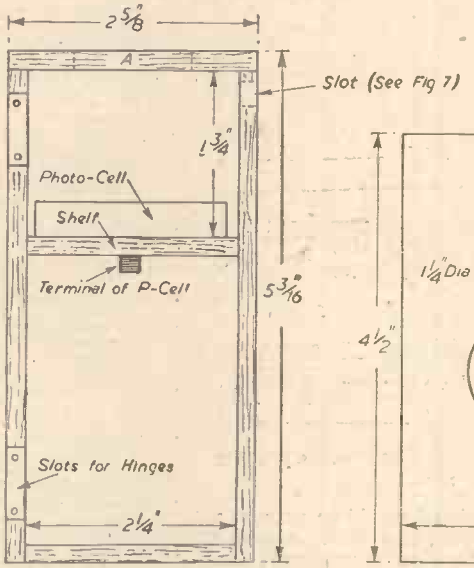


Fig. 5.—Front view of box with door removed.

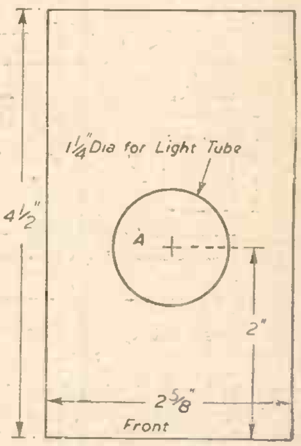


Fig. 6.—Top of box.

Photo-cell Box

This is illustrated in Figs. 5, 6 and 7, and is made from 3/16in., 3-ply wood; the number of pieces and their sizes are as follows:

Back	4 13/16in. × 2¼in.
Sides (two)	5in. × 4½in.
Tops	4½in. × 2⅝in.
Bottom	2¼in. × 4½in.
Door (front)	2⅝in. × 5 13/16in.
Shelf	2¼in. × 4 5/16in.

The back is drilled with two holes at top and bottom for fixing the box to the back-board. The top of the box has a hole cut in it, 1¼in. in diameter, to take the brass tube (10) Fig. 1, in the position shown in Fig. 6.

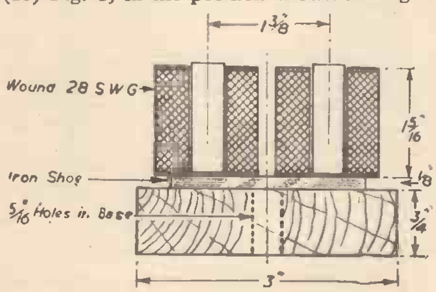


Fig. 4.—Sectional view of the impulse magnet.

The right-hand side of the box has a slot, ¾in. × ¼in., cut in it in the position shown in Fig. 7, to allow the shutter arm to project into the box. The front of the box should be hung to the left-hand side thereof with small brass hinges to form a door.

The components of the box are assembled with ⅜in. gimp pins, or small tacks, and the outside can be given a coat of good varnish stain. The inside of the box is given a coat of black-board paint.

The shelf supporting the photo-cell is fixed inside the box in the position shown in Fig. 5.

The Photo-cell

This is a selenium barrier photo-electric cell, with a rectangular plate, 50 mm. × 37 mm., as supplied by Messrs. G. R. Products, of Brislington, Bristol. The cell is supplied mounted in a frame, 3in. × 2in. × ⅜in., at the back of which are two terminals, being the positive and negative connections of the cell. The shelf of the box, referred to above, is drilled with two holes to take these terminals in a position so that the centre of the photo-cell plate lies directly below the centre of the 1¼in. hole in the top of the box. The photo-cell is fixed horizontally on the shelf and with its length at right-angles to the back of the box.

The Arm and Shutter

These are shown in Fig. 8, and are made from 18 gauge sheet brass. The arm is a strip of brass, 3¾in. long overall and ¼in. wide, one end of which is formed to close round the pendulum rod, and a second short piece of brass is made to form a clip with this end of the arm, the two sections being secured and tightened round the pendulum rod with a 6 B.A. screw and nut, as shown. The plane of the strip when fastened to the pendulum rod will now be vertical and, since the shutter is carried in a horizontal plane, the remainder of the arm must be twisted near the clip screw, as indicated in Fig. 8, so that it is horizontal.

The shutter is practically self-explanatory from the drawing. A piece of brass sheet, 1⅜in. × ⅜in., is made to form a clip over the left end of the arm, as shown at (c), Fig. 8. It should be a sliding fit on the arm to allow for lateral adjustment on the latter.

The Light Tube

This is illustrated in Fig. 9 and consists of a piece of brass tube 1½in. long and 1¼in. outside diameter. Soldered on to one end of the tube is a brass disc, 1¼in. in diameter, with a hole ¼in. in diameter drilled in its centre; this is the "aperture" through which light falls on the photo-cell plate below. Round the circumference of the tube is soldered a brass band, ¼in. wide, in the position shown; this keeps the tube in the correct position when its lower end is inserted in the hole in the top of the box.

The tube should be drilled above the band with a number of holes about $\frac{3}{16}$in. in diameter for ventilation purposes, and the outside of the aperture disc and that part of

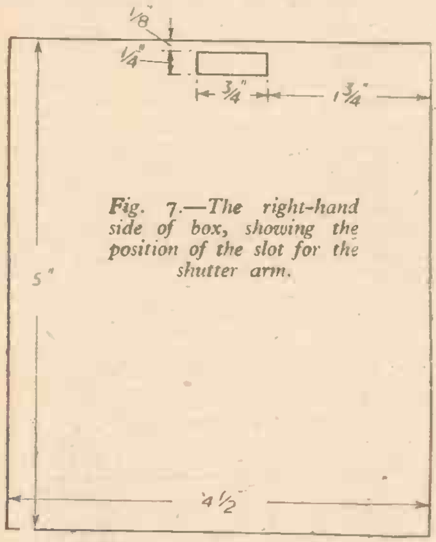


Fig. 7.—The right-hand side of box, showing the position of the slot for the shutter arm.

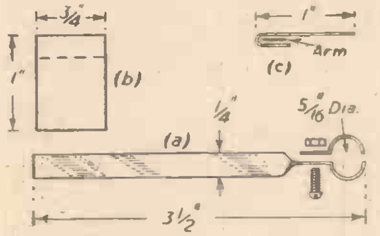


Fig. 8.—Details of the shutter and supporting arm.

the tube below the band should be given two or three coats of blackboard paint, as should also the shutter arm and shutter on both sides. The object of this paint is to prevent reflection and diffraction of light inside the box when the aperture is closed by the shutter.

Position of Arm

The arm is fixed by its clips to the pendulum rod at a point 16in. below the point of suspension, so that when the pendulum is at rest the arm is at right-angles thereto. The brass tube and aperture disc protrude below the under side of the top of the box by about ¼in. The slot in the right-hand side of the box is so positioned that the arm carrying the shutter may be adjusted to hold the latter in close proximity to the aperture above it. It will be found that, as the arm is held rigidly on the pendulum rod, the shutter will have a slight vertical movement as it swings to and fro. This does not, however, affect in any way the proper working of the photo-cell. The best position of the shutter can be found by experiment.

The point at which the shutter reveals the light through the aperture and again obscures it is explained fully later on.

The Lamp and Holder

The lamp is a 12-volt 6-watt, double-pole, car side lamp and is supplied with 12 volts at about ½ amp. The lamp is inserted in a small two-pin "bayonet" adaptor and the whole is held vertically so that the lamp hangs downwards inside the tube with its glass bulb centred on and just touching the sides of the ¼in. aperture in the bottom of the tube. The lamp holder can be supported by means of a wire clip resting on the top of the tube and this can be adjusted so that the maximum amount of light falls on the plate of the photo-cell. It does not matter if the frame of the photo-cell is also illuminated, but the aperture must not exceed ¼in. in diameter.

For steadiness of light it is advisable to use a 12-volt accumulator kept constantly charged through a rectifier and transformer from the mains. If A.C. mains are used direct from a transformer, fluctuation of power will vary the intensity of light falling on the P.C. plate and hence the timing of the mechanism will be affected.

PHOTO-ELECTRIC FREE PENDULUM CLOCK

LIST OF PARTS

No.	Material	Part	Quantity	Remarks
1	Mild steel rod, 47½in. × 5/16in. dia.	Pendulum rod	1	
2	Mild steel, 4in. × 2⅜in. dia.	Weight bob	3	
3	Soft iron, 2in. × ½in. × ½in.	Pendulum armature	1	
4	Spring steel, .015 in. × 1½in. × ⅜in. wide	Pendulum suspension	1	
5	Steel bracket, 2in. × 2½in. × ⅜in. (plate)	Suspension bracket	1	Jaws should hold pendulum 2in. from backboard.
6	Mild steel, ⅛in. × 3/16in.; length of 5in.	Top chop	2	
7	Mild steel, 1¼in. × ½in. × ⅜in.	Bottom chop	1	
8	Brass disc, 5/16in. × 2⅜in. dia.	Rating disc	1	
9	Horseshoe electromagnet	Impulse magnet	1	See drawing.
10	Selenium barrier photo-electric cell. Plate 50 mm. × 37 mm.		1	
11	Brass tube, 1½in. × 1¼in. dia.	Light tube	1	
12	Brass plate, 16-18 gauge	Impulse relay parts, arm and shutter		See drawings.
13	1 sq. ft. 3/16 in. 3-ply wood	Photo-cell box		
14	Micro-ammeter movement. Reading 0-500 micro-amps.	Photo-cell relay	1	
15	12 volt 6 watt car side lamp (double pole)	Photo-cell light source	1	
16	Siemens sensitive high-speed relay. Total res: 3,400 ohms	Relay from P.C. relay to impulse relay	1	
17	Siemens relay. Total res.: 70 ohms	Dial relay	1	
18	15-tooth clock escape wheel ½in. diameter approx.	Impulse relay wheel	1	Can be left mounted on arbor (see No. 21).
19	12-gauge brass wire	(a) Revolving contact arm. (b) Back-stop support		
20	Strip silver, 3/32 in. × 3/32in. × 1/16in. approx.	Impulse relay contacts	2	
21	Clock arbors 1½ in. long approx.	Impulse wheel and rocker arm spindles	2	
22	Watch main-springs (a) 3/32 in. width	Rocker-arm return spring	1	A certain amount of experiment is necessary with these springs to determine proper strength.
	(b) 1/16in. width	Fixed contact spring	1	
23	.015in. steel × ⅛in. wide. Piece 1½in. long approx.	Gathering pawl and back-stop		
24	6 B.A. screws 6 B.A. nuts	Rocker-arm stops	2 4	
25	Soft iron, ¼in. × 5/16in. dia.	Rocker-arm armature	1	
26	Soft iron, 1⅜in. × 5/16in. diam.	Impulse relay magnet core	1	Bobbin ends made from 3/16in. 3-ply.
27	Hardwood, 4ft. 7in. × 8⅜in. × ⅞in.	Back-board	1	
28	Steel or brass plate, 8in. diam.	Dial supporting plate	1	
29	(a) Brass brackets	Dial plate supports	2	
	(b) Brass clips	To take (a)	2	Screwed to clock case sides.

The Micro-ammeter Relay

This is made from a micro-ammeter movement reading 0-500 micro-amps. The current generated by the photo-cell when the light falls upon it should be sufficient to move the needle of the movement across the whole width of the dial with a fair momentum.

Making the contacts requires great care and is done as follows. The needle of the movement is cut off carefully until the remainder is about ½in. long. Near the end of this "stump" is clipped a small piece of very thin sheet silver—the smaller and lighter the better. This operation can best be accomplished by using a pair of stamp collector's tweezers.

The arrangement of the contacts is shown diagrammatically in Fig. 10. The fixed contact is a piece of thin sheet silver, about $\frac{5}{16}$in. long by $\frac{3}{32}$in. wide, and is screwed to the end of a small wood insulating block which itself is screwed to the frame of the movement. The size and position of this block will depend on the adaptability of the movement frame, but it is desirable to arrange the block so that the position of its contact can be varied in relation to the needle contact by turning the block about its screw. It will be seen that the needle contact strikes the edge of the fixed contact strip, and this assists in a good contact being made.

One of the contact leads can be taken from the frame of the movement, since the needle

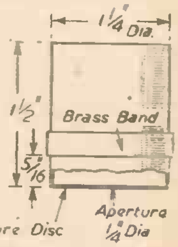


Fig. 9.—Part-sectional view of the light tube showing the brass supporting band.

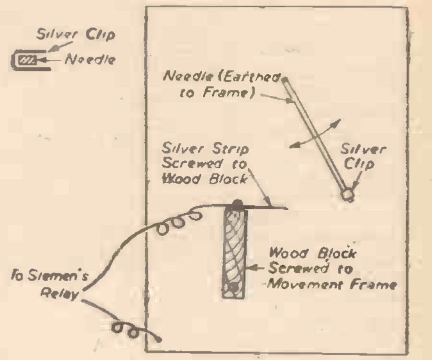


Fig. 10.—Diagram of the sensitive micro-ammeter relay.

is earthed thereto, and the other from the fixed contact itself, which, of course, must be insulated from the frame. The whole movement is housed in the lower compartment of the box so that the needle moves in a horizontal plane; this is to reduce varying gravitational interference with the needle, since smooth working thereof is essential.

The Siemens Relay

This is a standard Siemens high-speed relay with a total coil resistance of 3,400 ohms, of which one set of "make and break" contacts only are used, i.e. those engaging when the magnet is energised.

(To be concluded.)

Facts About Standardisation

How Waste is Being Saved by Standardisation at Home and Abroad

By Professor A. M. LOW

DURING the war the difference between the British and American standards screw threads is estimated to have cost the two nations £25 millions. If both countries had had the same standards there would have been immense savings all along the production line. I give this striking figure, quoted in an official document, to show what can be achieved by standardisation.

Standardisation is a word that has acquired an unpleasant association, smacking of everyone being forced to buy the same kind of soap, live in the same kind of house, eat the same kind of bread and generally be allowed no freedom of choice in the everyday things of life. But standardisation, in the technical sense, has really nothing to do with this. It means reducing the variety of patterns of things which have one and the same purpose, and concentrating manufacture on the standardised sizes. The convenience of this method is obvious to anyone who has wanted a spare nut and bolt, or even a pound of nails; the choice of nails in every imaginable size from half an inch to three inches would not only be bewildering but extremely wasteful in manufacture, since a different machine setting would be required to produce each size.

This is what the engineer calls "dimensional standardisation." Standardisation may also be "functional," that is to say, agreement about certain standards of performance or quality may be decided. Standardisation may be on composition, as it is with food and drugs, so that the consumer knows what he is getting; or it may be a matter of performance, as with a steel girder, where the engineer will be certain that it will bear certain stresses. The two kinds of standardisation may also be combined again as in a girder, where both sizes and performance may be standardised.

Steel and iron sections are a good example to take, because they were among the first things to be standardised in Britain. Fifty years ago, perhaps as many as a thousand different sections were being produced. After consultation it was found possible to reduce the number to 175 standard specifications to cover every possible need. There were 75 different kinds of tram rails. Standardisation enables them to be reduced to five. Not so long ago investigation showed that no less than 3,000 different types and sizes of colliery tub wheels were being used in British mines. British standards for 25 were found to cover every possible purpose.

And so it has been with one industry after another when the possibilities of standardisation have been investigated. Not long ago the most infinite variety of gear wheels in clockwork meant the production of an equal variety of cutters. One manufacturer alone was asked to make 800 different types of the same part. Standardisation enables the numbers—covering the same needs—to be reduced to 11.

Post-war Saving by Standardisation

After the last war, the United States conducted an investigation into the saving that could be achieved by standardisation. They found that there were 98 different sizes of roofing slates, and after discussion by all parties interested, it was agreed that 48 would serve. There were 67 varieties of hospital beds manufactured—and it was decided that four would cover the same needs. There were eleven different brick sizes, and this was cut to five. In general, it was found that the "avoidable waste" due to lack of standardisation, mostly unnecessary multiplicity of sizes, varied between 30 and 60 per cent.

Now we have been doing something of the same kind in Britain since the stress of war. It is probably a surprise to most people people to learn that before the war we had 680 different kinds of windows and several hundred different kinds of baths. The production of this diversity meant waste.

In other cases, unnecessary variations means inconvenience. There are, I believe, about 800 different types of radio valves with an almost infinite variety of fittings. People who have had to get their sets altered to take some valve with the same performance but a different fitting will appreciate the benefits that could come if the radio industry were able still further to reduce the number of types.

To-day we take some forms of standardisation for granted. The "battle of gauges" on the railways seems fantastic until we remember the variety of voltages of our electric supplies to-day, slowly being standardised at immense cost when a little forethought would have shown the enormous advantages of having the same type of voltage all over the country.

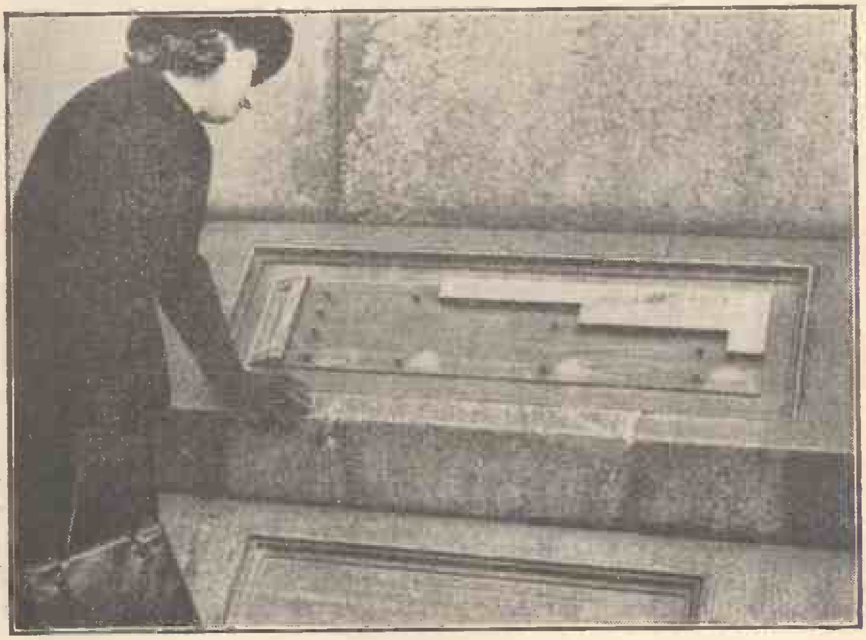
Further Benefits

The benefits of standardisation accrue to manufacturer, distributor and consumer. In a nutshell, the manufacturer producing less variety saves by having fewer machines, requiring less factory space, needing smaller technical and inspection staff and in carrying smaller stocks of raw materials. The distributor saves by requiring less capital locked up in stock and less storage space—imagine the storage and stock problems of a radio dealer who was determined to be able to supply any customer with any part for which he asked! The consumer benefits by reduced prices and convenience in being able to get replacements.

In the case of one shoe manufacturer who determined to do a little standardisation of his own, he found that by reducing his output from 2,500 different sizes and styles to the 100 post popular, he could save 25 per cent. on overheads, 30 per cent. on the cost of production, and 27 per cent. in the cost to the consumer. Incidentally, his turnover went up by 50 per cent., and if he lost a few customers who required virtually a "hand made" article, he gained many others by the reduction in price.

The B.S. Institution

The British Standards Institution which grew out of a committee which met to standardise steel sections in the '90s has done and continues to do, a tremendous amount of work. The number of new standards agreed averaged about 90 a year before the war, and the total number of British Standards now exceeds 1,325. I have used the word "agreed" deliberately. The standards are not—except in certain cases like food and drugs—enforced. The basis of organisation is committees representing particular industries—there are about 38—while the producer, user and distributor are represented. Each committee considers the desirable standards in its own industry, and where other industries are affected the standards are prepared by joint committees. The Institution received government aid for its national work, but is not government controlled. This is one of the secrets of its success. Standardisation in accord with the needs of industry, fulfilling a generally recognised want, taking into consideration the interest of producer and consumer, maintained by industry as a whole, and quite independent, is a very different thing from standardisation by the State. It is important, I think, that we should have a minimum of standardisation in the things through which we express our personality. The consumer should be given the widest possible choice



The Imperial Standards of Length in Trafalgar Square.

of really different articles—and it is important that the decision on what he might want should be made by the manufacturers, chambers of commerce and consumers and not by civil servants.

International Standardisation

Britain has an excellent organisation for securing standardisation. The next stage, in a world where we hope trade will be freer and British exports will reach every country, is to secure international standardisation. The waste resulting from its lack is excellently shown by the case of the screws I have mentioned. In fact, there have been a number of meetings of U.S., Canadian and British experts and it seems as if full agreement may come out of the war's experiences. Every draft British standard is reviewed by each of the Dominions and changes which might make it more acceptable are discussed. The result has been agreement on a number of uniform specifications. The British Standards Institution maintains contact with every other national standardising body. In Argentine there is a special committee that co-operates with the national standards organisation. Translations of British standards are published in countries where they may be useful, such as in Turkey. The Institution is a member of the International Standards Association, and although work in the international field has been retarded, there are now far greater possibilities. In overseas trade it is, perhaps, necessary to tread warily—variations in traditional practice, national custom and even religion, may result in prejudices against certain "standards" which while "unreasonable" from a purely scientific point of view have to be taken into consideration when the other man is paying the bill!

Studies in Electricity and Magnetism

Power and Energy : R.M.S. Value : Inductance : Voltage Dropping

WHILE there is more to discuss on circuits, I must give some attention to other important quantities of which no mention has yet been made. Thus, we have made some power calculations here and there, but we have not inquired into the meanings of such quantities as *watts*, and *watt-hours*.

What is *power*? Is it the same as *energy*? In what circumstances should we consider one, but not the other?

Mechanically, it is easy to see the distinction. If you lift a pound weight 1ft., you are performing 1ft.-lb. of "work," no matter whether the performance takes two seconds, two minutes, or two years. The *energy* expended is a ft.-lb.; *time* has no bearing on the figure.

But your *rate* of working obviously depends very much upon the time; power is the *rate of expenditure* of energy, and, to take a different illustration, you are working at very different rates when you walk and when you run uphill.

If with the aid of a machine you lift 550lb. 1ft. in one second, or 55lb. over 10ft., or, in general, work at a rate of 33,000 ft.-lb. per minute, energy is expended at a rate of 1 *horse-power*. Whether or not there ever has been a real horse capable of such a performance is beside the point. A hypothetical "ideal" horse would, in theory, work at precisely this rate.

So much for the mechanical aspects, which should always be kept in mind.

Watts and Kilowatts

In electric circuits the fundamental unit of work is the *erg*. All these are really mechanical units, and we need not trouble to inquire how much work is represented by an *erg*. It is very small. I read somewhere it is about the energy expended by a fly in one flap of its wings!

A larger unit, the *joule*, is equivalent to 10,000,000 (10^7) ergs. A current of one ampere passed through a resistance of one ohm for one second represents one joule of energy, from which you should be able to estimate electrically how really small is an erg.

Well, a *power* of one watt denotes energy expended at a rate of one joule, or 10^7 ergs *per second*. The power in the above resistance is one watt, but the element of time is a little confusing to many students in estimating energy and power.

If one ampere flows in one ohm for one second, the energy is one joule, and the power (the *rate* of energy expenditure) is one joule/sec. = one watt; if one ampere flows in one ohm for ½ sec., the energy is ½ joule, but the power is still one watt, since, rate of energy expenditure = energy ÷ time = ½ joule/½ sec. = 1 joule/sec.

(*Continued from page 27, October issue.*)

Let us take other illustrations. If a short-circuit occurs on a heavy-current 200v. circuit, and the current reaches 10,000 amperes for 1/10th sec., the Power = 2,000,000 watts (= 2,000 kW. = 2 mega-watts)—an enormous figure which may possibly result in widespread damage in spite of the short interval of time.

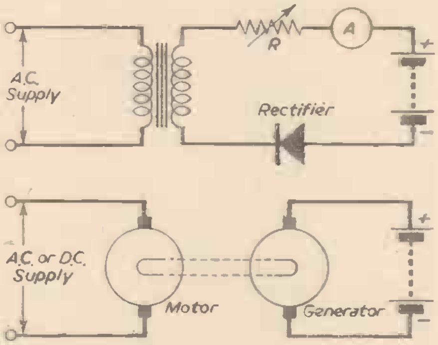


Fig. 1.—Economical methods of accumulator charging.

But, if we ask: what is the *energy* in the short-circuit? we must take account of the time-interval. The energy is joules = watts × seconds = 200,000. Reckoned in *kilowatt-hours*, however, 0.1 sec. = 1/36,000th of an hour, and B.O.T. Units = kW. × hours = 2,000 × 1/36,000 = 1/18th kWH.

For the time it lasts, the short represents an enormous *rate* of expenditure, but the total energy will be small, as registered on an electricity meter.

Watt-hours and kWH

We have just used kWH. The joule is altogether too small and inconvenient a unit for specifying the energy quantities generally used in engineering. A more useful unit is adopted by taking the hour as time basis, then specifying large powers in kilowatts (thousands of watts) instead of watts.

The kWH is the Board of Trade unit registered by electricity meters. Watts are multiplied by Time in the integrating mechanism of the meter. Hence a supply meter is correctly described as an *energy* meter—not a "power," or "watt-meter." The supply authority is precise in its use of technical terms in sending you a bill for "Electrical Energy."

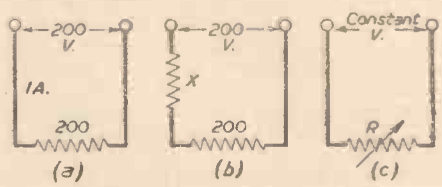


Fig. 2.—In (c), the power will clearly not be proportional to (Current)² if R is varied.

Remembering that 1 kW = 1,000 watts, it is easy to estimate how long various devices will take to register a unit on the meter.

A 60-watt lamp takes 0.06 kW. per hour, or will consume 1 kWH. in approximately 1,000/60 = 17 hours; a 100-watt lamp consumes a unit in 1,000/100 = 10 hours; a 2 kW. fire, however, takes 2 kW. every hour = 2 kWH. = 2 B.O.T. units every hour; it costs approximately 4d. an hour to run, if energy is supplied for heating at 2d. a unit.

Ampere-hours

Consider another instructive estimate. How much electrical energy is used to charge a 2-volt, 60 ampere-hour accumulator?

Here, volts × ampere-hours = watt-hours. If the accumulator was 100 per cent. efficient, the energy = 2 × 60 = 120 WH. = 0.12 kWH. If we assume 20 per cent. loss, the figure works out to 0.12/0.8 = 0.15 kWH. Charged off a heating circuit at 2d. a unit, the total cost amounts to 0.3d.

At least, this is the cost of the actual amount of energy used for charging. But if you insert lamps or resistances to drop volts, their consumption will be many times the energy utilised. Economical charging requires the use of a transformer or motor-generator (Fig. 1)—if there is enough work to justify it—when the overall figure for our 2v. cell would still work out well below 1 kWH, after including the losses in these devices.

The Square-law of Power

What is frequently lost sight of in problems is that:—

$$\text{Power} \propto (\text{Current})^2, \text{ or } (\text{Voltage})^2,$$

and therefore, Current or Voltage $\propto \sqrt{\text{Power}}$.

Fundamentally, power in watts = volts × amperes. If you pass twice the current through a given resistance, you will need twice the voltage to do so, or the current will set up twice the p.d. or "drop." Twice the voltage × twice the current = 4 × the power, hence the "square" rule.

Conversely, if you wanted to double the power (or the heat) in a given resistance, you would need, not twice the previous current or voltage; that gives four times the power. The answer is $\sqrt{2}$ times = 1.414 times.

This type of problem is apt to be troublesome. In Fig. 2a we have a resistance of 200 ohms connected across 200 volts. The current = 200/200 = 1 a., and the power =

$200 \times 1 = 200$ watts. Heat is developed in the element in direct proportion to the power dissipated.

Now, suppose in an examination problem you were asked: "In what ratio will the heat be reduced if another resistance of 200 ohms is added in series?"

This is easy, because you can do the arithmetic over again, find that the current is ½-amp., and the power 50 watts = ¼ of 200W. The heat developed will be reduced in the same proportion 1 : 4. But using simple ratios, many forget the square-root rule, or get queer answers by writing equations.

Suppose the problem was a little more involved: "What value resistance should be put in series to reduce the heat in the ratio of 4/5?" (Fig. 2b.)

The power is reduced in the ratio of 4 : 5—or 0.8 of the original power. Therefore the current in the circuit must be decreased in the ratio $\sqrt{0.8} = 0.894$ of the previous current. Therefore the total circuit resistance must be $1/0.894 = 1.118$ times as great, or we require extra resistance of $0.118 \times 200 = 23.6$ ohms.

Examples

When discussing *maximum power*, I mentioned cases where power is simply proportional to the current, not $(\text{current})^2$.

Students sometimes fall for the "square" rule in problems where a *variable resistance* is connected across a *constant voltage* (Fig. 2c). If the voltage were varied, power ∝ $(\text{voltage})^2$, and $(\text{current})^2$; but since we have a constant voltage, the rule obviously cannot apply.

The current will increase as we reduce resistance. But watts = volts × amperes, and with the volts constant the watts will be directly proportional to current—twice the current will give twice the power, not four times.

Where a battery or "generator" has appreciable internal resistance r, Fig. 3, the terminal volts will fall as we decrease the external resistance R from some large value—the current also increasing. Here, as previously explained, we have a maximum power condition when R = r.

Theoretically, it is true to say there is a "maximum power" condition for every source of supply of internal resistance r—for example, a generator. It is of no practical importance there, because the terminal voltage is sensibly constant for all loads within the capacity of a generator.

Again, inserting resistance in some circuits cannot appreciably alter the current. Thus, in the motor circuit, Fig. 4, the resistance will drop the speed, but the armature will take a current to suit its mechanical load requirements; the drop in speed will cause a reduction in the back e.m.f. generated, automatically giving a larger resultant (or effective) voltage to overcome resistance.

One other small point about handling figures in power calculations. Suppose a supply voltage increases five per cent. What percentage will the power increase? The square-law applies, and we should write: Power ∝ $(1.05)^2$ ∝ 1.1, i.e., a power increase of 0.1 in 1.0 = 10 per cent.

A.C. Power

How are we to specify power when the current is *varying all the time*, and reversing at periodic intervals?

The alternating-current cycle, Fig. 5a, represents such a quantity. If passed through a resistance R ohms, the power will be *different at every instant*, reaching a maximum, or *peak instantaneous* value—for a fleeting instant—when the current is at its positive and negative peaks, Ip and —Ip.

The peak instantaneous power = I^2pR, remembering that the square of a negative quantity (—Ip) is also positive—obviously the heat generated in a resistance does not depend upon current-direction. (See power curve, Fig. 5b.)

But if we put an A.C. ammeter and voltmeter in the circuit, and multiplied their readings, the watts figure thus obtained would not be the "peak power"—as previously stated the peak is but an "instant" in a cycle, entitled to no more consideration than a large number of similar instants.

Suppose Ip = 1.0A, R = 10 ohms. The maximum peak power = 10 watts. The power is truly 10 watts for this infinitesimal instant. But, using A.C. instruments, we should find a

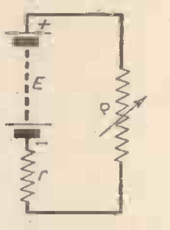


Fig. 3. — A circuit where we get a "maximum power" condition — previously considered in detail.

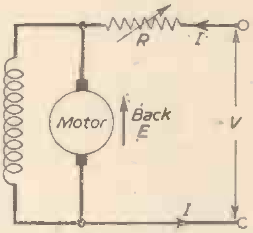


Fig. 4.—Resistance R will make no appreciable difference to the current, but will vary the speed of the motor. The motor takes a current according to its load requirements.

power of exactly half this, 50 watts—if the A.C. cycle is of true *sine* shape.

For other wave-shapes, such as Fig. 5c, and Fig. 5d, we might discover the power is more, or less, than 50W.

In every case, the heat developed in the resistance will correspond to an *average power*—the power values at all instants *averaged over the cycle*. For a sine-wave, this is *one-half of the maximum power*, i.e.,

Mean Power = $\frac{1}{2}I^2pR$.

In Fig. 5c the average will be greater than ½, and in Fig. 5d less than ½. It follows

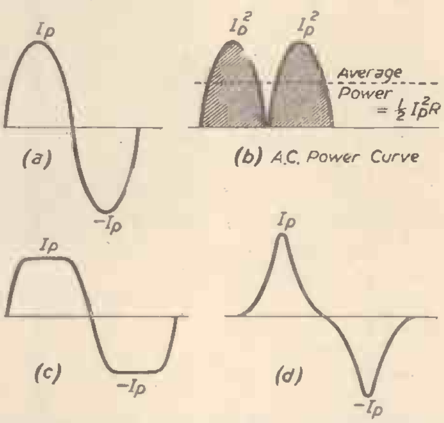


Fig. 5.—Some A.C. waveforms. With a pure sine wave, (b) shows the power curve obtained on squaring all the current values throughout a cycle—the square of negative values becomes positive, and the Average Power = ½ × Peak Power.

from what we said about current, or voltage ∝ √power, that A.C. voltmeters and ammeters register *effective* values—voltage or current values equivalent to the mean power developed.

"R.M.S. Value"

Another name for this is *virtual*, or *root-mean-square* value.

Since, with sine-wave, the mean power is ½ the peak power, the corresponding virtual current (or voltage) is $\sqrt{\frac{1}{2}} = 0.707$ of the peak current.

Suppose, in Fig. 5c, we found the power to be 60 watts = 0.6 (peak power). Then, the effective current or voltage registered by A.C. instruments would be, $\sqrt{0.6} = 0.775$ of the maximum peak values. If, in Fig. 5d, we found that the mean power is 40 watts = 0.4 (peak power), the ratio, virtual current/maximum current = $\sqrt{0.4} = 0.632$—always remembering that the same applies to alternating voltages.

This should make it perfectly clear that effective values are related to the average power developed. In standard electrical engineering theory, a sine-shape is always assumed, hence the factor 0.707.

The complicated sounding term, *root-mean-square*, summarises the following reasoning:—

Power ∝ $(\text{current})^2$; therefore, if i = the current at *any point* in a cycle (an instantaneous value), the power in a resistance R *at that instant* is i^2R watts; similarly for all other instants throughout the cycle; hence the nett power, or the mean power, is proportional to the mean of all such quantities as i^2 over a full cycle—the *mean-square* value. Finally, the instrument scale is calibrated to indicate the square-root of this "mean square," i.e., the actual value of current.

Another way of looking at the matter is in terms of the "heating value" of an alternating current. If of sine waveform, it will develop in a resistance a quantity of heat exactly the same as would be developed by a steady (D.C.) current of 0.707 of the peak value; in Fig. 5c the heating effect corresponds to a steady current of 0.775 the peak; in Fig. 5d 0.632 the peak; and so forth.

Whenever you meet the terms, R.M.S., effective or virtual, A.C. values, think of the *average power* produced by a current which rapidly passes through a series of values, including zero.

More About "Inductance"

We have already considered inductive effects which occur in D.C. circuits: the slow growth of current, and the large e.m.f., which may be self-induced on breaking a circuit suddenly.

But the term *inductance* has to be defined. As you may know, inductance is measured in *Henrys*—or millihenries (mH.), or microhenries (μH.), for air-core coils, or coils of few turns on an iron core. It is denoted by "L."

Now, we must differentiate between inductance and its effect—*induction* of e.m.fs.

We may have a coil of L = one Henry. If we vary a current rapidly, we shall get a large induced e.m.f.; if we cause a slow change of current, the e.m.f. will be proportionally less.

You see, the induct*ance* (L) is not altered. It remains 1.0H., no matter at what rate the current is changing. But the induct-*ion*—the induced e.m.f.—is in direct proportion to the rate of change.

As long as we do not have an iron core of variable permeability to complicate things, the *ratio*:

$$\frac{\text{Induced E.M.F.}}{\text{Rate of change of current}} = \text{A constant.} = \text{L.}$$

Thus, in the one Henry coil, if we vary the current one ampere in one second, one volt will be self induced. If, in the same coil, we switched-off one ampere in 0.01 sec., that is a *rate* of $1/0.01 = 100$ amperes per sec.; the induced e.m.f. will be 100v. But the ratio,

$$\frac{\text{100v.}}{\text{100 a.p.s.}} = 1 \text{ H.},$$

the inductance is *independent of the rate of change of the current, or of the self-induced e.m.f. resulting therefrom.*

We will look at the question from a magnetic viewpoint in the concluding article.

(*To be concluded*)

THE WORLD OF MODELS

French Model Engineering Exhibition : "Barnes Model Shipyard"

By "MOTILUS"

MODEL clubs in this country will be interested to know that an outstandingly successful exhibition was held early in 1951 at Nancy, in France, organised by the Lorraine Model Association. This Association was formed as recently as 1947, yet they were able to stage an exhibition that attracted more than ten thousand visitors during its run of one week, and which was opened in the presence of the Mayor of Nancy and many municipal representatives.

The model railway section of this exhibition included no less than four working layouts. One of these, to which various members had contributed, comprised a gauge 0 railway with scenic effects, stations, etc., in the centre of which a gauge 00 express train circled, in lively contrast to its neighbour, on its own independent layout. Another model railway displayed there had been built in 1910 by the exhibitor's father, to a gauge of 59mm. (This measurement includes the rails and is equivalent to 2in. gauge in England.) This gauge is little used nowadays, so the model drew much attention, especially as a steam model locomotive was used part of the time to draw a goods train round the track.

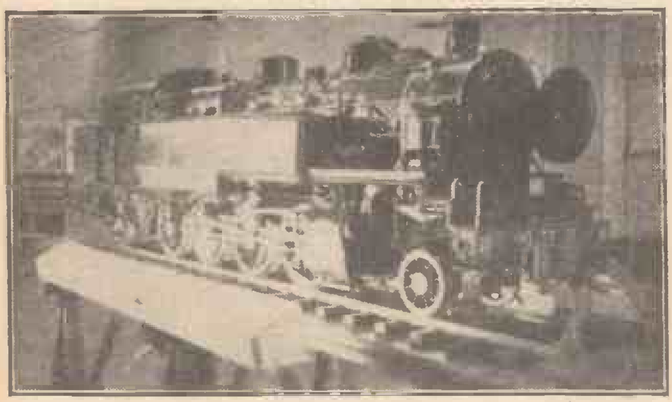


Fig. 1 (left): — The fully detailed model of a 141 T.C. locomotive built by apprentices at the Dépôt d'Epernay of the French National Railways and displayed at the Nancy Exhibition, 1951. (Photo. by courtesy of "Loco-Revue," Auray, France.)

A really beautiful exhibit on this occasion was among items contributed by various depots of the French National Railways. Outstanding among these was a model of a 141 T.C. locomotive built by apprentices at the Dépôt d'Epernay and which took them three years to construct (Fig. 1). It was to a scale of 1/5th actual size, weighing about 1,800lb., and every detail had been scrupulously reproduced. I am indebted to M. J. Fournereau, of the French magazine, *Loco-Revue*, for the picture of this excellent model.

The "Barnes Model Shipyard"

I expect some readers will remember that just over two years ago I wrote about the "Barnes Model Shipyard" at Wilmslow, Cheshire. Recently I was pleased to hear again from Mr. Barnes, who has continued his good work in training his group of enthusiastic boys in ship modelling, and giving them informal talks on real ships and how they are built. So the model shipyard progresses towards more ambitious activities, and I was pleased to see the accompanying photograph of their latest triumph. This is a model of a luxury cruising liner, m.s. *Patria*, built to a freelance design (Fig. 2). She is 5ft. 8in. long, with a single three-bladed propeller of 2½in. diameter. She is powered by a 15 cc. diesel engine.

Mr. Barnes is now directing the building of a model of an actual luxury liner, R.M.S. *Caronia*, for which the Cunard White Star Company were kind enough to lend drawings. I look forward to hearing how this model progresses, and to seeing photographs taken during the building, and when the model is finished.

Fig. 2 (right).—Critical eyes examine detail on the freelance model luxury liner, m.s. "Patria," built at the "Barnes Model Shipyard." Mr. Barnes and two of his assistants are seen here checking up on the finished model.

Models in Industry

The wide use of models in industry to-day is evident when we visit large industrial exhibitions, such as the bi-annual Engineering, Marine and Welding Exhibition at Olympia, where I spent several interesting hours this year, along with numerous visitors of various nationalities. The Exhibition was well attended, yet despite the huge size of many of the spectacular exhibits, the layout was such that there was plenty of room for viewers to circulate. The majority of stands were in the charge of technical staff, able to deal with the varied questions and enquiries raised by prospective buyers on these occasions.

An even greater number of firms used models this year to draw attention to their products and services. Working models can be valuable in attaining this end, especially in demonstrating machinery or new ideas in engineering apparatus. Being also a marine exhibition, there were many beautiful ship models of present-day vessels of all kinds.

A model of a new passenger-cargo liner, the *Vera Cruz* (Fig. 3), was displayed on the stand of Bassett-Lowke, Ltd., the Northampton modelmakers. The *Vera Cruz* is being built by the Belgian shipbuilders, Messrs. John Cockerill, of Hoboken, and carries some interesting features in ship design. Trend of the design follows the very modern lines of Continental builders, with almost a clipper bow and a streamlined swept-back bridge front, giving a yacht-like appearance to the vessel. This is emphasised by the single mast, which has a radar scanner fitted into the crows nest. This new vessel, of 21,276 tons displacement, is owned by Cia. Colonial De Navegacao, of Lisbon. The model is to a scale of 1/75th actual size (or 4/25in. to 1ft.), and was built to the order of Messrs. John Cockerill.

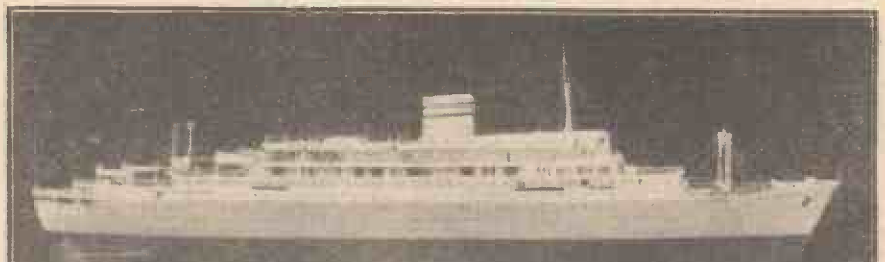


Fig. 3.—A profile view of a model of a new passenger-cargo liner, "Vera Cruz," to a scale of 1/75th actual size.

Submarine Escape Apparatus

SIR,—Having read with interest Mr. J. Wordsworth's article on escape from submarines in the October issue of PRACTICAL MECHANICS, I feel that one or two points should be made, first, in fairness to the Admiralty, and secondly, in regard to the feasibility of Mr. Wordsworth's suggestions.

Their lordships were *not* too hidebound to profit from the experience of *Truculent's* survivors. All submarines are now supplied with immersion suits, one-piece double-skinned rubber suits which can be inflated on the surface, thus keeping the survivor afloat and providing an insulating layer of air between his body and the water. The suit covers the whole body except the face and hands—waterproof gloves are put on when the man has finished the "surfacing drill" in his Davis submarine escape apparatus breathing set.

The other main lesson learned was that insufficient information was available to submariners on the subject of the time they can safely allow before making their escape. This depends on: (1) The number of men in the compartment; (2) its size; (3) the time the submarine was dived before the accident; (4) whether the submarine had been snorting, i.e., breathing through its air pipe while dived; (5) the number of oxygen candles and CO_2 absorption cannisters available; and (6)—most important of all—whether there are men without D.S.E.A. sets. The danger to the latter is CO_2 poisoning, *not* oxygen starvation. When the compartment is flooded up to equalise the pressure, the amount of CO_2 in a lung full of air increases as the pressure rises. This fact must be allowed for.

A simple table has been compiled from all these factors, which gives the answer very quickly.

I mentioned oxygen candles and CO_2 absorption canisters, did Mr. Wordsworth? These are, in fact, fitted in all submarines (in *Truculent*, too). The oxygen candles which burn slowly, generating oxygen, are more convenient for storing oxygen than a cylinder. Oxygen cylinders are also carried and can be used for this purpose, but their primary purpose is to fill up the breathing bag of a D.S.E.A. set before use, to conserve the oxygen in the bottle attached to the set.

Of Mr. Wordsworth's suggestions, I think the breathing buoy is the only one which could be applied to present-day submarines. It is relatively small and light and free from moving parts, watertight seatings, and other such victims of salt-water attack. To render it even more immune, I would suggest that the buoy be held in by means of bolts holding down the gratings at the centre, release being effected merely by withdrawing the bolts *via* shafting from inside the submarine; this is the method employed for releasing submarine indicator buoys. I would also point out that an efficient water trap at the top of the intake pipe is essential.

About the only disadvantage of the escape lift is, unfortunately, a completely damning one—top weight. The apparatus is extremely bulky, and its weight plus that of the hull fittings and the reinforcement which would be required on that part of the hull make the idea quite unacceptable to those who work out stabilities. A submarine has little enough stability as it is when half-dived, half-surfaced, and a lump like that so high above the centre of flotation would certainly turn the craft over. The removal of the gun might compensate for this, but such a drastic lowering of the fighting efficiency would not be acceptable either.

The existing equipment is far more efficacious than Mr. Wordsworth would have his readers believe. D.S.E.A. is simple, independent of electric power, high-pressure air and other such facilities which might quite possibly be denied the escapers as a result of damage; one man can make an escape unaided without difficulty, and the apparatus works just as well if the submarine is on its side. Provided that the submarine is not at too great a depth, the chances of a completely successful escape are very high.—Q. KINGSTON (Edinburgh).

Plastic Sheet

SIR,—With reference to the query in the October issue on "Interior Decorating," by R. Horne (Birmingham), I can inform him that he can obtain plastic sheet 1/16in. thick at 1s. per sq. ft. or ⅛in. thick at 2s. per sq. ft. from J. Perris, 197, Broadway, Burnt Oak, Edgware, Middlesex. It is available in most shades and finishes, and is officially flawed, but in many cases the flaws are invisible to the layman and do not affect wear or life.—W. R. SWIFT (Woodmansterne).

Fluid for a Hygrometer

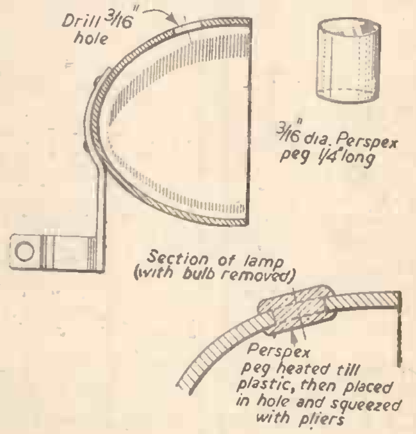
SIR,—In the article in the October issue describing an ingenious hygrometer it is not made clear whether the paraffin to be used is lamp and stove paraffin (kerosine) or medical liquid paraffin. No doubt many readers would like this elucidated.—C. MARSHALL (Bromley).

The Author's Reply

SIR,—In reply to C. Marshall (Bromley), the fluid used in the original model made by the author has household paraffin, i.e., kerosine. Liquid paraffin could have been used, but due to its higher viscosity it might have been troublesome to introduce free of air bubbles. The properties desirable for the filling fluid area are: (a) not too high a viscosity; (b) it must not be mixable with water or it will dissolve the glue capsule; (c) it should hold only a trace of water dissolved in itself at room temperature; (d) it should be cheap and, if possible, readily obtainable; (e) it should not solidify at a low room temperature.—J. E. C. STRINGER (North Shields).

Light Indicator for Cycle Rear Lamp

SIR,—The accompanying sketches illustrate a dodge which will help cyclists who ride at night. One of the most irritating features of a bicycle dynamo is that one never knows whether the rear light functions



Details of a light indicator for a cycle rear lamp.

or not. To remove the danger I modified my lamp as shown. Now a quick rearward glance assures me if all is well, as the glow through the plug is surprising.—C. I. HALDING (Leyland).

Denture Repair with "Perspex" Cement

SIR,—It may interest other readers to know of a little experiment I carried out recently. In answer to a friend's urgent plea I cemented his broken denture with "Perspex" cement. To my astonishment the result was a complete success, the plate being used the same day, much against my instructions. I should point out that the cement is made by I.C.I., and that it sets much quicker than trichlorethylene solution, an obvious advantage in this case where clamping was out of the question.—H. BURTENSHAW (Milford).

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Trade Notes

A Review of the Latest Appliances, Tools and Accessories

Johnsons' Photographic Year Book

MESSRS. JOHNSONS, of Hendon, have just issued their Photographic Year Book for 1952. Although the contents of the book are on much the same lines as previous issues, it has been completely revised and brought up to date and many chapters have been re-written. The instructions for using the now famous Exposure Calculator have been simplified and should meet with general approval. The price of this Year Book is now 5s. 6d., including purchase tax, and it can be obtained from photographic dealers anywhere.

The "Marine Dixon"

ALTHOUGH the Dixon combined scrubbing, polishing and carpet shampooing machines have been in extensive use for some time throughout industry, in hospitals, municipal buildings and hotels (and, incidentally, in the Royal Festival Hall), a new model has been introduced to the range called the "Marine Dixon."

The chief difference between the Industrial Dixon and the Marine Dixon is that the latter has a special protective finish that resists sea-water corrosion.

The jobs that the Marine Dixon does efficiently are: deck scrubbing, polishing lounges, bars and public rooms, shampooing carpets *in situ*, and holystoning wooden decks.

The holystoning adaptation consists of an aluminium back to which are clamped three segments of holystone.

Sailors using a Marine Dixon machine on the deck of R.M.S. "Queen Elizabeth."

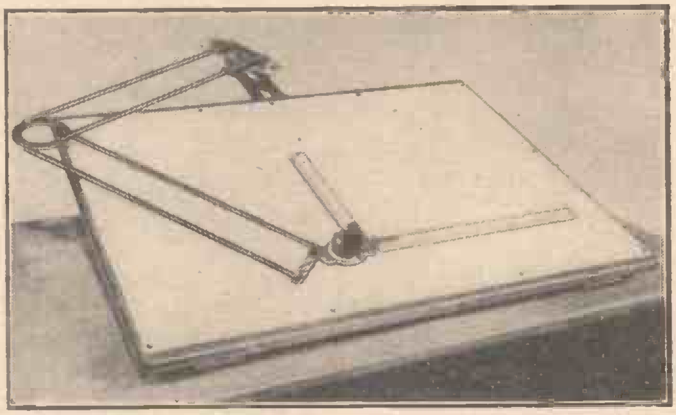
We understand that this machine is the only one of its kind made in this country and available in the sterling area.

Ships that are already using Marine Dixons include: Cunard's R.M.S. *Queen Mary*, R.M.S. *Queen Elizabeth* and the battleships H.M.S. *Vanguard* and H.M.S. *Duke of York*.

Further particulars are obtainable from R. G. Dixon & Co., Ltd., Capitol Works, Empire Way, Wembley, Middx.

Precima Major Drafting Machine

THE Precima Major is a new drafting machine which embodies every essential requirement of the modern drafting machine, and its design ensures simplicity of operation and extreme accuracy. An outstanding feature is a runner plate on which the arms are supported by ball bearings. This relieves the stress being placed on the main posts and reduces wear to a minimum. In addition, precision bearings ensure that the machine is always true and dead centre, and even after years of service any slight play which develops can readily be corrected. The machine is light in weight but strongly constructed and all components are of the highest quality material. Bright parts are heavily chromium plated and all others are crackle finished. The protractor head is easy to operate and locates automatically every 15 deg., and gives any intermediate angle for a full 180 deg. by lock. The Precima Major, arranged for horizontal use, can be worked on boards inclined up to 20 deg., and can readily be fitted to existing D.E. or antiquarian-size drawing boards, which the machine covers completely. The machine is priced at £15 15s., and further particulars can be obtained from W. G. Pinner and Company, 1 York Road, Birmingham, 16.



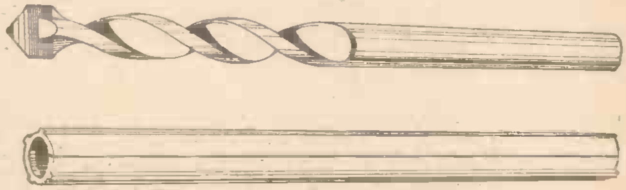
The "Precima Major" drafting machine in use on an antiquarian-size board.

The "Mason Master" Bit

SPECIALLY designed for boring clean straight holes in concrete, brick, marble or tiles, the "Mason Master" drill bit has a tungsten carbide tip, and can be used with a breast-drill or portable electric drill. It is rapid in action, and is silent and vibrationless. Glazed tiles can be holed near to the edge without risk of breakage. The makers are John M. Perkins and Smith Ltd., Braunston, near Rugby.

Mason Plastic Rynplugs

THESE plastic plugs are hard enough to be hammered into a hole bored in brickwork, or other substance, without smashing the end. They are pliable enough to expand readily in the softest plaster wall without enlarging the hole or pulling out. Plastic Rynplugs are split the entire length thus giving greater grip and easy expansion. They can be cut with an ordinary penknife, and are impervious to corrosion, moisture and chemicals which makes them particularly suitable for outdoor and laboratory use. Their insulating properties make them indispensable for fixing electrical fittings, and for many other jobs of a similar character. Plastic Rynplugs are also marketed by John M. Perkins and Smith Ltd., from the address given above.



A "Mason Master" drill bit, and a plastic Rynplug.

Books Reviewed

Modern Motor Boats and Yachts. By Norman H. Loveless. Published by Temple Press, Ltd. 88 pages. Price 8/6 net.

IN this book, which is uniform with the Boys' "Power and Speed" Library series, the author tells the fascinating story of the little ships which ply round our coast; the motor cruisers and sailing yachts, the Light Coastal Forces of the Royal Navy, and the lifeboats of the R.N.L.I., manned by the bravest of seafaring men. A vivid insight is gained into their adventurous work. The reader is also taken to inland racing waters, where tiny outboard hydroplanes provide plenty of thrills for pilots and spectators alike.

Other chapters are devoted to sailing yachts from the famous Americas Cup racers, to humble sailing dinghies. This interesting and instructive book, which is beautifully illustrated, provides an enjoyable introduction to little ships and the sea.

Club Report

Aylesbury and District Society of Model Engineers

THE October meeting, held on the 17th at Hampden Buildings, was devoted to a showing of local films by H. East. The films though of various vintage were still very interesting, and the presentation left nothing to be desired.

A cylinder casting, made in true "back yard" style by Mr. C. Gill, aroused plenty of interest among members, as did two loco chassis brought over by our friends at Luton. —E. SMITH (Hon. Sec.) Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

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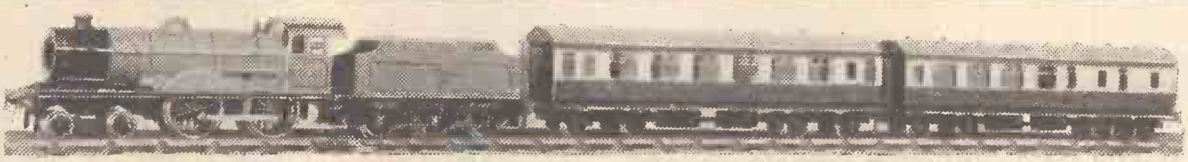

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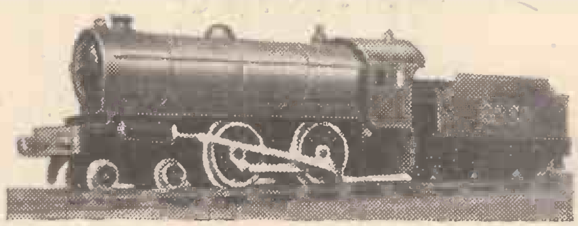

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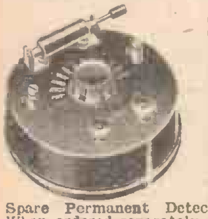

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New Headphones, 10/- a pair. Balanced armature type (very sensitive), 12/6 a pair. Both post 8d. New **Single Earpieces,** 3/6. Bal. armature type, 4/6; ex-R.A.F. earpiece, 2/-, post 4d. **Headphones,** in good order, 5/6 (better quality, 7/6), all post 8d. **Headphones** with moving coil mike, 15/-. Similar phones with throat mikes, 12/6, post 8d. **Headphone Cords,** 1/3 a pair, post 3d. **Replacement Bands,** 1/3, post 4d. **Wire Bands,** 6d. **(All Headphones listed are suitable for use with our Crystal Sets.)**

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Hand Microphones, with switch in handle and lead, 4/-. Similar instrument, moving coil, 7/6, post 6d.

Sparking Plug Neon Testers with vest-pocket clip, 3/3, and with gauge, 3/6, post 3d. **S.B.C. Neon Indicator Lamps,** for use on mains, showing "live" side of switches, etc., 3/6, post 4d.

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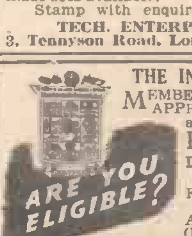

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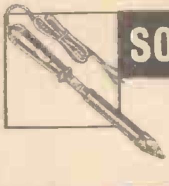

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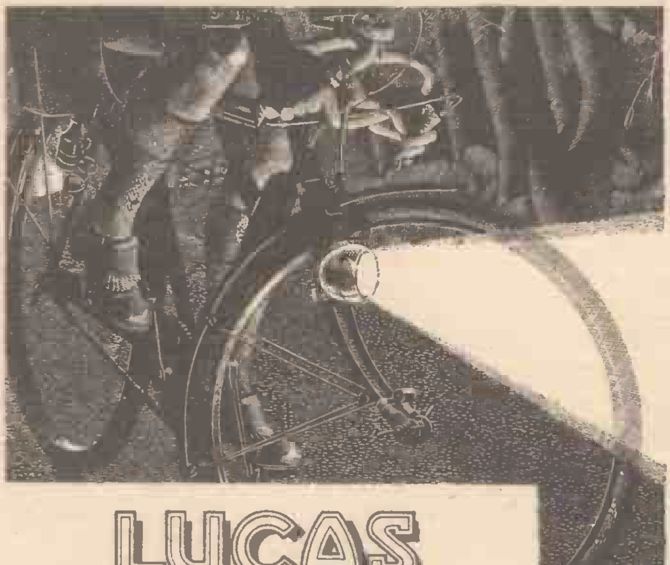

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THE Cyclist
Editor: F. J. CAMM
VOL. XX DECEMBER, 1951 No. 355

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Comments of the Month

N.C.U. REJECTS ROAD RACING PROPOSALS

VOTING—34 FOR, 39 AGAINST

By F. J. C.

EVIDENCE that the growing demand amongst N.C.U. membership for a more realistic programme, one in keeping with the changing times, was provided at the meeting of the General Council of the N.C.U. when, within a couple of minutes, and without discussion of any sort, it rejected the Legal and Parliamentary Sub-Committee's Report on Massed Start Racing, and the proposal for N.C.U. promoted road races. The result was comparable to the General Election. The gap was narrowed, for the voting disclosed 34 in favour of the proposals and 39 against. Thus we have concrete evidence that the N.C.U. is divided against itself.

It was the Birmingham Section which proposed that the rule of racing, which prescribed that road courses must be closed to all other vehicular traffic, be deleted.

A letter was read from the Ministry of Transport (is it necessary to inform readers that a copy was sent to Road Time Trials Council?) couched in the usual Ministerial terms—"massed start racing is *liable* to be prejudicial to the safe and free movement of traffic. The Government would, therefore, view with concern . . ."; it is unnecessary for us to complete the sentence of a letter which had obviously been inspired for the purpose in hand, namely, the rejection of the proposition.

Some of the provincial delegates did not hesitate to express their contempt and disapproval of the attitude of the London delegates. They were there as a solid phalanx to defeat the proposition, which was supported by Manchester, Birmingham, Newcastle, Scotland, and Southampton. It would veritably appear that London controls the provinces, and does not intend to listen to anything, or to any proposition which London alone decides is bad for the sport.

At the N.C.U. London Centre Meeting the Legal and Parliamentary Sub-Committee's Report was defeated by an even narrower margin—113 for, and 110 against. Here again there was no discussion, and Councillors were not given instructions as to voting.

But, of course, it is apparent that massed start racing must eventually be accepted. The proposition will be raised again and it is likely by that time that the few "don't knows," representing the floating population in cycling, will force the N.C.U. hierarchy at the democratic pistol point to obey the wishes of the majority, and not to rule by a sort of divine right. We must remember, too, that a different Government is in power, with a different Minister of Transport, Lord Leathers; he may have views which differ from those of his somewhat inexperienced predecessor, who listened rather too much to promptings from outside. But for our services in connection with the B.L.R.C., massed start racing might have been banned by now.

There was a similar threat in the early days of cycle racing but no Government has been so unwise as to ban it. Those now most vociferous in their opposition to racing on the highway were those who in the early days disregarded Government warnings.

What is the value of a Legal and Parliamentary Committee if its findings and advice are to be ignored? It is wasting its time.

PEDESTRIAN CROSSINGS

OCTOBER 31st saw the introduction of the new regulations governing the use and marking of pedestrian crossings. From that date all previous regulations relating to pedestrian crossings have been revoked.

Pedestrians have priority over vehicular traffic only at crossings which are not controlled by traffic lights or police. The marking of crossings not controlled by traffic lights is a pattern of alternate black and white ("zebra") stripes in addition to the studs and beacons. Pedestrians no longer have precedence at controlled crossings (i.e., where there are traffic lights or police control).

The number of uncontrolled crossings has been greatly reduced in accordance with the recommendation of the Committee on Road Safety that crossings which were unnecessary or badly placed should be removed. Local authorities were asked to remove about two-thirds of the existing uncontrolled crossings. Many local authorities have suggested that more than a third should be retained, and in a number of instances this has been agreed to. The actual reduction is expected to amount to a little over 60 per cent.

The idea behind both the new and simpler regulations and the reduction in the number of crossings is to inspire all road users with a respect for and confidence in the whole crossing system which up to the present have too often been lacking.

An important feature of the new regulations is a provision under which local authorities may impose a prohibition (subject to exemption for loading and unloading, etc.) on the waiting of vehicles within 45ft. of pedestrian crossings on the approach side. Vehicles waiting within these limits might prevent pedestrians from seeing approaching traffic and drivers from seeing pedestrians on the crossing. It will not be practicable to impose this restriction in every case, but it is hoped that it will be introduced as widely as possible. The extent of this prohibition of waiting will be indicated by two yellow half-circles at the edge of the footway or carriageway.

RECORD CYCLE PRODUCTION

RECORD output of bicycles was reached in July, 1951, when a total of 372,000 machines was made. Exports were also at their highest monthly level, with 260,000 for overseas trade.

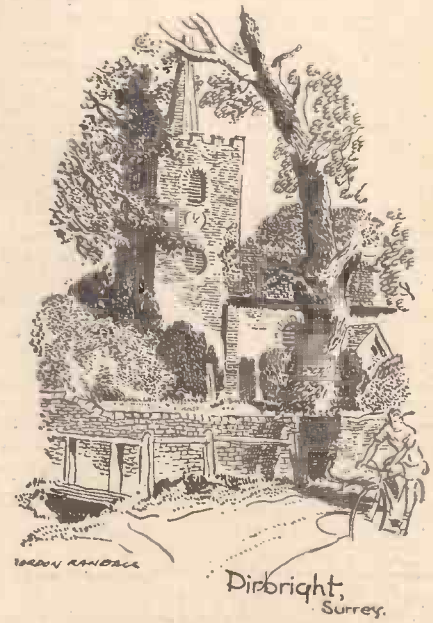
Previously, the greatest monthly output attained was in May of this year, the figure then totalling 367,000. Pre-war, the average monthly output (in 1935) was 166,000, with 31,000 exported.

The latest figures of motor-cycle output, for August, 1951, show that 10,950 machines were produced, with those for export numbering 5,910. These figures compare with output of 13,300 in July of this year, and 11,190 in August, 1950. Average monthly output in 1950 was 14,270 and in 1935 was 5,390.

TRACK ACCIDENTS

THE number of accidents on the track is increasing, and it is suggested that the N.C.U. should form yet another committee to investigate the causes and, if necessary, to amend the rules, or more efficiently to enforce existing rules.

A contemporary rightly comments that cases of disqualification for breach of rules are rare, and with them we wonder why nothing has been done about dangerous riding on the track. We thought, however, from recent criticisms of massed start racing on the road, that track racing on closed circuits was safe, because the N.C.U. will have nothing to do with races which do not take place on closed circuits. Are British leaguers asked to forsake the imaginary dangers of racing on the roads for the proved dangers of riding on the track?



In the churchyard of this little country church lie the remains of H. M. Stanley, the great explorer, who searched and eventually found David Livingstone at Ujiji in Central Africa. His grave is marked by a great slab of Dartmoor granite.

Tyre & Tube Maintenance

Notes on the Upkeep and Repair of Your Cycle Tyres

By C. J. J.

THAT cycling is the cheapest form of transport is undoubtedly true to-day in spite of the fact that most accessories have been affected by the world-wide increase in prices. Rubber is one of the raw materials which is short and cycle tyres cost more than twice what they did ten years ago, and it behoves the cyclist to give more attention to this part of his machine. A regular check-up and a certain amount of care can avoid the risk of a puncture and lengthen the life of the tyre.

Simple Precautions

One of the easiest ways to avoid rapid deterioration of tyres, inner tubes and rims is to keep tyres hard. The tyre manufacturers are always stressing this point and have even given the pressures in lb. per sq. in. at which their products should be maintained.

They are as follows:—

Ordinary tyres—

$1\frac{1}{4}$in. section	....	35lb.
$1\frac{3}{8}$in. „	....	30lb.
$1\frac{1}{2}$in. „	....	25lb.

Road-racing tyres (high pressure)—

$1\frac{1}{4}$in. section	......	70/90lb.
$1\frac{3}{8}$in. „	......	50/80lb.

Tubular tyres—

The higher pressures specified for road-racing tyres should be used.

A soft tyre is likely to cause the inner tube to be pinched when going over a bump, with the consequent puncturing of the tube. It also causes the walls of the tyre to split and, with the canvas-walled lightweight tyres, increases the risk of a blowout. Finally, a soggy tyre increases the tractive resistance and the cycle is very much harder to propel.

Punctures are, in many cases, caused by a sharp flint penetrating the outer cover and, while there is no way of avoiding a puncture when one goes straight through in this manner, it is possible, by regularly going round the tyre and extricating all the flints which are embedded in it, to avoid a puncture caused by one of them working its way through. The embedded flints should be removed with a penknife or some similar tool, and it is advisable to fill the holes which are left with one of the special filling-preparations which are available from most cycle shops.

On lightweight machines with caliper brakes, there is always the possibility that a shifting brake block shoe will cause the brake to act on the side of the tyre, instead of on the rim. If this is not checked, it can, in a very short time, and especially with canvas-walled tyres, wear through the side of the cover. Even if not actually perforated, the tyre is likely to blow out some time in the near future.

In hot weather the cycle should, if possible, always be left in the shade when not being ridden, the reason being that the sun can loosen patches on the inner tube, causing them to lift and re-expose an old puncture.

When fitting tyres and tubes on to a new pair of wheels or on to wheels that have been trued, it is always advisable to check to see that there are no spoke ends protruding through the rim which have been missed by the wheel builder, because these can, in time, work through the rim tape and so pierce the tube.

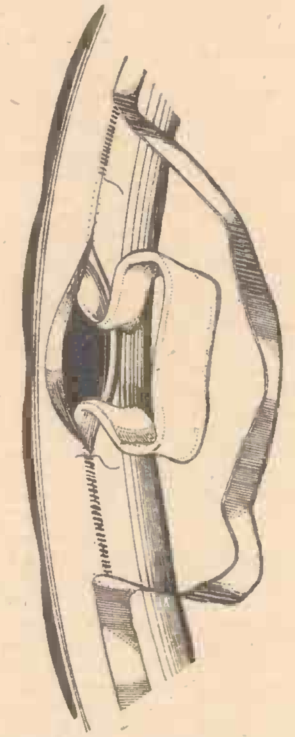


Illustration showing the construction and method of repairing a tubular tyre.

A few words of warning on a point which must be familiar to anyone who has repaired a puncture, namely, that of being careful not to pinch the tube when refitting the tyre. This is a mistake which is unfortunately made not only by the novice, but by the experienced cyclist as well. It pays to take precautions always.

Repairing the Puncture

Repairing a puncture is quite a simple operation and most people have probably, at some time or another, successfully carried out the operation.

First, when the puncture is in a roadster type of cycle fitted with rod- and lever-type brakes, it is better not to take the wheel out of the frame, but with the modern lightweight it is often much more convenient to do this. When the wheel is left in the frame and it is the back wheel which is being dealt with, remember to expose the tube on the opposite side from the chain; this will avoid a considerable amount of dirt being deposited on the inner tube and on the hands, too.

A small point, but one which can save much time if observed, is to put the small parts of the valve, dust cat, etc. in your pocket or somewhere equally safe. They are not easy to find when they have been kicked into the grass verge. Before replacing the tube, always run your hand round the inside of the cover and remove any flints which have penetrated, otherwise you will mend one puncture, pump up the tyre, and then find that you have another in the same spot. If the puncture was caused by something penetrating the outer cover and this has left a large cut, it should be temporarily repaired by adhering a piece of thin canvas (provided in most puncture outfits for the purpose) over the cut on the inside of the tyre, using rubber solution as the adhesive.

When replacing the tyre, tyre levers should seldom be used, and if it is a tight fit, pinch the part of the tyre that has both edges over the rim into the centre well of the rim and it will be found much easier to replace.

Reseating the Valve

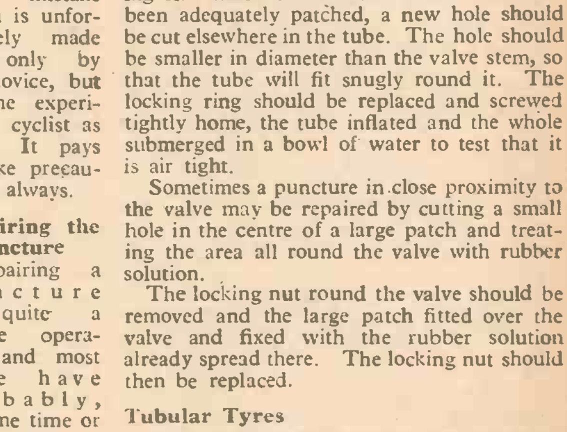
Sometimes, when the inner tube is found to be leaking round the base of the valve, it cannot be patched in the usual way, and it becomes necessary to remove the valve, patch with a large patch and reseat the valve elsewhere in the tube. The valve is easily removed by unscrewing the hexagonal locking nut at the base of the valve stem and pulling the flat disc-shaped base through by stretching it. When the old site of the valve has been adequately patched, a new hole should be cut elsewhere in the tube. The hole should be smaller in diameter than the valve stem, so that the tube will fit snugly round it. The locking ring should be replaced and screwed tightly home, the tube inflated and the whole submerged in a bowl of water to test that it is air tight.

Sometimes a puncture in close proximity to the valve may be repaired by cutting a small hole in the centre of a large patch and treating the area all round the valve with rubber solution.

The locking nut round the valve should be removed and the large patch fitted over the valve and fixed with the rubber solution already spread there. The locking nut should then be replaced.

Tubular Tyres

Most of the remarks already made regarding wired-on tyres apply equally to tubulars, especially those about the regular removal of embedded flints. These lighter tyres are much more easily punctured and are much more difficult to repair than the wired-on type and thus more care is necessary. Many riders use tyre-savers when riding tubulars and these are gadgets made of wire which are fixed behind the locking nut of the brake



Two views of a commercially made tyre-saver.

and bear on the surface of the tread. Their function is to brush off any flints which adhere to the surface and which may be pushed through the tread. They may also be used with high-pressure road-racing tyres.

Sprint rims for which tubular tyres are designed are hollow in section and the surface round which the tyre fits has only a shallow depression. The tyre is held on to the rim by the air pumped into it and the harder they are inflated the tighter they fit. There is still the danger, however, that the tyre may roll off on a particularly sharp corner and to obviate this a special adhesive is used to cement the tyre to the rim. Some riders use tape in preference to the cement method, and this is merely wrapped round the tyre and tube at five or six regular intervals round the wheel.

When riding on the road as distinct from the track, a spare tubular is usually carried in case of punctures. Sometimes the spare is strapped behind the saddle and sometimes is twisted into a sort of double loop and carried across the shoulders; it is the former method that can be harmful to a tyre. If it is tightly folded and lashed behind the saddle for any length of time and is kept for this purpose only, the tyre becomes weakened on the folds and may, when finally used, develop an ugly bulge and eventually blow out.

Tubulars should never be kept folded when not in use, but should be deflated and hung up in some dry place.

Repairing a Punctured Tubular

The successful repairing of punctured tubulars is a simple matter and can be accomplished quite quickly after a little practice, but if you do not feel inclined to trust your own efforts, either the makers or a good lightweight cycle specialist will usually undertake to do it quite cheaply.

When the puncture has been located, pull away the protecting band immediately underneath the puncture and cut the stitching underneath with a razor blade just enough to allow the inner tube to be exposed. The puncture in the tube is repaired in the usual way and a little air inside will help its stowage without any folds. The tube should then be deflated and the edges of the cover restitched, taking great care that the needle does not perforate the tube. Special thread may be bought for the purpose or strong carpet thread is a good substitute. Great care should be taken to ensure that the stitching is adequate and tight or a bulge will result when the tyre is pumped up. The protecting tape should be restuck with a good adhesive.

Coslettising Explained

Notes on the Well-known Rustproofing Process

STATEMENTS to the effect that frames and other bicycle components have been "coslettised" before being given their preliminary and final enamel finishes are frequent enough in catalogues, yet the average bicycle user has but hazy ideas of what this process consists.

The characteristic coslettised finish is a soft black one, a surface-finish to a metal part that is smooth to the touch, free from irregularities and almost perfectly unrustable under any normal rusting and corroding conditions. If a plain coslettised finish on an article of iron be rubbed up with a little oil, the metal surface becomes darker in colour, this darkening in hue afterwards persisting as long as the least trace of the surface film of oil remains.

History

The process of coslettisation is essentially a rustproofing process, devised originally by an English chemist named Thomas Watts Coslett as far back as 1907. Despite the British origin of the process, much of the early work in connection with it was carried out in America.

In its essentials coslettisation consists in immersing the iron and steel articles, after they have been thoroughly surface cleaned, in a dilute solution of phosphate of iron contained in a large vat. The solution is heated to boiling point by means of steam pipes which pass through the vat near the bottom of the liquid. After the immersion of the iron objects in the coslettising vat, bubbles of hydrogen gas stream off from the surface of the metal. The evolution of this hydrogen gas is rapid at first. Then it becomes slower and slower, and finally after a lapse of some 40 minutes, it ceases altogether.

Tough Surface Film

During this time, a chemical process takes place. The surface of the iron or steel is attacked by the phosphate bath and a film of phosphate of iron mixed with black iron oxide is deposited upon the metal. This surface film is an extremely tough one. It is a tenacious one, also, being very difficult to remove. Nothing other than acid will dissolve it and, since it completely covers the metal surface like a layer of plating, it prevents the metal beneath it from being attacked by air and moisture and thus from rusting away.

Ironwork treated in this way is said to be *coslettised*. When withdrawn from the coslettising bath, the surface of the metal is dull-grey in colour. It is then rubbed down with oil in a subsequent operation, this oil treatment converting the greyish appearance of the bare coslettised finish into a velvety black surface, resistant to weathering influences in the extreme and one upon which coats of enamel or other finishing lacquers may be readily laid.

Modifications of the original coslettising process are now being used, salts of calcium, manganese, molybdenum, and even of the rare metal tungsten, are being added to the phosphate bath in order to modify the appearance and character of the resulting metal surface.

The coslettising process is without action upon metals such as nickel and chromium. Consequently, it is possible to produce a sort of two-colour effect upon the surface of a metal article which has been partly nickel or chromium plated. By confining the plating to certain areas of the metal, the article may afterwards be coslettised, the final result being plated design on a dark background.

Final Finishes

Coslettised metal may, of course, be enamelled, painted, lacquered or cellulosed by normal methods, thus affording additional rust protection to the metal. Many bicycle frames are lightly coslettised before enamelling merely for the sake of the efficient degree of rust-protection.

A bicycle frame or other component having an iron or steel core which has been well coslettised will never rust. Many beautiful and refined surface-finishes which can nowadays be given to iron, iron-alloy and various steel articles by modifications of the original coslettising process, render this method of surface treatment one of the most valuable developed in modern times. Of course, there are other processes, such as Bonderising.

Eileen Sheridan Joins Hercs.

EILEEN SHERIDAN has joined the Hercules Company with the intention of attacking professional records. This takes my mind back to the days just before the war, when Marguerite Wilson, also employed by Hercules at that time, successfully attacked all of the W.R.R.A. records. There was some attempt made at that time to separate professional records from amateur, and the proposition was that the proposed regulation should be made retrospective. Women do not, of course, have the same experience in these affairs as men. It was not until I vigorously attacked this move that they saw wisdom and dropped it, although there are now the two classes.

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Around the Wheelworld

By ICARUS

Macmillan's Bicycle

YOU will remember that a few years ago I promised to prepare scale drawings of MacMillan's bicycle—the first "boneshaker" to be propelled by rods and cranks applied to the rear wheel. I am not sure whether MacMillan should have achieved fame for this comparatively simple "invention," nor am I certain that the credit for its production has been given to the right man.

Presuming, however, that we must give MacMillan the credit for making the first rear driver (it would scarcely be possible now to do anything else, since the Centenary Road Club was formed in his honour in 1939 to celebrate the centenary of the invention, and has therefore virtually set the seal on the matter) it is my opinion that he should have achieved fame for riding the clumsy contraption.

The treadle and crank as a means of driving a wheel is centuries old, so it did not need a great deal of inventive ability to transfer the drive from the front wheel, where the drive was direct by means of pedals attached to a live spindle, to the rear wheel by means of a somewhat complicated structure of swinging levers, connecting rods and cranks.

However, for one reason or another the machine has only recently been returned to its original home in the Science Museum, Kensington, from whence it was taken in the early days of war to be safely buried in the fastnesses of Wales.

It is not the original machine, however, and I have been quite unable to trace who made it. It is obviously a blacksmith's job, with hand-forged front forks, a backbone of hornbeam or elm (it is impossible to say since it has been painted), twist grip control for the single rear brake by means of a cord and pulley, live axles running in plain bearings, wooden wheels with iron tyres and splayed spokes, a pan seat, and wooden pedals.

It will be remembered that on his first ride from Courthills to Gorbals he was fined 5s. for dangerous riding, and thus achieved further fame in that he was the very first cyclist ever to be fined. The search for the originator of the first rear driver went on for many years during the first part of this century. The late H. H. Griffin, in his famous book on the "History of the Bicycle" (copyright owned by George Newnes, Ltd.), originally gave the credit to Gavin Dalziell, but later research revealed that Kirkpatrick MacMillan was many years before him. Dalziell agreed that this must be so.

The drawings have now been prepared, and I believe that this is the first time that drawings of the machine have been made. Undoubtedly Kirkpatrick MacMillan built his machine piecemeal, and as he was a blacksmith and wheelwright he would, unquestionably, adopt the old blacksmith's method of merely chalking out the design roughly on the floor, fitting up the various parts as he went along and altering them to suit.

The machine has a 14-spoke back wheel, 44in. in diameter, and a 12-spoke front wheel, 33in. in diameter. The wheel centres are 47¾in. apart. I have made a ⅛in. scale model of the machine as accurately as possible in every detail, and its construction will be described in an early issue of this journal. Here, again, I think this is the first time that a model of it has been made.

The drawings and the model will preserve the facts about the machine. A set of the drawings is being presented to the Centenary Road Club.

The Cycle Show

FROM those very early beginnings has sprung the Cycle Show, which took place in November. I wonder how many of the visitors there cast their minds back to

The Apostles. Dovedale

These great limestone rocks which tower above the little river are known as the Twelve Apostles. They stand on the Staffordshire bank near the Lovers' Leap

those pioneering days when bicycles were propelled by sheer brute force. It was many years later, due to the work of many inventors, that the bicycle started to evolve and to reach its present highly efficient form. Bown's ball bearings, originally fitted to the ordinary and later to the safety bicycle pioneered by Harry J. Lawson, the pneumatic tyre, the tangent spoke wheel, chains, sprockets, hub gears, lighter steels, improved methods of production; these have all contributed to the lightweight machine of today which was the keynote of the Show.

Alas, the rearmament programme has forced manufacturers to adopt in some cases a utility finish. They must not be blamed for that, for nickel and chromium plating are now out of the question. I am not really sorry about the loss of chromium plating. It was seldom satisfactory because manufacturers, in some cases, did not do the job properly. Parts must first be copper-plated, then nickel plated, and finally chrome plated, if the plating is not to peel off.

An all-weather finish is not unattractive.

Lord Goddard on Drunken Drivers

IN a recent judgment Lord Goddard made it quite clear that sterner penalties were to be imposed if a motorist is convicted of being drunk in charge of a car. He added that it could not be offered as an extenuating circumstance that an accident did not occur. That indeed is a merciful dispensation of providence. At the same time there is another side to the story. A man may not be so drunk that he does not know it. At present, however, if he decides to "sleep it off" in his car he can still be prosecuted for being drunk whilst in charge of a vehicle.

A recent case illustrates the point. A motorist was charged under Section 15 of the Road Traffic Act, 1930, with "being under the influence of drink to such an extent as to be incapable of having proper control of the vehicle—a motor car." The motorist did not dispute the evidence that he approached his car unsteadily and that he stumbled into the driver's seat; nor that the police surgeon judged him to be drunk. His defence was that he was a little muddled on his way home from a celebration, that the car was not his, and that he got into it only for rest and recovery. Well, a driving seat can serve as a resting place, and the fact that a man sits there for that purpose is not complete evidence that he is in charge of the car. The car might be in charge of him, preserving him from the perils of his own folly. The case was dismissed.

In this case I think rightly so.

Purchase Tax Reductions?

I AM not raising the matter as a political issue, but as the Government has announced that it intends to reduce the cost of living, it could make a start by reducing purchase tax on necessities. Included in these are cyclists' accessories, and the bicycle itself. Over 90 per cent. of the bicycles which are sold are bought for utility purposes, and only about 3 per cent. for racing and pleasure cycling. Now that we have a new Government I hope it will address its attention to this point.

Dovedale Derbyshire

The entrance to the lovely dale, looking towards the stepping stones.

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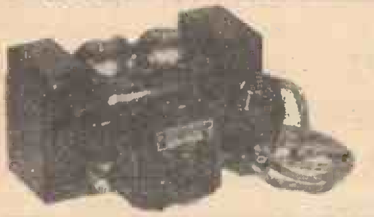

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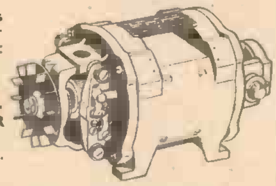

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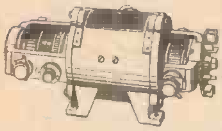

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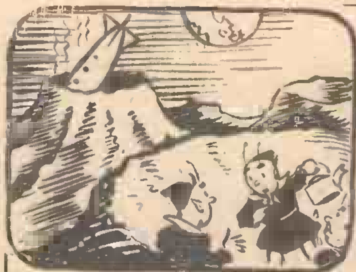

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Wayside Thoughts

By F. J. URRY

Autumn Gales

IT was a windy autumn with sunny patches to relieve some of the storms, and riding through such weather possesses certain advantages frequently unrecognised during the time of draughty antagonisms, or at least only partly recognised. On occasion I have said that if I were very rich my cycling would be windborne or practised in comparatively calm weather; but such a thought is perhaps the effect of growing old and discovering a full day's travel against half a gale makes one give too much attention to progress and not enough to observation. The easiest way of going where you desire, even though the wind may be obstructive, is to go slowly, rest often and never worry if you must shorten the planned mileage to achieve comfort, and this is what I do, or peradventure, take an extra day to complete my pilgrimage. The younger folk will scorn such schemes, get down to it and make a hard journey if a satisfying one; and so would I a few decades ago, but not now. I write these things because I want far more folk to continue riding bicycles in the sure and certain knowledge that they will be happier and fitter people, and can also be very comfortable travellers. These changes in cycling outlook have not occurred suddenly, they have very simply and naturally come to me with the climb of the years, and to a large extent have eased that inevitable handicap by presenting me with a kind of personal freedom that is very precious. When I tour to-day the mileage is not important, it is the visions and the changes in outlook, the people along the road, and that jolly but inexpressible feeling of freedom that cycling never fails to give to me that counts; neither the windy weather nor the hilly road troubles me, I just take them in my stride at my own tempo, and make the journey full of joy.

Making it Easy

THIS sounds so easy in the writing and may fall on the ears of the too often disillusioned as a deliberate overstatement. I can understand that; but the reason is that often the disillusioned cyclist rides to a performance instead of a perfection. He seeks to cheat the weather, and if that be the object he will never win on the count of joy whatever pride he may collect in a difficult journey done. If you are riding for pleasure let that object be the main reason for your journey, and, believe me, it can be achieved even in the stormy days of a wet period. I suppose there are few old riders who cannot recollect the joy of riding away the hours of a rainy day until a gorgeous sunset has crowned the end of the journey. To do such things calls for no great adventure or even intense application, but simply a sweet reasonableness in speed and the use of decent macs. I have known many such journeys and hope to experience many more. When the value of freedom, so happily associated with cycling, overcomes the natural reluctance of braving a wet or stormy day, that reluctance will disappear, not only because you know you can do it, but for the reason that you know you will enjoy it. I once persuaded eighteen elderly men to make a thirty miles round of the Derbyshire dales on a day when the damp, driving, misty rain looked most disconcerting from a warm room. The time occupied, with a long lunch break included, was seven hours, and not one of that party regretted the little adventure, and all of them now talk of it with a sort of amazement that they *could* have enjoyed it, and kept so dry and comfortable. All a question of modesty in speed matching the condition, and far too frequently we do not relate these things, but rush in and spoil the experiment.

The Utilitarian Aspect

CYCLING has so many phases and is so matchless in its variety that its values are often lost among the people who use their machine for purely utilitarian purposes, and here, too, it is unmatched in cost and convenience. I know, for my home-to-work-and-back riding totals more than 3,000 miles per annum, and I will not give up that excellent daily exercise until age withers me, for I know its health values and have come to a full appreciation of them. Besides, I am always reasonably fit to make a journey of joy when the chance occurs, without the subconscious worry of the weather not being kind, the miles being too many or the hills too steep, which is an uncomfortable mental attitude to take with you on a tour.

Among certain types it is "not the thing" to be seen riding a bicycle to work, but I have always wondered why, and no one has yet been able to give me the real answer. It is, of course, ostentation; certain salary earners are above that sort of thing, and have the rather silly notion that the boss must not descend to the travel methods of his workfolk. My experience has been quite the opposite; the fellows in the works apparently like to see the "old gaffer" turn up morning after morning, rain or fine, looking brisk and happy for a start on the day's work, having shaken off the morning's sloth with a seven miles' ride. Occasionally I hear one of them say, "the old man sticks it," when the day happens to be damp and stormy, and no doubt the impression is left that there is more in this cycling than meets the eye. The result is I am often asked for a specification, a holiday route, or some information on the matter of accommodation. That, however, is a personal point in happy working relationships which does not always occur when the boss drives, and the workfolk walk or make the journey by tram or bus. There is economy in my method, too, a subject on which far too many people lecture others but signally fail in example.

A True Record

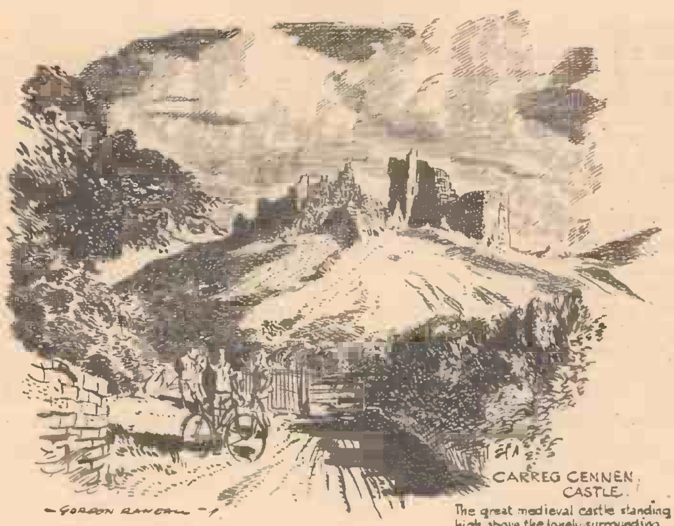
I AM able to understand a middle-aged man shying from town journeying unless he has remained a cyclist since his young days. That is the value of regular riding traffic conditions. The motorist is wrapped in an envelope of steel and it makes him feel secure. Put him on a bicycle as part of the traffic stream and he feels naked and scared. Yet the truth is, in my experience, that the traffic-trained rider is far safer than the driver because his mobility is greater and his judgment—and I'm speaking of the regular cyclist—far more certain. In any case it is unwise to take risks whether you ride or drive, and especially so for the cyclist who is vulnerable and sometimes, alas, unconsidered by the hurrying drivers. Yet you come to know all the little failings of your fellow travellers and, being aware of them, can dodge most of the awkward folk. Indeed, I often get a lot of quiet humour from the antics of the traffic-streamers when impatience often makes fools of them. Actually there is no need to be scared of the road if you are sure of yourself, and are prepared—as we all should be—to use our common property as a common right demanding common courtesy. The trained cyclist does this for his own safety and therefore is a happy journeyman. There are fools among the wheeling ranks, reckless people who risk their safety for the sake of a second in time, but they are not trained cyclists and, in any case, are a greater menace to themselves than a danger to other folk, even though they may be the cause of invective. For 55 years I have been making my home-to-work-and-back journeys and am still whole, and in that long period have never lost a day through accident, and only on rare occasions needed a dab of sticking plaster.

Pride in Performance

IT is interesting to me to recall that, though I always carry a miniature first-aid outfit when on tour, its service has only been used on my companions on rare occasions or on chance mishaps sustained by unknown riders, but never on me. All of which suggests I am a careful soul, but I think such a description would scarcely fit the case; rather it is that long use of the bicycle has made me expert I suppose, and my objection to take risks appears to have had its reward. Indeed, nearly all my personal accidents have occurred when playing other games, the worst of which was a twisted knee joint when playing tennis. I especially remember that because it kept me off a bicycle for three weeks. I have sprained an ankle shooting, and also been peppered in hand and arm by No. 6 shot from the musket of a careless gunner; and on several occasions have been crippled for a few days as the result of playing football; so you see, so far as I am concerned, cycling is the safest game extant. Once, many a year ago, I was chased down the road by a bull, but the bull got tired first, thank goodness. True I have crashed during my racing days, skidded and fallen on numerous occasions before the real mud was removed from the road and waterproof surfaces substituted, and have ridden into unlighted road obstructions in the days (or nights) when strictures on such carelessness were not so severe, but beyond bruises and slight abrasions have come through unharmed. Surely that is a testimony to cycling and to the value of early tuition in the pastime, and I cannot understand the parents who keep their offspring pining for the ownership of a bicycle with the excuse that the roads are too dangerous. The roads were never dangerous, however bad: the careless folk who use them are the trouble.

CYCLORAMA

By H. W. ELEY



CARREG CENNEN CASTLE.

The great medieval castle standing high above the lonely surrounding countryside. It lies a few miles to the south of Llandilo Carmarthenshire.

Star Attraction

USUALLY, a shop window attracts the closest attention when it is dressed in the most modern fashion, and when the display is of goods of up-to-the-minute modernity; but the other day, in the pleasant Derbyshire town of Ashbourne, I saw a cycle dealer's shop window which was a "star attraction" simply because it contained the old, and not the new; there, in this small shop, looking rather odd and incongruous, right in the centre of the window, was a "Penny Farthing" bicycle . . . and, alongside it, a small replica of the old machine, made by the dealer himself! I fancy that this shop window, during the period of this display, attracted more attention than all the other windows in the town, and it was highly diverting to hear the comments of the "youngsters" who, dismounting from their brilliantly coloured new machines, gazed at this model of former days. Some laughed, some seemed a trifle awe-struck, and a few went into the shop and were entertained by this enterprising dealer with some facts about early bicycle design and historic models. I should not be surprised to learn that by exhibiting this "antique" this dealer has sold one or more *new* cycles . . . I hope he has, for his window display was an example of real salesmanship.

Tyre Tread Design

I HEARD an interesting little chat the other day between some cyclists on the question of tread design. The occasion was one of those pleasant little intervals in the day's work, when I wander down to the village inn. The riders were out for a spin around the Peak district and had come upon my small village unawares; they liked the look of it and decided to rest awhile. Tyre treads came as a topic out of the blue, and I was intrigued, as an old "tyre man," to hear the view expressed that it was all a matter of evolving a "pretty pattern"—there did not seem to be any appreciation of the fact that the tyre designer produced a tread design for good and sound technical reasons — perhaps more particularly in the case of car and motor-cycle tyres. I joined in the chat and mentioned some of the designs I had seen evolved over my Dunlop years; we talked of cornering, of road grip, of designs which picked up too much mud and grease . . . and our little "tyre talk" was quite interesting and informative. Everything about a bike is full of interest, and there is no better audience than a bunch of cyclists, proud of their mounts, and with minds open to absorb new knowledge.

Fan Mail

I CONTINUE to receive letters from cyclists inspired by these rambling notes, and the other day one reached me from smiling Somerset. The writer was "Zummerzet born" and rightly proud of his county. Three pages of eulogy about Glastonbury, and the Mendips, and aristocratic Bath, and the orchards where the apples weigh down the trees in mellow autumn, and the beauty of Minehead, and the glory of Wells and its ancient cathedral. It is grand to receive these letters about the scenic beauties of England, and grand to realise how aware are many cyclists about the treasures of our towns and cities and hamlets and villages, and hills and dales. And I am—and always have been—a "Somerset fan," for the county has loveliness unsurpassed and history is woven into the stones of its towns. As for Glastonbury and its Holy Thorn, and many legends, well, here is something which touches the very cradle of our faith, and wings our thoughts to the dawn of Christianity in our land. My Somerset correspondent mentions apples and cider, and an inn-cum-farm where, on summer evenings, he is wont to take his ease and sip his county's beverage from a pint mug, and join in rollicking Somerset songs with men from the rolling moors where the red deer roam. Salute to Somerset!

In the Year of Grace, 1924

WE hear a lot to-day about price comparisons, and it is a common thing to be told, by old men with long and nostalgic memories, of how in their golden youth ale was threepence a pint, tobacco fourpence an ounce, and a tailor-made suit of clothes about three guineas. Well, a price comparison in the cycle business was brought to my notice the other day . . . I unearthed a daily newspaper of the year 1924 containing a Hercules cycle advertisement, with the price shown with startling boldness . . . Three Pounds, Nineteen Shillings and Sixpence! Only 27 years ago! Now, I am not going to make comparisons between the bike you could buy for that small sum and the gleaming colourful models which grace the windows of cycle shops to-day: that would be foolish. But I did find myself murmuring: "How on earth was it done?" Other days . . . other prices, and after all, the whole question is relative, and I quite cheerfully handed over my four shillings for my ounce of tobacco later in the day and gave not a thought to the times when the price would have been four PENCE!

Never Too Old to Learn

AN old "saw"—and a true one! A gentleman of 80, in a neighbouring village, has just bought himself a bicycle and is learning to ride it along the quiet road which leads to Holly Tree farm. He is a sprightly old boy and looks forward to many short but happy rides around the district . . . and I do not doubt that he will benefit from the exercise and find quite a thrill in his possession of this "new toy." "I'm not out to break any records . . . or any bones," he told me cheerily the other morning when I set out with my dog for a walk to the old plantation where there are good logs for sale . . . I have electricity cuts in mind, and I must see to it that my wood shed is full against the storms and snows of King Winter.

Christmas Cameo

IT may be hard, in these rather prosaic days, to capture the spirit of Dickens and enter into all the old-time revelry of Yuletide, but the spirit of Christmas cannot be killed, and there will be "waits" singing carols in the village on Christmas Eve, and the tap-room of the inn will be gay with festoons of holly and mistletoe, and there will be a jolly Christmas party for the children in the schoolroom. And, on Christmas night, I shall smoke a pipe by a log fire, and—as in easier years, read a bit from "Pickwick" and conjure up mental pictures of rounds of English beef, and tables which groaned with joints of pork and succulent Surrey chickens, and all the gargantuan Yuletide fare which rejoiced the hearts and warmed the stomachs of our forefathers. Something of the glory of Christmas remains in the countryside, and the age-old greetings have meaning still.

Debate on Diet

ONE day recently, in a little inn, I fell to chatting with some cyclists, and the talk turned on to diet and the best form of "sustenance" when on a longish ride. Much expert discussion about calories . . . about which I know little or nothing. One of the riders was by way of being a dietician, and he quickly got me out of my depth when he discussed food values. But we agreed on one or two points: all of us had proved that chocolate—and cheese—were good things to ride on. We were divided as to the respective virtues of tea and coffee . . . but we agreed that on a hot day, after a long "pull," it was good to come across an inn and drink cool beer out of a tankard. As for the ideal "snack" . . . well, I shall stick to chocolate, cheese and apples! About their calorific values, I do not much care!

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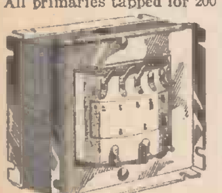

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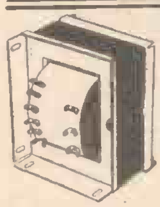

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