

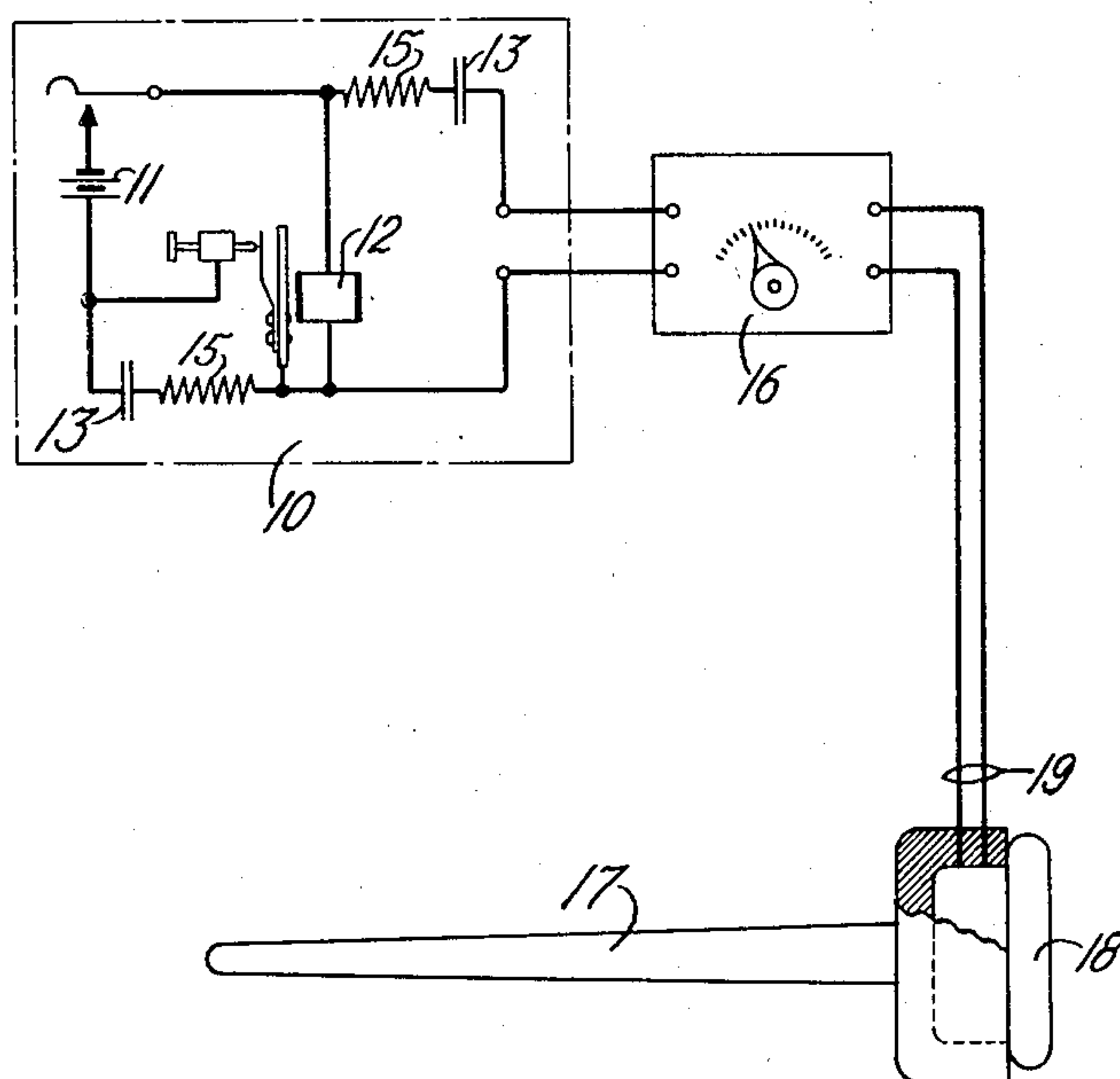
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SOUND MEASURING

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UNITED STATES PATENT OFFICE.

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SOUND MEASURING.

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This invention relates to a sound or noise measuring device and a method of measuring the amount of noise emanating from a given source.

5 In certain mechanical systems, where there are moving parts, the noise may be such as to cause considerable annoyance to either the user or people in the proximity. This is especially true in the higher class automobiles
10 where noiselessness of operation is a very desirable characteristic and is one of the problems which automobile engineers are continually attempting to solve.

The object of this invention is to provide
15 for an indication of or the determination of the amount of sound or noise from a given source, as, for instance, a bearing.

In carrying out this object there is preferably provided an ordinary listening stick
20 in one end of which is mounted a telephone receiver. This receiver is in circuit with a source of electrical power of desired frequency components to actuate the telephone receiver, the amount of power in the receiver
25 being readily variable at will. It is well known from a study of acoustics that one sound may mask another sound and that such masking is dependent, to a certain extent, upon the frequency and intensity of the
30 masked and masking sounds, the intensity, however, being the predominate factor. In carrying out this invention this principle of masking is made use of, the noise or sound from the source to be investigated being used
35 to mask the sound from a known source. A comparison of the electrical power supplied to the receiver when the sound from it is just masked by the noise from the noise source, with the electrical power supplied to the
40 receiver to cause the sound therein to be just inaudible when no other noise is present gives a measure of the noise from the noise source.

The attached drawing shows a preferred
45 form of listening stick and the apparatus used with it and the following description covers this preferred form.

The standard source of power the output from which can be measured is shown schematically at 10, and includes a battery 11,
50 buzzer 12, condensers 13 and resistances 15. An attenuator 16 regulates the power delivered to the telephone receiver. This apparatus forms what is commonly known as an

audiometer, which is well known in the art. 55

The listening stick consists of a rod 17, one end of which is pointed and if desired may be metal tipped. The other end of the stick is cup shaped, as shown, and mounted in this end is a telephone receiver 18, preferably of
60 the watch case type. The receiver is connected to the audiometer through conductors 19 and transforms the electrical power received through this medium into sound energy.

It is understood that the masked tone is developed by the telephone receiver and that the noise to be measured, that is the masking tone, is developed in the ear by the vibration of one or more moving parts to which the
70 pointed end of the stick is applied.

In operation, the listening stick and audiometer are taken to a room in which no perceptible sound exists. The audiometer is then adjusted until the sound produced by
75 the receiver 18 is just imperceptible. The whole device is then taken to the source of the noise to be studied and the pointed end of the stick is applied to the surface or part from which the noise emanates. Again the
80 audiometer is adjusted until the sound produced in the receiver is just imperceptible.

It has been determined that when using the listening device in this manner the sound power supplied by the receiver is less than
85 the power supplied from the noise source, by a substantially constant factor, which may be determined by trial. Further, the sound power intensity from the receiver is proportional to the electrical power input there-
90 to, so that the acoustic noise power bears a constant relation to the electrical power input to the receiver.

The attenuator is calibrated in units loss, that is, with a known amount of power out-
95 put from the buzzer, the maximum loss or highest reading on the attenuator scale produces in the receiver the least sound. As the sound from the receiver is increased, the scale reading becomes less since there is less loss. 100
From this it follows that, if the setting of the attenuator in the quiet room is "X" and the setting when the listening stick is applied to the noise source is "Y" and the masking constant is "A", the intensity B from the
105 noise will be $X - Y + A$. The attenuator may be calibrated in any arbitrary unit as long as the constant factor "A" is in the same unit.

It has been found, however, in practice that it is convenient to use the transmission unit represented by "TU" which is used quite universally in telephone practice.

5 While the embodiment of the invention herein described involves the use of a listening stick and a telephone receiver, the invention in its broader aspects, as expressed in certain of the appended claims may obviously
10 be carried out with other instrumentalities.

What is claimed is:

1. In combination, an element capable of transmitting sound and adapted to be applied
15 to the ear, a source of controllable wave energy for setting up sound waves in said element, means for decreasing the amplitude of said sound waves until the threshold of audibility is reached, and means for
20 transmitting energy from a source of sound to be investigated to said element simultaneously with the setting up therein of the controllable sound.

2. In combination, an element capable of
25 transmitting sound and adapted to be applied to the ear, a source of controllable electrical wave energy for setting up sound waves in said element, means for decreasing the amplitude of said sound waves until the
30 threshold of audibility is reached, and means for mechanically transmitting sound from a source of sound to be investigated to said element simultaneously with the setting up therein of the controllable sound.

35 3. In combination, a listening stick, one end of which is adapted to be applied to a noise or sound source and the other end of which is adapted to be applied to the ear, and means for producing at the end of the
40 stick to which the ear is applied, a sound independent of that from the noise or sound source.

4. In combination, a listening stick, one end of which is adapted to be applied to a
45 noise or sound source to be investigated, the other end of which is adapted to be applied to the ear, means for producing at the end of the stick to which the ear is applied, a sound, independent of that from the source
50 to be investigated, and means to vary the intensity of the sound produced by said means to permit a comparison of the two sources.

5. In a sound measuring device, a listening
55 stick having one end adapted to be applied to a noise or sound source to be investigated, the other end adapted to be applied to the ear, a telephone receiver in the ear end of said stick, a source of electrical im-

pulses, said impulses being audible when applied to said receiver, and means to vary the intensity of said impulses to permit comparison of the two sources.

6. In a sound measuring device, a listening stick having one end pointed so as to
65 be readily applied to a noise or sound producing source to be investigated and having the other end cup-shaped and arranged to be applied to the ear, a telephone receiver mounted in said cup-shaped portion, a source
70 of electrical impulses connected to said receiver, said impulses being made audible therein, and means to vary the intensity of the sound in said receiver produced by said electrical impulses to permit a comparison
75 of the sounds from the two sources.

7. A method of obtaining an indication of the amount of sound emanating from a noise or sound source which comprises utilizing vibrational energy from said source
80 to set up sound waves at a point accessible to the ear of a listener, setting up other sound waves, the intensity of which can be controlled, superimposing upon said controllable sound waves the sound waves obtained
85 from the source to be investigated, and adjusting the intensity of said controllable sound waves until they reach the threshold of audibility.

8. A method of obtaining an indication of
90 the amount of noise emanating from a noise source, utilizing a listening stick having a receiver mounted in the listening end in which a controllable sound may be produced, said method comprising obtaining an indi-
95 cation of the energy supplied to the receiver when the controllable sound only is present and is just at the threshold of audibility and obtaining a second indication of the energy supplied to the receiver when the sound
100 therein is just masked by the noise from the noise source.

9. In combination, an element capable of transforming electrical power to acoustic power and adapted to be applied to the ear,
105 a source of electrical power suitable for transformation to acoustic power by said element, means for decreasing the intensity of said acoustic power until the threshold of audibility is reached, and means for trans-
110 mitting energy from a source of sound to be investigated through said element to the ear simultaneously with the setting up therein of the controllable sound.

In witness whereof, I hereunto subscribe
115 my name this 19th day of March, A. D., 1926.

DAVID G. BLATTNER.