AN IMPROVED METHOD OF CABLE WORKING.

By J. EBEL.

WHEN the length of time that has elapsed since the discovery that telegraphy was possible over long ocean cables is taken into consideration, one is forced to the conclusion that very little advance has been made in the systems of practically working such cables.

It is very probable, however, that many electricians have arrived at some method of improved working which, for some reason or other, they have not made known; and in reflecting on the small progress that has been made in this particular branch of electrical science, regard should be had to the fact that it is very

FIG. 1.

difficult for students and inventors to obtain access to the cables themselves, to test theories by experiments. It is very likely, in a great measure, due to the want of such facilities that some improved systems of working have not long ago been devised.

The accompanying diagrams illustrate the result of my own investigations.

For working the duplex system, where the bridge wire (sometimes called the fork) can be dispensed with, I maintain that the employment of a receiving instrument, with differentially wound coils, is preferable to the ordinary instrument.

In Fig. 1, a condenser is connected up, having three plates, or an equivalent thereto, two condensers with one plate of each joined. In this case, the middle plate is charged by the sending current, and the opposed, *a*, *b*, discharge themselves each through half of the coil of the receiving instruments, which are so

FIG. 2.

wound that when no current is received from the distant end of the circuit, their effects neutralize each other.

In the event of any inequality in the rate of absorption of the condenser plates, *a*, *b*, means are provided for inserting resistance in one or the other half of the instrument coils, or by rendering the influence of the coil on the needle or magnet by moving the coils to or from the needle.

For working greater length of cables, where the rate of speed depends on a well established balance, the plan indicated in diagram, Fig. 2, is employed.

In this arrangement, one additional subdivided condenser is inserted between the coils of the receiving instrument, *a'*, *b'*.

The capacity of the first condenser in regard to its plates, *a*, *b*, is as nearly as possible balanced. In the event of any difference in the absorption of the plates, a special form of adjustable induction resistance is em-

FIG. 3.

ployed, which is so constructed that, by means of a screw, I, turning to one or the other side, the difference in the unequal absorption of the upper and lower condenser plates can be adjusted to a nicety.

Diagram in Fig. 3 represents an improved system of working cables by simplex.

The receiving instrument is also supplied with a differentially wound coil or two separate coils.

The condenser is not, as hitherto, placed before or after the receiving instrument, but inserted between its coils, so that one plate is discharged through one part of the coil to earth and the other through the opposite part to cable; thus both discharges passing through the instrument will deflect the needle or coil in the same direction. By this means I purpose to utilize the induction between the coils in assisting the discharge, and so to neutralize the extra current developed in the said coil.

A higher rate of speed is obtained by this system.—*Electrical Review*.

DOMESTIC ELECTRICITY.

THE electric alarm shown in Fig. 1 is called by Mr. H. Levy, its manufacturer, a "chronophone." It consists of a mahogany box having the form, externally, of a watch stand. Inside of this there is an electric bell and two small Leclanche couples, the exciting liquid of which is mixed with sand, so that if upset no accident shall occur. The upper part of the stand is provided with a hook for supporting a watch, the crystal of which, having a small aperture in the center, supports a metallic rod. The object of this latter is to establish an electric contact every time the hour hand reaches it. It is capable of being brought over the desired figure on the dial by revolving the crystal, to which it is fixed by a rivet, and which insulates it. A small, flexible steel arm is connected with the rivet, and in this way establishes a permanent contact between the pile and metallic rod. On another hand, the hook from which the watch is suspended establishes the second communication. It will be seen from this that every time the hour hand of the watch touches the rod fixed beneath the crystal, a communication is at once set up, and the bell rings. A small commutator on top of the stand permits of changing the course of the current and of actuating the bell within, or another one located at any distance whatever in the house, and connected with the chronophone simply by two wires that start from terminals near the commutator.

The apparatus is rendered complete by two small electric buttons designed for directly actuating either the bell in the watch stand or one at a distance.

This ingenious application of electricity is well conceived. The apparatus serves at once as an alarm and a watch stand. It can be used as a bell to call a servant, or for awakening either master or domestic at any hour of the morning for which it has been set on retiring at night, and it can be used for ringing in any part of the house without the necessity of having another pile.

The second apparatus (Fig. 2) that we shall call attention to is an electric lighter constructed by Mr. Delforge. This does not differ in principle from others that we have described, but it is beautifully made, and has the merit of being portable. It consists of a small varnished, black, wooden box which may be carried by

FIG. 1.—ELECTRIC ALARM WATCH.

means of a handle or be fixed to a wall by means of hooks, and which contains two Leclanche couples. A commutator button on top permits of closing the circuit, and of bringing to incandescence a spiral of fine platinum wire which lights the wick of a small naphtha lamp beneath it. When the platinum spiral is destroyed, it may be easily replaced from a supply kept in the box.—*La Nature*.

THE PLUMBER AS A SANITARIAN.

By WILLIAM HALLEY, Columbus, O.

SINCE self-preservation is an instinctive law of human nature, the observance of sanitary regulations should be the cardinal rule of conduct. In theory this is admitted, but in practice the rule is more conspicuous for its neglect than for its observance. Every one concedes the fact that health interests are paramount to all others, yet they are the last to receive attention. In this wonderful age of material development and scientific advance, all art and philosophy, it would seem, have reached the acme of perfection; yet the science of healthy homes and healthy living has only begun to receive the attention of intellectual people.

At last it is understood that prevention is better than cure, safer and cheaper; that a knowledge of physiology and hygiene is more important than a knowledge of materia medica; that it is better to observe health laws than to submit to the laws of disease; that many diseases are avoidable.

In ancient times, the ravages of epidemic diseases were thought to be the work of the gods. In the days of the Esculapian temples, the office of physician was linked to that of the priest. Both the body and soul of man were held in bondage at the caprice of the gods. Traditional influences still cling to the credulity and practice of modern times. Many people still think that some inscrutable fate stands in a causative relation to the duration of human life. Thus God, instead of unsanitary environments, is held responsible for the terrible devastations of disease and death. "The faith cure" is consistent with this view as to the origin and progress of disease.

There are laws governing both health and disease. When the masses learn that a mysterious fatality is not responsible for the spread of disease and the decimation of cities; that God should be acquitted on the charge of spreading pestilence and death among the people; that there is much of disease due to unsani-

tary environment and living, then will they take counsel at the shrine of sanitary science.

The medical profession in giving special attention to sanitation has awakened public interest, and accomplished much in stimulating the effort of artisans to an effort for the production of healthy homes. Builders, contractors, architects, engineers, and plumbers are uniting with sanitarians, working shoulder to shoulder with physicians and health boards.

It is with pleasure that I take this opportunity to represent the master plumbers of Columbus in this sanitary organization. A good index to the thoroughness and efficiency of this society is witnessed in the co-operation of various trades and professions in solving the great problem of how to live comfortably and wisely. Every man, of whatever craft, who contributes to the character of buildings and dwellings should be a practical sanitarian.

The construction of a sewer, a vault, or a cellar, as well as the general features of heating, ventilating, and plumbing, involve sanitary questions upon whose solution hinge the health and comfort of the householder. The sewer builder and drain builder who effect a pure sub-soil and a dry cellar, have larger opportunities in carrying out the principles of preventive medicine than the physician who is called too late to a case of croup—the result of damp walls. The architect who sanctions unhealthy habitations in default of proper specifications, and thereby fails to provide for efficient ventilation, heating, and plumbing, is just as guilty of crime against humanity as if he neglected the more palpable cause of destroying life when a faultily constructed tenement house crashes to earth—the result of conniving, with criminal avarice, in the use of bad material. And thus, the engineer, builder, and plumber are responsible, to a high degree, for the health and happiness of homes wherever they ply their arts.

Of the various craftsmen who assist in constructing dwellings there is not one, perhaps, whose position in the light of sanitary science is more important and responsible than that of the plumber.

In days gone by, the plumber was considered a mere worker in lead to supply the simple wants of his employer, as ignorant as himself of the physical laws of his occupation. But now his work assumes the dignity of a sanitarian.

Plumbing has special relation to house sanitation,

FIG. 2.—ELECTRIC LIGHTER.

and should be placed fairly upon its merits. Dr. Derby says: "The well are made sick, and the sick are made worse, for the simple lack of God's pure air and water." The plumber is almost wholly responsible for the supply of these two essential elements, in their native purity, wherever he is employed. Yet it is a fact that there are few avocations in which skillful work is so little appreciated as that of plumbing. People are not interested in the work because it has no reference to ornamentation, and is almost wholly out of sight.

When they appreciate the worth of good plumbing and the baneful effect of that which is bad, they will exercise the same care in the employment of a plumber that is bestowed upon the selection of a lawyer or physician. When they learn how unventilated traps and untrapped waste pipes may become the means of communicating disease, then will the dignity and worth of sanitary plumbing assert itself. Every trap, every pipe, and every closet adjusted gives complexion to house sanitation.

The sanitary plumber is a veritable practitioner of preventive medicine. His work involves the skill of an artist and the technical knowledge of a scientist. Natural laws and physical forces must be mastered at every step. Questions in pneumatics, hydrostatics, chemistry, and hygiene must receive intelligent solution and application. The importance of house drainage, as well as its complications and difficulties, increases *pari passu* with the growth of cities and the tendency to metropolitan life. The conditions of healthy living are compromised proportionately with the increase in population.

A city without a perfect system of sewerage—of which house drainage is a unit—would be in as great danger as though it were destitute of a fire department or a police department. A city must be in a sorry plight indeed without sewerage. Think of the vast amount of refuse matter! There is a ton of excreta daily for every thousand inhabitants, and a like proportion for domestic animals. Besides, there are the refuse products of kitchen and stable, and other organic and putrescible matters to be removed by sanitary art or left *in situ* to saturate the soil, contaminate the atmosphere, and poison neighboring wells.

Although a system of sewerage affords a remedy, it must be applied intelligently and skillfully, or the result will be an elongated cesspool and worthless trappings in every house to serve as ventilators, and thus permit sewer gas to escape into living apartments. Much depends upon the plumbing. If it is

perfect, the house is healthy; if imperfect, an unhealthy home is the result. It is easy to be seen that plumbing is the most important feature of a house, to which may be added all the convenience, beauty, and polish of a palace.

But first of all, stamp it with the character of health by sanitary plumbing. Even with the best devices, it is almost impossible to prevent sewer gas at times. Unused fixtures will, in time, permit the water-seal in traps to evaporate. A string or shred of cloth in a trap may act as a siphon. Fixtures are liable to get out of repair. A reckless carpenter may drive a nail into the soil pipe. Rats sometimes gnaw into lead pipes. Traps may become obstructed by the carelessness of servants. There are many accidents by which plumbing work will become crippled and allow gas to escape. Hence it is advisable to exercise extreme care about the location and quantity of plumbing work.

The proper ventilation of pipes and traps is the most essential feature of plumbing. Without ventilation, traps will be siphoned by the suction caused by a flow of water from fixtures above; again, the same downward flow is likely to force the water-seal by increasing the air pressure. Without this ventilation all plumbing is extremely dangerous. It should be remembered that the foulest portion of a sewerage system is that located on private grounds and in dwellings. Any circumstance that favors the ascent of gas and its diffusion through the house should be carefully guarded. However secure the trap in the house-drain may be made, its water-seal is liable to be broken by any event working to compress the sewer air. Wind blowing into the mouth of a sewer may cause sufficient pressure to drive sewer-gas bubbling up through the trap water. A rush of storm water may so lessen the air space in the sewer, and so compress the contained air, as to force the trap. Barring these accidents, the fact that water will transmit aeriform matter, and thus take up sewer-gas and transmit it to the house side of the trap, is to be considered.

If it is desired that living apartments should not ventilate a sewer, these evils must be remedied. I repeat, therefore, that ventilation of plumbing work is the watchword of house sanitation. It is not within the domain of this paper to detail the essential requirements of plumbing; but it is desired to generalize upon a few of the more important principles of house drainage.

All soil-pipe should be continued without change of diameter a few feet above the roof, and, below, deliver into ventilated traps outside the house, so that gas forced back from the sewer need not even depend upon the ventilators at the top, and need not enter the house at all. But this is not sufficient. The waste pipes and traps at various points along the main pipe must likewise be ventilated by separate ventilating pipes taken off close to the sewer side of all traps and joined into a system, if need be, and conducted separately above the roof or conjoined to the soil-pipe *above* the highest fixture. With such a system of ventilation, traps can neither be forced nor siphoned by discharge of water from fixtures. All gas accumulating within drain-pipes is carried off above the house. It is to be remembered, then, that a trap, as the only seal in a house-drain, cannot be depended upon alone to keep foul gas out of the house. It is of imperative importance that there should be a free vent for all gases within the drain-pipe, soil-pipe, or waste-pipes—not into the house, or under its eaves, or near its windows, but above the highest point of the roof. This essential point is attained only by an independent system of free ventilation of all plumbing work. This imposes more material, more work, and more expense. But good plumbing is worth all it costs, while cheap plumbing is, in the long run, extravagant, expensive, and dangerous. This last paves the way to frequent repairs, petty annoyances, foul odors, sickness, doctors' bills, impoverishment, and short life. Sanitary plumbing reduces such evils to a minimum, and is the ounce of prevention where a ton of trouble is pending.

The popular indifference about the nature of plumbing work has caused the plumber to chafe under the abuses imposed. He is considered a dirty laborer, who is supposed to follow the imperious dictates of the architect, owner, and builder in accordance with specifications. A first-class architect will make none other than sanitary specifications for plumbing. Unfortunately for the plumber and for sanitary effect, the architect is too apt to ignore plumbing, giving undue attention to other matters which serve better to display his æsthetic conception. House drainage is made subordinate and subservient to convenience and display. At the last moment it is remembered that the house must be drained, and plumbing specifications are made to fill in the cubby-holes. The contractor is interested in the plumbing only to the point of subcontracting to the lowest bidder after subjecting the plans to cut-rate competition. The plumber is handicapped at every turn. The architect ignores his wants as a sanitary artist; the contractor does not know the value of trapping all fixtures and ventilating all pipes, and so the lowest bidder omits these essential features. The plumber has nothing to do with the specifications, and is not permitted to give his work proper sanitary direction. Being subjected to the thumbscrew of ruinous competition, he must either make a bargain with the devil to put in poor material and scamp work, or allow some conscienceless "scab" to underbid him. Would you know why it is that there is so much poor plumbing done, then consider how plumbers are hampered, instead of being assisted, by all the conditions promotive of sanitary work.

It affords me pleasure to do honor to the Columbus architects in exempting them from the complaints generally urged against their profession. For the most part, our architects are sanitary artists. They consult with the plumber as to the best means and methods of plumbing, and thus produce the most happy effect for the owner and for the public health.

Notwithstanding this green spot in the architectural field, the relation of plumber and architect throughout the country is unsatisfactory and fruitful in evil results.

Mr. James Allison, of Cincinnati, President of the National Association of Master Plumbers, in an address before that society, says upon this point: "An architect is not necessarily a plumber, and is seldom, if ever, practically familiar with the laws of sanitary science, and still less with plumbers' devices, methods, or materials. Yet the plans and specifications of a building

are prepared by the architect without consultation with the plumber, who is expected to do the work, and who alone is held responsible for its efficiency, not only by the owner, but also by the public. Let us not be misunderstood here. With the architectural beauty of a building or of the building materials of which it may be composed, the plumber has nothing to do; but with its water and air supplies, its sinks, closets, piping, drainage, and sewerage, he should have everything. It has been customary for the architect to plan a house, arranging the sinks, closets, piping, etc., according to his fancy, without reference to its sanitary correctness, economy, or expediency. The specifications for plumbers' materials refer, for the most part, to their appearance rather than quality, and the expense of a device according to specifications may be made to vary one thousand per cent.

"Some builder will take the whole contract to be executed under the supervision of the architect, according to plans and specifications. The builder sub-lets the plumbing, not to the best, but to the lowest bidder, who, in order to save himself, puts his whole mind on the arts of substitution and how not to do things and still keep within the letter of the specifications. The chief sufferer is, of course, the confiding owner, who, perhaps, finds his costly and magnificent dwelling little better than a 'whited sepulcher.' He spends the rest of his life in repairs and alterations, and is fortunate indeed if he is able to save his family from avoidable sickness and his fortune from the doctors."

What the plumbers want, what the interests of sanitary science demand, is reform in the matter of the design and execution of plumbing work. Popular education is one means, legislative enactment is another. Either public sentiment or legislation must force unsanitary plumbing out of existence, else the people must continue to suffer the dire result.

If one-half be true of what is alleged of *bacteria* and the capacity of sewer-gas for their propagation and the spread of disease by them, then plumbing—*sanitary* plumbing—is the most powerful prophylactic agent known, and the plumber one of the most cogent factors of practical sanitation.

Then, in the name of sanitary science, in the name of philanthropy, in the name of disease-stricken homes, I ask this Association to put forth its best endeavors in the promotion of house-drainage, and to secure for its humble representative, the plumber, a recognition—not for his own sake, but for the sake of humanity—among architects, sanitarians, and health boards, and protect the mandates of his practical wisdom by popular education and legislation.—*The Sanitarian*.

CREMATION OF GARBAGE.*

By JOHN ZELLWEGER, C.E.

GARBAGE comprises household and market refuse, and consists of organic and inorganic matter in varying proportions according to the season. The organic matter is of vegetable or animal origin, and the in-

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organic consists principally of ashes and water. Under the influence of the atmosphere, of moisture, and of heat, garbage is subject to decay, and then becomes a source of danger to our health; its prompt disposal is therefore an important factor in the care for public health.

Garbage is disposed of either by simple removal by teams and cars to points outside of cities and towns, and there used as manure or as filling and left to itself, or it is collected at stations within the cities and there destroyed by heat as fast as it accumulates, and the ashes used as filling for streets, etc.

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The destruction of the organic portion of garbage is based upon the decomposing effect of heat on the combination of elements contained therein, and upon the affinity of some of these elements for oxygen. The process of destruction is effected in an apparatus designed to expose the charge and the gases emanating therefrom to a high heat and to the contact of hot air. The heat required for this purpose is produced by com-

bustion of garbage with or without additional fuel. For the sake of economy, it is desirable that the process of destruction be self-sustaining—that is, that the heat required be produced by the combustion of the carbon and hydrogen in the organic compounds and in the coke in the ashes.

The problem of destroying garbage by heat, therefore, involves the construction and operation of a furnace that will completely and economically burn great quantities of a fuel containing a large percentage of ashes and water. The capacity of a garbage furnace and the economy of its operation are greatly dependent upon the quantity of an organic admixture to the fuel, and it is therefore indicated either to collect the organic

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matter as much as possible free from ashes and non-fuel, or to separate it from them by means of screens before charging into the furnace. Water and other liquids should be drained out of the garbage intended for cremation, and can be conveyed under the grate of the furnace, there vaporized, and passed through the incandescent fuel for decomposition. Garbage cannot be completely destroyed by direct charging and burning on an ordinary grate without an excessive use of additional fuel; it requires a systematic treatment and a furnace adapted to the same. The cremation of garbage consists of several distinct processes, which may be classified as follows:

1. The drying of the fresh charge.
2. The destructive distillation of the dry matter.
3. The burning of the remaining charcoal and coke.
4. The decomposition and oxidation of the organic vapors and gases produced in drying and charring the garbage.

These several processes must be carried on separately and in different parts of the furnace, so that the consumption of heat does not interfere with its production. It is essential for the successful cremation of garbage that the full calorific power of the fuel be developed, and all the available heat be transferred to the fire gases before these are allowed to mingle with the aqueous vapors and organic gases rising from the fresh charges in the furnace. The heat produced by the combustion of charcoal, coke, and the gases expelled by destructive distillation is then brought to act upon the gases mingled with and protected by steam, to decompose them and to cause their oxidation in the accompanying air.

The accompanying drawings represent a battery of two garbage furnaces, each of 7 tons capacity for 24 hours. The garbage is to be hauled on top of the furnaces by wagon and deposited in an iron bin, where it can drain itself of water; from this bin it slides by gravity on to a solid inclined plane in the furnace, and is here exposed to radiant heat from a hot brick arch

above it, and to the contact of hot fire gases passing over it. When by the action of heat and ventilation the material has become dry, it is pushed down the inclined plane and replaced by a fresh charge. The garbage, on descending the inclined plane, is exposed to higher degrees of heat, and undergoes destructive distillation; the charcoal formed is pushed on to the step grate at the foot of the inclined plane, where it commences to burn, and is finally consumed on the level grate in the bottom of the furnace chamber.

*Read before the Western Society of Engineers, February 2, 1886.