situated between two old positions of the alternating coil. If the alternating coil be placed at a point where a node was found in some other position of the alternating coil, the system of nodes and internodes generally completely disappears, and now on moving the telephone coil round the ring the intensity uniformly diminishes until the diameter is reached, and then increases round the other half of the ring. This gives the phenomenon a distinctly resonant character. The induced current as observed by a galvanometer is always of the latter character—that is to say, a uniform fall, and then a rise on going round the ring.

As a rule the permanent magnetism of these large rings is irregular, and apparently apt to change frequently. A determination of the permanent magnetism was easily made by means of one of the coils connected with a ballistic galvanometer. By moving this through a given amount at a time, say an inch, and noting the throw of the needle, one was able to plot out a representation of the state of the permanent magnetism. In this way, places where no throw occurs were found, while to either side of such a point the throw changed sign. It was sometimes found that there was a decided tendency for the position of no throw to occur between two telephone nodes, the throw changing sign on either side of these points. But further experiments showed that this arrangement of the permanent magnetism was probably accidental, and due to the very currents employed in making the telephone observations. For when only very feeble currents had been used on a ring, these consequent poles were absent.

It is possible, as one would expect, to artificially make a minimum intensity position, at any point on a ring, by winding on a few turns of thick copper wire. But the fact that the phases on either side of such a point (found as before by means of two coils in circuit with a telephone) are the same precludes the idea that the nodes can be due to Foucault currents.

Obviously, however, the phenomenon depends on some permanent peculiarity round the ring which happens to occur fairly regularly. What this peculiarity is, or how it is brought about, I have not yet been able to discover.—*Fred. T. Trouton, in Nature.*

HOW TO INVENT THE SUCCESSFUL COMPETING TELEPHONE.

By EDWARD P. THOMPSON.

A POINT of valuable knowledge, among other matters, with which the would-be inventor of the successful competing telephone should be equipped is the gist of each class of telephone which has been invented thus far. It is almost safe to say that the successful competing transmitter will consist of some slight improvement over some existing improvement or original invention. The most powerful example which presents itself is the very transmitter which suggests the present problem. Although the result is far inferior, the Reis transmitter of musical sounds is exactly like the Berliner transmitter, except to those who know the gist of both. In each case two terminals of an electric circuit are normally in contact. However, when the device is in operation, the contacts separate in the one, and remain together in the other with variable pressure. It is found that all the telephones at present known are divisible into a comparatively few classes, and that a short sentence will give the pith of each. They are treated, not in any chronological order, but in the order in which they naturally appear in the mind. Even if read, not for the purpose of assisting in inventing, the classified knowledge may be useful in other ways.

The State of the Art.—In one or more transmitters at present known, electrical undulations, corresponding to air vibrations, are produced by causing the mechanical energy of the condensations and rarefactions of the air.

To vibrate a diaphragm of iron before the poles of a magnet.

To vibrate the diaphragm of iron before the poles of a magnet in which the core is partly or wholly of steel.

To vibrate a steel diaphragm before the poles of a magnet with or without a core.

To vibrate a magnet before the poles of a second magnet.

To vibrate an iron sheet between the poles of a magnet.

To vary the temperature of a heated conductor of very small diameter, such as a platinum wire, the condensations and rarefactions of the air causing the alternate heating and cooling of the conductor (comparatively), whereby its resistance is similarly varied.

To vary the temperature upon the face of a thermopile, the condensations and rarefactions of the air causing an alternate heating and cooling of the thermopile, whereby electrical undulations are produced (theoretical).

To vary the length of a continual spark between the two electrodes, the electromotive force of the current being sufficient to maintain the spark (theoretical).

To vary the linear resistance of a ligature, such as a carbon filament, the air vibrations causing a conducting liquid to rise and fall alternately along a part of the length of the wire.

Same as above, the air vibrations causing a second conductor to intermittently touch or short-circuit variable portions of the first conductor.

To vary the amount of light falling upon a conductor, such as selenium, which is sensitive to light in such a manner that for variable light its resistance varies.

Same, except that a substance sensitive to heat rays is employed.

To vibrate a card board, supporting iron filings, before the poles of a magnet.

To circularly vibrate the armature of a minute dynamo before the poles of the field magnet.

To vary the pressure existing between the two carbon or metallic or conducting liquid electrodes normally and abnormally in contact with each other.

Same, the number of the electrodes of one or both polarities being increased.

Same, one of the electrodes, when metallic or carbon, being pulverized.

Same, in which one of the electrodes is a valve, loosely located upon the end of a tube which is the other electrode.

To vary the pressure upon the plates of a voltaic pile,

an alternate increase and decrease of distance between the plates causing variable amounts of current generated.

To vary the shape of a globule of mercury balanced in a conducting liquid, the vibrations of the better conductor, mercury, varying the resistance of the circuit.

To vary the static charge of condenser plates, whereby the electric current of the line becomes varied as to its electromotive force.

Conditions of the Problem.—It is needless to mention that these are very severe. The transmitter must possess novelty over all those at present known, and further, it must be equal and if possible superior to the carbon transmitter. It should be applicable to long lines, and in such a manner that the receiver will give forth the words clearly and loud enough to be heard intelligently. It should serve the test of transmitting the ticks of a watch and whispering, when two or three feet away from itself, not simply over a small distance, but for a mile or so. For a short distance it should transmit the sound of heavy breathing. It is assumed that a good Bell receiver is used, such as that on which the patent expires in March, 1893. One of the difficulties, in order to be as profitable commercially as the carbon transmitter, is the cost of construction. The latter consists substantially of two pieces of compressed carbon powder, a diaphragm of tin-type metal, and the frame, the carbons being supported in a relatively yielding position, and means of adjustment being provided. It is one of the cheapest electrical devices manufacturable.—*Electrical Engineer.*

THE ELECTRIC STAIR CLIMBER.

ELECTRICITY in all its forms is entering further and further into the uses of centers of human population. Rapid telegraphy, telephony, and electrical machines, with their various applications to lighting, metallurgy and to the mechanical transmission of power in manufacturing, have for the last fifteen years shown incessant progress.

In addition to the important applications of industrial order, there are others of a more modest character which respond none the less to our daily needs, and render a host of minor services, the necessity of which

ELECTRIC STAIR CLIMBER.

is appreciated better and better from day to day. In this category we must mention the interesting electric stair climbers which Mr. J. A. Amiot, the engineer, exhibited this year at the Exposition of Labor at the Palace of Industry, and which obtained a deserved success.

It is a question, in short, of a practical utilization of electric energy realized under remarkable conditions of simplicity and safety.

Every one to-day, be he landlord or tenant, is agreed as to the utility and sometimes even, in our large modern houses with interminable stories, as to the necessity of the elevator. Owing to it the upper apartments are pleasanter to live in than the others, since the air therein is purer and more salubrious, and the dust and noise from the street reach them with difficulty. But the necessities of the installation render the use of the elevator difficult and often impossible. The car that it necessitates is spacious, and the room that it requires is but rarely met with in houses constructed in times gone by; so it is, therefore, necessary to install it in the court yard, which carriages often thereafter can no longer enter. The rod of mechanical elevators is lengthy and necessitates the sinking of a very deep well, which the nature of the subsoil does not always permit of establishing without very great difficulty.

In addition to the cost of installation, which is generally high, it is necessary to count every year upon a large outlay for the running of the apparatus, and which is sometimes such that certain house owners, after paying the cost of establishing an elevator in their dwelling, have left it idle in order to avoid the expenses of operating it and keeping it in order.

Let us add that the hydraulic elevator, save in the case of certain important improvements introduced by special manufacturers, is dependent upon the distribution of the water in the house and upon the quarter in which the latter is situated. Some grave accidents have resulted from it, and it is not judging this ingenious apparatus unjustly to say that it is often regarded with justifiable distrust by the public. A person, even though he be a mechanic, hesitates to be inclosed in a car at the bottom of the house, and the button pushed, to confide in the good organization of an apparatus inspected and verified from time to time. This is not pusillanimity, for it is certain that it would be impossible to jump out of the elevator that is carrying you, or to arrest it easily should some accident occur to its

motive power. There are elevator accidents, just as there are railway accidents. They are relatively rare, but always grave.

Mr. Amiot has proposed to remedy the general inconveniences that we have just pointed out by having recourse to electricity as a motive power without having to take either stairs or the width of the car into consideration. The idea of utilizing electric energy for the operation of ordinary elevators instead of employing hydraulic power is not new. There was an elevator of this kind shown at the Exposition of Electricity of 1881, and since then some analogous types have been devised; but that is not the question here, and the inventor has not proposed to adapt electric energy to the operation of a familiar apparatus. That would have been to meet again with the majority of the inconveniences that we have mentioned. It is the arrangement itself that he has attacked, and this is how: The electric stair climber consists, essentially, of a car rolling upon two superposed rails and carrying a box, and of an electric windlass which actuates the car through a steel cable guided by rollers.

This brief description, which the accompanying engraving will make better understood, shows the simplicity of the arrangement adopted.

The security is complete, owing to the enveloping form of the box, which dispels all apprehension by always presenting to the person who is rising or descending an invariable point of support. Moreover, an eccentric brake stops the apparatus at the top of a step—that is to say, at a height of about nine inches—in case the cable (which is calculated to resist a traction of 13,000 pounds) chances to break. Experiments made at the Exposition of Labor in simulating an accident of this kind constantly succeeded.

The stair climber has the advantage of occupying, in width, only about twelve inches of the steps of the staircase, a little less than is taken up by a person going up or down—that is to say, in the part necessarily unused for travel. It is, as may be seen, adaptable to all existing staircases without requiring any essential modification or any masonry work. The two rails are simply fixed by bolts to the banisters, which are consolidated thereby.

As for the electric current brought into play, that is feeble, and the conductors that convey it being out of reach of the hand, no shock is possible. The current is obtained by simply connecting the motive apparatus with the street distributing wires. In the exceptional cases in which there is no such line of wires, a gas, petroleum or compressed air motor, or batteries or accumulators, may be installed. The electric installation lends itself naturally to the lighting of every house and staircase independently of the hoisting of visitors.

Let us add that the maneuvering of the electric stair climber is of extreme simplicity. The person who makes use of the apparatus operates it himself, through the shifting of a lever, which he has under his hand, and around which are marked the words, "Up," "Stop," "Down." Buttons upstairs and down permit of calling the apparatus at any point of the staircase where it chances to be, and a peculiar safety device prevents any false maneuvering. Finally, the apparatus stops automatically at the end of its travel, so that no forgetfulness or negligence on the part of the person who is using it is to be feared.

Upon the whole, Mr. Amiot appears to us to have obtained in the stair climber that he has constructed a practical apparatus, which is utilizable on any staircase whatever without much expense and which causes no disturbance in the use of the stairway itself, for it makes no noise and occupies an extremely small space. It affords valuable advantages to the tenants as regards the facility of occupying top stories, and also to the landlord, who will be able to let such apartments more easily.

This apparatus deserves to be classed in the highest rank among the applications of electricity to the house that we alluded to in the beginning of this article, and which are daily continuing to develop in a series of uninterrupted progress.—*Le Génie Civil.*

NEW YORK AS IT MAY BE IN THE YEAR 2000.

PARODIES and imitations of Mr. Bellamy's dream of the good time coming have been numerous; and yet the public doesn't seem to tire of them. Our forbears, not so long ago, in the ages of faith, spent much of their time in looking back at the past. In both cases the Golden Age is the object of vision, but its location has been changed. To-day it is dimly seen through the mist of the future; in the good old days, which, alas! were not so good, it was buried in the mystery of the past.

Well, then, dreams of this misty Golden Age being so pleasant, may we not in the opening weeks of the new year indulge in one about the city of New York in say the year 2000 A. D.? We may, and we will. But how shall we transport ourselves to that period? Some of the Bellamyiteists—pardon the barbarous but descriptive word—manage it by getting the hero knocked on the head by something. When hereovers conscious he finds himself in an earthly paradise not yet due for several hundred years, or else on one of the planets, whose inhabitants have been vastly more progressive than the stupid Tellurians. But when we recall the fact that Mark Twain's Connecticut Yankee was sent back to the time of King Arthur through a blow on the head, we hesitate. We don't want to risk fetching up in the days of some of those old dead and gone bad men, who would just as soon as not clap us into a donjon keep for an indefinite period, or even put us to death. It is altogether more pleasant to meet them in our histories.

What spell shall we use to project ourselves forward to the year 2000? Tutelary genius of Gotham, shade of old Father Knickerbocker, and spirit of Modern Progress, be with us! Presto! the present grows dim, the dear, old, dirty, and shabby New York we know so well through every one of our five senses fades away, and Manhattan, the proud and happy Metropolis of the World, stands before us.

The city we see is not so much a city as a blending of city and country. The people have learned what their forefathers did not know, that bricks and mortar, or even people, do not make a metropolis. There are no longer any of those human hives called tenements—