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D R. C. F. GOODEVE, F.R.S., assistant controller for research and development at the Admiralty, recently lifted the black curtain which has shrouded the scientific achievements of our technicians during the war. Because of this secrecy, and the shortness which prevailed the inventions by our enemies as they were discovered, the public may be misled into thinking that ability to produce new inventions is only possessed by the Germans and the Japanese. As Dr. Goodeve points out, the battles of World War II have been fought not only in the field, at sea and in the air, for some of the most interesting operations have been behind the scenes, in which the scientists and designers of Britain and the United States have outstripped their brains against Germany. They are still working to defeat Japan. The knowledge thus gained will have a profound effect on the struggle to win the peace.

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The most outstanding technical battle—almost a self-sacrifice—was won in the field of radio, including radar (as radiolocation is now known). The development of radar has produced the most startling military significance of the discovery that echoes from aircraft of wireless waves intersect. In September 1939, the English Channel was no longer a barrier, as Germany invaded Britain. The German scientists improved on the old design in many ways. One was in devising techniques for the destruction of magnetic mines, on that famous night of November 24th, 1939, not only showed the mechanism of World War I was for materials, and this was fought by chemists. Britain owed her preparation in World War I to the strong chemical industry then founded—a industry which is strongly backed by its great research laboratories. The battle for materials has gone on in World War II, but has seldom produced such grave problems as it did in the former conflict.

The Battle for Materials

In any battle one must first know what is being done. The Battle of the War was fought by chemists. The enemy was using a magnetic mine, on that famous night of November 24th, 1939, not only showed the mechanism of World War I was for materials, and this was fought by chemists. Britain owed her preparation in World War I to the strong chemical industry then founded—an industry which is strongly backed by its great research laboratories. The battle for materials has gone on in World War II, but has seldom produced such grave problems as it did in the former conflict.

**Mobilising Chemists and Engineers**

The major technical battle of World War I was for materials, and this was fought by chemists. Britain owed her preparation in World War I to the strong chemical industry then founded—an industry which is strongly backed by its great research laboratories. The battle for materials has gone on in World War II, but has seldom produced such grave problems as it did in the former conflict.

**Menace of the Magnetic Mine**

The knowledge thus gained will have a profound effect on the struggle to win the peace.

The Battle of the Scientists

The Germans copied some details accidentally given them in aircraft lost over the Continent. Additional information is reported to have come even describing how Britain had conquered the U-boat menace by means of radar. The scientists who created radiolocation have been called the saviours of their country. It was not through its centre, so that it is free to rotate in a vertical plane (like a see-saw), instead of in the horizontal plane as in a compass, then the north-seeking pole of the rod will dip downward on a line depending on how far it is from the North Magnetic Pole. At the Pole itself, its would be in the vertical position, at the Magnetic Equator it will not dip at all, and south of this the south-seeking pole will dip. By fitting such a needle with an adjustable helical spring one can accurately balance the force tending to make the needle dip by an equal and opposite force of the spring. Under a steel ship the magnetic field is greater than normal, and a balanced needle is forced down to make the electrical contacts.

The German scientists improved on the old design in many ways. One was in devising an ingenious clock which automatically measures and sets on the spring the exact force necessary to balance the magnetic force on the rod in the latitude in which the mine is laid.

The analysis of the first German magnetic mine, on that famous night of November 24th, 1939, not only showed the mechanism by which it worked, but gave the crucial technical figures of the strength and duration of the magnetic field required to fire it. Without these, counter-measures were barely possible. On that November night the technical battle was joined.

The Double I Sweep

"DOUBLE I" stands for Double Longitudinal, and the sweep is made up of two minesweeping ships, each towing a long belt of self-guiding electric cable. The current is generated in the ships, stored momentarily in batteries and passed through both cables simultaneously as a large surge. The current goes into the sea via the electric cable. By this means 10 or more acres of the sea bottom can be subjected to a magnetic field of sufficient strength and duration to exclude the mines. The ships proceed on their parallel courses and make a second "surge" of magnetic field. In this way is cleared a continuous line of the sea bottom, providing a safe channel through which ships can pass.
Our Electricity Supply

Details of the Structure of the Electricity Supply Industry, and How the Grid System Works

By KILOVAR

The organisation of the Post Office, the railways, the B.B.C., and of many other bodies is fairly well known to the general public, and the fierce and sometimes blustering light of publicity has infrequently turned on almost every public utility service. Electricity, however, which has crept in an almost insidious manner into the national body until it is its very breath of life, has relatively seldom been in the news until, a few months ago, the wildest stories circulated during the cold weather spell, when the Grid authorities had to "shed load" (that is, to shut consumers down), over peak periods; and there are widespread misconceptions about the functions of the Grid and its relationship to the local electricity authority.

Behind that simple face of electricity supply, which is seen by the household or, small business proprietor—the reading of the meter, the paying of the bill, and the occasional mending of a fuse—there lies a mass of complicated organisations in which there is much to admire and much to deplore. Centralisation of control, monopoly rights, nationalisation, private enterprise, municipal ownership—all these bold principles have their being within the framework of one of the country's most vital and widespread industries.

The purpose of these notes is to set out in brief the present structure of the electricity supply industry, and to give some answers to the questions, "What does the Grid do?" "How much public utility service is there over the electricity supply in my town?" "Why is my electricity bill more expensive than that of my colleague who lives in another suburb?" "At what rates are my supplies, as they are "cheaper" or "more reliable," or because they installed free cookers.

The Act also laid down that municipalities had the right to purchase the undertakings, and in that year the Board of Electric Lighting Act was passed. It gave electricity companies the right to open public supply industry. The first central station for the supply of electricity came into being in 1878, to light the Embankment, in London. It was not until 1882 that legislation took any account of this new "fluid," and in that year the Board of Electric Lighting Act was passed. It gave electricity companies the right to open public supply industry. The London and Home Counties Joint Electricity Authority was an outstanding example.

Before the last war, then, we had a large number of independent electricity suppliers, partly springing from private enterprise, partly from municipal far-sightedness, and some few Joint Boards. They were subject to control by the Board of Trade in matters of maximum price and safety, and to a certain extent in matters of voltage and electrical details in their systems of supply. But there was no national co-ordination of the industry. If the company operating in Blankenborough was old-fashioned and inefficient, it was no one's business to do anything about it except the directors.

The 1914-1918 war, with its urgent necessities for immediate supplies of electric power, brought the need for a proper national outlook on this vital matter to the consciousness of the Government. In 1919 a new Act was passed which took sweeping steps to centralise and transform the whole industry. It established the Electricity Commissioners, who, as the Act stated, are "the body through whom the Government . . . promote, regulate, and supervise the supply of electricity." From the Board of Trade, the whole matter of electrical supplies passed into the hands of the Minister of Transport, and since the present war it has been again transferred, this time to the Ministry of Fuel and Power, who exercises his authority through the Electricity Commissioners. A levy on the revenue of all undertakings pays for the Commissioners' costs, and they comprise five men, appointed by the Minister for their outstanding experience and knowledge of all matters pertaining to the generation, transmission, and employment of electrical energy.

The next important step occurred in 1926. A few years earlier the Government had appointed a committee, under Lord Weir, to consider the whole problem of electricity supply, and this committee had recommended the construction of a Grid system to be run by a new Statutory body to be known as the Central Electricity Board. The Act of 1926 embodied these proposals.

What Does the Grid Do?

In considering the question, "What does the Grid do?" we can take a very simple analogy. Imagine three cottages, each with a well and a pump. The first one has a very efficient well, and the water can be pumped easily. The third one has a poor well, which is inefficient and needs a great deal of labour to produce a small quantity of water. The second installation is mid-way between the two. Imagine further that the water—and this is where the analogy has to be stretched a little—to make it fit—cannot be stored, but must be pumped as it is used.

Suppose now that an outside authority were to review the water position in our imaginary hamlet. The obvious thing to do is to supply all three cottages from the efficient well. But in case it breaks down, or has to be overhauled, you must also keep in being the second, and so arrange matters that it can too be used. The third well can be abandoned, and the cottager can use his efforts in more profitable pursuits than painfully pumping from an inefficient source.

To accomplish this, you must first couple all three cottages together by pipes, so that...
each tap can draw from any well. You must then arrange that someone has the power to insist on the efficient, well supplying all the water to the three cottages, and if he fails, or if on occasional days the total demand is too high for him, then the controller must bring in the second well. And he must also have power to direct the third man to close his well down, as he is not using his pumping energy to the best advantage in the general scheme, whereby all water is obtained in the most efficient manner, no matter by whom it is pumped.

If this can be accomplished, you have a system where every drop of water used by the three cottages is produced efficiently and, moreover, where each cottage has at least two independent sources of supply. In the total production of water, there is no waste of energy at all.

But, obviously, although each cottage might be able to be convinced, by argument, of the desirability of such a scheme, he would jib at the prospect of paying for it out of his own pocket, and unless there were an overriding authority with legal powers, the sharing of the production of water between the most efficient wells would not be equitably done, and would give rise to argument and difficulty.

Coming back to electricity, the Grid has performed almost exactly what the linking of the water-systems of the cottages was shown to do, in the simple example given above.

The outside authority, set up by the Government, was the Central Electricity Board. The equivalents of the three cottages are the whole of the statutory electricity undertakings in the country—about 600 in number. The pipes interconnecting the cottages are the symbols equivalent to the overhead wires and sub-stations of the National Grid. To pay for the construction, the C.E.B. was authorised to borrow £60,000,000, against a Treasury guarantee.

Eight Regional Schemes

The Central Electricity Board prepared eight regional schemes, for Central Scotland, South Scotland, North-west England and North Wales, North-east England, Mid-East England, Central England, South-West England and South Wales, and South-east and East England. In each of these schemes certain power stations were chosen as "selected stations," in which generation was to be concentrated. The less efficient, non-selected stations were not to be closed down immediately, but were not to be allowed to extend. The Board's powers included the duty of arranging and supervising the installation of new plants, which had to be allowed by the Electricity Commissioners on the Board's recommendation. Thus no new inefficient "wells" could be dug (to revert for a moment to our former analogy), and any further wells would have to be constructed so that they formed part of the plan of the independent authority for the most efficient supply of water to the whole body of consumers.

To link these "selected stations" together, the Grid was constructed. Taking a typical case, let us think of the town of Blankborough. It has a steam power station, owned by the municipal authority. It was classed, in the Electricity Scheme prepared by the Board, as a selected station. The Blankborough load has a maximum demand, in winter, of 50,000 kW. To supply this there, were installed in the power station three turbo-alternators, two rated at 7,500 kW., and one recent addition at 15,000 kW. The total plant was thus of 30,000 kW. capacity. At peak load time, the 15 MW. set and one of the 7.5's would be needed, giving 22.5 MW. of plant for 20 MW. of load. There would be 7.5 MW. of plant standing by in case of breakdown of either of the running sets. This would be idle capital, and since no chief engineer would allow his load to grow to such proportions that all his plant had to run at peak time to supply the demand, it follows that all over the country, in towns like Blankborough, there was idle plant, simply there in case of emergency. Even the simplest and smallest public supply could not be given without two sets for a load which only required one, in order to duplicate sources of supply against the failure of one of them, and also to permit maintenance to be carried out. The same reasoning, of course, applied to boilers, and to much other auxiliary plant.

If, however, in the next town, say, ten miles away, was another power plant, of which a proportion also lay idle for the greater part of its life, one can see at once that an interconnecting cable between the two towns would enable the Blankborough spare plant to act as standby for the possibility of breakdown not only in its own undertaking, but in that of its neighbour, via the cable.

Reduction in Standby Plant

Instead of two idle machines, there need only be one. The remaining generator would be liberated for commercial use. In addition to gaining this advantage, the periods of light load, as in the middle of the night, could be supplied by using only one machine in one of the two stations, and since the efficiency of a set is higher (in general), the greater the load, it follows that this one machine, running perhaps nearly fully loaded, and supplying the other town through the cable, as well as its own load, would be running more efficiently than would be the case if two lightly-loaded sets were used.

This reduction in standby plant, and the better utilisation of the plant as a whole, are two of the most important economies which the Grid has effected. As—with certain relatively unimportant exceptions—the whole of the generating plant of the country is connected together, it stands to reason that the standby plant can be reduced to a minimum, since a machine can act as standby for any other machine on its Grid ring, or on other rings, if the interconnectors are loaded suitably.

In order to give some slight further consideration of the methods by which the Grid ensures that the generation of all the electrical energy needed by the whole country at any instant is being generated only by the most efficient operators, let us return to Blankborough's power station.

The efficiency of the power station at Blankborough would be governed, in pre-Grid days, by the design of the plant, and by the skill and care of those who supervised its operation. It is possible to visualise that plant might be purchased which, for reasons of price, or for other considerations, is not of the most efficient kind. And ageing, with consequent loss of efficiency, especially by comparison with more modern designs, is a common factor. Again, individual skill and methods of operation vary. So one can easily imagine that there were wide variations in the over-all efficiencies with which power stations produced their final product. In pre-Grid days, Blankborough might suggest, was of an average figure in the efficiency of power for great distances. This example is a 30,000 kV.A. 132/33 kV. transformer, loaded for road transport to site.

(217x309)An essential part of every electricity supply scheme is the transformer, which enables economical high-voltage transmission lines to carry large blocks of power for great distances. This example is a 30,000 kV.A. 132/33 kV. transformer, loaded for road transport to site.

(217x309)An essential part of every electricity supply scheme is the transformer, which enables economical high-voltage transmission lines to carry large blocks of power for great distances. This example is a 30,000 kV.A. 132/33 kV. transformer, loaded for road transport to site.
ladder, and it was thus chosen as a selected station. The Grid was constructed in 1929-30-31, and by some date, say in 1919, the scheme was sufficiently advanced to go into commercial operation in the district to which Blankborough belonged.

From that date, the chief engineer at Blankborough was no longer the sole person who determined when his power station should run and what power it should generate. In fact, he lost a very great deal of his control.

Centralised Control

In the centre of each of the eight Grid areas is a control room. From it radiate private telephone channels to each of the power stations in the area. The control engineers, who are always on duty, know at any moment the total load on every undertaking on their system. It is their duty to arrange that sufficient generating plant, at whatever station it may be situated, is steaming to supply that load. When they anticipate a rise in load, they telephone the next most efficient station to those already running, and ask them to have, say, 10,000 kW. of plant ready to be on load in two hours. As the load drops off, they arrange to shut down set after set, one here and one there, until only the most efficient machines are left running, and those machines will be reasonably fully loaded. They will carry the whole of the district’s night load.

The chief engineer at Blankborough, then, does not control the running of his plant. But he still owns it—or is the representative of the corporation, who are the real owners—and he still retains control over its efficient running. If it fails to be efficient, it will seldom be called on to run. He still engages and controls the staff, and he still is responsible for maintenance.

How is the load of Blankborough itself supplied?

The usual interconnection between a power station and the Grid takes the form of a grid transforming station, perhaps situated some little distance from the power station, where the standard grid voltage of 132,000 volts is transformed down, on duplicate transformers, to 11,000 volts, which is the main busbar distribution voltage at Blankborough. Cables operating at this voltage are laid between the Grid and the power station busbars. Into these busbars go the output of all the generators in the station, and from them also are taken the many feeds to the different parts of the town.

A Day’s Cycle

Imagine a day’s cycle, in winter, starting at midnight. The load is about 5,000 kW. The power requirement of the highly efficient kind which will be run by the Grid authorities for 24 hours a day, in this time, must be switched on and burned down. The busbars are supplied, via the cables from the Grid, from any of the most efficient stations which the Board have selected, on this particular night, to generate the area’s night load. The nearest might be fifty miles away, the next sixty. During the night, the load remains steady until about six in the morning, when it begins to rise. This rise, which has been forecast by the Grid control engineers, is met by the addition of more efficient plant in another of the distant “base-load” stations. A similar rise will be going on all over the country, and the Grid authorities will be arranging a programme of generating plant to be started up.

The Blankborough shift engineer has been informed, the night before, that he will be required to have 22,500 kW. “on the bars,” that is, switched in and ready to deliver full load, by 7.45 a.m. This means that at about half-past six in the morning preparatory arrangements will start up his 15 MW. and his 7.5 MW. generators. The boilers, which have been banked all night, are brought to full pressure. At about 7 o’clock the 15 MW. sets, and a few minutes before the appointed time he rings control and informs them that he is ready. They ask him to put his plant on load, and he does this by synchronisng both sets on to the busbars. All this time the Blankborough load has been rapidly rising. But the Blankborough shift engineer pays very little attention to this fact, which would at one time have been his most vital and immediate concern. At the time when he switched in his sets, the Blankborough load may perhaps have been 18,000 kW. All this would have been, up to that moment, imported from the Grid, and flowing onwards down the interconnecting cable. As Blankborough causes his sets to deliver full load at once, which is not generally quite true, the balance at once changes from import to export, and he is delivering 22,500 kW. into the station busbars, and his own load absorbs 18,000, so he exports 4,500 kW.

This is going into the general Grid pool, to supply those undertakings whose generation equipment is either so inefficient that it is seldom run, or to those who have no generation department at all.

The Blankborough load rises, until at some time exact balance may be reached, in which there is no inward or outward flow at all. But this is no concern of the Blankborough engineer. It is determined by the C.E.B. Control. If the Blankborough load still further rises, then the flow is again inward, from the Grid.

At midday, the whole area load drops, and it may be that the C.E.B. anticipate that it will rise to a figure sufficient after lunch to justify as much plant being kept steaming. They may therefore ring Blankborough and tell him to shut down their 15 MW. machine at one o’clock. At this hour, then, the slight export from Blankborough may swing round to a fair-sized import from the Grid. During the afternoon, when the load is perhaps 15,000 kW, set will be kept warm up, as it is actually being used as part of the standby plant for the whole Grid, but if the load does not exceed the anticipated figure forecast by the Grid engineers, it will not be needed again that day. At perhaps seven o’clock in the evening, the load will be shut down, and Blankborough will revert to total import.

The Grid scheme is constructed in a number of rings. From Blankborough Grid sub-station there will radiate a feeder to the north, and a feeder to the south, so that if one of them fails, there is always a supply available over the other. Where there are four or five Grid feeders radiating from one switching point, so that the various rings and the different areas into which the Grid is divided may interchange load.

Duplicated Supplies

Before the Grid, Blankborough had to rely entirely on its own power station. A simultaneous breakdown on two large machines, or a fire in the boiler house, or a busbar fault, would put out the whole of Blankborough’s lights, perhaps for days or even weeks. Now, it has at least three sources of supply—its own plant, and the two Grid feeders. Many towns take supply from the Grid at two separate points, so that the final bottleneck, the common busbars at Blankborough power station, are no longer liable, in the remote event of their failure, to shut down the whole town. Failure of supply, except for a few moments, become virtually impossible with this new facility. Anyhow, this facility has obviously been invaluable. Throughout the most severe blizzards, electricity supply from the various central stations has seldom ceased for more than a few hours.

To transmit the large amounts of power over the vast distances involved, the Grid needs to use as high a voltage as possible, and 132,000 volts is the standard. The three-phase 50-cycle system is carried over the countryside on steel pylons, and at the end of 1944 there were 3,172 miles of these transmission lines, of which 3,164 operated at 132,000 volts. They connected together 348 switching and transforming stations, with
an aggregate transformer capacity of 13,422,750 kVA. Up and down the country there were a total of 142 selected stations, with a total installed generating capacity of 10,054,656 kW. These figures are taken from the Board's seventeenth annual report, for 1944.

Control of Distribution

Turning now to the question "What amount of public control exists over the electricity supply in my town?" if it is a municipality the electricity department of the corporation are in direct control of the distribution of electricity. But if it is a company, then the distribution is in private hands. Both the corporation and the company are subject to the general supervision of the Electricity Commissioners, and their control grows tighter from time to time. They will not permit excessive rates of tariff, and they do not allow non-standard voltages to be used on new extensions. They inquired into the causes of breakdowns. They call for records of every possible technical detail to be sent to them at regular intervals.

But neither the municipality nor the company can control the price of the current as they receive it from the C.E.B. The "Grid tariff" is a figure based on the overall cost of the generation of the whole of the units required in a district, by the most efficient plant only, with the Board's transmission and management costs added. The Board do not, of course, make a profit. The cost of generation at each station is paid to the C.E.B., subject to many safeguarding financial clauses of great complexity.

Rationalisation

And that is as far as Acts of Parliament have so far succeeded in rationalising the vital industry concerned with electric supply. When the current is received at Blankborough, the Board no longer have any control as to its distribution. The control, so to speak, the wholesaling of the product, and the retailing is left to each individual retailer to arrange and manage. He is subject to over-riding supervision by the Electricity Commissioners.

Your electricity department has been relieved, through the operation of the Grid, of one worry. If you, as a manufacturer, decide to establish a factory in Blankborough, which will require 5,000 kW., in pre-Grid days one of the factors which might have influenced you against building your works in a particular area, such as Blankborough, was that the power station could not, with its existing plant, supply the whole of your load, and for that reason your costs would have been higher.

You would have had to wait for an extension to be built. This the corporation might be unwilling to do, as they might not feel justified in incurring the large expenditure necessary, to supply your factory alone.

Nowadays, all that is needed is for the chief engineer at Blankborough to write to the Board, and the (relatively small) additional load can be supplied straight away, from the Grid. This increase, with many others, is taken into account when the Board and the Commissioners plan the extensions they propose to ask the various undertakings to install in their generating stations during the coming years.

Differing Tariffs

The final question as to why your electricity costs more than that of your friend in the next town is answered when we realise that no two distribution areas are alike. They both receive the energy at the same price, from the Grid, but one has a large rural area where there are miles of expensive overhead line between small hamlets with only a farm, a public house, and 10 cottages connected to the mains, and the other is situated in an area of sufficient to maintain the lines and pay the capital charges. This town may have two tariffs, one for the expensive outer area, and a cheaper one for the central area; but its total expenditure per unit sold may be high, and so its tariffs must be high. The chief engineer may have been left by his predecessors in a position where to extend meant a definite scrapping of a large number of non-standard mains and transformers, and the capital charges on the new gear have to be met.

Another town, by comparison, may have a small outer area, and a densely populated centre, with large factory loads at close intervals, each mile of cable, and each step-down transformer, earns a large return. It is thus enabled to distribute electricity cheaply, and the tariffs are correspondingly lower.

Many engineers envisage a National Distribution Board, to embrace the present Grid organisation, and also the whole of the distribution undertakings, on the lines of the Post Office. A uniform national electricity tariff, or tariffs, could then be promulgated.

The 1914-18 war laid the foundations of the national organisation of the electricity supply industry; it will be interesting to see the changes that come at the conclusion of the present conflict.

Clock Repairing and Adjusting

Striking Trains: Chiming Controls, and Calendar Mechanism

By WILLIAM G. PIKE, F.B.H.I.(Lond.)

(Continued from page 230, April issue)

FIG. 6 is an illustration of an Enfield 14-day hour and half-hour strike. A stroke is the name used to distinguish a timepiece from a clock. In a stroke, apart from the striking mechanism, there is a second extra train of wheels. This extra train is complete with its own motive power, except in the case of 30-hour English long cased clocks, where one weight drives both the timekeeping and striking trains.

The wheels of the striking train are driven by a pinion attached to an elongated circular plate or disc. This consists of an arbor with pallet, and pin wheel. The warning wheel, and pin wheel, as its name implies, allows the clock to warn the owner that its striking pallet is about five minutes before striking; in other words, the striking train is partially released to allow the rack to fall to its correct position in readiness for gathering-up at the hour.

Gathering Pallet Wheel

The gathering pallet wheel has an extended arch which carries the gathering pallet, which is a single curved tooth; when it

revolves it gathers up the rack and finally arrests the striking. Fig. 7 shows three kinds of gathering pallet. In clocks which do not use the rack control there is no gathering pallet, but the edge of the locking plate is divided into eleven slots, each slot being placed a...
little farther from the last. The eleven steps are therefore all of different length, the largest representing 12 o'clock, the next 11 o'clock and so on until 1 o'clock. This last position on the plate merely consists of an extra large slot, there being no step. Whilst the locking arm is resting on a step of the locking plate the train of wheels is free to run, but immediately the locking arm drops into one of the slots it arrests the train. A locking plate and locking arm are shown in Fig. 8.

Rack Chiming Control

Rack control is used occasionally for chiming as well as hour striking. The rack consists of a toothed segment, usually a cam-shaped disc attached to the hour wheel. Some are very simple and consist only of a narrow toothed wheel rotating upon a stud fixed to the back of the cannon pinion. In English clocks this hook engages the teeth and prevents the rack from falling backwards as the gathering pallet gathers it up. The gathering pallet is an important part of the striking mechanism, as this lever, which actually releases the striking or chiming train, is in direct contact with the hand mechanism. This two-armed lever lifts the rack hook, allows the rack to fall to its required position and by means of a small tongue arrests the warning wheel until the time for release. The lower arm of the gathering pallet is raised by the cannon pinion or minute wheel. In some clocks the cannon pinion is fitted with one or more short pins, in others a two- or four-pointed star is fixed to the back of the cannon pinion. In English clocks one or more short pins is fitted to the minute wheel.

Chime Barrel

In Continental chiming clocks, which utilise the locking plate for control of the chiming train, an extra lever is provided for the release of the hour. This lever is called the hour warning lever. In English clocks there is no extra lever. When the quarter striking train of wheels, and a separate bell or gongs, but modern chime clocks use several of the chime hammer to strike the hour. Of the five-rood gongs fitted, four are for the quarters and one for the hour. The striking lever has a long pin at one end which lifts the three hammers striking the three lowest notes, thereby giving a chord instead of a single note. Practically every chime clock is now fitted with self-correcting chime mechanism which automatically corrects the chimes should they get out of correct sequence in relation to the hands. This consists of an extra cam and locking lever which is operated by the longest finger of the lifting star. The mechanism will be more fully described in a later article.)

Calendar Mechanism

Many antique clocks have calendar mechanism. Some are very simple and consist only of a thin toothed wheel rotating upon a stud at the back of the dial. Called the “day of month” wheel it has 60 teeth and a pin in the hour wheel moves it forward one every twelve hours. An alternate style is a flat metal ring about 6in. in diameter. Fig. 10 shows two kinds of calendar wheel. When a moon dial is fitted the clock dial is semicircular in shape at the top to permit this extra dial. A clock.

For Yachtsmen

A NEW invention, concerning which a patent in this country has recently been applied for, is of special interest to yachtsmen.

The object of this invention is to construct a yacht which is suitable for, or which combines pleasure cruising and racing.

It appears that when a sailing yacht is to be fitted so as to enable it also to be power driven, the necessary power unit or engine and the fuel tank are located in the cabin space. Such an arrangement considerably reduces the room available and likewise renders it unsightly because the fumes from the engine. This naturally does not add to the amenities of the vessel.

Hollow Keel

To obviate these disadvantages is the aim of the device in question. In this case the engine and the fuel tank and other accessories are placed in the keel or fin of the yacht. The keel is made hollow so as to receive a power unit such as an internal combustion engine.
Diamonds from the Gold Coast

On the cutting edge of thousands of tools in British war factories there would be found a diamond from the Gold Coast, one of the four British Colonies in West Africa. Though the Gold Coast is better known for its cocoa and its gold (not forgetting its soldiers) diamonds were already becoming an important element in the country's economy before the war. Large deposits were located in 1919, and their exploitation began the following year. The stones obtained are small, and, although the total output to the end of March, 1937, was well over 11 million carats, the largest stone weighed less than three carats.

After the waste material has been removed from the diamonds they are weighed again by a European expert.

Diamond-bearing clay gravel being tipped into the bottom of the conveyor belt at the recovery plant. On arrival at the top of the belt the clay gravel will receive a preliminary wash.

The grease table. The jig concentrates pass over this shaking grease-coated table assisted by flowing water. The diamonds have an affinity for grease and stick, whilst other minerals are carried along in the overflow.

From the classification trommel the size concentrates are then passed to the jig house shown in this picture. Here the pan concentrates are subjected to up and down oscillations in water. The diamonds and other heavy minerals settle to the bottom.

Large stones collected from the gravel washers being shovelled into trucks to be carried away as waste. Waste is used to fill in and cover off worked-out ground.
The Food of the Future
Synthetic Nourishment: Its Pros, Cons, and Possibilities

SINCE the first beginnings of things Mankind (to say nothing of animal-kind) has supported its existence on the products of the plant and the animal kingdoms. No creature can sustain life and activity for any length of time without an adequate supply of food, for food is to the animal body what fuel is to the power-producing machine, and it is for this reason that every living entity has to prey continuously on other life forms in order to support its own individual existence.

But food is fickle. It has ever been so. One of its characteristics is to present itself to the world in alternate gluts and scarcities. It has never been easy to obtain. Often enough it is difficult to prepare. Most of its sources are wasteful. Many of them demand an enormous amount of labour for the production of a relatively small quantity of consumable material, and even with all its modern resources of production, transport, distribution and preservation, our present civilisation, after the scourge of a protracted war, finds itself faced with a probable severe shortage of many essential and semi-essential foodstuffs.

Good food is not only necessary for the effective and pleasurable sustenance of life, but it is also a source of much mental satisfaction to the healthy individual. Yet, philosophically considered, our present system of feeding is a most unsatisfactory business. If we take too great a quantity of food—good or otherwise—we let ourselves in, sooner or later, for a hundred and one ills of the body. If we do not consume food sufficient in quantity and of a minimum standard of quality we also attract all sorts of diseases to ourselves. We cannot store food very adequately because after prolonged storage the majority of foodstuffs not only lose their palatability, but usually deteriorate badly even if they do not become actually uneatable. There exist—at the present day, for instance, samples of dried soups and of canned meat which are well over a hundred years old and are in fairly good condition. Probably they might be consumed without ill effects, but a diet of such material would have but little nutritional result.

The inherent unsatisfactoriness of the food position has give rise in many minds to thoughts regarding the ultimate possibility of our casting off completely our present utter dependence on Dame Nature and her queer and fickle ways for our food supplies and replacing her nutritional products of the contract upon foods which have never seen a plant, a vegetable, or an animal, but which have been chemically created from a handful of elementary materials such as carbon, hydrogen, oxygen, nitrogen, together with traces of essential auxiliary materials like sodium, iron, chlorine, phosphorus, manganese, iodine, and sulphur?

That is the question, and, for us at our present stage of civilisation, it is a basic question which is impossible to answer.

It would, indeed, take a clever chemist or other scientist to imitate the succulent deliciousness of roast chicken and fresh green peas, or to create a gustatory rival to a juicy beefsteak. In fact, we may say that any such idealistic achievement would be well-nigh impossible.

The chemist, if he is going to strike out for human independence in this matter of foodstuffs must take the path leading to the discovery or creation of new nutritional materials, of novel types of food. He must not endeavour to imitate the old ones, for Nature's products are not usually imitable, although they may frequently be surpassed.

Of recent years our knowledge of foods and of nutrition has been very considerably advanced in consequence of the large amount of attention which has been paid to the subject. We know not only more about the chemical composition of foods than we ever did before, but we have also gained a good insight into the many mysteries concerning the fate of foods within our bodies. Then again, chemical science has also worked out much of the mechanism of those strange yet essential nutritional aids to which we have given the name "vitamins."

Vitamins, however, are not foods. They are only chemical aids to physical and mental well-being, and thus, although we can synthesise or create artificially on the manufacturing scale the very vitamins upon which our bodies seem so greatly to depend, this modern feat cannot be classed as one of actual food synthesis.

The modern age has witnessed the rise of the so-called food manufacturing industries, so called because, with one or two excep-
Living Food-machine

Our friend the pig is about the most efficient food manufacturer we have. A pig is a machine which converts a miscellaneous assortment of scrap products into wholesome food. But, even so, the pig only returns to us as usable, consumable food about one-sixth of the material which it feeds on. The rest goes to waste.

The cow, however, is a much less efficient food-manufacturing machine than the pig. Although a growing calf may give in food about a twelfth of the material which it has eaten, its parent, the cow, only returns about 1 part in 30, whilst the common sheep is an even worse performer in this matter of food manufacture.

The hen, when in good condition, returns in the form of eggs about 1 part in 20 of its food intake, so that although an egg may be full of nourishment, it is, at the best, a rather expensive form of nourishment.

In the matter of milk production, a good dairy cow returns as milk about a sixth of the food which she ingests. Here, her efficiency as a food producer compares, with that of the pig, but, from the viewpoint of pure economics, the performance of either cannot be said to be in any way exalted.

Why cannot we cut adrift from the cow and manufacture milk in our own factories? After all, milk is, for the most part, a natural emulsion of fats in water containing a soluble form of calcium phosphate, with sugar, a quantity of protein matter, and a few other odds and ends.

There would be no difficulty in manufacturing an emulsion of the fats—provided that eaten, its parent, the cow—of the same composition. In the first place—and we could procure calcium phosphate by the ton from our mineral resources. The trouble mainly concerns the proteins which milk contains, the casein material which is so essential to the nutritive properties of the milk. Unfortunately, these proteins are all very complex, so much so that the chemist has, as yet, been unable to determine their composition.

The Problem of the Proteins

The complete elucidation of the long-standing problem of the proteins must be brought about before we can even hope to commence the artificial manufacture of milk. Apart from the fact that proteins contain nitrogen, and that they are seemingly composed of long chains and other molecular complexes of atomic groupings known as "amino-acids," we know little about the constitution of these very vital and necessary proteins. Serious scientific thinkers have at times expressed the opinion that it would take a hundred years or more of concentrated research to ferret out the true nature of even a small number of the natural proteins, to say nothing of working out methods of creating them artificially from simple basic materials. Hence it would seem likely that the present generation will not be able to feed itself on cowless milk, although it may continue to have its dried, canned and concentrated natural milks galore.

The protein difficulty at once rears itself whenever we begin to contemplate the synthesis of any natural food material of animal origin. Take the contents of an egg, for example. Much of it is composed of egg-white, or albumen. Now, this stuff, at first sight, appears to be simple enough. In reality, however, it is anything but simple.

It is probably a complex mixture of different varieties of albumen. All albuminous materials are to be included in the protein class and, as such, are exceedingly complicated in chemical make-up. One doubts whether even trained researchers have yet dared to make an accurate guess of the intrinsic nature of the egg-white material which we call "albumen." The subject is, as yet, far too complicated. Chemistry is, at present, in the amino-acids, or the unit stage of protein investigation. Chemists can continue the process during the European war just ended.

Although we can break down the very complex cellulose into the relatively simple sugars which we need for our nourishment, we cannot, as yet, proceed the other way and convert sugar into cellulose. Not, of course, that we have any actual need for so doing, but such chemical ability would give us a greater insight into the carbohydrate compounds and enable us to make or break them as we desired.

Sucrose Synthesised

Very recently, the laboratory-scale synthesis of sucrose, or cane sugar, has been announced. It is a crowning feat of many years of endeavour. To be able to manufacture sugar on the large scale (as distinct from merely extracting it from beet pulp or some other natural source) would result in the world being once and for all independent of all natural supplies, both in peace and in war time. The basic materials of sugar production are simple enough—carbon, oxygen and hydrogen. They are available in unlimited amounts. What we have to do, therefore, in this particular matter, is to refine and improve our theoretical and laboratory methods and to apply them to mass-scale production. The task is difficult enough, without a doubt, but it is one which will probably be solved in our lifetimes. If, therefore, such a feat could be achieved, one branch of synthetic foodstuff would be made secure. We should probably build up our sugars from carbon dioxide (carbonic acid gas) of which enormous amounts are produced daily among the world's industries.

Fats and oils come next. They are essential to us in one form or another and, at present, we derive them all from natural sources. With the above materials, the difficulty of chemical synthesis is at a minimum. Many methods of artificially creating fats and fat-like substances are already known. The trouble is that natural fats and oils are very much cheaper than any present-day synthetic ones could hope to be. Which fact forces us on the conclusion that no matter how successful from a theoretical or even a practical point a synthetic food production method may be, if the process is not an economic one it will be, commercially speaking, useless.

At the present time, therefore, we content ourselves with collecting oils and greases from whales and from other sources, and in chemically modifying these in order to con-
vert them into margarine. Such processes, which are claimed to improve the nutritive value of the feed, are far too slow to be practical. It is the judgment of many that a technological approach, together with a little sugar (by way of carbohydrate ration), will make this clear. The experiments, which were recorded in the scientific press, showed that the average healthy human body possesses powers of good digestion which we are not ordinarily aware of. Further experiments are proceeding in such nutritional studies, yet, of course, we have by no means got to the stage of eating coke and of making a dietary success of it! And almost certainly, we never shall do so.

**The Economic Factor**

The simpler types of foods, such as sugars, starches, milks, etc., together with numerous true flavours and essences, we thought economically to be able to create artificially after the necessary chemical problems and difficulties have one by one been surmounted. With such materials, it seems, given the necessary technical knowledge, all is a matter of economics. If, for instance, you can only turn out a synthetic sugar or an artificial fat from your factory at two or three times the price of the natural product, then nothing but your material, even though it be identical with the natural substance.

**Synthetic food,** to be anything of a success, must be cheaper than food from natural sources. That fact, of course, at once raises another train of difficulties. But regarding the chances of making synthetic apples and oranges, bananas and beefsteaks, chicken-flesh and cereals, they must be reckoned as almost infinitesimal. We may, very probably, be able, at some distant time, to create chemically the nutritional essences of such food forms, but to make these materials themselves with all their characteristics of flavour and texture most probably requires a skill which will never be Man's. Without any doubt, the food of the future will be a disgusting mixture of artificial materials. Its elements, such as sugar, starch, and possibly even protein matter, will be turned out artificially in large amounts, but unless some revolutionary scientific achievement is brought about, our natural food forms, despite their disadvantages, their periodic gluts and scarcities, will still constitute the most healthful and most economical material. After all, man is what he eats!
Timing Wave

A 50-cycle timing wave is included in the film record to enable any of the above recorded time intervals to be related to the peak of each cycle being 0.02 second for 50-cycles per second. It is recorded by merely connecting a 50-cycle supply to the cathode-ray oscillograph during the actual testing operations, the cathode-ray oscillograph being driven by the motor which drives the drum. When the camera shutter is controlled by one of the drum segments, hence synchronisation of the test circuit breaker with the camera shutter is ensured.

Cathode-ray Oscillograph

The cathode-ray oscillograph gives a continuing record of the following:

1. Recovery voltage in red, yellow and blue phases of the circuit breaker under test.
2. Voltage in each phase as above.
3. High frequency transient restriking voltage, also in each phase of the circuit breaker.

It is usual for this instrument to be arranged to record two voltages on a film. The film dimensions are as before, but in this case it is moved along at a much greater speed; such that one cycle of the voltage waves recorded spread over the whole 36in. length of the film. The records are obtained by taking a number of tests, the time intervals being through capacity voltage dividers to the elements of the cathode-ray oscillograph. These tappings are shown in Fig. 4. A 50-cycle cycle timing wave is recorded on this film in exactly the same way as for the electromagnetic oscillograph record.

Restriking Voltage Indicator

The restriking voltage recorded by the cathode-ray oscillograph during the actual short circuit test of a circuit breaker may, or may not, be the same as the inherent restriking voltage indicator with the test circuit dead. The reason for this is that the actual interruption of the arc current may react on the test circuit with the result of modifying the inherent restriking voltage. From the above it will be understood that whilst the restriking voltage indicator gives a measure of the test circuit severity, the latter may be altered during an actual test. The restriking voltage indicator is an entirely specially designed piece of apparatus, and the various manufacturers of switchgear employ different methods of measuring. The firm with which the author is connected use a restriking voltage indicator consisting of:

2. Time scanner.
3. Amplifier.

Tests are made with the test circuit dead, by injecting current surges at the circuit breaker terminals.

Control and Observation

All testing operations are controlled by a control relay, situated in the control house. The control relay consists of a motor-driven drum on which is mounted the necessary contact segments. These segments can be adjusted so that they make contact with the test circuit at a set time interval in relation to one another, as the drum revolves. All connections for the controlling of the various testing operations are made to the segments and contact fingers, and thus control is automatic. The films for recording the oscillographs are driven by the motor which drives the drum, whilst the camera shutter is controlled by one of the drum segments, hence synchronisation of the testing operations with film motion and the camera shutter is ensured.

These points in particular have to be taken into account when deciding the system of transporting and handling circuit breakers on the testing station.

The firm with which the author is connected use a very elaborate system of controlling their circuit breakers for test. The testing station yard is laid out with a carefully planned set of standard 4in.8-in. gauge lines, which are connected to the main line.

One of these yard railway tracks is laid in the end of the circuit breaker assembly bay, and out off this line, branches are run to the repair and maintenance fitting shop of the station and the various test cells and bays. Low, flat-topped bogie trucks are used on these lines to run in and out of the various test cells, etc.

The bogie trucks consist of a ridged wooden frame, to which, on the sides, at top of this frame are welded a number of standard rolled steel channels at suitable distances apart to form the top of the truck. A number of these would be needed to carry from the smallest to the largest of circuit breakers.

Testing a Breaker

When a breaker is to be tested, it is lifted by the assembly bay crane and located on to a suitable truck as described above. It is then securely clamped to the truck top and wheeled to the testing cell, where the truck itself is chained to the floor, thus preventing any movement of the circuit breaker for testing. If it is found necessary to carry out any repair work after tests, the circuit breaker can be readily wheeled to the maintenance fitting shop of the station; likewise, after testing operations are completed, the circuit breaker is wheeled to the shipping bay and lifted off the truck.

The advantages of such a system are self-explanatory. Lifting by crane is cut to an absolute minimum, which, of course, cuts down the risk of damage in every way to a proportionate measure. No special heavy lifting tackle is required in the testing cells, which otherwise would be awkward from the electrical clearance point of view. Damage to high voltage bushings is considerably reduced, since these are often damaged through being knocked by wire slings, etc.

In general, rapid and easy handiwork of the circuit breakers is the object of which is important when a large number of routine tests have to be carried out.

Oil Handling Equipment

The oil in a circuit breaker tank becomes very carbonised during short circuit testing, and it is, therefore, necessary that an adequate supply of clean transformer oil be available at any time it may be required. Suitable storage tanks are provided in a position well away from the testing cells, because of fire risk. A motor operated pump is used to pump the oil into the circuit breaker tank, the oil being carried through fixed pipes into a suitably located reservoir with respect to the test cells. From this fixed vessel a flexible metallic hose is connected to the circuit-breaker tank. The motor driving the pump is controlled by push buttons, giving “start,” “stop,” and “reverse” operation.

The oil becomes contaminated with carbon after test it is drained out of the circuit breaker tank into an underground tank. At various intervals, according to the demand, the oil is sucked out of the underground tank by an oil circulator and cleaner, and pumped back into the clean storage tanks ready for further use.

(Te to continue)
What is Time?
A Discussion on this Ever-perplexing Problem

For once in a way, the reader beginning
the perusal of this article may be pretty
well assured that when he arrives at the
end he will be very little wiser than he was
at the commencement, since the subject with
which it deals constitutes one of the most
abstruse and gigantic problems which have
ever presented themselves to the inquiring
mind of man.

To call time a mere mystery is something
akin to a gross understatement. Time, indeed,
is practically the most colossal, the
most perplexing, the most paradoxical,
and the most inscrutable of the many first-
rate conundrums which secret-loving Nature
has to offer us.

If, throughout the entire gamut of Creation,
there exists any greater and more completely
perplexing natural mystery than that of
Time it is, perhaps, the unutterably deep and
fantastically complicated problem of the
production of human consciousness, and of all
that such a state implies through the agency of that
strange chemical complex, the slimy, wobbly, jelly-like
mass of material which we
call the brain.

If consciousness is
Creation's problem No. 1,
Time comes almost certainly
as No. 2 problem. And
here it is interesting to note
that Time, or, at least, its
perception by us, has some
connection with our higher
consciousness. This is made
clear by the fact that it is
quite possible by means of
drugs or by very carefully
administered anaesthetics to
so blunt the mechanism of
consciousness that although
that state may still persist,
all perception of time or
duration is abolished.

The same condition of
affairs frequently reigns
also (and can afterwards be
recalled by an effort of
memory) when we pass
through that fleeting phase
'twixt waking and sleeping,
that is to say, between
normal consciousness and
normal unconsciousness.

Sensing Time
The perception of Time,
therefore, the "sensation"
as it were, which it causes
us is concerned with our
higher mental faculties and
with those only. It is highly
improbable that an oyster
or an earthworm has any
perception of Time because
such creatures do not possess high mental
faculties. A four-legged animal, a horse or a
dog, for instance, may, on the other hand,
have some sense of time or duration because
in all such animals there are present the
beginnings of the higher faculties which we
ourselves enjoy.

The subject of our actual sensing or perception
of time, however, gives us very little
help when we begin to investigate scientifically
the real nature of Time.

If we grasp a red-hot iron bar, the inevitable
result in no way indicates to us the true nature
of heat or of thermal sensation. It only informs us in a practical
manner of one of heat's baneful effects. In
the same way, if, being watchless, as many of
us are in these wartime days, we manage
to miss the last bus or train home at night, we
experience an apparent effect of Time which,
in our circumstances, is harmful, or, at least,
inconvenient to us. We say that the Time has
passed quickly or that it has flown, but any
such statement quite literally implies very little to the
scientifically-minded inquirer, for it gives him
no idea of the inner nature of the thing which
has flown or of the precise manner of its
assumed flight.

From considerations such as these there are
many thinkers who have come to the con-
clusion that Time is merely one big illusion
and that it has no real, genuine existence.

Such opinions, however, only beg the
question, for have there not been philosophers
who, in their own minds, seriously come
to the conclusion that everything external
to us which we can grasp or appreciate with
our senses is illusory, and devoid of true
existence? So that merely to say that Time
has no existence, that it is non-existent in a
scientific or philosophical sense helps us
little in our endeavours to ferret out clues to
its real nature.

Time's Passing
We speak, as before mentioned, of the
"passage of time" and of "time flying by,"
to say nothing of the familiar and hackneyed
tempo fugit. Do all such expressions mean
that Time has dynamic properties, i.e., those
of movement? If so, time must be some
thing because it is perfectly obvious that you
cannot have movement without a thing
to undertake the movement.

However, a small amount of reflection
shows us at once that all statements con-
cerning the so-called passage of time must be
incorrect in just the same way as are our
allusions to the passage of the sun across our
daylight skies. Relatively speaking, the sun
stands still; it is the earth which moves.

And, in precisely the same manner, too,
in relation to the assumed "passage of time,"
it is we who move along Time or through Time
and, in doing so, create for ourselves the
common illusion of Time's passing by us.

Time, therefore, if it has any tangible
existence apart from other things, must be
static or stationary, not dynamic or endowed
with movement. It is we who perform do
the moving.

Our next question regarding Time is this:
has it any real existence apart from our
conclusiveness or apart from our universe of material things?
Is it possible, for instance, for "empty time" to exist? That is to say, can we conceive, say, in some unfathomably remote area of stellar space far beyond the range of even our most powerful telescope, a region which is endowed with perpetual stillness, which is devoid of all forms of matter, energy or energy-radiations, a region desolate, void and utterly empty? Can such an area have any true existence in Time? Apparently it can, on first reflection, but when we consider the utter changelessness of this hypothetical region, many doubts must at once arise about Time's dwelling there, for Time and changelessness do not agree.

In many ways, therefore, it would seem that time is interrelated with or dependent upon matter and space because we cannot have a "timelessness" of nothing for "nothing" implies non-existence. Hence we must associate Time with created things or entities, material or otherwise.

The Fourth Dimension

To many inquiring minds, it has seemed that Time is actually a dimension, and that it is a dimension along which we and all material things move at a regular pace. Think, for instance, of a solid object such as a bar of metal. Such an object obviously exists in three dimensions, for it has length, breadth and thickness. But the metal bar has another type of existence, superadded to its linear dimensions. It exists in Time, and this is so because we cannot by any stretch of the imagination conceive an instantaneous metal bar, one which has no duration at all.

On these reasonings, many scientific people have supposed that Time is a fourth dimension which is the attribute of all material things, for just as all objects must have length, breadth and thickness, so, also, must they have the added attribute or "dimension" of time if their existence is to be in any way apparent to us.

Therefore, for these thinkers, is an actual fourth dimension or path along which all things are impelled at an apparently fixed and unalterable rate.

There is, undoubtedly, some truth in this aspect of the time problem. Nevertheless, such notions fail completely to give us any real idea of the nature of this "time dimension" to which they refer. Length, breadth and thickness are all distance measurements. They are not material things or forms of energy or anything like that.

Time is Distance

And so, too, must be Time. It cannot be a form of energy. It cannot be even sub-matter. Neither can it be a wave phænomon. From our worldly point of view, we may define it as a distance measurement just as length, breadth and thickness are distance measurements. "Time" being the distance measurement between one event and another.

We cannot point to or even imagine a lump of length or a barreled of breadth. And when we are considering material things and the universe of movement, we cannot imagine a state which is lengthless, breadthless and depthless, for it is one of the properties of material things that they all possess these three linear dimensions or distances: length, breadth and thickness.

The material, physical world is manifestly one of continual change. The earth revolves around the sun, the sun revolves around the gravity center of the sun, and that gravity center revolves around a central nucleus. Man and animals come into this world. They live, die and decay.

Now, all these processes are not effected instantaneously. They all have duration. They all consist of sequences. And the distance between one event and another manifests itself to us as duration.

That, in short, constitutes the practical aspect of Time.

Is Time Eternal?

Will time ever end? Such a question is often asked. Yet, strangely enough, few inquire whether linear distance will ever end.

Suppose, for example, you were asked whether the distance between London and Manchester will ever end, your reasoned answer would be "Yes—when Manchester and London end."

In the same manner, if you abolish material things, including space, you automatically annihilate Time because space and matter bring about movement and change, and Time, or at least one aspect of it, is the measure of movement and change.

And here we come to the question of Eternity. Now, eternity is not quite so difficult to conceive in the mind as one is apt to think it is. Eternity cannot be a mere unending succession of time units. It is not an infinity of time. Rather, it is an absence of time. A state of existence where time is absent must be an eternal one. It must be a condition of perpetual "now-ness," there being no past or future, only the everlasting present. Clearly such a state or condition must be entirely dissociated from the material world as we know it, for the material world cannot operate at all without Time.

Time's Termination

It is clear, therefore, that if the material world or universe is ever run down or dissolved into all-pervading nothingness, as some astronomers and physicists (to say nothing of the theologians) predict, then Time also will come to an end. There will be no more Time.

If time, given the above circumstances, will so obviously terminate, the may be well excused for asking whether it has ever had a beginning? To this conundrum, the answer seems also to be in the affirmative, for no matter whether our universe has been created suddenly or has slowly evolved from a single cause, a state must have existed before the sudden creation took place or the cause began to operate. So far as we can see therefore, time, like matter, arose out of the black chaos of physical nothingness.

Time, therefore, probably did begin, just as heat and light began. And just as heat and light will end, so, also, must Time. The unrest and the dynamic nature of our present universe necessitates the phenomenon of Time. Hence, at the ultimate transition of changing to unchanging existence, Time will automatically vanish, for the circumstances under which it exists will then be no more.

Although we cannot prevent the continuance of change (or the "passage" of time as we commonly put it) we can make records of time at any given stage of its "passage."

What, for example, is a photograph other than an accurate time record? The photograph records an event or a happening which took place at a definite time instant, and, by means of the reflection of light rays, it brings back to us the state of affairs which prevailed in a given space or area at that given time instant.

Time, space, matter and motion seem in some strange way to be intimately related, and the record, or, as we might say, the trace of time, can be very curiously affected by motion, as we shall now see.

Space Rocket

Let us, in our imaginations, build for ourselves a space rocket capable of travelling at any imaginable speed. We embark in our space rocket for an experimental tour into the confines of the universe, taking with us, besides food, heating equipment, oxygen apparatus, etc., and an enormously powerful, automatic focusing telescope. Before we set off we adjust our telescope so that it continually projects a screen image of some selected area of the earth.

The rocket crew being all aboard, we set off gently from the surface of our planet, and for the first few million miles we crawl along at a speed of only a thousand or so miles a second. On our telescopic screen we see events on the earth, or on our selected area

A linear measurement during a compression experiment. Here, distance is being measured from one spot to another. In a analogous manner, "duration" is time-measurement— from event to event.
of it, in very much the same way as they are happening at that time.

We instruct the rocket pilot to "step on it." He does so. Very soon we are travelling at the speed of light, which is approximately 186,000 miles a second. Just before attaining this rocket velocity we glance at our telescopic screen and, to our amazement, see an image! It is a "still" in a cinema drama. We travel outwards for days, for weeks and even for months and years still keeping very precisely in step with those light particles that have just been emitted by the heart of the sun. We travel away from the earth in exactly light's velocity the cruel murderer who has just been hanged for his crime years ago. We can see him, knife in hand, about to plunge it into her body. But, strangely enough, as we fly away from the earth at exactly light's velocity the cruel murderer never seems to complete his wicked task. Our telescopic picture is held like a "still" in a cinema drama. We travel outwards for days, for weeks and even for months and years still keeping very precisely in step with those light particles that have just been emitted by the heart of the sun.

**Record of a Tragedy**

Why is this? Well, obviously when any screen or record is continually reproduced by a series of light rays which proceed from it travel outwards into space with an absolutely constant velocity of 186,000 inches per second, and if, by means of our imaginary space rocket, we travel ahead of those light rays and keep up with them in velocity, then, naturally, we shall witness a particular record or record which those light rays carry with them. Thus we may travel for years at the speed of light in our space rocket, and have continually on our telescopic screen the spectacle of the man murdering his wife because we are ourselves actually keeping in step with those light rays, whereas, far away from us on the earth, the man may have been hanged for his crime years ago.

Suppose, however, that instead of travelling away from the sun, we change the direction of the light rays, and catch them, or "take the light" back to the earth, and then have the amazing spectacle of seeing a tragedy being enacted on earth.

**Inverting Time**

In these circumstances, an extraordinary state of affairs would take place. We should, in a way, be able to invert time and to witness the past, or, at least, a moving record of what has happened so far. By travelling out into space faster than light we should be able to overtake light rays which had left our earth before we had embarked upon it. And, consequently, the faster we travelled in excess of the speed of light the more long-departed light rays from the earth would we overtake. Hence, on our automatic telescopic screen we would witness a sort of cavalcade of past history taking place on the earth, or, on our selected selected area of the earth, as we were able to "hold" any required screen picture for as long as we required. Thus, we should, given these fantastic means, be able to examine, at leisure any stage of the earth's historical record in which we were particularly interested. We could, for example, witness any selected moment of the Battle of Waterloo for hours together if we so had the mind.

Similarly, by decreasing the speed of our space rocket below that of the speed of light, past events would retrace from our screen view and the apparent future would gradually build itself up, for, under those circumstances the light rays projected from earthly scenes would gradually overtake our travelling rocket.

Thus, whilst travelling freely in our space ship, past and future would have apparently little meaning, for, by altering our speed we should be able to mix them up to our hearts' content. We should literally be "playing with time."

Time, therefore, although its real positive nature eludes us, is a relative sort of thing. It cannot exist by itself. It depends on the existence of matter, and, very likely, on the presence of space. Certainly, also, its manifestations are greatly modified by motion through space.

It looks, therefore, as if Time, Matter, Space and Motion are all intimately associated, for we are never able to experience any one of these entities separately and independently of the others.

**Time, apparently, began.** So, also, does it seem likely to end. But, seemingly, it will be the last of all material attributes to end.

*Tempus edax rerum* (time consumes all things) said the old Latins.

It cannot exist by itself.

It cannot exist by itself. Space and Motion are all intimately associated, and, very likely, on the existence of matter, is a relative sort of thing.

It cannot exist by itself. By altering our speed we can mix past and future together, creating a present.

By K. W. GATLAND

(Continued from page 316, June issue)

**Rocket Propulsion**

Power Rockets : Stability Trials and Details of Alighting Methods : Range Sighting

By K. W. GATLAND

**Powder Rocket Trials in 1935**

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**Rocket Propulsion**

Power Rockets : Stability Trials and Details of Alighting Methods : Range Sighting

By K. W. GATLAND

(Continued from page 316, June issue)
The German experimenters employed parachutes in their early powder rockets—particularly the mail-carrying versions—and the Verein für Raumschiffahrt E.V. fitted them to the Repulsor liquid-fueled type as also did Johannes Winkler in his liquid fuel rocket of 1932.

Some of these earlier rockets simply had a released parachute function, the gear while others incorporated a clockwork "photographic" timer. The pressure within the propellant tanks has, too, been employed as an explosive medium, effecting operation through a spring-loaded, plunger when the fuel is consumed and the feed pressure has dropped to zero.

In the more recent and larger type rockets, the parachute release is effected by the firing of a small powder charge, similar to the method employed by J. H. Wyld in his sounding rocket. (PRACTICAL MECHANICS, June, 1945, page 316.)

Other devices recently developed are functioned by air pressure, in the operation of a trip mechanism by a barometric pointer. Release is arranged to take place at a height predetermined from the performance calculations, the trip device either ejecting a pilot 'chute through the release of a compressed spring, or causing the explosion of a small powder charge.

Yet other release devices have been advocated which would work under rapid negative acceleration, but in the event of a rocket which had just ceased firing and slowed up by atmospheric resistance. This factor, coupled with the rocket's curving trajectory away from the flight apex, it has been suggested, would cause any free body in the rocket to be forced upwards, and so enable the function of a pendulous device, or some form of escapement mechanism, in conjunction with a spring or "shot" ejecting gear.

Tiling "Flying Rocket"

Finally, in this short summary of allightment apparatus, the patented design of Reinhold Tiling (U.S. Patent 1,880,586, Tiling, Osnabruck, Germany, 1932) cannot go without mention.

The method as fully outlined in Tiling's specification does not involve the parachutes, but the four fins which concern us, one being arranged to extend transversely from the shell body, having provision for mail in the nose. Equally spaced around the shell are fitted four stabilising fins which project some distance from the free end of the rocket, hinge at a set angle of incidence, to form supporting blades. By this means, the rocket is brought to the ground as a glider.

The Tiling "flying rocket" (Fig. 25), as the device is termed, is of form simply a finned powder rocket, and differs conventionally from the shell body, having provision for mail in the nose. Equally spaced around the shell are fitted four stabilising fins which project some distance from the free end of the rocket, hinge at a set angle of incidence, to form supporting blades. By this means, the rocket is brought to the ground as a glider.

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Committee carried out tests of similar commercial charges of the 3lb., 4lb. and 6lb. size, and their conclusions are set out graphically in Fig. 27.

The designations of these charges follow the usual practice of pyrotechnics that in each case a lead shot of diameter equal to the charge represents the weight. The actual weight

Concerning the 4lb. type, the true weight is 0.906lb., of which 0.406lb. constitutes propellant. This size has a case of 12.0ins. long by 2.5ins. diameter and a nozzle diameter of 0.64in. The last size investigated, the 6lb. charge, has a weight of 1.5 lb., of which 0.656 lb. is powder. It is 13ins. long by 2.5ins. diameter and has a nozzle orifice of 0.64in.

Firing Results

In the above table (Fig. 28) is shown, for easy comparison, the results of the 23 individual firings. Of these, rocket No. 17 is of particular interest, being of the two-step type. It consisted of two distinct sections, each a self-contained propulsion element—the main component having a 6lb. charge of commercial origin and the other a similar 2lb. charge. In this type the two sections are connected, and the larger, first, having consumed its fuel in raising the small component, a connecting fuse fires the latter, which automatically disengages and accelerates away from the expended "parent" rocket.

Another unusual type, rocket No. 26, had fins fitted forward of the centre of mass, but this model proved markedly unstable on test.

Other rockets, Nos. 6 to 11 and 21 to 27, were strengthened by the removal of part of the charge casing, and to this is attributed the explosions of models 6 and 9.

(To be continued)
What Do You Think?

A Talk on Observation, "Jets", Rockets, and Small Things of Importance

By Prof. A. M. LOW

July, 1945

NEWNES PRACTICAL MECHANICS

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I AM rather nervous of our Editor, for it is true that I have never yet asked a question to which he could not give a reasoned reply. Now I am asking one, and I want to know what I am about. It is true that the reason for this alarming state of affairs is mainly skill in observation. I believe that this word covers all happiness, education and knowledge. I will be blunt and say that, in my opinion, most people walk through life—or run nowadays—with their noses to the ground like cabbages. Cabbages do have noses in the sense that they are very responsive to gaseous atmosphere.

To-day (I will get to the point in a moment) education has reached a stage where we often read pages of mathematics written for the one purpose of giving complicity to the few simple things we know. The cause of our being certain are so few that we are still little better than savages. If you doubt this statement please note that a large, because the whole of the power is not to be wasted in a very similar principle by which we have been led to this so-called success of which we have not yet been proved to be untrue, can in no way replace observation. That is what I think.

Who Invented "Jets"?

Take "jets" as an example. I read that they are new and that they are old. That they were invented in Italy, and that they were invented in India. None of this is true. For millions of years fish have used the reaction principle in a most skilful manner, and in many tropical pools these creatures can be seen swimming backwards and forwards by means of water sucked in or expelled.

Hundreds of years ago, when I was a boy, we used to make power-boats on a very similar principle by fixing a metal U-tube in a piece of wood, and curving part of by spirit lamp. These little model's were jet-boats. The hot water was blown out, and the steam condensed by the surrounding cold water which thereupon rushed in to be blown out again so that the boat quickened to the touch as it dashed quickly round the local ponds.

Internal Combustion Engines

The remarkable part of all internal combustion engines is that most of them are totally unsuited to their job. The motor-car is only satisfactory because the only criterion of efficiency is the weight of mixture in and out of the cylinder per minute. That is one kind of efficiency. To secure all the others, such as comfort, silence and convenience, we dare not turn the petrol into a gas or the combustion chamber overheats. We want to compress it and make it burn quickly and efficiently, but not so quickly as to waste the entire power, and the weight of the water is not to be wasted in water.

We would also like the heat to be turned into mechanical work, so, logically, the cylinder should be exceedingly hot. Do this and the incoming gases are overheated. The solution is gloriously simple. We buy an expensive radiator, and deliberately waste half the horse-power. If we had some other system to make sure of getting rid of another 40 per cent. Frightfully scientific is it not?

The Flying Bomb

The flying bomb is a clever device because of its control, its turbine-fed mixture regulation, its compression ratio and allowing the gas of combustion to drive into the atmosphere so that equal and opposite pressure drives the engine forward. It is by no means marvellous. Fuel consumption must be appalling, and I believe, in this case the reason is not only that of its skilful control. It is because for the first time a fuel is being used which is complete and requires no extra combustion. Allowing for the need for the machine to travel when there is no atmosphere before it can move efficiently it suggests the possibility of all kinds of queer progress.

You may say that rocket posts, high-speed travel to America, and control by radio are mere exaggerations of present-day ideas to me is that peak horse-power may be in the neighbourhood of 500,000 or more. When I am told sarcastically that this only lasts for a minute or two, I point out that if you could reduce the horse-power to 2 the time would proportionately increase, and I see no reason why something of this kind should not eventually be accomplished.

Anyone who troubles to think must agree that the modern reciprocating engine is chiefly interesting for its triumph over difficulties. Thermally it is horrible; mechanically it is worse still. Who in his right mind would want to take a dozen thousand revolutions per minute and rotate them backwards and forwards many times a second? The engine is expected to do this, and, more is further added to function reliably with a temperature in its stomach very nearly high enough to liquify steel.

Reaction Machines

It looks to me as if reaction machines, if you will forgive my colloquialisom, are one day destined to make speeds of a few thousand miles per hour quite common. It may happen that in the far future old ladies will mistake Africa for England instead of Golders Green. I am not sure how, but men wearing white ducks and solar topees are not mad because they cross Hyde Park to pick up a cinema ticket on their way spending Sunday afternoon in Africa.

No! I am right. Popeye had the idea of reaction and relativity most accurately. You may remember that after a helping of spinach he would commonly pick up an aeroplane by which vulgar people call the "prop" and spin the whole kite round it instead of the other way about. It should indeed be a source of satisfaction to know when you start a car and let in the clutch, that it is the engine which revolves and not the car. The car has very little difference.

Nor is this point so foolish. One of the great causes of aircrew inefficiency used to be that of clutter. The engine fires, we hope, and at each kick the tips of the blades are left behind. As these blades are springy, a high-speed cinematograph may show that the end is vibrating like a comic picture of a man in his glory. A high-speed camera cannot be allowed to show that 15 per cent. of total horse-power could be lost in this fashion.

Very Small Things

I should hate you to say that these are very small things and therefore of no interest. Just the other way about. In fact, it will be a poor advertisement for a manufacturer of photo-electric cells if this was his standard of efficiency. Now, come to the cinema where, incidentally, you sit half the time in pitch darkness while the film moves. Yet you are quite willing to pay the full price. If your eyes had no retentivity you could never enjoy Donald Duck, and if the picture came on again before the next take was ready, the projection would be worse than those of the earliest biograph.

A Poser

So you will agree that the world is an interesting place. It is quite impossible to be bored. That is what I think. But if you must trouble yourself with unnecessary figures, and if you insist occasionally upon confusing smartness with intellect, I will give you a problem.... A man had a dog which was his master when it left the office, take his hat, stick and gloves, etc., and dash home. The dog ran at 10 miles per hour, and the man dog and left office and house at the same time; the dog running faster than the man, met his master not far from the city, took its place, the projection would be worse than those of the earliest biograph.
The Introduction of the Mercury Thermometer

Gabriel Fahrenheit was a German, because he lived most of his life in Holland and spent a number of years in England. At any rate, although the details of his personality have vanished from the world's memory, his name, in consequence of his thermometric activities, has been wellknown immortalised and, in many countries, has become almost a household word.

Although Fahrenheit played the role of a mechanic and an instrument-maker, although, indeed, he even had leanings towards the primitive engineering science which, was current in his days, he would best be described as a working physicist, for he made the science of thermometry and, to a lesser extent, that of meteorology, the principal study of his life. It is, of course, clearly in connection with his thermometric associations that his name and some record of his activities have been preserved.

Before Fahrenheit's time, the primitive spirit thermometer had been an instrument of little practical use. It had not even been calibrated. Nor had the more accurate and reliable mercury thermometer come into use, although the idea of a thermometer containing the highly expansible mercury had previously been mooted.

The first thermometer containing alcohol or, as it was then known, "spirit of wine," was the invention of a Frenchman named Rey, who first devised the instrument in or about the year 1632. Hence, this, the first liquid thermometer, had not been known very long when Gabriel Daniel Fahrenheit, to give him his full name, introduced himself to the world in the City of Danzig on May 14th, 1660. He came of a fairly affluent family, his father being a well-known Danzig merchant.

It appears that young Fahrenheit went to a good school and received in full the recognised education of the day. His parents had destined him for the shipping trade from his early boyhood, and it was into this family occupation that the lad Gabriel was entered not long after he had reached his teens.

Commercial Career

At this time, so far as we can ascertain, Fahrenheit had no notion of taking up a scientific career, such as it was in those days. He became energetically interested in "trade," and shortly after he went to Amsterdam, Holland's noted port and trading centre, to train as one of the merchants and shippers of the day.

Here the historical record of Fahrenheit's early career becomes somewhat blurred because certain details are lacking which would supply positive evidence as regards his early activities in Amsterdam. One story has it that Fahrenheit set up actively in business at Amsterdam and that, after a few years' trading, he failed badly, barely managing to escape bankruptcy, whereupon he conveniently conceived a taste for scientific pursuits and promptly set himself up again as a maker of "philosophical" instruments.

Another, and, almost certainly, a more accurate record asserts that Gabriel Fahrenheit was always interested in the physics and chemistry of his day and that, after a few years of "trade" in Amsterdam, he took an intense dislike to a purely commercial life and, as a result, threw the whole business up voluntarily and gradually got together the nucleus of an instrument-manufacturing shop.

About this time of personal unsettlement, Fahrenheit seems to have been affected with some degree of wanderlust, for he travelled pretty extensively through Holland, Denmark and Sweden, and he also made his first visit to London. Being an educated man, who could read, write and converse in Latin, the scientific language of the period, Fahrenheit seems to have had little difficulty in becoming intimate with the scientific characters of the period. He was well known to our own Royal Society, in London, to whose Philosophical Transactions he afterwards contributed five scientific papers in Latin. He was particularly friendly with Olaf Römer, the Danish astronomer, whom he visited in Copenhagen and, with him, during the exceptionally cold winter of 1709, took careful records of temperatures.

Whether, during Fahrenheit's pre-thermometer days, the instrument business at Amsterdam was sufficiently "thriving," to maintain him we do not know. Probably there was no need for it to amass much wealth, for Fahrenheit, at this time a somewhat indefatigable worker, appears to have given more attention to original-physical investigations than to the routine claims of his business.

Temperature Measurement

He had become very interested in temperature measurement. As time went by, he recognised more and more clearly the paramount importance of having some thermometric standard, and of being able to construct thermometers which would accurately keep to such a standard.

The first liquid thermometer containing alcohol or spirit was, as we have previously seen, a French invention dating from about the year 1632. As a matter of fact, the first of Rey's thermometers utilised ordinary red
wine as the heat or temperature-indicating liquid. It underwent rapid improvement under other hands, and about ten or a dozen years later, a noted Jesuit scientist, Athanasius Kircher, actually proposed the use of mercury for thermometer making, a project, however, which he did not carry out.

The Mercury Thermometer

The first maker of a mercury thermometer is quite unknown at the present day. There are two or three claimants for that honour. According to some, it was Fahrenheit's friend, the astronomer Romer (or Roemer), Fig. 1, the first man to calibrate a thermometer, that is to say, to give it a regular indicating scale. Previous thermometers having been devoid of any constant system of scaling. Fahrenheit was not the first originator of the thermometer based on mercury, whilst a noted Jesuit scientist, Athanasius Kircher, actually proposed the use of mercury first as the heat or temperature-indicating liquid.

It will readily be understood that after a serviceable scale had been added to the thermometer by Fahrenheit, its use as a practical everyday instrument went up by leaps and bounds, for a thermometer with a scale is often a highly indispensable instrument, whilst one minus a scale is about as useful as an automobile without a steering wheel.

Fig. 2.—Fahrenheit's hydrometer for the measurement of specific gravities of liquids. It is fixed in front of the furnace door and records the radiated heat from the furnace.

According to some, it was Fahrenheit's friend, the astronomer Romer (or Roemer), first measurer of the velocity of light, who successfully made a mercury temperature-measuring instrument. Another story has it that Edmund Halley, of Halley's comet fame, made a thermometer based on mercury, whilst a third contention is that as far back as 1765 the Italian Academy of Science had produced a mercury thermometer.

These contentsions, however, do not concern us, since it is quite clear that although Fahrenheit was not the first originator of the mercury thermometer, he was the first practical constructor of it. Moreover, he was the first man to calibrate a thermometer, that is to say, to give it a regular indicating scale having fixed points of temperature, all previous thermometers having been quite devoid of any constant system of scaling. It is depicted that a thermometer had been added to the thermometer by Fahrenheit, its use as a practical everyday instrument went up by leaps and bounds, for a thermometer with a scale is often a highly indispensable instrument, whilst one minus a scale is about as useful as an automobile without a steering wheel.

From what we can document, the available records, Fahrenheit first became really scientifically interested in thermometer construction and improvement in consequence of being struck by the paper written by one Guillaume Aumontos (1663-1705) that water always boils at one definite point, as measured by the older forms of thermometer. Fahrenheit became curious to ascertain whether other liquids besides water would show fixed boiling points. He put a number of liquids to practical test and found that in every case a constant boiling-point was indicated.

Later, he went a little further, and made the important observation that the boiling-points of liquids are appreciably altered by changes in atmospheric pressure. A liquid's boiling-point, therefore, is a sort of fixed balance between its temperature and the pressure to which it is subjected.

At first Fahrenheit made his thermometers with "spirits of wine" (i.e., alcohol). This was about the year 1718, but in 1720 he completed his first mercury thermometer, an instrument which had almost the same appearance as our present-day one. Fahrenheit made the bulb of his thermometer cylindrical instead of spherical, as previous thermometer constructors had done, for he claimed that better and quicker heat-transfer to and from the mercury was obtained with a cylindrical bulb. Such a style of construction has been followed ever since in the best designs.

Fahrenheit's Success

To some extent the success of Fahrenheit's thermometers was due not only to their design, but also to his method of cleaning the mercury which he used. He noted that dirty or contaminated mercury will stick to glass and leave "tails" on it, whereas perfectly clean, lustrous and bright mercury slides up and down a glass tube with the minimum of friction.

In the previously-mentioned Latin papers published in the Royal Society's Philosophical Transactions, Fahrenheit revealed, for the first time, his detail process of making thermometers.

He perceived clearly that some sort of a scale was vitally essential for thermometer usage. The question which at first perturbed him was what kind of thermometer scale to use. For his first thermometers, of both the mercury or spirit type, he "invented" two fixed points, the lower one constituting the average temperature of an ice-salt-water mixture and the higher one comprising the blood temperature of the human body. Between these two points, Fahrenheit divided his thermometer stem into 96 equal steps. He had the notion that the temperature of his ice-salt-water freezing mixture was the coldest cold which could possibly exist.

Absolute Zero

It is interesting to note here that Fahrenheit had some idea of what we now term "Absolute Zero," that is to say, of a final state of coldness at which a body is entirely devoid of heat. We now know that this state of "heatlessness" to coincide with a temperature of minus 273 deg. Centigrade, but Fahrenheit, with the limited amount of experimental information available at his time, took his "absolutes" to be the temperature of his ice-salt-water mixture. This, therefore, was his zero on his thermometer scale.

In his next batch of thermometers he added a third point on the scale, i.e., that which coincided with the temperature of melting ice. He found that the distance between the mercury level at his zero temperature and at the temperature of melting ice could be divided into thirty-two equal parts. Nothing, therefore, was easier than to mark the freezing-point of water (or the melting-point of ice) "32" on his scale.

Between the freezing-point and the boiling-point of water, the mercury column was found to expand by a length which could be divided into thirty-two equal parts. Hence 180:32 = 5.625 was fixed by Fahrenheit as the boiling-point of water, the scale, of course, being decidedly arbitrary but, nevertheless, having some experimental basis for its calculation.

Says Fahrenheit in one of his later papers in the London Philosophical Transactions: "Later, I recognised through various observations and experiments that this point, i.e., the boiling-point of water, is fixed for one and the same weight of the atmosphere, but that for different weights of the atmosphere, it may vary either way."

Alteration of Boiling-point

In other words, boiling-points vary with the pressure to which the liquids are subjected. Fahrenheit had the scientific sense to see that his fixed standard of 321 divisions or
degrees only applied to water under normal atmospheric pressure. After the pressure, and the boiling-point at once changes, the atmospheric pressure.

It is a curious fact that Fahrenheit never had the clearness of perception to realise that two fixed points on his thermometer scale to wit, the freezing-point of water as 0 deg. and the boiling-point of water as 100 deg., would constitute a much more convenient and simpler arrangement of temperature scaling than his cumbersome scale of 212 divisions. Had Fahrenheit lived longer he might, perhaps, have come to this conclusion, but as it was, the 0-100 deg. thermometer scaling had to wait a number of years before it was first practically introduced in the form of the now well-known "scientific" centigrade temperature scale which, in view of its greater simplicity, is used in all laboratories and scientific institutions the world over. It is rather strange that only the English, and the Dutch at first appreciated Fahrenheit's thermometers, the Dutch, perhaps, because the new thermometers were Amsterdam products, and our own countrymen because the Royal Society had taken them more or less under its augustegis.

France adopted another thermometer scale due to Réaumur, whilst other European countries seem to have been satisfied with "local" scales of their own. The present-day "Centigrade" thermometer was originally due to Andreas Celsius in 1742. But this worker, curiously enough, marked the boiling-point of water as 0 deg. (zero) and its freezing-point as 100 deg., thereby giving a strangely inverted scale. Our present Centigrade thermometer scale was introduced some eight years later by an associate of Celsius named Martin Strömer.

The Hydrometer

Contrary to Gabriel Fahrenheit, however, it is interesting to note that he was responsible for other devices besides temperature-measuring instruments. He invented, for instance, the hydrometer, which constituted an instrument similar to that shown in the accompanying diagram, Fig. 1. The Fahrenheit hydrometer comprised a cylindrical glass tube terminating in a short narrow tube leading to a glass bulb, upon which latter was surmounted another length of narrow glass tube having a very fine bore and being topped with an upper glass bulb.

The lower glass tube was filled with a liquid and allowed to remain for a few hours at normal temperatures, during which time the liquid rose to a position in the narrow tube below the first glass bulb. This position of the liquid indicated its temperature on a lower scale.

The device was then placed in boiling water, whereupon the liquid, by its expansion, rose in the tube, filled the lower glass bulb and entered the upper capillary tube. Its height in this latter tube (which was measured on another scale) served as a measure of the exact temperature at which the water boiled under the existing atmospheric pressure. Fahrenheit was also responsible for the design of a special form of hydrometer (Fig. 2), comprising a mercury-weighted glass tube having an upper metal plate on which additional weights were placed until the hydrometer became immersed in the liquid up to a predetermined mark. This form of "variable immersion" hydrometer might term mass-production thermometer constructions.

Elected F.R.S.

In 1724, Gabriel Daniel Fahrenheit was elected an F.R.S., London, in honour, no doubt, of his thermometer constructions. From henceforward he went in for what we might term mass-production thermometer construction and, apparently, made a good thing out of it.

Later, he spent a good deal of time on the design of a machine for land draining, a project which was to be applied in the extremely low-lying parts of Holland. The details of this invention are, however, missing, for the machine was never completed and put to practical test, the reason being due to the death of its inventor, which occurred in Holland on September 16th, 1736.

Little notice was taken of Fahrenheit's invention. Indeed, there is some doubt as to the actual date of that event, one narrative ascribing it to the year 1740 instead of 1736.

But his memory has lived on, and despite the admitted imperfections of his thermometer scale, it seems that we are likely to retain it for many years to come.

A Tyre "Hospital"

The accompanying illustration shows a corner in one of Britain's factories which has devoted energy and ingenuity to the wartime task of rubber conservation on a large scale, and is now slowly turning to the peace-time job of repairing tyres for commercial and private vehicles, as well as providing the additional output which the increase in public transport necessitates. Man (and woman) power is saved by an over-dimensional system which discharges tyres at pre-selected points throughout the factory. Seven thousand tyres per week are received here, first for inspection, then for classification according to treatment required, and finally for repair.

Unsuitable tyres are scrapped and the rubber content is reclaimed.

What happens when the tyres reach the factory is this: After examination, tyres accepted for reconditioning are prepared for their new treads. With the use of precision machines, the existing tread surface is rasped down or, in case of need, stripped to the fabric. These rasplings are saved for claretman purposes. Should any major defects be detected at this stage, the tyres are passed to the repair shop. Again on machines, the rasped tyres are brushed clean, then solutioned and dried in ovens. The new rubber tread stock is applied by machinery in the "building-up" shop. Tyres are then conveyed to the moulding shop, where the new rubber stock is vulcanised to the carcass in regulated steam-heated moulds engraved with a familiar non-skid tread pattern.
The Annals of Electricity - 5

Frictional Electricity and the First Electrical Machines

If, in a darkened room, you shake up a little dry mercury in a perfectly dry glass tube, you will probably witness some momentary miniature flashes of luminescence within the tube. And if, by any chance, you have an air pump available to extract the air from the tube before commencing the experiment, the luminous effect will be much more pronounced.

This peculiar phenomenon must have been noticed soon after the invention of the barometer, but, so far as we can trace, the luminescence was first recorded in the year 1675 by an individual named Picard.

The luminous effect is, of course, an electrical one, due to the friction of the metallic mercury with the inner walls of the glass tube, and it is of some interest because it happens to constitute one of the early experimental observations from which the science of electricity took its rise.

The contemporary explanation of the luminous effect was that it was caused by the presence of a special phosphorescent material in the mercury which, when agitated, gave forth flashes of light. Quite a controversy raged on the matter for a number of years, but the dispute was at last settled by an Englishman, Francis Hauksbee, one of the early Fellows of the Royal Society, who, in consequence of a number of experiments which he made, established the fact that the said luminescence is of frictional origin.

The Magdeburg Experiment

But before noticing the experimental work of Hauksbee any further, let us, for a moment, retrace our steps along the avenue of electrical discovery to the time of a certain very picturesque figure in the history of science, Sir Isaac Newton, in London, repeated it. Newton, however, used a glass globe instead of a sulphur one, and got better results.

Francis Hauksbee

That is as far as electric development went until the aforementioned Francis Hauksbee came on the scene. Who Hauksbee was, where he came from, where he was born and when he died, are points of information which historians of science are still seeking. In fact, apart from Hauksbee’s Fellowship of and association with the Royal Society and his published experimental work, there is practically nothing whatever known about him.

Whoever Hauksbee was, he must have been something of a genius. He seems to have stood at a focal point of electrical discovery and, by his work, to have given clues and indications to other inquiring minds which took up the trail of electrical discovery.

Hauksbee, we have already seen, explained the strange luminescence of shaken mercury in a tube. But he did far more than that. He contrived a frictional machine in which a glass sphere was rotated within an enclosing sphere exhausted of air. The inner sphere was revolved in contact with a dry woolen pad, and Hauksbee demonstrated to the members of the Royal Society the continuous production of electric luminescence.

The frictional electricity from it by means of a suitable rubbing surface. Von Guericke chose sulphur (one of Gilbert’s “electrics”) for his rotating sphere. He poured molten sulphur into a round glass bottle or flask, and, after the sulphur had solidified, he gently broke the bottle and extracted the sulphur ball. This he rapidly rotated on a hand-turned machine, using his free hand to make contact with the revolving sphere. In this way, he managed to draw sparks from the sulphur. When the machine was turned in a darkened room, Guericke noticed a feeble luminosity flickering around the contact area of his hand with the sulphur.

Strictly speaking, this was the first artificial electric illumination which the world had yet seen in continuous generation.

A few years after Guericke’s experiment, Sir Isaac Newton, in London, repeated it. Newton, however, used a glass globe instead of a sulphur one, and got better results.

Dr. Priestley’s electrical machine. It comprised a rapidly revolving glass globe making frictional contact with a lower spring-applied pad.

Charging a Leyden jar by means of a large frictional machine. (From an 18th century print.)
as long as the inner sphere was kept rotating and which the outer glass sphere was maintained in a state of partial vacuum. Immediately, however, air was admitted into the outer receiver, the luminescence ceased, or, at least, diminished to barely appreciable proportions.

Francis Hauksbee, therefore, may be regarded as the inventor of the first practicable glass frictional electrical machine, for although Newton had previously used a glass sphere, thus advancing on Otto von Guericke's sulphur ball, he had only really dabbled in it. Newton had previously used a glass sphere, which he performed a sort of frictional machine in which three or four glass spheres were simultaneously rotated against frictional contacts instead of only one globe, thus producing a greater "kick" than the single globe. For a contacting material, Winkler used soft leather pads or cushions dusted with chalk. These increased the frictional effect, and so heightened the intensity of the electrical charges which were forthcoming. Winkler seems to have made his electrical machines on a semi-commercial basis, for, in Germany, these machines were becoming fashionable among wealthy amateurs.

The fashion, too, had spread to England, whose society circles at that time were becoming increasingly Germanised in view of the Hanoverian monarch who was then reigning in Britain. Consequently, a number of the German machines found their way over to our country for the detection of not a few would-be amateur scientists of the period. Winkler must have "cashed in" to some considerable extent with his electrical machines, which were certainly strong and well made. He brought out a non-spherical electricist, also. This comprised a glass tube along which oscillated with a piston-like motion a leather rubbing pad. After this, he devised a machine for whirling an ordinary drinking tumbler on its axis against a frictional pad. There was no end to Winkler's practical constructive ability in the matter of his electrical machines.

Multi-frictional Machines

Then, as if to outdo his better, another experimenter of Leipzig. J. H. Winkler by name, devised and constructed a sort of multiple frictional machine in which three or four glass spheres were simultaneously rotated against frictional contacts instead of only one globe, thus producing a greater "kick" than the single globe machines. For a contacting material, Winkler used soft leather pads or cushions dusted with chalk. These increased the frictional effect, and so heightened the intensity of the electrical charges which were forthcoming.

Winkler seems to have made his electrical machines on a semi-commercial basis, for, in Germany, these machines were becoming fashionable among wealthy amateurs.

A Schoolmaster Experimenter

Among the really serious adherents of the electrical science of this period was a schoolmaster, John Canton by name. He was born in 1718, and died in 1772. He was friendly with Benjamin Franklin, and had been the first to repeat and to confirm the electrical experiments of that pioneer in this country. Canton, too, had interested himself in the Leyden jar, the newly discovered accumulator of static charges, and, besides being elected a Fellow of the Royal Society, he had received a gold medal from that body for a paper dealing with the making of artificial magnets.

Naturally enough, John Canton gave his attention to the frictional electrical machine. His contribution to the improvement of such machines was the coating of the "rubber" or contacting material of the machine with an amalgam of mercury and tin, thus increasing its efficiency.

But, in 1753, Canton made a far more important discovery. He found that electricity could be generated in a material merely by the approach of an electrified body to it and without any actual contact between the two. Stephen Gray, before him, had obtained glimmerings of this phenomenon, but Canton, living in a slightly more advanced age, was enabled to study the effect at greater length. He found that if a cork ball suspended on a thread is brought near...
to a positively charged metal rod, the ball becomes negatively electrified on the side facing (but not touching) the ball. If the closeness of proximity is sufficient, the cork ball is attracted to the rod, and, on touching the latter, the ball is at once repelled, since positive repels positive. The ball remains in this state of repulsion until its positive charge is dissipated by the ball's being touched. On this principle, Canton constructed a set of light bells which were sounded by "hammers" consisting of cork balls in their attractions and repulsions. "Canton's electrical chime" is still an article of lecture and laboratory demonstration in the majority of present-day technical schools and colleges.

Electricity Across the Thames

Another contemporary experimenter in the realm of frictional electricity was William Watson (1715-87), also a Fellow of the Royal Society. Watson made electrical machines, including a multi-sphere machine, but his most important technical achievement comprised his sending an electric charge across the River Thames. This took place in the year 1747. Aided by several other Royal Society members, Watson rigged up an electrical circuit consisting of a large Leyden jar, a length of wire stretching across Westminister Bridge and the water of the river, passing, of course, through the bodies of the operators on opposite banks of the river. Watson was, in reality, an experimenter who followed closely in the footsteps of Stephen Gray early in the century, for just as Gray had transmitted feeble charges through hempen lines, so did Watson, some two decades afterwards, transmit more powerful static charges stored up in Leyden jars through external circuits, the largest of which amounted to some two miles in length. Watson also made a serious attempt to transmit an electric current along the river. The electrical charges were conducted by the wire circuits, but his attempts were inconclusive, as the speed at which the electric charges travelled was very great. It is interesting to note that Benjamin Franklin found Watson's experiments sufficiently important to repeat for himself in America.

The Disc Machine

A decade or so after the middle of the 18th century, an important modification was introduced into frictional machine construction by Jesse Ramsden (1735-1800), who introduced the use of a revolving glass disc instead of the rotating globe or cylinder which had been used previously. This construction not only simplified the electrical machine, but it also made it more efficient and it quickly resulted in the previous types of machines becoming obsolete.

Jesse Ramsden was in many ways a truly remarkable man. The son of a Halifax inn-keeper, he became a clerk in a woolen warehouse. At the age of 23 he threw up this job and apprenticed himself to a mathematical-instrument maker. Afterwards he opened a shop in the Haymarket, London, and quickly acquired lasting fame for himself as a reliable and ingenious instrument-maker, an optician, a telescope constructor and, last of all, an electrostatic instrument-maker. It is of interest to note that all the present-day frictional electrical machines, including the "Watson's Machine," operate on the glass disc principle originated so long ago by Jesse Ramsden, the London instrument-maker.

The Going Train

As it has less to do, the going train is lighter than either of the striking trains, and all three of the wheels and other parts is greater near the weight barrel and is gradually diminished as the velocity of the train increases. When the train is passing the parts near the escapement can hardly be too light, for it is necessary that they should get into action quickly, directly they are unlocked, and give as light a blow or shock as possible when they are locked again. The four pairs of hands are driven by four horizontal minute arbors placed high above the movement, and leading each one to the centre of one of the dials. Each dial has separate motion wheels for reducing the rate of travelling of the hour hand, the motion work being carried on the walls of the clock room. It will be seen from the illustration that connection between the movement and the minute dial is of the usual oblong form, the locking plate K falling free of the locking lever I and the train of wheels begins to run, the lever K being lifted sufficiently high by the cam L to disengage the locking lever K, and as the quarter part when the time for striking the lever K catches the locking lever I as it comes round. But at the next quarter, after one chime has been sounded, the tip of the tongue rests on the periphery of the locking plate till another chime is struck, when it falls into the next notch. The locking plate makes one rotation in three hours, and it will be observed that it is spaced out to allow three sets of quarters. The interval between the hammer blows is kept constant by the resistance of the air against the revolving fly which is composed of two large blades of sheet iron.

The action for letting off the hour striking is very similar to that for discharging the quarter striking except that there is no double warning. The hour striking train is held by a stop on the locking lever, resting against the upper of the two blocks on the lever T. A few minutes before the hour the locking lever falls on the lower block and is released 30 seconds before the hour by the snail R, which revolves once in an hour (the four-armed nail attached to the hour snail is for actuating a lever which stops the winding of the quarter part when the time for striking the quarters approaches). The locking lever is then held by a small independent lever till

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[Newnes Practical Mechanics]
two seconds before the hour, when a snail on the second wheel arbor, which rotates once every 15 minutes, allows one extremity, then hits up the independent lever and releases the locking lever. By the time the two seconds have elapsed the first stroke is sounded on the bell. While one o'clock is striking the lever T is held clear of the locking lever by the cam W, the tongue on the lever then descends into the wild notch of the locking plate S; at two o'clock it is retained on the edge of the plate till two blows have been struck, and so on; the locking plate, which turns once in 12 hours, being divided so as to allow all the hours to be struck in rotation.

Operating the Bell Hammer

Around the side of the great wheel (X) of the hour part are 10 cams for pressing down the lever, which, through the intervention of the wire rope shown in the drawing, raises the hammer of the great bell in the chamber above. This wheel is 3ft. in diameter, has 140 teeth and gears with a pinion of 21; the second wheel has 90 teeth and gears with a pinion of 15 on the arbor of the locking lever. The great wheel of the quarter part (Y) is 3ft. in diameter, and the side of it is spaced out for 60 cams. This wheel has 150 teeth, gearing with a pinion of 20; the second wheel of 90 teeth gears with a pinion of 15 on the arbor of the locking lever.

Attached to the clock frame over the hour striking lever is a strong curved spring, as shown in the drawing, to check the upward motion of the lever. The length of the wire rope connecting this lever with the bell hammer lever is so adjusted that the hammer is lifted after the last blow is struck, so that when the train is again released the lifted arm is disengaged from the cam at once, and the hammer immediately falls.

Maintaining the Pendulum Movement

To maintain the vibration of the pendulum during the 20 minutes or so that it takes to wind the going part of the clock, Lord Grimthorpe invented a special kind of maintainier. The back bearing of the winding pinion arbor is carried in a loose link shung from the barrel arbor. To obtain a resisting base so that the winding pinion should not run round the wheel with which it gears a click presses against the ratchet teeth on the side of the great wheel, and so drives the clock. But as the great wheel travels on the back end of the winding arbor in following it is taken out of the horizontal line, and soon becomes so oblique that the winder has to stop and let it down to its normal position again. Although the maintainier work is ingenious for clocks of moderate size that take but a few minutes to wind, a spring maintainier is preferred.

To obtain sufficient purchase in winding the hour and quarter parts there is an intermediate wheel and pinion to each, and the bearing of the arbor of the intermediate pinion is formed of an eccentric bush, so that the pinion may be readily disengaged from the wheel when the time for striking approaches, or when the winding is completed. The hour pinion is shown out of gear, the lever attached to the eccentric being pushed away from the spring catch, while the one for the quarter winding is shown in gear ready for winding.

The clock frame is not in the centre of the room, but placed so as to allow a space of about 2ft. clear from one of the walls, to which a very strong cast-iron bracket is fixed, and from this bracket the pendulum is hung.

Hour and Quarter Bells

The bells are arranged in a chamber above the dials, and hung from massive wrought iron framing. The hour bell is 9ft. in diameter, 8£in. thick at the sound bow, and weighs 13 tons 11 cwt. It is struck by a hammer with a cast-iron head weighing 4 cwt., which is lifted 9in. vertically and 13in. altogether from the bell before it falls. There are four quarter bells, weighing respectively 78 cwt., 33£ cwt., 26 cwt. and 21 cwt.

The hammers for the quarters are each about one-fortieth of the weight of the bell it strikes. To prevent the hammers jarring on the bells they are kept from contact by india-rubber buffers on which the shanks fall.—"Watch and Clockmakers' Handbook."

AERODROME IMPROVEMENTS

Among recently accepted applications for a patent in this country is one relating to an invention which enables the take-off of a 'plane to be easily and quickly effected.

Another object of the invention is an improved method of conveying passengers to and from an aerodrome.

The new device arranges for an aerodrome having a circular track and a platform to run on the track and to carry an aeroplane. Radiating from the track are a number of runways, each of which is provided with a turntable. The platform moves round the track so as to bring the aeroplane into alignment with any selected runway, the turntable being employed to turn the 'plane.

The invention further comprises the above-mentioned aerodrome in combination with an overhead railway, the inner terminus of which is located at a station within the circular track.
THE WORLD OF MODELS

By "MOTILUS"

A Miniature Fair Ground, and Some Examples of "Pyruma"

The fair has been a feature of English life for generations, and, with the advance of steam, and later the Diesel engine and electricity, this feature has become more attractive and more noisy, and it still has the greatest thrill for youngsters. The whirling roundabouts - playing their tunes, the coconut shies, the stalls and booths - in fact "all the fun of the fair" - I hope will long remain the peculiar property of the English countryside.

Miniature Fair Ground

It is a fair ground in miniature, constructed to a scale of 1 in. to the foot, which has been on view at several exhibitions. The fair has its own loudspeaker, and current is distributed from a transformer van. There are models of living vans and two or three container vans into which it is possible to pack the whole apparatus. There are a variety of stalls and booths shining with multicoloured lights, fair engines chugging away, and roundabouts whirling round with the familiar music coming from the centre hub. The big roundabout, nearly four feet in diameter, is complete to the last detail, with inviting-looking "gondolas," and a model organ.

It is amazing to realise that Mr. Cooper has worked throughout without the aid of drawings. The three fair engines alone - two driven by electricity and the other by steam - must have kept him busily occupied for hundreds of hours. The whole model - or series of models - contain much finely-constructed engineering work, and even now Mr. Cooper does not consider his fair ground complete, and continues to add new pieces as time permits. More power to his elbow!

A Model Zoo

Last month we were discussing the value of model making in a school - a model boat constructed by a class of boys. This month we also have news of model work at a girls' school, and our old friends "Pyruma" and "Tiluma" come into the picture.

Miss Gretchen Studer, A.R.C.A., art mistress at the Northampton School for Girls, Northampton, decided to introduce this modelling cement to her girls. First she made an experiment, giving the cement to an adult, who had previously very little modelling experience. The result was the Zoological Garden which is seen in Figs. 3 and 4. The model depicts a group of students wearing the school blazer, visiting the Zoo with their mistress. Among the animals modelled are gorillas, elephants, a lion, kangaroo, polar bear, horse, zebra, seal, tiger, camel and hippopotamus. The cages are ingeniously made from wire flower baskets, and ordinary wooden boxes have been effectively disguised to make realistic local colour. The garden foliage came from the shrubbery plants, suitably adapted and fixed with Pyruma and Tiluma, which form the bulk of the model.

The dimensions of the Zoological Garden are approximately 4ft. by 3ft., and the figures are for the most part approximately 1/15th actual size. Some of them, particularly the kangaroo and the elephant, are good examples of modelcraft.
From this model Miss Studer decided Pyruma was a suitable modelling medium for schoolgirls, and subjects of the three other illustrations, Figs. 5, 6 and 7, are the work of girls from the ages of 11 to 16. Toy Town, an attractive layout, showing a toy soldier with a circle of toy animals around him and a little tree shrub in each corner, is the work of one girl. Four eleven- to twelve-year-olds were responsible for the Recreation Ground, with its swings, sandpit, see-saws, and other items of fun for kiddies. Fig. 7, the modern Nativity, was the work of three fifteen-year-old girls.

All these models were on view last year at the Art and Handicraft Exhibition of the school, held at the local art gallery.

This modelling is done by the girls from their own choice, and this season again a number of pupils are working on another Pyruma model for the next art exhibition.

New Book on Models

Looking in Bassett-Lowke’s branch at Holborn the other day I see they have a new book on sale—Marvellous Models, published by the Penguin people. It is the joint work of Mr. W. J. Bassett-Lowke and Mr. Paul B. Mann, and I should say from scrutiny will prove one of the most popular in this well-known series of Puffin books for juveniles.

Among the models featured in the book are Euston Station in the early days, a canal model complete with water, and the process of picking up the mails on the L.M.S. There is the Queen’s Dolls’ House, H.M.S. Hood, some historic models from the Science Museum at South Kensington, including the Cutty Sark and an Elizabethan galleon, and finally the famous Robot model which was the feature of a Radiolympia Exhibition some years ago.

The centre spread deals with the building of the largest model of the largest ship—R.M.S. Queen Elizabeth. Another point to appeal to the younger generation is the description of how to make their own models, including a windmill, a waterline model of the Hood, and a cardboard dolls’ house, and a ship propelled by camphor. The well-guarded mystery of the “ship in a bottle” is explained, and another useful set of pages are those which tell you “How models work,” covering steam, clockwork and electric, with descriptions of their internal mechanism.

The author is well known in the model world, and Paul Mann is a sapper in the Royal Engineers who went overseas just as the work was completed. This book is obtainable direct from Messrs. Bassett-Lowke, Ltd., Northampton, post free today.
Inventions of Interest

By "Dynamo"

Bandage Remover

A MONG applications for patents accepted by the British Patent Office is one relating to means for cutting and removing plaster and similar bandages from patients. The object of the invention is to furnish a simple power-driven saw worked by pneumatic pressure.

The device consists of a circular saw mounted in a case. This is driven by a pawl and ratchet means actuated by a piston and piston rod operated by compressed air. The casing is provided with a safety guard extending round the teeth leaving only sufficient teeth exposed for the cutting operation.

One such safety member, preferably the lower one, is shaped as a prong or claw. This serves to engage the end of the bandage and guide saw proper during its operation. It also prevents the cutting members from injuring the skin, underlying tissues or a bone.

Rubber Floors

A N inventor has been devoting his attention to rubber flooring. He points out that this kind of flooring is very generally used, and has outstanding wearing and cushioning characteristics. Certain disadvantages, he adds, have been encountered in special applications. For example, in some places the build-up of static electricity during the use of the flooring creates a serious explosion hazard. This danger, he further mentions, exists in plants where explosives are manufactured.

The aim of the inventor in question is to provide rubber flooring which will minimize this danger and the attendant hazards in particular installations.

The improved flooring consists of a vulcanised rubber compound of relatively high electrical conductivity and, embedded in the rubber, spaced readily stretchable and compressible linear metal elements capable of expansion and contraction with the rubber without breaking.

Fire Extinguisher Guard

FIRE extinguishers when fixed in public positions are liable to be tampered with. It is stated by an inventor who is applying for a patent in connection with these extinguishers that such tampering cannot be detected by mere external inspection. The inventor has conceived an arrangement whereby the fact that the extinguisher has been tampered with, and may have been partly or completely emptied by proper usage or maliciously, can be visually examined.

The author of the device affirms that it simplifies the means whereby extinguishers may be kept in proper working order.

The invention comprises a fire extinguisher of the pump type, and a bracket to hold it. The latter supports the extinguisher in such a manner that the operating handle cannot be actuated without removing the extinguisher from the bracket and breaking sealing means interlinking the extinguisher with the bracket. The removal of the extinguisher from the bracket will break or destroy the sealing means.

Razor Sharpener

A NOther safety razor blade sharpener has made its debut. In this instance there is a hollow cylinder rotatably mounted in a frame intended to be held by the hand of the person shaving.

The rotation is effected by a crank or a lanyard. And the blade is held with its edges in contact with the interior wall of the cylinder by a finger of the hand holding the frame. The crank or lanyard is held by the other hand of the user.

Flypaper Suspender

WHEN the temperature rises flies usually commence their activities. As a rule the only point in a room from which a flypaper can easily be suspended is the gas or electric light fitting. This is not an ideal position, because it is liable to damage the fitting as well as the shade. Moreover, the paper is often too low to permit it to be used at full length.

An inventor has submitted to the British Patent Office a device the principal object of which is to enable a flypaper to be hung without injuring the ceiling or fittings. The device comprises an open and generally V- or U-shaped attachment adapted to be moved laterally against a lighting fitting for engaging without encircling the latter. There is an arm provided with a hook or loop for carrying a flypaper.

Airfoil Sharpener

A NOther safety razor blade sharpener has made its debut. In this instance there is a hollow cylinder rotatably mounted in a frame intended to be held by the hand of the person shaving.

The rotation is effected by a crank or a lanyard. And the blade is held with its edges in contact with the interior wall of the cylinder by a finger of the hand holding the frame. The crank or lanyard is held by the other hand of the user.

Aircraft Wheel Cooler

THERE has already been invented a wheel for the undercarriages of aeroplanes, making provision for a current of air to be drawn through ducts which separate the braking surfaces of the wheel from the rim that carries the tyre. The object of this arrangement is to prevent the heat generated at the braking surface from damaging the tyre.

An improved invention of this type has air ducts within the wheel and also impelling means rotatably mounted within the wheel assembly and driven by the wheel to aid circulation through the above-mentioned ducts of a cooling medium. This is in addition to the normal impelling effect of the ducts.

The impelling means may take the form of vanes rotated at a speed higher than that of the wheel. It may be mounted either within a hollow space inside the wheel itself or within a hollow shaft or axle on which the wheel is mounted.

New Form of Clock

W HAT is termed a Time and Clock Educator has been contrived to teach young persons how to tell the time.

There is a clock face which has apertures through which are displayed the hours and the minutes corresponding to the position of the hands of the clock.

The clock hands are attached to the concentric mounting of a minute-indicating disc and an hour-indicating disc, upon which the minutes and the hours are applied and displayed through the apertures. The hour aperture is elongated to allow each hour reading to be exposed throughout 30 deg. of its travel.

This Time and Clock Educator is economical to make and may be manufactured in metal, wood, cardboard and plastics. It may be produced in a variety of designs.

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This Time and Clock Educator is economical to make and may be manufactured in metal, wood, cardboard and plastics. It may be produced in a variety of designs.
A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue. I am, however, not sure whether, or how, my letter may be enclosed with every letter containing a query. I send my query to the Editor, PRACTICAL MECHANICS, Geo. Newman, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Chemicals for "Storm Glass" 

Could you please inform me as to what are the chemical constituents of the liquid which is used in so-called "storm glasses"—D. Francis (Breckon).

This type of storm glass is very unreliable, and seldom gives lasting satisfaction. However, for what it is worth, here is the method of making one: 

Cadmium Rectified spirit, 1 drachms. 

Water, 3 drachms. 

Sulphite, 3 grains. 

Hydrate, 1 grain. 

Soak the camphor in the spirit and the sulphite and dry it in a warm oven. Then mix the camphor and the solutions together. Pour the mixed solution into a tube and then provide the latter with a tightly fitting glass cap, which should be as tightly as possible in position. Use a fine needle, pierce the cork through with a very fine hole. After mounting the tube suitably on a wooden frame or board, it will be ready for use. 

Its indications are roughly as follows:—

Tube filled with soft and powdery crystals—Rain. 

Tubes which are bent and liquid crystals are formed—Thunder. 

Crystals gradually rising in tube—Change. 

Tubes in which the crystals will usually rise in the tube, whilst during the summer they will be lower. 

The device is, of course, nothing more than a scientific toy, and you must not expect any reliable results from it.

Immersion Water Heaters

What is the formula for calculating the windings for copper sheathed electric immersion water heaters rated at 30 volts, 1.50 watts? These heaters, too, have a core of strip mica approximately 0.015 in. thick with laminations about 0.0014 in. thick. 

Tapes of 0.025 by 0.003 give p x a as 0.056 : 0.000075. 

The total resistance of the element would need to give you the same temperature rise with the same material as Lane, W.I, 31/32 s.w.g. would reach goo deg. C. 

Will you kindly give me the formula for calculating the windings for copper sheathed electric immersion water heaters rated at 30 volts, 1.50 watts? These heaters, too, have a core of strip mica approximately 0.015 in. thick with laminations about 0.0014 in. thick. 

Dimensions for making an 80-twt. fluorescent lamp core, built up to 1 in. thick with laminations about 0.0014 in. thick. 

Halves in contact, increasing the air gap very slightly until you obtain the best operating results, or until the temperature rise is about 0.8 and 0.2 above the boiling point. Tin strips of mica could then be placed in the air gap to make the core solid. An air gap approximately 0.001 in. will probably give you the required chilling effect.

Light-sensitive Emulsion 

(1) BEING a keen amateur photographer and unable to procure film or plate, I would like to have the following information:—What is the formula for the gelatine substance which is found on one side of the film? Could I buy the amount of cellulose needed if I wrote to, for instance, J. Washbourne (Southampton Street, W.C.2)? 

(2) Could you also give me a formula for a plastic substance which would pour into a mould and set the substance of a hair-comb, for example.—R. Brooke (Mirsfield).

Painting Asbestos Cement Sheet 

I wish to apply an ordinary household exterior paint to the asbestos cement sheeting used for such material myself. After having painted some time I have noticed the paint flakes off. Could you please inform me of:

(1) Is it necessary to treat the sheeting with a primer before applying paint?

(2) If so, what is the best preparation?—T. B. Smith (Chester-le-Street).

The compressed asbestos material to which I am referring is an ordinary good-quality paper for a second or two in duration of working this material, but it cannot be very carefully made by means of delicate controlled chemical processes, and it is just these processes which completely imitate by chemical processes. 

Principle of Household Water Softeners

Could you please explain the principles of an ordinary household water softener? I am also interested to know when common salt is used to soften the water, the action takes place in the same manner, or is there an essential difference? Is this correct? Also, is it to be expected that the use of these water softeners will deteriorate, need replenishment?—F. B. Pervin (Stoneleigh). 

The household water softeners operate on what is termed the "base exchange" principle. You will be able to make a household water softener yourself from a modern textbook on inorganic chemistry. Briefly, the principle is as follows:—

The hard water is trickled through a bed of a naturally or artificially-made (generally the latter) material, which acts as the active material and softens the water by exchanging some of its ions with the ions of the water, and retaining them in chemical combination. After a time, the "active material" will be exhausted, and the process must be repeated by extraction process. Hence, as you say, the softener deteriorates with use. In order to replenish it, you can obtain some of the thermo-setting bakelite resin, you will have to put it in a mould and subject it to pressure and heat in order to gain an accurately moulded article. Water softeners have the very difficult proposition in front of you.

Plastic materials are not prepared merely by mixing a few substances together and then leaving them to set or cure. There are processes, and these have to be very carefully made by means of delicate controlled chemical processes, and it is just these processes which completely imitate by chemical processes.
If your asbestos sheets are in reasonable condition, you can try to repair them to a degree by painting them thinly and roughly during a sunny spell of weather. Then give them a thin priming coat of a good primer paint. Let this harden properly, then repair the cracks, finally, apply the paint which you desire to have on the asbestos sheets.

For this purpose the only treatment which I have tried giving is to mix the above to a stiff consistency with just sufficient water to make a good consistency, and apply this to the sheets. The function of the priming paint is to keep the surface paint to the asbestos material. It does this by thickening the surface so that the underlying asbestos surface is in good condition. Otherwise, the painting will have little effect.

**Push-button Motor Starter**

I have just fitted up a 310, centre lathe with a h.p. single phase electric motor, and wish to fit a push-button switch. Please advise me as to the type to install and where I may obtain same.

**NEWNES PRACTICAL MECHANICS**

Mix the above with boiled linseed oil to a stiff consistency with just sufficient water to make a good consistency, and apply this to the sheets. The function of the priming paint is to keep the surface paint to the asbestos material. It does this by thickening the surface so that the underlying asbestos surface is in good condition. Otherwise, the painting will have little effect.

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CLAUD BUTLER
IN view of the opposition to any development in cycle sport by the old authorities on cycle litigation, and through the efforts of two rival bodies to get massed start racing suppressed, he reached the conclusion that he was being made a catspaw. Obviously it was the greatest possible interest and value to the greatest of the past, and their stupid adherence to the principles of the last century, it is not surprising to find that a cyclist was recently prosecuted for "furious" riding on a bicycle in a recent race. The cyclist in question was a member of the Wrekin R.C.C., a club affiliated to the British League of Racing Cyclists, and he faced a charge that "he did ride a pedal cycle furiously on a certain highway so as to endanger the lives and limbs of passengers on the highway," a charge made under section 78 of the Highways Act of 1835.

The archaic language in which the charge is framed will, of course, be in keeping with the traditional language in which cycle sport was to be run, have decided that it must show so run in perpetuity. It would be an anachronism to use modern language in addressing those whose minds have remained static from 1890 onwards. It may strike modern cyclists as odd that a cyclist was recently fined £20 for 10 miles an hour, free-wheeling. The girl stepped off the path from behind a post, and the cyclist swerved to avoid a collision, and she was not provided sufficient grip!

After a very short retirement, the chief magistrate announced the decision of the bench to dismiss the case.

The result of this case is a great disappointment to the N.C.U. and the R.T.T.C., who would have made great capital out of a conviction. They would probably have trotted along to the Home Office, as they have done on other occasions, and urged a further Home Office announcement. The case rest on prejudice, and our surprise is that the police were so misguided as to have brought it at all. We do not suppose that either of these two bodies will give publicity to the result of this case, as they are only interested in anything which can be used against the new sport.

Because, in the early days of the motor-car, our ignorant legislators of the day opposed the development of mechanical road vehicles by passing the Red Flag Act, they will argue that all motor-cars should still be preceded by a man carrying a red flag. It would be natural for them to do so, since the main platform in their argument against massed start is that it was tried in the 90's and was condemned by the police. Therefore, it must always be opposed! The police must always be right. The police opposed time trials, and it was the secretary of the R.T.T.C. who introduced the modern form of time trial in which the riders are started at intervals and race against the watch. It became the custom to refer to such races as "trials" in an effort to hoodwink authority.

They are races whether the riders are started at intervals or in mass, and as we have said before, there is no more danger in the slow start of a massed start race than there is in the massed finish of a time trial. Both are races in which the risk is to the rider and not the car, and the riders are no more coagulated in one than in the other during the course of the race. The police are usually informed to-day by the promoting club when an "open" is to be held.

The secretary of the National Cyclists Union, at the dinner given to the winners of this year, tried to gloss over the attitude of the N.C.U. towards the end of the last century, when it banned time trials and road records. We can well understand why now it seeks to lean upon the R.T.T.C. The arrangement between the two bodies is merely a marriage for the convenience and face saving of the N.C.U.
Poole Wheelers

An attempt is being made to revive the Poole Wheelers and to place the club back on something approaching its pre-war strength.

Jack Muspratt Passes

JACK MUSPRATT, well-known North London veteran, has died. He was 82 and well known on Northern roads.

Distinction for Ilford Rider

L/CPL W. COWELL, Ilford Road Club, serving with the Royal Army Service Corps, was mentioned in despatches for outstanding achievements during the final advance into Germany.

Beds. Road Man Decorated

SERGEANT NAVIGATOR HARRY BOX, Beds. Road Club, was awarded the Distinguished Flying Medal for outstanding bravery.

Pontypidd's Loss

HARRY NEALE, National Clarion C.C., South Wales Union, Pontypidd Section, died of wounds sustained in the final stages of the war against Germany.

Southgate Celebrates

THREE members of the Southgate C.C., who had been prisoners of war in Germany—Messrs. J. Acott, M. Mattmains and P. Gram—were liberally entertained by club members on their return home.

Clague Back

AMONG the returned prisoners of war is Sergeant James C. Clague, Manx Viking C.C., who played a prominent part in the initial massed start ride on the Isle of Man. He was taken prisoner at Crete.

Finsbury Park Loss

SERGEANT AIR GUNNER ERNIE STAPLEY, for 17 years a member of the Finsbury Park C.C., who was reported missing following a raid over Paris some months ago, has now been posted as killed in action. He was Time Trials Secretary of the North Middle and Herts. Cycling Association and first National Secretary of the R.I.C.C.

Pioneer Dies

LAST of the original ten members who founded the club in 1876, Harry Bingham, Darlington C.C.—the oldest club on Teesside—has died. He was 82.

Northern Ireland Activities

NORTHERN IRELAND TEMPERANCE C.C. has been revived after a lapse of some years.

Ilfracombe's Activities

THE Ilfracombe Wheelers C.C. has been re-established.

Mr. Fred Keller

M. FRED KELLER, Advertising Manager of the Raleigh Cycle Group, has been elected chairman of the Incorporated Advertising Managers Association (London).

Progress of Phoenix Peddlers

THE Calcutta Forces' own club, the Phoenix Peddlers, continues to progress, and now issues a monthly bulletin.

Midlander Dies

HARRY EDWARDS, prominent Midland track rider of a few years ago, has died. He was a member of the Rover Racing Club. His other interests included cross-country running.

Home Again

AFTER being reported "missing," and then "killed" after the airborne attack on Arnhem, Harry Gallacher, well-known Scottish polo player, is now safe among his "lat' folks.

Towards the End

ONLY a few hours before the capitulation of Germany, Sergeant J. Monahan, Gilfield Wheelers, was killed in action.

Bromley Road Club

THE Bromley Road Club is again fully active. It has had five very quiet, but useful, years.

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Around the Wheelworld

by Icarus

British All-rounder Competition

At May 31st the position was as follows:

A. Palmer
Scafell, 23.250
2.9.2
D. S. Burrows
Calkeva R.C.
2.9.16
V. Callanan
Norwood Par.
2.13.5
C. Ferrebrother
Canterbury R.F.
2.14.4
R. J. Brown
Calkeva
2.15.15
A. W. George
Tudor R.C.
2.16.10
A. D. Sime
2.16.51
Leading team: Calkeva R.C. 22.017.

Single distance leaders—50 miles: D. K. Hartley, Dukinfield, 2.654; A. Boulte, Barnet C.C., 2.759; B.L. Smith, Yorkshire R.C., 2.9.8; 23.259.


N.C.U. Special Meeting

A special meeting of the N.C.U. London Centre Council was held on Wednesday, July 8th, 1945, at the Holborn Grays, as announced at 6.30 p.m. No items other than the special purpose, namely alteration to Articles and Rules consequent to the Birmingham General Council can be accepted for the agenda. The alterations involve increase in subscriptions for affiliated members from 2s. to 3s. and associates from 3s. 6d. to 3s., both to take effect from September 1st, 1945.

N.C.U. Decisions

At a meeting of the Emergency Committee held in London, the following decisions were taken: That, in order to implement the resolutions of the General Council on post-war planning, a special general meeting of the General Council be held on Saturday, July 28th, 1945, commencing at 9.30 in the morning. Details of the venue will be announced later. The purpose of the Council will be to ratify the alterations to racing rules, articles of association, and by-laws of the Union as recommended by the General Council in Birmingham at its meeting held on April 14th-15th, 1945. This meeting will be followed by an extraordinary general meeting of members at 2.30 p.m. on the said day to deal with the question. Assuming that members implement all the recommendations of the Council the following will occur:

(1) An increase in subscriptions to the Union will become operative at the commencement of the 1946 membership year, September 1st, 1945; i.e., clubs from 2s. to 3s., associates from 3s. 6d. to 3s.

(2) An alteration in the rules of racing permitting the giving of accessories as prizes will become operative.

(3) The General Council will meet three times a year instead of twice. There will be no General Committee; Standing Committees, as recommended by the Post-War Planning Committee, will become the system of management.

Herne Hill

The recent announcements that Herne Hill would come under the management of the N.C.U. were followed by statements from Mr. W. J. Bailey, chairman of the executive committee of the S.C.U.S.P., and from Mr. M. J. Hennessey, chairman of the management committee of the G.C.B.S., who declared that the new arrangements had been made with the complete approval of the N.C.U. committee. No reason has been given as to why the function of the N.C.U. committee was set aside on this occasion.

The President Selects

Apparently the President of the N.C.U. now selects international teams, for the N.C.U. committee "confirmed the action of the President in selecting Messrs. Harris, Ford, Seabrook, and Barnet C.C., for a team to compete in Paris on June 17th." We consider that there were others with stronger claims and that the President in selecting the team and we therefore do not approve the President's selection, nor approve the approval of the President's selection. No reason has been given as to why the function of the N.C.U. committee was set aside on this occasion.

Road Accidents During the War in Europe

During the war in Europe, there were, on the average, over 20 deaths a day. In Great Britain as the result of road accidents. The total number of road deaths during the war period to the end of April of this year (including the first two days of September, 1939) was 42,556.

Of this total, 7,148 were children.

Ealing C.C. First Road Race Promotion

The Ealing Cycling Club can justly be proud of its first Road Race promotion, which was run over a sticky 87-mile course on Sunday, May 13th. The event, which started at Greenford, went out through Amersham, Princes Risborough, Thame, Stoniuchurch, West Wycombe, Gr. Missenden, and then returned again to Greenford. The riders, who included E. Clements, J. Williams (a newcomer to massed start racing), L. Hook, P. Burston, L. Davies and others, got away to a clean start at 1.30 p.m., the start having been delayed because of certain transport difficulties. The field went well along the road to the Amersham turn, going off to Chalfont St. Giles, where Jack Williams, deciding evidently that he had had enough of bunch riding, tried to make a time gap out of the event. Pip Burston, riding his first race for many months, owing to a leg injury, with Dick Boyden of the Southern Couriers, Froude of Manchester, Tilley of the East London R.C. and Ron Filsall of the Achillies Velo took up the chase and soon were 30 secs. up on the main bunch, followed by S. Howell, Boyden and E. Clements, who thought that the breakaway was only a flash in the pan. However, the leading riders maintained and increased their lead and at Risborough were 24 mins. up on the main bunch, which had spread out a bit by this time, with V. Humphreys of the W. London way back, 17 mins. down. The first prize at Stokenchurch was hotly contested by Williams, Burston and Boyden and was only narrowly won by the first named from Brown. At the stage the leading group (including the first two days of September, 1939) was 42,556.

Of this total, 7,148 were children.
The Peace

The European war is won, and it is difficult to realise that some of our habits of work and play will last for nearly six years after they should have altered to meet the dreadful demands of war. How good it will be for us, if the boys and girls come home again, to take up the fine habit of cycling with the new values for the lovely land in which we live, and for which so many people have been working and working to preserve, and one hopes in the years ahead, to improve. It is easy enough to be patriotic in these days of victory; to feel we are all part and parcel of the new life now all growing in dawn on the rim of history, and to realise as never before that we are one people, one people who have made many friends throughout the world and are determined to keep them. It will not be easy to live up to the high standard that war annihilates, but unless we are agreed that freedom, in its fullest sense, and simplicity in its sheer delight, are the aims to which we must endeavour to hitch our wagon, and to do this thoroughly we must first compose our own quarrels and consider our own particular game of cycling a worthy expression of freedom and simplicity, always expecting some people will not be able to go so far with us along the road of our choosing. Intolerance was the cause of war; it is a terrible sin, and it is very easily caught. Yet the common object that moves all of us is the enjoyment of life, and if we enjoy our way of life, let us say so and give our reasons, but if our friends think otherwise, then do not let us forget that precious gift of freedom of speech and action, part of our own happiness, and let us as a part of our own happiness, have a different method of movement. That I shall always be a cyclist does not blind me to the other fellow's in a different method of movement. Action, part of our own happiness, and no less a part of the other fellow's in a different method of movement.

Preliminary Test

I KNOW some of my keen cycling friends will feel a little sense of despair that their retaining, or gaining, the pleasure of motoring may mean an increase in accidents, and that we must face up to that problem. Personally, I looked upon the re-introduction of the basic ration in the nature of a try-out, to see how the pre-war can stand up after so long an idleness, how post-war users drive under their limited freedom, and most important of all, what the certain increase in road traffic will reflect in the way of accidents. The basic ration is a preliminary test, and it is the hope of many that the M.O.W.T. will deem it essential to achieve that higher degree of road safety with which all but the severely prejudiced will be reconciled.

Our arguments and objections as cyclists is not and never has been against the limitation of road conduct, but the method adopted to achieve it. I am contenting to enter into any form of controversy now; I have my own ideas and my own opinions, but until this pre-

A Good Addition

Let us get on to a more congenial topic, the behaviour of the new bicycle, that is to say it was new just because it has travelled over many thousands, sufficient distance to prove it a worthy addition to the stable. I am always rather indifferent about praising new machines, for a bicycle is the one thing I have been fighting and working to preserve. Now such an attitude is intolerant and one that ought to stand the weather, and I that is to say I am not going to feel we are all part and parcel of the new life now all growing in dawn on the rim of history, and to realise as never before that we are one people, one people who have made many friends throughout the world and are determined to keep them. It is easy enough to be patriotic in these days of victory; to feel we are all part and parcel of the new life now all growing in dawn on the rim of history, and to realise as never before that we are one people, one people who have made many friends throughout the world and are determined to keep them. It is easy enough to be patriotic in these days of victory; to feel we are all part and parcel of the new life now all growing in dawn on the rim of history, and to realise as never before that we are one people, one people who have made many friends throughout the world and are determined to keep them.

The CYCLIST

July, 1945

Bury Times

LIFE is going to be a very urgent business in the weeks and months after the war for the trade, the sport and the pastime. The crescent of activity will be hard on the new labour force and on the material which will be immediately available, but plan-

The famous old BRIG OF BALGOWIE.

across the River Don at Aberdeen.
Vehicles bogged in deep shingle . . . . sitting targets for the defenders. To obtain flotation, tyre pressures are dropped as low as 10-15 lbs. Wheels begin to pull through but the tyres revolve on their rims and valves tear out . . . . the vehicles are still sitting targets.

This was the alarming situation disclosed during invasion tests.

Yet, on D-day our fighting vehicles charged the beaches and treacherous shingle without bogging. The reason? The spring type bead-lock—a Firestone invention developed with Toledo Woodhead Springs Ltd., Sheffield—locked tyres to rims even at pressures as low as 10 lbs.

Adopted for all D-day transport, the spring type bead-lock—outcome of Firestone specialized knowledge—had conquered the beaches.
FERODO have contributed to the British war effort the Lion’s share of all Friction materials used in the air, on land, on and under the sea. In the three elements FERODO Brake and Clutch Linings, and other products of Ferodo Ltd., have played their part faithfully throughout.
Apple Day," as I rode through some leafy lanes, in green Warwickshire. I recalled that when I was a boy it was the custom to wear a sprig of oak (preferably with an apple) in one's coat, to commemorate the episode . . . and woe be to the luckless boy who forgot to "sport" his oak . . . he was severely "neltled" by the others. A strange survival! But somehow these old customs are very alluring, and one regrets their passing.

The Rolling English Road

SOMETIMES a very ancient road, laid down in the days of the Romans, and bearing traces of their genius. Sometimes a road that seems to lead nowhere but to an isolated village "off the map." But to-day, a road that needs much repair , and no wonder when one considers the amount of heavy traffic that has passed over it in these war-years. Th ose hug e American lorries; those amazing tank-transporters and enormous vehicles for carrying parts of planes . . . they have all done their bit towards making the road unworthy, though it is fair to say that our roads, in the main, have stood up to the strain exceedingly well. But the time is coming when there will have to be a good deal of repair work put in hand, and it is to be hoped that the Government will adopt a bold and courageous policy, and set going a great programme of road-work. Here is "reconstruction" of a vital kind, and of a character which will repay us a thousand-fold.

"Now It Can Be Told"

THROUGH all the long war years the curtain was drawn upon the activities of our great industries contributions to the war effort. Now, with Germany beaten, in many cases the security ban is being lifted, and the nation will be able to learn something of the great and ingenious work of our factories; and let us not forget that the cycle industry has a great story to tell. It made a contribution to the common cause which is a source of pride to all who control it, and work in it. Apart from the "special" jobs undertaken, and which did not come within the normal manufacturing programmes of the industry, the making of cycles in itself was a contribution. Where would our agricultural workers have been without bikes to get them to and from the farms? How would thousands of muni- tions workers have been able to work in factories without the help of the cycle? Oh, yes! the cycle plants have done a splendid job, and the industry should not hide its light under a bushel.

Village Worthies

THE twin glories of the English village are—its church and the inn. Both, in many hamlets, are so old as to be venerable indeed. The former, often ivy-covered, and embowered in trees; the latter, often truly picturesque, with its swinging sign, its old worn step, and its little bar-parlour with the sanded floor. But men of the village can be "glories" too . . . and I was reminded of this fact recently when I cycled to a little Staffordshire village, not far from ancient Tamworth, with its castle which dates back to the days of King Offa of Mercia. In this village I met and shook with the sexton, with the landlord of the inn, and with the schoolmaster. Each, in his own way, a village worthy, with a wealth of knowledge of the place and its history, each proud to be a villager; each possessed of a deep love of the land, the fields, the trees, the ways of life in the small community. The sexton knew the history of the church by heart and loved its grey old walls and the call of its bells. The landlord of the inn was just the kind of man a landlord should be—tactful, genial, proud of his calling, and expert in the care and treatment of the good ale he served in those blue and white mugs. The schoolmaster was quite erudite, and obviously loved his calling, looking upon it as much more than a mere way of earning his daily bread; he had a full measure of his responsibilities as a trainer of boys; and as I talked with him I smiled at the thought that many would pity him for being "buried alive" in a country schoolhouse. But he was happy. And I was happy, too, as I rode homewards, with the owls hooting in a coppice, and the road stretching ahead like a silver ribbon in the purpling dusk.

An Instructional Advertisement

SOME advertisements are just blatant "name-blocks"; some are humorous, and depend solely on their humour to catch the eye; others are useful and informative, and in this last class I place a recent advertisement issued by Dawes Cycles Limited: "published in the interests of national cycling." It shows, by a series of happy pictures, the right and wrong ways of riding a cycle, and cannot help but assist riders to get more pleasure out of their mounts and their touring. The "squier" is shown, riding in his grotesque fashion, and so is the "stretcher"—ungainly and awkward; then the "slow roll" is illustrated, and finally, as a centre-piece, we have the "proper way." All credit to Dawes for a good advertisement, and one very much in the best interests of all who ride a cycle.

Bikes and Bunting

ON VE-Day and afterwards I saw plenty of cycles decorated with Union Jacks and other flags, and was glad that the cyclist was not to be outdone by the motor-ist in a show of patriotic fervour and joy at the end of the war with Germany. One group of riders I saw out on the road to Lichfield might well have been called "The Victory Club"—for every machine sported a fluttering little flag, and most of the riders had rossettes or ribbons. Who says that we are not a demonstrative people? The King Who Hid in an Oak Tree

IT was, of course, King Charles, who hid in the leafy security of a great oak to elude his pursuers, and I was reminded of the legend on May the 29th. "Oak
Notes of a Highwayman.

Britain's Touring Grounds (8)

I do not suppose that cyclists come from all over the world to visit the Chilterns, but there can be no doubt that they form a happy hunting-ground for London and Southern cyclists alike. Like other touring areas they have a charm of their own and they appeal to cyclists especially to those of the reputedly weaker sex. It is a hardship having to carry an extra load for a few miles across the downs, but if the descent is large a cross with a very broad base. As with many of these old relics it is something of an experience to see them from above while some say they could not be seen out to celebrate the victory of the American over the Dansie in 1868. The 1945 point out that the war was commemorated by any of the local authorities, so that it cannot be in more than 200-300 years old. The second carrying this date is on the downs near Dunstable.

Interesting Towns

The towns such as High Wycombe, Wendover and Aylesbury have many attractive features, among which may be mentioned some very fine old inns. On the road between High Wycombe and Aylesbury was a guest-house, whose story of a Greek cross scarcely visible until you are close to it, has been commemorated by a memorial in the near home of the district. Wynige, Chenies and Latimer have many attractive features, and can be regarded as the perfect English scenery.

Pretty Villages and Beech Lanes

The hills are not high, and as a consequence, many good roads cross the downs, and in some parts of the downs, on the roads covered with a moss-like mantle that the cherry trees are in blossom, the paths are lined with beeches, although some, like Finnest, Chenies and Latimer have many attractive features, and can be regarded as the perfect English scenery.

Water End, in the Chilterns

There are extensive views for miles. It is said that Rupert Brooke, probably wrote "The Chilterns" on the top of this chalk hill.

My Point of View: By "Wayfarer"

Good-bye To All That

A few weeks ago, after going through a very disturbed night at a main-road guest-house, I made up my mind that, for the future, such establishments would be avoided, sanctuary being sought in quieter places. When, however, pleasure outdoor came to an end, my was put into cold storage for the time being. In the spring of last year I spent a week at a house on one of our main roads, at a point where another main highway came in, and I slept in peace. This spring I put in a week at another main-road house, and again was undisturbed at night.

Killing Enthusiasm

But I feel, however, that the time is now approaching when my self-denying ordinance must once more come into operation. Certainly, when the full tide of motoring flows along our highways, main-road establishments will be no place for those cyclists who, putting in strenuous rides day after day, like to be sure of resting in peace during what ought to be the silent watches of the night. So, in my case, houses in quiet backwaters, where the traffic "does not" early in the evening will be sought, and, as a further "mess from the road, the better I shall be pleased.

Modern Plague

It is sincerely to be hoped that the plague of pilfering in other ways, existing—which is sweeping over the land, and disfiguring the national life of this country, will be brought to a full-stop as soon as a return to normality is achieved. The army habit of "acquiring" some article which is missing from one's equipment, at the expense of a comrade's possessions, may be all right—for the army. It is not good enough, however, in the civil sphere, where carelessness or bad luck should be paid for by the person concerned, and not passed on to somebody else. This thiefery, of which so many people have reason to complain, is experienced in an acute form by cyclists, who may lose complete bicycles or essential parts thereof. A boy with whom I rode for a mile or two on VE-day plus one complained in an acute form by cyclists, who may lose complete bicycles or essential parts thereof. A boy with whom I rode for a mile or two on VE-day plus one complained...
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