R. S. M. MITCHELL.

TRANSMITTER.

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1,056,350.

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Fig. 1.

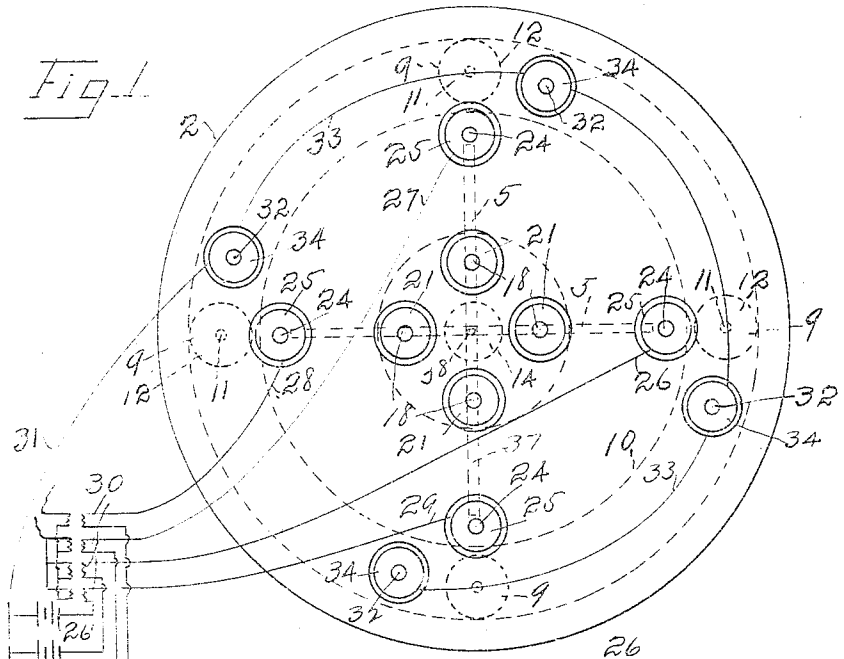


Fig. 2.

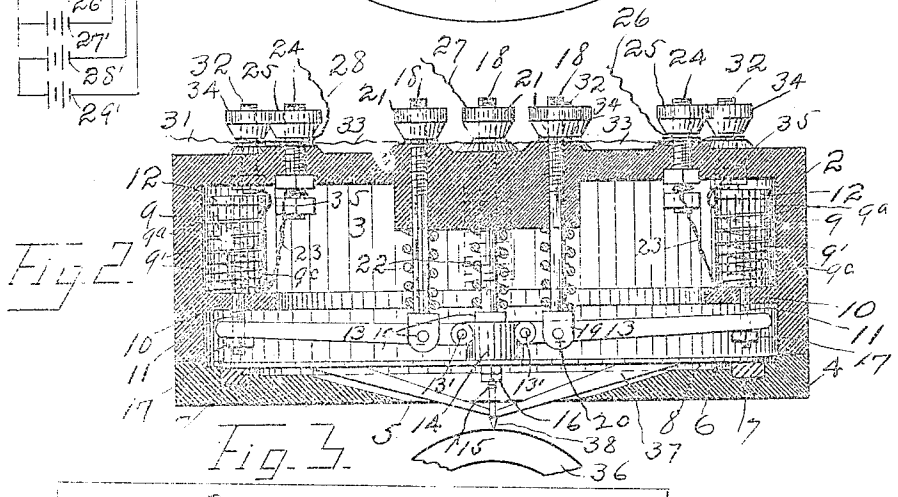
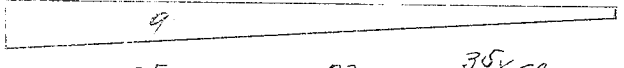


Fig. 3.



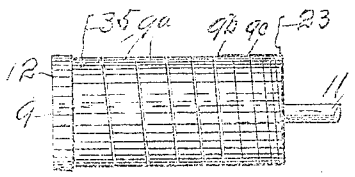


Fig. 5.

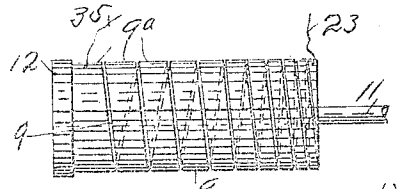


Fig. 4.

Fig. 6.

WITNESSES.

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TRANSMITTER.

1,056,350. Specification of Letters Patent. Patented Mar. 18, 1913.

Application filed March 29, 1912. Serial No. 687,218.

To all whom it may concern:

Be it known that I, RICHARD S. M. MITCHELL, a citizen of the United States, residing at Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Transmitters, of which the following is a specification.

This invention relates to improvements in transmitters, and has for its object to provide a novel, simple and effective device of the class, which is capable of being employed for the recording and reproducing of vibrations corresponding to the sounds of voices, music and the like, whether used in connection with electrographs, talking machines or the common telephones.

A further object is to provide a transmitter which is capable of giving a greater, more uniform and more delicate means for introducing a variable resistance into the primary circuits of the transmitter. And a further object is to provide a transmitter wherein the construction and arrangement of the parts are such that all the troubles incident to the pulverizing of the carbon which frequently occurs in the most improved forms of "granulated-carbon and solid-back" transmitters is entirely eliminated.

Figure 1 is a top plan view of the transmitter. Fig. 2 is a central vertical section through the transmitter; showing the construction and arrangement of the same. Fig. 3 is an enlarged detail view showing a strip of carbon from which the electrode-coils are made. Fig. 4 is an enlarged view of one of the carbon coils; showing the same relaxed for offering the full measure of resistance. Fig. 5 is a similar view showing the carbon coil partly compressed for decreasing the resistance of the electrode. Fig. 6 is a view; showing a plain diaphragm for use in making records.

In the drawing, 2 represents a solid circular cap preferably made of hard rubber or like insulating material, having a hollow interior or chamber 3. 4 represents a base of the same material, which is also circular in form and which may be secured to the cap by any suitable means. The base 4 is also solid except for a narrow four-way slot 5, in which certain of the vibrating parts are disposed when the transmitter is used for reproducing vibrations.

6 represents a diaphragm, preferably made of steel and circular in form, which is disposed between the cap 2 and base 4, and rests upon a felt or other like ring 7, which is supported by the base 4. Otherwise the diaphragm is unsupported.

8 represents a shallow recess or cavity formed in the base 4 for allowing the diaphragm to vibrate freely. The arrangement of the top 2 and base 4 is such that when joined together they form a hollow casing for inclosing and protecting the working parts of the transmitter.

9 represents a series of electrodes, which are preferably made of thin tapering strips 9′ of pure carbon. The said strips may be made of any other suitable material, which offers adequate resistance. The electrodes 9 are preferably made in the form of cylinders comprising a spiral winding of the strips 9′, as shown. The arrangement of the electrodes 9 is such that the convolutions increase in width gradually from the bottom toward the top of the coil, and the said convolutions when normal are intended to be evenly spaced apart by a small fraction of an inch, preferably from five to ten one-thousandths of an inch. The object of the said construction is to provide a resilient spiral carbon electrode which is extremely sensitive to compression and relaxation when acted upon by the vibrating diaphragm 6, for decreasing and increasing the resistance in the circuit controlled by each electrode. The electrodes 9 are preferably mounted upon an inwardly facing shelf or ledge 10, upon which they are held in vertical position by bolts or rods 11, which pass through and are supported by caps 12, which are mounted on the tops of the coils 9, the caps or head pieces 12 preferably comprising an insulating material. By this arrangement the upward and downward movements of the rods 11, acting through the caps or heads 12, effect the compression or relaxation of the carbon springs 9.

I have shown four electrodes 9 disposed at equal distances around the chamber 3 of the cap 2, but a greater or less number of the electrodes may be employed in connection with the transmitter, if desired. The electrodes 9 in the present case are arranged vertically, but they may be disposed horizontally or in any suitable position, and instead of the simple levers 13 any other suit-

able means for actuating the springs may be employed. The rods 11 are operatively connected with the diaphragm 6 by a series of levers 13. The inner ends of said levers are pivoted by means of pins 13' to a common support 14, which is secured to the center of the diaphragm 6, by means of a bolt 15 and jam-nuts 16. The outer ends of the levers 13 are preferably pierced by the bolts 11 of the electrodes, and said bolts are rendered adjustable for increasing or decreasing the tension or set of the electrode-coils, by means of nuts 17, which also hold the levers 13 in place. The levers 13 are each fulcrumed near their inner ends by means of bolts 18, which pass through and are suspended from the center of the cap 2. The lower ends of the bolts 18 have yokes 19 to receive the levers 13, and the latter, are pivoted to the yokes by means of pins 20. The upper ends of bolts 18 are threaded and fitted with nuts 21, by means of which the levers 13 and 18 are adjusted vertically for increasing or decreasing the play or movement of the said levers relatively to the diaphragm. By means of this adjustment the normal status of the coils 9 may be varied to suit conditions. The fulcrum supports 18 of the levers 13 are positioned so as to amplify the vibratory movements of the diaphragm 6. Under this arrangement, the movements of the diaphragm in either direction while vibrating are multiplied three or four times, and thereby effect a greater range of variation of the resistance in the coils 9. The levers 13 being securely fastened to the central support 14, and the said support being fastened rigidly to the diaphragm 6, both tend to effect the damping of the diaphragm, thereby checking, or preventing the prolongation of the vibrations.

22 represents a series of coil springs carried by the rods 18. These springs are preferably stiff enough to hold the said rods from yielding upwardly under the vibratory pressure of the diaphragm, the said springs being flexible enough, however, to yield when said bolts are operated by the nuts 21. The springs 22 may be dispensed with entirely and any other suitable rigid adjustment may be substituted therefor.

The electrodes 9 are connected with separate primary electric circuits, each of which comprises a wire 23, which connects with a binding post, comprising a bolt 24, which pierces the cap 2, and a thumb-nut 25. The said binding posts connect respectively with wires 26, 27, 28, and 29 which lead to a series of coils 30, the said coils connecting with separate batteries 26', 27', 28' and 29'. The said batteries then connect with a common return 31, which in turn connects in series with binding posts 32, by a wire 33, the binding posts 32 being fitted with the usual thumb-nuts 34. The binding posts 32 then connect with the upper ends of the electrodes 9 by means of wires 35.

When the transmitter is employed for reproducing a record, as from a cylinder 36, the diaphragm is fitted with a stylus support or spider 37. The said spider is preferably arranged in the form of a cross, having four arms, and the outer ends of the said arms are preferably soldered or otherwise permanently secured to the underside of the diaphragm. The spider 37 is preferably made of thin steel, and projects through and plays in the four-way slot 5 of the base 4.

38 represents a stylus which is connected to the center of the spider 37, and is adapted to engage the record cylinder 36, as shown in Fig. 2, for reproducing a record.

When the transmitter diaphragm is at rest, as shown in Fig. 2, the levers 13 and the fulcrums 18 should be adjusted to normally hold the electrodes, so that about one-half of the convolutions 9^a of the coils 9 are closed, as shown in Fig. 2 and Fig. 5. Under this arrangement the mean of the resistance of the electrodes is exerted upon the several circuits when the diaphragm is normal or at rest. When, however, the diaphragm is vibrated, the resistance of the electrodes will be increased or decreased according to the direction in which the diaphragm moves. For instance, if the diaphragm, when vibrated, moves upwardly, the outer ends of the levers 13, rods 11 and caps 12 will be moved downwardly, which will close the upper coils 9^a of the electrodes, thereby decreasing the resistance in the primary circuits 26, 27, 28 and 29. When the diaphragm is moved downwardly below its normal position, shown in Fig. 2, the outer ends of the levers 13, rods 11 and caps 12 will be raised, thereby allowing the coils 9^a of the electrodes to spring apart, which will correspondingly increase the resistance in said primary circuits.

When the electrodes 9 are properly made and the adjustment of the device is right, a broad range of the resistance may be obtained, and owing to the peculiar construction and arrangement of these coiled electrodes, the increase and decrease of the said resistance, will be gradually and evenly effected. When a number of the coils 9^a are closed-up, as best seen in Fig. 5, the current will pass from the wire 35 to the first coil at the head of the electrode, then traverse each of the succeeding separated coils until it reaches the coil 9^b. The current will then pass (via the dark line 9^c) directly across the remaining coils to the wire 23, thereby cutting out the resistance of the latter coils. The increasing and decreasing of the resistance in the electrodes 9 cause corresponding fluctuations in the primary circuits, which may be amplified many times, as compared

with the vibrations of the diaphragm, by reason of the location of the fulcrum points 20, as shown.

Heretofore, the better forms of transmitters, known as the "granulated carbon and solid back" transmitters invariably weakened and sometimes failed entirely, by reason of the pulverizing of the granulated carbon under the crushing strains of the vibrations which were imparted to them. This is due to the fact that the particles of the carbon being more or less fragile, the constant crunching and crowding of the granules upon or against each other while confined in their closed receptacles tends to break them up into finer and finer particles which eventually become like powder. The pulverizing of the carbon destroys the sensitiveness of the resistance of the electrodes, which cuts down the current and impairs the strength of the induction coils. It also causes frying—or the drawing of arcs between the electrodes, and frequently the primary circuits controlled by the granulated carbon electrodes fail or break entirely, due to the too wide amplitude of the vibrations. Each of the electrodes 9 of the present invention comprise but a single strip (9') of carbon wound in the form and having the nature of a spiral spring, the convolutions of which are preferably regularly and evenly spaced apart, as shown.

In the operation of my improved electrodes, there is no tendency at all of the carbon to wear away or to become pulverized, and when the springs 9 are properly constructed, and the actuating parts are suitably adjusted, there is no danger of the breaking or disintegrating of these coils by reason of the shock or impact caused by the strongest vibrations. When a strong vibration is imparted to the coils 9a, they simply close up, each convolution in order contacting firmly and evenly with the adjacent convolution, and owing to the fact that the spacing of the convolutions is but a small fraction of an inch, as described, the closing of the convolutions even under sharp or strong vibrations does not bring the coils together with sufficient force or jar to injure them. When the coils of the electrode are forced together or spring apart the variation in the resistance is gradual, and never abrupt. This is due to the fact that whether the springs are being compressed or relaxed, the point of contact moves, without interruption, in the same circle and at the same rate as the spiral spring itself.

It is obvious that a plain diaphragm, as 40, may be substituted for the part 6, for receiving sounds in the first instance, and for converting them into electromagnetic vibrations and pulsations which may be recorded by any suitable instrument, and the functions and working of the electrodes 9 and the related parts will be substantially the same as above set forth, and that my improved transmitter may be used in connection with electrographs, telephones and talking-machines for either recording or reproducing vibrations, without departing in a material way from the construction, arrangement of operation as herein shown and described.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is—

1. The combination of a diaphragm, a support for said diaphragm, a series of spirally formed electrodes, a support for said electrodes, a series of levers carried by said diaphragm for compressing said electrodes, a series of rods for connecting said levers with said electrodes, and means for adjusting said levers for increasing or decreasing the compressing and relaxing of said electrodes.

2. In combination, a diaphragm, a support for said diaphragm, a series of independent spring electrodes disposed adjacent said diaphragm, a series of levers, one end of said levers connecting to the said diaphragm, the other ends of said levers connected with said electrodes adapted to impart the vibrations of said diaphragm to said electrodes, and means comprising a series of fulcrum rods for adjusting said levers for varying the normal resistance of said electrodes.

3. The combination with a hollow casing, and a diaphragm disposed in said casing, of a plurality of the spirally formed cylindrical electrodes disposed in said casing, a series of rocking levers carried by said diaphragm, a series of rods for connecting said levers with said electrodes, whereby the vibrations of said diaphragm alternately effect the compressing, and permit the relaxation, of said spiral electrodes, for decreasing and increasing the resistance of said electrode, an adjustable fulcrum for each of said levers adapted to control the vibratory movements of said diaphragm for varying the compressing and relaxing movements of said electrodes, and means for adjusting said electrodes for controlling the opening and closing movements of the coils of said electrodes.

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

RICHARD S. M. MITCHELL.

Witnesses:
WM. C. ANDERSON,
HARRY DE WALLACE.