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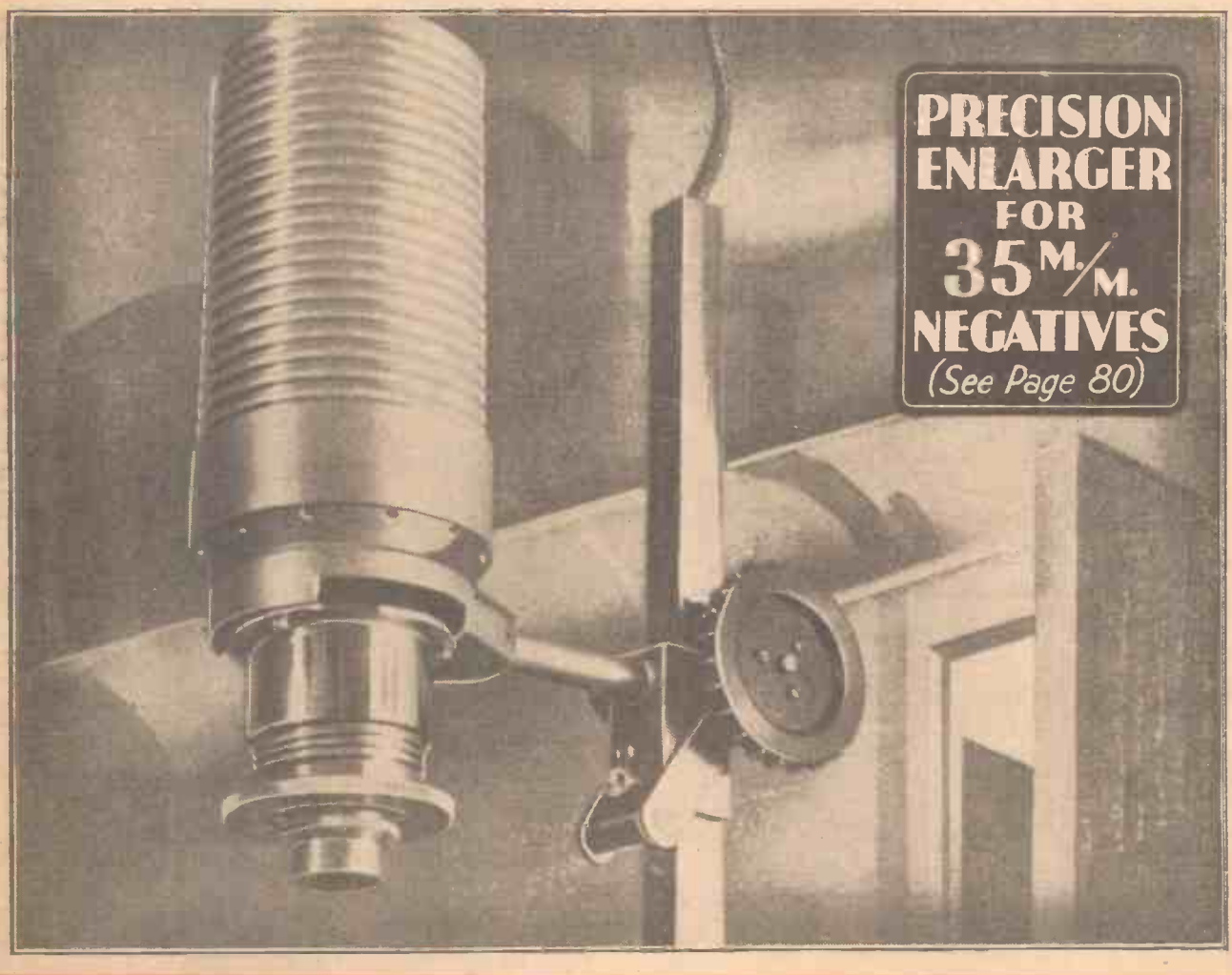
NEWNES

PRACTICAL MECHANICS

9D

EDITOR: F. J. CAMM

JANUARY 1951



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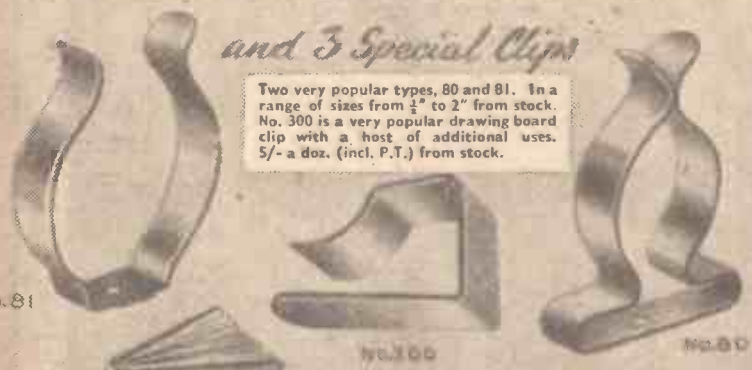

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PRACTICAL MECHANICS
EDITOR F. J. CAMM
JANUARY, 1951
VOL. XVIII. No. 205

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

FAIR COMMENT — By The Editor

An Electronic Brain

THE National Physical Laboratory have recently announced the perfection of an automatic computing engine, from the initial letter of which term they have arrived at the name of ACE.

Unlike some similar types of machine which are built to deal with one recurring problem only, the ACE can be made to tackle any problem requiring arithmetical calculation. All mathematical calculations in the end resolve themselves into addition, subtraction, multiplication and division, so that for practical purposes there is no limit to what ACE can do in this field.

Intricate and lengthy arithmetical problems occur nowadays with increasing frequency in science, industry and administration. Many require so great a bulk of arithmetical computation that even using desk calculators, it is almost or quite impracticable to carry them out. For most people long calculation taking weeks or months to complete is drudgery. Even when the calculation is done it is a serious problem to ensure that it has been done right.

Lens Problems

For instance, a lens is a complicated structure, and it is often by no means obvious what changes in its shape will result in an improvement. The art of lens design consists in making an informed guess at what change is likely to help and then working out the paths of the rays of light through the lens. With, say, ten refracting surfaces the calculations take about eight days, working seven hours a day. In practice less is usually done than is desirable and the best solution is not always found. ACE has done such calculations in less than a quarter of an hour. The instructions for making the machine do these calculations took about a week to make, but the machine was then ready to work out any problem of lens design and the instructions are now available for all lens problems. If a new lens problem requires solving, the instructions in the form of a pack of cards can be taken out of the library and put into the machine and the problem can be solved in a matter of minutes.

Problems vital to the safety of civil aircraft, such as the design of wings for a given loading, or for the determination of their flutter characteristics, can ultimately be reduced to the solution of sets of simultaneous equations. There might be 50 equations each of which has in it the same 50 unknown quantities. The whole process of calculation, using a desk calculator, would take one computer six or seven months to work out. The computation time on the ACE would be under 10 minutes.

Other uses for the ACE and subsequent machines could be the making of radar navigational charts, surveying, load distribution in electrical power networks, and crystallography.

Crystallographers, for instance, can frequently determine the structure of important substances, such as penicillin and vitamin B.12, by a combination of mathematics and experimental work with X-rays; but the mathematics may involve thousands of wearisome calculations taking months to solve by large teams of computers.

In certain fields of research there are problems, such as those relating to the structure of the atom, which so far have not been attempted at all, simply because their computation would take years. In these problems the high speed electronic computers will prove of great value in the future.

Prodigious Speed of Operation

The ACE works at prodigious speeds made possible by the use of wireless valves and modern electronic techniques. The speed is really too great for stating in ordinary terms. Consider the multiplication

3,971,428,732 × 8,167,292,438.

A skilled arithmetician would do this sum with paper and pencil in about 8 minutes. With a desk calculator it would take about 1 minute. The ACE will do the sum in about one five-hundredth of a second.

The ACE uses pulses of electricity generated at the rate of a million a second. These pulses therefore pass a particular point at the rate of one pulse for every millionth of a second. On the machine the pulses are used to indicate the Figure 1, while the gaps are used to indicate the Figure 0. All calculations are done using only these two digits, in what is known as the binary scale. When a sum is put into the machine the numbers are first translated into the binary scale and, after completion of the calculation, the result is re-translated into ordinary numbers.

The machine must have a memory to enable it to carry out long sequences of operations. It may have to combine the results of a dozen or more separate calculations and since it can do only one computation at a time it must remember each one until it is wanted. This is the equivalent of writing a result down on paper ready for when it is needed.

The "memory" is a very complicated portion of the machine and cannot be explained properly in other than technical language. In effect, the numbers, in the form of electrical pulses, are "shunted" into closed loops where they continue to circulate until required. If necessary they can be retained for hours. If the same number is going to be wanted again later on, it can let out a copy of itself and then continue to circulate. Actually, the electrical pulses that have to be remembered are converted into supersonic waves in a mercury column; if they were left as electrical pulses each loop would have to be 186 miles in circumference.

Coding

Instructions are given to the machine by coding them as holes in cards and using the holes to make electric contacts. The cards are fed into a specially adapted Hollerith accounting machine connected to the ACE. The holes in the cards start momentary electric currents which release corresponding trains of pulses which are then distributed to, and stored in, the memory loops. As soon as the ACE is loaded with numbers and instructions it begins on the calculations. The results are passed back to the Hollerith machine which punches another set of cards in accordance with the impulses received from the ACE, and translates the punched holes into ordinary printed numerals. The ACE can only calculate with binary numbers but the input and output arrangements are such that it can convert decimal numbers into binary form and *vice versa*. The machine is completely versatile in this respect and can accept input numbers and instructions in either binary or decimal form, or even one in binary and the other in decimal at the same time. The output also can be in either form.

The mechanism that controls the sequence of the calculations is far more complicated than the calculating mechanism itself. The preparation of the instruction cards is a specialised job, sometimes requiring considerable mathematical ingenuity. Instruction programmes for standard calculations are made and stored in a library. For a particular programme the instructions are assembled from these prefabricated units, and linked together by special instructions. The library already contains many prefabricated units ready for use.

Human computers are liable to make mistakes and so is the ACE. They can be detected and corrected in both cases. Mistakes are no special problem with such machines and the checking can be done as fast as the actual calculations.—F. J. C.

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A Precision Enlarger

Constructional Details of an Instrument for Use with 35 mm. Negatives

By J. STANDRING

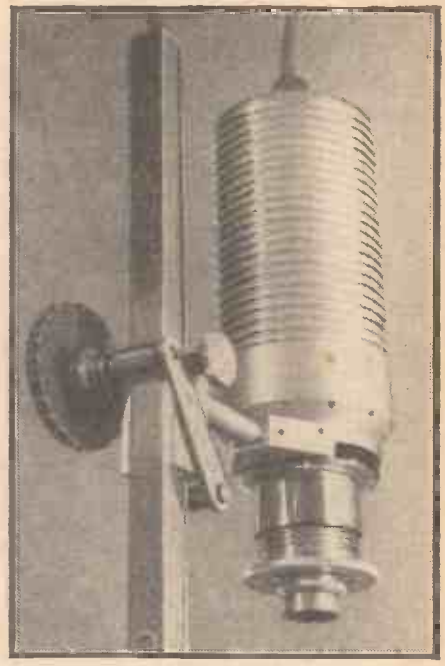
IT is evident at the present time that the trend in modern camera design is in the direction of the small camera, very often termed the miniature.

This term miniature generally embraces cameras using roll film where the usual size of negative is divided to give 16 or 12 exposures. In the true sense, miniature is usually derived from the king of all 35mm. cameras, namely, the Leica. Since the introduction of this fine instrument, many models have appeared, both expensive and inexpensive, by various manufacturers; until at the present time the 35mm. camera is extremely popular with the amateur and the professional.

As most amateurs are aware, this type of film is the same material as used in the cinema industry throughout the world and is known for its excellent quality. The usual frame size for still photography on this film is 36mm. x 24mm., or roughly 1½in. x 1in.; it is evident, therefore, that some degree of enlargement is necessary. Photography has always been known to be an expensive hobby; present-day cameras are expensive, and enlargers are certainly no exception. It is at this stage that the lathe owner is at a considerable advantage.

Lathe Work Necessary

The model engineer or amateur mechanic who possesses a 3in. to 4in. lathe and the usual accessories is in a position to turn out a first-class precision enlarger equally as good as any commercial product, and in many cases better. It will be evident that any piece of apparatus which is designed primarily for 35mm. work has to be of the first order. The standard of workmanship, mechanically and optically, is certainly not confined to the camera; the enlarger is equally important in these respects.



Rear view of the finished enlarger.

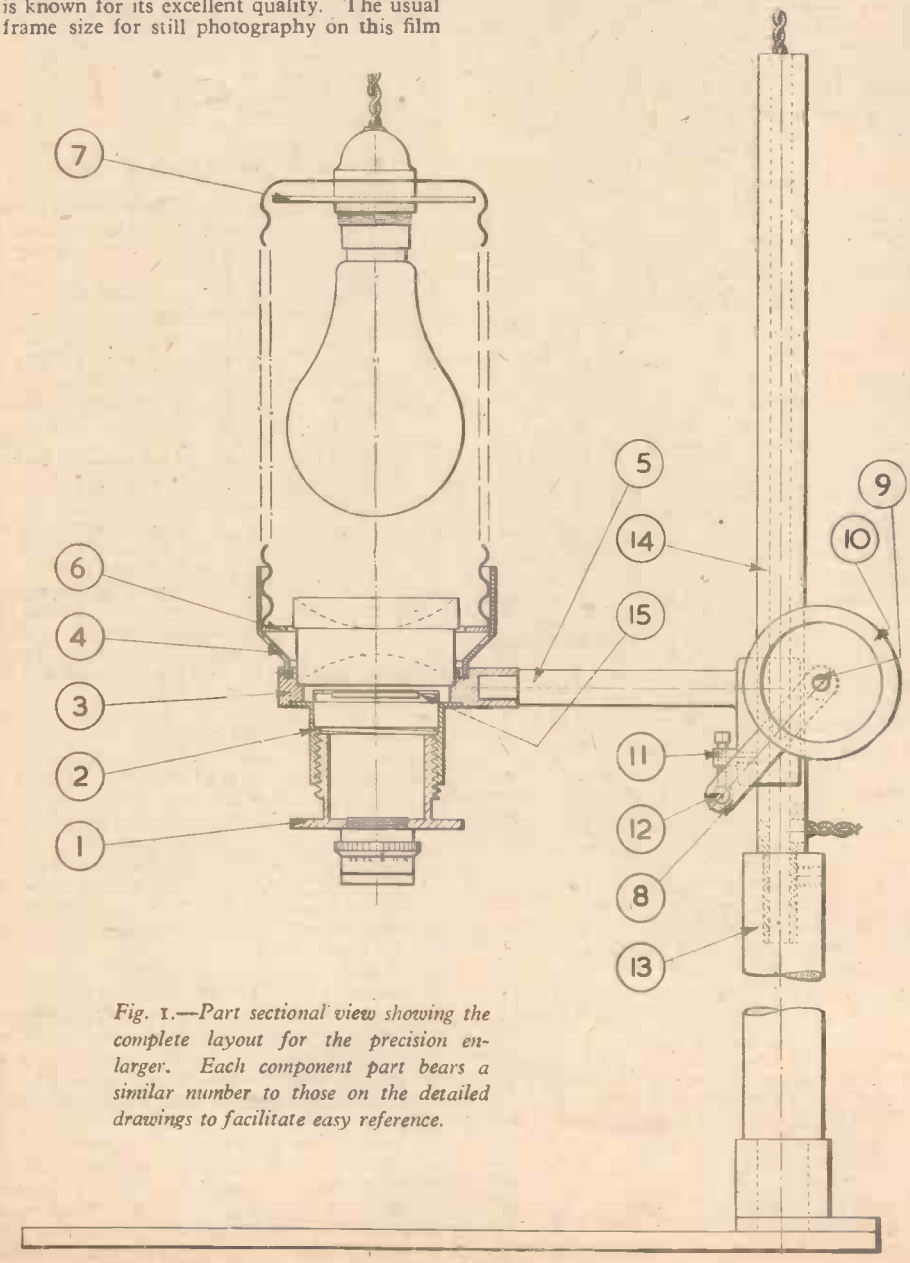


Fig. 1.—Part sectional view showing the complete layout for the precision enlarger. Each component part bears a similar number to those on the detailed drawings to facilitate easy reference.

Lenses Required

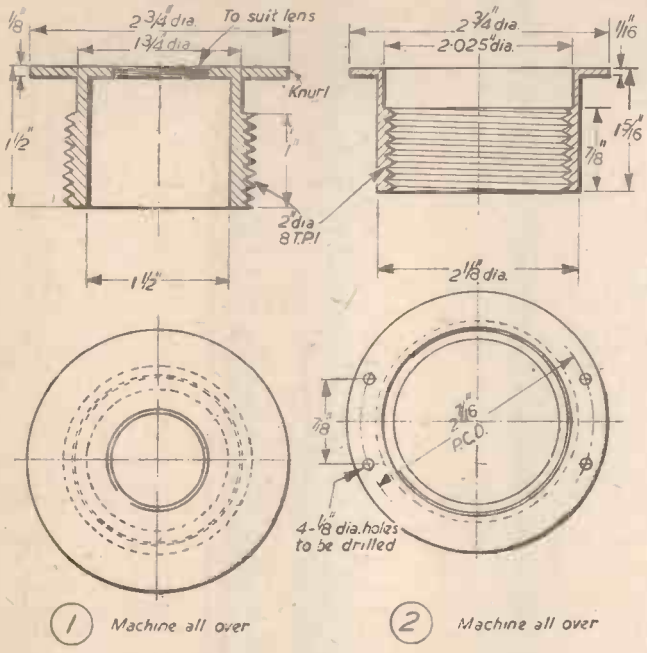
In the instrument about to be described many difficulties have been overcome in order that it can be made solely on the lathe. The lens, condenser, electrical fittings and the bulb are the only parts which will need to be purchased. Practically any make of enlarging lens will suit this design, providing the focal length is 2in. or thereabouts. The condensers are double, optically ground, 60mm. in diameter and approximately 2in. focal length; this size is very common in 35mm. enlargers and should not prove very difficult to obtain. The lamp-holder is of the standard household variety and the bulb is a specially prepared one for photographic enlargers and can be obtained from all photographic dealers, the size being 75 or 100 watts. It will be seen that the majority of parts are aluminium, this material being most suitable for enlargers, and the most easily worked.

Taking a look at the principle of an enlarger, it is evident that the object is to project an image, in this case the negative, through a lens on to a baseboard. In more detail, a light source, in this case an electric light bulb working in conjunction with a condenser, throws a parallel beam of light on to the negative and evenly illuminates it. By virtue of the varying distance between the negative and lens, and lens and baseboard, we can obtain an enlarged image of the negative on the baseboard of the enlarger. These features can be clearly seen from the general arrangement drawing (Fig. 1). Each part has been separately detailed and numbered and can be quickly referred to on the drawing. Therefore a few comments on the making of the various parts will be helpful.

The Focusing Screw (1)

This part and its companion the nut (2) are the most important parts of the whole job. The screw will undoubtedly have to

be a casting (unless a piece of bar is available), and a chucking piece on the opposite end to the thread will greatly facilitate machining. Gripping the casting by the spigot in the chuck, the whole job can be bored out, turned on the outside, knurled and screw-cut at one setting. Turning the job round and gripping by the bore, the focusing screw can be faced and the $\frac{1}{8}$in. wall at the end bored out and screw-cut if necessary to suit the lens. Care must be taken with the surface finish of the 8 t.p.i. portion. The success of the smooth focusing action depends on this.



Aluminium focusing screw and brass focusing nut.

The Focusing Nut (2)

This is a very similar operation on the lathe. In this case the thread is internal and care must again be taken with the finish. Very little clearance is permissible between the two threads. Face the $2\frac{3}{8}$in. diameter flange at the same setting as the screw-cutting operation. Since the negative carrier rests on this face, it ensures the negative is normal to the lens axis.

The Support Ring (3)

This component is the most complicated, yet the design has catered for its manufacture in the 3-jaw chuck. By chucking on the outside diameter the boring and recessing on one face can be carried out, and similarly, by turning around, the other face can be recessed to the dimensions shown. This then leaves the slot 2in. wide and 5/16 deep to be put in. If the lathe is not capable of milling this slot, it will have to be put in by file; rule dimensions are quite satisfactory for this.

The Lamp-house Ring (4)

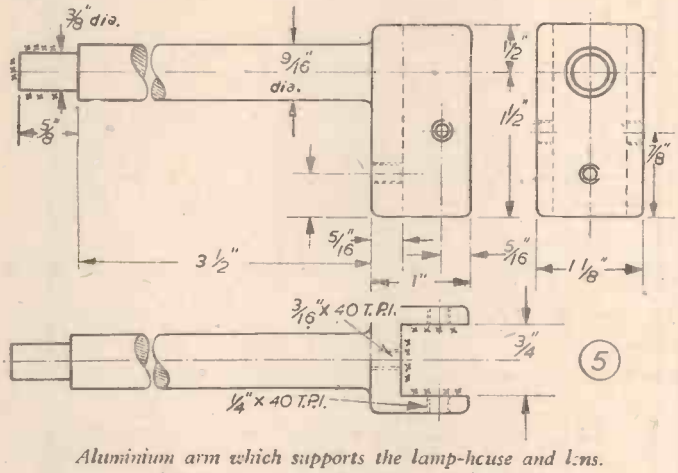
This part could be spun out of thin material if the necessary equipment is available; failing this a casting will have to be resorted to.

The Arm (5)

An aluminium casting is used for this; the best way of machining it is to turn the $\frac{3}{8}$in. diameter portion between centres before slotting for the $\frac{3}{8}$in. square bar. The slotting can be carried out on the lathe by mounting the arm on the saddle and milling with a $\frac{3}{8}$in. diameter slot-drill held in the chuck.

Light Baffles (6 and 7)

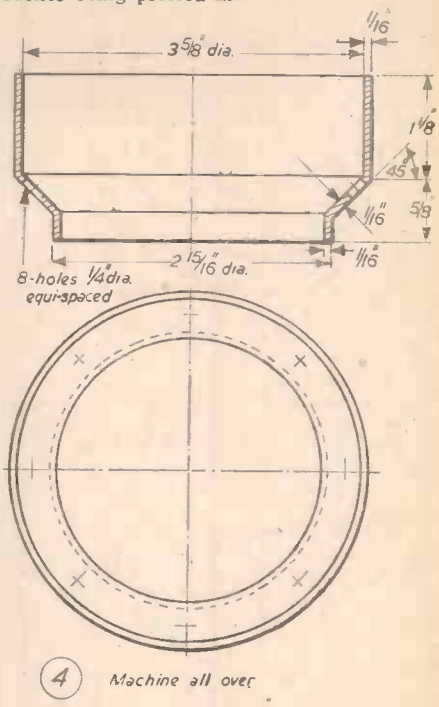
These are made from 16-gauge aluminium sheet.



Aluminium arm which supports the lamp-house and lens.

The Tension Arms (8)

These are made by straightforward drilling in $\frac{1}{8}$in. aluminium sheet, the small brass bushes being pressed in.



Aluminium lamp-house ring.

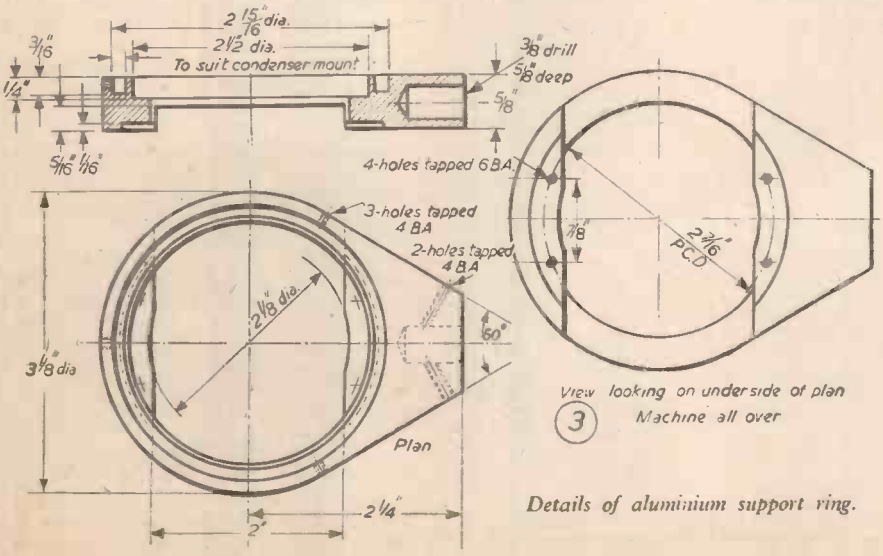
The Rubber-covered Roller (9)

This has a length of rubber tube cemented on; the best solution for this job is known as Bostic.

Parts 10, 11, 12 and 13 are all straightforward turning operations.

The Square Bar Pillar (14)

This has a hole drilled down the centre to house the flex for the lamp. This operation might prove difficult on a small lathe, and can be omitted without effecting the working of the enlarger.



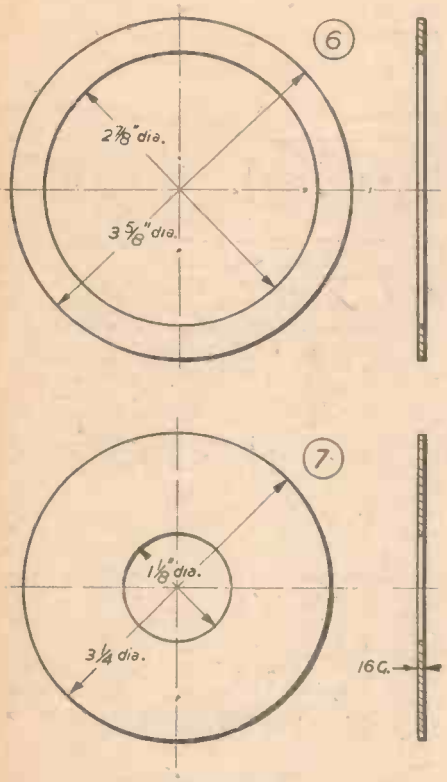
Details of aluminium support ring.

The Negative Carrier (15)

This component is in two pieces. The guide is aluminium grooved to suit the width of negative material, i.e., $1\frac{3}{8}$in. An alternative method to milling the groove is to rivet two strips of 1/16in. material 9/32in. wide on to a piece of aluminium $4\frac{1}{2}$in. by 1 15/16in. The pressure plate is glass, preferably optical, and pressure is brought to bear by means of two swing-away clips at the ends.

Lamp-house and Baseboard

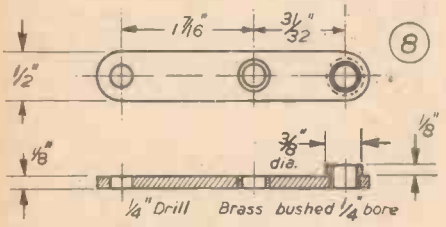
Only two items now remain for comment, namely, the lamp-house and the baseboard. The lamp-house presented difficulty in my effort to produce an efficient yet easily made job; undoubtedly the ability and equipment to spin one would have solved the problem immediately. Since the capacity of my lathe would not permit spinning, I had to resort to other means, and finally I was compelled to make use of the commercially produced aluminium hot-water bottle. On seeing these in the local stores it became



Light baffles.

evident that I had found at last an article (price 2s. 9d.) that would serve the purpose admirably, and at the same time add a little dignity to the finished job.

The baseboard can be made of any sub-

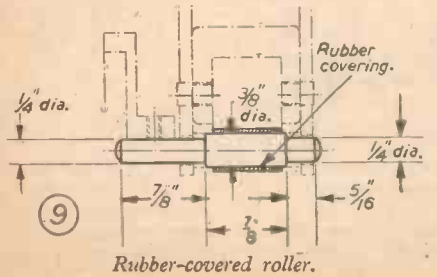


Tension arms.

stantial material providing it is rigid, e.g., good thick plywood. I have made mine from the top of a box and utilise the interior for the storage of paper, etc. As a matter of taste I had the square bar pillar and the focusing nut chromium plated to bring the finish in line with the rest of the enlarger.

Degree of Enlargement

The degree of enlargement permissible with this design can be altered somewhat to suit individual tastes. The maximum enlargement is dependent upon the length of pillar, the length of the arm, and the distance between negative and lens. The design permits a 12in. by 8in. print to be made—the format of the negative, i.e. 36mm. by 24mm. To increase this size the pillar will have to



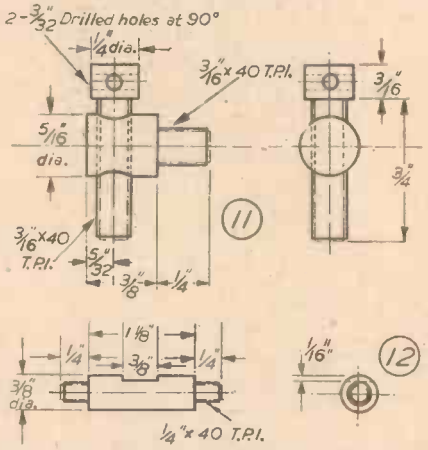
Rubber-covered roller.

be lengthened and the arm made longer; the focusing arrangement will be all right as it stands. The baseboard will have to be capable of taking larger papers, dependent upon the degree of enlargement required, unless one is prepared to project, say, off a table on to the floor.

Negative Carrier

In the design of the negative carrier I have not catered for projecting from a roll of film, but from strips in, say, three- or four-exposure lengths. It is preferable to support the film over as great an area as possible rather than by the two perforated edges as found in the glassless type of carrier. I feel that by sandwitching the negative between twopieces of optical glass, one can be assured that the film remains perfectly flat and rigid. This is particularly important when there may be a chance of heat from the lamp causing the negative to distort. One of the greatest advantages with glassless carriers is that the image projected is free from dust-marks, which are apt to be troublesome in the glass type.

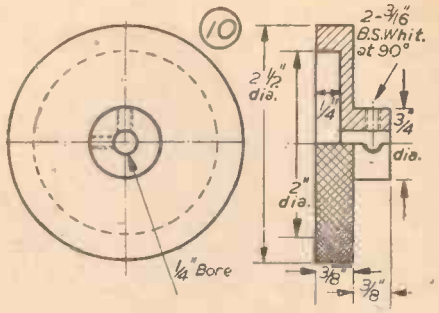
A very important feature in 35mm. enlargers is the high degree of enlargement



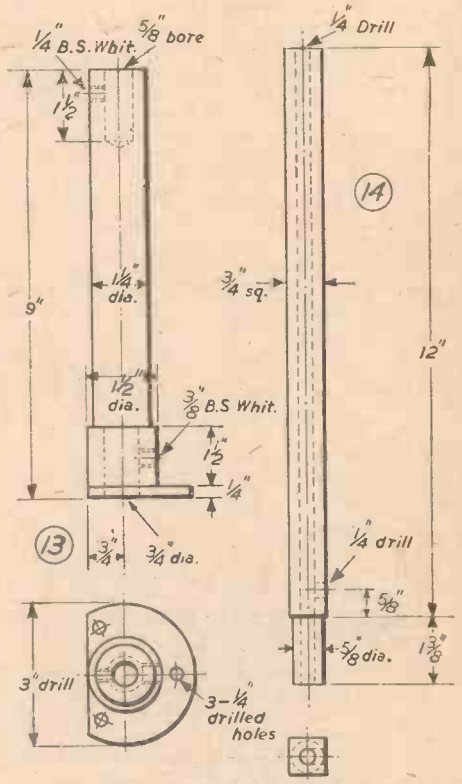
Details of tension screw and boss, and tie rod for tension arms.

which is necessary in, say, exhibition prints, so it will be appreciated that any small foreign matter present on the negative will show itself in magnified form on the print. Therefore, if we take into consideration all these points, it seems obvious that, firstly, we must obtain a correctly projected image, and secondly, exceptional care must be taken with the mounting of the negative. After considering all the points for and against each type of carrier, the optical-glass type is definitely the lesser evil of the two. Slight imperfections on the print can easily be removed by spotting, whereas there is no remedy for an incorrectly projected negative, i.e. one, say, that has been distorted during exposure.

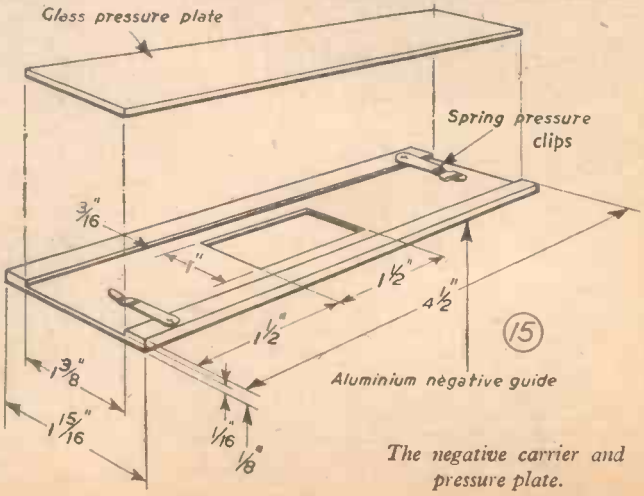
In conclusion, a first-class instrument can result if care is taken in the making and assembly of the various parts, and the user will be amply repaid for his efforts when the enlarger is put to work in the dark-room. That shown in the drawings has saved and earned pounds.



Aluminium handwheel.



Square bar pillar and base.



The negative carrier and pressure plate.

The Magic Crystal

The Piezo-electric Effect and its Applications in Modern Science and Industry

By ERIC LOWDON

NEARLY seventy years ago a rather curious phenomenon came to light. Two young scientists, Pierre Curie and his brother Jacques, established that when plates cut from certain crystals are subjected to mechanical pressure then voltages are developed on the plates ; or conversely when voltages are impressed across the plates, internal pressures are set up which cause them to distort. The effect is actually very small and 1,000 volts applied to a plate, one tenth of an inch thick, will produce a movement of about one millionth of an inch.

Contemporary science was greatly interested in the experiment, but mainly from an academic point of view, for it was not sufficiently far advanced to appreciate the immense possibilities which lay in this apparently simple action. The name "Piezo-electric effect" was suggested, "Piezo" being derived from the Greek "Piezzen" meaning "To press."

So it remained a mere scientific novelty for some thirty years, though in 1895, the year in which Pierre married the lady who was to become famous as the discoverer of radium, the brothers were awarded the Planté Prize for their work on crystals.

A millionth of an inch being ground off a crystal plate at the Salford Electrical Instruments factory by whose courtesy this photograph is reproduced.

During the first world war scientific research was speeded up to an unprecedented degree. The experiments of the young Frenchmen were recalled, and the piezo-electric crystal was dragged down from the attic, given a dusting and subjected to a thorough scrutiny ; it was seen to contain a number of possibilities. By the end of the war uses were being found for it in such things as experimental echo-sounding devices for ships, and in the years that followed many new techniques were evolved for its use.

The Crystal as a Time Standard

Of the many substances which proved to be piezo-electric such as topaz, amethyst, tourmaline, even tartaric acid and cane sugar crystals display the phenomenon, quartz and rochelle salt emerged as the most important. To-day these two find applications in many wonderful devices.

It is, for example, no exaggeration to say that our daily routine is controlled by the quartz crystal, for the three accepted standards of time for the home and office—the radio time signals, the telephone speaking clock TIM, and the electric clock on the mantelshelf at home, are all controlled by it.

The radio time signals emanate directly from the most accurate type of timepiece in existence, a quartz crystal clock situated in the Royal Observatory establishment at Abinger. This instrument also supplies an hourly signal to the Post Office to control the speaking clock, and for other purposes. The frequency of the domestic electricity supply, which determines the accuracy of electric clocks, is checked against one or the other of these standards, which are accurate to within one twentieth to one fiftieth of a second. This should be sufficient to enable anyone to catch the 8.30 train to town in the morning.

The characteristics of the piezo-electric crystal which makes this possible, is the fact that when an alternating voltage is applied to it, it is found that at one particular frequency, depending on the physical dimensions of the plate, it acts like a series resonant circuit made up of an inductance and capacitance, but with very much greater efficiency. Further, the crystal in this condition can be made to control the frequency of the applied voltage to within very fine limits. In the case of the clock, the crystal is resonant at a frequency of 100,000 cycles per second, and is made to control the alternating supply to a synchronous motor which drives the clock.

A mass of quartz crystals. The characteristic hexagonal form with terminating pyramids can be clearly seen. (Photograph by courtesy of Salford Electrical Inst., Ltd.)

The crystal used in this way is called a quartz resonator, and is also used in a similar manner to maintain radio transmitting stations on their allotted frequency. In fact, the Post Office authorities insist that all transmitting stations from the B.B.C. giants down to the humblest amateur shall have access to a crystal frequency standard.

In Surgery and Industry

Another interesting use for the crystal is to be found in the Burden Neurological Institute, Bristol, where experiments are at present being carried out in so-called "bloodless" brain surgery. Here an alternating voltage with a frequency of 650,000 cycles per second is applied to a quartz crystal which is thus caused to vibrate rapidly in sympathy with the voltage. In this way a high-powered ultra-sonic beam is generated which is, by means of a mirror system, brought to a fine focus with a diameter of about 3 millimetres. It will be appreciated that this concentration of beam energy in so small an area will have considerable destructive force.

It is thus possible to beam this energy into the brain and arrange that it focuses at any chosen part of the nerve system, so bringing about temporary or permanent interruption of function at this point, without the necessity of making an incision. The bone and tissue through which the beam passes on entering the skull is unharmed because here the energy is spread over a comparatively wide area. So far promising results have been obtained by this method.

In the industrial field an instrument recently developed by Ferranti, Ltd., should save the textile industry many thousands of

A crystal with its mounting assembly. The circular crystal can be seen in the foreground, to the right.

pounds. The problem was to design a device which would detect even one broken thread out of hundreds entering a loom and give warning so that the fault could be rectified before the weave of the cloth was ruined.

In the past the problem has been tackled by making each individual thread pass through an exceedingly light switch which operated if the thread broke. The crystal, however, does the job in a very simple and efficient manner. A wire is stretched beneath the threads and at right angles to the run. It is anchored at one end, whilst the other end is attached to a crystal. A broken thread falling across the wire causes vibrations to be communicated to the crystal which, in turn, generates voltages. After suitable amplification these voltages are made to light a warning lamp or switch off the machinery.

As Sound Producer and Reproducer

The piezo-electric crystal, usually rochelle salt, is commonly used in gramophone pick-ups, earphones, microphones, etc. and the principle of operation here is exactly the same as in the examples already mentioned. Either a voltage is impressed across the crystal, so causing it to distort, or a mechanical pressure is applied to it thus giving rise to voltages on the crystal.

In the case of the pick-up, the crystal is subjected to a varying mechanical pressure communicated to it by the movement of the needle in the grooves of the record ; a varying voltage thus appears on the crystal which is then amplified and passed to the loudspeaker. In microphones, the movement of a diaphram when sound waves impinge on it provides the crystal with a varying pressure, and the earphone is the same thing in reverse —a varying voltage is applied to the crystal which vibrates in sympathy and actuates a diaphram.

Accuracy in Manufacture

The manufacture of these crystal plates, particularly those to be used as quartz resonators, deserves some mention because of the almost incredibly fine limits to which they are made. The finished products, which are made in a variety of shapes and sizes according to the purpose which they are to serve, look like nothing more than small pieces of glass, and yet the cutting and polishing of the most expensive diamond receives no more care.

The quartz resonator, for instance, is sliced from a large crystal block by means of a diamond-loaded circular saw, and the direction of cut with reference to the axis of the crystal is so important that X-rays are used to ensure that errors in the direction of cut are reduced to negligible proportions.

In some cases the plate must be ground, initially, to an accuracy of 40 millionths of an inch, and in the final adjustment it is necessary to remove less than one millionth of an inch. These adjustments are done by hand and obviously demand a high degree of skill.

This, then, is the Magic Crystal, and the examples mentioned herein are but a few of the host of applications of the piezo-electric effect. Pierre Curie died at a tragically early age, but Jacques, though stone deaf and broken in health, lived to see the fruits of that early experiment. He died in 1941.

Making Worm Gears

A Handy Device for Use in the Home Workshop

By H. D. ROBERTSON

I HAVE often found the need for worm gears for use in models that I make, and since the machinery for making these gears is not easily obtained I made the device shown in the accompanying drawings.

It consists of a cradle holding a ¼in. tap which can be rotated with a joiner's brace. By this means a forward thrust is also imparted in order to prevent the end of the tap from coming out of the countersunk hole. Details of the parts for making the cradle are given in Fig. 1. The tap can be brought into contact with the edge of the gear blank by means of a screw, and hence the depth of cut can be controlled.

The two guide screws are adjusted to just clear the sides of the blank and thus support the blank whilst cutting is in progress. The use of a taper tap gives a more gradual cut since the cut gets deeper as the blank is slowly rotated.

Operation

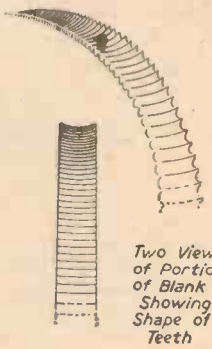
The blank diameter can be calculated as follows :—

$$\frac{\text{No of teeth required}}{\text{Threads per in. of tap used} \times \pi} = \text{dia of blank}$$

Having obtained this I usually increase the diameter by 10 per cent. before commencing to cut the gear.

Drill a ⅛in. hole in the blank centre and mount as shown in Fig. 2, in the nearest hole suitable by means of the ⅛in. pin. Bring the tap into contact by means of the screw provided, very lightly at first, and increase the cut after every revolution of the blank.

The number of teeth will be too many but by increasing the depth of cut gradually the diameter and hence the number of teeth will diminish accordingly until the right number is obtained.



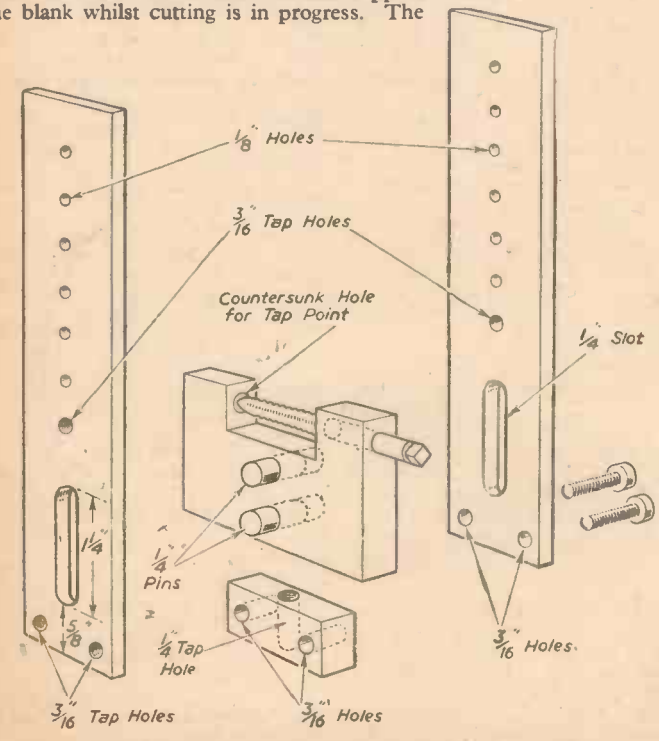


Fig. 1.—The various parts for making the cradle.

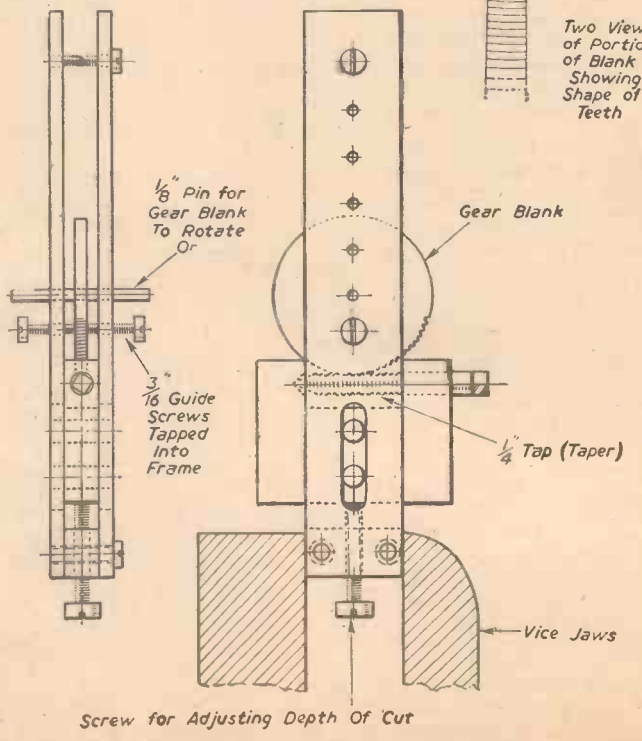


Fig. 2.—Side and front views of the complete cradle held in a vice.

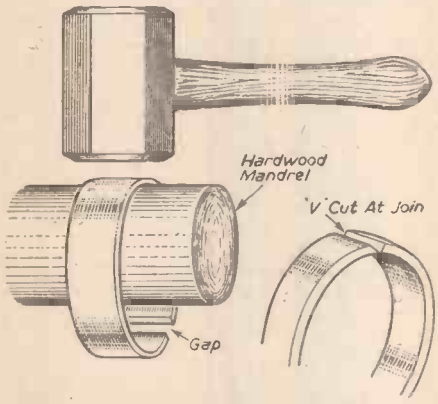
A Table Microphone

Constructional Details of a Simple but Efficient Unit

By J. S. KENDALL

THE main points of this microphone are the simplicity of construction and its neat appearance. The finish is blue gunmetal.

The materials required are: A 12in. length of ⅜in x ⅛in. brass strip, a piece of brass 2in. x 1⅜in. x ⅛in., six inches of ⅜in. diam. brass tubing, and one of those microphone capsules which are readily obtained



Figs. 1 and 2.—Method of beating out irregularities in the ring, and detail of V-joint.

from ex-W.D. stores at about half a crown. Also required is a piece of wood for a base, four ½in. x 4 brass screws, and an elastic band.

Supporting Ring

The foot-long brass strip is first bent into circular form. This is not as easy as it first sounds, but if these instructions are followed it is not too difficult to manage. Mark off half-way on the strip on the inside of the bend, clamp in a small vice, and with the aid of a movable spanner grip the end of the bar and twist so as to bend the bar in a semi-circle. Bend slowly and any unevenness can be taken out with pressure from the other hand. It is surprising how little extra pressure is needed to cause quite a large amount of extra bending! After the first half has been done the piece of brass is unclamped and the now curved portion packed and gripped in the vice; care has to be taken over this packing or a flat or bad kink will result. The bending is done as before.

It is quite probable that there are some uneven places in the ring, and these can be quite simply removed by placing the ring on a round piece of wood and beating them out as shown in Fig. 1. After the unevenness has been removed the ring will be found to have sprung, or slightly opened out, and this can be overcome by means of gentle pressure.

When the ring is round it has to be soldered at the join. This is done by filing a V between the two ends as shown in

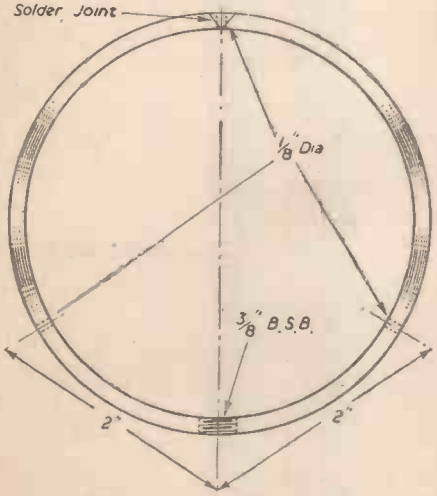


Fig. 3.—Showing the positions of the holes in the ring.

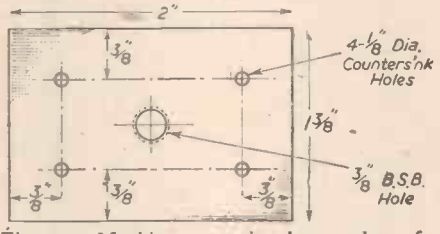


Fig. 4.—Marking out the brass plate for drilling.

Fig. 2. The best type of file for this purpose is a three-cornered one. The V is then filled with solder, using a heavy soldering iron or, better still, a bunsen burner or blow-lamp, the edges being clamped for the operation.

After soldering, all the surplus solder is

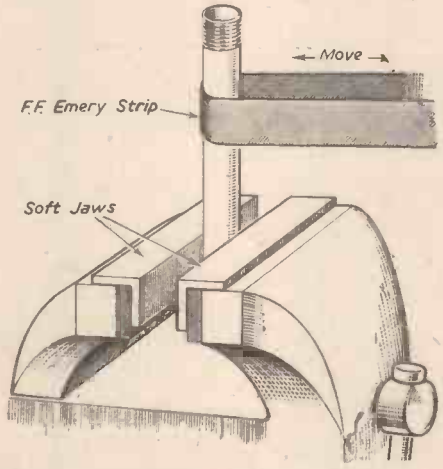
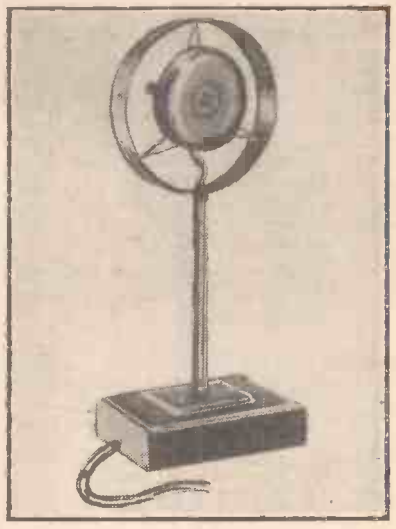


Fig. 5.—Method of holding and polishing the brass tube with emery strip.

removed with the aid of a file. The next operation is the drilling of four holes, i.e., three for mounting the microphone and one to be tapped ⅜in. x 26 t.p.i. (British Standard Brass). If a B.S.B. tap and die are not available a ⅜in B.S.F. can be used, but not a Whitworth, as the thread is too coarse and deep.

Now mark off the position of the ⅜in. B.S.B. hole exactly opposite to the join, then scribe two lines two inches either side (see Fig. 3). Mark off the centres for drilling, centre pop, and drill the holes, starting with the ⅜in. tapping hole, not forgetting to use the correct size of tapping drill. Next,



The completed microphone.

drill the two ⅜in. holes two inches each side and finish by drilling a ⅛in. hole through the soldered join. After tapping the ⅜in. hole the constructional work on the mounting ring is finished.

Stem and Base Plate

The stem is made from the 6in. length of ⅜in. diam. brass tube, tapped at each end to suit the thread in the mounting ring and the base plate.

To make the base plate, take a piece of brass 2in. x 1⅜in. x ⅛in. and mark it out as shown in Fig. 4. The four fixing holes are drilled ⅛in. and countersunk. The wooden part of the base is made preferably of hard wood, 4in. long and 2¾in. wide by 1in. thick. In this a ½in. hole is drilled in the centre and to a depth of about two-thirds of the thickness of the wood. A ¼in. hole is then drilled from the centre of one side through the thickness of the wood to meet the vertical hole. These two holes form the outlet for the flex from the microphone. The wood block is finished by staining and polishing, either rubber feet

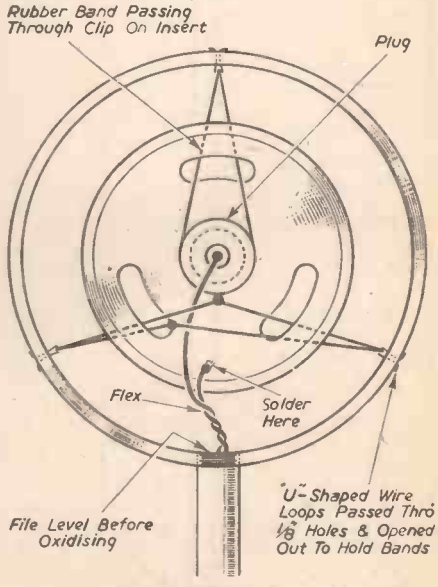


Fig. 6.—Showing how the inset microphone is mounted in the ring.

or baize being fixed to the bottom.

The finishing of the brass presents a job requiring quite a large amount of patience. The mounting ring is first clamped in the vice and any hammer marks removed with the aid of a fine file, care being taken to file along the circumference of the ring. Next, with the aid of FF emery cloth, polish the ring, being very careful not to get any grease on the ring or even touch it with your fingers. Remember that any unevenness in the polishing will show on the finished item. To polish the stem, clamp one-half of it in the vice and polish with the aid of a strip of emery cloth, as shown in Fig. 5. When one-half is polished, reverse and clamp the polished end in the vice, using a piece of clean rag as protection, and repeat the polishing.

Finishing

The base plate is finally polished, care being taken to get all the lines running in one direction.

To obtain the blue-black oxodised finish get a glass dish of the heat-resisting kind and of sufficient size to take the three brass parts either all together or separately.

Partly fill the dish with .880 ammonia, stir in a quantity of copper carbonate until there is some left undissolved in the bottom of the dish, then add three times as much boiling water as ammonia. Immerse the components in this solution until they are a nice blue-black colour. Take out the components and swill in water. It is also advisable to oxodise the screws by the same process.

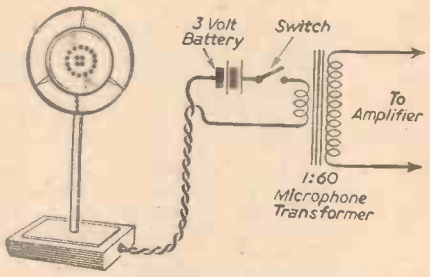


Fig. 7.—Diagram of connections.

The method of fixing the parts together is quite simple. The actual insert is mounted as shown in Fig. 6. One connection is made to the centre of the insert by means of a plug whilst the other is made by soldering the wire to the frame of the inset.

The unit when completed is quite sensitive and must be matched to the amplifier or radio by means of a microphone transformer, and energised by means of a three-volt battery. The circuit for connecting up the microphone and energising battery to the transformer and amplifier is shown in Fig. 7.

The Law About Patents

9.—Protection Abroad

By a BARRISTER

THE British inventor, after long waiting and the filling in of many forms, has his patent;—he has what may well be a valuable item of industrial property. But his patent rights are confined to Great Britain, Northern Ireland and the Isle of Man. The British patent does not extend even to the Crown Colonies; a tiny territory like St. Helena has its own patent law. Unless, therefore, he does more than obtain the British patent, the inventor may find to his dismay that what he devised at the cost of tedious toil and anxious thought is being vigorously exploited abroad, and he gets nothing from the exploitation.

Convention Countries

To know that a copier abroad is, without licence, reaping a bounteous harvest from one's invention must be peculiarly galling. Cannot one protect himself against such trespass upon his patent rights? Russia, indeed, is closed to him. There the home inventor himself can only ask the Exploitation Office of a nationalised industry to use his invention, and he may get some reward. A foreign inventor can expect nothing. Mutual arrangements—conventions—are, however, in force with the rest of the industrial world. A British inventor can take out a patent abroad; a foreign inventor can take out a patent here. In this list, for example, of applications for British Patents are two from the Ford Motor Co., Ltd. (U.S.A.), the first for "a measuring device," the second for "internal combustion engines," one from a Swiss firm for "glass metal joints," and one from a Swedish inventor for "shelling of oats."

Additional Patents

That is, the inventor seeking protection abroad will need to take out an added patent in whichever patent territory he would have protection. There is not—unluckily from the patentee's point of view—a convention whereby grant in one country implies grant in another. Payment of fresh fees and fulfilment of new formalities will be requisite for each separate patent territory. The convention, in effect, amounts only to the recognition of prior publication in the first territory for which the inventor took out his patent. Under the convention an inventor who has made application for a patent in a convention country has the right, within twelve months from the application, to apply in another convention country. Restricted though its scope is, however, we may look upon the International Convention for the Protection of Industrial Property as an encouraging instance of co-operation among nations.

Lack of Uniformity

The procedure for obtaining patents is by no means—again unluckily from the inventor's point of view—uniform over the industrial world. The inventor, therefore, will, to obtain protection abroad, be almost obliged to have the help of a patent agent. In some countries, for instance (France is one of them), there is no official investigation as to novelty. The application for a patent—payment of fees being duly accomplished—is accepted as a matter of course. It is after the grant that his troubles may begin. For then it is that opposition may appear. His patent may become invalid because his invention was no novelty or because he was not the first and true inventor. And fees once paid are gone for ever.

Inventions Affecting National Security

One further point is important. In the Patents Act, 1949 (which now governs the grant of patents), a provision of the Defence Regulations has been incorporated. By Section 18 of the governing Act, an inventor must have the written permission of the Comptroller to make application for a patent abroad unless (1) application for a United Kingdom patent for the same invention has been filed more than six weeks previously; and (2) no direction prohibiting publication or communication of the invention has been given.

New Gas-turbine-engined Launch

A demonstration motor launch fitted with Rover gas turbine engines was put through its paces on the River Thames recently and engineers were able to see the newly-developed engines (two of them in a 60ft. launch) in action. It is reported that the Admiralty has already placed an order for some of the engines, and it is hoped to develop them up to 200 h.p.

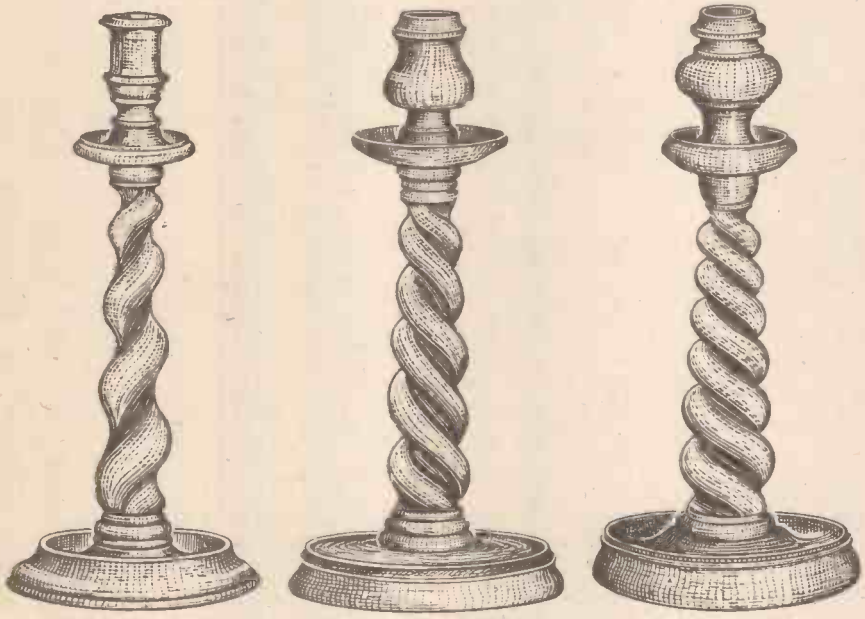
Wood Turning—12

Further Examples of Spiral Turning

By FREDERICK JACE

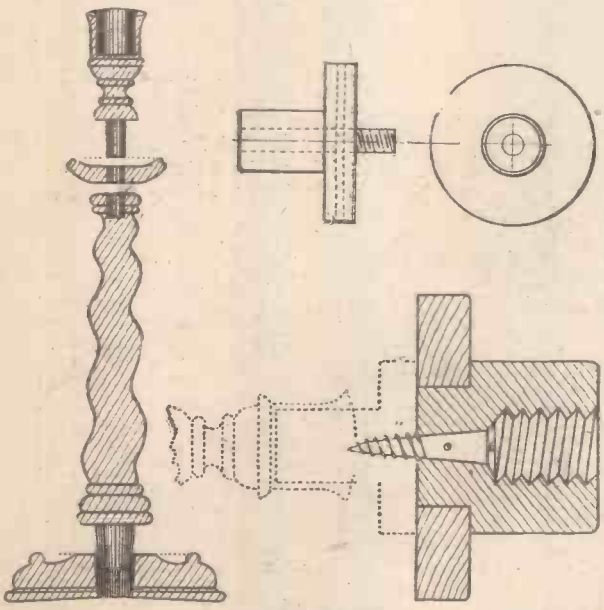
THE twisted candlesticks, three examples of which are illustrated in Figs. 127 to 129, provide an interesting exercise in this style of work. We have already seen how the pitch of the spirals is laid off by one of a number of different methods. The candlesticks carry spiral turning a stage further in that the stems are tapered from base to the point where the drip-tray and candle-socket are attached. The candlestick can, of course, be turned from one piece, but this entails cutting a great deal of wood to waste, and it is therefore more usual to turn the socket and drip-tray either in one or two pieces, the base as a single piece, and to screw them together, either by means of a long bolt passing through the complete assembly, or by separate screws.

The reader will perceive that by this system there is no limit to the length of work which can be turned, section by section, and assembled end-on. A standard lamp, for example, can be turned piecemeal in a lathe which only admits 14in. or 15in. between centres. The operator can let his fancy have free-play in the shapes to be turned, and he is not bound to follow any standard formula. If the finished job looks right it *is* right.



Figs. 127 to 129.—Examples of taper spiral turning—single and double helical.

The general effect of spiral turning, however, is wrong, if the pitch of the spiral is made too fine. It would look too much like an ordinary screwthread. By combining a right- and left-hand spiral a really pleasing intertwined effect can be obtained, as in Fig. 128. By carefully gouging out the core the two spirals can be separated, although this entails a certain amount of handwork. The timber should be one of the hardwoods such as oak, elm, boxwood, lancewood, Honduras mahogany, etc.



Figs. 132 to 135.—Section of candlestick, and two chucks for turning the base.

Bases

The bases of the candlesticks should be turned slightly concave so that they do not rock when stood on the table. They should be covered on the underside with felt, or green baize. The operation of turning the base is shown in Fig. 130, whilst Fig. 131 shows the set-up of turning the cup part.

Brass sockets can be purchased to hold the candle; it would be dangerous if the socket part were not lined in this way, for the candle might burn down to the wood.

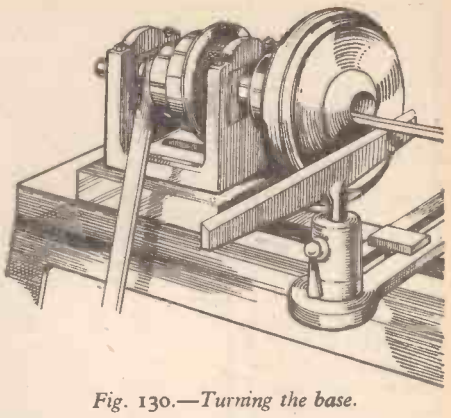


Fig. 130.—Turning the base.

Figs. 132 to 135 show a section of a spiral turned candlestick, the screw chuck for turning the socket, and an alternative chucking idea for the latter. Figs. 136 to 140 show the tool used for turning the base, the hardwood plug inserted when turning the stem (the plug spigot being of the same size as the spigot on the base), the method of setting off the spiral on the taper stem blank with a piece of adhesive paper, and the method of rough-cutting the spirals before using the gouge and beading tool.

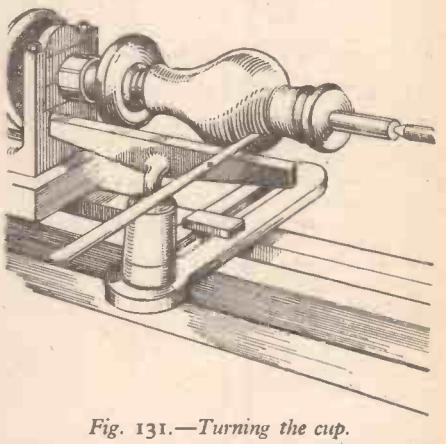
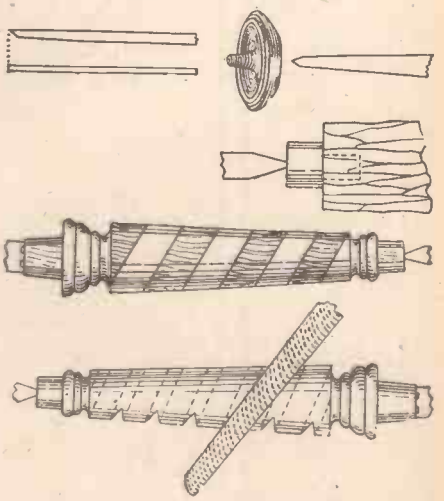


Fig. 131.—Turning the cup.

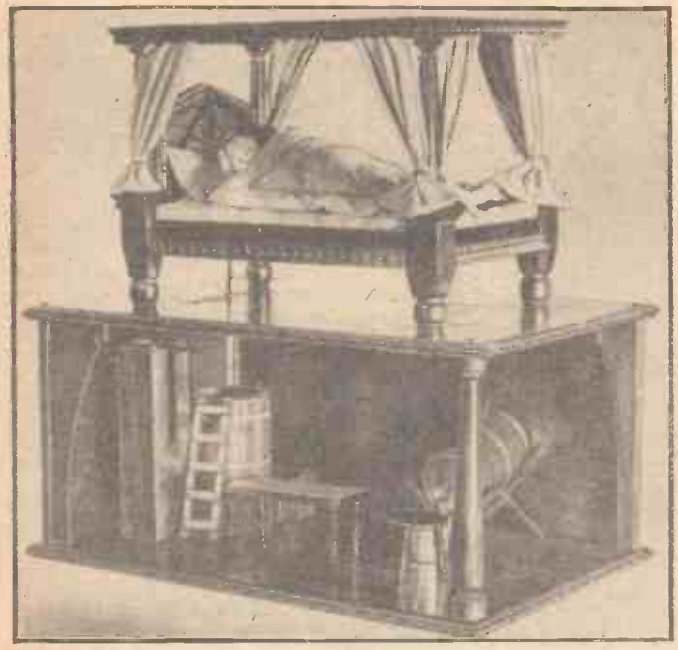
Assembling the parts

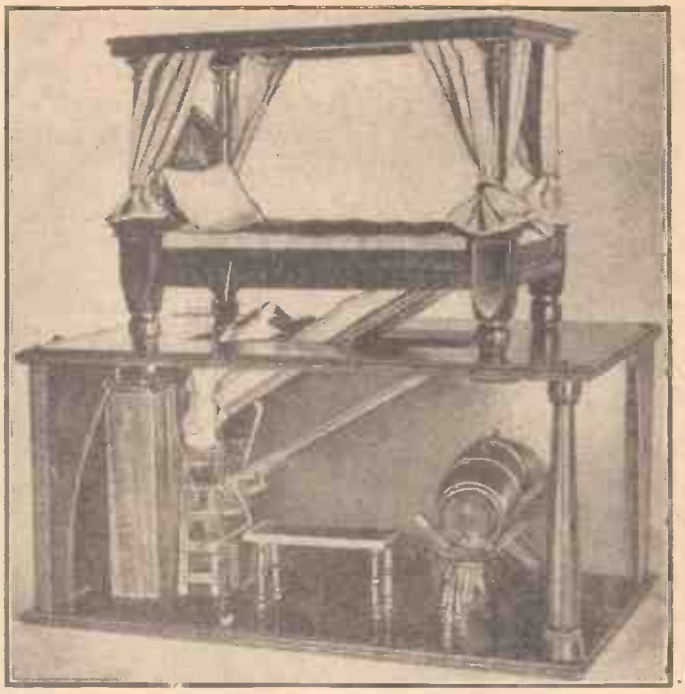
Before securing the parts together they should be glued, unless the screwing method mentioned above is adopted.

(To be continued.)



Figs. 136 to 140.—Tool for base, plug for chucking, and method of laying off and setting-in the spiral.





Above, the "victim" in bed. Right, the "victim" being debouched into the brewing vat. The model was made by Mr. F. J. Camm.

Model of a Famous Four-poster

Working Model of the Famous Tilting Bed by Means of which over 60 Murders were Committed at "The Ostrich" Inn at Colnbrook

By F. J. CAMM

ONE of the best sellers of the 17th century was a thriller entitled "Thomas of Reading," by Thomas Deloney. This story was recently broadcast and it has revived interest in an old inn built in 1106, "The Ostrich," situated opposite the 17th milestone from London along the Bath Road and in the ancient village of Colnbrook, which has the distinction of being located in three counties.

The Deloney thriller was based upon fact. In the days when this old inn was built there were no public houses or inns as we now know them. They were hospices erected by charitable-minded persons, such as monks and priests, to help those who travelled by road in those days of highwaymen.

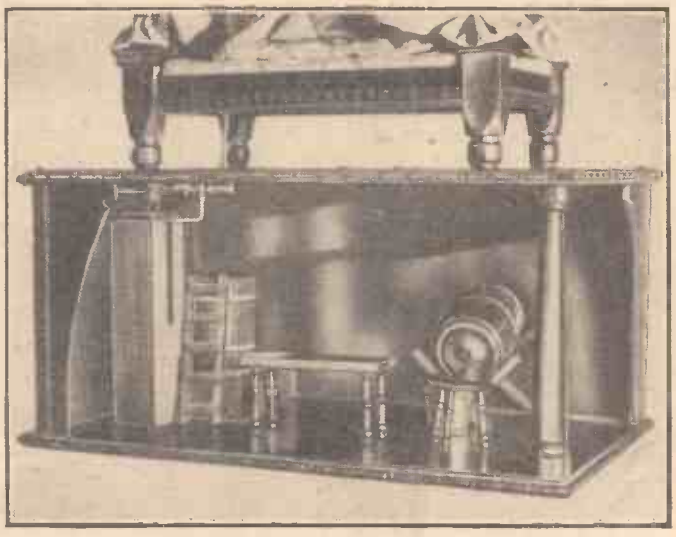
The Brewing Cellar

There were no brewers; each hospice had a brewing cellar and brewed its own beer, somewhat stronger and certainly much cheaper than that we buy to-day! The *hospice* at Colnbrook, a term which has been corrupted to *Ostrich*, was built by one Milo Crispen and bequeathed to the Abbot of Abingdon, near Reading, to be used "for the benefit of travellers in this world, and the peace of their soul in the next. (*Quoddam Hospitium in via Londinæ pud Colebroc*)."

Those were the days of the pack-horse and saddle, which was the only method of conveying goods and passengers. The post-chaise and the stage-coach did did not come till the middle of the 16th century. Neither was there a police force, nor communication between places except by means of "runners"; and it is therefore easy to see that highway robbery and murder could be carried out consistently and without much fear of detection. It seemed, indeed, as serious an offence to take a sheep as a life, for people caught in the former act were hung.

The hospices or taverns were the only means of communication between one town and another. Visitors would bring news and letters to these taverns for local distribution. Truly has it been said that the history of England is written in its inns.

To the taverns came the rich travellers loaded with money, for there were then no banks, and those who were not robbed by highwaymen were often robbed by the landlords of the time. Highwaymen and the bonifaces were in league with one another.



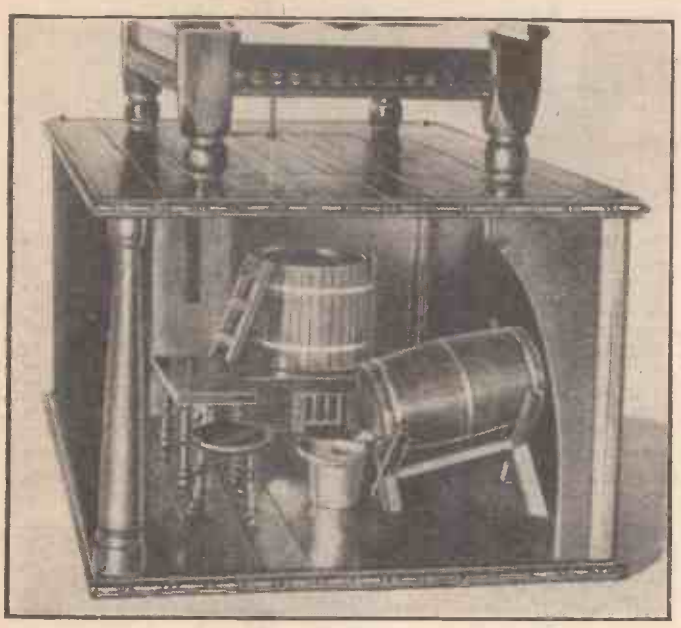
Another view of the brewing cellar.

The blue room at "The Ostrich," which was the lethal chamber for a long succession of predatory landlords, is still there for the visitor to see and to reflect upon the grim series of 60 murders enacted within its precincts. Most famous of the murders was committed in the 16th century by the landlord of the time, one Jarman, who, with his wife, made a profitable sideline out of the liquidation of their guests after they had retired for the night. They had a trap-door built in the centre of the blue room. As soon as a rich traveller arrived, Jarman would inform his wife that a fat pig was available if she wanted one, and she would reply by asking her husband to put him in the sty until the morrow.

The Lethal Bedstead

Now the bedstead was so contrived that a hinge on the trap-door would debouch the sleeper into the brew-house vat of boiling liquid immediately beneath.

A spy hole ingeniously secreted behind a cupboard provided the rascally landlord with a means of observing when the victim went to sleep; then the trap was released and the sleeping guest incontinently dropped into the boiling liquid especially prepared for him. With this picture of the lethal trap in mind, we may pass to the arrival of one Thomas Cole, a rich clothier with a business at Reading, who was one of the regular customers of the period. A successful business man, he always carried large sums of money with him, and it is not surprising, therefore, that he was marked out as the next on the list in the series of gruesome murders. Some-



Side-view of the brewing cellar.

how, he managed to escape on a number of occasions when the trap was set. The Great Fire of London prevented him from making an expected visit and on another occasion he was ill. On a third occasion a friend by the name of Gray, who lived at Gloucester, stayed with him. Naturally, the landlord became suspicious, even nervous at the succession of frustrations, for it seemed that Cole had a charmed life. The wife, however, nagged him for his nervousness, and for being such a coward as to suggest that on his next visit Cole should be permitted to sleep elsewhere whilst the trap was laid for a less elusive victim. There were the two of them, huddled like wizard and witch around the fire and the cauldron, arguing, until the wife eventually persuaded him to set the trap again.

The Last Victim

Cole was stupidly prevailed upon to make his will before he retired and to place it in the safe keeping of the landlord's wife. Jarman by this time was petrified with nervousness and the portent of coming disaster. His further appeals to his wife proved unavailing. Besides, a fair sum of money had been spent in preparing the fire and the vat, and so the deed was done.

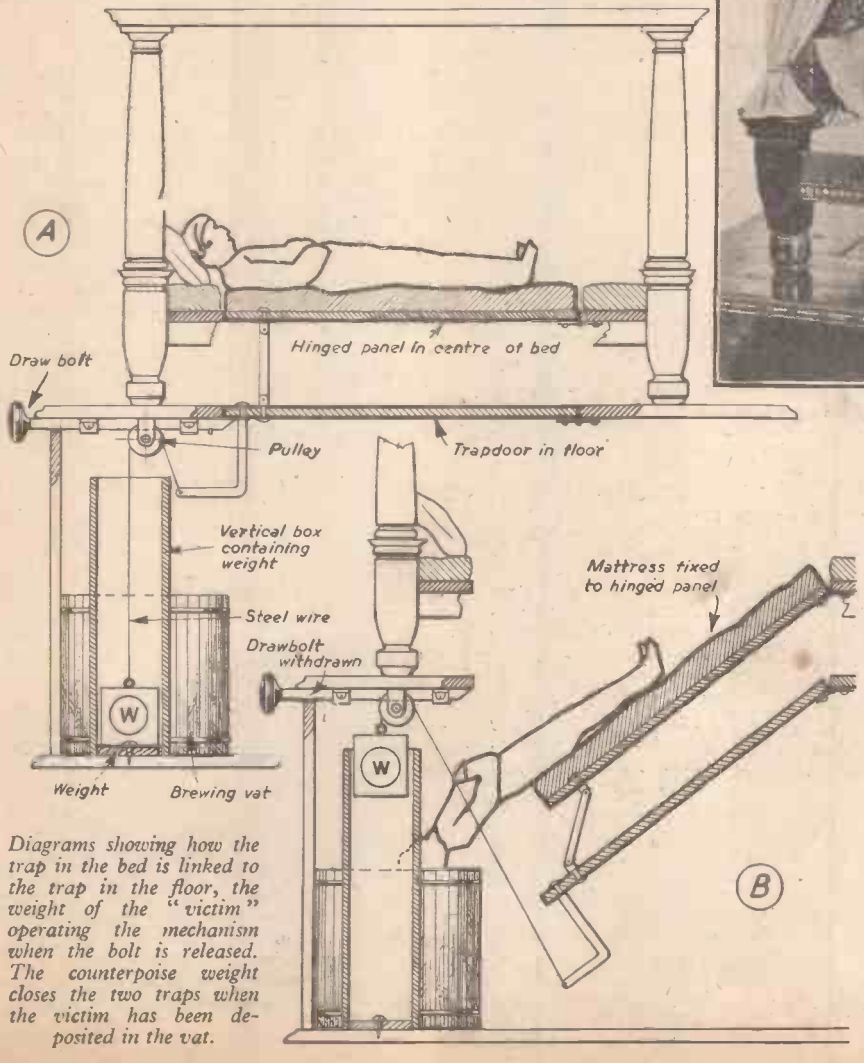
"Cole-in-the Brook"

Unfortunately for Jarman, Cole's horse was found wandering in the streets of Colnbrook and this caused a hue and cry for its owner, who was well known, and when last seen was entering "The Ostrich." His body was recovered some time later from a nearby brook, and it is said that the village takes its name from that incident—Cole in the brook, which has been corrupted to Colnbrook. However, whether true or not, it is a nice story and worthy of its setting. There is no need for me to record how the guilty couple were brought to book, compelled to confess, and punished, by what means is unstated but probably they were slung from one of the gibbets with which the old Bath Road abounded. There was one at Longford and several on the Heath. Anyway, that is the last reported murder that took place at "The Ostrich."

The Working Model

Deloney describes the bedstead in some detail, and it is from these details that I have constructed a working model to demonstrate exactly how it was done. It will be seen that the mattress is not in one piece.

A close-up of the famous four-poster.



Diagrams showing how the trap in the bed is linked to the trap in the floor, the weight of the "victim" operating the mechanism when the bolt is released. The counterpoise weight closes the two traps when the victim has been deposited in the vat.

The centre panel is attached to a hinged trap, connected by means of a connecting rod to a trap in the floor beneath. The bolt securing the traps in place operates underneath the trap in the floor. Attached to this lower trap is an arm carrying a rope which passes over a pulley and has a heavy counterpoise weight attached to its free end, the weight being obscured in a vertical casing.

The Counterpoise

This counterpoise weight is just sufficient to return the bed to its normal position once the sleeper has been precipitated into the vat beneath. It is, of course, lighter than the sleeper. Thus his own weight was made to operate the mechanism.

Dick Turpin, who disposed of most of his day's "takings" to the landlord of the time, narrowly escaped capture at this inn, at which coroners' and other courts were held. It was also used as a robing room for those on their way to Windsor Castle. The powder room is still there.

The model, which was recently unveiled by the Marquis of Donegall at the Ostrich Inn, Colnbrook, may be inspected by interested visitors.

Progress in Radio

Its Development and Possibilities for the Future

By Prof. A. M. LOW

IN the first year of the twentieth century three men wearing head-phones sat in a room in a Government building in Newfoundland listening intently. They had been listening for days when at last they heard a trivial sound, just the three dots that are "S" in the Morse code, but the cause of the sounds had travelled 1,800 miles from England and, scientifically, they were the fanfare to usher in a new era. They had bridged the Atlantic and it meant that now nation could speak to nation. Wireless telegraphy, still widely regarded as a toy, was showing itself something that would change the world.

Like all evolutions, it produced fear in those who had vested interests in things as they were. A telegraph company ordered Marconi out of Newfoundland because it had a monopoly of all telegraphic communications in that area. Even the great Edison suggested that it was atmospherics and not signals from England that they had heard.

But wireless telegraphy, which had bridged the English Channel only two years before, was a lusty infant, not to be restrained by old-fashioned nurses. Intercontinental wireless was born with the twentieth century and is perhaps its most typical product.

To-day, not yet in its prime, it is so grown that its parents of 1900 would not recognise it, and it has a rapidly increasing family of its own, apparently destined to bring great changes in every phase of life through the science of electronics.

From the dawn of history to the middle of the nineteenth century—just 100 years ago—the speed with which men could convey information was limited by the speed at which they could travel. In 490 B.C. Pheidippides dropped dead after running the 22 miles from Marathon to Athens to carry the news of victory in battle, giving a name to long-distance races. Over 2,000 years later, news of battles, births, deaths and other events was being conveyed in much the same way. The history of the world has been changed a hundred times because men in one part of the world could not learn what others were doing or thinking until weeks or even months later.

Instant International Communication

By the dawn of the twentieth century this was changing. For 60 years telegraph wires had been creeping across the land and cables under the sea, and for 20 years telephones had been linking houses and towns. But the change was slow, and it is only in the last 50 years that we have come to expect instant communication between all people and all nations. Even in World War I there were remote places in the world which knew nothing of the conflict for months or even years after it had started.

To-day, whether a man is on a ship a thousand miles from land, in an aeroplane flying three miles high or sitting in a hut in the Polar regions, he can be in instant communication with the centres of world civilisation. He can lift a telephone receiver and, almost instantly, be talking with any one of millions of people in the five continents, hearing them as clearly as you would your friend in the next street. A man can sit before a microphone in his study and speak so that he is heard by a hundred million people scattered over millions of square miles. A century ago men read news of events weeks and months old. To-day any event more than six hours old is considered "stale news."

All the ideas about "one world" are based on the changes that have taken place in communications in the first half of the century. The crude wireless was improved by the inventions of Professor Fleming and Dr. Lee Forest until we not only had radio-telegraphy but also radio-telephony and broadcasting. When the British Broadcasting Company built its headquarters it inscribed over the door the legend "Nation shall speak peace unto nation." It is the misfortune of the first half of the twentieth century that most of its great inventions have been devoted to war rather than peace, and that broadcasting has been used by nations not so much for speaking peace as making war.

Apparatus used for transmitting photographs by telegraphy and radio.

Left: Clipping the photograph to be transmitted on to the drum, or cylinder.

Above: Placing the cylinder, with photograph, in the transmitter.

The Effect of Broadcasting

Radio telegraphy and telephony have been of immense importance, but, when the history of the century comes to be written, it is broadcasting that may be noted as the most far-reaching invention of the first half. Until broadcasting, the audience of any one person was limited. He could speak to a few thousands, he could slowly reach some hundreds of thousands through the printed word, but at best he could hope to speak to only a small fraction of the population of a nation, a minute percentage of the people in the world. Broadcasting changed that in a decade. A man's audience became limited only by the number that could be persuaded to listen to him and could be counted in millions instead of thousands. Without broadcasting Hitler might not have risen to power. Without broadcasting there might not be the present wars of ideas;

How radio helps to speed-up London transport. An inspector at the Earls Court Report Centre communicates with a break-down vehicle. He can direct materials and men to "trouble spots" on any of London Transport's many bus routes and railway stations.

nations trying to persuade other nations into their own ways of thinking and acting. Without broadcasting there would not be the great exchange of information that exists to-day about other people's ways of living and entertaining themselves.

Its social effects have been profound, although not yet fully appreciated. It has, to give only one example, given millions an opportunity to hear good music and first-class entertainment, and has given them new standards of art. At the beginning of the century only a very small fraction of the population of civilised countries heard the best orchestras and musicians. It is a fact, however, that there are still more houses in the world without radio than with it. That will be changed in the second half of the century, when new manufacturing methods bring a radio receiver within the means of the poorest Chinese coolie.

Advent of Television

When the century began television was not even imagined. To-day it is a lusty child but still very much an infant, and the great feature of communications will be the growth of television.

The second half of the century starts with only a few countries able to receive television, and the number of sets in Britain less than half a million. By the time it ends there will be a television set in every home, probably of a quality which will make the set of to-day seem as quaint and old-fashioned as the 1922 crystal receiver.

World events will not be something to read about next day, but will be visible in every home. The landscape and entertainments of South Africa, for instance, will be almost as familiar to the Englishman as those of his native country and vice versa.

"Broadcast" Newspapers?

Radio to-day has many offspring still in swaddling clothes. There is "facsimile," by which pictures and print are permanently reproduced at a distance. The idea that a photograph taken in London should be available for reproduction in Cape Town, Sydney or New York a few minutes later would have seemed fantastic when the century began. Now it has become so common that no one remarks upon it.

By the time the century ends the reproduction by radio in a matter of minutes, not merely of single pictures but of hundreds of thousands of complete newspapers or even books, may well be an accepted part of life. Instead of using its present elaborate methods of distribution, a newspaper will "broadcast" itself, and a copy could be printed on the radio receiver of every subscriber and be waiting for him when he comes down to breakfast in the morning.

If the idea that the printing press as we know it will become unnecessary seems fantastic to-day, consider what anyone in the first year of the century would have said if you had told them that in 25 years' time a single person would be able to read the news every night to millions. Yet the fundamental discoveries of Hertz, Branly and others that make this possible had already been made—as the fundamental discoveries of radio-facsimile have been made to-day.

By A.D. 2,000 the carriage of letters as we know it to-day may seem as old fashioned as did the use of postboys in 1900. Facsimile machines will televise letters at the rate of hundreds a minute direct to post offices in all parts of every country, where they will be reproduced in a fraction of a second. By the end of the second half of the century, cargo-carrying aircraft may be travelling along the world's air highways without any human being aboard, their course dictated by radio "rails" and occasional orders from a human controller watching them from hundreds of miles away.

Mathematics as a Pastime

Shouting the Odds

By W. J. WESTON

YOU may, at times, simpletons being many, bet on a certainty. The penny thrown up will show head or tail when it comes to rest; you can safely wager against its standing on its edge. You put four white and five red balls into a bag; you need not hesitate in wagering that the first extracted will not be black. But what are the chances when certainty gives place to possibility? It is a fascinating study, one, indeed, of absorbing interest to a great number of people.

Suppose we let 1 stand for certainty and 0 for impossibility. Then for chance you have a fraction between 1 and 0; the chance of throwing a six with a dice is $\frac{1}{6}$, the dice having six faces and being unloaded; the chance of winning the toss is $\frac{1}{2}$. Very well, now do a few calculations.

The four white and five red balls, for instance; what are your chances of drawing out two whites in succession? Four out of nine are white; the chance of the first extraction giving you a white is therefore $\frac{4}{9}$. Three out of eight are now white; and your chance of the second extraction being white is therefore $\frac{3}{8}$. Combining those chances, you have $\frac{4}{9} \times \frac{3}{8}$, or $\frac{1}{6}$; a quite fair bet against your drawing out two whites in succession would be six to one.

Try another: what are the odds against throwing "snake's eyes"—two ones—at a single throw of two dice? Each of the dice has six sides and, each being unloaded, the probability of throwing one is for each of them $\frac{1}{6}$; $\frac{1}{6}$ combined with $\frac{1}{6}$ is 1/36. Your perfectly fair bet against two one's is therefore 36 to one against; if you offered odds of 30 to 1 you would be the winner, if not at first at all events after no long interval.

Suppose we assume—and our assumption does no injustice to the great majority of those that bet on the Derby—that no more is known about the horses competing than their names. Suppose we assume, too, that the competitors number 20. What is the probability of your spotting the winner? 1/20 clearly, for we exclude the very remote probability of a dead-heat. But now what are the odds against your naming the first and second past the post? Here 1/20 standing for the probability of your correctly calling the winner is combined with 1/19 for the probability of calling the second. It is 1/19 (not 1/20), since you have already allotted one horse to the first place. Now 1/20 combined with 1/19 is 1/380; the odds against your prophecy of the first two is, therefore, 380 to 1; the bookmaker that offered 200 or even 300 to 1 would soon be in affluence.

Possible Placings

Convince yourself of the truth of this last by considering the placings when only four horses run. The possible placings are 24: ABCD, ABDC, ACBD, ACDB, ADBC, ADCB (six possibilities when A is first, six when B, six when C, six when D). And the same pair of leaders always occurs twice in the series: 12, therefore, is the number of ways in which the first two horses come. The probability of naming them is, therefore, $\frac{1}{2} \times \frac{1}{2}$, that is, 1/12.

That we have simplified matters by omitting the possibility of dead-heats is clear. Admit that possibility and matters begin to be complicated. For instance, work this out for the fun of it. How many possible results attend a race by three horses? That the answer is 13 may at first seem strange. But consider: there may be dead-heats for first and also for second place; the three horses may even, like a well-trained troop, keep nose level with nose. So here are the results: A B C, A C B, B A C, B C A, C A B, C B A (six possibilities excluding dead-heats), AB C, AC B, BC A (three dead-heats for first place), A BC, B AC, C AB (three dead-heats for second place); and ABC.

The Atomic Bomb

Official Technical Facts About Its Power

By "TECHNICUS"

THERE has been a great deal of speculation on the exact effects of an atomic explosion, so that the newly-issued volume on the subject by the Department of Defence and Atomic Energy Commission, entitled "The Effects of Atomic Weapons," will be welcomed by technical men all over the world. It may not be a subject over which one can enthuse, by its forbidding nature, but such weapons having been, regrettably, invented, there is nothing left but to try and understand their significance. The following facts, based on the official facts issued in America, will bring home to us the devastating nature of an atomic bomb.

For the purpose of illustrating the practical effects a "nominal atomic bomb" of one kilogram of uranium 235 has been taken as a yardstick. This is equivalent to about 20,000 tons of T.N.T., being the size of bomb, more or less, which has been used by the United States up to now. In 1945 the famous Smyth report on atomic energy was issued with the sanction of the authorities in America, that being the most comprehensive picture of the subject up to then. This latest volume of facts brings the story up to 1950, and includes the results of the Bikini "Baker" tests in the Pacific, about which we, in this country, read so much in 1948.

There is a characteristic difference between the explosion from T.N.T. and that from atomic material. In the former the unstable chemical, Trinitrotoluene, oxidises explosively, giving rise to a violent pressure wave, which is termed blast. The maximum temperature reached in the explosion is about 5,000 deg. C. With the uranium bomb the maximum temperature attained is in the vicinity of 1,000,000 deg. C.

"Ball of Fire"

There are well defined phases in the development of the explosion. When the uranium breaks up enormous heat is developed in a fraction of a second. There is created a *ball of fire*, to use the official description, which has a diameter of 45ft. in one ten-thousandth of a second after the commencement of the atomic disintegration. The temperature of this *ball of fire* is initially so high that it makes the surrounding air luminous, to the extent that, at a distance of six miles from the seat of the bomb, the light is 100 times the intensity of the sun at the surface of the earth.

A shock wave then develops, moving out at tremendous speed. In 15 milliseconds (a millisecond is one-thousandth of a second) the *ball of fire* has reached 300ft. diameter and its outside temperature is about 5,000 deg. C., which incidentally is hot enough to melt steel. At this stage the shock wave is travelling at 15,000ft. per second and this phase of the explosion is termed the *breakaway*. In effect it represents the concentrated explosion spreading out or fanning out. In one second the *ball of fire* has reached a diameter of 450ft. to become 1,500ft. about ten seconds later.

In itself this *ball of fire* represents something terribly destructive, but the shock wave that moves out from it appears to have a mechanical effect quite unlike that produced by T.N.T. in producing *mass distortion* of buildings. A survey of the damage caused by the atomic bombs dropped on Japan indicates that buildings were engulfed by the pressure wave, while roofs were thrust down from above, the reason for this being fairly well understood. Immediately after detonation of the bomb there is a rapid rise

A remarkable photograph of the great cloud following the test explosion of an atomic bomb over Bikini.

in pressure, followed by a fall in pressure for about one second. There follows a suction wave which is also very destructive, the pressure giving rise to a violent wind, while the suction causes the wind to reverse its direction. A close study has been made of the theoretical aspects of this pressure wave effect, and the destructive effect of the bomb at various distances from its source can be estimated. It might be added that after ten seconds, when the *ball of fire* has increased to 1,500ft., the shock wave will have moved out about two miles, the damaging effect then subsiding.

Optical Effects

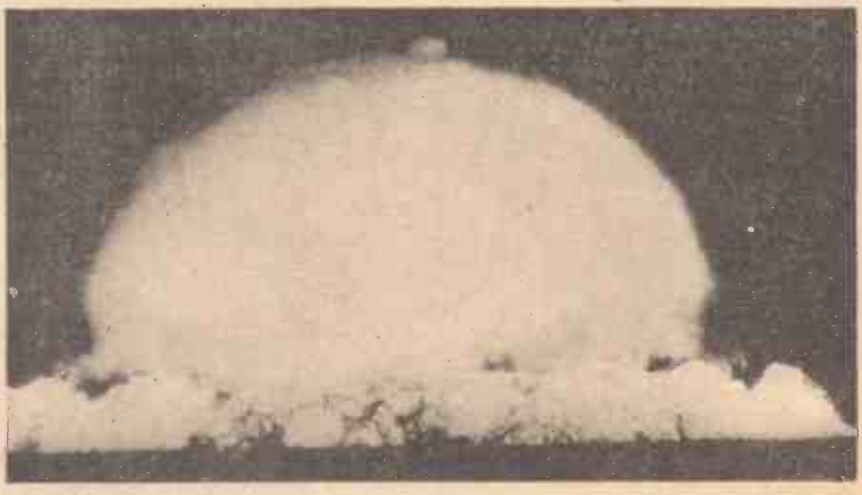
One remarkable phenomenon observed after such an explosion is a violet glow in the air which persists for some time. This is considered to be due to the formation of oxides of nitrogen out of the air. The peach-like colour of the clouds over the Bikini Atoll during the Pacific experiments was deduced to be nitrogen dioxide, of which about 100 tons are thought to be formed during an explosion.

Reference has already been made to the light emitted during the early part of the explosion. This is due to the tremendous temperature to which the surrounding air is raised, the latter assuming a dazzling incandescence. It is not hard to visualise that an atomic bomb detonated at night would turn night into a brilliant daylight for a short period; far in excess of any artificial light which has been created by man up to now.

Another unusual effect noticed shortly after detonation is the *cloud-chamber effect*. As is generally known, air contains water vapour, and on a warm, humid day it may be saturated with water. If the air is cooled slightly deposition of the moisture takes place, either in the form of a cloud, fog or, as is customary in summer in Britain, as night dew. Shortly after the burst the shock wave gives rise to a very high air pressure, followed by a rarefaction. As a consequence there is formed a large cloud in the sky some distance from the *ball of fire*, the distance depending on the position of the rarefaction zone.

General Effects

The effect of an atomic bomb will, of course, vary according to where it is detonated. The outcome will be very different when the explosion takes place



Taken at a range of six miles, this photo records the mushroom-shaped cloud after the historic atomic bomb test in New Mexico which preceded the use of the atomic bomb against Japan.

under the sea from when it occurs a few feet above the ground. If it is detonated about 500ft. from ground level the *ball of fire* will, in the space of about one second or two, touch the ground. Anything that comes within its orbit will be heated to a high extent, and metals will be vaporised. There will be a great upheaval of molten metal and other debris, but for one-pound uranium bombs exploded at more than 500ft. there will not usually be a crater formed.

There has been much loose talk about the effect of radiations from this weapon. When the bomb explodes near the ground the dust created by the disintegration of structures and from other causes will become irradiated or become radioactive. When this dust settles it will provide a hazard to human beings, but if the burst takes place at a height of, say, 1,000ft. or more, the danger from radioactive dust particles is lessened, and the gamma rays from the explosion itself are largely dissipated in the surrounding atmosphere. All of this is, however, relative, and it is difficult to generalise. Measurements have been made of the height to which an atomic cloud, or the effects of an explosion, will reach into the air. On theoretical grounds it had been estimated that the upper limit would be that of the stratosphere, and observations have confirmed that at the "Trinity" test at Alamogordo with a "nominal" size atomic bomb. There had also been a thought that a burst would lead to thunderstorms but experiments have, so far, failed to confirm this.

Under-water Explosion

When the atomic bomb was exploded under water at the "Baker" Bikini test the plume of water thrown up rose to 8,000ft., with a maximum diameter of 2,000ft. This plume formed, as it were, a hollow column the wall of water being about 300ft. thick, containing a million tons of water. On falling back this huge quantity of water created a mist wave of 1,000ft. high, which behaved like a homogeneous liquid due to the density of liquid droplets. This is called the *base surge*, and forms within about ten seconds after the initiation of the explosion. This rushed along at high speed over the surface of the lagoon at Bikini and created what seemed to be a violent rain storm, but as it moved forward it lifted off the surface of the sea and assumed the character or appearance of a heavy cumulus cloud.

It is evident that much is known about the progress and effects of an atomic bomb, the scientific data having been mainly derived from the series of carefully controlled experiments in the Pacific.

Making a Toboggan

A Strong Toboggan Made Chiefly with Tubular Conduit

By G. LORD

THE accompanying illustrations show a strong machine which can be made with ordinary tubular conduit.

Constructional Details

The conduit used is 1in. diameter and was bent by a blacksmith who first packed it with dry silver sand to prevent flattening on the small radii.

The ¾in. conduit was then cut to length, welded between the flattened ends of the 1in. diam. conduit and the main runner (Fig. 1).

Next, the 1¼in. by ¼in. M.S. flat iron was cut and bent, and one end was notched out to suit the ¾in. diam. conduit. The flat iron stays were then welded to the ¾in. conduit, as shown in the cross section, Fig. 2.

The flattened ends of the 1in. diam. conduit and the free ends of the flat stays were then drilled with a 11/32in. diam. drill, to suit 5/16in. bolts.

The 2½in. by ¾in. by 3ft. hardwood was placed on the runners, marked off and drilled for the bolts, and then securely fastened.

The Platform

The lengths of tongued and grooved boards were drilled for 2 5/16in. wood bolts in each end, at a distance of 1½in. from the edge. These were then laid on the 2½in. by ¼in. by 3ft. pieces and the holes marked out and drilled. Finally, the holes were drilled through the tongued and grooved boards to take the bolts for the stays.

Care should be taken to see that the runners are parallel before drilling the 2½in. by ¾in. by 3ft. pieces, and that the runners are vertical before drilling for the bolts for the stays.

MATERIALS REQUIRED

2 pieces of 1in. diam. conduit, 9ft. long.
1 piece of ¾in. diam. conduit, 4ft. long.
1 piece of 1¼in. by ¼in. M.S. flat 3ft. long.
2 pieces of 2½in. by ¾in. by 3ft. hardwood.
14 5/16in. bolts—cup head and sq. neck with nuts and washers—2in. long.
4 5/16in. as above but 1¼in. long.
Enough tongued and grooved planed board 1in. thick to form a platform 3ft. long and 1ft. 6in. wide.

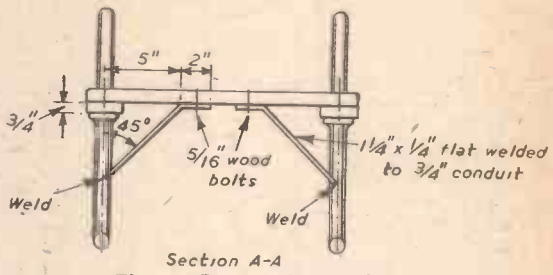
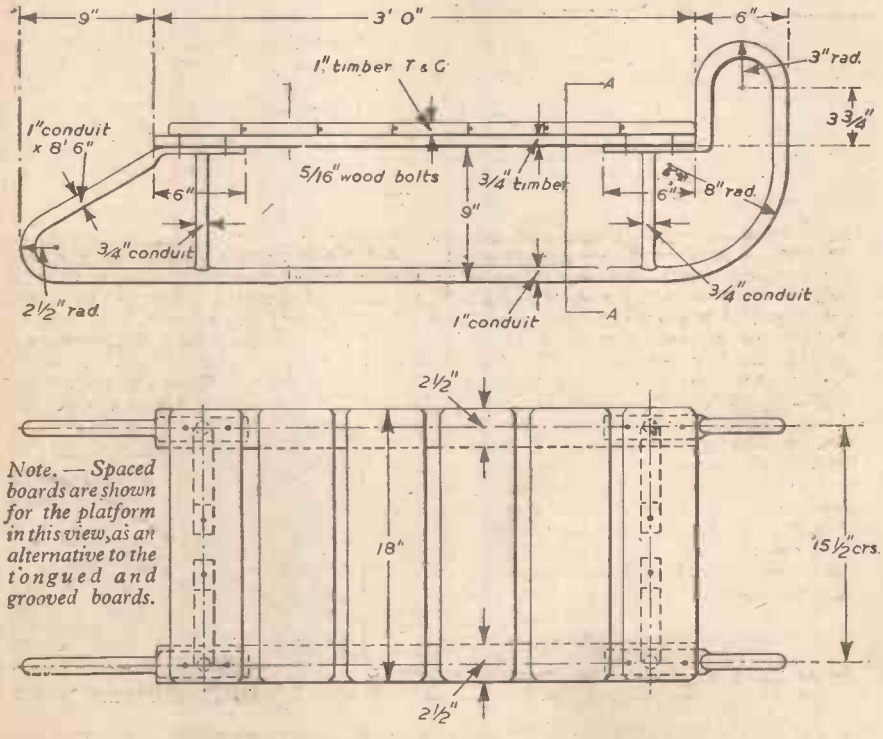


Fig. 2. Cross-section showing the welded stays.



Note. — Spaced boards are shown for the platform in this view, as an alternative to the tongued and grooved boards.

Fig. 1. Side elevation and plan of the completed toboggan.

Direct-current Motors

Their Characteristics and Performance

By J. L. WATTS

THE operation of an electric motor under various conditions depends to a large extent on the design of the motor. In order to be able to utilise a motor to its full capacity, or to modify its operation to suit new conditions, a knowledge of the characteristics of the various types of motors is extremely useful.

It is a well-known fact that the speed of a motor usually changes to some degree when its load is increased or decreased; in fact, this is characteristic of all types of power plant.

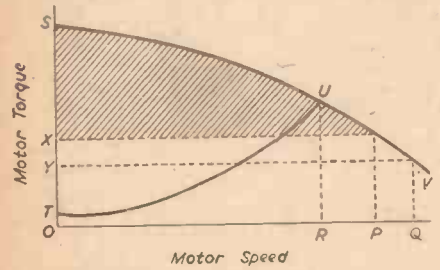


Fig. 1.—Starting conditions with a permanent-magnet motor.

Provided that the throttle is not opened to increase the power of a motor-car engine when climbing a hill, i.e., when the gravity load is increased, the speed of the engine will fall. The engine speed, in fact, often falls even when the driver has opened the throttle to its full extent, owing to the engine having insufficient power to maintain its speed against the increased load torque. Hence the need for altering the gear ratio to reduce the load torque on the engine, so that the engine can run at high speed whilst driving the car up the hill at reduced speed. In the case of a stationary engine which may drive a dynamo or a works load, a speed-controlled governor is fitted which automatically increases the oil, gas or steam fuel supply to the engine, should its speed fall owing to increased load. The engine speed will then be maintained within certain limits, provided it is not loaded beyond its capacity.

The Permanent-magnet Motor

Now each type of electric motor has its own peculiarities, which determine the speed at which the motor will run against a given load. The torque created in any direct current (D.C.) motor is due to the reaction between the current-carrying armature conductors and the magnetic field flux produced by the field magnets. The torque T is proportional to $I_a \phi$, where I_a is the armature current and ϕ the magnetic field strength. It is very convenient to consider first the simple type of motor which is used for driving certain small models, namely the permanent-magnet motor. This machine is suitable for direct current only, and cannot be used on alternating current.

Such a small motor is usually started up by switching it directly on to the supply of voltage V, generally provided by a battery. Under these conditions the armature current which flows at the instant of switching on will be given by $I'_a = \frac{V}{R_a}$ amps., where R_a is the resistance of the armature in ohms. The strength of the permanent magnet field magnets will be taken as ϕ. Thus the motor will develop an initial starting torque which is proportional to $I'_a \phi$. $T' = k\ I'_a \phi$, where k is a constant for the motor. If this torque is greater than the resistance torque of the load to which the motor is mechanically coupled, the excess torque will cause the motor to accelerate the load from rest. The rate of acceleration will be proportional to the amount by which the motor torque exceeds the load torque at any speed, and inversely proportional to the moment of inertia of the armature and its coupled load.

Generation of Back e.m.f.

As the armature rotates its conductors cut across the magnetic field ϕ, and this action generates in the armature windings an electromotive force or voltage e_a the value of which is proportional to the product of armature speed and the field strength ϕ. Actually, the strength of the field magnet flux ϕ which acts on the armature is not absolutely constant, even though it is from a permanent magnet, because it is reacted on by a magnetic field which is created by current in the armature conductors. This effect is comparatively small, however, so that we can consider ϕ to be practically constant; thus, the back e.m.f. e will be proportional to the speed of the motor.

The back e.m.f. opposes the supply voltage so that, as soon as the motor starts to turn, the armature current falls from the value $I'_a = \frac{V}{R_a}$ amps to $I''_a = \frac{V-e}{R_a}$ amps. The motor torque will fall from the value $T' = k I'_a \phi$ to the value $T'' = k I''_a \phi$. $T'' = \frac{V-e}{V} T'$

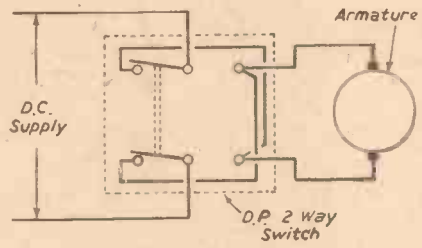


Fig. 2.—Connections of reversing switch for a permanent-magnet motor.

The curve SV in Fig. 1 indicates how the torque of the permanent-magnet motor falls as the machine speeds up at starting. The motor will continue to accelerate with falling torque so long as its torque is greater than the load-resistance torque. When the motor torque and the load torque are exactly equal acceleration will cease, and the motor will continue to run at a steady speed. The shaded area in Fig. 1 shows the accelerating torque available when the motor starts up against the steady load torque OX, and OP will be the steady speed reached by the motor against such a load. When started up against the steady load OY the rate of acceleration will be greater, owing to the increased difference between the motor torque and the load torque at starting; the motor would then accelerate to the steady speed OQ. The resistance torque of certain types of load is not constant at all speeds; for example, the load torque of a centrifugal fan or pump increases with increase of speed, as indicated by the curve TU in Fig. 1. Against such a load the motor would accelerate to the speed OR.

Effect of Load Variation

We will now consider the effect of increasing the load on a motor which is running at a steady speed, for example, the effect of increasing the load from OY to OX. The immediate result is that the load resistance torque is now greater than motor torque, consequently the motor will slow down somewhat. This reduces the rate at which the armature conductors cut the magnetic field flux ϕ, and will thus reduce the back e.m.f. The armature will then draw an increased current from the supply, since $I_a = \frac{V-e}{R_a}$, in consequence of which the motor torque (equal to $kI_a \phi$) will be increased. Thus the motor torque and current increase automatically as the speed falls, the conditions being exactly opposite to those obtaining during starting. Fall of speed will be arrested when the motor torque has risen to the same value as the new load torque OX, and the motor will then run at the steady speed OP, the fall of speed being equal to PQ. Fig. 3 indicates the variation of armature current with load torque, whilst the curve A in Fig. 4 shows how the motor speed varies with the load torque.

When current passes through any conductor, such as the windings of a motor, heat is developed at a rate which is proportional to I^2R, where I is the value of current flowing through the winding of resistance R ohms. This heat causes the temperature of the winding to increase more or less gradually; whilst the increased temperature of the winding causes heat to be dissipated to the surroundings in various ways, as by radiation, conduction, and by air which comes into contact with the windings. It follows that a motor which runs on a steady load and is fed from a steady voltage supply will eventually reach a certain temperature at which heat is being dissipated at the same rate as it is generated in the machine. The continuous full load rating of a motor is the load which the motor can drive continuously without reaching so high a temperature that there is risk of rapid deterioration and premature failure of the insulation.

Motors which are used only for short periods at a time are often "short time rated." Such motors are only intended to develop their short-time-rated power for certain stated periods, and must have intervals of rest between operations, during which the motors can cool down. If a short-time-rated motor is used continuously on its short-time-rated power it is likely to reach a dangerously high temperature.

Since the starting current of a motor is usually greater than the running current taken on full load, a motor is likely to be damaged by overheating if left switched on when coupled to a load which is greater than that which it is capable of starting. In addition to the increased rate of heat generation in the motor when stalled, the rate of heat dissipation from the machine is also reduced

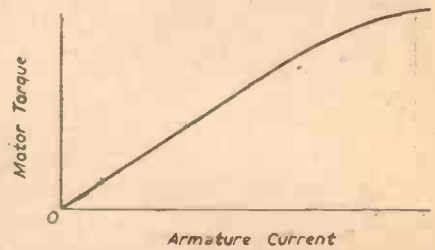


Fig. 3.—Variations of torque with armature current in a permanent-magnet motor.

because the stationary armature has no fanning action.

Reversal of Permanent-magnet Motor

The rotation of a D.C. motor may be reversed by reversal of the armature current or the polarity of the field magnet poles. The poles of the permanent-magnet motor have a fixed magnetic polarity, hence this motor can be reversed by reversal of the armature current. A double-pole two-way switch can be used for this purpose, as shown in Fig. 2. If the switch has an "off" position as well, the one switch can be used to stop the motor or to start it in either direction. The permanent-magnet motor is the only D.C. motor which can be reversed by simple reversal of the supply to the motor. This feature has considerable advantages in the case of a model train, for example, as it simplifies the control circuit very considerably.

Speed Control of Permanent-magnet Motor

As mentioned previously the torque developed by a D.C. motor is proportional to $I_a \phi$, or $T = k I_a \phi$, where k is a constant for a particular motor. In the permanent-magnet motor the torque developed is thus practically proportional to I_a. Now I_a is proportional to the difference between the applied voltage V and the back e.m.f. e generated in the armature. $I_a = \frac{V-e}{R_a}$ amps.

In a given motor e is proportional to the product of field flux ϕ and the speed N revs. per sec. In the permanent-magnet motor e is thus practically proportional to N, or $e = k_1 N$ where k_1 is a constant for the motor.

Thus the torque T is equal to $k\phi I_a = \frac{k(V-e)\phi}{R_a}$.

or $T = \frac{k(V-k_1 N)\phi}{R_a}$. $R_a T = k(V-k_1 N)\phi$,

thus $N = \frac{Vk\phi - R_a T}{k_1 \phi}$.

It will be noticed that the speed of the motor on any given load torque T can be reduced by increasing the value of R_a, by connecting a resistance in the armature circuit. The effect of such a resistance is indicated by the curve C in Fig. 4. As the load torque increases so does the effect of the resistance. This effect is largely responsible for the increased variation of motor speed on a varying load when using a series control resistance. The speed of the motor on any given load can also be altered by altering the supply voltage V. The effect of an increase of voltage is indicated by the curve D, whilst the curve B shows the effect of using a reduced voltage.

Modification for Different Voltage

In order to use a motor on a different voltage than that for which it was designed, without appreciable alteration of its full load torque and speed, it is necessary to alter the constants k and k_1 of the motor, which is effected by changing the number of turns in the armature winding. Now the voltage V applied to an armature is used in overcoming the back e.m.f. e, and in overcoming the volt drop in the armature circuit. The latter volt drop is equal to $I_a R_a$, plus about two volts total drop at the positive and negative brushes. In a large motor, $I_a R_a$ will be comparatively low compared with e, so that e may be taken as practically equal to the applied voltage V. (See Table I.) In such a motor the speed N, which is proportional to $\frac{e}{\phi}$, will be practically proportional to V. Thus in order to run the motor at the original speed on changed voltage the number of armature turns should be altered in proportion to the voltage applied to the armature. The largest possible size of wire should be used so that the motor can develop maximum power without overheating. Usually it will be necessary to change the cross-sectional area of the wire in inverse proportion to the voltage, i.e., the diameter of the wire in inverse ratio to the square root of the voltage.

When the turns are changed in proportion to the voltage it is reasonable to assume that $I_a R_a$ will be changed in the same proportion. However, it is necessary to make allowance for the volt drop at the brushes when making changes in motors of very low voltage. For example, we will consider a 12-volt permanent-magnet motor which is required to be run at approximately the same speed on eight volts, the original armature winding having S turns per coil. On such a low-voltage motor it is suggested that the armature turns be made proportional to (V—2) volts instead of V. Neglecting the volt drop the new winding would have $\frac{8}{12} S$ turns per coil, or 66.7 per cent. of the original turns. Allowing for the brush drop the new winding would have $\frac{(8-2)S}{12-2}$ turns per coil, or 60 per cent. of the original turns.

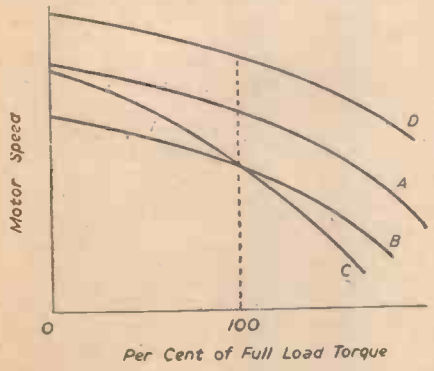


Fig. 4.—Speed control curves of a permanent-magnet motor.

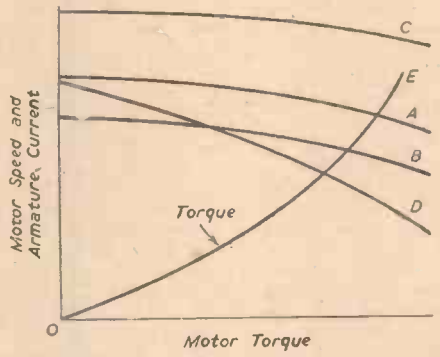


Fig. 5.—Characteristics of a typical shunt motor.

Modification for Changed Speed

If it is required to change the speed of a permanent-magnet motor from N to N_1 revs. per second, without change of voltage, the number of turns per armature coil should be altered in inverse proportion to the speed. When reducing the speed of a motor in this way it is usually necessary to use smaller wire in order to accommodate the required number of turns in the armature slots. This reduces the safe full load current and usually reduces the power of the motor, horse-power being proportional to the product of torque and speed. The full load torque is usually unaffected by such a change, as this is proportional to the produce of field strength and armature ampere-turns. A slow-speed motor is usually less powerful than a high-speed motor of the same dimensions.

The Shunt Motor

The shunt motor has very similar characteristics to those of a permanent-magnet motor, but is made in very much larger sizes, as well as fractional horse-power sizes. In this motor the field magnetism is created by the field coils, which have a large number of turns of relatively fine wire, which are connected across the supply when the motor is running, as may be seen from Fig. 6. On a supply of constant voltage, therefore, the field current I_f and the magnetic field flux ϕ are practically constant, and almost unaffected by the amount of load which is driven by the motor. Due to this feature the speed of a shunt motor varies little from no load to full load, as indicated in the curve A in Fig. 5. This characteristic is particularly suitable for most industrial drives.

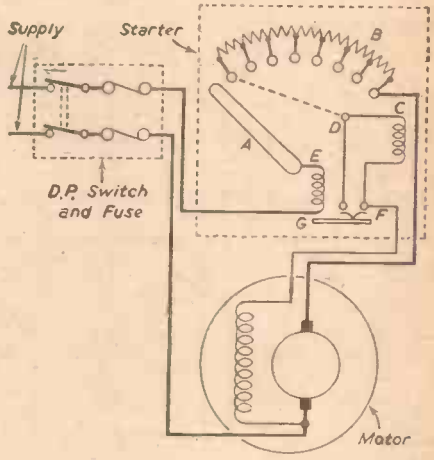


Fig. 6.—Connections of a shunt motor starter with under-voltage and over-current releases.

Starting the Shunt Motor

Shunt motors up to about half horse-power may be started up by switching them direct on to the mains, but larger motors

Horse Power of Motor	Armature Volt Drop ($I_a R_a$) Voltage of Motor				
	115	230	460	500	600
0.5	16.5	31	67.5	74	89
1	12.5	23.6	53	57	65.2
2	14.4	28	56	60	72.5
3	14.3	27.5	55	57	72
4	12.2	23	46	50	60
5	9.7	18.4	34	37	46.2
7.5	8.1	15	29.4	31	38.5
10	8	15.2	28.5	30.5	37.5
12.5	7.9	14	28.8	30.8	36
15	6.9	13.8	28	31.2	35.5
20	6.1	11.5	23.4	26.2	30.8
25	5.7	10.8	23.5	26	31.5
30	6.3	11.9	24.2	26	31.5
35	6	11.2	23.2	25.5	30.2
40	6	11.4	22.3	24.4	28.5
45	5.4	10.4	21	23.3	28
50	5.2	9.6	19.6	21.3	25
60	4.9	9.5	19.2	20.8	24.5
80	3.9	9.4	18.6	19.5	24

TABLE I.—FULL LOAD VOLT DROP ACROSS ARMATURES OF TYPICAL D.C. MOTORS

require a starting resistance in the armature circuit to limit the starting current, as indicated in Fig. 6. If a shunt motor is started up with no starting resistance in the armature circuit the initial armature current I_a will be equal to $\frac{V}{R_a}$, where V is the supply voltage and R_a the resistance of the armature. A ½ h.p. 230-volt motor may have a full load current of 2.4 amps. and armature resistance of, say, 13 ohms. The initial armature current when started direct on line would be equal to $\frac{230}{13}$ amps., i.e., 17.7 amps., or 7.35 times the normal full load current. A 20 h.p. 500-volt motor may have a full load current of 33 amps. and armature resistance of 0.77 ohm. The initial armature current of this motor when started direct on line would be equal to $\frac{500}{0.77}$ amps., i.e., 650 amps. or 19.7 times the normal full load current.

Due to the generation of a back electromotive force (e) the armature current falls as the motor accelerates, but the following difficulties may be experienced in attempting to start a large motor by switching direct on line:

(1) The high starting current may cause a momentary volt drop on the supply mains which is sufficient to cause dimming of connected lamps.

(2) The brushes may be unable to commutate the high armature current, resulting in flashing across the commutator and possibly short circuits between brushes of opposite polarity.

(3) The motor would develop a very high torque, which might cause very rapid acceleration and damage to the motor, the driven plant, or the power transmitting medium.

(4) It would be difficult to protect the motor properly against excess current during running without the protective device operating at starting.

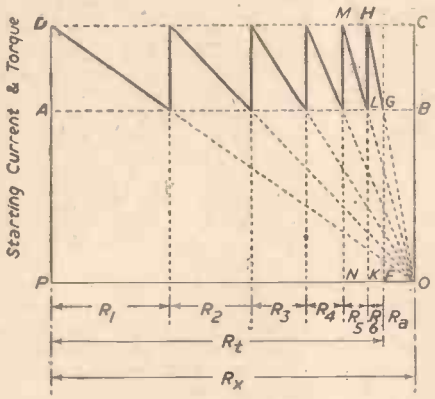


Fig. 7.—Graphical method of finding values of resistance steps for shunt motor starter.

Control of Starting Conditions

It is common practice to design the sections of starting resistance to keep the maximum starting current within a certain limit, say 1.5 times the full load armature current I_1. The total resistance R_x of the armature circuit necessary to limit the armature current to the value of 1.5 I_1 on a supply of voltage V is given by $R_x = \frac{V}{1.5\ I_1}$. Assuming that the magnetic field strength ϕ is constant the motor torque, which is proportional to $I_a\ \phi$, will then be 1.5 times the normal full load torque on the first stud of the starter.

Assuming that this is greater than the load resistance torque to which the motor is coupled, the excess torque will cause the motor to accelerate. As the armature revolves its back e.m.f. e will rise, opposing the supply voltage so that the armature current will fall to the value $I'_a = \frac{V-e}{R_x}$. As the armature current falls so will the motor torque, acceleration ceasing when the motor torque has fallen to the same value as the load torque. When started up against constant full load torque the armature current will then have fallen practically to the full load running value. If the motor was started against a lower torque it would accelerate to a higher speed on the first starter stud (see Fig. 7).

(To be continued)

The "Buddicom" Express Locomotive

France Lends the Festival a British Locomotive

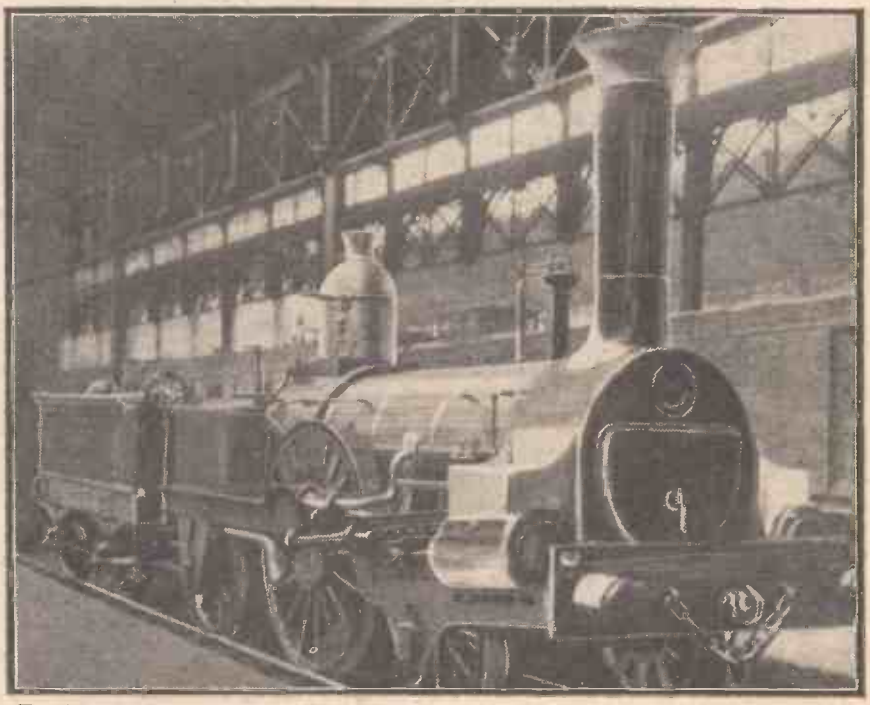
A LOCOMOTIVE which typifies the enormous impact that British engineers of 100 years ago had on railway development in overseas countries, will be shown at the South Bank Exhibition of the Festival of Britain, 1951.

The locomotive, a 2-2-2 Buddicum express passenger engine belonging to the French Railways, was built by Allcard Buddicom and Cie, at Chartreux, near Rouen, in the early 1840s. Greatly esteemed on the Continent as one of the outstanding early contributions to steam locomotive development, the "Buddicom" is still in running order after a century of service. Though its equally famous contemporary, the "Crampton," achieved its greatest fame only in France (a fame which is still undimmed there), the "Buddicom" was to be found during the 19th and part of the 20th century in most of the countries of Europe. It figured on railways in Italy, Spain, France, Canada, and elsewhere, and was long favourite on railways in this country, where it was known as the "Crewe" type.

The association of three men was responsible for the "Buddicom's" development and wide use. They were Joseph Locke, one of the great railway civil engineers who designed railways in France, Spain and elsewhere; Thomas Brassey, perhaps the greatest figure among public works contractors (100 years ago he employed over 70,000 men on railway construction throughout the world, and his contracts amounted to the staggering figure of £28,000,000); and William Barber Buddicom, one-time Locomotive Superintendent of the Grand Junction Railway.

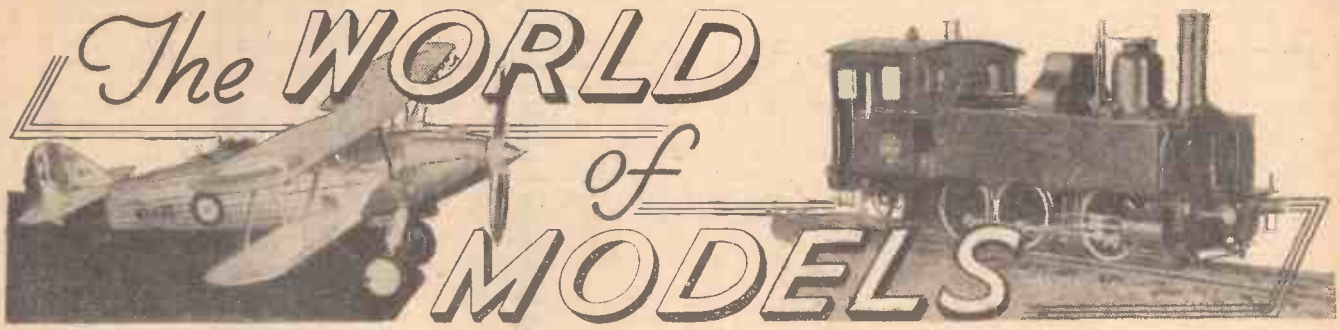
Mr. Harold Wyatt, of the Council of Industrial Design, who is responsible for the railway exhibits at the Festival of Britain, seized on the "Buddicom" as one of the most important links in the story of Britain's early world railway prestige. His interest in this engine was echoed in France, and as a result of the whole-hearted co-operation of the French Railway administration, both in Paris and London, the locomotive will be exhibited in 1951. Mr. Wyatt found great evidence of the British railway tradition in France, even meeting in M. Maurice Cook, a railway telegraph linesman of the Western Region of French Railways, a descendant of one of Buddicom's engine drivers.

Recently fully overhauled in the French Locomotive shops, the "Buddicom" will leave Paris early in January, 1951, and will travel to Dunkirk, where it will be shipped on the train ferry to Dover. From Dover it will make its journey to Bricklayers' Arms Station, London—the first known occasion on which a foreign-built Buddicom locomotive will have been seen in the country whose engineering skill produced it.



The "Buddicom" express passenger locomotive, built in the early 1840s, which the French Railways are loaning to the Festival of Britain.

The WORLD of MODELS



Model Calorimeter Building : Exhibition at Leicester

By "MOTILUS"

ONE of the most interesting and useful sections of the Department of Scientific and Industrial Research is the Fuel Research Station. This section carries out tests on domestic heat-producing units of any manufacturer on their request. For this purpose a calorimeter building was specially constructed at the station. It consists of cabinets in which heating appliances are installed for operation and measurement of their performance.

The tests give a complete record of the behaviour of appliances under various operating conditions. It is possible to measure radiant heat, warmed air from convention jackets and heat passing to boiler water: also total useful heat from whatever appliance is being tested can be directly measured.

A sectional model of this calorimeter building, to a scale of ¾in. to 1ft. (Fig. 1), was built for the station by Messrs. Bassett-Lowke, Ltd. This model was exhibited this year at the London "Model Engineer" Exhibition on the stand of the Department of Scientific and Industrial Research. It proved of great assistance to visitors interested in the technical side of the work of the Department.

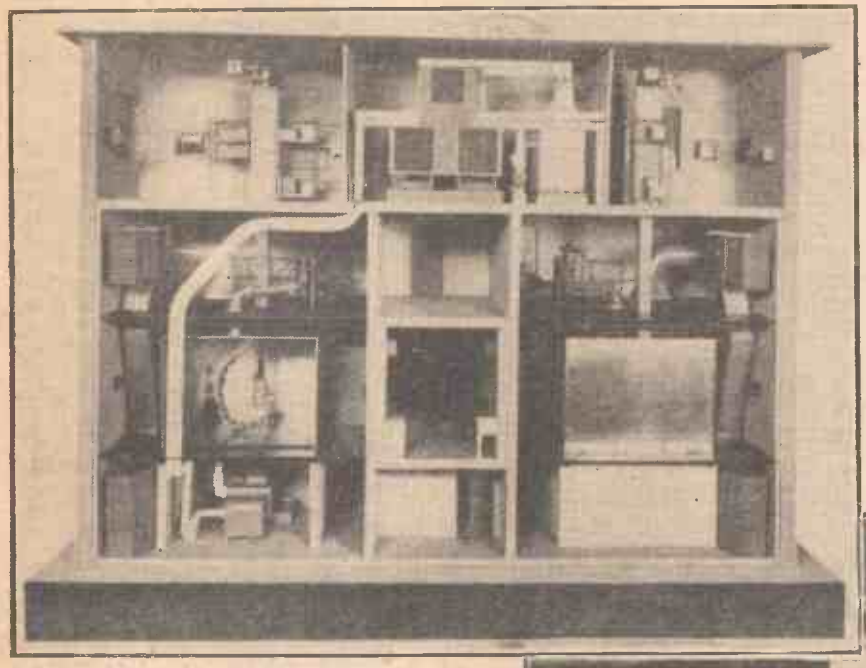


Fig. 1 (Above).—A sectional model of the calorimeter building of the Fuel Research Station. The model is built to a scale of ¾in. to 1ft. and shows in detail the various chambers where tests are carried out on heating appliances.

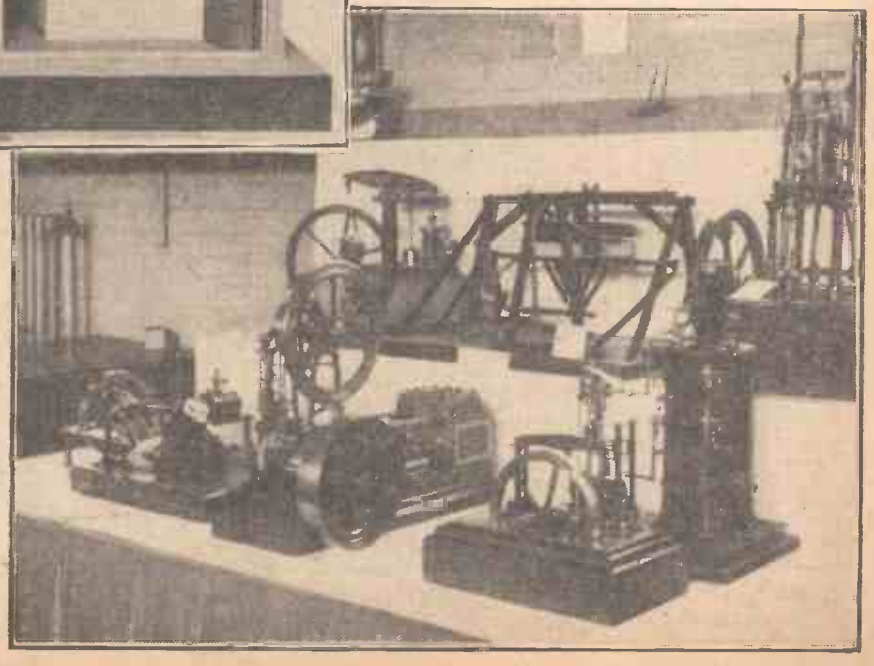


Fig. 2 (Right).—A group of model stationary engines on display at the Exhibition of the Leicester Society of Model Engineers. All were loaned by Mr. F. Smith, of Pinxton.

Exhibition at Leicester

The Leicester Society of Model Engineers held their eleventh annual exhibition in August this year at St. Mark's Schools, Belgrave Gate, Leicester. As a regular visitor to this exhibition I feel that each year the keen members of this society improve their exhibition, with the introduction of new features and greater varieties of model work, as well as maintaining good standards with displays of old favourites. In an introduction to the exhibition catalogue, Mr. E. A. F. Dallaston, hon. secretary and exhibition manager, writes: "One of the objects of the exhibition is the encouragement of good craftsmanship." I felt that this aim was amply illustrated this year when I saw the exhibits. The enthusiasm and interest of all members were apparent in the large number of entries: together with models from Grantham, Nottingham, Derby, Nuneaton and Loughborough Societies and the Leicester Model Railway Group, they totalled over 260 exhibits.

One of the accompanying illustrations (Fig. 2) shows a varied collection of stationary engines. Central focus of this group is a model of a coal winding gin (scale 1in. to 1ft.) as used at Pinxton Colliery in 1844 period. The model shows the chains for lifting the coal and the bridle for use by men coming up to the pit surface, as well as a model of the horse used for operating the winding gear. All the models in this group were loaned by Mr. F. Smith, of Pinxton. They include two beam engines, one of 1840 and one 1850, horizontal steam engines and other model engines, from the period 1821 to 1900: altogether an historic collection.

Model Paddle Steamer

An attractive piece of work in the shipping section was the paddle steamer model (Fig. 3) by Mr. A. Allsopp. Also in this section was a most unusual model of an Athenian galley of the fourth century, B.C. This showed some good detail, including the paddle oar and the square sail set on the one mast. Another good exhibit was a partly finished model of the 4-masted

barque, *Archibald Russell*, a ship of 2,385 tons, registered at Glasgow. This model was to a scale of 3/16in. to 1ft., or 1/64th actual size, and was made by Mr. J. Thompson. Mr. Thompson also had another good old-time ship model on display: this represented the American 16-gun brig, *Lexington*, and was a well-constructed model.

There were several outstanding traction engine models exhibited. One of the most interesting was that constructed by Mr. H. H. Morris, a first attempt at a scale model, which was unpainted at the time of the exhibition, but showed some excellent workmanship for a beginner in scale modelling (Fig. 4). This engine was to a scale of 1in. to 1ft. All turning, milling, drilling, making of boiler fittings and most of the screws, had been done on a home-made drilling machine and lathe out of scrap and improvised material. The model was not quite complete as governors and lubricator needed adding.

An outstanding piece of work came from a member of the Derby Society: This was a scale model of a mill engine made by Mr. W. Widdas. This accurate and well-finished model was mounted on a mahogany base with a fireproof covering. The cast flywheel had a diameter of 9in. The cylinder, which has a 2¾in. stroke and piston 1¾in. diameter, is in brass and mounted on a brass bed. Stephenson link motion was used and a reversing lever with notched quadrant provided a variable cut-off. The whole was surrounded by a hand-rail in metal.

A member of Nuneaton and District Society, Mr. J. Posnett, exhibited a complete steam plant for a model steamboat, which included copper boiler, engine, lamp and base for fitting into the boat. Mr. Posnett was only 20 years of age when he made this model and constructed all his own fittings. He is to be congratulated on a beautiful model with a first-class finish.

Model Locomotive Section

An interesting entry in the locomotive section was a model of Blenkinsop's locomotive to a scale of ⅛ actual size. The prototype was one of four engines built by Fenton Murray and Wood in 1812-13 to work on a rack railway patented by John Blenkinsop in 1811 and laid at that time between Leeds and Middleton Colliery, a distance of 3½ miles. The engines remained at work for over 20 years. Such a model as this is very seldom seen in exhibitions nowadays.

One of the large-scale locomotive models was a 3½in. gauge L.M.S. locomotive: a well known one, the "Princess Royal." This model was very well built, with excellent detail work, and won the "Mercury Cup" for Mr. J. Farmer.

Models not often seen in amateur exhibitions are designographs. The Leicester Society showed an electrically-operated designograph made by Mr. W. Hart. Visitors were able to watch demonstrations of the enormous variety of patterns which can be made with this fascinating and entertaining instrument.

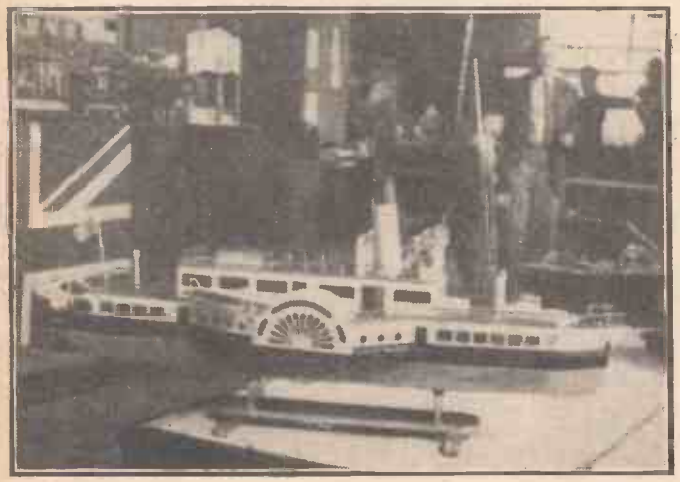


Fig. 3.—A working model paddle steamer built by Mr. A. Allsopp and displayed at the Leicester Society of Model Engineers' Exhibition.

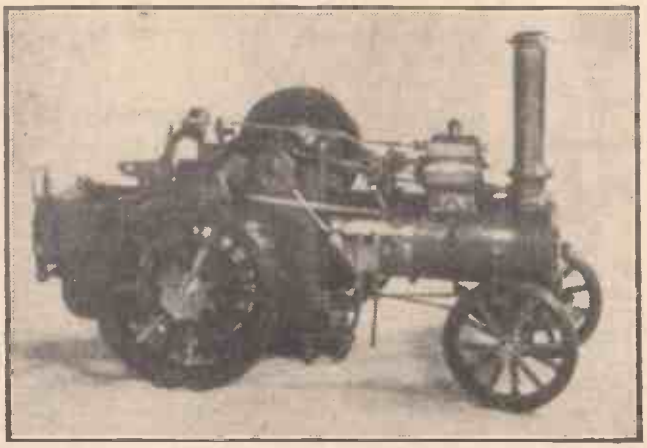
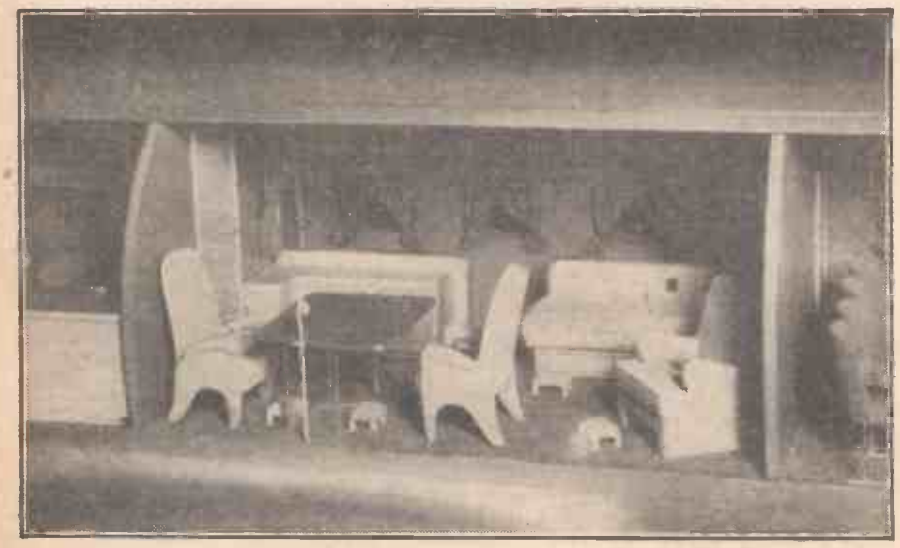


Fig. 4.—Leicester Society of Model Engineers' Exhibition; a first attempt at a scale model. Mr. H. Morris's 1in. scale traction engine model, unpainted, but an example of good workmanship in model engineering.

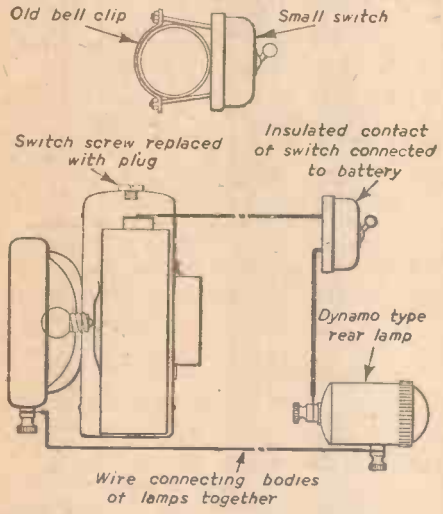
Realistic Interior Modelling



A close-up view of the interior details in a model K.L.M. "Skymaster" aircraft. The model is to a scale of ¼in. to 1ft., and further particulars were published in our December 1950 issue.

Series Lighting for a Cycle

SIR,—The accompanying sketch shows an arrangement of series lighting which I have used for some years now on my cycle and has proved most satisfactory using 2½ volt lamps. One battery lasts one season. The arrangement is handy for town use, where a powerful light is not required. I removed the top switch screw on the headlamp and replaced it with a plug. I then fixed a small tumbler switch to the right-hand



Front and rear lamps of a cycle arranged for series lighting.

side of the handle-bar stem with two screws and nuts and a clip from an old bell. A wire is connected to the switch (insulated contact) and the other end is soldered to top contact of battery. The other side of the switch is connected to a dynamo-type rear lamp.

I find it much more reliable to use a wire for the return instead of relying on the frame, the terminal point shown on headlamp being the best arrangement.—W. A. MELHUISH (Tiverton).

Flat Oil Paint

SIR,—On reading the October issue of PRACTICAL MECHANICS, I noticed in your "Queries and Enquiries" column a suggested formula for a flat white paint.

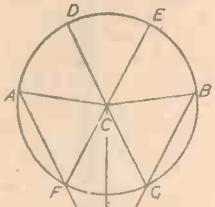
I would like to point out that barytes or *blanc fixé* are not pigments, but extenders. Whilst the amount of oil stated would be all right for white lead, it would be low for titanium dioxide or zinc oxide. The use of this amount of oil with titanium or zinc white would result in an underbound paint, especially if the wall remained porous through faulty sizing. I would suggest that an ideal pigment mixture would be zinc oxide, white lead and barytes.

The use of zinc oxide by itself will lead to an early breakdown of the film due to cracking. The film will also get very brittle. Titanium dioxide will fail within a few months due to excessive "chalking."

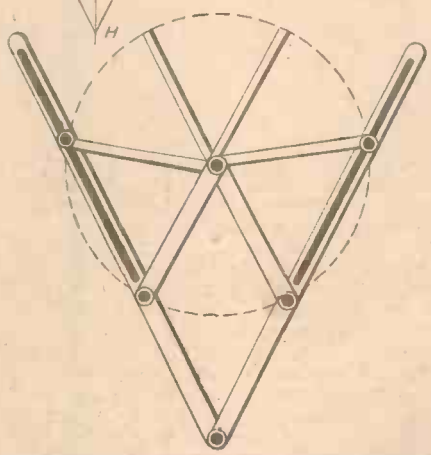
Zinc oxide will give the film a good whiteness, overcoming the tendency of white lead to darken, whilst the white lead will give enhanced water resistance and prevent cracking due to a high percentage of zinc oxide. The barytes (as distinct from *blanc fixé*) for an unknown reason gives the film longer life.—R. BURCHELL (Clayton).

Trisecting an Angle

SIR,—May I point out that the construction shown on page 389 of the August issue of this journal is not "perfectly accurate." For the smaller angles the approximation is quite good, but for an angle of 180 deg. I calculate the middle angle as being nearly 60.8 deg. Though the theoretical geometricians are baffled by this problem it presents little difficulty in practical geometry. (See the diagram herewith.) ACB is the angle to be trisected. From centre C draw any convenient circle, then draw CH bisecting angle ACB. On a piece of tracing paper draw a straight line and mark along it a distance FH equal to the radius of the circle. Place the tracing paper over the drawing and



Diagrams showing the trisection of an angle by geometry, and a suggested mechanical device for trisecting an angle.



adjust so that H is on the line CH, F is on the circle and HF produced passes through A. Draw a straight line from F through C to E and complete the drawing as shown.

Proof: CF=FH=HG=GC, thus HFA is parallel to GCD and HGB is parallel to FCE. ∴ ∠AFC=∠FHG=∠CGB=∠DCE. CA =CF ∴∠FAC=∠AFC. DC is parallel to AF ∴∠DCA=∠FAC. Thus ∠DCA must be equal to ∠DCE and similarly ∠BCE must be equal to ∠DCE. Therefore the ∠ACB is trisected. The larger drawing suggests a mechanical device for trisecting an angle.

After this, it is almost amusing to think of how the practical draughtsman trisects an angle. He sets his dividers to a judged distance and steps round the arc opposite the angle. He may have to adjust a time or two, but he gets there.—J. W. (Rochdale).

SIR,—The trisection of an angle which has amused your correspondents W. Duncan and his mentor M. Davis, has doubtless resurrected this problem for many of your older readers.

Historically it was one of the three famous problems of antiquity. The period from

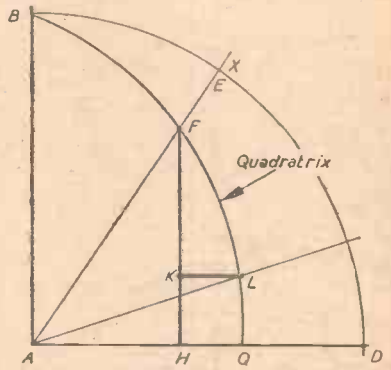


Fig. 1.—Trisection by the quadratrix

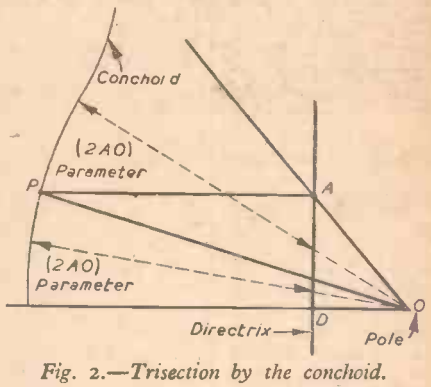


Fig. 2.—Trisection by the conchoid.

Pythagoras to Plato was focused upon these problems, which were:—

(a) The squaring of a circle,

(b) Trisecting an angle,

(c) Constructing a cube whose volume is twice a given cube. Each of these problems is *beyond* plane geometry; the ruler and compass can only solve equations of the first and second degree. They cannot assist in the solution of transcendental numbers (problem a) or cubic equations (problems b and c). Amateur mathematicians should in this enlightened age not waste their midnight oil.

The trisection of an angle may, however, be accomplished by the use of the Quadratrix of Hippias of Elis (circa 425 B.C.) or the famous Conchoid of Nicomedes (circa 180 B.C.).

Trisection by the quadratrix (Fig. 1): Consider at angle BÂD and quadratrix BQ. Let the angle to be trisected be XÂD. AX cuts the quadratrix in F and the circle at E. Draw FH perpendicular to AD. Then trisect FH and through K, the point of trisection, draw KL parallel to AD cutting the quadratrix in L. Draw AL. The angle DÂL is the required angle.

Trisection by the conchoid (Fig. 2): Consider angle AÔD the angle to be trisected. Draw any line AD perpendicular to OD. Describe a conchoid having O as the polar point, AD as directrix and 2(AO) as parameter. Draw AP parallel to OD to meet the conchoid curve in P. Then PO trisects angle AÔD.—F. W. COUSINS, A.M.I.E.E. (Greenford).

Trisecting an Angle

SIR,—Despite rigorous demonstrations of its impossibility, propounders of "perfectly accurate" methods for trisecting any angle, using compasses and straight-edge only, seem as indefatigable as the designers of perpetual motion machines.

In essence the first steps in the construction submitted by Mr. W. D. Needham are as follows: $\angle XAP = \theta$ being the given angle (Fig. 1). An arbitrary point C is chosen on AP and a length AB=AC laid off along AY. BT=BC is also laid off along AY.

By simple geometry it is readily seen that $\angle CBA\ (=\angle ACB) = \theta/2$, and $\angle CTA\ (=\angle BCT) = \theta/4$.

Clearly there is a point, Z say, on BT such that $\angle CZA = \theta/3$, but the naïve assumption that Z in general coincides with E, the midpoint of BT, is easily shown to be false.

For suppose $\angle CEA = \theta/3$.

Then $\angle TCE = (\theta/3 - \theta/4) = \theta/12$.

and $\angle BCE = (\theta/2 - \theta/3) = \theta/6$.

Because CE is a median of $\triangle BCT$,

$$\frac{CT}{CB} = \frac{\sin\ \theta/6}{\sin\ \theta/12}$$

But $$\frac{CT}{CB} = \frac{\sin\ CBT}{\sin\ CTB} = \frac{\sin\ \theta/2}{\sin\ \theta/4}.$$

Hence $$\frac{\sin\ \theta/6}{\sin\ \theta/12} = \frac{\sin\ \theta/2}{\sin\ \theta/4},$$

that is $$\frac{2\sin\theta/12\cos\theta/12}{\sin\theta/12} = \frac{2\sin\theta/4\cos\theta/4}{\sin\theta/4},$$

a relationship which cannot hold if P is a point not on XY.

An alternative way of disproving that the proposed trisection is a general method, i.e., one valid for every angle, is to show that there is even one angle for which it fails. For instance, if $\angle XAP = 60$ deg., we may calculate that $\angle CEA$ is, not 20 deg., but about 20 deg. 6 mins. One would not wish to denigrate the French railways to the extent of suggesting that, to their engineers, this degree of closeness is synonymous with perfect accuracy!

Fig. 1

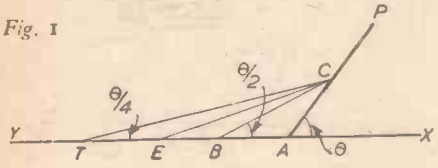
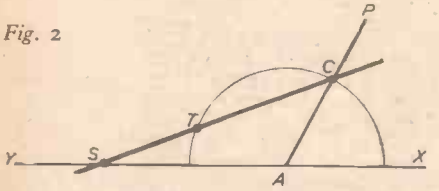


Fig. 2



Diagrams illustrating the trisection of an angle.

It is perhaps worth mentioning that, if it is permissible to extend the use of the ruler beyond its function of drawing a straight line through two given points, valid constructions are possible. The following method is found in the works of Archimedes.

$\angle XAP$ (Fig. 2) is the given angle. With centre A and any radius AC describe a semicircle. Mark two points S and T on the edge of the ruler such that ST=AC. Keeping T on the semicircle, slide the ruler until its edge passes through C, and S lies on AY.

Then $\angle XSC = \frac{1}{3}\angle XAP$.

—H. E. AIREY (Hessle).

[*This correspondence is now closed.*—ED.]

Fire-alarm System

SIR,—In the June issue ("Queries and Enquiries" column) there was supplied to P. C. Campbell, Stonehaven, a diagram to his own specification for an electric fire-alarm system, and it was suggested that a lower voltage could be used for the bells if desired.

The diagram included a connection from about the centre of the bank of cells. This intermediate connection, which is also shown in the improved diagram submitted by F. Slater, Spalding, in the September-October issue, introduces complications for it makes the bank equivalent to two separate batteries, and thus separate switching will be required for each.

If the system were connected, as shown in either diagram, the left-hand side of the battery would discharge through the bells and "klaxons" in series and there might be spasmodic but feeble sounding of either or both until the cells become polarised.

This difficulty could be overcome either by fitting an extra pair of contacts to the relay to control the bells, or by using bells of the same voltage as the "klaxon" circuit, when the earth could be moved from the intermediate point on the battery to the left-hand end.—J. W. ROBSON (Wallsend).

Plaster Moulding

SIR,—As a plaster moulder I can assure your readers that hot melt compounds are by no means the answer to the moulders prayer. I have had no experience with "Vinamold," but I have used "Castogel" for two years and, lately, "Fleximould."

First, let me give this warning. Any double saucepan or porringer with paraffin wax in it is a positive danger. When I first used this I got some wax with a very low flash point, and when I took out the inner vessel to pour in moulds the wax burst into a big flame. It was so unexpected that it might easily have caused a serious fire. Luckily I managed to extinguish it. It is far safer to use a thick pan or ladle direct over a very low gas. I know this is inclined to char at the edges.

Another very important point is, only a metal pattern (master) is really any good. This can be polished. This polish is taken by the hot melt and is really a very fine job. But getting a metal pattern is not so easy, especially if it has a fair amount of fine detail; and they are very expensive.

Hot melt firms say it is possible to make moulds from plaster (or other porous material) but any painting of the surface will fill in the interstices of the design. This is not important in big rough things, but with any work with fine detail it just spoils it.

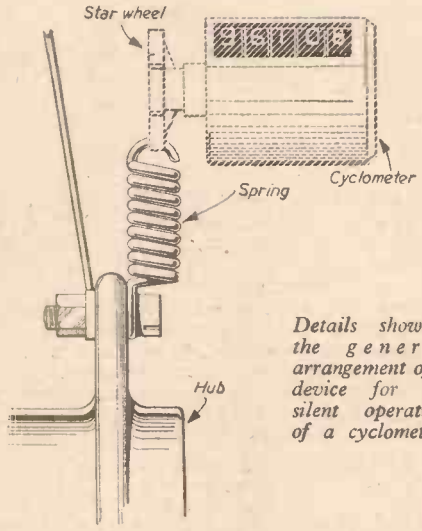
Perhaps "Vinamold" is better than those I have used. If so it is all to the good, but one of the things I have been surprised at for a long time is, why don't the plastic people try to give us moulders something we do really want, and that is something harder than ordinary plaster. I have been working on this line for many years, and I now have some plasters (or rather mixes) that are much harder than anything else I know; but they are not perfect yet. True there are the cold-setting resins, but what a price compared to plaster of Paris, and they don't take paint very well. I have tried a number of "liquid marbles" but they are a lot of trouble and not so good as to justify using them.

What is wanted is a really hard plaster-like substance that will compete with plaster on its cheapness and plastic on its hardness. A light, strong, hard, free-flowing, unshrinkable white material, at about 6d. per lb. It will eventually come, of course. Stonecast is harder than most plasters, but it is heavy and not white. I fancy it is more a cement than plaster, and is 9d. per lb. Cement, too, is harder than plaster, but again the colour is bad, and it is too heavy.—C. THOMPSON (West Kensington).

Cyclometer Striker Improvement

SIR,—Here is a dodge which will appeal to those cyclists who, like myself, are irritated by that incessant tick of the cyclometer striker. It was the outcome of not being able to fit the striker in its correct position, as this occurred at the crossing of the spokes.

It consists merely of a short, stiff, close-wound, tension spring, with loops arranged at right angles, secured to the hub flange, and engaging with the cyclometer star wheel.



Details showing the general arrangement of a device for the silent operation of a cyclometer.

The spring should be secured with a screw (nut and washers) inserted through one of the keyhole slots in the flange at the spoke heads.

A little grease gives this device complete silence. My cyclometer is extremely stiff to rotate, yet I sometimes wonder if it is operating owing to the absence of any noise.

The accompanying sketch gives details of the device.—A. E. WINNETT (Acton).

Painting Asbestos Sheet

SIR,—Regarding your reply to T. E. B. Wardle (Sark, C.I.) in the September-October issue, re painting asbestos sheet. It may interest other readers to know that some six or seven years ago I boxed-in my domestic bath using asbestos-cement sheeting.

This was painted at the time with two coats of flat and one coat finishing colour (ordinary lead paint). The original paint has never flaked, rubbed off or deteriorated in any way except the usual discoloration, etc., due to wear and tear. The paint has merely been rubbed down with glass-paper and repainted at intervals when the room has been redecorated.—D. G. WETTON (Colchester).

Mathematical Problems

SIR,—With reference to Mr. Bowen's mathematical query, the error is introduced when taking square roots of each side of the equation $(2-5/2)^2 = (3-5/2)^2$. Now, the square root of $(2-5/2)^2$ is $\pm\sqrt{(2-5/2)^2} = \pm(2-5/2)$ and similarly the square root of $(3-5/2)^2$ is $\pm(3-5/2)$. Therefore, inserting the appropriate signs:

$$\pm(3-5/2) = \mp(2-5/2)$$
$$3-5/2 = -2+5/2$$
$$+\tfrac{1}{2} = +\tfrac{1}{2}$$

The sign in front of the $\sqrt{}$ depends upon the arrangement of the quantities at the time of factorisation. Consider the following equation which is the problem in algebraic form:

$$a^2-2ab+b^2 = c^2-2cb+c^2$$

and factorising

$$(a-b)^2 = (c-b)^2$$

Now if a>b when c>b or b>a when b>c the signs in front of the $\sqrt{}$ are the same when taking the square root, but if a>b when b>c or c>b when b>a, the signs are different.

If in this particular case the numbers were arranged in the form $(5/2)^2 - 2\times2\times5/2 + 2^2$ and factorised into the form $(5/2-2)^2$ the R.H.S. of the equation being the same, the signs of the roots would be the same and no difficulty would have been encountered.—L. GAUDET (Norwich).

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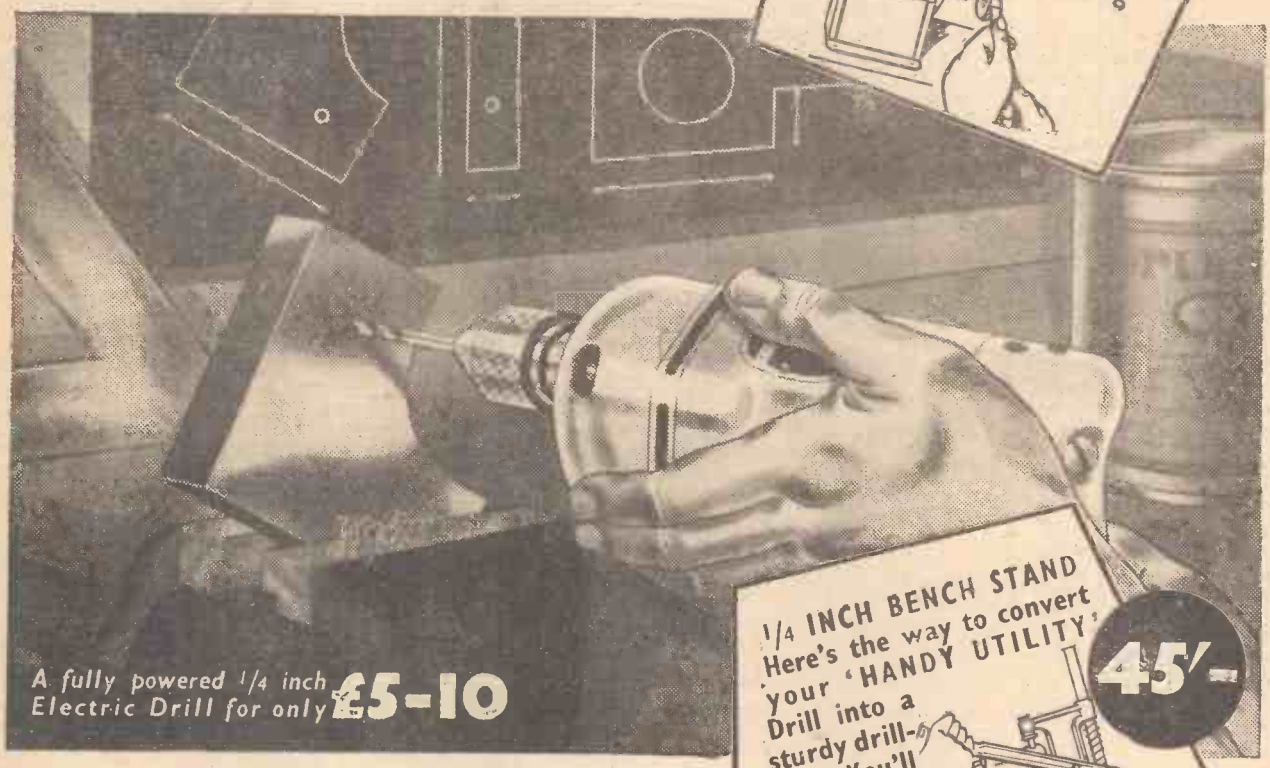

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Trade Notes

A Review of the Latest Appliances, Tools and Accessories

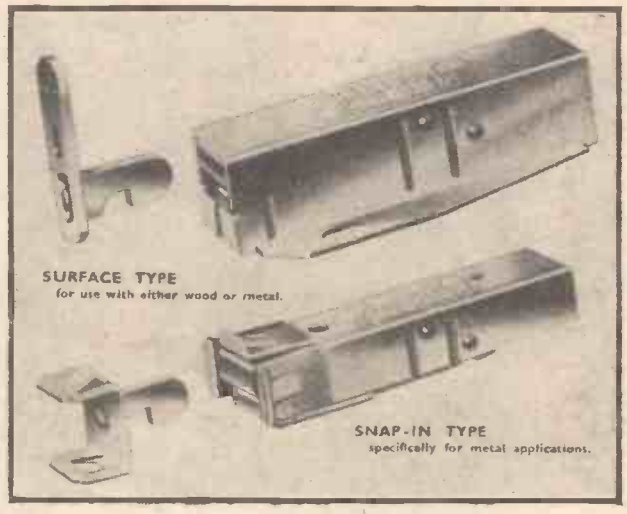
The Tutch Latch

MESSRS. LINREAD LTD., Cox Street, Birmingham 3, are now marketing a handy fitment known as the Tutch latch. This new latch, which can be fitted to all types of office furniture, cabinets, cupboards, drawers, etc., is made up of two units—the latch and the strike hook.

The latch consists of a catch and a pusher, spring-loaded with a common spring and secured within a housing by two rivets. The basic operating principle centres on the pivoting action of the catch and pusher on the two rivets, assisted by the action of the spring, which operates for part of its length in tension and part in compression. When the strike hook enters the latch it compresses the pusher, causing the catch to fall and hold in the notch provided in the strike hook. The Tutch latch is now in a locked position. Immediately the catch holds, the pusher, released from compression, moves forward to its original position and presets the catch for releasing the strike hook. Release is achieved upon the next compression of the pusher, which causes the catch to move upwards, freeing the strike hook.

The Tutch latch is made entirely from steel by presswork operations, using multiple follow-on tools. Every component is rust-proofed to ensure an easy and efficient operation over a longer period of use. A special feature that puts the Tutch latch in an "original" category is its positive action. The catch holds firmly, and releases just as promptly and surely.

The Tutch latch is retailed at 3s. 9d., and is now under distribution to dealers throughout the country.



Two types of the new Tutch latch.

Gauge "o" Model Railway Catalogue

BASSETT-LOWKE LTD., St. Andrews Street, Northampton, have recently issued a new edition of their Gauge "o" Model Railway Catalogue. This is considerably enlarged, and includes a number of new models. Outstanding models listed are the L.M.S. "Royal Scot" and "Duchess of Montrose," B.R. "Flying Scotsman" and G.W.R. "Pendennis Castle." In addition there is a range of new all-metal goods and passenger rolling stock, wagon and coach parts, and an electric Permag mechanism and clockwork mechanism. The Permag mechanism has been re-designed, and forms a very efficient unit. A feature of this useful catalogue is the fine half-tone illustrations. Copies of the catalogue are obtainable from the above address, price 1s., post paid.

Trojan Sales Organisation Changes

TROJAN LIMITED inform us that in view of the expansion of business which is taking place, both with the parent and subsidiary companies, certain rearrangements have been made, and the sales organisation in the Trojan group of companies is now placed under the control of Major W. T. Charles, T.D., F.I.M.I., M.S.M.A., as general sales manager.

Major Charles, who joined Trojan Limited in 1932, is well known in the motor trade, and has been responsible for the sales of Trojan Limited since his return from the Services in 1945.

Mr. H. A. Hora, T.D., will continue to act as sales manager (home sales) of the associated company, Mini-Motor (Great Britain) Ltd., while Mr. D. F. Doherty, M.I.M.I., will be sales and service representative for both companies in the North of England. Mr. Doherty has also been associated with Trojan Limited for a great number of years.

Wolf Cub All-purpose Tool

WOLF ELECTRIC TOOLS, LTD., Pioneer Works, Hanger Lane, London, W.5, have recently issued a well-produced 48-page handbook featuring that handy little tool, the Wolf Cub electric drill and its equipment. Written by G. W. Arthur-Brand, an enthusiastic user of the equipment, the book describes in detail what the equipment comprises, how it can be fitted together, and how to set about the various odd jobs on repair and maintenance in the home, the garage, or the garden shed. The hobbyist and the worker in wood or metal will find this Wolf Cub Home Constructor Kit indispensable. Among the various operations efficiently carried out with this equipment are drilling, sanding, buffing, turning and grinding. There is also a handy 4in. circular saw and table which should answer the requirements of the handyman. The handbook, which is priced at 2/6, is well illustrated with "close-ups" clearly showing the various operations and how the different components are handled.

Johnsons "Wellcome" Year Book

THE 1951 edition of this useful handbook, published by Johnsons, of Hendon, Ltd., Hendon Way, London, N.W.4, has now made its appearance. The technical contents have been confined to the practical aspects of taking photographs (rather than to darkroom technique) and several new chapters have been added on this subject.

The pages for recording exposures have been increased in number as these have been found so valuable. The calculator, conforming with the British standard tables, is retained and the instructions for using it have been clarified.

The price of the Year Book is 4s., plus 1s. purchase tax, and it is now being distributed to photographic dealers everywhere.

"Satchwell" Temperature Control

WE have received a copy of the current catalogue of the various types of instruments manufactured by the Rheostatic Company Ltd, Farnham Road, Slough, Bucks. This firm specialises in thermostats and other appliances for the automatic control of temperature in industrial installations and for domestic uses. Central heating plants, air conditioning, electric cooker control, temperature control for electric water heaters and coal stoker control are a few of the many applications of "Satchwell" Temperature Control Units.

Bassett-Lowke's New Gauge "o" Loco

IN our December issue (page 37) an advertisement appears displaying a new "Prince Charles" model locomotive for either clockwork or electric drive. Although not mentioned in the advertisement, this model is made in gauge "o."

New Laboratory Stirrer

A NEW laboratory stirrer manufactured by Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C., incorporates many important features not hitherto found together in this class of apparatus. A totally enclosed A.C./D.C. motor with built-in speed regulator is provided. There is also down-draught fan motor ventilation; stainless steel collet-type chuck with pulley for use in belt-driving other equipment; drum vat clamp for works' use, and flexible drive. The stirrer has been designed to perform any stirring operation simply and efficiently and provides a universal unit indispensable in all modern laboratories. A leaflet giving full particulars is obtainable from the above address.

Club Report

Aylesbury and District Society of Model Engineers

THE club met on the third Wednesday in November, as is its usual custom, at Hampden Buildings, Temple Square, Aylesbury.

After a brief discussion on club business and future fixtures the evening was devoted to a talk on patterns by our chairman, Mr. E. D. Hasberry. Mr. Hasberry modestly admits that in pattern making he is self-taught. The excellence of his patterns are sufficient proof of his own teaching. The talk he gave was both informative and interesting, and he showed quite conclusively what could be got out of the pattern box. Mr. Hasberry has quite a considerable start in this field, as his father was, by profession, a cabinet-maker—a lead which unfortunately we do not all possess.—E. H. SMITH (hon. sec.), Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

THE Cyclist
Editor: F. J. CAMM

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Comments of the Month

By F. J. C.

"At His Wits' End"

LORD LUCAS, Parliamentary Secretary to the Ministry of Transport, in a recent speech referring to accidents, said "I have just about come to my wits' end on this terrible question of road accidents." The tragedy is that every regular road-user knows what is wrong, except those at the Ministry of Transport. If the money which has been subscribed by motorists in the form of Road Fund and Petrol Taxes had been used for the making and repair of roads, the accident statistics would have reached negligible proportions.

Lord Lucas is comparatively new to transport matters, but he undoubtedly knows, or should do, that large numbers of accidents are caused because road development has not kept pace with traffic increase. It would appear that Lord Lucas has been wrongly advised on the amount of money which his Ministry spends on roads. For example, he is reported as saying that "he was not convinced that the roads were a major factor in accidents." This is a refusal to face facts. Colonel Bennett, when County Surveyor of Oxfordshire, proved that by adopting the recommendations of Lord Lucas's own Ministry in regard to road layout, it was possible to avoid three-quarters of the accidents occurring at junctions. On the same day that Lord Lucas made this statement (November 15th) the Minister of Transport, referring in the House to a fatal accident at a road junction, said: "The best solution for conditions at this junction would be to improve the layout. I am therefore putting this proposal to the highway authority."

Only £20,000,000

Lord Lucas is reported to have said that £300,000,000 had been spent on *road improvement* since 1945. This is wrong. The actual figure is £20,000,000 (*twenty million pounds*).

Lord Lucas also said that "the non-motoring public would raise an outcry if money was diverted from housing to roads for motorists." Motorists would be the last to suggest that money and resources should be diverted in this manner. But the boot is on the other foot. Vehicle owners, commercial and private, are contributing some £220,000,000 this year in motor and fuel taxation. *Only £26,000,000 of this is being spent by the Government on roads for all purposes.* The balance of some £194,000,000 is being diverted to unspecified purposes. Meanwhile, industry is forced to waste its indispensable motor transport on roads which the Minister of Transport recently described as "hopelessly behind current needs."

Surely lives are more than houses? And is there not a greater public outcry about road accidents?

The Government refuses to modernise the road system, but there is no need for inaccurate statements such as that made by Lord Lucas.

Let Lord Lucas reflect upon some indisputable facts, analyse them, and draw the proper conclusions from them. In the first place, accidents are on the increase where speeds are lowest—that is to say, in towns and cities. In those towns and cities there are pedestrian crossings, traffic lights, speed-limits, police control, one-way streets, subways, etc.

In London, for example, these devices introduced in the name of Road Safety have done nothing to make roads safer. They have, however, successfully reduced the speed of traffic and rendered a speed-limit unnecessary in that in most parts traffic could not travel at 30 miles an hour if it wished to.

Traffic lights at almost every crossing see to that. We must remember that although traffic lights were put up in the name of Road Safety, they were really erected to relieve the police from point-duty. However, the conclusion to be drawn is that speed does not cause accidents, and these experiments, having been tried, should be abolished. The more vehicles there are about in a road at a given time, the greater are the possibilities of accidents, irrespective of speed. The causes of obstruction should therefore be removed, and the accident figures would go down.

The pedestrian, who has at present absolute right of way on crossings uncontrolled by traffic lights and policemen, seldom uses them. Evidently the Ministry of Transport have realised that, because that right is shortly to be taken away.

Secondly, the endeavour to make roads safe by prosecution has singularly failed, and many of the regulations should therefore be abolished. Alternatively, if it is still thought in spite of the statistics that prosecutions will help to solve the accident problem, then many of the regulations should be made to apply to every road-user. Pedestrians, for example, should be made to carry rear lights. A pedestrian is just as much a vehicle as a cyclist. Indeed, according to Lord Goddard's argument, a pedestrian is a carriage, because he is capable of carrying.

We hear too much about the accidents which happen and too little about those which *could* have happened, but which are avoided by skilful driving or riding. Often the person causing the accident escapes scatheless, and is not even involved in proceedings. Many an accident has been caused by a jay-walking pedestrian, or a cyclist who is insisting on his rights. They do not even stop after the accident has happened. They are the guilty parties, but the law does not bring them to book.

Lord Lucas went on to say that in the next twelve months 5,000 people will be killed and 250,000 injured on the roads of Britain.

It is difficult to believe that the staff at the Ministry of Transport have ever been regular road-users. They could not possibly continue to use the roads of London under the present chaotic conditions without at once making regulations remedying the scandalous state of affairs. Public time is just frittered away at useless traffic lights and by police on point control, who do not use their heads as well as their hands.

Traffic lights are insensitive to the needs of the moment, and needlessly hold up traffic. A very high percentage of them could be removed without adding to the duties of the police or to the danger of the roads. It is a serious state of affairs when the Parliamentary Secretary to the Ministry of Transport admits that he is at his wits' end on the matter of accidents. Surely he could resign and give place to someone with a less defeatist attitude, someone who will listen to reason and boldly make the necessary changes which statistics prove to be necessary. Someone, in other words, who will not be misled by sectarian interests and the bleatings of cycling associations or pedestrian associations, or even motoring organisations.

The armament programme will undoubtedly mean that some of the money will be saved out of road expenditure. For the past 11 years roads have been under-maintained. The present permitted expenditure is insufficient to make good the increasing number of surface and foundation failures.

The end of the Honister Pass—the sharp descent to the little village, and the road to the wonderful Borrowdale Valley.

The Cycle Show

This year's Bicycle and Motor Cycle Show opens at Earls Court on Saturday, November 10th, for eight days, closing on the following Saturday evening, November 17th. The Council of the Manufacturers' Union announces that they have decided to hold an eight-day show because of the success of last year's eight-day opening, when there was an all-time record for attendance, including a large number of overseas visitors.

Paragrams.

Cycle Dealer and Blacksmith

THE death has taken place, at the age of 76, of Mr. George William Drewry, of High Street, Ulceby, North Lincs., who in addition to carrying on business as a cycle dealer and repairer was Ulceby's last remaining blacksmith. He had been in business for some 45 years at Ulceby.

115 *Years Back*

THE Highway Act of 1835 was invoked at Chesterfield Magistrates' Court when a 25-year-old cyclist was charged with "riding furiously a pedal cycle so as to endanger the life and limb of passengers at High Street, Chesterfield," and the offender, who pleaded not guilty, was fined 10/-. Stopped by a police constable, the cyclist was alleged to have told him: "I was on an urgent errand for my boss. I was only doing 20 miles an hour." He was stated to have narrowly missed several pedestrians and ridden on to the wrong side of the road.

To John o' Groats

TWO 17-year-old pupils at Wellingborough Grammar School, feeling that this year they might do something different for a holiday, set off on a three weeks' cycling tour from Wellingborough to John o' Groats and back. They followed the east coast route by way of Doncaster, Newcastle, Edinburgh, Aviemore, Inverness and Wick and then to John o' Groats. Their return journey took them across the North of Scotland to Cape Wrath and then down to Kyle of Lochalsh (with a trip across the ferry to Skye and a ride round the island) and back via Fort William, Dumbarton, Gretna, Carlisle, Penrith and through Lancashire and Derbyshire down to Leicester, Kettering and home to Wellingborough. The total mileage covered was more than 1,600.

Matchboxes to Help Road Safety

ARRANGEMENTS are being made by a firm of match-makers in Gloucestershire for road safety slogans to be printed on the backs of their matchboxes instead of the usual jokes. The idea came from the Road Safety Officer for Gloucester, who noticed that his children invariably read the joke printed on every box of matches in the house, and he feels that the matchboxes can prove very useful in passing on road-safety slogans and ideas.

"Most Dug-up Place"

"We are the most dug-up place in the world," complained a member of Boston (Lincs.) Town Council during a discussion regarding complaints of the continued tearing-up of the town's roads. He said that people tended to blame the local authorities for this, but the real offenders were the public utility undertakings who were continually digging holes in the road for their gas and water mains and electricity cables. Councillors were told that things would be better when the Bill now before Parliament became law. This limits the right of the undertakings to dig up the roads and to ensure some co-operation between the undertakings and local authorities.

Bicycle is Carriage Sometimes!

DURING the hearing of an appeal in the King's Bench Division by a man who had been sentenced to one month's imprisonment for being drunk in charge of a bicycle, contrary to the Licensing Act, 1872, there was considerable argument by counsel as to whether or not a bicycle was a carriage. The words of "Daisy Bell" were quoted by the appellant's counsel, who tried to prove that a bicycle was not a carriage within the meaning of the 1872 Act, but he was unsuccessful. The appeal was dismissed, and the Lord Chief Justice said it was clear that the word "carriage" in this instance did include a bicycle, but, he added: "It does not follow that in any other Act of Parliament a bicycle is a carriage."

Track for Brigg Cyclists

BECAUSE of disagreement as to the means of access to the grounds, the Ministry of Transport has objected to an ambitious scheme for laying out the recreation grounds at Brigg, Lincs., to cater for all types of sport. However, the Town Council propose to arrange for part of the scheme to be carried through, which includes a cycle track for the use of local riders who have never before had proper track facilities.

Doncaster Speedway Planned

MR. PAUL GOW, of Ellers Avenue, Bessacarr, Doncaster, has plans for starting up cycle speedway events in Doncaster and organising a league for the town and district. He thinks it is time that the sport reached Yorkshire and he feels that things ought to be well under way by next Easter, with at least one league in operation.

Those Built-up Areas

AN increasing number of complaints are being made about the dangers from traffic in our villages. The streets of villages where hundreds of adults and scores of children live are, legally, free for any motorist to speed through, and woe betide the unwary cyclist or the not-so-quick pedestrian. At night the state of affairs is really Gilbertian, for there is no speed limit along an unlighted village street, yet when the street has lamps and is, presumably, less dangerous, it becomes a built-up area and is subject to a speed limit.

National Record Goes

TWO young Peterborough cyclists and members of Peterborough Cycling Club, Ray Needle and Len Young, have broken the national London to York tandem record which was set up in 1935 by two Australian professional riders. Because of an unfortunate puncture they had to make a re-start, but they completed the 196 miles in exactly eight hours, so beating the existing record by 15 minutes. The record is, of course, subject to official recognition and confirmation. Following the riders was a van carrying the official observer for the R.R.A. and Mr. A. C. Mundy (who prepared the machine for the trip) together with the organiser of the attempt.

New Type Three-speed Gear

THE New Departure section of the American car firm of General Motors has produced a new type of three-speed gear, but it can only be used on cycles already fitted with the New Departure coaster type hub. The new gear resembles an outsize freewheel, inside which are the gears, and it is fitted to the cycle instead of the former coaster gear. There is the usual cable control and the gear also contains a coaster brake and freewheel.

Leicestershire Speedway Growth

FROM a few cycle speedway teams which got together last year, Leicester Cycle Speedway Association now has 24 member-teams from the city and county. The Association became affiliated with the national organisation early this season and is making good progress.

Ingenuity

IT is disclosed by a statistical and economic review, published by the United Africa Company, that the sales of surgical rubber tubing have been increasing among the natives. Someone wondered what use an African native could have for surgical rubber tubing, and it was discovered that the natives use the tubing as guards to keep their flowing robes from becoming entangled in the wheels of their bicycles.

Still Tricycling

AFTER 64 years' service with Godmanchester Borough Council, during most of which time he has ridden round the town on an ancient tricycle, 82-year-old "Ted" Cross has been granted a pension of £1 a month for the rest of his life. The tricycle and Ted have grown old gracefully together, but there seems to be no truth in a suggestion that Ted will save up some of his £1 a month towards one of the latest racing bikes.

Good Crop—Many Croppers

ALTHOUGH there may have been some complaints about the quality and quantity of the harvest in general this year, there ought to be no complaints about the sugar beet crop—if the scores of outsize beet left on country roads to trap unwary cyclists are anything to go by. A collision with only one beet is quite enough to supply a nasty spill, but when they are scattered along the road as if they were mines it is getting beyond a joke.

Lincs Record Broken

RIDING in the Lincolnshire Centre N.C.U. championship 25-mile T.T., J. Baxter (Grimsby Paragon) broke the existing course record by knocking four seconds off the former best time of 1hr. 3min. 12sec. Second, by the margin of a second, came R. Rayson, of Buckminster, a member of Notts Wheelers, who also broke the existing record. Of the 51 starters, only three failed to complete the course.

Around the Wheelworld

By ICARUS

6-day Race in 1951?

IT was eleven years ago that we held the last 6-day race in this country. The first 6-day race was held in London at the Agricultural Hall over half a century ago, and it was instituted by one Etherington, one-time Editor of the early cycling journal "Wheeling," whose son was a member of the Bath Road Club.

There was a lapse of over 40 years before an Australian came over here just before the war and endeavoured to popularise it at Wembley. It was not a financial success. The public did not attend in large enough numbers to make the "gate" a paying one, and so the promoters had to rely upon charitable donations in the form of *primes* in order to attract riders and make it pay.

I am very much against 6-day cycle racing as hitherto practised. Anyone with a little money can attract crack riders, offering the bait that firms and private individuals will be encouraged to put up prize money to stimulate the riders into sprints. Otherwise they just tour at a slow pace for most of the six days (one member at least of each team must be on the track) and the public having paid for admission must "bribe" the riders with *primes* in order to give them a show. It is professionalism at its worst, and is more suitable for the profiteering Continental promoter than it is for Englishmen. I do not think that sporting cyclists in this country want 6-day races, and even if they did it would be practically impossible to find a team of first-class riders who could put up anything like a show.

With the possible exception of Harris and one or two other riders we have no one of the calibre of Sid Cozens or Frank Southall. The last 6-day race eleven years ago was an experiment to see whether the cycling public would support such an event, and it failed. Interest in it died many years before. Anyone, therefore, who attempts to revive an event of this type, at a time when it is impossible to make Herne Hill pay, is indeed most courageous. I can inform them in advance that this journal will not financially or otherwise support it, in view of our experiences of the last event.

Unwarrantable!

SOME Act can always be raked up when petty policemen bring petty charges for petty offences. Thus it was quite easy for a policeman recently to dig up the Public Health Act, 1925, when he prosecuted a cyclist a few weeks ago. I can imagine this constable standing in the box, throwing a chest, smiling at the Magistrate and his colleagues, in pride of his supreme knowledge of the law when he gave evidence under this Act, which said "*If any person rides or drives so as to endanger the life or limb of any person, or to the common danger of the passengers in any street, not being a street within the Metropolitan Police District, he may be arrested without warrant by any Constable who witnesses the occurrence, and any person who so rides or drives as aforesaid shall be liable to a fine not exceeding £5.*"

Bicycle is a Carriage

LORD GODDARD, who has in previous cases concerning cycling exhibited his erudition, particularly on time-keeping and racing, has decided that a bicycle is a carriage. The fact is it has been so regarded for over 70 years. The facts of this case were that a cyclist who was drunk in charge of a bicycle on the highway was prosecuted, and the defence was that a bicycle was not a carriage. The police evidence was that he was incapable of having charge of the bicycle, and certain cycling critics seem horrified that the cyclist should have been fined, having sufficient wit left to realise that he was incapable of riding his machine. Many motorists, it must be remembered, who have slept in their cars when drunk, rather than risk driving it, have similarly been prosecuted.

It is certain that the Act under which this case was brought did not envisage cyclists being charged under it. The architects of this specious document clearly had in mind horse-drawn carriages, motor vehicles, road locomotives and steamrollers.

"Speed"

TEMPLE PRESS, LTD., have just published at 7s. 6d. a 136-page quarto book entitled "Speed," with contributions by famous speedmen such as Lt.-Col. Goldie Gardner, Graham Walker, Donald Campbell and Capt. H. S. Broad. It deals with speed on the land, on water and in the air. Very attractively illustrated in half-tone and coloured plates, cyclists will be particularly interested in the description of Vanderstuyft's famous hour record of 76 miles 504 yards, the article by H. H. England on Mile-a-Minute Murphy, Don Lyford's account of Coppi's Greatest Victory, and "My Most Thrilling Races," by Reg. Harris.

Roller Racing

NOW that a national Sunday newspaper is putting its force behind the development of roller racing it is gaining enormously in popularity. A national roller racing competition is thrilling thousands every week. It is a form of racing which has never fascinated me.

I like to witness a good time trial, or an attempt at an R.R.A. Record. There is something very fascinating about riding in the early hours of the morning to a remote road to witness a solitary rider endeavouring to beat the clock. No word is spoken, nor must it be. You watch the rider slowly approach, grimly straining his thews, and you watch him recede into the distance. You go home and await the result, or you may wait a considerable time before deciding that the rider has abandoned the attempt.

Whether you are a marshal or merely a spectator, such events are quite thrilling.

R.T.T.C. Rules

IT is somewhat amusing to learn that the West District Council of the R.T.T.C., which has probably done as much as any other section to add to the number of R.T.T.C. Rules, now considers that they have become unwieldy, that they should be condensed under two headings—those that are necessary for public safety and uniformity in the conduct of time trials, and those which are desirable and not completely necessary. In the latter case it is suggested that District Councils should have discretionary powers.

If a rule may be broken at someone's discretion, it is an unnecessary rule. Much better to allow secretaries of District Councils to make rules fitting to the event and the course over which it is run. The rules, altogether too voluminous, presume that every time trialist is a potential cheat. It would relieve the duties of officials and, indeed, reduce their number if many of the rules were deleted entirely.

Rex Coley Joins Raleigh's

REX COLEY has joined the advertising and publicity staff of the Raleigh Cycle Co., Ltd. A touring enthusiast for many years, Mr. Coley's lantern lectures have proved extremely popular to cycling and hostelling audiences throughout the country. Interested club secretaries should write to "Ragged Staff," Advertising Department, Raleigh Industries, Limited, Nottingham, stating evening preferred.

Lucas No. 60 Battery Tail Lamp

JOSEPH LUCAS, LTD., asked me to state that their new No. 60 battery tail lamp retails at 5s. 6d., and not 5s. as they hitherto announced.

England's Unbuilt Motorway

TWENTY-SEVEN years ago last month Parliament was offered an opportunity that would have enabled Britain to set an example to the world in modern road construction.

A private concern, the Northern and Western Motorway Company, was formed in 1923 for the purpose of constructing a motorway 110 miles long between Coventry and Salford. The width between fences was to be 100 feet and the road was to have two carriageways. This super highway was regarded by its promoters as the first instalment of a motorway 226 miles long between London and Liverpool. The cost was estimated at £60,000 a mile. The Government was to have powers to take over the road on an equitable basis if it desired to do so.

Lord Montagu of Beaulieu, an authority on transport and traffic movement, was chairman of the company. During a Press interview, he remarked:

"On the main roads of this country horse-drawn traffic now averages not more than 5 per cent. of the total traffic, and it is clear that the road of the future must be made for the 95 per cent. traffic and not for the 5 per cent. In other words, we must build our roads as enduring highways with foundations of reinforced concrete and a surface which will stand this immense and heavy traffic. We all know that our main roads, with few exceptions, are inadequate to carry even now the immense amount of commercial and mechanical traffic upon them. . . . The congestion of to-day will develop into a jam."

The Private Bill for the motorway was presented to Parliament in November, 1923, by the late Mr. J. R. Clynes. Early in 1924, the Minister of Transport (Mr. Harry Gosling) announced that the Government was not prepared to give any financial assistance to the scheme. It was then abandoned and never revived.

Only two years later, the first motorway was built in the United States. It proved an outstanding success. Italy's first motorway was constructed soon afterwards, and Germany followed suit in 1933. To-day European motorways are carrying fast-moving industrial traffic in Belgium, France, Holland, Sweden and Yugoslavia, apart from Germany and Italy.

The Ministry of Transport's 1946 plan includes a motorway between London and Manchester. It is a depressing thought, however, that to-day this vital arterial route will cost £150,000 a mile, nearly three times as much as in 1923. Had it been built when first planned, the motorway would already have paid for itself many times over.

The GRANTLEY ARMS, WONERSH.

The village inn dating from the 15th century. It contains some fine half timber work . . . .

Wayside Thoughts

By F. J. URRY

A Good Gear

RECENTLY I have been riding one of the new Cyclo four-change gears fitted with twist-grip action, and it is excellent. What I like about it is the quick chain take-up, together with the slight movement of the grip necessary for making the change, all of which results in exceedingly easy manipulation. When the new machine came home from the makers, the gear was incorrectly fitted and the low cog of the range was difficult to engage ; I telephoned my friend Louis Camillis, and at his invitation rode to the works, with the result that in less than ten minutes this combination was in perfect trim and the low ratio as easy to obtain as the others. I shall be surprised if this gear does not become very popular with touring cyclists, especially tandemists, for it is robust and possesses gear ranges particularly suitable for use on the double-seater. I think I have told the story of my first fitment of a Cyclo gear long before it was made in England, looking at the bicycle when the job was completed and thinking it was the ugliest thing I had ever seen. But it worked, and for the first time I could choose my range of three gears with an exactitude hitherto unknown. I said that very thing in print, and a then young man by name Louis Camillis came to see me, talked about the matter, went to France and obtained the sole agency. From that point the Cyclo was launched in this country, and now the company has a busy, well-equipped factory and is finding difficulty in producing sufficient gears to meet demand—and people still persist in saying there is no romance in business ! I like the Cyclo derailleur gears in fine weather, but when the rain is heavy and the thin mud flies from the wheels on to chain and sprockets, the sheltered cluster of a hub gear has its advantages. Both are good, and if you have the luck to own more than one bicycle, my suggestion is obvious.

Convenience—or What ?

I HAVE frequently noticed that when the baby of the family goes out with father and mother on singles, more often mother carries the offspring. This arrangement on shopping and the short daily journeys would be more convenient for the lady when the man is at work, but to-day the fitment of carriers is a very simple and quick performance, and so could, I submit, be a reflection of the old-time chivalry. Perhaps I am old-fashioned, but I hate to see the ancient courtesies in decline. I never had the experience of carrying a youngster round the countryside, and in my day such things would probably have been looked upon with horror had young parents thought about them. Indeed, when such notions first occurred, public, as well as medical opinion denounced the idea of carrying young folk either in side-cars or on suitably padded carriers, and all sorts of troubles were prophesied for the child if the cycling parents persisted in the practice. Nowadays we hear nothing about the terrible results predicted of old time, and my own opinion is that the practice is good for both parents and children.

The Good Sign

MY own county of Warwick is signposting its roads very neatly in black and white standards and is doing the job very thoroughly ; every little lane is being catalogued, though many of them have never previously worn a sign. This, I presume, is part and parcel of a clean-up to make this part of Britain worthy of its 1951 Festival, and, candidly, I like it. Not so some of my cycling friends, however, who seem to think the signs are a slur on their map-reading intelligence. But, as I tell them, not 5 per cent. of road users can read a map properly, and less than half that number quickly, so if these neat directions send people on new journeys they are all to the good. Nor must it be forgotten that next year Britain hopes to entertain many thousands of her foreign friends, and to me such easy signposting seems to be a gesture of welcome. I should like to see this idea of welcome extended by the catering establishments, for there is still a certain dourness in such places, a kind of attitude that almost resents your intrusion, often most noticeable in the small country inns, which should be the first to give you the ever-fresh delight of a welcome. We may not have much to offer in the way of fare, but the pleasant manner of that offer is ample compensation for unavoidable meagreness, and daintiness in execution leaves the impression of a hospitable people. One hopes that this Festival of Britain, in such simple matters as this, will live up to its nomenclature.

A Vigorous Cure

I CAME from Cumberland, after a recent tour in the Lake District, just in time to join a week-end run with the Centenary Club, that company of trade executives who ride bicycles a few occasions in the year—or most of them—on trips of this nature. Our area on this week-end was the Peak District on the borders of Derbyshire and Staffordshire, not a selection of flat roads or easy grades which indeed seldom run through striking country. Our quarters were at the Peveril of the Peak Hotel, where we were well treated for food and given the comfort of good fires. It was as well, for the rain came in reckless storms half the time of our stay, and capes were in constant demand. We arrived on a Friday evening just in time to avoid a downpour, and just after dinner I went off to bed with a pint of hot milk to soothe my aching bones. When I looked at the dawn on Saturday morning, I could not see it for the mist and the steely rain running through it in dull streaks. Not a very good omen ; but it was seven o'clock then, and a couple of hours later would make a difference. It did ; worse. For the mist came lower down and the rain hit harder. Now, I have heard some of the expert lads refer to the members of the Centenary Club as butterflies, frightened of hills, and scared of rain. Well, the hills and the rain were with us on this occasion in full measure, but of the seventeen people out on this week-end, everyone was macked up and ready to start at 9.30, and from my knowledge I could name quite a crowd of real cyclists who would have "jibbed" at leaving comfortable quarters on such a morning.

Gloom and Gaiety

NOR was the start propitious, for the man who planned the day's ride had last traversed a couple of fields under sultry conditions. Now they were mud and tufted grass. However, that traverse was over in due course, and we reached hard if hilly surfaces with the mist closely enveloping us and the rain wetter than ever. And so we came down the long hill to Waterhouses, and a very large pot of tea taken in the hope that the inside application would at least diminish the damp outside. But we had no such luck, so the superb beauty of that six miles of the Manifold Valley to Hartington was a mist-closed vision with only an occasional crag emerging from the swirl of gloom; which was a pity, for that is one of the finest cycling journeys in England, reserved for them and the jolly walkers. Not a soul did we meet on this stretch, not even a stray dog, nothing but the hiss of the rain and the swirling mist. The "John Cotton" at Hartington received us gallantly and the lively crowd at lunch—only four of whom had ever been through the Manifold Valley—swore we must come again when the weather was happier. It had been the intention to traverse the Dove Valley to the stepping stones under Cloud Thorpe, but the path in places was a foot under the river, and the stepping stones awash, a fact we verified the next day. So we climbed out of Hartington through a thinning mist into a rising wind and driven rain, up and up until the Buxton road, and then the swinging way back to our headquarters, seventeen gay but sodden cyclists, eager for baths and changes and then a satisfying meal. This to be followed by much chatter on a diversity of subjects in front of a roaring fire, as indeed is the way of cyclists the world over. If anyone tells me the Centenary Club are butterflies now, I shall take up the challenge, for these rather elderly lads did thirty of the roughest miles I have ridden this year with a joke on their lips, and a laugh ever ready for the other fellow's troubles.

FOR a good many years the identity of Icarus, the well-informed scribe of THE CYCLIST, was a popular topic of conversation in club rooms and round the fires of inns frequented by cyclists.

So far no one had guessed or found out who he (or she) was. In common with hundreds of other cyclists I, too, had been one of the curious, and it struck me that one who was so obviously "in the know" would be well worth meeting.

I therefore called at the office of THE CYCLIST to see whether I could obtain an interview. The secretary of Icarus was polite, but firm. "Icarus sees no one," said he. "I will tell him that you have called. It's possible that later I may have a message for you."

Three weeks passed by and no word came from the secretary; I was beginning to feel that I never would hear from him, when one evening, returning from a run in Kent with a few cronies, my wife handed me a large foolscap envelope of bulky proportions, heavily sealed. I noticed that the envelope bore in the corner THE CYCLIST. I broke the seal and opened it with trembling fingers.

The letter was from the secretary, and ran as follows: "Dear Sir,—With reference to your recent call at this office, I have informed Icarus of your desire to meet him. He has agreed to do so, providing you will read the enclosed instructions (in separate envelope) and abide by the conditions contained therein. Yrs. faithfully, N. GORHAMBURY, (sec.)."

Opening the other envelope, I found several sheets of foolscap with typewritten instructions. It will not be necessary to enter into all the details; briefly, if I wished to see him I was to go by road to his house in the country. But it was not quite as easy as that. I was to go by bicycle, and the machine must be over forty years old. This first condition had me guessing for a while, until I remembered a friend of mine in North London who had a 1902 Pedersen. I called him up, and he agreed to loan it to me. The Icarus interview was fixed for 8.15 p.m. on a winter's night in January. I was not allowed to have an electric lamp on the front of the machine, but to comply with the law I could carry an oil lamp on the front forks, providing the wick did not exceed ¼in. in width. I had an old "Silver King" in good order, so dug this out. An ordinary electric rear lamp was in order, so I fitted this.

I was to be dressed in the costume of a typical cyclist of forty years ago. Here again my North London friend came to the rescue. He let me have his old Norfolk jacket, knickers and black cashmere stockings; I already had a pair of "Shorland" pattern cycling shoes, which completed the costume.

My wife entered into the spirit of the adventure, and spent the evenings before the run in darning up the Norfolk jacket and knickers. For myself, I was busy "hotting up" the Pedersen. This venerable vehicle was in fairly good shape, but needed a little attention to make it thoroughly roadworthy. It was an original model with the bars halfway down the front forks. I didn't like the look of the suspension strap, so had one made by a local saddler. I went over the whole machine with spanners and screwdriver, and finished up with the liberal use of an oil can.

The journey of sixty-five miles was in a south-westerly direction. I was to take a few sandwiches, but not to eat after 6 p.m., as a meal would be awaiting my arrival. The consumption of this meal was compulsory, and on its successful dispatch depended my chance of seeing Icarus. I was warned that the meal would be "difficult," and if I suffered from a poor digestion I had better cry off; however, as I was determined to go through with it, I went on a milk diet for a week before the run.

My Journey Begins

The morning of Saturday, January 5th, dawned cold and wet, with a bitter north-west wind to boot. I was not allowed to start until half an hour before lighting-up time, and promptly at 4 p.m. I wheeled the Pedersen out, spent five minutes chatting and then took leave of my wife and children. I was off. Fortunately, it had stopped raining, and the roads were rapidly drying up. I made good time through the suburbs and within an hour was in the open country; it was plain sailing until I left Guildford. I had consumed my sandwiches just before entering the Surrey capital. I then proceeded to enter a maze of lanes at the foot of Hindhead, and had to watch my step and follow the route given me by the secretary.

The old "Silver King" showed me enough of the road to keep me out of the ditch, but not being used to the Pedersen I was a trifle saddle-sore, and my knees ached due to the 7in. cranks with which the machine was fitted. Presently I had to cape up, as the wind had got stronger and was rapidly approaching gale force, and it had commenced raining again. As I had a bit of time in hand I took shelter in a barn, and lighting my pipe I cogitated on the adventure, and smiled to myself as I thought of what my pals would say when I told them all about it.

Knocking out the pipe, I proceeded on my way. The roads of the route were rapidly deteriorating and presently I entered some real "rough stuff." It was now nearly 8 p.m., and I began to bristle with excitement. At last I came to a high wall alongside the road, and following this for half a mile I was suddenly confronted by a huge ornamental iron gate at the back of which was a lodge. Alighting, I rang the bell, in answer to which a man in livery came out and asked me my business. I showed him the letter from the secretary and he let me in. "It's three-quarters of a mile to the Hall, sir," he said. "Just follow the drive."

Riding slowly up the drive I realised I was in the grounds of what must have been a very large estate. I couldn't see much as there was no moon, and the low clouds and light rain made matters worse. Coming round a bend I could just make out in front of me the dim outline of a huge Jacobean mansion. Dismounting, I ran up a few steps with the Pedersen and rang the bell; it was exactly 8.15. A manservant of cadaverous appearance ushered me in, and I entered a very large hall, dimly lit.

"Will you step this way, sir?" said the servant, and he showed me into a long, low room. There was a dining-table already laid, and a bright fire.

"Please be seated," said the servant, and left the room. I stood in front of the fire and looked through some illustrated papers. A discreet knock at the door was followed by the appearance of the secretary.

"Good evening; pray be seated," he said. "You will be allowed to smoke one cigarette or pipeful of tobacco prior to the meal." He put a world of meaning into the word "meal," and I grew quite apprehensive.

"I've brought the menu with me. Perhaps you would care to see it. You quite understand that if you fail to consume the meal you will not be allowed to go into the presence."

Having consumed the meal, which consisted of *Scarabaes sacer* (sacred beetle), squatina angelus (monk fish), cold boiled whelks and suet pudding, I glared defiance at the secretary.

"Is there anything further?" I asked.

"No; but would you care for some coffee?" he said.

"Only if it's normal," I remarked.

He smiled and rang the bell and the servant brought in some delicious "Maxwell House" coffee, which he prepared on a small table with a glass percolator and spirit lamp.

The secretary handed me a Sobranie cigarette, and I began to feel slightly better. "When you are quite ready," he said, "I will show you into the presence."

In a few minutes I signified my readiness, and followed the secretary through a long, very badly-lit corridor. Several times I stumbled on loose flags. Up several flights of steps we went, higher and higher, until at length he stopped at a carved maple door. He took from a pocket of his jacket a bunch of keys, selected one and opened the door, and then switched on a light. It was quite inadequate for the size of the room. The corners were in darkness, and long shadows were on the walls. As I entered the room I noticed that it was furnished lavishly but in faultless taste. I selected an armchair before the fire and prepared to await the presence. The secretary bade me good night and withdrew.

Presently I heard music. But what music! it was of a quality not of this world. Strings of a ravishing beauty, woodwinds surpassing the standard of the "Philadelphia," and percussion like fine glass breaking on rich Turkish carpets. I wondered what work I was hearing; it was modern and pungent, and yet had an ethereal beauty impossible to describe. It was like a man praying aloud, and it reminded me somehow of Mahler. Presently the music came to an end with an exquisite *pianissimo*, the light grew more dim and finally went out — the only illumination was from the log fire.

A soft voice informed me that I had just heard Atomic Symphony No. 1, written by Icarus.

Presently a dim light appeared in the mouth of the huge Voight horn in the corner; it grew brighter and brighter, and soon I could make out the features of a man's head.

He wore glasses and was smoking a cigarette.

"I am Icarus," he said softly. "What do you want to see me about?"

With a shock which nearly stopped my heart I recognised him. "Good God!" I said. "It's YOU!"

CYCLORAMA

By H. W. ELEY

"Teas Provided"

IN the old days, before a pound of tea was as precious as rubies, and before ration-books were thought of, how one used to rejoice at the sight of the sign "Teas Provided"—on some cottage or village shop! It was one of the delights of the week-end cycle ride . . . this stop for a "high tea." And *what* a tea! Old-time cyclists can recall the plates loaded with bread-and-butter, the gay assortment of fancy cakes, the dishes of home-made jams, the honey . . . and the eggs. A neat outside sign does not always mean that one can be sure of getting even a cup of tea, let alone an egg.

Sojourner from the South

IT was in a little Derbyshire village inn —an inn with stone walls—that I heard the "accent from the south." It belonged to a young fellow, with a gay, colourful bike, who was touring, and who had "thought he would like to go north." I commended his wisdom and fell to chatting with him. Dorset had bred and reared him, and he came from the good country where Thomas Hardy lived, and dreamed, and made immortal the villages and hamlets. Did my Dorset friend like grey Derbyshire? He did . . . but he sensed the great gulf betwixt north and south; he found the folk "harder"; he hardly knew whether he liked the stone walls or not . . . but he felt the "pull" of Derbyshire, and would not easily forget Arbor Low and Youlgreave, and the moors where in August, I assured him, there would be grouse (he had imagined the bird as peculiar to Scotland); he had seen the loveliness of Beresford Dale, and at Matlock he had wisely bought a copy of "The Derbyshire Guide." It was a mutually interesting talk, for I told him of my own trips into Dorset . . . of my good memories of the Purbeck Hills, and of the lure of Dorchester, and the dignity of Regency Weymouth. I wish that more sons of the south would come northward, and forget for a spell the Sussex Downs and the glories of Surrey and Kent. The English scene is varied and not all the beauty is concentrated in the sunny south. . . .

Danger Can Lurk in the Lane

I USED to think, when I first came to live in what can truly be described as "the heart of the country," that road dangers would be rare or even non-existent. I was wrong. There is the menace of the narrow lane, down which milk lorries are liable to hurtle with undue speed. There is the problem of the uncut hedges . . . hiding one's view; and there is the problem, too, of the hens and ducks which "take to the road" at the most awkward moments. One has to be *very* careful when riding along these narrow lanes . . . which were never intended for heavy lorries and gargantuan coaches; the number of the latter is amazing, and they hail from Blackpool and Manchester, and Leeds and Bolton and Wigan.

"I Remember"

ONE of my old colleagues visited me recently and we fell to talking of old times . . . of early Dunlop days, of makes of cycles now no more, of "freaks" like the old "Dursley Pedersen." How good it was to slip back into the days when we were young, and the purchase of a bike entailed much self-denial and saving of pennies! We agreed that we both like the modern craze for colour; we were at one in enthusing over the lightness of the present-day machine; and we found that both of us acquired a "Hyde" free-wheel at the same time! Looking backward may not be a good thing . . . but occasionally it is pleasant to turn back the pages and recapture something of the romance which so sadly fades as the years roll by.

Healthy Export Figures

EXPORTS of the bicycle and motor-cycle industries were £15,139,449 for the first half of this year, and the total shows an increase of £165,892 over the first half of 1949. The leading buyers of bicycles were Pakistan, Malaya, British West Africa, Eire, Brazil, British East Africa, Iran and the Belgian Congo. These figures make very impressive reading, and are heartening indeed at this time when every effort has still to be exerted to increase the volume of our overseas trade. The director of the Manufacturers' Union, Major H. R. Watling, not long ago returned from talks with more than 100 trade and Government officials in Canada and the U.S.A., and he takes an optimistic view of the future, particularly of the prospects for the cycle industry in Canada. The British cycle industry has full reason to be proud of its export activities, and is doing its very adequate share in the "export drive."

The Bike and the Baby

YOUNG parents who are keen cyclists, and who do not intend to let matrimony rob them of the joys of the open road, show much ingenuity in their methods of taking baby with them on their rides. For some, the solution is the little "side-car," fitted alongside the tandem machine. Others seem to favour a basket-carrier affair, fitted behind the saddle of "Dad's" bike.

I have looked at many of these devices this summer, and have sometimes admired their undoubted ingenuity . . . but, sometimes, have felt qualms for the comfort and safety of the baby carried! No trouble could be too much to ensure that the infant taken out for a cycle ride should be comfortable, and entirely safe . . . and some parents, I feel, should be a little more careful of their charges. It is splendid to see the family out on the road, and certainly, the earlier a child learns to appreciate cycling, the better. One day I talked with a young couple who were out for a spin with a small kiddie and they had solved all the problems . . . the side-car attachment was good and safe, and the mother was provided with everything essential for the youngster when hunger indicated a stop and a rest.

Touring Abroad

ONE or two keen cyclists have written to me asking for information about taking cycles abroad . . . one correspondent wished to tour in Spain. I admit that I found myself rather at a loss to give any reliable guidance and referred the rider to the C.T.C. —and I fancy that body would be able to provide all the information necessary. It is many a long year since I cycled on the Continent, and one imagines that since the war regulations have multiplied, and there may be many forms to be filled up! Anyway, I hope that my correspondent, if he goes to Spain, will get good riding, much sunshine, and—maybe see a bull-fight!

The "Black Country"

IT has not much of a reputation for scenery . . . that scarred belt of country around Oldbury, and Wednesbury, and Tipton, and Darlaston . . . and yet, on the very fringe of the Black Country, there is scenery of real and magic beauty. King Coal has not succeeded in spoiling *all* the area of South Staffordshire and the borders of Worcestershire. I recall Kinver Edge and some of the good country around Stourbridge. Not far from the pit-banks, and the slag heaps, and the smoke and the grime, there are green fields, as green and lovely as those of the sunny south; there are cattle grazing in meadows; and, in the spring, the birds sing as sweetly a mile from a colliery-working as they do in a Hampshire or Surrey lane. Cycling is popular in the Black Country towns, and there are some very flourishing clubs . . . whose members know how to escape with ease from the drab towns of pits and forges. . . .

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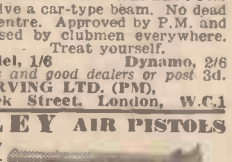

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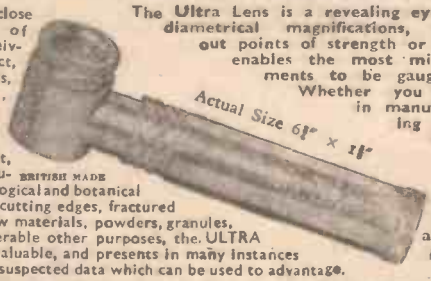

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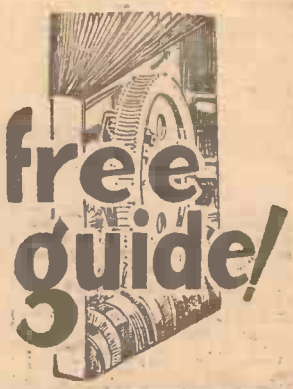

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