

[54] **CARBON MICROPHONE**

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179/130; 338/223, 224, 100; 252/29

[56] **References Cited**

**UNITED STATES PATENTS**

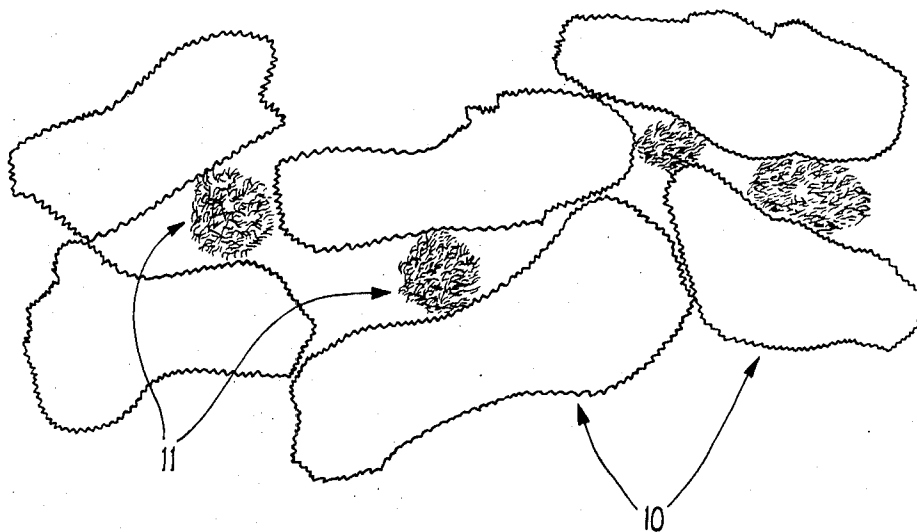
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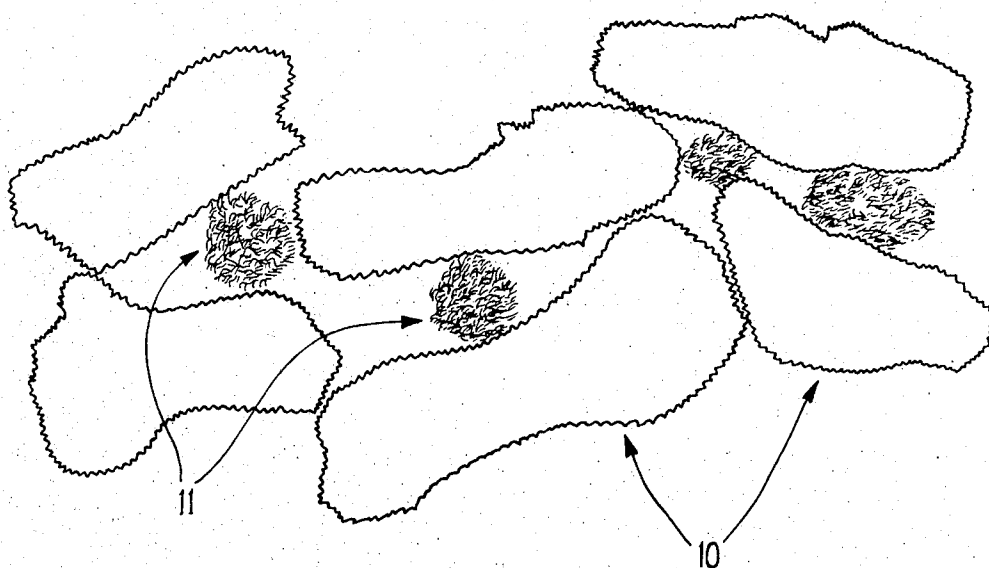
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**ABSTRACT**

This relates to a carbon microphone in which the carbon granules will not pack. This is accomplished by a mixture of carbon granules and aggregated particles of a dry powder lubricant such as a silica material. The powder lubricant form individual masses of between one and 10 microns in size and is not to exceed 2 percent by weight of the mixture.

**4 Claims, 1 Drawing Figure**





## CARBON MICROPHONE

## BACKGROUND OF THE INVENTION

This invention relates to carbon microphones, and more particularly to carbon microphones used in telephones.

Existing carbon microphones suffer, to various degrees, from three major faults:

1. Carbon granules tend to pack into semi-solid blocks, giving reduced sensitivity.

2. According to the angle at which the microphone is held the carbon granules settle into differently shaped piles connecting diaphragm electrode to back-electrode and, thereby, produces varying mechanical stiffness to affect both frequency response and sensitivity.

3. Arcing between granules sometimes produces excessive noise.

One cause common to all these faults is too great a sliding friction between granules which prevents easy relative movement of the granules. It is desirable that the pile of carbon granules shall be constantly rearranged as one speaks to avoid packing and breaking an arc. At present rearrangement of the carbon only occurs for very loud speaking or for "conditioning" of the microphone, that is, deliberately moving it through an angle greater than 90°. If the sliding friction were reduced then automatic "conditioning" would occur for normal speech levels or small movements of the handset.

## SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a carbon microphone which has reduced sliding friction between the carbon granules.

A feature of the present invention is the provision of a carbon microphone comprising: a mixture of carbon granules and aggregated particles of a dry powder lubricant; the aggregated particles forming individual masses of between one and 10 microns in size and not exceeding 2 percent by weight of the mixture.

In a preferred embodiment the dry powder lubricant is a silica material.

## BRIEF DESCRIPTION OF THE DRAWING

Above-mentioned and other features and objects of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawing, the sole FIGURE of which illustrates the action of a dry powder lubricant mixed with carbon granules.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The carbon granules 10 are irregular particles with hard surfaces. The granules are generally of the order of 100 microns in size, while the surface irregularities are in the micron range. The addition of a dry powder lubricant having particles 11 of between one and 10 microns in size reduces friction between granules 10. The dry powder lubricant particles 11 are attracted to the

granules 10 by electrostatic forces and, once they are evenly distributed, act like ball bearings to reduce friction. The lubricant particles can be mixed with the granules by tumbling. Once lubricant particles 11 are attached to granules 10 lubricant particles 11 will adhere quite firmly and are not displaced or broken down by large amplitude vibrations at frequencies of 20 kHz (kilohertz).

It has been found that additions of about 1 percent of dry powder lubricant showed a maximum average increase of 1.5 dB (decibel) to 2 dB in sensitivity with a decrease in sensitivity toward the sensitivity achieved with only carbon granules when adding more dry powder lubricant to the mixture. The sensitivity showed a general tendency to be lower with higher temperatures, but this applied also to microphones with no lubricant added. The improvements in sensitivity are associated with an increase of less than 5 percent in dynamic resistance. Greater improvements are obtained only if resistance is allowed to increase beyond 10 percent. It has also been found that a decrease in sensitivity relative to the sensitivity achieved with only carbon granules occurred if the proportion of dry powder lubricant exceeded 2 percent by weight of the mixture. The dry powder lubricant employed was a silica material.

The drawing shows the distribution density and relative sizes of aggregated silica particles 11 among the carbon granules 10. Part of the sensitivity of a carbon microphone depends on varying the number of contacts between the microscopically rough surfaces of the carbon granules. The aggregated silica particles are accumulations of a multitude of basic silica particles held together by electrostatic forces and appear to form branched fibrous structures between one and 10 microns in size and which are highly compliant. When distributed evenly throughout the carbon granules as shown in the drawing they reduce the tendency of the carbon granules to settle into a solid packed mass and increase the overall average compliance.

While we have described above the principles of our invention in connection with specific apparatus it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of our invention as set forth in the objects thereof and in the accompanying claims.

We claim:

1. A carbon microphone comprising: a mixture of carbon granules and aggregated particles of a dry powder lubricant; said aggregated particles forming individual masses of between one and 10 microns in size and not exceeding 2 percent of weight of the mixture.
2. A microphone according to claim 1, wherein said dry powder lubricant is a silica material.
3. A microphone according to claim 2, wherein said silica material is substantially 1 percent by weight of the mixture.
4. A microphone according to claim 1, wherein said dry powder lubricant is substantially 1 percent by weight of the mixture.

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