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K. M. TURNER & N. W. JOHNSTON.

CARBON BALL TRANSMITTER.

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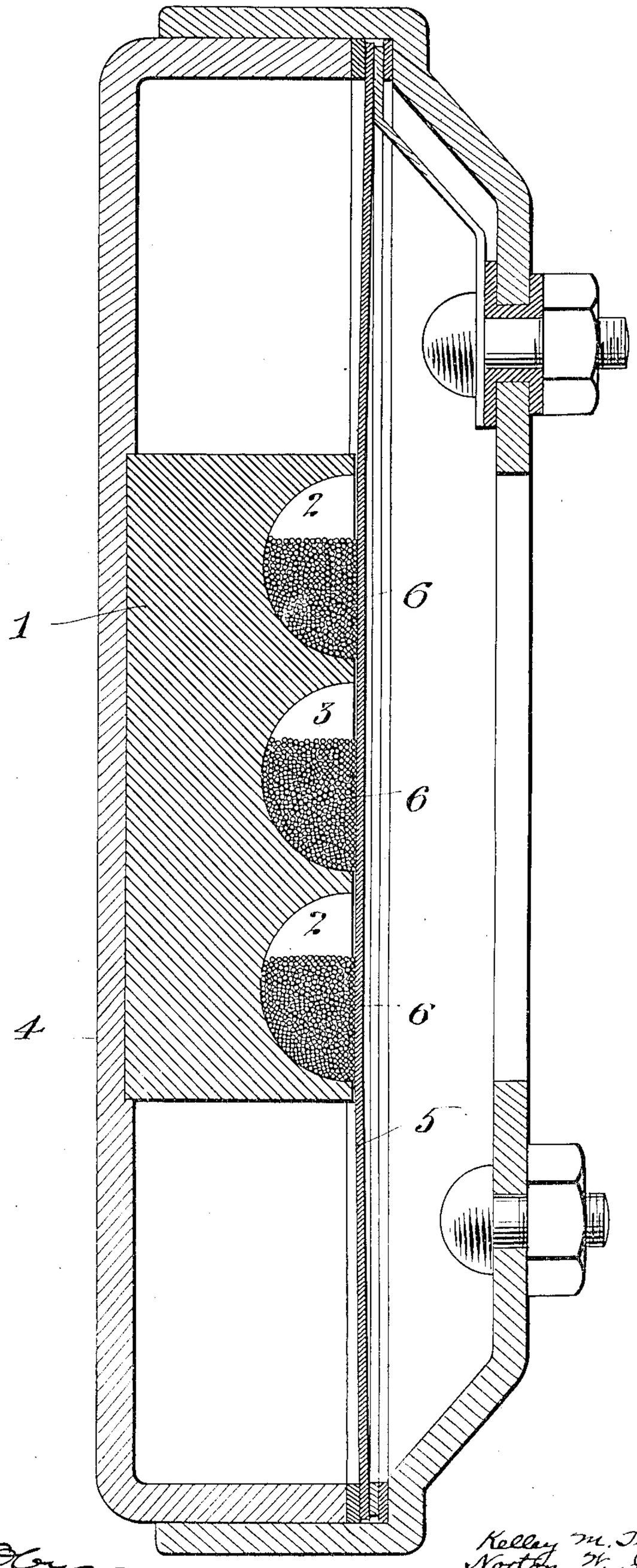

Witnesses
Paul O. Otis
[illegible]

Inventors
Kelley M. Turner and
Norton W. Johnston
By their Attorneys
Rosenbaum & Stockbridge

UNITED STATES PATENT OFFICE.

KELLEY M. TURNER, OF NEW YORK, AND NORTON W. JOHNSTON, OF CHAPPAQUA, NEW YORK, ASSIGNORS, BY MESNE ASSIGNMENTS, TO GENERAL ACOUSTIC COMPANY, A CORPORATION OF NEW YORK.

CARBON-BALL TRANSMITTER.

No. 844,635. Specification of Letters Patent. Patented Feb. 19, 1907.

Original application filed September 8, 1905, Serial No. 277,616. Divided and this application filed September 8, 1905. Serial No. 277,615.

To all whom it may concern:

Be it known that we, KELLEY M. TURNER and NORTON W. JOHNSTON, citizens of the United States, residing, respectively, at the city of New York, county of New York, and State of New York, and at Chappaqua, county of Westchester, and State of New York, have invented certain new and useful Improvements in Carbon-Ball Transmitters, of which the following is a full, clear, and exact description.

Our invention relates to carbon-ball transmitters.

In our companion application, Serial No. 277,616, filed herewith, we have particularly described the features of a transmitter which is adapted to contain carbon balls as the operative element. In the present divisional case, we desire to particularly describe and claim the construction and arrangement of the carbon-ball element *per se*.

Carbon balls have hitherto been used in telephone-transmitters; but so far as we are aware their use has been entirely abandoned in all modern practical telephone-work. The reason for this abandonment was on account of the inertia of the carbon masses, which were constrained to take higher rates of vibration than it was possible for them to attain under the influence of a transmitter-diaphragm. When balls of any ordinary size, such as have always been employed, were used, the vibrations of the diaphragm caused the balls to be knocked back and forth entirely out of rhythm with the diaphragm, so that the electrical pulsations instead of corresponding with the sound are largely the result of the impact of the heavy balls against the diaphragm in their independent movement. In other words, as the diaphragm vibrates the heavy balls acquire such an inertia that they wholly break contact therewith and in returning to position strike the diaphragm-surface with such a hard blow as to produce too great a contact and obviously one having no relation to the sound transmitted. This defect is known as "cracking" or "frying" and is quite intolerable in practice. In order to overcome the defect, such balls have been abandoned and pulverized or granulated carbon substituted therefor, which is free from the above defect, although it is not an advantageous material, since it is apt to pack hard and is not very sensitive. The production of an exceedingly sensitive transmitter is a great desideratum in the telephone art, particularly for long-distance work. Such a transmitter would also be advantageous in local work, since it would avoid the necessity of placing the lips closely thereto, which is obnoxious from a sanitary standpoint. By the present invention we provide such a transmitter.

Our invention consists in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally particularly pointed out in the appended claims.

The drawing shows a greatly-enlarged sectional view of a carbon-ball transmitter embodying the principles of our invention.

Broadly stated, our invention consists in making and using carbon balls of exceedingly reduced diameter, amounting to three or four times as small in diameter and from twenty-seven to eighty-one times as small in mass as those heretofore used. The effect of such a marked reduction in the size of the balls is manifold and leads to the most surprising results in practice. By virtue of the exceedingly-reduced inertia each ball can attain a proportionately higher rate of vibration and in practice a vibration which accords with any ordinary tone of speech used in telephone transmission. Also by virtue of the reduced inertia there is no hammer effect of the balls against the diaphragm when returning thereagainst to produce the objectionable frying and cracking effect heretofore always incident to the use of balls. By virtue of the reduced size the number of points of contact is increased as the cube of the diameter, with a proportionate increase in sensitiveness and efficiency. At the same time there is retained all the advantages which are obviously attendant to loosely-mounted balls—namely, extreme mobility and uniform contact through out the mass which the balls make on account of their symmetrical contour.

Referring to the drawing, which is drawn to a greatly-enlarged scale in order that the shape of the individual balls may be possible of illustration in somewhat near the proper relative size thereof, 1 designates a carbon

block having recesses 2 in the face thereof, which we preferably form of hemispherical section, and polished interiorly in order to obtain more efficient contact and to enable greater mobility of the balls. A convenient arrangement is to make the block 1 circular and to arrange the recesses 2 annularly around the face with an additional cavity 3 at the center.

4 indicates a base-plate into which the block 1 is inset as described in our companion application above referred to.

5 designates the carbon diaphragm, which is supported in exceedingly intimate proximity to, but not actually touching, the block 1, as also set forth in the above case. The arrangement is such that the diaphragm 5 does not vibrate sufficiently to quite touch the block 1 under any ordinary vibrations incident to its use in telephone-work.

Within the recesses 2 we place the carbon balls 6, so as to substantially two-thirds fill each cavity formed between such recesses and the diaphragm 5. The size of these balls approximate the characteristics of very fine sand, they being, in fact, from two-tenths to five-tenths of a millimeter in diameter. These balls lie loosely in their containing-recesses and move about freely among themselves with every vibration of the diaphragm. They do not pack together in use, but retain their mobility and secure a multitude of contact-points, and have masses whose inertia is so small as to accommodate any periodicity of diaphragm vibration.

We do not, of course, desire to be restricted to the exact size of the balls which we employ, it being merely essential to use a size whose inertia is at least ten or twenty times as small as the forms heretofore used, it being evident that every size of ball has its own periodicity of vibration, and it is merely necessary to go beyond the limits of vibration of ordinary speech. The transmitter will work efficiently and avoid frying, cracking, and snapping for any size smaller than the above limit.

What we claim is—

1. In a telephonic transmitter, a block having cavities, a carbon diaphragm in intimate juxtaposition thereto, and carbon balls contained between said diaphragm and said block and loosely collected in said cavities, said balls having a maximum diameter of five-tenths of a millimeter, whereby their natural period of vibration is greater than the period of vibration of ordinary human speech.

2. In a telephonic transmitter, a block having a series of hemispherical cavities polished on their interior faces, each cavity being substantially two-thirds filled with carbon balls loosely resting against the diaphragm, each carbon ball being of a diameter of from substantially two-tenths to five-tenths of a millimeter, whereby the balls may take a periodicity of vibration which accords with that of the diaphragm.

In witness whereof we subscribe our signatures in the presence of two witnesses.

KELLEY M. TURNER.
NORTON W. JOHNSTON.

Witnesses:
ALFRED W. PROCTOR,
FRANK S. OBER.