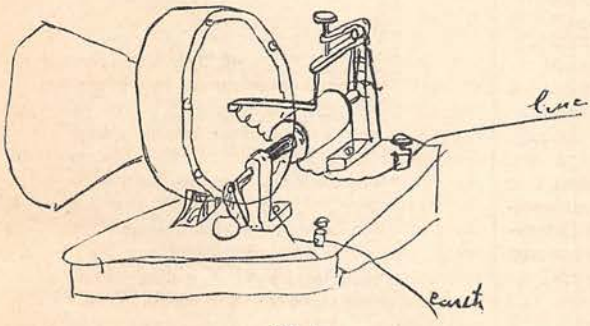
THE WORLD'S WORK.

Edison's Electro-Motograph.

THE telephone, though it is in both its forms in daily practical use in all parts of the world, still labors under one serious defect. It fails to reproduce the words delivered at the transmitting end of the line in anything like their original volume. The conversion of the sonorous vibrations into electric action and its reconversion into waves of sound or spoken words imply a double loss, and it is only by holding the receiving instrument close to the ear that the words can be heard at all. To convert a slight electric action into mechanical action or work of equal or greater power at a distance has been the aim of research for some time, and after a long series of experiments, often given up in despair and then resumed, it has been accomplished. A telephonic receiver has recently been constructed that will perform work under the impulse of electric action from a distance, or, in other words, that will reproduce sonorous vibrations having a volume equal to the initial vibrations.

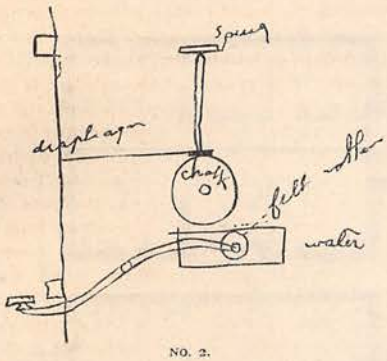


NO. 1.

The above cut represents an ideal telephonic receiver based upon the new discoveries in this direction. It consists of a disk of mica about 12.5 cm. in diameter secured to one end of a short cylinder, having a trumpet-shaped funnel at the other end. To the center of this disk is fastened a flat strip of metal the outer end of which rests on the revolving cylinder, as shown in the figure. Above this strip of metal is a powerful spring that by means of a short rod, pointed at each end and resting in cups above and below to give it a slight lateral motion, presses the strip of metal firmly down on the cylinder. The wire from the telephonic line passes through the binding post and then to the metal strip near its junction with the mica diaphragm. The line to earth passes through a binding post to the base of one of the supports of the cylinder, the track of the current thus being through the metal strip to the cylinder, and its supports by the wire to earth. This apparatus at once suggests a form of musical telephone brought out some time ago and afterward withdrawn on account of certain defects of construction. This new appliance is, in fact, the same invention revived and now perfected by the original inventor, and brought to complete practical success under the title of the "electro-motograph." The action of the "electro-motograph" depends on the fact, discovered during former experiments, and employed imperfectly in the musical telephone, that the friction of moving bodies varies in greater or less degree with their electrical condition. In the electro-motograph a cylinder made of prepared chalk and saturated with a strong solution of caustic alkali is set upon supports so that it can be turned upon its axis. A strip of metal fastened to the mica diaphragm rests on the cylinder and is pressed so firmly by its spring upon the cylinder that when it is turned by means of the handle the friction of the strip on the cylinder tends to pull the diaphragm out of shape, causing it to bulge inward as long as the cylinder is in motion. If now, while this motion of the cylinder is maintained, an electric current passes through the strip of metal and then through the chalk cylinder to earth, the amount of this friction is varied or it is destroyed altogether, and the strip slides freely on the cylinder. This was the basis of the former invention. The release from friction by a change in electric condition in the first instrument failed simply from ignorance of some slight matters of detail, that in the electro-motograph are corrected and made practical. In the musical telephone the releasing of the frictional resistance by electric action caused the sounding-board of a guitar to vibrate, and thus set up sonorous vibrations. In the electro-motograph the mica disk takes the place of the guitar, and, by the improved construction of the apparatus, intricate and complex vibrations such as are produced in speaking are reproduced in their original or even in greater volume. When the apparatus is at rest the diaphragm is motionless, and electric currents shot through the apparatus produce no effect. In the same manner the mere turning of the cylinder without electric action produces no effect, except to pull the diaphragm slightly out of shape. If while the cylinder is being turned an electric impulse arrives, the pull on the diaphragm caused by the friction of the strip on the cylinder is more or less released, and the diaphragm is free to vibrate or spring back into its original condition. If now, the electric impulses follow one another in regular order in correspondence with the sonorous vibrations imparted to the transmitting telephone, the alternate slipping and catching of the metal strip on the cylinder will follow in the same order, and thus the diaphragm will be made to vibrate in unison with the original vibrations, and thus reproduce the original words. As the mica disk is much larger than the disk of the transmitting instrument, the amplitude of its swing may be much

greater, and consequently, it will repeat the words with greater power. The electro-motograph is practically an apparatus for transforming electric action received from a distance into mechanical work. The amount of electric action has nothing to do with the amount of the mechanical work performed, because the movement of the cylinder is controlled by power independently of the electric action, the electricity merely releasing this power by destroying the friction in greater or less degree. The electric action set up by the sonorous vibrations at the transmitting end of the line may be very slight, while the mechanical action at the distant end may be powerful, and in this manner the amplitude of the vibrations may be increased to an indefinite extent, and a whisper may reappear as a loud shout.

In cut No. 2, details of the apparatus left out of



NO. 2.

the first cut are shown. The chalk cylinder is made by submitting precipitated chalk to great pressure, and it then becomes the vehicle for a solution of caustic alkali; and in this connection it may be noticed that any absorbent material would answer for the cylinder, but chalk has been found best. To compensate for the loss by evaporation, a dish of water is placed below the cylinder, and by means of a lever, shown in cut No. 2, a roller resting in the water may be pushed up against the cylinder till it is thoroughly moistened. This work only takes a moment or two once a week. In constructing the electro-motograph for telephonic use, the diaphragm is placed at the top of a box at an angle of 45° and the spring, cylinder, bell-call, etc., are inclosed in the box, while the transmitting disk is hung upon a double-hinged arm just above, in convenient reach. The electro-motograph is not only a solution of the telephone, making it capable of sounds of every quality and pitch and in greatly increased volume, but by this conversion of electrical action into mechanical work at a distance makes it possible to unite the telephone and phonograph. Telephonic messages by the electro-motograph may be impressed upon a self-acting (clock-work) phonograph, the same current starting and stopping the phonograph after the manner of the stock-reporting machines, and afterward the phonograph may be made to repeat the message impressed upon it. The electro-motograph offers a wide field for research and seems destined to increase greatly the practical business of telephony. The two cuts possess a double interest, as they are off-hand ink sketches made by the inventor, Thomas A. Edison.

The telephone lines hitherto erected in this country have been single wire lines, the wire being exclusively used for sending message by telephone. By a device recently brought out, the common Morse sounder has been combined with the telephone, and it is found in practice that the use of one does not interfere with the other, telegraphic and telephonic messages being sent over the same wire at the same time. By a still greater refinement five messages can be sent over one wire at the same time by combining a telephone with a quadruplex instrument. These latest improvements promise to increase greatly our means of communication by wire, and it is to be hoped will tend to cheapen the cost.

[The next number of the magazine will contain a fuller account of the electro-motograph, brought down to the latest possible date, and considered with reference to its new and unexpected developments. The paper referred to will be the first of an important and authoritative series on the inventions of Mr. Edison, which will have a romantic as well as a practical interest, and will exhibit in an interesting way the curious and wonderful methods of the inventor.—ED. S. M.]

Plans for Tenement Houses.

IN laying out the city of New York, the blocks between the streets were cut up into house lots of one uniform shape and size, 7.62 m. by 30.50 m. (25x100 ft.), and upon these lots houses of every description have been built. For business and manufacturing purposes, and for the dwellings of the better class of people, the shape and size of these city lots have not proved specially inconvenient. The whole lot need not be occupied by the building unless the owner is willing to submit to the inconvenience of the dark rooms in the middle of the house. In the dwellings of the poorer class of people space under the roof seemed of more value than the comfort or even the health of the tenants; and the greediness of the landlords, combined with the excessive demand for accommodation, led to the erection of tenement houses occupying all or nearly all the surface of the lots. From this vicious system of building have come so many evils that much public attention has been drawn to the matter. Long and narrow buildings, often six stories high, and with four suites of rooms on a floor, present every sanitary evil,—want of light and air, darkness in the halls and interior rooms, want of privacy, and exposure to danger from fire, disease, and all the ills that flow from overcrowding, and there is but one redeeming feature: that such buildings do make a good return as investments. So great are the evils flowing from this mistaken system of land division and this unhealthy style of building that many attempts have been made to design and construct improved forms of tenements that shall be at once cheap, safe, and profitable. The most notable of these experiments has already been described in this department, and with this are now presented