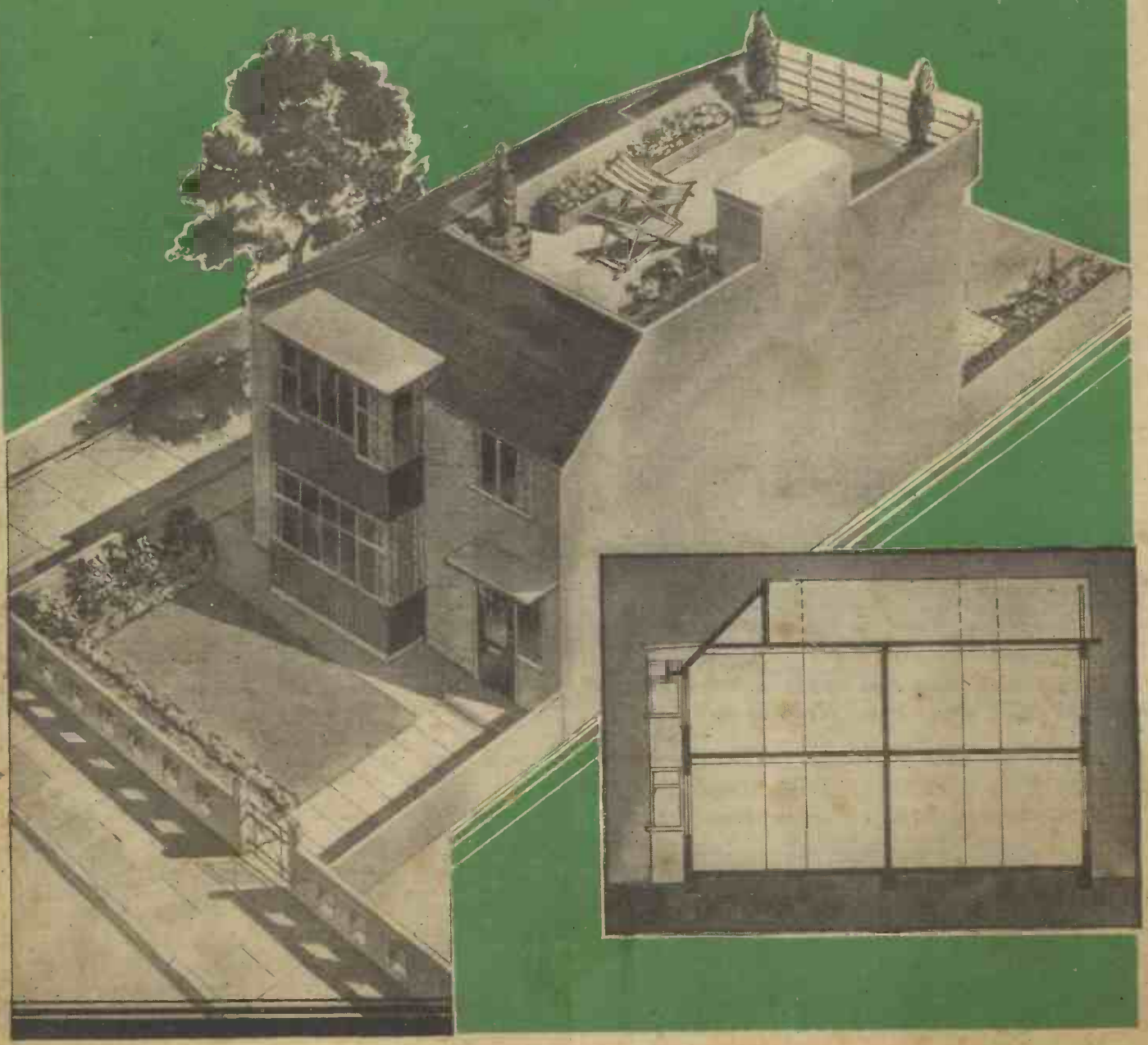
ENGINEER-BUILT HOUSES

NEWNES

PRACTICAL MECHANICS

9D.

FEBRUARY 1943



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

Editor: F. J. CAMM

VOL. X. FEBRUARY, 1943 No. 113

FAIR COMMENT—BY THE EDITOR

Continuation Schools—Should They Continue?

IN previous months I have dealt with the question of the selection of a career according to the ability and natural aptitude of the individual. A great deal is being spoken and written about this subject, for our post-war plans will include schemes for making industry more attractive and work more interesting. Industry should be a way of life, not a tedium to provide the wherewithal for bare existence. The Government supports this point of view.

Some years ago efforts were made to the same end, but they failed. When a boy left school he could attend one of the monotechnics which provided him with theoretical and practical training in the evenings, in the craft which he had selected for his career. It was found, however, that the monotechnics were rather narrow because they did not give instructions in correlative subjects. The Polytechnics followed, and they have been very successful indeed. Unfortunately, there are not enough of them, and so the benefits that they confer are available only to those within easy travelling distance of their work or their homes.

Continuation classes held at local institutes were originated by the Board of Educational Institutions to provide for elementary scholars a means of studying various arts and crafts in the evenings after they had left school, and were engaged in some trade. These classes, specially created as a result of criticism that poor boys were debarred from higher positions because of lack of education, failed for lack of attention. For 2s. 6d. a session first class technical instruction was available, with a fairly stiff examination up to matriculation standard each year. It was found, however, that those who excused their lack of progress on the grounds of poverty did not want to make the effort to acquire the knowledge they lacked. Evening study and homework were necessary. Knowledge cannot be obtained merely by the payment of a fee; it requires effort on the part of the individual. However, as I have said, the classes failed in many districts, for the main cost was borne by the State and advantage was not taken of them.

Post-war Education

I return to the point this month after reading an interesting discussion on the question of whether Continuation Schools should continue. The discussion was considering these schools as an element in post-war education. The discussion took place at the Institute of the Motor Trade between two former teachers in Continuation Schools—Lord Latham, the L.C.C. leader, and Mr. H. L. Kenward, the Dunlop Sales Director. Mr. Kenward argued that after the war a boy ought to be trained for a business career as he is for medicine and law. He objected to education *for* industry, and preferred to deal with education *and* industry.

Education has been described as the process of casting imitation pearl before real swine, and the pearls which are described as business practice are extremely synthetic. Every business has its own practices, every industry has its variety of procedure, and Mr. Kenward thought that there was no such thing as business practice. He thought that children between the ages of 14 and 16 are not in a fit position to absorb any information on the subject of commerce, and that one is hindering their minds by attempting to inculcate it. Education on commercial subjects must be completely divorced from the schools which deal with adolescent education. The preparation for a special kind of life, either professional or commercial, should come after the mind and the body too have been trained and made aware and livened. The first duty is to see that the children of the parents who are serving are given a breadth of education, and are not harmed by this terrible fever of examinations.

Board of Education's Report

The Board of Education is about to produce a report, and one item in it will be an extension of the school leaving age, but little is done to guide the boy into a career for which he is fitted. Education for industry is the affair of industry, and industry must take an active interest in it. The preparation and training for entering a particular trade will be governed and supervised by that trade, in the same way that entry into the professions is controlled and supervised by the professions. As I have so often remarked, this is not a job for the schools. The average headmaster is not capable of picking a career for his pupils. Many a boy's career has been ruined by exaggerated school reports written to please the parents, for a bad report is a reflection upon the schoolmaster and the staff. Many a boy has been misled by the flattery and bad judgment of his teacher.

Industry, therefore, has some right to say what form education should take, and it has a right to demand that there should be an equal educational opportunity for all. The present scholarship system is merely a palliative which pays far too much attention to feats of memory. The relationship between the mind and the hand has been largely overlooked in favour of the book and the pen. Education properly planned should reveal the aptitude and the natural gifts of the individual, for educate means to draw out (Latin, *educare*, to lead out).

We must make ourselves a nation of craftsmen, instead of a nation of shopkeepers.

Mr. Kenward visualised in each county a series of schools. At the age of 15 or 16 there would be a stocktaking of the boy's mental outlook, his abilities and his aptitudes. While Mr. Kenward was against evening classes because he found the students tired after their day's work, Lord Latham stressed the instructional usefulness of evening classes for older students, and pointed out that technical instruction was already being given in our day schools. He maintained that we have done more in this country than any other country in the world in the direction of teaching handicrafts. He did not agree that industry should have its own educational establishments. There should be a closer tie-up between education and industry.

"Mathematical Tables and Formulæ"

A new Vest Pocket Book, entitled "Mathematical Tables and Formulæ for Engineers and Technical Students," has just been published from this office at 3s. 6d., or by post at 3s. 9d. The book contains 137 pages, including a 16-page index. Contents include Standard Mathematical Symbols; Mathematical and General Constants; Approximation; Trigonometry; Calculus; Progression; Permutations and Combinations; Interest, Discount and Annuities; Binomial Theorem; Algebraic Identities; Mensuration; Velocity; Acceleration, Force, Energy and Power; Horse Power; Electrical Units; Electrical Equations; Ohm's Law; Heat, Time and Velocity; Pressure; Equivalent Pressures; Water; Force, Energy and Power; Units and Equivalents; English Weights and Measures; Metric System; Metric Conversion Factors; Metric Equivalents; Metric Conversion of Fractions; Standard Density; Slide Rule Gauge Points; Specific Gravity and Weights; Density of Solids and Liquids; Weights of Various Substances; Weights of Woods; Table of Elements; Properties of Elements; Comparison of Thermometers; Temperature Conversion Table; Values of Single Degrees; Chords and Radians; Table for Converting Minutes into Decimals of a Degree; Natural Sines; Logarithmic Sines; Natural Cosines; Logarithmic Cosines; Natural Tangents; Logarithmic Tangents; Chords of Circles; Powers and Roots; Prime Numbers and Factors; Powers and Roots of π and g; and Decimal Equivalents of Fractions.

Index for Volume 9

The Index for Volume 9 is now ready. It is obtainable from The Publisher, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2, for 9d. post paid.

Engineer-built

The Possibilities and Advantages

By R. V. BOUGHTON, A.I.Struc.E.

Fig. 1.—Typical pre-war houses similar to those which each weigh about 125 tons. Brick built, tiled roof, tiled bathroom and chromium-plated fittings.

ABOUT 125 tons of building materials are used in an ordinary semi-detached, brick-built, tiled house for accommodating about six tons of average quantity of humans and furniture. Six tons is about 5 per cent. of 125 tons, and this weight of various materials has to be handled, loaded, transported by various means, unloaded and handled again and again.

This huge amount consisting of about 20,000 bricks, 4,500 tiles, about 15,000 linear feet of floor and roof timbers, flooring boards, tiling, battens, laths, etc., about 14,000 nails, several tons of cement, many cubic yards of ballast and sand, hundreds of gallons of water, and many other materials and sundry items.

Jerry-building

Just consider for a moment this great quantity of valuable materials left to the tender mercies of jerry-builders to build "well built" modern residences, "architect designed," with chromium-plated fittings, etc., built under cut-throat piecework and sub-contracting conditions, and foisted on a gullible public. It is only fair to say that by no means *all* builders are jerrybuilders.

It is a nasty tale to tell of this canker of jerry-building; but it must be told to protect the public in the great post-war revival of building; and it is highly probable that engineers, and not builders, will protect the public by introducing standardised and pre-built housing and units which will not only revolutionise building but will provide scientifically perfect work, capable of long life and, despite the fears of some, of real artistic merit. And instead of 125 tons of materials we may have only about 40 tons, or at any rate something considerably less than 125 tons; instead of about 20,000 bricks, each of which is capable of absorbing from one half to one pint of water, we shall use much lighter and much less absorbent materials of ample strength. Instead of thousands of little roofing tiles, nailed, or supposed to be nailed, properly to thousands of linear feet of tiling battens or boards fixed with thousands of nails to many hundreds of linear feet of roofing timbers, it appears to be reasonable to suppose it is time for us to wake up and use something different, much better, cheaper, lighter, and free from trouble; and in lieu of many cubic yards or tons of ballast, sand, cement, and thousands of linear feet of laths, many thousands of nails, hundreds of gallons of water, and a considerable volume of sloppy materials, is it not probable that engineers will point the way to more sane methods of construction? Yes, I think it is! Also is it not probable that external joinery work may be of different materials than wood and metal, and may be of concrete and/or plastics of pleasing colours which will not require painting and repainting? And walls and ceilings similarly covered?

Will masses of brickwork be used in fireplace construction? Will we have filthy roof spaces, frozen pipes in winter, hot-water systems which necessitate drawing off a gallon of cold water before the hot water reaches the tap? I believe not.

Vested Interests

Vested interests, which are extremely strong in the building world, will, of course, oppose any revolutionary methods in building which would affect adversely the many millions of pounds of capital invested in the businesses connected with the manufacture of building materials. Such opposition may be countered by the probability that the transitional period of the change-over to the engineer-built houses would coincide with the very considerable amount of work in reconstruction in the post-war decade, such work calling for very great quantities of ordinary materials. Also the engineer-built houses would by no means entirely eliminate the use of such ordinary materials. Labour is another interest which might be affected by the blending of engineering and building operatives. It is my belief that the huge building programme for the post-war one or two decades, will find more than enough work for both engineers and builders, and that a carefully planned scheme of reconstruction will permit the addition of perhaps another half million unskilled and semi-skilled operatives to the pre-war total of about one and a third million engaged in building industries. There appears to be little doubt that the cost, exclusive of land, of an engineer-built pre-built house will be

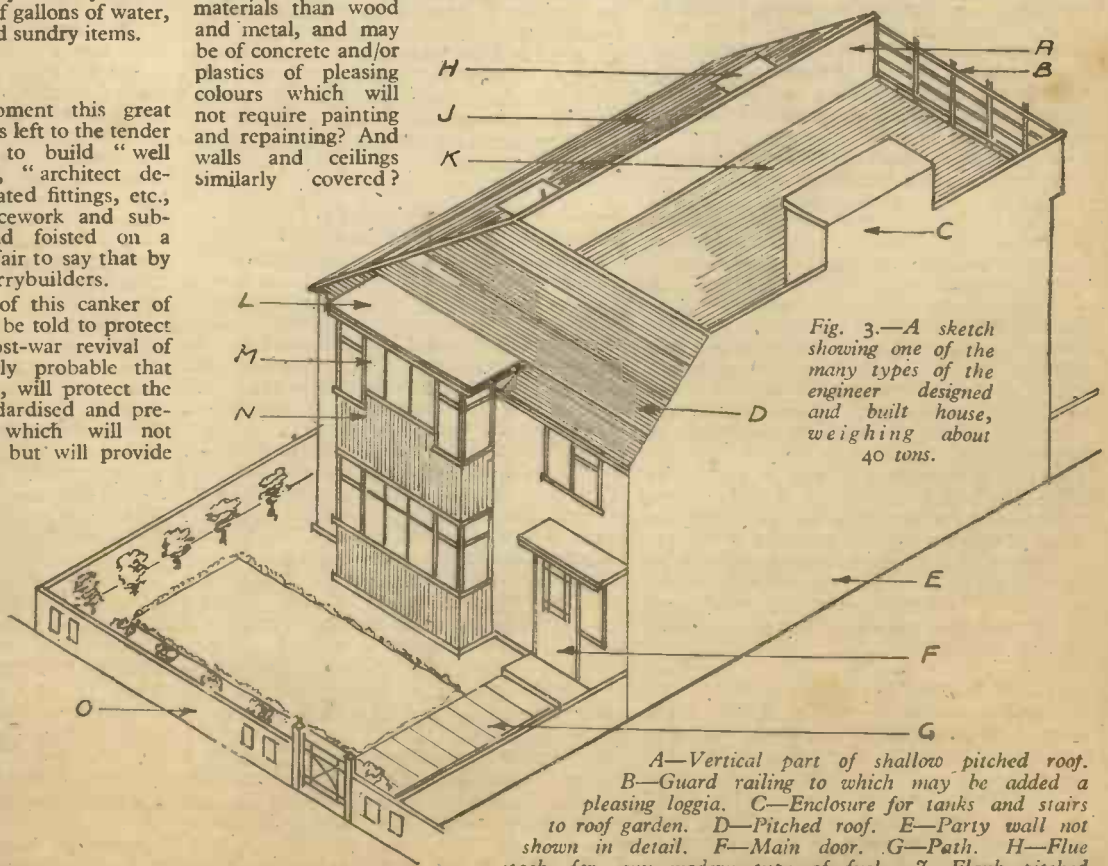


Fig. 3.—A sketch showing one of the many types of the engineer designed and built house, weighing about 40 tons.

A—Vertical part of shallow pitched roof. B—Guard railing to which may be added a pleasing loggia. C—Enclosure for tanks and stairs to roof garden. D—Pitched roof. E—Party wall not shown in detail. F—Main door. G—Path. H—Flue stack for any modern type of fuel. J—Flank pitched roof. K—Flat roof used as roof garden. L—Flat roof over bay. M—First-storey window of modern design. N—Bay. O—Fence.

Houses of the Future

of Pre-building

only about two-thirds that of its brick-built brother.

The builders of houses will moan; but I respectfully suggest that jerry-building—the cancer of an honourable craft—will make the moan well deserved.

The professional elements, such as architects, are already preaching the doctrine of æsthetic spoliation of our countryside by the erection of pre-built houses. In this respect I will voice one opinion of some of the great thinkers of the building professions and industries. It is: "What did the professional elements do to prevent the erection of many millions of jerry-built houses in the period between the Great War and the present war?" They did practically nothing.

Advantages of "Engineer Houses"

The public, trained as they are to enjoy the "beauties" of what they are taught they should enjoy, would very soon realise and appreciate the great advantages of houses built under a code of practice and principles which would ensure the minimum expenses in upkeep and repairs, and houses which, to the ordinary onlooker and man in the street, would look not much different from the ordinary type of house. And, when it is found that "engineer houses" are well designed architecturally, in planning and in elevation, are free of the many hitherto curses, and cost so much less initially that the saving in rent or repayments will at least equal the Beveridge contribution, it is very difficult to refrain from suggesting that a practical Utopia would have spirited itself into the house-building world.

The illustration, Fig. 1, depicts a good type of pre-war modern house. To avoid any chance of an action for libel against me, I have *not* chosen typical jerry-built houses, but some which were built by an old company of which I was a director, and actually these houses were designed by a good architect. Fig. 2 is an approximate section of the house which is similar to those which weigh about 125 tons. The annotations should be studied carefully so as to allow an understanding of the main principles of ordinary house construction, which causes their great weight of materials and the imposition of them on the foundations and ground. Figs. 3 and 4 show only a few of the many possibilities in design and general construction of engineer houses. Many standard types and sizes of wall, floor and roof units would make it an easy matter to provide houses to suit practically every requirement in planning, size of rooms and architectural treatment. If the section, Fig. 5, is compared with that of the ordinary house, Fig. 2, it will at once be seen that the whole structure of the engineer house is exceptionally light; there is no top-heavy roof construction, but instead a combination of flat and pitched roof construction—or it may be entirely flat if desired—and the roof may be used as garden with loggia and many other pleasing amenities.

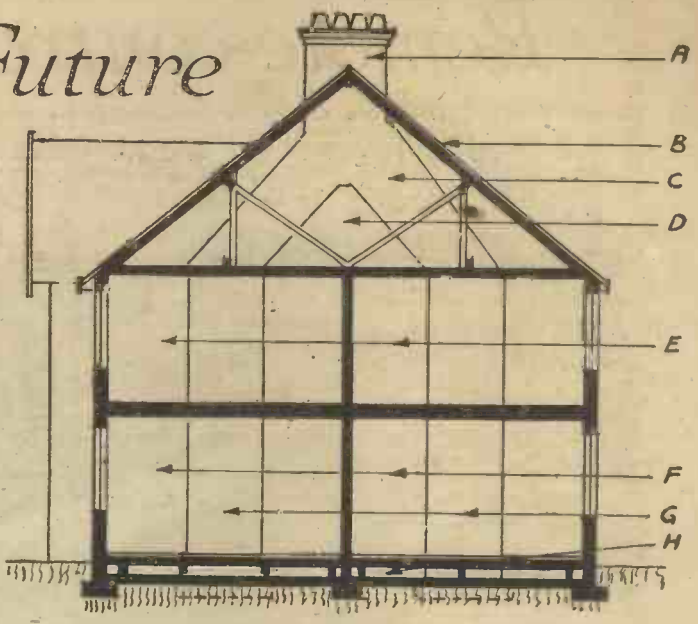


Fig. 2.—Section through the 125-ton house.

A—Heavy chimney stack. B—Roofing of thousands of little tiles on thousands of linear feet of wood battens nailed with thousands of nails to hundreds of linear feet of timber rafters. C—Masses of brickwork in ordinary flue construction. D—The useless, dirty, cold-in-winter roof space of considerable cubical extent. E—First-storey rooms. F—Ground-storey rooms. G—Heavy masses of brickwork in fireplaces, etc. H—The ordinary type of floor with surface concrete, sleeper walls, plates, joists and flooring; all timber work subject to dry rot if not constructed properly.

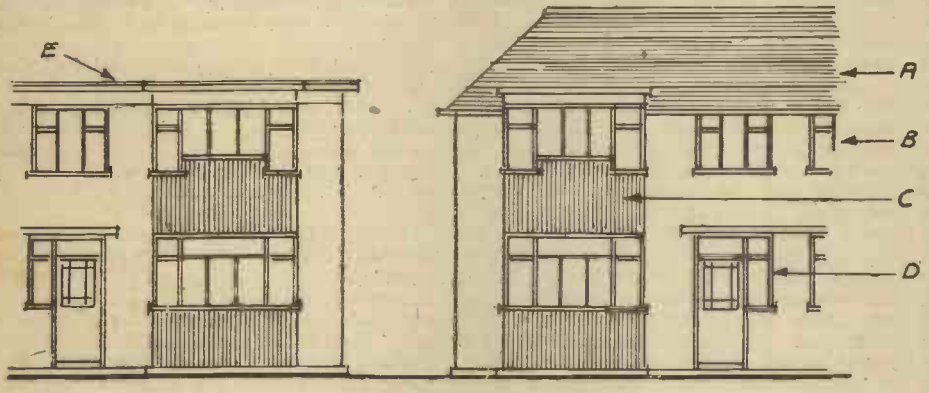


Fig. 4.—Two elevations of engineer designed and built houses with flat and combined flat and pitched roofs.

A—Pitched roof part of combined flat and pitched roof. B—Windows. C—Bay. D—Main door. E—Flat roof.

Thinner Walls and Floors

Future articles of this series will explain designing, constructive, equipment and decorative subjects connected with the types of houses which are advocated so strongly. At this stage it is wise to state it is a fallacy to think that walls require to be of great thickness to provide adequate strength and insulation against temperatures and sound; it is unnecessary to make floors of the hitherto thickness of about 10 or 11ins.; in fact, it will be understood that there are a very great number of items in the construction of the ordinary brick-built, tiled-roof house which can be eliminated most advantageously; and the engineer house would contain so many items which come under the category of furnishing equipment—all to please the housewife because of their simplicity, good design and utilitarian value—that furnishing costs would be reduced.

Finally, in connection with this preliminary survey of the great advantages of engineer houses, it can be said without hesitation that they could be erected at great speed, without the use of much water or damp-causing materials, and made habitable within a limited number of days of commencement of operations. There would be no awkward handling of the units, because quickly erected, easily movable, and speedily dismantled portable and transported machinery would replace the scaffolding, plant and machinery now used.

(To be continued.)

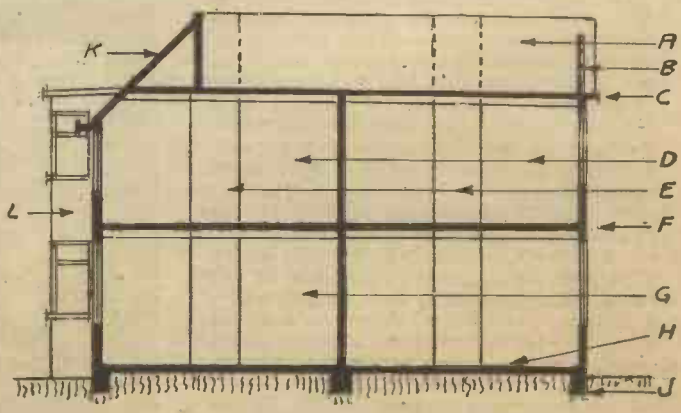


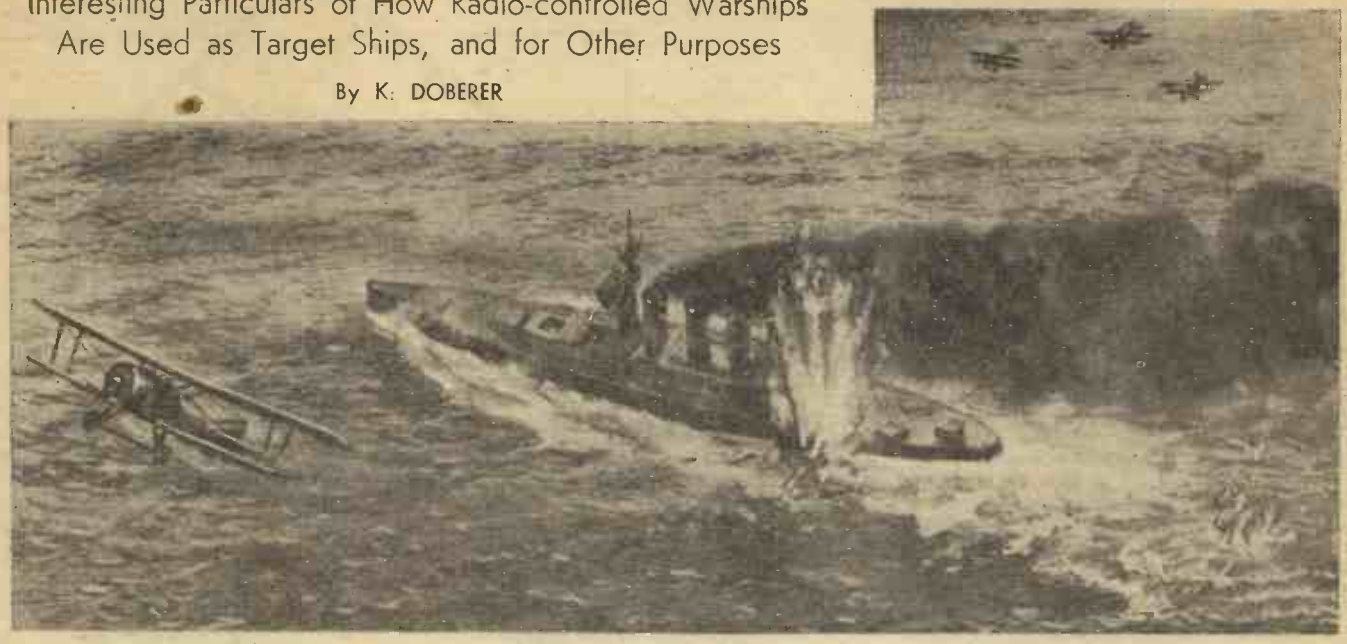
Fig. 5.—Section through the 40-ton engineer designed and built house, showing in outline the strong but light pre-built units of walls, floors and roof.

A—Vertical part of shallow pitched roof. B—Guard railing. C—The flat roof used as roof garden. D—First-storey rooms. E—Light fireplace and flue construction. F—First floor. G—Ground-storey rooms. H—Ground floor. J—Small foundation base due to light weight of building. K—Front pitched roof. L—Bay.

Remote-controlled Warships

Interesting Particulars of How Radio-controlled Warships Are Used as Target Ships, and for Other Purposes

By K. DOBERER



Radio-controlled target ship being bombed by aircraft.

AFTER the Great War of 1914–18 the American Navy were the first to employ the system of remote control for large warships. At that time the U.S. Navy and Air Force used several obsolete warships for target practice on the high sea. As the naval bombardment and the bomber attack on ships lying motionless differs too much from actual war conditions, when the enemy ships are travelling at full speed, it was decided to equip one of the ships with a remote control installation. By these means warlike conditions were created, but, at the same time, all danger to the crew was avoided.

The antiquated battleship *Iowa* was fitted with an automatic oil fuel plant, and with remote control apparatus. Its manœuvring ability was so excellent that gunners and bomb-aimers now saw themselves faced by a battleship able to avoid being hit by clever cruising and turning. To avoid the valuable target vessel being sunk immediately by hits it had been filled with cork. Eight years later the *Iowa* was replaced by an even larger ship, the obsolete dreadnought *North Dakota*. In rapid succession, the wireless-navigated battleship *Utah* and the three remote-controlled destroyers *Boggs*, *Kilty* and *Stoddert* were added to the dreadnought.

In the year 1924 Great Britain followed in America's footsteps by building remote-controlled target ships. The first vessel equipped with remote control was the battleship *Agamemnon*. The radio operating centre for the *Agamemnon* was installed on a destroyer. By wireless command from this destroyer the unmanned *Agamemnon* was able to elude the attackers at a speed of 19 miles per hour.

Included in the target practice of the *Agamemnon* was a very characteristic test, which is worth recording. Forty-eight bombs were dropped on the ship, travelling at full speed amidst extremely heavy winds and a rough sea. Forty-five of these bombs scored hits. The nearly unbelievable success of this experiment shows how peace-time manœuvres, thought to be made under difficult conditions, can get results very far from reality. In this case it is obvious that a decisive factor in warship bombing, the multiple anti-aircraft gun, was not taken into account. The ability to outmanœuvre the air defence of a battleship to-day surely takes more of the skill of a pilot than the task to place a bomb exactly on an undefended ship.

Not by such conclusions, but in some other way, British naval experts had been convinced by a series of bombing experiments that a modern super-dreadnought does not run great risk at the hands of attacking 'planes.

In this case, the experiments were carried out by the dreadnought *Centurion*, a ship of 27,000 tons, for which a new battleship, the *Rodney*, was commissioned. The definite tests with the *Centurion* took place after it was rebuilt and fitted with a remote-control equipment, and an automatic oil fuel plant. Acting on instructions, warplanes dropped heavy bombs on the unmanned *Centurion*. It was ascertained that even a heavy bomb, after hitting the upper deck of the ship, did astonishingly little damage.

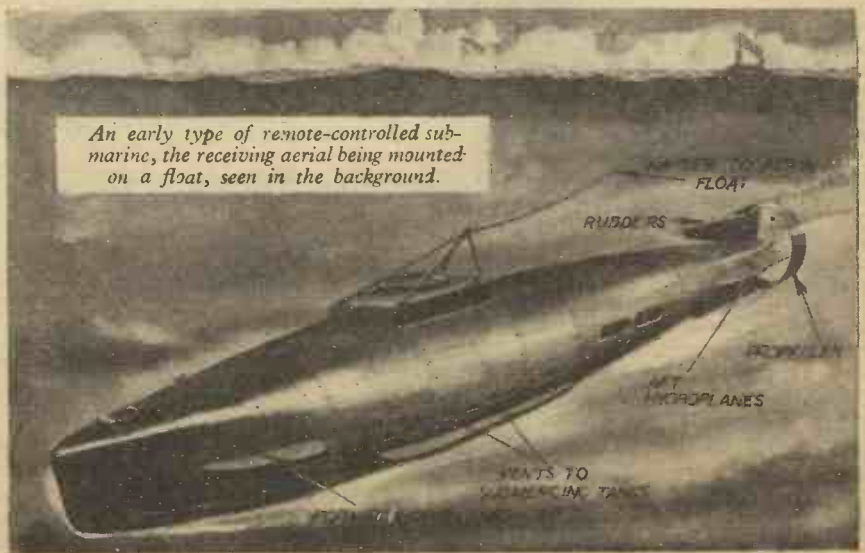
In this connection Admiral de Giamberardino may be quoted, because he arrived at the same conclusion as the British commission for the examination of the vulnerability of super-battleships through aeroplane attack. In the concluding remarks of his controversy with General Crocco, Admiral de Giamberardino said:

"If we do not become acquainted with new rays by new physical discoveries, rays able to . . . melt metals and detonate explosives a long way off, then it really appears to be probable to-day, under the present conditions, that the battleship will again maintain its way as the most powerful weapon for a long time to come."

It seems to me, however, that not wireless long-distance blasting or the effects of the Death Ray, as Admiral de Giamberardino suggests, may have a decisive influence, especially on the development of the battleship. But, as the events of this war suggest, perhaps the crewless unperturbable dive-bomber may become a danger to the big ships.

Cork and Powder

Besides America and England, other countries have also collected the data concerning their experiences with remote-controlled warships. For instance, Italy also equipped a warship with wireless control, based on certain



An early type of remote-controlled submarine, the receiving aerial being mounted on a float, seen in the background.

earlier Italian experiences. They also had a special experimental ship for remote control investigations.

A remote-controlled ship about which many details are known was the German target ship *Zaehringen*. In 1926, the German Parliament granted the means for making the necessary alterations to convert the old iron-clad into one of the most modern remote-controlled ships. Already, in the summer months of 1926, the *Zaehringen* was able to leave port for the first high sea artillery practice. She was fitted with an automatic boiler plant. The engines had a capacity of 50,000 h.p., sufficient for a target ship of 11,800 tons.

This wireless-controlled ship was able to execute manœuvres of several hours' duration at a speed of eight miles per hour. It was able to carry out more than a hundred various commands, and it received these by wireless from the controlling ship *Blitz*. Apart from all other navigation commands, it could throw out a smoke-screen, and use searchlights as well as give rocket signals. If a break-down on the operating ship *Blitz*, or on the remote-controlled ship itself, temporarily prevented the transmission and execution of orders, the remote-control mechanism cut off the oil-firing under the boilers, and the steam supply to the engines. The remote-controlled ship then stopped automatically.

Bombs from war 'planes and shells from ships could not damage the *Zaehringen* seriously, even when full hits were scored. The engine rooms were protected by specially heavy armour plates. These armour plates could have been much heavier than those selected for a battleship, as they were only placed over the engine room, as the *Zaehringen* lacked the heavy armament with ship's guns. It was not before 1934 that the *Zaehringen* was armed with a number of mortars, so as to be able to optically adapt all manœuvres to actual warfare. When the feigned action commenced, these guns were discharged by the operating centre aboard the *Blitz*, so as to give the gunners of the practising attacking fleet the optical and acoustic impression of an enemy replying to the fire—the clouds of smoke, the flashes of the guns in action, and the thunder of the detonation adding to this effect. In spite of all this, there can be no doubt that the whole noise, especially those manœuvres connected with the dropping of bombs, cannot be treated too seriously, as we have to forgo the psychologically so important iron answer of the opponent's guns. Especially in Great Britain it was always taken into consideration that, merely from the psychological point of view, the intense fire of a good anti-aircraft artillery greatly diminishes the accuracy of the attacking bombers. And this has to be dealt with quite independently from the point of view that one hit from a gun can always prevent also materially the proper bomb-throwing by damaging the bomber.

In comparing the wireless-controlled target battleships with armoured battleships, it does not seem to have been taken into account sufficiently that the armoured battleships not only are not buoyed up by cork—the target ship, for instance, the *Zaehringen*, has 350 railway trucks full of cork deposited in her bowels—but are filled with explosives. In modern battleships, ammunition is not only stacked in the so well protected ammunition chamber, but it is constantly being transported to the gun turrets on deck. The sinking of the battleship *Espana* in 1937 gave us an indication how such explosions spread to the chambers by way of the hydraulic ammunition lifts, and by other means.

Wireless-controlled Block Ships

It would be a mistake to assume that the tasks of these target-ships terminate with the outbreak of war. They must, on the contrary, from that day onwards rank as ships for special employment among the naval forces on duty. Their indestructibility, attributable to the load of cork, qualifies them for other tasks for which neither the vessels nor the crews of ordinary ships would be risked. By the use of its own smoke-screen plant, the remote-controlled ship is able to produce a misty veil, impenetrable for observation, in front of the fleet, and within the firing zone of the enemy guns during a naval engagement.

In its capacity as leader of the smaller units approaching in line, it can break through mine fields. Even if it is torn open by the mines, the cork-filled body of the ship can withstand the inrushing volume of water long enough to keep a lane open for the ships in her wake to navigate through the dangerous field.

Loaded with concrete, stones and explosives—instead of the usual cargo of cork—the remotely controlled ship can be directed to the entrance of the enemy's harbour, and can there be sunk or exploded by remote command. Ramming, blocking, and blowing up these obstacles are the war-time tasks for remote-controlled ships. But besides this, remote control will play a part in naval warfare in connection with a new type of warship.

Remote-controlled block ship, laden with explosives, destroying dock installations.

Aircraft Carriers

Aircraft carriers, constructed to make them as safe as possible against sinking, can be sent very far into the danger zone of the enemy. At the decisive moment, the aeroplanes take off and the unmanned aircraft carrier can be withdrawn from the zone of action by the operating vessel steaming behind the battle zone.

For these tactics, giant aircraft carriers as the *Ark Royal* and the *Lexington* are, of course, unsuitable. The special type adaptable to this purpose are the air-base ships built by the Germans in a Kiel dockyard. These craft have a displacement up to 2,000 tons with only one machine plant, consisting of two Diesel engines of 900 horse-power each. The idea is to use these ships as far advanced take-off places in case of a naval attack by an enemy, and to so ensure a favourable and late start for their own aeroplanes.

Electrical Equipment for Aircraft

Details of Electrically-operated Systems and Accessories Used on Modern Aeroplanes

THE use of electrical power to operate the various systems installed in aircraft is now an established fact, and as more efficient equipment is designed it is probable that hydraulic and pneumatic power will not be used in future aircraft. The general practice is to use a 12 or 24-volt D.C. system, although A.C. current has been used in America. Accessories and systems which may be operated electrically include undercarriage retraction, wheel brakes, de-icing, armament, bomb doors, flaps, V.P. airscrews, etc.

A generator, usually mounted on and driven by the aircraft's main power unit, charges the batteries which supply current to operate the various electric motors, lighting systems, landing lamps or the navigation lights. Fig. 1

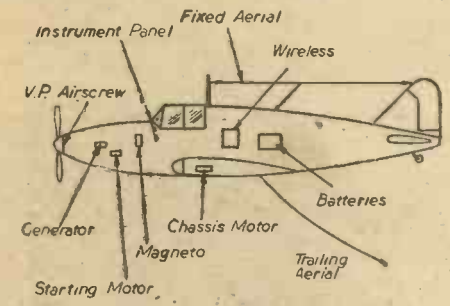


Fig. 1.—Main items of electrical equipment on a modern aeroplane.

indicates the positions of the main items of equipment, although it should be noted that their actual positions vary on different types of aircraft.

Landing Lamps

The landing lamps may be mounted in the leading edge of the wing, e.g., the Fairey Battle, or may be of the retractable type which are normally housed in the wing's undersurface, and are swung downwards when required (see Fig. 2). A certain amount of axial movement under the control of the pilot is generally arranged for in the design. The bulbs used are of a special type as they incorporate two filaments. One is used when an intense light is required for actual landings and take-offs, and the other is utilised for taxiing along the tarmac. The main filament is only used for the minimum possible time to prevent overheating. Three cables run to the landing lamp, one to each filament, and one common return. A special switch is installed in the pilot's cockpit to prevent both filaments being switched on at the same time: 250-watt bulbs are commonly used. The direction of the beam of light projected by the landing lamp is parallel to the centre line of the aircraft and the actual lamp is placed as far outward from the fuselage as possible.

The navigation lights are fitted in both wing tips and also at the rear end of the fuselage as shown in Fig. 3. The angles and colours indicated are laid down in the air navigation rules, and the lights must be switched on between sunset and sunrise.

Identification lamps take the form of fixed bulbs mounted on the upper and lower surfaces of the fuselage or alternatively a hand-lamp is carried which may be plugged in at various positions. A morse key is fitted to enable messages or identification codes to be transmitted to the ground staff or, in the case of military aircraft, to anti-aircraft units.

The lighting of the pilot's instrument panel and cockpit presents some difficulties as there must not be any tendency to dazzle the pilot. This is extremely important when the aircraft is landing. Small adjustable hooded lamps which may be dimmed are used. Alternatively, bulbs are positioned in the actual instruments. Due to the possibility of fusing, the lighting is generally wired in several parts, so that if one section fails, the remainder will supply enough illumination for the pilot to carry out his duties.

Electrically-operated Instruments

Several instruments are operated electrically and these include fuel contents gauges, engine revolution indicators, and undercarriage position indicators. The contents gauge records the amount of fuel in the supply tanks and operates as follows. A float rises and falls with varying levels of the fluid and this movement is transmitted electrically to a gauge in the pilot's cockpit.

The engine revolutions indicator takes the form of a miniature A.C. generator and the voltage developed naturally varies with the speed of rotation of the engine. The dial on the instrument panel registers in r.p.m. instead of volts.

The undercarriage position indicator informs the pilot whether or not the undercarriage is safely up or down. Controls and switches are arranged so that movement of the chassis connects or breaks various electrical circuits which are connected to coloured bulbs in the indicating instrument.

An important use of electricity in military aircraft is the heating of the crew's clothing. When flying at great heights the temperature is considerably reduced, and this affects the aircrew's efficiency. Their flying suits are lined with resistance wires which, when connected to the heating plugs, maintain the occupants at an even temperature. Gloves, arms and legs are connected so that any or all the various parts may be heated as required. The goggles may also incorporate fine heating

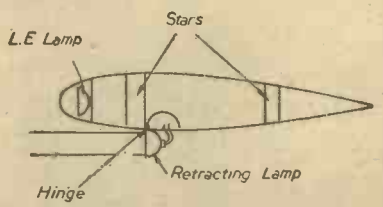


Fig. 2.—Showing the position of retractable landing lamps.

wires running across the eyepieces to prevent misting. A small switchboard is installed in the cockpit labelled body, feet, hands; each switch enables one part of the clothing to be heated.

Electricity is also used to heat the armament, as in low temperatures the oil which is used to lubricate the operating mechanism tends to congeal, and therefore render the guns useless.

The pitot head may also be heated by means of an electric coil and by adopting this precaution ice accumulation is avoided. As this instrument, when connected to the recording apparatus in the pilot's cockpit, indicates the airspeed of the aircraft, it will be seen that it is extremely important that it should be kept working under all conditions of flight.

On many modern oil systems an electrical immersion heater is incorporated in the oil tank to facilitate starting in low temperatures.

Wiring Cables

The actual wiring of an aeroplane requires extreme care and there are several important details that should be noted. No joints in the cables are allowed, and a terminal block must be fitted at each break in the run. It is usual to leave a coil of wire at the block so that if the wire is shortened at any time the whole length need not be scrapped. Cleats made of fibre or other insulating material are fitted at frequent intervals to support the cables. It is extremely important that cables carrying heavy currents should not be run near any magnetic compasses. If this is not adhered to, incorrect reading will be the result. Small diameter cables are frequently twisted round each other to avoid this induction trouble by cancelling out the electro-magnetic fields.

The cables used in the aircraft industry have been standardised by the Air Ministry, so that ordering and replacement is as easy as possible. Two examples illustrating the above are: "Triflat," i.e., a cable with three cores laid side by side; "Uniflex 4," i.e., a cable with one core capable of taking four amperes. To facilitate recognition of the various circuits it is usual to have each system coloured differently, e.g., ignition cables are blue. A further help is the variation in the colouring of the cores, the positive being red and the negative blue. Other colours are available when more than two cores are used.

Bonding

It is necessary that aircraft, both military and civil, should be bonded and screened. Bonding is the connecting together of all the metal parts of the aircraft to ensure that the whole system is at the same electrical potential. By carefully carrying out the bonding, the risk of fire caused by electrostatic charges is reduced. Screening is the reduction of the effect caused by induced magnetic fields by surrounding the offending details with a metal screen.

A typical example in bonding is illustrated in Fig. 4, in which a thin strip of metal gauze connects the airframe structure to the pipes. Short-wave wireless sets are seriously affected if the bonding is not efficient.

As the ignition system produces high-voltage sparks, it must be screened if good radio reception is required. The screening is carried out as follows: H.T. and L.T. cables are completely enclosed in a metal sheath which acts as a condenser. The disadvantage of this method is the load that it introduces in the magneto. Sparking plugs and magnetos are screened with metal tubes or plates. When the plugs are thus screened they are referred to as integrally screened sparking plugs.

Radio Equipment

Wireless is installed in the majority of present-day aircraft, except for the light trainer and sporting types. Military machines

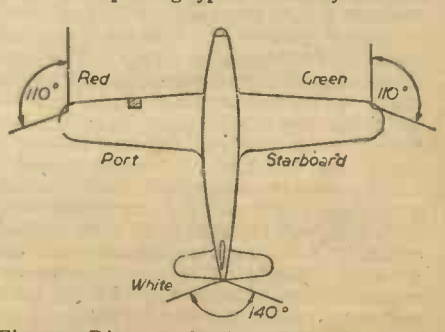


Fig. 3.—Diagram showing the positions and colours of the navigation lights.

often have several sets fitted for various duties. The actual transmitting and receiving apparatus is generally fitted into any convenient space and operated by means of flexible controls or electro-magnetic relays. Rubber mountings are used to absorb vibration. Microphones, in the case of military aircraft, are fitted into the oxygen mask, thus leaving the operator's hands free. A typical transmitter and receiver covers a wave range of 110 to 75 metres, with an average range of 50 miles. The power supply is often independent of the main supply system.

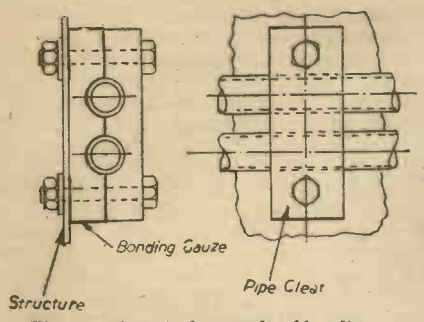


Fig. 4.—A typical example of bonding.

Two kinds of aerial are used, either the fixed or the trailing type. Fixed aerials extend from the wing tips to the tail unit, or run above the top of the fuselage. This type is naturally limited in length. Trailing aerials are wound on a drum and let down in flight, through a chute in the floor, by means of a small hand winch. Military fighter aircraft do not have trailing aerials due to the fact that this type of machine is often flown upside down. The aerial masts are constructed of a steel tube, streamlined in shape. A spring or a length of elastic cord is incorporated in the fixed type of aerial to ensure tautness.

Blind Approach System

Many modern aircraft, especially of the long range transport or bomber type, are fitted with a blind approach system which enables safe landings to be made in darkness or fog. The method of operation is as follows. Marker transmitter beacons are positioned on the ground, the first one being approximately two miles from the aerodrome, and the second being placed on the actual aerodrome boundary. A main beam transmitter giving directional bearings is also employed. The aircraft, when it comes within range of the main beacon, is notified in the following manner.

The signals are received by means of a short vertical aerial which is usually made retractable. If the aircraft is flying to the right of the correct line of approach as indicated by the beacon, a series of dashes is heard by the pilot and when flying to the left, a series of dots. Visual indication is also given by a needle which moves either to the left or right as the case may be. When the correct line of approach is being followed the dots and dashes combine into one steady continuous note and the needle remains in a vertical position. Immediately on passing the outer marker beacon a lamp is illuminated on the indicator mounted on the pilot's dashboard and a series of dashes, different in length from those previously mentioned, is heard. This warns the pilot that he will reach the aerodrome in approximately a minute. Another lamp is illuminated after passing the inner marker and the sound alters to a series of dots. When these dots are heard the aircraft may be landed in the normal manner. For the reception of the marker beacons' transmissions a dipole aerial is mounted horizontally in the aircraft.

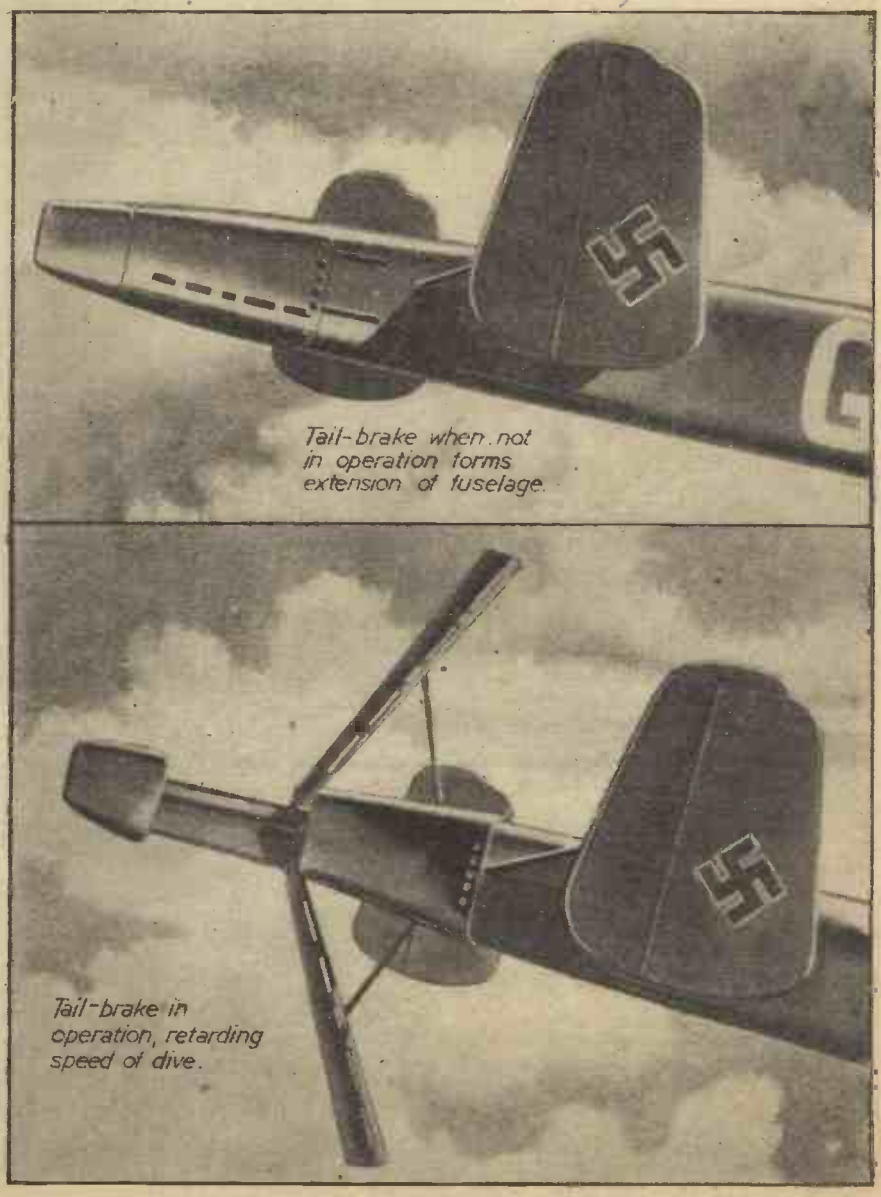
Batteries

The batteries used in aircraft may be either the acid or alkaline types. The lead acid battery is similar to those used on motor vehicles, except that unspillable vents are incorporated when the aircraft is of the aerobatic type. Alkaline batteries use nickel-iron or nickel-cadmium plates with potassium hydroxide solution as the electrolyte. The lead acid battery is, generally speaking, lighter in weight, but the alkaline battery has a longer life. The main drain on aircraft batteries is generally due to the starting equipment which requires a current of from 100 to 200 amperes. The load during normal flight may be 200 watts, but this figure, if the undercarriage is operated electrically, probably rises to as high as 500 watts when the aircraft is about to land. Small batteries for the wireless valves are also carried.

The generator is usually engine driven, although wind-driven types are still utilised. Four field poles and armatures containing at least 12 coils are usual in aircraft generators. The larger types require cooling and a duct is usually arranged in the engine cowling to direct a cool stream of air over the generator. A voltage regulator is fitted to maintain a constant E.M.F. at varying revolutions owing to the fact that the rate of rotation varies as the engine is throttled up or down.

From the above description of the main electrical items that may be fitted in various types of aircraft it will be seen that the maintenance of the different systems is extremely important. Ground engineers who specialise in electrical maintenance usually possess an Air Ministry Ground Engineers X Licence to certify that they are competent to perform the various duties.

"Do. 217E" Bomber Tail-brake



Several German dive-bombers have been fitted with an ingenious braking arrangement, and our illustrations show the brake folded up for ordinary flight, and extended for use during a dive.

Desert Repair Shops

THE illustrations on this page, which are of special interest at the present time, show the various activities in workshops of an Eighth Army Armoured Division in the Western Desert. Among the craftsmen whose job it is to return vehicles and equipment to the fighting line in the shortest possible time are fitters, blacksmiths, turners, welders, armourers, instrument makers, radio engineers, electricians, carpenters, etc. Their workshops are fitted with the most up-to-date machinery, spare parts and repair equipment of every kind. Should a spare part be unavailable, however, much ingenuity is shown in improvising one.

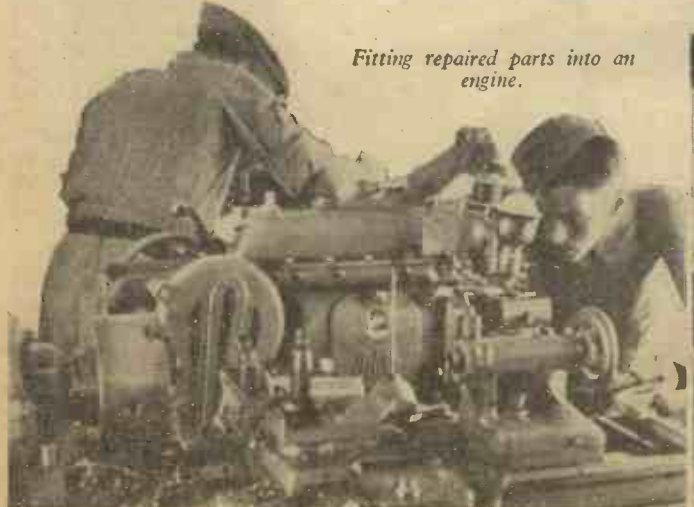
A new engine is hoisted up and lowered into a General Stewart tank.

A turner at work on a modern lathe in the workshops.

Preparations being made to haul the disabled tank on to a transporter.

A mobile instrument workshop, where optical instruments of all kinds are repaired.

The blacksmith's shop is hard at work all day. Added to the heat of the desert, the men have to put up with the heat of their furnaces.



Fitting repaired parts into an engine.

The Operation of Dynamos

Voltage and Current Problems Explained

By I. L. WATTS, A.M.I.E.E.

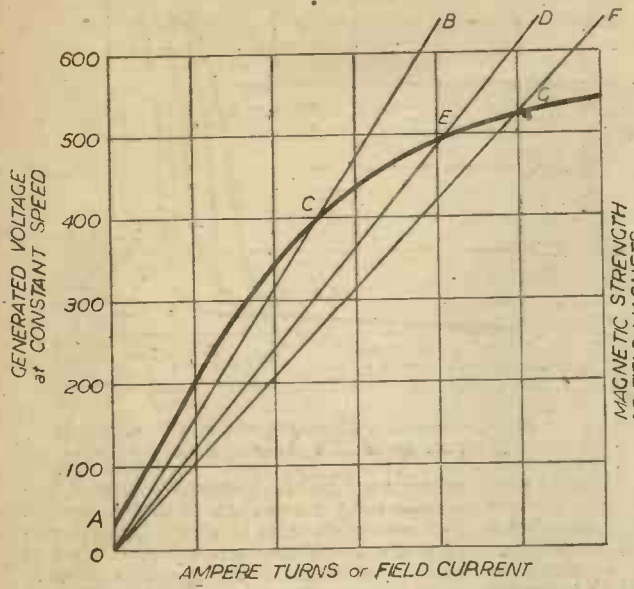


Fig. 1.—Magnetisation curve of a shunt dynamo.

THE voltage generated in a given dynamo is proportional to the rate at which the armature conductors cut across the magnetic lines of force passing between the poles of the field magnets. The voltage is therefore proportional to the speed of rotation and the magnetic field strength. It is useful to consider the way in which the magnetic field strength varies with the field current; this is indicated by the curve ACEG in Fig. 1. The magnetising force is usually measured in ampere-turns, i.e., the product of the field current in amps and the number of turns of wire in the field coils. On a shunt dynamo which has the field windings connected across the armature, the curve, therefore, shows how the dynamo voltage varies with the field current, when the dynamo is run at a constant speed on no load.

It will be noted that a small voltage OA is generated when no field current passes. This is due to the residual magnetism retained in the field magnets. The curve of magnetic flux, or voltage, tends to flatten out near the normal field current value, which may correspond to a point such as G, due to the iron becoming somewhat saturated with magnetism.

When the dynamo is started up the small voltage OA causes a little current to flow through the field windings. This field current increases the magnetic field strength so that the generated voltage and field current increase and in this way the voltage builds up to normal voltage; this may occur within a few seconds of starting up. The current passed through the shunt field windings is proportional to the voltage and inversely proportional to the resistance of the field circuit. With a constant field resistance a line such as OF may be drawn to show the field current passed at any voltage. The point G shows the maximum voltage to which the dynamo would build up with that particular field circuit resistance, since above that point a greater field current is required to give a particular voltage than would actually be passed at that voltage.

The resistance of the field windings increases as the windings become warm owing to prolonged operation, the resistance of copper increasing by 0.428 per cent. of its value at 15 deg. C. for each degree Centigrade rise of temperature. A line such as OD may then give the field current at any voltage when the field coils are hot and their resistance high. The reduced field current passing will cause the dynamo voltage to drop to just under 500 volts as shown by the point E. Generally, an extra variable resistance, in the form of a voltage regulator, is connected in the shunt field circuit, and some of this resistance can then be cut out to compensate for the increased resistance of the warm shunt field coils.

Effect of Load Current

As the dynamo supplies current to a load circuit the passage of current through the armature sets up a magnetic field through the armature, the strength of which is proportional to the armature current. This magnetic field acts along the neutral axis, that is to say, when the brushes are in the neutral axis (usually in line with the centre of the poles) the armature field acts at right angles to the main field created by the magnet poles. With the brushes in this position the armature field tends to strengthen the main field at the leading pole tips and to weaken it at the lagging pole tips.

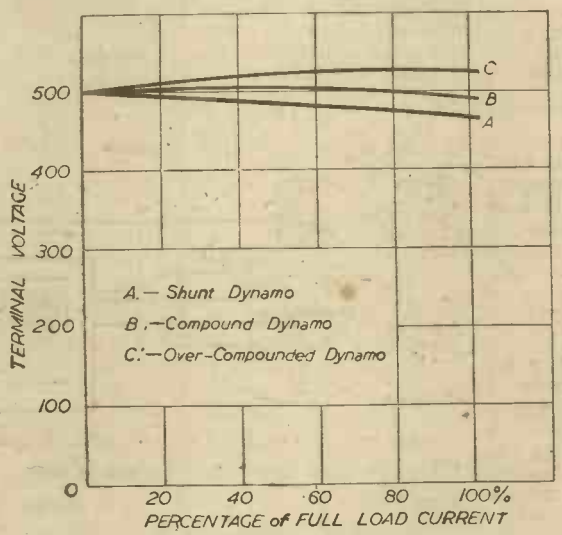


Fig. 2—Load curves of dynamos.

On a dynamo which has no interpoles, however, it is usually necessary to advance the brushes slightly in the direction of rotation to eliminate sparking at the brushes on load. Theoretically the brushes of such a machine should be advanced by an amount which is proportional to the load current, but in practice it is usual to compromise and set the brushes in a position which gives the best average results for the varying load. The effect of advancing the brushes from neutral is that the armature field then tends to oppose and weaken the main field of the dynamo. This naturally reduces the dynamo voltage with increase of load current. To avoid the necessity of moving the brushes from the neutral position, wound interpoles are often fitted between the main poles, these windings being of heavy gauge and connected in series with the armature so that their strength is proportional to the load current. The function of these coils is to eliminate sparking at the brushes and each interpole should have the same magnetic polarity as the next main pole forward in the direction of rotation.

In addition to reduction of generated voltage directly due to the armature field when the brushes are not in the neutral position, it will be appreciated that the shunt field current will also fall and cause further reduction of main field strength and generated voltage. There will also be a drop in voltage across the armature on load, owing to the resistance of the armature windings, and this will reduce the terminal voltage of a shunt dynamo on load. This effect is indicated by the curve A, in Fig. 2.

Any fall of dynamo voltage has a cumulative effect, by reducing the shunt field current, this being especially the case if the field system is unsaturated as shown by the portion of the magnetisation curve A to C in Fig. 1. At the point G, where the curve starts to flatten out, a given reduction of field current has less effect on the magnetic strength and voltage. Saturation of the iron is, therefore, advisable to render the dynamo stable. A machine which works on the unsaturated part of the curve can be rendered more stable by reducing the cross-sectional area of the iron liners fitted behind the poles.

Compound Windings

The drop of voltage occurring with increased load on a shunt dynamo may necessitate frequent adjustment of the regulator in order to maintain the desired voltage. For most variable load supplies, therefore, a compound dynamo is used. The field poles of this machine carry a shunt field winding connected across the armature and a series field winding which is in series with the armature and carries the load current. The magnetic strength of the shunt winding is assisted by that of the series winding, and since the latter automatically increases with increased load current the terminal voltage is maintained practically steady on load, as shown by the curve B in Fig. 2. Operation of the shunt regulator may then only be necessary to compensate for reduced shunt field current when the dynamo is hot.

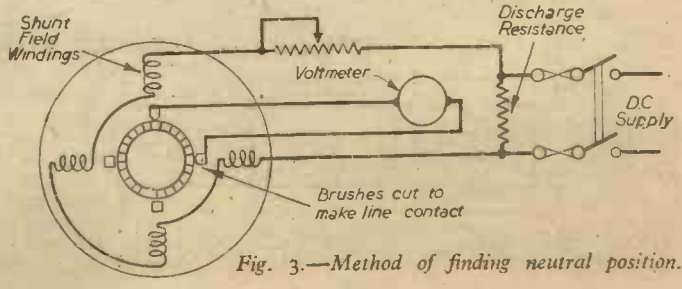


Fig. 3.—Method of finding neutral position.

In certain cases where a dynamo feeds load circuits situated some distance from the machine, the series field coils may be particularly strong and designed to raise the dynamo voltage on heavy loads. The extra voltage generated will compensate for the increased voltage drop on the cables and tend to give a steady voltage at the distant load circuits.

If it is desired to add series field turns to the poles of a dynamo to compensate for voltage drop on load, the following method will enable the correct number of turns to be decided upon. A few turns of heavy gauge wire can be wrapped round each of the existing field coils, taking care that they create a field of the same magnetic polarity as the existing coils (this may be tested with a compass needle) and supplying the temporary winding from an accumulator in series with a variable resistance. The current through the temporary winding is then adjusted to give the desired generated voltage. Suppose it is found that 20 amps have to be passed through 10 turns of wire on each coil to compensate for the drop of terminal voltage on a load of 16 amps. The ampere turns required on the series winding are then $10 \times 20 = 200$ amp. turns per pole. This is to be provided by a load current of 16 amps. so that the number of series turns necessary on the permanent coils is $\frac{200}{16} = 13$ turns per coil.

The same method may be used if it is desired to raise the voltage of a dynamo at all loads, where it is not convenient to raise the dynamo speed. If it is found that 30 amp. turns are needed on each pole of a 4-pole dynamo to raise the voltage from 220 to 250 volts, each coil might consist of 30 turns carrying 1 amp. in which case the whole set of 4 coils would require to have a total resistance of $\frac{250 \text{ volts}}{1 \text{ amp.}} = 250$ ohms. Another alternative would be to have 120 turns on each coil with 0.25 amp. current, in which case the total resistance of the new winding would require to be 1,000 ohms. It is important to note that since the voltage is to be raised at all loads, this shunt winding must be connected in parallel with the existing shunt field winding.

Brush Position

Excessive sparking and voltage drop on load may be experienced on a dynamo if the brushes are in the wrong position. On an interpole dynamo the brushes should be almost exactly in the neutral position, but where there are no inter-poles the brushes may be advanced slightly. If the neutral position is not marked it may be found as follows. The brushes are raised from the commutator, two brushes on adjacent spindles are then cut to make line contact with the commutator as shown in Fig. 3, these being connected to a low reading voltmeter. A direct current supply may then be switched on to and off the shunt field windings. If the brushes are not in the neutral position the needle of the voltmeter will flicker when the switch is opened and the brush gear should be moved until this does not occur. If the supply is more than about half the normal voltage of the dynamo it is important that a discharge resistance, which may consist of a few lamps in series, be connected across the field coils until the supply is cut off, as a high voltage is otherwise likely to be induced in the windings when the circuit is broken, and this may break down the insulation.

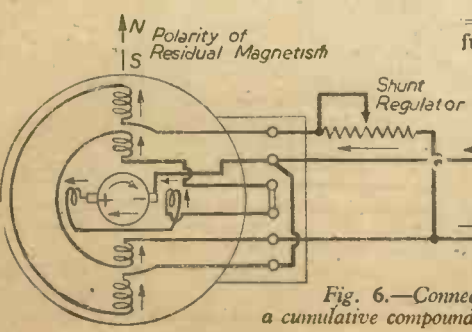


Fig. 6.—Connections for a cumulative compound dynamo.

Speed of Dynamo

Reduced speed gives reduced generated voltage since the armature conductors cut the magnetic field at a reduced rate. In the case of a shunt field winding which is not saturated, the field strength will also fall with a cumulative effect on the voltage. Curve A in Fig. 4 shows the voltage generated by a shunt dynamo when started up, whilst curve B shows the voltage with falling speed. For a given speed the dynamo voltage is greater with falling than with rising speed; this is due to the tendency of the iron in the field magnets to retain its magnetism. The curves C and D show the voltage when a field regulator is connected in circuit and it will be seen that there is a very rapid fall of voltage with speed.

Reduced speed may be due to wrong pulley sizes, speed of the prime mover or driving shaft being too low, incorrect governing of the prime mover, slipping belt, or prime mover of insufficient power. Many of these defects will cause considerable drop of voltage, particularly on load.

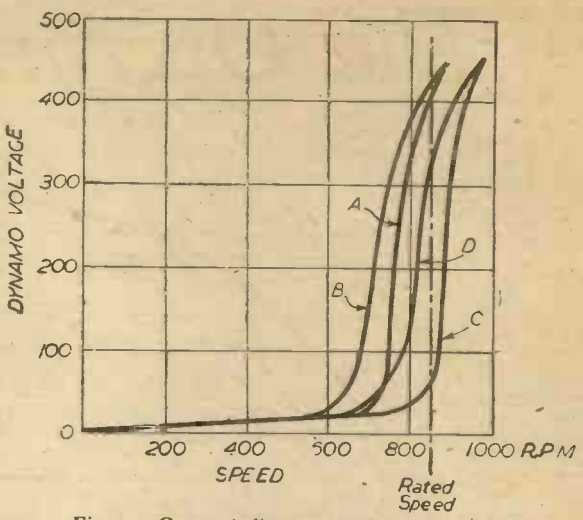


Fig. 4.—Curves indicating variation of voltage with speed of a shunt dynamo.

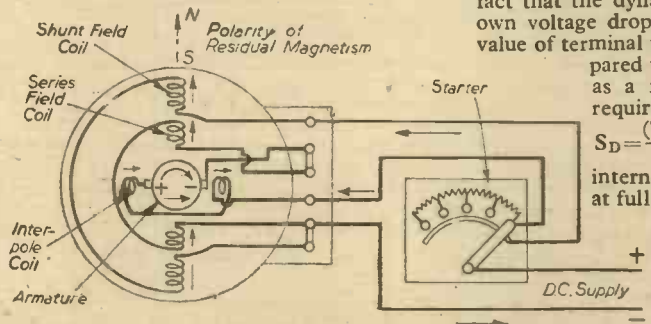


Fig. 5.—Connections for a cumulative compound motor.

The electrical output of a dynamo in kilowatts is equal to $\frac{\text{volts} \times \text{amps.}}{1{,}000}$. The brake horse power required to drive a dynamo may be calculated from the formula $\text{B.H.P.} = \frac{\text{volts} \times \text{amps.}}{746 \times \text{efficiency}}$. The efficiency of the dynamo may be taken as 75 per cent. for a 1 kw.; 80 per cent. for a 6 kw.; 90 per cent. for a 20 kw.; and 93 per cent. for a 100 kw. machine. The power required to drive a 500-volt 40-amp. dynamo, which has an output of 20 kw., would therefore be $\frac{500 \times 40}{746 \times 0.9} = 30$ brake horse power when the dynamo is fully loaded.

Use of D.C. Motor as a Dynamo

It should be possible to use any direct current motor as a dynamo. When run as a motor the rotation of the armature in the magnetic field causes the armature to generate a back voltage which is proportional to the speed of rotation and magnetic field strength. The field current of a shunt motor will be proportional to the terminal voltage. The voltage drop through the armature, brushes and any series field windings or interpole coils is equal to the terminal voltage minus the back voltage. If the resistance of these parts is known the volt drop on load can be calculated since the volt drop is simply the product of the load current in amps. and the resistance in ohms.

When the machine is run as a dynamo with the same shunt field current as the motor had, and with the brush position as far advanced from neutral as it was retarded when running as a motor, it will generate the same voltage as the motor developed back voltage at the same speed. The difference lies in the fact that the dynamo now has to supply its own voltage drop. To develop a particular value of terminal volts T_D as a dynamo compared with the supply voltage T_M as a motor, the dynamo would require to be driven at a speed $S_D = \frac{(T_D - V) \times S_M}{(T_M - V)}$ where V is the internal volt drop in the machine at full load and S_M is the full load speed as a motor with a terminal voltage T_M. Roughly, V may vary from about 5 per cent. of T_M for a shunt machine to about 10 per cent. for a compound machine.

In general, it is wise to allow for the generated voltage to be 10 per cent. to 15 per cent. higher than required and to control it to the desired value with a shunt regulator, which will also compensate for increased field resistance when hot. If the dynamo is run at a much higher speed than calculated above it will be necessary to have a high-resistance regulator in the field circuit to reduce the field current to less than normal value. This is likely to mean that the dynamo will work on the unsaturated part of the magnetisation curve, in which case unstable operation is likely.

The connections of a cumulative compound motor are shown in Fig. 5. On a cumulative compound machine the series and shunt coils have the same magnetic polarity and assist each other, and may be arranged to give a high starting torque. For simplicity the direction of current flow through each coil is assumed to be the same as the magnetic polarity which it creates. It will be seen that the shunt and series coils have a magnetic polarity as shown by the arrow over the motor, this, of course, being the polarity of the residual magnetism which the motor retains when it is stopped. To operate such a machine as a cumulative compound dynamo,

the usual arrangement, with the same direction of rotation, the terminal connections would require to be changed as shown in Fig. 6. One important point is that the field windings must have the same polarity as the residual magnetism if the machine is to build up, this being shown in the diagram.

A plain shunt motor can be run as a dynamo by simply driving it at the desired speed in the same direction as before, without any alteration of connections. Some motors are differentially compounded, that is, the series and shunt field coils create opposing magnetic fields which tend to keep the speed of the motor constant on varying load. If such a motor is driven in the same direction of rotation without alteration of connections it will function as a cumulative compound dynamo, which is usually what is required. When an interpole motor is used as a dynamo the interpole coils must create a reversed polarity; this is shown in Figs. 5 and 6. If the machine has no interpoles the brushes will probably be retarded back from neutral as a motor, so that when it is run as a dynamo the brush-gear may require advancing in the direction of rotation.

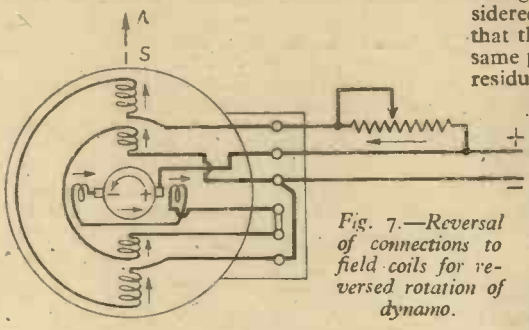


Fig. 7.—Reversal of connections to field coils for reversed rotation of dynamo.

Reversal of Rotation of a Dynamo

It may be found desirable to reverse the direction of rotation of a dynamo or to run a motor as a dynamo with a reversed rotation. The new connections are shown in Fig. 7, taking the same machine as previously considered. The important points to note are that the shunt and series field coils have the same polarity and that this is the same as the residual magnetism, and that the interpole coil polarity is reversed for reversed rotation. Where no interpole coils are fitted the brush-gear will probably need moving forward in the new direction of rotation, so that they are advanced from the neutral position.

A later article will deal with dynamo troubles, and the operation of dynamos in parallel.

Chemical Warfare

Notes on the Poison Gases Used, and the Importance of Respirators

By S. J. GARRATT

CHEMICAL warfare has been used in various forms for centuries, but has recently become very important, since the introduction of poison gas in the last war by the Germans. The coming of aeroplanes has provided a new method of carrying out a gas attack by aerial bombardment.

The British Government has always endeavoured to prevent the use of this form of warfare, and an agreement was signed at The Hague in 1899 in which all the Great Powers (including Germany) agreed to abstain from the use of poisonous gases in projectiles. This was reconfirmed in 1907 when the possibility of air attack became apparent.

Early Attempt

Early attempts at chemical warfare took the form of food or water poisoning, or the use of poisoned weapons. Records show that as early as the 7th century B.C. an extraction of the hellibore plant was used to poison a stream supplying water to the besieged garrison at Kirrha. This poison affects the stomach, and the idea was presumably a success, for the city fell to the besiegers in due course.

Some centuries later, during the Punic wars, the Carthaginians poisoned some of their own food supplies with mandrake and arranged for the capture of this doctored food by their Roman enemies. Mandrake has narcotic properties, and the Carthaginians attacked again when the Romans were sleeping off the effects of the drug, killing many of the enemy while they were asleep.

Weapons, such as spears and arrows, dipped in poisonous plant extracts or snake venom have been used by savage tribes, who must have developed their own ideas of chemical warfare as many early explorers found to their cost.

Poison Gas

Poison gas is, of course, a branch of chemical warfare, and was also in principle known to the ancients. The basis of early gas attacks was usually sulphur, thrown on to fires to the windward of the position under attack, thus producing sulphur dioxide fumes which were carried forward by the wind. There is a record of such procedure being used in the 5th century B.C., and it is interesting to note that there is a reference to a gas attack in the Bible (*Rev.* 14 : 10). This refers to "fire and brimstone," but the product is essentially sulphur dioxide, which is an asphyxiant, and an effective poison if used in a suitable concentration, say about 1 volume to 1,000 volumes of air. This, however, is a high concentration when compared with modern war gases; for instance, 1 volume of phosgene in 50,000 volumes of air will kill a man if breathed for 10 minutes or so; while some tear gases are effective in concentrations as low as 1 part in 10 millions of air, though they would not endanger human life at this strength.

Chlorine Gas

The first use of poison gas to any considerable extent was by the Germans in 1915, when they launched big clouds of chlorine gas at the British troops. This occasion forms a striking instance of German mendacity, for to prepare such an attack the chlorine gas has to be made literally in tons, large numbers of storage cylinders have to be made, men trained in their new duties and the whole lot concentrated in the required position. All this must certainly have taken several months of planning, and preparation. Yet on April 17th, 1915, the Germans falsely accused us of using poison gas and announced their intention of retaliating, and *five days* later launched their gas attack!

The attack took our army by surprise, and resulted in 25,000 casualties, 5,000 being fatal. This far exceeded the German expectations, and they were not ready to exploit their opportunity. If they had had reserves ready they could have broken through our lines, but by the time they realised this they were too late.

Of course, our troops were supplied with respirators as quickly as possible to protect them against a repetition of the attack. We retaliated in kind in due course, and in the following September launched a gas attack on a similar scale to that of the Germans, with a corresponding number of casualties.

Mustard Gas

The development of our respirator was so successful that it could be relied upon to neutralise any poisonous vapours in the air, and the Germans, after trying various gases and mixtures of gases to beat our respirator or to take us by surprise, eventually started using "blister gases," which have a destructive effect on the skin unless removed immediately. Mustard gas is typical of these, and is really a liquid. The liquid affects the skin after a few minutes' action, and the vapour given off affects the lungs. The respirator is an effective protection against the vapour, but, of course, cannot prevent the liquid or spray from reaching the body, and ordinary clothes give no protection, though a "gas-proof" cape can be worn. Mustard gas, however, was not an unknown product; it was quickly recognised by our scientists, and the Germans found to their cost that two could play at that game.

There is a lot of difference between the poisonous effects of different gases. For instance, a bomb containing 100lb. of sulphur dioxide would provide a dangerous cloud of gas sufficient to cover an area of about two acres to a depth of 12ft. or so, but a bomb containing the same weight of phosgene would liberate enough gas to cover about 130 acres to the same depth and to endanger the life of everybody in that area for a period of time depending upon the weather conditions. Thus, it is pretty safe to assume that the Germans will not use sulphur dioxide, because 65 aeroplanes would be required to produce the same effect that one aeroplane carrying phosgene could do.

A gas attack can produce most disastrous effects on an unprotected populace. Mussolini's attack on the Abysinnian natives, for instance. If, however, the people are supplied with gas masks and carefully follow instructions there is not much to be feared. If the gas mask is put on it will provide adequate protection until the gas clears away; it will usually diffuse away very soon, particularly if there is any wind, unless, of course, it is of a persistent type, such as mustard gas. In this case the area should be evacuated until it is cleaned up by the decontamination unit.

Poison gases must be treated with respect, but there is no need for alarm if a respirator is worn, and they should not be ignored in a spirit of bravado. Coal gas is poisonous, but nobody thinks of doing without it for this reason: everybody is familiar with it, and if there is a leak the windows are opened to get rid of the gas and the main tap is turned off until repairs are done.

With the ordinary respirator properly used a gas attack will be far less formidable than a high explosive "blitz," the chief danger probably lying in the possibility of the enemy attempting to take us by surprise. For this reason his first attack is likely to be the heaviest he can possibly manage.

It is unlikely that any new or secret gas will be used, though, of course, the possibility cannot be ruled out entirely.

Aircraft De-icing Equipment

The Various Systems Adopted and Their Operation

By T. E. G. BOWDEN, M.I.E.T.

THE formation of ice on the various surfaces and equipment of aircraft is extremely dangerous. In order to prevent ice accumulation several de-icing systems have been evolved, and the fitting of one of these systems is now obligatory on all civil aircraft which are liable to fly in weather that may lead to ice formation.

Types of Ice Formation

There are several types of ice formation, each with its own particular danger and problem. First, when an aeroplane is being flown in a region of air where rain is falling and the temperature is below freezing point, a layer of clear ice forms on all the external surfaces. This coating is often quite thick, and its danger lies in the fact that it alters the contour of the wings, thus reducing the lifting properties and increasing the drag. The weight of ice deposited is considerable and the wing may not be able to support the added load. The result is that the aircraft will be forced lower and lower, until it crashes, or the ice is removed. If the layer of ice formed is not very thick and the pilot has not noticed it, the chief danger is the increased stalling speed, so that when a landing is attempted at the normal flying speed, i.e., slightly above the normal stalling speed, a crash is extremely likely.

A second type of ice accretion is a white opaque layer formed whilst flying in clouds which consist of super-cooled water drops. The layer of ice is not generally as thick as the one mentioned in the preceding paragraph, but it is still dangerous. The weight deposited is not excessive, but venturi tubes and pitot heads are liable to be put out of action if they are not protected. The super-cooled water drops are well below the normal freezing point, and ice is formed when they come in contact with the leading edges of the wings.

Thirdly, is a heavy deposit of transparent ice, formed in a similar manner to that described in the previous paragraph, except that the super-cooled drops are larger in size. If this type forms on the airscrew blades, vibration may be caused, followed by a fracture and resultant loss of the airscrew or damage to the engine and airframe. Lumps of ice may either be flung off or may break away and jam the controls. As in the case of the clear ice, the weight deposited is considerable, and is extremely dangerous.

A form of icing-up which is not so dangerous is that which occurs when flying through a damp, warm layer of air after diving from a height. A semi-crystalline white layer of ice is formed, being equivalent to hoar frost. The chief danger is the probability of an obscured windscreen.

Other dangers caused by ice are as follows. Unless the carburettor is protected, ice may form in the air-intake duct with a consequent decrease in the area of opening, thus reducing the power output of the engine. Should ice form on the control surfaces, i.e., the rudder, ailerons, or elevators, they are liable to become unbalanced and render the aircraft uncontrollable. Diagrams of the various shapes of ice formation that occur are shown in Fig. 1.

Ice-forming Clouds

The height at which ice is liable to occur varies considerably, and in winter may be taken as 2,000ft. in England. The two types of cloud which are the most dangerous are the cumulo-nimbus and cumulus types. These clouds usually consist of heavy masses with vertical development, and occur from 1,500ft. to 20,000ft. As they are distinctive in shape, the pilot usually has time to alter his course and thus avoid flying through the clouds. The maximum temperature at which icing occurs is approximately 32 deg. F. Ice is also liable to be formed when flying

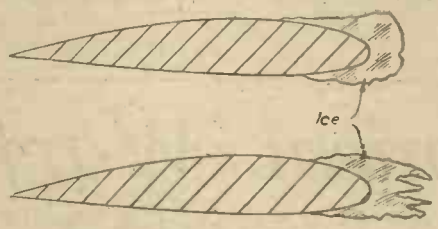


Fig. 1.—Types of ice formation.

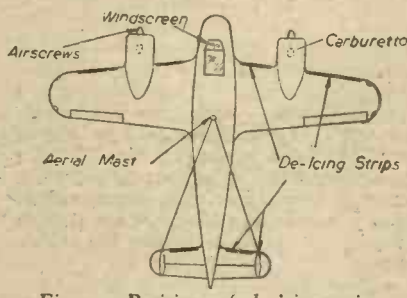


Fig. 2.—Positions of de-icing strips.

through strato-cumulus clouds, but as the maximum height of this type is 6,000ft. they may easily be circumvented by rising to a higher altitude. When flying at night it is often impossible to avoid flying into the dangerous clouds and this is when the fitting of a de-icing system is definitely necessary.

In order to help pilots and to prevent accidents as far as possible, radio transmissions are sent out by the Meteorological Office whenever necessary. Pilots also are asked to report any occurrence of ice formation, so that a warning giving the position of the danger area may be transmitted.

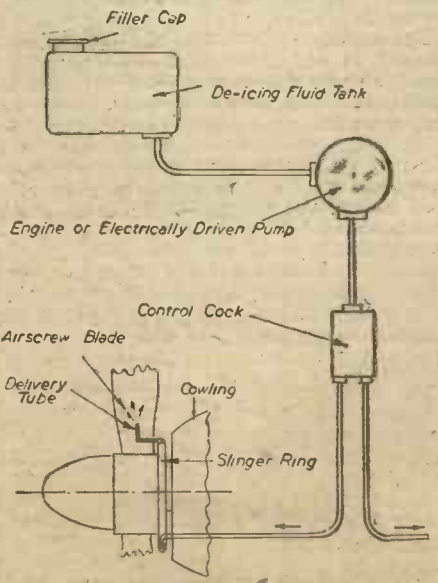


Fig. 3.—Diagrammatic arrangement of airscrew de-icing equipment.

De-icing Methods

The methods of ice prevention which will now be described are by no means perfect or 100 per cent. efficient and experiments are still being carried out to try and reduce the icing-up danger.

A non-mechanical method of ice prevention is the use of a de-icing paste having ethylene-glycol as a base, which is smeared all over the portions of the aircraft likely to be iced-up. The main disadvantage when this method is adopted is the fact that after several hours' flight, depending on the weather conditions prevailing, the paste is washed away and no more can be added until the aircraft lands at the end of its flight.

A more efficient method is as follows. Instead of smearing paste on to the wing and tail-unit leading edges, an ethylene-glycol mixture in fluid form is forced through perforations on to the actual parts to be protected. A rubber tube is laid along the leading edge and covered with a layer of rubberised fabric, which is doped to the wing surface. The de-icing fluid is forced through this tube and out via a series of small holes, positioned at frequent intervals, to the fabric. The leading edge is therefore thoroughly wetted as the fluid soaks through the porous outer layer and thus ice is prevented from forming. A tank is carried in the aircraft in which the fluid is contained and a pump fitted with a control cock, so that the flow can be controlled and varied according to circumstances. Fig. 2 illustrates the positions on an aircraft which are usually protected in this manner. The advantage of this system is the fact that the period in which ice prevention is available is only limited by the volume of de-icing fluid carried. The disadvantage is that the leading edge profile is slightly altered, thus reducing the efficiency of the aerofoil.

An alternative system is that in which rubber tubes are placed along the leading edges and inflated and deflated by means of compressed air. The number of tubes varies according to the surface being protected, three or four being required on the wing leading edge, and probably only one on the tail-unit leading edges. The rubber tubes, when not in operation, lie practically flush with the wing leading edge profile, incurring very little extra drag. Compressed air is supplied from the regular supply if the aircraft already uses pneumatic power for operating the various services, or, if not, from a small engine-driven pump. A distributor, usually electrically operated, is fitted to guide the air to the correct tubes.

The de-icing action of this system is as follows: By inflating and deflating the tubes, not at the same time, any ice which has accumulated is cracked and broken up. After being split up, it is carried away by the slip-stream. The main advantage of this system is the fact that there is no de-icing fluid to run short of, as the operating medium is air, of which an unlimited supply is available, provided the pump is being operated. The pressure required for operation is ten pounds per square inch maximum and a relief valve is incorporated in the system to prevent excessive pressures being obtained. It is important that no oil or petrol should be allowed to come into contact with the tubes as they are liable to deteriorate. An occasional wash should be carried out as an additional precaution.

Using Exhaust Gases

A method which has not found very much favour in England is that in which the hot exhaust gases, or air heated by the exhaust, is passed along the wing inside the leading edge of the wing. Ice is prevented from forming by maintaining the wing surface at a temperature above freezing point. The Junkers Ju 88 has pipes which allow hot air to flow to the leading edge. When not required, the air is passed to the atmosphere by means of valves and a control cock. The disadvantage of this system is the space taken up by the pipes, the danger of poisonous exhaust gases passing to the fuselage, and the complication in design.

Airscrews are protected from ice by feeding the de-icing fluid to a slinger ring mounted as shown in Fig. 3. As well as causing vibration, ice, if allowed to accumulate on the blades, will also decrease the thrust developed, owing to the alteration in profile of the blades. A small electric pump is fitted to pass the fluid from the supply tank, along the feed tubes, to the slinger ring. The fluid is then flung outwards by centrifugal force through the delivery pipes (one for each blade) and flows along the area to be protected. Owing to the heat caused by the rate of travel of the outer third of the airscrew blades, this portion does not require the same amount of protection as the blade root. A rise of approximately 8 deg. C. has been recorded on tests between the root and the tip. The airscrew spinner is usually covered with a layer of rubber or leather. This covering is saturated with de-icing fluid which is flung outwards along the blade and at the same time protecting the airscrew hub containing the variable pitch mechanism from icing. The amount of de-icing fluid consumed is approximately half a gallon an hour per airscrew.

Carburettor Protection

Protection of the engine carburettor against ice formation is usually made as follows. First, hot air from the exhaust is passed over the carburettor casing, thus maintaining a temperature above freezing point. This system has not been adopted generally, owing to the complication required in the exhaust system.

A second scheme is to place the carburettor air intake behind the radiator. By doing this, the air supplied to the carburettor is warmed, due to the fact that it has passed through the radiator honeycomb.

On some aircraft the hot oil, which is being returned from the engine sump, is allowed to flow round the carburettor casing. Special channels are provided in the actual casing which forms the air intake.

An electrical warning device which informs the pilot by illuminating a lamp on the instrument panel, when ice is being formed in the air intake, has been designed. Usually, however, a drop in the engine revolutions gives an indication that something is wrong.

The most efficient method is that in which alcohol, or some other similar fluid, is introduced to the petrol supply. A delivery pipe is so positioned that the alcohol is drawn along with the air past the jet and through the choke, thus mixing with the petrol vapour and passing into the induction system.

Windscreens

Cockpit windscreens have been protected from frosting over by incorporating fine electrical heating elements, although this system has not met with universal approval.

Pitot heads incorporating electrical heating coils are commonly fitted to prevent blockage of the tubes. Ice, if allowed to accumulate, will render the instrument useless.

From the above description of the various methods adopted to protect airframes, engines and airscrews from the formation of ice, it will be seen that there is still room for considerable improvement. As electrical power is developed it is likely that all the surfaces requiring protection will be heated by electrical means. The use of direct-injection engines does away with the danger of ice in the carburettor, and this method has been developed to a high state of efficiency by German designers. In the future when it will become common, as it is rapidly becoming even at the present time, to fly 5,000 miles non-stop, in all weathers, the de-icing system will assume an extremely important position, as the safety of the aircraft and the occupants will depend on its efficiency. Research is continually being carried out to improve existing systems and to develop new types.

Battery-electric Bicycles

WE have received the following letter from a reader, J. Finnegan, of Cullybackey, Co. Antrim:

Sir,—I was interested in the particulars of Mr. Boyd's electrically driven bicycle, published in the October issue of PRACTICAL MECHANICS. I have been using for many months a battery-electric-motor-driven bicycle which has given me the greatest satisfaction, never once letting me down. I use it six days per week. My journeys are short, totalling about 60 miles per week to and from business, having covered to date about 600 miles, and this on an Exide battery which had already done about four years' service as a car starter—type 6 X.C.K.9.M., capacity 57 amps at 20-hour rate. Approximate weight, 60 lbs. The accompanying illustration may be of some help to interested readers. It will be noticed that my method of mounting the motor is slightly different from Mr. Boyd's. I use two tubes in line with the front forks connecting to front spindle and to stem of handlebars. Two pieces of 1in. angle iron are welded to these and the motor rests on them, and is held in position by a 2in. by ¼in. strap of iron. The chain is ½in. by ¼in. from a 16-tooth sprocket on to a 48-toothed wheel, this being an ordinary cycle driving wheel welded on to an ordinary cycle free-wheel, which of course leaves the chain and motor idling when going downhill. An ordinary starter motor switch is used on the handlebar for starting the motor; there is also a two-speed switch giving about 17 and 22 miles per hour. The motor carries me over any hill, and I might mention one I have to cover: it rises about 1ft. in 9ft. and is about 500yds. long. The roads here are ordinary country roads and not to be compared to streets in towns. There are also head and tail lights, horn, amp-meter and also a battery capacity indicator, which I consider the most essential fitting, as it lets me know the condition of the battery at any time. While on the subject of the battery I would advise anyone contemplating fitting up an electric bicycle, and who knows little about batteries, to buy two batteries and always have one at a charging station.

The battery-driven bicycle, and its constructor, J. Finnegan.

Motor Details

For the guidance of any of your readers who are working on the building of one of these machines, the motor is the important part. By blocking my machine up so that the front wheel is clear of the ground, and switching on the motor, it registers 4 amps. on the meter. On low speed, on the 22-mile switch, it is about 7½ amps. The motor weighs about 35lbs. and this is balanced by a heavy coil spring attached to an iron bar which carries a shield to keep the battery clean; this keeps the front wheel from falling to one side owing to the weight of the motor. I might mention that the two tubes on which the motor is mounted are slotted at the spindle ends to allow for chain adjustment. Also, on one of the battery terminals I have fitted a male and female single socket on the position line; by withdrawing this one can leave the machine anywhere with safety. The design of the present machine frame is not all that could be desired, but under present conditions it suits the purpose, and gives one experience which may be further developed in the future when one's activities are not restricted by supply problems.

Odd Jobs in House and Garden

A Shaving Cabinet with Electric Light

By "HANDYMAN"

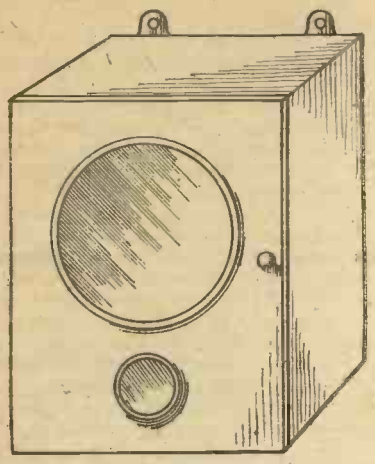
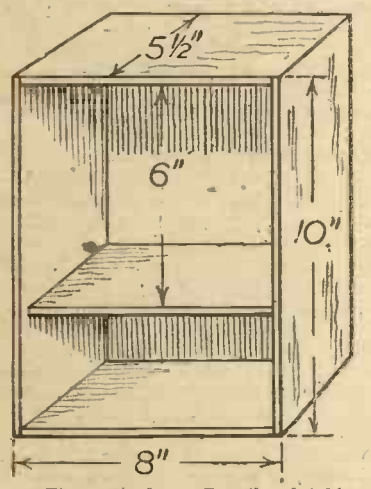
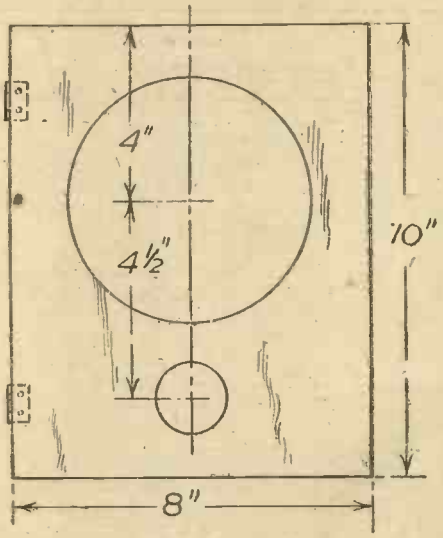


Fig. 1.—The simple shaving cabinet, fitted with electric light.

DURING the black-out, when lamps are shaded, the need is often felt, whilst shaving, for a light near the shaving mirror. The simple cabinet described below, and shown in the accompanying sketches, Figs. 1 to 4, helps to solve the problem, as it contains its own electric light—in the form of an ordinary torch. Any size torch will answer the purpose, but, for preference, one with a reflector diameter of 1¾in. to 2in. should be chosen.





Figs. 2 and 3.—Details of cabinet construction, and front view of the door.

Cabinet Construction

The cabinet is of simple construction, and plywood, or wood taken from a clean box, knocked apart, can be used. Cut the various parts to the sizes given in the sketches, and plane the wood on both sides, if necessary. Fix the top, bottom, and sides together, and then nail on the back. The shelf, which can be fixed with panel pins driven in through the sides and back, will be useful for holding shaving tackle, and other toilet requisites.

After trimming the door flush with the edges of the cabinet, mark a centre line on one side, and draw the two circles (Fig. 3), one about 5in. diameter, and the other to fit the end of the torch that is to be used. Cut the holes with a coping saw, and smooth the edges with a rough-cut half-round file, and finish with fine glass-paper.

Obtain a circular mirror, about 5in. diameter, and after fitting it in the hole in the door, screw three or four small bent brass clips, A (Fig. 4) to the back of the door to hold the mirror in place. If a circular mirror is not available, a rectangular one of suitable size could be used, the hole in the door being cut to suit. The door can be hinged, as indicated in Fig. 3, the hinges being screwed on about 2in. from the top and bottom edges respectively. A small knob, with catch, can be fitted on the other side of the door.

Two brass eye-plates can be screwed to the back of the cabinet, as shown, for hanging it on a wall. The finished cabinet can be coated, inside and out, with cellulose paint, or enamel.

When required for use it is only necessary to open the door slightly and switch on the torch, when plenty of light will be provided for shaving on the darkest of mornings. A piece of thin tissue paper should be stuck over the lens glass to diffuse the light.

Alternative Methods

In cases where an existing cabinet is available, a torch can be used for providing the illumination, in the manner illustrated in Fig. 5. Assuming that the cabinet is one of the popular white-enamelled metal ones, of the pattern shown, all that is required is a loop of stout wire for holding the enlarged end of the torch, and another piece of picture wire, tied round the cabinet to form a loop for holding the other end of the torch, as shown in the illustration.

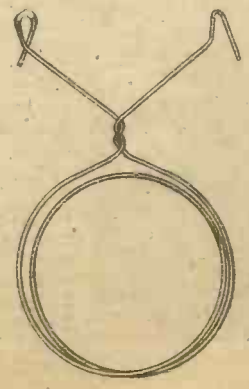


Fig. 5 (right).—Alternative method of fitting a shaving cabinet with electric light.

Fig. 6.—Wire loop for supporting the torch.

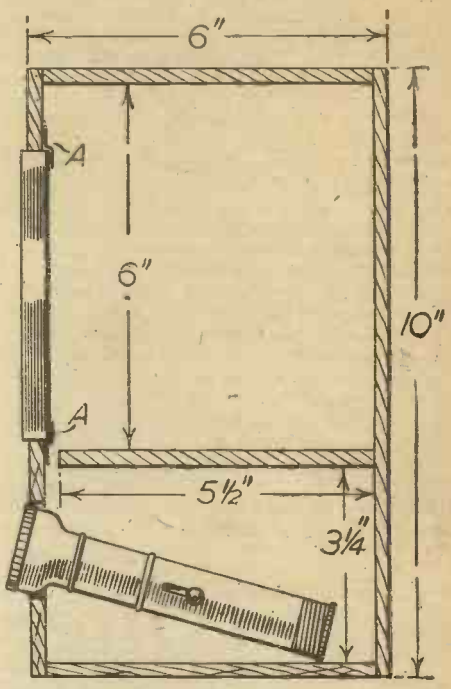
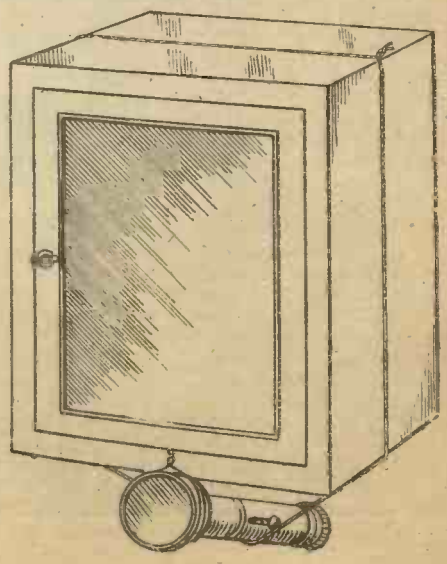


Fig. 4.—Section of shaving cabinet, showing the mirror, torch and shelf.

To form the loop for the front of the cabinet, take a piece of zinc or copper wire, 16in. long, and bend it twice round the head of the torch to form a double loop. Give the wire a double twist, as in Fig. 6, spread the ends of the wire out, and bend to form two hooks for slipping over the bottom edge of the cabinet front. The picture wire around the cabinet should be of sufficient length to tilt the torch so that the light illuminates the lower part of the face.

For those readers who like experimenting, another alternative method is to take the reflector and bulb from an old torch and fit them in place in the hole provided. A pair of batteries of the flat type could be housed in the lower compartment of the cabinet, and connected to the bulb, and to a small switch on the side.



The Distribution of Electricity

Cantor Lecture Given Before the Royal Society of Arts

By E. AMBROSE, M.I.E.E.

Introduction

LAST year marked the 60th anniversary of the first public supply of electricity—1882—although experimental installations in which the electric arc was the only form of light-giving apparatus had been in existence for many years prior to that date. In these early installations there were required the electric generator (with some form of engine to drive it), the arc lamps and the necessary connecting wires to convey the current from one to the other, that is, from the generator to the consuming apparatus. In the public distribution of electricity to-day the fundamental principles remain unchanged, but the details have been considerably expanded. The consuming apparatus, instead of being but a few yards from the generator is, in many instances, a hundred or more miles away.

Frictional Electricity

About 2,500 years ago (600 B.C.), Thales, the Greek philosopher, is said to have observed that amber, when rubbed with woollen substances, acquired the peculiar property of attracting light bodies. Amber was known to the Greeks as "electron," and from this the English word "electricity" is derived.

The attractive force possessed by amber when subjected to friction remained an isolated fact for about 2,000 years.

In the year A.D. 1600 Dr. Gilbert, physician to Queen Elizabeth, discovered that many other substances besides amber (glass, sulphur, sealing-wax, resins, etc.), when suitably rubbed, became similarly endowed with the power of attracting light bodies. A body which has been rubbed and acquires this property of attracting other bodies is said to be electrically charged, or is electrified.

Electrical charges are for convenience divided into two kinds, positive and negative. If a glass rod is rubbed with silk, the glass becomes positively charged and the silk becomes negatively charged. If sealing-wax is rubbed with flannel the sealing-wax acquires a negative charge and the flannel becomes positively charged. Electricity produced in this way is known as frictional or static electricity. The terms "positive" and "negative" are conventional.

Much work has been done by many investigators on the behaviour of electrical charges, on conductors and insulators, on quantitative measurements, and on frictional machines for producing greater quantities of electricity than is obtainable with glass rods or sealing-wax.

The Primary Cell

The next important discovery was due to the experimental work of Galvani and Volta. About the year 1780, Galvani, a professor of anatomy in Italy, whilst experimenting in his laboratory, found by accident that if two different metals are held in contact, and one metal touches the nerves of a frog's leg while the other metal touches the frog itself, the leg kicks out violently as if a shock had been administered. It is interesting to speculate whether, having broken or mislaid his forceps, he used an improvisation consisting of different metals. Poverty and illness prevented Galvani from following up his discoveries, but these effects were investigated more thoroughly by Volta, a professor of physics in Italy; and a scientific battle took place between these two men.

Galvani held that electricity originated in the frog. Volta, on the other hand, believed the electricity to be generated by the contact of dissimilar metals, and as a result of much experimental work on the contact of different metals, he announced in the year 1800 that he had constructed an electric "pile." (Fig. 1.) It consisted of a number of circular discs of two metals, silver and zinc. These discs were placed, alternately silver and zinc, one on top of the other, like a stack of coins, and between each pair of discs was inserted a similar disc of cloth or blotting paper which had been moistened with brine. Volta found that if he put one hand in a vessel containing brine, which was connected to the bottom of the pile, and touched successive discs with a moistened finger of the other hand, he could feel a shock which increased in intensity as he touched higher up the pile. Moreover, he found that he could repeat Galvani's experiments with greater effect.

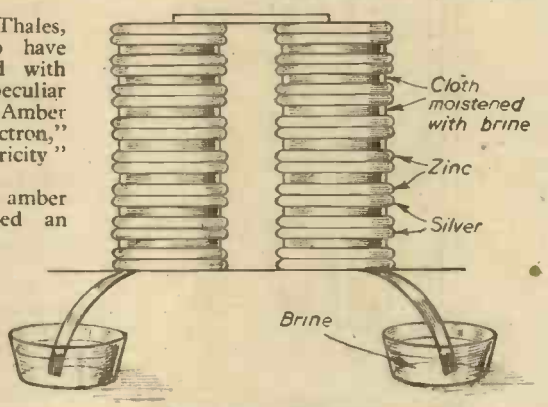


Fig. 1. A Volta pile.

Volta varied the construction by substituting glass jars containing weak sulphuric acid for the moistened pads, and copper in place of silver. Into each jar he placed one copper rod and one zinc rod, and so formed an electric cell. By arranging a number of these cells in a row and connecting the copper of the first cell to the zinc of the second, and so on, he formed what is called the first primary battery. The end of the zinc rod outside the liquid was found to possess properties similar to that of sealing-wax after it has been rubbed with flannel, that is, negatively electrified. The copper, on the other hand, had an electrical state similar to a glass rod after it has been rubbed with silk, that is, positively electrified.

The experiments of Galvani and Volta are therefore very important as they led to a means of creating a continuous electrical current by the action of liquids upon metals.

It was soon found by experimenters that the Volta pile and the simple primary cell, when at work, were not able to maintain the current at a constant value; the current gradually became weaker and weaker. This defect was caused by the formation of hydrogen gas at the surface of the negative electrode. The effect increased so long as the cell remained in circuit and, in the end, the flow of current ceased. In this condition the cell was said to be "polarised." Numerous investigators set to work to overcome this defect and, as a result, the Daniell, Grove, Bunsen, Leclanché and other constant-current cells were invented.

The Storage Battery

The storage battery of to-day is sometimes referred to as the secondary battery. Gautherot, in 1801, observed that during his experiments on the decomposition of salt water the platinum or silver wires which served as electrodes became polarised, and that by the absorption of oxygen and hydrogen they became electrically different. By disconnecting his battery and then connecting the two electrodes he obtained a secondary current.

Two years later, Ritter obtained the same effects with gold wires and noticed the formation of metallic films and peroxides by electrolytic action. He embodied the results of his observations in his secondary pile, which consisted of discs of copper separated by discs of pasteboard moistened with saline solutions and arranged in the manner of Volta's pile. By means of connecting wires, current was allowed to pass for some time from Volta's pile to his secondary pile. After this process of charging, the secondary pile could give out transitory currents. Ritter was well aware of the importance of his experiments, but did not follow them up at the time. Some say the cause was lack of means.

Planté's Experiments

It was not until after Planté's extensive investigations that the construction of secondary cells was completely achieved. He investigated the phenomena of polarisation with a view to their utilisation instead of their elimination. He carefully examined the polarisation of all the ordinary metals, and found that all gave secondary currents, although, in some instances, this was very small; those obtained with lead electrodes in dilute sulphuric acid far exceeded the others, both in duration and intensity.

Planté constructed the first practical secondary cell. He placed lead-plate electrodes in a 10 to 30 per cent. solution of sulphuric acid, and passed a current through the cell; the direction of the current was frequently reversed. The hydrogen liberated at the negative bubbled away, but the oxygen liberated at the positive oxidised the lead to form a thin layer of lead peroxide (PbO_2). On reversing the current, the negative electrode became superficially oxidised, the lead peroxide on the other electrode being reduced to spongy lead. This process, many times repeated, finally resulted in the formation on one plate of a layer of lead peroxide, on the other a layer of spongy lead. The active material formed in this way was very strong mechanically, but the process had two great disadvantages. The storage capacity of the finished plate was very low, compared with its weight and volume, and the time and electrical energy needed for the formation was excessive. Later improvements in the process resulted in more rapid formation.

Although Planté showed how a practical storage cell could be constructed, the time was not ripe for its commercial application, and further development was held up for some years. Interest in the subject was renewed when the development of the dynamo reached a commercial stage, enabling large currents to be furnished at comparatively high voltages.

In 1881 Camille Faure took out a patent for preparing the active material for the plates of lead storage cells. The material was mechanically applied to the plates and thereby obviated Planté's long process of formation from the material of the plates themselves. Faure coated the plates with a paste of red oxide of lead mixed with dilute sulphuric acid, but in the more modern cells the pastes are lead oxides for the negative plate and red lead for the positive plate. When the cell is charged the positive plate takes the chocolate colour of lead peroxide and the spongy lead of the negative plate is a light grey colour. In order to increase the volume of active material the modern plate is made in the form of a lead grid, of which a large number of types exist. The voltage of this type of cell when fully charged is two. To avoid using very large plates, cells of large capacity are provided with a number of plates. For portable cells the containers are usually made of celluloid or glass, but for large batteries, such as those for emergency lighting in hospitals, for telephone exchanges or for generating stations stand-by use, the containers are large open-topped glass jars or lead-lined wooden boxes.

Electro-magnetism

With the availability of cells, such as Volta described, for producing electric currents, scientific investigators in many countries set to work, and reference has already been made to the experiments of Gautherot and Ritter. In 1819, Oersted, of Copenhagen University, whilst demonstrating the work of Galvani and Volta, placed a magnetic compass needle near the current-carrying wire and observed that the needle was affected. Oersted had discovered that electricity in motion is capable of exercising a magnetic effect. An account of the direction in which the needle turns in obedience to the magnetic force evoked by the current flowing in the wire was described by him in July, 1820.

Ampère, in France, showed that a wire coiled in the form of a solenoid and carrying current behaves like a magnet, and he demonstrated that mutual action exists between two wires carrying current. His name is perpetuated by its use to denote the unit of current.

Michael Faraday believed that somehow a wire carrying a current ought to be able to produce a current in another wire placed alongside it. His experiments in this direction led to his epoch-making discovery, in 1831, of the fundamental principles of electro-magnetic induction. He wound two coils of wire on the opposite sides of an iron ring, one coil being connected to a battery and the other to a wire passing over a pivoted magnetic needle. Faraday found that whenever he started the current by connecting the battery, the needle was deflected in one direction, and whenever the current was stopped by disconnecting the battery, the needle was deflected in the opposite direction. This experiment showed that an electro-motive force, as it is called, was induced in the second coil by the magnetism set up by the current in the first coil. A few weeks later he discovered that whenever he moved a magnet close to a coil of wire, he again produced momentary currents in the coil, and so solved the problem of generating electricity from magnetism.

The Dynamo

By rotating a circular disc of brass between the poles of a horseshoe-shaped electro-magnet, Faraday obtained a steady current of electricity, and so started the evolution of the dynamo. Collecting brushes rubbed against the edge of the disc and the axle.

The early machines based on Faraday's experiments were, naturally, of the laboratory type. Possibly the first machine to be constructed was Pixii's in 1832 (Fig. 2). The fixed portion consisted of two soft iron cores on which were wound several turns of wire. The rotating portion consisted of a powerful permanent magnet shaped like a horseshoe, which was made to rotate under the fixed iron cores. The changing condition of the magnetic circuit induced currents in the wires, and the direction of the current was reversed as first one and then the other pole of the magnet passed an individual core.

Pixii thought that the continued alteration of the current direction might be inconvenient for many purposes, so he therefore added a commutator to this machine, which caused the currents in the external current to flow in one direction. Although the current obtained from such machines was uni-directional, it was rather intermittent, owing to the relatively large interval of time, in one complete revolution, during which the coil was outside the influence of the magnet.

Other machines based on the same principle were produced by different workers, and in

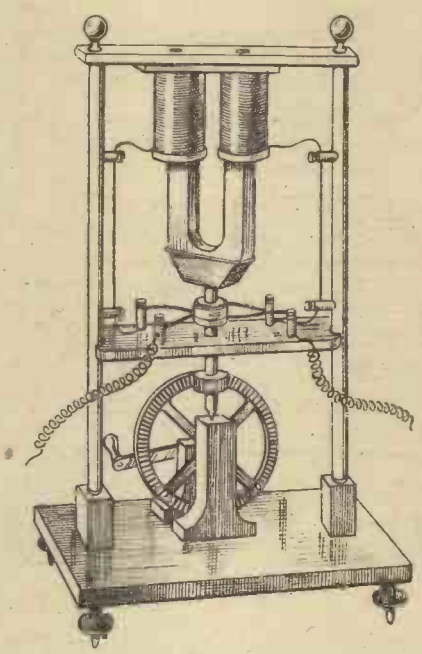


Fig. 2.—Pixii's magneto-electric machine.

some instances the permanent magnet formed the fixed portion, the coils being made to rotate.

Siemens' H-Armature

An important advance in construction was due to Siemens in 1857. He devised the cylindrical armature for the rotating portion. In its simplest form it consisted of an iron cylinder which was cut away so that its cross-section was of an "H" form. Covered copper wire was wound longitudinally round the cylinder and the two ends of the wire were connected to a two-part commutator. For the magnet system, some eight or nine horseshoe magnets, made of rectangular section steel, were placed parallel to each other, and cut out at their poles to form a hollow cylindrical space in which the armature could be made to revolve. With this arrangement the coils moved in a much more concentrated magnetic field, but there still remained a relatively large interval of time when the coils were inactive.

The use of electro-magnets for the field system had been suggested by Wheatstone and Cook in 1845, and a machine of this type, in which the exciting current for the electro-magnets was obtained from a separate small generator provided with permanent magnets, was constructed by Wilde in 1863. A further advance was made in 1867, when Siemens described a machine in which the whole of the current induced in the armature was passed through the coils of the electro-magnets in order to maintain and increase the magnetic strength. The magnet cores were initially magnetised feebly by sending through a current from a battery. In the same year Wheatstone suggested that a part of the induced current of the armature should be passed through the field coils. Such are called dynamo-electric machines.

These two methods of connection exist to this day in what are known as "series" and "shunt"-wound dynamos. Each has its purpose—the series-wound machine being used for constant current, and the shunt-wound machine for constant voltage operation.

There remained the problem of producing currents with less intermittency. This was solved by substituting for the "H" armature, with its one coil of many turns, an armature in the form of a ring, on which the wire is wound continuously round the core; a large number of tappings, equally spaced, led to a multiple-part commutator. The first armature on this principle was constructed by Pacinotti, about 1860, but little progress was made until the improvements by Gramme in 1870.

From the foregoing, it will be realised that the essential parts of a dynamo are an electro-magnetic field system, a continuously wound armature and multipart commutator with brushes for collecting the current, and, with all these essentials, the Gramme machine provided the starting point for the generation of electricity on a practical scale. Since 1870 there have been many improvements in the construction of the armature, the method of winding and the introduction of the multi-polar machine.

Alternating Current Machines

It will be remembered that Pixii, when constructing his dynamo, thought that the alteration in the direction of the current which his machine produced might be inconvenient for many purposes. This was true, because, without a direct, or a uni-directional current, it would not be possible to carry out electro-deposition, or to charge batteries except, of course, by using the small currents which could be obtained from primary cells.

Between 1857 and 1863 permanent magnet machines, without commutators, were constructed and installed in lighthouses for supplying current to electric arc lamps. In place of a commutator two separate rings were fitted on the spindle, and from these the current was collected by brushes and conveyed to the lamp. The current increased and decreased in strength and changed in direction as the armature coil passed successively the opposite poles of the magnets. This complete set of changes is called a cycle, and the number of cycles per second is defined as the frequency. In some of these machines the frequency was about 50. A current which repeats itself in this manner is called an alternating current, and the type of machine which generates it is called an alternator.

In or about the year 1876, when there was a considerable demand for alternators, the Gramme alternating current machine was perhaps the most popular. This machine was of the radial revolving field type with a fixed armature, the field coils being excited from a separately driven dynamo. (Incidentally, Wilde, in 1863, anticipated the use of separate machines for exciting modern alternators.)

In the early 'eighties alternators were being constructed by various makers to the designs of Siemens, Gordon, Ferranti and others. In 1895 an alternator, known as the Copper Alternator, was designed by Ferranti for use at the Deptford power station of the London Electric Supply Corporation. The armature, which was the rotating part, consisted of flat coils of copper strip mounted in pairs and supported by insulated clamps to the rim of a flywheel.

(*To be continued*)

The Story of Chemical Discovery

No. 19—Enzymes and Their Effects. Some of Nature's Own Chemicals, and the Parts Which They Play in Plant and Animal Life

FERMENTATION constitutes a phenomenon which has been known from the remotest ages. All nations, civilisations and communities at all stages of their development have been familiar with the fact that pleasant-smelling and pleasant-tasting beverages can be produced by allowing sugar solutions, fruit juices and the like to undergo that peculiar natural process which we now designate by the term "fermentation."

The early alchemists paid much attention to this process of fermentation, but they could make little or nothing of it and they cloaked their exceedingly nebulous ideas concerning it with an atmosphere of fantastic and nonsensical terms. Indeed, it was not until the middle of the last century, when that renowned genius, Louis Pasteur, appeared on the scene that scientific chemistry seriously got to grips with the age-old problem of fermentation.

Before Pasteur's time, chemists, such as Liebig, had shown that the process of fermentation results in the breaking-down of complex substances into simpler ones. For instance, it had been proved that sugars could always be fermented by means of yeast into ethyl alcohol and carbonic acid gas (carbon dioxide), both of which are far simpler substances than the relatively complex sugar.

It had been shown, also, that many of the natural processes of decomposition, such as the gradual rotting of damp straw, the putrefaction of dead leaves at the bottom of a pond, the souring of wines and of milk are all brought about by fermentative processes. Liebig himself considered that all fermentation is purely a chemical process which is brought about by some mysterious instability of the molecules of the fermenting substance.

Yeast Cells

It took the researches of Pasteur to demonstrate once and for all the essential connection between the ordinary alcoholic fermentation of sugars with the living yeast cell.

Yeast, as the reader will be well aware, is a lowly form of life. A mass of yeast or "balm," such as is used by brewers and bakers, consists of innumerable millions of separate cellular organisms, each endowed with life, and each one being capable of reproducing itself. Yeast, in fact, is a low form of plant life. It is higher than the bacteria in Nature's life-scale, but, like the bacteria, it is a form of life which is ever-present in most of Nature's environments.

Just as there are numerous different strains of germs or bacteria, so, also, are there varying strains of yeasts. It is possible to cultivate these yeasts. One yeast strain is used for the baking of bread, another yeast goes into the brewing of beer, whilst another will be applied for the fermentation of wines.

Pasteur's idea was that the yeast fed upon the sugar solution and, by so doing, converted some of it into alcohol and carbon dioxide gas. For a time, this explanation of fermentative action held, but, eventually, it was discovered that living yeast could be put under powerful pressure and made to give up a juice, which juice had the property of fermenting sugar solutions just like ordinary yeast does.

Here, clearly enough, was fermentation without the aid of any living cells.

Before this discovery was made it began to be realised by scientific men that yeasts, bacteria, moulds and other types of organisms are capable of bringing about important chemical changes, not so much of themselves but in consequence of some highly mysterious substances which they secrete. These substances were called *enzymes* in 1878 by a German physiologist, W. Kuhne, the word being derived from the Greek, *zyme*, a leaven.

It was recognised that enzymes are not living organisms like bacteria, yeasts and moulds, but that they merely comprise chemical substances (or mixtures of such substances) of very high complexity. Yet, though lifeless themselves, enzymes are always the products of living matter.

Louis Pasteur

Enzymes are not vitamins. In fact, they are still more mysterious substances than vitamins, for a number of the latter compounds have been isolated and even manufactured synthetically. Up to the present, however, no one has ever artificially produced an enzyme. Indeed, not one single enzyme has ever been prepared in a state of purity, so mysterious and complicated in chemical composition are they.

Enzymes are Nature's own chemicals. They comprise the reagents with which she performs all her chemical operations. And they are amazingly wonderful and efficient reagents, too, for, by using small amounts of them, Nature is able to bring about rapid chemical changes with automatic precision and with the greatest possible ease.

The chemist considers himself reasonably efficient, for example, when he boils a fat with a strong solution of caustic soda and, after a few hours, obtains from it glycerine and soap. But the enzyme *lipase*, which occurs in human and animal intestines, can saponify or break down fats at the temperature of the living body, and, moreover, it remains still active when its work has been completed.

That is only one example of Nature's own chemical reagents, the enzymes. Others will follow.

Diastase

One of the earliest recognised of the enzymes was *diastase*, which is an enzyme occurring in malt extracts. Early in the last century it was known that extract of malt has the power of changing starch into sugar, but it was not until about 1883 that an Irish chemist, O'Sullivan, discovered a method of isolating from malt extract by means of alcohol-precipitation a white powder which possessed all the activity of malt extract. This was *diastase*. But this prepared substance was far from being a pure compound. It showed itself to be a mixture of chemical substances of very great complexity whose compositions were unknown and which, even to this day, remain unknown.

Perhaps one of the examples of enzyme action which is most familiar to all of us is that manifested by ordinary domestic mustard. As purchased in the "flour" form, this yellow mustard has little or no smell. But immediately the mustard is made into a paste with a little water, it gives off its characteristic odour of mustard oil which at once affects the nostrils.

Now the explanation of this rather amazing action is as follows :

The ground mustard seed contains a natural chemical called "sinigrin" (or potassium myronate), which material is always accompanied by an enzyme known as *myrosin*. It is a characteristic of most enzymes that they can only operate in the presence of water. Hence, as long as the sinigrin and the *myrosin* remain dry in their mustard-seed cells, no action takes place, but immediately a little water is brought into contact with them the enzyme *myrosin* acts on the sinigrin and splits it up into a sugar (glucose), a salt (potassium hydrogen sulphate) and "mustard oil" (allyl iso-thiocyanate), which latter material is entirely responsible for the pungency of freshly-mixed mustard.

In the chemical laboratory we can break down sinigrin or potassium myronate into its

Bacteria observation in a works laboratory.

components, but it takes boiling liquids and a considerable time to effect this process. Yet Dame Nature with the aid of her remarkable chemical, the enzyme *myrosin*, accomplishes this profound chemical change almost instantaneously.

Our bodies are full of enzymes, for it is by means of these natural substances that the chemical mechanism of our organisms is conducted.

In our saliva there is an enzyme called *ptyalin*. This, by the process of mastication, is mixed with our food and it changes the starchy matters therein into more easily assimilable substances such as maltose (a sugar) and dextrin.

In the stomach there is the enzyme *pepsin*, which breaks down proteins and other meaty matters into simpler substances. *Pepsin* works best in mildly acid surroundings. That is why Nature conveniently arranges that our stomachs, when healthy, shall always contain 0.2 per cent. of hydrochloric acid.

Trypsin

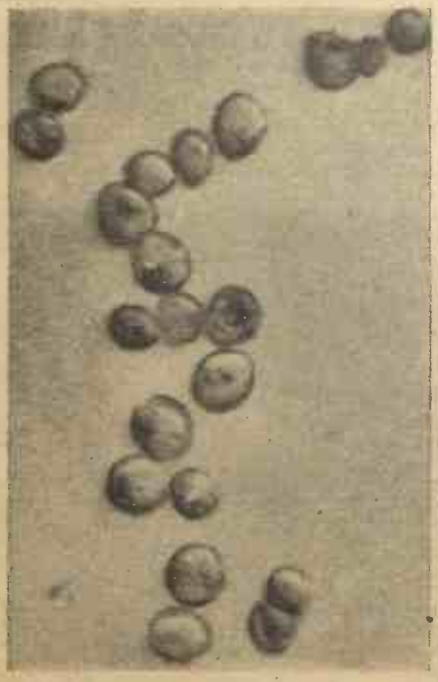
In the secretions of the pancreas occurs *trypsin*, another enzyme which acts on the protein matter in our food. *Trypsin* works best in alkaline solution. Hence the pancreatic juices are always alkaline.

In the intestines, the food meets with the fat-splitting enzyme *lipase*, and also with a similar enzyme, *steapsin*, both of which break down the fats into fatty acids and glycerine.

Other enzymes are secreted by the kidneys, the liver, the mucous linings of the intestines. Even our blood has at least one enzyme of its own, which is called *thrombin* and whose function it is to bring about a quick clotting of the blood when the latter becomes exposed to air.

Thrombin is only one of the several "clotting enzymes" which are known. Another is *rennet*, which occurs in the lining of the calf's stomach and which is much used for the curdling of milk in cheese manufacture.

When an apple is cut, the exposed interior quickly turns brown. This well-known phenomenon is an example of the action of another class of enzymes which are termed "*oxidases*." Their function is to bring about the quickest possible oxidation of plant tissues. A similar enzyme known as *laccase* occurs in the rhus, a Japanese plant, and results in the cut surface of the plant stem becoming dead-black within a few seconds.



A high-magnification photograph of living yeast cells which bring about alcoholic fermentation.

Zymase

The enzyme of yeast is known as *zymase*. It is this substance which has the extraordinary power of "fermenting" or breaking down sugar into alcohol and carbonic acid. Despite the most active researches and some encouraging results, the ultimate composition of this *zymase* is entirely unknown, and for this reason mankind has still to rely upon the different strains of yeasts for the production of the world's different beverages, its beers and wines, to say nothing of its breads and its other baked cereals.

But mysterious as the ultimate chemical compositions of the many different enzymes are, the precise mechanism of their actions is still more perplexing.

Consider, for example, the fact that *pepsin*, the enzyme of the stomach, has the power of digesting flesh and other protein matters. Why, therefore, does not the stomach digest itself? Why, also, does not our blood turn solid in our veins in view of the clotting enzyme, *thrombin*, which it undoubtedly contains?

Mould growing in a laboratory culture medium. Many varying enzymes are produced by moulds.

Anti-enzymes

No scientific researcher has yet been able to bring to light an adequate explanation of such problems. For the time being, chemical science has postulated the existence of a class of "anti-bodies" which it terms "anti-enzymes." It is supposed that many of the enzymes of the human and animal body are always accompanied by a corresponding number of "anti-enzymes" which, under given conditions, in some mysterious way hold the power of the normal enzymes in complete check. "Anti-enzymes," therefore, are to be regarded as natural protective substances. They constitute the chemical controls of the many operations in Nature's animal and plant laboratories. Without them, the animal and plant organism would at once fall into disorder.

"Anti-toxins"

It has been suggested in connection with the modern theory of infectious diseases and the immunity which is to be obtained from them by the injection of certain "anti-bodies" into the system, that the relationship between the often highly virulent "toxins" of the disease and the powerful "anti-toxins" which are used to secure immunity from the disease in question may be similar in basic principle to the relationship between an enzyme and its corresponding anti-enzyme.

Whether this supposition will ever be scientifically substantiated in the laboratory has yet to be seen, but it is almost certain that the ravages of disease germs are fundamentally due to the presence of enzyme-like secretions which they generate in the bodies of their hosts.

"Mechanism" of Infections

It would appear, therefore, that the purely chemical problem of enzymes, their composition and their characteristic actions may, ultimately, be found to be inseparably bound up with the question of the "mechanism" of infectious and bacteria-borne diseases. In such a case, the solution of the chemical problem would be followed by a great advance in the treatment of infectious diseases.

The sundew—a British marsh plant which catches flies on its sticky leaves, and subsequently secretes an enzyme which dissolves away the softer portions in the insects' bodies.

The subject of these mysterious natural secretions to which the name "enzyme" has been given forms a sphere of chemical science—and, perhaps, *the* domain of chemical knowledge—in which the least amount of progress has been made. That the entire subject is complex and intricate in the extreme goes without saying. But for the serious student of chemistry, enzyme action has a fascination which is never subdued. For by means of the enzymes, old Mother Nature not only controls the chemical mechanism of our own and of all other animal bodies, but she also, through the agency of these strange and potent natural chemicals, performs much of the necessary routine work of the natural world for us, in addition to presiding over not a few of the world-wide industries which, during the ages of history, we have gradually brought into being.

Our Busy Inventors

By "Dynamo"

Amateur Glazing

PEOPLE whose windows have been blasted by the blitz will be interested in a new glazing expedient.

When a large window is blown out by enemy action, difficulty may be experienced in obtaining glass of sufficient size to fill up the main frame in one piece. According to this improved device, the aperture can be rapidly adapted by units to take smaller glass.

The inventor has devised a system of quick repair by means of frame units which are finished components that can be assembled with locking bolts, and unskilled persons are able easily to fix them in the window.

An Improved Rat Trap

A RECENT invention has for its object the trapping of rats and mice.

Traps of the break-back type usually have the tripping mechanism and loop in the direct line of vision of the vermin. It is suggested that this arrangement excites the suspicion of the prospective victim. Indeed, it is stated, practice has proved that, in order to be effective, such traps must be allowed to remain in position long enough for the rat or mouse to become familiar with its appearance.

In an improved trap, the operating mechanism and the break-back loop are situated below the surface of the base in which they are mounted. Consequently, the only portion above the level of the base is the short bait-carrying spike which causes the tripping arm to function.

Match Holder

IN our prodigal pre-war days an enormous amount of timber was thrown away in the shape of discarded matchsticks. To save wood or other material in the case of the match is the *raison d'être* of what appears to be a striking invention.

One example of the idea proposed is a length of material—wood, cardboard or wax—provided at one end with a striking head and at intervals with additional striking heads. Short pieces can be broken off and inserted in a holder. To facilitate breaking off, the material may be weakened or notched near the heads.

The holder may be of wood or cardboard, and have a socket of any suitable non-burning substance, for instance, asbestos, metal foil or bakelite.

Safety Razor Blade Holder

ANOTHER kind of holder is the subject of an application for a patent in this country.

The construction of this holder permits a safety razor blade to be attached and detached easily, quickly and safely. And it enables the blade to be firmly and securely fixed, while the cutting edge is left completely free.

The invention includes a handle and head portion. There is a flat surface for the blade to lie on, and there are studs for insertion in the holes of the blade. The studs have aligned holes engaged by a wire or rod which can be withdrawn. The wire or rod extends longitudinally above the blade, thereby holding it flat on the above-mentioned surface to prevent it becoming disengaged from the studs.

Mobile Hoists for 'Planes

A MOBILE apparatus for rapidly hoisting aircraft is the subject of a recent invention. Retractable undercarriages, bomb racks and landing flaps have to be tested and repaired, and for these purposes it is necessary to raise the aeroplane.

Stationary plant for this purpose has been devised, but it is subject to disadvantages. For example, in the event of damage by enemy action to the part of the building in which such plant is situated, it may not be available.

To counteract this drawback, an inventor has designed mobile hoists which can be quickly transported from one spot to another.

The device comprises a wheeled trolley having a low platform for a telescopic ram assembly with the ram axis perpendicular. On the trolley is a self-contained hydraulic system and there is control means, which may be remote from the trolley, adapted to operate the system to raise and lower the ram.

Preferably, there is a gang of three such trolleys, one under each wing, and a third under the tail of the aircraft. In this way, a 3-point suspension may be effected. The trolleys can be linked to one control. This, where the source of power for the hydraulic system is electrical, can, with advantage, be a portable switchboard controlling an independent motor for the hydraulic system on each trolley.

The apparatus enables aircraft to be elevated wherever situated, in the assembly, repair or maintenance shops.

A Joint Remedy

AMONG recent applications for a patent in this country, I note one relating to an appliance for the treatment of rheumatism and also for promoting the growth of hair.

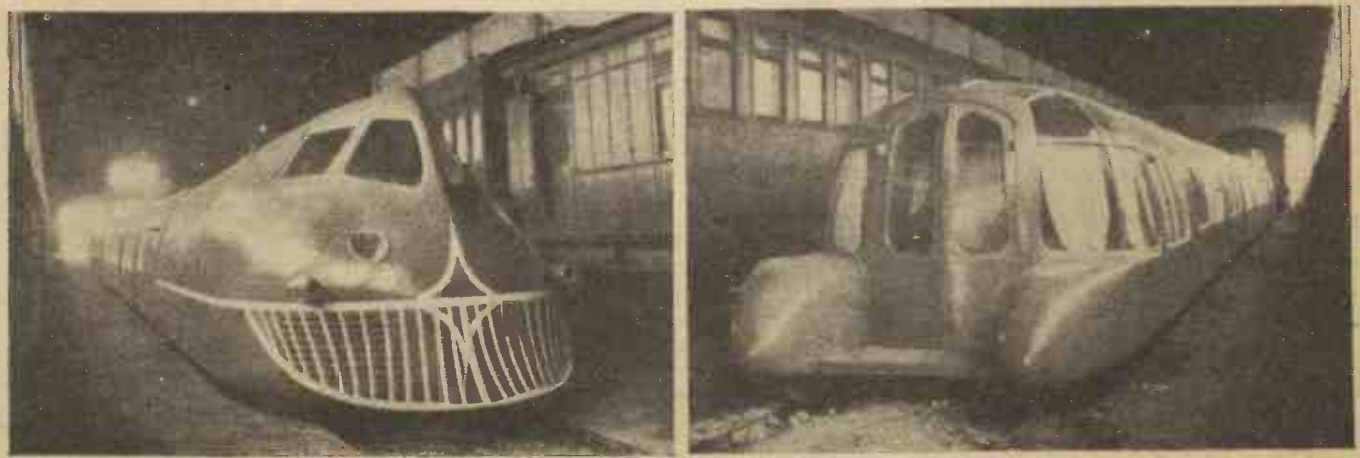
The appliance consists of a substance sprayed with a solution for use as a medium for transmitting daylight or artificial heat. This can be used as a hand appliance held at a distance of 3 or 4 in. from the body, or it may be employed as a covering for windows. If it takes the form of a hand appliance, it may be circular in shape with a diameter of 3in. and a quarter of an inch thick. And it will have a small handle attached.

The substance used in the manufacture of the appliance is glue. This is subjected to a process, after which when it is held up to a light it will be seen to be of a deep red colour and will be intensely cold- and highly heat-resisting.

For Pipe Smokers

THE number of contrivances having for their aim the comfort of the smoker is legion. Yet one more has made its advent. In this instance, the inventor has endeavoured to produce a method of eliminating the tarry substances or condensates which constitute the principal drawback in pipe smoking. He maintains that his invention not only catches these objectionable products, but to a great extent disposes of them by subjecting them to the temperature of the burning tobacco. This is stated to cause destructive distillation or otherwise to consume the condensates. As a result, there is left behind a slowly accumulated carbon residue.

Broadly, the invention consists of an absorbent aggregate of fine heat-resistant glass filaments lying in the bowl of the pipe. In the bowl is a sack-like arrangement which may be of woven or knitted glass yarns.



This articulated train—a Spanish invention—has proved itself very satisfactory during recent trials, a speed of 200 kilometres per hour being reached. The train consists of various carriages connected by a special articulation arrangement, the undulating system of which gives the train a reptile-like movement. The maker of the model of this new train is Engineer Lieutenant-Colonel Goicoechea.

A Wind-driven Generator

This Interesting Article Has Been Written Around the Details Supplied by Mr. F. G. Hales, Who Designed and Constructed the Wind-driven Plant Described

DURING the last six years I have been experimenting with various types of windmills in an endeavour to secure a satisfactory prime mover for use with a small dynamo. My efforts have met with varying degrees of success, and, I must admit, have caused a certain amount of amusement among my friends. However, I feel that I am now in a position to smile, as the installation about to be described has been supplying me with light, and charging radio accumulators, for the past 18 months. To avoid any misunderstanding I would like to point out that the present design has been developed by "trial and error," which, quite naturally, involved a fair amount of work and many headaches, but as very little data was available, and as I like scheming things out, I had no alternative. These details are given solely for the benefit of those engineers who might feel inclined to suggest that the finished article could have had, shall I say, cleaner lines and been less cumbersome.

The First Problem

Anyone who has constructed simple windmills will agree that the making of the vanes, etc., and securing reasonable speed and power are not factors which present any great difficulties. The problems arise when one has to consider winds varying from a light breeze to a gale—obtaining reasonably consistent speed, and devising a construction which will withstand all the strains and wear likely to be imposed on it by our erratic climate.

As I was chiefly concerned with the windmill driving a dynamo, experiments quickly revealed that some form of automatic control would be essential to solve the first two problems, namely varying speed of the wind and constant speed of the dynamo. These two might seem closely related, but in actual practice they did not work out quite as I expected. I thought I could overcome the second item by making use of a cut-out in the electrical circuit, thus ensuring that the charging circuit was only brought into action when the dynamo produced a certain output, or was being driven at a specified speed. However, as I wished to limit the cut-out to the small operating margin of 2 to 3 volts with respect to the 12 volts of the charging circuit, results were not too successful. Therefore, I abandoned the electrical idea and concentrated on securing the same effect by purely mechanical means, but more about that later.

Variable Pitch Vanes

If a windmill having vanes or sails of fixed pitch is erected and left to the tender mercies of the winds, it is highly probable that it will rotate at reasonable speeds during, say, nine days out of ten—depending, of course, on its geographical location—but on the tenth day the owner-constructor might witness the rather terrifying sight of the windmill rotating at a speed greatly in excess of that anticipated, and obtain the impression that something might come apart if the speed is not reduced.

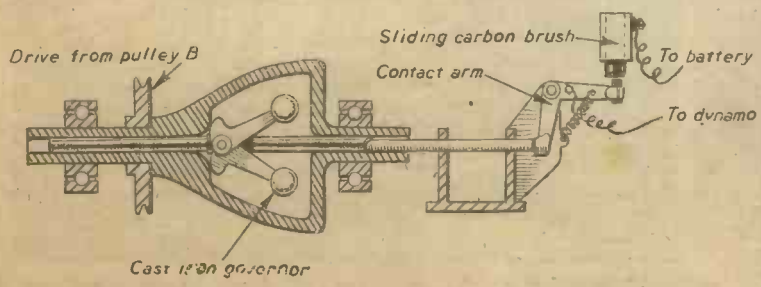


Fig. 2.—The governors which operate the make and break contact in the charging circuit.

To counter the effect produced by abnormal wind speeds, various methods of automatic control have been used, one of the most popular arrangements consisting of an air-brake which is brought into operation once the speed of the windmill exceeds some predetermined figure. In the case in question, I decided to experiment with a form of variable pitch windmill, the idea being to reduce the angle of the vanes to the wind as the latter increased in velocity. The design eventually evolved will be best understood by reference to the illustrations.

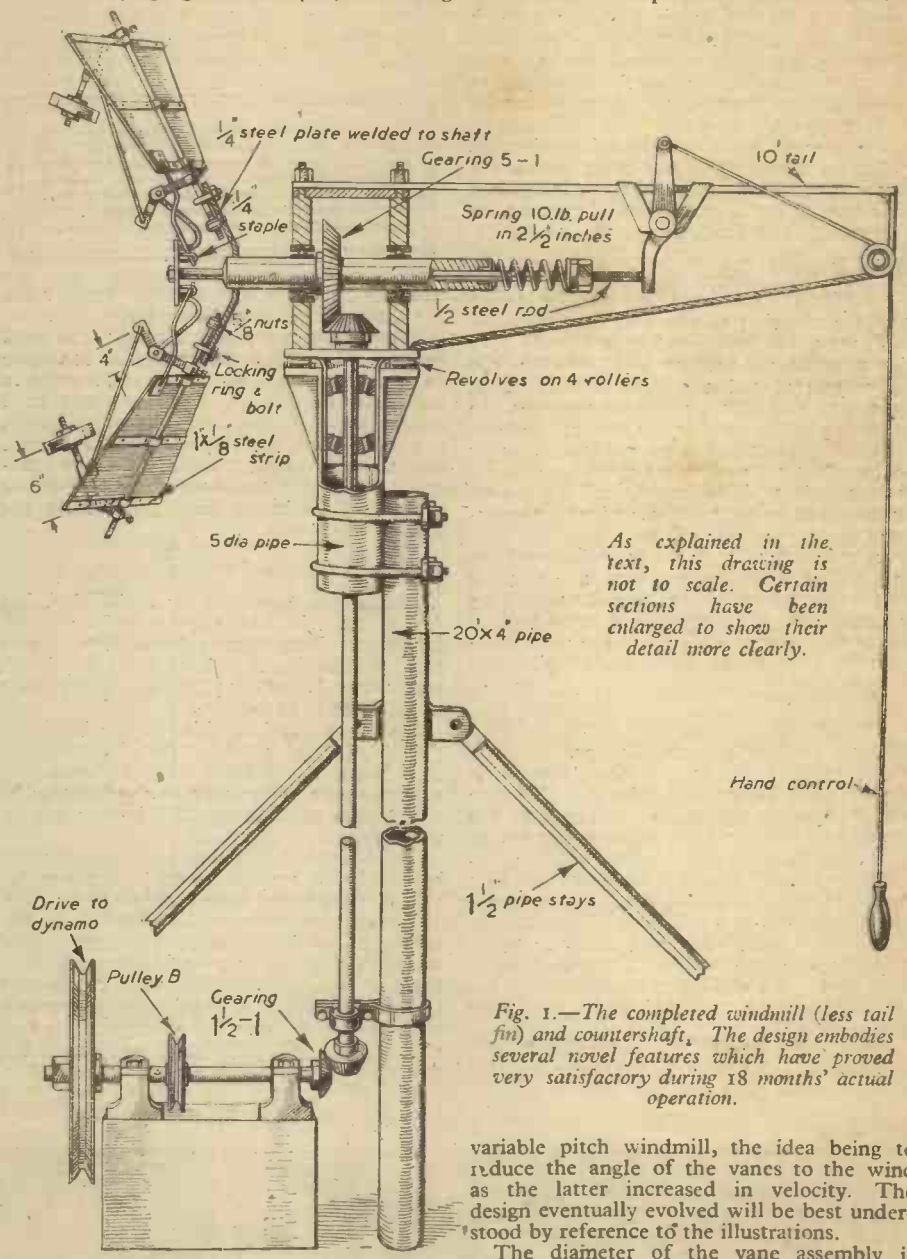


Fig. 1.—The completed windmill (less tail fin) and countershaft. The design embodies several novel features which have proved very satisfactory during 18 months' actual operation.

The diameter of the vane assembly is approximately 8ft. 4in. and this is shown in the front elevation, Fig. 4, where it will also be seen that eight vanes, each 3ft. 6in. in length, are located symmetrically around the dished ¼in. steel plate which is welded to the hollow driving shaft.

Operation

The completed construction, except for the tail fin, which is 30in. x 22in., is shown in Fig. 1—which, incidentally, is *not to scale*—and the following words about its operation should make the matter clear.

To the dished centre plate, eight ⅜in. steel rods are securely fixed. These form the bracing and axes about which the vanes can rotate, but such movement is limited and controlled by the smaller plate (12in. diameter

by ¼in.) A, which is depicted in the enlarged view in Fig. 3.

The plate A is secured to the ½in. steel rod which passes through the hollow driving shaft, the opposite end being spring loaded to hold the plate in its normal operation position. Bearing against the rear of A are the fingers B, these are linked to and operated by the 1½lb. weights which form governors at the end of each vane.

In Fig. 1, the vanes and governors are shown in normal operating positions, 30 deg. to the wind, due to pressure of spring, at rear, but in Fig. 3 the governors have been thrown outwards by excessive speed of rotation of windmill, thus drawing out plate A and causing the vanes to be turned edge-on to the wind.

In actual practice, the latter position is seldom reached except during a heavy gale, when the governors and vanes are varying continuously and likewise cause unsteady running. From a light wind to a medium gale the control is very satisfactory, and I feel justly proud of the results, though that does not mean that I shall cease thinking out ways of improving the whole design.

If for any reason I wish to put the windmill out of action, I can do so by means of the manual control which brings the sliding rod and plate A into operation as shown in Fig. 1.

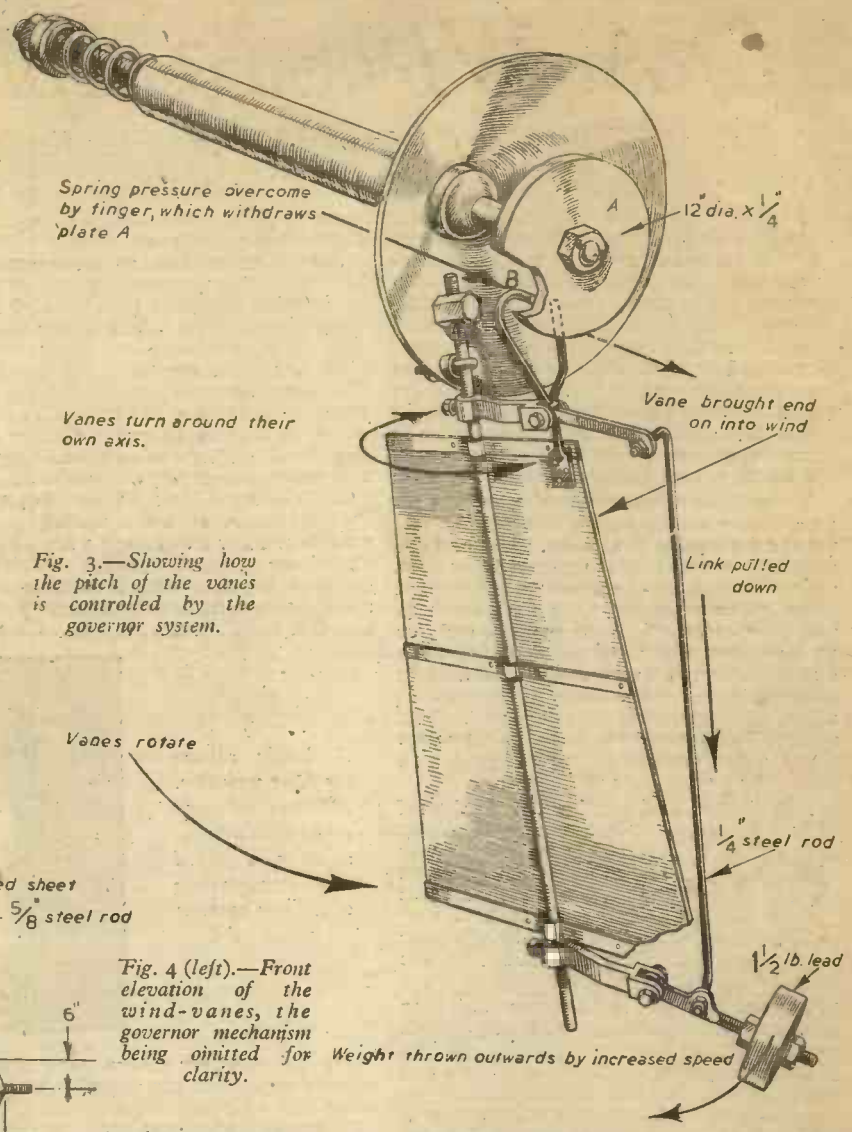


Fig. 3.—Showing how the pitch of the vanes is controlled by the governor system.

Dynamo Drive and Control

The actual drive to the dynamo is perfectly straightforward; the model I use is a series wound type having an output of 50 volts at 1,000 r.p.m. It was found that the most efficient speed for the windmill was in the region of 85 r.p.m., therefore, by using the gear ratios shown, plus that obtained by the pulleys, the dynamo is run at approximately 700 r.p.m. and at that speed produces an output of 16 volts.

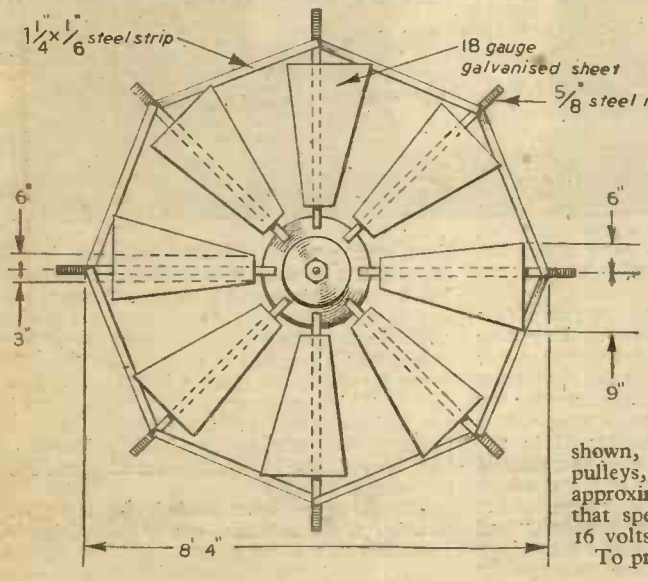


Fig. 4 (left).—Front elevation of the wind-vanes, the governor mechanism being omitted for clarity.

To provide the necessary control for the charging circuit, the separate governor operated circuit breaker was designed and brought into use. It is shown in Fig. 2 and, owing to its simplicity, calls for little explanation. The weights and movement are adjusted to allow the contact arm to break the circuit when the output from the dynamo falls to 14 volts, thus preventing any back pressure from the accumulators (12 volts) reaching the windings of the dynamo. It is possible to regulate the device within 2 volts limits.

Aero Notes

Keeping the Path Flares Burning

"HAPPY landing" is the motto of a small squad of airmen who work in all weathers on a bomber station when night operations take place. They are the flare path party and their job is to maintain sufficient light to enable aircraft to touch down safely in all circumstances.

Mist or fog may have blown over the airfield while the bomber crews are away over enemy territory, and landing is difficult. The runway is edged with small, permanent lights, but large flares are needed when visibility becomes poor. So the airmen run along the edges of the runway, placing and lighting "goose-neck" flares, which resemble watering-cans provided with wick and paraffin.

Still more light may be needed. The squad lights larger flares which consist of buckets of paraffin topped with wire baskets holding the wick. Sometimes these flares are put in position before aircraft take off, but if this has not been done and visibility deteriorates quickly the lives of the crew depend on the speed of the flare path squad. At times another runway has to be prepared before the aircraft return; at others the auxiliary electric lamps placed beside the permanent lamps have to be brought into use. The auxiliaries are laid in position for each operation.

The permanent lights can be switched off, but the flares have to be doused by hand. The party is responsible also for the light guides which help the pilots to approach the runway at the correct angle. Even after the squadron's aircraft have landed, the men of the flare-path party stand by to cope with any aircraft diverted from other airfields owing to bad weather. They give the aircraft the light to land safely, but they get little of the limelight. Their reward comes when the aircraft touch down safely.

Squadrons Moved by Gliders

THE entire ground and clerical staff of a Mustang squadron of Army Co-operation Command were moved recently from one airfield to another by gliders in the remarkably short time of one hour.

"I knew little about gliders before this trip," said a member of the clerical staff of the squadron, a corporal, describing the move. "I admit I was a bit worried at first, but the cheerful confidence of the pilot soon reassured me. We airmen sat facing each other along the length of the body, and saw one after another of the 'tugs' get ready for the take-off. Ropes were made fast, and with a roar the tug and the glider raced down the runway. We all quietened down when our turn came. The tow rope slackened and became taut alternately, then the noise and the bumping were replaced by a gentle swaying motion and a sound of rushing wind. We were airborne."

Storing Photographic Negatives

Two Filing Systems for Keeping Films Handy for Future Reference

By JOHN J. CURTIS, A.R.P.S.

THE individual who only exposes two or three spools a year is not sufficiently interested in photography as to wish for a means of keeping his films for future reference. He will possibly place this year's holiday snap negatives in his pocket book or in an envelope or wallet, or he might even keep them in a drawer at the office; if they are wanted at some future time, well, he may be able to find them, but it is more likely that he cannot remember where they were put, and the search proves fruitless.

There is also the person who exposes six to a dozen spools during the year at odd times on a variety of subjects. Generally it will be found that he starts on a fairly good scheme for keeping the negatives, but does not complete or carry the work far enough to make a success of it, each spool of eight or 12 negatives being carefully placed in a small envelope with perhaps a terse description of the contents, and probably a date showing when the contents were exposed. This method helps towards tidiness, and it shows that a certain amount of care is expended on the hobby by this class of amateur.

It is obvious that whether the number of films runs into tens, hundreds or thousands they should be retained in an orderly way whereby any specific negative can be found without a lot of seeking, returned to its place without wasting time and, what is of very great value, any data that might be of service in the future carefully recorded with the negative.

The writer has had in the course of his long experience the opportunity of trying various means of storing negatives, from the old idea of keeping them in the original boxes in which the plates were packed, and when the box was full attaching a sticky label on the end of it with the titles, names or number of the exposures clearly written in ink. This was the system adopted by many professionals in the old days, but what a job it was to find the negative; it was usually in the bottom box under a high column of other boxes, all of which had to be removed so that the last could be lifted out. The grooved wooden boxes to hold a hundred ¼-plates were very good in their way, but their index or record card was stuck to the lid on the inside, and this meant that every box had to be stencilled with a number on the outside, to act as a guide to which box the negative belonged, as, for instance, box 12—1935 or 16—1936. This could lead to confusion when both ¼ and ½ plates were stored in these boxes, for the large size only held 50 negatives and required much room.

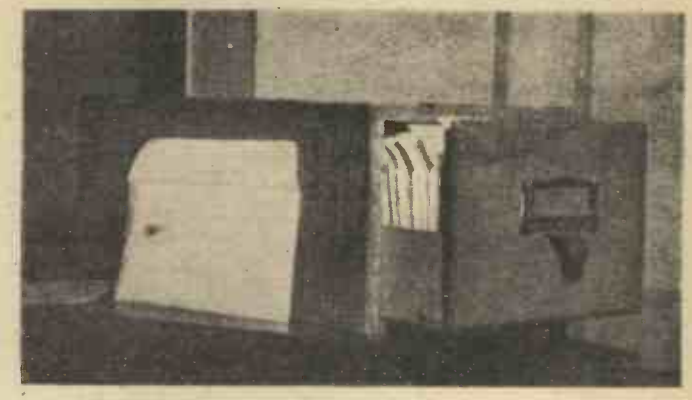
Film Albums

The advent of films reduced the amount of space required and, because of their flimsy nature and the ease with which they could be damaged, the necessity for storing became much more essential and manufacturers soon gave us different styles of albums, boxes or files, not to mention various types of bags or transparent envelopes.

In giving the two systems which I have had functioning for a very long time—one for at least 20 years—I am convinced that they are sound as a means of storing, reference, and for recording useful data, and they can therefore be recommended to all readers whether using large or small quantities of films.

Card Index System

Some years ago I was passing a second-hand furniture dealer's shop and happened to notice a card index cabinet in the doorway. It was a single drawer type, taking a card about 6in. wide by 4½ to 5in. deep; it was the usual varnished style, very dirty but quite sound. The sight of it fitted in with what was running through my mind at the time, viz., what was going to happen to my collection of film negatives? They were accumulating so fast that unless something was done quickly they would never get filed. That cabinet drawer changed hands for a few shillings, and at a stationers a few doors away a stock of special envelopes of good quality manilla was obtained together with a number of cards ruled feint; naturally both these were of a size that would fit the drawer. On my way home I devised my scheme, and during the evening more than 500 negatives were stored away and reference cards inserted.



A handy cabinet for filing negatives. A small envelope containing the negative is placed in a larger envelope which also contains a data card.

The majority of my films in those days were 3¼ by 2¼ and were of the usual amateur type, landscape, seascape, river scenes, a few portraits, and so on. If it was felt that it was best to store them under landscapes, or the names of the district or town where they were taken then they were placed in the envelope marked landscapes or that marked "Blankton," but on the face of the envelope was a number and a brief description of the contents, such as "Pastoral at Blankton," and the number would be the position the envelope held behind the index card, and this number would appear on the card as No. 3. Landscapes at Blankton. No. 4. Blankton Views. It was possible to store 30 or even 40 negatives in one envelope, but they had to be of the same type or subject and, of course, the more one filed in the envelope the longer it took to find the particular negative required, but this never really became a bad fault. Now every index card has at the top, very clearly typed, the year, as 1927 or 1933, and it is surprising what a help this little item has been to me, not only as a quick means of finding what I required, but also as an aid to memory. Often one is asked, when did so and so happen? You suddenly remember that it was when you went to——, and so you turn up the card in the negative file and get the date from it.

The envelopes are of very stout material, and they have stood up to all sorts of handling and have never wanted renewing, unless for the purpose of adding more data, but usually my data is inside with the negative, perhaps on a smaller bag or else on a small card. With regard to the necessary data: sometimes it is useful to know the make of film, the stop used, and the time of day, but always the name of the developer, usually Azol. Also, what paper gives the best result, and the exposure required for a particular grade. These last items save a lot of time, because I often have to make a number of prints some time after the original was made, and not only time, but also paper, for it takes a first-class expert to judge the accurate exposure for any and every negative; one can estimate fairly well for contact printing on gaslight paper, but it is a very different story when the printing is done by enlarging.

Alternative Method

There is a second method of filing which may appeal to many as being more suitable than the one already described. At the present time, owing to special circumstances, I am finding it is in many respects quite a success, but I would not say it is better. Two years ago it was necessary to make up a small collection of prints of various subjects, which meant that a search had to be made through some hundreds of films taken at different times. This, as you can understand, was something of a task, and it revealed a weakness in my system; nevertheless, it still holds good, but, for the time being, the second scheme is the one in force.

The guide cards are headed with the class of subject, for instance, one is headed landscapes, others snow scenes, interiors, street scenes, figure studies, portraits, and so on; then behind each guide card is placed an envelope with the index number in the top left-hand corner, and then the name of the place or district, and the month of the year; and each set of negatives made at that particular spot and time will be in a smaller and thinner bag inside the envelope accompanied by details of data that might be useful later on. The larger envelope can contain other sets of the same class of negative, but taken at a different time and place; but each set is recorded on the envelope and also on the guide card with its reference number. It does not matter how many guide cards you use or how many envelopes behind the cards. Landscapes can be divided into several groups with more definite titles as harvesting, woods, pastorals, etc., this would depend very much on the number of exposures you are likely to make each year. The great advantage this method presents is when I want a dozen good negatives for, say, a dozen lantern slides of street scenes all I have to do is to look on the envelope behind the guide card marked street scenes, and I find them in a few seconds or, if

one negative is required for an exhibition print to be made of an interior of a church at some village near where a holiday was spent, my file will tell me immediately where to find the negative, and it will also give me a very good idea what exposure I am to give.

Storage Albums

Here are two systems of filing which have proved very efficient, and can be recommended for those readers who have an accumulation of negatives extending over several years, and which includes all sorts of subjects; to those who are just starting or have only two or three hundred films I would certainly recommend the Holborn Cellofile storage albums; they are well made in different sizes to take the popular size films, and each album will hold 100 negatives, each in a transparent envelope, which can easily be removed; a useful index is also included. Although there is a shortage of this type of album, there may be a few about in dealers' shops.

Tidiness

Some readers may think that storing negatives in a systematic manner takes time, but this is not so, as it can be started in a few minutes, and it takes only a few seconds longer to put a negative into its right place, where it can be found when wanted, than it does to slip it into a drawer where it will be forgotten, not to mention damaged. After all, tidiness should be the maxim of all amateur photographers if they wish to be successful.

The World of Aviation

110-ton Aeroplane : Spitfire's Stratosphere Record : New Fighter's Speed Record
R.A.F.'s New Bomber : Torpedo Bombers : United States Army's £130 'Plane
Navy's New Fighter

110-ton Aeroplane

MR. GLEN MARTIN, United States aircraft manufacturer, stated in Baltimore recently that he is designing a 110-ton flying-boat which, when completed, would be the world's largest 'plane.

Spitfire's Stratosphere Record

THE lead in stratosphere flying has been gained by Britain with the improved Spitfire, which has been given its supremacy at altitude by the introduction of a new Rolls-Royce engine—the Merlin 61—fitted with a two-stage supercharger. An important feature about this new supercharger is that it maintains a sea-level pressure up to 40,000ft., at which altitude the charge is being compressed to six times the surrounding atmospheric pressure, and thus doubling the power of the original Merlin 3 engine.

New Fighter Reaches 725 M.P.H.

IT was revealed in New York recently that a speed of 725 miles per hour during dives was reached by two United States Army pilots when testing the new high-altitude fighter, the P.47 Thunderbolt, now being built for the United States Army. The dives began at 35,000ft. and pulled out at 25,000ft.

R.A.F.'s New Bomber

THE Lockheed Ventura reconnaissance bomber, numbers of which took part in the raid on the Philips works at Eindhoven, is now being mass produced in America. The Ventura is bigger and faster, and has greater endurance than the Hudson. The outward appearance is similar, a notable difference being that the underside of the end of the tail is swept up from a step like a flying boat. A greater load is carried and two more-powerful engines—Pratt and Whitney Twin Wasps of 1,200 h.p. each—give a higher speed. A crew of four is carried. Guns carried in the nose and elsewhere protect all vital parts.

A Seafire on the flight deck of an aircraft carrier.

Torpedo Bombers

IN adapting the Ju 88 as a torpedo bomber, the Germans are following a practice which has become common to the Luftwaffe and the R.A.F. We have converted both the Hampden and the Beaufort to carry torpedoes. The Germans have adapted the Heinkel III bomber, and its floatplane version, the He 115, to this use.

An improved Spitfire, showing the slightly longer nose, with four-bladed propeller and multiple outside exhausts. The two cannon guns can be seen on the wings.

U.S. Army's £130 'Plane

A SMALL two-seater commercial aeroplane, known as the Piper Cub, has been converted for use as an observation 'plane for United States artillery units.

Costing only about £130, the Piper Cub is equipped with a 55 h.p. engine and can take off or land inside 40yds. Its cruising speed is 75 m.p.h., rising to 90 m.p.h. flat out.

The Navy's New Fighter

HIGH-SPEED fighters operating from British aircraft carriers first came into the limelight as the result of their fine work in protecting the great Russian convoy from air attacks last August. Now the Royal Navy has a still newer fighter—the Seafire—which has already proved its worth in the North Africa operations. The Seafire, as its name implies, is a Spitfire modified for the special conditions of working from an aircraft carrier, a development which will undoubtedly have a very important bearing on future naval operations (see illustration above).

Tank-carrying 'Plane

A LOCKHEED triple-tailed aircraft capable of flying a light tank across the Atlantic, recently made its first flight in the United States. The machine is powered by four 2,000 h.p. air-cooled radial motors.

Welding Technique

How Important Engineering Repair Jobs Are Carried Out by Welding

By C. W. BRETT, M.INST.W., Managing Director of Barimar, Ltd.

Power press failures are not frequent—there is usually a wide margin of safety. Sometimes, overloading in an emergency or by error causes a breakdown, as in the case of this hydraulic press base weighing nearly two tons.

THERE is a vast difference between welding for new production, and similar methods applied to repair needs. The former is generally a matter of systematic routine, the latter a series of individual problems that consummate skill and long experience alone can solve.

Practically every branch of engineering can benefit from the maintenance facilities afforded by scientific welding; it is therefore surprising that considerable ignorance of these possibilities exists. In normal times the price of this lack of knowledge would be in the overwhelmingly greater cost of new replacements. Nowadays insistence on renewals creates a serious drain on resources of material and labour.

Those who read PRACTICAL MECHANICS regularly will have been impressed by recurrent difficulties in the way of obtaining parts of all kinds to meet inevitable needs in the matter of wear, breakage, or corrosion. With few exceptions, the resources of welding provide the solution.

Electric Process

It is one thing to make assertions, another to prove them. Facts there are in plenty, and one of the most striking is the modern technique used in handling crankshafts. This is one of the most difficult components to replace. Moreover, when breakage does occur, usually through a web, there is nothing half-hearted about it and one is lucky to escape major distortion. As steel is the metal involved, the electric process is favoured. Great strength is a vital necessity, but this is useless if alignment is not accurate to within at least 1,000th part of an inch in all respects.

The job is one that calls for the utmost skill on the part of the operator, who works in conjunction with a metallurgical chemist, for the type of welding rod, speed of working and a score of other interconnected points must be settled. This can only be done by long experience. Work of this kind is first carefully prepared and then layer after layer of metal is put down with amazing precision, each one normalising the previous run. This is so important that the final layer stands "proud" and is machined away entirely, thus leaving only normalised weld metal.

During the whole of this work the point of fusion is enveloped by hydrogen. This is to avoid atmospheric contact, for oxygen creates pit marks and lowers the quality of the weld because of its affinity for the molten metal.

Scientific welding came to the rescue—here is the repaired base, as good as new. (Repaired in the Barimar Welding Works.)

If crankpins and journals are scored and worn they can be built up in the same manner, and a mirror surface entirely free from blemish obtained. This is better than grinding undersize, in fact many engineers specify oversize diameters so that after a further long period of service, grinding then reduces the bearing surfaces to the designed diameters.

The cylinder block of a powerful diesel engine belonging to a tractor engaged on vital National work. The engine has been rendered useless by an accident which resulted in a large part of the crankcase being broken away.

X-ray Examination

When this part of the work is done X-ray examination is applied and this would reveal any flaw, however slight, and allow of its speedy elimination. Faults are extremely rare and never remain undisclosed. This points to the interesting fact that of some 700 crankshafts, mostly belonging to private cars and commercial vehicles, each kept under observation after being welded subsequent to breakage, only one failed a second time and this was at a point remote from the repair and due entirely to an error in the original forging. Not all these shafts were of the type described. Several are operating in large stationary and marine Diesel engines, whilst one belongs to a main line locomotive. Many needed re-aligning as they were distorted when they were received.

Where welding repairs are concerned it is essential to have a well-equipped machine shop so that the parts needing attention can be precision-machined and made ready for immediate fitting. This is often of great advantage when dealing with smashed cylinder heads and blocks which are likely to be burst by frost if draining has been neglected. It is often supposed that damage of this kind consists merely of a crack or, at the worst, a piece of metal being broken from the cylinder wall. Welding engineers know that it can be much more extensive. A cylinder block in as many as 30 fragments is not a rarity. If the tally is incomplete it makes no difference, apart from the need for casting a new section. Knitting these parts together so that the primary strength is regained is only one aspect of the operator's task. True alignment is vital, and, moreover, the repair must be invisible. When the job is done by experts it would puzzle anyone to detect a sign of repair.

The same cylinder block after all the damage had been repaired within a few days and at a comparatively small cost by scientific welding. (Repaired in the Barimar Welding Works.)

It is a fact that certain makes of engines usually fail in the same way. One power unit, which shall remain unnamed, fails internally under the pressure of ice. Thus the unfortunate owner may think that all is well until he finds water and fragments of cast iron in the crankcase. Many motors of this type have been welded successfully.

A boon to the inventor, and all those who produce single machines for special work, welding avoids the cost of patterns as it obviates foundry work. Of course it cannot compete in cost where repetition needs are concerned, for the outlay upon patterns can be spread over a large number of items.

Welding Dissimilar Metals

One of the most interesting of all recent welding developments is a process whereby totally dissimilar metals can be welded together. Not many years ago it was considered remarkable to weld cast or malleable iron to steel, now aluminium can be welded to steel and scores of other combinations are equally successful.

This process has nothing in common with brazing. Tests to destruction invariably cause the weaker parent metal to fail before that within the area of union, thus proving that a true weld results.

The opportunity which welding offers in regard to reconditioning second-hand and discarded machinery is often overlooked. Usually this can be done at little cost and without the need for a single new part. Even when gear wheels appear to be irreparably damaged and teeth are broken away and lost they can be built up afresh and re-milled accurately.

It is a fact that a welded part is very often better than a new one. This is because when the duty calls for resistance to wear or corrosion the weld metal is chosen with special regard to the service required, therefore added opposition to these influences is often possible, thus increasing both the dependability and the life of the item concerned.

The whole subject is one of special interest as well as national importance. So momentous are the strides being made that they will exercise a potent influence on post-war production.

Diesel Engine Pistons

Materials Used, and the Various Types and Designs

By P. BOUSFIELD

THE design of the piston of a diesel engine is a matter of supreme importance. Whilst quite a number of diesel pistons are designed to the usual familiar standards without any special feature —there are others which have a little more in the way of modifications and adaptations not met in the everyday straightforward type.

Production of a Piston

Nearly everyone is familiar with the cylindrical piston casting arising from the molten metal poured into the moulded form left by the pattern and core. It is then just a cylinder with one end open and the other surmounted by the unfinished shape of the crown.

As a rough casting it is well oversize to allow plenty of material for machining and transforming it from its crude—as cast—appearance to the polished looking "finished" piston. Apart from the general turning work, the piston ring grooves have to be cut, the gudgeon-pin hole finished bore to size, and the inside of the piston will probably be sand-blasted, unless it is a very clean casting.

Every piston is produced in three stages, which are as follow:

1. The pattern and the core boxes are made.
2. The piston is cast.
3. It is machined.

Material

So far as the material of the piston is concerned there are variations in practice according to the working conditions. Of course, if the job is designed for an aluminium piston, it is no use supplying a cast-iron piston, as the weight will be wrong. From this it can be gathered that weight, and its accuracy, are important matters.

The majority of pistons are of cast iron for diesel work. This has to be a special high-grade, close grained cast iron to give long life and good results. Very often if no particular grade of iron is specified, the foundry are asked to give details of analysis, or submit a sample of the metal for approval.

A number of pistons are made in cast steel, but the problem here is the long time for delivery. This especially applies for marine jobs when time is usually all too short.

Design

Variable details in the piston design include:

1. The shaping of the piston crown.
2. The webbing inside the piston.
3. Such features as the position of ring grooves, special designing for cooling arrangements, etc.

Variations in the shape of the crown include special formation for creating the necessary turbulent conditions in the combustion space. In one design there is a curved piece fitted to the crown which is made separately and is detachable, which part tallies with a depression in the underside of the cylinder cover.

There are various other shapes relating to efficiency of combustion; but these should not be confused with the shaping to one side of the piston in some two-stroke engines which relates to the scavenging of the cylinder in conjunction with exhaust ports situated in the latter.

In regard to the webbing, the design varies largely in accordance with the working temperatures of the job.

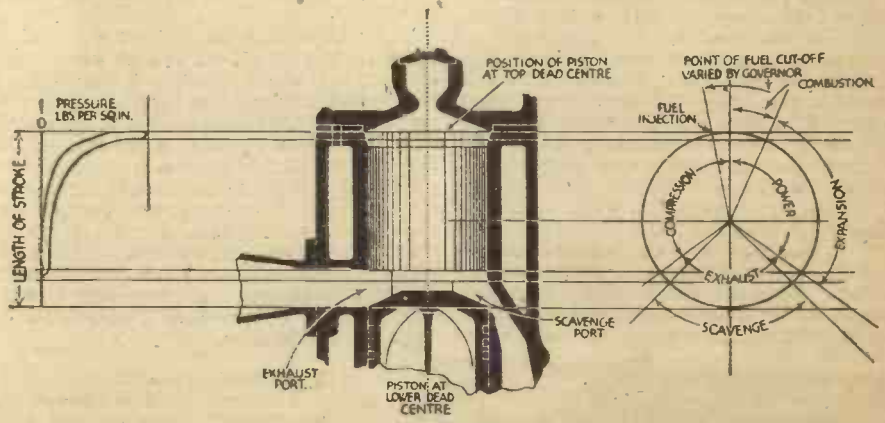


Diagram of the head of a diesel engine cylinder, showing the piston, and sequence of operations.

The general principle of webbing in metallic contact with the crown is the conduction of excessive heat away from the piston crown, and generally speaking the larger the cylinder bore the more is the necessity for provision of ample webbing for reducing temperatures at the crown.

The design of the grooves, etc., may be altered from the original spacing, taking into consideration any adverse working conditions and results which may have been obtained.

For example, the grooves may have been originally designed to take ordinary plain Ramsbottom rings. Then trouble possibly arises in the matter of loss of compression, or excessive lubricating oil consumption.

There are a number of special patent rings on the market, and the grooves of a piston may be enlarged to take a special "restricted" ring, or upon the advice of piston-ring manufacturers, which are well acquainted with compression troubles, etc., in so far as they are effected by the rings already employed.

The position of the scraper ring groove—or grooves—is variable; as also is the distance of the top ring groove from the crown of the piston.

Another matter to be considered is the position of the centre of the gudgeon-pin hole relative to the crown of the piston. By varying this distance even slightly, considerable differences in compression are obtained.

Cooling Arrangements

One other feature of special note is the cooling arrangement. On small pistons the metal to metal contact in the cylinder walls—and possibly fins on the cylinder—is sufficient to carry away unwanted heat; but in the case of large cylinder bores, e.g., in main diesel engines for marine jobs, some special cooling system is necessary, and special designs embodying pipes for circulation of oil or water are found necessary.

In conclusion, it may be mentioned that pistons may be single acting, double acting, or of the opposed type, in which latter case the combustion space is in the middle of the cylinder.

Also to be noted is the taper of the piston. Pistons are in a number of instances smaller in diameter at the crown than they are at the lowest ring groove; in other words the clearance (when cold) is greater at the top than at the bottom of the piston. This is to allow for expansion of the metal, and here again this varies with the material used in relation to temperature.

MASTERS OF MECHANICS

No. 82.—John Broadwood, Founder of the British Pianoforte Industry

THE present-day popularity of the modern pianoforte is unassailed. Despite the many counter-attractions, and the undeniable advantages which are held out by radio and other sound-reproducing devices, the ubiquitous piano is enthroned in countless households, if not, perhaps, always as the chief instrument of musical performance, at least as the one dependable stand-by for music-making in the home.

The dependability and the all-round efficiency of the modern piano as a musical instrument arise from the fact that the up-to-date pianoforte constitutes, among its many other attributes, a skilled mechanical piece of workmanship. Given regular tunings and the merest minimum of upkeep and attention, any piano will, year in and year out, remain in first-class condition and playing efficiency.

Pianoforte construction began commercially, so far as this country is concerned, as a result of the activities of John Broadwood, a Scottish youth, who tramped to London in search of a job about the middle of the 18th century. Previous to Broadwood's time, only a few pianos had been made, and these were, for the most part, quite inadequate instruments. That John Broadwood fulfilled the rôle of "Father of Pianoforte Manufacture," none will deny, for it was the original excellence of his hand-made instruments, coupled with the new types of construction which he devised, which was responsible for the almost phenomenal rise of the pianoforte into a position of prominence during the latter quarter of the 18th century.

The Clavichord

The actual inventor of the piano is unknown. The instrument—which is, of course, one of percussion—is based upon the principle of the dulcimer, in which crude instrument a tuned wire or metal rod is struck by hand with a soft hammer. Now, dulcimers were known to the Assyrians, the Egyptians and the Arabians in the pre-Christian ages, and it is assumed that such instruments gave rise to the clavichord, one of the oldest-known of keyboard instruments, in which a series of tuned brass wires are impacted by means of a "jack" or "tangent" comprising a vertical piece of brass attached to the farther end of the key. In the clavichord, when the key was depressed, the brass "jack" made forcible contact with the underside of the brass wire, which latter was, in consequence, set in o vibration. These vibrations, being communicated to a simple soundboard, enabled the instrument to emit its characteristic feeble but none the less very expressive and beautiful sounds.

Clavichords were never much used in England. The English preferred the virginals and, at a later date, the harpsichord and the spinet, in all of which instruments the string

John Broadwood.

or tuned wire was actually plucked by a crow-quill or a leather plectrum-like device which was set into operation by the depression of the key.

The 18th century harpsichord was capable of emitting a very loud and an exceedingly characteristic colourful tone. True there are critics who have declared harpsichord tone to be "like a scratch with a sound at the end of it." Nevertheless, for many years the harpsichord held its own as a home instrument and also as an instrument for use in the theatre and orchestra, and even to-day there exist in England a few individual craftsmen and constructionalists who, imbued with the old traditions, carefully and patiently carry on the work of harpsichord construction for the sake of connoisseurs of these old instruments.

An antique clavichord—the keyboard instrument from which the modern piano was evolved.

The First Piano

The first piano instrument is, by some authorities, claimed to be the invention of a certain Father Wood, an English monk at Rome, who, about the year 1711, constructed such an instrument and afterwards disposed of it to an Englishman, Fulke Greville, Esq., who brought it over to this country.

On the other hand, other authorities claim the piano to be the invention of an Italian, Bartolommeo Cristofali, harpsichord player to the Prince of Tuscany, and who, about 1711, made three instruments which he called "hammer harpsichords." Suffice it to state that, at some period during the first half of the 18th century, an instrument similar in basic principle to the modern pianoforte did come into use in Europe, but that, owing to gross imperfections of its mechanism, it fared but badly under the hands of performers, both amateur and professional.

There was one respect, however, in which even the early crude pianofortes excelled the lordly and powerful harpsichords. From the percussion-actuated pianofortes it was possible, by varying the energy with which the key was depressed, to control the force with which the hammer struck the strings, and thus to modify the intensities of the resulting sounds. Such an instrument, therefore, was one which could be played softly or loudly at will, or, to use the Italian musical terms, the instrument could be played "piano" or "forte." The original "hammer harpsichords" accordingly became known first as *forte-pianos* and, later, as *pianofortes*, which name has remained with them to modern times.

No harpsichord could be played with much contrast of tone. The harpsichord "jacks" plucked the strings of the instrument no matter whether the keys were depressed quietly or forcibly. Hence the harpsichord, despite its tonal attractions, emitted sound almost at one dead, monotonous level of intensity.

When John Broadwood was born, in the tiny village of Cockburnspath, Berwickshire, in the year 1732, the 18th century harpsichord was in process of being perfected. A few harpsichords had arrived in Scotland, but, almost certainly, the lad Broadwood never saw any, for his early years were taken up by routine work on a small farm, a type of life which, in those days, offered him not the slightest opportunity for even the rudiments of a formal schooling.

Actually, Broadwood, although born in Scotland, was not of Scottish descent. His parents came of an old Northumberland family which had for years worked some of the wild moorland acres of Northumbria, but which, in the early 18th century, moved northwards across the Scotch border.

Early Years

John Broadwood, during his early years, evidently showed signs of constructive abilities, for he was apprenticed to a local joiner and carpenter. But, seemingly, as he advanced

A modern harpsichord—the present-day version of a keyboard instrument which was popular when John Broadwood first arrived in London.

in his late teens, Broadwood realised that little productive work existed for him in or around his native village. Thus he arrived at the age of nineteen or twenty, making up his mind to venture Londonwards and eventually trudging slowly to the metropolis on foot in order to seek employment as a skilled carpenter or cabinet-maker in the world's capital.

It was during the summer of 1751 that John Broadwood first set foot in London. He was fortunate in obtaining employment fairly quickly, his employer being one Burkhardt Shudi (or Tschudi), a maker of harpsichords.

Shudi, indeed, became one of the most celebrated of the London harpsichord-makers, for, in 1765, when the famous Frederick the Great of Prussia set himself to acquire a harpsichord from the best and the most renowned of makers, he selected Burkhardt Shudi, of London, for the construction of the instrument.

The action of a grand piano.

We have no record of how far Broadwood's abilities went towards the early establishment of Shudi's European fame. But there is no doubt of the fact that Shudi and the youthful assistant, Broadwood, got on well together. Both Mr. and Mrs. Shudi developed a great liking for and a great trust in the Scottish lad; and so, eventually, did Miss Barbara Shudi, for John Broadwood, in the end, like the proverbially good apprentice, married his master's daughter, and ultimately became a partner with Shudi in his harpsichord-making business. According to an old playbill, the pianoforte first appeared in public in London on the evening of May 16th, 1767.

Partnership

It was two years after this event that John Broadwood married Barbara Shudi and was soon after taken into partnership by old Shudi himself. No doubt, Broadwood's attentions turned towards the construction and sale of the "new instrument," for, in 1770, he began his first essays in the art of piano construction in association with another employer of Shudi's, one Becker, or Backers, a German. After three years of experiments, Broadwood succeeded in producing a satisfactory hammer action, and in 1773 he constructed and sold his first "square" pianoforte, which was rectangular in shape, and had its horizontal strings running crosswise from right to left.

In this year another event took place. Old Burkhardt Shudi died, leaving John Broadwood in sole command of the business. Broadwood then took Shudi's son into partnership with him, but, apparently, the younger Shudi turned out to be either an uninterested or else a grossly inefficient partner, so much so that eventually Broadwood bought him out and from then onwards became the sole proprietor of the thriving business.

English pianoforte manufacture dates from 1773, the year of Burkhardt Shudi's death and Broadwood's first acquisition of the business. Prior to this, a German named Zumpe had made a few of the so-called "square" or rectangular pianofortes which had met with some signs of public accord. Broadwood's first "square" instrument was modelled on Zumpe's lines, but its hammer mechanism was much improved, both mechanically and in basic design.

Such design matured about seven years later, when, in 1780, Broadwood put on the market a form of "square" piano which was peculiarly and entirely his own. Zumpe's pianos, were, in principle, built upon clavichord lines, but, in his 1780 model (which he patented three years later, in 1783), John Broadwood came out with a virtually new design of pianoforte in which the old clavichord lay-out and wiring was entirely discarded.

First Grand Piano

In 1781, John Broadwood went a step further and produced his first grand piano, which, in general shape and appearance, was not unlike the modern grand instrument. In this instrument, and in those which came after it, an increasingly heavier construction was apparent. Broadwood increased the length, the gauge and the tension of his strings, thus enhancing the tone qualities and intensity of his instruments. In 1788, he patented an improved method of stringing his pianos in order that longer bass strings could be carried over the soundboard and thereby increase the tonal range of the instrument. The 1788 patent also provided for a "divided bridge," the "bridge" being the curved narrow strip of wood secured to the soundboard at its base and bearing the strings of the instrument on its upper surface, therefore serving to convey the vibrations of the strings directly to the soundboard.

The old harpsichords had carried a "continuous bridge," which extended uninterruptedly from the bass strings on the left of the soundboard to the treble strings on the right. But with Broadwood's "divided bridge" principle, the bass strings of the instrument were carried over a specially-strengthened bridge of their own, which type of construction enabled these strings to be increased considerably in length without necessitating any undue increase in the length of the instrument.

Broadwood, after he had established himself as London's leading pianoforte maker in Great Pulteney Street, Golden Square, found several competitors rising up around him. Some of these were ingenious mechanicians. Others rose up for a year or two and then as quickly disappeared.

Broadwood's Output

In 1795, Broadwood's eldest son, James Shudi Broadwood, entered into partnership with his father, and thereafter John Broadwood himself gradually withdrew from active participation in the practical concerns of pianoforte manufacture. The fact that John Broadwood's pioneering activities in the establishment of pianoforte manufacture in Britain led to lasting success may be judged from the statement that between the years 1773 (when pianoforte manufacture first started) and 1851, no fewer than 103,750 instruments were produced by Broadwood and his sons alone.

John Broadwood lived on until 1812, in which year he died at his house in London, and was interred in the burial ground attached to the Methodists' Chapel in Tottenham Court Road. His son, James Shudi Broadwood, survived him for many years in command of the pianoforte-manufacturing business, but James Shudi, although a man of energy, lacked the originality of his father, so that, in the course of time, improvements in pianoforte design came from sources other than the house of this noted manufacturer.

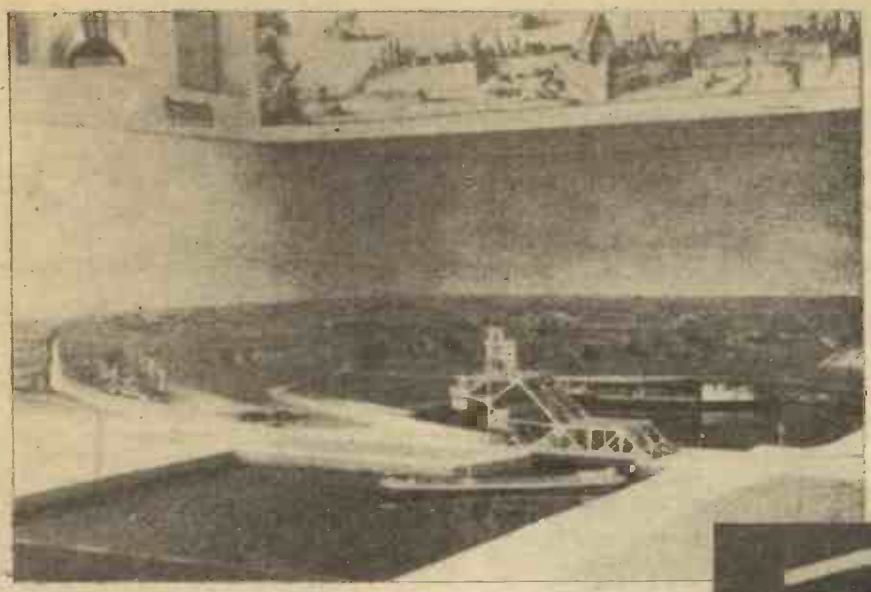
None the less, John Broadwood and his sons created a tradition in pianoforte production, a tradition which has lasted up to the present day and which, no doubt, will persist through the future. For, without a doubt, it was John Broadwood's genius which, by a favourable combination of circumstances, became manifested in the design and construction of a musical instrument whose pleasure-giving qualities and all-round efficiency has withstood the test of a century and a half.

A modern grand piano made by Challen.

THE WORLD

By

Some Fine Continental Model
Model, and a Station Signal



General view of Strasbourg Basin model, with panorama of Antwerp in the background.

Strasbourg Basin Model

BEFORE the German Army invaded Belgium and the fall of France in the summer of 1940, I was in touch with a remarkably interesting Belgian firm of model makers, trading under the name of Chemins de fer, Aviation, Marine, and who have constructed some excellent scale models for exhibitions in various parts of Belgium.

I was most interested in the model they made for the Exposition Internationale de l'Eau (the International Water Exhibition) at Liège, because I was over in Belgium in the spring of 1939 and visited this exhibition, and had the opportunity of seeing a little of their work.

This exhibition, readers may recall, was held to celebrate the completion of the world famous Albert Canal, which links Liège with the port of Antwerp. This canal, which cost over £14,000,000 to build, and was 10 years in construction, is 76 miles in length and is capable of accommodating water traffic of the ocean-going type, for vessels of up to 2,000 tons in register can navigate its entire length. It was named "Albert" in honour of the great King-Chevalier in whose reign it was begun.

The model firm mentioned built for this Exhibition a model of the Strasbourg Basin of the Albert Canal (Antwerp end of the canal). It was made to a scale of 1/50th, and the special feature of the scenic model was the super detailed reproduction of the "pont basculant"—a special type of bridge only to be found on this canal. When lowered it allows free transit of either railway trains or road vehicles, and when raised, of course, vessels can pass up and down the canal.

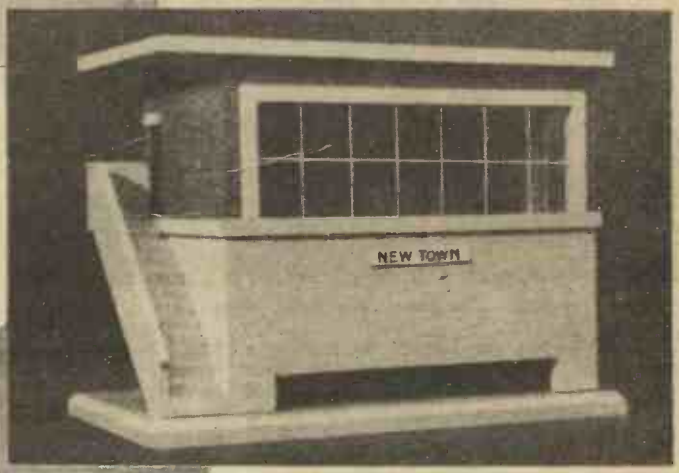
The model demonstrates the working of the bridge. The two vessels seen in the general view are new types constructed for use on the Albert Canal—one a ship of 2,000 tons and the other a barge of 600 tons.

The bridge is raised and lowered automatically. When it is down the locomotive crosses the bridge, and when raised the two vessels change places, passing through the bridge channel. The signals, whether of road, railway or navigation, operate as in the real thing, and the electrical consumption is 500 watts, with water capacity of 2,000 litres.

The size of the model, including the diorama of the port of Antwerp in the background, is approximately 16ft. by 24ft.

Model of Blankenberghe Station

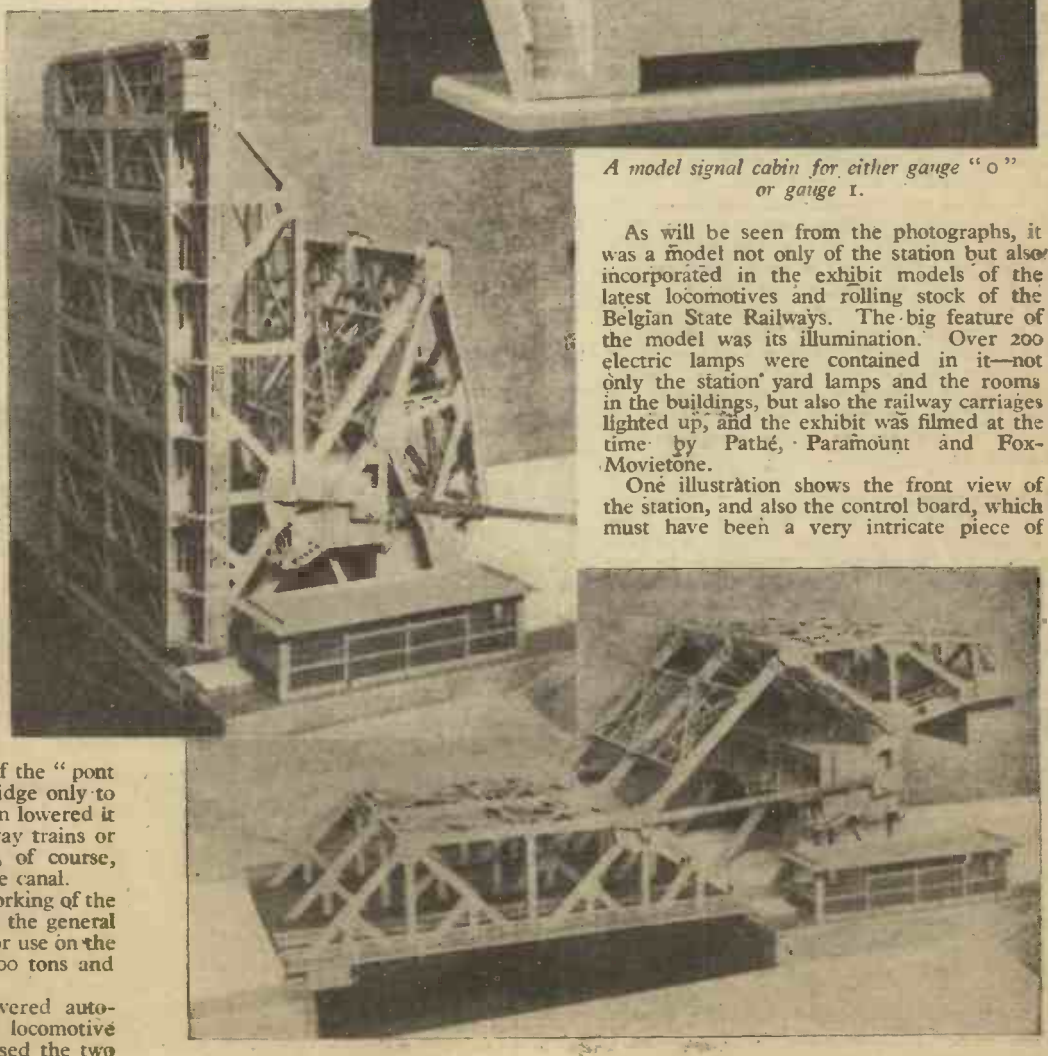
Another model, of which I include photographs, was that exhibited at the 1940 Brussels International Fair on the stand of the Society of Belgian Railways. It is a model of the new station at Blankenberghe to the scale of 1/43, or "0" gauge. Blankenberghe is a seaside resort of Belgium, second only to Ostend in popularity with English holiday-makers in pre-war days.



A model signal cabin for either gauge "0" or gauge 1.

As will be seen from the photographs, it was a model not only of the station but also incorporated in the exhibit models of the latest locomotives and rolling stock of the Belgian State Railways. The big feature of the model was its illumination. Over 200 electric lamps were contained in it—not only the station yard lamps and the rooms in the buildings, but also the railway carriages lighted up, and the exhibit was filmed at the time by Pathé, Paramount and Fox-Movietone.

One illustration shows the front view of the station, and also the control board, which must have been a very intricate piece of

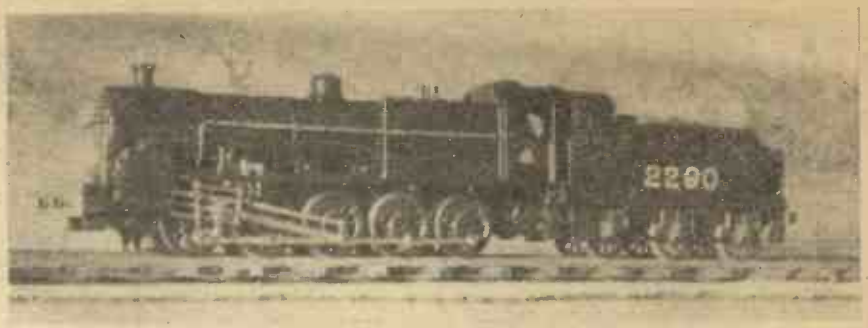


A fine piece of model making—the "pont-basculant" in its raised and lowered positions.

OF MODELS

"MOTILUS"

Work—a Unique Locomotive Box for the Handyman



A gauge 1 steam model of the "Lickey Banker."

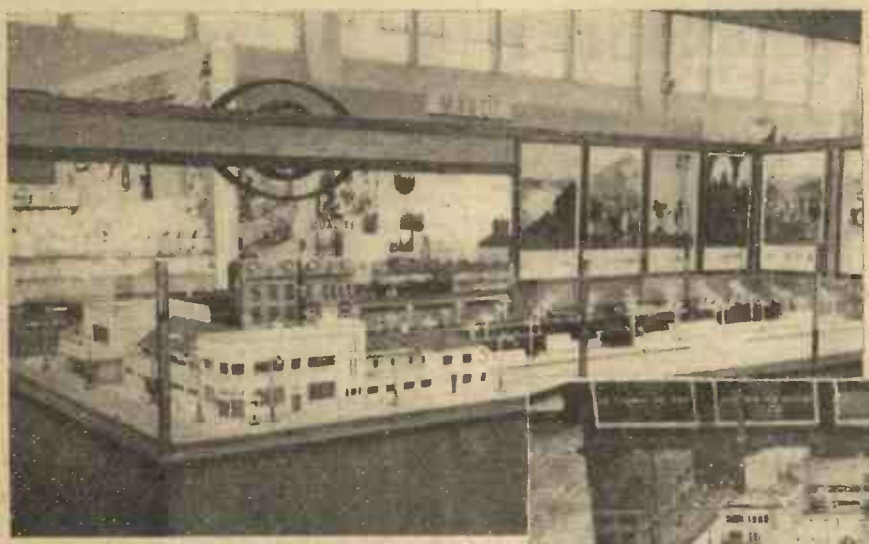
apparatus, as the lighting was, as in the real thing, arranged to switch on separately.

Unique Model Loco.

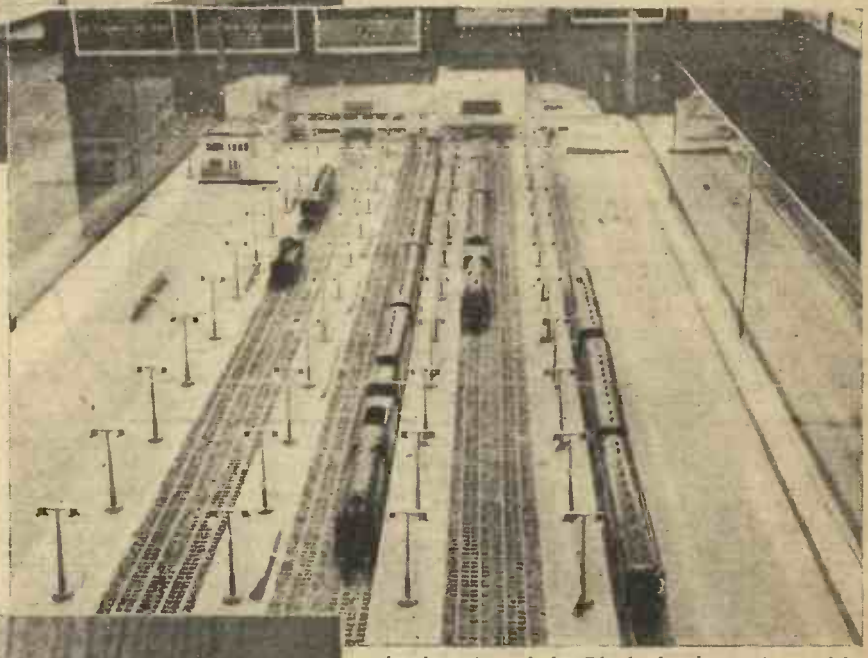
One of the unique locomotives of British railways is the 0-10-0 L.M.S. goods locomotive, popularly known as the "Lickey Banker." The engine was built specially for banking trains up a sharp incline on the L.M.S. railway between Bristol and Birmingham—the steepest gradient on the L.M.S. system.

Only one of these locomotives was ever built, and as far as I know only one model was ever built of it, and this was the work of the late Captain A. B. Lockhart, R.N.—a gauge-1 steam model with full valve gear.

This unusual model locomotive was until recently on show at the Holborn branch of Bassett-Lowke Ltd., but unfortunately the locomotive was stolen out of a showcase, and so far has not been traced. And as the whole affair is so "unusual," and the model the only one, to my knowledge, in existence, this may be an easy means of tracing the person who took a fancy to it, but was not prepared to pay for it!



View of the Blankenberghe station model exhibited for the first time at the Brussels International Fair in 1940.



Another view of the Blankenberghe station model.

Model Signal Cabin

A model railway enthusiast has asked me what is a good design for a simple yet modern signal cabin, which he wishes to construct.

Well, here is one I think would meet his requirements. It can be made with ordinary hand tools and painted in cream or white to represent concrete, with the upper portion covered with brick paper. According to usual railway practice it has a front and end window—just a plain piece of glass with white lines painted on it to represent window bars.

The roof is a flat piece of wood, which can be lifted off to reach the levers, and the complete box drops on to a wood base to which the signal frame is secured. It can be made suitable for either gauge "0" or gauge 1, and requires very little material, plus a little ingenuity, to make a worthwhile modern model railway building.

A Fine Model Railway Layout

I recently had the opportunity of paying a visit to the West of England home of Prince Birabongse (B. Bira, of motor-racing fame), and he is still as keen a model enthusaist as ever. He has entirely rebuilt his Trix layout referred to in the August issue of PRACTICAL MECHANICS, and has installed an elaborate system of train control working on a time-table schedule. The illustration shows him seated at the controls, and I am hoping on some future occasion to refer to the arrangement he works, which contains many unique features. His railway is fully equipped with night effects.

Prince Birabongse of Thailand, at the controls of his latest model railway.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page iii of cover, 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.

Lantern Slides

OWING to the impossibility of obtaining lantern plates at the present time, could you please tell me if it is possible to make a solution for coating ordinary glass to give the same effect as a lantern plate coated with emulsion? If so, I would be glad if you would give particulars of same.—James Fair (Edinburgh).

SOME of the best lantern slides are made by the wet-plate process: pieces of glass the same size as lantern plates are very carefully cleaned, and are then coated with iodised collodion, and while still wet are placed in a silver bath, made by dissolving 1 oz. of nitrate of silver in 15 ozs. of water, which has been boiled and allowed to cool. The plate becomes sensitised in a few minutes and is then ready for exposing; exposure is made while the plate is still wet, therefore it requires a special back to the camera. The slide cannot be made by contact; the negative must be placed in a frame with plenty of diffused light behind it and copied, by means of the camera, on to the wet plate. It is then developed in a solution of iron sulphate, 1 oz., acid acetic, ¾ oz., water, 20 ozs.; after developing it is fixed in a very strong, almost saturated solution of hypo. and carefully washed.

As you will see, the process requires special apparatus, and unless large quantities of slides are required, it is not worth while; the chemicals could possibly be obtained from A. H. Baird, of Edinburgh, but in these days there are so many calls by the Services for chemicals and apparatus that great difficulty is likely to be experienced. Collodion cannot be made by amateurs, as guncotton is one of the ingredients, and is not being marketed.

Some good results might be obtained by using slow film in contact with the negative; one or two experiments will give the required exposure, and if the positive is developed with a soft developer, as Azol, and the time of development carefully watched, there is no reason why the results should not be quite satisfactory. When the positive has been washed and dried it should be bound very tightly between the usual cover glasses. For occasional work this method would be less expensive and more convenient than the wet-plate.

Write to the makers of sensitised material and see if it is possible to obtain slides; we have not heard that manufacture has stopped.

Resistance for Cinema Lamp

I HAVE a resistance which plugs into the mains (200/240 volts A.C.) and feeds a 16 volt 3 watt lamp for a home cinema. It gave a very poor light on the screen, so I have now obtained a new lamp (80 volt 100 watts) which should give a much better light. Would you please give me full particulars of how to rewind the resistance above to give the new required output?—J. F. Eareley (Romford).

YOUR new lamp of 80 volts 100 watt rating will require a current of 1.25 amperes, and with this current you will need to proportion the resistance to give you a volt-drop of 240 minus 80=160 volts; in other words, the value of the resistance must be 160 divided by 1.25=128 ohms. No. 26 B. and S. "Advance" resistance wire would be suitable as to gauge, and this has a resistance of 1.16 ohms per foot, so that the required 128 ohms would be met with a length of 110ft. approximately, and if the resistance is well ventilated, the temperature will not rise beyond 200 deg. C.

Black Crystalline Finish

COULD you give me details of how to obtain a black crystalline finish on bright steel articles? The finish I am thinking of is often seen on the casings of scientific instruments made of steel. Can this be done in an oven which can be home-made?—S. Jackson (Leeds).

CARBONIA finish is probably the best method, and to give the matte-line finish, the parts can be sand-blasted before treatment. The articles should be placed loosely in a container with a small quantity of charred bone, and heated to 370-425 deg. C. When they are fully oxidised, allow the temperature to fall to about 345 deg. C. Then add a mixture of bone and one or two tablespoonfuls of carbonia oil. Continue to heat for several hours, take out, dip in sperm oil, and the desired black finish will be obtained.

If lower temperatures are desired, a longer time will be needed and the colour will not be so lasting. There are also chemical colouring and oil-blackening and electrolytic methods.

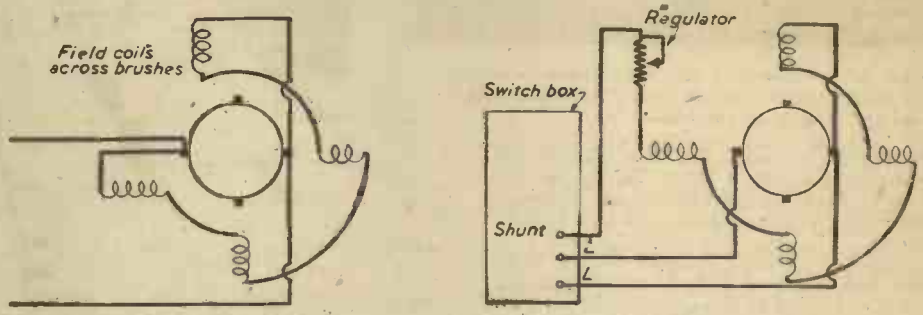
Dynamo Failing to Excite

I HAVE a four-pole dynamo with 21-slot armature, having four brushes. Two of the brushes are connected direct to the frame, the other two are insulated. This machine has been entirely disconnected and I have direct coupled it to a ¼ h.p. A.C. motor, but it will not excite. It is intended to use it for accumulator charging. One of the terminals on the switch-box I am using is marked "Shunt." I shall be grateful for any assistance in the matter.—J. L. Knowles (Manchester).

POSSIBLE causes of failure to excite may be that the speed is too low, that the direction of rotation is wrong, that the commutator surface is poor, or the brushes are not making good contact. It is also possible that the fields have lost their residual magnetism, in which case they could be magnetised by connecting a six-volt battery across the field coils. If the field coils have been disconnected, it is possible the connections have been reversed. Assuming these points have been checked, the fault may lie in the connections to the switchbox.

First try running the machine with the field coils connected direct across the brushes, as shown. If it does not excite, pass current through the field coils from a battery and test the magnetic polarity of the poles with a compass needle, the deflection of the needle should reverse as it is passed round the machine from pole to pole. If it does not, change the connections to the coil having wrong polarity. If it fails to excite after this, try the effect either of reversing the rotation or reversing the connections to the set of field coils as a whole.

When connecting the machine to the switchbox, one end of the field coils should be connected to one brush and the other end to the terminal marked "shunt." If desired, a regulating resistance can be connected in the shunt lead, as shown. If the dynamo works with the field coils connected across the brushes, but not when connected to the switchbox, the two main leads "L" in the sketch may be reversed.



Diagrams illustrating the answer of query on a dynamo failing to excite.

Making Charcoal

I WISH, if at all possible, to make charcoal suitable for use in a producer gas plant fitted to a car. Could you

please give me particulars regarding the apparatus needed and method of making charcoal ?—J. Owens (Enniscorthy).

THERE are many ways of making charcoal. Essentially, charcoal is produced by heating wood out of contact with air, or in a very limited supply of air. You can, for example, make a good charcoal by laying wood pieces in an iron cylinder and by strongly heating the cylinder until fumes cease to be evolved from it. The cylinder must, of course, be provided with a removable top and with an escape pipe or vent for the exit of gases.

Alternatively, you may stack selected pieces of wood in a low fire grate, which latter should be almost completely enclosed with brick so as to keep out all excess of air other than that required for the slow burning of the wood. After all the tarry fumes have been driven off, the wood will become completely carbonised through and through. When a sample of the wood shows this character, all the air holes in the "furnace" should be sealed off so as to smother the fire and the whole arrangement left to cool down slowly. The interior of the grate will then be found to be a mass of charcoal.

For most purposes, beechwood makes the best charcoal. In any case, however, the wood used for charcoal making should be clean, and it should not have any portions of bark adhering.

Steam "Pressure Cooker"

I AM thinking of making a "pressure cooker," using a cast-iron cooking pot and an aluminium cover. I intend facing up the top of the pot and the cover, fixing two brackets to the side of the pot to hold two fins and wing nuts to hold down the cover. I am also going to fix a relief valve on the cover to blow off at the required pressure.

As I am doubtful about the following points, can you please help me :

(1) The best way to fix the brackets to the side of the pot, bearing in mind that it is cast iron.

(2) What kind of joint should I use between cover and pot ?

(3) What pressure is the relief valve usually set to blow off at ?

(4) Approximately how long should the food be left in the pot after the steam has reached the required pressure, and the gas extinguished ?

(5) Will different foods, such as potatoes and other vegetables, take different times in the steam to cook, and if they do, how can I best avoid opening the pot, and losing the pressure ?—C. Spoors (Rutherglen).

1. IT would be best to have bolts with shallow mushroom heads coming inside the pot. 2. Either leather, or asbestos sheet. 3. Three or four pounds would probably do. 4. About twenty minutes; it may depend on the food, as some potatoes take longer than others. 5. If you have the potatoes cooked properly, other vegetables will not spoil by being left the whole time.

Glasshouse Boilers

SINCE fuel economy is now such a vital matter I should be glad if you could supply some information concerning glasshouse boilers. Mine are of the water-tube type in brick setting, and are hand-fired with anthracite fuel.

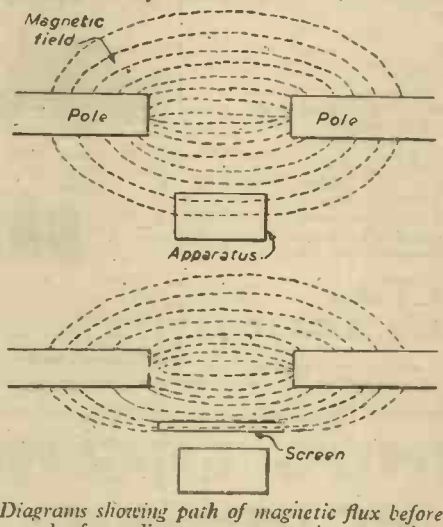
1. Would preheated air supply to fire improve combustion, and if so what would the temperature need to be ?

2. Would preheated secondary air over firebed improve combustion ? (There are on the market several makes of apparatus to fit to firedoors for this purpose.)

3. Can any simple check be kept on flue gases to determine the degree of combustion efficiency ?

4. How can clinker formation be kept at a minimum ?—S. A. Payne (Nazeing).

WE assume that your boilers are maintained in good condition regarding freedom from air leakage through the brickwork, that furnace and ashpit doors fit accurately, and that flue dampers and flues are in good repair. Although it is possible to give general information and advice, it should be remembered that every furnace installation has individual characteristics which must be considered, so that before making any modifications the approval of the makers of the equipment or the installers should be sought. This advice applies particularly to your inquiries regarding preheated primary and secondary air supplies, as safe furnace temperatures for this particular boiler may be exceeded if preheating is adopted. The efficiency will only be improved if the preheating is carried out entirely by heat at present wasted, either up the flue or by surface losses. (The latter



Diagrams showing path of magnetic flux before and after adjacent apparatus is screened.

should be negligible if the insulation is correct.) What heat can be taken from the flue gases without seriously interfering with the flue pull can only be determined by direct measurement and the problem is not "what the preheat temperature would need to be ?" but "what is the safe temperature which could be used ?" We feel that this question can only be answered by the manufacturers of the boiler. We would not advise the attachment of any apparatus to fire-doors or elsewhere without first having obtained their opinion.

Your third query is extremely important as only by flue gas analysis can combustion efficiency be determined and hence controlled. If you are willing to take trouble the cheapest method would be to use an Orsat gas analysis apparatus which can be obtained from any laboratory outfitters such as Baird and Tatlocks or Beckers, who should be informed for what purpose it isr equired. (You would need a three-bulb CO_2. O_2. CO only.) This apparatus is simple to use, but requires careful attention, and is rather fragile. The simplest method of flue gas indication is by means of a CO_2 recorder or alternatively a CO H_2 indicator. These instruments are invaluable, and are manufactured by such firms as The Cambridge Instrument Co., Elliot Bros., George Kent, etc. It is probable that they would be difficult to obtain at the present time, however, without Government priority.

In answer to your question regarding clinker you should remember that coal ash fuses at a lower temperature in a reducing atmosphere than in an oxidising atmosphere. Thin spots in the fuel bed should be avoided, and even firing is essential.

Electric Welding

I HAVE been interested in welding for some time, as I should find it very useful in my work as an agricultural contractor.

Can you inform me if electric welding can be done direct from a dynamo, and if so, what would be the most useful voltage and amps. to use, and the h.p. required to drive same ?

I thought I might be able to make up a portable set to carry in my trailer, or I might get a power drive for the tractor and drive the dynamo with that, reaching back to the dynamo in trailer. This seems to be the most suitable and economical way of applying the power required, and would be approx. 25 h.p.

The only other alternative would be to carry oxy-acetylene apparatus. Would there be danger of the "bottles" exploding with the jolting of the trailer, or other danger with this kind of apparatus ?—William D. Collins (Tiverton).

THE equipment suitable for electric welding depends so much on the type of repairs it is proposed to deal with that it would be difficult to advise definitely. The outfits needed for "arc-welding" and for "spot-welding," for instance, differ entirely from one another, and we are of the opinion that you would do best to study a few makers' catalogues with a view to determining first which type you desire to use. Messrs. Quasi-Arc Co., Ltd., of Bilston, Staffs, will provide you with everything needed for the arc welding process, while particulars of spot-welding equipment by "resistance" methods can be obtained from Messrs. A-1 Electric Welding Machines, Ltd., 61, Victoria Street, London, S.W.1.

Electro-plating

I HAVE been experimenting with electro-plating, using a nickel anode and a solution in water of nickel sulphate and ammonium sulphate with a little citric acid. I am using a 6-volt battery reduced by sliding resistance to 1½ amps. I have cleaned and polished the article to be plated, but the only results I get is that the article turns black. I should be very pleased if you could put me right on this matter.—C. Willey (Nottingham).

NICKEL deposits are sometimes liable to turn black owing to the production of nickel oxide. This effect can result from (a) too high a current density, (b) too high a bath-temperature, (c) the presence of dirt or grease or other contamination on the surface of the metal undergoing plating.

It is not possible for us to say infallibly which of these causes is responsible for the failure of your nickel-plating. Your electrolyte seems correct in composition, although you do not state the exact proportions of the bath.

We suggest that you adopt the following bath: Nickel ammonium sulphate, 10 parts; nickel sulphate, 2 parts; boric acid, 4 parts; distilled water, 175 parts.

Use a pure nickel anode and operate the bath at ordinary temperatures, and at 4 volts (not 6 volts).

The articles to be plated should be made scrupulously clean before they are placed into the bath. This is best done by boiling them in a fairly strong solution of common soda in water, and by well rinsing them afterwards.

To obtain a brilliant surface, the plated articles will require to be polished by means of some mild abrasive. If desired, you could obtain nickel-plating salts ready made up from Messrs. S. Canning, Ltd., Electro-platers, Birmingham.

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All letters should be addressed to the Editor, "THE CYCLIST," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

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Telegrams: Newnes, Rand, London

Comments of the Month

By F. J. C.

The Liability of Clubs

MANY of the larger motoring and motor cycling clubs are registered under the Companies Act, so that the liability of members is restricted to the annual subscription. It is easy to imagine circumstances where in a race or a trial a member of the public may be injured or killed and the club might therefore be mulct in heavy costs and damages. A member of a club might also feel aggrieved over some club matter and bring an action.

Two Kinds of Clubs

Clubs are of two kinds—proprietary clubs and members' clubs. The members of a members' club are co-owners therein, but the members of a proprietary club are merely the paying guests of the proprietors. A cycling club is a members' club, and it may be incorporated in the same manner as an ordinary company under the Companies Act, and if the profits of the club are to be devoted to promoting its objects, and not for the purpose of paying dividends to the shareholders, the word "Limited" may be dispensed with and the words "Club," "Association," or "Society" may be used instead of Company. Any club formed for the purpose of social intercourse, mutual helpfulness, or rational recreation may be registered as "Friendly Societies," under the Friendly Societies Act of 1896, and are subject to the laws of such societies. Nearly every club is constituted, regulated, and governed by rules which provide for the admission of members, the subscriptions payable, the conduct of the club, and the provisions for the retirement and expulsion of members. No person should be expelled from a club otherwise than in accordance with the rules. The power given by the rules must be exercised in good faith for the benefit of the club in a judicial manner and strictly according to the rules, otherwise the members who have brought about the expulsion of a member may be called upon to defend in an action for wrongful expulsion. No society will be registered under the Friendly Societies Act unless it comprises seven persons or more, nor will any Friendly Society be registered which contracts for the assurance of an annuity exceeding £50 per annum. An application for registration must be sent to the registrar, signed by seven members and the secretary, together with copies of the rules, and a list of the names of the secretary and of all the trustees and authorised officers of the society. A society cannot be registered under a name which is either identical with that of another registered society or so similar thereto as to be likely to deceive the public. If the registrar refuses to register a society an appeal against his decision may be made in the High Court. Every registered society and branch must have a registered office and one or more trustees. The trustees are appointed by the resolution of the majority of the members present, and entitled to vote at a meeting of the society. A copy of such resolution, signed by the secretary and the trustees appointed, must be sent to the registrar and the accounts must be audited annually, and a return of the receipts and expenditure, funds or effects of the branch as audited must be made to the registrar before the 1st of June of every year. Every five years the assets and liabilities must be valued, and a return made. A copy of the rules must be supplied to anyone on payment of a sum not exceeding 1s., and to members of the society free of charge. The members are entitled to a free copy of the annual audited balance sheet.

Disputes

In the event of disputes arising between members, or persons claiming under the rules, such disputes are generally decided in the manner provided by the rules. There can be no appeal from such a decision, if the rules do not provide for the calling of a special general meeting. If the decision is disobeyed it can be enforced on an application being made to a County Court. Unless the rules expressly forbid it, the parties to a dispute may by consent refer the matter to the registrar. Where the rules contain no directions as to disputes, or where no decision is made within 40 days, the person aggrieved may apply either to the County Court or to a Court of Summary Jurisdiction to hear and determine the matter under dispute.

Fresh Burdens for the Secretary

Clubs cannot be registered under the Business Names Act.

It will be seen from this that additional burdens are placed upon the officials of a registered club. One famous club, the North Road Cycling Club, Limited, became a Limited Liability Company many years ago. Of course, it is only when a club embarks upon a programme or a course of action which is likely to involve the members in heavy expenses that these matters are considered, for it must be remembered that every member is jointly and severally responsible in law. For example, suppose during a cycling event organised by a cycling club, one of the riders knocks down a member of the public and injures him, the action can be brought by the pedestrian against any individual member of the club, or against those members who the aggrieved party thinks is best able to meet his claim in the event of his claim being upheld by a Court. In the case of a club which is a Limited Company the action would, of course, be brought against the club with probably the secretary acting as defendant.

The Mass-start Controversy

These matters are of great interest at the present time in view of the controversy on mass-start racing, upon which we preserve an open mind. We have given the point of view of the N.C.U., who feel that the present time is not opportune to introduce mass-start racing since quite false conclusions may be drawn from the freedom from risk with which such races can be run during the war when there is little traffic on the road. They feel that after the war such immunity from accidents may lead the authorities to continue to provide police supervision, and that when traffic returns there may be serious accidents. It is also thought that with so many members of clubs in the Services it is impossible to obtain a representative opinion on the matter. On the other hand, the clubs in favour of mass-start racing assert that the N.C.U. has no authority over road events; that its constitution provides for the control of track racing only, or racing on closed circuits, and that the control of road racing is in the hands of the Road Time Trials Council.

N.C.U. and R.T.T.C. Attitude

The N.C.U. and R.T.T.C., however, are in agreement with the point of view that mass-start racing should not be sanctioned. One well-known club has already broken away from the N.C.U. and the R.T.T.C. because of their attitude in the matter, and it is likely that other clubs may follow suit. A new body has been formed to which clubs may affiliate, and which will not only deal with open events, but also with mass-start racing. There can be no doubt that there is a considerable movement in the cycling world against the old methods of control, and it is quite impossible at this stage to conjecture where the matter will end. Each party to the dispute seems adamant.

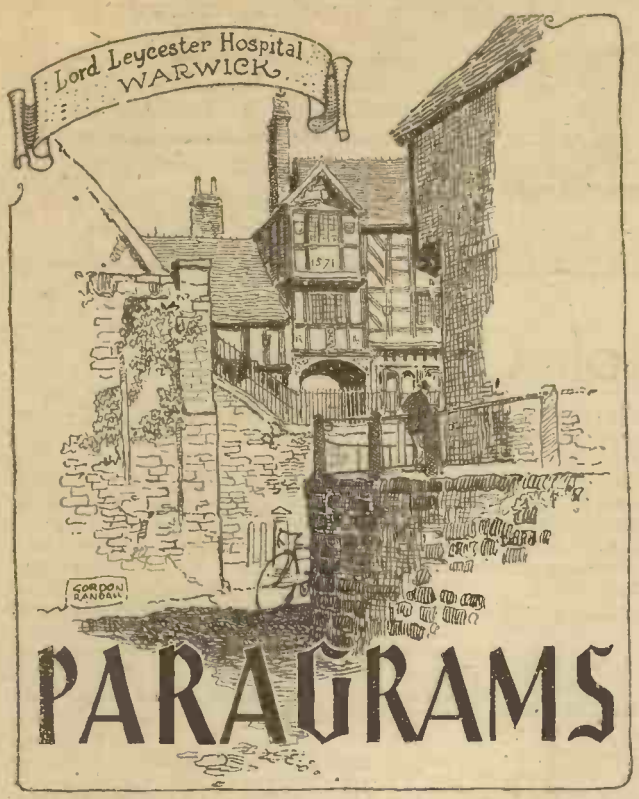
There is nothing illegal in running mass-start races on the road. We are aware that in the past some of the cycling authorities have expressed the opinion that it is illegal, so when the controversy started we took the matter up with the Government and obtained the ruling that they had no powers to stop mass-start racing on the roads as such, but that such races must be run in strict accord with the law. They must be run without risk to other road users, and for this purpose promoters have sought the co-operation of the police. This has been given, and a number of such races have been run on the open roads without untoward incident.

On the Continent mass-start racing is an event. It is front page news, and draws enormous crowds. A large number of people in this country, however, are against mass-start racing, and the N.C.U. has suspended over 60 riders who have taken part in such races. The question is: Are such suspensions valid?

There are insufficient closed circuits upon which such races can be run. The Isle of Man course would probably be available for one or two events a year.

N.C.U. Monthly Greetings

THE N.C.U. is issuing a Monthly Greetings Sheet to cyclists in His Majesty's Forces abroad, whether members of the N.C.U. or not. The first letter contains some interesting facts. The first year of the war saw the membership at 32,000; the following year it had dropped to 24,000; while in 1942 it had risen to 36,000.



PARAGRAMS

National Hostels Meeting

THE Y.H.A. National Council will be held at Rugby School on April 10th-11th.

Eire Penalty for Stealing Bicycles

ANY person who takes or uses a bicycle without the consent of the owner in Eire will in future be liable for the same penalties as if he had taken a motor car.

Cyclists—a Delicate Subject

WHEN Mr. Morrison, Home Secretary, was asked in the House recently if he would ask the police to pay more attention to lightless cyclists, he answered: "Cyclists are a delicate subject, but I will consider it."

South Africa Short of Bicycles

SOUTH AFRICA is beginning to feel the shortage of bicycles, and spare parts in particular are becoming a problem.

Free Storage at Chichester

THE City Council of Chichester at a recent meeting decided to fit a number of cycle racks in the Butter Market for the free storage of bicycles owned by members of the public.

Ten Bicycles a Week

THE Chief Constable of Norwich recently reported that 10 bicycles a week were being stolen in the city. Last year 800 bicycles were stolen in Norwich.

Cyclists and Planned Town

THE Strathblane area, familiar to cyclists because of its situation on the main road to the Trossachs, has been suggested as the site for a future planned town.

Newton's Orchard for Nation

SIR ISAAC NEWTON'S orchard and farmhouse at Woolsthorpe, near Colsterworth, is to be given to the nation.

Chairman of Youth Committee

LORD KEITH, who is a member of the Scottish Y.H.A., is the chairman of the new Scottish Youth Advisory Committee.

More Cyclist Committeemen

AT the recent annual meeting of the Scottish Y.H.A., Glasgow District, the number of cyclists serving on the local committee was increased.

"Free Passage"

AT Norwich recently a motorist who negligently opened the offside door of his van and knocked down a cyclist was fined £1 10s. with 8s. 6d. costs, for failing to report an accident and "interrupting the free passage of a cyclist."

Hertfordshire Green Belts

GREEN belts round such towns as Watford, St. Albans, Hatfield and Hertford, are advocated by Hertfordshire planning authorities in a recent report.

Punctures Repaired at Work

A HERTFORDSHIRE factory is now running a puncture repair service for its workers, who can have punctures repaired for threepence each.

Ships as Hostels!

AT the annual meeting of Edinburgh youth hostel members, Sir John Sutherland suggested that after the war surplus ships should be used as youth hostels.

New Scots Hostel

THE Scottish Y.H.A. opened its new hostel at Cove, Dumbartonshire, at the end of 1942. There is accommodation for 40 cyclists and hikers.

Trolly Bus Inquiry

LORD LEATHERS, Minister of War Transport, has notified the Pedestrians' Association that its request for an inquiry into the number of road accidents caused by trolly buses is being examined.

Fewer Traffic Lights

GLASGOW has cut out 12 one-way streets and three traffic lights because of reduced motor traffic in the city.

Devon Farm for National Trust

EAST TITCHBERRY FARM, North Devon, has been given to the National Trust. The property lies close to Hartland Point, in a district noted for its beautiful coast.

Roman Relic at Buttermere

THE first Roman relic to be discovered in the Buttermere Valley, familiar to cycle tourists, is a large brass coin of the Emperor Hadrian, A.D. 75. A visitor found the coin in a piece of stone.

Theft Conviction Quashed

AN Alness crofter who was convicted of stealing a bicycle has been acquitted by the Appeal Court in Edinburgh.

Oban's Granite Cathedral

THE West Highland resort of Oban, well known to tourists in the district, has an all-granite cathedral practically completed, one of the few such schemes which have been continued during the war.

Hostel Membership

AT the end of 1942 there were 78,383 members of the Y.H.A. of England and Wales.

Liability for Disused Tram Track

AT the Court of Appeal recently it was decided that failure by Islington Borough Council to take up an old tram track in Caledonian Road, where trolly buses have now been substituted, and make up the road made them liable for the death of a 16-year-old boy, who was killed by a bus when his bicycle skidded on a defective piece of tram-line.

Against Broken Glass

GLASGOW police are to take action against persons found breaking and leaving glass in the streets. The Cyclists' Touring Club, Glasgow District Association, and the West of Scotland Cyclists' Defence Committee, have protested against the amount of broken glass left lying in the streets, and have offered the co-operation of organised cyclists to combat the menace.

Club Dinners

ALTHOUGH shorn of much of their glamour, annual dinners and prize distributions of many clubs are still being held. Some are no more than a re-union and convivial gathering of old and young members, but the club spirit remains.

Dangerous Studs

WOOLWICH BOROUGH COUNCIL is to spend £1,000 on "cat's eye" reflector studs for local main roads.

In Italian Hands

STAN WALTON, Barnesbury C.C., is a prisoner of war in Italian hands.

Ron Carey's Double

AFTER 12 years' time-trialling, Ron Carey has won Southampton Wheelers road and track championships. His average speed for 25, 30 and 50 mile road events was 22.402 miles.

Sheffield Phœnix Supreme

THREE open hill climbs in Derbyshire were won by members of the Sheffield Phœnix. Of the 20 awards offered in these three events, members of the Sheffield Phœnix won no fewer than 16.

A Welcome Guest

GUESTS at Bedfordshire Road Club's annual dinner included Inspector Bridges of the Bedfordshire County Constabulary who complimented the club on its dispatch riders' section.

R.A.F. Awheel

THE Royal Air Force has just placed an order for an additional 80,000 machines. At the numerous stations all over the country 230,000 cycles are already in use.

Barnesbury Rider Missing

A NAVAL gunner serving on a merchant ship, Albert Cheetham, Barnesbury C.C., is reported missing following enemy action at sea.

Middle East Coincidence

WHEN Alex Morgan, former hon. sec. Dundee Time Trials Association, was wounded in the Middle East, he was first attended by Bob Lamb, member of the Dundee Roads Club, now serving with the R.A.M.C.

Wolverhampton Wheeler's Adventures

AN engine-room artificer in the Royal Navy, William Allen, Wolverhampton Wheelers, a regular pre-war rider in massed start events, was torpedoed off Tobruk. His ship reached the United States for repair, since when he has been on Coastal patrol.

Death of Pioneer Cyclist

AN Edinburgh magistrate, Mr. Mathews White, who died at his home in Dalkeith at the age of 86, was a pioneer cyclist, and rode frequently until about five months ago.

Gift to the Nation

CLIVEDEN, Lord Astor's famous country house on the Thames, near Taplow, Bucks, is to be handed over to the National Trust. Lovers of the Thames Valley will welcome the generous offer, as the palatial mansion and its lovely grounds stand in the finest part of Berkshire.

The Ideal General Meeting

THE annual general meeting of Willesden C.C. took place in true cyclists' fashion at a venue to which all present cycled, between lunch and tea.

New World's Hour Record

THE one hour unpaced cycle record, which has stood to the credit of Maurice Archambaud since 1937, has been broken by the Italian, Fausto Coppi. The new record is 28 miles 885 yards. The ride was accomplished on the Val Vigerelli track, Milan.

George Logan's Injuries

ONE of the most popular of pre-war riders, George Logan, Vegetarian C. and A.C., now serving with the Fleet Air Arm, sustained severe head injuries; so severe that at one period no hope was held for his recovery. He is now mending reasonably well, but suffering from loss of memory.

Veterans' Time Trial Association

THERE is a move afoot in North London to organise an association to cater specifically for veterans over 40 years of age. Time trials at varying distances will be held.

News of David Powrie

AFTER being reported missing for more than a year, news has been received that David Powrie, Ivanhoe and Lagrannoch C.C., is a prisoner of war in Japanese hands.

Ron Kitching's Career

FORMER member of the Yorkshire Road Club, but now with the North Road C.C., Ron Kitching can look back on a remarkable year of success. He has had six wins, two seconds and three thirds—all against strong opposition—and in the North Road "12," the hundredth event in which he had finished, he again demonstrated his ability as a long-distance expert by winning with 233¾ miles.

Ealing C.C. Decision

THE first club officially to break with the N.C.U. and the R.T.T.C. in the London Area is the Ealing C.C., whose members at a special meeting voted in favour of affiliating to the British League of Racing Cyclists. Their two important open events will be held under the auspices of that organisation.

Fred Willett's New Role

FRED WILLETT, road and track enthusiast of the Norwood Paragon, is now a sergeant observer in the Royal Air Force.

Record Change

ONLY one competition record (recognised by the Road Time Trials Council) was broken last year. It was the 30-mile team race and now stands to the credit of the Barnsley trio, J. Simpson, A. W. Martin and H. Bailey, with 3 hr. 50 min.

Wheels to Wings

SHEFFIELD CENTRAL C.C.'s star member, William Loosemore, has gained his "wings" at Pensacola, Florida, and is now a sergeant pilot in the R.A.F.

Polo Enthusiasts

DURING the past year bicycle polo enthusiasts donated £97 to the British Red Cross as the result of charity matches. Seventy-five per cent. of the Association's registered players are serving with the Forces.

Joy for Wessex Cyclists

SOME months ago George Attenborough, Bournemouth Jubilee Wheeler, serving with the R.A.F. in Malta, was reported "missing, believed killed." It is now known that he is a prisoner of war in Italian hands. He is well known among Wessex clubfolk.

Jack Salt's Consistency

FEW time-trialists have been so consistently successful as Jack Salt, of the Anfield. Sixteen years ago he came into prominence by winning the Southgate "25." Since then many famous events have been won by him and he is as enthusiastic as ever.

Norrie Ward's New Rôle

FORMERLY prominent legislator for Yorkshire, Norrie Ward, Yorkshire Road Club, and now with the R.A.F., is still interested in cycling politics and affairs even though he is now frequently ordered to be chief navigator on bombing operations.

W. Robinson Torpedoed

SIGNALMAN W. ROBINSON, Yorkshire Road Club, was torpedoed while serving with the Merchant Navy in the Middle East.

Home from South Africa

SERGEANT-OBSERVER FRANK DEAN, R.A.F., a member of Southgate C.C., has returned from South Africa after completing a course of operational training.

A Club's Call Up

SHOTTS WHEELERS lost five good men when calling-up papers were received simultaneously by S. Graham, G. Stewart, A. Glen, W. Corbett and J. D. White.

The Clarion Call

OVER 200 members of the London Union of the National Clarion C.C. are with the Forces.

Liverpool Century Activity

THIRTY-ONE members of the Liverpool Century Road Club are now serving with H.M. Forces. Although no club championship was held in 1942, a special prize was awarded the club's tricycle enthusiast, L. Hill, for his ride of 199¾ miles in the Manchester Clarion "12."

Death of Banbury Club Official

AS the result of a railway accident while at work, J. Russell, racing secretary of the Banbury Star C.C., has lost his life.

Mid-Scotland Opens in 1943

THE Mid-Scotland T.T.A. and its affiliated clubs will be holding a total of nine events in 1943. This was decided at the Association's annual meeting, when Mr. John M'Lean, 19, Kelvin Drive, Shotts, Lanarkshire, was elected secretary, in place of Mr. R. Richardson, who has joined the Navy.

Scots Officials at Presentation

SEVERAL leading Scots officials were present at the annual prize-giving of the Gilbertfield Wheelers, held at Cambuslang. Amongst those present were Harry Price, secretary of the Scottish Amateur C.A., and Alex. Urquhart, chairman of the West of Scotland T.T.A.

New Lakeland Hostel

A YOUTH hostel has been secured at Hawkshead, the quaint Lancashire village, but it is unlikely to open until next season.

Forth and Tay Bridges

DUNDEE Town Council has appointed a sub-committee to bring up-to-date plans for road bridges over the mouths of the rivers Forth and Tay.

West Riding Reopening

THE hostel at High Flatts, not far from Huddersfield, has reopened. It was used as a youth hostel between 1933 and 1938.

Bomber-Pilot

SERGEANT-PILOT ANDY BURNS, Crawick Wheelers, is with the R.A.F., and captain of a twin-engined bomber which has taken part in several daylight raids over enemy territory.

Walter Heathcote a Prisoner

WALTER HEATHCOTE, Sandon C.C., is a prisoner of war in Italy. He was missing for three months.

Attendance Prize Winners

D. W. BRUNWIN has won the Brentwood C.C. attendance prize for 1942. His brother, "D. N." (who won the previous year) was second. Miss M. Pipe was best of the ladies.

Alec Glass—Pilot Officer

ONE-TIME secretary of the Road Racing Council (now the R.T.T.C.), Alec Glass, Upper Holloway C.C., is a Pilot Officer. Glass was holder of many tricycle records.

Veteran's Hard Ride

SIDNEY CAPENER, Speedwell C.C. and F.O.T.C., cycled 105 miles on his 70th birthday.

Another New Club

NORTH LONDON has yet another new club, the Enfield Wheelers, which is open to riders of both sexes.

Seeley's "Come-back"

AFTER an interval of seven years, Edgar Seeley, Calleva Road Club member, and holder of the 24-hour competition record with 444¾ miles, has returned to competitive riding. Late in the season he won his club's hill climb.

D.F.C. for Highgate Member

FLIGHT-LIEUT. A. C. WOODLEY, R.A.F.V.R., Highgate C.C. stalwart, has been awarded the D.F.C. The official citation tells of 26 operational flights, including such targets as Berlin, Mannheim and Hamburg.

The Southgate Diamond Jubilee

SOUTHGATE CYCLING CLUB celebrated its diamond jubilee with a tea. The event, which was outstandingly successful, showed remarkable enthusiasm among old and young members and those serving with the Forces.

A Lost Title

FORMERLY recognised as the most northerly cycling club in the British Isles, Thurso Social Cycling Club has had to take second place to the Service Wheelers, a company of Service cycling enthusiasts, in the Orkneys.

Harry Green—Tricyclist!

HARRY GREEN, prince of unpaced record breakers, whose End-to-End, London-York and 12-hour records stood for almost 21 years, has taken to tricycling.

Midlander's Tragic Death

SERGEANT-PILOT GEORGE COOKE, Birmingham and Crescent Wheelers' path crack, lost his life in an air crash. He was well known at Midland and provincial tracks.

Barras Road Club News

AMONG members of Barras Road Club in H.M. Forces are L.A.C.s Meyler, with the R.A.F. in Texas, and Alfred Laird, who has been promoted lieutenant in the Royal Navy.

Chale Church, Isle of Wight. Standing on open ground facing the sea, this interesting little church is well known to many island cyclists. It commands a fine view of the coast looking towards Freshwater.

PHOTO COMPETITION RESULT

List of prizewinners in Johnson's No. 1 photographic competition which closed on November 30th, 1942

Two FIRST PRIZES of £5 each awarded to Mr. Alex H. Hamilton, 13, Broomside Crescent, Motherwell; Mr. M. Popplewell, 39, Scholes Park Drive, Scarborough, Yorks.

Three SECOND PRIZES of £2 each awarded to Mr. Leslie W. Sharp, 137, High Street, Ponders End, Middx.; Mr. C. F. F. Snow, The School House, Braywood, Windsor; Mr. J. F. Lugton, 59, Kingswood Drive, Crosby, Liverpool, 23.

Ten THIRD PRIZES of £1 each awarded to Mr. Mr. G. H. Wright, 17, Buckingham Avenue, Leeds, 6; Rev. F. E. Thomas, 54, Sturges Road, Wokingham, Berks; L.A.C. Esner (1470853), 162, Queen Alexandra Mansions, Judd Street, London, W.C.; Mr. John T. Knight, 24, Linkfield Road, Musselburgh, Midlothian; Mrs. D. E. Newham, "Norcove," Victoria Parade, Scarborough, Yorks; Mr. T. Carlisle, 21, Greentons Avenue, Paisley; Mr. Thomas Rawes Dinnen, 21, Prospect Road, Barrow-in-Furness; Mr. O. T. Leighton, 6A, Keswick Road, Boscombe, Bournemouth; Rev. J. R. Ellison, "The Parsonage," Eccleston Park, Prescot; Mr. E. G. Granger, 147, Sulgrave Road, Hammersmith, W.6.

Twenty FOURTH PRIZES of 10s. each awarded to Mr. S. T. Bird, 21, Broom Leys Avenue, Coalville, nr. Leicester; Mr. S. Phillipson, The Fell, Burnopfield, Newcastle-on-Tyne; Rev. C. W. Garratt, "Allendale," Kellet Road, Carnforth, Lancs.; Mr. E. Mason, 10, Stepney Drive, Scarborough; Mr. H. C. Chamberlin, 36, Grange Road, Erdington, Birmingham, 24; Mr. C. Lawson, 13, Queen's Road, Oldham; Mr. J. A. Bell, 3, Parkmount, Lisburn, N. Ireland; Mr. Will Parkinson, The School House, Scalby, Scarborough; Mr. William K. Chadburn, 77, Wydhall Road, Northfield, Birmingham; Mr. L. W. Sanders, 95, Estcourt Road, Woodside, S.E.26; Mr. H. M. Eccles, 4, Masham Place, Heaton, Bradford; Mr. W. Bucknell, Wilwin, Wexham Street, Stoke Poges, Bucks; Mr. William G. Fryer, 19, Stephenson Place, Chesterfield; Mrs. F. W. Wyand, The Hermitage, Ovingham-on-Tyne; Mr. G. W. Perkin, 16, Marion Grove, Alverthorpe, Wakefield; Mr. H. Crabtree, 112, Wrose Road, Shipley, Yorks; Mr. J. W. Morris, 34, Cornbury Road, Edgware, Middx.; Mrs. Jessie Eaton, New Cottage, Blackwell, Shipston-on-Stour; Mr. R. S. Hildersley, "Somerdawne," Butts Hill Road, Woodley, Reading, Berks; Mr. J. B. Robinson, "Moss Cottage," Lowe's Lane, Gawsworth, nr. Macclesfield.

There were also 25 consolation prizes.

A fine old thatched house in Broad Street, Hatfield Broad Oak, Essex.

Around the Wheelworld

By ICARUS

O.B.E. Awarded to Major H. R. Watling, J.P.

I WAS glad to note that in the New Year's Honours List, Major H. R. Watling's name appears as one of the new O.B.E.s. Major Watling is the director of The British Cycle and Motor Cycle Manufacturers and Traders Union, Ltd., and chairman of the Bicycle and Motor Cycle Export Groups. He receives the O.B.E. for services to the Board of Trade.

Cyclists owe an enormous debt to Major Watling for his work on their behalf behind the scenes. Himself a keen cyclist, he has represented their interests on a large number of occasions, and with my colleague, Frank J. Urry, has been responsible for successful opposition against moves which would take away some of the hard-won rights of cyclists. Major Watling was one of the first to receive, and to accept, invitation to membership by the Council of the Roadfarers' Club.

More Honours

MR. W. H. RAVEN, until recently works manager of the Raleigh Cycle Company, also receives the O.B.E. F. J. Bates, works director of B.S.A. Tools, Ltd., and H. Simms, the works manager of Rotax, Ltd., receive the M.B.E. Congratulations.

The Late Sir Henry Maybury

THE death of Sir Henry Maybury (Major Watling's old chief) early in January is deplored by a wide circle of friends and acquaintances, and particularly by cyclists who knew of his work in connection with roads. He was taken ill early in December, and had expected to be present at the debate held by the Roadfarers' Club, but was unable to leave his bed. He did, however, prepare a most interesting paper, which was read by the chairman, Lord Kenilworth. Sir Henry was, of course, a member of the Roadfarers' Club. Brigadier Sir Henry Maybury became K.C.M.G. in 1919, having received the C.B. in 1917. He was created G.B.E. in 1928. He was a member of the Institute of Civil Engineers, Justice of the Peace for Kent, Consulting Civil Engineer, president of the Institution of Civil Engineers for 1933 and 1934, member of the London Passenger Transport Board, and of the London and Home Counties Traffic Advisory Committee. Born in 1864, he served in the European War, and retired in 1919. He was Director-General of Roads to the Ministry of Transport from 1919 to 1928; Consulting Engineer and Adviser to the Ministry of Transport on Road and Traffic questions, 1928-1932; chairman of London and Home Counties Traffic Advisory Committee, 1924-1933; and president of the Institute of Transport for 1921-22. Sir Henry had an enormous knowledge of all road and traffic problems, and his death is a severe loss, coming at a time when the country is so much in need of his knowledge. He evinced a very lively interest in the Roadfarers' Club and he intended to co-operate with them as an active member in their search for a solution to road problems.

New Members of the Roadfarers' Club

INVITATIONS to membership issued by the Council of the Roadfarers' Club have been accepted by Rex B. Coley, Reginald Sparks, T. M. Craft, H. Calkin, Harry Miles, Shirley James, W. J. Bassett-Lowke, E. P. Richford, D. Ellis Jones, H. C. North, A. N. Rawlinson, W. H. M. Burgess, B.C.H. Davies (*Ixion* of "The Motor Cycle"), and Alan Newland.

The next meeting of the Roadfarers' Club is on Saturday, February 6th, when this roadfarers' Parliament will debate the subject of street and vehicle lighting. Council meetings are held every week, and sub-committees have been appointed to deal with various problems. The chairman of Council is Mr. J. Dudley Daymond, and the hon. sec. is R. A. West, 32, Elmbank Gardens, Barnes, S.W.

The Ministry of Transport has notified the Council that it recognises the Roadfarers' Club as a body from which it will receive and consider memoranda.

Tandem Tricycle Record

I MUST apologise to L. Ellis of the R.R.A. for having wished on to him a new R.R.A. record. In last month's issue, in reporting the record of Morford and Lawrie, the printers referred to it as a four-hour tandem tricycle record at 232¾ miles; it should, of course, have been the 12-hour record. I do not think that even Morford and Lawrie could do 58 miles an hour on a tandem tricycle.

For "Veterans"

A CONVENING committee interested in road time trialling for veterans over 40 years of age has decided to call a public meeting which will probably be held at Barnet on the morning of Sunday, February 7th, with a view to founding a Veterans' Time Trial Association. In the draft constitution which will be put before this meeting, it will be suggested that the association be open to individuals only over 40 years of age, and of the male sex, who are already members of clubs affiliated to the R.T.T.C.

Granville Bradshaw—Cyclist

WE hear that the family of Mr. Granville Bradshaw, the famous technician, are among the latest recruits to cycling.

Mr. Bradshaw has presented them with machines of Coventry-Eagle manufacture.

Ealing C.C. Break Away

AT the annual general meeting of the Ealing Cycle Club, the president of which is Jimmy Kain, the following resolution was passed: "*That the Ealing Cycling Club sever all connection with the R.T.T.C. and N.C.U. and affiliate to the London League of Racing Cyclists, and to the British League of Racing Cyclists.*"

The annual general meeting, which was well attended, agreed that the following remarks be placed on record: "*This annual general meeting of the Ealing C.C. views with grave concern the dangers to which our great sport is being exposed by the manner in which certain journalists are abusing the freedom of the Press in order to voice their own narrow and prejudiced views, whereby factual news items of historical and current interest, particularly in respect of the mass-start controversy, are being distorted, misrepresented, and even suppressed.*"

Stranraer, Scotland. The picturesque ruins of Castle Kennedy.

Cyclorama

By H. W. ELEY

Chailey Smock Mill, Sussex.

Scrap Rubber : Famous Men of Buckinghamshire : Cyclists' Freedom : Inn Names : Cycle Trade "Red Cross" Fund The Cycling Dutchman

I HOPE that one of the New Year resolutions made by cyclists had relation to the important question of pumping up tyres . . . and pumping them up *Hard*. The good advice has been given in a notable series of Dunlop advertisements, and although all tyre users have had the gospel of "inflation" preached to them over many years, it is nevertheless true that thousands of riders neglect this most elementary form of tyre maintenance . . . and because they do, tyre miles are lost . . . and that is a serious matter in war-time! So, in the words of the advertisements quoted, "pump 'em up *Hard*."

Scrap Rubber

APPARENTLY, the great drive for the collection of scrap rubber through motor garages was a pronounced success. Some thousands of tons was secured, and the garages played their part well, and the motorists responded to the appeals with commendable enthusiasm. Now, what can the *cyclist* do? It is obvious that an old cycle cover does not contain anything like the quantity of rubber which a motor cover does, but then, in this scrap rubber business, every ounce counts . . . so cyclists who have old covers and tubes knocking about in sheds or attics can do a useful bit of war-work by handing such items in to a scrap centre. In the words of that American motto beloved of some of our "big business" executives, "DO IT NOW!"

Famous Men of Buckinghamshire

A VERY brief respite from business enabled me to do a bit of riding in that lovable county of Buckinghamshire. And what a county of delights it is! Everyone knows its glorious beeches, and I vow that no other English county can boast more glorious woodland glades. But as I rode along its lanes, and lingered in some of its pleasant little wayside taverns, I mused chiefly on the fact that Buckinghamshire is, pre-eminently, the county of famous men. First of all, there is Milton, the towering giant of English letters. His cottage is still preserved at lovely Chalfont St. Giles, and in normal times it is a shrine for thousands of Americans and others who do homage to the immortal author of "Paradise Lost." Poor Milton . . . his life was one of much sorrow, and one's abiding thought about one of the world's greatest poets is a pathetic picture of an old blind man, being read to by young daughters of his last marriage, and seeing glory through the darkness.

Buckinghamshire, too, is the county of the gentle poet Cowper, who gave us such sweet and wonderful hymns, and such tender poems as "The Task." Cowper, too, was a man visited by much sorrow. The Buckinghamshire place associated more than any other with this man of letters is Olney—where Cowper is reputed to have tamed those hares with which he loved to play on the lawn.

We link Literature with Politics when we think of another famous man associated closely with Bucks. . . . Lord Beaconsfield, and to get the right "Dizzy" atmosphere, we must go to Hughenden. We shall think of great days and great achievements—of the securing of the Suez Canal for Britain, of a triumphant return from Berlin . . . and of primroses, the great man's favourite flower, still worn by the faithful every April the Nineteenth. And finally, if we go to Jordans, we shall be in the country of William Penn. So Bucks is indeed the county of the great and famous. But maybe we shall still think her greatest glory those majestic beech trees, and those wondrous woods where in autumn there is pageantry of gold, and amber, and brown.

Cyclists' Freedom

TO-DAY, I verily believe that the lot of the cyclist is indeed a happy one! How free and unhampered he is! Recently, I have read quite a lot of accounts of court cases connected with the prosecution of motorists who have strayed from the routes for which they had petrol. The man in the car is hedged about with all kinds of restrictions which do not apply to the cyclist. Why, when we get down to brass tacks, there is really only one thing we have to bother about—the law relating to lights. We are a free band of brothers . . . and apart from areas probibited on military grounds, we can go where we will—our own physical energy is all the "petrol" we need!

Inn Names

IN a recent article I made some reference to the fact that few inns seemed to be named with the bicycle or cycling in mind. I deplored the scarcity of taverns dedicated to the Tandem, or the "Ordinary." My comments brought me an interesting and friendly letter from a reader in Kent, who kindly pointed out that on the road between Rotherfield and Mark Cross, in Sussex, there is an inn known as "The Bicycle Arms." I am grateful to this reader, and possibly there are more inns associated with bikes and biking? Let's have some more letters on this interesting subject. There ought to be lots of "Bicycle Arms"—for why should the horse, and the dog, and the swan, and the rumbling old stage-coach have all the inn-name glory?

Cycle Trade "Red Cross" Fund

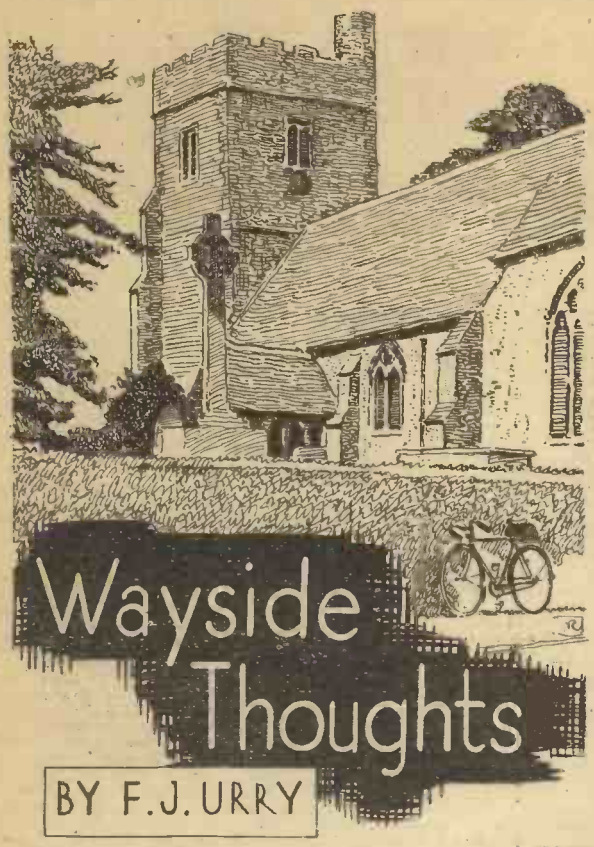
GOOD news of the Cycle and Motor-cycle Trades "Red Cross" Fund, which is mounting up nicely. And progress is being made in connection with the Fund associated with cycling as a sport and pastime. Everyone knew that men who make cycles, and men who ride them, would not lag behind others in this greatest of all war appeals. The Red Cross has a claim on us all, and if we happen to have forgotten to send that remittance along, well, it's not too late . . . and the need is desperate!

What of the Winter?

RIDING around the Warwickshire-Staffordshire borders at Christmas-time I was struck by the abundance of holly berries in the district. Of course, I at once thought of the old country belief about a hard winter—and there is yet plenty of time for the weather to become Arctic, for pools to freeze over to the delight of skaters, and for snow to fall silently in the night, and present us, in the morning, with a white world. But, on the other hand, old country beliefs do not always come true, and maybe we are to have, for a change, a mild winter—which, in view of the fuel situation, may be the best thing for us all!

The Cycling Dutchman

THE war brings strange and unexpected "contacts." In London the other day, in a well-known City hostelry, I fell into conversation with a Dutch soldier. He had known England well before the war—and had toured most of our southern counties on a bicycle! We spoke of the enormous numbers of cycles in Holland in peace-days—of the stream of riders crossing the great bridge at Rotterdam as the factories closed. And my good Hollander told me that he looked forward with zest to the good days when he could resume his English touring—he particularly wanted to ride in Wiltshire, and see Stonehenge. Good luck be with him!



Wayside Thoughts

BY F.J. URRY

This Awful Position

AS one grows older one is probably more moved by the horror of road casualties than is the case during one's younger manhood. Because these tragedies are spread over a month or a year—segregated in a period of time—the general public seem to lose the sense of horror respecting these happenings. If the number of deaths and maiming occurring in a month happened on any one day of that month the frightfulness of such pain and destruction in the midst of our civil life would arouse such an outcry that something would be done to put a stop to this awfulness. There, it seems to me, lies the secret of this amazing lack of public protest respecting road tragedies, not only in this country, but all over the world. These accidents are spread over wide areas and segregated by time, their horror drips rather than floods, so that we shake our heads at the monthly totals and pass by on the other side, as it were. I am not saying that all the road safety devices and propaganda have not had an effect, but such effect seems to have been to stabilise rather than reduce accidents, and as this was never the intention of their authors, it can and should be said that they have failed in their purpose. Now, as I see the matter, this question affects everyone, and especially those among us who find road travel useful and pleasurable, and since authority has failed to completely check the tide of accidents, much less reduce them, it is up to the leading spirits in the road travel sphere to get together and devise some method of conduct and control, and put their findings in front of the Ministry of War Transport.

The Roadfarers' Club

I WONDER if light can be shed on this problem by that newly constituted body, The Roadfarers' Club, a kind of road club led by Lord Brabazon of Tara, inaugurated for the purpose of improving the fellowship of good feeling among every type of road user? The names on the membership roll are impressive, if the holders of those titles can be brought to sink the moss-grown prejudice of years, and examine this matter in the beam of the present (remembering the immediate restrictions on road travel and their relation to the past), and the possible scene of the future. And from such an examination can they proceed to the action of agreed recommendation founded by all the road interests they represent? It is a tall order, but given goodwill I do not think it is insuperable. It seems to me the very first thing that must be recognised by such a body is the fact that the rapid advance of motoring outstripped legislation intended to control it, so that law was always lagging behind progress instead of guiding it. And that thought suggests a clean sweep of all the present complications and restrictions, and the introduction of a new charter on road law. There will be, must be, restrictions, for the freedom of the road depends on its fair use by all types of traveller, and the freedom of the road, as such, must surely be the basis of any new charter. Here lies a wide field for advance and development, a chance for any representative body to assist in solving a problem which has defied legislation up to this moment, and that defiance stands erect in our midst as a crying shame to the credentials of our civlisation. That is a challenge to The Roadfarers' Club or any other group of individuals capable of handling a problem bristling with pitfalls, with commercial interests, and with death.

Who Will Take It?

IT is true that I feel strongly on the matter, probably because the older one grows the greater responsibility one feels for happenings occurring on the road one loves. Certainly never a time was more propitious than the present since motoring first started, for we are in a period when most motorists and many cyclists are prohibited from the use of the roads in their private capacity, owing to petrol restrictions or the call of the Services. When this trouble is over both types of travel will return to the road with a rush directly the restrictions are raised and the supplies of cars and bicycles are available. Do we want that return to occur, based on the present regulations which will inevitably mean an immediate rise in the death and accident lists? I think there is only one civilised answer to that question. Yet the problem remains: how are we to so reconstruct the laws of the road to defeat this horror of death and destruction? If it is to be done then a start should be made at once, and the platform will have to be compacted of geniality, compromise, and free of the corroding commercial interests, if it is to have a chance of reaching a successful issue. If we can wipe from our minds personal interest and bias, and supplant them with the ideals of the commonweal, there should surely be no bar to the discovery of a solution. Remember that such a body would start fresh, and yet possess a wide experience of the pitfalls of a past epoch. The general body of road users will be prepared to accept rulings over which they may have haggled in pre-war days, for our apprenticeship of control has at least taught us there is fairness in the method, and that the individual is equal in the national eye. That seems to be the starting point: who will make the start?

Why Hurry?

IT always seems to me a curious thing that the whole population hasten on their "lawful occasions" when the rain descends, even though they are well protected from the downpour. The pedestrian, the motorist, the bus driver and the cyclist seem to be equally affected in the hurry to reach work or home, and I should not be at all surprised if, in the analysis of accidents, it was found that a sharp rise in them occurred in wet weather. This hastening process is most noticeable in the evenings when the imminence of the black-out and the storm converge in time, a dangerous period for the traveller, and one which I think is a bad error of self-imposition. Usually the saving in time is trifling, and is certainly not justified by the extra risk undertaken. My seven miles' journey home usually takes me forty minutes, and I don't care if I occupy another five minutes, because the home journey is at least using up my own time. But that doesn't seem to be the temper of most of the cyclists who pass me, some of whom take traffic risks that are unwise and frequently unmannerly. I have always found that circumspect procedure during wet spells is far more comfortable than the rant and tear that seems to be the fashion with all types of traveller, and I would far rather be comfortable than agitated. It used to be said in my younger days that when you don cape and overalls the wise way of procedure is to reduce your normal speed a couple of miles an hour; and I still have no quarrel with that dictum. Try it next time you are caught in the storm, and I'm sure you will find the advice sound.

Those Glims

THE present black-out reminds me that we are still confined to the feeble glim allowed by the Ministry of War Transport and, candidly, the regulation is an unfair handicap on night riding cyclists. I used to enjoy night riding, but not now, unless there is a moon to silver the way. As a matter of fact, riding in town or suburb after lighting-up time on a moonless night is a nerve racking business, simply and solely because the authorities have not allowed us sufficient illumination. Authority indeed has recognised this statement as a true exposition of the present state of affairs, for during the summer months the lighting department of the M. of W.T. was experimenting with a new form of cycle head-lamp mask which was a very big improvement on the present regulation masking. But—and here's the rub—the difficulty of providing the material to manufacture the new mask could not be overcome, and as far as I know that position still holds. So if we are to abide by the law, we night prowlers are still heavily handicapped, and what makes that handicap seem worse is the amount of light the motorist is allowed. Certainly the cyclist has a justifiable grievance in this matter of illumination, but there seems no immediate prospect of a remedy. It is true that many riders are taking risks with their lamps by showing a brighter forward light than the regulations allow; but I think the majority of such people are erring in ignorance, for the authorities have allowed, and are allowing, lamps to be offered for sale which do not conform to the rules, and many police officers, to my certain knowledge, are using them. It is a funny business that a Government Department issues regulations which apparently it takes no trouble to enforce even on manufacturers; how can it expect the average cyclist to obey them? These are facts that can be proven any time; I am not suggesting we cyclists should break the law, but I am earnestly pressing for relief from the present dimness to which we are lawfully condemned.

The Union Talks

I WAS very glad to read the memorandum issued some time ago by the N.C.U. Emergency Committee respecting the question of massed start racing on the road. That document has been circulated to all the Centres of the Union, and puts the whole question of the position of the sport of road racing in clear outline, strongly advocating that no alteration be made in the existing rules of the Union dealing with the sport. It is an important pronouncement, and calls for the most careful scrutiny, for it brings the whole controversy on this matter to the point I recently raised in these columns. Personally I have no doubt of the issue as far as the N.C.U. is concerned, now that their leading officials have given so plain an indication of their advice; but the new movement to form a body to deal with massed start racing will, if successful, be likely, in my opinion, to jeopardise the time-trial system which received the blessing of the M.O.T. Advisory Council in 1938. This is one of those break-away incidents of an unwise nature which may easily be stifled at birth, but if allowed to grow will eventually achieve far more than its own ruin. It is up to all of us, and particularly the N.C.U., to endeavour to kill this outbreak now, for it seems certain that the massed start enthusiasts are intent to go forward with their project, irrespective of the risks they are imposing on the time-trial system of cycling sport, and possibly on organised runs and rallies.

CLUB NOTES

Twenty Years of Cycling

TOMMIE CHAMBERS, a Glasgow cyclist, has just completed 250,000 miles of cycling in 20 years.

More Scots Events

SHOTTS WHEELERS are to add to the number of open events in Scotland by running an Open 10, an Open 25 and an Open Hill Climb this season.

Scots Massed-start Decision

THE Royal Albert C.C. has decided to ask the N.C.U. to amend its rules to permit massed-start racing on the roads.

Clarion to Promote Rough-stuff

WEST OF SCOTLAND Clarion C. and A.C. is to promote an open rough-stuff as a pipe-opener to the Scottish season. This is a new departure in Scotland.

Brinkins in R.A.F.

JIMMIE BRINKINS, one of Clydeside's fastest time trialists, hill climbers and trackmen, has just joined the R.A.F. He has been an active rider in Scotland for 10 years, and has won many events as a member of Glasgow Wheelers.

Opens for 1943

TWO of Scotland's leading open events, the Glasgow Nightingale 25 and 50, are to be held again this year.

Bicycle Polo in Scotland

THE National Clarion C.C., Paisley Section, and the Royal Albert C.C. are trying to re-establish bicycle polo in Scotland.

Satisfactory Year

THE West of Scotland T.T.A., at its annual meeting, was able to look back upon a successful year's working in 1942. Most retiring officials were re-elected, and it was decided to approve most of the Scottish Amateur C.A.'s proposals for remodelling the working of time trials in Scotland.

James Moncrieff in Navy

JAMES MONCRIEFF, for many years an official and helper in Scots road events, and a member of the Douglas C.C. and the West of Scotland Clarion, has joined the Navy.

Good Ayrshire Average

AT the annual meeting of the Ayrshire and Dumfriesshire C.A. it was reported that during 1942 there had been an average of 25 riders in every open time trial promoted. This figure is very satisfactory in such a scattered district.

Most of the retiring officials were re-elected, and it was decided to hold nine events in 1943, including a special Red Cross open.

My Point of View

BY "WAYFARER"

The Countryside's New Hope

THE connection between the new Ministry for Town and Country Planning (England and Wales) and the pastime of cycling is not far to seek. Many of us have been horrified and amazed at the reckless and deplorable manner in which large sections of our lovely countryside have been disfigured at the hands of people whose mental processes are related to pigstyes. The abomination known as "ribbon development" was allowed to get well into its stride before the passing of an Act of Parliament restricting (unfortunately, not prohibiting) this method of enlarging towns and cities. Meanwhile, much mischief had been done, with the result, from the cycling point of view, that the country has been pushed farther from our homes, and that it is harder than ever to get away from "bricks and mortar." In many instances we find ourselves riding through populous streets instead of along sublime country roads and lanes.

But worse—far worse—than "ribbon development" has been the growing practice of flinging down shacks, of more or less hideous design, on the most planless method imaginable. Most of such constructions, as well as the much-vaunted parlour-houses which rub shoulders with wood and tin abominations, are grossly offensive to the eye. They are the very negation of common sense and of all the virtues. They cry aloud our national indifference to the claims of beauty. They proclaim us as vandals and as worshippers of Mammon. They combine to create for us an evil reputation which will make our descendants blush—and which should cause our ancestors to twist and turn in their graves. It is well for us to remember that, while we speak of the country as "ours," that is not exactly the position of affairs. At any rate, we cannot do as we like with it. The countryside is ours in trust, to be held and cherished for the benefit of those who come after us.

And so I, for one—as a cyclist and a citizen—heartily welcome the projected new Ministry, with its promise that artistry will dominate the future development of town and countryside, and its further promise that this land, so far as such development is concerned, will become one fit for beauty-lovers to look upon without a feeling of shame and disgust. The manifold evils which have been perpetrated may remain with us for the time being, though it is not too much to hope that the day will come when they are swept away, and dumped where they belong—the rubbish-tip.

No "Hang-over" for Me!

POSSESSING (and desiring) no acquaintance with what is currently spoken of as "hang-over" (formerly, I believe, known as "the morning after the night before"), my plan is always to take a dose of corrective medicine in order to set aside the effects of generous feeding, whether during the festive season which, at the time of writing, has just gone by, or at public dinners. That corrective medicine takes one or other of two forms, though sometimes these are blended. After a public dinner it is more convenient, as a rule, to walk. I generally foot-slog it home, but, if that is not convenient, then I go out for a brisk tramp after reaching home. As regards the Christmas season, I indulge in the other (and more important) corrective—cycling. Being a family man, I must of necessity spend the bulk of my Yuletide holiday at home, but there is nothing to prevent me from making an occasional disappearance—in the interests of my health. Thus, at the season which has just faded into history, I carried out no fewer than four of my 30-mile between-meal jaunts—on Christmas morning, on Boxing-Day morning and afternoon, and on the Sunday morning. Result: complete fitness, without the faintest hint of any of those innumerable complaints which perusal of patent medicine advertisements convince you that you possess in great variety. No "hang-over" for me, thank you—especially when the preventive (or corrective) medicine is so easy to obtain and so pleasant to take.

The Thrill of It All

WHAT a joy it was, on those fine but rather austere days which comprised the holiday in my part of the world (that statement can now be made without wrecking the war effort entirely!), to get going on a bicycle! The weather conditions acted as a temporary deterrent as regards the actual start. It seemed a shame to leave glowing fires, and it was a shade frigid facing the external world. But when once you had "broken the ice," so to speak, you were all right. At times there was little or nothing to see, owing to the screens of grey fog which enclosed the countryside, and one went cycling for the sheer delight of riding. Oh! the thrill of it all! The joy of quick progress (now and again) through that tingling air! The feel of the beat of the wind on one's face! The mental and physical tonic arising from that self-created movement! The world seemed to be less and less inhospitable as one forged ahead, and one speedily surmounted the discomfort of the first mile or so.

Long before the allotted "task" was achieved on each of those four occasions, I felt thoroughly convinced that the adventure was well worth while, that this was the way of health and happiness, and that there would be a new and vigorous appetite for the meal which awaited me at journey's end. It is no exaggeration to say that I was thrilled with each of those rides, all of them over familiar roads and through known country, and I knew that, in leaving the seductions of the fireplace, I had indeed chosen "the better part."

Gingering-up Required

IT occurs to me that vigour and acumen are not at present the outstanding characteristics of those who present the demands of cyclists to people in authority—those to whom our fortunes are entrusted. A year or more ago we were given to understand that the bureaucrats had agreed to some improvement of cyclists' front lighting, to the end that we might the better be able to see where we are going. So far, so good—but the "far" has turned out to be not very extensive. The authorities sat back in their chairs and preened themselves on their generosity, quietly announcing (in the smallest possible type) that the Great Concession could not be implemented for the time being, owing to the lack of material. Nevertheless, the cycling representatives—or, rather, the representatives of cyclists; rather a different thing!—went away figuratively wagging their tails, and telling one another (after the manner of "Little Jack Horner") "what a good boy am I."

Of course, a Concession like this disarms people—shuts 'em up—and we practical cyclists, to whom lighting is a matter of some moment, start in to hope for the best. Now, months after the Great Concession was granted, and we are still waiting with such patience as we can command, we learn that the new device, which cannot be supplied for lack of material, is no blue-pencil good. How the nabobs who threw dust in the eyes of the representatives of cycling must be chuckling! And how the said representatives must be commencing to realise that they were taken in and done for! Meanwhile—this is worthy of special note!—certain real concessions recently made to our motoring friends were at once brought into operation, and their head-lighting is so extended in volume that we cyclists are again suffering from the curse of dazzle that plagued us in pre-war days.

What is to be done about it? Just nothing? Are we going to continue to be hoodwinked by those in authority? No! We cyclists must insist on having a square deal: we must insist on those who purport to represent us taking a course of ginger. In my view, we should now go all out for an immediate return to pre-war lighting, letting the authorities know that anything in the nature of chicanery or unfairness is repellent to us, as well as being unworthy of those who sit in high places. It is obvious to the meanest intelligence that, if the volume of motor-car lighting now in use does nothing to endanger the safety of the realm, an unanswerable case exists for the restoration of pre-war cycle lighting.

Notes of a Highwayman

By LEONARD ELLIS

JUDGING by the letters I have received many readers were interested in my recent article on the song "The Road to the Isles." The experience of one cyclist from Edinburgh is most informative and will no doubt prove of interest to my other correspondents. He says: "I cycled along the road to the Isles this summer. I had heard that there was a path from the station at Rannoch Road-end over the moor to the hotel at Kingshouse. I already had vague ideas of travelling the 'Road to the Isles,' and this 'information' settled the matter. I arrived at Rannoch Station about noon, and, after a meal, crossed the railway line and immediately struck a cart-track with quite a reasonable surface. I was highly delighted, and cycled on for perhaps a mile, to find that the 'road' came to an end. I searched around, but could find no sign of a path, so I slung the bike over my shoulders and plunged into the jungle of bracken. I am no 'pass-stormer,' but where occasion demands it, I am ready to do a reasonable bit of hoofing. I struggled on, expecting to come across some kind of path, as *one was shown clearly on my map*. After two miles or so of this kind of travel I began to feel disheartened, so I left the bike against a boulder and climbed right up the side of the hill, till I was far above Loch Laidon.

Maps at Fault

"I WAS forced to the conclusion that no paths existed, so retraced my steps to the machine and went back to Rannoch Station. The hillsides were pouring with water, as there had been heavy rain the previous day, so I did not feel like doing another 10 miles through bracken. I inquired at the station about a path to Glencoe, but no one seemed to have heard of such a thing. I proved, however, to my satisfaction, that there is no path from Rannoch to Glencoe!" Of course, this is not the only road to the Isles, in fact it is one that is better avoided if the cyclist is not a good sailor. This route will inevitably bring him by Morar to Mallaig and thence by a small motor-boat across the Sound of Sleat to Armadale. From experience, I can say that the Sound can be very choppy, and the journey in the little boat anything but pleasant to a poor sailor. Other possibilities are to turn northward at Fort William along the Great Glen, continue through Fort Augustus and then turn westward at Invermoriston. To my mind this road is equally fine, though different in character. In some ways the mountain scenery is grander particularly as we reach Cluanie Bridge and cycle under the shadow of the line of giants called the "Sisters of Kintail."

Other Ways to Skye

THERE is still another way, a very wild and adventurous one, which may be found by turning west at Invergarry. The first part of the road by Loch Garry is very beautiful, and then the way becomes wilder and wilder through Tomdoun. The surfaces are bad, but if time is no object and solitude is sought, this is the road I recommend.

Shiel Bridge, and the "Sisters of Kintail."

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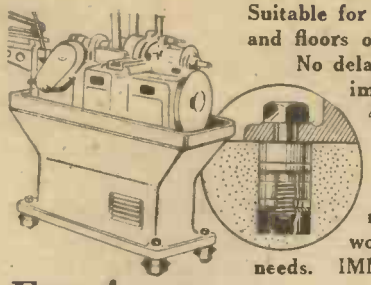

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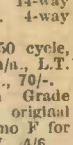

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