(No Model.)

W. B. HALE.

ELECTRIC TELEPHONIC TRANSMITTER.

No. 305,812. Patented Sept. 30, 1884.

Fig. 1.

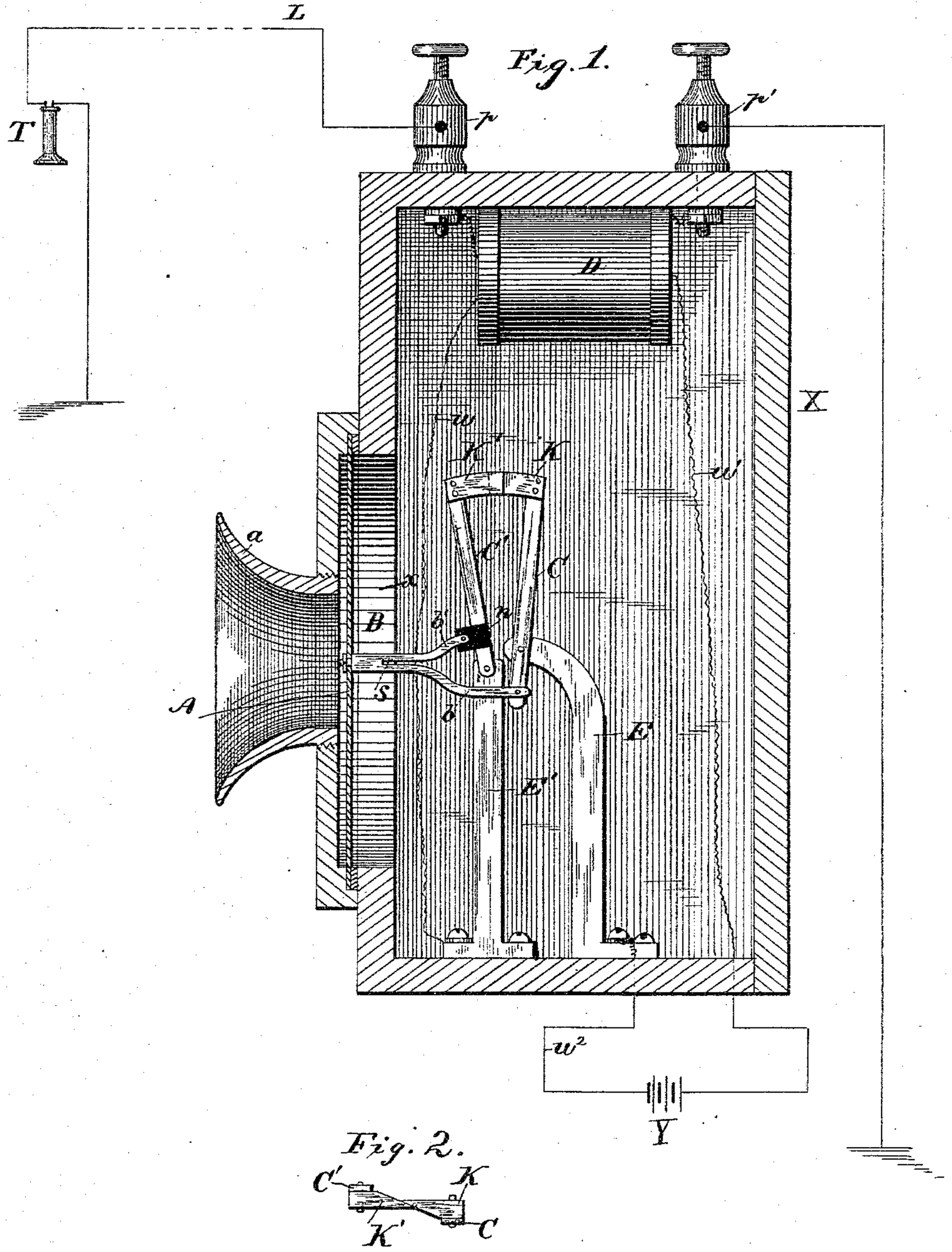

Fig. 2.

WITNESSES

Chas. R. Burr.

A. F. Stewart.

INVENTOR,

William B. Hale.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM B. HALE, OF WASHINGTON, D. C., ASSIGNOR TO THE FULLER UNIVERSAL TELEPHONE COMPANY, OF NEW YORK, N. Y.

ELECTRIC TELEPHONIC TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 305,812, dated September 30, 1884.

Application filed February 27, 1884. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. HALE, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Electric Telephonic Transmitters, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improved means for varying the contact between the current-varying electrodes in that class of electric telephonic transmitters commonly known as "variable contact" telephones or microphones.

The main object of the improvement is to cause electrical currents having an extended range of variation to traverse a main line as the effect of sounds, and to cause the reproduction of such sounds loudly and clearly in one or more receiving-telephones in such main line. This object is accomplished primarily by causing the vibrations of the diaphragm of such a transmitter to act mechanically upon the opposite contacting electrodes through intermediate levers in such manner as to intermittingly press said electrodes against each other with a movement corresponding to the vibrations of the diaphragm, but of greater amplitude, whereby is effected an extended range of variation of contact between said electrodes, and a consequent and corresponding extended range of variation in the current on the circuit in which said electrodes are included. A further object is to cause the vibrations of the diaphragm, amplified in transmission, to act through mechanical connections upon the opposite contacting current-varying electrodes in such manner as to alternately and positively increase and relax their pressure toward each other in contradistinction to the hitherto practiced mode of increasing the pressure positively and allowing the relaxation to occur by the recession of one electrode.

Another object of the invention is to cause the diaphragm to act upon the opposite contacting electrodes in such manner through intermediate mechanism as to vary the area of their contacting superficies in direct proportion to their variations of pressure.

In the accomplishment of its objects the invention consists in certain novel combinations of devices and modes of operation which will be hereinafter particularly described with reference to the accompanying drawings, in which—

Figure 1 is a vertical section of the case, mouth-piece, and diaphragm of a transmitter constructed according to my invention, the interior parts being shown in full lines. Fig. 2 is a top view of the contacting current-varying electrodes.

The letter X indicates the inclosing-casing, having in its front wall a circular aperture, *x*, in front of which a diaphragm, A, and mouth-piece *a* are secured in the usual manner. Within and upon the bottom or floor of the casing stand two metallic standards, E and E′, the former having its upper end curved slightly toward the diaphragm. To the top of this standard is pivoted a lever, C, having a long arm extending upward and a short arm downward from its pivot, while to the top of standard E is pivoted the lower extremity of an upwardly-projecting lever, C. These levers have fastened to their tops, respectively, the electrodes K and K′, which have their facing surfaces beveled wedge-like and in lapping contact with each other. These electrodes are preferably made of carbon, such as is used for battery-plates and other electrical purposes, and are held in yielding contact with each other by the elasticity of the metallic levers C C′ when they are lapped and the levers upright, as shown. These levers are held upright by being pivotally connected with the prongs *b* and *b′*, respectively, of a forked arm, B, projecting from and secured to the center of the diaphragm A. The prong *b* is the longer of the two, and is pivoted to the lower end of the short arm of lever C, while the prong *b′* is pivoted to a non-conducting lug, *n*, rigidly fastened to the lever C′ between its pivot and its upper or electrode-bearing end. The arm B is split horizontally for a portion of its length from its forked end, as shown at *s*, in order that the forks *b* and *b′* may be sprung slightly away from each other under strain and resume their normal positions when the strain is removed. Power for moving the levers C and C′ is applied through the prongs *b* and *b′*, and as the levers are connected or linked together

by the prongs and arm B, they must move simultaneously. In the present instance the lever C is of the first class, and the lever C′ of the third class, and when the arm B is moved in the direction of the arrow, the prongs will swing the levers C and C′, so that their electrodes at their upper ends will be pressed toward each other endwise, and their wedge-like shape causes an increase of pressure between them as they are thus moved, as well as an increase of their lapping surfaces. When the arm B moves in the opposite direction, a reverse movement of the electrodes takes place with a corresponding decrease in their pressure and lapping surfaces. Now, it will be readily understood that when these electrodes are included in an electric circuit, and are pressed toward and from each other, as described, the variation of their contact due to both variations of pressure and of lapping superficies, will so vary the resistance of the circuit as to cause great variations in the quantity of electric current passing thereon, and if these variations of current correspond to vibrations of a diaphragm under the influence of sounds, similar sounds will be produced by receiving-telephones in circuit with the electrodes. Any of the known forms of magnetic telephones may be operated in such a circuit.

The letter D designates an induction-coil, such as commonly used in transmitters of this class. One terminal of the primary circuit of this induction-coil is connected with the metallic standard E′ by a wire, *w*, and the other terminal is connected by a wire, *w′*, with one pole of a local battery, Y, having its other pole connected with the standard E by a wire, w^2. The terminals of the secondary circuit of the induction-coil are respectively connected to binding-posts *p* and *p′*, to the former of which may be connected a line-wire, as shown at L, and to the latter a ground-wire. Any other known mode of connecting a transmitter for use may be employed. Now when words are spoken or other sounds produced in the vicinity of the diaphragm A, said diaphragm will be set in vibration thereby, and such vibrations, causing longitudinal vibrations of arm B, will be transmitted through said arm, its prongs and the levers C and C′ to the electrodes K and K′, causing alternate increase and decrease of their pressure against each other, and alternate increase and decrease of their lapping superficies, with the result that a receiving-telephone in the main line, as shown, for instance, at T, will promptly and clearly reproduce the sounds made at the transmitter, as already explained. The levers necessarily move simultaneously in opposite directions at their upper ends under control of arm B, and therefore both the increase and relaxation of the pressure, and increase and decrease of lapping surfaces of the electrodes are the result of positive actions, and the variations of current resulting from both halves of each vibration of the diaphragm are as nearly equal in proportion as are said half vibrations themselves, a greater variation being thus produced than when one electrode follows another on its return half vibration.

It will be understood that the tops of prongs *b* and *b′* move in small arcs, and it is to allow them to follow these arcs that the arm B is split. The prongs might of course be made slightly elastic and the split omitted.

I am aware that a transmitter has heretofore been constructed, in which one electrode is by a lever pressed against another which is moved directly by the action of the diaphragm, and supported by a lever which has its arm opposite that supporting said electrode connected by a spiral spring and cord with the corresponding arm of the other lever. In such a transmitter one of the electrodes is at the power end of its lever, and the tendency of said lever is to cause its electrode to retreat as the other electrode is pressed toward it, while in my present invention the levers cause the electrodes to press each directly toward the other and relax each directly from the other, neither electrode retreating while the other advances toward it.

Having now described my invention and explained its operation, I claim—

1. In an electric telephonic transmitter, the combination, with a diaphragm, of levers carrying contacting electrodes and mechanical connections by which the vibrations of the diaphragm are made to cause the levers to press said electrodes against each other with varying force, substantially as described.

2. In an electric telephonic transmitter, the combination, with a diaphragm, of levers carrying contacting electrodes at their free ends, and mechanical connections, through which the vibrations of the diaphragm are made to cause the levers to press said electrodes against each other with varying force, substantially as described.

3. In an electric telephonic transmitter, the combination, with a vibratory diaphragm and two levers carrying contacting carbon electrodes at their free ends, said electrodes being in the primary circuit of an induction-coil, of intermediate mechanical connections through which the vibrations of the diaphragm cause the levers to press said electrodes against each other with varying force, substantially as described.

4. In a transmitting-telephone, and in combination with the diaphragm thereof, two resistance-varying electrodes mounted upon swinging arms, and mechanical means for causing the simultaneous approach and simultaneous recession of said levers by the movement of the diaphragm, substantially as described.

5. In combination with resistance-varying electrodes supported upon levers and maintained in constant electrical contact with each other, a diaphragm and intermediate mechan-

ism so arranged and combined that the movement of the diaphragm in a given direction shall cause the simultaneous approach of the electrodes in proportion to the amplitude of the motion of the diaphragm, substantially as described.

6. In an electric telephonic transmitter, the combination, with a vibratory diaphragm and two pivoted levers having free ends provided with electrodes maintained in elastic contact with each other, of an intermediate link connecting said levers and arranged to cause the pressure of either electrode in one direction to produce an opposite pressure of the other electrode, and suitable mechanical means for transmitting the vibrations of the diaphragm to said levers, substantially as described.

7. In an electric telephonic transmitter, the combination, with a diaphragm and two electrodes in the primary circuit of an induction-coil having its secondary circuit arranged for connection in a main line, of two counter-moving levers arranged to press said electrodes against each other simultaneously with varying force, in response to the vibrations of the diaphragm, substantially as described.

8. In an electric telephonic transmitter, the combination, with a diaphragm and two contacting electrodes in the primary circuit of an induction-coil having its secondary circuit arranged for connection in a main line, of two levers connected to move simultaneously in opposite directions at their free ends, which support said electrodes, respectively, and means for mechanically transmitting rocking motion to said levers from the diaphragm when the latter vibrates, essentially as set forth.

9. In an electric telephonic transmitter, the combination, with a vibrator arranged to vibrate in response to sound-vibrations of the air, and two contacting electrodes, of two levers of different classes supporting said electrodes, respectively, and mechanism connecting said levers and the vibrator, whereby said levers are caused to press the electrodes against each other with varying force in response to the movements of the vibrator, substantially as described.

10. In an electric telephonic transmitter, the combination, with a vibrator arranged to vibrate in response to sounds produced in its vicinity, and two contacting electrodes lapping each other in the direction of their motion and included in an electric circuit, of two levers having mechanical connection with said vibrator, and arranged to be operated thereby for alternately pressing said electrodes toward each other, and causing their pressure and contacting surfaces to be increased simultaneously, substantially as described.

11. The combination, with the wedge-like electrodes, and means for pressing their beveled surfaces together with elastic force, of means for transmitting motion from the diaphragm of a telephonic transmitter to both of said electrodes for sliding them alternately in opposite directions, substantially as described.

12. The combination, with the pivoted elastic levers, having at their free ends, respectively, the lapping wedge-contact electrodes, of the diaphragm and intermediate mechanical connections, whereby amplified vibration is communicated therefrom through the levers to the electrodes, substantially as described.

13. In an electric telephonic transmitter, the combination, with a diaphragm and two resistance-varying electrodes, of two reactionary levers operated by the diaphragm for pressing said electrodes against each other, substantially as set forth.

14. In a telephone, reactionary levers arranged to press resistance-varying electrodes against each other, in combination with a diaphragm and suitable intermediate devices, whereby motion is transmitted from the diaphragm to the said levers for varying the pressure of said electrodes, substantially as described.

15. In a telephonic transmitter, the combination of the diaphragm with two electrode-carrying reaction-levers, and mechanical connections between the same, and with the diaphragm, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM B. HALE.

Witnesses:
HARRY Y. DAVIS,
J. M. YZNAGA.