ELECTRO-THERMIC TELEPHONE.

To the Editor of the Scientific American:

Some of the recent European scientific papers contain an abstract of a paper read by Mr. W. H. Preece before the Royal Society, in which he describes a telephone receiver, whose action is due to the linear expansion of a thin wire under tension when placed in a microphonic circuit. According to his own statement the instrument is inefficient, as it fails to articulate distinctly, and requires a very strong current, which would soon destroy any microphone or telephone transmitter.

This experiment is exceedingly interesting and is undoubtedly new to Mr. Preece, but, as many of my friends can testify, I tried the same experiment long since, and as it seemed to give promise of being a good telephone receiver, I followed the idea with great avidity, until I found, after a great deal of experiment with wires of different metals and of different lengths and thicknesses, that only tones with their modulations could be produced; articulation being almost entirely wanting.

Among the metals tried were iron, steel, copper, aluminum, magnesium, and platinum. The only alloys tried were brass and German silver. I also tried very thin pencils of carbon.

The apparatus by means of which these experiments were carried on was so similar to that of Mr. Preece that I send a sketch of it herewith. The head of an ordinary telephone case, containing a thin iron diaphragm, 2¼ inches in diameter, was secured to one end of a board about three feet in length. Near the opposite end was placed a post supporting a hook, to which was attached one end of the wire to be subjected to electro-thermic influence, the other end of the wire being attached to the center of the diaphragm.

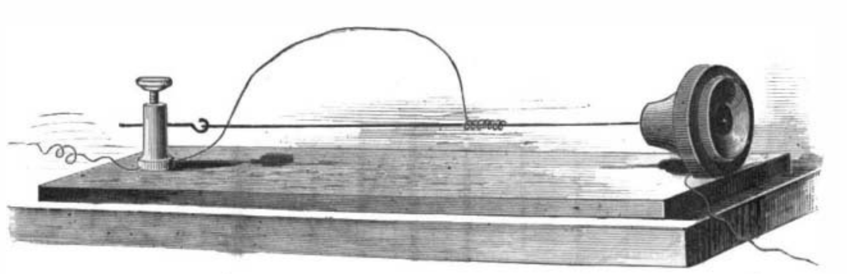
The diaphragm and the post were placed in a microphonic circuit, and a long copper wire attached to the base of the post was wound several times around the expansion wire, so that it could be moved along to expose more or less of the expansion wire to the action of the current, thus virtually altering the length of the wire.

Currents of various strengths were employed during the course of the experiments; but with all the modifications of the apparatus, or of the current applied to it, I was utterly unable to get anything like the distinct and perfect articulation secured by either the Bell or Edison receiver when used in connection with a good transmitter. However, I soon found a practical application of the electro-thermic principle, in a telegraphic relay, and adapted mechanism to the expansion wire which would faithfully render the impulses of a line in a local circuit, notwithstanding the variable expansion of the wire under different strengths of current.

Although the electro-thermic telephone receiver was practically a failure, I do not regret the course of experiment, as it has resulted in the development of an invention of practical utility, but widely different from that which was originally sought for.

GEORGE M. HOPKINS.

New York, June 28, 1880.



ELECTRO-THERMIC TELEPHONE.

American Wood Engraving.

In a review of the volume of proof impressions of wood cuts from *Scribner's Monthly* and *St. Nicholas*, Mr. Philip Gilbert Hamerton, the distinguished English art critic, says that "modern wood engraving, imitating the qualities of many different kinds of art, has never been carried so far in Europe as it is now in America. A more versatile process it would be impossible to imagine. The only objection that strikes us is the painful sense of the toil involved when we know how the work is done; but this toil may be pleasurable to the engravers themselves when they have reached such a high degree of skill."

Apple Jelly.

Much inquiry has been made of late years for the best way to utilize the surplus crops of apples in abundant years. As the promise is strong for a heavy crop in 1880, it will be well for owners to prepare for the best modes of marketing. In addition to selecting and shipping fine specimens, drying, and converting into vinegar will be largely employed. Another mode, less known, and less extensively adopted, is manufacturing the fresh juice into jelly.

One of the most successful manufacturers of apple jelly, and who succeeds in making uniformly an excellent product, is Isaac Mekeel, of Poplar Ridge, Cayuga county, N. Y. By several years' experience he has brought the process to great perfection. The first, and a most essential requisite, is to use good apples—such as would be regarded as excellent table sorts. They must be fully ripe. If not quite ripe, they must be allowed to remain in heaps after gathering. Autumn table sorts are first employed, and as the manufacture continues, winter varieties ripened in a warm place come into use.

The next essential requisite is a cool temperature. The juice being separated with a grater cider mill, will ferment too soon if the weather is warm. The thermometer should never range higher than 60° in the middle of the day; 40° or thereabouts is preferred. The work is commonly commenced about the middle of October, and is continued till the first of December. If a warm day occurs, the manufacture is omitted till the weather is cooler. The slightest fermentation of the juice spoils the character of the jelly. In cold weather the whole process may extend through three or four hours, from the grinding of the apples to the completion of the jelly; but if the temperature is as high as 60°, the time must be less than an hour.

Cook's copper evaporator is used for boiling down the juice. Iron will not answer. The evaporator is thoroughly washed daily. The juice is reduced to about 30° or 32° of the saccharometer, and three quarters of an hour to one hour is required for the process. A barrel of juice will make fifty pounds of jelly. A gallon will weigh about eleven pounds—or nearly five gallons are made from a barrel of juice. The evaporator is twelve feet long, the process is continuous, and one barrel or more is reduced per hour. The jelly is poured into the moulds while hot and liquid.

Mr. Mekeel manufactures more largely in abundant years. In 1878 he made twelve tons of jelly. One bushel of apples will make five or six pounds. Not over twenty or twenty-five bushels of apples are ground or worked at a time, as it is all-essential to evaporate before there is any fermentation. The fruit should be well assorted, so as to have all of equal ripeness. The cost of manufacturing is about a cent and a half per pound, including fuel. The price of the best apples is of course greater than the labor. The wholesale price of the jelly is eight cents per pound, and large quantities are shipped to purchasers. The jelly will keep any length of time; it has been found good and fresh after the lapse of four years.

It is probable that the process of manufacture might be continued into winter, in a large basement, any desired degree of coolness being secured by ventilation.—*Country Gentleman.*

NEW TELEPHONE EXPERIMENTS.

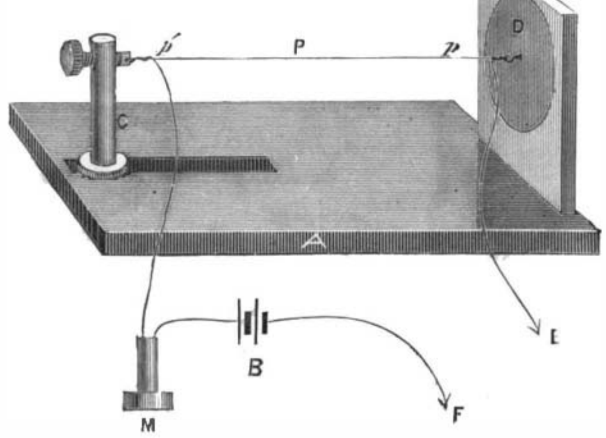
At a recent meeting of the Royal Society a paper was read "On some Thermal Effects of Electric currents," by William Henry Preece, General Post Office:

I have been engaged for some time past in experimenting on the thermal effects of electric currents, but the final results of those experiments are not sufficiently ripe at present to justify my bringing them before the Royal Society. I have, however, obtained one result which I believe to be sufficiently novel to justify a short preliminary note.

The most striking facts elicited by these experiments are:

1. The extreme rapidity with which thin wires acquire and lose their increased temperature.

2. The excessive sensibility to linear expansion which fine wires of high resistance evince.



THERMAL TELEPHONE.

Now as the rate of heating, and therefore of expansion and contraction, varies very nearly directly as the increment or decrement of the currents when these variations are very small, it occurred to me that if a long wire of small diameter and high resistance were attached to a sounding board or to the center of a disk (such as one of those used for telephones and phonographs) and it formed part of a circuit conveying telephonic currents, sonorous vibrations ought to be reproduced.

The sketch shows the arrangement of the apparatus used for the experiment.

A was a stout base of mahogany, on which a brass support, C, was attached so that it could slide and be fixed at any distance from D.

D was at first a disk of thin paper, and then of thin iron.

P was the wire experimented upon whose loose ends were connected to terminals on the wooden base, so as to be inserted in the circuit containing a microphone transmitter, M, and a battery, B, of six bichromate of potash cells in another room out of hearing.

A platinum wire of 0·003 inch diameter and six inches long from *p* to *p* was first used, and the sonorous effects were most marked and encouraging when the microphone transmitter, M, was spoken into. The articulation, though muffled, was clear, and words could easily be heard.

1. Experiments were first made to determine the length which gave the loudest sound and the clearest articulation, and, after repeated trials with every variation of length from one inch to six feet, it was found that a wire six inches long gave the maximum effect.

2. Experiments were then made to determine the diameter of the wire that gave the best effect, and after repeated trials with every gauge drawn from 0·0005 inch to 0·005 inch, it was found that wire of the diameter 0·001 inch gave the best effect.

3. Experiments were then tried with wires six inches in length and 0·001 inch diameter of different materials, namely, gold, iron, aluminum, silver, copper, palladium, and platinum, and they came out in the following order of merit:

Platinum, very clear; aluminum, very variable; palladium, clear; iron, clear; copper, faint; silver, faint; gold, very poor.

4. The effect of mechanical strain was tried. It was found not to vary the effect. When once the requisite tension, which varied with each metal, was obtained, further tightening up did not vary the clearness or loudness of articulation. Gold would scarcely bear the tension required to reproduce sonorous vibrations, hence its low position.

5. Very thin carbon pencil, 0·0625 inch diameter, was tried under compression and under tension, but no effect whatever was experienced unless a bad joint was made, when at once a faint microphonic effect was apparent.

6. No sibilant sounds whatever could be reproduced.

7. That the effect was due to heating and cooling was shown by the fact that it was possible to increase the current to such a strength as to render the temperature of the wire sensible to the touch, and then to make its elongation and contraction by low sounds evident to the eye.

It therefore appears from these experiments that wires conveying those currents of electricity which are required for telephonic purposes expand and contract as they are heated and cooled, and as the variations in the strength of the current are small compared with the strength of the current itself, the expansion and contraction vary in the same ratio as the condensation and rarefaction of the air particles conveying the sonorous vibrations which produced these vibrations.

The mechanical changes, or molecular vibrations in the wire, due directly or indirectly to telephonic currents, which result in the reproduction of sound, bear a close analogy to the mechanical changes due to the direct transmission of sound, but with this important difference, that while the vibrations due to sound are progressive along the wire, and their velocity is low and easily measured, those due to thermal effects are practically instantaneous, and therefore affect simultaneously the whole length of the wire.

Note.—De la Rive, in 1843 (*vide* "Electricity," vol. i, p. 304), observed that an iron wire emitted sounds when rapid discontinuous currents were passed through it; but he attributed the effect to magnetism, for he failed to obtain the same effect in non-magnetic wires like platinum or silver.

Graham Bell found, in 1874, that a simple helix without an iron core emitted sounds, and (in 1876) that very distinct sounds proceed from straight pieces of iron, steel, retort carbon, and plumbago, when conveying currents.

Professor Hughes showed that his microphone was reversible, that is, that it could receive as well as transmit sonorous vibrations.

Mr. Weisendanger (*Telegraphic Journal*, October 1, 1878) reproduced sounds on a microphonic receiver which he called a thermophone, and attributed the effect to its true cause, namely, the expansion of bodies under the influence of heat, which, in fact, is the explanation of all microphone receivers.

Ader reproduced speech by the vibrations of a wire conveying currents of electricity, but he found that only magnetic metals were effective, and therefore, like De la Rive, he attributed the result to magnetic agencies (*vide* Count du Moncel, *Telegraphic Journal*, March 1, 1879).

These and many other sonorous effects of currents on wires may be really due to such heat effects as I have described.

The Hudson River Tunnel.

The bill "to provide for excavating and tunneling and bridging for transportation purposes within the villages and cities of this State," passed by the New York Legislature, has been signed by Governor Cornell. The completion of the Hudson River Tunnel is now authorized, and becomes purely a question of scientific and financial engineering.

Honors to Electricians.

A committee appointed in 1876 and presided over by M. Dumas, have reported to the French Chamber of Deputies in favor of granting the first Volta prize of 50,000 francs to Prof. Graham Bell, of telephone fame, and the second prize of 20,000 francs to M. Gramme, the well known inventor of the dynamo-electric machine bearing his name. The first one to receive this distinction was Ruhmkorff.