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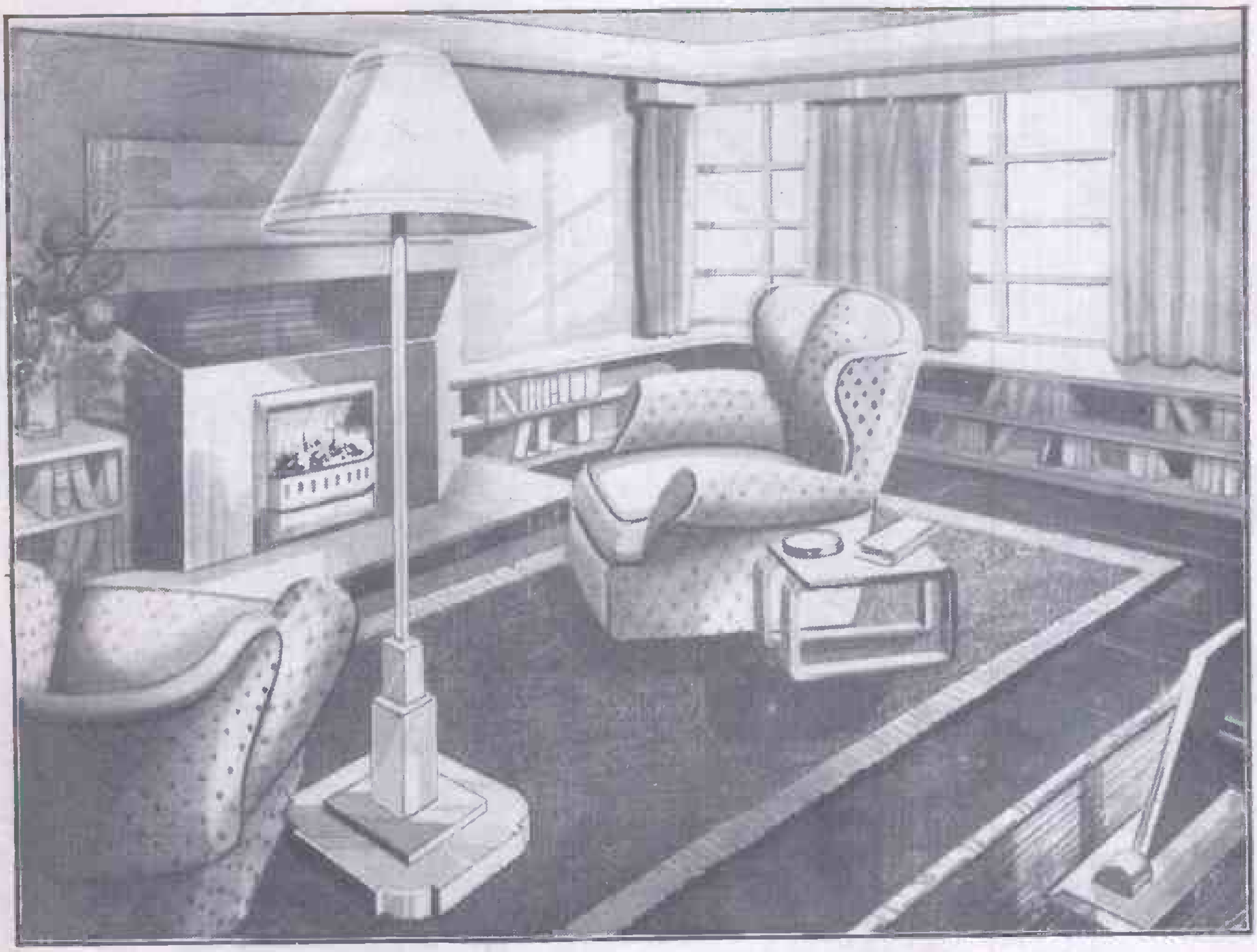
9D.

EDITOR : F. J. CAMM

FEBRUARY 1948



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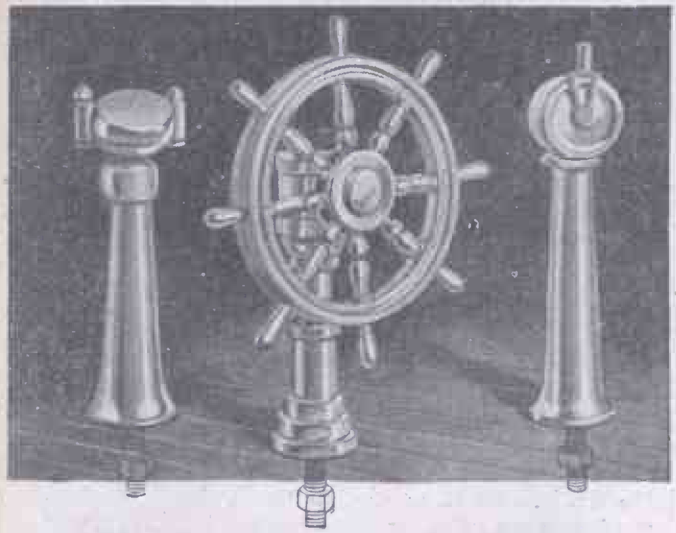

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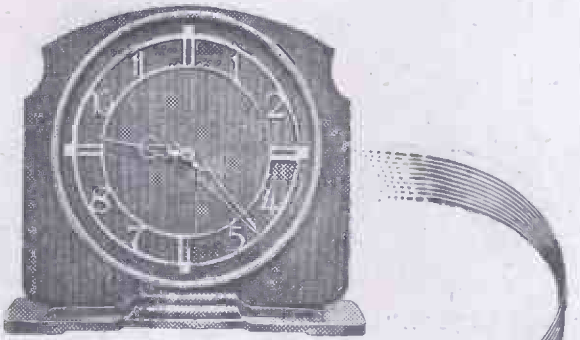

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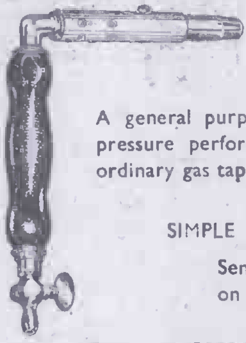

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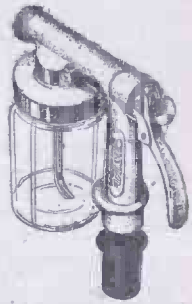

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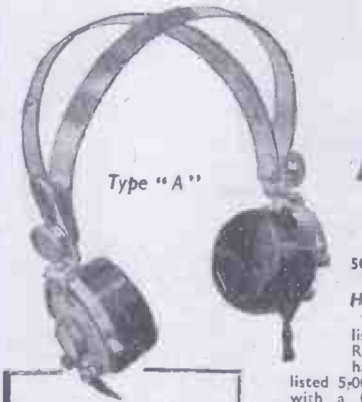

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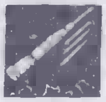
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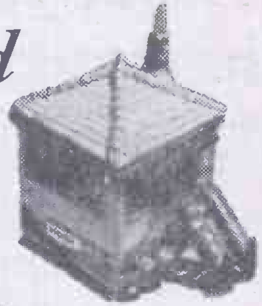

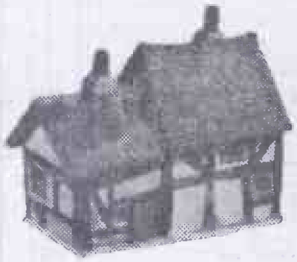

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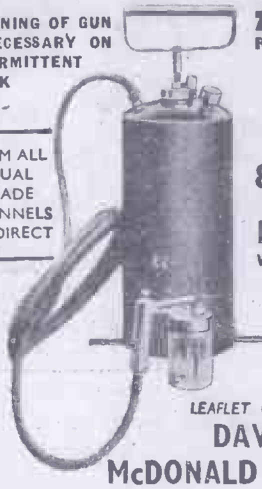

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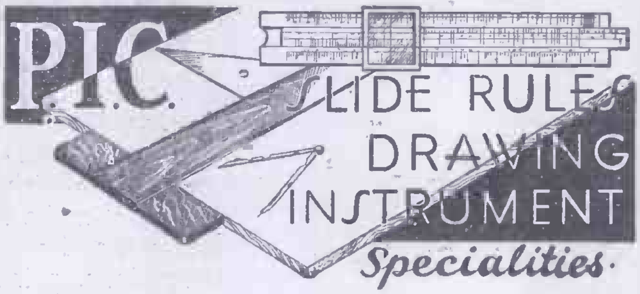

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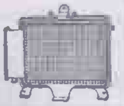

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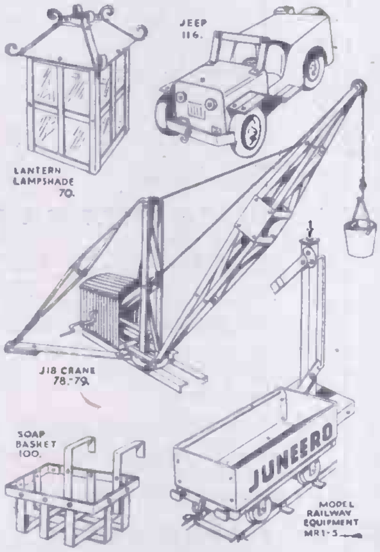

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Owing to the paper shortage "The Cyclist," "Practical Motorist," and "Home Movies" are temporarily incorporated.

Editor: F. J. CAMM

VOL. XV FEBRUARY, 1948 No. 172

FAIR COMMENT——BY THE EDITOR

About Time and Timepieces

THERE is a never-ending fascination about clocks, watches, and other devices for measuring the passage of time. These go back to the very earliest days of which man has record. The Chinese probably invented the first form of clock, the Clepsydra, or water-clock, consisting of a container filled with water with a float. The water was allowed to drip from a small orifice, and as the float descended with the diminishing level of the water, a cord wound round a rod and attached to the top of the float caused a hand to record the movement on a dial.

Many modern copies of the Clepsydra have been made for demonstration purposes, and they can be made to keep reasonably close time. Sundials and graduated handles were introduced by the Greeks from the Romans.

The earliest astronomers observed that the earth took a year to make a revolution round the sun, and one day to make one revolution round its own axis.

Julius Cæsar was the first to attempt to construct a calendar which would tally with the sun's year, and he decided on a year, divided into twelve months, or a year the odd months having 31 days and the even 30, with the exception of February which was to have 29, and 30 every fourth year. It is common knowledge that the year consists of 365¼ days. The quarter of a day is ignored excepting during Leap Year, when it is added to the month of February. July took its name from Cæsar's christian name, the month of Julius.

However, the Roman Emperor Augustus, who was born in the eighth month, thought that one of the months should be named after him, so he borrowed February's 29th day and added it to August, thus bringing February to 28 days.

It was not until 1,500 years later that it was discovered the Julian system resulted in a loss of 11 mins. 10 secs. every year; thus by the year 1532 there was a deficit of 11 days, and to remedy this 11 days were dropped from the year 1532 and a new calendar was established which was lengthened by 5hrs. 49 mins. This calendar was introduced by Pope Gregory XIII, and it is known as the Gregorian Calendar. He decided that rather than add the awkward figure of 5 hrs. 49 mins. to the year, he would add an extra day every 300 years.

England followed this example, and on September 2nd, 1752, there was a gap of 11 days, and people went to bed on September 2nd to awake on September 14th. It was in 1752 that January 1st was established as New Year's Day.

It is a popular belief that Leap Year is every year that is divisible by four, but the year 1900 was not a Leap Year, although the year 2000 will be.

Of course, by adding a day every fourth year in the course of a century we have added almost a day too much, and therefore the century years which are divisible by 100 are not Leap Years unless they are also divisible by 400.

First Mechanical Clock

IT was not until the 14th century that the first mechanical clock was constructed. Although the name of its inventor is unknown, it is certain that it was until 1872 in the tower of Dover Castle. It was probably made in about 1395, and may be seen working in the Science Museum, South Kensington. Its construction is of great interest, because it paves the way for the early watch escapement. All of the clocks and watches until 1750 were fitted with an escapement similar to that used in the Dover clock, and known as the Verge.

In it the balance-arm or foliot was not fitted with a spring, but carried two heavy lead blocks which swung through an angle of about 90 deg. under the action of the escape-wheel.

It was in 1670 that Huygens adapted the pendulum to the control of clocks. The properties of the pendulum had been discovered about 1620 by Galileo while comparing the swinging of a lamp pendulum with the beating of his pulse during a service in Pisa Cathedral. He discovered that isochronism (or equal time periods) of a pendulum is approximate only, and is only exact when the arc remains constant. The Verge escapement, the only one then known, demanded an arc of at least 60 deg., and the timekeeping therefore was not good.

Dr. Robert Hooke invented the anchor escapement in 1675, and this made it possible to use a pendulum which swung through a small arc only and thus enabled greater timekeeping accuracy to be obtained. It was Hooke who also discovered the law relating the action of forces with the deflection of springs, and he also discovered the coupling for shafts which are not in line known as Hooke's joint, or the universal joint.

The early clocks were invariably driven by means of a weight, and it was the invention of the mainspring by Peter Henlein of Nuremburg at the end of the 15th century that made possible the construction of a watch. The first watch escapements were of the Verge type, and the amount of space occupied by this escapement caused the watch to be almost spherical in shape, which resulted in them being called Nuremburg Eggs. They were not accurate timekeepers.

There are plenty of specimens of Verge escapement watches still in existence, and they may be picked up quite cheaply. They are, of course, beautifully made, but most erratic and inaccurate timepieces.

The "Fusee"

IN an effort to improve their timekeeping by providing a constant torque, a device known as the fusee was invented about 1525. It is still used in some clocks to-day and in a few pocket chronometers. In this device the mainspring is contained in a cylindrical drum or barrel on which is wound a length of slender chain. The other end of the chain is wound on a spiral drum, so contrived that as the spring runs down and becomes weaker the leverage on the axis of the spiral becomes greater, thus giving a practically constant torque throughout the range of the spring. In many respects, however, it was found that the fusee was a fallacy for accurate timekeeping, which does not depend so much upon an equal torque as upon the isochronism of the escapement; that is to say, when the watch or clock is fully wound and the balance has a greater arc of movement the time of each arc should be exactly equal to the short arc when the watch is nearly run down. It also depends to some extent upon the compensation of the balance, to correct temperature changes. When the temperature of a watch is raised the hairspring lengthens, becomes weaker and the watch tends to lose. To correct this the balance is made bi-metallic, and under the influence of heat tends to become smaller in diameter. As it thus has a smaller radius of gyration, it will tend to go faster and so compensate for the weakness of the hairspring.

Elinvar Hairsprings

To-day, in very high-class watches, elinvar hairsprings are used. This metal has the peculiar property of being practically unaffected by heat.

It was Hooke who invented the hairspring in 1660. It gives the balance a definite period of oscillation. The first big improvement in escapements, was made by George Graham in 1725, with his cylinder escapement. This is now practically obsolete, for it still did not attain the perfection sought. Mudge invented the detached lever escapement, and with modifications this is the form of escapement almost universally employed to-day. A few chronometers are made with detent escapements, in which a lever is not used.—F. J. C.

Developments in Magnetic Sound Recording

A Meeting of the B.S.R.A.

Reported by DONALD W. ALDOUS, M.Inst.E.

The new British wire recorder, the Model "A" Boosey & Hawkes unit, intended for speech recording.

AT a recent meeting of the British Sound Recording Association in London, Mr. P. T. Hobson (of Boosey & Hawkes, Ltd.), delivered a lecture on developments and present-day applications of magnetic recording, with special reference to the wire system.

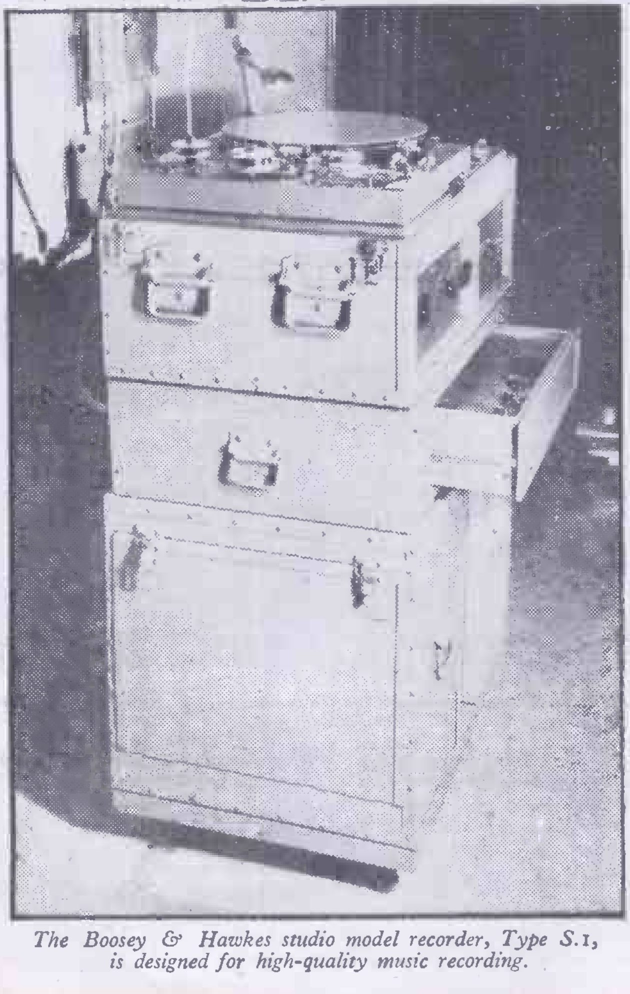
Dr. L. E. C. Hughes, president of the B.S.R.A., was in the chair, and in his introduction he made a brief reference to the historical aspect of the subject. He mentioned that the principles of magnetic recording have been known for more than 40 years, as Valdemar Poulsen, the Danish scientist, demonstrated his "Telegraphone" at the Paris Exposition in 1900, and in the same year Poulsen obtained U.S. Patent No. 661,619 for steel tape as a recording medium or carrier. A model of the early Poulsen wire recorder can be found in the Science Museum, South Kensington.

Mr. Hobson, in his opening remarks, explained that there was no important advance in this method until the advent of the thermionic valve amplifier and the production of suitable steel tape. These resulted in the introduction of the Blattnerphone (named after the late Ludwig Blattner) and its improved successor, the Marconi-Stille recorder, both using steel tape, the former being first used in this country by the B.B.C. in 1930.

The Magnetophon

In Germany an instrument known as the Magnetophon was developed and marketed by A.E.G. of Berlin several years before the war, primarily as a dictating machine. During the war intensive research produced marked improvements in performance, and the quality of reproduction now obtainable is of a high order. The two principal novel features are : (1) the use of supersonic frequency A.C. for biasing (i.e., premagnetising) as well as for wiping (i.e., erasing the signal), and (2) the use as a recording medium of a tape the magnetisable layer of which consists of a dispersion of iron-oxide particles in a plastic material (usually acetyl-cellulose or polyvinylchloride).

The difficulty that had, since the beginning of the century, impeded progress was the view accepted by science of the magnetisation process itself. Research by the Armour Research Foundation, of the Illinois Institute of Technology, Chicago, particularly the work of the young American engineer Marvin Camras, and later through experiments in this country, had revealed a much clearer picture of the requirements of the material for wire recording, and on applying the results to the design of practical machines, magnetic recording on wire had been raised to the high-quality class, as Mr. Hobson proved by a demonstration of specimen recordings.



The Boosey & Hawkes studio model recorder, Type S.1, is designed for high-quality music recording.

Stainless Steel Wire

The clue to the realisation of practical equipment was in the wire. A stainless steel wire of 4 mils. diameter had finally been selected, and the standard speed for quality reproduction is 24in. per second. The standard playing-time is 66 minutes, which could be increased if a lower grade of speech quality is acceptable. Longitudinal magnetisation is used, and the wire runs through a carefully designed head. If the wire should break, a knot could be tied, the ends trimmed and the joint would pass safely over a channel in the head.

The process of magnetisation induced a multitude of disc-like magnets, face to face along the length of the wire, of a thickness depending on the wavelength. The demagnetisation effect was of paramount significance, as it determined the losses for a given wire speed and maximum frequency of the recording currents because of the self-erasing effect of the high demagnetisation in short magnets, here related to the constant diameter of the wire.

A demagnetisation curve of a sample of material, used to indicate the relation between H and the resulting B, showed the relation between the applied field H and $4 \pi I$, where I was the intensity of magnetisation. The curve revealed the applied field which was necessary to reduce the coercivity to zero, and this value determined the effectiveness of the material as a permanent magnet.

The term coercivity covered two conceptions: the inductive coercivity, which was the field required to reduce the remanent induction to zero, and the intensity coercivity, which was the field required to reduce the intensity of magnetisation to zero. This distinction was not of importance, however, when permanent magnets rarely had total coercivities greater than 100 oersteds, because below that figure there was practically no difference between the two.

Magnetic Induction

After this exposition of the magnetisation process, Mr. Hobson explained that it was the magnetic induction in the wire that generated a reproducing voltage, and even if the self-demagnetisation was complete, there still remained some intensity of magnetisation which was only entirely removed if the total demagnetising field was increased to the intensity coercivity of the material.

If a line was drawn from the origin to the demagnetisation point on the B : H curve (hysteresis loop), it was found that the tangent of this line to the vertical, D, was directly related to the ratio of the wavelength to the diameter, and thus to frequency. Hence, for the purposes of sound reproduction, it can be shown that: Loss in db. (decibels) = 20 log.R/(R + D), where R is the ratio of inductive coercivity to remanent induction, which depended experimentally on the material, and it had a limit of unity.

The wire for the original machines had a remanence of 6,000 to 7,000 gauss, and required a speed of 5ft. per second for speech when employing an available stainless steel wire, with a coercivity of 60 to 90 oersteds. It had now been shown that the highest inductive coercivities at the expense of remanence were needed, and these requirements were met in a completely annealed austenitic steel which, because of the necessary heat treatment, was substantially non-magnetic, the remanence being 600 gauss and coercivity 300 oersteds. This type of wire was now in production in Great Britain, with continuous monitoring and automatic control of the hysteresis loop on a cathode-ray tube as the annealing current was passed through the wire.

The use of a high amplitude biasing or polarising current was usually thought to be essential in overcoming the bend in the initial magnetising curve when recording, but Mr. Hobson outlined a more fundamental approach according to the Weiss domain theory of magnetisation.

Noise Analysis

Noise analysis is complex, commented Mr. Hobson, as there are several types of noise contributing to the total output; for example, virgin noise (i.e., as the wire comes from the drawing machine), dynamic background noise from the recording bias, static background noise from erased recordings, and a modulation noise component, but as one of the chief noise sources is proportional to the remanence it is possible to obtain a low noise level corresponding to a signal/noise ratio of 60 decibels.

The speaker revealed, in conclusion, that the British version of the American Armour Model 50 wire recorder, which was extensively used during the war by the Services, both in the air and on the ground, was now in production, and a few units were available strictly for speech and non-entertainment applications costing around £147. Fidelity models for music recording were now being developed, and it is hoped they would be marketed in about a year.

Electric Light and Power Installation—3

House Circuits : Conduit Sizes : Looping-in Wiring System.

By S. T. CORNER

(*Continued from page 87, December issue.*)

THE main cables of all installations are led to a main distribution board, and from there the current is distributed to the various localised centres which may be on different floor levels.

Local distribution boards are placed as near as possible in the centre of the area they serve. From the local boards conductors radiate to various branch circuits. Each of these circuits will feed a number of lighting and/or power points. The number of points is usually limited to not more than ten on one fuse. In case of a short circuit blowing a fuse the least number of points put out of action the better; it is also easier to locate the source of trouble.

House Circuits

Ordinary private house installations usually have only one distribution board, or box, with fuses on both poles of each circuit. A circuit feeds all the points on one floor only, so that it is quickly known which fuses have blown without having to withdraw all of them for inspection. Incidentally, the fuse box should have a diagram inside the lid, showing the position of the fuses for each floor. Unfortunately, most small installations have only one switch serving the distribution board. A first-class installation will have a switch for each circuit. A fuse should not be changed without switching off, for it is not safe for an amateur to tamper with a live circuit.

Capacity of Cables

All electric cables develop heat when a current is passing through them. As the temperature rises the resistance of the wire to the passage of the current becomes greater and this causes a loss of voltage.

The safe current carrying capacity of a cable, in amperes, is proportional to its cross section. It must be of such a size that the rise of temperature is not appreciable when carrying a maximum load. In lighting circuits a very small fall in potential makes a considerable difference to the illuminating power of the lamps.

On long main feeders the cross section area is calculated to give a minimum voltage drop. It is the general practice to instal cables of little greater capacity than is necessary to carry the possible maximum load. Too liberal an allowance in this respect will add very considerably to the cost of cables and other materials. There are also other important factors that require consideration.

Standard Loading Capacity

Standard maximum loading has been fixed by the rules of the Institution of Electrical Engineers. The amount of current that can be safely carried by a cable depends on the cross section area of the wires, and the rise of temperature within safe limits. Heat that is developed in a cable is dissipated to the surrounding atmosphere through the insulating material. Much, therefore, will depend on the composition and thickness of the insulation, and, in turn, the thickness of the insulation depends on the voltage of the system.

A metal conductor (copper in most cables) of small cross section area has proportionately greater surface area than a thick conductor. It has, therefore, a proportionately superior heat dissipating area. Within certain limits, a thin conductor can safely carry a higher current density than one of greater cross section.

Standard cable loadings are calculated to carry a maximum current with a minimum voltage drop taking all the foregoing factors into consideration.

The following table gives a range of suitable cables to carry from 5 to 37 amperes.

CURRENT-CARRYING CAPACITIES OF CONDUCTORS

Number of Strands	Diameter of Wire (in.)	Carrying capacity in amperes I.E.E. Rules	Approx. length in feet (lead and return) for 1 volt drop by I.E.E. Rules
1	.044	5	36
3	.029	5	47
3	036	10	35
7	.029	15	34
7	.036	24	33
7	.044	31	39
7	.052	37	45

Conduit Sizes

Before wiring an installation it is most important to determine the size and the number of wires to be run. This will depend on the system of wiring adopted, which will be dealt with later. The number of cables to be run determines the size of the conduit. If the correct size of tubing is used no difficulty will be experienced in drawing in the

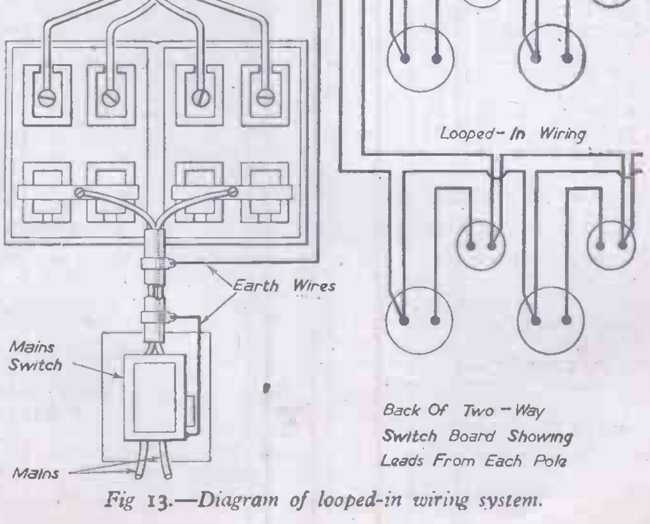


Fig 13.—Diagram of looped-in wiring system.

wires and easing them from one bend to another, or from a tee piece or elbow to the tube ends.

Wiring is always a two-man job ; one is needed on the draw wire while the other feeds in and eases the wires around bends to prevent damage to the insulation. Should the cables be too tight a fit in the tubing the insulation may be damaged and the wires stretched or even broken. Powdered french chalk, sprinkled on the insulation, may be used as a lubricant to assist when drawing in. Anything of the nature of grease or oil must not be used in any circumstances ; the insulation would be ruined.

The following conduit wiring table may be taken as a general guide for tube sizes.

CONDUIT WIRING TABLE
Giving approximate number of cables that tubes can contain.

Cable Size	Light Gauge Size of Tube				Heavy Gauge Size of tube			
	½in.	⅝in.	¾in.	1in.	½in.	⅝in.	¾in.	1in.
1/044	2	4	6	10	2	3	5	8
3/029	1	4	5	9	1	3	4	8
3/036	1	3	4	8	—	2	4	8
7/029	—	2	3	7	—	1	3	5
7/036	—	2	3	6	—	1	2	5
7/044	—	1	2	4	—	—	—	4
7/064	—	1	1	2	—	—	—	2

Circuit Wiring

The wiring from the circuit distribution boards is much smaller than that used for the main cables. As a general rule lighting circuits are divided up so that each carries a maximum load of about three amperes ; the wiring is actually calculated to carry five amperes. There is an alternative choice of two types of cable, viz., single strand 0.044 gauge, or three strand 0.029 gauge, known in the trade as 1/.044 and 3/.029 respectively. Stranded wires, being more flexible, are preferable to the single wire type.

In good modern wiring work the use of jointed wire is strictly taboo, and in no circumstances is a jointed wire drawn into a tube. Where a joint is unavoidable, for any particular reason, it is made in a special joint box or a junction box. Unsoldered, or dry joints, are barred at all times. No matter how carefully they may be made corrosion is sure to develop in time ; this will set up a high resistance that will generate heat, which may cause fire. There are occasions when a jointed wire is unavoidable, but it must always be soldered, and well insulated with a rubber sleeve and insulating tape.

Cut-outs and Fuses

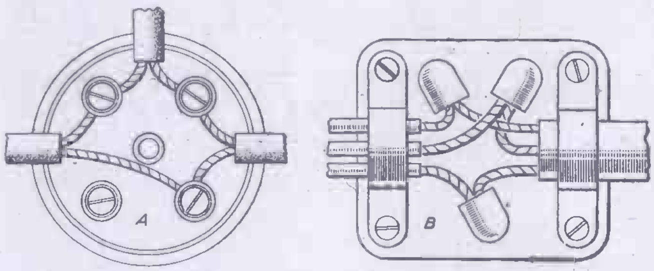
Every electric circuit is protected by a cut-out device to prevent damage to the wiring by over-heating if a sudden overloading or a short circuit occurs ; it also protects the lamps, motors, and instruments in the circuit. At the power station the mains are protected by automatic cut-out devices that break the circuit by dropping out the main switches. Similar devices are used for high-power motors. Ordinary house circuits are protected by main fuses fitted between the main switch and the distribution board, and each of the auxiliary circuits has a pair of fuses.

House fuse boards are usually installed in a cupboard under the stairs, or in an inconvenient position in a pantry. It is very bad practice to place a fuse board high up over a door where fuse renewal is difficult in an emergency. At the same time, the fuse board must be kept out of reach of children, or placed where it is not likely to attract attention as a possible plaything. Where this danger exists an ironclad fuse box is safest, with a lid secured by screws, or a safety device which prevents lid from being opened until the switch is off.

The fusible wire cut-out is, of course, simplest and cheapest. It is a well-known device consisting of a detachable porcelain hand-grip fuse holder with two slip-in terminals that fit into spring-clip terminals on the base of the fuse-holder. To the terminals of the base are connected the incoming main cable and the outgoing circuit wire, respectively. Between the two slip-in terminals of the fuse holder is a wire of copper, tin or lead of a thickness sufficient to carry an electric current of pre-determined value.

Safety Fuse-holders

Fuse-holders of the safety type are those with a tube or a channel through which the fuse wire passes from one terminal to the other. Whether for quickness or ease, the fuse wire must not be made to by-pass the proper course. The tubular type serves a double purpose ; when a fuse blows the molten metal is retained in the enclosure and prevented from causing damage or fire ; and the violence of the rupture induces heated air to rush out of the tube and break the arc as the circuit is opened.



Junction Box Suitable For Tough Rubber Cables. Junction Box Suitable For Lead Covered Cable

Fig. 14.—Two types of junction box.

All fuses are fitted between the switches and the lighting and power circuits, so that the current can be switched off before a fuse is renewed. A fuse acts as the weakest link in the chain, which will break before an overload can do damage. Normal lighting circuits are usually wired to carry five amperes, but are loaded to about three amperes. Generally a five-ampere fuse wire is used. Circuits carrying variable loads, such as those that feed electric motors, which normally take a heavy starting current, have fuses that blow at as much as 100 per cent. above the rated current intake of the motor.

Looping-in Wiring System

Most, in fact it might be said all, modern lighting circuits are wired on the "looping-in." system. This method has the advantage of being easy to run without having to make a multiplicity of joints, or use of a great number of joint boxes. Wires of two different colours are used to facilitate recognition at the connecting ends. The red wires are carried to the switches and the black to the lamps. Red, or switch, wires are connected to the live side of the circuit.

Referring to Fig. 13, it will be noticed that the feed wire is taken to the live side of the first switch and then looped out and carried to the live side of the next switch, and so on in unbroken succession. The wires are of necessity cut at the switch and the ends twisted together, but the joint is a safe mechanical one secured by the switch terminal screw. Provided the screws are tight, there is little fear of corrosion. From the other terminal of the switch another red wire is taken to one of the lamp-fitting terminals.

The black wire from distribution board is carried to the first lamp fitting and from there looped out and taken to the next lamp fitting, in exactly the same way as the switch wires are run. Each lamp terminal acts as a mechanical joint fitting which is electrically sound, and is in a safe and convenient position within the fitting itself.

The great advantage of the "looping-in" system is the absence of intermittent joints. When it is necessary to test out an installation, or to trace a fault in the wiring, the positions of all the joints are known. It is necessary only to open up or remove a fitting to get at the bare end of a lead and connect a testing instrument.

Junction Boxes

Looping-in is not always so simple as it may appear from the foregoing description ; runs are not ideally straight, nor devoid of complications, and it is frequently necessary to use junction boxes, two examples of which are shown in Fig. 14. The junction box "A" has a special type of terminal which makes a sound mechanical joint. The box itself, being made of metal, provides for the continuity of the earthing system of the tubing. Box "B" is suitable for lead-covered cable being provided with earthing clips that grip the metal sheath. The base of the box in this case is also of metal. Junction boxes of plastic material do not provide continuity, and when these are used the outer sheaths of the cables are connected by a bare copper wire, preferably run round the outside of the fitting.

On small installations a considerable amount of tubing and cable can sometimes be saved if the main leads are taken to a centrally situated junction box, and from there the looping runs carried to the various switches and light points. Various switching systems call for additional wires or a different arrangement of the looped-in wires. These will be dealt with in a later article.

(To be continued.)

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Stone Polishing for Amateurs

A Simple Explanation of a Fascinating Process

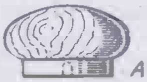
WHEN you visit any of our seaside resorts a close scrutiny of the sands and shingle may reward you with what is usually termed a "pebble," though not always will it have that rounded form we associate with the word.

Pebbles may be recognised by their translucency and colour, and most commonly are forms of silica to which such names as agate, cornelian, jasper and chalcedony are applied. They include also cairngorm and amethyst, though these two are local and rare. The south and east coasts are happy hunting grounds for the pebble hunter.

Now, having found your pebble, you will want to cut it, in other words, to reduce it to a regular shape and give it polish to bring out its colour and markings.

Tools Required

Just what tools are required will depend upon what is to be done with the stones.



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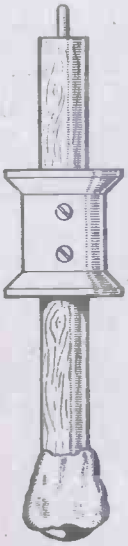

Fig. 3.—This arrangement, using an Archimedean drill, can also be adopted.

B

Fig. 1.—(Above) The apparatus used in stone polishing. Fig. 4.—(Right) The stone should be cemented to a short handle when the lapping board is used in the lathe.

If it be desired to only grind and polish a single face to bring out the colour and markings, very simple appliances will serve. The rough grinding will be done on a grindstone or emery wheel, if either is available; if not, then the more arduous process of rubbing down by hand on a slab of sandstone, or wood charged with coarse carborundum powder and water, is the next best way.

Having ground the stone to a fair surface, free from pits and other blemishes, the next thing is to repeat the process with a new tool and a finer grade of carborundum, until the surface shows no sign of scoring and takes on a surface that may be compared with ground glass.

The Polishing Process

It will then be ready for polishing, which may be done on a pad of felt tacked to a slab of wood and charged with putty powder and oil. The polishing process demands patience, and must be continued until the polish remains after the surface has been washed free of oil. If the utmost brilliancy be desired, the polishing may be continued with jewellers' rouge on a surface of pitch, using the rouge wet, but allowing it to become nearly dry as the process approaches completion.

Should the stone be of such a shape or size that it cannot be held in the hand, it may be cemented to a block of wood, so as to give a better hand-hold.

Mounting the Stones

Stones polished in this way have a certain amount of interest as mineral specimens, but there is no very useful purpose to which they could be applied. If it be desired to mount the stones either in jewellery or as surface decoration, say, to a box lid, then the polishing process must be adapted to the production of a regular convex surface. This may be done by the use of the simple appliances illustrated.

Fig. 1 shows a spindle made from dowelling on the centre of which a cotton reel with bore enlarged is fixed; at top a wire nail is driven in, the head cut off and the nail filed to a rounded point. The pebble is cemented to the other end of the spindle as shown. A knob handle, shod with a plate of brass in which a central socket is drilled, must be made, as shown at A. This spindle is rotated with a bow, pressure being put on with the handle held in the left hand, whilst the pebble is sunk in a hollow gouged in the slab of wood B, carborundum being used as the abrasive. It is with this simple appliance the lapidaries of India cut and polish their gems. Fig. 2 shows the process in operation.

An Archimedean Drill

If the worker has an ordinary drill stock with expanding chuck, the arrangement shown in Fig. 3 might be adopted with advantage. The stone is cemented to a short piece of dowelling, into which a stout screw is driven and its head cut off with the hacksaw.

Grinding and Polishing Pebbles

Those who possess a lathe may use it for the grinding and polishing of pebbles, chucking the wood block B, Fig. 1, and mounting the pebble on a short handle as shown in Fig. 4, but they must be warned not to allow the abrasive to get into the lathe bearings.

Fig. 2.—The polishing process in operation.

The process obviously can be better conducted with the lapidaries' wheel, which rotates horizontally. This tool may be adapted also to slitting and faceting stones and, in fact, to every process connected with the cutting and polishing of precious and other stones.

Science Notes.

By A. M. L.

High-speed Photography

I LIKE to remind my friends that they are unintentionally scientific. You cannot spend a day without using science. If, which heaven forbid, you play golf, you must realise that high-speed cinema pictures have been employed to record the flight of balls, that instruments which would show the bending of a half-inch plank under the weight of a fly have helped to balance the ball, or that a most expensive mechanism has prepared your club and the green.

If you go to the cinema, remember that high-speed photography has shown that gas moving fast can break glass and that it is only the poorness of your eye which prevents you from discovering that you sit in darkness every time each "frame" changes. That is, of course, when successive photographs are thrown upon the screen.

Paper Saucepans

IF you take a paper jar such as is used for ice cream or milk you can easily boil water in it; this may be used commercially one day to save washing-up. Washing-up machines are not good, badly as they are needed, if their setting up takes more time than the whole operation.

To return to the paper saucepans, you can soon prove to yourself that water conducts the heat away through thin paper so quickly that the paper will not catch fire. If the paper is doubled so that the air is trapped between the layers it will act as an insulator to both sound and heat. Many cinema theatres are equipped with absorbents made of cellular paper.

Radiated Energy

Thick or folded paper will burn, simply because the heat cannot get through it quickly enough and so the temperature rises. Heat, by the way, radiates through the ether like light although it has a far longer wavelength. The radiated energy from the sun actually presses upon the earth to a total extent of about 75,000 tons. Heat hits you, in truth, as well as phrase.

Electrical Notes

A Discussion on Various Electrical Problems of General Interest

By "MICRON"

MUCH argument sometimes arises concerning earthed mains, or potential "to earth," etc.

For instance: In the 200 v. insulated D.C. system, Fig. 1 (*a*), is one main 200 v. "above," and the other 200 v. "below" earth potential? If so, should not the potential-difference across the pair be 200 v. $-(-200$ v.$)=400$ v.? If the system were *perfectly insulated*, would it be possible to receive a shock from either line, standing on earth?

One does occasionally hear wrong reasons for earthing D.C. or A.C. distribution systems. Would there be any advantage whatever in connecting solidly to earth *one of the lines* in Fig. 1 (*a*)?—to take the simplest example.

The answer is none, as far as any safety requirement is concerned. In fact, there would be some disadvantages.

Voltage "To Earth"

The "earth return" is still with us in railway traction. It effects a saving, of course, but a second "earth" on the insulated line means a shut-down, whereas in a system where both lines are insulated a single dead earth would not immediately amount to a "dead short."

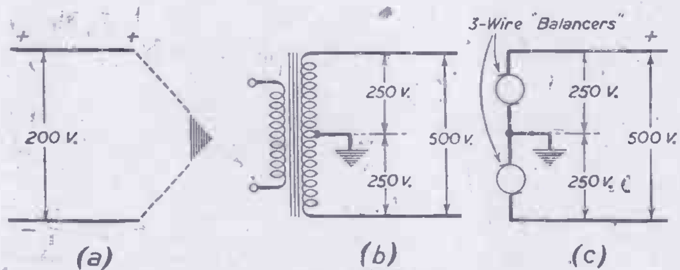

Fig. 1.—Diagrams illustrating earthing problems.

To get a clear perspective of why earthing is essential as a safety precaution—and also to halve the strain on the insulation of transformers, etc.,—consider a transformer secondary, Fig. 1 (*b*), delivering a fairly dangerous pressure, say 500 v. across lines. By earthing the centre-point of the secondary, the maximum r.m.s. potential with respect to ground will be limited to 250 v., which is the highest pressure allowed in domestic installations.

The three-wire D.C. system, Fig. 1 (*c*), reduces to the same thing, except that a neutral conductor must be provided right back to the balancer—there must be no possibility of breaking the neutral conductor by fuse links, etc., since the voltages on each side would then be entirely independent of the balancer, i.e., dependent only upon the loads on the two sides.

Some Basic Principles

As a useful introduction to insulation problems in general, let us consider one or two theoretical examples.

In Fig. 2 (*a*), two resistances of 4 and 6 megohms, respectively, are shown connected across a 250 v. two-wire system, with mid-connection earthed. This is an exact representation of the "leakage resistances" to earth from each line.

The voltage to earth from + and — sides could be accurately measured by an electrostatic voltmeter which takes no current. Any other type of instrument would shunt a relatively low resistance in parallel with the much higher leakage resistance on the side to which it is connected, as in Fig. 2 (*b*), and so give an entirely false indication—assuming it is sensitive enough to give any reading at all.

It is a straightforward example of potential division. Thus:

Voltage from + Side to Earth
$=$ P.D. across 4 megohms
$=4/10$, or 0.4 of 250 v. $=100$ v.

Voltage from — Side to Earth
$=6/10$, or 0.6 of 250 v. $=150$ v.
or $=250$ v. -100 v. $=150$ v.

Consider, next, the slightly more complicated network of Fig. 3 (*a*). With the resistance values shown, what is the potential of the point P to earth? As before, the 4 and 6 megohms might denote the insulation resistance of each side.

The four resistances form a Wheatstone Bridge, Fig. 3 (*b*). In one arm we have: LP $=$ 1,000 ohms, PO $=$ 4,000 ohms; in the opposite arm: MQ $=$ 4 million ohms, QR $=$ 6 million ohms, with point Q tied to earth potential.

If a voltmeter or other resistance (making a fifth) were connected as a "diagonal" across points PQ—or from P to earth—a couple of simultaneous equations would have to be solved to find the current in this resistance, and hence the p.d. As it is, things are simple. Thus:

From the + main:
Volts dropped across MQ $=0.4\times$ 250 v.
$=100$ v. as before.
Volts dropped across LP $=1/5\times$ 250 v.
$=50$ v.

Point P is 50 v. negative with respect to the + line, and point Q is 100 v. negative. Hence point P is 50 v. *less negative* than point Q, or is therefore at $+50$ v. (50 v. *positive*) with respect to Q and earth.

The same results would be got by considering the negative line and resistances RQ and OP.

"Capacitance" Potentials to Earth

In Fig. 4 (*a*) is shown again our 250 v. D.C. system, supposed to be *perfectly insulated* on + and — sides.

Some may find it a little difficult to answer the question: What is the potential of each line "to earth," where we have no leakage resistances? In other words: Would a voltmeter register anything if connected between a line and earth? From a safety point of view, would a "shock" be received on touching either line?

A moving-coil or a moving-iron voltmeter would show absolutely nothing—and the same applies to every type of instrument which has an internal conducting circuit. An electrostatic type would register the static "charge" in the capacitances C_1 and C_2 (intended to include the internal capacitances in generators, etc.).

Each line forms one plate of a "condenser," with the earth as the opposite plate, and the insulation as "dielectric." C_1 and C_2 are in series across the line, and are therefore charged to potentials:

$$\frac{C_2}{C_1+C_2} \text{ of 250 v.,}$$

and, $$\frac{C_1}{C_1+C_2} \text{ of 250 v.}$$

Thus, if $C_1=C_2$, the potential-difference of each line "to earth" will be 125 v. But the "earth" is 125 v. *negative* in relation to the + main, and 125 v. *positive* to the — side, which answers the question why the total potential-difference must be 250 v., and not $250-(-250)$.

If C_1 and C_2 had different values, the potentials would be calculated as above, remembering that the *larger* capacitance will be changed to the *lower* voltage, i.e., P.D. across $C_1=C_2/(C_1+C_2)$; P.D. across $C_2=C_1/(C_1+C_2)$.

The effect of shunting a resistance R across one side is shown in Fig. 4 (*b*). This resistance might be leakage, a moving-coil or moving-iron voltmeter, or the "resistance" of a person standing on earth and touching one main!

Condenser C_2 will become charged to the full 250 v., or the p.d. between the opposite main and ground will be raised from 125 v. to 250 v. Depending upon the value of R, a voltmeter connected between the *negative* and earth would show some value of steady voltage—250 v. if R was comparatively low, or no reading at all if the resistance was large enough to pass insufficient current to move the pointer.

During the minute interval when C_2 is receiving extra charge to raise the p.d. across its plates from 125 v. to 250 v., a current will be flowing in R; if C_1 and C_2 are large, a "shock" would certainly be felt. But as soon as the potential has attained 250 v., the back e.m.f. in C_2 will be equal and opposite to the line voltage; charging current will cease, and there will be no potential-difference across R or C_1.

Thus, the "earth" would be "charged" to the same potential as the + line, so putting that line at ground *electrostatic* potential. But, of course, in an actual D.C. system there will always be some leakage resistance from each side, more or less as in Fig. 2 (*a*), hence it is not so helpful to look at things here from an electrostatic point of view.

A.C. Supplies

Irrespective of leakage, the capacitances

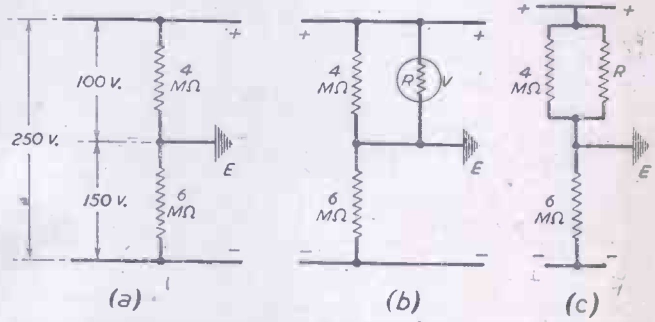

Fig. 2.—Potential-division "to earth" across leakage resistances, (a). In (b) and (c) is illustrated the effect of trying to measure these potentials with a voltmeter of comparatively low resistance R.

C_1 and C_2 will act very differently when the supply is alternating.

As before, we have virtually two condensers in series across the line, with the middle connection earthed, and the alternating p.d.s can be found by the same rules as in the D.C. case. Only they are no longer "electrostatic" potentials. A capacitance behaves more like a "resistance" to A.C.—or, more precisely, a *reactance* of $1/2\pi fC$ ohms. It takes a definite charging-current of constant r.m.s. value. True, this current is quarter of a cycle *leading* on the line voltage, but nevertheless flows over complete cycles.

Thus, independent of any leakage resistances, we now have a definite A.C. "path" with part of the line alternating p.d. across C_1 and C_2, acting as a potential-divider.

Of course, we must not forget that electrostatic charges can be extremely dangerous. There are no e.h.t. D.C. systems, but consider an 11 kV. A.C. feeder of such length that the capacitances are considerable. If $C_1 = C_2$, each will be charged to a maximum potential equal to half the *peak* voltage across lines, i.e., $\frac{1}{2} \times 11{,}000 \text{ v.} \times 1.4 = 7{,}700$ v. If the supply had been switched off at this instant of peak voltage, the lines will remain "charged" at 7,700 v. to earth, and must be discharged before any work is attempted. The large internal capacitances of machines and transformers have been the cause of fatal accidents through failure to realise such facts.

As regards "earthing" the neutral in three-phase star-connected systems, a number of somewhat involved considerations enter from the standpoint of protection, fault-isolation, harmonic currents or voltages, etc. It is hoped to discuss some of these in future articles. For present purposes it is sufficient to know that the voltage "across lines" is $\sqrt{3} = 1.732$ times that from each line to neutral—or 73.2 per cent. greater than the phase-voltage. Hence, two alternative pressures are available for domestic and other consumers, whilst by solidly earthing the neutral the maximum potential to ground is limited to the *phase*-voltage.

A great deal more might be written on these questions, but possibly the foregoing exposition of a few principles will help.

Racing Characteristics of Motors

The reason *why* D.C. motors will, under certain conditions, "race" at dangerous speeds is seldom well understood.

A car starter motor I saw tested on the bench the other day is a case in point. Connected to a 12 v. battery, it accelerated rapidly to a speed which developed into a "roar." It was obvious the machine had never been designed to run at such a speed, and a breakdown would inevitably have resulted if left to accelerate.

For a motor of this type *would* accelerate until something gave way—usually the commutator segments are "thrown out" by centrifugal forces, which is quite enough to start with!

Of course, many readers will know that a starter motor is a *series* machine. The field windings are connected in series with the armature, and, when this is so, the motor will run at normal speed *only when coupled to its mechanical load.* If started when uncoupled from the load—or with too light a load—the field will become very weak, with the result indicated.

But it should not be forgotten that *shunt* motors, too, can race. I have seen quite a few doing so, with sad results. Normally, a shunt motor will not run at excessive speed when disconnected from its load. The field is energised directly across the supply, and as long as we get normal field the speed will be about the same on no-load and full-load—there is a drop of a few per cent. (depending on the size of motor) when the load comes on.

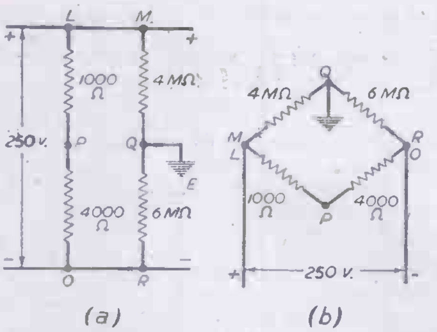

Fig. 3.—Analysing a slightly more complicated network. What is the potential of point P "to earth"?

Shunt-wound machines are not employed for car-starting, or for any other heavy duties such as traction, because the series type can exert extremely large starting torques—at least, that one reason will do to get on with. On the other hand, a motor whose speed is likely to undergo violent fluctuations with load changes would be rather hopeless, say, for a machine-shop drive where no large starting torque is necessary.

If, however, when on light load, *the shunt-field connection is broken* at some point, a shunt motor will race much the same as a series motor running on no-load. If there is any appreciable load on the shaft the shunt motor will not accelerate dangerously, since the excessive current will blow the fuses.

It may not be very clear how any motor can run even at normal speed when the winding responsible for providing a field is disconnected? Actually there will be residual magnetism—weak though it is—to provide enough torque for acceleration at light load, whilst it is possible for the armature current to reinforce this field.

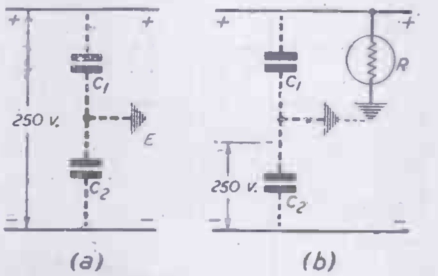

Fig. 4.—"Capacitance Potentials" to earth assuming (a), a perfectly insulated D.C. system. In (b), a moving-coil voltmeter of resistance R would discharge "condenser" C1, throwing the full 250 v. across C2.

Speed/Flux Relationship

What is difficult to understand is why the speed of a motor should *increase* when the flux is made *weaker*.

Another catch question involving the same principles is this: Would a motor run faster, or slower, if more "turns" were put on the armature?

The answer to all such problems is simple once a few fundamental facts are understood. First, *at a given speed* a machine takes a definite amount of power from the supply. Thus, if on no-load, the power will be just sufficient to make up all the losses: friction, windage, magnetic core losses, etc. It is running at a *steady speed* because of this state of balance where *power supplied = total power losses.*

If for any reason *more* power is supplied, it will now be in excess of the amount required to balance losses at the "given speed," so the armature accelerates to some higher speed where, once again, increased power supplied = increased total losses. It will continue accelerating until this fundamental "equation" is exactly true, after which the speed will again be steady at some higher value.

After all, these facts are obvious, once stated. They are necessarily true of all machines, not only electric motors.

But in the motor we have another "governing" device—an electrical one, which causes the machine *to regulate its power requirements automatically* to suit the load conditions. This is the *counter e.m.f.* or *back e.m.f.* generated in the armature coils.

The important thing to realise regarding a "back e.m.f." is that it *annuls part of the applied voltage*, in so far as a portion of the latter (equal to the back e.m.f.) will not be available for overcoming resistance—or for giving rise to a current. A numerical illustration will make this clear.

If we had a supply at 200 v., and if the armature of a motor developed a counter e.m.f. of 199 v., the only effective voltage producing a current in the circuit is 200 v. − 199 v. = 1.0 v. If the resistance of the armature is 0.04 ohm, the current will be 1.0 v./0.04 = 25 amperes—a fairly large "amperage," since, although we have only 1.0 v. available for overcoming resistance, that resistance is only four-hundredths of an ohm.

All this, of course, boils down to the basic equation for a circuit having a back e.m.f.:

$$\text{Current} \quad I = \frac{V - e}{R}$$

where V = the supply voltage
e = the counter e.m.f.
R = the circuit resistance in ohms.

If we denote the resultant voltage $(V - e)$ by some symbol, such as v, we have simply:

$$I = vR$$

Thus v is the difference of two e.m.f.s that will normally be almost equal, e.g., 200 v., and 199 v. as above. Also, because of the low "R," a *small change* in this difference, i.e., *a small change in the back e.m.f. can give rise to a relatively large change in the current.*

For example: If the counter e.m.f. dropped from 199 v. to 198 v. due to an extra "pull" on the shaft, the current will rise from 25 a. to 50 a., and the power taken will thus be increased 100 per cent. Observe that the back e.m.f.—and the *speed*—has dropped by only 1 v. in 199 v.—a little more than 0.5 per cent. It explains why a shunt-wound motor (having a constant field) is practically a constant speed machine.

What will happen if we weaken the field? The immediate effect will be a reduction in "e"—everything else remaining constant in the above equation. The armature at once takes more current and power from the supply, much in excess of that required for the speed at which it is at present running. In fact, the increase of power will accelerate it to a higher speed; e will increase, the current "I" will fall, until *Volts × Amperes* (VI = Power) is just sufficient to maintain a steady speed at some higher value than before the field was weakened.

It is not quite correct to say "the speed will increase until the back e.m.f. is the *same* as before." No machine can run at a higher speed, taking the same power. As seen, the back e.m.f. will always be of about the same magnitude as the applied voltage. In this case, if it was 199 v. before weakening the field, the motor will accelerate so as to generate, say, 198.7 v.; with the reduced flux, it cannot become 199 v., exactly the same as at the lower speed.

From this there should be no difficulty in explaining what the armature is "trying to do" when it is racing under very weak field conditions. It should also be clear that putting more turns of wire on an armature will *reduce* the speed, since a *given back e.m.f.* can be generated at a lower speed than before.

A "Power" Problem

What value of resistance should be put in series to *halve* the power in a resistance of 20 ohms?

This question cropped up in connection with a heater, but I am not going to give any kW. or voltage figures, because the correct answer is not at all dependent upon them. You are given only the resistance (20 ohms), and you must do the rest.

Quite easy if approached the right way, though I have known a page of quadratic expressions used to arrive at a solution—from lack of a little clear thinking about "I^2R."

One or two points should be noted. First, it is the *power*, not the current, which is to be halved. Secondly, we want to halve the power in the 20 ohms—not the *total* power taken from the supply. Therefore, the answer is *not* "another 20 ohms in series." Evidently that would halve the current and halve the total power—at a constant supply voltage; the power in the 20 ohms would then be reduced to one-quarter.

To halve the power in a given resistance, in what ratio should the current be reduced? What extra resistance must be added to give this current reduction? Reasoned along these lines the answer is almost self-evident. It is about 8 ohms extra resistance in series, making a total of 28 ohms.

What would be the total power saving as a result of using such an arrangement? The power has been reduced 50 per cent. in one part of the circuit, but the series resistance will dissipate some—the total reduction in the power from the supply will not be as much as 50 per cent. Roughly, it will be almost exactly 30 per cent.

Anyhow, see if you can spot the easy way of arriving at the answers.

Rectifier Instruments

From time to time I have had numerous queries from students and others regarding the "*form-factor* error" to which A.C. instruments incorporating rectifiers are subject.

A point of some difficulty is to understand that these are not *r.m.s. instruments* proper. The scales are calibrated to show r.m.s. values, it is true, but the figures must not be taken as "fixed" and correct for all sorts of alternating currents; in fact, they are correct only for a sine-wave.

Any meter embodying a rectifier is an "*average current*" instrument. The alternating current is rectified, becomes "pulsating D.C.," whilst the *moving-coil* instrument gives deflections proportional to the "average" or "mean" value of this varying D.C. Upon a sine-wave assumption, the instrument is then scaled-off to read what the r.m.s. values *should be* with an ideal waveform.

If rectified as described (i.e., *full-wave rectification*), the average current will be about 0.637 of its maximum value at the peak of a pulse, whilst the r.m.s. value will be 0.707 of the maximum as for a sine alternating wave. Thus the r.m.s. value is $0.707/0.637 = 1.11$ times, or 11 per cent. greater than the mean value—still upon a sine-wave hypothesis.

The important thing to realise is that the r.m.s. *calibrations* are strictly correct only for *one* particular waveform. For any other wave-shape, the mean current will not be 0.637 of the maximum, neither will the r.m.s. value be 0.707. The *form-factor* will thus be some figure other than 1.11. It all boils down to saying the "ideal" scale-calibrations will not be correct.

An *r.m.s. instrument*, proper, reads the true root-mean-square value, *no matter what the waveform*. The reading depends, for instance, upon the heating effect of the current to be measured. The heat developed in a wire is proportional to the *mean power*—not the mean current—and "r.m.s. value" simply signifies the *effective current* which is the equivalent of this average power.

Thus, the heating effect will depend upon the wave-shape, but the instrument indication will vary accordingly, still representing the true effective current value. There can be no "form-factor error," because the average value of a rectified current simply does not enter into the matter.

Power-factor Correction

In simple terms, why is it necessary to "correct" a lagging power-factor, if, as stated, a "wattless current" does nothing whatever in a network?

This question can most profitably be discussed by taking a concrete example. Suppose you had a load of induction motors or electromagnets taking a total *true power* of 1 kW., but at a power-factor let us say as low as 0.5—probably 0.7 or 0.8 would be nearer the mark under full-load conditions.

What size of transformer would you order from the manufacturers? No doubt, any manufacturer of standing would want to know more about your "load" before supplying a transformer, but if you purchased one advertised secondhand as being "1.0 kilowatt," the meaning of power-factor would soon become evident!

For although there is a "wattless" current component in the circuit, the *total current* the windings have to carry would be that corresponding to 2 *kVA.*, not 1 kW., and the wire used must be thick enough to carry the *total* current—"wattful," and "wattless."

Remembering that power-factor is the *cosine* of the phase-angle, a p.f. of 0.5 means a current lagging 60 degs. on the voltage. Suppose the total current is 100A., lagging 60 degrees.

The wattful (in-phase) component is $100A \times \cos 60^0 = 50A$. The wattless component is $100A \times \sin 60^0 = 86.6A$. The latter "does nothing." Nevertheless, the transformer secondary must carry 100A., not 50A.—the current equivalent of the "true power."

In fact, if the power-factor was corrected to *unity* ($\cos \phi = 1.0$), 50A. would be the only current. The heat generated in wires varies as "I2R," so if windings designed to carry 50A. are loaded with 100A., there is going to be a pretty serious temperature rise!

The Supply Authority

Apply the argument to all the transformers, cables and generating plant the supply authority has to provide, and it will be clear why he is bound to impose drastic penalties to consumers whose p.f. is notoriously poor—charges of such magnitude as will render "correction" an economic necessity.

The "size" (kVA. rating) of plant right back to the central station is partly determined by the total *current* to be carried, whilst that, as seen, varies in an inverse proportion to the power-factor.

What are the things responsible for poor power-factors? Actually, anything that takes an A.C. *magnetising-current*—electro-magnets, transformers, induction motors, etc. This current is purely lagging, by 90° on the supply voltage, and while usually small compared with the normal full-load current of a particular piece of equipment, a large number of such "pieces" coupled to the supply network, many of which may be on light loads for appreciable interval, will load the system heavily with reactive volt-amperes.

If p.f. was looked at from a practical angle instead of merely remembering it is something given by "$\cos \phi$," it would help as an introduction to aspects of supply economics generally.

The New Twin-engined "Aerocar"

Many new aircraft not previously seen in public were on view at the flying display and exhibition organised by the Society of British Aircraft Constructors, at Radlett, recently. It was the biggest show of its kind held in this country, and visitors from all parts of the world viewed the aircraft on show, including the machine illustrated, the Portsmouth Aviation Company's new "Aerocar," a six-seater, powered by two Cirrus major engines.

The Elements of Mechanics and Mechanisms—4

By F. J. CAMM

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The Second Law of Motion : Falling Bodies : Forces Acting in Opposite Directions

IF a ball is struck with a cricket bat so that it travels with a velocity of 5ft. a second, and whilst the ball is in motion it is struck with a second bat with a similar force, it will have a velocity of 10ft. per second, thus the second force acting on the body in motion has produced a velocity the same in magnitude and direction as if the force had acted on the body at rest.

Now take the case of a boat on a running stream or river. Assume that in still water an oarsman can propel a boat at a speed of five miles an hour. Assume also that the same oarsman using the same force propels his boat on a stream which runs at the rate of five miles an hour. It therefore follows that, when rowing in the direction in which the current is flowing, his muscular force, plus the current of the stream will produce a speed of five plus five equals 10 miles an hour. This is called the resultant velocity. If he rode against the stream his actual speed in relation to the river bank would be nil. If the speed of the stream were two miles an hour, the speed of the boat in relation to the bank would be three miles an hour upstream.

The velocity of a falling body provides a further example of the application of the second law of motion. Assume that the force of gravity acts for one second upon a body. During this time that body will fall a distance of 16ft. and will acquire a velocity of 32ft. per second. If gravity then ceased to act the body would fall 32ft. during each succeeding second. We all know that gravity does not cease but continues to act irrespective of time.

During the second second, therefore, the body will fall through 32ft. by virtue of the velocity attained at the end of the first second, and through an additional 16ft. because of the continued action of gravity, thus making a total distance traversed during the second second of 48ft. At the end of the second second the falling body will have a velocity of 64ft. per second, which would carry it through 64ft. in the third second. But the force of gravity urges the body through 16ft. in this third second just as in the first, causing the total distance traversed in the third second to be $64+16=80$ft. It is, therefore, clear that a force acting on a body in motion will produce its full effects apart from any motion the body may already have. In other words it will produce exactly the same effect as if it acted on the body at rest. We may summarise this in the form of a rule :

The resultant velocity of a body urged onwards by more than one force in the same direction will be equal to the sum of the velocity that the forces would produce if they were to act separately on the body at rest.

Forces Acting in Opposite Directions

The vertical velocity of a falling body increases until the upward resistance of the air on its surface is equal to its weight. The vertical acceleration is then zero and a maximum velocity has been reached. This velocity is called the *terminal velocity*, and it depends on the weight of the body in relation to its windage. It is obviously affected by the shape of the body, streamline form giving the highest terminal velocity for any given weight and body. The heavier the body the higher does its terminal velocity tend to be.

Terminal velocities can be determined with reasonable accuracy only from special tests. For heavy bombs they are of the order of 700 to 1,000ft. per second. Similarly, the rate of acceleration during ascent can be found with certainty only by experiment, but the following analysis gives a reasonable approximation to actual conditions if the terminal velocity is known. It assumes that air resistance is proportional to the square of the relative velocity, and it is known that for bodies that approximate to streamline shape this is very approximately true.

The downward acceleration of a falling body is equal to that due to gravity minus that due to air resistance, or : $g-ku^2$, where k is a constant to the body and u is its downward velocity. If the terminal velocity is U, $g-ku^2=0$ by definition. Hence $k=\frac{g}{U^2}$ and in general acceleration $\frac{du}{dt}=g\left(1-\frac{u^2}{U^2}\right)$

This gives $\frac{du}{1-u^2/U^2}=g\,dt.$

and by integration

$$\frac{U}{2}\log_e\frac{1+u/U}{1-U/u}=gt \quad \ldots\ldots (1)$$

whence

$$u=U\frac{\exp(2gt/U)-1}{\exp(2gt/U)+1} \quad \ldots\ldots (2)$$

Here exp (2gt/U) means $e^{2gt/U}$ where e is the base of Napierian logarithms. In handling numerical values it is convenient to use the identity $e^x=\text{antilog}_{10}\,0.4343\,x$.

If s is the vertical distance of descent from an instant at which the vertical velocity is zero,

$\frac{ds}{dt}=u$, and integrating (2) is found that

$$s=U\left[t-\frac{U}{g}\log_e\frac{2\exp(2gt/U)}{\exp(2gt/U)+1}\right] \quad \ldots\ldots (3)$$

Equations (2) and (3) may be used to determine velocity and distance below the starting point after any time t. The time taken to attain any velocity u is determinable from (1). The time taken to fall through any distance s may be determined from (3) by repeated trial.

For example, if U=700 f.s. and s=10,000ft, insertion of numerical values (including g=32.2 f.s.s.) in (3) leads to

$$10{,}000=700\left[t-\frac{700}{32.2}\log_e\frac{2\exp(t/10.9)}{\exp(t/10.9)+1}\right]$$

or

$$14.29=t-21.75\log_e\frac{2\exp(t/10.9)}{\exp(t/10.9)+1} \quad \ldots (4)$$

In the case of a free fall without air resistance, the time taken to fall through a distance s is

$\sqrt{\frac{2s}{g}}=\frac{\sqrt{s}}{4.01}$. If s=10,000, this is 17.63 sec.

The actual time will be longer than this.

If the velocity were equal to 700 f.s. continuously, the time taken would be $\frac{10{,}000}{700}=14.3$ sec. The actual time will be longer than this.

As a first trial some value of t greater than 17.3 should be used, say t=25. With this the value of the right-hand side of (4) is

$25-21.75\log_e 1.818=13$ instead of 14.29.

It is found that t=28 leads to 14.55, t=27 leads to 14.05 and t=27.8 leads to 14.35.

Hence the value t=27.8 may be accepted as being sufficiently accurate.

The vertical velocity on reaching the ground is determined by inserting this value of t in (2), where

$$2gt/U=2\times 32.2\times 27.8/700=2.56$$

Then exp 2.56=12.88 and so

$$u=700\,\frac{12.88-1}{12.88+1}=600 \text{ f.s.}$$

Horizontal Velocity

The variation in horizontal velocity during the fall is less easy to estimate. The initial horizontal velocity is that of the aeroplane at the moment of release and the horizontal air resistance may be taken as proportional to the square of the horizontal velocity. The exact value of the resistance for any particular velocity can be determined only from actual test on the particular bomb, but it may be assumed to be at least four times for the same velocity in the direction on the axis of the bomb. On this basis the horizontal retardation (i.e., perpendicular to the axis of the bomb) due to air resistance at a horizontal speed v is equal to $\frac{4v^2}{U^2}g$. Where U is (as before) the terminal velocity in a free fall.

Starting from an initial velocity V, the horizontal acceleration at any time t

$$\frac{dr}{dt}=-4\frac{v^2}{U^2}g$$

and by integration this gives

$$\frac{1}{v}=4\frac{g}{U^2}t+K$$

where K is the arbitrary constant of integration.

As v=V when t=0, $K=\frac{1}{V}$

and so

$$v=\frac{1}{\frac{4g}{U^2}t+\frac{1}{V}}=\frac{V}{1+\frac{4gVt}{U^2}} \quad \ldots\ldots (5)$$

Taking the previous examples in conjunction with initial horizontal velocity V=250 m.p.h.=367 f.s., the horizontal velocity on reaching the ground, i.e., after time t=27.8 secs., is, by (5)

$$V=\frac{367}{1+\frac{4\times 32.2\times 367}{700^2}\times 27.8}=\frac{367}{3.69}=99.5 \text{ f.s.}$$

The striking velocity is the resultant of 600 f.s. vertically and 99.5 f.s. horizontally, i.e.,

$$\sqrt{(600^2+99.5^2)}=608 \text{ f.s.}$$

The horizontal travel of the bomb between release and impact with the ground is determined by writing $v=\frac{ds}{dt}$ in (5) and integrating. This gives

$$s=\frac{U^2}{4g}\log_e\left(1+\frac{4gV}{U^2}t\right) \quad \ldots\ldots (6)$$

Using the same numerical values this gives for the horizontal travel on reaching the ground

$$s=\frac{700^2}{4\times 32.2}\log_e\left(1+4\times\frac{32.2\times 367}{700^2}\times 27.8\right)$$

$$=3{,}810\log_e 3.69$$

$$=4{,}970 \text{ ft.}$$

(*To be continued.*)

Making a Pin-hole Camera

Constructional Details of an Easily-made Instrument

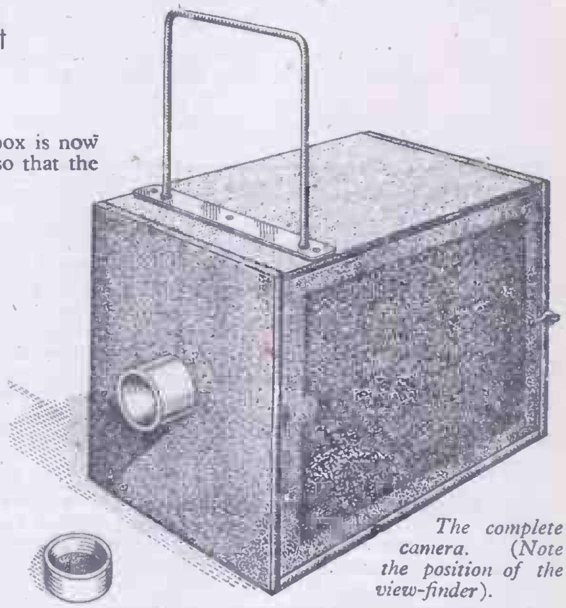
By E. S. BROWN

A PIN-HOLE camera can be very instructive and interesting and, provided that its limitations are realised, quite good photographs can be taken with this simple camera. Of course, one cannot expect the results of a camera costing many pounds—indeed, it would be foolish to do so—but with little practice quite creditable and pleasing results can be obtained.

The pin-hole camera is, of course, novel in that it functions without any lens; the image being cast on the sensitised plate surface by a small pin-hole. This strange optical feature is often duplicated in nature by sunlight filtering through the foliage of trees, and projecting a true image of the sun wherever a break in the foliage allows a minute shaft of sunlight to penetrate and strike an object.

The camera that is described in this article can be very easily made from the most elementary materials, and provides photography in its most simple and inexpensive form.

The bottom portion of the pill-box is now placed on the front of the camera so that the pin-hole in same is exactly central to the hole drilled in the camera front. With a washer of thick paper interposed between the pill-box and camera front, fasten the pill-box into position with two small screws. Needless to say, it is of the utmost importance to make sure that a light-tight fit is made, and the camera should be held up to the light and thoroughly checked for any light-leakage, not only from the pin-hole assembly, but also from the various joins at the sides and front end of the camera. If any leakage is detected it should be painted with a mixture of glue and lampblack. Sufficient lampblack should be added to make the glue opaque. Slight difficulty may be experienced in rendering the glue and lampblack miscible, due to the oily nature of the latter. If, however, the glue is maintained at a fairly high temperature it will be found that by adding the lampblack in small quantities, and well stirring, the recalcitrant properties of the lampblack will be overcome.



The complete camera. (Note the position of the view-finder).

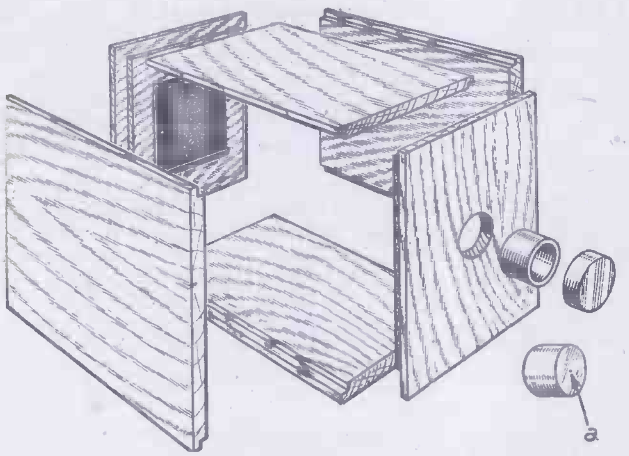


Fig. 1.—An "exploded" view of the pin-hole camera.

Constructional Details

To construct the camera, two pieces of 9in. by 6in. by ½in. and two pieces of 9in. by 5½in. by ½in. smooth wood are required. These are rebated ¼in. along both edges, and joined together with panel pins and glue to form a box 9in. long and 6in. square. The front of the camera is made from a piece of 6in. by 6in. by ½in. wood rebated to make a close fit into the sides. It will be noticed that all the joins in the camera are rebated. This ensures a practically light-proof form of construction. A hole ½in. diameter is next drilled through the exact centre of the front, which is then fixed into position with glue and panel pins. (Fig. 1.)

The "lens" of the camera is made from a pill-box or similar article, preferably of the metal variety, complete with lid. A small hole is made in the dead centre of the pill-box with the aid of a normal-sized pin. The size of the hole determines the ultimate speed of the camera, and the clarity of the photographs taken. Unfortunately, in the pin-hole camera one cannot have both. A small aperture is conducive to clear pictorial detail, but if the aperture is too small then the time of exposure is unduly protracted. Therefore, the result must be a compromise, and a normal-sized pin-hole will be found suitable for most purposes.

Plate Carrier

The back of the camera is made from a piece of 6in. by 6in. by ½in. wood, rebated for a distance of ½in. from the edges. A plate carrier is constructed of tin, as illustrated, and is screwed exactly central to the back of the camera. The overall dimensions of the plate carrier are 4¼in. by 3¼in. The runners are ⅛in. in width, and provide a 1/16in. clearance to accommodate the plate. (Fig. 2.)

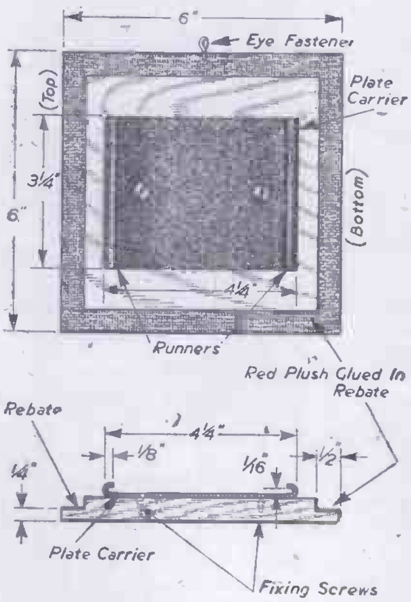


Fig. 2.—Back of camera and detail of plate-holder.

The carrier should allow the plate to slide fairly easily into position, but at the same time the plate must be held securely in place. If the plate is not satisfactorily secured, the runners should be slightly bent inwards to increase the tension on the plate.

A strip of red plush is now glued on to the rebate to ensure a light-tight join when the back is closed. The hinge is made by glueing a piece of American cloth or similar material on to the back and one side of the camera. On the opposite side a hook and eye fastener is fixed. Care should be taken to see that when the back is closed slight tension is imposed on the fastener. This ensures a perfect light seal.

The inside of the camera and the pin-hole assembly must now be painted with a matt black finish. This finish or paint can be obtained at most photographic stores. A glossy paint should not in any circumstances be used, as the reflection from its surface will almost certainly cause "fogging" of the negative upon exposure.

The exterior finish of the camera can be left to the readers' choice. American cloth or leatherette glued into place gives a very pleasing appearance, and, moreover, has the merit of being easily cleaned. Of course, if one decides to cover the camera in one of these materials the hook and eye fastener must not be fixed until after the camera is covered.

The camera illustrated was covered in leather removed from a very old damaged box camera. Although the job was difficult, the results were very satisfactory.

View Finder

There, finally, remains the view-finder to make and fix into the correct position. This is made from a piece of fairly heavy gauge wire, 4¼in. in length by 3¼in. in width. This is soldered centrally to a piece of tinplate 6in. long by 1in. wide. The view-finder unit is then secured to the extreme front end of the camera with three small screws, and the camera is then completed.

As before stated, the camera has certain limitations to its use. It is not possible to take instantaneous exposures, which, of course, implies that the subject must be immobile. The time of exposure depends, of course, upon the rapidity of the plate used, and the quality and degree of light at the time of taking. This usually varies between three seconds for brilliant sunshine, and upwards of 20 to 30 seconds for varying conditions.

When taking landscape views a bright, although not necessarily sunlight, day should be chosen, and should the subject include trees and foliage in the foreground, a calm day is necessary, otherwise the movement of the trees will blur and spoil the photograph.

Loading

To load the camera first see that the cap is in position over the pin-hole attachment. The plate required is 4¼in. by 3¼in., or quarter plate, and it should be fairly rapid. It should be loaded in a dark room by sliding the plate in the carrier with the emulsified surface uppermost. With some plates, notably the Panchromatic type, it is not permissable to load with the aid of a normal dark-room lamp. In this case, the emulsified side of the plate can be detected by gently stroking the finger across both surfaces of the plate. The sensitized surface can be found by its matt texture as opposed to the smooth feel of glass.

Before detection by this means it is advisable to wash the hands, otherwise there is the risk that the natural oils from the skin will be deposited on the sensitised plate surface, and so prevent the full development of those affected parts. When the plate is in position securely fasten the back of the camera, and it is then ready for use.

When taking a photograph choose a day when the light is intensive and strong. Rest the camera on a firm basis, and sight the object through the view-finder. Steady the camera with the left hand, and with the right remove the pin-hole cap for the necessary duration of exposure. When the exposure is completed replace the cap as quickly as possible.

Observations

Further Interesting Scientific Facts About Everyday Topics

By Prof. A. M. LOW

(*Continued from page 122, January issue.*)

Reaction

EVERYONE talks nowadays of reaction, but they mean, as a rule, that they are tired after the strain of war. Reaction has a technical meaning too. It is equal to action, as one of the first laws of mechanics tells every student.

If I push you against a wall, my feet or body push equally hard in the opposite direction. A bullet flies from a gun but the gun jumps too; being heavier it jumps less far.

My car has just been rebored and every time I cautiously accelerate in neutral the car shivers because it is trying to turn round the engine just as much as the engine is turning round in the car.

Relative speeds offer some comparable problems. Bullets fired from trains at the engine driver can hit him because their total speed is that of the bullet plus the train, relative to the earth. Fired from the track, they merely run beside the driver if the speed of bullet and train are (most improbably) equal.

When you step on to a moving platform or stairway, walk quickly so that your body and the track travel together. If you walk at the rate of the moving platform and stand still when reaching it, there will be no shock. This avoids all chance of "after-dinner" accusations!

Secrets

I CAN scarcely remember one occasion when I have ever approved of secrecy. In the first place it is nearly impossible; and secrets nearly always do harm in the end.

That is one reason why science is not very popular. Until quite recently science was rather frowned upon in England, and was looked upon to some extent as the prerogative of poor people while the wealthy devoted their time to the glories of Plato, Socrates and Louis XIV. Or were supposed to do so.

All this brushes aside the brutal truth that unless dead languages and old thoughts can be reborn as something new or original they are next door to worthless. The medical profession have been sinners in this respect. Everyone knows that many diseases have grown due to the secrecy surrounding their onset. I understand that both cancer and T.B. can often be cured or rendered innocuous when taken in time. These things are not matters for whisperings.

Nor do I like the extensive use of Latin, or rather Dog Latin, terminology for I think it gives the partly educated an unfair advantage over those who are too easily impressed. I had the honour to learn chemistry from the great Professor Armstrong, and I recollect that he would never allow us to speak of sulphuric acid until we knew what we meant. "Call it firewater," he would say, "in the meantime."

Patent Medicines

LOOK at the number of patent medicines which are sneered at because they are patents, although this trouble has now been remedied in most cases by the new Patent Laws which do not permit a combination of a few chemicals to result in worthwhile protection! One hears people say "How absurd to charge 5s. when the materials are worth a farthing." "Not at all," I reply; "they are well combined, conveniently manufactured and they do their job."

So let us sweep away this idea that science belongs only to a few queer men with big black hats and bushy hair. The housewife using soda for cooking, or bicarbonate of soda in bread, may be making a complicated experiment. As well treat this a secret as the atom bomb. In short, it is impossible to keep it dark.

If I mix a little acid and a little bicarbonate of soda into a pudding, carbon dioxide is evolved. Just the same gas that so many fire extinguishers produce. A gas which is inert, can be used for preserving apples, and which comes out of our lungs every time we breathe. The chemical actions which can be expressed in complicated symbols really need no glorification.

If hydrochloric acid is used with chalk as a "riser" the pudding would rise most excellently. Some of the carbon combines with some of the oxygen to produce carbon dioxide, some of the calcium in the chalk combines with some of the chlorine in the hydrochloric acid and a little water in various stages of composition is also released. The real point is that chlorine, a deadly poison, is quite harmless when combined with something it clings on to out of the chalk.

There are many similar examples. Think of the hydrogen from the gas jet which combines with some of the oxygen in the air, boils your kettle, forms steam in doing so long before the kettle boils, and then probably condenses on the bottom of the kettle before the rate of heat transfer becomes great enough to turn the water drops outside the kettle into steam. All very scientific indeed.

Flowers Can Think!

THERE is no need to look at pictures with ones' head on one side, although it might be logical not to look at them with the very centre of the eyeball. Let me explain. The millions of sensitive points which make up the retina at the back of the eye are of different kinds. Some seem so shaped as to be very sensitive to light, while others appreciate colour.

You will have noticed that looking at a clock in a dimly lit room it is better to look a few inches to one side for this brings the light-sensitive part of the eye into better play and the time is more easily seen. Colour, I imagine, should be looked at straightly because it is in the middle of the eye that the majority of colour cells are found.

But to return to nature; not literally. We rely upon artificial aids for most pleasures, and this is natural in an era when we try to subdue the body that our minds may improve.

Flowers turn to the sun, some catch flies, others shrivel up when touched. They are sentient. How can we be sure that they do not think and that, in fact, some are not evil? Not evil because they may be poisonous, which doubtless has a vital purpose, but nasty in their outlook. Flowers may be, I think, on an infinitesimally smaller scale, living, thinking, and instinctive parts of life. Do you experience no feeling of diffidence when you cut down a tree?

What Are the Consequences

THAT depends upon what you have done. But to be very serious, I have always wanted to write a book on consequences and platitudes. The latter are too terrible, for I listen to them all day in railway carriages and in restaurants. Why do people imagine that one wants to hear their noise any more than we would care to notice their smell?

Consequences are quite different. They are fascinating because of their illimitable range. Might it not be that wars are caused by a woman who loses her comb (1d. combs are 1s. in London streets nowadays) annoys a man and so on? Could not a squabble between Mr. and Mrs. Engine Driver one morning, account for an accident? Why do some seeds become weeds over long periods of rest; what, in fact, is the result of every thought we make? For thoughts do make material things in time.

"Action Stations"

IN about the year 1916 I was at a shore station awaiting the arrival of a submarine fleet which had been signalled in enormous numbers. Guards turned out, it was "action stations" and guns were loaded. A few minutes' hurried investigation showed a small fly to be stuck across the wires of an indicating galvanometer. Think of some of the consequences of things you have done, and you will realise when you wake up how far you have travelled. I cannot say I believe wholeheartedly in chance.

Notes on Optical Calculations

A New Method of Working Which Simplifies Optical Problems

By D. C. STILL, F.S.M.C.(Hons.)

IT is frequently necessary for the engineer or model constructor to work out a simple optical system and, unless he has retained a very good grasp of his earlier lessons in physics, he may find the task somewhat difficult. There are, unfortunately, several quite different "sign conventions" in vogue, and the tiro is often puzzled by the fact that the sign in the well-known u v (conjugate foci) formula seems to vary from text-book to text-book in the most inconsequent way.

It is the writer's intention, therefore, to endeavour to clear the air a bit in regard to these formulæ, and to present a newer method of working which greatly simplifies optical problems. This necessitates the introduction of a unit little used except by opticians—the dioptre—but readers will find a clear conception of the term most helpful.

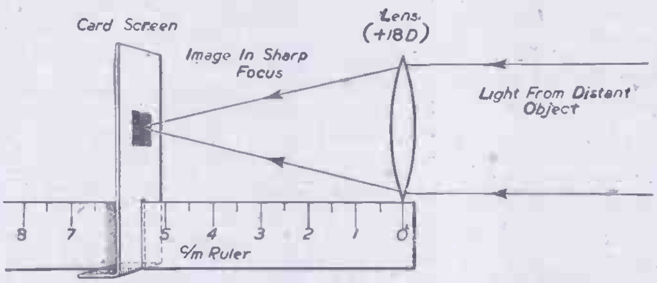


Fig. 1.—Simple apparatus for finding the focal length of a lens.

When the conventional formulæ connecting object and image distances with the focal length of a lens are used, great attention has to be paid to the direction of the light, and a plus or minus sign given to it according to some arbitrary convention. Depending on this convention, the sign in the formula may be either plus or minus; hence the confusion among students transferred from one college to another where a different sign convention is in use. In the method I shall presently outline there are only two things it is necessary to understand—the dioptric system, and the *elementary* principles of the behaviour of light on reflection or refraction. No formulæ are required; and the sign convention, depending directly upon the type of lens or mirror used, cannot possibly confuse. All that is really required in addition to a knowledge of the rudimentary principles of refraction is a logical mind.

The Dioptre

The dioptre is a unit of *vergence* (convergence or divergence), and is given by the reciprocal of a focal length or other optical measurement in metres. Thus, a lens which has a focal length of 20 cm. will have a dioptric power of 1/.2 m.=5 dioptres; if its focal length is 80 cm. it will have a focal length of 100 cm./80 cm.=1.25 dioptres.

Similarly, if a mirror has a focal length of 8 cm. its dioptric power will be 100 cm./8 cm=12.5 dioptres (written 12.5 D.). Incidentally, I would remind readers that the focal length of a curved mirror is not to be confused with its radius of curvature; the radius of curvature being always just double the focal length.

The advantages of the dioptric system are very great. In the first place, a good idea of the power of the lens is obtained in manageable figures. Moreover, the stronger the power of the lens, the higher its dioptric number. Again, a combination of two or more lenses can easily be calculated simply by adding their respective dioptric powers, whereas their focal lengths admit of no such simple calculations. Finally, the focal length can always be got back from the lens by the simple expedient of taking its reciprocal again; a 2 dioptre lens has a focal length of 1/2 m.=50 cm., or a lens of 50 cm. focal length has a dioptric power of 1/.5 m.=2 D. It is just as simple as that. The optician always works in dioptres, which grew out of the focal length system many years ago. Of course, if you know the focal length of a lens accurately in inches, it can still be converted to dioptres quite easily. There are 39.37in. in a metre—near enough 40in. Divide, therefore, the focal length of your lens in inches into 40, and you again find yourself with its dioptric power.

Finding Focal Length

You may have a collection of lenses by you, but have shied off trying to do anything with them because you have no idea of their focal lengths. It is very simple to find out what their powers are. Simply set up your lens at one end of a ruler, and focus a *distant* object (in practice anything over 20ft. away) on a piece of card set up behind the lens in such a manner that it can be slid easily along the ruler. The diagram, Fig. 1, should make this clear. Then the distance of the lens from the card screen is its focal length.

If you have a lens of very short focal length, or a concave lens, the quickest and most accurate way to find its focal length is to take it along to your optician, who should be able to tell you within an astonishingly short time exactly what its dioptric power is. Don't, however, worry him with microscope objectives or combinations of thick lenses.

Convergent and Divergent Light

Certain basic facts about lenses and mirrors even the youngest student knows well. A convex lens always *converges* light; so does a concave mirror. A concave lens always *diverges* light; so does a *convex* mirror. So much we all know.

It is not, then, too much to ask us to consider any lens or mirror which converges light, or any convergent beam of light, as "plus."

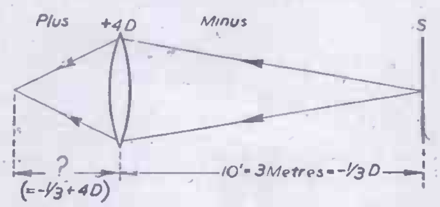


Fig. 3.—If the direction of light is reversed signs of object and image distances will be transposed, but the calculations remain identical.

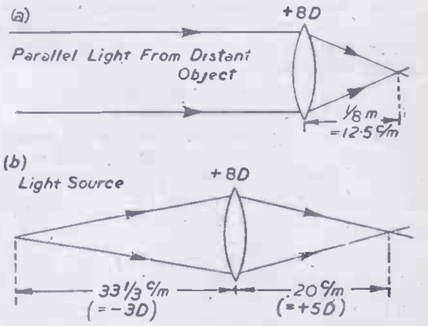


Fig. 2.—Diagrams showing parallel light, and divergent light rays impinging on a lens.

On the other hand, all lenses or mirrors which diverge light, or any divergent beam of light, are to be considered "minus." In the special case of light coming from a source it is always taken as minus, because it diverges, spreading out in all directions. If, therefore, we have a source of light quite near to a lens, we are in effect using divergent light, and the focus of the lens will correspondingly be altered.

Consider, for instance, the example illustrated in Fig. 2. In the first sketch (a) we have parallel light impinging on an 8 dioptre lens. As the focal length of this lens is ⅛ m., the light will be brought to a focus 12.5 cm. from the lens. Now suppose our source is brought to 33 cm. from the lens (Fig. 2b). The light from the source is now divergent, and the focus of the lens will consequently be farther away.

But how much farther away? Well, the light divergent 33 cm. from the lens has a dioptric vergence of −3 dioptres. We have, therefore, light divergent −3D redirected by a lens of plus 8D. It is not difficult to see what the result is going to be. Recall that you can add and subtract dioptres—that they are not difficult to handle like focal lengths. So we have minus 3 plus 8, equal to plus 5 dioptres. The reciprocal of +5 gives you the image distance in metres, so that the light converges to a focus on the image side of the lens at a distance of 20 cm. from it.

In case there is any shadow of doubt remaining, look at it like this: A convergence of 8 acts on a divergence of 3; there will thus be a preponderance of 5 of convergence, 3 of the 8 dioptres of the power of the lens being used up in overcoming the divergence of the incident beam.

Another Example

Suppose we are making a "magic lantern" and wish to project our image on a wall about 10ft. away. We have a lens of 25 cm. focal length.

It is always easier if you draw a clear diagram for these problems, as in Fig. 3.

An important fact to remember, which can often greatly simplify calculations of this type, is that the path of light through an optical system is reversible. We can, therefore, consider it as *coming* from the screen (S), diverging for 3 metres (divergence=⅓D) until it reaches the lens of plus 4 D). It will have a vergence on leaving the lens of −⅓ plus 4=3⅔D. The reciprocal of this gives us the object distance in metres; it is obviously 3/11 metres, or 27.27 cm. from the lens—rather too long to be satisfactory in practice.

I do not propose to deal with concave lenses or convex mirrors, as it is only rarely that these are required. Suffice it that if you have a convex lens of too high a power it is possible—but not always practical—to place it in contact with a concave lens to give you the required difference in power. If you have a plus 7 lens you can make this in effect a plus 6 by placing a minus 1 dioptre lens in contact with it. Concave mirrors are occasionally used for various purposes, though they are not as satisfactory as a convex lens, generally speaking. I will give one example incorporating a concave mirror for readers who are interested.

Concave Mirrors

Take the case of a mirror of 24 cm. radius of curvature. Its focal length will be half this distance, 12 cm., and its dioptric power will be plus 8.33 dioptres. If we place an

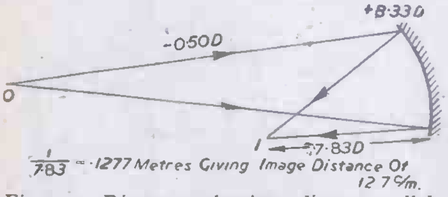


Fig. 4.—Diagram showing divergent light impinging on a concave mirror.

object 2 metres from the mirror where will its image be found?

Those readers who have grasped the basic principles of the vergence method of calculating will have no difficulty in solving the problem with the aid of the diagram (Fig. 4). Divergent light from the object 2 metres distant; dioptric vergence of this light is −0.50 dioptres. Impressed vergence of mirror = plus 8.33 D. Therefore, vergence of reflected light will be plus 8.33 D minus 0.50 D = +7.83 D. The reciprocal of 7.83, easily found from four-figure tables, is .1277 *metres*. So the image will be found 12.77 centimetres from the mirror. (By the way, those readers who are digging into reciprocal tables after a long rest from them must remember to subtract the differences in the end columns.) If you require to project an image on a screen the light after passing through your lens must always be convergent (plus). If your calculation gives you a minus result you must either use a stronger lens or increase your object distance.

Magnification

The approximate magnification is very easy to find—indeed, it is simply given by the relation of the image to the object distance. This is clearly illustrated in the following example:

You have a lens of 14 cm. focal length, and wish to project an image on a screen about 6ft. away. What will be the object distance required and what will be the magnification?

Here again, the problem is two-thirds solved with the aid of a diagram (see Fig. 5).

Now that the method has been shown in detail it will be encouraging to work this problem out without going into explanations, to illustrate its speed and simplicity.

(a) Incident light may be taken as travelling backwards through the known distance, so that we have:

Incident light diverging from 2 metres	minus 0.50 D
Power of lens = 100/14 cm.	plus 7.14 D
Dioptric vergence of emergent beam	plus 7.14 minus 0.50 D
	= +6.64 dioptres

Therefore object distance = (reciprocal of 6.64) = +15.06 cm.

(b) Magnification.

Object distance = 15 cm. (near enough)

Image distance = 200 cm.

Therefore image will be 200/15 times the size of the object, or about 13½ times.

Like reversibility of optical path, magnification applies both ways round, too. It is best to regard it, not simply as the number of times the image is larger than the object (it may be smaller), but rather as the ratio of the image and the object distances. If the image distance is three times that of the object, then the image is three times the size of the object. On the other hand, if the image distance is a quarter that of the object, the object is four times the size of the image, and so on.

I might add, by the way, that it is impossible to calculate the magnifying power of a lens used as a magnifying glass, or the magnifying effect of one's spectacles, in this simple manner.

A Few Notes on Optical Models

It will be realised that there are serious limitations to what the amateur can do when constructing optical models. To make a camera, for instance, that will give only a passably good picture, a first-class lens is required, and even the simplest telescope will give a rainbow-coloured image unless an achromatic lens is used, the cost of which may be prohibitive.

Often, however, one can pick up a good quality lens, either new or second-hand, which will do for an enlarger, magic lantern or epidiascope. A few hints on optical troubles you may find in setting up such instruments yourself may be found useful. If you are getting a blurry image, you can often improve the definition enormously by "stopping down"—that is, reducing the aperture—of the lens. But this, of course, cuts down the amount of light to a corresponding extent, so that the degree to which improvement can be effected by this means is limited. If a black-and-white picture comes out with red and green edges on your screen, it is probably because your lens is not achromatic and will not give very good results whatever you do with it. If, however, the lens is for use, say, in an enlarger, you can incorporate a coloured filter—say green—in the system, which will reduce the trouble appreciably and will make no difference to the print. Your exposure time, of course, will have to be lengthened and, if possible, your illumination improved in this case. It must be realised, however, that a lens has a different focal length for every colour, and you will have to make a fine adjustment to your object or image position to get the best results if coloured light is used.

An epidiascope needs a large aperture lens and a strong light to get a worthwhile result, and the projecting lens should be fairly close to the photograph if practicable. You will probably find, with most amateur work, that the images are rather disappointing; you may also find that if the centre is in focus the edges are blurred, and if the edges are clear the centre is blurred. All you can do about this is to reduce the blurring as much as possible by any of the means suggested, and set your focus somewhere in between the two positions, so that the whole is very slightly blurred. You will find your audience will not be nearly so critical of your result as you are yourself.

A "magic lantern" needs a condensing lens as well as a projecting lens. The reason is that it is most important to get the slide evenly illuminated, and unless a condensing lens is used you will find your image patchy.

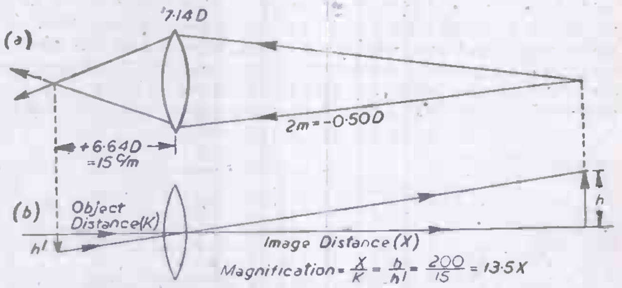


Fig. 5.—Diagrams illustrating the method of calculating object distance and magnification.

The source of light should be placed approximately at the focal point of the condensing lens. Incidentally, if the condensing lens you have is somewhat scratched, it does not matter, though the condition of the projecting lens should be good. However, it is far better to use a good scratched lens than a perfectly clear one of mediocre quality.

First British Commercial Helicopter

A FEW months ago, when the world's largest land-plane, the 126-ton "Bristol" Brabazon I, was towed from its building site at Filton to the new Assembly Hall for final assembly, the Bristol Aeroplane Company provided a fitting signal to the world that Britain was determined to capture air supremacy over the oceanic routes. The Bristol Company has not, however, devoted its entire post-war energies to the construction of trans-oceanic air-liners, for at the other end of the scale it has produced Britain's first commercial helicopter.

Designed as a four-seater and known as the "Bristol" Type 171, it is intended for use as an air-taxi, feeder-line aircraft, rescue work or artillery spotting. In building this helicopter, the company has aimed at producing a "foolproof" aircraft, capable of operation not only by airlines but also by the private individual.

Many safety features have been incorporated in the design. Apart from the special controls which give an outstandingly light and vibration-free control, together with a very neat rotor head, a particular feature of Type 171 is the rotor itself, which has been designed to have an unusual high moment of inertia and to run at high r.p.m. This combination provides the rotor with a very high kinetic energy, which can be used in the event of an engine failure to ensure a safe forced landing. One of the great dangers of helicopters in the past has been that in the event of engine failure at a fairly-low altitude, if insufficient height was available to put the machine into an auto-rotating glide, there were no means of preventing a very heavy or possible crash landing. With the high kinetic energy of the Type 171 rotor, however, a safe landing is always possible because the energy of the rotor can be used to destroy the sinking speed of the machine and still leave it capable of hovering for a few seconds before touch-down, even with no engine power.

Another feature of the "Bristol" 171 is that it has been designed throughout with a view to long-service life with a minimum of replacements of working parts. This applies particularly to the transmission system, where all parts, including the gears and bearings, have been designed for a life of 10,000 running hours.

A Radio Metal Locator

A Device for Finding Buried Metal

By J. COBHAM

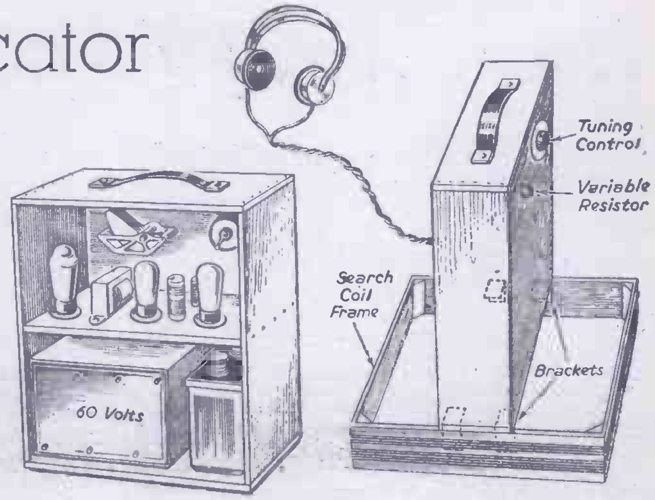


Fig. 2.—Rear view, showing components, and the locator ready for use.

THERE can be few radio experimenters who have not at some time felt the desire to stray down one of the side tracks of radio and to carry out tests with some pieces of apparatus employing wireless principles and materials, although not being concerned with communication.

With this thought in mind the following apparatus was designed. The circuit was found to give excellent results, and many interesting experiments have been carried out with it. Used on the sites of old Roman camps in Dorset, many coins, rings and other metallic objects were located, some of them of considerable value.

The Case

This is a simple box constructed of thin wood. It is fitted with a shelf on which the components are mounted. The measurements of the case are not important and will obviously depend upon the size of the components to hand, and also whether one uses midget valves or those of the more normal size. If some of the very small valves can be obtained and are used in conjunction with other miniature components, a really light and compact unit can be made.

The Search Coil Frame

This was made of thin wood 16in. by 14-in. by 4-in. deep. It is fixed to the bottom of the case by means of small right-angle brackets.

The search coil windings are as follows:

L.1—7 turns of 30 gauge DCC wire.

L.2—9 turns of 30 gauge DCC wire.

A space of about half an inch should be left between the windings.

The Circuit

This employs three valves: The first is an oscillator, the second a combined detector-oscillator and the third a low-frequency output valve. This last may be a small power valve or a pentode.

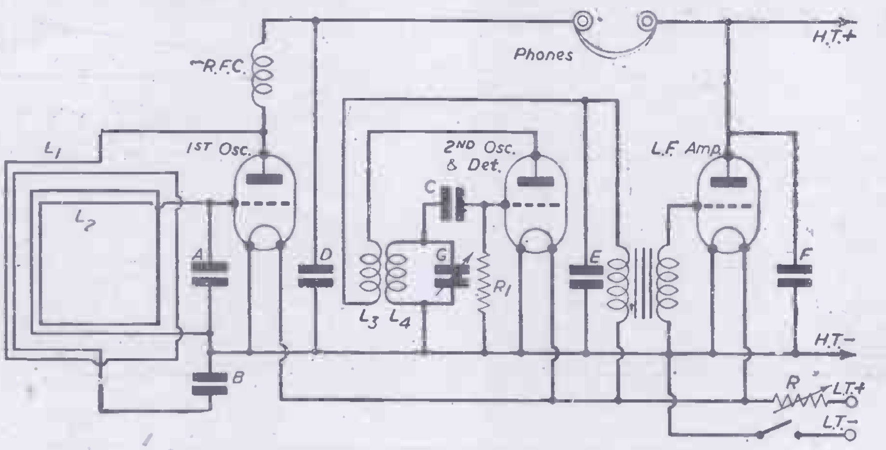


Fig. 1.—Circuit diagram for the radio metal locator.

The coils for the det.-osc. stage are wound on a former made from a small-length of ebonite tube 1½in. in diameter.

L.3—5 turns of 30 gauge DCC wire.

L.4—18 turns of 30 gauge DCC wire.

The following is a list of values of the other components required:

Condensers.	*Resistors.*
A—.0001 mf.	
B—.0001 mf.	R—30 ohm variable.
C—.0001 mf.	R.1—1 meg.
D—1mf.	
E—.002 mf.	Transformer. — 3-1 ratio.
F—.002 mf.	
G—.0001 mf. variable.	RFC.—25 turns, 30 DCC on ½in. former.

Operation

When the set has been completed it is advisable to test it out before it is put to any serious use. This may be done by burying a small sheet of metal such as copper a few inches under the ground, then with about 60 volts H.T. adjust the tuning condenser and the variable resistor until a whistle is heard in the headphones. With the search coil held just above the ground it will be found that the pitch of the whistle will alter when the apparatus is passed over the buried metal.

Valves

With regard to these, it is best to try out several valves, as it has been found in practice that one valve will not oscillate as well as another, although they may both be of the same type and, according to their markings, identical.

New British Standard for Screen Brightness

For the Projection Millimetre Film (B.S.1404)

THE question of screen brightness was under consideration by a Committee of the British Standards Institution in 1938 and this work, which was interrupted by the war, was resumed in 1945 when it was found necessary to examine the effect of the following variations:

Type of film.—It was generally believed that colour film required more light than black and white film for satisfactory projection, but no very significant difference was in fact found between the two. The effect of fine-grain release, positive-film was also examined.

Distance of print.—For the average theatre a decrease of density gives an inferior result owing to loss of tone-discrimination in the high-lights; this factor was found to be highly significant, but the problems involved were complex.

Contrast of the print.—A loss of tone-discrimination may be at least partially offset by an increase of contrast and this factor, although less significant than density of print was still important.

Projector arc and screen.—The most important of these factors was the nature of the arc.

Auditorium lighting.—This affects projection in two ways, the degree of dark adaptation of the audience and the tone-discrimination of the screen: reflected light from the walls does; this is shown by the fact that the white screen is clearly visible when the projector is shut down.

The problems arising from this factor were also complex and some of these problems are awaiting attention by a B.S.I. Committee, but the results showed that, under conditions where auditorium lighting was almost entirely controlled by the nature of the scene projected, no significant variation of brightness levels were found to correspond with changes in type of scene.

Subject.—The investigations show that only insignificant variations in optimum brightness levels resulted from the type of scene being projected.

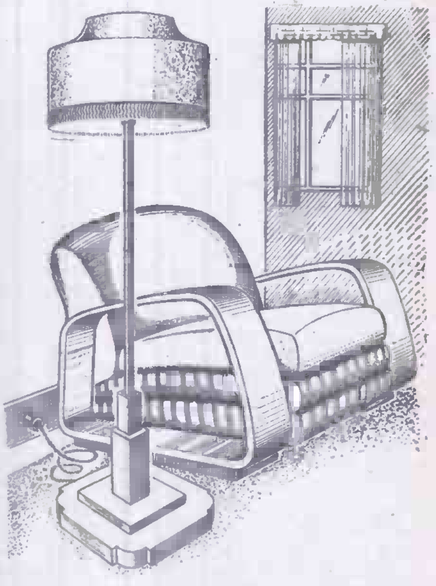
Result of investigations published.—These investigations, which were carried out by a Committee of independent experts, yielded valuable results upon visibility of grain, flicker, glare and the general quality of projection. Consideration of these results led to the publication of B.S.1404 which contains not only the Committee's recommendations but also a comprehensive report on the tests carried out and the results.

Copies of this Standard may be obtained from Sales Department, British Standards Institution, 24, Victoria Street, London, S.W.1, price 2s. post free.

An Electric Floor-lamp

Constructional Details of an Attractive and Inexpensive Appliance.

By R. J. CHAMBERLAIN



The completed floor-lamp in a homely setting

USING a length of ordinary tubular brass curtain rod as a column greatly simplifies the construction of electric floor lamps and the simple, modern type of lamp described in the present article should appeal to most handymen. A piece of rod 4ft. 6ins. or 5ft. long is wanted. Its outside diameter depends on the diameter of the nipple end of a lamp holder. This end has to be a tight fit in the "bore" of the tubing.

As most bakelite holders, with push-bar switch, have nipple ends about ¾in. diameter, the brass rod will be about 1in. or possibly ⅞in. in diameter. Therefore, as it is imperative that the holder fits in the tubing, the holder must be obtained first, then tried in curtain rod of varying "bore" diameters until the correct size is found. Incidentally, it is always a good idea to bear in mind that, in the case of a slightly loose fit, the nipple end can be wrapped with a strip of insulation tape to build the correct diameter required. In the case of holders which are a trifle too large, the diameter can be reduced by filing. Try, however, to avoid having this job to do, as the bakelite is weakened near the shouldering.

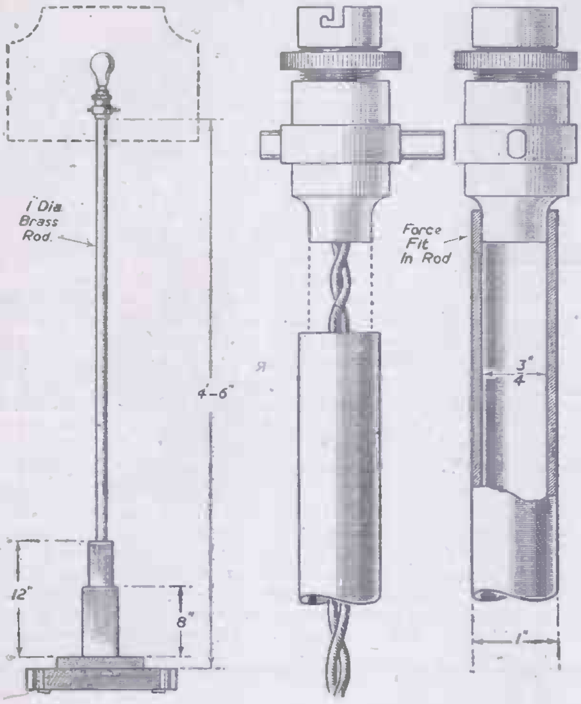


Fig 1. (Left).—Side elevation and enlarged details of lamp-holder and tubular column.

Other materials you will need consist of a 9ft. length of twin flex, four 1½in. diam. metal furniture gliders, some 1¾in. by 6 (or 8) flathead iron screws, a 60-watt frosted lamp and the wood for making the base and column shouldering. Regarding the lamp shade and its holder, these are best purchased. The shade should be about 16ins. to 18ins. in diameter. Anything smaller, such as 12ins., is out of proportion.

Fitting the Lamp Holder

As mentioned previously, the nipple end of the lamp holder is fitted tightly into one end of the brass rod, as sectioned at Fig. 1. Having tested the holder in the rod, connect the twin flex to its terminals, push the free end of the wire down the rod and finally force the holder home. A touch of paint could be applied to the nipple end of the holder to serve as a fixative.

It should be explained that the type of lamp holder suggested has a proper screw-off nipple. This enables the holder to be used as a pendant (ceiling) type. For floor or table lamps, the actual bakelite nipple is removed so the end of the holder may screw on a brass adaptor plate affixed to the top end of the lamp column. As tubing is used, such a plate would be difficult to attach. As the rod is tubular and takes the nipple end of the holder, such a plate is unnecessary.

The Base and Shouldering

The base measures 14ins. by 14ins. by 2ins. It could be built up from 2in. thick planking 7ins. wide by rub jointing two 14in. lengths together. For extra strength, the pieces may be dowelled together, and this is recommended.

Having levelled both sides with a smoothing plane and carefully trimmed the wood square with a try plane or block plane, the corners are shaped as shown in Fig. 2. Note that the shaping conforms with the position of the metal gliders. Simply gauge a 2in. margin all round the top side, then scribe the quarter circles with the compasses. With a tenon saw, make cuts in line with the marginal lines to the depth required and saw off the corners, following which the wood is rounded with a wood chisel, paring off a little waste wood at a time until the shaping is correct for filing and glasspapering. A ⅜in. hole is bored through the centre of the base. This is the outlet hole for the flex wire.

A constructional view of the column shouldering is shown in Fig. 2. It consists of a wooden socket, fitted with a skirting. Assuming the column rod is 1in. in diameter, you require two pieces of wood 13ins. by 1in. by ½in. and two side pieces of similar length, but 2ins. by ½in.

Glue and nail the narrower lengths between the sides (using 1½in. oval nails), then try the curtain rod in the square socket hole. The rod should be a neat fit and not wobble. Before adding the skirting pieces, make the upper base piece, this measuring 8ins. by 8ins. by 1in. or ⅞in., with a 2-in. square hole into which the shouldering fits neatly.

Add the skirting pieces, these measuring 8ins. long. Cut two 2ins. wide and two 3ins. wide from ½in. stuff. Affix to the shouldering with glue and nails. A few screws should be driven through the upper base piece into the skirting to give additional strength.

Affixing the Base

Thread the twin flex through the ⅜in. hole in the base and proceed to attach the upper base in position with screws, one being driven into each corner via the underside of the heavier base. To facilitate handling and

(Continued on page 168)

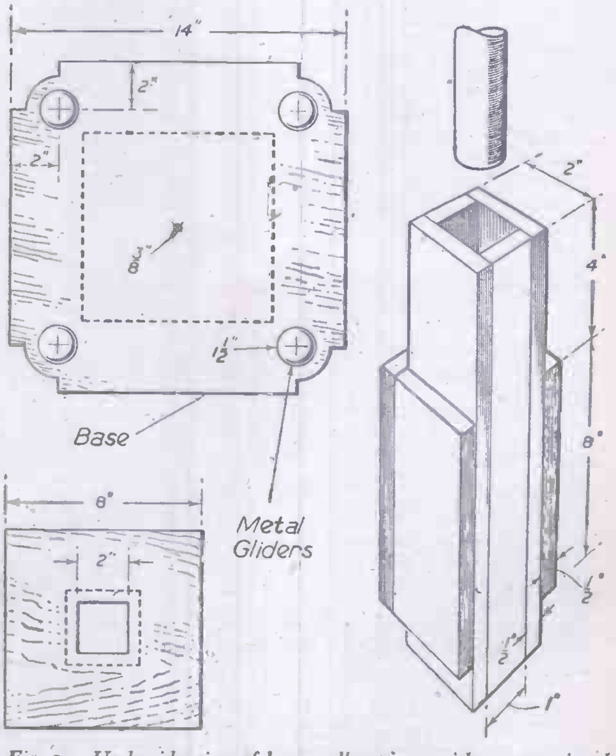


Fig. 2.—Underside view of base, collar piece, with constructional view of shouldering to the brass tubular column.

Davy or Stephenson?

The Priority of the Miner's Safety-lamp Invention

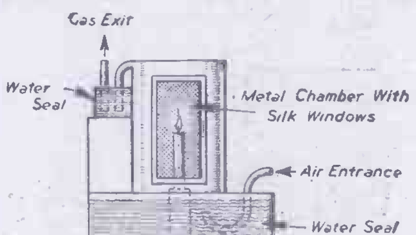
By J. F. STIRLING, M.Sc.

WHO originated the well-known miners' safety-lamp, that simple, foolproof efficient lighting device which, during nearly a century and a half, has preserved innumerable mine workers from sudden and tragic disaster?

No doubt, if you follow the official history which is retailed in popular textbooks you will aver that Sir Humphry Davy, the Cornish chemist, the discoverer of sodium and potassium, and also one of the pioneer electrical experimenters in this country, is to be credited with the honour of inventing the first successful miner's lantern, the device which even to this day is known as the "Davy lamp."

But popular history, even when it deals with inventions and discoveries, proceeds only in broad outlines, neglecting significant details of a subject. It is, indeed, precisely in the matter of the miner's safety-lamp invention that a good deal of credit has been bestowed in the wrong quarter, for despite the enormous success of the miner's hand-lamp constructed on the Davy principle, Sir Humphry Davy himself cannot be said to hold priority in this invention. Another inventor, and one no less eminent than the renowned George Stephenson, the railway pioneer, devised a form of mining lamp and actually used it in underground colliery workings some time previous to Davy's announcement of his invention.

The question of the priority of this important and vital invention has been talked about, written about, argued and even quarrelled over since the first days of the miner's lamp. There have been Davy factions and Stephenson enthusiasts, neither of these being inclined to admit the claims of the opposing party. Hence the result has been that the historical matter of the priority of the miner's lamp invention has never been universally



The "water" lamp invented by Dr. Reid Clanny in 1813. It preceded both the Davy and Stephenson lamps and was the first of all miners' safety-lamps.

admitted. Such, indeed, is the position at the present day. The Davy claimants, having had the greater influence, have been able to attribute the miner's lamp invention more or less solely to their hero, and to sidetrack the Stephenson issue as one of little importance.

Let us, however, consider a few of the more salient facts in this historical dispute, facts which are available to any inquirer who has the time and the inclination to go to their sources and sift them patiently for himself.

Dr. Clanny

In the first place, neither Davy nor Stephenson was the originator of the miner's lamp. That honour goes to a certain Dr. Reid Clanny, of Sunderland, who, in 1813, invented the first of the miner's flame lamps. The Clanny lamp was an absolutely safe contrivance and it extinguished itself automatically in an atmosphere of inflammable gas. It comprised merely a suitably-mounted candle which was burned in an enclosed space. Air was fed to the lamp through a water seal below the candle and the products of combustion also had to pass through a water seal.

George Stephenson, creator of the "Geordy," or first miner's lamp.

The necessary air was blown into the lamp by means of a diminutive pair of bellows actuated by a boy whose special duty this was.

But because the Clanny lamp was cumbersome, because it needed careful and continual attention from the "bellows boy," and in consequence of the great ease with which the candle flame could be put out accidentally, Dr. Clanny's lamp never became accepted as a suitable illuminant for mine use. All the same, it is to this rather mysterious Dr. Clanny that the fame of being the originator of a mine safety-lamp rightly belongs.

George Stephenson, it may be recollected, at the time of his earliest locomotive trials, was engaged as an engine wright at Killingworth colliery, about seven miles north of Newcastle-on-Tyne. Previously he had been a brakesman or engine-attendant at other collieries in the district and he was well familiar with the many disastrous "blasts" or mine explosions which, at that time, were increasing in frequency in the Durham and Newcastle mining districts.

So dangerous were some of these colliery workings that miners, driven to desperation, refused at times to enter the pits, preferring, seemingly, economic and, indeed, actual physical starvation to a daily encounter with pit perils which threatened hourly to put an end to their existence.

"Blowers"

Some of the mines were so bad that their workings were full of "blowers" or fissures in the coal seams through which inflammable mine gas escaped with a characteristic gushing noise. In these mines, naked candles were utterly impossible. The phosphorescence of decayed fish skins was tried as a means of illumination, but it was of little use. In such mines the "steel mill" was employed. This was a device in which a notched wheel revolved against a flint. It struck a stream of cold sparks which, it was found by experience, would not ignite the gas, and by this feeble illumination the Durham and Northumberland miner carried on his dangerous work.

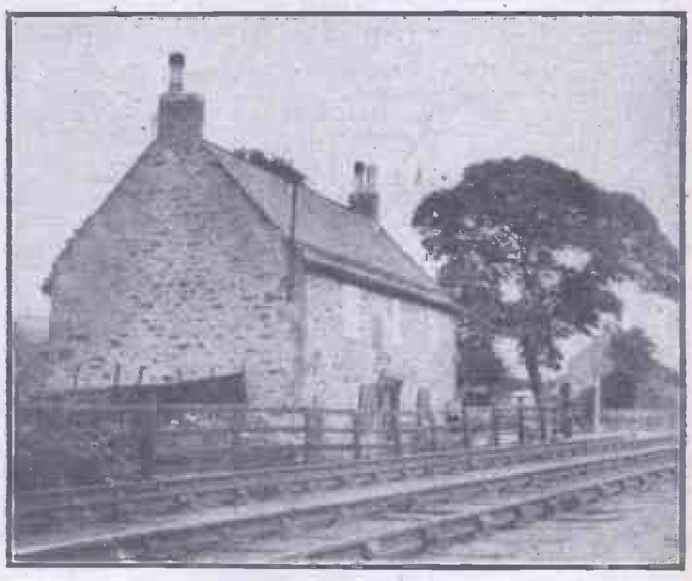
There is an anecdote about George Stephenson, aided by a few chosen men, bravely extinguishing a fire in the workings of Killingworth colliery by building a wall of bricks across the entry to the workings. One of the men, Kit Heppel, subsequently asked engineer Stephenson whether he thought that something could be done to obviate these continual mine explosions.

The answer which Stephenson gave was that he thought that something could be done to this end.

"Then," ejaculated Kit Heppel, "the sooner you start, the better; for the price of coal-mining now is *pitmen's lives.*"

And that, if we are to believe records, is how George Stephenson brought himself to grips with the pressing problem of constructing a lamp which would not fire mine gas in underground workings.

The first idea of the afterwards celebrated locomotive pioneer was that if he could construct a lamp having an elongated chimney a current of air would continually ascend through the lamp and this would prevent the inflammable mine gas from descending down the chimney and thus becoming ignited. Air was admitted to the lamp through a narrow tube at its base, and Stephenson had a regu-



The rail-side cottage at Wylam, Northumberland, in which George Stephenson was born, 1781.

lating slide fitted to this air tube so that he could control the amount of air obtaining access to the interior of the lamp.

A Brave Trial

It was on October 21, 1815, that Stephenson received from Messrs. Hogg & Co., tinmen, of Newcastle-on-Tyne, the very first safety lamp which had ever been manufactured. It was a lamp which had been made to Stephenson's own design.

Almost immediately, Stephenson subjected his lamp to practical test, a trial which, perhaps, if it had failed, might easily have ended his life abruptly and on the spot.

Taking a couple of colliery workers, Nicholas Wood and Jack Moodie, with him, Stephenson carried his new lamp down the mine and into one of the most dangerous workings where explosive gas was issuing with a loud noise from a fissure or "blower" in the roof.

The men erected some deal boarding round that portion of the workings from which the gas was escaping, thereby making the air fouler than ever it had been before. Moodie, whose practical experience of fire-damp was greater than that of either of his companions, averred that it was suicide to enter into the boarded-up enclosure with any form of light.

But Stephenson declared his confidence in the safety of his lamp. Leaving the others behind, he went boldly into the enclosure and held his lamp up to the escaping gas. The flame of the lamp grew bigger. Then it flickered and went out. But there was no explosion.

In a distant part of the mine workings, Stephenson relighted his lamp. This time his companions followed him into the boarded-off enclosure. Again, the same sequence of events occurred. This time, not only did the flame of the lamp grow bigger, but the lamp's interior seemed momentarily to be filled with fire. However, the flame was quickly extinguished and the lamp went out.

Several times that night was the same experiment repeated. Always the same result happened. The problem of the mine safety-lamp had, in its essentials, been solved, and George Stephenson knew it.

About a fortnight afterwards, Stephenson repeated his experiments in the pit, this time in front of a larger number of interested individuals. As before, the lamp was entirely successful. Not, of course, that the lamp was not capable of improvement. Its fault was that it tended to become extinguished in the presence of only traces of inflammable gas, and in such atmospheres it had to be very steady and free from vibration.

Stephenson had an improved edition of his lamp made. This was tested and found to give better results. A third lamp was also subjected to tests in the mine on November 30, so that between October 21 and the latter date Stephenson had designed and tested three safety-lamps of his own invention.

Sir Humphry Davy, to whom popular history has accorded the chief fame of the safety-lamp invention.

The Sunderland Committee

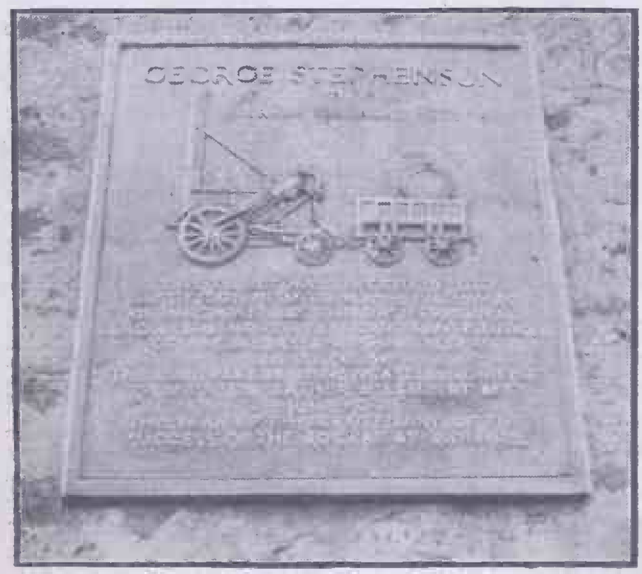
Now let us consider the Davy side of this safety-lamp controversy.

In the summer of 1815, a committee of mineowners and their agents, alarmed at the increasing frequency of colliery disasters in Northumberland and Durham, sat at Sunderland to consider ways and means of reducing the hazards of mining. The committee sat and talked, but found itself unable to do anything from a practical viewpoint. It did, however, recommend that Sir Humphry Davy, of London, should be approached in the matter and that he should be requested to turn his attention to the possibility of devising a safe light for mines.

And that is how Davy, the chemist and electrician, came into the mining world. Davy, at this time, was very much at the height of his career and his fame. He was being lionised by London society. His experimental genius was everywhere admitted. His fame as a "chemical philosopher" was second to none in Europe.

Quite unknown to Stephenson, the great Davy visited a number of coal mines near Newcastle-on-Tyne on August 24, 1815. He made a rapid tour of inspection and then departed. No doubt, one day in a colliery was enough for him.

In London, Davy concentrated on experiments. His idea was to have a flame burning in an iron-mesh cage. Air is given free access to the lamp and the products of combustion escape equally freely. In an explosive atmosphere, the inflammable gas passes through the gauze and is ignited within the gauze cylinder surrounding the flame. The ignition, however, is unable to pass beyond the metal gauze, the gauze thereby acting as a flame sieve.



More famed as a locomotive engineer, Stephenson's memory is preserved by this memorial tablet set into the wall of his birthplace cottage at Wylam.

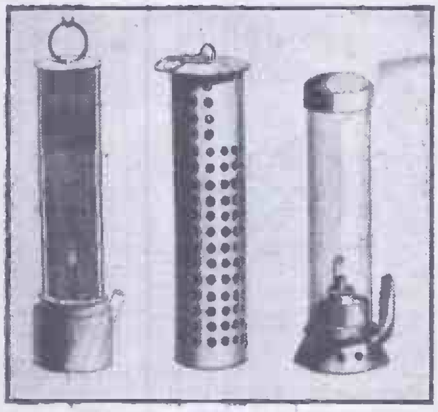
Such was the principle which Sir Humphry Davy applied to the design of his safety lamp. He announced his invention in a new historic paper entitled "On the Fire-damp of Coal Mines, and on Methods of Lighting the Mine so as to Prevent its Explosion," which he read before the Royal Society of London on November 9, 1815.

Davy seems to have conducted his experiments more or less in secret. True it is that he wrote a few letters to interested friends in which he mentioned the progress of his experiments, but the fact remains that his first demonstration of his experimental lamp took place during his Royal Society lecture on the date above mentioned.

By this time, Stephenson had designed and tested two of his safety lamps and was well on the way to having a third lamp made.

Such are the facts, and they are facts which clearly demonstrated the contention that, apart from the initial efforts of Dr. Clanny, it was Stephenson and not Davy who was first in the field with the safety-lamp invention. The time interval between the two inventions was a small one, but the priority was undoubtedly Stephenson's.

The Davy lamp was rather simpler than Stephenson's, and gave a better light. Moreover, it did not tend so greatly to go out in the presence of inflammable gas as did Stephenson's lamp. But, of the two, the Stephenson lamp was rather safer, because if the wire gauze surrounding the flame in the Davy lamp became red hot, it then lost its ability to keep back the eternal spread of flame and in such circumstances it became actually dangerous.



(Left). The original Davy lamp. (Right) The Stephenson lamp with its metal cover removed.

"Davy" and "Geordy"

Davy's lamp won the day. It was publicised extensively and popularly dubbed "the Davy." The Stephenson lamp, on the other hand, which became known as the "Geordy," was more or less restricted in use to the Northumberland-Durham collieries.

The rival claims of the "Davy" and the "Geordy" were hotly disputed, although, eventually, a synthesis of the two lamps was brought about. All the scientific people of the day sided with Sir Humphry Davy, his scientific reputation being so well established. The Davy faction affected supreme disdain for Stephenson and his claims. Typical of this attitude is the following passage extracted from Dr. Paris's "Life of Davy" (1831):

"It will hereafter be scarcely believed that an invention so eminently philosophic, and which could never have been derived but from the sterling treasury of science, should ever have been claimed on behalf of an engine-wright of Killingworth, of the name of Stephenson—a person not even professing a knowledge of the elements of chemistry."

In 1816, steps were taken to raise a subscription for the purpose of making a suitable presentation to "the inventor of the safety-lamp." Meetings were held in which feelings ran high. The claims of the Davy lamp were well admitted by the Stephenson faction, but the contention that Davy had priority in the invention was stoutly resisted. After a number of meetings had been held, the sum of £2,000 was ultimately presented to Sir Humphry Davy as the *inventor* of the safety-lamp and a purse of £100 was voted to George Stephenson "for what he had accomplished towards the invention." Without any doubt, it was a case of Davy being given the first prize and of Stephenson having to put up with the booby award!

The flame lamp displaced. An early accumulator electric lamp for mine illumination.

Stephenson was, of course, uneducated and illiterate, although something of a natural genius. But, with the assistance of his son, Robert, the indomitable George put together a written account of his activities and achievements in the development of his safety-lamp. The document was printed and published and it subsequently appeared in the local newspapers, the upshot of this publicity being that George Stephenson was entertained at a public dinner held in the Newcastle Assembly Rooms on January 18, 1818, and there presented with the sum of £1,000 in testimony of his being the *first* to construct a practical safety-lamp for mining use.

And there Stephenson left the matter. After all, he had other and more spectacular interests around him. He had already constructed a successful locomotive engine which was to be seen running about daily at the Killingworth colliery. This had not been heralded by articles in the newspapers and by eloquent lectures at the Royal Society, by fashionable cartoons and by various reviews as were many of Davy's achievements. It was a creation of his own brain which, he imagined, might ultimately serve a much greater purpose than a mere colliery runabout and which might, indeed, be developed into a locomotive engine for use in conveying passengers from town to town. And to what extent Stephenson's dreams and imaginings came true we are all well aware.

Summing up, there is no doubt that both Stephenson and Davy worked on their respective lamps independently and unknown to each other. Stephenson got in with his practical lamp first, but Davy, the fashionable scientist of the day, had by far the better backing and the greater publicity. The respective lamps possessed points of advantage and disadvantage over each other. By different routes, both the inventors arrived at similar results, although, as old Nicholas Wood, the Northumbrian mine-worker and an excellent judge on colliery matters, once remarked: "Davy's lamp is safe—but Stephenson's is safer."

The modern safety-lamp as used in the Lancashire collieries.

AN ELECTRIC FLOOR-LAMP

(Continued from page 165.)

screwing, the position of the upper base should be pencilled on the surface of the main base, then the screw holes bored and countersunk at the underside. It will then only be a matter of positioning the upper base, making starting holes with a bradawl, and driving home the screws.

It is assumed that all exposed nail heads in the woodwork are punched and covered up with plastic wood or beaumontague (a hard wax filler). When the wood has been glasspapered smooth, it may be stained and polished. A light walnut finish is suitable. It can be obtained by brushing on several applications of light walnut french polish. Each application should be allowed to dry, then be rubbed down lightly with No. 0 or No. 00 grade glasspaper. Three separate coats is sufficient. The final coat, of course, is not glasspapered.

To complete the work, fit a plug to the flex, and secure the latter to the underside of the base with a suitable staple. The metal gliders are then added. Use a frosted lamp, as there is too much glare from lamps having clear glass envelopes.

It may be thought that, by having an 18in. diam. shade, the floor lamp will be top-heavy. Actually, the shades are very lightly made up, and if desired, the main base could be 12ins. square. If necessary, a 16in. shade could be used with this size of base. Bases, however, are seldom smaller than 12ins. square. When smaller, the base is usually "loaded" with lead, thereby counteracting any top-heaviness.

Club Note

Richmond and District Engineering Society

THIS society has been formed with the object of fostering interest in all aspects of engineering and to provide a common meeting ground for engineers of all branches within the various trades and professions.

Another object is the presentation of lectures, talks, films, visits and exhibitions of general engineering interest.

Further particulars regarding membership, etc., can be obtained from J. W. Parton, hon. sec., 53, Onslow Road, Richmond, Surrey.

WORKSHOP CALCULATIONS TABLES AND FORMULÆ

Eighth Edition

by F. J. CAMM

A handbook dealing with methods of calculation, solution to workshop problems, and the rules and formulæ necessary in various workshop processes. It contains all the information a mechanic normally requires.

From all booksellers, 6/- net, by post 6/6 from the publisher,

GEORGE NEWNES, LTD. (Book Dept.), Tower House, Southampton Street, W.C.2.

Report of New Storage Battery

THIS report gives an outline of the basis of a new type of electrical storage battery. Whilst the principle is well set out, the information is far from complete and considerable work would be necessary before such batteries could be produced on a large scale.

The battery is reputed to have a cell potential of 3-4 volts; the cathode consists of mercury or an amalgam retained behind a porous diaphragm such as a clay cell, whilst the anode is a lead oxide grid. The electrolyte is a mixture of sodium hydroxide and sodium sulphate solutions. On charge, sodium is deposited on the cathode and the anodic lead oxide is converted to the peroxide (which, incidentally, is termed superoxide in the report). On discharge the reverse reaction takes place, sodium hydroxide being reformed.

It is important to note that the cathode must be specially shaped in order to prevent self-discharge of the battery whilst on open circuit. For further details, anyone interested in this subject should refer to the F.I.A.T. report published by the Stationery Office.

This report is issued with the warning that if the subject matter should be protected by British and/or U.S. Patents or Patent Applications, this publication cannot be held to give any protection against action for infringement.

Electric Water Heating Practice

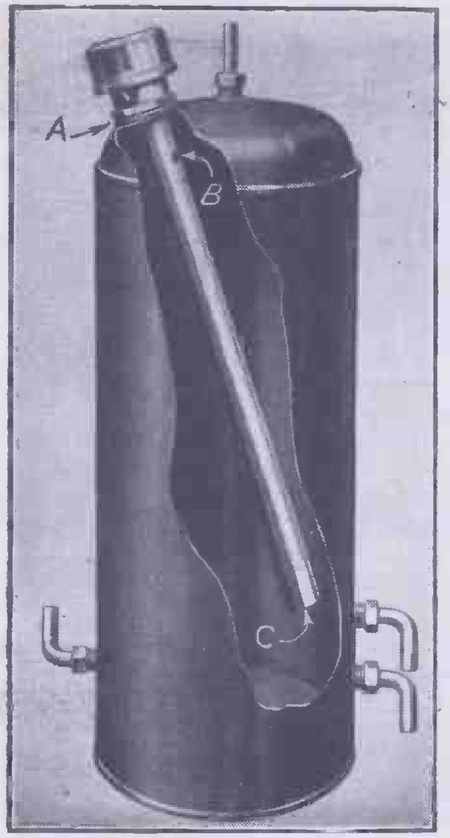
Converting Existing Installations : Various Types of Circulator : Thermostatic Control

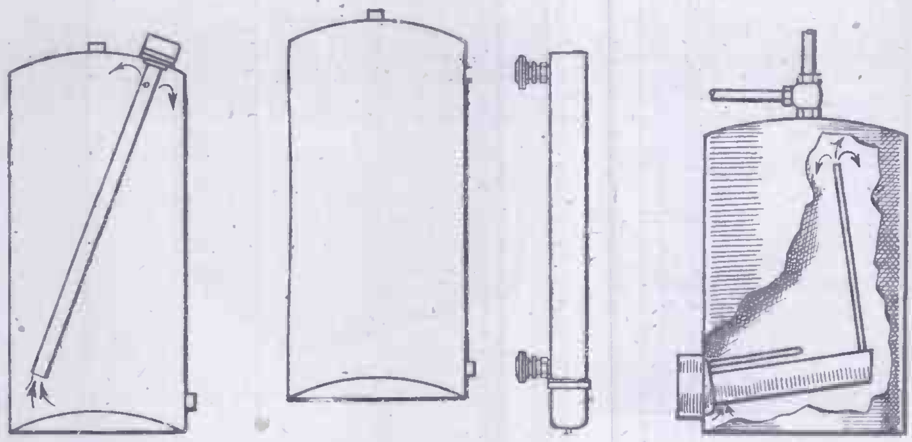
By G. A. T. BURDETT, A.M.I.I.A.

(*Continued from page 118, January issue*)

SINGLE-HOLE fixing is widely adopted for copper cylinders (Fig. 6), some types being made for tinning and soldering to the copper cylinder wall (Fig. 7). Sometimes it is necessary to use a template, and this is often provided by the manufacturers.

Where drilling the tank is particularly difficult or impossible and the tank capacity is larger than necessary, it is often possible to fix the immersion heater in the inspection cover. To do this, the cover is removed in the normal way, the hole drilled and the heater screwed home. Inspection of the element is then a simple operation. Before adopting this method, care must be taken to ensure the tank contents, viz., water, *above* the element will meet the demands of the household.





Circulators

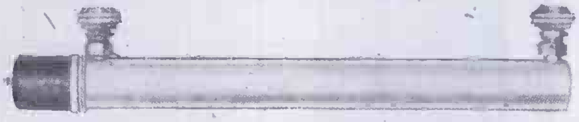
These are fitted in the existing storage tank and enable small quantities of hot water to be drawn off soon after switching on.

They consist of an immersion-heater element surrounded by an outer sheath or draught tube (Fig. 6). Water in contact with the element circulates upwards inside the draught tube and passes through a comparatively small hole at the top. This is stored in the top of the tank and can be drawn off at once by the user.

Circulators should, however, only be used in soft-water, *not hard-water* districts, as the vent hole quickly becomes fouled with scale. In fact, circulators which can only be mounted vertically are particularly adaptable in the soft-water districts, for it is in these areas where the cylindrical copper tanks are largely fitted. These tanks have a height much greater than their diameter. Horizontal immersion heaters are usually too long and cannot be accommodated, but circulators, due to their length, will usually extend almost to the base of the tank, but rarely can be fitted in rectangular galvanised tanks, which are not, of course, installed in soft-water districts.

Other Types of Circulator

Where there is little head room above a cylinder and it is not possible to instal a conventional type of circulator which is fitted



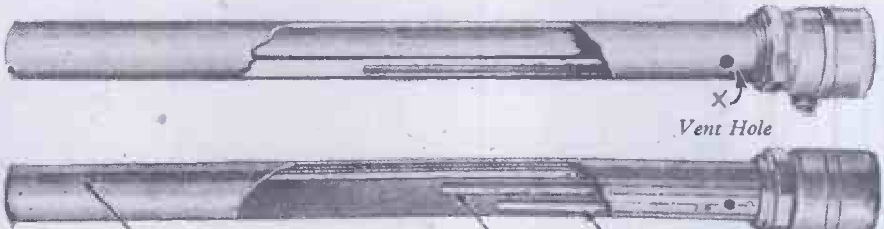


Fig. 6.—(Above). Cut-away cylinder showing the position of the circulator type heater. Thermostat is enclosed in draught tube. Note the single hole fixing of heater flange in the top of the cylinder. (a) Non-soldering Essex type flange; (b) "sweated" ring type.

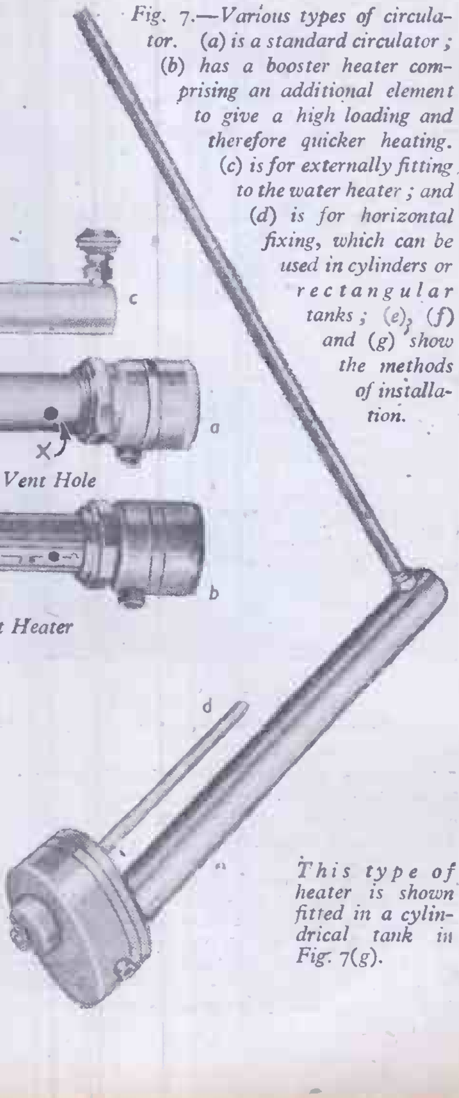
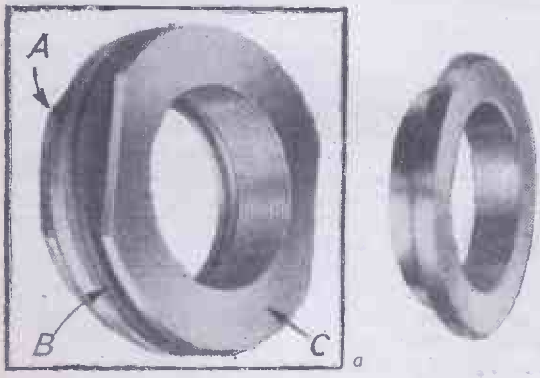


Fig. 7.—Various types of circulator. (a) is a standard circulator; (b) has a booster heater comprising an additional element to give a high loading and therefore quicker heating. (c) is for externally fitting to the water heater; and (d) is for horizontal fixing, which can be used in cylinders or rectangular tanks; (e), (f) and (g) show the methods of installation.

This type of heater is shown fitted in a cylindrical tank in Fig. 7(g).



vertically in the top of the cylinder, two other types are available. These are: Side entry circulators (Fig. 7d) and external circulators (Fig. 7c).

The side entry circulator consists of an immersion heater fitted horizontally in the side of the tank and a vertical extension draught tube which passes through the body of the tank and terminates near the top. This has an open outlet through which the hot water circulates. As with the conventional type, small quantities of hot water can be drawn off shortly after switching on the heater. A thermostat is usually incorporated. These, like all circulators, should not be installed in hard-water districts owing to the scale which is likely to form in the small draught-tube outlet.

External Circulator

These are fitted externally to the side of the tank or cylinder. Two holes are bored in the tank, into which flanges are inserted or "sweated" and the heater is screwed on (Fig. 7f). If the cylinder is fitted with boiler flow and return connections and these are not being used, the circulator can be fitted to them.

Two-element Conversion

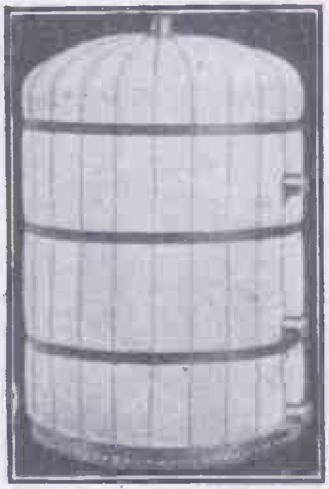
This system has become a most popular method of control. Two immersion heaters are installed in the tank, one at the bottom with a loading or 2-3kW. and one of 1kW. near the top of the tank. These can be controlled by separate thermostats, though hand control may be used, but is, of course, less satisfactory.

For all normal use the smaller heater at the top may be used. Small quantities of water for washing and washing up can be drawn off, but when a bath is required the lower heater is also brought into operation, when the whole contents are heated. Chief advantage of this method is the saving in running costs, since, as only part of the tank contents are normally heated, losses are therefore reduced to a minimum. It is necessary only to lag the top portion.

Lagging

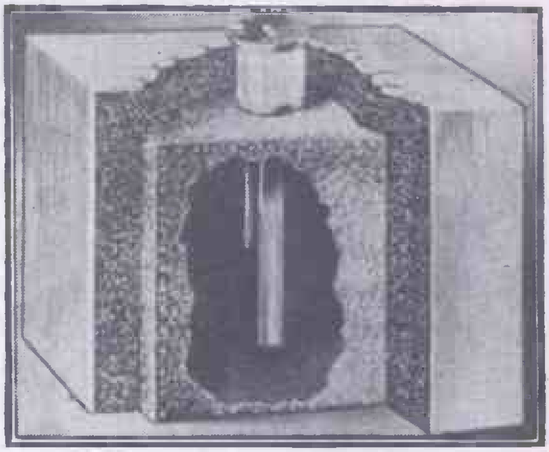
A converted electric hot-water tank should be adequately lagged to prevent undue loss of heat and unnecessary consumption of electricity.

Lagging is generally carried out with granulated cork. This form is one of the cheapest and most effective methods of lagging a rectangular tank. Special prefabricated heat insulated jackets are, however, obtainable for both rectangular and cylindrical type tanks, and are wrapped round as a jacket (Fig. 8). Granulated cork can, of course, be used for cylindrical tanks, while an effective job can be achieved with an old blanket or corrugated cardboard using several layers over which is sewn a canvas cover.



a

b



d

e

c

Fig. 8.—Various types of cylinder and tank lagging. (a), (b) and (c) are special jackets which can be purchased and tied on the cylinder or tank; (d) shows how a wood framework can be built around a tank and filled with cork granules; and (e) a similar method of lagging a cylinder.

Before applying granulated cork to a rectangular tank, a frame of matchboard should be built, leaving a space of at least 2ins. between the tank and woodwork for pouring in the cork. This is then rammed in firmly and evenly (Fig. 8d) and an effective heat insulator is thus made.

Heat losses from a lagged tank (3ins. of granulated cork) where the temperature of the water is 180 deg. Fahr., are approximately 4 watts per sq. ft. of surface area. Heat losses, on the other hand, from an unlagged tank where the water temperature is 180 deg. Fahr. are between 36 and 72 watts per sq. ft.

Immersion Heater

Immersion heaters are made in various electrical loadings from 500 watts up to 6 kW. (6,000 W.). Size of heater to install depends on capacity of tank, whether thermostatically or hand controlled and, if hand controlled, the time which is to be allowed to heat up the tank's capacity from cold. Maximum loading in an individual case also depends upon the electricity supply authority's regulations. Some authorities require a low loading.

Calculating Optimum Size of Element

The average hot water tank has a capacity of between 20 to 30 gallons. One 2 kW. heater where a thermostat is incorporated is usually sufficient, but with hand control a 3 or 4 kW. heater should be used.

Some knowledge of the mechanism of heat and electricity is, however, necessary to determine the optimum loading in a given case.

(To be continued.)

THE WORLD OF MODELS

Nottingham Exhibition of Models : Model-making Activities in Barnstaple : New 00 Gauge Permanent Way

By "MOTILUS"

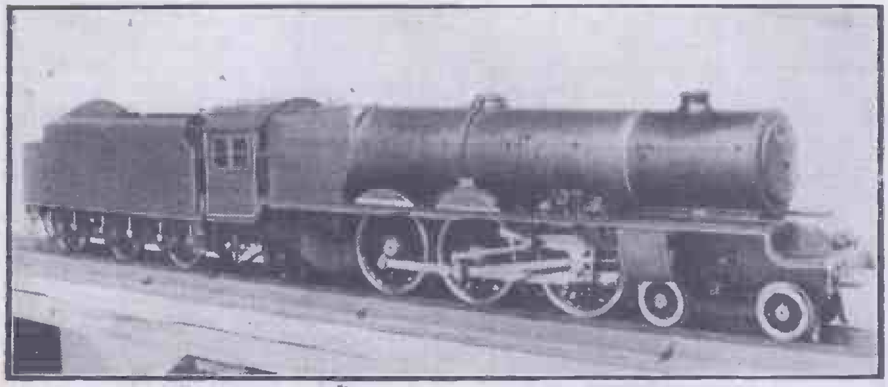


Fig. 1.—Mr. Barkes' ¾in. scale L.M.S. locomotive, "Princess Royal," used on the running track at the Nottingham Society's Exhibition last March.

(Photo by Reginald Clarke, Nottingham.)

AT the end of March the Nottingham Society of Model and Experimental Engineers will be holding their twelfth annual exhibition. Those who had the opportunity of seeing the exhibition last year, already have an idea of the splendid display of models that this society can produce. Full particulars of this year's exhibition, which is to be held from March 31st until April 3rd, can be obtained from the Hon. Secretary, Mr. E. S. Wright, 186, Wilford Road, Nottingham.

I think this is a good opportunity to say a little more about the Nottingham society's show last March and some of the two hundred models gathered there. Out of five thousand visitors, some two thousand children enjoyed rides on the multi-gauge passenger-carrying railway. Three locomotives were used on the track: the society's 5in. gauge 0-6-0 goods engine, Mr. J. Barkes' 3½in. gauge "Princess Royal," and Mr. Ruffle's "Flying Scotsman." The two latter engines are illustrated here (Figs. 1 and 2). Mr. Barkes was awarded the society's principal award, the "Pool Trophy," for his ¾in. scale "Princess Royal." Other notable awards were the "Wallis Binch" Challenge Cup to Mr. J. Tilson for his watchmaker's lathe, and the "Syne anonyme" cup to Mr. J. Witty for his 2½in. gauge L.N.E.R. "Flying Scotsman."

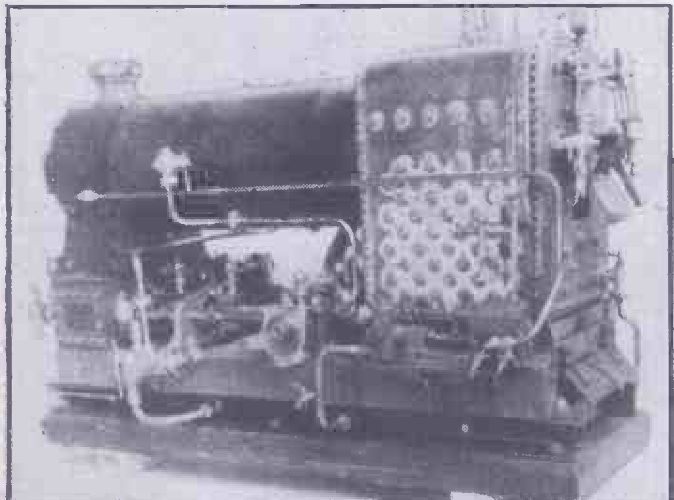


Fig. 3.—Mr. S. J. Bradley's compound, under-type engine and boiler, awarded a certificate of merit for good workmanship at the Nottingham Society's Exhibition last March.

(Photo by Reginald Clarke, Nottingham.)

As well as the excellent locomotive models, there were many other varied items to catch the eye of all model-makers, in whatever special branch of the hobby they were interested. Not least among these was Mr. S. J. Bradley's under-type engine and boiler, shown in Fig. 3. The Nottingham Model Yacht Club also had a good display of model sailing yachts and boat hulls of several types. (Fig. 4.)

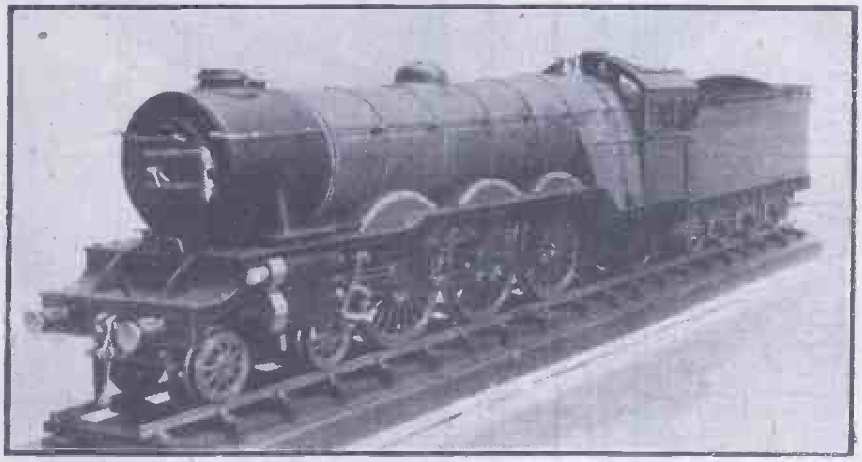


Fig. 2 (Above).—Mr. Ruffle's ½in. scale, 2½in. gauge, "Flying Scotsman," also used on the Nottingham Society's running track.

(Photo by Reginald Clarke, Nottingham.)

Mention of just these few exhibits, with the accompanying illustrations, will convince readers that this exhibition is well worth a visit if they are within reach of Nottingham between March 31st and April 3rd. Even if you have to come from far afield, you will be well rewarded by making a pilgrimage to

Fig. 4.—A group of sailing yachts and boat hulls of various types, displayed by the Nottingham Model Yacht Club on their stand at the Exhibition.

(Photo by Reginald Clarke, Nottingham.)

Victoria Baths, Sneinton, where the exhibition is to be held. Mr. Wright has told me that the society are extending an invitation to all model engineers to enter the open competition held in conjunction with the exhibition, for which they are offering their usual prizes of 5 guineas, 3 guineas and 2 guineas.

Model-making in Barnstaple

While spending a short while in Barnstaple, North Devon, recently, I noticed in the Athenaeum museum there a good model of a steam winding engine, made by Wm. Sparks, of Pilton. Mr. Sparks was awarded a medal at the exhibition of the Agricultural and Industrial Association of Queensland, Australia, in 1894. This is an excellent piece of amateur workmanship and makes a welcome contribution to the small but well-arranged museum at Barnstaple.

Shortly after I had examined this engine I found I had the opportunity of a brief meeting with Mr. J. S. Hutchinson, of Barnstaple, who is a keen model-maker, now engaged in building a ¾in. scale, coal-fired, 4-6-2 locomotive, to the designs of "L.B.S.C." Mr. Hutchinson has converted one of the rooms in his home into a well-equipped workshop and the locomotive had reached a stage where it was possible to examine the fine workmanship put into the model. Mr. Hutchinson has promised me some photographs, showing various stages in the construction of his model, which I hope to include in a later article.

I was pleased to learn that Mr. Hutchinson is gathering a few enthusiastic friends to form a local Model Engineer Club. From what he has told me, I feel sure it will be a success. The intention is to launch this club with a local exhibition of models, and to get some of the influential residents in Barnstaple to give active support to the venture.

Fig. 6.—Another view of the model Cotswold village, showing the stream, bridge and railway station. The piece of oo gauge permanent way track is the new, realistic, "Peco-Way."

"Puffin Building Books"

Almost everyone is familiar now with the Penguin, Pelican and Puffin books that are to be seen brightening every bookstall, and on all booksellers' shelves. I am pleased to see some new publications now on sale, the "Puffin Building Books." The first three of this series, numbered 1A, 1B and 1C (price 2s. 10d. each, including tax), are to enable modellers to build a miniature Cotswold village, from cut-out drawings in the book. More than this, the completed model is to a scale of 4 mm. to the foot, which is the standard OO gauge scale. Here is a chance for OO gauge fans to enrich their railway layout with characteristic scenery. I do not think a better choice could have been made for all who know and love the pleasant, mellowed atmosphere of the Cotswold villages. The cut-out drawings in these books have been planned by an architect, Mr. L. A. Dovey, who is familiar with the matured stone buildings in the Cotswolds. Here in these books you will find all the features associated with an English village: the cottages, the church, the village hall, the inn and the wayside railway station. Here, too, are the stream, spanned by a simple stone bridge, and the paved village street, edged with the old stone walls. The railway station is fenced off with a wooden paling, where you can imagine small boys running from the village schoolroom to perch themselves, regardless of discomfort, watching the Midland expresses rush past, heedless of the quiet peace they so rudely disturb for a short space.

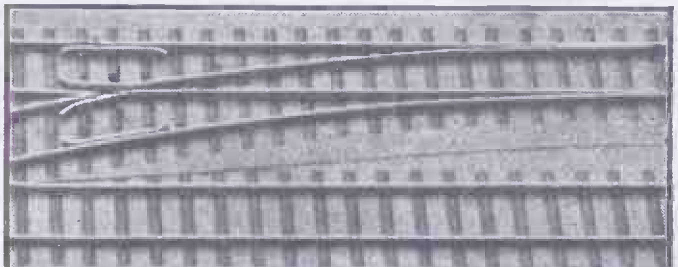


Fig. 7.—Section of "Peco-Way" oo gauge track, showing detail.

Margaret and Alexander Potter contribute some very pleasing sketches and notes to assist in the cutting out, folding and erection of the model. I am fortunate in having a friend who is keen on architectural models of this kind. The two illustrations, Figs. 5 and 6, show different views of the complete village, after my friend had built it and, aided by the black and white sketches, added some imaginative improvements in the way of trees, lawns and an impression of water in the stream, which heightened the realism of his model. He mounted it all on a base, 2ft. 6in. by 3ft. The piece of railway track you can see in the foreground of Fig. 6 was not taken from the "Puffin Building Books," but is a piece of "Peco-Way" OO gauge permanent way.

"Peco-Way" OO Gauge Track

Talking of Peco-Way, I wonder how many readers are conversant with this very realistic new form of OO gauge permanent way. It is now becoming very popular among OO gauge enthusiasts who demand realism as a feature of their track. Fig. 7 gives a close-up of a section of a railway laid with this track, including a pair of points. Centre or side rail for electric traction may, of course, be added if you require it. The main new feature in this track is the base, which is of special card with the sleepers embossed on it, darkly coloured, and pierced ready to receive the chairs. M.E.T.A. standard nickel silver rail is used. If you are interested in Peco-Way, you can obtain further information about it from Messrs. Bassett-Lowke, Ltd., at their branch at 112, High Holborn, London, W.C.1, or by post from the Head Office and Works at Northampton.

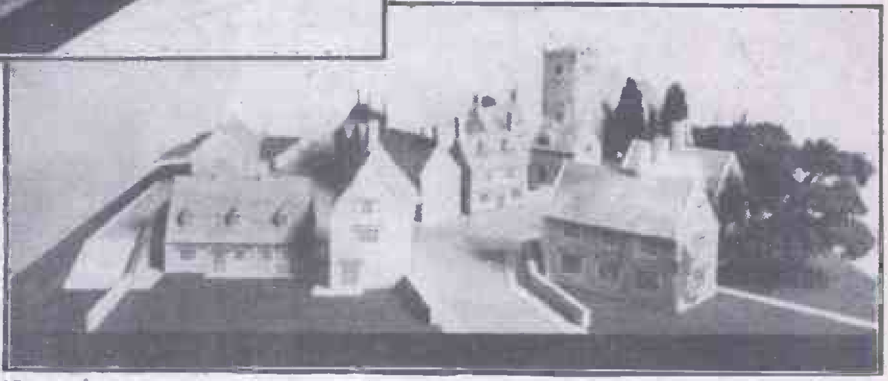


Fig. 5.—The model Cotswold village, built up from the three new "Puffin Building Books."

I have just heard that Messrs. Bassett-Lowke also have some news for ship modellers. They are shortly issuing a new catalogue devoted entirely to ship models, fittings, parts and all accessories for the model ship builder. The catalogue is now with the printers, and should be available by the time this journal is in your hands, ready for you to start building in preparation for the summer season.

A NEW VEST POCKET BOOK
NEWNES METRIC & DECIMAL TABLES
By F. J. CAMM
3/6 or 3/9 by post from
Geo. Newnes, Ltd., Tower House, Southampton St., Strand, W.C.2.

Trade Notes

The "Handyman" Anvil

THIS sturdy anvil has been produced to meet the demand for a small anvil suitable for engineering enthusiasts, model makers, and handymen. Made by the manufacturers of the well-known Coburn range of anvils, the "Handyman" anvil is of solid

The "Handyman" anvil.

high carbon cast steel with flame-hardened working surface. Further particulars are obtainable from K. and L. Steelfounders and Engineers, Ltd., Letchworth, Herts.

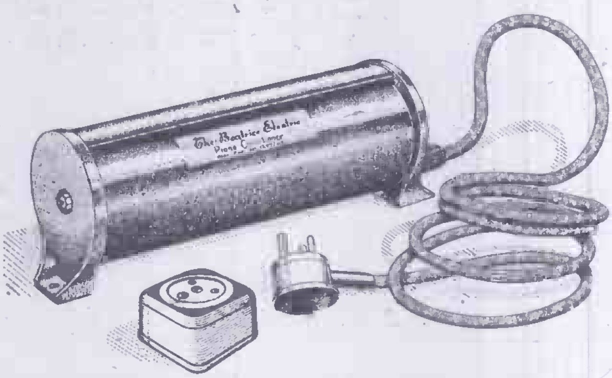
The "Beatrice" Piano Conditioner

THIS electric conditioner is designed for the purpose of keeping a piano in perfect playing condition. This it does by maintaining the interior of the piano at an average temperature of 60 to 65 deg. Fahr., thus drying out all dampness from the operating mechanism. It also has the effect of preventing "bloom," so keeping the exterior of the piano case in a highly polished condition.

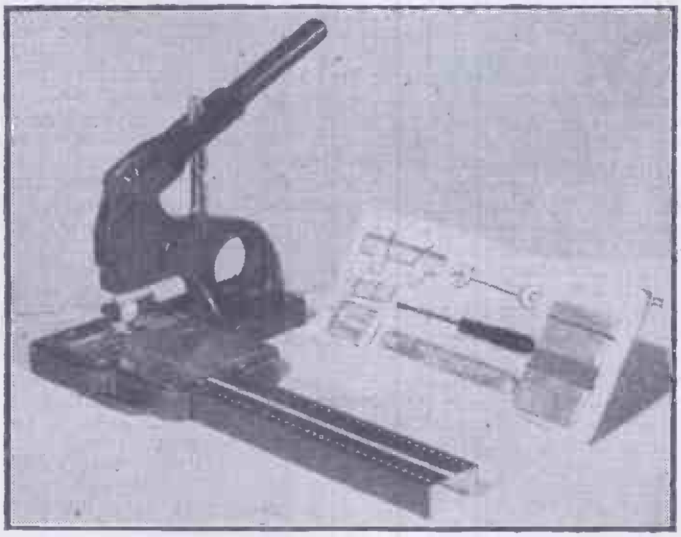
The conditioner, which is 7¼in. long, 3ins. high and 2½ins. wide, is supplied complete with 2 yards of 3 core cable, power plug and socket, and fixing wood screws. (Extra cable will be supplied, if desired, at 1s. per yard). The aluminium alloy case is designed to prevent accidental or intended insertion of foreign bodies, and to be dustproof, yet to allow free circulation of air. The metal case of the conditioner being earthed and complying with electricity regulations. The instrument is designed to be coupled through the power plug and socket *continually* to the mains (220-250 volts) A.C. or D.C. and consumes only 30 watts per hour.

It is easily fitted in the lower right hand corner of the upright type of piano, screwed to the baseboards, and in the case of grand and baby grand pianos is fitted beneath the piano case at the top of the pedal column. Full fitting instructions are enclosed with each conditioner.

Particulars as to price, etc., can be obtained from B. Whittaker, 252, Bury New Road, Heywood, Lancs.



The "Beatrice" electric piano conditioner.



(Right) The Prestacon Press and accessories.

The Prestacon Press

THE Prestacon Press is a precision tool that will appeal to all model-makers and home handycraftsmen. It will pierce round and square holes in sheet metal, rout larger holes or straight slots and bend metal strip and plate to any angles up to 45 deg.

All these operations can be carried out at any position on a metal plate and each operation can be reproduced on any number of plates with complete accuracy. This is due to an ingenious arrangement of indexed holes into which the "location" or "guide" bars fit at right angles to each other. These guide bars form set edges against which the metal for working is placed. No measurements have to be made by the operator and it takes only a few seconds to change the position of the metal or the operation of the press. The guide bars also provide for a "minus" working which allows for metal thickness when bending or when piercing holes to match inside an angle.

With the aid of this handy tool, which brings workshop practice within reach of every model-maker, various metal parts can be made into an unlimited range of models.

A comprehensive Prestacon outfit includes: All necessary tools, guide bars, piercing punches, dies, forming die spanner, screwdriver, metal plates, strips and angles.

Further particulars are obtainable from L. Rees and Co., Ltd., 31-35, Wilson Street, London, E.C.2.

Civil Aviation News

"Bristol" Hercules on Show in Melbourne

PROMINENT among stands designed to give British industry a boost at the recent Royal Melbourne Agricultural Show was that of the Atlantic Oil Co., featuring a section model of the "Bristol" Hercules 630 sleeve valve engine.

Mounted on a railed, circular stand, the engine stood in front of a strikingly effective backcloth showing Herculean figures at work at the glowing forge of Industry.

The stand was the centre of attraction for thousands of Australians who flocked to Melbourne for the show—the most important event in the calendar of the Australian agricultural world.

Freighter's 35,000 Miles Trip

"UNDOUBTEDLY one of the largest and most ambitious air-freighting projects ever undertaken since the early days in New Guinea" . . . in these words, Mr. G. D. Nicoll, manager of the Aircraft Division of the Overseas Corporation (Australia), Ltd., summed up the latest exploit of the "Bristol" Freighter, *Merchant Venturer*, which, after a successful 35,000 miles demonstration tour of Australia and New Zealand, is now in charter service with Ansett Airways Pty., Ltd.

The project was delivery by air from Melbourne to Launceston, Tasmania, of a fleet of ten passenger tourist coaches urgently required for the summer season. Tours had already been arranged, and it was therefore essential that the operators, Pioneer Coaches Pty., Ltd., should have at least six of the vehicles delivered by October 1.

Unable to obtain shipment by sea because of the widespread strikes and shortage of shipping, Pioneer Coaches, Ltd., appealed to the Overseas Corporation—the Bristol Aeroplane Company's Australian agents—for assistance. Aid was readily given and, thanks to the versatile *Freighter*, the entire fleet of ten coaches was delivered before the end of September. In a series of twice-daily flights from Essendon Airport, Melbourne, the *Freighter* crossed the Bass Strait to Launceston, carrying on each flight one coach 22ft. in length and weighing 6,000lb., plus an additional 1,000lb. of freight. On the return trips the aircraft carried on each occasion a freight load of approximately 7,000lb. of miscellaneous merchandise.

Letters from Readers

Trisecting An Angle

SIR,—Why do the people imagine such a vain thing? It is impossible to trisect an angle by Euclidean geometry.

The construction suggested by R. E. Brett in your December issue is based on an incorrect assumption to which he lends an air of truth by stating that "it is well known."

If the base of an isosceles triangle be divided into two parts of ratio m : n, then the angles subtended at the apex will have their *sines* in the same ratio. This cannot be extended to more than two parts.

Examine his Fig. 2. The triangles ABP and APQ have the same height and bases of equal length. Therefore, their areas are equal. But the area of a triangle can also be expressed as $\frac{1}{2}$ ab sin C., i.e.,

$\frac{1}{2}$ AB AP sin BAP = $\frac{1}{2}$ AP AQ sin PAQ.

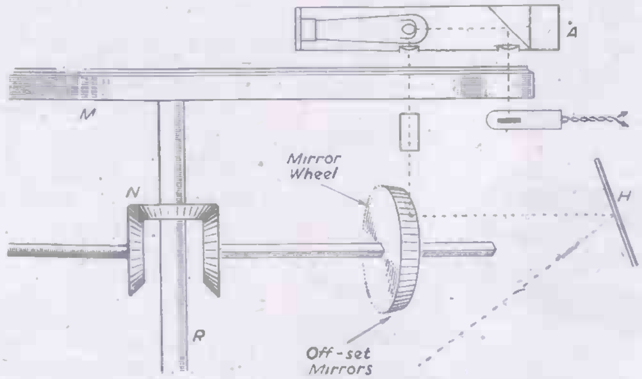
Now AP is common and AB and AQ are obviously not equal in length. Therefore, the angles BAP and PAQ cannot be equal. —M. C. MOORE (Epsom).

The Cinegram

SIR,—I recently read in the October issue of PRACTICAL MECHANICS an article by Mr. F. Townsend Pamment on the Cinegram which I found most interesting, but for which I would suggest a slight improvement. Instead of having an oscillating mirror (G, Fig. 3) it should have a series of rotating mirrors, i.e., a revolving wheel driven by a shaft at right-angles to the spindle (R) and driven by the bevel gear (N), revolving at the same speed as the turntable (M), having on its edge a series of mirrors suitably set. Each of them would follow the image the same way as the oscillating mirror, but at the end, instead of flicking back, would be replaced by the next one, that would now pick up the next image, and so on.

This would give a much steadier image on the screen, as practically there would be no interruption between the images and no flickering, and would be easier to regulate.

The new shaft or spindle should have a square or T-section and a free longitudinal movement through the centre of the revolving wheel with the mirrors, to allow for the forward movement of the turntable, and so be always centred under the tone-arm.—DR. ANTONIO LEITE MONTEIRO (Funchal, Madeira Island).



Cinegram movement with rotating mirror wheel.

Synthetic Fats

SIR,—I found the article on fats by J. F. Stirling (November, 1947, issue) very interesting as I have had actual experience of the ersatz margarine named "Prima" which he mentions as being issued to the German forces.

During the occupation of Guernsey I worked in the German food store, and when the stocks of French butter ran out we got a stock of this margarine in 250 gramme packets. I used plenty of it at home and had no complaints regarding taste from friends to whom I gave packets. Of course, this may have been because it was a welcome gift, any kind of fat was, but, personally, I found it all right, particularly for making chips.

That was in 1941-2, but later, in 1944-5 we had some issued to us in the internment camp I was then in.

An interesting sidelight on the German stocks of fats is that towards the end of 1944 the Commandant told us that we would have to have our fat ration of butter, as no more margarine was available. I suppose they needed it all for war purposes.—E. WEBSTER (Brighouse).

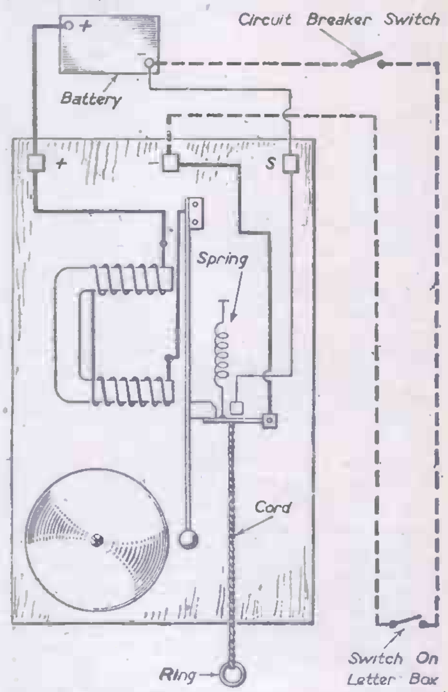
An Effective Alarm

SIR,—I was very interested in C. Bradshaw's practical method of contriving an alarm which appeared in the December issue of PRACTICAL MECHANICS.

I would like to improve on this by using a three-terminal, continuous ringing bell, thus eliminating one or two disadvantages, such as the newspaper coming in too far, and the possibility of it getting wet in bad weather.

The accompanying diagram explains itself. After the newspaper has fallen to the floor the bell will still continue to ring, until the cord is pulled to replace the trip.

These bells are very little dearer than the ordinary bell and are obtainable at most electrical supplies shops.—H. WILLIAMS (B.A.O.R.).



An alarm circuit with continuous ringing bell.

Books Received

Motor Cycling Manual (12th Edition). By the Staff of "Motor Cycling." Published by Temple Press, Ltd. 160 pages. Price 5s. net.

THE purpose of this useful manual is to provide the newcomer with a groundwork of knowledge which should make him self-reliant and conversant with technical terms, which are usually puzzling to the beginner. The intricacies of construction and operation are explained in a manner which is easily understandable by the most unmechanically-minded novice, whilst at the same time being satisfactory to the most exacting enthusiast. There are also chapters on such practical problems as "vetting" a second-hand machine, and hints on the roadcraft which distinguishes the really efficient rider from the novice.

Among other noteworthy features of this manual are the many excellent line drawings which illustrate it.

Let's Take a Photograph! By G. J. Matson. Published by Thomas Nelson & Sons, Ltd. 212 pages. Price 7s. 6d. net.

THE beginner with a camera need have no fears if he has this interesting and useful book to help him with his first experiments in the realm of photography. The subject matter covers the whole art in simple and clear language, from descriptions of the various types of cameras to developing, printing and enlarging. The book is illustrated with numerous photographs and diagrams.

Electrical Engineering. By Frederick W. Purse. Published by Southern Editorial Syndicate, Ltd. 104 pages. Price 5s. net.

THIS book, which deals with the scope, training and prospects of electrical engineering as a career, caters primarily for young students of both sexes who are aiming for one of the higher posts in the profession. There are nine chapters under the headings: Electricity in Retrospect; Various Aspects of Electrical Engineering; Preliminary Decisions; Foundation Studies and Training; Career to be Adopted; Successive Progress; General Prospects; Ultimate Aim; and Looking Ahead.

In addition to students, anyone coming within the scope of electrical engineering will find this book interesting reading.

NEWNES ENGINEER'S POCKET BOOK
By F. J. CAMM
10/6 or by post 11/-
Obtainable from booksellers, or by post from George Newnes, Ltd., (Book Dept.), Tower House, Southampton Street, Strand, London, W.C.2.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 32 (THE CYCLIST), must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Experimental Battery

I HAVE a drawing of an experimental apparatus for producing electric current by aluminium and copper plates revolving half-immersed in "a liquid." Would the liquid, or electrolyte, be chromic acid? Can you suggest any better electrolyte for this purpose?—R. Wright (Golders Green).

WE are afraid that, with such meagre details of your experimental project, we cannot be of much assistance to you. The electrolyte would certainly not be chromic acid since this would rapidly destroy the metal.

We consider that a solution of sodium phosphate (say, 1 part in 3 of water) would provide a more adaptable electrolyte. A similar solution of sodium metasilicate might also be useful, or even a very dilute solution of hydrochloric acid. You might also try solutions of citric and tartaric acids.

All these suggestions of ours, however, are purely tentative ones, and, in the circumstances, we cannot possibly guarantee their success.

Any of the above materials may be obtained from chemical houses, as, for example, Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, W.C.2; Messrs. Hopkins and Williams, Ltd., 16-17, St. Cross Street, Hatton Garden, E.C.1; or Messrs. Vicsons and Co., 148, Pinner Road, Harrow, Middlesex, if not, through, or from, your local druggist.

"Ferrotype" Process

CAN you advise me on the following matter: I would like to know what are the solutions used by the street photographers who produce a print in one minute. I understand the "plate" is bromide paper.

I have tried many reversal solutions and find that the results are poor. Would you also give me working details of the camera used and the address of a manufacturer who supplies camera and solutions.—L. Clancey (Mottingham).

THE street photographers to whom you refer operate the old "ferrotype" process, or a modification of it. Originally, this process gave direct positives on enamelled iron plates which were coated with a very rich silver emulsion. Nowadays, paper is substituted for the metal plates.

Ferrotype cameras and materials can be obtained through any of the big photographic dealers, such as Messrs. Jonathan Fallowfield, Ltd., Newman Street, London, W.1; or Messrs. Wallace Heaton, Ltd., Bond Street, London, W.1.

The image is not reversed. It is developed up as a positive in a single operation. Developers vary, but the following is a typical one:

Sodium carbonate	4oz.	or	200 grams.
Sodium sulphite	2oz.		100 grams.
Hydroquinone	¼oz.		12.5 grams.
Potassium bromide	290 grains		29 grams.
Hypo solution (as below)	½oz.		25c.cs.
Warm water to	20oz.		1,000c.cs.

Allow the above to stand for two days. Then pour off the clear solution for use. In cold weather, use only half the above quantity of potassium bromide.

The fixing solution is made by dissolving 4oz. of hypo in 20oz. of water.

Development of the exposed plate or paper normally takes 8 to 12 seconds in hot weather; 12 to 20 seconds in cold weather. The plate is then momentarily rinsed in water (if practicable) and fixed in the above fixing solution for 20 to 30 seconds. It is finally rinsed.

Note that in this ferrotype process the image is always reversed in relation to right and left. Usually, however, this is quite immaterial.

Waterproof Distemper

CAN you tell me how to make a waterproof whitewash mixture? I wish to use this outdoors. My objection to marketed brands is the high cost. —Norman James (Orpington).

DISTEMPER paints nowadays are expensive on account of the high cost of the casein compound which is put into them. On this casein depends the water-resisting properties of the colourwash. Hence, at the present time, a dependable distemper cannot possibly be made cheaply.

Distempers have varying formulæ, many of them secret. They all contain casein, however, or some similar and related compound. The following is a typical formula:

Casein	100 parts
Urea	34 "
Hexamine	21 "
Lithopone	690 "
Zinc oxide	100 "
Lime	50 "

The above gives a white distemper. It may be coloured by replacing the zinc oxide with mineral colours.

Unfortunately, you will hardly be able to make up the above formula for yourself since casein, which is indispensable, is extremely difficult to obtain.

By dissolving glue in an ordinary whitewash mixture, a certain amount of extra binding power is given to the whitewash, but the material is not waterproof in the strict sense of the term. For outdoor use, such material might, however, last a season. The amount of glue dissolved should be about 5 per cent. of the volume of water used to make the whitewash.

Filler for Woodwork: Mixing Paints

(1) COULD you please inform me how I could make a filler for motor-car bodywork, mudguards and woodwork which could be flattened with a pumice block?

(2) I have a can of azure blue paint; how can I change it to a wedgwood-blue shade?—J. W. Howie (Glasgow).

(1) A MIXTURE of equal parts of whiting and fine silica dust makes an excellent filler for woodwork when moistened with a little thin oil. For metalwork and car bodywork generally, the following filler medium is better:

Rubbing varnish	2 gallons.
Boiled linseed oil	½ gallon.
Japan varnish	½ gallon.
Finest silica	4lb.
White lead	4lb.
Aluminium silicate	20 ozs.

The aluminium silicate has a flaky structure which makes it so suitable for filler purposes. Whiting, however, may be substituted, but not quite with the same results.

(2) It is quite impossible for us to give you direct instructions to bring about the colour change which you desire, since there are so many shades or varieties of the two blues which you mention. Moreover, paints do not readily permit uniform colour changes without some process of regrinding the colour into the paint. Your best plan will be to mix together ultramarine blue, 3 parts; white lead, 12 parts; lemon-chrome yellow, 1 part, and then to work this mixture very slowly and cautiously into your existing paint.

Fluorescent Sign on Glass

I WISH to make a fluorescent sign on glass to hang in a shop window.

Would you please inform me as to how to go about it, and what type of electric bulb is required to make the sign become fluorescent?—D. Delany (Leix, Eire).

TO obtain a fluorescent effect from certain fluorescent substances you must have a source of light containing ultra-violet rays. Ordinary incandescent electric bulbs do not emit these rays. You must have either a mercury-vapour lamp, an arc lamp, or a discharge type of lamp emitting ultra-violet rays. No other variety of artificial light will bring about fluorescence.

The fluorescent material is dissolved either in water or spirit and painted on the glass or, if it is insoluble, it is finely powdered and mixed with gum water or a gum arabic solution and then painted on the glass. After drying, the glass thus treated is placed in the path of the rays from the special electrical device, whereupon the painted areas fluoresce so long as the exciting rays are emitted from the electrical device.

To obtain a source of ultra-violet light your best plan, we think, is to consult one of our advertisers in electrical materials, or, alternatively, to apply to one of the large firms of electrical fittings dealers.

Anodes for Silver Plating

WILL you kindly give me the following information?

(1) Can I use old sterling silver articles for plating direct on to new work?

(2) Should this not be possible, will you explain how I can recover silver and render it suitable for use as anodes?

(3) Can you also give a method for indicating the amount of silver deposited?—D. J. Easterbrooke (Exeter).

(1) ANODES for a silver-plating bath must (or should) be of fine silver, not sterling silver. Sterling silver contains 7.5 per cent. of copper. This copper would find its way into the bath and upset its chemical balance. For occasional silver-plating, sterling silver anodes *can* be used, but for any regular work fine silver anodes must be employed.

Suitable anodes of fine silver can be purchased from Messrs. Wm. Canning & Co., Ltd., Great Hampton Street, Birmingham. They are not very expensive.

(2) It is not easy to convert sterling silver into fine silver, and the trouble and cost renders the process not worth while in the majority of instances. The sterling silver is dissolved in warm dilute nitric acid, and the solution of silver nitrate which results is filtered. Dilute hydrochloric acid is added. This precipitates the silver as white silver chloride. This is filtered, washed on the filter, and suspended in water through which a stream of hydrogen is passed. The silver chloride is reduced to silver which is deposited in a black, powdery form. This is collected, washed, dried and then fused at a near-white heat under a layer of borax and sodium carbonate. A silver "button" results at the bottom of the crucible.

From the above description you will, we think, agree that the process is a tedious one and that it calls for a good deal of chemical knowledge, to say nothing of experience and practical skill.

(3) There are several methods of indicating the amount of silver deposited in a plating operation, but they are all somewhat complicated, and for their description we must refer you to a book on electroplating, such as Field and Weill's "Electroplating": (Pitman, 1946, 15s. net).

Messrs. Canning (address above given) may be able to supply a suitable "silver meter."

If you have access to a chemical balance, you can obtain an indication of the amount of silver deposited by accurately weighing the object before and after plating. In this case, the increase in weight will represent the quantity of silver deposited.

Sterilising Air in a Laboratory

IN a small laboratory, size 9ft. by 6ft. by 8ft. 6in., used for the preparation of sterile solutions, I wish to institute a system whereby the air in the laboratory is sterile and maintained at a higher pressure than that outside.

This will entail drawing air from outside the laboratory through some sort of filter into a pump discharging into the laboratory, from which it presumably escapes by leaking past the door.

What I want to know is:

(a) The type of filter necessary.

(b) Capacity and type of pump.

(c) How many changes of air per hour are necessary?

(d) How is the air pressure inside and outside the laboratory measured?

—H. T. Thomas (Kelso).

YOU will require a certain amount of reliable equipment for the establishment and maintenance of sterile air in your laboratory. It will be necessary for you to have a small rotary pump which is caused to draw air through a 6in. layer of glass wool ("Fibreglass"), and then through two or three separate "wads" of this material which have been impregnated with a hypochlorite solution, such as can be obtained from I.C.I., Ltd. The "wads" of glass wool should be loosely packed and should be about 3in. thick and 6-8in. square; all these, of course, being contained in a suitable glass jar fitted with inlet and delivery tubes. The glass wool wads will have to be re-impregnated with the hypochlorite solution every day.

Suitable glass wool can be obtained fairly cheaply from Fibreglass, Ltd., Ravenhead, St. Helens, Lancs.

Pumps suitable for the work are obtained from any of the following firms, although in these days there may be great delay in delivery of a suitable pump:

Messrs. James Beresford & Sons, Ltd., Cabo Street Works, Birmingham, 7.

Watson-Warner Pumps, Ltd., Pottery Lane, Newcastle-on-Tyne.

THE P.M. LIST OF BLUEPRINTS

"PRACTICAL MECHANICS" 12 FT. ALL-WOOD CANOE.* New Series. No. 1. 3s. 6d.
"PRACTICAL MECHANICS" 10-WATT MOTOR. New Series.* No. 2. 3s. 6d.
"PRACTICAL MECHANICS" COMPRESSED-AIR MODEL AERO ENGINE.* New Series. No. 3. 5s.
"PRACTICAL MECHANICS" "SPORTS" PEDAL CAR.* New Series. No. 4. 5s.
F. J. CAMM'S FLASH STEAM PLANT. New Series. No. 5. 5s.

"PRACTICAL MECHANICS" £20 CAR (Designed by F. J. CAMM), 10s. 6d. per set of four sheets.
"PRACTICAL MECHANICS" MASTER BATTERY CLOCK* Blueprints (2 sheets), 3s. 6d.
"PRACTICAL MECHANICS" OUTBOARD SPEEDBOAT 10s. 6d. per set of three sheets.
A MODEL AUTOGIRO* Full-size blueprint, 2s.

SUPER-DURATION BIPLANE* Full-size blueprint, 2s.
The 1-c.c. TWO-STROKE PETROL ENGINE* Complete set, 7s. 6d.
STREAMLINED WAKEFIELD MONOPLANE—3s. 6d.
LIGHTWEIGHT MODEL MONOPLANE Full-size blueprint, 3s. 6d.
P.M. TRAILER CARAVAN* Complete set, 10s. 6d.
P.M. BATTERY SLAVE CLOCK* 2s.

The above blueprints are obtainable, post free, from Messrs. George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

*An * denotes that constructional details are available, free, with the blueprint.*

Messrs. Philip Harris & Co., Ltd., Laboratory Furnishers, Birmingham.

Hardly more than one complete change of air in the room every two or three hours will be necessary, but in order to set up a constant slight pressure, the pump will have to be a substantial one and all possible leakages from the room will have to be eliminated. The pump manufacturers themselves will advise you as to the best type of pump to establish any required pressure.

For pressure measurements inside and outside the room, a barometric mercury tube is the simplest and, also, a sensitive means of measurement.

Furniture Cream

I WANT to start manufacturing a furniture cream in a small way.

Could you give me a formula for a cream that only needs to be rubbed on, dries quickly and leaves a brilliant non-greasy hard surface?—A. Bullock (Beeston).

WE note that you wish to prepare a furniture cream, as distinct from the more usual paste polish. A cream formula is the following:

Canauba wax	6 parts (by weight)
Japan (or candillila) wax	3½ " "
Paraffin wax	1½ " "
Turpentine	12 " "
White soap	3 " "
Pale resin	2 " "
Water	30 " "

Dissolve the soap in the water. Dissolve first the resin, then the waxes in the hot turpentine. Allow the resulting solution to cool so that it is just warm. Then heat the water to nearly boiling-point and add the turpentine solution of the resin and waxes with continual (and preferably mechanical) stirring, which should be continued until the resulting cream is quite cold. If the cream is too thick, add more hot water. The cream may be coloured or tinted with a trace of dye, if required. It may also be perfumed.

Unfortunately, the materials above mentioned are all difficult to obtain unless you are an established polish manufacturer.

Decoration of China Under Glaze

I SHOULD be grateful if you could supply me with detailed information on the above subject, especially on the following points:

(1) Obviously metallic oxides must be used for colouring. What oxides produce black, grey and other colours? Can they be obtained?

(2) What oil medium is used for brushwork, and up to what temperature must the design be fired?

(3) What is the composition of the glaze?

(4) Would you suggest a coke oven blown up to the required temperature? Can you advise how to construct a simple one?—C. S. Knapp (Gillingham).

(1) METALLIC oxides and other compounds for ceramic use are obtainable from Wengers, Ltd., Etruria, Stoke-on-Trent.

Ceramic colours are usually compounded to secret formulæ. Here, for example, is a published formula for a black ceramic colour:

Iron chromate	24 parts
Nickel oxide (black)	2 "
Tin oxide	2 "
Cobalt oxide	5 "

A dove grey is produced by the following formula:

Nickel oxide	7 parts
Cobalt oxide	2 "
Chromium oxide	1 "
Flint	18 "
Paris white	3 "

In all cases, however, it is better to purchase ceramic colours ready prepared.

(2) You can mix your colours with a little raw linseed oil, or, better still, use the oil or other medium which is prepared by the colour makers. No standard ratio of colour to oil is extant. The colour should just "flow" on the unglazed surface.

The design is fired around 1,100 deg. C. to 1,250 deg. C. for about five hours, depending on the nature of the clay, the glaze and the colour.

The glaze is similarly fired, but for a period up to eight hours.

(3) Glazes vary enormously in composition. Like colours, they can be purchased ready compounded for use. The following is a typical formula for a hard glaze:

Feldspar	25 parts
Flint	5 "
Red lead	15 "
Plaster of paris	1 "

(4) We doubt whether a coke oven furnace would suit your purpose. A specially designed gas muffle furnace, or, better still, an electric furnace is really required. You could construct a simple gas furnace by arranging a ring of gas jets (blue flame) within an asbestos-lined firebrick chamber, making sure that the gas jets do not actually impinge on the articles being fired.

You will understand, however, that, within the space of a short reply, we cannot give you all the details and instructions which you are apparently seeking. Hence, we must refer you to a suitable elementary textbook on the subject, such as "The Potter's Craft," by C. F. Binns, or "Handcraft Pottery for Workshop and School," by H. and D. Wren. Another book which would be of interest and use to you is C. F. Binns' "Manual of Practical Potting."

Lighting and Charging Plant

IN the accompanying diagrams Fig. 1 gives details of a cut-out attached to a small generator. Fig. 2 is a charging circuit I have arranged for lighting two lamps and for charging a 12-volt battery.

Would you please advise me on the following points:

(1) Is the circuit in Fig. 2 correct, especially from terminal P through the red lamp?

(2) Would the lamps get full generator voltage if I removed the 12-volt battery?

(3) When and how does the cut-out operate?

(4) Would the regulation of the cut-out have to be altered to run the lights without the battery?—J. B. Singleton (Scunthorpe).

(1) IN order that the red lamp shall light from the generator when switched on, the circuit should be from (P) terminal through the lamp and switch to the (—) terminal.

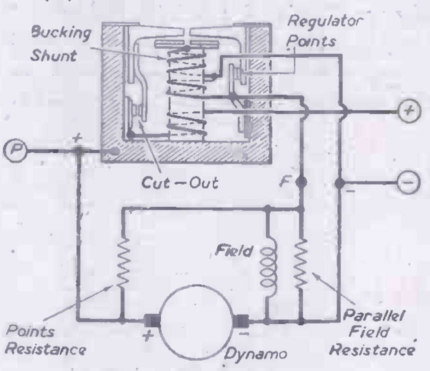


Fig. 1. Diagram of cut-out

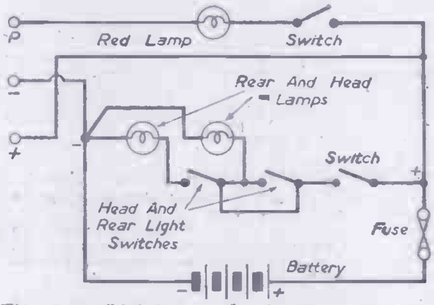


Fig. 2. Lighting and charging circuit.—(J. B. Singleton.)

(2) The lamps would receive the full generator voltage if the battery was removed.

(3) Apparently the regulator contacts are of the vibrating type, the coil connected to the cut-out contacts being connected so as to assist the bucking shunt coil when current flows to charge the battery. When the voltage rises high enough the core magnetism is strong enough to close the cut-out contacts so that charging current passes to the battery. The current through this coil then assists the bucking coil to increase the period of opening of the regulator contacts, to avoid overloading the generator when the battery is discharged, and its voltage low. The battery voltage rises with charging and the charging current will cease when the battery voltage is equal to the dynamo voltage. Should the dynamo voltage fall, due to reduced speed, a reverse current through the cut-out coil will oppose the voltage coil and weaken the core magnetism so the cut-out will open.

(4) It should not be necessary to alter the regulator in order to run the lights without the battery, provided the voltage is correct with the battery also in circuit.

Argon: Tungsten Wire

IN connection with experimental work I shall be glad if you can help me with the following:

(1) Can you state at what pressure it is usual to fill electric lamps with Argon?

(2) Is Argon of 98 per cent. purity good enough?

(3) Can you suggest where I might obtain .001 tungsten filament wire?—G. Davies (Brookmans Park).

(1) THE degree of vacuum in a gas-filled lamp varies a good deal. Originally, such lamps were filled under slight pressure. Now, however, the gas pressure is reduced to about a twentieth of an atmosphere. Pure argon is rarely used, a mixture of about two-thirds argon and one of nitrogen being preferred.

(2) Argon of 98 per cent. purity may or may not be good enough. It all depends on the purpose of the lamp in question. If the 2 per cent. impurity in your 98 per cent. argon is nitrogen and nothing else, well and good. A minute trace of oxygen is not of much consequence, since this will quickly disappear. But if the impurities embody any water vapour, then the gas is highly unsuitable. The most minute trace of water vapour in a lamp gas will steadily deteriorate the filament, the water vapour traces setting up a cyclic action, so that relatively few water vapour molecules can effect a great damage within a lamp.

If the argon contains traces of the other inert gases—helium, neon, krypton, xenon—no harmful effects will occur.

(3) Tungsten wire of varying thicknesses can be obtained from one or other of the following firms: Messrs. Johnson, Matthey and Co., Ltd., Hatton Garden, London, E.C.; British Driver Harris Co., Ltd., Little Peter Street, Manchester, 15; Messrs. Everitt and Co., Ltd., 40, Chapel Street, Liverpool.

Waterproofing Indian Ink

WOULD you please tell me what I must mix with Indian ink to render it waterproof?—J. Hunter (Dulwich).

GOOD quality Indian ink is usually quite waterproof after it has been exposed to light and air for a few hours.

Your best plan is to dissolve a single crystal of potassium dichromate in a teaspoonful of water and to mix a little of the resulting orange solution with the ink. After being exposed to light for a few hours, this ink mixture will become quite insoluble in water.

You must only treat a small amount of ink at a time with the bichromate solution, otherwise the whole of the ink in the bottle (if exposed to daylight) will become a thick mass and will not flow well from your pen.

Luminous Paint

COULD you please supply me with the necessary formulæ for phosphorescent paints used to cover the figures of dials?

I have seen paints giving the phosphorescence in three colours: green, pink and blue, and also phosphorescent enamel covering an ash-tray made from pressed sheet. How should I make it?

In what books could I find something about phosphorescent paints and enamels?—K. Edwards (Henley-on-Thames).

SATISFACTORY luminous paint is very difficult stuff to make. In fact, the only really efficient material of this nature is that which contains a trace of radium salt.

However, for the making of an ordinary luminous paint, proceed according to the following formula:

Calcium oxide (lime)	5 grams
Sulphur	10 "
Starch	2 "

Heat the above to white heat for 20 minutes. This forms the "luminous base," although it is not luminous itself.

To make a luminous powder from the above, use the formula below:

Luminous base (as above)	15 grams
Potassium sulphate	0.25 grams
Sodium sulphate	0.25 grams
½ per cent. solution of bismuth nitrate	0.5 c.c.
½ per cent. solution of thorium nitrate	1.0 c.c.

Calcine the above at white heat for a quarter of an hour and expose the residue to sunshine. It will have a bluish luminescence.

Unfortunately, however, thorium compounds are not now obtainable without a special permit, since they are radioactive. You will, therefore, have to omit the thorium nitrate, but we are afraid that the result will not be good.

You can obtain luminous (no-radium) powders for paint-making from Horne's Luminous Co., Ltd., London Road, North Cheam, Surrey.

There is no book dealing comprehensively with the making of luminous paints. Information is to be found scattered through the back numbers of various paint and chemical journals, but, for the most part, the "know how" of this manufacture has been kept more or less secret.

Waterproof Glue and Cement

CAN you please supply me with particulars for making a glue that will fasten hooks on to gut for fishing purposes? Is there a solution or preparation that I could buy?—S. Beedham (Sheregreen).

A WATERPROOF cement used for the making of microscopical preparations is made by Messrs. Flatters and Garnett, Ltd., Oxford Road, Manchester, 13. This—cost about 2s. per bottle—might suit your purpose.

Alternatively, you might use any type of cellulose cement; or, again, you might use ordinary thick glue solution in which has been dissolved a little potassium dichromate, say 3 parts of the dichromate in 97 parts of the glue solution. This dichromated glue *must not* be exposed to daylight, for it possesses the property of becoming insoluble under the influence of light. It can be exposed to any ordinary household artificial lighting.

Make the joint with the dichromated glue, let it set, and then expose it to strong daylight—preferably sunlight—for about half an hour, after which time the glue will have been insolubilised.

PRICE CORRECTION

The price of S. G. Brown Type "K" Headphones, as advertised in PRACTICAL MECHANICS for January, page 113, should read Price £5 : 5 : 0 per pair.

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The tragedy of it all is this; you know that you have within you the intelligence, the earnestness, and the ability that can take you right to the high place you want to reach in life! What is holding you back? One scientific fact. That is all. Because, as Science says, you are using only one-tenth of your real brain-power.

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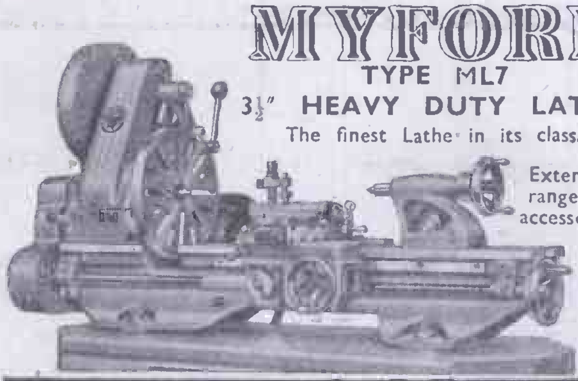

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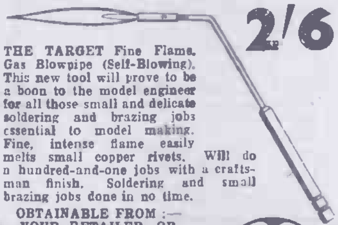

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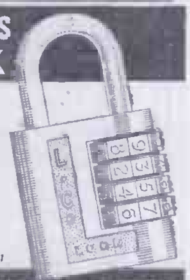

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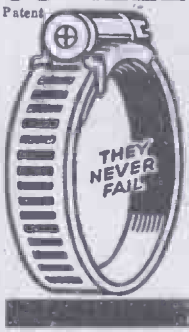

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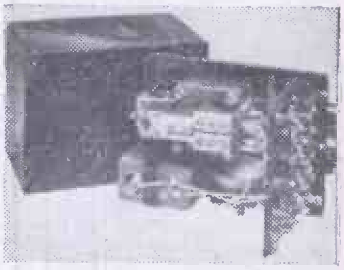

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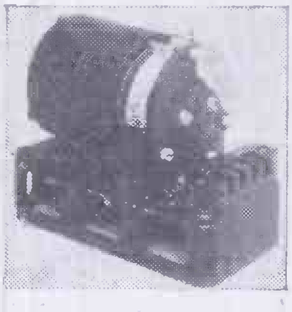

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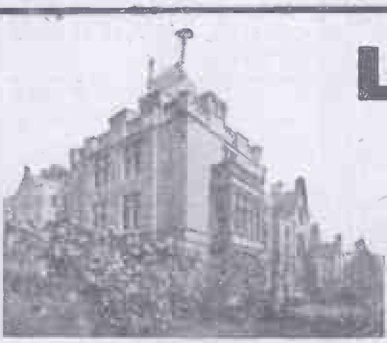

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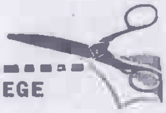

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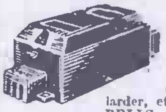

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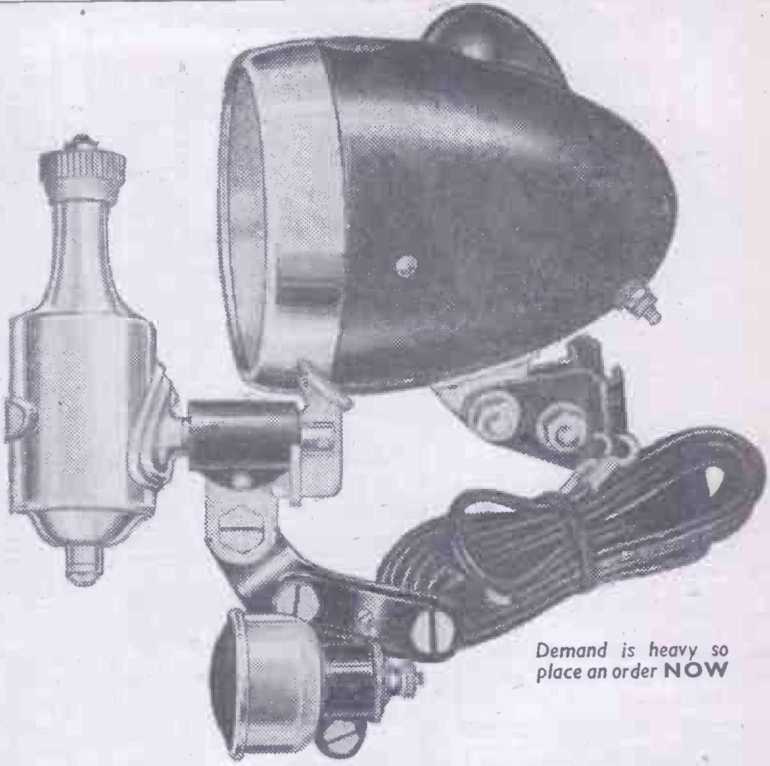

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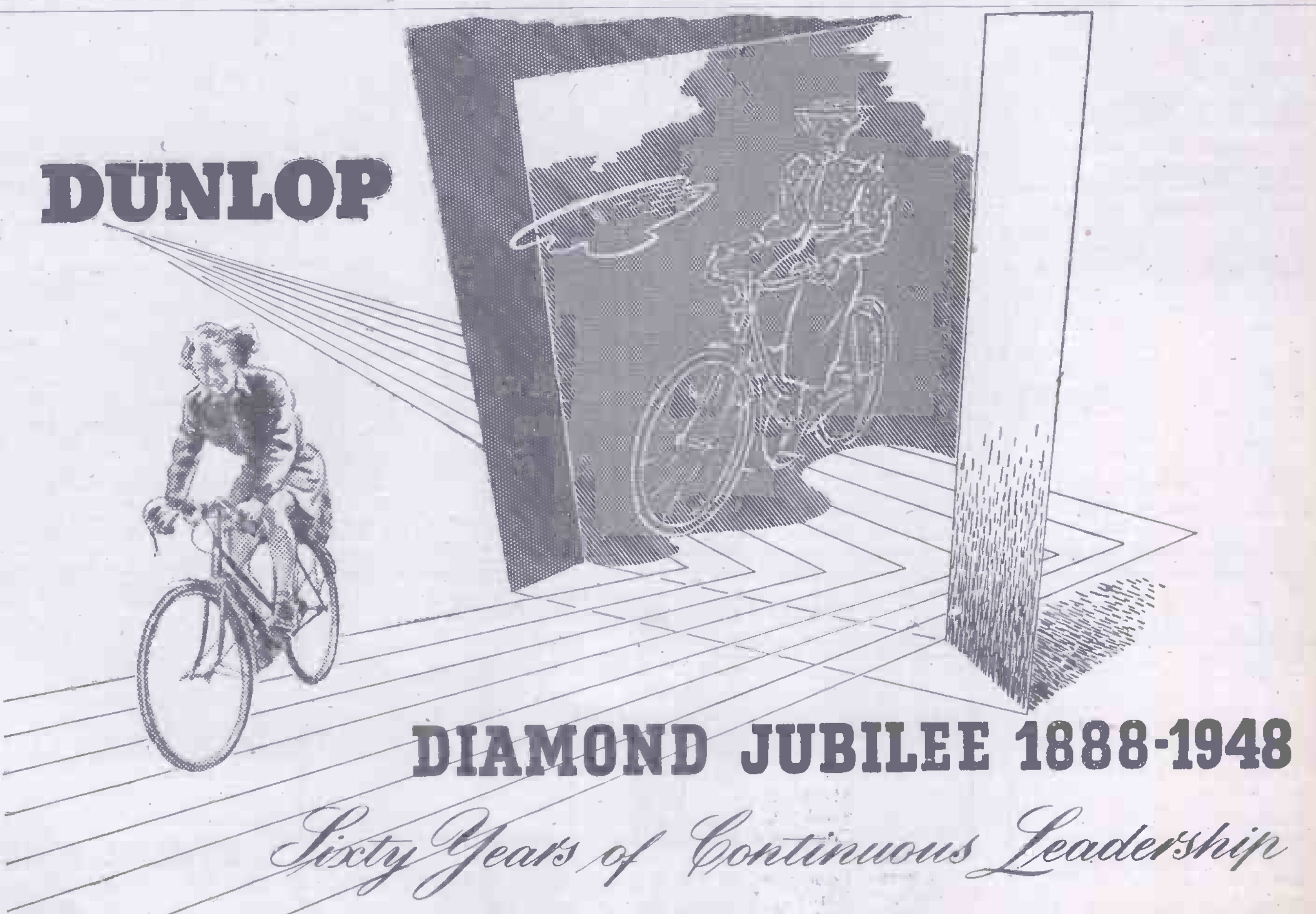

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THE Cyclist

Editor: F. J. CAMM

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Phone: Temple Bar 4363

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Comments of the Month

By F. J. C.

Cycle Show in November

FOR the first time since 1938 The Cycle and Motor Show is to be held at Earls Court from November 18th to the 24th. This is good news indeed, for it indicates that the industry is back again on its feet. Although supplies to the public will still be scarce the show presages a time, not far distant, let us hope, when all controls will be removed and cyclists will be able to purchase in a free market, with a free choice; when there will be an abundance of goods and our exports consist of an over-spilling in the foreign markets of production in excess of home needs.

The cycle industry was one of the first to get back to its peacetime activities, and the vigilance of the British Cycle and Motor Cycle Manufacturers and Traders Union has been responsible for the removal of many of the restrictive controls.

Steel and other raw materials used in the manufacture of bicycles and accessories remain a handicap to increased supplies. Notwithstanding this the industry is producing goods at a rate almost equal to the pre-war level. Many countries have for the first time sampled the delights of British bicycles, and even America, whose bicycles look like the grandparents of all dreadnoughts, is beginning to either purchase British bicycles or the American copies of them, instead of the imitation motor cycles with dummy tanks which provide film stars and others with a means of getting their photographs into the papers.

Cyclists have enjoyed a greater freedom from controls and restrictive legislation than other road users, for successive Governments naturally hesitate to offend so large a voting section of the population. It is true that on the question of rear lights and one or two other small matters points have had to be conceded, but in the main we retain our freedom.

At the Show there will be reunions and celebrations. We shall meet old friends whom we have not seen for over 8 years. We shall see under one roof all of the new bicycles and accessories, and be able to survey the whole industry from one building. Clubs will include a visit to the show as an item in their club run calendar.

Let us hope that no international catastrophe causes the plans to be abandoned or that some internal crisis does not do so as it did last year. The industry is ready to exhibit its goods to its home market and its foreign buyers.

Battery Lamps

THERE has been much criticism regarding the quality of battery lamps, which in the opinion of cyclists are cheap and shoddy. It has been suggested that a big market exists for a reliable combination of front and rear battery lamps. In defence of the battery manufacturers we should like to say that the limitation of supplies and the poor quality of the materials available are responsible for most of the causes of complaints.

The zinc pots used in dry cells is of a lighter gauge and therefore not so durable. This is not the fault of the manufacturers; they are allowed so much metal and have to do their best to make as many batteries as possible from it. This does give everyone a chance to buy a battery. Like clothing or furniture or any other article produced to-day on a utility basis, quality has to suffer because of the shortage of material. We do not think that the criticism of batteries is reasonable at the present time.

The Committee on Road Safety

THE Minister of Transport, as previously recorded, has set up a Committee on Road Safety as a permanent feature of the organisation of the Ministry in relation to the study and prevention of road accidents. The setting up of the committee was recommended by the Committee on Road Safety which recently issued its final report after three years of intensive survey of the road accident problem.

The new committee will be presided over by Mr. James Callaghan, M.P., Parliamentary Secretary to the Ministry of Transport, and it is composed of members nominated by the government departments concerned, the police, education and local authorities, road users' associations, the Royal Society for the Prevention of Accidents and the Trades Union Congress. The committee will advise the Minister on those matters relating to road safety which he may refer to them, and will report to them on other questions which seem to be of importance to the relation of road accidents.

The members of the Committee are as follow: Mr. H. R. Lintern (Ministry of Transport); Mr. E. B. Hugh-Jones, M.C., B.Sc., M.Inst.C.E. (Highways (Traffic and Safety) and Engineering Divisions); Mr. F. G. Humphrey, O.B.E. (Information Division); Mr. J. H. Burrell (Home Office); Mr. D. H. Leadbetter (Ministry of Education); Dr. W. H. Glanville, C.B.E. (Department of Scientific and Industrial Research); Mr. H. G. Whiles (Scottish Home Department); Mr. H. Dalton, C.B.E. (Metropolitan Police); Capt. Sir Archibald Horden, C.B.E., A.F.C. (English County Police); Mr. A. C. West, O.B.E. (English City and Borough Police); Mr. J. McConnach (Scottish Police); Mr. A. Floyd, C.B.E., M.Inst.C.E. (County Councils' Association); Alderman T. J. W. Templeman (Association of Municipal Corporations); Mr. F. L. Snow, J.P. (Urban District Councils' Association); Bailie Peter Meldrum (Association of County Councils in Scotland, Convention of Royal Burghs and Counties of Cities' Association); Mr. H. M. Spink, M.C., M.A., B.Sc. (Association of Education Committees); Mr. J. R. Howard Roberts, B.C.E.; Dr. Ewart Smart, M.C., M.A.B.Sc.; Lt.-Col. J. A. A. Pickard, D.S.O. (Royal Society for the Prevention of Accidents); Major R. A. B. Smith (National Road Transport Federation); Major Frank Bale (Standing Joint Committee of the Royal Automobile Club, Automobile Association and Royal Scottish Automobile Club); Mr. R. C. Shaw (Cyclists' Touring Club); Mr. V. H. Robins (British Motor Cycle Association); Mr. T. C. Foley (Pedestrians' Association); Miss F. Hancock, Mr. F. Donlon (Trades Union Congress); Mr. Ben Hall (Municipal Passenger Transport Association and Public Transport Association); and S. G. Griffin (Secretary).

All correspondence should be addressed to the latter at the Ministry of Transport, Berkeley Square House, W.1.

The Committee seems comprehensive, and we are hopeful that something useful will emerge from it.

Whether or no they implement the recommendations made in the Report, which is the *raison d'etre* of the Committee's existence, remains to be seen. We do not think that all of those recommendations will be adopted.

Nationalised Transport

AT midnight on December 31st, 1947, the principal railways of Great Britain, London Transport, and the greater part of the Canal system passed into public ownership. The Ministry of Transport already controls all of the arterial roads of this country and thus is in complete charge of our roads, the vehicles which use them, as well as the railways and the canals.

There should be no excuse therefore in future for inefficiency in our transport system, nor for bad roads or bad street lighting. Fortunately, cyclists are not affected by this great change-over from private enterprise to State Control. They are not tied to timetables or queues, and run their own transport system, which never can be nationalised. There are those who watch their interests in and out of Parliament. Has not the time arrived, however, when a new cycling organisation is required more in keeping with the times, less hidebound by the traditions of the past and with more up-to-date knowledge of the changing times? We have made this suggestion on more than one occasion, and the time seems ripe to revive it. What is required is an organisation representative only of cyclists' interests, and not especially interested in touring or track racing or time trials. We have a national Committee on Cycling, but its members are chiefly drawn from existing organisations, including the Manufacturers' Union. Their views are well known, and, understandably, they represent the views of the organisations to which they are attached. What is required is an organisation independent of all these bodies and drawing its membership from that vast body of cyclists outside the comparatively small ranks of the present organisation.

Tintagel Cornwall
The quaint Post Office

Paragrams

Smells of Prejudice!

COMPLAINTS were made at the November meeting of Grimsby Highways Committee that while scores of cyclists are regularly fined for disregarding a diversion sign in Scarthoe Road, Grimsby, practically every Corporation bus driver ignores the sign and gets away with it. It was described as "making a mockery of the law." One councillor said he left the Bench in disgust when one cyclist pleaded guilty, after others had pleaded not guilty, and was fined double. The diversion of traffic is to continue for a further three months, so no doubt quite a few more cyclists will be appearing before Grimsby Bench.

Training Them Young

BELIEVING in practical training for children in road safety, the Parks Committee of Oldham (Lancs) Borough Council has decided to use a portion of their parks as training grounds for child cyclists. The Committee have in mind the construction of miniature roads and a portion of a town on some four acres of ground. The children will learn traffic sense and the rules of road safety by riding their cycles and pedal cars while others act as pedestrians. Special lectures will be given by police experts.

Doncaster's Alderman-cyclist

THE abolition of the basic petrol ration is no worry to Alderman Walter Crookes, of Doncaster, who has just completed his twenty-ninth year as a member of the town council. The bicycle is his favourite means of transport and he ought to know as he first started riding a "penny-farthing" in the very early days of the sport, and was a member of what was probably one of the very first cycling clubs in the district, the Adult School Cycling Club of Doncaster. He is still on the road regularly, although he celebrated his seventy-seventh birthday on Christmas Eve. For many years Mrs. Crookes used to accompany him on his trips, but lately her health has prevented her from doing so.

Cycling at 52 m.p.h.

AT Grantham Road Club's roller contest, held in a local dance hall, the winner of both the 440 and the 880 yards sprints was R. Meadwell, of Melton Mowbray, who is the East Midlands Clarion champion rider and a likely competitor in the Olympic Games. His speed in the 440 yards was 52.94 miles an hour. The winner of the women's 440 yards scratch was Miss G. Copeland, of Oldham Clarion Club, whose speed was 42 miles an hour.

Bedford Trader Dies

MR. ARTHUR WILLIAM CHATTELL, of 197, London Road, Bedford, a cycle trader in the town for some 25 years, has died at the age of 68. When he first went to Bedford he commenced business in Ampthill Road, later removing to St. Mary's Street. In 1935 he extended his business and opened an up-to-date shop at the present premises in St. John's Street. Mr. Chattell was a prominent member of the local Chamber of Trade, of which he was, this year, vice-president.

Growing Up

THE report of the Fenland Clarion Cycling and Athletic Club, presented at the club's first annual meeting at Peterborough, showed satisfactory progress during the year. Members agreed that the coming year would be even more successful. At the meeting Mr. P. Goodale was elected chairman and Mr. J. R. Maxfield was re-elected secretary and treasurer.

Police "Lit Up"

WHEN an electricity cut in Peterborough after dark put the traffic lights out of action the lights were replaced with illuminated policemen. The policemen each wore white helmets, bearing the word "Police" illuminated from a pocket battery, and white capes, and controlled the traffic by means of one red and one green cycle lamp in the hands. The scheme, devised by the Chief Constable (Mr. F. G. Markin) when he was at Salford during the war, worked perfectly, and at each of the three busy crossings where the policemen substituted for the traffic lights the traffic flowed well without a check. The three outfits used by the policemen cost altogether 16s. 8½d., and the Chief Constable has sufficient material left to complete a fourth outfit.

End of Cavendish Bridge

THE last remaining arch of the Cavendish Bridge, which spanned the River Trent at Shardlow for 176 years until it was severely damaged by the floods of early 1947, has been blown up. Blasting charges were used in the demolition, but these had to be placed with great care, as the masonry to be removed was very close to the Bailey bridge which was erected to provide an alternative means of crossing the river. The work of demolishing the bridge has taken some five months and a great deal of careful planning.

Delivery Boys' Reliability Trial

FOR the first time since the war a post office boy failed to gain first place in the delivery boys' reliability trial held at Leicester. This year the winning cyclist was 14-year-old D. Naylor, an employee of the Leicester Co-operative Society. There were 32 entrants, not quite so many as the previous year, but interest was keen. The boys had 69 minutes to cover a course of 11½ miles in the city, passing five checking points and riding so as to observe the rules of the road rather than to complete the course in the quickest possible time. Cycles were all checked before the start and roadworthiness and general condition of the machines were taken into consideration. The trophy, the Russell Cup, is presented by Mr. S. Hibbert Russell, chairman of Leicester and County Accident Prevention Council.

Finding the Trouble

MUDDY, dishevelled and looking a bit under the weather, an airman called in at a village public house in Huntingdonshire to inquire if there were anyone about who could have a look at his bicycle and tell him why it was he kept falling off every time he tried to ride. He said it was also making a queer noise. Several Good Samaritans went outside to look at the cycle and were soon able to explain to the airman that a cycle with the handlebars and front wheel bent completely round back to front is not the most satisfactory of mounts.

Long-distance Cyclist Dies

MR. TOM MADDEX, of Kempston, Bedfordshire, who recently died, was particularly well known for his long distance cycle rides. He won the North Road 12-hour race in 1930, over a distance of 213¾ miles, and in 1928, 1930 and 1931 he did 24-hour rides over distances of 395½, 383¾ and 379¾ miles respectively. Riding a tricycle, he set up a national record for covering the 383 miles from Edinburgh to London in the time of 27 hrs. 17 mins. He was a member of the Bedfordshire Road Cycling Club, and a life member of the North Road Cycling Club, which he joined in 1928. Mr. Maddex was also interested in cycling journalism, being from 1941 to 1944 editor of *The North Road Gazette*.

Cowboy's Ambition—To Cycle

BACK home for a holiday with his father at Fishtoft, Lincs, is a real live cowboy, "Tex" Bedford, who for 27 years has been riding the ranges in the States, the Argentine, Canada and Old and New Mexico. Before he goes back home to his ranch in British Columbia next February he is determined to learn to cycle. He can do anything on and with a horse, but a bicycle has so far proved his master. His sister is taking him in hand and when he goes back she means him to be a real cyclist. Tex, who is 46 years old, has during his cowboy life broken all his ribs but two at one time or another, and if learning to cycle is any tougher than that he will be surprised.

What's Wrong?

LABELLED "What is wrong with this bike?" a much ill-treated bicycle was suspended from the ceiling in the room in Gallowtree-gate, Leicester, devoted to the Leicester and County Safety First Week Exhibition. Judging from the appearance of the machine, the boys and girls under 18 who were eligible for the competition would have found it easier to write down the one or two things that were right with the machine. Some ruthless hand had been so busy with the cycle that anyone who took it on the road would have been well advised first to book a space for himself in the local cemetery. Even so, it was probably only a little more decrepit than some machines that are actually ridden.

Yorkshire Officials

MR. FRANK SPENCER, of Blaxton, Yorks, has been re-elected chairman of the North Midlands District of the Road Time Trials Council at a meeting held at Rotherham. On the committee are N. Phillips (Thorne Paragon Club), T. R. Snowdon (Doncaster Wheelers), W. H. Lindley (Brodsworth Road Club) and M. Clark (Bircotes).

Prejudiced?

AFTER paying tributes to three L.N.E.R. goods van drivers at March, Cambs, on the occasion of their being presented with awards from the Royal Society for the Prevention of Accidents, the chairman of the Urban District Council said that the great trouble of the drivers on the road was cyclists. Such a sweeping statement, suggesting that every cyclist on the road is just a menace to everyone else, ought to have some foundation in fact before being made.

Generous Givers

SPEAKING at the annual dinner of the Grimsby Cyclists' Club, held at the Town Hall, Grimsby, the Mayor (Ald. J. W. Lancaster) congratulated club members on their work for charitable causes. During the seven years since 1940 the club has given altogether £3,690 to various deserving causes and the Mayor said it must be a record for all clubs and organisations in the town. "The public of Grimsby," he said, "should be grateful for all the cyclists' club has done." Over 200 members and friends were present at the dinner and the dance which followed.

Fast Married Men!

PROBABLY because married men have to be more nippy on their feet than single men, a 25 mile trial event organised by Peterborough Cycling Club resulted in a win by the married men's team over the single men's team. The aggregate time of the married team was 3 hrs. 29 mins. 46 secs. and that of the unmarried was 3 hrs. 31 mins. This event was the club's last event of the season.

Sensible Advice

THE suggestion that the State generally is tending too much in the direction of spoonfeeding people was made by Mr. John Garrett, headmaster of Bristol Grammar School, at the School Speech Day, and he gave as one example the fact that the police and others have to inspect the cycles used by school-children, otherwise the parents would allow children to ride machines that are in a shocking condition. "I suggest it is within the province of every responsible father to do that for his children," he remarked. "Unfortunately, however, most fathers seem to prefer to leave the job to someone else these days."

Not One Of Those

A CYCLIST who appeared before Peterborough magistrates charged with ignoring a "Halt" sign, said he took exception to the remarks of a policeman who stopped him. He said he had been up and down the road 15 times that morning and had seen the police watching, and when he passed the sign he was "dreaming." When he told the policeman he had no occupation, being in fact a disabled soldier, he said the policeman smiled and said: "Oh! You're one of those!"

Tributes to St. Neots Club

MANY tributes to the keenness of members and the efficiency of the club were paid at the 10th annual dinner and prize distribution of the St. Neots and District Cycling Club, held at the Cross Keys, St. Neots, Hunts. St. Neots was described as "the home of cycling" by Mr. Woodbine Haylock, president of the Bedfordshire Road Cycling Club, and he added that the Cross Keys was the Mecca of road racing men. In the chair at the gathering was Mr. E. J. Bass, himself once a very well-known figure in road racing circles, who was a member of a cycling club at St. Neots in 1896, and he presented the awards obtained during the past season.

Missing Bicycle Mystery

THE fact that no trace of a cycle could be found after the body of a man wearing cycle clips had been taken from the water at the North Bank, Thorney, near Peterborough, made the Thorney coroner adjourn the inquest. However, in spite of an intensive search by the police, no trace of the machine has been found and at the resumed inquest a verdict of "Found Drowned" was returned. The coroner said there was no evidence to show how the man got into the water, where apparently the body had been for several days.

Feet v. Wheels

IN the first cross-country scramble between cyclists and harriers organised by the Boston Cycling and Athletic Club over a 3½ mile course the runners were well ahead of the cyclists. The first six runners had crossed the finishing line before the third cyclist had completed the course, but the cyclists secured second and third places, with a runner first and fourth. A gate and one or two ploughed fields hindered the cyclists more than the runners but matters became more even at other places on the course. One cyclist retired with a puncture during the scramble, and four others found similar pleasant surprises when they had completed the course.

Around the Wheelworld

By ICARUS

"Motives Behind Massed Racing"

THE talk by Jimmy Kain as the guest speaker at a recent meeting of a club, during which he dealt with the history and methods of the B.L.R.C., and of massed start racing, has invoked an article in a contemporary under the above title.

The article is written by G. H. S., who admits that massed start racing on public roads is a "subject of more than ordinary interest." Kain explained the organisation of massed start events, how law and order on the highway is "preserved," how the events are marshalled and supervised, and how police and other co-operation is secured.

G. H. S., however, thought that the audience would have preferred to learn why, rather than how, massed start races are being promoted. He says that the important questions to be answered in this connection are: (1) Do we want massed start racing at all, and, if so, why? (2) Is it practicable to establish such a system of road sport as a permanent feature of our national life as in France and other continental countries?

Now G. H. S. does not like massed start racing. He has said so many times, and it is therefore not surprising to learn that "the answer in each case must be in the negative." G. H. S. is, of course, entitled to his views, but it must not be presumed that those are the views of the majority of cyclists. I am in favour of massed start racing, and although that happens to be my personal preference, to my certain knowledge it is also the opinion of many tens of thousands of other cyclists.

It is true that I have had a few letters opposing massed start, but those few represent something less than 1 per cent. of those I have received in favour. Mr. Kain rightly insisted that his club was not a breakaway from the National Cyclists' Union. Of course not. I have already pointed out to those who wanted to "heal the breach" that there wasn't a breach, and if there were it should be hailed, not healed.

G. H. S. is right when he says that B.L.R.C. methods differ from the old style of massed racing in England and from the modern methods adopted on the continent. They differ, however, only in detail, and the difference is insufficient to provide a distinction. He says that in the past century the only massed start events were a few scratch races such as the North Road "24," and the Bath Road "100" (the original Bath Road "100" Cup is in my possession. I am the only one to possess a Bath Road "100" Cup without having ridden a hundred miles for it!), and club contests were confined to handicaps. Pacing was, of course, employed in the scratch events. The fields soon dispersed and the massed formation was only "temporary."

Such events were before my time, but I have debated the matter with some of the veterans who tell me that the massed formation was anything but temporary; that in some of the events there were massed finishes as well as massed starts, as G. H. S. admits took place in the handicaps towards the finish. Under the modern methods the mass, he says, tends to remain unbroken all the time.

Unlike the continental counterpart, where there is some high speed racing in the towns and villages, B.L.R.C. events are neutralised in the interests of public safety, and he thinks that this renders B.L.R.C. events "a faint shadow of the continental prototype." On this score he thinks that no one can say that this is a finer type of sport than the unpaced races that we have developed under our system of time trials.

With something approaching a sneer or a tinge of acerbity he asks: "For what reason are massed start races being promoted? The argument that this hybrid type of competition in which the riders lay off at intervals to parade through a town, to deliver a message to a Mayor, or to receive a kiss from a film star, will eventually give us international supremacy is not to be taken seriously." Unfortunately for these views it *is* taken seriously, in spite of the opposition of those who would like the sport to remain on the hole and corner system, with its aspenlike fear of intervention by the police, introduced when many of the critics were youths in the 'eighties and 'nineties.

He asks whether there is any possibility that the higher authorities will agree to it, notwithstanding the support of police officers and civic dignitaries. He rightly says that highly-placed members of the Government have condemned this form of road sport, but omits to say that it was an inspired condemnation, the inspiration coming from the National Cyclists' Union and the R.T.T.C. with supporting remarks in the Press, from G. H. S. and others who, because they do not like massed start racing, think that you should not like it also. The few inspired police cases which have been brought against massed start riders (here again I think the police were "making a case" as a result of inspiration!) have ended ignominiously for the police and for massed start opponents.

"Is It Worth While?"

WITH a concern for the continuation of time trials, a concern which I have at heart, too, he asks: "Is it worth while to risk so much for so little?" My answer to that is that no one in authority would have taken the slightest notice of massed start racing, if attention had not been drawn to it by those who vigorously opposed it, not sincerely on the grounds that it was dangerous, but because they felt that it would replace those branches of cycle sport in which they were interested, either as officials or as competitors.

When the opposition started and the bogy of danger to the public was raised, I pointed out how weak their case would be if as a result of experience of massed start they were proved wrong. It was said that the absence of traffic on the roads when massed start was introduced during the war would give a false impression of its safety. Well, many events have been run since the war, when traffic has been well-nigh back to pre-war standards, without accident and without incident. The few "test" cases which have been brought have been lost, and all of the evidence shows that under the rules it is perfectly safe. The critics have been more than proved wrong.

The point made by critic G. H. S. that, in its present watered-down form as compared with the continental methods, it is not really massed start racing, goes. No one pretends that it is. The fact is that it is a new form of massed start, that it is wanted, and enjoyed by several thousand riders and spectators, and that its adherents are increasing.

The B.L.R.C. are in the strong position of being able to fortify their arguments and to confound the critics by the direct evidence of the police. There seems no end to which the opponents of massed start racing will not go in order to get it suppressed. Many years ago they proclaimed that such a form of racing was illegal. It was left to me to investigate the legal position, and to proclaim massed start racing quite legal. A great deal of the opposition is, as I have said before, not promoted by sincere concern for the safety of the public, otherwise the practical demonstrations they have had of its safety and of the care taken in running these races would cause them to admit that they had made a mistake. Their real concern is that, having aroused the interest of the authorities in it, the whole sphere of road sport has been brought into the limelight. If one goes it is extremely likely that the other will, too.

Does G. H. S. suggest that road records should be abolished because there have been accidents? Does he suggest that because Donovan was killed (to cite only one example) time trials should be abolished?

The matter is to be further debated at a later meeting, and I shall refer again to the matter next month.

Perhaps the recent attempt by the N.C.U. to regain control of all forms of cycle sport has something to do with the opposition. For I shall not tire of pointing out that the N.C.U., which professes such an interest in cycle sport, 50 years ago abandoned all forms of it except racing on closed circuits. It now wishes to control time trials again. In the unhappy event of that being brought about, we hope that the N.C.U. is entirely reorganised and that some fresh and youthful blood is made to pulse through the arteries of this old body which is suffering from atrophy and thrombosis.

It has not exhibited any great ability in its running of track events since the war, and in my view is a quite inefficient organisation and unrepresentative of the cycling movement it professes to dominate.

New Light Alloy Rim

SMALL supplies for original equipment will soon be available of a new light alloy rim specially designed by Dunlop for tubular sprint tyres. Its sizes are 26in. (weight 11¾ ozs.) and 27in. (12¼ ozs.). The rim has flat side walls suitable for caliper brakes, a reinforced base for strength and spoke tensioning, and a rigid bayonet type pegged joint. It is depressed and pierced for true tangential spoking and is suitable for all types of hub, with a highly polished metal finish. The retail price is 78s. a pair.

Rhos-on-Sea Cycling Club (Affiliated to the W.R.R.A.)

I AM informed that the N. Wales R.C. (B.L.R.C.) and the above club have amalgamated and will continue as the Rhos-on-Sea C.C., affiliated to the B.L.R.C. Hon. sec. is J. P. Thomas, 15, Tan-Lan Road, Old Colwyn, N. Wales.

Road Accidents—November, 1947

FATAL accidents on the roads of Great Britain during November were the lowest recorded for any corresponding month since 1931. The total of 476 killed is 55 fewer than in November, 1946, and 23 fewer than in October last year. Non-fatal accidents totalled 14,152, compared with 14,496 in the corresponding month of 1946.

Adult deaths were highest among pedestrians and pedal cyclists, being 194 and 73 respectively. In the case of pedal cyclists there was an increase of 14 compared with November, 1946.

Child deaths included 74 pedestrians and 8 cyclists, compared with 63 and 7, respectively, in the corresponding month of 1946. It is disquieting that more than half of the children killed were under seven years.

Wayside Thoughts

By F. J. URRY

Chale
Isle of Wight
The weatherbeaten old church overlooking Chale Bay

One Good Turn

THE days of mellow fruitfulness have gone, but the mists persist on occasion, and they are a bleak and oblique nuisance. To be sure we are better off on bicycles than in motor-cars when the grey ghosts of cloud cling to the earth and the familiar places become a phantasy merged in dirty cotton wool that clings clammily and spottles your person and apparel with a sample of the industrial haze. Usually I can find my way home without trouble and manage to dodge the maelstrom of blaring cars that congregate at cross roads; and with a certain subdued sense of importance frequently pilot a string of smoking vehicles as far as I go along the road. It is quite a pleasant sensation to undertake a job of this sort, because it provides proof of the wonderful mobility of the bicycle when conditions are difficult, and you undertake the small aid without any personal inconvenience, always provided the fellow on your tail light can stop as quickly as you. And it provides a nice lesson in patience for the folk who are not usually renowned for that virtue. Generally, the fellows who follow me home are pleasantly thankful for the slight assistance, and when in the mornings the elements have recovered from their bout of nuisance the numbers of greeting horn-pips as overnight friends pass me on the way to work considerably increases. I wish all road users were more partial to the improved tempers displayed when foggy conditions reduce all traffic to a crawl for that would help enormously in the solving of our road problem. I do not desire to reduce traffic to a crawl, when conditions are normal, but I would like to see a happier exchange of common courtesy between all road users, and a far greater care exercised when the ways are slippery with mud, wet leaves or silvery frost.

Autumn Glory

UP to the middle of November my mackintoshes had enjoyed the longest rest from their protective duties I ever remember; or perhaps I had enjoyed it and my macks had lain dormant in the bag. Twice, I think, since mid-June I had slipped the cape on to resist a passing shower, and its only other service was as a sitting-mat for a wayside lunch interval when the dew had not quite departed. It was indeed a wonderful time for the outdoor folk, and I should think there never was a finer cycling time than the late spring, summer and autumn. I had used up all my holiday time before November, but during that month enjoyed one glorious week-end when the sun shone most of the day on woodlands rioting in colour as rich and warming as in any late autumn I remember. With so dry a season one would have thought autumn and its pageant of glory would be short, yet it was the longest period of gold and russet beauty I remember. Its glory came right up to the edges of the towns, and in some places invaded them, and I thought on my journeying how lucky we cyclists were to roam at a speed that always kept the pictures positive rather than a blur of vision induced by speed. In the middle of the supposedly doleful month—you know, "No sun, no moon, no light, no noon—November!"—I was out amid our Warwick woods on a Sunday morning and they were the richest thing I have seen on the eleventh month of the year. What a gift the possession of a bicycle is and the ability to ride it comfortably; yet how few folk realise what they are missing. If they were shown the pageant of this autumn in Technicolor on the films, many of them would enthuse about the vision; yet it is, or was, down the road for the youngest and the oldest to revel in from the saddle of a bicycle, and nothing to pay.

Still Short

WHILE the cycle trade is to be congratulated on its achievements in the export field, I'm afraid that fact does not help greatly in supplying native riders with the first-class goods they have been awaiting the opportunity to buy for so long. Ask any dealer and you will find he cannot keep a stock of good bicycles or accessories. They are snapped up the moment they arrive, and the high prices seemingly make no difference. Personally I find it most difficult to use myself to the new sense of values; which I suppose is not surprising, for I was buying bicycles in the Victorian age, and became far more used to looking for reductions than anticipating rises. The fact is that the number of high-class machines and their proper equipment will be meagre compared with demand, and the lucky ones among us who have decent mounts will be wise to care for them more closely than ever. Thank goodness we can buy light tyres now, for the Sprite is back on the market at, to me, an astonishingly cheap price, 8s. 9d. per cover, considering that the pre-war figure was 7s. 6d. That fact will make a lot of difference, it will enliven the old machine no end, taking away that feeling of drag the wartime tyre induced, which was sufficiently positive to penetrate consciousness. And I understand a new line in Sprites will soon be available, to be known as the Tourist Sprite. This cover is a little sturdier than the open-sided type, for its walls are protected with thin white rubber, and the tread is of a vigorous, non-skid pattern; a good, sound light tyre for winter use, or for the rough rider who likes to negotiate the remoter tracks. Yes, we shall have to wait yet awhile before we can make the ideal choice in bicycles or equipment, but the fact that first-class tyres are now available is a lively step forward in the comfort of cycling.

They Are Good

I KNOW quite a lot of people think I exaggerate the cycling value of light and lively tyres, and some have told me they would prefer an added handicap in running quality for the sake of obtaining greater security from punctures. Now, I've little recent experience of the resistance of what are known as full roadster covers, but I can tell you that my average of punctures riding on the open-sided Sprites are three a year, one more than was the case well pre-war, because of the increase of the broken glass menace. Three thousand of my annual 8,000 miles are over city and suburban roads, and half that town mileage is over granite setts. I keep my tyres fully inflated and normally do not wear them to the last bit of rubber, yet even so I get an average of 7,000 miles a cover provided I escape the disaster of a broken bottle segment when riding in the dark. That fate would deal just as severely with a roadster tyre. In return I get a lively bicycle, and the comforting consciousness that I am making the best use of my automatically declining powers. Personally I think the added tyre cost per annum between the light cover and the heavy one is no more than ten shillings at the most, and what value for the little extra outlay? At speed—which I do not now practise, because it makes me blow—I consider the difference between the light and heavy tyre at least two miles an hour, and if you transfer that speed increase to ease increase, it makes a very great difference to happy cycling, and happy cycling is the fact I want to impress on all people, young and elderly, or in-betweens, who love the country, the ever-changing panorama of the road and value the health of outdoor living.

The Difference

DURING the Christmas holidays I saw a lot of my young friends off to the hills and the sea, gay little parties who made the four days' break a joyous journey amid delectable places; to be candid I envied them such freedom, wishing them the luck to make the most of it while such conditions lasted. It reminded me of my young adventures half a century ago when few cars prowled along the roads and every inn had a welcome for the wanderer, while to review the food we ate would be unkind to-day and perhaps unwise. Once, when in North Wales, Boxing Day came in with storms of sleet and rain, and Barmouth Bridge quivered under the impact of the wind. Nothing daunted, we lads struggled along the coast road to Towyn, found a warm room and the considerable remains of a Christmas dinner to console us, so it was late in the afternoon before we reached Tal-y-Llyn, but the gale helped us to be in time for tea. Being fairly dry by then I wanted to stay the night, but the Sancho Panza of the party would insist we push on in order to shorten the homeward journey for the morrow. So out we went, the four of us, into the bleary night with the hail more prominent in the descending moisture, and much trouble with oil lamps which "doused their glims" when a more fierce gust than usual came screaming through some crevice in the rocky passage. A bright thought struck our leader; we would climb the hill to Corris and seek shelter there; it was only four miles from where we struggled with the lamps. We did, and got a soaking from the knees downward for the pain of crossing the divide. And, believe it or not, Corris was locked up for the night at 8.30, and was apparently sound asleep. We awakened the custodian at the hotel on the right as you start to fall down the long street, and he did his stuff nobly, building up a huge fire from the smoulder, reaching down the ham and cutting thick slices half way round that great leg of pig, and soon the eggs were added and the scent of it dismissed all thoughts of the howling storm. "A nasty night it is whatever, not fit for man or beast," and we agreed. "But this will do you good indeed," and it did. And my recollections of the bill, with a breakfast repetition of the supper, was five bob. Yes, I've seen some changes; no wonder I find it difficult to match to-day with yesterday, especially in the matter of prices.

Making Good

MANY years ago I knew intimately a youth whose keenness for speed cycling was extravagant. Work and racing was his motto, and though his training for "the littleness of life"—earning a living—was hard, it did not appear to sap his wheeling energy, for his greatest delight was to knock a few seconds or minutes off the last occasion on which he rode the measured course. I expected him to mellow in due course, to see and love something of the beauty he passed by so swiftly. Then the accident happened. Early one morning on his way to work a car crashed into him, and a third of the bones of his body were shattered. He was a long time recovering, partly due to depression. His early industrial training was wasted, his wrecked body could not do the job, nor would he ever move swiftly again by his own effort. Life looked bleak indeed, despite a fair sum of money paid over as compensation. One day he came to see me with an advertisement offering a country inn. It would take all his capital and more. Could he make good? And I thought he could with the aid of the girl whom he forthwith married "for better or worse." It was a brave thing to do, the marriage and the purchase, the all or nothing. A year later the couple were learning by trial and error the duties and also the delights and disappointments of host and hostess; and they learned slowly and completely. In his spare time the boy's early training resulted in building a model of the charming village in which he lived, a whole miniature village in a garden, with its river, its church and its inn. It was an attraction, a tiny loveliness in the great glory of a lovely countryside; and the couple prospered, learned their business thoroughly, added the laughter of children to their fortune, and always remembered they were once cyclists. There is a great welcome at this inn for the comfortable rider, and a happy recollection of those faraway days when some roadside was busy in the pearly dawns, and numbers of us—now growing old—were busily despatching the fleet-limbed youngsters of yesteryear. That is one of the memories worth committing to print, the happy outcome of a great disappointment. Of such stuff are men and women made who ride bicycles and fortify themselves against "the slings and arrows of outrageous fortune."

GEARS AND GEAR CUTTING

Edited by F. J. Camm.

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CYCLORAMA

By H. W. ELEY

The Land's End, Cornwall

The famous westernmost point of England, and the Longships Lighthouse.

Among the Southgate Boys

I KNEW that I should enjoy myself with the members of the Southgate Cycling Club, when I attended their annual dinner at the end of November. It was a most happy gathering, presided over with dignity and charm by the year's president—my old friend Ballantyne. And what an enthusiastic lot of cyclists gathered round the festive board. Good speeches (I except my own), good fare, considering these austerity times, and that sense of comradeship which I ever associate with cycling men: there is no doubt about it—this game of cycling does promote harmony and good fellowship to a remarkable degree. Good luck to this old club—founded originally in the year 1882.

Curious Place-names

THE Dunlop Company, I think, hit upon a happy idea when they introduced that current series of cycle tyre advertisements, featuring curious place names . . . those odd names which many English villages bear, and which never fail to intrigue me. "Barton-in-the-Beans" is one in the series, and "Box's Shop" is another. One may meet with curious names like this in many parts of England, and I know of one keen rider with a love for the curious and out-of-the-ordinary, who has made quite a collection of them. But personally, I like best the "lovable" names, of sweet cadence, which one may come across particularly in Cornwall. . . . "St. Just-in-Roseland" is one I recall, and I cannot think of a more beautiful name for a village. To get back to this Dunlop advertisement series, I feel that it is always good to advertise cycling, and not merely the bicycle. It is what a bike can give us, in the way of happiness, scenic beauty, and good health, which really counts.

The Raleigh Industries Fair

THIS event, which attracted so much favourable attention, owed much to the organising ability, and strenuous work, of my old friend Fred Keller, the advertising manager of the Raleigh Group. I met him at this unique show, and congratulated him on the excellence of the arrangements . . . the show was marked by that good hospitality which one ever associates with the Raleigh name. Touring the show, and looking at that intriguing display of cycling clothing, presented in conjunction with the Wool Secretariat, I met several old Nottingham friends, and—as a loyal Midlander—felt that I was back on my native heath for a few hours.

The Good North Road

RECENTLY, business and private engagements have necessitated some travel along the Great North Road, and in renewing cycling acquaintance with this most famous of highways, I have recaptured something of its charm. Barnet, despite all the modernisation which has taken place in the recent years, is full of charm, and some of the "old bits" are uniquely historic. And down Galley Lane there is an old and picturesque farm where my small son has his pony . . . and it is good for me to ride out to this farm and watch the youngsters putting good cobs over jumps, and inspecting the sleek cattle in the modern cowsheds, and imbibing, with a nostalgic love, all the sights and sounds of farmland, stable, and byre—which were my delights in childhood days in the long ago. And the Great North Road is one of those good highways which retains some historic and comfortable inns. Not all have been spoiled by some misguided brewer with a passion for chromium-plated fittings, and a fine disregard for the treasures and traditions of the past. The low-ceilinged taproom, the cosy bar, the blackened rafters . . . these are the things I love in an inn.

"February Filldyke"

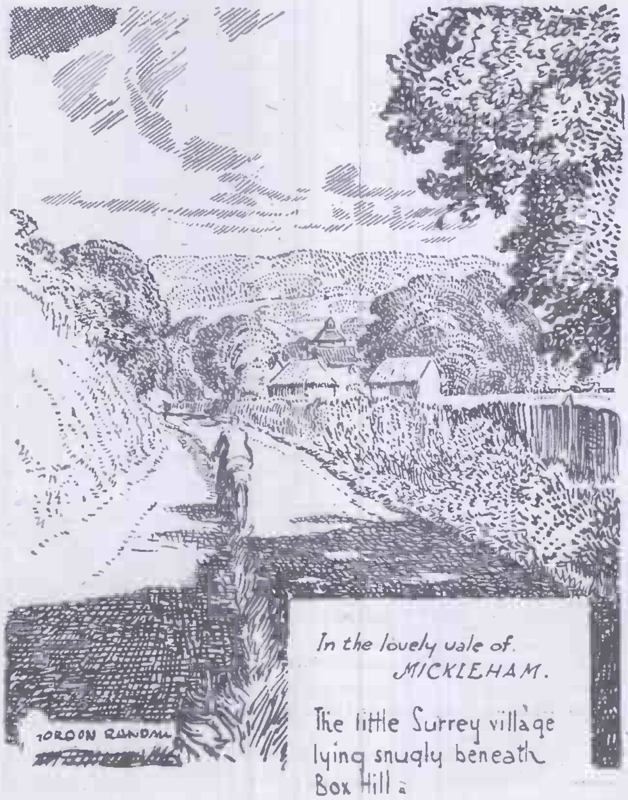
NOT always do the ditches run with rain in this the shortest month of the year. But February rain is good and beneficial, and I always like to associate the month with showers which kiss the cheeks whilst one is a-wheel, and my good farmer friends smile when they see the rain-soaked fields, and hear the gurgle of the water in the ditch. And, February brings us St. Valentine's Day . . . when, in my far-off youth, sweethearts exchanged gay, colourful cards, pledging perpetual love. And even in this unromantic age I see that modernised editions of these amorous greeting cards are available . . . and St. Valentine is not forgotten.

And . . . Spring is On the Way!

THE cold rain may beat on our faces as we ride down the lane, and the trees may still be bare . . . but it is quite possible that there are snowdrops abloom in the dell by Sweet Briar Farm. Shy, virginal blooms . . . which have to be looked for carefully . . . but what more lovely harbinger of spring?

Plea for Comfort

QUITE recently I was chatting with a young cyclist in an inn. It was in homely Hertfordshire, and I took a good look at his bike . . . and it all ended in my giving him a lecture on the virtues of comfort in riding. Because that boy's bike needed a bit of attention! The saddle springs had gone . . . and how he managed to ride any distance in any degree of comfort, I do not know. And his tyres: sadly under-inflated! And brakes . . . a menace! Such simple things to put right . . . but then this was only one case of neglect I have met with recently. It really is surprising how many cyclists let their machines get into bad condition and suffer therefrom. Now is the time, before the spring touring season is with us, to give the mount a thorough overhaul, and remedy any defects. A comfy saddle, properly-inflated tyres, and sound brakes make such a difference!



In the lovely vale of MICKLEHAM.

The little Surrey village lying snugly beneath Box Hill.

My Point of View

By "WAYFARER"

Summer by the Mole.

Looking across the river to the little church of STOKE D'ABERNON. A treasure chest of monuments & brasses, including the brass of the first Sir John D'Abernon - the oldest in the country dated 1277.

Parrot Saying

IT is to be expected that we shall hear, *ad nauseam*, statements to the effect that "the bicycle is coming into its own again," thanks to the abolition of the basic petrol ration. If this means that many people who are unable to use their motor-cars and want a quick form of transport (preferably in fine weather!), will turn—probably in desperation—to the bicycle, then undoubtedly the statement is true. In point of fact, however, the bicycle "came into its own" very many years ago, and has always maintained that position, which is unaffected by the folks who drift away and worship "other gods." The popularity of the bicycle—of cycling—endures. It endures through sheer merit—even when those who view the magical two-wheeler only from the utilitarian standpoint cease to employ it, thus casting aside the tremendous potentialities of the pastime. The cycling vogue is not made of those who are here today and gone tomorrow.

Open-air Merchants

I ALWAYS feel slightly curious about the attitude of mind of cyclists—fresh-air fiends, if ever such existed—who, on occasion, shut themselves up in ill-ventilated places. On a recent Sunday I entered the cottage where I usually obtain tea and found no fewer than 18 fellow-cyclists ensconced. Many of them were smoking (cigarettes and pipes) and the door and windows were closed. I, who had just ridden 55 miles to reach this rendezvous, did not fancy the atmosphere and opened the door wide—and blocked it open. Nobody was any the worse! I recall that, when I lived in Birkenhead and crossed the River Mersey every day, a small group of my brother-Anfielders were usually on the same ferry-boat. Like myself, they were keen on fresh air, and yet they made a point of gathering on the lower deck in close proximity to the engine-house, where they could obtain liberal draughts of warm oil! For my part, I always patronised the upper deck of the boat, where there were tons of fresh air.

Lonely Furrow

BY chance, on a recent Saturday, I had tea with a collection of Midland cyclists, members of one of the oldest of our clubs, sharing with them the almost invariable torrent of badinage and leg-pulling which enlivens such occasions. When the time came for me to start for home, I mentioned my proposed route and asked if anybody were bound that way. "You're too fast for us!" was the surprising reply, and, as they refused to put this valuable statement into writing, so that I could use it as a testimonial, I was driven to the conclusion that the remark was merely a spill-over from the tea-table flippancies.

So, lighting my lamps, I set forth to plough my lonely furrow. I had the vaguest ideas as to the distance lying before me. In any case, that point was unimportant, and irrelevant—especially as I kept adding bits to my itinerary—and, three hours later, on reaching home, I found 31 miles on the tally. How pleasant it was, that serene travel in the dark, along almost deserted roads: turning here to the right, and swinging there to the left: intent only on filling in the time and having a quiet and happy evening. I happened to be using a network of roads and lanes which circumstances have caused me to neglect for a few years, but I had no difficulty, in the blackness of the night, in finding my way, and in recalling where this switch or that would land me when tempted to leave my main route. I found, as I always find on the arrival of autumn, all the old joys of night cycling, even when the furrow is a lonely one.

Active Participation

MY eye was attracted by the following paragraph in an article about mountaineering printed in one of the daily newspapers a few days ago: "I climb because, in common with every man—and many women—I need a recreative sport; because, in common with a large minority, I prefer to take part in sport myself rather than pay someone else to take hazards while I look on; because, of all sports, mountaineering, to my mind, is the finest. I get nothing out of it except health, strength, adventure, comradeship, freedom, and a deeper sense of the endless magnificence of our earth." What conviction that statement carries, and how admirably it is expressed! Moreover, with the alteration of but one word ("cycling" substituted for "mountaineering"), how well it fits our great game. Yes, we who are enthusiasts for cycling propel the bicycle because we feel the need for recreation. We view cycling as the best-ever pastime, and we extract from our chosen game just what our mountaineering friend obtains from his—health, strength, adventure, comradeship, freedom and education. The bicycle opens the door to all these tremendous gifts. Alas, that so many people pass by without realising the infinite possibilities lying in wait for them . . . at so little cost. Other people, slightly (and only slightly) wiser, go through the open door and, lacking enterprise, fail to take their toll of the manifold delights and advantages which the bicycle will provide. The pity of it!

Undesirable System

AN ex-Serviceman, with whom I ride pretty regularly, tells me that when he was learning to drive a motor-car, which was part of the R.A.F. curriculum, he was reproved by the sergeant-instructor for leaving too much space for a cyclist who was being overtaken. My friend, as a cyclist of many years' experience, treated the wheelman as he himself likes to be treated—and thereby put himself in the wrong! The statement can be relied upon, and it appears to me that therein may lie the secret of some of the bad driving on the part of Servicemen, which provoked so much criticism and condemnation during the war period. To reprove a driver for allowing a cyclist too much room seems to me to be part of a very undesirable system.

"Some" Tyre

JUST before setting forth for a brief holiday a few weeks ago I was fortunate enough to acquire a pair of Dunlop "Sprite" tyres, and you may be sure that these added very considerably to the enjoyment of the tour in which I indulged. The mental effect of riding "Sprites" was most marked, and I am certain that there was a physical counterpart. Having reached an age when any little bits of help which the bicycle as a whole can give me are most acceptable, I welcomed those light tyres with both hands. The recent war struck cyclists a savage blow when it put the manufacture of "Sprites" on the top shelf, out of the way. Personally, I did not do so badly, thanks to a spot of foresight and perhaps a bigger spot of luck, but my stock of "Sprites" ran out a few months ago, and I then had to take to fully-rubbered tyres. However good these are, they do not possess the lightness and "life" of open-sided tyres, and I was accordingly more than glad to get back to wheels shod in my pre-war fashion.

Immunity Badge

IT must be admitted that the immunity badge of which I would now speak is not a badge at all, nor does it ensure 100 per cent. immunity. Nevertheless, it bears some relation to that badge which is sold to members of the public, who are then saved from being pestered by sellers of flags and things in favour of some charitable object.

This paragraph is the result of a conversation with a young friend who, when she lived within convenient reach of her office, was able to cycle to and fro, and she claims to have thus enjoyed an almost complete immunity from colds. Now, in changed circumstances, it is neither convenient nor easy for her to continue the cycling act, and she has to rely on public transport, with the result that, as she puts it, she is "getting cold after cold." Further, a relative of mine is putting her husband on an expensive cold-avoiding course of medicine, "as he has to travel so much on buses." For my part, I cannot help feeling that a better cure—or preventive—would be indulgence in cycling. A bicycle is available for his use, and while it is at times admittedly disagreeable to ride through unpleasant weather, it seems to me to be at least as disagreeable—at least, I say—to walk to the bus, wait in a queue, and then to be crowded into a small space with a lot of other people, with the prospect of another wet walk at the business end of the journey, the whole procedure being repeated, in the reverse, at the end of the day's work. Whatever else may be said in favour of cycling to and fro, the bicycle does take one from door to door. There is no waiting: there is no jostling: there are no steamed windows, speaking of air which has been breathed again and again.

Alive and Kicking

THE recent delivery, in little over half a week, of three cycling lectures at widely spaced towns gave me a like number of opportunities of linking up with people who, because of my long-sustained work for cyclists, are good enough to write me as an old friend. It was very pleasant to meet these people, some of them for the first time in the flesh, their previous contact with me having been by correspondence, and they were able, uncannily enough, to quote bits of advice I gave them long years ago, and to repeat passages from articles I had written, while some of them were good enough to thank me for forgotten services I am supposed to have rendered. Here and there one came across a feeling of surprise that I was still "alive and kicking," and still "getting 'em round," those who have drifted away from the pastime being prone, at times, to believe that I had done likewise. On this point I can only repeat what I said to these friends, namely, that when I find something better than cycling—and I've not found it yet!—I may be in danger of relinquishing the pedalling process. I have made a point of telling all these people that I am still writing in this journal, and that *The Cyclist*, though merged for the time being with PRACTICAL MECHANICS, will one of these days resume weekly publication with a bang, and we shall then see what we shall see!

Day of Days

ON the penultimate Sunday of November I set forth for my usual 70-mile ride without a pullover, and with a thin pair of gloves packed away in the bag. It was a grand morning, with plenty of wind (which caused me to "step on it" at times) and a joyous measure of visibility and sunshine. A change came over the scene as three of us dealt faithfully with a knife-and-fork (not to mention spoon!) lunch, and it was actually raining when our journey was resumed. At least, that was our impression. We were in no doubt half an hour later, when the rain came down in torrents—cold torrents—and the wind increased in fury. There was a feeling amongst us that this form of madness would not endure for long, and the impression was well based, but we had no conception of the beauty which was to follow. The rain stopped, and the sun returned to duty. An extraordinary translucent light was over everything, and up above, where blue sky was not showing, there were stupendous cloud effects, with a range of colouring which one seldom sees. The massive architecture of the heavens was indeed a joy to behold. The colour scheme gradually faded, and as daylight gave place to darkness we had a final glimpse of the distant hills, seen at an earlier stage of our journey.

Tea at a small country cottage formed a mighty pleasant interlude. There was a glowing wood fire, and the room was pleasantly warm. The welcome was just as warm. The food was plentiful and good, and our table was lighted—if "lighted" is the word to use—by a small oil lamp. Then out into the night again, to find a nearly-full moon on duty; to find, also, a much reduced temperature, making the wearing of gloves desirable. Thus the Three Musketeers went their way, weaving in and out of deserted lanes, now riding in silence, now talking of old times, and all the while enjoying to the full this day of days—which they felt it to be. A day to remember—a day to look back upon with pleasure, if only because of the magnificence of the aspect when the afternoon's fury had died away. So another joyous Sunday passed into history, with another 70 miles of pleasure to be recorded.

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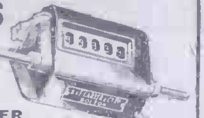

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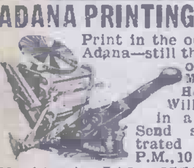

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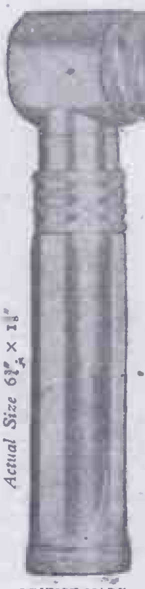

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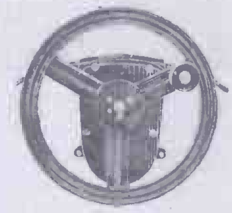

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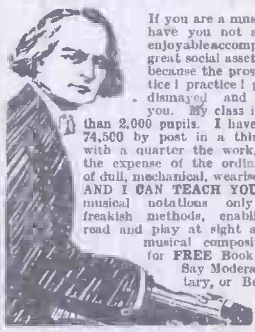

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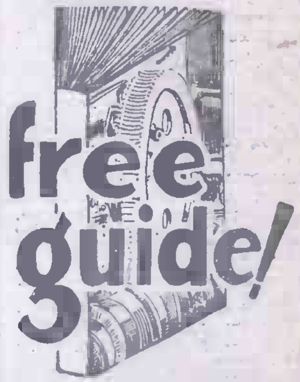

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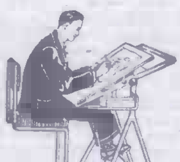

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