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THE Government, through the Department of Scientific and Industrial Research, is setting up a special organisation for scientific research in mechanical engineering to meet and anticipate the needs of industry and Government departments. The eventual annual expenditure will be in the region of £30,000, although it is unlikely that this figure can be reached for some years because of the present difficulties in obtaining suitably qualified staff and buildings. The research is intended mainly to supplement the work carried on in other research organisations in this country and will largely be confined to those fundamental problems which underlie all mechanical engineering; thus the subjects in which research is expected to be carried out are: Properties and strength of materials; Mechanics of solids, stress, stability and vibration of structures; Mechanics of fluids; aerodynamics; gas dynamics and hydraulics in their mechanical engineering applications: Lubrication, wear and mechanical engineering aspects of corrosion: Machinery, mechanism and noise control; and problems of formation of materials; machine shaping of material; Heat transfer, heat exchange apparatus and allied thermodynamics.

The wide scope of the mechanical engineering industry naturally influenced the Committee in its recommendations. Mechanical engineering covers the design and production of all engines and power plant for marine and aircraft propulsion; locomotives for railways, motor-car engines and transmission systems; the production of power from coal, oil and water; the machinery concerned with the manufacture of iron and steel, and the production of chemicals, textiles, foods; ventilation, air conditioning and refrigerating machinery; and many other matters. The central register of the Ministry of Labour schedules 98 separate activities in mechanical engineering compared with 57 in electrical engineering and 23 in civil engineering. There are about 60,000 mechanical engineers in this country eligible for the technical and scientific register of the Ministry of Labour. There are approximately four times as many mechanical engineers as there are civil engineers, and twice as many as there are electrical engineers.

There is a very considerable amount of mechanical engineering already in progress in this country, at the universities, in Government establishments, at some of the Industrial Research Association laboratories, and in the research departments of the larger firms. There are, however, gaps, such as the mechanics of fluids, which are largely a matter of guess, and - noise control. There is little that can be added to our present knowledge on the properties and strength of materials. Stress calculations are largely a matter of guess, based on empirical formulae, which depend for their success upon the use of the correct theories of safety. Similarly, the mechanics of fluids is a subject upon which a large number of excellent textbooks divulge all present knowledge. As far as noise control is concerned we want the devices which make the noise first.

The general plan and the early work of the new organisation will be based on the recommendations of a D.S.I.R. Committee on Mechanical Engineering Research, which reported on the essentials for research in mechanical engineering and examined in detail the mechanical engineering research facilities available throughout the country.

Wide Scope

The wide scope of the mechanical engineering industry naturally influenced the Committee in its recommendations. Mechanical engineering covers the design and production of all engines and power plant for marine and aircraft propulsion; locomotives for railways, motor-car engines and transmission systems; the production of power from coal, oil and water; the machinery concerned with the manufacture of iron and steel, and the production of chemicals, textiles, foods; ventilation, air conditioning and refrigerating machinery; and many other matters. The central register of the Ministry of Labour schedules 98 separate activities in mechanical engineering compared with 57 in electrical engineering and 23 in civil engineering. There are about 60,000 mechanical engineers in this country eligible for the technical and scientific register of the Ministry of Labour. There are approximately four times as many mechanical engineers as there are civil engineers, and twice as many as there are electrical engineers.

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A Simple Epidiascope

Constructional Details of an Easily Made but Efficient Instrument

By R. L. G.

ALTHOUGH the epidiascope about to be described cannot be expected to compete with the very perfect results obtained by the manufactured article, it has the advantage of simplicity of construction, low cost of materials and, like all other home-constructed apparatus, gives added pleasure to the constructor.

It is suggested then that those readers who have not seen such an instrument in use may like to try out this simple arrangement, after which they will understand the general principle of this system of projection and will appreciate the various refinements advertised by the manufacturer of the commercial article.

Size of Picture

The apparatus illustrated will give a very brilliant picture of 10in. x 8in. at a distance of 3ft from the original picture size of 2½in. x 2in., this being increased to about 1½in. x 1¼in., if projected. A suggested method of adapting a magic lantern lens to the condenser mount, both lenses in relation to the picture was necessary. Using a standard magic lantern lens, no diaphragm was necessary. The front lens only was used, and at 3ft. 6in. a picture 10½in. x 8½in. was obtained, whilst at 6ft. a good picture of about 1½in. x 1¼in. was projected. Again, suitable adjustment of the lens, in relation to the picture was necessary. A suggested method of fitting the lens to the condenser mount, both lenses in combination being first removed, of course, is seen in Fig. 1.

Construction

Constructional details can be clearly seen in the drawings. Fig. 1 shows an exploded view of the instrument with the parts in their order of fitting. The main body, or lamp house, is made from a standard biscuit tin measuring 9in. x 8½in. and 9½in. deep, with suitable apertures cut for mounting the lens and for the necessary ventilating passages. The latter consist of a tin superstructure soldered or riveted on top, with holes to allow escape of warm air. Similar holes are cut out of the bottom of the tin for the cool air inlet. The original lid of the biscuit tin is used for the picture aperture, which is arranged for in a tin recess fitted to the lid. A light screening tube, in which the lens itself fits, is fitted by a flange to the plywood panel, as shown. This panel itself is screwed to the wood frame fitted to the front of the biscuit tin.

A sectional view through the tin lamp house is shown in Fig. 4, whilst three of the four corner electric bulbs can be seen in the adjoining view. The centres for the lamp holder will be found about correct for clearance for 100-watt bulbs. For the purpose of current economy, lower wattage lamps can, of course, be substituted and the projected size of picture kept down to the smaller size previously mentioned. One of the corner lamps can just be seen inside the lamp house in Fig. 1. The lamps are, of course, wired up in parallel, and, although the writer shows the flex connections inside, these might with advantage be taken outside, but in doing so care should be taken that any holes drilled for the purpose are suitably protected to avoid cutting through the insulation. Light leading cable would prove advantageous if available.

In Fig. 2 is shown a view of the back of the instrument, with a picture or print clamped in front of the aperture by means of the spring clip, which are small strips...
of tin or brass, turned over at their top end and soldered at the lower end. The pictures are inserted from the top, and adequate room should be available if the clips come half-way up the picture width, as shown. Fig. 3 is a view from the front of the instrument, showing it connected to the lamp adaptor. This may be of the switch type, for convenience. In Figs. 5, 6 and 7 are given details of the various parts needing construction. A smaller size of tin might be utilised for the top vent, and this can be soldered or riveted to the main lamp house. It should be given a coat of photographic black, however, before fixing in position. A hole is also cut out at the bottom of the tin for air inlet, and the lamp house is raised upon two battens as shown, with a strip of tin screwed to them at the front to act as a light trap. As it was found difficult to screw these battens from the inside of the tin, setscrews and nuts were used, the holes being countersunk, as shown.

The Light Screen Tube

The front strip of tin could, of course, be formed by a cross-batten of the same wood section of 1½ in. x 1 in. This might be an advantage.

The Light Screen Tube

This is important as it prevents direct light from the lamps striking the lens, and allows only that reflected from the picture passing through the lens. The tube is made from medium gauge brass sheet, cut to size, and soldered to an end or front flange, drilled with fixing screw holes. If using the condenser lens combination the best plan is to wrap the cut sheet of brass round the lens mount, spot solder at the two extreme ends, remove from lens mount and solder along the seam. The inside should be given a coat of photographic black to prevent reflections.

The optical system is shown in pictorial form in Fig. 9, and it will be seen that a mirror is shown at an angle of 45 degrees to the lens. This will correct the projected image as regards right and left, and the screen will have to be to one side of the epidiascope, as shown. If projected straight on to the screen, the image, as well as any lettering, will be reversed. Such a mirror could be readily fixed to the lens panel at the correct angle. The reader may, of course, vary the sizes given, and much will depend upon the projecting lens available.

Some reading magnifiers may be found suitable, but some experiments should first be carried out to arrive at correct distances, and the largest aperture possible, for good definition over the whole picture area. If a biscuit tin is not available, the whole lamp house might be made up from sheet tin. Riveting would possibly be easier than soldering. It is suggested that some form of reflectors might be incorporated to increase light concentration on the picture area. The simple air vent and light trap arrangement could be elaborated on, if desired, by fitting a further section above the first, when complete light trapping would be secured. Also the bottom air inlet could be elaborated.

The black margin will be found to prevent reflection near the edges of the projected image. If possible, switch off the lights as often as possible, both to save current and allow the lamp house to keep cool. Finally, it is quite interesting to see the palm of one's hand, reflected in full colour, on the screen, and serves to demonstrate to the "unbelievers" that this is not just an ordinary magic-lantern.

Fig. 8.—Details of lens mounting.
Fig. 9.—Diagram illustrating the optical system.
Fig. 10.—Diagram of wiring construction.

NEWNES PRACTICAL MECHANICS
Making a "Skyway Runner"

A Novel Accessory for Kite-flying Enthusiasts

To kite-flying enthusiasts the idea of the "messenger," the circle of cardboard slipped on to the string and gradually blown up to the kite, is well known. This led to the question being asked if it would not be possible to make something that would not only go up but also return. This started a discussion with a few friends and various ideas were forthcoming. It ended with a little experimenting, and eventually the writer evolved the following design that worked very well. The following description and drawings of the apparatus may be of interest to other readers.

The main idea of this "Skyway Runner," as shown in Fig. 1, consists in the provision of two sails or planes which, on reaching a step fixed on the kite string a few yards from the kite, roll up tightly and the weight of the runner is sufficient for it to slide down the string.

The materials required are a few cycle spokes, some tin, brass wire about 18 gauge, 4½ in. of ½ in. round dowelling, greaseproof or similar paper, thread and elastic bands or model aeroplane motor rubber.

Constructional Details

To construct, first mark out a piece of tin to form the runner platform (Fig. 2). The holes can be drilled or punched to approximate size and cut to shape. Chisel cut the centre on three sides, and bend up on the broken lines, the centre part front end, and sides. A spot of solder at the corners will strengthen it. Bend a cycle spoke for the roller support frame (Fig. 3). This is soldered to the underside of the runner platform, as shown by dotted lines. The bottom roller bearing of tin is soldered to the roller support. The wood roller (Fig. 4) is next fitted, using a tack at the top and a piece of spoke with cross piece of wire soldered on in the bottom. Make sure the roller revolves freely. The striker bar (Fig. 5) is made of spoke 3½ in. long, with a U-shaped piece of brass wire soldered to one end and made a sliding fit in the three holes in the centre piece of the runner platform. The striker bar stop hook is soldered to the striker bar about 3 in. from the end. This stop hook can be used in conjunction with a parachute carrier (Fig. 6). The two paper sails are cut and glued to the roller so that they are equal each side. The ends of the sails are strengthened by gluing over a thin strip of cardboard (Fig. 8). Tie a 9 in. piece of thread to the end of each sail. With the sails rolled up, fit a rubber band round one end of the cross piece at the bottom of the roller and, giving it one turn for tension and direction, slip the other end of the rubber band over the end of the roller support frame, as in Fig. 1. Fit in the sail arms by putting the tapered ends through large holes, just aft of the runner platform centre, and press the point into the smaller hole on the opposite side. Pull striker bar forward each made of spoke 7 in. long with a small wire ring—⅛ in. hole—soldered at one end, the other end being square tapered. The two paper sails are cut and glued to the roller so that they are equal each side. The ends of the sails are strengthened by gluing over a thin strip of cardboard (Fig. 8). Tie a 9 in. piece of thread to the end of each sail. With the sails rolled up, fit a rubber band round one end of the cross piece at the bottom of the roller and, giving it one turn for tension and direction, slip the other end of the rubber band over the end of the roller support frame, as in Fig. 1. Fit in the sail arms by putting the tapered ends through large holes, just aft of the runner platform centre, and press the point into the smaller hole on the opposite side. Pull striker bar forward and

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By H. B. BALL

Fig. 1.—General arrangement of the "Skyway Runner."

Fig. 2.—The runner platform before being bent to shape.

Fig. 3.—Roller support frame made from a cycle spoke.

Fig. 4.—Details of sail roller.

Fig. 5.—The striker bar.

Fig. 6.—Parachute carrier and striker bar stop-hook.

Fig. 7.—Sail arm.

Fig. 8.—One of the sails.
Shaping and trueing follow normal polishing and thus receive a distorted figure. This is sometimes due to the doubling of angles and the other causes. For this reason, among others, polishing proceeds from 30 to 75 strokes per minute in spells of half an hour each. The thickness of the mirror is important, as anything thinner than one-eighth of the diameter may sag under its own weight enough to destroy the image. Also, it may flex during polishing and thus receive a distorted figure.

Polishing Technique

The fabrication of these surfaces on a mass production basis is not feasible for the larger class, as the tolerances are measured in millionths of an inch. Therefore, these methods differ from the factory methods recently described in this journal, and applied to laboratory work. Temperature control is necessary, as the expansion of the mirror during the polisher is not enough to distort the surface, unless the mirror is of a substance with a low expansion figure, such as Pyrex or quartz. For this reason, among others, polishing proceeds from 30 to 75 strokes per minute in spells of half an hour each. The thickness of the mirror is important, as anything thinner than one-eighth of the diameter may sag under its own weight enough to destroy the image. Also, it may flex during polishing and thus receive a distorted figure.

To Operate

The kite string is threaded through the runner stop from the disc end, and is held about 3 or 4 yards from the kite by plugging the string in the tube with a matchstick. When the kite is flying steady, put the "Skyway Runner" on the string. Pull the striker bar forward. Take the two sail rings and, pulling them to the centre, hook them on the releasing points on the striker bar. Push the runner up the kite string a few yards and the air currents will start it running up towards the kite.

When it reaches the stop the striker bar will release the sail cords, allowing the sails to be furled. The runner will then return down the string. When a parachute is put in the hinged holder, it is dropped when the string is pushed back on reaching the stop. It will be noticed that the runner attains a good speed on its return journey and, unless checked, is likely to give the hand holding the kite string a nasty knock. If the string is given a circular action of just a few inches when the runner is about five yards away it will be braked.

Optical Mirrors

Methods Used in Forming Large Optical Surfaces Required in Telescopes and Image Forming Instruments of High Power

By G. HOLE

PERFECTING the excellence of the performance being directly dependent on this. The permissible tolerances for this purpose are: in the absence of pressure, which is sometimes necessary, as the polishing of a large figure, such as Pyrex or quartz, for this reason, among others, polishing proceeds from 30 to 75 strokes per minute in spells of half an hour each. The thickness of the mirror is important, as anything thinner than one-eighth of the diameter may sag under its own weight enough to destroy the image. Also, it may flex during polishing and thus receive a distorted figure.

Shaping and trueing follow normal polishing and thus receive a distorted figure. This is sometimes due to the doubling of angles and the other causes. For this reason, among others, polishing proceeds from 30 to 75 strokes per minute in spells of half an hour each. The thickness of the mirror is important, as anything thinner than one-eighth of the diameter may sag under its own weight enough to destroy the image. Also, it may flex during polishing and thus receive a distorted figure.
hairy edge if turned edge exists on the mirror. The remedy is to shorten the stroke and/or trim the edge of the polisher, and polish until the defect disappears. The eye-piece is then removed and the returning cone of light received directs into the eye. The glass under test appears full of light just like a full moon. A vertical knife edge is now slid in front of the eye, its edge just cutting through the shadow made seen to cross the mirror. Now, if the knife edge is inside the mirror focus, the shadow will travel across the same way as the knife edge. If it is outside the focus, the shadow will travel in a direction opposite to knife edge feed. When it is at the focus, the mirror, if spherical (all parts of same radius), will darken evenly (see Fig. 1).

The mirror will, however, not be spherical in all parts. It may possess a central hollow (region of shorter focus). The shadow on this region would be confined to the opposite side to the knife edge, and the remainder of mirror, if spherical, would be grey (see Fig. 2). Should any departure from the sphere exist, it will show as a variation in position and depth of shadow, and the expansion of the glass, caused by placing the finger-tips on it for five seconds, is plainly visible as a hill where each finger rested. This gives some idea of the delicacy of this test.

The mirror for use as a reflecting telescope must not be spherical, but must be of shorter focus at the centre. Therefore the curve must be deepened towards the centre by increased polishing. This may be done in a variety of ways, the safest being to trim the polisher facets from full size in the centre down to nothing at the edge. This will leave the full-area polishing in the centre, while the edge is not being polished so much, according to the amount of trimming. Polishing with the mirror on top and off centre on the tool will also deepen the centre, but is likely to turn the edge, as is a longer stroke. This deepening must be perfectly regular, from nothing at the edge to the full amount at the centre of the mirror. The difference in focal length of the edge and centre, when masked off and measured, should be $r^2 (\text{where } r = \text{ half diameter and } K = \text{ radius of curve})$, and when this difference is reached the mirror is a paraboloid. If it is regular, has no turned edge and the above-mentioned difference in focal length exists, it is finished and ready for silvering. Various methods exist, the best being Brashear's process, details of which can be found anywhere. Silvering may in future be displaced by coating with a film of aluminium deposited in vacuo, and this service is available from various commercial houses. It has the advantage of being more permanent than silver, and gives better reflection in the ultra violet.

**Plane Mirrors**

Surfaces of comparable accuracy are required on plane mirrors as used in Coelostats and Helio-heliostats, on the surfaces of certain prisms, etc. These can be tested by placing them in the cone of rays coming from a perfect spherical mirror. It has been seen that a spherical mirror appears evenly grey under test from centre of curvature, if perfect. It also gives a perfect pinhole image in this position only. Obviously, if a perfect plane surface is placed so as to reflect the rays from the sphere, it cannot alter them at all if the plane is perfect. It can only divert the whole beam (see Fig. 3). If, however, the plane is not perfect, the previous beauty of the sphere's image will be lost and irregularities of the plane will be seen in elliptical outlines, apparently on the surface of the sphere. They will be doubled owing to the two contacts with the faulty surface, and should be treated by figuring, as in the case of the mirror previously described, until the even shadow is obtained and the pinhole image of the sphere is equally good, with or without the plane. When this condition obtains with freedom from local irregularities and turned edge, the surface is plane and finished. This means that should the surface be imagined enlarged to one mile in diameter no hills would exist higher than 1/10 in., and no hollows deeper than same. Such is the level of perfection required in these large optical units.

**Convex Mirrors**

One more type of mirror remains, the convex. This surface is not an image former, as reflection forms a divergent cone with no focal point available. It requires a larger, more powerful convergent cone of known perfection to test with, obtained from a spherical mirror of short radius. If the convex be placed so as to reflect this cone of rays it will modify its angle but not destroy its perfection of image, provided the convex is perfect. Figuring should be worked until this end is obtained. The test is one of the doubly rigorous type, as the light from the testing pinhole contacts the surface under test twice, on its outward and return journey.

The various types of surfaces are used in telescopes of both refracting and reflecting type. The lenses of refractors need spheres and planes, and in some the plane is replaced by a concave. The great mirror of a reflector of one of the three normal types must be a paraboloid, and the cone of rays from this may be modified by any of the three curves—convex, as in the Cassagrain, plain, as in the Newtonian, and concave, as in the Gregorain.

This survey cannot be detailed and still remain within the limits of a short article, but enough has been written to show the reader the road to follow in order to produce surfaces of the ultimate accuracy obtainable by human effort.

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**Swiss Railway Centenary**

_A hundred years ago—on August 19th, 1847—the first railway journey was made from Zurich to Baden. To celebrate the centenary, an exact replica of the locomotive that made the journey has been constructed. With officials dressed in uniforms of the period, it is to tour the Swiss Federal Railways as part of the centenary celebrations. Our illustration shows the replica of the 100-year-old train on a trial trip._
A New Type of Electric Motor

Details of Construction and Operation of the Rev Electrotor

Details are now available of a new small power electric motor known as the Rev Electrotor, which employs an electro-magnetic phenomenon new to electric motor design. The motors are built on completely unorthodox lines; they have no commutator and no soldered joints. The extreme simplicity of construction ensures complete freedom from faults and high efficiency.

Description

As will be seen from the "exploded" view, Fig. 1, the Rev Electrotor consists essentially of:

- A permanent ring magnet (e).
- A gap-ring armature winding (f) mounted on a bobbin (i) and spindle (j).
- Two end plates (b) with contacts (a). Cover tape (c). Two securing clips (d). (See also Fig. 7.)

The edges of the winding (f) are bared and the contacts (a) bear directly upon these edges.

The winding (f) has a core of iron wires (g) of high permeability, cased in an insulating coat, upon which several layers of double nylon covered copper wire (h) are wound in such a way that current flowing between the contacts energises all the layers.

Theory of Operation

Consider first the condition which obtains when no current is flowing, and the gap in a winding is adjacent to the S. pole of the permanent magnet (Fig. 2). Both ends of the armature core have induced N. polarity and the peripheral centre of the core (which is adjacent to the N. pole of the magnet) has induced S. polarity.

When the current is applied (Fig. 3) the winding becomes, in effect, a horseshoe electro-magnet with polarity between the points of contact of the contacts and the ends of the core (but with concentrated polarity at its ends), the end nearest the + contact being a strengthened N. pole, and that nearest the - contact a S. pole of reduced strength. Consequently, the N. pole is attracted to, and the S. pole repelled by, the S. pole of the magnet, and rotation ensues, the effective torque depending upon the width of the gap.

It will be obvious that this width is vitally important and years of painstaking research have been devoted to the establishment of the exact dimensions necessary to give the required torque, consumption, and efficiency.

As rotation continues (Fig. 4) the flux density of the N. pole of the winding loses its end-concentration and becomes more evenly distributed between the end and the contact point, and eventually has concentration at the contact point; conversely, the flux density of the S. pole of the winding becomes progressively distributed.

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Fig. 1. "Exploded" view of the Rev Electrotor

Fig. 2. Section through armature and permanent ring magnet. (Reference letters indicate same parts as in Fig. 1.)

Fig. 3. Diagrams explaining the theory of operation.
concentrated at the end of the core. There is, consequently, strong attraction to the poles of the magnet, with resulting high torque.

The next stage to be considered obtains when both ends of the gap are under the — contact (Fig. 5) and have therefore strong S. polarity. The peripheral centre of the core (which is under the + contact) is similarly strong N. polarity. Rotation therefore continues.

The final stage occurs immediately after the gap has passed the — contact (Fig. 6). The N. pole of the armature is now concentrated under the + contact, the terminal energised polarity being cancelled by the S. polarity induced by the magnet. Consequently, the point of flux concentration is attracted to the S. pole of the magnet. The following end of the armature (i.e., that under the — contact) has strong S. polar concentration, and is therefore strongly attracted to the N. pole of the magnet.

From the foregoing notes, it will be seen that at two stages in the cycle, flux concentration at one or other of the ends of the winding is utilized to give an additional surge of power, and the whole cycle is balanced by the constant variation in the distribution of flux density.

Science on View

Some Notable Exhibits Which Were Seen at the Recent Ideal Home Exhibition

At least it was a relief from the "Britain Can Make It" Exhibition that the great majority of the exhibits at the Daily Mail exhibition which came broadly under the heading of scientific were to be available within a reasonable time and actually function.

"Cooking by Radio"

The only example of something that did not work as well as it might at the Ideal Home Exhibition was E.M.I.'s "cooking by radio." Two young ladies were demonstrating this cooking with what looked to me a bit of turboc. Sure enough, in a few seconds the fish and sliced potatoes emerged cooked.

"That's all very well," I said, "but what happens if I want some Brussels sprouts with my fish?"

It appears that I can't have them unless I boil them in the ordinary way, and in that case I can't see the point of buying a machine costing two hundred and something pounds to cook the fish and potatoes in a few seconds if I've got to wait for it to get cold while the vegetables cook.

What happens in this "cooking by radio" is that house current is transformed into radio-frequency current and, as it is focused directly on the food, no heat is wasted. There is apparently a larger model which will cook a family joint in five minutes.

Another thing that is claimed for it is that a fishmonger can de-freeze a selected portion in a few moments.

Magnesium

In my last article I touched on the demonstration of magnesium as the lightest metal for use in the home. This demonstration of magnesium from sea-water was organized by F. A. Hughes and Co., Ltd. A child can lift a five-gallon dairy can with one finger, and a scaled had been rigged up on which a chair—similar to the usual tubular chair—exactly balances against a glass of water.

Owing to the fact that magnesium heats quicker than other metals, it is excellent for griddle-plates and heating elements similar to those on view.

The manufacturer of nylon had a demonstration stand in which the Ministry of Supply had a hand. I suspect that the Ministry's contribution was the Horsa glider tow-rose, worth £5 a foot, and equivalent to 17,000 pairs of nylon stockings; also the parachute cords. We saw how chemical compounds of coal and air go in one end and come out as nylon threads at the other end. Perhaps the most rare nylon exhibit as far as the ladies were concerned was a pair of British-made nylon stockings.

Synthetic Resins

There was a Human Torpedo on show, which the Marquis of Donegall described as "a display of domestic gas appliances seen at the Ideal Home Exhibition."
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on film-strip or wire years ago if so many interests were not involved does not detract from the way the show was produced. It did, however, seem a shame that all the artists worth hearing have been tied up by people whose profit lies in saddling us with cumbersome, scratchable, breakable and cumbersome forms of woodwork which imitate the wood-carver's art for such household uses as furniture boaîsettes. It is said that machine gears made from this substance are silent and less subject to temperature expansion and contraction than metal.

Another point is that, when you consider that it takes a lifetime to grow a large tree for timber, a process which enables broad planks to be made from small trees is something of a revolution in the forestry industry.

Cheap Watches

I mentioned some popular cheap watches in my last article. The pocket watch will be on sale shortly at 30s. and the wrist watch is on sale now at £2 5s. Further along this stand they were demonstrating and selling a new design of household door lock.

That thoroughly antiquated vested interest, the making of recordings on shellac, or "wax," as it is popularly called, was beautifully demonstrated in detail by H.M.V. The new design of household door lock, a process which enables broad planks to be made from small trees is something of a revolution in the forestry industry.

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into kippers in 24 hours. If they have a better flavour, which is claimed for these smoke-wind kilns, it is obviously more efficient than the old method of hanging to smoke over a peat fire.

Intercom in the Home

The only snag I saw to the "intercom in the home" is that in my small experience one of the things that make the housewife's household chores less dreary is the two or three minutes gossip with the milkman, butcher, baker or itinerant vendor as and when these worthies present themselves and their wares.

The "intercom in the home" consists of a small gadget which the housewife carries about and plugs into the mains in any room where she happens to be. A caller approaching the front door automatically causes the bell to ring. She switches on and inquires the nature of his business, her voice coming through a loud speaker outside the front door. If he has goods to deliver, she presses a button and a hatch-way opens while he puts the deliveries into it. She can tell little Willie to behave himself in another room or leave a recorded message for her husband to play back when he comes in.

Our old Home Guard friends the "sticky bombs" have given up their moulds for making plastic sprays for shower baits. The transparent noses of aeroplanes have become cigarette boxes and plastic machine belting yields attractive belts for women. Some of the plastics were non-inflammable. We were, in fact, invited to put our cigarettes out on them to prove that they are undamageable. Others were luminous and such things as door handles, key-hole plates and light switches were shown in a darkened cupboard. The organisers of this Plastic Section were Messrs. de la Rue.

Invisible Heat-ray

To me the most novel demonstration was of seeing in the dark. You looked through a slit in a wall and saw nothing but pitch black; then you looked through eye-pieces similar to opera glasses and saw in a sort of greenish light a night nursery quite distinctly enough to tell if all was well without disturbing the child in the cot. This phenomenon was achieved by invisible heat-ray and was a demonstration of top-secret war appliances by the Ministry of Supply.

The chair covers and curtains of glass by Messrs. Fiberglass were not only attractive but are said to be untearable, unburnable, unrustable and moth proof. It was also stated that one glass marble weighing 1oz. and 3in. in diameter would be the equivalent of 182 miles of the glass thread used in combination with plastics.

The last demonstration in the Science Section attempted to explain what atomic energy is all about. I have no doubt that you, dear readers, would immediately find the whole thing crystal clear. As for myself I shall take the wise course of fading gracefully away rather than show you that the atom remains to me, even after the demonstration, a highly mysterious and more than unpleasant subject.
Experiments with Ozone
What Ozone Is—Its Peculiar Properties—How to Make Ozone from Air

E
e
ey amateur experimenter, when working with electrical apparatus in which sparks are produced, must, at times, have noticed a peculiar smell in the vicinity of the apparatus, an odour which is not unpleasant, despite its being somewhat pungent.

For years this "electrical smell," as it was once termed, was observed and commented on by various electrical and chemical workers, but it was not until a little more than a century ago—in 1840, to be precise—that a Swiss experimenter, one Christian Friedrich Schönbein, discovered that the electrical odour was due to the presence of a gas, to which he gave the name "ozone," from the Greek ozo, "I smell."

One of our countrymen, too, John Benjamin Dancer, a now almost forgotten Manchester optician, instrument-maker and photography pioneer, was struck by the peculiar and characteristic smell surrounding working electrical instruments, and he, also, gave some attention to discovering the cause of it. It is very probable that Dancer identified ozone as a separate substance before Schönbein did. Nevertheless, the latter worker published his discovery in a better form, and is nowadays generally given the credit of having discovered ozone.

The nature of ozone was a great mystery to Schönbein and to the other experimenters of the day. At first it was thought to be a new element, an element belonging to the well-known "halogen" family, of which chlorine, bromine and iodine are members. Then the view was put forward that it might consist of a new form of water, a new compound of oxygen and hydrogen. Finally the real composition of ozone was discovered, and it was found to consist of nothing other than oxygen in a peculiarly condensed form.

Condensed Oxygen

Chemical science, as, no doubt, the reader will be well aware, terms the smallest particle of a substance which can exist as such, a molecule. Now, in the ordinary way, a molecule of oxygen consists of two oxygen-atoms linked together by an attractive force existing between them.

We may visualise an oxygen molecule as:

\[ O = \overset{\cdot}{O} \]

Ozone, however, contains three atoms of oxygen in each of its molecules. Consequently, a molecule of ozone is represented as:

\[ O = \overset{\cdot}{O} \]

two ordinary oxygen molecules having been condensed together to form the special kind of contracted molecule containing three oxygen atoms.

We may, for the sake of greater clarity, write down the condensation process of oxygen into ozone in the following manner:

\[ O = \overset{\cdot}{O} = O + O = O = O \]

(Three oxygen molecules.)

(From an old silverprint photograph.)

Two ozone molecules."

This curious condensation of oxygen into ozone may be effected in several different ways. In many small amounts of oxygen are generated, for all experimental purposes by far the best method of generating oxygen is by means of the "ozone tube," a simple device which can be made by any electrical or chemical worker.

Ozone Tube

To make an ozone tube, obtain a narrow glass tube of about in. bore and approximately 12 in. long. Insert into the tube a length of thin bare copper wire, the far end reaching to about an inch off the end of the tube, the other end of the wire being brought out of the tube and secured in position by means of a little blob of sealing wax or some other plastic material placed at its point of emergence from the tube.

A second length of copper wire (bare or D.D.C.) is then coiled round the outside of the tube, the length of the coil being about an inch shorter than the length of the wire inside the tube. This coil of wire is also secured in position by suitably placed blobs of sealing wax or by some other convenient means.

We now require an induction or spark coil. Quite a small one will suffice, one capable of giving, say, a quarter-inch spark, and it need only be actuated by a two-or four-volt battery or accumulator. To the secondary terminals of the induction coil the two electrodes of the ozone tube are connected. The ozone tube itself is suitably mounted either by means of clamps or on a wooden base. A supply tube is attached to it at one end and a delivery tube at the other end.

The supply tube may consist of a length of ordinary rubber tubing, but the delivery tube should be made of glass and attached to the ozone tube by only a short link of rubber tubing, since ozone rapidly attacks rubber.

We may now connect up the supply tube to a bicycle pump and in that manner cause a slow current of air to be blown through the ozone tube, or, better still, we may attach to the supply tube a large hard-glass test-tube containing a mixture of three parts of powdered potassium chlorate and one part of manganese dioxide. This mixture, when heated, will give off oxygen abundantly, and the oxygen will perform its task of passing through the ozone tube on its way to the external air.

During the time at which oxygen or ordinary air is being slowly passed through the ozone tube, the induction coil should be brought into operation. A silent electric discharge will thus pass around the tube and a considerable percentage of the air or oxygen flowing through the tube will undergo its peculiar condensation into ozone. If pure oxygen is sent through the tube, about 8 per cent. of it will be changed into ozone. If only air is passed through the tube, the proportion of ozone will be less and it will be likely to be contaminated by traces of oxide of nitrogen.
Chemical Method

Another way of making ozone is to pass air very slowly through two or three flasks containing sticks of phosphorus half submerged in water. The slow current of air issuing from these flasks is finally passed through a wash-bottle flask containing a little water to dissolve out phosphorus oxides and the traces of hydrogen peroxide which are also formed by the oxidation of the phosphorus.

The phosphorus employed must be the yellow variety of this element—not red phosphorus.

Even a single stick of phosphorus placed at the bottom of a bottle and half covered with water will charge the air in the flask with ozone. Consequently, when the delivery tube of the ozone apparatus is allowed to dip beneath the surface of either of these liquids contained in a small vessel the liquid will smell strongly of ozone.

The powerful smell of ozone is very characteristic. It is pleasant, yet pungent, and too much of the gas may possibly set up a transient throat irritation.

The sense of smell, however, is by no means the most delicate test for ozone. If we make up a little ordinary starch solution and dissolve in it a small quantity of potassium iodide and afterwards impregnate a number of pieces of white blotting paper with this solution, subsequently allowing the impregnated paper to dry, we shall have prepared "starch-iodide" paper which is exceedingly sensitive to the presence of ozone in the atmosphere. These "ozone papers" should be preserved in a well-stoppered bottle.

In order to detect traces of ozone with them, all we need do is to moisten them with water and then to hold them in the situation in which the presence of ozone is suspected. If the slightest trace of ozone is anywhere in the neighbourhood the ozone paper will turn blue. This colouration arises from the fact that ozone has the power of liberating free iodine from potassium iodide and that the iodine thus freed from its compound combines with the starch to form a vivid blue substance.

Ozone is fairly soluble in water and also in turpentine. Consequently, when the delivery tube of the ozone apparatus is allowed to dip beneath the surface of either of these liquids contained in a small vessel the liquid will smell strongly of ozone.

Powerful Oxidising Agent

Ozone is a very powerful oxidising agent since the additional amount of oxygen which it contains is very easily given up by it. It is for this reason that ozone is one of the best disinfectants known. It destroys germs rapidly, and when passed in small amounts into water it sterilises the latter very effectively.

Ozone, too, in consequence of its oxidising powers, can be used as an effective bleaching agent. If, for instance, we allow the delivery tube of our home-made ozoniser to dip below the surface of water coloured with a little indigo or cochineal extract or aniline dye solution, the liquid will become decolourised.

In view of its bleaching properties, therefore, it is not advisable to conduct ozone experiments in any room containing valuable oil paintings or water-colours which, although fast enough to light, may be sensitive to the action of traces of ozone.

When carrying out experiments with ozone it is also inadvisable to breathe too great a quantity of the gas, in spite of its containing nothing but oxygen. High concentrations of ozone give many people lasting headaches. Small amounts of ozone in a room, however, impart to it a delightful freshness and a faint, "clean" odour.

Whenever lightning strikes through the atmosphere, great quantities of ozone are formed in its path. It is for this reason that the atmosphere, after a severe thunderstorm, usually becomes very refreshing to breathe. The slow evaporation of seawater and, also, the action of sunlight on large masses of wet seaweed is productive of considerable quantities of ozone. Hence it is that the seaside air has often a peculiar freshness and tang which is absent from country air.

Action on Mercury

Ozone has an extraordinary action on mercury or quicksilver. If, by means of our ozone tube, we collect a jarful of ozonised oxygen or air and introduce into it a globe of mercury, afterwards shaking the mercury globe about within the jar, the mercury will quickly lose its mobility and lustre and will spread itself in the form of a grey film on the sides of the jar. The mercury, however, may afterwards be restored to its original condition by shaking it up with water. In view of this curious effect, ozone preparation should not be carried out in rooms containing mercury barometers or other mercury-containing instruments in which the mercury is exposed to the air.

A piece of silver foil—real silver paper—is heated and then held in a jar of ozone, the silver will immediately, be blackened owing to the formation of an oxide film on its surface.

Ozone, too, will oxidise black lead sulphide and convert it into white lead sulphate. This is a particularly useful reaction to remember, for if we have any white lead paint which has yellowed during the course of time we have only to wash it over with water in which ozone has been dissolved in order to freshen it up very considerably and, indeed, in some instances, to restore it to its original whiteness, the ozone oxidising the traces of lead sulphide to whose increasing presence the gradual yellowing of the white lead paint has been due.
Liquid Ozone

By strongly compressing ozone and by cooling it to the temperature of liquid air, the gas condenses to a deep blue liquid which boils at a temperature of minus 197 deg. C. The liquid prepared in this way is never pure. It contains greater or less amounts of other oxides of oxygen, and it is only by careful fractionation of the liquid that a fairly pure ozone can be obtained.

In the liquefied condition, ozone is a rarefied gas used in some substances. It is explosive and has been suggested that liquid ozone might be used as an effective blasting agent in coal mines and other underground situations, since the products of its explosion can only consist of pure oxygen. Unfortunately, however, liquid ozone in its pure state seems too uncontrollable an explosive for this use.

Ozone Into Oxygen

As we have already observed, it is not a difficult matter to change oxygen into ozone. It is, however, a still easier task to change ozone back again into oxygen. All we have to do for this purpose is to fill loosely a short length of glass tubing with powdered copper oxide and to attach it to the delivery tube of the ozone apparatus. All the ozone air or oxygen which passes through the copper oxide tube will be completely decomposed and the air or oxygen which escapes from the end of the copper oxide tube will not have any effect on ozone paper.

Even heat alone will break down ozone into oxygen. Heated to a temperature of 250 deg C. this breakdown of ozone is complete. Hence if ozone is sent through a glass tube heated by means of a Bunsen flame, the ozone will be reconverted back again into oxygen.

Atmospheric Ozone

Town air contains little or no ozone. Country air, however, contains about one volume of ozone to every 700,000 volumes of air, whilst the percentage of ozone present in seaside air is still greater.

Small as these atmosphere traces of ozone may be, they are sufficient, it is thought, to hold the world of micro-organisms in some considerable check, for were the atmosphere entirely devoid of ozone it is probable that micro-organisms would multiply extensively and that the world would quickly become a place of continual disease and pestilence.

Ozone, therefore, is one of Nature’s most powerful disinfectants. By means of it the Earth’s atmosphere is kept reasonably pure and all living creatures are to some extent protected against one of their greatest enemies, the disease-giving germ.

The germ-ridding properties of ozone are, of course, well recognised, the various commercial ozonisers testifying to this fact. Such instruments consist merely of a device wherein a high-tension electric discharge is passed across a space through which air is made to pass. The issuing air then contains appreciable amounts of ozone.

The household ozoniser may not yet be a common device, but the industrial ozonising apparatus for the air in factories, workshops, hospitals, underground workings, theatres, cinemas and the like was, previous to the war, becoming a very common and effective aid to air conditioning.

Science Notes

By Prof. A. M. LOW

Coloured Fire

Not so long ago I happened to witness a number of fires all round me. It is interesting to think that by touring London at such a time with an instrument consisting of little more than a prism made from an old-fashioned chandelier or a cheap lens, one could estimate the nature of all the materials on fire.

I was amazed, as the headlines say, to find every fire had a distinctive colour. Due to some dust or moisture in the atmosphere, but usually, I think, to the materials concerned. Perhaps they were of interest to another world where peculiar people are saying, “They are lucky to have so much carbon in such convenient forms!”

I feel that the early savages who made fires by rubbing sticks together, a most trying business which seems to warm the person concerned more than the sticks, must have had its own local characteristics. Perhaps they were interested in another world where peculiar people are saying, “They are lucky to have so much carbon in such convenient forms!”

No Wonder We Breathe

Breathing is a habit. A very good one, I imagine, but here is a very interesting thing. Ask this is about air. Of course, it makes the green fields we breathe it and it is pleasant. But it is so much more than just “air.” Aeroplanes fly in it, but without some of the queer substances it contains their manufacture might be slowed down by about 30 per cent.

Air is mainly a mixture of 21 parts oxygen and 79 nitrogen. It was this nitrogen that saved Germany from a nitrate shortage in 1914 that might have slowed up production of explosives and fertilisers. To-day the separation of air into its various component gases has enabled almost every form of industrial and manufacturing process to be vastly speeded up.

Oxygen is a great “speeder up.” There was a time when it was just used occasionally in hospitals to help sick lungs and hearts and to heal wounds. Now oxygen is one of the most vital tools known to the engineer. It welds, it cuts, builds gun mountings and ships in a miraculous fashion.

Nitrogen, too, is almost as important. Unlike oxygen, it is a very lazy gas which never wants to join with anything else. So it can be used for preserving food. Just think what would happen in canned food-stuffs if they were sealed up with air—rust, fermentation and waste. Not so when nitrogen is all around. Nitrogen, in a sense, feeds the world in more ways than one, for, given good canning and dehydration, famine can be abolished.

Atmosphere also contains minute quantities of other gases such as neon—you see its effect in modern lighting—and argon, a valuable gas used to prevent electric light bulb filaments from wastage at high temperature. All these materials are made from air by apparatus which, in itself, is a romantic story. Queerly enough, the microscopic quantities of rare gases in air help to keep us healthy.

Thinking Up a Pot of Jam

You will have noticed from the Press, and therefore you will have known that it is true, that the energy in atoms must have been “put there,” as it were, by the sun in its heat and at its birth. Star dust is made more romantic by a little knowledge, and not less so as has been said by people who do not grasp, fortunately, that scientists are as ignorant as anyone else.

We know, it seems, that matter can be converted into energy by a bomb, and we also know that in the preparation of the uranium family we can seemingly create a new element from “bricks” of which it is basically constructed. Call them electric particles if you prefer.

Now, if matter is energy at partial rest, and energy can flow through the ether, why not, in the vastly distant future, transfer material things by radio? The betatron may be a beginning. An Atlantic flight was represented by a two-year hop only yesterday in the realms of time.

More exciting still is it that thought also is energy. It even produces other waves. I remarked long ago that I felt very small indeed besides the man of the few million, million years hence who might look positively frightful with atrophied legs, artificial aids to everything, no hair and no teeth. But supposing he could think a pot of raspberry jam across the Atlantic, that would be far more interesting than the best of bodies! As far as I am concerned at the moment it would be an extraordinarily desirable accomplishment.

REFRESHER COURSE

IN MATHEMATICS

By F. J. CAMM.

8/6, by post 9/
The Design and Operation of D.C. Machines

The D.C. Dynamo.

By W. H. Sutherland, B.Sc.

The armature, or rotating part, of a dynamo consists of an iron cylinder with a number of deep slots lengthwise along its periphery. In these slots are laid the active portions of the insulated copper conductors which form the winding. The minimum number is usually two conductors in each slot. In the following article "conductor" may refer to a single copper bar, or to all the turns in one side of a multi-turn coil. As the armature rotates each conductor passes through intense magnetic fields the directions of which are shown dotted in Fig. 1, which is a cross-section through the armature and field system of a typical 4-pole machine. By making the armature in this way the magnetic flux travels through iron for practically its whole journey, and, since it is about 1,000 times easier to establish a flux through iron than through air, the necessary flux is thus obtained with the minimum expenditure of energy in the magnetising coils. The small double air-gap in each flux path is inevitable, but can be reduced to a minimum by accurate construction.

Flow of Induced Current

As a conductor cuts the lines of magnetic force four times in each revolution a small E.M.F. is induced in it, the direction of the resulting current flow being obtained readily by the application of Fleming’s Right-Hand Rule (Fig. 2).

Hold the thumb and first finger of the right hand as fully extended as possible, and bend the second finger at right angles to the palm. If the first finger represents the direction of the magnetic field and the thumb denotes the direction of motion of the wire, then the second finger shows the direction in which the induced current tends to flow.

As an aid in remembering this useful rule, associate the "f" in first finger with the "f" in field, and the "m" of motion. If the left hand is used, the rule shows the direction of motion (thumb) of a current-carrying wire (second finger) when placed in a magnetic field (first finger), and is useful in the case of electric motors.

When this rule is applied to Fig. 1, it will be seen that current flows up out of the plane of the paper in those marked 1, 2, 3, 4, 13, 14. The remaining conductors are in positions of zero or negligible induced E.M.F. at the instant shown in the diagram.

The conductors are connected in series to form a continuous closed path, which may be considered at any instant to commence at one brush and end at the other brush. The elementary condition which must be satisfied by the winding scheme is that current shall be driven in the same direction all through a conducting path by the separate induced voltages of the individual conductors forming that path. A conductor carrying a "down" current must therefore be connected across to one carrying an "up" current and so on around the circuit. In this way the current receives a "push" from the induced voltage in each wire as it passes through the generating portions of the winding on its way from one brush to the other. Of course, the wires used to form these end-connections do not generate but serve merely to link up the active portions lying in the armature slots.

Armature Windings

If we start to trace a path through the winding of Fig. 1 from the conductor marked 1, we could satisfy the above condition about current direction by joining the far end of 1 to the far end of any one of the conductors marked 7, 8, 9, 10, 17, 18, 19, 20, all of which are carrying "up" currents. In practice the choice is limited by two important conditions. Firstly, it is customary to connect top-layer conductors to bottom-layer conductors, and vice versa. This is purely a mechanical point leading to a more symmetrical winding, and permitting the use of "former-wound" armature coils. In fact, in very small hand-wound armatures the exact opposite condition usually holds. We shall assume former winding for the present discussion. Secondly, conductors which are joined together at either end of the armature must be separated by approximately the same "pitch" (= angle) as adjacent field poles. This is necessary in the interests of efficient commutation, and will be justified presently.

The pitch in the present case is 90 degs. With these points in mind conductor 1 could be connected, at the far end, either to 8 or to 18. There is nothing to choose between these two alternatives, and, in practice, if 1 is joined to 8, then 2 will be joined to 17 (not to 18, since 2 is in the bottom layer). Alternatively, if 1 is joined to 18, then 2 would be connected to 7. In the present instance 1 is shown joined to 8, and this defines the pitch to be used for all end-connections at the far end of the armature. Conductor 3 is therefore joined to 10, 5 to 12, and so on, each end-connection "spanning" seven intermediate armature conductors.

We have traced the current down through 1, across and up through 8 to the near end of conductor 8. From here the path may go in either of two directions, producing the two different kinds of armature winding. The near end of 8 may be joined back to the near end of 3, or it may go forward to the near end of 13. These two possibilities are illustrated in Fig. 3 and Fig. 4 respectively, where, for simplicity of representation, the conductors are drawn radially, the inner ends indicating "front" or near ends of Fig. 1. In either case, the pitch of the front end-connection is seen to be 5. It is usual for the front and back pitches to differ numerically by 2 in this way, each being of necessity an odd number, when top-layer conductors are joined to those in the bottom layer.

Fig. 1.—Section through armature and field system of typical 4-pole D.C. dynamo carrying 22 armature conductors in 11 slots.

Fig. 2.—Illustrating Fleming’s Right-hand Rule, used to determine the direction of current flow in a conductor moving through a magnetic field.
Fig. 3 is a lap winding. After a succession of the fundamental "lap" or elemental "lap" as just described, the winding eventually returns to the starting point at the near end of 1, thus forming a complete closed circuit containing all the conductors in series. Each fundamental "wave" encircles the armature once, and after a number of such windings, the winding again returns to the starting point. These windings are shown fully developed in Fig. 3 and Fig. 6. These may seem complicated at first sight, but it represents nothing more than a succession of the simple elemental "lap" or "wave" of Fig. 3 and Fig. 4. The centre point of each front end-connection is joined to the nearest commutator segment.

Path of Current Through Armature

The condition that current should flow in the same direction throughout a complete brush-to-brush path cannot be made to apply consistently to the whole winding. On tracing around the lap winding of Fig. 5 it will be found that the direction of the current reverses suddenly at four points in the winding, and segments commonly from contact of these points to the next. In other words, the winding divides naturally into four separate conducting paths, with currents along the respective directions. These paths are shown dotted and full-line in Fig. 5, and the junction of each two indicates a correct position for a brush on the commutator. The arrow heads which indicate the direction of the current-flow are seen to meet at segments (e) and (j), so that current will flow from the armature into the external circuit from positive brushes placed in contact with these segments. Similarly, current tends to enter the armature at segment (h) and segments (b) and (h), and the negative, or return end, of the external circuit is therefore brought to brushes in these positions. The current, returning to the armature after passing through the external circuit, will divide into two parts, half entering the winding through segment (b), and segments (a) and (b). The current which enters at (b) will divide again, one quarter flowing through the full-line path to the positive brush at (c) and thence back through the external circuit, and the other quarter passing through the dotted circuit to re-enter the external circuit at segment (g). The other half of the current, one quarter will pass through the dotted path from segment (g) to (e) and the other quarter through the full-line path from (h) to (j). In general, the lap-wound armature there are thus four separate generating circuits, all in parallel with the external circuit. The terminal voltage of the machine is that generated in any one of these paths, that is, in one quarter of the whole winding. On the other hand, the possible current output is high, since any conductor carries only one quarter of the total armature current. In general, the lap-wound armature is divided into as many parallel paths as there are field poles, and since the junction of any two paths must be supplied with a brush the number of brushes is also equal to the number of poles. Brushes of similar size are joined together externally. Multiple lap windings are therefore supplied from vol- tages in the armature and current machines such as those used for carrying out large-scale electrolytic processes.

In Fig. 6 only two parallel paths can be found, except at segment (e) where passing by dotted or full lines to segment (b). Wave-wound armatures have never more than two parallel paths no matter how many poles are used, and the number of brushes need never exceed two. Moreover, the terminal voltage is always that generated in the correct direction but only half as large as it would be in the fresh path, since as the conductor in question leaves the brushes and becomes part of the fresh circuit the full current of that path will flow through it. If the instant of transfer is such that the fresh current must therefore jump from half to the full value for the fresh path, and, since all armature windings are alike, this sudden forced change of current will lead to the production of local-induced voltages which will cause sparking at the brushes. The absence of which by which means this reversal of current is achieved is called commutation, and may be effected in two distinct ways, or, in practice, by a combination of these two ways.

Resistance Commutation

For this, carbon brushes are required at least as wide as a single commutator segment, so that pairs of adjacent segments are short-circuited for a moment while bridged by the brush. This causes the short-circuiting of each elementary path, just at the moment when the induced E.M.F. in the lap or wave has dropped to zero as the brushes pass the point of zero flux in the centres of the interpole gaps. The lap or wave which is thus momentarily shorted and undergoing commutation is shown in heavy line in Fig. 6, the absence of arrow-heads indicating that the current has fallen to zero at the instant shown in the diagram.

More short-circuiting of a loop for a moment would not cause the sequence of current changes outlined above. The orderly reversal of current in the commutated loop depends on the instantaneous so that the contact resistance between a carbon brush and a commutator segment is inversely proportional to the area of contact. That is to say, the resistance is low when the segment is directly opposite the brush, but increases rapidly as the area of contact between the two becomes less as the segment moves away from the brush. The effect of this phenomenon is detailed in Fig. 7, which shows a section of the lap winding of Fig. 5 drawn in simplified form.

The resistance commutation of loop 21/6 (i.e., the loop shown in heavy line in Fig. 5) as it passes to the brush is shown in Fig. 8. The negative brushes are shown. In (A) the two parallel armature paths meet at segment (h), and the current is conveyed to the winding from the brush through both paths. When segment (g) enters the brushes the current flowing from the brush internal full-line path is transferred into segment (g), but since the contact resistance at (g) is very large at first, due to its small area of contact, the current prefers still to follow the longer path through segment (h) and around loop 21/6. Thus, the shorting of loop 21/6 by the brush does not immediately lead to zero current in the lap winding, but the interrupting current is reduced to zero by the sudden increase in the current of the loop, as would occur, for example, if copper brushes were used. As the area of contact with (h) increases, and that of (g) decreases, more and more of the full-line current takes the direct route through (g) so that the current passing via the shorted loop drops progressively and finally at (C) the full-line current is passing through each of the shorted segments: By the time the brushes have reversed, completely, at (C), all of the full-line current is passing through the direct route by segment (g), and the current around loop 21/6 has dropped to zero. The conduction of the loop at the instant shown in Fig. 5. As the contact resistance to segment (h) increases still more, some of the dotted line current begins to find an easier route into the winding through segment (g) and around loop 21/6, so that current commences to flow.
in the reverse direction around the short-circuited loop. At (D) half of the broken-line current is passing through the loop and half is passing through segment (h). Just before segment (h) leaves the brush, all of the broken-line current has transferred to loop 2/6, so that when contact with segment (h) is finally severed and the commutated loop becomes part of the broken-line circuit, it is already carrying the full reverse current and no sudden change in the value of the loop current occurs.

A moment later commutation of loop 1/4 commences, and so on.

**Cause of Brush Sparking**

In the foregoing notes we have dealt with the routes taken by the main armature load current. If the loop 2/6 is not in the position of zero induced E.M.F. (i.e., in the centre of the interpole gaps) during the period of short-circuit, an additional circulating current is set up in one or other direction around the shorted loop by the E.M.F. induced in the loop by its movement through the field. When the trailing edge of the brush breaks contact with segment (h), this circulating current is suddenly interrupted, a self-induced E.M.F. rapidly builds up in the inductive loop, and a spark jumps to the brush from the segment before the gap has widened sufficiently to prevent it. To avoid this, each brush must be placed so that it bridges those commutator segments which are joined to conductors passing through the region of zero flux, midway between the poles. This is the primary consideration governing the placing of brushes in all D.C. machines. It explains also why the winding pitch should be kept as close as possible to the pole pitch, so that both sides of any loop may be situated in the centre of the interpole gaps at the same instant.

As an examination of the winding diagrams will show, the placing of the brushes which best satisfies this vital condition brings them also in contact with the points in the winding at which parallel paths meet, so that no sacrifice of available E.M.F. need be made to secure sparkless commutation. Unfortunately, the problem of sparkless commutation is complicated in practice by several other factors to be discussed in detail next month.

(To be continued)

**The Model Railway Exhibition**

The Model Railway Exhibition, recently held at the Central Hall, Westminster, was the first exhibition to be held by the Model Railway Club since 1939. As with previous shows of this kind, the organisers staged a very attractive display of model locomotives, rolling stock and accessories. The accompanying illustrations give a good idea of the high-class workmanship noticeable in many of the exhibits. Model railway layouts in various scales were much in evidence, particularly in “OO” and “O” gauges.

Judging by the fine attendance at the show, the war years have not dimmed the enthusiasm of young and old for the fine hobby of model railway construction and operation.
Penicillin Production

Details of the Plant and Methods Used in the Manufacture of This Remarkable Drug

By A. E. WILLIAMS, F.C.S.

Penicillin, a very useful drug developed largely during the recent war and now made by large-scale fermentation processes, requires special types of plant for its efficient production. To obtain 4 lb. of penicillin over 30 tons of the raw material have to be handled under strictly controlled and exacting conditions. Because penicillin is an extremely sensitive substance the technique of producing it differs widely from other methods used in manufacture.

The flow sheet, Fig. 1, outlines the procedure adopted for penicillin production at the Speke (Liverpool) factory operated by the Distillers Company, Ltd., on behalf of the Ministry of Supply. In this plant the materials for the fermentation vessels are sterilised by heating in the steriliser, then passed through a cooler into the fermenters, wherein the mould to induce fermentation is added. Compressed air is blown upwards through these vessels to assist fermentation. The fermented batch is next filtered, and from the clear liquid the penicillin is extracted, being next combined with either sodium or calcium to give a stable penicillin salt.

In this form the penicillin goes forward through sterilising, testing and special drying plant.

In processing, the liquid is first sterilised by the use of superheated steam at a pressure of about 150 lb. per sq. in.; the type of fermenting vessel used being seen in Fig. 2, which shows some 5,000 gallon vessels of Glaxo Laboratories, Ltd. Fermenters may be of mild steel, welded or riveted, with pipes arranged at intervals up the side of the vessel for the drawing off, when necessary, of the various portions of the batch. In such a building, not only steam pipes are lagged, but the carrying the process liquids are also similarly protected to maintain the desired temperature while they move through the pipes. To maintain a vigorous fermentation in the vessels a strong current of air has to be blown through the tons of liquid in each vessel. This is done by compressors drawing from atmosphere via an elaborate system of air-purifiers, since the air passing through the compressors must be perfectly sterile.

Air Cleaning

The installation of air purifiers, or scrubbers, at the Speke factory is seen in Fig. 3. Air is sucked in at the top of the towers by compressors and passes through different chemical agents to eliminate atmospheric impurities. It is then filtered and washed before proceeding, under pressure from the compressors, to the fermenters.

Normally, the different forms of impurity in the average atmosphere may be classed as solid, liquid, gaseous and bacterial, the different proportions of these varying widely according to district. Visible particles, which we commonly call dust, are larger than 0.0002 in., and these are easily collected from the air by the use of suitable filters; while the smaller, invisible particles can also be eliminated by suitable washing methods. These invisible particles may, in fact, be arrested at the same time as the liquid and gaseous impurities by chemical and washing treatment. The amount of solid impurities in an average atmosphere ranges from 1 to about 10 grains in every 1,000 cubic feet of air; but in congested industrial areas this concentration of impurity may be greatly exceeded. It is not difficult to estimate, therefore, the amount of solid dirt alone which will be collected by air-purifiers handling thousands of cubic feet of air per minute.

In the case of fermentation processes the elimination of bacteria and sterilisation of the air to be passed through the vessels is of paramount importance; because air, even though freed from other types of impurities, that contains even a low concentration of bacteria may quickly spoil a fermentation process. To create sterile air quickly and in large quantities is no easy matter. Extensive use has been made of glycerine as a collecting medium for bacterial impurities, and one plant for this purpose consists essentially of a series of revolving drums, partly submerged in a bath of glycerine. The air to be cleaned is passed through the upper section of each drum and thus contacts the glycerine-coated surface of the drum. As the drum is slowly revolving a fresh contact surface is continuously presented to the air.

Fig. 1.—Flow sheet outlining the process adopted for penicillin production.

Fig. 2.—Penicillin Glaxo 5,000 gallon fermenters.
Rotary Filters

After fermentation it is necessary to remove the solids (mycelium) from the liquid containing the penicillin, and this is done by rotary filters. Fig. 4 shows a filter of this type in action at the Speke factory. The mycelium is removed in a continuous layer, and the plant operates under vacuum created by Pearn pumps. In operation, the liquid from the fermenters is fed in a constant stream to the vessel in which the filter rotates, and gradually a layer of mycelium forms on the surface of the filter by reason of the reduced pressure inside the drum created by the pump. The layer of mycelium is removed continuously as it is formed on the filter surface.

A typical rotary filter consists of a drum revolving in an open tank, which latter may be constructed of cast iron, mild steel, stainless steel, or other metal having a high resistant action to the material passing through it. The object of having a non-corrosive metal for the construction of this tank is not only to prolong the life of the tank, but also to avoid metallic contamination of the batches passing through it. The drum shell has an inner surface which is impermeable to liquids or gases, and this carries a grating to support an outer surface which is porous and forms the filtering medium. Different compartments are built into the space between the two surfaces by the provision of metal strips running parallel to the axis of the drum, the compartments being entirely separate from each other and are connected by a series of pipes to an automatic valve at the end of the shaft. In this type of valve the seat is bolted to the drum trunnion and the two revolve together, while the valve chamber is fixed.

When in operation, the liquid that has to be filtered is fed at an appropriate speed to the tank, and as the drum revolves in the liquid, a cake or layer of solids from the liquid gradually forms on the porous filter surface. The clear liquid which has passed through the porous material is collected by a series of pipes inside the drum and passed through the automatic valve to the outside. As the cake emerges from the liquid a current of water is sprayed on it; the vacuum serving to clear quickly the excess water. At a point just before the layer, or cake, meets the scraper to remove it, the vacuum may be replaced by compressed air, which loosens the cake for easy removal by the scraper. The clear, porous surface then enters the liquid in the tank again and the next cycle commences.

The clear liquid from the filters passes on to large, stainless steel tank fitted with high-speed agitators.

Recovery of Penicillin

At this stage a small proportion of finely divided activated carbon may be added to the liquid, the amount depending on the actual concentration of penicillin present. The penicillin is rapidly absorbed by the

at the Speke (Liverpool) factory of the Distillers Co., Ltd.
carbon and after passing through filter presses the clear liquid is thrown away. The next step is to recover the penicillin from the carbon and to purify the crude penicillin by a series of operations using organic solvents. For this purpose the carbon may be transferred to another stainless steel vessel and stirred up with a solvent, which dissolves the penicillin from the carbon.

The penicillin is later passed through a series of alkali extractors, Fig. 5, which shows some of these vessels in the Speke factory, whereby a solution of either the sodium or calcium salt of penicillin is obtained. These vessels are of stainless steel, glass lined, each vessel carrying stirring gear operated by its own individual motor, with variable speed gear. The method of stirring materials, as depicted in Fig. 5, wherein each vessel has its own individual stirrer and prime mover, is a vast improvement on what was, until recently, almost standard practice. This was to stir a whole series of vessels in a row by means of line shafting and a belt operating each stirrer through simple gearing; the stirrers each having a fast and loose pulley. With the old method it frequently happened that the necessarily high-powered motor employed to drive the line shaft had to be kept running merely to stir one vessel in the series.

So that in order to stir one small vessel a motor far too big for the job had to be used, and in using it the belts on all the unoccupied vessels had to be kept moving, running on the loose pulleys, thus creating unnecessary wear and tear. Another great drawback to the older method of stirring is that if the big motor breaks down, all the stirrers operating from that line shaft are immediately out of action, but with the individual stirring method, if one motor stops only one stirrer is out of action.

Drying

After further purification and concentration, the penicillin is transferred to bottles, which are filled at a rate of 3,000 per hour. Trays containing the filled bottles are covered and placed in dry-freezing machines which reduce the temperature of the solution to 70 below zero C., thus freezing the solution to a block of ice. The bottles are then transferred at high speed to vacuum ovens and vacuum is applied. In solution, penicillin is so unstable to heat that dehydration must be accomplished in the freezing state and the ice is, therefore, evaporated directly without going through the liquid phase. This is assisted by the use of high vacuum diffusion pumps.

Drying equipment at the Speke factory consists of two batteries of vacuum ovens, seen in Fig. 6. The massive construction of these units is necessary, for when in operation under high vacuum there is a pressure of about ten tons on the outside of the oven doors. These doors are constructed of special cast iron, while the body of the drier is of welded steel construction. Around the rim of the door is a composition gasket to give an airtight joint quickly when the door is closed.

The diffusion pumps operating on these driers are seen in Fig. 7. Eleven sets of these pumps handle the two batteries of driers. The pumps are 4in. diameter units, of multi-jet design, in welded steel. The operating medium is chlorinated hydrocarbons, which have a lower vapour pressure even than that of mercury. In operation, the hydrocarbons are continually vaporised and condensed again on the cooled sides of the pump. A vacuum higher than \(10^{-4}\) mm. Hg. is obtainable with these diffusion pumps.

After the trays of uncovered bottles are placed in the ovens, the system is evacuated down to about 300 microns within five minutes.

(Continued on page 319.)
The British Industries Fair

Some Afterthoughts: A Glance at the Trinity

By the MARQUIS of DONEGALL

THERE was little in common between the three divisions of the B.I.F. (Olympia, Earl's Court and Castle Bromwich) except such things as good catering, courtesy and efficiency for dealing with overseas buyers' language requirements.

There was, however, one important angle common to all that struck me particularly, having visited this year's fair at Basle. That was that it was obvious, as was the case at Basle, that an architect, or team of architects, must have been employed in the design of each section.

These architects had a difficult task because, just at the time that their designs were ready to be materialized, the sundry shortages, and especially the fuel shortage, set them furiously thinking out substitutes and improvisations.

I am not sure that the result was not if we could only get hold of the things in this country it might make the dry-cleaning think again when they airily tell us that we won't get the curtains back for three months, if lucky.

Perhaps I was only particularly impressed by the bed-linen and the Witney blankets, because everything tolerable in this department has been out of the shops for so many years. The shades in which all these things come, including the quilting, were certainly pleasing, even if one had seen them long ago.

Earl's Court

Earl's Court was the largest of the three sections, and consisted mainly of the textile exhibits which included a great many articles depending on processes developed during the war. Particularly I would mention fireproofing and sponge-down qualities.
and one realised that their counterparts in Switzerland were British.

The Movie-doll

To go less serious for a moment, one of the unexpected riots of the Olympia section was the movie-doll, of which, in its present various forms, I submit a picture. The fact that it is modelled on Disney-esque lines, is cheap, washable, unbreakable and will retain any grotesque position that you twist it into, apparently caught the imagination of overseas buyers. Also it was for immediate delivery. Anyway, South Africa ordered a million, and America was only a little behind with the Dominions. You will be able to see this popular monstrosity because a large Oxford Street store has bought the entire Olympia stand to transplant lock, stock and barrel. (I was not able to ascertain whether it has also purchased the British and American film stars who swarmed round the Olympia stand.) One of the reasons that I have picked out this particular product to be the only one that I shall mention by name is that it is made entirely by ex-Servicemen, 50 per cent. are disabled—with a proportion of one-armed and some in wheel-chairs.

Precision Instruments

It is rather interesting to recall that there were over 3,000 exhibitors at the first post-war B.I.F. as against just over 2,000 at the last one in 1939. Undoubtedly at Olympia a main attraction was what I would call the Precision Instruments Section. This department—hardly by chance, I feel, was situated immediately through the main entrance of Olympia. Quite apart from the "British Leica," which I mentioned in my former article, there were such things as binoculars, microscopes, optical measuring machines, instruments fitted with plastic precision lenses, etc.

Plastic Lenses

All these things we manufactured before the war—including plastic lenses—better than anybody in the world. I happen to know about the plastic lenses, because I am original shareholder in a company which spent seven years on research working out the variation of refraction between glass, quartz and "Perspex" for every known prescription of spectacles.

It takes you back a bit to remember that King George V wore a pair of our plastic spectacles for the last two years of his life. As may well be imagined, the art that we had developed was put to good use in the war, but, not being a technician on submarine periscopes, I will not go further than to say that I believe we were able to eliminate what would correspond in a motor-car to the "blind spot" provided by the supporting limb between roof and chassis.

As an instance of the optical apparatus there was the equipment made to replace that which was removed from a Norwegian lighthouse by the Nazis. This was such a landmark that it corresponded as a meeting-place to the famous clock at Lord's Cricket Ground. When installed this apparatus will give a triple flash per minute of 4,000,000 candle power, which, in good conditions, should be able to warn ships as much as 40 miles away. Also among the scientific instruments there was one which records the behaviour of cosmic rays and another by the aid of which "sets" can detect a piece of metal that your dog has swallowed. This instrument was on the same principle as the wartime land-mine detector.

Then we have instruments that are capable of measuring such things as the speed of a camera-shutter within one-millionth of a second.

Also there was a machine that will indicate to the "backroom boys" any weakness in the design of an aircraft before the prototype takes off on its first test flight.

Watches and Jewellery

As far as watches and chronometers are concerned, we have always made the best in the world since Harrison lived and died at a time old age in the eighteenth century to give the world the marine chronometer. We got slack about this virtual British monopoly towards the end of the last century.

Frankly, the watches were not very startling to one who has glued his face to watch-shops in Switzerland, but it was good to see the chronometers and equally satisfactory to note that someone had taken the trouble to get them right.

I was particularly interested in the telecommunication show of high-speed transmitters and receivers, as fitted in one of the trains for the Royal tour of South Africa. On the television side, the full-size van for outside broadcasts was interesting and, although not new to readers of this magazine, I saw for the first time a television set employing only one wavelength for sound and vision.

It would be impossible to give any idea of the multiple uses of plastics. It went from allegedly unbreakable doll's furniture to a full-size kitchen display of gaily coloured Perspex.

Whatever the arguments may be for or against the holding of the fair, it is certain that the British craftsman has not lost his skill—ray, has indeed taken full advantage of wartime scientific advance—even though he may not have the tools or the material to make in the quantities that we would all like to see.
Napier's Bones

Suggestions for the Construction of a Strip Calculator of this Type

By A. Milner

Many minds have been intrigued by these ingenious devices, and in view of the recent articles in this magazine the writer feels that some of the ideas and methods outlined below may prove of interest and use. From the point of view of present day requirements, the "Bones" are hardly in usable form. The inconvenience of arranging the separate sticks for each multiplier, together with the mental resistance to adding numbers arranged diagonally, and the carrying forward detract considerably from the usefulness as a practical calculator.

Strip Calculator

Anyone desirous of constructing a calculator of this type, but without the inconvenience of the separate sticks, may do so on the following lines. Take 10 sheets from a pad of thin squared paper and, as shown in the illustration (Fig. 1), use each sheet to contain a number of vertical columns for sets of the tables for each multiplier. By cutting carefully between the columns, but leaving all sheets fastened at the top, it is possible by turning up the strips to obtain a table for the desired arrangement of numbers.

The centre row of figures is in distinctly coloured ink, and the figures indicate each of the multipliers 1-9. The use of diagonal lines is avoided, and the figures which it is necessary to add together are shown between the columns, but leaving all sheets fastened at the top, it is possible by turning up the strips to obtain a table for the desired arrangement of numbers.

Simple Method

As the mental effort required to effect the additions and the carry forward figures causes appreciable delay and as the multiplication table up to 12 X 12 is well known, attention was directed to performing the multiplication mentally and leaving the additions to a separate step. The following method allows for products to be written down on alternate lines as before. The product of such as 3 x 2 should be shown as 06 to maintain alignment.

Multi-add 1

Example 1

<table>
<thead>
<tr>
<th>8 x 6732</th>
<th>4824</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5616</td>
</tr>
<tr>
<td>3 x 2</td>
<td>53856</td>
</tr>
</tbody>
</table>

Example 2

<table>
<thead>
<tr>
<th>9654 x 3275</th>
<th>9654</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2755</td>
</tr>
<tr>
<td>2</td>
<td>1812</td>
</tr>
<tr>
<td>1</td>
<td>1810</td>
</tr>
<tr>
<td>7</td>
<td>635</td>
</tr>
<tr>
<td>6</td>
<td>4228</td>
</tr>
<tr>
<td>5</td>
<td>5430</td>
</tr>
<tr>
<td>6</td>
<td>624</td>
</tr>
<tr>
<td></td>
<td>31626504</td>
</tr>
</tbody>
</table>

For multiplication by two or more figures squared or lined paper is advisable, and the separate products for each multiplier are written down on alternate lines as before. The product of such as 3 x 2 should be shown as 06 to maintain alignment.

Multi-add 2

If a table of boxes of products for each of the numbers 1-99 is constructed as shown on page 316, the multiplication of any number by a two figure multiplier is obvious. It will, however, be seen that by performing one linking step on similar lines to that required with the strip calculator, the use of the table permits easy multiplication of any number by four figures.

Example 3

9 x 5758. Read as 513-51822 using boxes 57 and 58.

Example 4

9 x 5778. Read as 513-52002 using boxes 57 and 78.

Example 5

95 x 523. Read as 45-4707 using boxes 5 and 23.

49685

Markers or pointers to indicate the required boxes should be used. Where it is required to use boxes for an odd number of places the box for a single place should be used first, as shown in Example 5.

Long division is facilitated as the table allows the factor and its product to be quickly ascertained.

M.A.3 and M.A.4

While the M.A.2 is normally sufficient and is convenient on account of being on a single sheet, there are advantages which in the writer's opinion would warrant tables being constructed for three-place and four-place numbers. As an example of the M.A.3, boxes are shown in the table on the following page for numbers 365, 366, 634 and 635. The M.A.3 allows for six figure multipliers to be dealt with conveniently.

Complementary Division

The difficulty in long division, apart from the multiplication of the divisor, is the necessity of subtraction which is not usually an easy mental process. We can replace subtraction by addition if we arrange M.A.3 and M.A.4 tables in such a way that next to the box for a given number is to be found the box for its complement.

Example 6.

865456-365 using M.A.3 table.

4890326/426/46065

1270

49692

49692

5635

5635

1276

5080

1276

5080

8356

8356

By inspection of the box for 365 we see that the first figure of the answer is 2, and we then add the product of 2 x 6635 which is the complementary number and is found in the adjacent box, and so on. The first figure of each of the additions is crossed off to form part of the answer, and the rest is the remainder.

The method will be clear when it is seen that for example:

\[-365 \times 197 = 72056\]

\[-365 = 562\]

\[-365 + 365 = 0\]

\[-197 + 197 = 0\]

or:

\[-365 \times 197 = 72056\]

\[-365 = 562\]

\[-365 + 365 = 0\]

\[-197 + 197 = 0\]

Alternatively a slide rule can be used to ascertain the next few figures of the quotient, and as regards the table for the products of the complement of the number is then required.

Log Charts

As the name of Napier is so much associated with logarithms, one is tempted to see if any similar economies in this field can be effected. In this connection the writer has found that logarithmic scales constructed in sections on squared paper can often be used more conveniently than the usual four figure tables. These charts can be used in much the same way as a slide rule, by noting the number of complete lines of sections of the single log scale; and as regards portions of lines, by marking off the lengths on a strip of paper.

In this way it is easy to have the service equivalent of a slide rule 100 cms. long, or 1,000 cms. long, which naturally does not compete with the standard 10 cm. rule for convenience for the usual engineering requirements. These sections of a logarithmic scale are on similar lines to those used in Cooper's slide rule, and on account of being prepared on suitably selected squared paper, the mantissae can easily be read when necessary without the mantissa values being shown. Suitable layouts are 1,000 cms. divided into 50 lengths of 20 cms., and 100 cms. divided into 10 lengths of 10 cms. In the scales prepared by the writer it was found convenient to arrange on the left-hand side the mantissa value at the commencement of each line and on the right-hand side the number of the line.

In these days of strict economy the devices outlined may form a useful utility model calculating machine.

Fig. 1. A simple strip calculator. Alternatively the heavy figures can be replaced by red figures with vertical lines on each side.
A Modification of "Napier's Bones"

A Practical Calculation Aid which Permits of Easy Multiplication of any Number by a Four Figure Multiplier

<table>
<thead>
<tr>
<th>MULTI-ADD TWO-PLACE TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
</tr>
<tr>
<td>01</td>
</tr>
<tr>
<td>01</td>
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<td>01</td>
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<tr>
<td>01</td>
</tr>
</tbody>
</table>

NEWNES PRACTICAL MECHANICS

July, 1947
THE WORLD OF MODELS

Model Railway Activity in Germany : Northampton Society of Model Engineers : Model Yachting in Kensington Gardens

By "MOTILUS"

EVEN in times of great distress and suffering it is extraordinary to learn that model activities still find a place in the lives of those interested in the hobby. Since Postal Regulations have been somewhat lifted, I have had news from friends in various parts of devastated Europe, and have recently received a long and informative letter from JNG. Dr. Phil. Walter Strauss, of Ulm, Württemberg, Germany. As some readers may remember, Dr. Strauss is the author of that very comprehensive and famous book entitled "Lilliputbahnen," which was published in Germany in 1933. Unfortunately, owing to the outbreak of war, the English edition was never published. This book dealt not only with model locomotives and model railways in Germany, but also included illustrations of model railways all over the world, and was considered by many authorities to be a classic of its kind. Writing on the subject of his last railway book, "Lilliputlokomotiven," Dr. Strauss says: "This book, which deals with miniature passenger-carrying railways, was stamped in and scrapped by order of the Nazi regime, a book of ten years intensive international work, which showed my sympathy towards your country. Yet the invincible spirit still spurs him on-..."

Yet the invincible spirit still spurs him onwards and he admits that as soon as paper and printing are available he will start work on a counter-piece to "Lilliputbahnen," which will deal with indoor electric railways, especially of gauge oo.

At the beginning of the war, in order not to take part in anything connected with the taking of life, Dr. Strauss took the post of teacher in a private high school placed in a central station having eight branch lines for the traffic of four trains controlling themselves. Unfortunately, towards the last days of the Nazi regime, the head of the Gestapo in Württemberg selected the school as a place of concealment for himself and his Gestapo guardsmen, and after that, as the school was requested for French vacation children, Dr. Strauss had to live for nearly a year in the chemistry class-room among glass tubes, retorts, poison bottles, burners, etc. However, better times were in store, and eventually Dr. Strauss was appointed school leader of the Stubersheim Elementary School in the U.S.A. Zone. Now, living in the country on the summit of the Alp Mountain (some 2,300 feet above sea-level) he is re-erecting his oo gauge railway. This is surely a true example of the love of the hobby, although the German enthusiasts know nothing of the developments which have taken place in other parts of Europe during recent years, as they have been so totally separated from the rest of the world. Dr. Strauss says-"so the world of model life is all wherein we try to forget the terror of the last years of suffering, as we had a Jewish name."

In the name of his school he has asked that any reader who has some picture postcards which he could use as lantern slides in the epidiascope to illustrate his lectures about London and Great Britain would be greatly assisting him. Even used postcards will help him, he says, to show the beauties of our country to the German children. Let me pass on to you a message from Dr. Strauss-he would be most interested to hear from any model railway enthusiast who would care to write to him; his address being (14a) Stubersheim Kreis Ulm, Württemberg, Germany.

After receiving this letter, I looked through my store of photographs of long ago, and was lucky enough to find one which I had taken on my return from Germany some 20 years ago (Fig. 1). I had been visiting well-known model makers in Germany in company with Mr. G. P. Keen (chairman of the Model Railway Club), and we met Dr. Strauss near Hanover. We found that we had much of mutual interest to dis-

2,300 Feet Above Sea-level

At the beginning of the war, in order not to take part in anything connected with the taking of life, Dr. Strauss took the post of teacher in a private high school placed in...
fig. 4.—A summer scene on the Round Pond, Kensington Gardens.

Fig. 5.—A Bermuda rig "Alexandria" yacht.

to demonstrate how the Great Western Railway’s post-war plans for improved travel facilities are now materializing, a display of models was recently arranged at Paddington Station. Our illustration shows one of the Company’s new luxury cross-channel ships which is now in service.
Letters from Readers

Lubricating Car Springs

SIR—I was interested to read in the March issue a letter from motorist E. N. Crump (London), re keeping the road springs accurate workmanship are dealt with, with all kind respects to Mr. Crump!

Considering that the essential requirements of road springs are to suspend the vehicle's weight and to resist major road shocks, I wonder if it has occurred to motorists that to free lubricate the spring leaves will greatly increase the flexing and unflexing action and result in broken leaves, besides imposing greater stresses on shock absorbers?

I maintain that road springs should not be "mollycoddled" and wrapped up in oil and grease, but on vehicle overhaul they should be stripped and cleaned and coated with a graphite mixture. Concentrate more on shackles lubrication. Rarely do spring leaves squeak, but shackles and bushes—yes!

H. H. (Gravesend).

Books Received

"How Secrets Work." By Prof. A. M. Low. Published by Peter Davies. 224 pages. Price, 10s. 6d. net.

In this very informative book Professor Low explains, in simple terms, the many intricate new devices brought into operation by the war. His own wartime employment kept him in close touch with many new scientific and mechanical developments, and he is now able to reveal a great many facts which have hitherto remained secret. Among the inventions and developments which this book sets out to explore are radar, jet propulsion and atomic energy.

"The Amateur's Workshop." By Ian Bradley. Published by Percival Marshall and Co., Ltd. 244 pages. Price, 7s. 6d. net.

The special requirements of the amateur, both in fitting out a home workshop and in making the best use of tools, are the main theme of this useful book. Lathes, various light machine tools, metal-working hand tools, and many aids to accurate workmanship are dealt with in a practical way by the author, who is well known as a model engineer. The book is profusely illustrated with line drawings and half-tones.

"Petrol-engined Model Aircraft." By C. E. Bowden. Published by Percival Marshall and Co., Ltd. 230 pages. Price, 7s. 6d. net.

The fascinating subject of power-driven model aircraft is fully dealt with in this interesting book. Starting with a brief history of the petrol-engined model aircraft, the author traces the development of the ideas in design and construction which have led to the high performance models of to-day. Amongst the many subjects dealt with in detail are the ignition system, control of flight duration, automatic stability and design, and the action and pitch of propellers. A special chapter deals with radio control of model aircraft. The book is well illustrated with line drawings and photographs.

Trade Notes

Waterproofing Compound

The waterproofing compound known as "Nev" has striking properties inasmuch as it may be used on any article of clothing, or any fabric, wool, cotton, rayon, etc., completely water repellent—very simply in the user's own home. The appearance and "handle" are not affected in any way, and what is very important, the material remains just as permeable to air as it was before treatment.

In this climate of ours it is undoubtedly a very great benefit to anyone if their clothing and they themselves can remain completely dry, if they are compelled to go out during rainy weather. A woman's head scarf, for example, if simply dipped and pressed, will keep hair absolutely dry during the heaviest shower.

This waterproofing compound has been sold in bulk to the textile industry for many years, and is a most efficient product of its kind made in this country. There is a Government standard test called the Bundesman test, which brings water repellency of fabrics down to actual figures, and we have not found anything which even closely approaches "Nev" in efficiency. The manufacturers of "Nev" are Peel and Campden, Ltd., 183/9, Queensway, Bayswater, London, W.2., and the compound is obtainable from most of the large stores.

Club Notes

Plymouth and District Society of Model and Experimental Engineers

An exhibition of models by the above society was held in the showrooms kindly loaned by the directors of Barton Motor Company, Limited, from April 21st to May 3rd. The official opening was performed by the Earl of Mount Edgcumbe at 3 p.m., on the first day.

An interesting collection of models was brought together to add to the members' exhibits, from industrial firms, kindred societies and private individuals. There was a demonstration of "round-the-pole flying" and of hydrofoil boats on a circular water tank. A group of stationary engines was shown working, and Mr. W. R. Dunn exhibited his London and North Eastern 2.5 in. gauge electric locomotive working on a section of track.

Society Secretary, 3, Evelyn Place, Plymouth.

The Staines and District Society of Model Engineers and Craftsmen

The second annual exhibition of the above society will be held at Staines Town Hall on Saturday, July 5th, open to the public from 10 a.m. onwards.

This will cover all branches of model engineering and allied crafts, and prizes will be awarded for the best exhibits in open competition. Entry forms and details available to club secretaries and lone hands on request, and loan of models would also be appreciated.

Closing date for entries is June 30th.—Hon. Sec., R. F. STADE, 166, Kingston Road, Staines, Middx.
Dyeing a Sheepskin Rug

I SHALL be glad if you will assist me in the following way. I want a dye for the colouring of a sheepskin rug which is badly stained, and require to know what solution would be safe to use. My name is A. J. Smith, Forest Gate, London.

FIRST of all, wash the sheepskin rug gently with warm water and soap. Rinse it well and hang it out to dry.

Before the wool has completely dried, dissolve 5 parts of salt in 90 parts of water and immerse the rug in this solution in the cold, allowing it to remain therein for two or three hours, so that it is only necessary to immerse the wool of the rug, strips of wool can be placed along the alum bath to prevent the skin from sinking.

You will need a solution of alum to be used, which should have the following composition and weights:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight (by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dye</td>
<td>5 parts</td>
</tr>
<tr>
<td>Solution of sodium sulphate</td>
<td>3 parts</td>
</tr>
<tr>
<td>Water</td>
<td>90 parts</td>
</tr>
</tbody>
</table>

Again, the temperature is not necessary to be the same. Hence, the wool will be discharged in the solution 30 minutes after the dye, and the dye will now have been dyed. It should then be removed from the bath, washed well and allowed to dry slowly.

There are other methods of "vegetable dyeing" which will give very last colours. The following is an example of the method of dyeing a rug "vegetable" brown:

Dissolve 1 lb. of copper sulphate in a gallon of water. This is the "dye bath" for the vegetable dye. The wool is immersed in this in the cold for two hours. It is then boiled, drained (not rinsed) and dyed in a bath made by dissolving 1 lb. of copper sulphate in 1 gallon of water, and the brown colour will result. If log-wood is substituted for copper sulphate a black will result. If these colours are not intense enough, the fixing and dyeing process can be repeated.

Dusting of Concrete Floors

I HAVE a concrete floor in my workshop. Can you advise the use of any preparation to keep down dust?—R. G. Griffiths (Llandrindod Wells).

There is no certain cure for this, however, two methods that you may use are:

(a) Surface treatment with a colloidal wax solution. For this purpose, use "Aurigum," manufactured by British Asphalt and Bitumen, Ltd., The Docks, Preston, Lancs.

(b) Surface treatment with a silicon water which binds the loose floor particles together. This is manufactured by Messrs. Albright and Wilson, Ltd., Oldbury.

Neither of the above materials is cheap, but there is no doubt that by dusting the floor dusting problem—apart, of course, from removing the floor and substituting one of another type.

Bromine Lacquer

WILL you please give me details of the plating process which gives a "bromine" finish to steel objects such as wood screws, small door handles, etc.?—Mr. St. George, Forest Gate, W.12.

The bromination of small articles is not usually done by any process of plating. It is often effected by means of a brominating lacquer, such as can be obtained from Messrs. Wm. Canning and Co., Ltd., Great Hampstead Street, Northampton. Here, if the screws happen to be of brass, by immersing them for a short time in a short lacquer solution (1 part in 50 of ammonium or ammonium sulphide.

For steel screws, etc., you can apply what is termed a "bromine lacquer" over them. This is a paste composed of about equal parts of red oxide of iron and bromine. The parts are mixed together, and the paste is then allowed to dry on the screws at 60 deg. C for half an hour, after which it is brushed away with a stiff brush. The process can thus be repeated.

Steel articles which have been previously copper plated may also undergo this treatment, and, in such instances, please varying dark, reddish-brown colours are obtained.

The "P.M. LIST OF BLUEPRINTS"

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPER-DURATION BIPLANE</td>
<td>Full-size blueprint, 2s. 6d. per set of four sheets.</td>
</tr>
<tr>
<td>THE I.C.C. TWO-STROKE PETROL ENGINE</td>
<td>Complete set, 5s.</td>
</tr>
<tr>
<td>STREAMLINE METAL CONTAINER MONOPLANE</td>
<td>2s. 6d. per set of two sheets.</td>
</tr>
<tr>
<td>LIGHTWEIGHT MODEL MONOPLANE</td>
<td>Full-size blueprint, 5s. 6d. per set of three sheets.</td>
</tr>
<tr>
<td>A MODEL AUTOGyro</td>
<td>Complete set, 3s. 6d.</td>
</tr>
<tr>
<td>P.M. TRAILER CARAVAN</td>
<td>1s. 6d. per set of four sheets.</td>
</tr>
<tr>
<td>P.M. BATTERY SLAVE CLOCK</td>
<td>1s.</td>
</tr>
</tbody>
</table>

The above blueprints are obtainable, post free from Messrs. V. C. W. N. Ltd., portrait, House, Southwark Street, Strand, W.C.2.

An "c" denotes that constructional details are available, free, with the blueprint.
Enamel for Instrument Wire

CAN you please tell me where I can purchase Enamel for Instrument Wire? The same substance be made up from ingredients?

CAN you please tell me where I can purchase Enamel for Instrument Wire?

Water Turbine

I AM thinking of using a waterfall to produce electricity. The fall of water varies between 10 and 100 gallons per minute, and the drop is 10 ft.

What would be the most efficient way of using this power, and how much current could I say generate? The generator would continue to work when the fall was 10 ft. You could dispense with a battery if you can fit a governor which will cause the dynamo to run at a practically constant speed.

Electric Flash Light

I WAS very interested in the "Electric Flash Light," on page 321, January issue, but unfortunately I do not quite understand the circuit diagram. Can this be operated from the mains? If so, how would you explain this circuit by a practical diagram?

Magnetic Chloride: Portland Cement

WOULD you assist me with the following problems?

1. Are there any existing patents on the method of transferring photos with the use of magnetic chloride or Portland cement?

2. How is the white Portland cement made, and how is it cured?

3. Is there any relationship between magnetic chloride and Portland cement?

Removing Oil-bound Disteemer

CAN you tell me the best way to remove two or three coats of oil-bound diesterm which has, in places, begun to flake off my kitchen wall?

You should read the subject up in detail before sending it to the printer—J. A. Boskwell.

Modifying a Three-phase Motor

I HAVE a 1 h.p. 3-phase 220 volt motor. Could you tell me how this could be modified to run on a single-phase motor?

Photo Engraving

I HAVE read with considerable interest the article "Photo Engraving" in the November, 1943, issue of "Practical Mechanisms," on Photo Engraving. It seems to me that a similar, but much simpler, process could be used to engrave sketches and pen and ink drawings. Could you let me know if the process must be altered in any way? Could the plates be etched in both of acid, and must the remains of the glue be removed from the plate before sending it to the printer?—T. A. Boskwell.

Photo-Engraving Process

I am considering the use of the photo engraving process for producing line drawings, a large number of which are required for reproduction in a technical journal. The process would be used for reproducing the lines of drawings, and would be used together with line drawings produced by another method. I am interested in the possibility of using the photo engraving process for this purpose and would be grateful for any information you can provide on this subject.

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ride on DUNLOP in good company
THE Paris-London Race

THE Paris-London race has been run with great success, without hitch, without accident and without incident and is therefore a complete answer to those quondam critics who were more fearful of the prestige of their own particular organisations than they were the questions of road safety, which is always the bogey they erect when someone does something in the cycling world which they do not themselves promote. All credit, therefore, is due to W. J. Mills, who conceived the race and was largely responsible for its organisation, to the Manchester Chronicle, which sponsored it, and to all the helpers and officials who contributed so generously of their time in order to make the race the success it undoubtedly was.

Face Saving
There is no need for us to give the results since they have already been reported in the Daily Press. The important thing about this race is that it is a complete answer to elderly armchair critics who, grimly holding on to the memories of their salad days, are opposed to any progressive movement, and want the sport run on the lines of the 'nineties. Now that the R.T.T.C. has climbed down with a face saving arrangement with the promoters, we hope there will be more of these races, and that the R.T.T.C. and the N.C.U. (the latter were, of course, in favour of the race, whilst their uneasy bed-partner, the R.T.T.C., opposed it) will themselves bring their ideas up-to-date and the R.T.T.C., opposed it of the race, whilst their uneasy bed-partner, the R.T.T.C., opposed it.

The Urmston Road Safety Committee was without the advantage of the R.T.T.C.'s agenda. It is, therefore, impartial arbiters of the N.C.U. are making public statements couched in such terms as may lead the public to believe that they are reflecting Government views. Even in a recent broadcast one of the speakers in a Sports Talk based a considerable part of his argument against B.L.R.C. activities upon the fact that Parliament had made a law, which it has not yet even discussed, and as far as we have been able to check does not even contemplate. The officials of this body, it would seem, are putting up a barrage against these activities because they now realise that the B.L.R.C. will undoubtedly be recognised by the U.C.I. at its 75th Congress, to be held in Paris next July.

Another instance of the campaign against the League relates to the Circuit of Urmston Road Race, which was organised by the Manchester City Council in April. The chairman of the Urmston Road Safety Committee is reported as having referred to an anonymous letter he received about the matter, and this was included on the Committee's agenda. At this meeting it seemed somewhat strange that a member of the N.C.U. present by invitation, and in referring to massed start racing he made the irresponsible assertion that "this type of racing is dangerous." He also added the sweeping statement "that on the Continent the roads were closed to all traffic except drivers of this body, it is hopeless to try to make the race the success it undoubtedly was.

by the recent decision of the Minister of Supply to reduce the quantity of steel for the manufacture of replacement parts for bicycles. In these circumstances, it is hopeless for the Ministry to consider the provision of additional equipment such as would be required by the Act. The position will be further examined in the autumn."

Misleading Statements
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Parograms

Too Much Speed

MORE people will have to be killed on the Watling Street at Towcester before we get a reduced speed limit," said a member of Towcester (Northants) Parish Council when consideration was given to the dangerous nature of the road through the town. The present speed limit, of 30 m.p.h. has proven too slow a figure to catch the motorists, according to the road safety section of the council, and at one meeting, no notice of the existing 30 m.p.h. limit.

Cycle-wheeled Car

FOUR ordinary cycle wheels on a light platform are the main components of a sand car which some lucky holidaymakers have been using on the sands at Daytona Beach, Florida. Power is provided by a small electric motor which uses two-volt accumulators. These passengers can be carried at a speed of 6 m.p.h., an object usually missing from the English scene—the sun—operates regularly above Daytona Beach a sun-top is seldom found for the car.

No Short Cut

A ST. NEOTS (Hunts) "cyclist, who decided that the floods in the town and district would make it necessary for him to travel by train, had to travel 18 miles from his home on the outskirts of the town to reach the railway station. Normally, the journey would have taken only a few minutes.

Cavendish Bridge Collapse

ONE of the casualties of the great floods which swept the district was the Cavendish Bridge, the only link between Leicestershire and Derbyshire for a distance of some miles, which was swept away by the swollen river. The bridge was built in 1772 at a cost of about £3,000, but an expert suggests that a new bridge to be placed will cost something like £50,000.

Derbyshire Landslide

FOLLOWING a landslide which smashed a gap in the road in Little Bolehill, Wirksworth, Derbyshire, the whole of the nearby hillside was seen to be moving slowly downwards as a result of the frost and snow and subsequent rapid thaw. A number of houses were endangered by the landside and arrangements had to be made for the evacuation of the tenants. The road which was cut is the road to Belper and normally carries a good deal of traffic.

After Seven Centuries

COME time before the year 1375, a new bridge was built at Billing, Northants, between the parishes of Billing on one side of the river and Little Houghton on the other. It was a queer bridge with a bend in the middle, and the parishes on either side of the road with respect of the bridge and maybe the centre portion of the bridge and maybe the whole middle portion has collapsed. At one time Billing Bridge carried a considerable amount of traffic to and from London, in spite of its awkward shape.

Forty-nine Cycles Missing

ADVERTISING in a Derbyshire newspaper a man stated that he was in urgent need of an electric record player, 240 volts, go cycles, A.C. Shortly after the advertisement appeared, a woman wrote him saying: "Have seen your advert and can offer you one gent's cycle, with 3 speed, in good condition."

Mechanised Milkmaids

A SCHEME is in operation in East Sussex by which the children of Land Army girls, equipped with cycles set as mobile milkmaids for the farms in their area. The girls go to the various farms and take over the milking for one day in order that the regular farmhands can have a whole day free every week. This relief milking scheme is proving very successful and the girls say they prefer riding around and getting a change of scene to remaining on one farm all the time.

Invented Electric Cycle

MR. JOHN PIDCOCK, of 99, Crown Street, Peterborough, who has just retired after nearly 47 years at the Westwood Engineering Works of Peterborough, of Messrs. Baker Perkins, Ltd., carried his love of a cycling engineer into his home. During the war he evolved a bicycle driven by a small electric motor and batteries which proved most successful. He rode it regularly about Peterborough until recently, when he purchased a small car.

Prompt Identification

ALTHOUGH there were less than a dozen enthusiasts present at a meeting held to consider the revival of the Stamford Cycling Club, which came to an end during the war, it agreed that steps ought to be taken to bring the club to life again. A Stamford section of the Peterborough Cycling Club has now been formed and until enough supporters come forward to warrant the formation of a separate club this scheme will save much expensive and administrative work. Full details of the scheme were explained at the meeting by Mr. R. J. Seamer, the chairman of the Peterborough Cycling Club.

At the recent Manchester Wheelers International Meeting at M.A.C. ground, Fallowsfield, The illustration shows A. Bannister of M/C Wheelers, who won his heat in the 55yds. Open Scratch Race is waiting his time to beat E. Sorenson of Denmark.
Extract

Here with a quotation from The Cycle for 1895: "The National Cyclists' Union we are told, is controlling the body of cycling sport in England. The National Cyclists' Union, according to their critics, has for its name, Legion. What I have never discovered in all my peregrinations is the man who is not an N.C.U. critic, and a violently abusive one too. When I do discover such a man I shall have no hesitation in standing him a drink, for it would be a pleasure to talk to him. But, somehow, everybody I have met seems to have engendered a hearty dislike to the N.C.U. Everybody says pleasure to talk to him. But, somehow, everyone is not an N.C.U. critic, and a violently.

...such a man I who is not an N.C.U. critic, and a violently.

...everybody is not an N.C.U. critic, and a violently. Nobody says it is all wrong. Everybody says that everything it is all wrong. Nobody seems to have a good word for it, until at length I began to look upon the N.C.U. in much the same light as I should look upon the London County Council, were I not fortunate to smile upon me and I became a music-hall manager. Diligent inquiries revealed to me a glimmering of the constitution of this wondrous body. It was indeed a complex one.

Brighton Parking Place

Congratulations to the Brighton Corporation Entertainment Department for opening a covered parking place for cyclists which is provided with racks, and where cyclists can now able to park their machines for the day for a charge of 1s. The makers of the fittings state this is the only provision of its kind in the country.

The "Trader" Handbook, 1947


All the regular features of the Handbook have been retained and many new features have been added. The legal guide has been much enlarged and now covers points of the law governing normal trading conditions. Authentic information is clearly set out on the law of hire purchase, merchandise marks and patents, price control, purchase tax, trade number plates, warranty, to mention only a few of the points on which traders are continuously seeking advice. The principal trade and professional organisations are given in alphabetical order. Motor vehicle servicing data, providing tables of measurements, now covers 1939-46 models.

The garage equipment section has been re-introduced in classified form under more than 200 headings, giving the names of firms specialising in the manufacture or supply of garage and workshop equipment for use of motor vehicle manufacturers and repairers. Other new features include British tractor specifications, technical data, such as international standard screw threads, metric and decimal equivalents, etc., a table showing traffic area headquarters and the newly appointed driving tests supervising officers, a list of Regional Petroleum Officers and a full table of vehicle licence fees.

For ease of reference the various sections are printed on distinctively tinted paper.

"Cycling Record"

Again congratulations to the B.I.R.C. on the production of No. 3 of its official journal "Cycling Record," which costs 6d. a month. The acting Editor is James Kain, 24, Disraeli Road, Ealing, London, W.5. The journal is of newspaper format, is brightly illustrated and well edited.

Tyre Valves

Dunlop announce that they have reverted to the pre-war practice of fitting road racing (high pressure) cycle tubes with Presta valves, and the valve holes on new rim production are being reduced to suit this type of valve.

As there will be a number of rims already in use which have been drilled for the Woods valve, the tubes fitted with Presta valves are now supplied with a leather washer under the rim nut to ensure a good join in such cases. On the other hand, in fitting a Woods valve to a rim drilled for the Presta type valve, the rider is advised to widen the hole to 11/32in. diameter and remove rough edges with emery paper.

Bicycles in Luggage Vans

The following letter has been circulated by Major H. R. Watling, chairman of the National Committee on Cycling:

"The Minister of Transport states that British railways do not consider they would be justified in continuing to damage property of cyclists. But this is more than a cyclists' grievance; damaged bicycles must be replaced and the resultant waste of replacement parts, at present in short supply, is not defensible. Nor should the question of compensation of cyclists from Europe ever be ignored. The numbers of them have never been impressive even compared with the flow from this country to the continent before the war; and, should they now be persuaded to come to Britain, they will certainly not come back when they find their bicycles treated like old iron."

New B.I.R.C. Section

A NEW B.I.R.C. club has been formed in the Streatham Vale area, and full details are available from A. J. Tilly, 3, Broadview Road, Streatham Vale, S.W.16.

Swiss Industries Fair

In the cycle sections, as elsewhere, the great difference between this year's Swiss Industries Fair and any that we have had here since the war is that the exhibitors were there not merely to show off their products, but once more a buyers' market now that stocks and production are again approaching pre-war levels. And this produces for the unfortunate Briton, at least) a tonic atmosphere that is intensified in the Fair itself. The thousands of stands bear goods that are there for one purpose: the taking of orders. Not to show what the manufacturer could do if he was allowed, but to show what he has in stock right now... and he has a form ready with that good old dotted line right there for the buyer to sign on.

The bicycle section of Hall IX was crowded, owing to the very attractive exhibits of some 20 firms. The most attractive exhibit was an animated display of three stuffed bears riding cycles, and the most striking machine in the section was probably the "Aero-Stella," by Camille Piquerez, S.A. This greatly resembled the "bicycle of the future" seen at the B.C.M.I. Exhibition, but like anything else at the Fair is in production and for sale. With curved top tube and rear forks, this was a light and handsome machine, a speedometer, the handlebars incorporating a clock, speedometer and built-in lamp. The biggest crowd, however, was always around an exhibit tucked away by itself in another hall (and apparently not in the catalogue), the Rapid cycle made by Theodor Sazer, of Rorschach. Of conventional design as far as the frame goes, this has two wheel drive—a normal pedal drive to the rear wheel and a front-wheel drive from the handlebars, operated by depressing and pulling back each grip alternately. This is a freewheel drive, and the bars can be locked solid when it is not in use; apparently the additional motive power of the arms (normally wasted, after all) does give incredible results in speed, hill-climbing and long-distance riding without fatigue. The actuating mechanism is enclosed, small and streamlined.

Amongst the many sports models in Hall IX it is interesting to note how (as in all sports activities) English terms are used; to such an extent, indeed, that many of the English models are called after well-known English cars.

Both in the transport and sports sections a notable point about the cycle models (as in the commercial vehicle section) was the number of trailers shown. The cycle trailer is a feature of Swiss life that strikes the visitor immediately; every type of small transport uses them for deliveries, and many private cyclists own them and find them very useful.
Wayside Thoughts

By E. J. Urry

A Further Wait

At the moment of writing the cycle trade is in a state of chaos. Nobody knows how much steel will be available this season, and it is a debatable point and it means the postponement of the full return of the better bicycle for at least a year. And that is a pity, because I have some idea that the foundation of the sport and pastime, and that the suspension of its coming is a bitter disappointment to hundreds of thousands of people. It is easy enough to say that there is very little difference between one bicycle and another; and it is true as far as appearance goes, but I tell you that the comfort of the good bicycle is astonishing when compared with the quality of the bad type of machine. It is the old, old story that quality and the care in the making of the article gives character to the machine and satisfaction to the owner. The fellows in the trade who still ride bicycles are fully aware of this, and if you will examine such mountains you will discover the fact very quickly. Yet we shall be unable to understand why, during the war period, the suspension of its coming is a bitter disappointment to hundreds of thousands of people. It is the old, old story that quality and the care in the making of the article gives character to the machine and satisfaction to the owner.

Shoetle Duty?

Yet, with all these disappointments, cycling, both as a pastime and a business, is not suffering, for here is gained something comparable only to sloppy walking—and progressively conducts their children to avoid that. I have always felt the proper passion for cycling are the manufacturers, but how is this going to be the well-being of their customers? I am not teaching them how to ride. Go and watch a rider who has learned the principles and fundamentals of his own art and then judge the case of the, the pose of the body between the linked wheels, the touch of the hand on the handle bar, the avoiding of all unnecessary action over coming dead centre by the flexing of ankles and feet; the very grace of it all from position to performance, since I have seen it done. Then cycling is a joy, a poised and balanced exercise as near to flight as it can be, and his own exertions; and this I feel is what a great industry ought to teach the public, that joy and comfort of cycling—and that other galaxy of real riders, with many leagues in his legs to change his habitat any way of the road and country and his country companions more intimately and sympathetically than any other type of traveller. I exaggerate? If not, my own experience affirms the joy I gathered from life in the result of cycling, for more than fifty years. I am glad indeed to be fit and healthy, to see the very grace of it all from position to performance, and you may realise what I mean.

New Record

It gave me quite a thrill to learn that the Roads Record Association—after some 13 years' standing—has appointed the London-Pembroke route to the list of recognized rides. This round journey is over a romantic road full of historic pictures, historic riding our Island story, for it traverses North Wales, Carmarthen, and finishes on the sea verge at Pembroke Castle, where the Earls of Pembroke of that name founded so great a part in English history. The lady who can ride this route will be given a certificate of merit and the result will be of great interest to cyclists throughout the world. The record is open to the whole world, and I know of one case where American contacts in America have been interested. Naturally, such records are of great value to cycling, as they indicate the progress and development of the sport, and I know of one case where American contacts in America have been interested. Naturally, such records are of great value to cycling, as they indicate the progress and development of the sport, and I know of one case where American contacts in America have been interested. Naturally, such records are of great value to cycling, as they indicate the progress and development of the sport.
“No other tyre will really satisfy me now”

Claud Butler
BICYCLES—The Champions’ Choice

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71, Grand Parade, N.4
Phone: STAmford Hill
4368

EALING
16, Bond Street, W.1
Phone: EALing
3573

Lewisham
34, Lee High Road, S.E.12
Phone: LEE Green
2072

HARRINGAY
71, Grand Parade, N.4
Phone: STAmford Hill
4368

EALING
16, Bond Street, W.1
Phone: EALing
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An Ardent Propagandist

The effort!

The festival is a week away as I write, and I have no doubt that in town and city and hamlet keen cyclists were busy getting their machines in good trim for the on-the-road holiday. For myself I journeyed into unknown Essex...that little-known country so near to London and yet so desirous as a place of scenic beauty. But there are some who know the charms of Essex...her good thatched cottages, her lonely farms, her little villages where it seems to have stood still. And it is an easy trip...just slip out on the train to Chelmsford, and from that ancient place one may "do" a tour of surprising beauty not so many miles from town.

An Ardent Propagandist

I always think that the short "break" which comes to us at Whitsun is the best of all the year. Often Easter can be cool and chill, and sometimes, when Easter is early, there is little greener in the countryside; but at Whitsun most of the trees are in full splendour, the gardens are gay with flowers, and we feel that Queen Summer is really on her throne. The festival is a week away as I write, and I have no doubt that in town and city and hamlet keen cyclists were busy getting their machines in good trim for the on-the-road holiday. For myself I journeyed into unknown Essex...that little-known country so near to London and yet so desirous as a place of scenic beauty. But there are some who know the charms of Essex...her good thatched cottages, her lonely farms, her little villages where it seems to have stood still. And it is an easy trip...just slip out on the train to Chelmsford, and from that ancient place one may "do" a tour of surprising beauty not so many miles from town.

A Town on Cycles

Recently I had occasion to journey into the Eastern Counties...touching the old town of Huntingdon, and then visiting Cambridge and Bedford. They all have this in common...they are the homes of cycles! Bikes abound everywhere, and I imagine that there are no districts in England where more "town riding" is done. Women shopping...on bikes; boys and girls...going to and returning from school on bikes; factory workers using bikes to convey them from home to bench. I should think that East Anglia must be one of the most profitable "sales areas" for cycle manufacturers—and tyre and accessory manufacturers. And, for many years I have known that the manufacturers are well served in this area by old-established and enterprising dealers.

The Farmer Carries On

Just how seriously the farming community was hit by the frost, snow and floods of recent months, only farmers know...the urban dweller has but faint conception of the extent of damage suffered and of the setback to sowing. But the British farmer, ever a realist, is tackling the crisis with typical energy and optimism...and he will win through, just as he won through during the war years. But cycling in Lincolnshire the other week, on passing the fair and colourful bulb fields, I realised...that the original covers were...and the immortal "Fighting Mac." What curious little things will send memory racing back over the long years!

Cruelty to Cycle Tyres

Why is it so difficult to persuade cyclists to give their tires an adequate supply of air? All the tire makers, over many years, have preached the wise gospel that "the air carries the load"—and have stressed the importance of pumping up tires hard. But there is still gross neglect of this simple admonition! For my own part I can never feel comfortable unless my tires are well inflated...and as a tire man I know full well what potential mileage is sacrificed by the rider who will not give his tires a full supply of air. But there it is...I almost despair of success in this particular field of propaganda.

William Hume

Yes, the original and only William Hume, not passed on, but the man who won that historic cycle race at the Queen's Park Sports, Belfast, in May, 1908, in the presence of John Boyd Dunlop and the du Cros family, the superiority of the pneumatic tyre was so clearly and positively demonstrated. My friend married a daughter of William Hume, and we had a most interesting chat about the early days of the pneumatics. Tyre...those hectic days when there were cycle booms and company flotation galore...days when history was made and the beginnings of the transport revolution, so good, sometimes, to look back and muse upon the pioneers!

The Lure of Colour

Whether in the wide realm of Nature or in the range of manufactured articles, colour is a powerful factor, and never fails to attract. In bikes, we now have quite dazzling colours, and I have been particularly struck of late by the good colour combinations on a popular range of bikes...all kinds of pleasing shades are available, and, looking at the machines of a club the other day while out for a spin, I could not help thinking how far we have travelled in this direction of "bright bikes." It is all to the good, and I welcome the bright greens and blues and reds and oranges. A war weary world should welcome every contribution to cheerfulness!

Long-wearing Cycle Tyres

Notwithstanding the fact that for most of the war years cycle tyres were of the cheapest variety, there was a demand for good service. I saw the other day a bike a bought in the summer of 1940 and ridden regularly ever since...and the other day, in fine condition. I must not mention the "make"...but it is a well-known one! And I happen to know that this particular machine has been ridden on very indifferent roads. The builders of our cycle tyres deserve a bouquet...and I gladly present it!
"Where's the Bike?"

WHEN walking through a busy city street the other morning my ears were suddenly assailed by a question, hurriedly expressed by a man who appeared to be a complete stranger: "Where's the bike?"

It is to be a convinced and enthusiastic cyclist!

Hopeless Dawn

A MOTOR-CAR with a flat front tyre stood outside a bank. I assumed that the owner was interviewing the manager with regard to the more frequent bursting of his overvolt, and had no idea of the trouble which was awaiting him when he emerged. Momentarily it is something of a hopeless case for either motorist or cyclist when a bicycle flat is encountered. The motorist changes his wheel and is away in a few minutes; the cyclist has to get down to it and make a repair. How hopeless is the day depends on the circumstances surrounding the trouble, and on the amenities available. I, personally, would not welcome a puncture in a busy city street, though my remedy would be to find a cycle shop and get the job done for me; nor do I exactly delight in being held up in this manner on a country road, I am sure, none of my present students can say that he has been on a bicycle journey since 1897, not only as a beast of burden but as an instrument of pleasure also.

Setting the Responsibility

THE practice followed by certain folk of hanging a notice "Cantam—Private Drive" near the entrance to their premises tends to make us see red. The practice suggests a shifting of responsibility, but it is, I am afraid, one of those things that must be done. The need to take extra care rests on the person who is actually in control of the premises. The public highway, and the notice in question thus becomes legally unnecessary.

Cycling Flavour

WHILE away a recent six-hour railway journey from London to Liverpool I read a curious newspaper advertisement which I was deriving from Byron's "Don Juan," and it is a question whether this was a great exploit from Paris in June, 1949, accompanied by his second wife, the celebrated pianist. My journey to the Spanish frontier was done on bicycles. There was one machine to start with. It was a road bicycle bought from a light drunm French officer for 1,000 francs, and Downing made and attached a "Heath & Mabey" carrier. The bicycle was loaded to the gunnels with luggage and "D'" (the cross-but a start was made. We had empty five-gallon tins on a bicycle, and fortunately they were able to buy a second bicycle, which was loaded up. That is how the French carrier was arranged, with the result that I am able to tell you that a cyclist can, by the proper arrangement of luggage, be able to carry a pair of nail-clippers in his pocket, one screwdriver, a two-blade pocket knife, and a pair of moccasins.

Later my friend went on to Killarney, where there is one of the most beautiful roads in Ireland, and one of the most scenic. There is one road in all the world, he said, which I should like to have a try, and that is the one from Killarney to Kenmare. Here the ground is flat, there are no hills, the road is flat, and with excellent roads."

Two Letters

LET us share with you two interesting letters which have recently come to hand. The first is from a prominent member of a wealthy Midlands family, who writes about various goods in this world's goods, nevertheless remains intensely loyal to the bicycle. He is interested in writing with an attack of arthritic, he bemoaned his fate, saying "I am not exactly as it was when I could get out on my bicycle and work off an accumulation of rheumatism. That is why I happened to meet this friend. He was walking painfully, but he again assured me of his conviction—based on experience—that is no difficulty."

"Give me hills and undulations, and anybody can have flatness, but it is a great deal easier to walk on a level road and try to climb a hill."

The second of the two letters referred to comes from a keen cyclist who had made his first bicycle tour in Ireland, in long ago as 1913. Since then he had taken a whole lot of other rides, but admitted that he had just as much enjoyment in the last as in the first. He was writing from Dublin he says: "I can honestly say that I have been on a bicycle ever since. One thing that has struck me is the 'atmosphere' and friendliness of the place so quickly that we seem to have been here a few days. Everyone is friendly and chatty, and it is a great pleasure to receive interesting letters from you too."

Every one of us, who has had the good fortune to be able to make a tour of holiday-making in Ireland, would expect. Given hills and undulations, and anybody can have the lines of country too.
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