### THE COLUMBIA TELEPHONE SYSTEM—ITS FACTORY AND INSTRUMENTS.

When the Bell patents expired, the field of telephony was opened to the public. The famous undulatory current ceased to be an element in the finances of the world. But during the terms of the patents a practical monopoly, based on the extensive plants of the Bell Telephone Company, had been created. However open the field, it would now be very difficult for an opposition company to begin operations in any of our large cities. But in minor and local installations there is ample ground for the telephone. Owing to the system of fixed annual rentals established by the present corporation, the telephone has not begun to fill the role that it should. In the system of the Columbia Telephone Manufacturing Company, we find exactly what seems to be needed at the present time. It is a system applicable for twenty or thirty separate stations worked by a simple switch system, and so arranged as to be practically automatic. It is sold outright to customers, there being no annual tax for its use.

In our cuts the exterior of the factory is shown in Fig. 1, while Fig. 2 shows the woodworking shop, where all the cabinet work is executed. Fig. 3 is the machine shop and electrical department. Here all the parts are assembled, and the instruments are turned out complete and ready for use. Fig. 4 gives a view of the foundry, where brass and iron castings are made.

In the very complete factory which we have described are made complete telephone outfits, with a most sensitive microphone transmitter and a receiver of improved shape and qualities. These we shall next describe.

The transmitter is a multiple contact microphone, comprising several little carbon cylinders, held parallel and in a horizontal position between two blocks of carbon. A wooden diaphragm is clamped across the mouthpiece of the instrument directly in front of the carbons. The receiver is a magneto-telephone with special steel magnets and ferrotype metal diaphragm. The case of the telephone is of improved shape, making it much more convenient than is the ordinary instrument of more familiar shape. As call, a magneto bell is sometimes used. In the upper part of the cut are shown various types of the apparatus, including a plug switchboard.

One peculiar feature is to be noticed. The receiver when not in use is hung on a hook. Immediately above the hook is the knob or handle of a switch. To remove the receiver this has to be turned to one side. At once buzzers begin at both stations to sound and continue until the switch is turned back. Thus the telephone is removed and the buzzer sounds until the distant party removes his telephone and answers. Then when one telephone is replaced, the buzzer continues to sound until the other is in place also with its switch turned back. This arrangement dispenses with the magneto call bell and the gravity switch.

In Fig. 5 is shown a complete outfit for one station. At one side is the upright standard supporting the transmitter on its top and with the receiver hung from it. On the table is the switch with its various connections. This shows the simplicity of apparatus designed for perfect efficiency for a limited number of stations. Such an outfit is termed the warehouse system as applicable to large buildings where many people may have to be under call.

In the lower part of the cut are shown some interesting examples of early telephones constructed by James W. MacDonough, a pioneer inventor in this line of work. A metallic diaphragm carbon transmitter is illustrated in the cut marked A. This dates back to September, 1875. This instrument was designed to be held in the hand. A point bears against a German silver plate carried by a tightly stretched diaphragm. Various materials were tried for the point, among others a lead from a pencil, thus producing a carbon microphone, and one which transmitted speech perfectly. B shows the receiver used with the above transmitter in 1875. It is a horseshoe magneto receiver, and with the carbon transmitter constitutes a complete telephone system. The sketch marked C illustrates a pendulum receiver made in 1875, which was also a carbon point microphone. D is a combined instrument. The diaphragm acted as an element of a microphone, contact points being operated by it, and it also acted as the vibrating diaphragm of a receiver, a plate of iron being attached to it and an electro-magnet being placed beneath it. In E and F are seen other forms of transmitter and receiver, their construction being evident. These date back to April, 1875.

MacDonough is still living. He was led to experiment on the telephone by the study of the early work of Reis. There is little doubt that he is among the very first to have produced a speaking instrument, if not the earliest, for whatever has been done with the Reis instruments, there is no positive record that the old German inventor ever succeeded in getting articulate speech from his transmitters.

The work of the Columbia Company in exploiting this particular field of work is most interesting and makes it an appropriate inheritor of the work of MacDonough, for unquestionably a microphone system for strictly local work, and sold outright to the customer, is something which has long been a desideratum, unsupplied by existing companies.

They also furnish microphone instruments for exchanges and magneto transmitters of special construction.

The instruments and system can be inspected at the offices of the company, 136 to 140 Front Street, New York City.

### Lightning Conductors.

Writing in the Engineering Magazine on the subject of lightning and lightning conductors, Dr. Oliver J. Lodge remarks that the theory of lightning rods consisted in the idea, which originated with Franklin, of a charged cloud as a reservoir of electricity which desires to come down to earth, and the consequent belief that all that is necessary, in order to enable this to be done, is to provide the electricity with an easy path—to wit, a rod of good conducting material. Whenever this arrangement failed to act in the way expected of it, wherever a side flash sprang from it to other and apparently inferior conductors, wherever gas was ignited by apparently quite detached and unstruck conductors, it was customary to abuse the lightning rod as badly erected or imperfectly tested. The "earth" came in usually for the larger share of blame; but it is now known that in no case can a defective earth be held accountable for the whole of the mischief. The truth, as it is now understood, is that lightning is an oscillatory discharge of enormous energy, which no copper rod, however thick and long, can really dispose of harmlessly. Experimentally, it can be shown that when a lightning discharge takes place, even down such a rod as this, sparks may fly from it to all conductors near, capable of setting fire to any explosive compound or gas leak which they may chance to encounter. Practically, Dr. Lodge recommends for the protection of ordinary buildings the placing of a wire along all the gables, and down all the corners, with perhaps a few in between along any prominent features, so as to inclose the building in a sort of wire network. Any metal serves equally well for the conductor; conductivity being unimportant in comparison with durability. Points or projections to the sky are useful to take the violence of the direct flash at its point of incidence in a cheap and conspicuous manner. Earth connections are desirable to save the foundation, the soil, and the pipes therein from being damaged. After receiving a flash, all cellars and places likely to contain gas pipes should be inspected. Nor should a custodian of an important building rest secure until a sufficient lapse of time has rendered it unlikely that any minute ignition may be gaining headway in some obscure or inaccessible region. Plenty of iron wire instead of a single copper rod seems to summarize Dr. Lodge's prescription for the protection of ordinary buildings. For lofty chimneys, however, he suggests in addition throwing the conductor across the opening of the shaft.

### How to Move Large Maples.

To a correspondent who asked how to move and prune some large maple trees, six or seven inches in diameter, the editor of Garden and Forest replies: In removing trees the roots are generally injured to a greater or less extent, and those which are bruised must be cut away; it is good practice to prune in the branches to a corresponding extent, so that there will be not more leaves than the roots can supply. Norway maples of the size indicated cannot be removed without the loss of many roots, and pruning will be necessary. Such pruning will be perfectly safe, as these maples are not injured more than any other trees by this operation. A great deal of this pruning can be effected by thinning out the inner branches, but there should be no hesitation about cutting back limbs where this seems necessary. When the ends of the branches are pruned they should be cut back to a limb, the wounds should be covered with coal tar, and no stubs should be left to decay. In removing such large trees it is good practice to prune the roots back by digging a trench about the trees, say five feet from the trunk, and if this trench is filled with good soil new feeding roots will start out during the next year, so that the tree will be in excellent condition for removing in a year from the coming winter. Large trees can be removed with success, but it costs time and care and money. Persons who do not choose to go to the extra expense, however, can console themselves with the reflection that, as a rule, it is best to plant small trees, and that a tree ten or twelve feet high will probably be as large in ten years as one planted at the same time when it was twenty-five feet high.

IN Switzerland a milkmaid or man gets better wages if gifted with a good voice, because it has been discovered that a cow will yield one-fifth more milk if soothed during the process of milking by a pleasing melody.

## Correspondence.

### Cicada Hut Builders.

To the Editor of the SCIENTIFIC AMERICAN.

Mr. Krom, in his letter in your journal of November 10, has placed a wrong construction upon a statement in my article published in the issue of October 13. He seems to think I meant that the cicada structures were built by the pupæ to live in, as a protection from the unseasonable heat.

Not so; but rather that after opening their shallow burrows, in thin soil, when revived by the early warmth, they roofed them over; impelled by an instinctive impulse to protect themselves in some measure from the heat that would too soon develop them. Many cases of equal intelligence among insects could be cited. It seems a rather giddy flight of the imagination to suppose that I, or any one, could think they would seek a sun-baked dome on the surface for a refuge, instead of the cooler depths of their shafts.

I have abundant evidence that the huts were built in March; the hottest March as far back as the records of the weather station at New York extend—to 1870. (I inadvertently wrote April in my article.) And it was even hotter at Nyack, where most of the large aggregations of huts were found, the temperature rising to 70 degrees in the shade, bringing out the wild flowers a month ahead of their season. Even as far up as Poughkeepsie it rose to 71 degrees, north exposure.

Several large hut areas were visited by me on top of the Nyack hills and the Palisades, aggregating over one hundred acres; one of them certainly over sixty acres in extent. All of these were in shallow earth, over smooth, glacial-worn rocks.

Of course in other localities, where underlying rocks were more or less broken, fissured and uneven, some of the pupæ could descend deeper, and open holes might occur later among the huts. Even single ones might appear where undeveloped pupæ should happen to be near the surface, and so feel the vivifying warmth.

Mr. Krom's theory that the pupæ build the structures in order to receive heat will hardly do, since they could get all they wanted without going to that trouble by simply remaining at, or just below, the mouths of their burrows. I have seen very many peering from their holes. Insects, unlike the genus homo, do not waste their time in unnecessary labor.

There is almost positive proof that the building instinct is inherent with all of these insects, called out as occasion requires. The theory that the high ground builders were the progeny of those which had formerly built on low ground, subject to overflow, will hardly hold, since the few, if any, that might reach the elevations would be widely separated. It is illogical to suppose that the possessors of this alleged hereditary trait would all keep together; congregating in populous groups, and erecting their domed roofs by the million, in contiguity, separate from those which would later emerge from unroofed shafts. Why should they select shallow earth, either over rocks, or over sandy soil, too incoherent for burrowing, as in one case reported to me, just where the abnormal heat of March would sooner revive them? Why did those in low ground, subject to overflow, among the deep ground hollows of the hills and on the flats, build no huts? In such places countless open holes were observed.

The fact is, that in former years these structures have been exceedingly rare, and almost any guess as to their purpose would do. But in this year they have been found in vast numbers under the exact conditions of early high temperature and environment that would revive their builders in an undeveloped state, lending extreme probability to the early heat and shallow burrow theory. BENJAMIN LANDER.

Nyack, N. Y., November 12, 1894.

### How the Cat Falls.

A select company of the savants of Paris has been endeavoring to determine why it is that when a cat has to execute a fall it invariably falls upon its feet. To this end the society has subjected a subject to a series of falls from a height of some eight-and-forty inches. The drops have been made as awkward for the animal as science knew how, but the result has always been the same. In the course of its brief descent Grimalkin has always contrived a means to land neatly on all fours, with its tail at a triumphant right angle. How does it do it? The cat's determination to keep its secret has baffled the closest inquiry. No less than sixty instantaneous photographs have been taken of as many phases of the chute. At a convenient distance from the finish the cat is seen revolving in itself, without any visible assisting force, and stopping in its revolution when it has got right side uppermost. And all science can do is to abuse the cat for violating the laws of nature. The explanation of the phenomenon would seem to be that pussy knows better how to fall than the laws of nature could teach the scientist.—**Pall Mall Gazette.**

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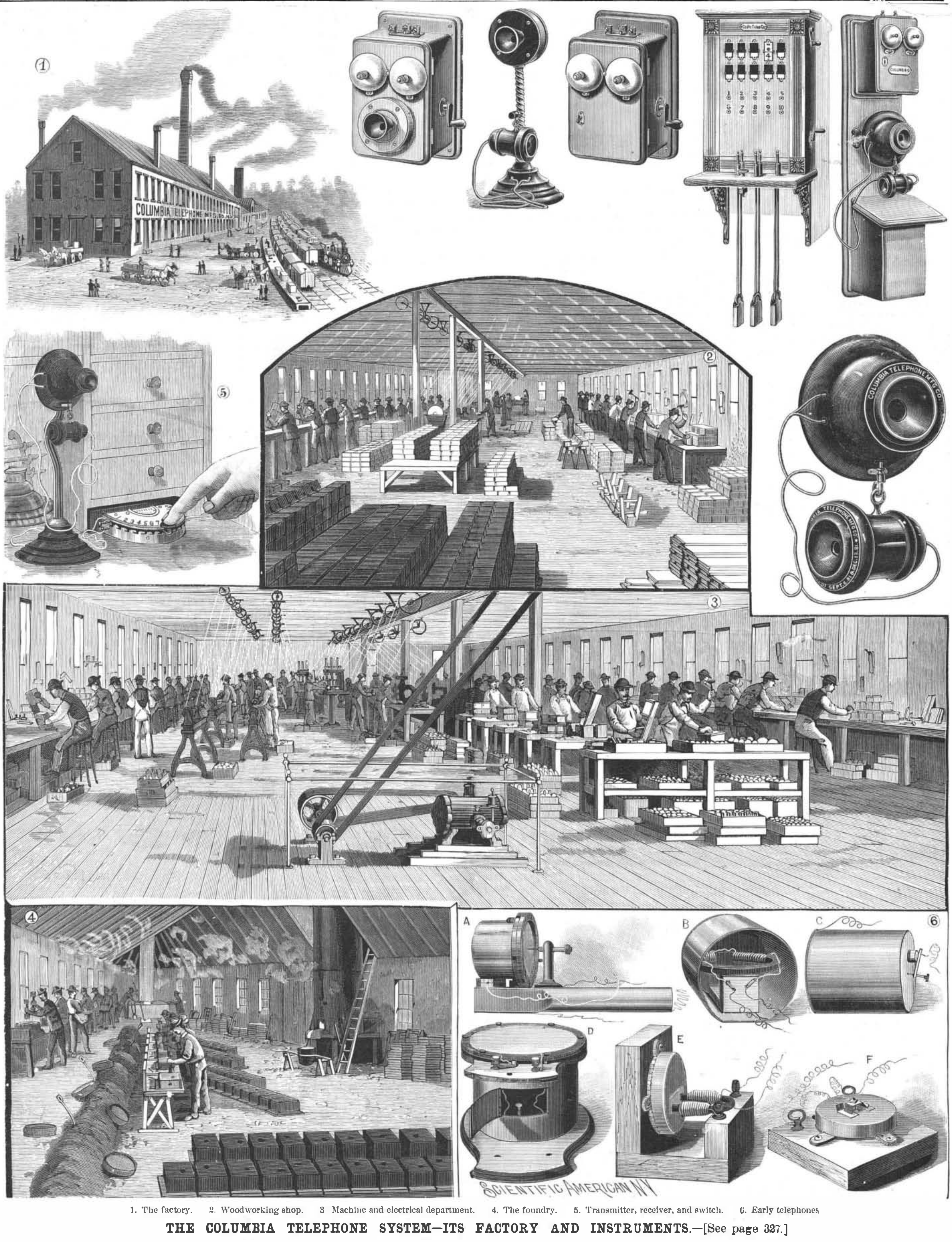


1. The factory. 2. Woodworking shop. 3 Machine and electrical department. 4. The foundry. 5. Transmitter, receiver, and switch. 6. Early telephones

**THE COLUMBIA TELEPHONE SYSTEM—ITS FACTORY AND INSTRUMENTS.**—[See page 327.]