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THE LATEST LONG DISTANCE TELEPHONE TRANSMITTER.

Early in the history of the telephone, after it had been before that great tribunal, the public, the verdict seemed to be that it might answer for local purposes, but much improvement would be required before it could be used for long distance communication. In the telephone, as in everything that comes "to stay," the required improvements have been gradually developed, so that at the present time, instead of communicating telephonically over even short distances with great difficulty and uncertainty, it is now as possible and practicable to carry on conversation over a line 200, 500 or 1,000 miles long as to converse face to face. Now New Yorkers can readily converse over the wires with Philadelphia, Baltimore, Washington, Chicago, Milwaukee, and other distant places, and wherever the long distance telephone is in use, not only does the user have the advantage of communicating over distances up to 1,000 or 1,500 miles, but he is sure of very superior local service.

These results are due mainly to the metallic circuit and the long distance transmitter, the receiver remaining practically the same as it was at first.

The long distance transmitter is fully illustrated by the accompanying engravings, and forms the subject of this article.

Into the ring forming the front of the diaphragm case is screwed the mouthpiece, and in a circular recess in the back of the ring is placed the sheet iron diaphragm having a binding of soft rubber around its edge, as shown in Fig. 8, and between the diaphragm and the cell is inserted the mica ring shown in Fig. 7. To the rear surface of the front of the diaphragm case is secured an offset bar, in the center of which, at a point opposite the center of the diaphragm, is inserted the shank of a metallic cell containing the electrodes. In the bottom or rear portion of the cell is placed a disk of dense carbon, the face of which is highly polished. To the front of the cell is clamped a disk of mica by means of a ring screwed on the cell and furnished with a fillet. In an aperture in the center of the disk of mica is inserted the shank of a button, the inner surface of which is covered by a disk of highly polished dense carbon. The space between the button and the rear carbon disk is filled with granules of carbon, and the shank of the button extends through the central aperture of the diaphragm and is held therein by a nut and a jam nut.

The diaphragm is held in its place in the case and damped by a spring (see Fig. 6) secured to the case and covered at its free end with soft rubber. The carbon cell is adjusted by moving it out or in until the required pressure is secured, when the shank of the cell is clamped. The cell is shown in detail in Fig. 10, the polished carbon button in Fig. 11, the front button connected with the diaphragm in Fig. 13, the mica disk in Fig. 14, the nut by which it is clamped to the button in Fig. 15, and the ring which screws on the cell and holds all the parts in place is shown in Fig. 16.

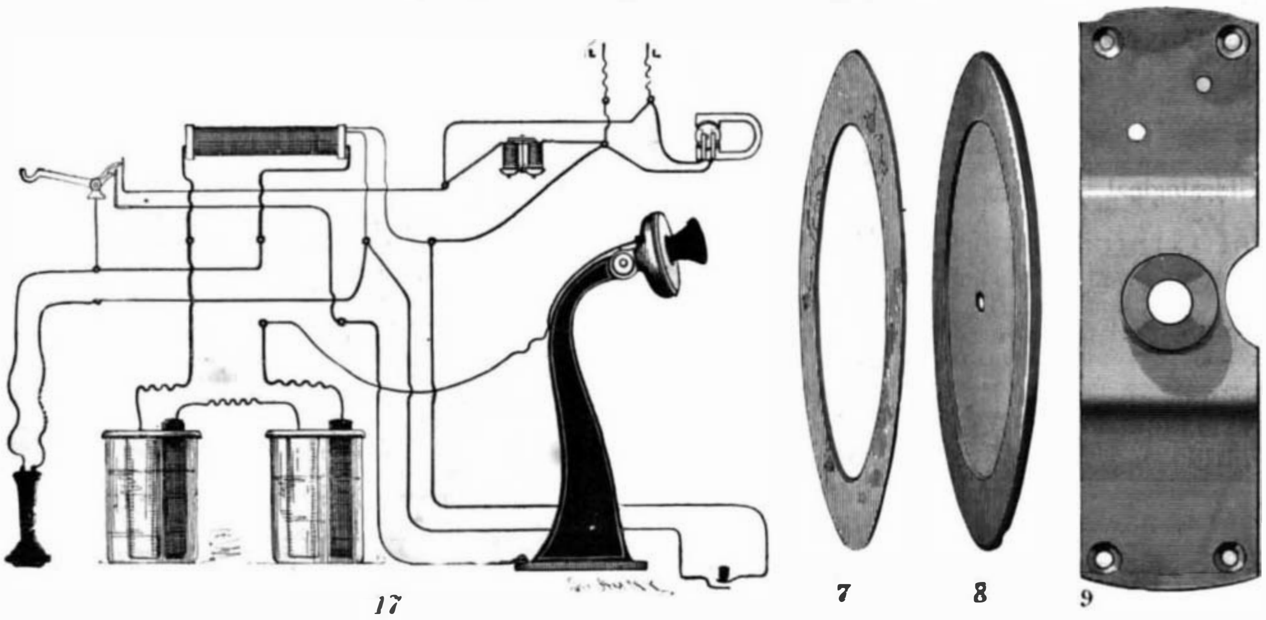
To the back of the bar extending across the cell is secured an insulating block of hard rubber into which is screwed the socket, shown in Fig. 5, for receiving the end of a flexible cord. The arm attached to the socket is connected with the metallic button carrying the outer carbon. The form of the insulating block of rubber is shown clearly in Figs. 2 and 3. The back of the diaphragm cell consists of a metal cup (Fig. 1) attached to the front plate by screws. The cup forms a metallic contact with the carbon cell and is connected electrically with one of the battery wires.

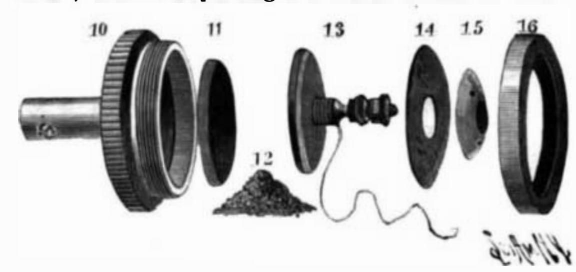
The granulated carbon used in the cell is made by one of the gunpowder manufacturing companies, and the secret of its manufacture is not known to the public, but it has been ascertained that coked Schuylkill anthracite coal will answer the same purpose. The carbon granules are screened through a wire sieve of 60 mesh; smaller and larger granules than those which pass through this mesh are rejected.

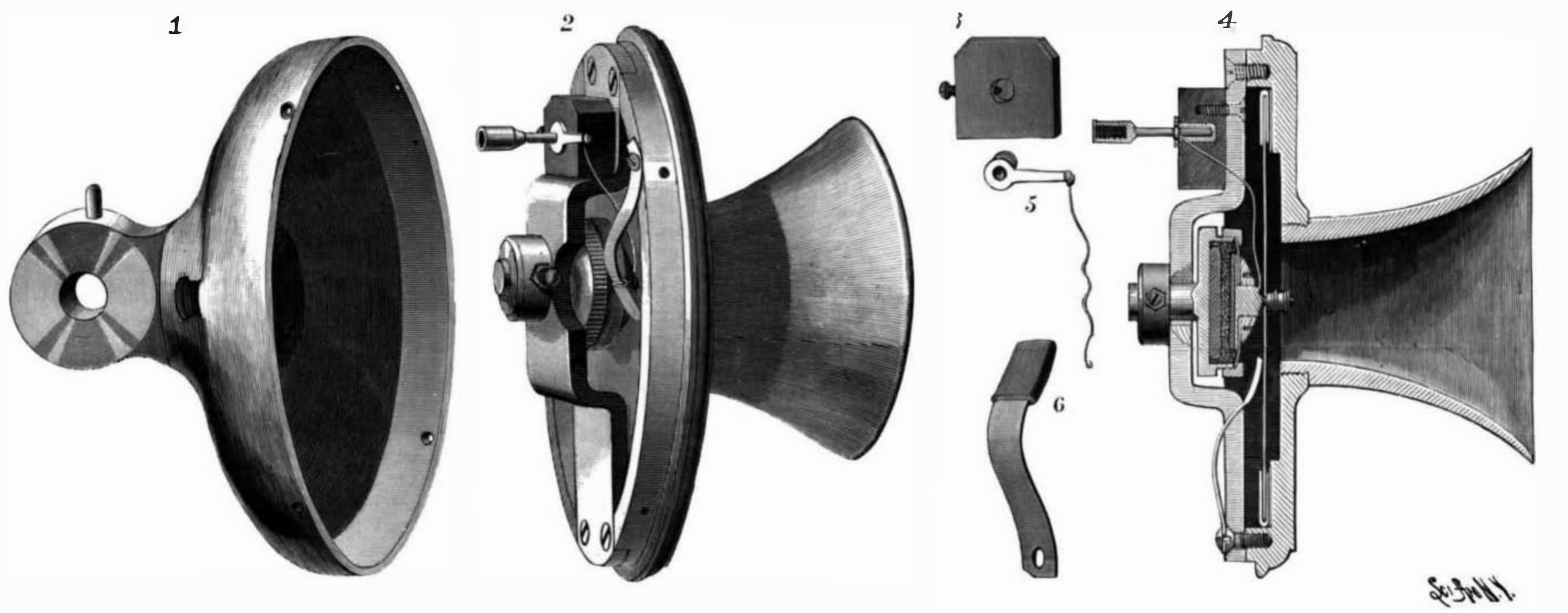
The local circuit of the telephone is shown in Fig. 17. In this diagram the transmitter is shown supported by a metallic arm which is in electrical communication with the rear portion of the telephone case. One of the flexible cords extends from the socket in the rubber block within the telephone case to one pole of the battery. The other pole of the battery is connected with the primary wire of the induction coil, and returns through the lever switch to the arm of the transmitter, thus completing the local circuit of the telephone. One of the line wires is connected with one terminal of the induction coil, the other terminal of the induction coil is connected directly with the telephone receiver, which in turn is connected with the lever switch, the latter being in electrical connection with the other line wire. Two wires connected with the secondary terminals run to a cut-out key at the right of the transmitter. It is found advantageous to short-circuit the induction coil by pressing this key while the message is being received, as it cuts out the resistance of the coil and also that of the call bell.

The induction coil has a half inch core of soft iron wires on which are wound three layers of No. 16 wire (A. W. G.), and upon this is wound the secondary wire, which consists of No. 23 (A. W. G.), a sufficient quantity being used to make the resistance of the secondary about 17 ohms. The length of the coil between the flanges of the spool on which it is wound is 6 inches.

(Continued on page 107.)







1 and 2. Back and front portions of transmitter. 3. Insulating block. 4. Diametrical section of transmitter. 5. Socket and arm for flexible cord end. 6. Damping spring. 7. Mica ring. 8. Iron diaphragm, with soft rubber binding. 9. Cross bar. 10. Carbon cell. 11. Carbon button. 12. Granulated carbon. 13. Carbon-lined front button. 14. Mica disk. 15. Nut. 16. Clamping ring. 17. Local circuit.

THE "SOLID BACK" LONG DISTANCE TELEPHONE TRANSMITTER.

THE LATEST LONG DISTANCE TELEPHONE TRANSMITTER.

(Continued from first page.)

The magneto machine and polarized bell are of the usual construction, the magneto having an automatic circuit closer which closes the circuit between the line wire extensions when the crank of the machine is turned. The resistance of the polarized bell is very high, so that its insertion in the circuit in the manner shown in the diagram is feasible.

When the telephone switch is up, as shown in the diagram, a switch arm forms an electric connection with the two springs, as shown, but when it is held down by the weight of the telephone, the contact is broken between the lever and springs. The battery used in connection with the long distance transmitter consists of two Fuller cells. This battery has been frequently described in these columns.

THE BLAKE TRANSMITTER.

DETAILS OF CONSTRUCTION.

As the patents on the Bell telephone receiver and Blake transmitter are no longer in force, the general use of the telephone is likely to be greatly extended.

The thousand or more uses the telephone can be put to and its manifest convenience in rapidly transmitting messages make it the most remarkable time saver the world has ever known.

The Blake transmitter has been, in a measure, discarded by most of the telephone companies, not because of any special defect, but because there cannot be safely put through the transmitter enough current for transmitting sounds over great stretches of wire, say three hundred miles or more. But with a modern copper metallic circuit, with the battery in normal condition, it can be worked successfully on lines 150 miles long. It has the merit of reproducing the voice very distinctly and with a naturalness of tone and amount of volume that is surprising.

For these reasons it is regarded by experts as one of the best forms of microphone made. It took a long time for all the niceties of adjustment and little points of manufacture necessary for its perfect working to be ascertained.

We show in the two illustrations the general appearance of the Blake transmitter (Fig. 1) and a diagram of the connections (Fig. 2). The external dimensions of the box, referring to Fig. 1, are 5¼ × 4¼ × 2¾ inches. The square frame of the box is ⅜ of an inch thick and the cover and back are about ¾ of an inch thick. The diaphragm aperture in the cover is ⅝ of an inch in diameter, while the diameter of the cup-shaped mouthpiece formed in the cover and converging to the central opening is 1⅝ inches in diameter. To the rear of the door is secured the cast iron circular ring, A, inside of which lies the Russia iron diaphragm, B, 2¾ inches in diameter, 2-100 inches thick, or No. 24 B. & S. gauge, enveloped at its edge with a Goodyear pure rubber band, Z (Fig 2), 2½ inches long by ¾ of an inch wide, such as can be purchased at any rubber goods or stationery store.

A seat ⅜ of an inch wide, 1-16 of an inch deep, and a little larger in diameter than the diaphragm, is formed in the iron ring. On this seat the diaphragm rests. A short, thin metal plate attached to the ring, A, on the right hand side clamps the diaphragm in position. The plate should rest squarely on the rubber edge of the diaphragm, holding it firmly against the ring. Its function may be described as being like that of a hinge, which allows the diaphragm to freely swing inward. The diaphragm should be perfectly flat and true, and all parts of its edge should rest easily or touch all portions of the seat. The steel damping spring secured to the ring at the opposite edge of the diaphragm is protected at its free end with a rubber glove on which is cemented a thin piece of fluffy woolen material. This spring extends to a point about half way between the periphery and the center of the diaphragm. It is 1½ inches long by ⅜ wide, and is bent with quite an arch, so that the end will press, finger-like, firmly upon the diaphragm. The function of this spring is to prevent excessive vibration. Once in six or eight months the spring should be removed and the fluffy end roughed up. About once in six months the rubber band should be removed from the diaphragm and a new one put on.

Referring to the iron circular casting, A, it will be observed that it has at the bottom a projection holding an adjusting screw, and to a similar top projection is attached by screws a brass spring, about No. 16 B. & S. gauge, from which depends another casting, C, in Fig. 1, and T, Fig. 2, supporting the complete microphone apparatus. Fig. 2 shows this portion separated from the supporting casting, A.

Referring to Fig. 2, A is one terminal of the primary battery passing by wire, S, to the hinge, H, to which it is soldered. From the other leaf of the hinge the wire, M, insulated and protected by a rubber tube, passes to K, where it is soldered to the upper end of the German silver spring, I. The spring, I, is ⅛ of an inch wide. At K this spring is clamped between two pieces of hard rubber and is thus insulated from the iron work. In the lower end of spring I is bored small hole in which is inserted and soldered a bit of No. 18 platinum wire having each end rounded off, forming a bead, one side of which is in contact with the diaphragm, N, the other side contacts with the carbon button, J, details of which will be given. Numerous experiments demonstrated the necessity of giving to the spring, I, a special curve in order to get the best results. The curve should follow as closely as possible from the point of support downward, an arc of a circle seven or eight inches in diameter, but it must not touch the diaphragm. When the button, J, is pulled back, away from the diaphragm, N, the spring, I, should follow it in contact from ⅛ to 3-16 of an inch before separating. The carbon button, J, is supported by a small brass weight attached by a small screw to a piece of watch spring, R. This spring which is straight is clamped in metallic contact at its upper end with the metal support, T.

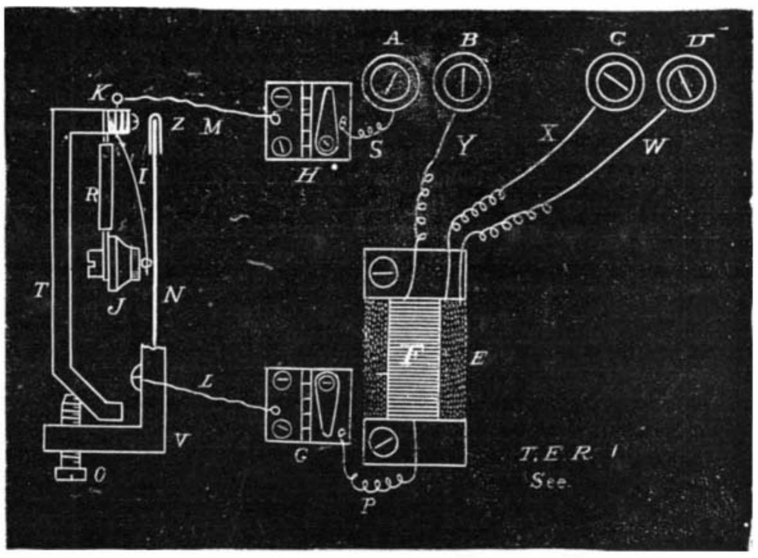


FIG. 2.—Internal Construction of the Blake Transmitter.

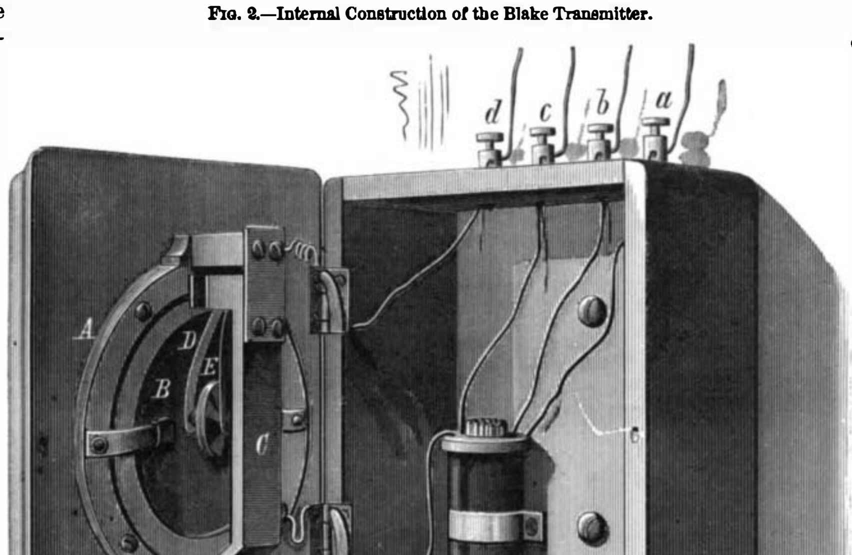


FIG. 1.—A. Metal circular ring. B. Diaphragm. C. Adjusting angle bar. D. German silver spring. E. Carbon button spring. a b. Secondary wires. c d. Primary wires.

THE BLAKE TRANSMITTER.

It is surrounded its entire length with rubber tubing to deaden any possible vibrations in the spring itself. The brass weight which holds the carbon button, J, is beveled outward, with its periphery milled, in order that it may be easily rotated for adjustment on the screw which holds it to the spring, R.

The proper way to polish the carbon button is not generally understood, and as the smooth looking-glass polish is one of the essentials to good articulation, we will describe the most approved method of producing it. The button is taken off its support, R, by unscrewing the screw in the back. A piece of the finest crocus emery paper, about two inches square, is placed upon some firm support and held flat by the two fingers. The button, held between the thumb and finger, is next placed, carbon side downward, upon the emery paper and rubbed over it in the space of an inch circle. At first the surface of the button is roughened, but as soon as the paper becomes filled with particles of carbon or is blackened, the polish begins to come. At this stage the sweep of the button is reduced and confined to the center of the sheet and a slight gyratory motion given to it; at the same time the button is rotated on its axis with the thumb and finger, half a revolution, then half a revolution in the opposite direction, the principle being that the fine carbon particles rubbing in contact with the surface gives the final gloss.

The whole operation requires less than five minutes, and it is surprising how easily and beautifully the high polish is obtained. After it is done, the emery paper is turned over and the button rubbed slightly on the back of it, to remove the loose particles of carbon from the surface, then the button is returned to its place in the transmitter, and the point of the platinum bead pressing against it is burnished by rubbing a knife blade over it.

The transmitter is adjusted by turning the screw, O, to the right or left, the tapered upper end of the screw engaging the beveled end of the casting, T. That is, the pressure of the button and platinum bead against each other and the diaphragm, N, is increased or decreased by manipulating the screw.

One of the guides in determining the right microphonic effect is to place the butt end of a lead pencil in contact with the outer face of the diaphragm, then slide the fingers gently along the pencil toward the diaphragm, listening in the meantime in the receiver. If this sound is readily transmitted and heard, the transmitter is considered quite sensitive. Having traced the circuit through the platinum, spring, and carbon button, where the spring holding the latter comes in contact with the iron support at K, the circuit continues from the iron ring, as shown at L, to the lower hinge, G, thence by wire, P, to the interior of the induction coil, usually consisting of two coils of No. 16 wire, and called the primary coil; see F. From the top of this coil it passes to the second binding post, B. The resistance of this coil is very small. The secondary wire, E, on the outside of the induction coil consists of several layers of No. 36 wire, having a resistance of 150 ohms; the terminals, X and W, are carried to the two posts, C and D.

The posts, A and B, are connected to the battery, which should have a voltage averaging from 1 to 1·6 volts. If it falls below a volt the microphone will lack snap, and will not transmit as loud. One average Leclanche cell is sufficient, or one cell of a dry battery like the Mesco.

If all the foregoing details are carefully observed, the transmitter will be found to meet the most exacting requirements; it can be shouted at without getting out of order, as we know by actual experiment.

Removing Impurities from Wools.

For above purpose (according to the process just patented in France and England by C. Delerue, of Roubaix, France), the wool sliver is fed by feed rollers in between a pair of cylinder brushes, and from them it is removed by a rapidly revolving comb in contact with which there is a more rapidly revolving cylindrical brush with a tapered casing, having an opening through which part of the periphery of the comb projects to meet the brush. By the current of air caused by the rapid revolution of the brush, the wool stripped by it off the comb is projected toward the small end of the casing, where it is caught by a pair of hollow wire gauze cylinders, and by them delivered to a pair of feed rollers to be again subjected to the action of a cylindrical comb and brush. These wire gauze cylinders, feed rollers, and combs, and the brushes and their casings, are repeated eight or ten times in the machine, the wool passing in succession through them all.

Cement Mortar.

About eight parts of furnace ashes, slag, or coke, four parts of slaked lime, and one of clay, are taken and mixed dry so as to form a cement, which, on mixing with water, sets in the ordinary way. The proportions of the materials may be varied so as to produce either an aerial or hydraulic cement.