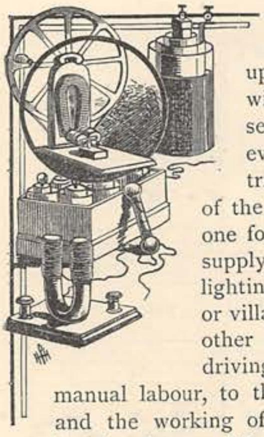
HOUSEHOLD ELECTRICITY.

IN TWO PAPERS.—FIRST PAPER.



IT is easy to foresee that we are now entering upon a time when electricity will be introduced for useful service into almost every home, even the humblest. The electric light is destined to be one of the illuminants of the future, in one form or another; and with the supply of the electric current for lighting purposes throughout a town or village will come a great many other applications of it: to the driving of small motors for saving manual labour, to the ringing of electric bells, and the working of such devices as fire and burglar alarms. There is, indeed, no end to the things which may be done by electricity, once it is supplied to houses like gas or water; for it is the most versatile of all the forces, and can be employed at will to generate heat, light, chemical decomposition, and mechanical power. The self-same current which lights our lamp will boil our kettle, plate our spoons, and drive our sewing-machine. It will tell us if fire has broken out in any room, if frost is too severe in the conservatory, if the water-level is too low in the cistern. It will regulate our clocks, call our servants within the house, or bring assistance from without; and it will guard us from the nocturnal intrusion of any visitor who has a fancy for our valuables, and no acquaintance with the family.

The chief duty of the electric current will, however, be to light our homes; and for this purpose the "incandescent system" is the most promising of all at present. Whether the existing incandescent lamp of Edison, Swan, and others, will maintain its ground by-and-by is, however, a very doubtful point. We are of opinion that it will not, and that it is but a step towards something better which has yet to be invented or discovered. Be this as it may, however, our duty now is with the best electric lamp we have; and we will select that of Edison because, among a variety of similar lamps, now constructed by Lane-Fox, Maxim, the British Electric Light Company, and others, there is none conspicuously superior to Edison's, which was the first in coming to the front.

The Edison incandescent lamp, pure and simple, is illustrated in Fig. 1. It consists of a wick or light-giver,* formed of vegetable carbon bent in the form of a loop. This loop is made by taking a thin slip of the outer skin of a Chinese bamboo shaft, and bending it round a plumbago "shape," then baking it in a heated crucible within a furnace. This has the effect of carbonising the fibre; and the carbon filament thus obtained is mounted within the globe of the lamp (Fig. 2). This globe is a pear-shaped bulb of glass, A, and through its bottom, or stem, E E, run two platinum wires, C C, fused into the glass. The ends of the carbon loop, F, are firmly cemented to these wires by electro-plating the joint with copper. After this process is complete, the air is exhausted from the bulb by a Sprengel air-pump of a peculiar kind, and the orifice at the top by which this was done is finally sealed up in the blow-pipe flame. The lamp is then ready for use; it is provided at the shank with a screw neck, which fits into a socket, B, specially prepared for it, and only a few moments are required to unscrew an old lamp and insert a new one in its place. The cock, D, serves to turn the light off or on.

The electric current, brought into the house by two wires from the generating machine, is led into the interior of the lamp by the platinum wires penetrating the glass, and flows round the carbon loop, raising it to a golden glow, like that of a pure wax taper. The light is almost an ideal one, for it is produced without combustion and the discharge of noxious fumes. It is simply derived from the agitation of the carbon atoms in the sea of ether by which they are surrounded, and none of the carbon is supposed to burn, or, in other words, unite with oxygen to form carbonic acid, as in the ordinary candle, oil, or gaseous flame.

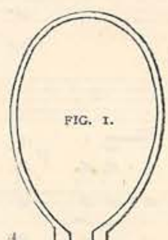


FIG. 1.

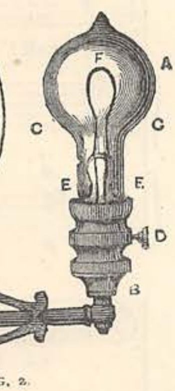


FIG. 2.

As a matter of fact, there is a little burning, due to the trace of oxygen left in the bulb; but this is an incidental defect. The incandescent light is a light *par excellence*, and little more. A lamp of 20-candle power, such as that illustrated, gives off only one-eighth the heat which an ordinary gas-flame yields; and having no opening to the air, it does not pollute the atmosphere of a room with deleterious gases, or tarnish paint and pictures. It has the advantage, therefore, of beauty, coolness, cleanliness, and healthiness, over the gas-light which it will in time replace.

That it lends itself to artistic decoration, in a way which gas-light cannot equal, was magnificently demonstrated at the recent electrical exhibition in the Crystal Palace. The crystal bulbs could be seen there beaming in the midst of fountains, foliage, and flowers, or suspended from the ceiling by silken cords. Wherever a wire can be led the light can

* In default of a better term, the author has suggested the name "electropyre" for these yielders of electric light and heat.

be obtained, whether in air or under water. It can be affixed to any ornamental object in a room, such as the mirror sconce, as well as fitted on standards or chandeliers in the ordinary way. Those who saw the fairy spectacle of the Alhambra Courts lit by Lane-Fox lamps at the Crystal Palace, or the great floral chandelier of Edison, will understand its capacities for adornment.

FIG. 4.

It is turned off and on by a cock, like the ordinary gas-flame, but, except in special lamps, does not admit of graduating the light. This, however, is a small drawback, which could easily be overcome, and is to some extent already, in the "Duplex" lamp, which has two carbons, and yields a half or whole light according as the current is sent through one or both at pleasure.

We need not concern ourselves at length with the dynamo-electric machine of Edison, by which the current is generated, any more than one need describe a gas-works in detail when treating of household gas-burners; for it is the intention of the electric lighting companies to found central stations and supply electricity, so that private individuals will draw upon them for the electric current they require, which will be regularly measured by an electric meter.

We may, however, give a short account of the Edison generator to make the subject more complete, and also for the reason that there will be outlying houses and homesteads which will generate their own supply of electricity. This machine is illustrated in Fig. 3, where M are a series of tall upright electro-magnets, three abreast, each triplet being connected at their bases by masses of soft iron, which form north and south magnetic poles, N S. Between these poles a coil of insulated copper-wire, A, of peculiar construction is rotated at a high velocity, and as it whirls through the magnetic space between the two poles a current of electricity is generated in the wire, and being tapped at a contrivance termed a "commutator," C, fixed upon the shaft of the coil, is led away by properly insulated wires, W, to the electric lamps. The coil, or armature, A, is revolved between the poles by means of a belt from a steam-engine, water-turbine, or other motor, running on the pulley, B, at the other end of the shaft. Thus the mechanical power of the motor is transformed into an electric current by means of magnetism, and after being led to a distant place by a circuit of wires, it can there be re-transformed into light in the electric lamp; into heat by traversing a low resistance of metal or some mineral compound; or back again into mechanical power, by a process exactly the reverse of that by which it was originally generated. That is to say, if we had another dynamo similar to that shown in Fig. 3, stationed at the distant place, and sent the current through its coil, A, that coil would begin to revolve of itself, and turn the pulley, B, which, by means of its belt or other gearing, could actuate a lathe or other piece of machinery, and thus perform mechanical work. This is the way in which the transmission of power to a distance by means of electricity is effected.

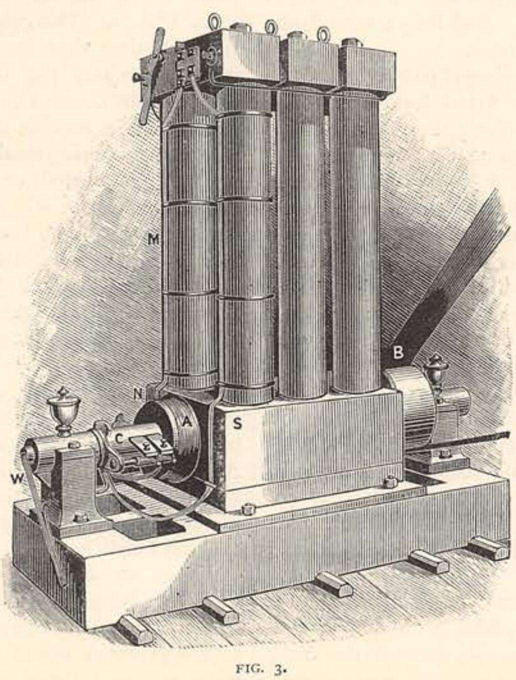


FIG. 3.

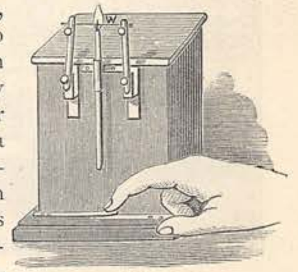


FIG. 5.

In the incandescent lamp, as we have seen, the current raises the carbon filament to a white heat; but if the current were not strong enough to do that, the carbon would only become hot, and perhaps glow with a dull red light. It is easy, therefore, to obtain only heat from the current, and not light, by selecting a suitable resistance of carbon, wire, or other resisting material. Fig. 4 is a sketch of an urn or water-boiler constructed on this plan. Here W W is a stout German silver wire carefully insulated in some composition, such as plaster of Paris, which will retain heat. The wire encircles the well or boiler, B, in which the water is placed, and the current is led to it by binding the conducting wires to the screw "terminals," P, N. The circulation of the current in W W creates heat, and in a short time the water begins to boil. This utensil is suitable for boiling eggs or making coffee.

A platinum wire rendered incandescent by the current is sometimes employed in the actual cautery for excising flesh, and Fig. 5 represents a contrivance for lighting a lamp by the same means. The finger pressing on a spring completes the electric circuit through the wire, W, and thus ignites the inflammable liquid.

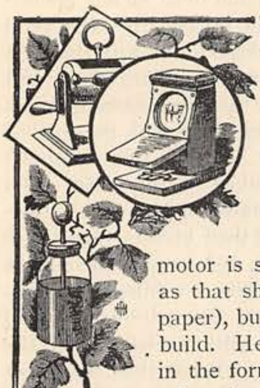
beat their foreheads for grief. There was nothing like sham or affectation in it; old men and young men and boys wept in their handkerchiefs, whimpered like whipped babies, or shook through all their frame in paroxysms of inconsolable sorrow. It was very astonishing to witness the passionate personal heart-broken anguish with which men, whom one knew familiarly as quiet industrious workers in brass, calm polite carpet merchants, or wary dealers in antiques, were affected as they listened to the story of a youth slain in battle twelve centuries ago. It showed an unsuspected capacity for passion in Oriental character, and it set me thinking on parallels in our religion and in mythology.

When the recital in Persian was finished, another man mounted in place of the narrator and re-told the story in Arabic. This was followed with the same fervid sympathy and the same expression of hopeless mourning.

The Arabic recital was, as a rule, slow and very pathetic; but it was varied here and there by a few passages of rapid chanting between the prose. At the end the speaker called on all the people to pray; and first, as they sat, they all stretched out both hands and held them uplifted, with their gaze fixed far away above, as they called, "Allah! Allah!" Then all rose up, turned to the east, and murmured a short prayer; the sheykh descended, and the ceremony was over—one of the strangest that the moonlight had ever fallen upon.

HOUSEHOLD ELECTRICITY.

IN TWO PAPERS.—SECOND PAPER.



COMING now to the employment of the current for driving sewing-machines, lathes, punkahs, coffee-mills, churns, pumps, and so on, we have an excellent sample of a small electric engine in the Griscom motor, which is illustrated in Fig. 1. This motor is simply a little dynamo, such as that shown in Fig. 3 (in the first paper), but differing in size, shape, and build. Here the electro-magnets, M, are in the form of a ring, having opposite poles above and below. The revolving coil, A, is placed within this ring, and the current is led to it by the terminals, S, and the commutator, C. Soon as the current is passed through the coil it begins to revolve at a rapid rate, turning the pulley, P, at the other end of the shaft with it. A strap, D, from this pulley to another, B, on the driving shaft of a sewing-machine conveys the power to the latter, and keeps it going.

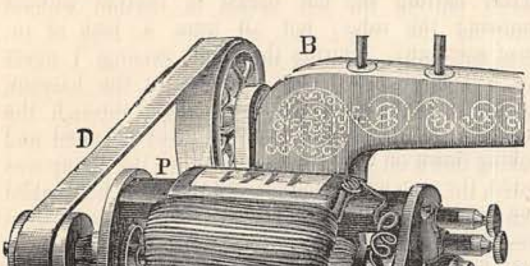


FIG. 1.

Such a motor can be, of course, maintained by the current from a voltaic battery as well as a dynamo. A useful battery for the purpose is the "bichromate of potash" battery, which is provided with it, and allowing the operator to regulate the speed of the sewing-machine by a pedal which dips more or less of the battery plates into the exciting solution. As, however, we are anticipating the time when the necessary current will be drawn from the general supply "laid on" to a house, we need not linger over this contrivance.

FIG. 2.

The "secondary battery," or accumulator for storing up the current, so to speak, in a kind of reservoir, is more to our present purpose than the voltaic battery, although some very large buildings have been lighted with current from the latter. One of the best accumulators is that of M. Faure, which is illustrated in Fig. 2, and consists of a glass vessel, V, containing a solution of sulphuric acid in water, and the plates in which the electricity is stored. These are two wide strips of lead, each coated with peroxide of lead or minium, and sheathed in a bag of felt or flannel. The two plates are then laid over one another, and rolled up together, as shown. Wires, W W, run through the cover of the cell to the lead plates, and connect its poles to the wires leading to the generator or the lamp, as the case may be. Such a battery, when charged by a dynamo, retains the current, as it were, in store, and yields nearly the whole of it up again at any future time. No doubt they will be supplied by-and-by to many homes, and charged during the day

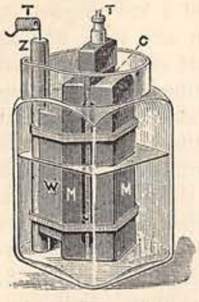


FIG. 3.

with electricity for consumption at night in electric lamps, or in other ways. They will also be useful for storing the current derived from fitful sources of power, such as windmills, tidal floods, mountain torrents, sunshine, and the induced currents of lightning-rods; for the day is not far distant when at least the gentler kinds of atmospheric current, hitherto kept at bay by the lightning-rod, will be actually brought into the home, to render good service there.

When accumulators are employed in houses, there will be little need of the ordinary voltaic battery to ring our bells; but these are at present so commonly used for this purpose, that we cannot omit a description of perhaps the most useful kind of all—namely, the Leclanché element. The most novel form of this is shown in Fig. 3. It consists of a glass vessel containing a solution of sal-ammoniac in water. A rod of zinc, Z, dips into the solution, and forms one pole of the battery, the other pole being formed by a plate of carbon, C. This is surrounded by two cakes of manganese peroxide, M M, mixed with powdered carbon, and the zinc is kept apart from these by a block of wood, W, inserted between them. The terminals, T T, form the poles of the battery from which the current is drawn off.

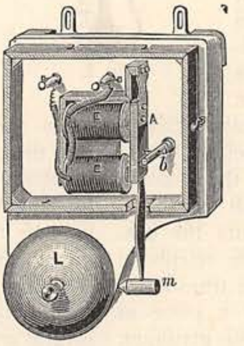


FIG. 4.

One or two of these cells will ring an electric bell of the pattern shown in Fig. 4, where E E are two electro-magnets, which, when traversed by the current, attract a soft iron armature, A, which knocks the hammer-head, *m*, against the bell, L, and causes it to sound. The forward movement of the armature, however, carries it out of contact with a screw pin, *b*, and as the current enters the electro-magnets by this contact, the interruption stops the current, and the electro-magnets, ceasing to be magnetic when the current in their coils is stopped, release the armature, which thereupon springs back into contact with the pin, *b*, again. This, however, has the effect of re-establishing the current in the coils, the armature is attracted forward as before, and the bell strikes another tone. This action goes on as long as the current from the battery is kept on the bell circuit, and the bell continues to ring with a trembling rhythm.

The press-button by which the battery circuit is closed and the bell rung is shown in Fig. 5, where A is the exterior and B the interior. The small knob, K, is pushed in by the finger, and, bearing upon the flat spring, S (B), brings it into communication with a metal contact

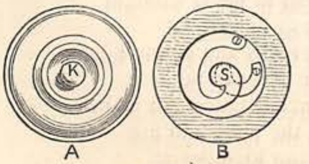


FIG. 5.

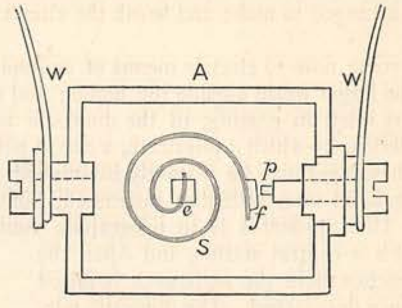


FIG. 6.

beneath, thereby closing the metallic circuit of the wires between the battery and bell. These press-buttons are of various design, and can be added to the handle of an ordinary drawing-room bell-pull as well as let into the wall. They can also be fixed between the edge of a door or window-frame, in such a manner that when the door or window is opened without the knowledge of the house, an alarm-bell will be rung; and thus they constitute an efficient burglar-alarm for safes and houses.

The use of the electric bell in telling fire is well shown by the thermostat of Mr. Edward Bright, C.E., which is sketched in Fig. 6. Here A is a very small box or case enclosing a coiled spring, S, made of two strips of different metals, say brass and iron, soldered back to back. The spring is fixed at one end, *e*, but free to move at the other end, *f*; and being composed of two metals which expand unequally for the same elevation of temperature, the spring curves outwards into contact with the metal pin, *p*, when there is an undue rise of temperature in the room where it is placed. The pin, *p*, and spring, S, are both connected in circuit with a battery and bell by the wires marked W W, and when the spring closes the circuit by coming into contact with the pin, the bell rings. Here, in fact, the heat of the room acts like the finger of a person pressing the button of an ordinary electric bell, and thereby closing the circuit. These little tell-tales can be fitted up in any part of a house, and either connected to an alarm-bell within the building or to the nearest fire brigade station, through the street fire-alarm system of the same inventor.

Frost tell-tales of a similar kind can be readily constructed by employing a thermostatic spring, or the mercury column of a thermometer, to complete the electric circuit by their shrinkage under cold. Flood and cistern levels may likewise be indicated by proper

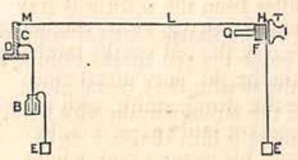


FIG. 7.

floats, arranged to make and break the circuit of such a bell.

We come now to electric means of communication with the larger world outside the home; and of these, we may refer, in passing, to the domestic telegraph of America, by which a physician, a cab, a policeman, or a messenger may be instantly summoned by shifting the hand on a little dial instrument hung on the wall. This apparatus is in telegraphic communication with a central station, and when the call reaches there the assistance required is at once despatched. The domestic telegraph is not yet introduced into this country, but will probably be so ere very long.

Meanwhile the telephone is among us, and doing excellent service in the hands of the United Telephone Company. The telephonic circuit is shown by Fig. 7, where M is a microphone transmitter connected by the telephone line, L, on the one hand, to the distant receiving instrument, T, and on the other hand, through the battery, D, to the ground by the earth-plate, E. The distant receiver, T, is also connected to the ground by an earth-plate, E, and thus the electric circuit is completed through the earth. Sometimes, however, a return wire, run close beside the outgoing wire, L, is substituted for the ground, especially if there are other telegraph wires in the neighbourhood, for this plan prevents the currents in these wires from disturbing the telephone message by an induced influence. The transmitter consists of a delicate contact between a piece of carbon, C, and another piece of carbon or platinum, M, these pieces being fixed on a support, D. The current from the battery traversing this sensitive joint is so modified by the sound of the voice acting on it, that when it passes through the telephone, T, at the distant place, it causes the latter to speak the same words there. The Bell telephone, as is now well known, consists essentially of a bar magnet, G, having a coil of wire, F, stuck on one pole, and in front of this pole a flat thin plate of iron, H, fitted with an ear-piece, I. The undulating currents set up by the voice in the transmitter traverse the coil, and modify the attractive power of the magnet on the iron plate in front, thereby throwing the latter into vibrations, which reach the ear in the form of speech. The actual appearance of the telephonic apparatus supplied by the United Telephone Company in this country is shown in Fig. 8, where T is the Bell telephone. It is combined in one board with the Blake transmitter, of which the mouth-piece is shown at M; and also with an electric call-bell, L, having its press-buttons shown at A A. The Blake transmitter is a microphone, in which the sensitive contact is formed of a button of hard carbon pressing on a tiny platinum head carried by an adjusting spring, which permits of delicate regulation. The agitation of the voice is communicated to the contact by means of a vibrating metal drum, or tympan, like that in the telephone receiver.

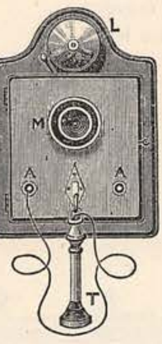


FIG. 8.

To speak by telephone, the first thing done is to ring the call-bell on the telephone board of the person of whom an audience is desired. When he responds by ringing the call-bell on the home board, he may be addressed by speaking into the microphone mouth-piece, and his reply can then be heard by listening in the ear-piece of the telephone, T. This is usually done now through the intervention of a central station, or exchange, where clerks are in readiness to cross-connect any two subscribers to the exchange, so that they can talk together in a private and confidential fashion.

Such are the leading uses of the electric current in our homes; but it is highly probable that there will be many other applications of this subtle servant.

THE SHOEING FORGE.

A STONE'S-THROW from the market town,
Close on the lane that wanders down
Between tall trees and hedgerows green,
The famous shoeing forge is seen;
Open it stands upon the road,
That day and night is overflowed
By ruddy light that leaps and falls
Along the rafters and the walls.

And often, halting on his way,
The idler from the town will stay
To hear the sharp, clear, ringing sound,
And watch the red sparks raining round,
And the bright, fiery metal glow,
While the strong smith, with blow on blow,
Hammers it into shape, a sight
To rouse his wonder and delight.

Now in the smouldering fire once more
The bar is thrust; the bellows roar,
And fan the flame to fiercer light,
Until the metal waxes white;
Then on the anvil placed again,
Ding-dong, the strokes descend amain;
Strong is the arm, the vision true,
Of him who shapes the iron shoe.

For thee, O Reader, is the thought
That great success in life is wrought
Not by the idler as he stands
With wondering looks and empty hands,
But by the toiler who can take
Each adverse circumstance and make
It bend beneath the force and fire
Of firm resolve and high desire.

J. R. EASTWOOD.