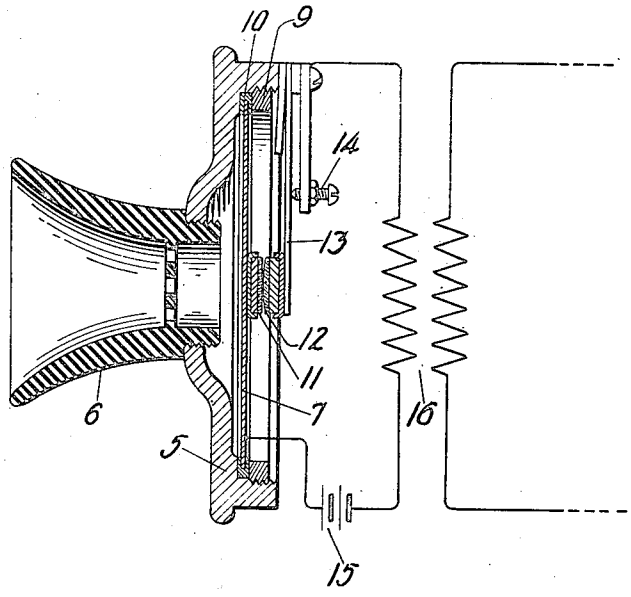
J. B. SPEED.

TRANSMITTER.

APPLICATION FILED NOV. 19, 1919.

1,436,206. Patented Nov. 21, 1922.



Inventor:
James B. Speed.
by Jos. R. Palmer
Atty.

Patented Nov. 21, 1922. 1,436,206

UNITED STATES PATENT OFFICE.

JAMES BUCKNER SPEED, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

TRANSMITTER.

Application filed November 19, 1919. Serial No. 339,216.

To all whom it may concern:

Be it known that I, JAMES BUCKNER SPEED, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Transmitters, of which the following is a full, clear, concise, and exact description.

This invention relates in general to transmitting devices and more particularly to transmitters for telephonic purposes.

The principal object of the invention is to provide a new and improved microphonic transmitting device.

In accordance with this object the present invention provides for varying the resistance between the electrodes of the transmitting device by producing changes in the area of contact between such electrodes, rather than solely through changes in the degree of pressure therebetween. There is further provided a large variation in the area of contact for small changes in pressure by the use of a convex spherical contacting surface of approximately five or more meters radius on one of the electrodes.

The present invention furthermore contemplates the use of silicon carbide, or other suitable material having an elastic limit of the same general order as silicon carbide, for the contacting portions of the electrodes of the transmitting device; the silicon carbide being preferably used in its crystalline form.

The drawing illustrates one embodiment of the invention as applied to a telephone transmitter of the contacting electrode type.

In the form of transmitter shown, a front plate 5 is provided and carries a mouthpiece 6. A diaphragm 7 is seated within a recess at the rear of the front plate 5 and is held therein by means of a clamping ring 9 carried by the front plate. A rubber ring 10 surrounding the periphery of the diaphragm 7 serves to insulate this diaphragm from its respective front plate 5 and also enables the diaphragm to be firmly held in place between the front plate and the clamping ring 9.

The variable resistance element in the transmitter shown comprises a front electrode 11 supported on the diaphragm 7 for movement therewith, and a rear electrode 12 contacting with the front electrode. The rear electrode 12 may be mounted in any suitable manner. In the present instance it is shown as mounted on a flexible spring member 13 carried on the front plate 5. An adjusting screw 14 is also preferably provided in order to obtain proper normal contact between the electrodes 11 and 12. These electrodes are included in an electric circuit with a battery 15. The variations in resistance between the electrodes upon movement of the diaphragm 7 in response to sound vibrations impinging thereon, produces corresponding variations in this circuit, which can be utilized directly for the operation of any suitable receiving or recording device connected in circuit therewith, or indirectly through the interposition of a transformer 16 between the transmitter and the circuit with which the receiving or recording device is to be associated.

In general, it is desirable in transmitters to produce as great a current variation for a given movement of the transmitter diaphragm as can be obtained without injury to the elements of the variable resistance used. Inasmuch as this injury may arise from breaking or permanent deformation of some of the elements due to the pressure therebetween exceeding the breaking or elastic limit of some one or more of the elements used, it is important that such elements should be of material having a high elastic limit. One such material is silicon carbide, commonly known as carborundum, and the very dense solid crystals thereof are particularly desirable for use as transmitter electrodes due to their great density and uniformity, as evidenced by their perfect optical mirror surface. These crystals occur in the electric furnace as flat sharp edged crystals having one plain face with a very fine optical mirror surface. The best electrodes of this material are obtained by choosing homogeneous crystals of suitable size and grinding them to form discs approximately 8 millimeters in diameter and 15/100 of a millimeter in thickness.

The next step in the preparation of carborundum electrodes depends upon the character of contact it is desired to obtain between the transmitter electrodes. In the construction shown it is desired on operation of the transmitter to vary the resistance between the electrodes by producing relatively great variation in the area of contact be-

tween them for moderate changes and pressure, rather than through variation in pressure alone; and the relatively low electrical conductivity of carborundum renders it particularly desirable for use in varying the resistance through changes in the area of contact between engaging electrodes thereof. This is accomplished in the present instance by grinding the front face of the rear electrode to a spherical surface of relatively long radius. While the radius may vary over a considerable range it is preferably in excess of 5 meters, while a radius of approximately 10 meters is not too great for satisfactory operation. For the best results, however, a radius of about 8 meters is preferable. The front electrode cooperating therewith has a plane surface which may be either the natural surface of the crystal or which may be a new surface produced by grinding and polishing.

After grinding, the electrodes may be arranged for mounting by silvering and copper plating the back of the disc and also the adjacent edges thereof. A backing is then formed thereon of metal sufficiently heavy to provide a firm backing and to also serve to radiate heat which may be generated on the passage of current through the electrodes. With electrodes of silicon carbide, the tendency thereof to burn on the passage of current between them is eliminated inasmuch as silicon carbide will not burn except at temperatures considerably higher than those resulting from the operation of the usual type of telephone transmitters. This quality of silicon carbide enables transmitters having contacting electrodes thereof to operate satisfactorily at considerably higher current values than can be used with the usual transmitter constructions. The maintenance of a considerable area of contact between the electrodes is also of aid in reducing the tendency of the transmitter electrodes to burn.

With an electrode approximately 8 millimeters in diameter having its surface ground to a spherical surface of 8 meters radius, or what is known in lens grinding as a $\frac{1}{8}$ diopter, cooperating with another electrode of similar diameter having a plane surface, the area of contact between them varies during the operation of the transmitter from about 1 millimeter, at which the transmitter may be set normally, to an area having a diameter 5 to 10% greater or less, due to changes in pressure. This, of course, involves temporary distortion of the contacting surfaces of the electrodes but does not injure them due to the high elastic limit of the material used therefor. Although silicon carbide is preferred for electrodes due to its non-burning properties, other materials having an elastic limit in the same general neighborhood as silicon carbide and possessed of sufficiently low electrical conductivity to operate satisfactorily due to changes in the area of contact between the electrodes may be used. Carborundum, however, has a peculiar excellence due to the extreme hardness and its strength, and its capacity for the highest excellence of gem polishing kind of surface that may be given to it.

In the operation of the transmitter the mouthpiece 6 directs the sound waves to the diaphragm 7. The sound waves impinging on the diaphragm produce corresponding movements thereof and of the front electrode 11 carried thereby. Similar pressure variations take place as a result between the electrodes 11 and 12 producing corresponding changes in the area of contact between these electrodes and thus producing corresponding current variations of relatively large amplitude in the circuit including the electrodes 11 and 12 and the primary winding of the transformer 16. Corresponding current changes are induced in the secondary winding of the transformer 16 and may be used for the operation of any suitable receiving or recording device operatively associated with the circuit including the secondary winding.

What is claimed is:

1. In a transmitter, a variable resistance element comprising a pair of electrodes adapted to engage each other, and each formed of silicon carbide in crystalline form; the contacting surface of one of the electrodes being the natural surface of a silicon carbide crystal.

2. In a transmitter, a variable resistance element comprising a pair of silicon carbide electrodes adapted to engage each other and movable to vary the extent of engagement therebetween, the contacting surface of one of the electrodes being the natural surface of a silicon carbide crystal, and the contacting surface of the other being substantially convex and finished to have a mirror like surface.

3. In a transmitter, a variable resistance element comprising a pair of silicon carbide electrodes adapted to engage each other and movable to vary the extent of engagement therebetween, the contacting surface of one of the electrodes being substantially plane, and the contacting surface of the other electrode being spherical, the said plane-surfaced electrode being the natural surface of a silicon carbide crystal.

In witness whereof, I hereunto subscribe my name this 17th day of November, A. D. 1919.

JAMES BUCKNER SPEED.