A FLASH-STEAM PLANT

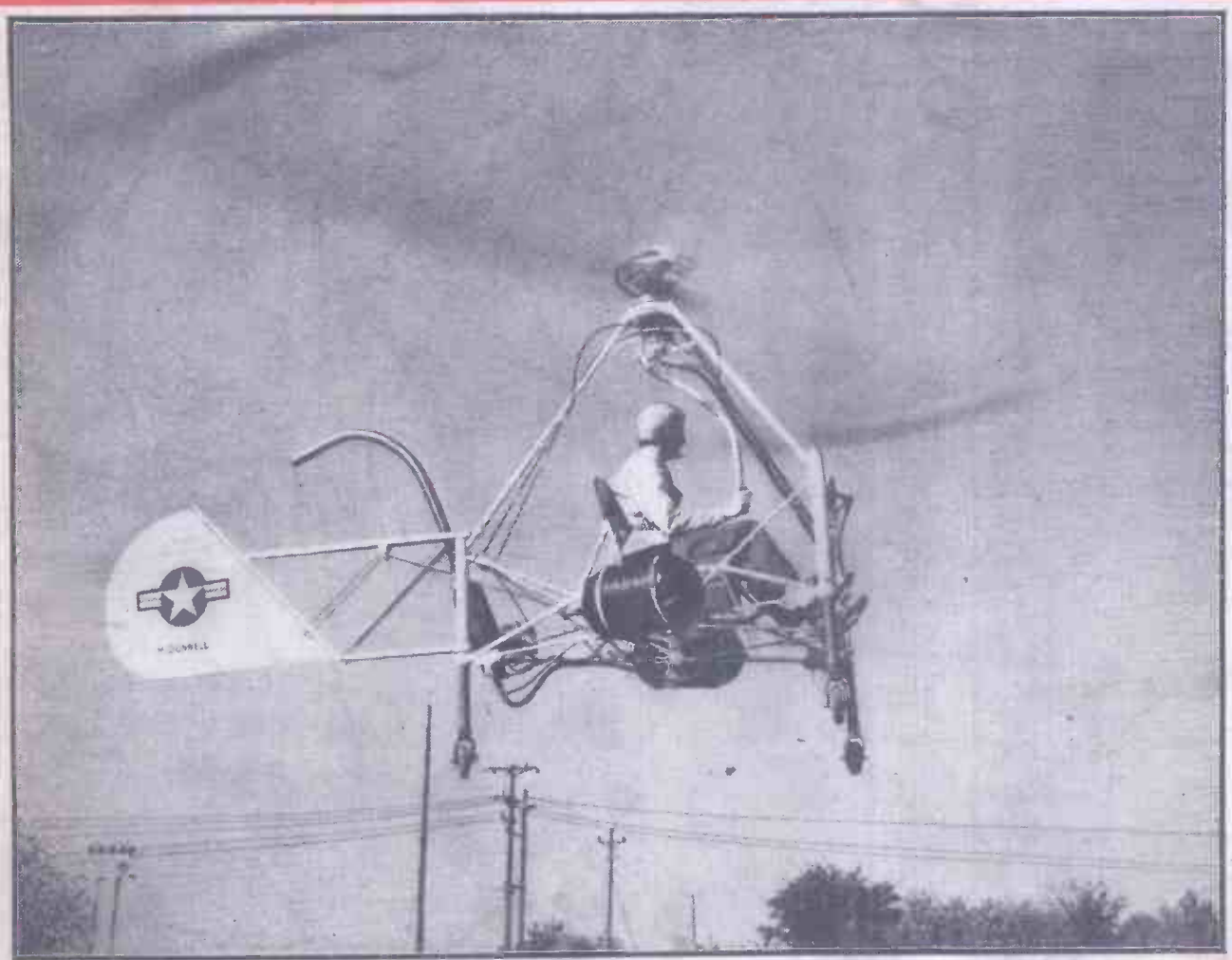
NEWNES

9D.

PRACTICAL MECHANICS

EDITOR : F. J. CAMM

JULY, 1948



THE FIRST RAM-JET HELICOPTER. (SEE PAGE 325)

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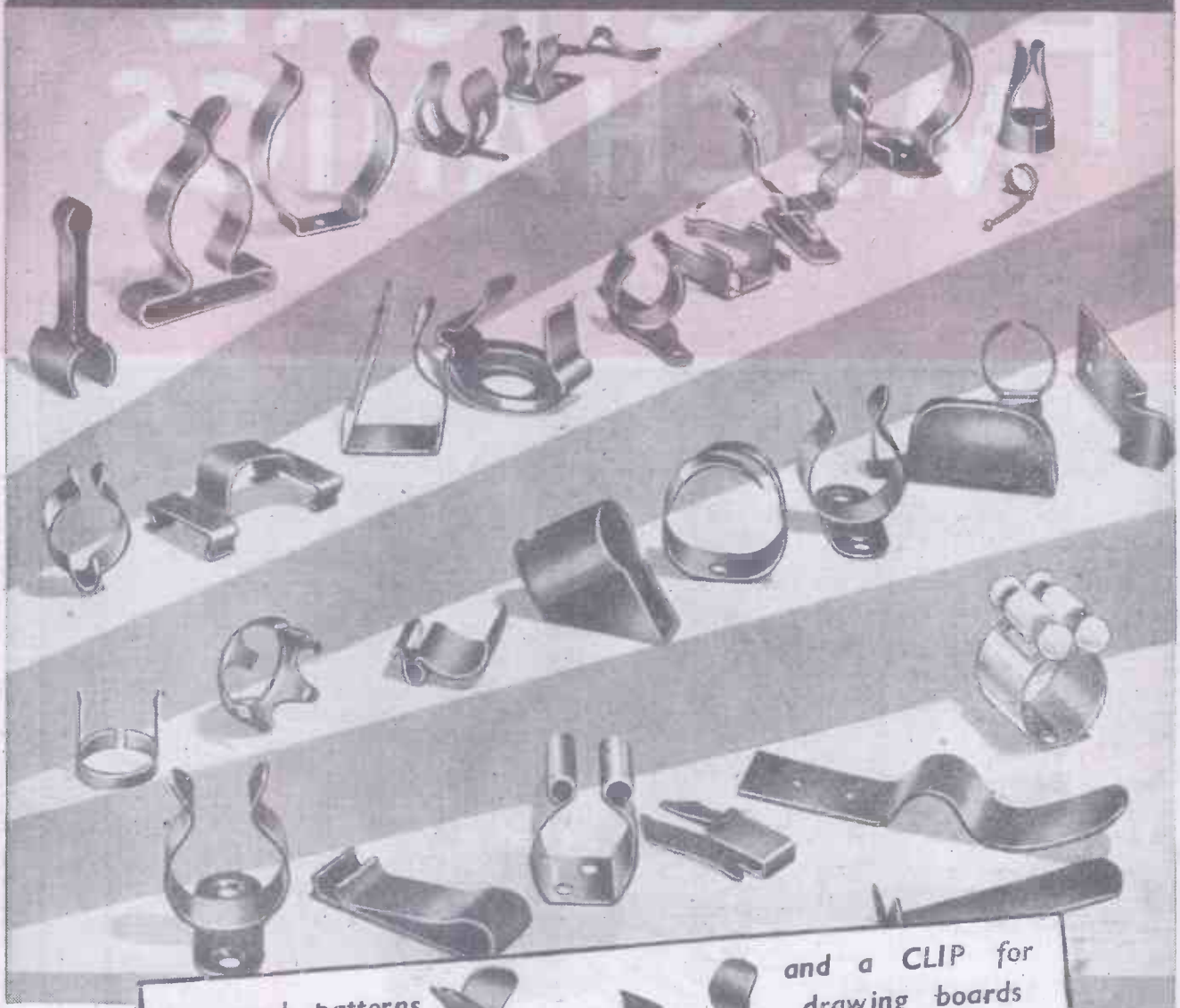

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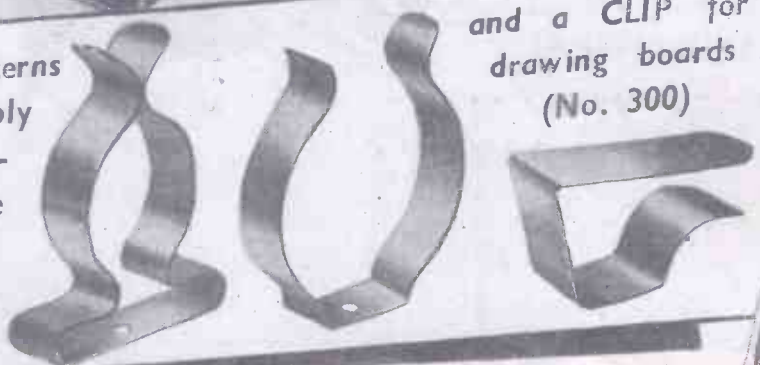

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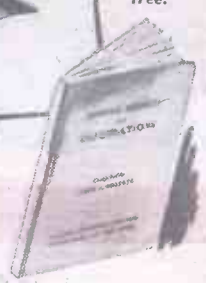

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PRACTICAL MECHANICS

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

Editor: F. J. CAMM

VOL. XV JULY, 1948 No. 177

FAIR COMMENT — BY THE EDITOR

The Advance of the Electron

THE recognition of the electron as the ultimate particle of electricity and a constituent of all atoms took place about 50 years ago. It provided us with a new conception which had repercussions far beyond the very limited range of phenomena giving rise to the original conception.

It provided an entirely new view of atomic theory of matter which previously had been based on almost entirely chemical considerations. Without this new conception of the electron communication without wires by broadcasting, television, and radio generally as well as radar would not have been possible.

The discovery has given rise to the new and important profession of electronic engineering. Electronic control devices in industry now contribute to the efficiency of manufacturing processes and greatly reduce monotonous routine work. Even the mathematician benefits, for we now have calculating machines employing thousands of thermionic tubes by which the most complicated mathematical expressions can be evaluated and equations solved.

No doubt this is why Sir Edward Appleton, Secretary of the Department of Scientific Industrial Research, took as his subject "The Electron in Theory and Practice," for the second Dunn Memorial Lecture. He rightly says that it would be rash to hazard a guess as to what the future holds in store, for we are only now entering upon the electronic age.

It has been estimated that in America nearly one-tenth of all the electrical energy now generated passes through electronic devices.

Theoretically, it should be possible to amplify the current corresponding to the passage of one thousand electrons per second through a resistance, that is, a current of about one-thousandth of one-millionth of a millionth of an ampere. Equipment has been developed by which electrical charges produced by a variation of temperature of one or two degrees in a steel making furnace can be amplified by electronic means so as to control the fuel supply to the furnace and maintain its temperature constant to within about one-tenth of one per cent. at 1,600 deg. C. In the textile industry another application is an electronic instrument which enables the cotton yarn and cloth to be maintained at the right moisture content so that subsequently processing could be carried out consistently and accurately without attention from the operator.

Magnetrons

SIR EDWARD APPLETON referred to the electronic valves, called magnetrons, used in radar, which reached a peak output of 1,000 kilowatts in the generation of radio waves of 10 centimetres in length. He went on to describe how infra-red sensitive cells had enabled objects to be seen in the dark when hot or illuminated by invisible infra-red radiation. He explained how electrons had been pressed into the service of illumination so that "daylight" fluorescent lamps had been produced giving much higher efficiency than is possible with filament lamps. "It is estimated," he said, "that if all the artificial lighting in this country were carried out with this type of lamp a saving of two million tons of coal a year would be effected and the generating capacity of two power stations of the size of Battersea could be redeployed."

He concluded by describing electron microscopes in which electron beams were used instead of light for illuminating the object to be examined, and the lenses, instead of being of glass, consisted of magnetic or electrostatic fields. With these instruments a useful magnification of 50,000 diameters was being achieved and it might well be possible, he said, to obtain magnifications of one hundred or even two hundred thousand with them. Objects which themselves are so small as to be transparent such as many bacteria, viruses, smoke and other particles, are particularly suitable for examination by electron microscopes.

Industrial Applications

"IN conjunction with the Ministry of Supply and a number of research associations, we in D.S.I.R.," Sir Edward Appleton said, "have recently been paying a good deal of attention to possible industrial applications of electronics. We have formed an Advisory Panel under the chairmanship of Sir Charles Darwin, Director of the National Physical Laboratory, which aims at bringing together the research worker, the supplier and the user, and, in addition, groups have been formed at the Telecommunications Research Establishment of the Ministry of Supply, and at the National Physical Laboratory to examine industrial problems at first hand with a view to suggesting how electronic equipment could be employed in their solution. These activities, in the long run, should help to step up the volume of production, improve quality and release men and women now engaged in routine operations for tasks usually more congenial and calling for a greater exercise of human intelligence."

Thus, the results of a series of experiments carried out quietly just over half a century ago, in a Cambridge physics laboratory have given not only new impetus to many branches of science, but have profoundly modified the way in which we go about our lives and work.

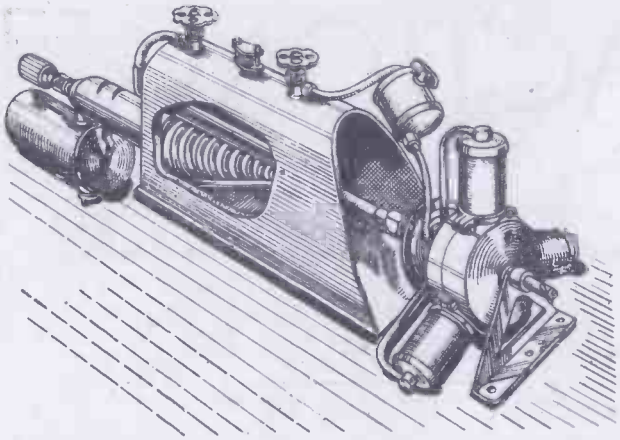
It is only fair that credit should be given to the National Physical Laboratory, which was founded in 1900 to assist and advance British industry in the fields of physics, electricity, engineering, metallurgy and ship design, and to which have now been added mathematics, metrology, aerodynamics and radio. Its work in connection with radar has already been described in this journal.

Wing Loading and Wind Tunnel Experiments

AMONG the new problems introduced by the increase of speed of modern aircraft, one of the most important is the accurate determination of wing loading. High speed has introduced the wing of low aspect ratio, with or without sweepback or of triangular plan form, and has further complicated the problem by requiring an allowance for the effect of compressibility of the air and of the elastic distortion of the wing under load. Early methods based on lifting line theory, which proved satisfactory for moderate aircraft speeds, have therefore become inadequate and require elaboration by treating the wing as a lifting surface.

Theoretical methods of solving this problem have been under development at the National Physical Laboratory for a number of years, and particular attention is being directed to the presentation of the work with a clarity which will encourage its general use. Detailed information on wing loading has become of increasing importance and is usually required by designers at the inception of a new design. Further developments are projected in connection with more advanced problems such as rotatory flight, sideslipping, the effects of wing thickness, and the addition of bodies and nacelles to the wing.

Concurrently with the theoretical work, a programme of wind tunnel experiments is in hand to act as a check on the theory, which cannot include such factors as the influence of the boundary layer and wake. Other problems, such as stalling and the stability under landing conditions of modern designs, involve so many uncertain factors that they can for the present be studied satisfactorily only by wind tunnel experiments. Measurements of force, combined with visual examination of streamers on the wing surface and measurement of the momentum loss in the wake, are being made on model wings of various plan forms with control and landing-flaps deflected, and a fundamental comparison between theory and experiment will be based on the detailed pressure distribution over a particular wing.



General view of the three-cylinder flash steam plant with rotary mitre D valve.

The Flash Steam Plant

Some Modifications and Improvements

By F. J. CAMM

IN our issues dated October and November, 1946, a description and drawings appeared of my flash steam plant. It will be remembered that the design provided for alternative sizes—one developing about 2 h.p. and the smaller size intended for model work, and developing .2 h.p.

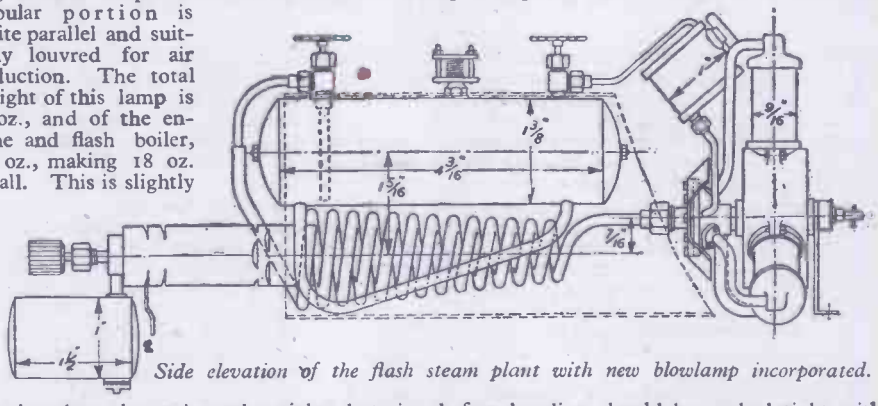
I have since constructed another of these engines, and made certain modifications and improvements resulting in a greatly enhanced performance.

In the first place the small blowlamp originally specified was found to be temperamental and not altogether reliable. Readers will know that it is necessary to soak some cotton wool with petrol to ignite this, and to lay the lamp within the flame. As it is of the self-vaporising type, the lamp will not begin to vaporise and to blow until a fairly high temperature is reached.

New Blowlamp

The Bunsen part of the lamp was throated to a Venturi form, but later experiments have shown this to be unnecessary. The new lamp shown in the two drawings accompanying this article is simpler to make, much more efficient, and has greater capacity, giving a longer duration of run.

From the previous description and from the drawings now appearing the reader should have no difficulty in constructing the new lamp. It will be seen that the tubular portion is quite parallel and suitably louvred for air induction. The total weight of this lamp is 3 oz., and of the engine and flash boiler, 15 oz., making 18 oz. in all. This is slightly heavier than the estimated weight, but in view of the power developed this is of no moment.



Side elevation of the flash steam plant with new blowlamp incorporated.

If the coil is to be located as in the side elevation it is necessary to place over the valve chest a piece of ⅛in. asbestos to prevent the heat from acting on the valve. The larger this piece of asbestos the better. In fact, it should be made sufficiently large to protect the cylinders as well. The flame should be adjusted so that its tip does not extend beyond the end of the coil.

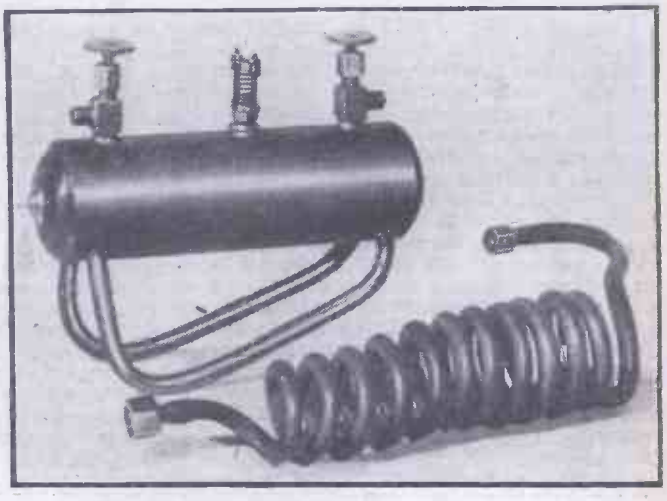
Bending the Coil

In bending the coil it is preferable to use sand for loading instead of lead. I found it practically impossible entirely to eliminate the lead loading after bending, with the result that when the coil was hot molten lead passed with the steam into the engine, choking up the ports and steamways. The tubing before bending should be packed tight with dry silver sand, the ends of the tube being plugged.

If the design of the model to which the plant is to be fitted will permit it, it is better to mount the boiler either above or below the engine, so that the blowlamp flame is well away from the latter. This can be arranged by suitably extending the flash coil.

The engine is extremely flexible. It can be throttled down to a mere tick-over and opened up gradually to its peak revolutions, namely, approximately 5,000 r.p.m. It runs extremely sweetly and consistently, and one filling of the tank is sufficient to run the engine for 10 mins. Care is necessary in filling the blowlamp to ensure that this runs out before the water does, and a few

Three-quarter front view of the completed flash steam engine with mounting bracket. A small flywheel has been fitted for test purposes.



The water container with cocks, and the steam coil.

experiments by timing with a stop watch are necessary, since the time taken for the boiler and for the lamp to become exhausted will naturally vary with each individual engine.

The plant is ideal for model boats, model 'planes, and model race cars, and I am glad to know that so many of them have been successfully built. I should like to point out, however, that the engine is designed as a model, and not for heavy duty. The latter would require larger bearings, and properly bushed connecting rods, as well as a larger diameter of crankshaft.

The engine will, of course, operate as a compressed air engine equally well, although for this purpose the construction is on the heavy side and I would advise readers who do not wish to use super-heated steam to make my three-cylinder compressed air engine, blueprints for which are available from the publishers for 5s. The blueprints for this flash steam plant are also available for 5s.

Fittings

Most of the fittings are available from Bassett-Lowke, Ltd., who would no doubt also undertake to supply finished parts to those readers who have not the necessary skill or equipment.

The method of mounting will, of course, depend upon the style of model to which the plant is to be fitted. For normal purposes the bracket shown is quite satisfactory.

The small flywheel shown in the photograph was merely fitted for test purposes. The small size of the blowlamp can be discerned in one of the photographs. It will be noted that in order to protect the machine from the heat of the furnace the whole of the steam generator is encased in thin sheet aluminium, which is well lined with asbestos cardboard.

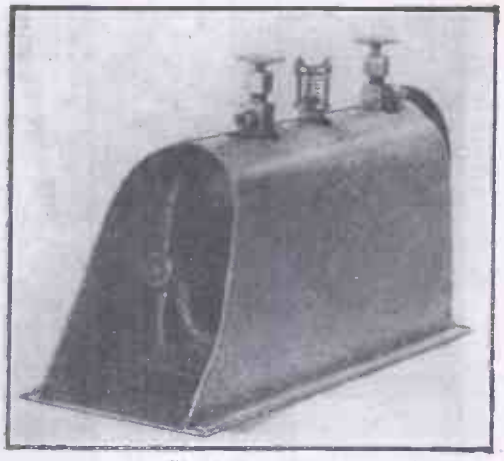
The end of the mixing tube of the blowlamp is introduced through a hole at the end of the casing opposite to the centre line of the engine. The thermal efficiency is therefore high. No trouble has been experienced by the carbonisation of the lubricating oil, although it should be noted that a high temperature oil must be used. The lubricating oil used for model diesels is quite satisfactory.

Piston and Cylinders

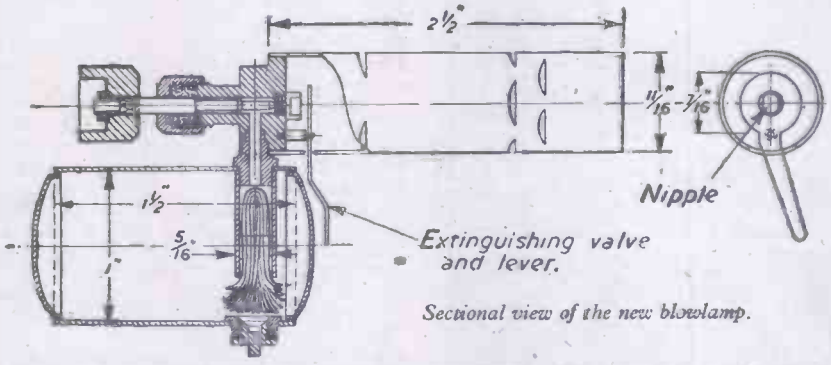
In making the piston and cylinders it is necessary to lap them to a good fit, since the pistons are not fitted with any form of packing or rings, although the pistons have grooves turned in them to prevent leakage. This form of leak prevention was used in the Williams & Robinson vertical tandem compound engine where, the cylinders being all in line, the piston rod passed from one cylinder into the next without any stuffing boxes or glands. The grooves were simply turned into piston rods.

The theory is that such small quantities of steam which may pass the top of the pistons have to fill the first groove, then be wiredrawn and fill the next, then wiredrawn into the third, and finally into the fourth. By the time the last groove is reached the piston stroke is completed, and so the steam loss is infinitesimal.

Although I originally specified steel tubing for the flash coil, difficulty was experienced in purchasing this. The coil shown in the photograph was therefore made up from copper tubing, and it functions quite satisfactorily. The reader may therefore safely use copper tubing about 3/16in. in diameter with 1/32in. wall. It should be bent around a tapered mandrel, turned to the diameters given on the blueprint. The tubing must, of course, be heated, and if the blowlamp is constructed first this can conveniently be used for the purpose. Cold bending is liable to result in cracks. The pipe at the point of bending should be brought to a dull red, for if brought to a bright red or nearly white heat it will flatten under bending. All of the joints need to be silver soldered to withstand the high temperature. For the barrel of the shell boiler, a 4 ⅛in. length of seamless copper is required of 1¾in. diameter and 3/64in. thick. The ends, of course, are silver soldered into place, whilst the central tie-rod is nutted and silver soldered. This tie-rod should be made of ¼in. diameter mild steel, and it should be tinned with an ordinary soldering iron to prevent rusting. Before this stay is fixed the two water tubes should be bent to shape, fitted by expanding into the shell and silver soldered.



The boiler casing.



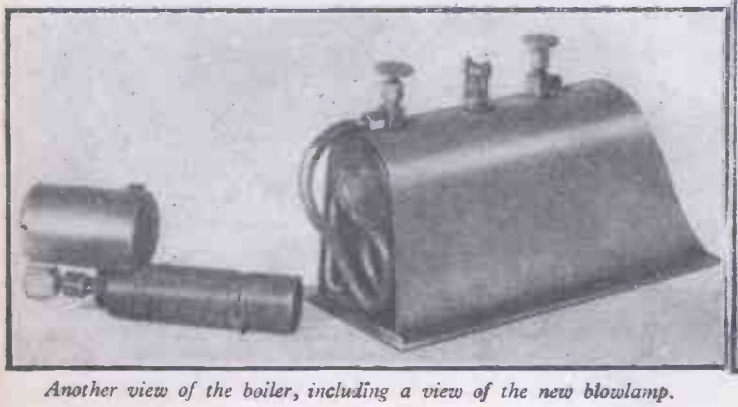
Sectional view of the new blowlamp.

The apparatus for automatically shutting off the flame when the water in the boiler is exhausted has already been illustrated, but it is important to get its adjustment quite correct.

In this second engine I built up the crank in the following way: The ends of the shaft and the crankpin were made a good driving fit in the holes in the crank-cheeks and were further secured by drilling taper reaming and knocking in taper pins.

The reader can, if he so desires, braze the parts together and those with the necessary throw plates may decide to turn it from the solid. The method I have used has the merit of simplicity and works well.

The reader is advised to obtain the blueprints already referred to.



Another view of the boiler, including a view of the new blowlamp.

Three-quarter rear view of the flash steam engine.

Modern Limestone Quarrying Methods

The Mechanisation of This Important Industry

By THE MARQUIS OF DONEGALL

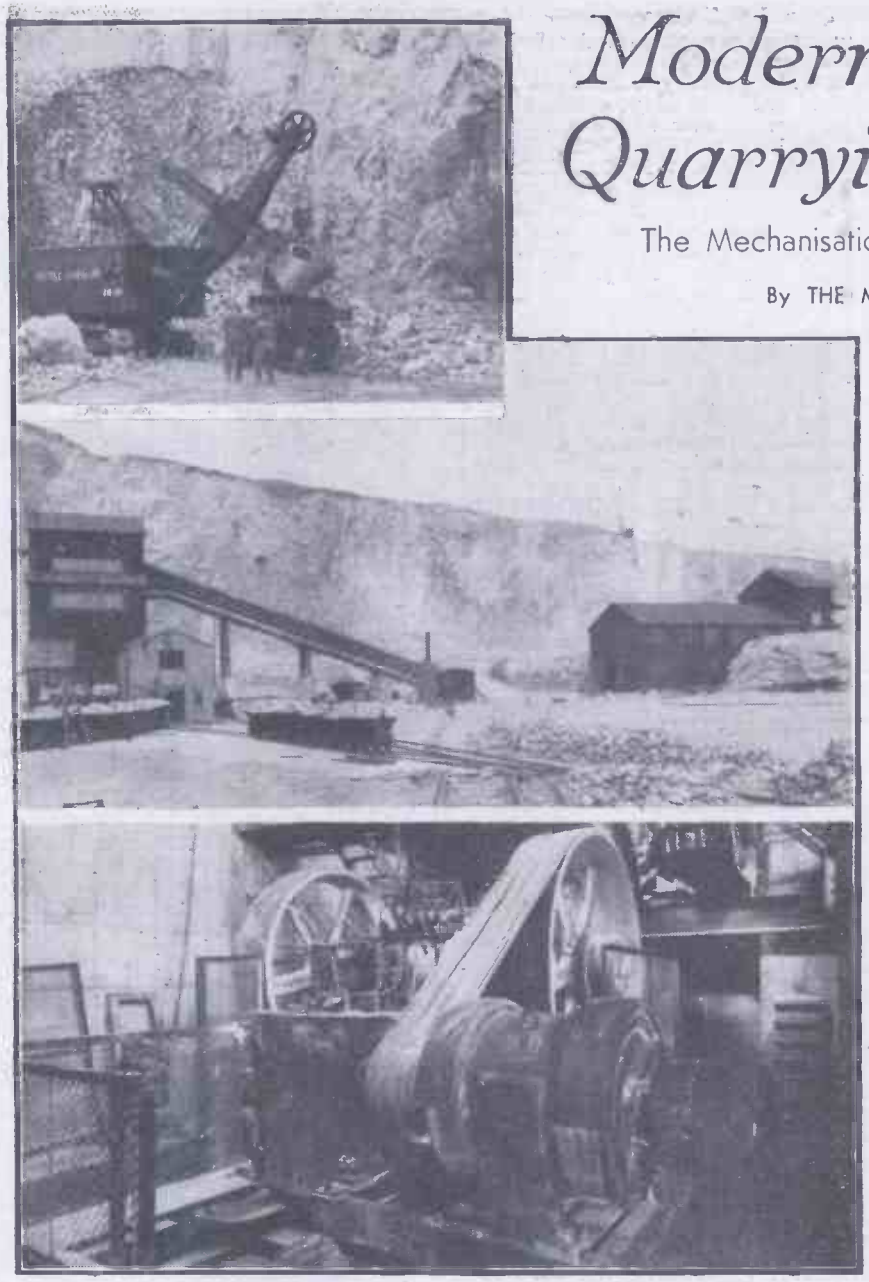


Fig. 1 (Top).—The latest type mechanical excavator at the quarry face.

Fig. 2 (Centre).—The crusher house, screening plant and interconnecting conveyor.

Fig. 3 (Bottom).—Part of the mechanism of the giant limestone crusher.

STARTING with a confession, I have to admit that until a friend of mine came to luncheon the other day I was no more interested in limestone, its quarrying or the mechanisation thereof, than a Central African would be in electrically heated suits.

Regrettable; yes, indeed. But I have tried to make up for my ignorance by a journey to Yorkshire in which I was privileged to see the Threshfield Quarry, where mechanisation is just being installed, and the Horton-in-Ribblesdale Quarry, where the mechanisation is almost one hundred per cent.

Now for a few words about limestone in general. It is, after coal, the most important mineral that we have in this country. It is comparatively cheap, costing a few shillings a ton at the quarry source. Our main quarrying areas are Derbyshire, North-west Yorkshire, the Mendips and South Wales.

Lime is, of course, produced by burning limestone in kilns; then there is hydrated lime, which is a lime scientifically processed.

Lime and limestone are important in the economic commodity structure of our country in that they have more than 200 industrial uses. To mention a few: correcting land sourness; an essential to the manufacture of steel, for every ton of which one to two hundred-weight of limestone are necessary to extract the impurities. In the manufacture of chemicals it is, because of its low cost, the most widely used alkali. It purifies sugar-beet and is used in the manufacture of animal feeding stuffs, glass, paper, leather, paint and pottery. It is also used to prevent coal-dust explosions and for purifying water and sewage.

At the moment the industry is suffering from shortage of labour and mechanical equipment. When I was in Yorkshire, German prisoner of war labour was about to be depleted to non-existence. In the two quarries that I visited various executives would announce as a piece of good news that they had found another one, two or three recruits to replace the repatriating prisoners. The difficulty about the European volunteer worker is housing, because the living accommodation of the prison camps does not come up to the standard officially required for E.V.W.s.

Heavy Equipment

As far as mechanisation is concerned, the main difficulty is the two-to-five-year waiting list for the heaviest items of equipment.

I first spent an interesting afternoon at the Threshfield Quarry to familiarise myself with limestone quarrying in general. The electric generator had only just been installed and it will eventually run the conveyor belts, the crusher and the bogies, which convey the limestone to the kilns and the finished product to the main-line railway. After a little mountaineering, Mr. T. P. Carr, the

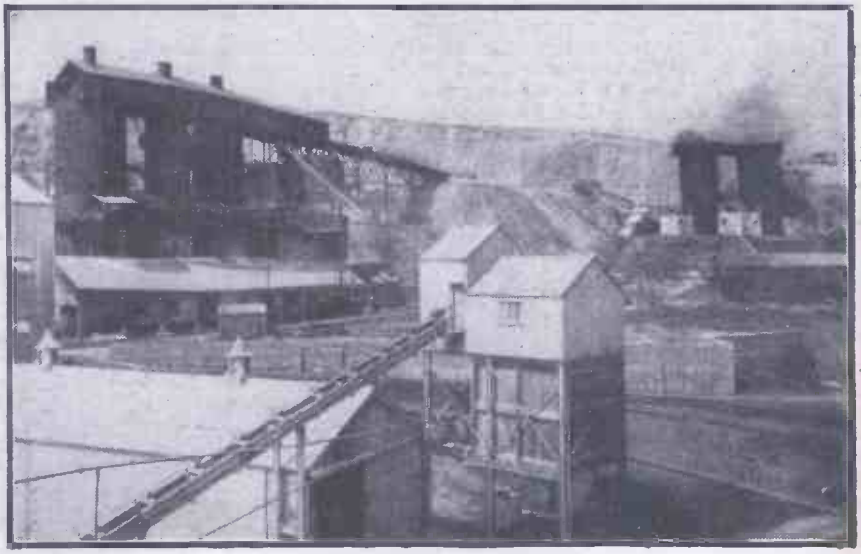


Fig. 4.—One vista of the Horton Limestone Quarry, showing the lime-kiln battery.

managing director of Settle Limes Ltd., negotiated me up the 80ft. of quarry face to inspect the drill. This is mounted on caterpillars and drills vertical holes from the quarry top some 18ft. from the face and some 16ft. apart, down to the "floor" level. These holes are just large enough in diameter to accept the 25lb. cartridges of explosive which blow out thousands of tons of limestone from the quarry face on to the "floor."

The average yield from six or seven blast-holes is about 25,000 tons of limestone.

At Threshfield this fall, after a blasting, has to be broken up by manual labour until mechanisation is complete. This is done by means of what is called "popping": in other words an individual quarryman drills a hole in the lumps that are too large, inserts a charge, and reduces it to more manageable proportions.

Working Processes

Much of this laborious procedure is eliminated by the mechanisation that I saw at Horton (Fig. 4.) I think that I can best take you briefly through the Horton processes. First of all, the working quarry-face is about a quarter of a mile in length and its height varies from 75ft. to well over 100ft. The method of drilling—to my untrained eye—is the same as at Threshfield, except that at Threshfield the caterpillar-mounted drill has to perform near-aerobatics to deal with the nature of the terrain.

At Horton, instead of hand-loading from the face into the bogies, they have an excavator which loads up to 1,000 tons a day (Fig. 1). The whole caterpillar set-up is run by an electric motor of a hundred horse-power. The shovel of this machine drops the stone into "dumpers" of the motor-lorry type. These "dumpers" take the stone to the mechanised crusher, which is indeed an awesome contraption (Fig. 3). It looks as though one could have a nice ride on top of the limestone as it goes down the chute. However, I asked the foreman, who has seen, in 50 years, limestone quarrying grow from entirely manual to entirely mechanical, what would happen if I took a ride? I won't attempt to imitate his Yorkshire. But what I think he said was that I would be reduced to a 10in. cube if I went in feet or head first, and that if I went in horizontally, the result would be about the same.

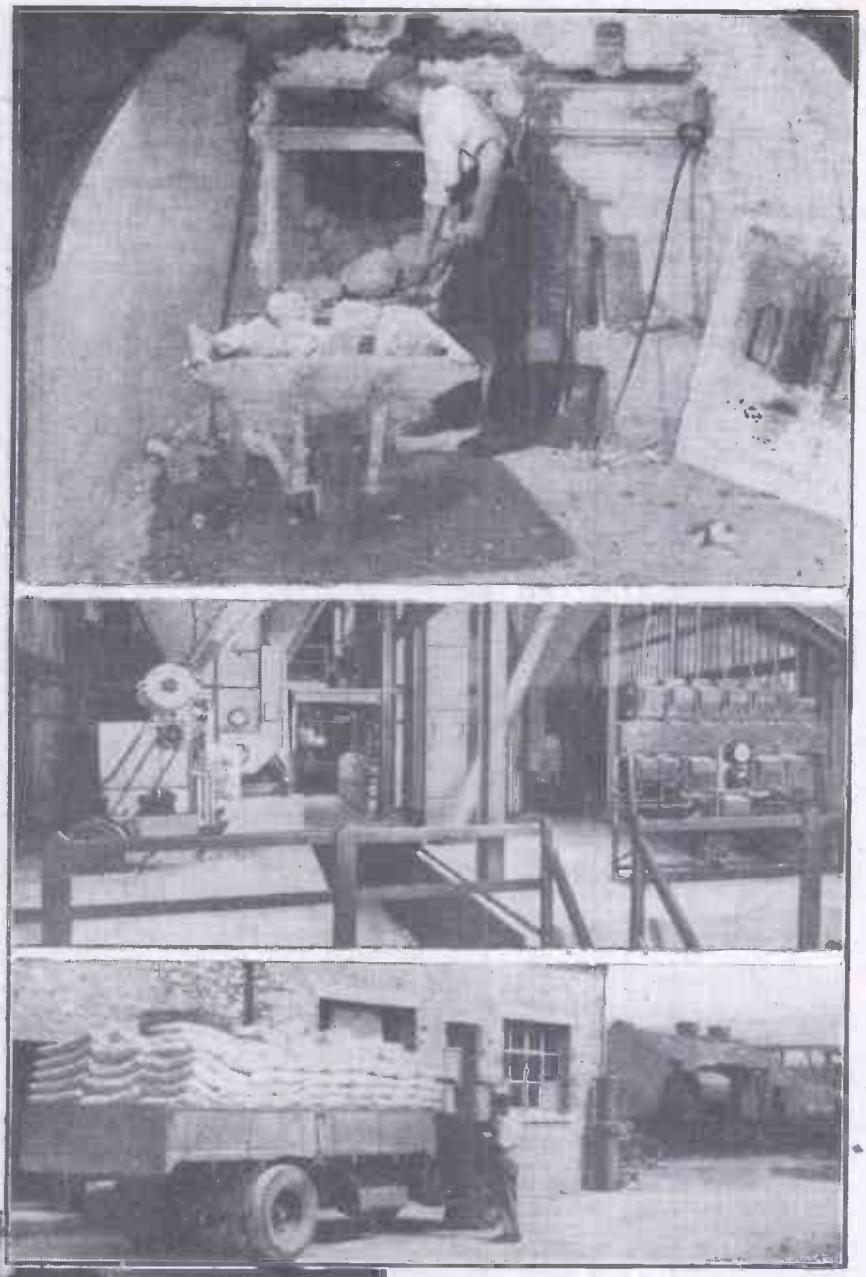


Fig. 5 (Top).—A lime "Drawer," drawing the lime from an "eye" at the bottom of a kiln.

Fig. 6 (Centre).—A modern plant for putting hydrated lime into self-sealing bags.

Fig. 7 (Bottom).—Bags of hydrated lime loaded up ready to leave the quarry.

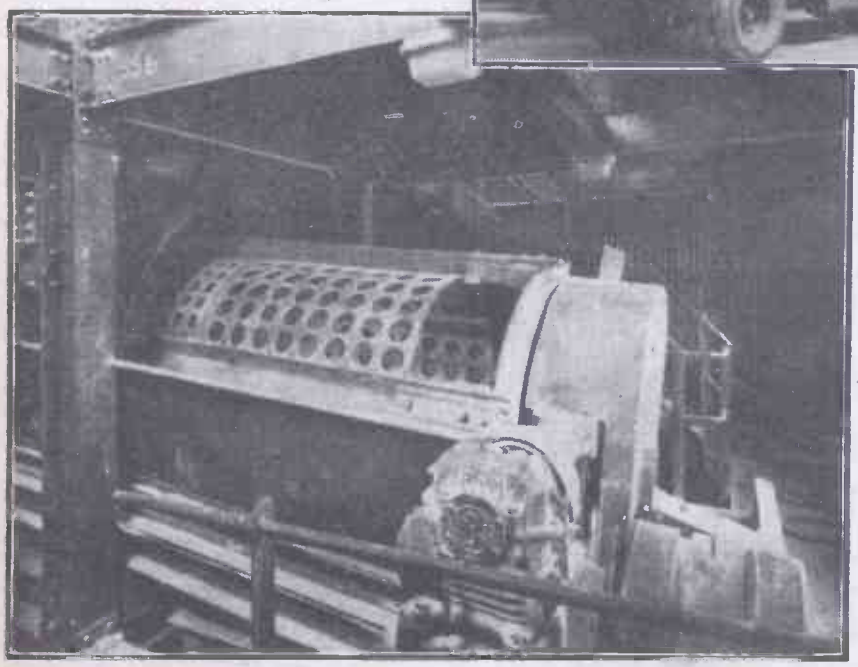


Fig. 8.—A rotary screen for separating the limestone into various sizes.

After that I took extreme care not to fall into the thing.

Crushing Plant

The dumper-driver operating between the mechanical shovel at the quarry-face dumps his load into this hopper, or chute, as I call it, which is constructed of reinforced concrete. The crushing and screen plant can not only take care of a large tonnage of stone per hour but can deal with hunks about two cubic yards and weighing up to 2½ tons. The crusher itself weighs 61 tons and has a mouth opening of 55ins. by 36ins. It is powered by an electric motor of 150 horse-power and, although it is not worked at maximum capacity, it could deal with up to 250 tons of stone per hour (Fig. 2).

On leaving the crusher the lumps of stone are all smaller than 10ins. cube, and the next thing that is necessary is to divide these into

different sizes, a process which is neatly achieved by a vibrating screen and by a rotary screen. It is now ready for use and has to be taken either to the kilns or to the point where it can be loaded on to railway or road transport. The plant-hoppers discharge the stone into bogies or narrow-gauge trucks, each of which carries about 2 tons.

Calcining Kilns

These pass over a weighing platform and are attached to a cable haulage which pulls the bogie to the required destination. Such raw stone as is not sold as such is calcined in huge kilns to produce lime. The kilns are large-diameter cylindrical steel casings about 80ft. high. They are lined with fire brick to give the proper shape inside. The stone is discharged into the kiln top through chimney doors and the fuel is provided by hand at the firing stage, approximately half-way down the kiln. The lime is drawn at the bottom of the kiln through holes which are called "eyes" and is loaded into railway wagons from the steel hearth by a lime-drawer. (Fig. 5.)

Much depends on the skill of the lime-drawer. For instance, I have seen these skilled operators detect, by tapping a lump of lime, not only whether it contains a core, but the exact size of it. This operation maintains the product at a high quality.

Apart from this, lime-kilns are said to be temperamental things, and it is according to the skill of these operators whether the kiln remains good-tempered or not.

A large proportion of the output of lime is merely graded by hand into different qualities and sold as it comes from the kiln.

Hydrated Lime

The remainder goes through another process to produce hydrated lime. This is a white powder from which the impurities have been removed.

Here again mechanisation comes in. The process used is controlled so that all particles coarser than 200 mesh are rejected. I understand that 200 mesh means a square aperture whose sides measure three 1,000ths of an inch. The hydrated lime is then blown into paper bags from a spout on the machine. These bags are self-sealing by means of an ingenious paper valve.

At the time I was there the paper bags seemed to be reaching a conveyor belt which takes them through a stocking shed at the rate of about one every ten seconds (Fig. 6.)

The three products of the Horton Quarry, i.e., raw stone, lump lime, after the kiln processing, and the hydrated lime powder, go out over a large territory by rail and road. A full-size gauge engine does the shunting from the stocking shed to the main-line siding, and lorries do the rest. (Fig. 7.)

I mentioned, at the beginning of this article, a few of the uses of limestone, but we must also remember that lime is one of the oldest processed chemicals. The stone itself is used in blast furnaces, as road metal and for agricultural purposes. It is also used as a building material.

Alkali Industry

In one of its three forms it is used as the basis of the alkali industry in the manufacture of soap and many heavy chemicals. In addition to its many uses there are also bleaching and dyeing, agricultural feeding-stuffs and even chocolate.

Having recalled that limestone quarrying is one of the most ancient industries, it is possible to go from mechanisation back to the Stone Age. Archæologists believe that the calcining of limestone, more by luck than by skill, is as old as the discovery of fire itself. Nobody, however, suggests that Eoanthropus Dawsoni made any intelligent use of this natural phenomenon.

Certainly the Pyramids of Egypt are nummilitic limestone. If we want commercialised limestone we have to travel quite a bit through history, and I remember from my schoolboy days that there is a reference in Xenophon to a shipload of lime that got lost in the Mediterranean. That must have been between 300 and 400 B.C.

Technical literature describing the production of lime dates from about A.D. 75, and, although I cannot trace it, there is said to be a reference in Pliny.

Progress was certainly slow from Pliny's time until just before the Kaiser's War, and the first angle to be developed was on the quarrying side, which made great progress between the world wars. Now the production side is making strides towards a hundred per cent. mechanisation, and I hope that I have succeeded in giving you a layman's picture of what is going on in this all-important industry.

Using Plates in Film Cameras

A Useful Conversion for the Amateur Photographer

By F. G. RAYER

WHILE films are still in rather short supply, most shops stocking photographic requisites have quantities of plates of all sizes on their shelves. For this reason, adapting a camera to take plates can be worth while. Plates are no more expensive per exposure, and there is the advantage that individual shots can be taken and developed as necessary, which is not so with roll-film. There is the disadvantage that the camera has to be loaded in a dark room, but as amateurs who use plates usually develop them themselves this is not serious.

The simple addition illustrated in the diagram fits into the back of the camera so as to hold a glass plate in the proper position. It can be pulled out in a second when films are to be used.

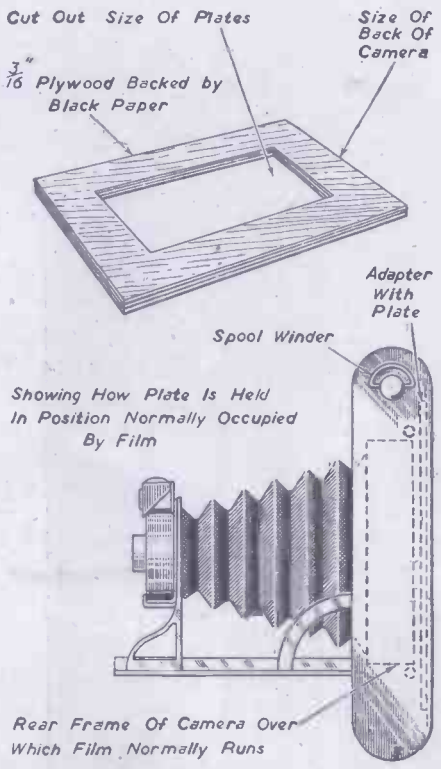
Size of Adapter.

Though thick cardboard could be used, 3/16th in. plywood is stronger, and is recommended. The centre cut-out is the size of the plates to be used; with the most popular cameras this will be 3¼in. by 2¼in. (same size as the popular "120" films).

The outside dimensions of the wood will depend upon the camera. For the average box-camera something about 3¾in. by 2¾in. will be necessary. For the folding camera the piece will be rather longer. It is cut so that when the back of the camera is put on, the cut-out where the plate will rest is flush against the back of the camera, occupying the position where the film normally passes.

A stout piece of black paper is glued over the back of the wood so that light showing through the ruby hole for reading the film-exposure numbers does not fog the plates.

In use, the back of the camera is placed flat on the table and the adapter slipped in. A plate is then put in the cut-out, emulsion side up, and the camera closed up in the usual way. The plates can be changed without removing the adapter, which should, however, be lifted out if films are used.



Details of the plate adapter and its position in a film camera.

Automatic Telephone for British Warship

AUTOMATIC telephony has been admitted to a new sphere through the Admiralty decision to install a G.E.C. automatic telephone exchange in an aircraft carrier. Although similar systems have already been installed in many passenger liners, this will be the first instance in which such apparatus has been fitted in one of His Majesty's ships, all previous installations having been of the manual type.

The exchange accommodates 500 extensions and will be used for domestic and administrative purposes. Because of the limited size of the hatchways, 10 units, each containing equipment for 50 extensions, will be used, these units being coupled together to give the size of installation required.

If desired, the 500 line exchange can be extended to accommodate a maximum of 600 lines, by the addition of two further 50-line units.

The circuits employed provide a complete guard against mal-operation, and selected officers will be provided with an executive right-of-way facility, which will permit the interruption of existing connections in cases of urgency.

When coupled to the British Post Office telephone system, eight pairs of wires will permit eight conversations and the use of eight teleprinter links. A single position manual board provides inquiry facilities and permits the extension of calls via radio links.

Although the exchange circuits are designed to match all known telephone systems, the Admiralty are investigating systems in use in the more obscure ports, so that further modifications can be incorporated to permit the equipment to work into them.

Standard equipment as employed in shore installations will be used, but in view of the arduous operational conditions under which the equipment may be called upon to operate, special precautions have been taken to afford protection against mechanical shock. These include the strengthening of certain parts, and the provision of rubber anti-shock mountings.

During the development of these modifications, shock tests to simulate the severest operational conditions have been repeatedly carried out. The complete equipment is to be supplied and installed by the telephone works of the General Electric Company, Ltd.

The First Ram-Jet Helicopter

Particulars of a Novel Type of Aircraft, the First of its Kind in the World

By J. W. R. TAYLOR

Charles R. Wood, Jnr., chief test pilot of the McDonnell Aircraft Corporation, at the controls of the new helicopter.

THE first ram-jet* helicopter ever built, McDonnell's "Little Henry," is hardly the most handsome of aircraft, but it is one of the most efficient. Although it weighs only 310lb. it can carry 300lb. of useful load at a forward speed of 50 m.p.h. —and this on two engines that weigh only 10lb. each!

Its makers—the McDonnell Aircraft Corporation of St. Louis, U.S.A.—do not make fantastic claims for the new helicopter. In fact, they do not refer to it as an aircraft, preferring to think of it as a flying test-stand for their new ram-jet engines. But there is no doubt that the machine opens up great possibilities as a three-dimensional motor-cycle, as well as for various military purposes in infantry and airborne operations.

Ram-jet Engines

Developed after almost two years of research and close co-operation between the U.S. Air Force and McDonnell engineers, this little helicopter consists only of a two-blade, 18ft. dia. rotor, two tip ram-jets, a small rudder and an open steel-tube structure supporting the pilot, fuel tanks and controls.

Its practical, light-weight ram-jet engines were developed by the company's engineers after three years of experimentation. The original design for "Little Henry" was submitted to the Air Force in 1946, since when both the engines and the helicopter itself have undergone considerable improvement. Constructed of special heat-resisting steel, the engines have required remarkably little maintenance work since they were installed.

The ram-jets are attached to the end of each of the all-metal rotor blades, which are actuated by conventional-looking helicopter pilot's controls. With power applied directly to the blade tips, heavy engine parts, gear systems and transmissions are eliminated. The rotor spindle is merely the means of attaching the rotor to the structure, consequently control is direct and the usual complex swash-plate system is eliminated. As the blade-tip jets do not develop torque, an auxiliary tail rotor is not required. All of these simplifications ensure fewer maintenance problems and a considerable saving in weight—that old nemesis of helicopter design.

Rotor-tip Speed

"Little Henry" made its first flight on May 5th, 1947, and gave great promise from the first. Although this flight was made with fuel fed through a line from a supply on the ground, subsequent flights were made with the fuel carried in two tanks strapped to the aircraft structure. Propane fuel was burned in all the early tests, giving a rotor tip speed of 600ft./sec. But petrol-burning jets are being developed and will eventually eliminate the necessity of using special fuel.

Fuel Consumption

Although high fuel consumption of the ram-jets has been a major problem, McDonnell engineers believe that they can reduce it to a practical point. Similarly, they are working to develop satisfactory auto-rotative characteristics and so conquer helicopter engineering's greatest headache—the fact that if the engine of any helicopter at present in production fails at low altitude then it will crash.

Many Uses

Military advantages of the ram-jet helicopter are obvious—at the disposal of ground force commanders, especially in cold climates where they require no period of "warming up" they could be dispatched quickly without reliance on highly-skilled pilots. For short-range observation, communications, artillery spotting and courier service they would be in a class by themselves. Larger models could provide speedy transport for bulky equipment in rough country. Commercial adaptation could eventually be extended to include taxi services between airports and town centres, and to lifting heavy loads in built-up or inaccessible areas.

The machine, shown in the accompanying illustrations, has been under flight tests at St. Louis for the past six months with very satisfactory results.

A side view of the tiny aircraft showing the small ram-jet units at the tips of the rotor blades. Weighing only 310 lb., this world's first ram-jet helicopter is capable of a forward speed of fifty miles per hour.

* A ram-jet is an engine without moving parts, which develops thrust by the continuous burning of fuel injected within a streamlined open-ended tube, thereby increasing the velocity of the air rammed in by flight and producing jet-propulsion.

The Elements of Mechanics and Mechanisms—9

Convection—Radiation—Heat Produced by Friction and Mechanical Energy

By F. J. CAMM

LIQUIDS and gases are generally heated in a different way. A kettle of cold water when placed over a gas ring becomes heated because the water next to the bottom of the kettle first becomes hot, and the heat drives the molecules of this bottom layer of water farther apart so that it becomes less dense and consequently lighter. The warm water, therefore, rises to the top and a colder layer takes its place to be heated and to rise in the same way. This is the principle of the thermo-syphon system of cooling on some motor-cars.

This system demonstrates the passage of heat by *convection*.

The hot-water pipes in a room are a further example of the transmission of heat by convection. The molecules of air touching the pipes become heated by their contact with the hot surface of the pipes, they rise, and fresh molecules take their place; so the action continues whilst the pipes remain hot.

Radiation

We may now consider how heat is transmitted from the sun to the earth. We know that the air extends for about 200 miles or so above the earth's surface, although the sun is 93,000,000 miles away. It is the modern belief that the intervening space is filled with a substance which we call ether. The existence of this cannot be proved, however, but its presence can be safely assumed. The vibrations in the molecules of the hot matter of which the sun is composed produce waves in the ether surrounding the sun and these spread out in every direction just as waves do when a stone is thrown into the water.

These heat waves travel from the sun to the earth, and when they strike the earth the motion of the ether is changed into motion of the molecules of the matter on which they impinge. This is an example of the transmission of heat by *radiation*.

All hot bodies radiate heat in this way.

Heat Generated by Friction

If two pieces of wood are rubbed together heat is generated, and it is generated because the surfaces of the two pieces of wood are not smooth. Sufficient heat can be generated in this way to cause ignition. Indeed, this was the principle employed with the flint and tinder box which preceded the lucifer and the phosphorus match. Friction arrests motion, and we have already seen that this lost motion is converted into heat. The friction produced when the brakes of a bicycle or other vehicle are applied also generates heat, which represents the lost motion of the bicycle caused by the braking force.

In brakes having metal-to-metal braking surfaces, the heat can be so great when the brakes are applied that a shower of sparks is produced. In striking a match we have a further example of heat produced by friction.

In most cases friction is undesirable, and we endeavour to reduce it to the lowest possible extent by placing oil between the contacting surfaces. This oil fills up the space between, say, a shaft and a bearing, and prevents the two surfaces from touching. There is, of course, the friction of the oil itself. It is impossible to produce a frictionless bearing, for, in spite of lubricating oil, heat is still generated, although to a smaller extent. This is proved by the fact that the oil itself becomes warm.

Heat Produced by Mechanical Energy

Mechanical energy may be defined by that produced by a body moving as a whole. At first it may appear to be the same as kinetic energy, but the latter term includes molecular motion as well as the motion of the body as a whole. For example, a piece of red-hot iron has kinetic energy because its molecules are in motion. It has not, however, any mechanical energy, for it is in a state of rest.

Mechanical Equivalent of Heat

From the foregoing it is possible to note what happens to the energy of a falling body. When a ball or a stone strikes the ground, at first sight it might appear that its mechanical energy is lost, although it is really changed into heat energy, because the stone or ball and the spot on which it lands will be a little warmer after the impact than before. If it is required to know how much mechanical energy is equal to a given amount of heat, we have to compare the facts with the height that 1lb. weight will have to fall in order to raise 1lb. of water through 1 deg. Fahr. Dr. Joule, of Manchester, after many experiments, proved that this height is 772ft.

If a 1lb. weight is dropped from a height of 772ft. into a basin containing 1lb. of water at 60 deg. Fahr., and if all heat produced by the impact went to warm the water, then its heat would be exactly 61 deg. Fahr., but the 1lb. weight in falling from this height does 772-foot lb. of work, and this is known as the *mechanical equivalent of heat*.

Conversion of Heat into Mechanical Energy

As an experiment, place some water at a temperature of 60 deg. in a kettle on a gas-ring or fire and keep a thermometer in the water. It will be found that the temperature of the water will steadily rise until it reaches boiling-point, namely, 212 deg. Fahr. At this point it remains constant. Yet heat is continually passing into the water. It is, however, not lost; it is spent in sundering the molecules of the water; in other words, in overcoming the powers of cohesion, so that the liquid changes into a gas.

It has been found that water-gas or steam takes up 1,700 times as much space as the water from which it was derived. In other words, one pint of water produces 1,700 pints of steam. This is one example of the conversion of heat into mechanical energy and which is made use of in driving the steam engine. We are not, of course, able to obtain in this way the full mechanical equivalent of the heat employed, for a great deal of it is dissipated in heating the different parts of the machine, and much of the heat escapes through the flues, chimney, etc. It is doubtful whether the most efficient steam engine provides more than one-tenth of the mechanical equivalent of the heat produced by the coal burning in the furnace.

Action of the Mechanical Powers

Every machine is constructed of a few simple contrivances for modifying forces, and these contrivances are known as the mechanical powers. They are seven in number: the lever, the pulley, the wheel and axle, the inclined plane, the wedge, the tooth wheel or gear and the screw.

No matter how complicated the machine, it must consist of a combination of two or more of these mechanical powers. A machine only using one of them is called a *simple machine*, whilst those which use two or more are known as *compound machines*.

Power and Resistance

The power is the force applied to a machine, and the force which the power is used to overcome is called the weight or resistance. In calculations relating to this, initials are used, P denoting power, R resistance and W weight.

Equilibrium

Whilst machines are generally employed to produce motion, they are sometimes used to prevent motion. When a machine is in a state of equilibrium, the power and the weight are exactly balancing one another and it is possible to calculate the proportion which one bears to the other. It is most important to know this, because when we know the power required to produce equilibrium the least additional force applied to the power end will enable the machine to move the weight and to do *work*.

Mechanical Advantage

The proportion which the weight bears to the power is termed the *mechanical advantage*. As an example, if a force of 20lb. applied to a machine will cause it to balance a weight of 40lb., the mechanical advantage is 2. If there is equilibrium with a power of 6lb. and a resistance of 24lb., the mechanical advantage is 4. In some machines the power is required to be greater than the resistance. For example, if the power is 100lb. and the resistance is 50lb., the mechanical advantage is $\frac{1}{2}$.

Friction and Weight

In every machine there is a loss of energy, and in studying the mechanical powers it is in the first place correct to consider the machines themselves as being without weight and without friction. The working power of a machine is always less than the force applied to it. We have seen earlier that the lost force is dissipated in the form of heat generated by friction.

Air is an additional source of resistance to the action of the machine.

(*To be continued*)

Electric Water Heating Practice—4

Piping Details : Electrical Installation : Heat Losses : Maintenance : Costs

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

(*Concluded from page 267, May issue*)

APART from cutting out a length of pipe for inspection, the only true examination can be made by removing the inspection cover of the hot water storage tank. Heavy scale deposit will indicate that the water has reached high temperatures and even, perhaps, boiling point. The outlet of the flow pipe from the boiler should also be closely examined.

Alternatively, a new system may be run which can be carried out by installing either a storage heater at each outlet point, leaving the existing hot water taps in position for use when the old solid fuel system is operated, or by installing a new system with a pressure type of heater to operate independently and in parallel with the solid fuel system.

When it is decided to install independent electric storage water heaters, e.g., one 1½ or 3 gallons, at the kitchen sink, a 12-20-gallons type to serve both bath and wash-basin and additional small heaters at other wash-basins, the only plumbing necessary when displacement type or single point heaters are installed is a cold-water feed.

General and best practice is to feed the kitchen point from the cold-water mains so that the water heater can be used for culinary putposes and other positions from the low pressure cold-water cold storage system. Since cold-water outlets at these points are normally fed from the low-pressure system, the only plumbing necessary in all cases should be a short piece of piping. This piece of piping should be the same as the main system, e.g., iron, lead or copper, but since iron piping is difficult to install without cutting tools, including a set of stocks and dies, the simplest method, where possible, is to insert a special brass to copper fitting at the point where the cold-water outlet is made.

Special compression fittings are made for this purpose. If unobtainable, other types of brass to copper conversion fittings should be used, one of the simplest being the "Yorkshire" type, further details of which are given later.

Plumbing a joint on lead pipe is not an easy matter for the amateur, and in cases of difficulty either a plumber should be called in or a brass to lead fitting obtained for insertion between the joint near the cold-water outlet and the heater.

These are easily fitted provided proper jointing compound is used. A piece of lead pipe can then be obtained with the conversion unions fitted. A piece of rubber pipe will operate satisfactorily, but should be used only as a temporary expedient.

When a complete water heating system is installed to operate in parallel with an existing system, the only alteration to the existing installation will be an outlet from the existing cold-water ball valve cistern. This job can be otherwise regarded as a new installation, of which more details are given later.

Types of Piping

When carrying out a new installation the question of the best type of piping to use always arises. For the cold-water side of the installation it is immaterial, but for the hot-water side copper is undoubtedly the best. At present, however, the decision must depend upon the materials obtainable.

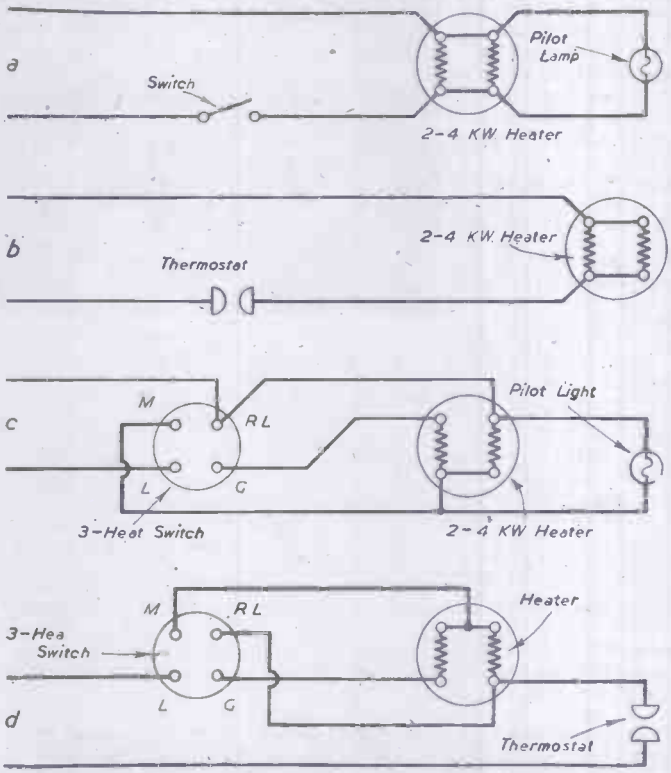


Fig. 24.—Four methods of controlling electric water-heating installations. (a) Is a normal hand-controlled circuit ; (b) is a conventional thermostatic control with no switch ; (c) is the converted three-heat switch control with pilot light, and (d) is a combined thermostatic and three-heat switch control circuit.

If iron pipe is available, care must be taken with the joints and, if it is to be installed in existing property, considerable cutting away and making good of the house structure and decorations may be necessary.

Lead pipe, on the other hand, can be installed with minimum of cutting away, but care is necessary in handling, and a complete installation should be carried out by a plumber, or troubles will develop.

Copper piping, on the other hand, besides being easier to obtain at present than lead piping, is simple to install.

Special capillary fittings of the "Yorkshire" type are made and, if used, the job can be carried out with little difficulty by an amateur.

Copper piping also has a higher operating efficiency and shows considerable saving in electricity when used for the hot water system, as will be shown later. The "Yorkshire" fitting which is used in conjunction with copper tubing is made in all types and eliminates bending of the piping. These fittings include elbows, bends, obtuse bends, tee fittings and a wide variety of special fittings and couplings, and are also incorporated in stop cocks, valves and waste traps to eliminate plumbed joints.

A fitting is made to fit each size of piping and the base of the fitting contains a channel of solder. The copper tubing is well cleaned and smeared with flux, and is pushed into the base of the fitting up to the shoulder. When in position, the heat from a blow lamp is played on the fitting, and the solder from the channel is drawn by capillary attraction into the joint, and the whole is fused together, forming a copper-zinc-tin compound. It is almost impossible to overheat a joint. Heat is applied until a ring of solder appears round the mouth of the fitting.

Since tube of various gauges is available, e.g., 18 and 19 S.W.G., it is important to ensure that the gauge number on the fitting is identical with that of the tube.

When necessary to take a joint apart, for alteration to the system or for other reasons, both the tube and the fitting can be used again.

First the fitting is re-heated and the tube withdrawn. To re-make the joint, the fitting and tube are re-heated until the solder ring is around the fitting mouth as before. If a new untinned tube is used, to re-make a joint this must be cleaned and evenly fluxed. When heated, solder is applied to the mouth of the fitting.

No trouble will arise with these joints if properly made. To ensure no faults or leaks will occur, the tube should be cut square with a hacksaw and burrs removed and the outside of the tube properly cleaned with fine sandpaper (not emery), or steel wool.

Each joint takes a minute or so to "sweat," and when installing a copper tube system, all lengths can be cut, each cleaned and fluxed, and inserted into fittings before any "sweating" is carried out. When all the pipe work is ready, the blow lamp can be prepared and each joint "made." Care

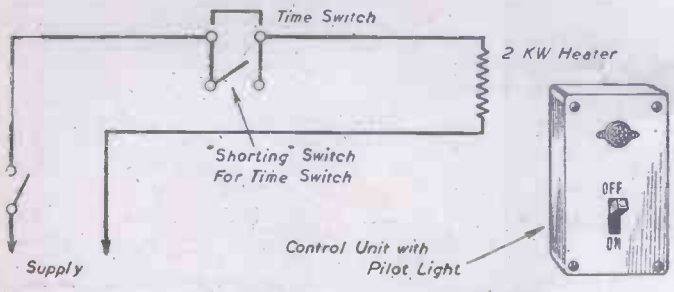


Fig. 25.—Time switch control with "bridging" switch.

must be exercised to ensure that the tube is pressed "home" into each fitting and that no joints are forgotten or, when the water is turned on, leaks will occur.

If a leak does occur in a horizontal pipe, due to bad workmanship, difficulty may be experienced in either re-making the joint or removing the fitting, owing to the presence of water, which will prevent the fitting heating up and melting the solder. Water must therefore be drained out first.

If extensions are contemplated later, tee fittings may be inserted in the place of couplings, and a stop end or cap inserted in the un-used tee. This practice saves work later.

Fixing Water Heaters

It is essential that water heaters be properly fixed or considerable damage will result from their falling out of position.

The weight of a water heater full of water is not always appreciated. Since one gallon of water weighs 10lbs., a 12 gallon water heater, which weighs approximately 72lbs. when empty, will weigh 190lbs., or over 1cwt. more, when loaded.

A good brick wall should be chosen so that rag bolts can be used. These are well cemented in, and the best fixing is obtained if the hole cut for each bolt is made as small as possible.

If the wall is lath and plaster, it is often possible to chose two upright studs and place bolts right through the wall. Where the studs do not coincide with the fixing brackets, stout wood slats or iron bars should be obtained and drilled accordingly (Fig. 23, May issue). One bolt of each should, if possible, coincide with the stud.

Many party walls in bathrooms are made of "breeze" blocks or cavity bricks, which are not suitable for direct fixing. Bolts should pass through the wall, with large metal washers on a wood or iron bar placed on either side.

Provision must be made for the overflow pipe when installing cistern type water heaters and head room for inspecting the small cistern should also be provided.

Room below the heater must also be allowed for withdrawing the elements.

Since a vent or expansion pipe is necessary with a pressure type water heater, the heater must be fitted in a position to allow the uninterrupted rise of water in this pipe. Although usually these terminate in a bend over the cold water cistern, they may terminate elsewhere provided they are at least a foot above the highest level of the cold water system. It is good practice also to allow an extra foot for each 20ft. rise since 13ft. of cold water will support 14ft. of hot water; the former being, of course, of higher density. If the expansion pipe is not high enough, a few pints of water will be ejected each time hot water is drawn off. Two or three draw-offs in quick succession will result in wastage of hot water and a higher operating cost.

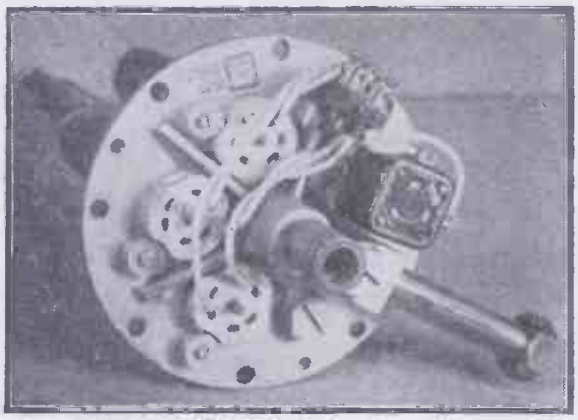


Fig. 26.—Apparatus-plate assembly of 1 kW. displacement type water heater removed for inspection.

It is always desirable to install a cold water cistern at the highest point to produce the most pressure on the system. Where there are restrictions in space and a displacement single point heater is installed, erratic operation may result. When the cold water inlet is operated the hot water flows but after about one minute the flow ceases and then gushes out and stops again.

This is due to insufficient pressure; the hot water outlet being greater than the cold inlet.

It can be cured by either increasing the size of the inlet or by reducing the size of the outlet; the former being the better alternative.

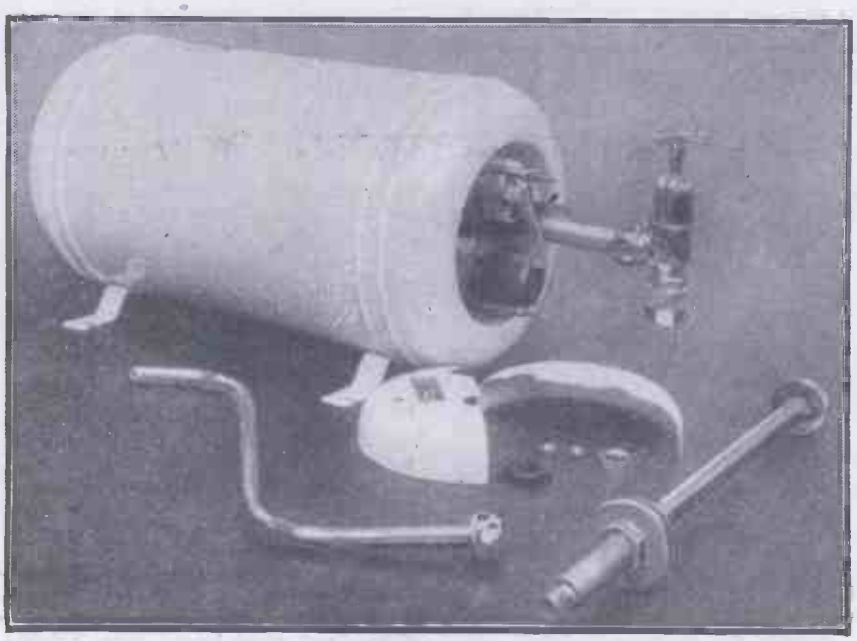


Fig. 27.—Hot water outlet removed from small displacement type water heater. Note mushroom head of anti-drip device where scale usually forms. This must not be bent or otherwise damaged when scraping off scale.

Electrical Installation

The water heating electrical installation is normally a small proportion of the total work and rarely consists of more than a simple electrical heating point, though with some forms of hand control more complicated circuits are employed.

The same principles apply to both the self-contained thermal storage heater and the conversion installation.

Where thermostatic control is adopted, and it is with all factory produced thermal storage heaters, wiring need consist of only a single circuit terminating in a switch plug adjacent to the heater. This circuit may be taken off a spare way of a heating distributing or fuse board, but where none is available it may be necessary to install a separate circuit right back to the meter position. Here a separate main-switch and fuse unit will be necessary. Such an independent circuit is particularly desirable where special low rates of charge are available from the electricity supply authority for water heating.

An alternative to a switch plug, at the heater end of the circuit, can consist of a special water heating control panel which incorporates a red light to indicate when the current is on. This is not necessary with thermostatically controlled installations since the heater is usually left in circuit continuously; the thermostat automatically controlling the current to the heating element.

Lead covered cable, vulcanised rubber insulated (V.I.R.) in conduit and tough rubber sheathed (T.R.S.) are all suitable wiring systems for the circuit. Normally the type of cable employed in the main installation, e.g., house lighting, heating, etc., should be used for extensions, but sometimes it is desirable to adopt an alternative method. For instance, should a watertight installation be desirable for outdoor work, or lead covered cable to obviate interference with decorative schemes, a departure from normal practice is justified.

Provision for earthing the electrical apparatus is necessary and where steel conduit, lead covered cable or T.R.S. cable with earth is employed, no further earthing conductor will be necessary. Otherwise, a separate earthing wire is necessary which must consist of a bare tinned copper cable of a size of not less than 7.029. This is a standard cable stocked by most electricians.

Switch Plug

A 5-amp. switch plug and 3.029 cable is suitable for water heaters having loadings up to and including 2.0 kW. Above this a 3 kW. (15 amp.) plug must be used with circuit wiring of a size not less than 7.029. A suitable lead from the plug to the heater comprises 3-core flexible cable covered with tough rubber sheathing. Where large heaters are installed, having loadings of 4 kW. and above, special circuits must be installed with suitable control gear; the capacity of which will depend upon the electrical load. Although switch plugs should, where possible, be installed adjacent to the heater, special precautions must be taken in bathrooms and similar locations to ensure that the plug cannot be reached by a person in the bath, or when operating a water tap at the sink.

In fact the installation should meet the conditions and recommendations laid down in the I.E.E. Regulations for the Electrical Equipment of Buildings, and conform to the Electricity Supply Regulations.

Hand Control

This is used on non-thermostatically controlled installations, whether of the conversion type or factory made non-lagged heaters. Switch control is essential, and may either consist of a switch plug or control unit. Where a switch plug is used, a pilot light should be fitted so that the user can see when the heater is on. Special control units for water heating are available, and usually include pilot lamps. Omission to install a pilot light on hand-controlled installations may result in the heater being left switched on. The water will then get too hot and probably boil, and the tank may burst, with consequent damage to ceilings and so forth.

A satisfactory method of controlling an installation of 2 kW. and above is by the three-heat method (Fig. 24). This switch gives a choice of high, medium and low heats. For general use low or medium is sufficient, but when a large quantity of water is required quickly, such as for a bath, the switch may be turned to high.

From the illustration it will be seen that to operate an installation by means of a three-heat switch, the heater circuit must be split into two parts. This is normally provided at the element terminals, for where a 1 kW element usually, though not always, consists of a single element, a heater having a loading of 2 kW or more consists of two elements. Where the heater consists of one element only, it cannot, of course, be adapted for three-heat switching.

On high, the two elements are connected in parallel and give maximum heat; on medium only one element is operated and gives half heat, and on low the two elements are in series which gives one-quarter heat. Therefore, on low the heating effect of a 2 kW heater would be only ½ kW.

No switching arrangement will, however, replace the thermostatic automatic control, which should be used where possible.

A good alternative is, however, possible by using a time switch. This is installed in the circuit (Fig. 25), and may be set to "cut in" about an hour before hot water is required. Where this is used, it will be found advantageous to set the switch for early morning supplies of hot water, and, by incorporating a hand switch, the time switch may be bridged during the day to give normal hand operation.

Heat Losses in Pipe Work

Heat losses should be reduced to a minimum to give the most efficient installation. These occur in a number of ways.

Loss of heat occurs in the storage vessel. From an unlagged conventional hot-water storage tank the losses are considerable, and if the installation is thermostatically controlled and in continuous use the system would be uneconomical. Adequate lagging of the tank reduces such losses to reasonable proportions. Losses in factory-produced thermal storage water-heaters are comparatively low. Figures for the various sizes were given earlier in this series.

Remaining losses are pipe losses. These are due to (a) heat absorbed by the metal in the pipe, e.g., copper or iron; (b) radiation and convection loss in the pipe if kept hot; this varies depending on the pipe and its location, and (c) heat stored in water where this is allowed to cool. Water in a pipe which serves a tap that is seldom used will become cold after use and results in a "dead leg" of water.

Since the metal in an iron pipe is greater than that in one of copper the losses from the heat stored in the metal are greater in the iron than the copper. For example, if the temperature of the water is 180 deg. F. the losses per foot run in an iron pipe of ½in. bore are 4.4 watt hours compared with 1.1 watt hours for copper. Therefore, each time water is drawn through a pipe having a "dead leg" of cold water, four times the losses will occur in iron compared with copper.

Radiation losses are only of importance where the water is being continually drawn off. These amount to approximately 20 watts per foot run of iron pipe. Losses from copper pipe (unpainted) are about 60 per cent. of this. If the pipe is painted a dark colour the losses will be higher.

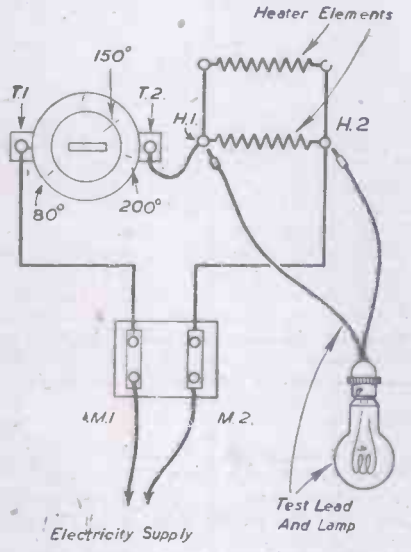


Fig. 28.—Testing water heater for electrical faults. A small test lead comprising lampholder, lamp and flex should be constructed and each part carefully tested with the electric current switched on.

Convection losses are due to the free passage of air around a pipe and are greater when the pipes are exposed to the cold air. Since the surface area of an iron pipe is greater than that of copper, convection losses in respect of the iron pipe will therefore be greater. If the water in a pipe is allowed to become cold, radiation and convection losses are of no account since all the heat is lost anyway.

Loss in heat stored in the water content where the water has cooled is about 3 watt hours for ½in. pipe and 7.5 watt hours for a ¾in. pipe. These losses can only be reduced by using a pipe of lowest possible bore and ensuring that pipe runs are short.

Lagging Pipes

Losses in pipes are reduced to about 1/5 when an iron pipe is lagged. The losses from a lagged copper pipe are of course the same as that from an iron pipe.

While lagging of pipes appears to result in appreciable savings of current, in practice this is not so.

There is nothing to be saved in lagging a pipe which is infrequently used, e.g., pipe feeding the bath outlet. Generally, if the intervals between draw-off are greater than 20 minutes, no saving accrues from lagging since the water has cooled in spite of it. If long runs of iron pipe are made to frequently used taps such as the kitchen tap, lagging should be carried out. Consideration should also be given to lagging a copper pipe where the run is excessive and the pipe is exposed, but in such cases savings are best made by installing an independent water heater at this point.

A greater amount of energy can always be saved by reducing the amount of heat absorbed by the water and pipe. This is eliminated entirely when a separate heater is used, but the losses of the heater must be considered. Copper pipes, in this respect, are superior to iron. Owing to the smoother bore of copper pipe, and the use of easy bends, it is often possible to reduce the pipe bore when using copper. For instance, ½in. copper pipe can be used for the same purpose as ¾in. iron pipe.

In normal circumstances about 20 pints of cold water have to be drawn off a 15ft. "dead leg" of ¾in. iron pipe before the water temperature reaches 150 degs. This compares with 8 pints from ¾in. copper and 6 pints from ½in. copper pipe.

Maintenance

Little maintenance is necessary for electric hot water systems over a period of years.

Chief troubles arise from scaling. Small heaters of the 1½ gallon and 3 gallon class may require de-scaling in hard water districts every six months where the thermostat is set high, and large water heaters may require treatment every two years. In soft water districts and where the thermostat is set low, e.g., 140 deg. F., de-scaling need be carried out only once every five years.

De-scaling is simple to carry out. First the electricity is cut off and the water drawn from the heater.

The thermostat and element (Fig. 26) may then be removed. The apparatus plate is then lifted off by removing the bolts or screws. A new gasket will be required before replacing the apparatus plate.

Most of the scale will be found on the casings of the thermostat and elements and these should be well scraped. All scale should then be taken out of the container and the hot water outlet inspected since the scale usually forms here and restricts the flow of hot water through the outlet. Care must be exercised when de-scaling to ensure that the mushroom head (the anti-drip device, Fig. 27) is not damaged or bent or this will not operate correctly.

Having cleaned the container, element and thermostat casings and obtained a new gasket, the apparatus plate may be refixed, taking care the gasket fits well and all bolts are well screwed home. The element and thermostat are now replaced, connections made, drain plug fitted and the water turned on.

Thermostats may need adjusting since the setting may have altered during the removal of the element.

In cases of doubt as to dismantling a water heater the makers should be consulted.

Electrical Faults

If the heater does not operate (water does

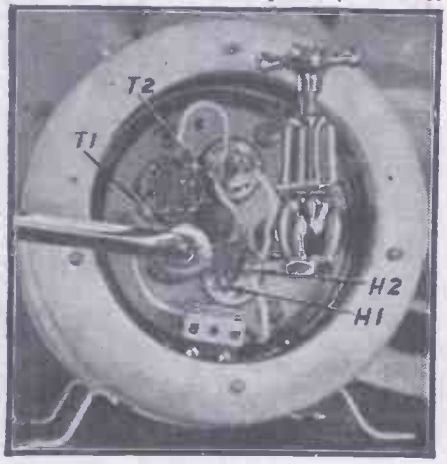


Fig. 29.—Electrical connections of a typical water heater with cover removed.

not get hot) when the current is switched on, and the fuses are intact, and the current is at the switch plug, it is most likely an element fault.

This can be ascertained by testing the terminals with a pilot light which consists of a lampholder, short piece of flexible wire and a lamp (Fig. 28). If there is no light, the thermostat has probably stuck in the open position.

The terminals T1 and T2 should be bridged by a short piece of wire (Figs. 28 and 29) and the pilot lamp test repeated. If no light, the fault lies in the wiring, but if the lamp lights, indicating an element fault, the element should be inspected. Where there are two elements, as in Fig. 28, rarely will both elements fail simultaneously. Therefore the connections at H1 and H2 should be carefully inspected.

Before removing the element, the connections should first be inspected, after switching off the current, and if these appear O.K. the element should be withdrawn.

The withdrawable element type can be removed by releasing two nuts holding the porcelain former, after the electrical connections to the thermostats are removed. The tubular sheath and flat blade sheath type cannot be removed, however, without first drawing off the water. These elements are then released by removing the large locknut. Practically all thermal storage heaters have withdrawable elements and difficulty in removing the elements will therefore only arise in conversion installations where the element is immersed in an existing tank.

Rarely is it possible to repair elements and they should be returned to the makers for replacement, quoting the voltage of the electricity supply. Damaged thermostats, too, cannot be repaired and should be returned for replacement.

Water Boiling due to Electrical Faults

Boiling of water can usually be traced to damaged or stuck thermostat; that is, stuck in the closed position.

To test for this fault, a pilot light is placed across the element terminals and when the water has reached the temperature at which the thermostat is set the lamp should be watched. If this does not go out when the temperature of the water is raised a few degrees above the setting temperature, a damaged thermostat can be suspected. No attempt should be made to repair it, but it should be returned to the makers.

More serious faults such as continuous fuse blowing, which is usually due to a short circuit or an "earth," should only be corrected by a qualified electrician. In fact, since the tests described must be carried out with the electricity on, they should not be attempted unless the user is a competent electrician.

Costs

True costs of electric water heating are difficult, if not impossible, to estimate.

Consumption of electricity always depends upon what use has been made of the water heating system, frequency of baths, number in family, whether electric water heating only is used or whether it has operated in conjunction with a solid fuel system. Consumption will also depend upon whether thermostatic control or hand operation is used, and the efficiency of lagging.

Where the water heating is solely by electricity, annual consumption in a small house of 3-5 in family is in the order of 2,500-3,000 kWh. This cost depends upon the charges for electricity which, for domestic electric water heating, vary between ½d. and ¾d. per kWh, depending upon the supply authority.

Thus, where the consumption is as above and the charges are ½d. per kWh, the annual amount will vary between £5 4s. 0d. and £6 5s. 0d., or from 2s. to 2s. 6d. per week. At ¾d. per kWh and the same consumption, this will be from 3s. to 3s. 9d. per week.

These figures have been taken for a thermostatically controlled installation, where the supply authority normally offers a low rate of charge.

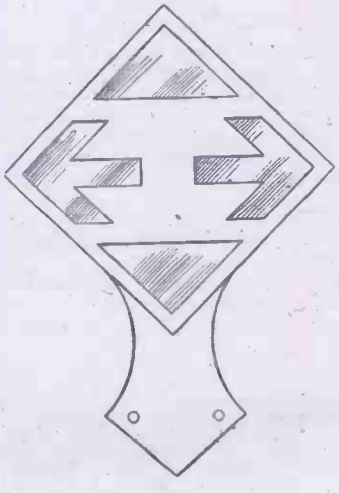
When the installation is hand controlled, the charges per unit are often high but, since the consumption of electricity is usually lower with hand control, the annual consumption of electricity is usually lower. These figures are given as a guide and a guide only, since in practice they vary between households.

While electricity for water heating approaches the ideal, due to its general efficiency and cleanliness, no existing system should be converted where it is obvious that it would not operate efficiently if so converted.

Direction Indicator for Cycles

By F. M. EASTON

IN the March issue of PRACTICAL MECHANICS mention is made of an American rear light for a cycle giving indication of turning left or right. The writer has had, for about twelve months now, a device of the same nature on his cycle which also includes "Stop" and rear lights. The accompanying illustration, Fig. 1, gives a good idea of the appearance of the finished indicator.



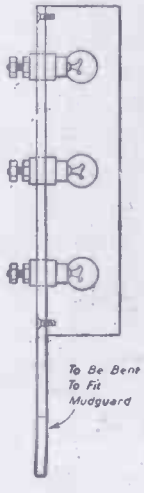


Fig. 1 (above). — Front and side view of the indicator showing the position of bulbs.

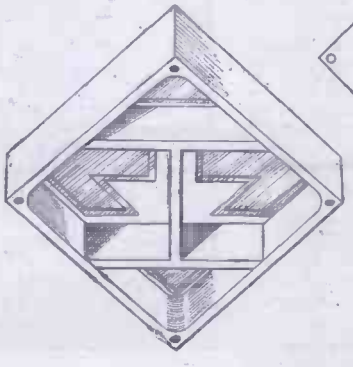
Constructional Details

The lamp box and base are made of aluminium, the base being ⅛in. thick. The box, which is cast in one piece with divisions, as shown in Fig 2, is fitted on to the base in the manner shown in order to have the joint away from the bulbs, thus preventing the light creeping into the compartment not to be illuminated. The coloured glass, Perspex or celluloid, is glued to the inside of the box.

The "Stop" light is worked by a press-button on the handle-bar. The "Left" and "Right" arrows are operated by a two-way switch with central "off" position (similar to a dynamo-battery switch for head-lamps). The "rear" light is lighted when the head-lamp is switched on.

The wiring is held under the rear mudguard by a brass strip bolted to the mudguard. In the writer's case, the head-lamp switch is under the lamp, which left room at the top to fit the "indicator" switch.

The press-button switch for the "Stop" light was used to save electricity when holding the rear brake on when there is no need to give indication of stopping.



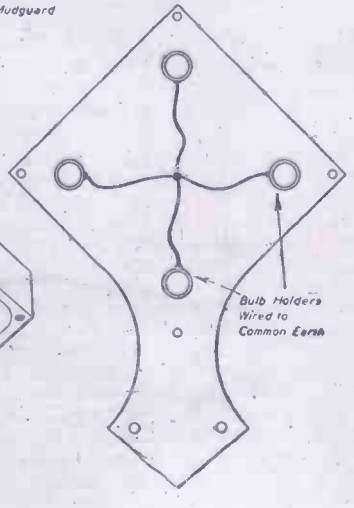
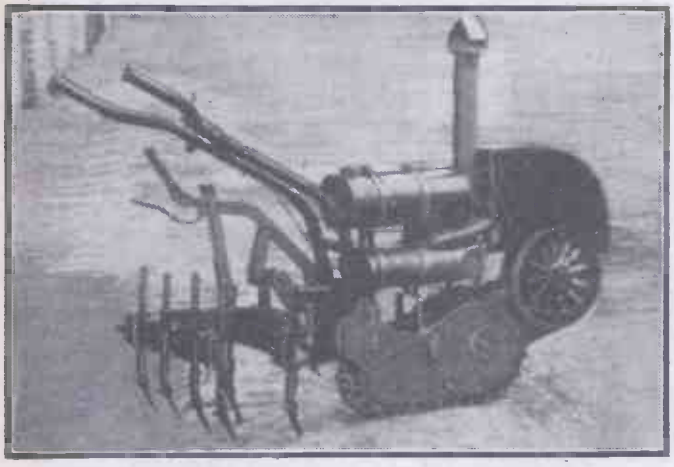


Fig. 2 (right). — Lamp box and base showing the earth wiring connections to bulb holders.

All-purpose British "Crawler"

A Remarkable Machine Which is No Larger Than a Lawn Mower

By R. R. RUSSELL



The new machine with small tool assembly attached.

A NEW 7½ h.p. universal crawler prototype incorporating several revolutionary features has just made its appearance. Its inventor is a North London experimental and welding engineer, Mr. Richard Bradford, who with the aid of some able assistants built it entirely from scrap in his small workshop.

New Features

The design incorporates 21 years' experience of the snags encountered by the owners of land machinery in general and the need to produce a machine meeting as far as practicable their many wants.

Probably the most striking feature is the way in which the 3 cwt. of working machinery is so finely balanced on one miniature-linked crawl track of only 6in. width while 18in. of its length contacts the ground directly; the entire mechanism is within 12in. of the ground. This produces an unusually low centre of gravity, and the drag on taking bends is eliminated.

Original Engine

The air-cooled engine of 825 c.c. runs at 2,500 revs. and the amount of fuel consumed for an average full day's land work is three gallons of fuel, which can be either petrol, paraffin or kerosene. The normal forward speed is 3 m.p.h. and a compression start is effected by means of a handle; if desired, a kick start could be fitted. Starting is easy and of instantaneous regularity, vibration being kept to a very pleasant minimum.

Overall Details

The induction exhaust silencer and cleaner is one new original item which performs a triple action; before entering the carburettor the air is cleaned and also heated, and by this means efficient vaporisation is assured and the engine kept to peak performance, carbonisation is prevented, engine noise suppressed and an exhaust channel is integrated with the structure. The exhaust stack has a swivelling louvre to stop fumes from blowing back in the face of the operator. Self-cleaning strakes are a part of the track assembly, and these remove soil automatically and prevent fouling.

The width, height and length of the steering is adjustable by a simple movement, one column of which carries the two controls, clutch and throttle. The gears, which are epicyclic and in constant mesh, are of single speed, and immersed completely in an oil bath.

The whole machine can be stripped down within 15 minutes and all normal adjustments are very easily accessible. It can climb a one in three gradient and engage unusually rough ground.

Operational Roles

When used for agricultural purposes this machine will do the heaviest work, though naturally slower than the large single-purpose motor tractors using three times the amount of fuel to cover large tracts quickly. From then on it comes into its own on such duties as keeping the farmland clean, removing headland wastage and cultivating between close-growing bushes, trees and plants, allowing more growth per acre by means of its one small track and its narrow width.

Universal Tool Frame

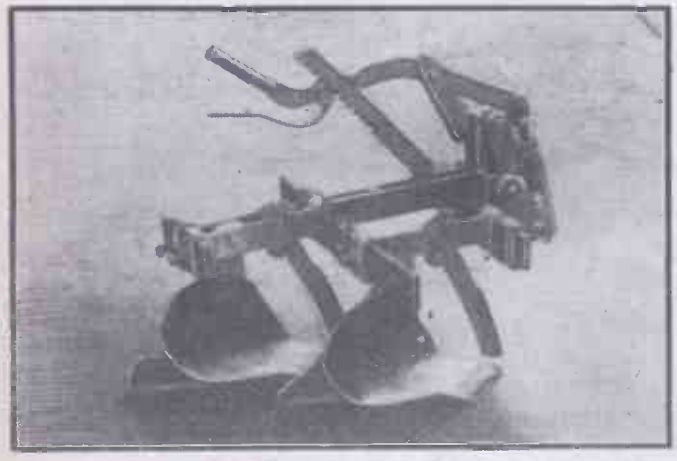
Another new machine, the "Universal Tool Frame," here makes its appearance. This multi-purpose trailer-type attachment, which is meant for use either with the "crawler" or any of the large range of auto tractors, eliminates approximately 10 tons of heavy farm machinery. To complete the unit is a full range of tool assemblies, and these are fully adjustable, and more compact in size and weight then the conventional type, and include ploughs, harrows, drills, etc. Elevating into position or lowering is done by a lever control situated next to the sprung driving seat. Removal of a steel pin jettisons the assembly in a few seconds.

For the smaller duties a minor set of the heavier tool assemblies each with their own individual lever control fit directly to the machine, which can then be walked around. Used for horticulture, the same "crawler" fitted with a hard rubber track and a suitable range of accessories will carry out the mowing of grassland and lawns, weeding, spraying, edging and digging. Its specialist duties include the pulling of co-axial cables through cable ducts, and acting as a light snowplough. An adequate tool box is to be fitted to the frame, and headlamp and rear lights attached for night work.

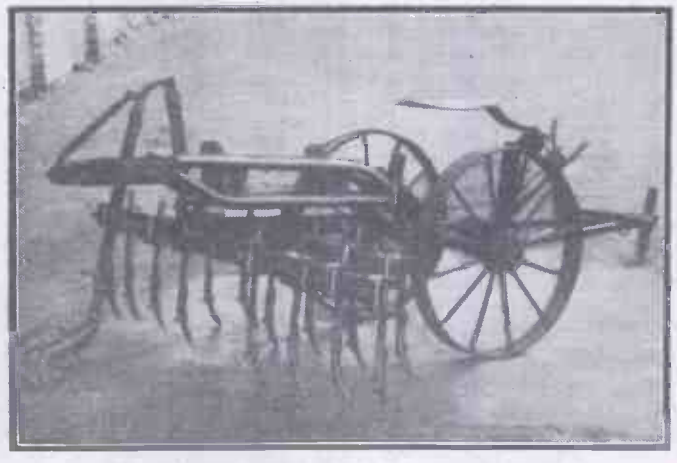
Negotiating Difficulties

Behind the construction of the prototype is a story worthy of mention. The inventor and his assistants were faced by an acute lack of steel, which looked like stalling their project, and so some ingenious and unorthodox methods were followed. They converted, by means of an acetylene cutter, a 100-year-old steel beam from the workshop roof into such important items as the flywheel, crankshaft, engine bearer brackets and side frame. A piston was taken from a 105 mm. bore diesel engine and used for the specially designed engine of the crawler. The cylinder was formed from a section of drainpipe. The rest of the machine and the universal tool trailer was constructed from a variety of scrap metal, retrieved from dumps.

Further information concerning this remarkable machine can be obtained from Messrs. New Welding, 308, Wightman Road, Hornsey, London, N.8.



Close-up view of a small plough unit, with an individual lever setting.



The tool frame with harrowing tool in position.

Gear Cutting With the

A Novel Method of Obtaining the

BEING desirous of building a small lathe for a friend, it was decided to incorporate screw-cutting and back gear features if possible. This meant producing a set of twelve gear wheels for change wheels and back gear. Features of the general design of the proposed lathe, such as pitch of lead screw and major dimensions, indicated that wheels of 20 diametrical pitch would be the most suitable.

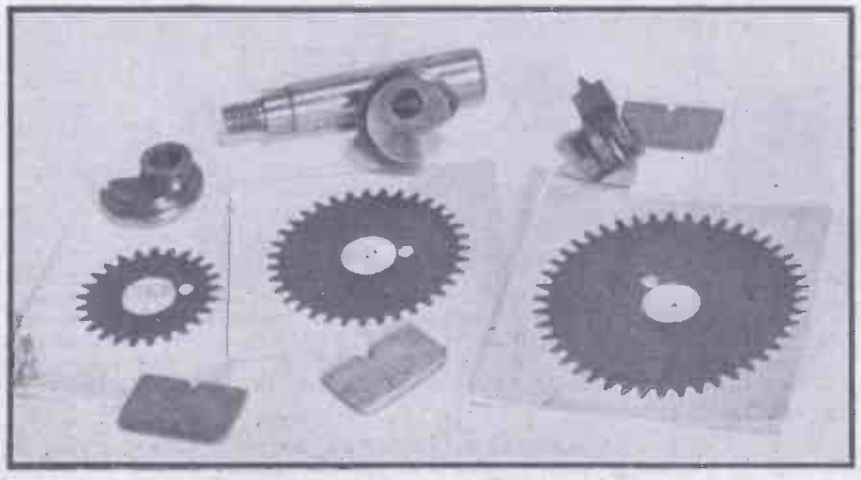


Fig. 1.—Photographs, with templates and cutters derived from them, and arbor for cutters.

The relationship between the number of teeth and the diameter of gear wheels is generally expressed in terms of diametrical pitch. This is a convenient figure indicating the number of teeth on the wheel per inch of pitch diameter. Thus a wheel of 20 pitch having 50 teeth will be 2½in. pitch diameter, one of 24 pitch and 1¼in. diam. will have 30 teeth, and so on.

No. 20 pitch cutters were unavailable, but a text book on gears and gear-cutting was, and study of this made the subject reasonably clear. Various diagrams showed the evolution of the involute tooth shape with the proportions and factors involved, so a large scale drawing was started of a portion of a gear wheel to 20 pitch proportions, with the idea of scaling this down by means of a pantograph or other mechanical means to produce a template for shaping up a fly-cutter. This attempt failed, for a reason which the book pointed out, that " the true involute shape can have no existence inside its own circle of generation." This was found to be true on attempting to draw the full tooth outline accurately, and the writer could find no work of reference which showed how this portion of the tooth could be drawn geometrically—that is, the portion of the tooth flank from the pitch circle to the root of the tooth. There the project stuck while attempts were made to borrow a set of 20 pitch cutters—without avail. Eventually an idea dawned which developed into the set-up as shown in the photographs.

Principles Involved

The germ of the idea was that any gear wheel having a given number of truly involute teeth is proportionately the same as any other wheel with the same number of teeth of *any other pitch*. Or, expressed from another point of view, the difference between any two gear wheels each having the same number of teeth is merely one of size, in direct proportion to their pitches. An example may make this clearer; one has, say, a wheel of 5in. pitch diameter having 80 teeth. This would be 16 diametrical pitch. Now, if this is scaled down in a ratio of 5 : 4, that is, to 4in. pitch diameter, the result is a correctly shaped wheel of 4in. pitch diameter having 80 teeth. Now a 4in. pitch diameter wheel with 80 teeth is clearly a 20 pitch wheel. Consideration of this will show that the ratio of 5 : 4 is one that holds good throughout the range of sizes of both the 16 and the 20 pitch wheels.

This idea seemed to have possibilities, as a range of change wheels was available as specimens to be reduced to produce a similar range in 20 pitch wheels. A way was then sought of reducing these accurately, eliminating the "human element" as far as possible, and the obvious way soon presented itself—do it photographically. This idea seemed particularly attractive, as it became apparent that by effecting the reduction with the camera it was completely unnecessary to establish the exact ratio of reduction, or even to know the pitch of the wheels to be copied. The range of wheels required was from 20 to 50 teeth by increments of 5, including four 20's and three 50's. These extra wheels at each end of the range were for the back gear, which required two each of the 20 and 50 teeth. The text book gave a list of the B. and S. gear-cutters in a set covering various numbers of teeth from a rack downwards, from which it appeared that one cutter was suitable for 35-54 teeth. A deviation from this was thought advisable to equalise the wear on home-made silver steel cutters, so it was decided to try and cut the range with three cutters, having shapes based on the 25, 35 and 45 wheels. This allocated them 105, 105 and 195 teeth each to cut, respectively.

Photography's Role

Accordingly, these three wheels were thoroughly cleaned, and photographed in such a way as to produce the sharpest outline and blackest silhouette possible on a light background. This was done by tilting a lamp with a metal reflector so that it pointed vertically upward, laying a sheet of glass on it, and placing each gear wheel in turn on the glass on two thicknesses of tissue paper. The camera tripod was arranged to straddle the lamp, with the camera aimed downwards directly over the wheel between two of the tripod legs. By movement of the wheel so that an even ring of the bore could be seen on the focussing screen, it was made certain that only the outline of the top surface of the wheel was photographed, with no foreshortened view of its thickness to confuse the outline. The number of teeth of the wheel being dealt with was written in indian ink on a scrap of tissue paper and placed under the wheel so that the number was legible down the bore of the wheel, and so was automatically reproduced in the print. For those interested in the photographic technical details, a 40-watt lamp was used about 4in. below the wheel, exposures were 1/25 second at f.11 on P.1200 plates which were developed in D.76 for 50 per cent. over normal time. Normal print procedure was carried out with vigorous glossy paper. Quite small pieces of paper were used for the prints, as they needed to be no bigger than sufficient to give a working margin round each wheel.

The accuracy of the reproduced tooth shape is largely dependent on the correct size of the wheel in the print; so particular care was taken to get this as correct as possible. An old scrap print on the same paper was found, and on the white back of this circles were drawn to the correct outer diameter of each wheel. These circles were drawn in indian ink, with the pen points adjusted to give the finest possible line. The 25-teeth wheel of course, had a pitch diameter of 1.25in., and from the formula $\frac{Dp \times (N + 2)}{N}$ the overall diameter came to 1.35in. This was a measurement easily obtained from a steel ruler marked in 20ths. In focussing the enlarger a sharp image was aimed for, with the tips of the teeth just touching the inside of the circle.

A further useful point here became evident, which had not been realised at the start of enlarging, and that is that as the wheels were all photographed without altering the camera position, when once the enlarger was set for one wheel it should be correct for the others. This proved to be so, and advantage was taken of it to provide a check on the size of the projected image by checking for size with the largest wheel

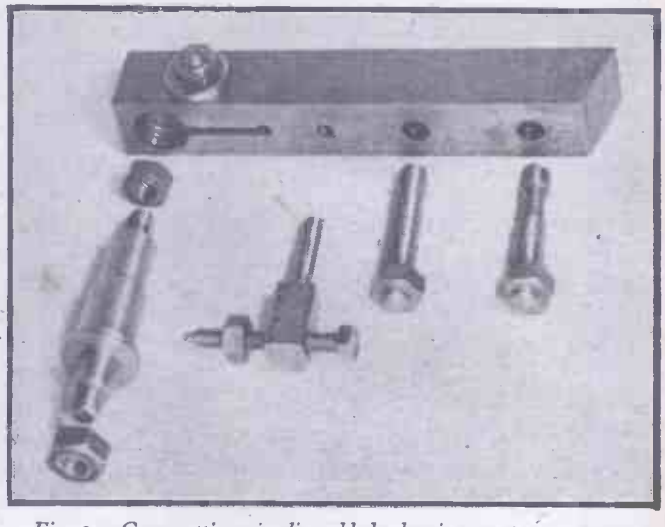


Fig. 2.—Gear-cutting rig dissembled, showing component parts.

Aid of Photography

Correct Tooth Shapes.

By L. C. MASON

in its circle after focussing with the smallest one. Prints of each wheel were then made in duplicate, in case of damage or wear and tear on the surface of the print which might spoil the clarity of the outline.

Producing the Cutters

The next stage was the production of a template to the outline of one tooth space, and a small piece of 1/16in. mild steel strip was used for this. It was not thought worth while case-hardening this for a "one-off" job, as the possibility of distortion through heating and quenching seemed greater than the chance of inaccuracy through wear and tear.

Cutter blanks were then prepared, and as can be seen from Fig. 1, these take the form of discs arranged to run eccentrically on an arbor held in the lathe chuck, and having the rim turned to the required form. The cutter blank was faced both sides while running truly, then gripped the necessary amount eccentric in the four-jaw chuck for drilling and tapping. A short, stubby arbor was then gripped a similar amount eccentric in the chuck, and its position adjusted when the cutter blank was mounted on it so that the blank ran true. The edge of the blank was then turned to form to match the template. A sector was cut out to form the cutting edge, so that the tip comes at the point furthest from the arbor centre. This shape of cutter has the advantage of being easily produced, and is capable of being sharpened a great number of times without losing the accuracy of form.

Set-up for Cutting the Gears

The actual gear-cutting rig is very simple, and was made up from oddments from the scrap-box. The illustration, Fig. 2, shows the components, which consist of a main supporting bar 1in. square, bored and split at one end to receive and grip a double-ended mandrel. The split and clamp bolt through the bar are located on the side of the mandrel away from the chuck. This was to avoid increasing the overhang of the cutter arbor necessary to reach to the centre of the gear blank. The mandrel holds the gear blank on one end, where it is clamped by the ⅜in. nut against the mandrel flange. The other end carries a spacing collar and change wheel for indexing from the lathe. The nut on this end clamps these two against the shoulder of the mandrel. The larger diameter of the mandrel is a fraction longer than the thickness of the bar, so that when the indexing wheel and gear blank are clamped up tight the assembly of mandrel and wheels can turn freely in the bar without appreciable end-play. Indexing round to each tooth position is effected by the ¼in. bolt which passes through the square block mounted on the bar. The bolt is threaded to screw tightly through the block, has its end shaped to fit the space between two of the change wheel teeth and is locked in position with the locknut tightened against the face of the block (Fig. 3). This block is located on the bar in relation to the mandrel centre so that it just clears the largest wheel likely to be used for indexing. This provision for using the largest of the change wheels—in this case the 60 teeth wheel—was made so that it could be used to index the cutting of the 20 and 30 teeth wheels, selecting every second or third tooth on the change wheel. This procedure tends to minimise any errors of circular pitch which might be present in the change wheel. With the largest wheel in use, the locknut is transferred to the greater length of bolt on the opposite side of the block.

The main bar is drilled for bolting by two ⅜in. bolts to the vertical side of an angle plate mounted on the cross slide, the spacing of the holes being arranged to match the angle-plate slots. The bolt furthest from the job is reduced where it passes through the angle plate's ⅜in. slot to 5/16in. to allow of some side movement in the slot to permit pivoting the bar on the nearer bolt for height adjustment of the gear blank.

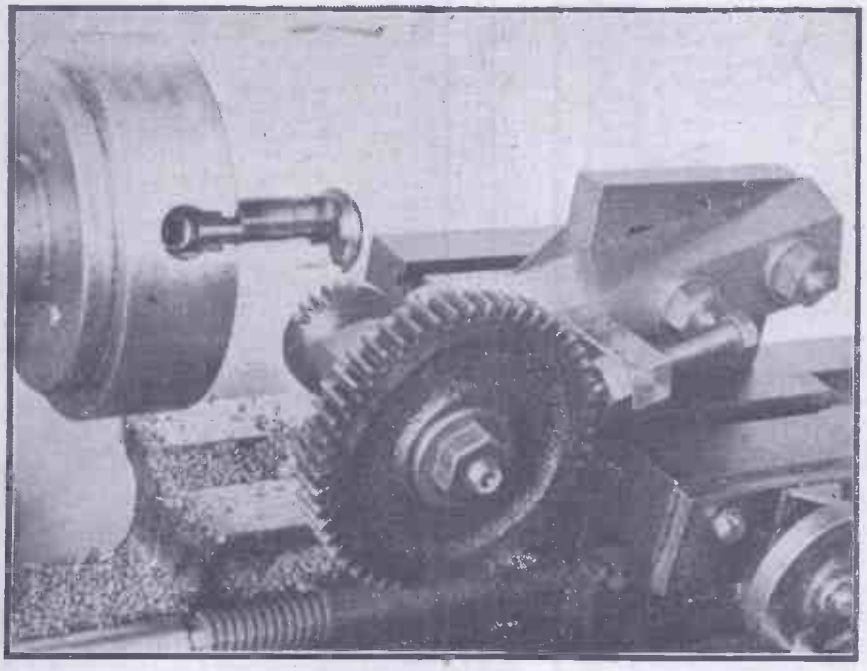


Fig. 3.—Gear-cutting set-up in operation, showing 25-toothed wheel being cut, indexed by the lathe's own 50-toothed wheel.

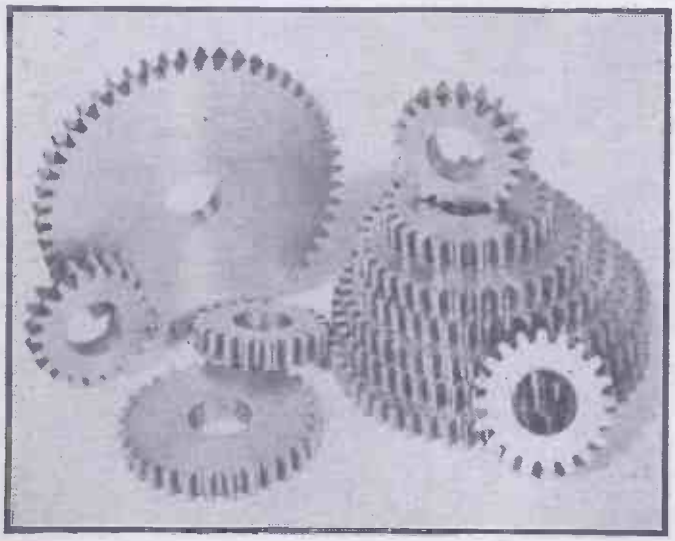


Fig. 4.—Set of 12 home-cut gears for lathe change wheels.

Gear Blank and Index Wheel

Determination of height for the gear blank was carried out by mounting the cutter and arbor in the chuck and turning the cutting edge to its lowest position. The blank was then assembled on the mandrel with its appropriate change wheel and the bar complete bolted lightly to the angle plate. The angle plate was then bolted down on the cross slide positioning the bar across the lathe bed and the slide traversed across to pass the edge of the gear blank under the shoulder of the cutter. This positioned the angle of the bar so that the cutter would cut full depth and its shoulders just touch the rim of the blank—that is, what would be the tips of the teeth. In this way, considerations of depth of tooth are conveniently by-passed, being determined automatically by template and cutter shape. The bar was then carefully tightened on the angle plate and the whole assembly removed from the cross slide and turned 90 degs. to bring the edge of the blank in position across the cutter. The centre of the blank was brought under the centre of the cutter by the lead-screw, the saddle locked on the bed, and the whole set-up fed across to bring the blank behind the cutter, when all that remained was the actual cutting.

It was found that back gear was best for this, as the slower speed gave a better finish and less vibration. Very light feed was required with plenty of cutting oil. A group of the resulting gears is shown in Fig. 4. Cutting the teeth this way with a single point cutter is a very slow business, but where the whole project is a spare-time job this is of secondary importance, providing one has enough patience.

Twenty Years from Now

Questions of the Future

By Prof. A. M. LOW

IN twenty years from now every single thing you know will be entirely different. The world will have changed out of all recognition. Judge for yourself by looking back twenty years. In 1927 the Atlantic had yet to be flown from east to west in an aeroplane. Only these few years ago the first solo flight by Colonel Lindbergh was such a sensational event that it held the headlines for days.

Look up the last edition of the Encyclopædia Britannica, published about twenty years ago, and you will find no entry for radar, penicillin, electronics and a score of inventions and discoveries which to-day every schoolboy understands.

The idea of "splitting the atom" was considered Wellsian—something that might happen some time, but more likely in the 21st century than the 20th and certainly not likely to trouble anyone living in 1927.

Aircraft, it was assumed, would always be driven by petrol engines which would become more and more powerful. The "jet" engine was not even mentioned, although in fact the R.A.F. had begun some tentative investigations which were not to be taken very seriously until ten years later. As for rockets—they were things which boys fired on Guy Fawkes night and anyone who suggested that they might be fired from Germany to London might have risked being certified as a lunatic or a sensationalist trying to disturb international peace!

A little earlier I had written one of my early books, "The Future," and some reviewers had treated its forecasts with good humour as the work of a scientist using his imagination, or an inventor having a nightmare. To-day, the book seems stale—so many of the forecasts which then seemed "sensational" have become accepted commonplaces.

Yes, a great deal has changed in twenty years. Not only in the field of the physical but in the social sciences. Men and women, their values and their customs have undergone great changes.

We can reasonably expect changes at least as great to take place in the next twenty years. Always remember that nothing ever remains unchanged for even a part of a second. If you will read any newspaper of twenty years ago you will wonder "how it could have happened." Unless you can think forward to-day, in twenty years time someone will say of you, "How *could* anyone be so careless, so wrong or so ignorant!"

In this series I shall answer some of the questions about the future which are so often put to me.

Shall We have Reached the Moon?

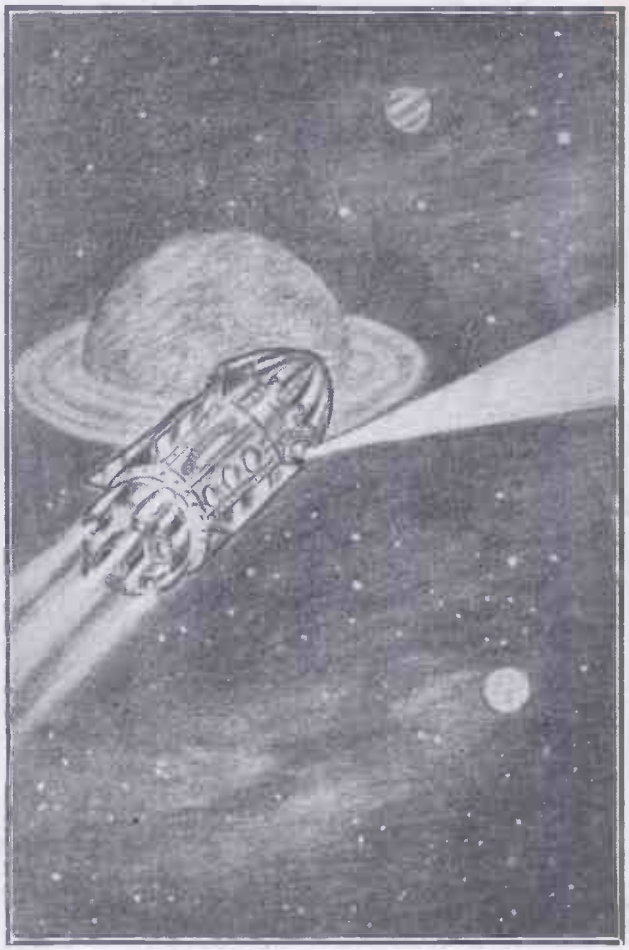
United States Army experimenters recently announced that they had sent a German V-2 rocket to a height of 111 miles from the earth and shot tiny metal slugs from it during flight at a velocity sufficient for them to escape the gravity of the earth and travel into space.

This is the greatest distance to which man has yet sent anything from the earth. But it is still a long way from the moon—to be precise, 238,730 miles. Shall we in the next twenty years see rocket projectiles improved to the point where they can travel two thousand times as far from the earth as this V-2 and reach the moon?

I think the answer is "yes." Twenty years ago it was easy for any mathematician to prove that Jules Verne's moonship was scientifically unsound and would never have escaped the clutches of the earth's gravity. To-day, the fantasy moon journeys of Verne and Wells are approaching the realms of possibility. There no longer remain insuperable "theoretical" difficulties barring the way of escape into space. It was the absence of any fuel capable of achieving the required velocity which made a moon-flight theoretically impossible until recently. Now the experts, inclined to be conservative, speak of a moon flight in from ten to fifty years. It seems to me that the first man-made "moonship" may make its journey well within 20 years and that there are people living to-day who may actually hear by radio this landing on the moon.

The first flight to the moon is likely to be as unsensational as a spectacle as was the first splitting of the atom. A guided missile of some hundreds of tons will take off and disappear into the sky. Even the most powerful telescopes will not make it possible to follow its flight, not only because of its comparatively small size, but also because of its speed. At 5,000 m.p.h. it would make the journey in about two days, but only its automatic radio transmitter sending back messages will enable us to know whether its flight has been successful.

At a spectacle it will be of no interest, but the public will, I believe, follow the flight communiques from scientists with breathless fascination. The tangible results will be a mass of figures unintelligible to all but a handful of experts. But so was Einstein's theory of relativity, and you will recall how this "hit the headlines" and influenced the thoughts of millions quite incapable of understanding its mathematics.



Our artist's impression of space-ships of the future.

Beginning of a New Era

The ordinary man will understand that this first flight by an unpiloted rocket will mark the beginning of a new era, the era of space travel so long forecast by the science-fictionists. The data obtained by the pilotless rocket will make it possible to get down to the details of a passenger-carrying space-ship which will eventually embark human beings on the most important and perilous journey since Columbus set sail. With this difference, that the first passengers in a space-ship will not have unknown perils to face, but known dangers of which the chances have been nicely calculated.

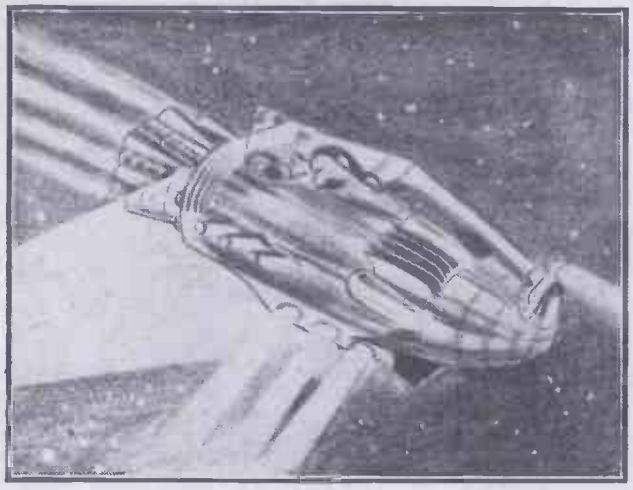
Possibly, within twenty years, more probably later, the day will come when half a dozen men will climb into a space-ship designed to encircle the moon or even land on its frozen surface. They will be men chosen from hundreds or even thousands of volunteers not only for their knowledge but for their physique and courage. Even with the many aids to space flying which will have been developed, they will have to be prepared for great hardship. To overcome the gravity of the earth and "escape," the space-ship must still attain a speed of 12,000 feet a second. To save the crew from being crushed like matchwood against the back of the rocket, this speed will be reached comparatively slowly, but they will still have to be strapped down and will suffer acute discomfort at all stages of the voyage.

Once acceleration slows down and the rocket cruises freely in space the passengers will have no weight. They will float in the air, and such simple things as pouring out a glass of water or swallowing food will be almost impossible. The release of all weight from the body will bring on acute sickness far more nauseating than sea or air sickness. Indeed, I think it probable that the experimental passenger flights which will precede the first flight to the moon will show that it is essential to produce "artificial gravity" by spinning the whole rocket-ship or the cabin inside it.

In space there will be risk of collision with a meteor. Millions of them are continually flying through the void and although the majority are very small, collision with something weighing only a pound or two at very high speed would be sufficient to destroy the space-ship. Once the pressurised cabin was punctured, death from cold would be a matter of moments. It may well be that the accident rate with early space-ships will be high, al-

though calculations of meteorite frequency suggests that this particular risk is less than that of crossing a main road.

In the next twenty years many of the technical difficulties of space flight will disappear. To-day we may wonder how the flight of the space-ship will be checked to make a safe landing, how the space-ship will be guided, how it will be powered and so on. We can suggest crude ways of overcoming the difficulties, such as reverse firing rockets for deceleration. But I think we can be confident that technicians will solve these problems. Just think how formidable first seemed deicing, variable pitch propellers, pressurised cabins, landing speeds of 120 m.p.h. and many other commonplaces of modern aviation, to the designers of early aeroplanes!



For landings on the moon, the passengers will require special suits supplying them with warmth and oxygen. The moon is without atmosphere and there are enormous drops in temperature. Suits have, in fact, already been planned, enabling men to walk, breathe and even eat in them. They weigh two or three hundred pounds, but since gravity (and thus "weight") on the moon is only about one-eighth that on the earth, this presents no serious hardship.

Light will be no difficulty. The journey will probably be arranged for the period when the earth will present a fully lit surface to the moon—a sort of "full earth." The earth reflects about 80 times as much light to the moon as does the full moon to the earth.

First Flights to the Moon

The first flights to the moon will be enormously expensive undertakings, far too expensive for private explorers. But given the incentive, the twenty or thirty millions that a space-ship might cost will not seem excessive to nations that spent this sum every day for years in warfare. What will be the incentive? There will be the natural urge to explore the unknown, the possibility of discovering valuable atomic minerals, and probably most of all the military aspect. Millions a year are being spent on the development of rockets to-day, primarily from the point of view of war, and it is this effort which makes the flight of a missile to the moon in the next twenty years seem so much more probable that it did even three or four years ago.

Commercially, the moon may seem as valueless as the Antarctic Continent when its exploration first began less than a hundred years ago. Expeditions to the moon may be as infrequent as Antarctic expeditions at the beginning of the century, although looking ahead it may be argued that if there are ever to be flights to other planets, it is from the moon, with its absence of atmosphere and low gravity, that they would best be launched. This conjures up pictures of a space-ship assembly plant on the moon, with all that will involve in constructing "pressurised" factories and even towns. To-day, it all seems wildly fantastic, but the discoveries of the next twenty years may make it seem no more difficult than, say, the construction of the Mulberry Harbours would have appeared to a 19th century engineer.

Rocket-flights of 160 Miles

In fact, during the next twenty years flight to the moon will be preceded by hundreds and even thousands of others to varying distances from the earth. The Americans have stated that within two years they will be sending unmanned missiles to a height of 160 miles and manned rockets to 15 miles. The purpose of these flights will be exploratory. A multitude of ingenious automatically recording instruments will discover all about cosmic rays, changes in temperature, reflection of radio, the danger of meteors, and many other problems that must be solved before we can venture into outer space. Postal Services at vast speeds are within our power during the next few years.

From these exploratory flights may come some astonishing developments. We may see the establishment of artificial satellites at varying distances from the earth. If a missile is propelled with a velocity below the 6.64 miles per second required to escape gravity it will eventually stop in space and circle the earth like the moon—but very much closer, a matter of a few thousands of miles. From its natural speed, we could ensure it circling the earth once a day, in other words, apparently remaining in the same spot all the time.

Artificial satellites such as this may solve our radio, television and lighting problems. If we "beamed" all radio to a re-transmitter on such a satellite, it would be re-broadcast so that it could be heard without interference or "fading" over a quarter of the earth. Four such transmitters would cover the whole world and make radio communication hundreds of times more efficient. It would be even more important in the case of television, offering the one alternative to thousands of transmitters at 50-mile intervals all over the world. These projects have been seriously discussed and worked out and they may conceivably be realised in our lifetime.

Artificial lighting may come through the electrical excitation of the gases of the air. The plan would be to have a kind of man-made "northern lights" over our big cities. Instead of thousands of not very efficient street lamps, there would be a pleasant soft gentle light from the whole sky, giving, perhaps, twice the light of the full moon.

These are only some of the possibilities of rocket travel in the more immediate future. Beyond lies the incalculable possibility of flights to Venus and Mars, flights of millions of miles compared with the quarter of a million miles of the moon, but not proportionately more difficult, for once we have "conquered gravity" great distances can be covered in space with almost no expenditure of energy. I shall probably be considered very rash in suggesting that any kind of space-ship capable of reaching one of the planets may be built before the end of the next century. I shall have to console myself with the thought that I may not be alive to be laughed at or, more practically, that H. G. Wells was considered extremely optimistic when in about 1900 he gave the date 1946 as the year in which a heavier-than-air flying machine would first leave the ground.

(To be continued)

Natural Lighting in the National Gallery

A MODEL showing what may be a great advance in the natural lighting of picture galleries was to be seen at the annual exhibition of scientific instruments and apparatus of the Physical Society at the Imperial College of Science and Technology which opened on April 6th. The model was designed by the Building Research Station, D.S.I.R., to show how the war-damaged rooms at the National Gallery might be reconstructed.

It has never been easy to daylight large picture galleries well. It is technically difficult, high standards are set, and reflections on the glass in the paintings have always been a nuisance.

At the request of the Ministry of Works, the Building Research Station has made a study of the problem, in preparation for the reconstruction of some of the war-damaged rooms in the National Gallery. A solution has been made easier by a decision to air-condition these particular rooms, so that the paintings need not be glazed. Reflections, therefore, will not be much of a problem.

There are two main difficulties. A roof-light usually has to be used; it is always so bright that the eyes adjust themselves to it rather than to the light lower down in the room. This is true regardless of the kind of glass used in the roof-light, and it means that the paintings are not seen as well as they could be. The other awkward problem is that the light on the higher parts of the walls is stronger than on the lower parts where the pictures hang. The eyes tend to be attracted to the brightest things in view, and the light upper walls are, therefore, distracting. Both factors create the impression, common in picture galleries, that the room is a sort of well, and that the paintings hang in a poor light. Shadows under deep cornices around the room often aggravate this.

Louvre System

The model showed a new proposal designed to overcome these difficulties. The essential feature was a louvre system arranged so that the strongest light faces on the paintings—not on the upper parts of the walls—and so that no direct view of sky is obtained from the main part of the floor. Thus the too-bright skylight and the bad distribution of light on the walls are both dealt with. The shallow cornice also avoids aggravating shadows. Trials with and without the louvres show that though these cut down the amount of light entering the room, they produce much more comfortable lighting and better conditions for seeing the paintings.

Other minor features have been introduced. There is a flat Laylight below the louvres to reduce the amount of air which has to be conditioned, and to help to insulate against outdoor temperature changes. Another feature is a glass louvre system outside to help to protect against the heat of the summer sun without reducing the light too much. Studies have shown what types of diffusing glass are most suitable for the louvres.

Letters from Readers

Clearing House for Inventions

SIR,—In the June issue you rightly suggest that a clearing house similar to the Mellon Institute in America is required in this country, but you forget that one or two organisations do exist in Great Britain, the biggest and most active being the Institute of Patentees, which was formed in 1919.

It is small and receives little recognition from our industries, inventors or Government; but its basic principles are right and it probably does more work for its members than most of our technical institutions, for the same or smaller annual fees.

If this body received the recognition deserved from inventors and industry, it would soon become a very efficient clearing house, and of a size to cover the requirements of Great Britain, and then the Empire later.

This, together with later co-operation of other organisations could provide adequate and efficient support to the Government's development of Inventions Bill in a very short time, and prove to be the best means to sow the seed for the revival of British industry and export trade on pre-war lines.

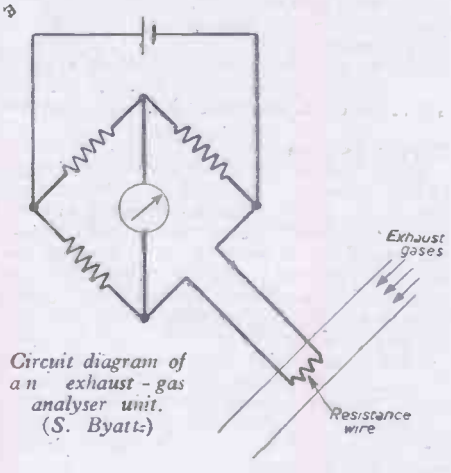
A suggestion for a development in greater detail can be given if wanted in the hope that it might create active interest among some of your readers.

Once started on the right lines, its help might prove unique in quite a short while, and much inventive talent would be retained within Great Britain and the Empire to be sold to other industrial countries instead of being acquired in its early infancy, another country obtaining the creative as well as the financial credit, in the eyes of the industrial world later.—SIR ARROL MOIR.

Testing Petrol-engine Exhaust

SIR,—With reference to the note on the above subject, which appeared in a recent issue of PRACTICAL MECHANICS, the following information may prove interesting.

I was flying several types of American aircraft during the war, and many of them were fitted up with a so-called exhaust-gas analyser.



Circuit diagram of an exhaust-gas analyser unit. (S. Byatt.)

I believe it worked on the Wheatstone net principle, one arm of which was a platinum resistance thermometer wire, inserted in the exhaust.

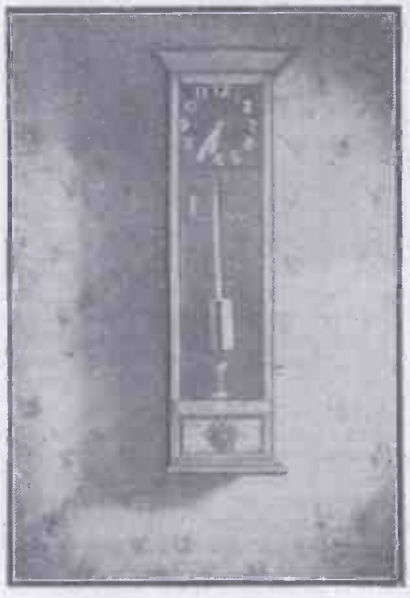
The idea was that the heat of the exhaust varied directly with the mixture strength, and the heat of the exhaust varied the resistance of the platinum wire.

A type of galvanometer was connected across the net, and was calibrated to read mixture strengths.

Although not extremely accurate, I found it most useful in setting the mixture control.—S. BYATT (Chester-le-Street).

"P.M." Master Battery Clock

SIR,—I feel that the accompanying photo of a clock made from plans of the PRACTICAL MECHANICS Master Battery Clock may be of interest to other readers. It was made entirely from scrap, the only material purchased being a ¼lb. reel of cotton-covered



A "P.M." Master Battery Clock made by a reader, T. H. Kent.

wire costing 2s. 3d. The point which surprises me is that it has been running since June, 1947, on a 10d. three-volt cycle lamp battery, and so far the latter shows no sign of becoming exhausted.

The pendulum weight was a short length of copper tube filled with lead, and the magnet was made from mild steel bolts, as I was unable to obtain any soft iron at the time. The clock face was made from a cocoa tin; the hands and numbers were of zinc sheet from an old water-cistern, being first polished and then clear-varnished. The "wheelwork" was taken from a small disused clock 2in. in diameter, which had somehow escaped the dustbin. The overall height of the clock is 26in. and the length of the pendulum 17in.

Although the workmanship is very amateurish, the clock works well, thanks to your excellent design.—T. H. KENT (West Green, London, N.).

Cutting Triplex Glass

SIR,—As a very old reader of P.M., I would like to reply to Messrs. Triplex's statement, that Triplex glass cannot be cut after being processed.

We all know that in the process of trial and error, sometimes the seemingly impossible is performed. I think that is what must have happened during the war when a friend smashed the windows in his Austin 7. Many ways were tried, without success, until we tried the following. We stretched a straight resistance wire across one side of the Triplex, heated the wire until quite hot from a battery, reversed the glass, repeated the performance, and broke the glass in the usual manner—with perfect results. Possibly we were lucky, but it worked.—J. H. TURNER (Northampton).

Celluloid Marking Ink

SIR,—Our attention has been drawn to your kindly reference to our name as the source of supply for special marking inks, in your issue of June, 1948, under "Queries and Enquiries."

Unfortunately, our old premises in Fetter Lane were entirely destroyed by enemy action in 1941, and we are now operating from the address given below. In addition to this fact, we are sure you would wish to know that our former interests in the manufacture of special inks has been transferred to our associate company, Rampart Inks, Ltd., whose registered office is also at this address.—ALFRED H. ATKINS, LTD. (54, Poland Street, London, W.1).

Club Notes

British Controlled Models Society

IN view of the county-wide popularity and interest shown in the Radio Controlled Models Society, the London area of the Society was formed at a meeting held in London on April 11th, 1948. The officers appointed for the area are as follows: Chairman, London Area, Mr. W. H. Mitchell, 48, Copse Avenue, West Wickham, Kent. Hon. Sec. and Treas., London Area, Lieut. G. C. Chapman, R.N., Pine Corner, Firwood Rise, Heathfield, Sussex.

The London area will hold a meeting monthly, generally on the second Sunday. The first meeting was held on May 9th, at 2.30 p.m., at St. Ermin's Hotel, Caxton Street, S.W.1. All interested should write to the hon. secretary, at the address given above.

Society of Inventors Exhibition

THE second annual exhibition organised by the Birmingham Branch of the Society of Inventors, will be held in the Chamber of Commerce Building, Birmingham, from October 25th to 30th, inclusive.

The object of the exhibition is to show to manufacturers and members of the public, the new devices that have been produced during the year.

A wide variety of products is expected to be on show, ranging from simple domestic gadgets to specialist machinery.

At last year's exhibition, the public were invited to record their views on the merits of the several inventions shown. Some of the highly technical exhibits were given a high proportion of credit. This would seem to show that visitors to the exhibition had not only a knowledge of the various problems, but an appreciation of the inventors' efforts at a solution as well.

Entries for the exhibition are accepted both from members of the Society and from non-members.

Anyone wishing to enter an exhibit, which must be either patented, protected or of registered design, should write to the Secretary, Mr. B. Thornton Clark, 244, Stoney Lane, Yardley, Birmingham 25, for full particulars and conditions of entry.

Rednal and District Society of Model Engineers

THE above Society was formed just over a year ago, to cater for Model Engineers in the south western suburbs of Birmingham.

Good progress is being made with a portable track, a straight portion of 108ft. in 3½in. and 2½in. gauge, being nearly completed.

Meetings are held on alternate Friday evenings, at Marie's Café, Longbridge, from 7.30 to 10 p.m.

New members are cordially invited. Especially we would welcome I.C. fans.

J. G. Tarrant, Secretary, 52, Middle Drive, Rednal, Birmingham.

THE WORLD OF MODELS

Exhibition of Models at Cambridge : An 18in. Gauge Locomotive

By "MOTILUS"

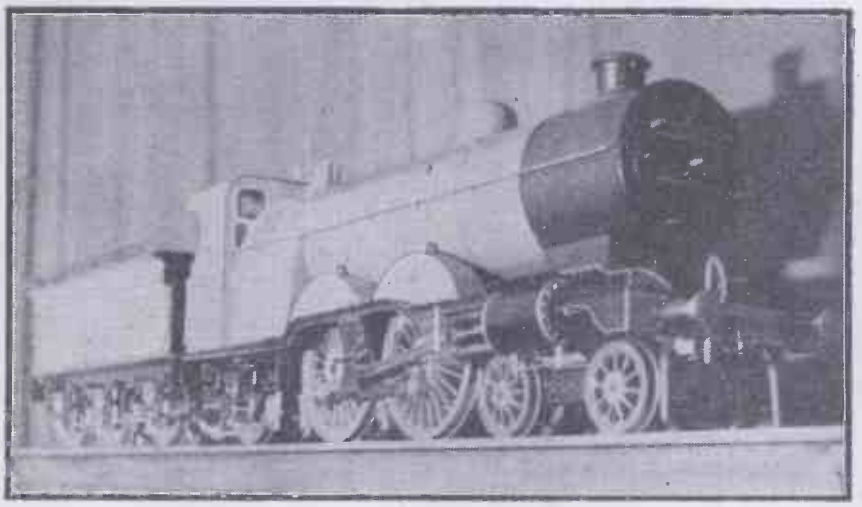


Fig. 1.—An accurate and well-finished 3½in. gauge model of a one-time popular locomotive, the G.N.R. "Atlantic" type. The model, made by Mr. D. J. Unwin, is finished in the G.N. colours of its period.

THE university town of Cambridge is perhaps so firmly impressed on our minds as a seat of learning that we are apt to overlook modern industries and hobbies that have developed there and which now play an important part in the life of the community. In the spring I had an invitation to accompany Mr. R. H. Fuller of Bassett-Lowke, Ltd., to the Cambridge University Railway Society, to take part in an address and discussion on "Model Locomotives and Railways," in which we talked about the various gauges, methods of propulsion and railway equipment. The audience was an enthusiastic one, including members of other allied clubs and I had the pleasure of meeting Mr. D. J. Unwin, secretary of the Cambridge and District Model Engineering Society. I was pleased to hear that this society were to hold an exhibition in Cambridge, to which I was invited. Mr. Unwin is in charge of the experimental department of the Cambridge Instrument Company; Dr. M. C. Marsh, who is in charge of the research department of this company, was good enough to ask me to visit the works, with two interested friends, when I returned to Cambridge for the Model Exhibition. Needless to say, I accepted this offer at once, and so made another journey to Cambridge the following month.

Exhibition at Cambridge

The exhibition was held in the Co-operative Hall at Cambridge, the premises being most suitable for a display of this kind. The place was crowded on the opening day and I understand that before the exhibition closed over four thousand people had passed through its doors, and also 250 school children who were admitted free of charge, to stimulate youthful enthusiasm for this fascinating hobby of modelmaking.

It is always impossible to deal comprehensively with an exhibition of this kind in one short article, so I will, as usual, confine my remarks to a few models that were outstanding either in design or good workmanship, or sometimes both.

Mr. D. J. Unwin, as well as being secretary to the Society, finds time to be an ardent modelmaker himself. Among the passenger-hauling locomotives was a 2½in. gauge locomotive that had been made by Mr. Unwin and entered in the competition at the Model Engineer Exhibition in London, 1935, gaining third prize. This engine has actually run over 300 miles and can still pull a load of four adults. It marks a real accomplishment for Mr. Unwin, who was only 16 years old when he built it. Another exhibit of his was a 3½in. gauge G.N.R., large boiler, "Atlantic" locomotive, finished in the original style and lettering (Fig. 1). It has working vacuum brakes and a baby injector which feeds about three quarters of a pint of water a minute. The locomotive can be steamed, from cold, to 80 lb. pressure, in four minutes and can haul ten adult passengers.

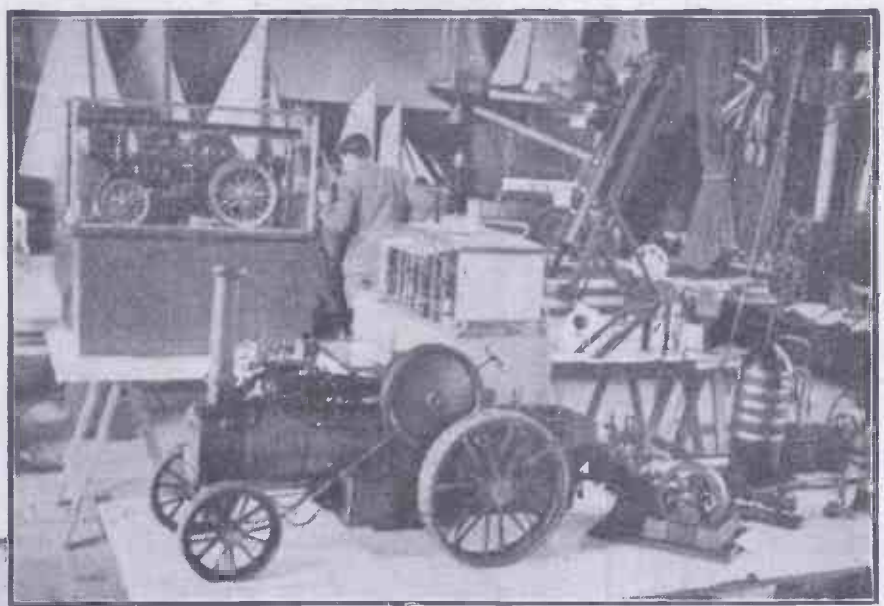


Fig. 2.—Sundry models at the Cambridge Exhibition, including: In the foreground: a 2-cylinder simple traction engine, built by Mr. S. A. Wilkerson. In the glass case: a "Fowler" compound showman's road locomotive, 1½ in. scale, which gained a silver medal in the 1947 Model Engineer Exhibition, London, built by Mr. D. J. Unwin. In the centre: An interesting ½in. to 1 ft. model of a portable milking bail, which enables the milking of cows to be done in the field; model built by Mr. F. L. Unwin.

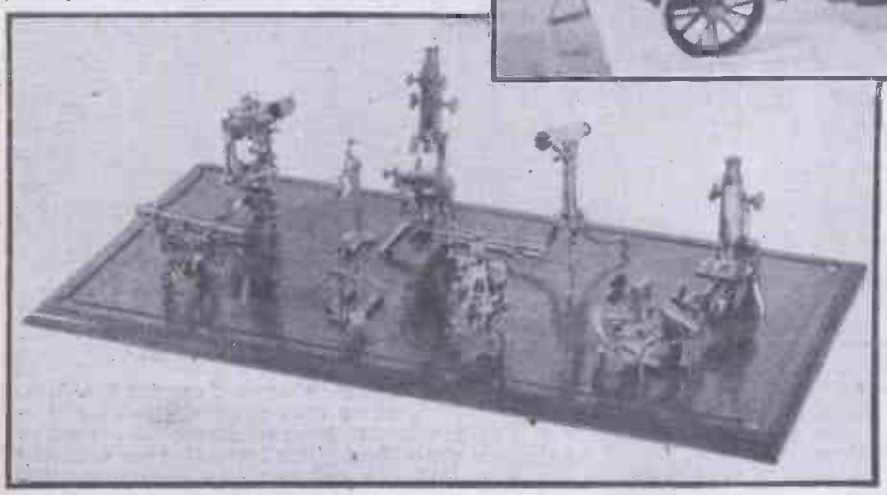


Fig. 3.—A unique set of miniature model optical instruments constructed by a skilled maker of the full-size prototypes. An exquisite piece of precision modelling by Mr. I. A. Pullen.

Altogether, Mr. Unwin had some fourteen exhibits including, apart from locomotives, a vertical steam engine, a road locomotive, tools, an astronomical telescope, a galleon and sundry other models; almost an exhibition in itself!

Model Road Locomotives

No model exhibition is complete without model road locomotives and there were two very good examples at Cambridge. One, as I have mentioned, was Mr. Unwin's model, a 1½in. scale Fowler's road locomotive, as used by showmen. This was a fine piece of workmanship which gained a silver medal in last year's Model Engineer Exhibition in London, and which has hauled as much as 100 stone along the road. The second model, made by Mr. S. A. Wilkerson, was a simple traction engine with two cylinders, 1in. by 1⅞in. This engine has hauled its builder along the street and has also been used to drive Mr. Wilkerson's lathe; a substantial and well-finished piece of work (Fig. 2).

A very interesting exhibit which attracted much attention, and which was unusual in a collection of models, was a set of miniature optical instruments, made by Mr. A. Pullon. Displayed under a glass case, they included a theodolite, surveyor's level, half circle theodolite, Van Hoeth microscope, Edinburgh students' microscope, stand condenser and lamp, sextant and astronomical telescope. (Fig. 3). The amazing fact about the exhibit is that all have optical work fitted and can be operated. Mr. Pullon was with Messrs. Troughton and Sims, the instrument makers, and the models are some of the types made by that firm.

Ship Models

Nautical models were well represented, and one of the best was an unfinished cargo-passenger boat built by Mr. A. G. Smith. Nearby was a model of a fishery protection cruiser, also by Mr. A. G. Smith. Another good nautical exhibit was a model of a 35ft. cabin cruiser, complete with all internal fittings, made by Mr. J. Hodgkinson (Fig. 4). An unusual model also on this stand was that of Mr. C. E. Howells, who had made a tiny replica of a thirteenth century cog. Mr. Howells also had on display a model galleon of *circa* 1500.

The working exhibits included a layout of Trix trains (Fig. 5) designed and installed by Mr. E. R. Boston, Secretary of the C.U.M.R.C., who kept it in frequent operation throughout the exhibition.

After seeing the exhibition I visited the Cambridge Instrument Company's works, where I once more met Dr. M. C. Marsh. This business has expanded considerably since Mr. (later Sir) Horace Darwin first formed a company in the 19th century to produce scientific instruments for the university. It was impossible fully to comprehend the highly technical aspects of the research and instrument production carried out in this well equipped and spacious plant, since my tour of inspection was limited to an afternoon.

It is sufficient to say that the products are mechanical and electrical instruments of high quality and of a great variety of types with a special bias towards temperature measurement. I was especially interested in a pyrometer which is an instrument for measuring the high temperatures encountered for instance in steel furnaces. There were also mechanical devices which were very intriguing to anyone interested in mechanical movements.

Such visits are always of intense interest to me, for it is not generally realised how much research is required to design and produce equipment that will carry out efficiently what may, at first view, appear to be the simplest function. Industry depends increasingly on technical advance and the research engineer is the essential link between the conception and the practical application of an idea.

My friends and I are indebted to Dr. Marsh for the privilege of a most instructive visit.

Fig. 4.—A varied collection of ship models at the Cambridge Exhibition, including one of the "Cutty Sark" (under construction), a fishery protection cruiser, a cargo passenger boat (under construction), an old London tug, a river launch, a cabin cruiser and lastly (but least only in size), a 13th century cog.

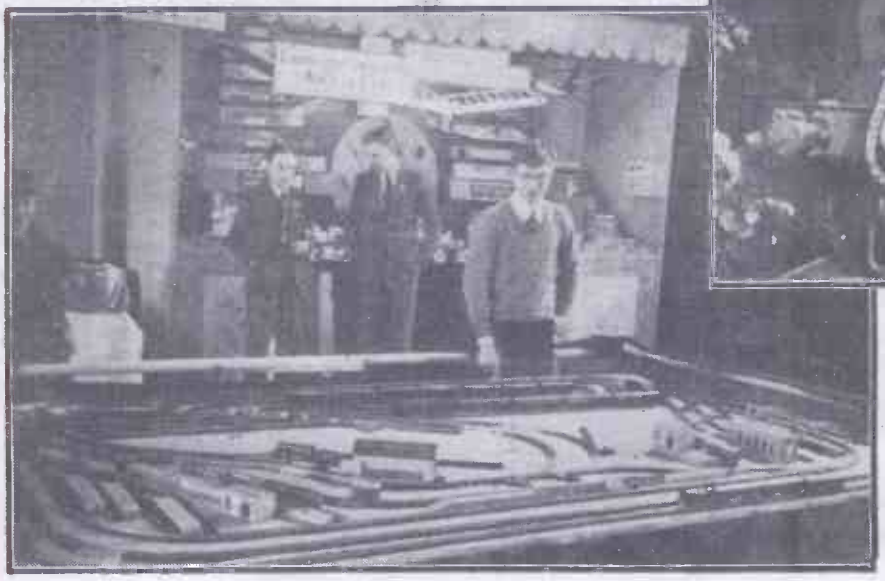


Fig. 5.—(Below) A comprehensive Trix train railway layout (00 gauge), designed and installed by Mr. E. R. Boston, who operated the installation during the Exhibition.

An 18in. Gauge Locomotive

At the social evening I mentioned, given by the Cambridge University Railway Society,

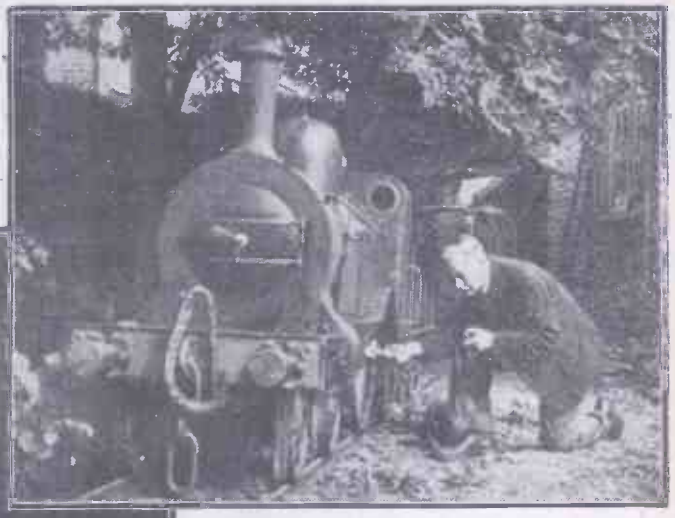


Fig. 6.—A G.N.R. old single driver locomotive, 18in. gauge, renovated and put into working condition by Mr. A. L. Bird, who purchased the model in a dilapidated condition.

I also had the pleasure of meeting Mr. A. L. Bird, whose 18in. gauge single-driver locomotive is featured among this month's illustrations. This locomotive was originally professionally built for use in pleasure parks, but Mr. Bird acquired it during the war in a sadly dismantled state. He built up the locomotive again himself, supplying such

missing parts as were necessary. The present locomotive has an overall length of 16ft. and is 4ft. 6in. high: the cylinders are 4½in. bore and 6in. stroke, the driving wheel has a diameter of 2ft. 6in., the fire grate area is 1.3 sq. ft. and the working pressure is 120lb. per sq. in. It is fitted with a steam brake and a Westinghouse air brake operates the tender and train; it also has steam-operated sanding gear. The illustration (Fig. 6) shows that the steam dome is obviously out of scale, but as Mr. Bird points out, this was put on so as to ensure dry steam to the cylinders, before superheating was a general practice.

Model Motor Coach

A young schoolboy of Trent College, Master K. P. Robinson, used cardboard for his small model of a Barton motor coach. I often think that beginners in model-making seldom realise the advantage of starting work with this medium. There are many grades of what we loosely term "cardboard," but the better and finer grades of Bristol board, which does not flake, are easy to work and take paint perfectly. As well as having these advantages for the beginner, Bristol board is indispensable in architectural modelling. Master Robinson's model of the Leyland Tiger PS.1/1 chassis with Duple body, is built chiefly from sheet card. The tyres are from an old "Dinky" toy, the headlamps are from 3/16in. by 3/16in. balsa strip, rubbed down with fine sandpaper, the windows are of celluloid and the interior lined with coloured paper. The model is finished in dark red cellulose, with cream lining and lettering, two coats of primer and three coloured, having been applied with a brush. The sunshine roof and the door into the coach can both be opened and shut.

I had hoped this month to let readers have some model news from Sheffield, where the Sheffield and District Society of Model and Experimental Engineers held their fifth exhibition last Easter. As space will not permit me doing justice to the many excellent models shown in this exhibition, however, I have postponed the pleasure until next month.

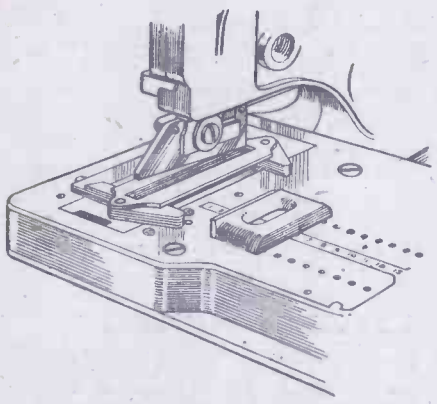
Readers are no doubt aware that the date of the Model Engineer Exhibition to be held in London again this year is slightly earlier than last year, the dates being August 18th to 28th. We all expect an even better year than last.

There will be one sad note about the exhibition this August: we shall all miss the late Mr. Percival Marshall, who, for more years than I can remember has been the central figure of the exhibition and who always had a kind word and welcome for all those interested in this fascinating and interesting hobby.

Trade Notes

Prestacon Guillotine Attachment

A NEW attachment has been introduced for the Prestacon precision press which considerably increases the scope of this handy tool. It is a guillotine which enables users of the tool to cut metal strips up to



The new Prestacon Guillotine Attachment

2in. wide and 12in. long to practically any length required. Shearing with this new attachment, using the patented self-measuring locations method, will add greatly to the scope and interest of Prestacon engineering. The attachment, which is shown in position, in the accompanying sketch, is adaptable to all Prestacon Presses. Further particulars can be obtained from L. Rees and Co., Ltd., 31-35, Wilson Street, London, E.C.2.

New Range of Aerofoil Fans

ONE of the post-war developments in fans has been the introduction of the Series I Aerofoil Fans by Woods of Colchester, Ltd., an associate company of the G.E.C. These are of the medium pressure, single-stage, axial flow, non-guide-vane type and are designed for high outputs against resistances up to 1¾in. static water gauge. They are available in nine different sizes from 6in. to 48in. diameter, one of which is shown in the accompanying illustration.

The range is intended primarily for applications which do not warrant the heavier capital cost of high pressure axial flow fans of the guide-vane type. Their total efficiency is of the order of 65 per cent., which may be regarded as amply satisfactory for the duties covered, since the power inputs are relatively low.

An outstanding feature of these fans is their compactness, as the design permits of comparatively small hub and motor diameters and eliminates the need for upstream and downstream fairings.

The impellers, which are cast in one piece from aluminium, have aerofoil section blades of the constant-chord constant-pitch type, and are housed in accurately dimensioned cylindrical casings. They have considerable mechanical strength and are accurately balanced to ensure vibrationless running at all listed speeds. The number of blades varies from four on the 6in. fan to twelve on the 48in. size.

Three different blade angles are offered in each size which, when used with the range of motor speeds available, provide a choice of fans to suit most duties. A non-overloading characteristic is also incorporated, the maximum power input occuring at approximately the point of maximum static efficiency.

The driving motors, which are manufactured entirely in the factories of Woods of Colchester, are specifically designed for their duties. They are totally enclosed and liberally rated, and have ample power to cope with the highest pressure which the fan is capable of developing.

The G.E.C. Aerofoil Fan

Books Received

Ignition Equipment. By Edgar T. Westbury. Published by Percival Marshall & Co., Ltd. 192 pages. Price 8s. 6d. net.

VARIOUS electrical ignition systems, from trembler coils to flywheel magnetos are dealt with in a thoroughly practical manner in this book, which is divided into ten chapters covering such subjects as: History and Development of Electric Ignition; Working Principles; Types of Ignition Spark Generators; Modern Ignition Coil Systems; Rotary-armature Magnetos and Rotary-magnet Magnetos. Much of the material contained in this book was collected during the course of several years of research work in the design of small ignition equipment. The practical results of this work are given in an appendix to the book for the benefit of students and designers.

Other books received from Percival Marshall & Co. are:

"Milling in the Lathe." By Edgar T. Westbury. Price 3s. 6d. net.

"Practical Armature Winding." By A. H. Avery. Price 3s. 6d. net.

"The Model Railway Hobby." By M. H. Binstead. Price 10s. 6d. net

"Practical Photomicrography." By R. F. E. Miller. Price 5s. 0d. net.

"Model Railways for the Beginner." (Parts 1 and 2). Price 3s. 0d. each part.

General Electrical Engineering. Edited by Philip Kemp. Published by Odhams Press, Ltd. 448 pages. Price 9s. 6d.

THIS book should prove invaluable for all interested in the practical applications of electricity. It forms a complete survey of the subject, from elementary theory to the design and use of high power apparatus, and from the generation and distribution of electricity to its application in all forms of communications and industrial processes.

Electric Wiring (Domestic). Edited by E. Molloy. Published by George Newnes, Ltd. 242 pages. Price 7s. 6d. net.

THE practical aspects of domestic electric wiring are fully dealt with in this handy book which is intended for installation engineers, contractors and electric wiremen. It provides a valuable supplement to the orthodox text books, and describes and illustrates modern methods of wiring houses. Concluding chapters deal respectively with the latest form of interior lighting using fluorescent tubes, and with safe and efficient earthing systems. The book is well illustrated in line and half tone.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 80 (THE CYCLIST), must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Hardening Roughcast

THE outside of my house has a lime and shingle roughcast finish, which is now beginning to crumble away in some places.

However, at one point where a gutter has been overflowing down a wall, a small strip has been very considerably hardened, and shows no signs of breaking up. This suggests that a small quantity of iron in solution has been responsible.

Could you please explain this action, and also let me know whether it would be possible to treat the walls to produce a similar result? If so, what method do you suggest?—J. S. Matthews (Wembley).

IT is hardly possible to give a categorical answer to your question without an actual inspection of the hardened strip of wall facing. We presume that this strip has yellowed to some extent owing to the deposition of iron oxide or hydrate or carbonate or a mixture of these three. It is quite possible for a porous material, such as cement, to become toughened or hardened to some extent in consequence of its impregnation with iron compounds, the latter being insoluble and, as such, resisting the attack of water in that area. This, we consider, is the cause of the hardening of the strip.

On the other hand, is it possible that chalk may have got into the water? If so, chalk deposition may have had something to do with the matter.

The whole question demands personal examination before a really definite answer can be given, but we are inclined to agree with you that iron deposition lies at the root of the phenomenon. This will be particularly the case if the hardened area shows signs of yellowing.

It would not be possible to treat the walls with any ordinary hardening agent. You could use a hydrolysed solution of ethyl silicate for the purpose, but the treatment would be expensive, this material costing about two guineas per gallon. If, however, you feel inclined to weigh up the practicalities of this method, get into touch with Messrs. Albright and Wilson, Ltd., 49, Park Lane, London, W.1, and request a copy of their booklet on ethyl silicate and its use in "stone dressing" and similar directions.

Sodium Metal

I SHOULD be very grateful if you could inform me as to the following: What is the action of sodium when in contact with water? Can it be obtained in large amounts?—A. K. Smith (Croydon).

WHEN a piece of sodium is dropped into water, the sodium metal assumes a globular shape and it reacts with the water forming sodium hydroxide (which goes into solution and gives the water a "slimy" feel) and liberating hydrogen gas. The sodium is quickly used up in this reaction, toward the end of which the globule of metal usually disappears with a miniature puff of flame. It is dangerous to subject a large lump of sodium to the action of water because, in this instance, very great heat is generated and the globule of metal is liable to explode.

Sodium metal is usually sold in 1lb. tins, price about 5s. per lb. It can be had from any laboratory chemical supplier as, for example, Messrs. W. and J. George and Becker, Ltd., 17-29, Hatton Wall, London, E.C.1. or Messrs. Vicsons and Coy., 148, Pinner Road, Harrow, Middx. Other suppliers are: Messrs. Hopkin and Williams, Ltd., 16-17, St. Cross Street, Hatton Garden, London, E.C.1, and Messrs. A. Gallenkamp and Co., Ltd., 17-29, Sun Street, Finsbury Square, London, E.C.2.

The metal must be stored under white spirit or naphtha to prevent access of water to it.

Carborundum Powder Cement

I WISH to make a cement from carborundum powder and a binding agent which would adhere firmly to wood. The carborundum presents no problem but the binding and adhering agent is not so easy. Could you suggest anything that would be both cheap, durable and weather-proof?—H. J. Southall (Cork).

FOR your purpose, you can embed the carborundum grains in ordinary Portland cement, or, perhaps better still, use a cement made by slaking to mortar consistency calcined magnesite with a solution made by dissolving 40 parts of magnesium chloride in 60 parts of water. The carborundum can be mixed with this cement whilst plastic. The cement sets dead hard in about 30-36 hours.

The necessary magnesium compounds may, we think, in Eire, be obtained from Harrington Brothers, Ltd., Shandon Chemical Works, Cork. Such cement is entirely waterproof, and has been in much use in the making of stair-treads.

"Waterproof" Poster Paint

I WISH to apply poster paint to wood and require it to be waterproof. I have been told of a preparation of bleached shellac with borax powder boiled with water, but do not know what proportions to use. Can you assist me, please?—C. J. Brown (Wimborne).

THERE is no way of rendering ordinary watercolour poster paint really waterproof. The best method is to mix it with casein powder and slaked lime (equal parts), but unfortunately, you will not be able to obtain the casein at the present day.

The only alternative method is to dissolve bleached shellac in water 85 parts, borax 5 parts, ammonia 10 parts. Warm this solution gently and to every 90 parts of it add 10 parts of the shellac. By increasing the ammonia strength somewhat you can dissolve more shellac in it, but under these conditions it will tend to darken rather badly.

The resulting liquid is mixed about equal parts with the concentrated poster paint. It thus provides a shellac binder to the particles of pigment in the paint and, as such, renders the paint damp-proof, although we cannot say that the paint will be rendered really waterproof.

If you want a good waterproof paint, you will have to use oil paints, or to mix your own dried pigments in an oil or a cellulose medium.

Electro-plating Vats

I WISH to construct one or two vats for electro-plating cycle and car fittings in nickel and chrome. Can I use wood vats lined with glass, painted with acid-resisting cement? If so, where can I obtain the necessary cement?—F. A. Charnley (Fleetwood).

FOR the plating work which you describe, glass lined wooden vats are excellent, and are in use in the best trade houses. With good fitting glass linings an acid-resisting cement is often not required. You can, however, run a little medium soft bitumen (not tar or pitch) up the glass joints, or if you prefer to use a special cement for this purpose you will probably be able to obtain a suitable one from a firm of specialists in plating equipment, such as Messrs. R. Cruickshank, Ltd., Camden Street, Birmingham, 1, or Messrs. Wm. Canning & Co., Ltd., Great Hampton Street, Birmingham.

Chemical Engraving on Celluloid

CAN you please give me any information about the methods used for chemical engraving on celluloid?

I should also like to know if there are any books on this subject available.—K. J. Smith (Catford).

SO far as we can trace, no books have been published specifically on the printing or engraving of celluloid, but the following might be of interest to you. It was published (pre-war) at 8s. 6d. net:

F. Bockmann (trans. by Stocks): "Celluloid: Its Raw Material, Manufacture and Uses."

For printing on celluloid, use an ordinary printer's ink, to which a few drops of copal varnish have been added.

In order to engrave celluloid, spread a film of beeswax over the celluloid sheet. Then use glacial acetic acid as an etching fluid.

Another way is to use a solution made by dissolving 10 parts of gelatine in 90 parts of water. This is spread (warm) over the celluloid, allowed to set, and the design inscribed in the gelatine film so formed. The etching fluid consists of acetone or a mixture of 2 parts acetone and ½ part amyl (or butyl) acetate.

Other types of celluloid inscribing are done by hot pressing the characters on to the celluloid sheet.

"Wet" Bulb Thermometers

WILL you please explain the difference between a "wet" and a "dry" bulb thermometer (F.), and the reason for using the former; also, what would be the result if a "wet" thermometer was used without water—would the reading be accurate?—M. Timms (Burton-on-Trent).

THE wet and dry bulb thermometer is not primarily intended for temperature reading. It is actually a "hygrometer." That is to say, it is an instrument whose function is to measure the relative humidity of the air in its surroundings. You will notice that the wet bulb is wrapped with tape or cloth which hangs down into a little well of water. This ensures the "wet" bulb being kept continually damp, and the result of this is that the "wet" thermometer always shows a lower reading than the dry thermometer. The difference bteween the two readings is taken and, on reference to tables, the relative humidity of the atmosphere can be at once read off. You will find an account of this instrument in any elementary textbook on heat in your local library.

If the "wet" bulb were used without the damp cloth, its reading of temperature would be perfectly accurate, and, under these conditions, should be identical with the reading of the "dry" thermometer, although, in these circumstances, the instrument would not be functioning as a hygrometer, or humidity measurer.

Bright Dip for Steelwork

WILL you please advise me how to make a bright dip for steel forgings? I am at present using dilute spirit of salts, and washing in water, but this needs burnishing with a wire brush to remove the deposit. Some of my work is too delicate for rough handling, and I would like to have a means of getting a bright finish without rough treatment. I have no power available.

Also, can you give me the address of a supplier of a transparent brushing lacquer, suitable for steel?—A. E. Gear (Cobham).

A 5 PER CENT. mixture of hydrochloric acid and water (HCl_1, 5 parts by vol.: water, 95 parts) makes a good bright dip for steel articles, always provided that the steelwork is free from oil and grease. If otherwise, it should be previously treated with a 5 per cent. solution of caustic soda (used warm) and subsequently rinsed before it is entered into the acid bath.

Strange though it may seem, the acid bath should contain about a desertspoonful of ordinary soot per gallon. The soot acts as an inhibitor and prevents a too energetic action of the acid which would result in a roughening of the surface.

The acid should not act for too long, say more than five minutes, otherwise there is a danger of embrittlement of the steel in consequence of the absorption of hydrogen into its pores. If, therefore, the steelware is subjected to a longer acid treatment than the above, it should afterwards be heated to the boiling-point of water to expel the absorbed hydrogen.

Suppliers of clear lacquer suitable for steel are: Messrs. Nobles & Hoare, Ltd., 3, Cromwell Road, London, S.E.1, and Messrs. James Beard, Ltd., 16, Great Ancoats Street, Manchester.

Testing for Iron Content of Soil

I AM having trouble with an iron content in soil, and would like to be able to test in a fairly simple way when I buy a fresh supply. Extreme accuracy is not necessary, as long as I can tell whether the content is high, moderate or nil. Can you suggest a simple method?—L. H. Crane.

TO make an accurate estimate of the iron content of a soil is a difficult matter unless you have analytical knowledge and skill. However, the following simple method will, we think, amply answer for your purpose.

Dry your test sample of soil, and then take a known weight of it, say 5 grams, or ¼oz. Place this in a flask or beaker. Cover it with a mixture of nitric acid

(1 part) and hydrochloric acid (1 part). Heat it in boiling water for half an hour. Then add to the beaker 10 times the volume of the mixed acids of water. Stir well, and then filter the whole of the liquid. When filtered, dilute the liquid with five times its volume of water.

Dissolve 1 part of potassium ferrocyanide (pure) in 6 volumes of water. Label this solution. Keep it in a dark cupboard and use it as a stock solution for testing purposes.

Half fill a test tube with the diluted soil extract, prepared as above. Add to it about a quarter of a test-tubeful of the potassium ferrocyanide solution. The presence of iron in the soil will be indicated by a deep blue coloration which is caused by the formation of Prussian Blue (ferri ferrocyanide). The relative amount of iron present will be indicated by the intensity of the coloration, deep blue indicating a large amount of iron, pale blue signifying only a small amount of iron. All soils contain iron, and all will give a blue coloration with this test to some extent.

Since ordinary tap water often contains iron, it is always best to use distilled water for dilution purposes, and, naturally enough, the acids used for the soil extraction must be of the "pure" variety.

"Flat" Paint

WILL you please inform me how I can make a dull paint—flatting or dope—in the following colours: Black, white, red, cream and lavender. I require this paint for finishing small model ships.

Also, what can I add to carpenter's glue to keep it from going mouldy after it has been left aside for a few weeks?—J. Kirwan (Waterford).

IF you require a "flat" paint of good quality, mix 1 part boiled linseed oil, ½ part turpentine and 2 parts white spirit. Dissolve in this mixture about ¼ part of pale resin (parts are by volume).

Take a quantity of the above medium and grind into it about one-third of its volume of fine pigment. This will constitute the paint. If you want it to dry more glossy, dissolve more resin in the medium. It is also advisable to add a small amount of a suitable drier, such as cobalt naphthenate or manganese resinate, in the medium for the purpose of speeding-up the drying of the paint.

For a black paint use "drop black" as a pigment, for white paint use white lead, or zinc white or titanium oxide. A white paint made with the two latter pigments will be non-yellowing. Cream paint is made from any white pigment, to which has been added just a touch of yellow ochre. Dull red pigments are the common red iron oxides. The brighter red pigments constitute the various "lake reds" which are (normally) obtainable from pigment manufacturers. For a lavender shade you will, we think, require a cadmium maroon pigment, with or without an admixture of pale cobalt blue, but we fear that you will not be able to obtain these pigments at the present time.

To prevent your glue from turning mouldy add to it (when in liquid form) a few drops of carbolic acid, say six or seven drops to the half-pint of ordinary glue solution. You can, of course, make use of clove oil or other essential oils for this purpose, but the carbolic acid will be found to be the least expensive.

Detecting Refrigerant Leakages

CAN you suggest a method by which small quantities of the refrigerant, methyl chloride (CH_3Cl.) may be detected when searching for leakages of the gas from refrigerating systems?

The method at present used, that of observing the change of colour in the flame of a blowlamp or Tilley lamp is found to be erratic as well as dirty and cumbersome.

Something of the ease and simplicity of the ammonia test used for the presence of sulphur dioxide (SO_2) is desired.—W. Hamilton (Belfast).

THE lamp test for the presence of traces of methyl chloride gas is still the most convenient one to apply. The device used is known as the "copper halide lamp." It comprises a lamp burning pure alcohol (or high-grade rectified spirit). If the atmosphere contains traces of methyl chloride, they are decomposed by the heat of the flame and they immediately react with a small copper screw in the nozzle of the lamp forming copper chloride, which at once colours the whole of the flame green. One part of methyl chloride in some three or four thousand parts of air can be detected in this way. This test is both reliable and clean.

A chemical test for methyl chloride consists of dissolving silver nitrate (1 part) in water alcohol (10 parts). This solution, exposed warm to an atmosphere of methyl chloride, turns milky owing to the gradual precipitation of insoluble silver chloride. It is not, however, anything like as sensitive as the copper halide lamp test.

Lead Acetate Solution: Storing Pyrophoric Lead

COULD you please inform me of a method of making a lead acetate solution, and a phenolphthalein solution.

Also, is there a method of storing a small amount of pyrophoric lead, and why does it ignite in air?—A. D. Bean (Wimbledon).

A LEAD acetate solution can readily be made by dissolving lead oxide (litharge) in warm acetic acid, of strength 2 parts acid, 1 part water. When the action has stopped, filter the liquid and then gently heat the liquid until it has almost evaporated to dryness. Redissolve the residue in water. This will give you a fairly pure lead acetate solution. Remember that it is poisonous.

Unless you are an expert chemist, you could hardly be expected to be able to prepare phenolphthalein yourself. This substance is made by heating phthalic anhydride (3 parts) with carbolic acid (4 parts) and zinc chloride (5 parts) at 115-120 deg. C. for 8 hours. The product is washed with water and then dissolved in caustic soda solution. The solution is then filtered, and the free phenolphthalein is precipitated from the filtrate by the addition of acetic acid.

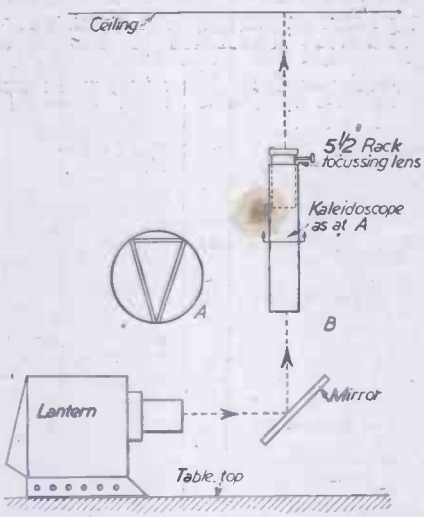
Phenolphthalein is best dissolved in alcohol.

Pyrophoric lead powder can only be preserved indefinitely when sealed up in glass tubes from which the air has been withdrawn. Alternatively, it can be preserved in similar tubes filled with hydrogen or carbon dioxide or nitrogen gas. It will not keep in the presence of air and/or moisture, since it is slowly oxidised by these influences. Its ignition when dropped through air is due to the oxidation of the very finely-divided particles of metallic lead by the oxygen of the air.

Lantern Kaleidoscope

USING a standard optical lantern taking slides 3¼in. by 3¼in., is it possible to project the image as seen in a kaleidoscope on to a ceiling of an ordinary room? If so, would you please tell me what apparatus would be necessary, and if possible let me have a sketch of how to obtain this result.—C. S. Gibbons (Potters Bar).

THE lantern kaleidoscope which you require can be made in the following way. First of all, fit an ordinary kaleidoscope (minus its loose objects) in a tube, as shown at *A* in the accompanying sketch.



General arrangement of a lantern kaleidoscope for projecting images on a ceiling. (C. S. Gibbons.)

At each end of this tube place a pair of lenses taken from a lantern objective.

The kaleidoscope objects are placed between two pieces of glass which constitute the lantern "slide," this being placed in the slide-carrier of the lantern. The necessary arrangement is shown at *B*.

Until the apparatus has been correctly adjusted, the effect is likely to be disappointing. The lantern kaleidoscope depends entirely for its success on the careful adjustment of the illuminant, it being necessary to adjust the light both as to position and distance from the slide.

Cleaning Pewter

CAN you inform me of a method of cleaning extremely dirty pewter? I have tried various metal polishes with indifferent results.—W. Hanstey (Blackpool).

IN general, very dirty and food-stained pewter dishes, plates, etc., are best cleaned with strong hydrochloric acid containing some dissolved stannous chloride—say, 10 parts of stannous (tin) chloride dissolved in 90 parts of the strong acid. Rub this on to the metal with the aid of a mop tied on to the end of a wooden stick. The treatment often works wonders, but, in bad cases, it has to be repeated again and again. The stannous chloride can be omitted if desired, but its presence certainly helps the job along.

If you get acid splashes on your hands, immerse them in water at once.

This treatment will take off the surface dirt and sulphurisation stains. Afterwards, the metal should be gone over with a paste of fine emery powder and oil, then well scrubbed with soap and warm water, and finally polished with ordinary metal polish. To keep the pewter bright, an occasional metal polish treatment will be all that is necessary.

Microscope Lenses

I AM interested in the building of a microscope. The lenses I hope to grind, besides making the body and stand, etc.

I have the necessary equipment for any metal work, but I realise that the lenses would present the greatest difficulty. Would "Perspex" be suitable for the lenses?

Can you please advise me on this matter?—S. J. Hoskins (Palmers Green).

ALTHOUGH you would, no doubt, be quite successful in constructing the mechanical parts of your own microscope, we feel sure that this would not be the case with the optical parts, unless, of course, you happen to have specialised knowledge, skill and experience of optical work, lens computing, grinding and polishing.

It is a task calling for the highest skill to grind and polish a microscope lens, and no amateur can undertake it with any chance of success. Although "Perspex" resins have been used for moulding some types of lenses, they have not been so employed for constructing the necessarily very delicate component glasses of a microscope objective. In the construction of the latter, not only have at least half a dozen lenses to be specially ground and polished, but each lens has to be separately computed mathematically as regards its exact curvature. Different glasses have to be used for the various lenses, and, finally, the lenses have to be cemented together and the various components of the objective have to be accurately mounted and centred. Without years of experience, you cannot attempt this highly specialised work, so that by far the best method would be for you to make the metal parts of your microscope yourself and to buy the lenses secondhand from some good dealer, such as Messrs. Broadhurst, Clarkson & Co., Ltd., of Farringdon Road, London, E.C.4.

If you wish to commence lens grinding and polishing work, by all means do so, obtaining a simple book on this subject from the above-named firm or any other firm of optical suppliers. In this way, you will be able to construct simple, single-lens magnifiers and, afterwards, cemented glasses.

You should also read up a few books on optical design, especially "Optics and Optical Design," by A. E. Conrady. This procedure will enable you gradually to explore the whole field and practical possibilities of optical constructional work from your own point of view, and you will then be able to assess accurately the labour and the difficulties which are entailed in this type of work.

Re-cellulosing a Car

I INTEND to re-cellulose a car (black) the existing paintwork of which is fairly good, but I don't know if it is cellulose or enamel. Will I have to strip the old paint off?

Could you tell me the procedure for properly doing the job, and if cellulose is easily obtainable?—J. Jacklin (Grimsby).

CELLULOSE colours do not go well over ordinary paints or enamels. Hence, if you are not sure of the nature of the existing paint, it would be best to strip away the old paint, using a good paint-stripping preparation for the purpose. These preparations can be obtained from any paint shop. The procedure is to rub the paint-stripping liquid on to the old paint, wait for five minutes, and then proceed to strip it away, using a blunt scraper for the process. After the old paint has gone the underlying metal work should be scrubbed down with a solution made by dissolving 5 parts of caustic soda in 95 parts of water. Use this solution hot, and, so far as possible, avoid getting it on your skin. Finally, wash away every trace of the caustic solution. Let the metalwork dry out and go over it with very fine glasspaper.

On the resulting surface two or three coats of cellulose paint may be applied, either by brush or by spray. Since you are using black you will not have any difficulty in getting the paint to cover well, and probably even a single coat may serve your purpose.

Cellulose colours are getting easier to obtain, and they are now in many of the larger shops. A firm specialising in these paints is Messrs. Nobles and Hoare, Ltd., 3, Cromwell Road, London, S.E.1. Many of the commercial cellulose paints for car body work are made to secret formulæ, but, possibly, the above-mentioned firm may be able to supply you (direct or through its stockists) with a special paint for your purpose.

"Frosting" a Glass Window

I WOULD be obliged if you can give me the simplest method of treating a glass window to give the effect of "frosted glass."—H. M. Mettrick (Huddersfield).

TO get a "frosted" appearance on the surface of glass, dissolve 10 parts of cooking gelatine in 90 parts of hot water. Then stir in sufficient whiting to give the liquid a strong, milky appearance. Brush the resulting liquid on to the window and allow it to set hard. It will produce a semi-opaque film. Several applications can be given.

If the hard film thus deposited on the window is gently sponged over with a mixture of equal volumes of water and formalin solution and then allowed to dry the formalin will render the gelatine insoluble. In this condition the gelatine film will then resist rain and all other types of wetting.

Another way is to make a strong solution of Epsom or Glauber salts and to brush this over the glass. A thin crystalline deposit is thereby obtained on the glass, but, unfortunately, it very readily powders away.

THE Cyclist
Editor: F. J. CAMM

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Comments of the Month

The Jimp

By F. J. C.

A FURTHER example of the Government's waste of paper on nationwide poster campaigns is the introduction of that portraying Jimp. Jimp will invite you to take a chance, to take a risk, and to be careless on the roads. By inverted logic you are supposed to read into this an instruction to do the reverse of what Jimp advises you. Jimp will have as much effect upon road safety and the accident problem as exhortations over the wireless, previous poster campaigns, and the lambastings of the more die-hard section of the old men of the movement.

We fail to see the drift of the psychology behind this poster campaign. If you want someone to do something surely the best method of achieving the object is to be as direct as possible in your request. You don't walk into a cycle shop with a flat tyre and ask not to have the puncture repaired.

However, it matters little, we suppose, because once the Government has made up its mind on this course nothing will stop it from squandering a lot of money and wasting hundreds of tons of paper which we can ill-afford, in order to add to the national poster gallery wherein appear the portraits of the war widow and other non-effective characters. It may be that the curious minds which direct national publicity, having failed by appealing to the macabre, now wish to titillate our sense of humour and make us laugh our way into caution. Any psychologist will tell you that when people are in a humourous frame of mind their caution reaction is reduced.

The fact is that in spite of a greatly reduced number of vehicles on the road there is no important reduction in the number of accidents.

Even the Society for the Prevention of Accidents appears to have a distorted outlook on the causes and the cures. None of the experiments, such as pedestrian crossings, traffic lights, one-way streets, cycle paths, and so on has been effective, and we think that such experiments should be discontinued.

Mr. James Callaghan, M.P., a Parliamentary Secretary to the Ministry of Transport, had the usual press conference when Jimp was introduced, and he said that a verdict of murder or suicide should be more often returned at coroners' inquests than those which, as a matter of fact, are returned.

Carrying the Jimp idea a stage farther, should he not have suggested that coroners in investigating the cause of death of a cyclist on the roads should return a verdict of murder against the cyclist and absolve the motorist concerned from all blame? The terms murder and suicide are more appropriate to the war widow than to Jimp.

Shock Absorbers for Bicycles?

FROM a press notice concerning "Britain's Best" Exhibition we are told that a "shock absorber which will save cyclists from jars, jolts, bumps and fatigue, and which will give additional life to tyres, has been invented by Mr. Robert Scott-Leigh." He has fitted it to the front wheel of his bicycle, and has proved the worth of his invention by using it over 63,000 miles of rough roads through Europe, Canada and the United States.

Now there is nothing new in the idea of shock absorbers for bicycles. Dozens of patents have been taken out for such devices, and particularly during those years when shock absorbers were most desirable, that is to say, in the early days of cycling, when roads had not the rut-free, billiard table surfaces which they now possess. They all failed. One which was very popular for a number of years consisted of a spring in the seat pillar. It failed because it caused severe chafing of the legs, and because when hard pedalling was necessary, as when climbing a hill, a great deal of the effort was expended in compressing the spring instead of rotating the cranks. There have been spring forks and spring frames, but none of them has been a commercial success.

If a shock absorber is necessary it is essential to fit it to both the front and the rear of the bicycle. With modern road surfaces, however, and the improved tyres, it is my view that a shock absorber is unnecessary.

No doubt the bicycle itself can be improved in design in some important directions, for design has been fairly static except for detail improvements during the past quarter of a century. It is true that weight has been considerably reduced, strength increased, rust-proofing is more general, speed gears have been introduced, and the bicycle has taken on a more pleasing appearance.

The greatest improvement is needed in the method of selling. Some dealers do not give sufficient care in advising their customers as to frame height, gear ratio, and in seeing that a machine is selected which suits the leg length of the customer, nor do they put themselves out to adjust the machine for saddle height and reach before the customer rides it away. Some manufacturers give useful advice on this in their instruction booklets but it is by no means general.

First 1948 R.R.A. Record

J. W. ROSSITER'S Land's End to London tricycle record, which has stood for 16 years, was beaten by no less than 1 hr. 17 min. by A. L. Wilkins, of the North Road C.C. Mr. Wilkins is 42 years old, and according to some standards would be classed as a veteran. He clocked 17 hrs. 44 min. for the 288 miles.

No Change in B.L.R.C. Policy

MASSED start events will continue to be promoted by the B.L.R.C. This was a reaffirmation of their policy at a meeting held in Birmingham recently. The B.L.R.C. at the moment of going to press has not withdrawn its membership from the Ligue Internationale de Cyclisme. It had been rumoured that it was doing so because of the Communistic attitude of certain affiliated overseas clubs. It is planned to run a 1949 Paris-London race as well as world's championships in Italy.

American-made British Bicycles

WE learn that Raleigh Industries, Limited, will supply racing cycle parts to Raleigh Industries of America for assembly in that country. The youth of America is showing an increasing interest in the light racing style of British bicycle as distinct from the over-tyred imitation motor cycle type of dreadnought bicycle chiefly used for posing film stars who, dressed in bathing costumes, poise one toe delicately on the wrong pedal and smile sweetly at the photographer. America is not, as yet, a cycling country. If it can get adequate supplies of the British-made machine there is hope yet that America may produce some fast road and track men, and that the country may be more adequately represented in international events.

Kain Out

AT the meeting of the B.L.R.C. referred to above, the action of the National Executive Committee in voting J. Kain out of the secretaryship was confirmed by a two to one majority. The meeting was not well attended, we understand, and Kain's opponents were able to carry the day. The journal which apparently is the official organ of the league will continue to be produced and edited by Kain, although we are given to understand that league members have been notified that they are not to take deliveries of supplies.

Bearing in mind the vast amount of unpaid pioneer work done by Kain in getting the league going, the action of the council is deplored, and we do not think that it represents the views of the majority.

We know that for some time past feelings have run high, but wiser counsels have not prevailed. It would seem that this is a split which ought to be healed, especially as the B.L.R.C. has announced that there is to be no change in the policy. As this policy was laid down whilst Kain was secretary, what is the grievance?

The Harlow Circuit

AFTER considerable search a massed-start course in the London area has been selected. The perimeter of an aerodrome near Harlow, Essex, known as the Mashing Green, will be used for the National Massed-start Championship of 120 miles on July 11th. The course provides a circuit of 3½ miles, and has a 40ft.-wide tarmac road. The final race will be held on August 2nd. We are informed that the surface of the circuit is ideal for even the lightest tyres.

Paragrams.

Safe Enough?

LINCOLNSHIRE County Education Committee was reported at a meeting of Brigg Road Safety Committee to have turned down a request for the formation of a Safe Cycling League in connection with Brigg schools. The Royal Society for the Prevention of Accidents is to take the matter up with the Ministry of Education. Lindsey County Council Road Safety Committee is in favour of the formation of the League, but this committee, according to a member of the Brigg Road Safety Committee, "appears to exist only on paper, as so far no meetings have been held."

Girls Improve Club

MEMBERS of Kettering Friendly Cycling Club are now blessing the day when they decided that girls should be allowed to join the club. With an all-male membership the club was not doing too badly, but with the decision to admit girls as members the sporting and social activities of the club increased considerably. There are now over a dozen girl members, whose interest in the sport was aroused by watching the boys ride, and they are taking an ever more prominent part. The girls will take part in their first 880 yards track race at the end of June and later they will train for a seven-mile road race.

No First Time

"ISN'T there a first time?" asked the girl cyclist who was stopped by a policeman at Boston for cycling without lights. Unfortunately she discovered that even the first time has to be paid for and it cost her 25s. to find out.

45-Mile Ride for Autograph

TO get the autograph of his hero, Reg Harris, the world's amateur sprint champion, a youthful member of Kettering Friendly Cycling Club rode 45 miles to find the champion and caught him in his dressing-room having a shower. Although not unused to admirers, the champion was interested in the lad's enthusiasm and after talking cycling with him for a while presented him with a signed photograph. After cycling the 45 miles back home again the lad collected a sixpenny bet from his sister, who had taken rather a poor view of his chances of getting an autograph.

Fen Mirage

A CYCLIST who was riding along near the Little Ouse, in the Cambridgeshire Fens, at peace with the world, got a shock the other day when he suddenly saw in the sky a mirage. There were the rippling pools of water in which houses, trees and animals were reflected and through which tractors and other vehicles seem to splash and leave a dancing wake behind them. The light breeze blowing at the time seemed to make little waves across the ghostly water, but after a while everything disappeared as quickly as it had come.

Poles and Posters

AT the annual meeting of Holland Road Safety Council, held at Spalding, Lincs, it was strongly urged that the Ministry of Transport and other Government departments should remove all poles put up by them near roads, as they were a constant danger to road-users. One speaker commented: "None of us will live to see them removed, but we shall be preparing for the future." The council is also anxious to see the strict limitation of posters which, it is suggested, should be at least 100 yards from any road junction in order not to distract the attention of road-users just when there was the most likelihood of an accident.

Country's Finest Windmill

THE Trader Mill, at Sibsey, Lincs, is regarded as being the finest working windmill in existence in the whole country. Mr. Thomas Ward, who comes from a milling family and has been miller there for 30 years, has received a certificate from the Windmill Section of the Society for the Protection of Ancient Buildings. The mill is a prominent landmark in the Lincolnshire Fens, with its tall tower and six sweeps. It was built in 1877 by a Lincolnshire firm of millwrights on the site of an ancient post mill and embodied all the "latest" improvements. Mr. Ward's care has kept the mill in perfect condition and the winds which always seem to be blowing across the Fens and turn the mill save a good deal of fuel which might otherwise be used.

Strange Beginning

FIFTY years ago two Kettering men, Mr. F. T. Allen and Mr. H. W. Caswell, took part in a cycle race and they put up such a good show that they got together afterwards and, during a conversation, decided to see what they could do in partnership in the business world. The Kettering boot and shoe manufacturing firm of Allen & Caswell is now well known in shoe-trade circles, with its goods going to all parts of the world, and has just celebrated its golden jubilee. Mr. Caswell is still actively engaged in the business, but his old friend and partner, Mr. Allen, died a few months ago.

Early Mechanised Postman

MR. PERCY HAGGER, of Ashby Road, Coalville, Leics, who has just retired at the age of 65, was one of the first postmen in Leicestershire to be provided with a bicycle instead of a pony and trap to cover his country district. When the round was mechanised Mr. Hagger received a further benefit which was the erection of a hut by the Post Office in the middle of Charnwood Forest. Here he kept a frying pan, together with an official coal cellar and something to sit on, and after delivering the morning letters he would cook himself a breakfast of eggs and bacon before starting his return journey. Mr. Hagger knows every house in the Charnwood Forest area he covered for so many years and was never in need of a map.

Three-wheeled Tandem

A TRICYCLE tandem attracted considerable attention from other road-users when it was being ridden along a Northamptonshire road the other day. In the front there were two wheels, wide apart, and at the rear there was a double wheel. The two riders sat between the two sets of wheels and pedalled, the steering being controlled by the offside rider by means of a steering-wheel. The machine was making quite a good speed with, apparently, not too much exertion on the part of the riders.

Orphans Were Unlucky

"I ENCLOSE 10s. for the fine, and if there is any surplus, please give it to the police orphanage," wrote a Desborough (Northants) girl cyclist to Kettering Bench after she had received a summons for cycling without lights. The magistrates took the whole of the 10s. for a fine, and so the poor orphans got nothing.

He Scooted

AN airman stationed at Barkston Heath, Grantham, who was stopped by a policeman and told he would be reported for cycling without a light, explained: "I wasn't riding it. I was using my bike as a scooter." The Grantham magistrates were intrigued with the novel explanation, but felt they could hardly accept it, and so imposed a 10s. fine on the airman.

Never Too Late

THERE would seem to be no age-limit for learning to cycle, in spite of the fact that some youngsters of 50 or so feel they have been missing something all their lives, and that it is too late to remedy it. Mr. John Thomas, of Immingham, Lincs, the parish's oldest inhabitant, whose last birthday was his 95th, started cycling when he was 70, as he had been offered a new job 14 miles away from his home. He rode to and from work regularly in all weathers until his retirement a few years later. Now, at 95, he feels he really is past cycling and his chief form of exercise is gardening.

Ready for Anything

THE old mill in the picturesque village of Houghton, in Huntingdonshire, which is now used as a Y.H.A. hostel, had a young visitor recently who was prepared for any emergency. He arrived at the hostel riding one of those light folding cycles used by the airborne forces during the war, with a fairly bulky package on the back. Next morning he went down to the river bank on which the hostel stands, unfolded the package and inflated it into an ex-R.A.F. rubber dinghy, folded his bicycle, hopped into the dinghy, and was away downstream. This water-mill at Houghton has stood for several centuries, and records show that there has been a mill on this site since the year 950.

Business Change

IN consequence of the retirement of Mr. A. E. Grimmer, of the Fitt Motor Co., Ltd., 7, Church Street and Bedford Street, Ampthill, Beds, the cycle department of the business has been acquired by Mr. F. R. Underwood, and will be carried on under his own name at premises, 3, Church Street, Ampthill.

Sportsmen!

SPEAKING at a meeting of the Football Association a referee suggested that other referees should be warned by what happened to him and not cycle to any matches. He said he refereed a match in Huntingdonshire, and when he went to collect his cycle at the end of the game he found that some "sportsman" had punctured one tyre and had taken away both valves.

Safe Cycling Leagues

IN order to encourage road safety among schoolchildren in Northamptonshire each school in the county is to have its own Safe Cycling League. Any child cyclist is eligible for membership, on condition that he or she studies and observes the Highway Code, takes a cycling proficiency test and attends a regular cycle examination and check. There will be prizes given to scholars at those schools where at least 10 cycles are regularly used, on the recommendation of the head teacher of the school or a police-constable.

Recipe for Long Life

PLENTY of fresh air, preferably obtained while cycling, is the recipe for longevity given by 96-year-old Mrs. Sarah Bray, of Blyton, Lincs. She bought a cycle in the early days and continued to ride until she was turned 80 years old, when she had an accident and had to give it up. Now she gets her fresh air in her garden, not sitting in it but working, and she celebrated her 96th birthday by mowing the lawn.

Centre of England

TALKS are going on between the Leicestershire and Warwickshire County Councils on the question of repairing the old High Cross at Claybrooke Magna, in Leicestershire, on Warwickshire border. It is claimed that this cross marks the exact centre of England, and it was erected in 1712 to mark the signing of the Treaty of Utrecht. The cross now stands in a farmhouse garden, but when it was erected it marked the crossing of two Roman roads, Watling Street and the Fosse Way. About 80 years after it was erected it was struck by lightning and badly damaged, and now only the base and part of the column remain. The inscription stating that the cross was "erected by the noblemen and gentry, ornaments of the neighbouring counties of Warwickshire and Leicestershire," is still legible.

Blind Cyclist

ALTHOUGH 38-year-old Mr. Arnold Cadwallander, of Doncaster, has been blind all his life there are very few things he cannot do just the same as sighted people. He can roller skate and swim and can ride an ordinary bicycle, but the only drawback to his cycling is, he says, that he would need a wide open space if he were to ride alone. His wife is a keen rider and they have bought a two-seater tricycle on which they will be able to enjoy the pleasures of the open road together. Mr. Cadwallander heard of this machine through an advertisement in a magazine for the blind, and it is expressly designed for the use of a sightless person and a companion.

Tally Ho!

WHILE on his way home the other day a Grantham cyclist found beside the road a fox cub, lying very still. He got off and examined the cub, which appeared quite peacefully inclined, so he tucked it under his arm and rode off home with it. After a meal of bread and milk the cub appeared quite frisky, so much so that the man decided he had better notify the police and the R.S.P.C.A. inspector, who advised that the animal should be taken out into the country again and released. Now somewhere in Lincolnshire is a fox that goes round telling his pals how he once rode a bicycle.

Nuneaton Children Play Safe

FROM the 12 senior schools in Nuneaton 24 boys and girls have been chosen as representatives of some 7,000 schoolchildren in the town as organisers of their own road safety campaign. A preliminary meeting has already been held in the Council House, Nuneaton, to elect officials and to discuss plans for the campaign. It is nearly two years since a Nuneaton school child was involved in a fatal road accident and Nuneaton Road Safety Council hope that this children's safety campaign will reduce still further the number of accidents.

Cyclists Save Town £10,300

BLACKPOOL'S Town Clerk has just disclosed that 12 men on bicycles have saved the town £10,300 in postal charges since 1940. Eight years ago it was decided that all corporation correspondence should be delivered by cycling messengers instead of by post and up to April of this year these messengers, who cover some 25 or 30 miles a day each, had delivered 3,978,183 letters. Included in the £10,300 saved is the sum of £4,000, which would have had to be spent on envelopes for gas, electricity and rate demands if they had gone through the post.

Around the Wheelworld

By ICARUS

Club or Lone Cyclist?

DURING a recent run down to the coast I was impressed by the absence of club cyclists—those organised groups with bent heads pedalling for all they are worth to their destination, where they arrive, during the summer, dust-begrimed and in a state of dripping perspiration. That is the average clubman's way of enjoying himself, and he is entitled to take his pleasures in the manner which he thinks suits him. It is, however, a spartan and somewhat stoical form of pleasure, and I doubt very much whether hard-riding clubmen really enjoy it. There is a personal vanity about it. The clubman hates to be dropped by his clubmates, and may often do himself harm in endeavouring to keep up with them.

There is always at least one member on a club run who wants to "tear it up," and his mates do not like to be chipped. The real pleasures of cycling, in my view, are achieved by those who ride lone or at most with one companion. I chatted with a number of these lone cyclists and asked each of them whether they belonged to a club. Most of them had never done so. A few had joined, but found that most of the members were either interested in racing or using the social club run as training spins, and so they dropped out.

It is unfortunate that most club life to-day revolves round racing, and I suppose that is the reason why out of at least 10,000,000 cyclists in this country, less than 100,000 belong to clubs. I should put the total number at less than half that figure, because there is a considerable overlapping membership and a multiplicity of affiliations.

I was also impressed with the deserted state of the roads during Whitsun. In a 60-mile ride, during what should have been the busy part of the day, I encountered less than 12 motor-cars.

The Tourists' Competition

WITH reference to the Tourists' Competition, briefly referred to in last month's issue, in which the *News. Chronicle* has offered £100 in prizes, and which is to take place in August, I am asked to state that the District Associations of the C.T.C. will organise the touring competition in all their areas, the contest taking the form of map-reading tests, hill-climbing, rough riding, braking tests, speed judging, cycle efficiency, road conduct and general knowledge of cycling topics. The winners of the District Competition will receive diplomas and documents which entitle them to enter the final, terminating at the York Rally.

Those qualifying for the final at York must undertake to cycle to York by any route from wherever they may be on the morning of August 8th, so as to arrive in York on the morning of August 13th (Friday). Each finalist will be provided with a special diary in which daily mileages will be recorded, together with signatures verifying visits to National Trusts on various points, thus helping towards the final decision. The closing tests will be held on the afternoon of August 13th.

The finalists will be given details on the morning, and they will be taken to the starting-point in the final test 10 miles out of York. Overseas visitors will not have to compete in the preliminary contest and will be judged in a special class of their own with their own award.

The purpose of the contest is to find the best all-round tourist in each class, but I do not think that the contest will do this, for no system of marking can be devised which can correctly differentiate between good cycling and map-reading, for example. As with the B.A.R. contest, the result will find the wrong man.

Light Alloy Cycle Rims

THE Dunlop light alloy cycle rim for high-pressure road-racing tyres is now being distributed to cycle assemblers and wheel-builders. A leaflet is available from the Dunlop Rubber Co., Ltd., St. James's House, St. James's Street, London, S.W.1, to assist manufacturers who are building light alloy wheels. The essential need for the use of cadmium plated nickels, if the possibility of corrosion is to be avoided, is stressed.

New Resilion Alloy Brake Lever

THE Resilion Co., Ltd., of 200, Liverpool Road, N.1, announce that they are able to supply limited quantities of their new alloy lever, which is approximately 50 per cent. lighter than the steel model they have used hitherto. It costs 10s. 6d. The lever is made in a high duty light alloy, and the design of the complete assembly as well as the general appearance has been greatly improved. Steel inserts in the pivot holes ensure maximum length of service. These levers are supplied with the special ball nipple and can be used with any cable brakes. It is supplied in two patterns, the Straight and the C, and the brackets, which are made to fit 1in. handlebars, will be supplied with liners to fit ⅞in. handlebars. Liners for 15/16in. handlebars are available on request.

I have fitted a pair of these levers to my own bicycle, and can bear out the claims of the manufacturers. They are beautifully streamlined and greatly enhance the appearance of my machine.

The Trader Handbook

I HAVE just received a copy of the Trader Handbook for 1948. It is a legal, technical and buying guide for the motor, motor-cycle and cycle trades, and the fact that this is the 42nd edition is sufficient evidence of the fact that it has become the bible of the industry.

It contains 410 pages and is, of course, available to recognised cycle dealers.

Enormous changes have occurred during the past year in names, addresses and products of manufacturers and trade suppliers of motor, motor-cycle and cycle goods, and the 1948 edition of the Trader Handbook will be welcomed by thousands of traders throughout the industries.

This is the 42nd edition and provides over 400 pages of accurate and essential information of inestimable value to those who sell, service or repair cars, commercial vehicles, motor-cycles, cycles and accessories.

All firms whose names appear in the directory sections have been approached for latest information of their products and activities, and every effort has been made to ensure reliability of information covering the trade regulations and data on trading problems.

The Trader Handbook will also prove of the greatest utility to overseas firms who seek contact with British suppliers, or who require the names of manufacturers of specific products.

The main sections of the handbook are:

Technical Information, Directory of Manufacturers and Wholesalers, Classified Buyers' Guide, Garage Equipment, Proprietary Names Directory, Legal Guide, Licensing.

Harrris the Boss at Herne Hill

NOT since the days of Toni Merkens, the German sprinter, who, before the war, rode so much at Herne Hill, have we seen a rider who was so undisputably "the boss" as Reg Harris of Manchester is to-day. At the recent Polytechnic C.C. meeting he rode as he pleased and won as he pleased, despite the severe car crash in which he was involved just before Easter, when his car was forced off the road by two lorries and he ploughed through 25 yards of brick wall before his machine overturned, injuring his spine when it threw him clear. The doctor in charge of Harris's case at Derby Royal Infirmary was present at the Poly meeting, and he told our correspondent that the chip off the world champion's spine was not of so much consequence as the injury that caused one of his sacrum bones to become chipped. Harris regards his back muscles as of primary importance in the effort of "jumping" for the line, and it is happily evident that no serious complications have accrued, for his sprint is every bit as electric as it was when he won the world title last August. In beating Ken Marshall, Poly, Alan Bannister, Manchester Wheelers, and Tom McNulty, Scottish N.C.U., in the final of the Invitation Victory Cup race, he stayed wide of his clubmate and the Poly boy until the end of the last banking, when he went by in his effortless style and won from Marshall by a length, the full time for the 550 yards being 39⅗ seconds; last 220 yards, 13 seconds.

Ivor Cox and Johnnie Dennis, the Norwood Paragon tandem pair, confirmed their ability in the 1,000 metre tandem race. Their last 220 yards in the final, when they beat the Scott-Thorpe and Waters-Pond combinations, prompted them to attack the quarter-mile flying-start time trial record set up in 1909 by McCaig and Piercy of 23⅗ seconds, but the headwind in the Burbage Road banking slowed them to lose by just one-fifth of a second.

Tall, dark C. G. Marriner, Southern Paragon, was again the best Australian Pursuiter, winning the nine-lap Roadmen's match in 5 minutes 31⅘ seconds from J. Love, Willesden C.C., 5.33⅕, with G. Nightingale, Charlotteville C.C., third in 5.34⅕, and A. W. Butler, Woolwich C.C., the only other man not to be caught, in 5.38.

A Collectors' Club

SOME of my friends have been talking over the idea of forming a cycling collectors' club.

There are quite a number of people who are interested in one way or another in the history and development of cycling, and some have quite respectable collections of machines, books, bric-à-brac, etc.

It is perhaps not generally known that the late Bartleet's collection was by no means the biggest—or indeed—the most genuine, collection of obsolete machines.

I have seen another collection which quite puts Bartleet's in the shade. The owner has restored all his specimens to their original condition, and beautiful indeed they are to look upon. He has not neglected other forms of transport and possesses several pre-1900 cars and motor-cycles.

If any of my readers are interested in forming a collectors' club perhaps they would care to write to me c/o "The Cyclist."

Wayside Thoughts

By F. J. URRY

Intentions

IN my pocket is the outline of a Scottish tour of nearly 600 miles, most of it north of the Great Glen, and the intention was that four of us would make the journey this month after derailing from the "Night Scot" at Inverness. Now only three will go—I shall be missing. Looking at the route scheduled, with annotations of hotels and their telephone numbers, and then comparing it with the map, the idea seems a trifle ambitious for men beyond the count of 65 years; but then, being cyclists they are of the actively sturdy type, and in any case can cut the route if wind, weather and inclination suggest easement. Personally, I was looking forward to the trip in the company of men who were boys when I was a boy, and with whom I mixed many wheeling adventures in the days when there were no motor-cars on the road. They are taking the risk of accommodation, nor do I imagine it will be a very grave one with the aid of the 'phone to fix up a day ahead; and they are going to "drum-up" in the good Scots custom, carry what they can in the way of rations, and for the rest live on the hospitable countryside. Of the quartette I was the only one who has been over the planned route previously, and no doubt I should have found it difficult to restrain my tongue from that exuberance of pretentious ownership so apt to attack the guide. But if I know my companions aright they will put their own values on the ever-changing beauty and grandeur of the scene. So, late this month, you can think, if you will, of three old cyclists bivouacking, say, at Rougie Falls on the banks of the Blackwater with the long, narrow road to Ullepool to traverse before the long shadows fall. The very thought of it makes me long for my moment to come, and of all the quiet comfort and joy of this cycling freedom.

The Young Year

HOW lovely is the spring! No wonder poets sing of the season when all the promise of a summer to be is trembling in the air or roaring out of the sou'-west to scatter the shedding blackthorn and plum blossoms like scented snow. Every week-end I have been out among the lanes, and although my longest journey has been only as far as Evesham, the miles I have travelled are memories of young beauty bursting into life by field and wood. The sheen of the forest in its misty greens and the undulating meadows rich with winter wheat; and never, it seems to me, have the grasslands shown greater promise. Afar are the blue hills, their mystic loveliness an invitation to invade, and as you reach the sloping grounds their orderly fields become a pattern with those of the plain. Only the walker and the cyclist know the quiet joy of such scenes, and of the two types only the cyclist can make the round without physical weariness in the measure of the miles. Or so I think, having grown older. These scenes I know so well; I'm often tempted to say I can visualise by the fireside without revisitation. Yet that is nonsense in any season of the year, but special nonsense when spring is transforming the everlasting beauty to its ethereal delight. This ever-young attraction is the basis of the cyclist's privilege; he is drawn to be a silent devotee and at the turning of a corner may be confronted with a vision, known of old yet transmuted by the season to a splendour impossible to imagine without the beneficence of the senses. This is not sentiment, it is merely the fulfilment of a satisfaction that is in the minds of all folk to a greater or lesser extent who love the vigour and the glory displayed by an English countryside in spring.

The Simple Truth

I WOULD like to carry on the good work of propagating the pastime of cycling for ever, but that cannot be. The point is that far too many people still think two wheels, a saddle and a pair of pedals are the useful adjuncts of the impecunious, and thereby are not to be considered in the curriculum of the well-to-do. Strange, is it not, that minds are apt to become inverted by the possession of cash, when the simple things of life are just priceless? I say there is nothing comparable to a bicycle and the ability to ride it with ease and comfort; yet that fact is not yet generally recognised because people place cycling as the travel instrument of the poor. It is, but it is also far more than that. For cycling as I understand the pastime touches the fundamentals of life, the joy of easy exercise, the innate pleasure of healthiness, and the silent means by which a man can know the land he lives in and the people who are his compatriots. Riches do not strip you of these simplicities, but they may give you more leisure to enjoy them if you are wise. If, mayhap, you have given way to the ease of mid-life, or because of circumstances have never known cycling joy since you discarded the juvenile bicycle, try it now, widen your knowledge and your miles, for the "basic" to-day will not help you very far on your way. Take the bicycle aboard the car for ten miles, then ride your twenty or thirty amid lanes mostly unknown to you, returning to the car for the quick journey home. If you are mounted correctly and have taken the trouble to be reasonably fit, you will be surprised to discover enjoyment joins you on the journey, that the silence and the freedom, the easy loping speed and the time to look and listen provide a new thrill and a way of life too long neglected. Do not hurry, just take your time, filling it with the comfort and the joy of the moment, and if you are moulded in the dignity of most people, with that desire for the beauty and delight of the land, you will be charmed. But before you do these things or attempt them, clear your mind of the prejudice that cycling is only for the young, the strong and the not-too-well endowed, or your adventure will suffer with that comparison too frequently associated with the possession of money.

Daily Journeys

OF course, there are many of my friends who seem to think I am foolish to ride to town every working day; they say I am too old and the traffic is a trouble. The term old must surely be defined in compliment or otherwise to one's fitness, and normally I am as happy in that respect as many a man twenty years younger, and honestly I believe the main reason for that desirable condition is my constant cycling. The traffic worries me not; I have grown up with it, and while circumspection is my model, I refuse to be bullied. To obey the road rules and practise courtesy is simple, and most of the folk whom I meet or who pass by me render their good manners to a grey-head. There is something valuable in being grizzled, for even the much begrimed driver of the coal lorry frequently invites me to "go on, dad," when the right of way is equally divided. Usually it takes me about forty minutes to travel six and a half miles to the works, and in the process I see quite a lot of humanity and something of their curious habits; and if I went by tram or bus, counting walking time each end of the journey you could add another fifteen minutes at least. As you will observe I am in no hurry on my daily journeys, and, therefore, I enjoy them by renewing acquaintance with many folk along the road who through the years have become friends of salutation, for I don't know the name of one in twenty. I would not give up this daily parade for the most sumptuous travel you can imagine, first because of its individuality and complete independence, and second for the sufficient reason that it is the sound basis of my fitness. Millions of people who have to ride to work may not look at the question from quite my angle, but if they stick to it, and use their daily acquisition of fitness to add pleasure to their leisure roaming, they will be happier individuals as a result.

Buy the Best

I AM told that bicycles are booming but customers are now showing discrimination in purchase. They want value for money, and they cannot get it while Purchase Tax, computed at 24 per cent. on the retail price, is in being. I had hoped that the Cripps Budget would give us some relief, based on the fact that when the Dalton Budget increased P.T. on bicycles, Sir Stafford promptly reduced the impost to the original percentage, recognising the important part the bicycle plays in helping to solve the transport problem. But we had no luck. Still the call for machines goes forward, for here is the cheapest and most convenient form of road movement. Yet paradoxically enough the cheapest bicycle in the money sphere is by no manner of means the cheapest in performance from whatever angle you look at the question. Energy is the first, the better the bicycle the easier it runs; then comfort in the matter of saddle, gear choice, position and freedom from irritating little faults of adjustment; and, finally, given equal attention the best machine will last double the years in hard wear, of the cheapest. So do not look too closely at the final figure; remember you are treating yourself to a far greater thing than an instrument of convenience, and if you buy for no other reason than that, a cheap purchase is treating your own activity very cheaply. I have just completed about a thousand miles on an R.R.A. Raleigh model of the latest type, and it is a superb bicycle. Its cost is nearly £40, but its hand-built excellence is worth it. The new mount follows my usual specification, with big saddle, four-speed hub with 60in. normal, and slightly dropped bar, and felt pedal blocks. Its weight is 28½lbs., a wonderful piece of construction made possible by the use of alloy bars, brakes and seat pillar; and the weight will be slightly reduced when Dunlop have marketed their new rim in 1¾ in. size. I like the Tourist Sprite with which the rims are shod, they are good and lively, but when I've worn them out they will be replaced with the skin-sided Sprite so that I may feel that little extra resilience when the open-sided tyre rolls under me. Yes, a good bicycle is worth its cost, and nobody knows that better than the old rider to whom conservation of energy means more and happier miles.

PARAGRAMS

(*Continued from page 74*)

Results From Safety Teaching

THE latest quarterly survey of road accidents, issued by the Northamptonshire Road Safety Committee, shows that there is a continued and well-maintained decrease in casualties to child cyclists. Road safety instruction to child cyclists appears to be bearing good fruit, but their younger brothers and sisters are not responding so well to advice on how to cross the road in safety. The report reveals that children in rural areas, where there is likely to be rush of traffic and then lengthy gaps with no traffic, are more likely to be involved in accidents than children living in towns and faced with a steady flow of traffic.

Tough Tyres!

EVER cussed at a tyre that suddenly went flat in the pouring rain? Then you should give heartfelt thanks to the research workers of the Seiberling Company of America, who have produced the toughest tyre ever made. It is claimed to be absolutely unpuncturable and tyres which have had large nails, chisels and all kinds of sharp instruments thrust into them have resolutely refused to leak. As a final test, some Chicago policemen used a tyre as a target and riddled it with bullets and still there was no puncture. So far the tyres are only to be manufactured for cars but it is quite possible that the same process will be used for making cycle tyres.

Bill Jinks's Tricycle

ALTHOUGH he will never see his 85th birthday again, Bill Jinks, who has spent a lifetime in land-work in Northamptonshire, can still be seen riding to and from his allotment on the old tricycle which his employer bought for him for a guinea over 10 years ago. Up to that time Bill had never been on a cycle but when he saw the tricycle at an auction he was tempted and for the next 10 years, until his employer died, he rode the six miles to and from work, winter and summer alike. Altogether he has ridden thousands of miles on it, but he makes the shameful admission: "I don't think I've cleaned it once since I've had it!" Town traffic doesn't scare him and, however thick the traffic is, he keeps on riding for, as he says: "The thing was made to ride, not to push."

CYCLORAMA

By H. W. ELEY

The lovely village of West Stafford Dorset.

The Friendly Inn

IT is part of my job to study advertisements, and I like particularly that good series being sponsored by the Brewers' Society, showing us the delights and facilities of the "friendly inn." To hosts of cyclists, a "country pub" is a thing of joy, and many of us have good memories of happy hours spent in some little inn where the atmosphere was one of peace and serenity; where there was honest and homely conversation with men of farm and field, and where, after a long and maybe arduous ride, one could be sure of obtaining good food and drink. And there is the roadside café or tea-shop—many have disappeared since the war, and those that remain cannot, of course, offer us those old pre-war teas, with lavish supplies of real butter and plenty of rich cream. . . . But I must not go on in this strain! I am afraid that many ration books will be printed and issued before we return to those halcyon days.

Taking the Bike by Train

MOST of us know that for some considerable time strenuous efforts have been made to secure better facilities in connection with the transport of cycles by train. I now understand that the Camping Club of Great Britain is associating itself with the National Committee on Cycling in an effort to get matters improved. There are many things which need to be done, and I hope that the joint efforts will result in success. I sometimes wonder why it always seems so hard to secure reasonable and equitable facilities and benefits for the cycling community?

Parson's Priority No. 1

RECENTLY I had something to do with the induction of a country parson . . . a man who left a London East End parish for a delectable little village not a hundred miles from London . . . a haven of rest and peace after the turmoil and grime of a typically blitzed East End area. I knew that my friend was a stranger to country ways, and I helped him with several items. Installed in his remote retreat, he telephoned me to say that we had overlooked the No. 1 necessity. How would he ever get about his scattered rural parish without a bike? I replied that he just wouldn't . . . and within a matter of hours he was the proud possessor of a good machine.

The Man With the Sketch-pad

I FELL in with him somewhere between Aylesbury and Bicester (and what a delightful bit of country that is!). He carried a sketch-pad, and I found that he had made a hobby, for many years, of making roadside sketches on his cycling travels. What a wonderful combination . . . sketching and cycling! When we dismounted and sat by the roadside for a pipe and a chat, my good friend showed me some of his work . . . charming little sketches of old milestones, old churches, bits of ruined, crumbling walls, timbered cottages . . . a truly delightful record of his tours . . . and those tours had been in many lands. How the sketches, in years to come, will bring back to that happy cyclist's mind the pleasures and scenes of the English countryside! I felt quite envious, and wished that I had been endowed with a gift for sketching. Before we parted he made a sketch of an old windmill and presented it to me . . . it now adorns the wall of my cottage retreat—yet another reminder of the joys which cycling can bring.

Inn Names

IT was THE CYCLIST which, a few years ago, ran a most entrancing series of articles on inn signs and names . . . and I remember the delight with which I used to recognise some sign of an inn I knew well. I also remember that at the time there was some correspondence about the small number of signs connected with the cycling movement. "The Wheelers," "The Cyclists' Arms" . . . just a few to mark the strength of our movement, but I submit that it is curious that, in view of the number of riders regularly using the roads, and the fact that the inn must have a particular significance for them, there are so few inns named with the bicycle in view. Maybe I am wrong, but I should much welcome letters on this subject.

High Summer

WITH July, the year reaches its green and lush peak, and I love to travel our English lanes during this month of rich growth in field and hedgerow and common and heath. The scabious is out, and the scarlet pimpernel gleams bright amid the thick growth of the hedgerow. Knapweed is abloom everywhere, and the railway embankments are dotted with flowers . . . while in the cottage gardens the tall hollyhocks and sunflowers stand like colourful sentinels in the borders; and around many a cottage door the clematis straggles in careless abandon. And as I ride along some green lane I look out over the wide fields and note the green of the wheat . . . and think ahead to the days to come, when the corn will be mellow and golden, and the orchards heavy with fruit. July! the crown of full summer, and a grand month in which to tour the English scene.

Planning for the Cycle Show

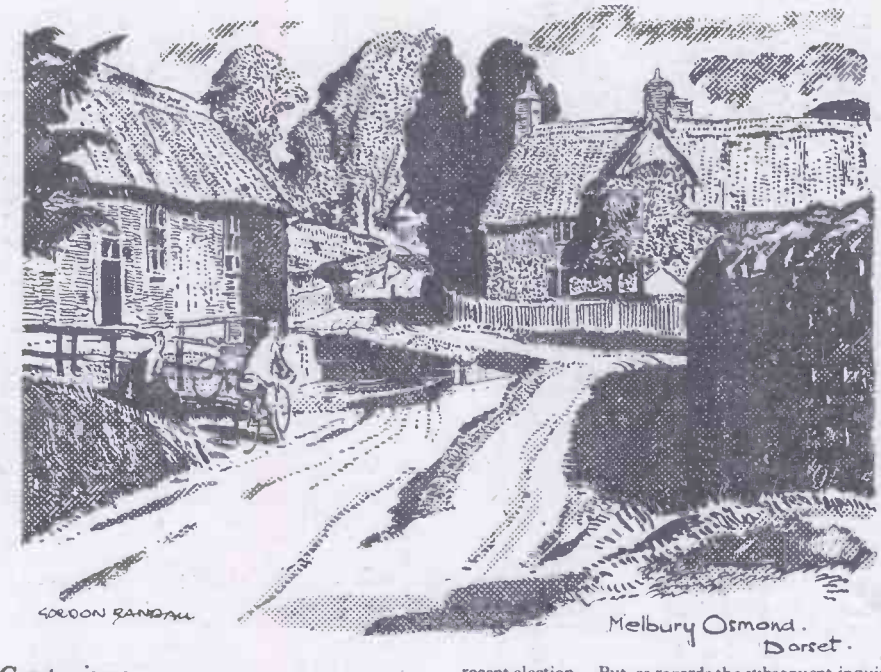
THE Show is a longish time ahead, but in a department where one has responsibility for the erection of the stand and the display of products thereon, one must start early to plan, to design, and to decide just how to display those tyres and accessories which will, I am sure, prove to every visitor that the British tyre industry is vigorous and able to cater very adequately for the needs of riders. I have been connected with a good many cycle shows . . . and I am hoping that the 1948 show will keep up the good old traditions of the industry.

Lure of the Dales

EVERY year, when I begin to think of holidays, I am perplexed by the "pull" of one touring area against another . . . and find myself floundering amid many plans. My old maps and touring notebooks are so full of happy memories that I find it hard to decide between Derbyshire dales, quiet Suffolk lanes, Welsh hills, or the moors of broad Yorkshire. How well I know what joy I should obtain from a ride through Central Wales . . . and how equally I realise what delights await me in the quiet Constable country of Suffolk. And how the Hardy country of Dorset appeals! Well, there is the time-honoured way of "tossing up for it" . . . and the coin comes down tails, which means that in this year of grace I propose to spend a fortnight on my bike in the good Derbyshire country around Dovedale, and Mayfield, and Ashbourne . . . and grey Youlgreave.

My Point of View

By "WAYFARER"



Comparisons . . .

OVER elevenses the other Sunday morning a friend, met at random, was telling me about a first-class feeding station he has recently encountered in the Dovey Valley. He characterised it as "the finest place in England." When I added "Or Wales," he accepted the correction.

. . . are Odious

THIS characterisation of places as "finest" (I am not referring now to tea-houses) is a shade invidious. I am quite satisfied that there is no "prettiest" village, and no "best" county; and, when a lady asked me a day or two ago which county was the better, Worcester or Hereford, I unhesitatingly replied (in accordance with custom), "Both!" But what I was going to remark was that, on a recent week-end in Herefordshire, my innkeeper asked whether I was acquainted with a certain nearby valley, which he thought was "the finest in the world." Being ignorant of its very existence, I went off at once to improve my knowledge. I enjoyed the little journey: the valley was certainly a nice fragment—it was no more than a fragment—but by no stretch of imagination could it be viewed as the top-notcher.

The Operative Word

ACCORDING to my daily newspaper, a cyclist "fell from his racing bicycle while carrying a folding table on it" and fractured his skull. Presumably, the operative word is "racing"; otherwise, why drag it in? I suppose that the same sort of accident could have happened to a man riding a policeman's heavy-weight, complete with sit-up-and-beg handlebars. The real point to be borne in mind, of course, is that considerable care should be taken when carrying anything bulky, whatever the type of bicycle in use.

The Wrong Remedy

ANOTHER of the newspapers I occasionally study recorded a fatal "accident" to two motor-cyclists which occurred at a road junction I know very well. These two people came out of the secondary road on to the main road and plunged into a motor-coach, being killed instantly. The coroner's jury, in their wisdom, decided to recommend that the County Council should take steps to improve visibility at the spot. To demonstrate the folly of that recommendation, it has only to be recorded that there is a "Halt" sign at the junction, and that the motor-cyclists elected to ignore it! Surely, the remedy for such an "accident" lies elsewhere.

Not So Humble

AS a cyclist, I am not in the least concerned with the Labour Party's inquiry concerning the telegram which was sent to a political party in Italy during the recent election. But, as regards the subsequent inquiry, I was intrigued to read that one of the M.P.s prominent in the action "arrived, with suitable humility, on a bicycle." "Humility" be blowed! If the writer of that piffle knew something about the bicycle and about cycling, and if he had been able to pause in the middle of a 1,500-mile tour and pat himself on the back on account of what he had achieved, and if he could realise that, in some ways, the cyclist (especially the touring cyclist) was still king of the road—still in full enjoyment of what in economic jargon used to be called "the most-favoured-nation" treatment—he would have less to say on the subject of humility. No road traveller deserves the epithet less than the cyclist.

Weather Gamble

HOW certain is the uncertainty of our English climate! On an April week which I have in mind I started off by doing my usual Sunday ride, which, on this occasion, accounted for 76 miles. The five following days saw me, in the course of my business, stamping about industrial and country districts, devoid of any such protection as is afforded by hat, umbrella, or raincoat. Friday, a superb day of terrific visibility, was the culminating point of a grand week, and it occurred to me that there was not a spot of rain within thousands of miles. Ochone! The morrow told a different story. In dismal conditions—what I call blanket weather, for opaque curtains hung all about me—I carried out a prearranged week-end jaunt into Herefordshire—surely one of the most delectable and least spoilt of all our counties. After a fair start, the rain of the dark hours returned to duty, and the conditions were unpalatable. Over lunch and tea, Jupiter Pluvius seemed to excel himself, and then, in the evening, there came a lucid moment, lasting about two hours, during which there was a show of blue sky and sunshine, and journey's end was reached. The sun went off duty in obviously angry mood, which boded ill for the morrow—but the morrow proved to be a grand day. What a gamble our weather system is!

"Glittering Prizes"

IT was my townsman, the late Lord Birkenhead, who once spoke about "glittering prizes." I often think of that phrase when, as a cyclist, I am aiming and striving for one or other of the special pleasures which our pastime holds within its gift. I thought of the phrase the other day when I was battling with the physical difficulty which the map names as Clee Hill. Much of that glorious country in the neighbourhood of Ludlow and Cleobury Mortimer provides hard—very hard—going, but the "glittering prizes" more than justify the "blood and tears." Angel Bank makes one cough, and one's "troubles" are far from over when the village of Clee Hill has been achieved. The down-grades are almost as troublesome—on a fixed gear—as are the upgrades! But oh! the glory of those immense panoramas—of that sublime pageantry of the countryside—when height has been achieved! How rewarding it all is—to be able to look for leagues and leagues over a most noble land compacted of rich fields and many trees, with here and there a tiny white cottage marking the habitation of man! Yes; these "glittering prizes" are well worth having, especially when they have been earned.

Meals

FOR a change, let's talk about food! I tried a new place during my Whitsun holiday, and I've "had it." It was very nice. The house was a big one, standing about 100 yards back from a main road, and it was superbly decorated. I was at once invited inside, and a neatly written menu card was displayed for my information, accompanied by the question: "Would I have a plain tea, or did I want something more substantial?" The first item on the menu card was "Plain Tea, 2s. 6d." Fortunately, I have a good constitution, and quickly recovered after an attempt to go off into a faint. Believe me, I had no difficulty in making up my mind! That establishment, pleasant though it is, has seen me for the first and last time. A week or two later, in another part of the world, I found myself "up against it." I was definitely hungry, and no tea-place seemed within reach. So into the village shop I went and innocently asked whether there was anywhere in the neighbourhood where tea could be obtained. After a moment's hesitation, the shop-woman "fell for me:" she could let me have a cup of tea. And a cup of tea I had; in fact, several of them, accompanied by white and brown bread and butter (and "butter" is meant), home-made jam, and four cream cakes. Total "damage," 2s. At a restaurant where I had a three-course lunch I asked for an ice-cream in order to wind up the show on a sweet note. I was informed that as I had had three courses, I could not have an ice. That, of course, was a silly interpretation of the law. When I said that I had better have my check and go and pay it, and come in again as a fresh customer, the waitress gave way. Elsewhere—no names, no pack-drill—I was served with a magnificent four-course lunch (plus bread) without the asking. There is "still corn in Egypt"—if you know where to go for it!

The Unpredictable Dog

I LIFT the following news paragraph from a recent morning newspaper: "After a motorist had swerved to avoid a dog at Liverpool yesterday his car skidded and struck a group of children on the pavement. Seven of them were taken to hospital. Two were seriously injured." A later report states that one of the kiddies has since died. This tragedy gives me another opportunity of saying that, under modern road conditions, there is no room on our highways for the uncontrolled and unpredictable dog. As cyclists we may not feel compelled to sympathise with the unfortunate motorist, though I do not see how we can get away from a feeling of regret as to the position into which he was forced. Nor can we avoid an impression that, if a cyclist had hit that erring dog, he might have suffered an unpleasant injury.

From any and every point of view I feel that steps must be taken, and taken very soon, to secure that dogs on the highway are kept under some sort of control. I hate to see our four-legged friends running to and fro in a busy suburban street, perplexed by the rush of traffic and not knowing which way to turn, and I often wish that the people who proclaim their love of dogs would show their affection in a commonsense way; that is, through the medium of control. It seems to me to be a contradiction in terms to say that you are fond of your dog and then to open the door and let him go out for a walk on his own.

My concern in this matter arises, of course, mainly as a cyclist. I dislike the thought of being thrown off my bicyle by an uncontrolled dog, or even of having a narrow squeak from the same cause, and I hope that the day is not far distant when the fact which stares me in the face—the complete unsuitability of the public highway as a playground for dogs—will become evident to those in high places.

Transformation Scene

THERE came into my mind the other evening a small incident in connection with the last tandem bicycle I had built. Some days after the order was placed I went round to the shop where operations were proceeding and inquired as to the position of affairs. It was a shade optimistic on my part. Nevertheless, some measure of satisfaction was forthcoming. "Your tandem?" said the man of the shop. "Why, here it is!" and with that he pulled a large sheet of brown paper across the floor and exposed to my gaze a mass of tubing. It did not look very promising, but, when I paid a second visit about a fortnight later a transformation scene had occurred. Order had been produced out of apparent chaos, and a glossy tandem, complete in every respect, was waiting for me. Having parted with the needful amount of "dough," I took the machine away with me, riding it home "on my own." There were small adjustments to be made, and then, a few days later, that "twicer" was carrying two of us on a most happy tour.

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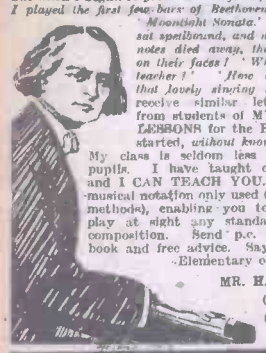
"They Laughed at First

but when I began to play—*a hush fell upon the room, I played the first few bars of Beethoven's immortal 'Moonlight Sonata.' My friends sat spellbound, and when the last notes died away, the excitement on their faces! 'Who was your teacher?' 'How do you get that lovely singing tone?'*" I receive similar letters daily from students of MY POSTAL LESSONS for the PIANO who started, *without knowing a note.* My class is seldom less than 2,000 pupils. I have taught over 75,500 and I CAN TEACH YOU. Ordinary musical notation only used (no freakish methods), enabling you to read and play at sight any standard musical composition. Send p.c. for FREE book and free advice. Say Moderate, Elementary or Beginner.



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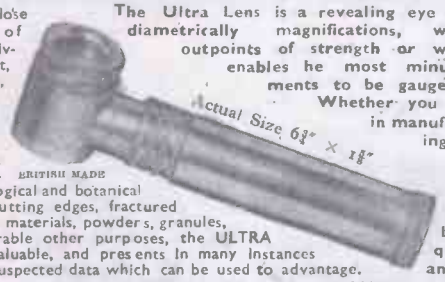

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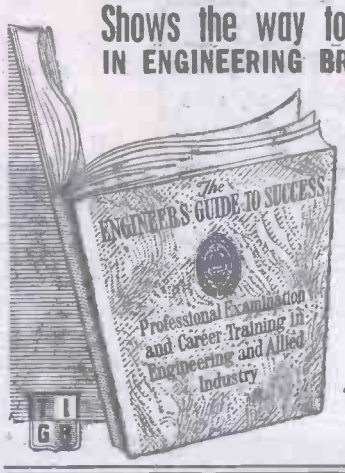

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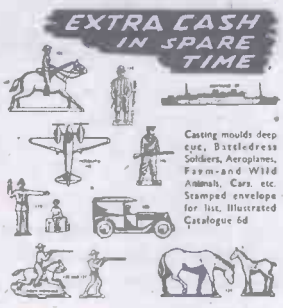

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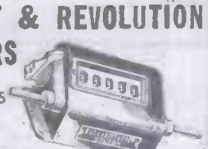

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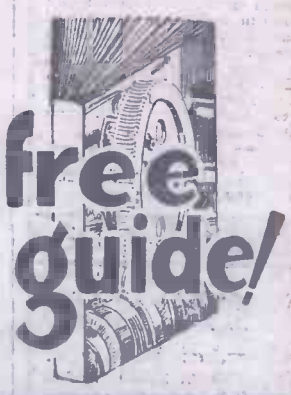

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