

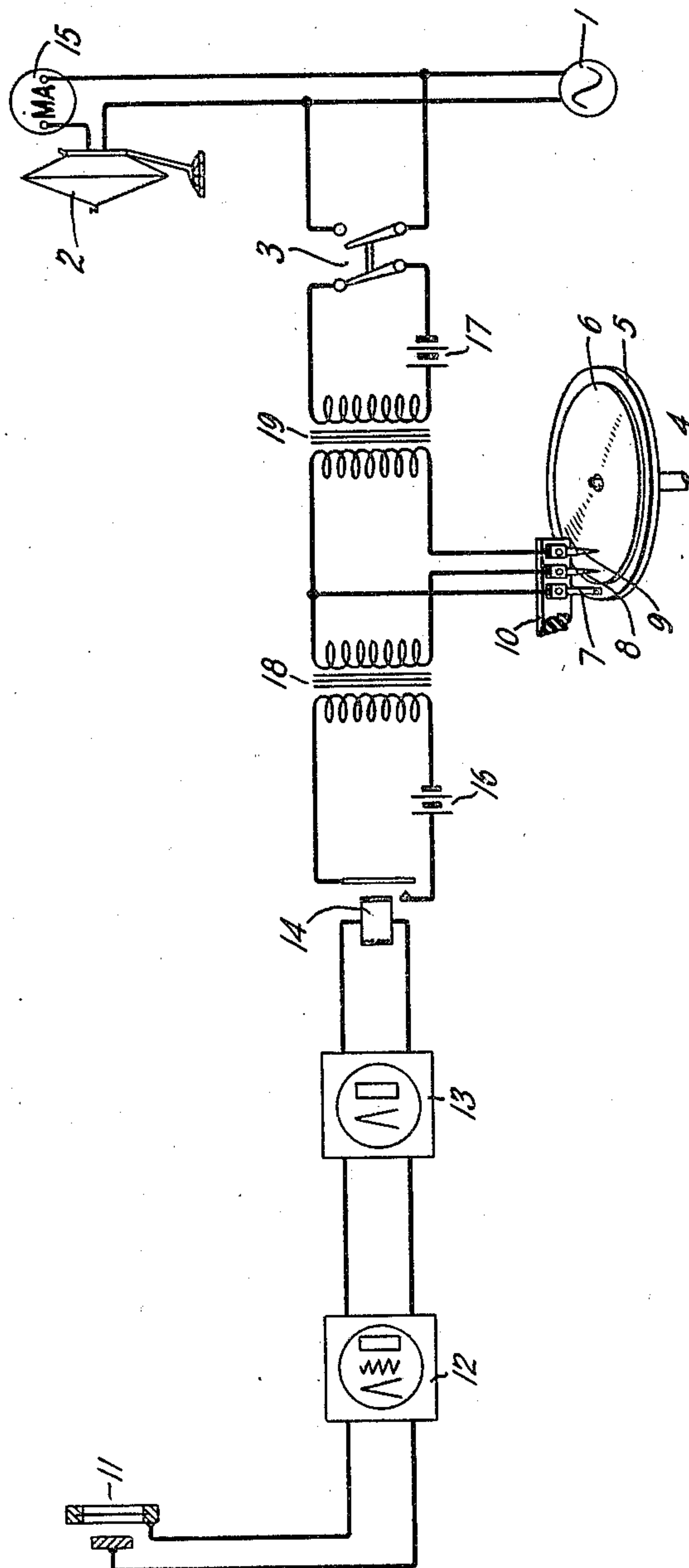
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ACOUSTIC DEVICE

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ACOUSTIC DEVICE.

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This invention relates to measuring systems and more particularly to acoustic devices.

The general object of the invention is to provide a precision method of measuring the rate of decay of wave energy, such as the energy of sound waves. When used to measure sound wave decay, this method determines what is known as the reverberation time of the room under consideration. This time as usually defined is the interval elapsing while the average sound intensity of the room decays 60 TU, or in other words, from any given value to one one-millionth of that value.

Heretofore, reverberation time has been determined by various so-called "threshold" methods differing in detail but all dependent upon the sensitivity of the human ear. It is well known to those skilled in the art that judgment of intensity by ear is unreliable and particularly so just after listening to the tone much in excess of the threshold value which is used in such methods.

According to the present invention this objection is overcome by using only precision apparatus so that errors of judgment cannot impair the accuracy of the result. In the embodiment of this invention shown, the reverberation time is determined by the interval between two sparks. The first of these sparks occurs at the instant when a loud speaker emitting sounds of a known intensity is short-circuited and the second spark results from the release of a relay when the acoustic density level of the room reaches a predetermined minimum value. This method has a further advantage over those previously proposed in that the disturbing effect of extraneous noises can be largely eliminated by choosing a lower limit not at the threshold of audibility, but preferably well above the noise level.

In the drawing, 1 represents an oscillation generator for supplying loud speaker 2 with energy at the desired constant frequency. A switch 3 is provided for simultaneously short-circuiting speaker 2 and opening the primary of transformer 19 when moved from the position in which it is shown. A phonograph turntable 4 is modified to serve as a chronograph in which 5 is a metal disc, 7, 8 and 9 are contacts mounted upon an arm 10, and 6 is a recording surface, preferably a smoked paper chart such as is sometimes used in recording

voltmeters and ammeters. When an electric spark passes through such a chart the smoke film is oxidized leaving a white dot of paper exposed. The pick-up of microphone 11 which is preferably of the condenser transmitter type, is amplified by amplifier 12, rectified by rectifier 13, and finally energizes relay 14.

The operation of the meter is as follows: Suitable upper and lower limits of acoustic density are chosen according to the nature of the room under test, the amount of extraneous noise, the capacity of the speaker, etc. The room is first brought to a steady state at the lowest practical acoustic density and the reading of the milliammeter 15 noted as a measure of that density. With the oscillator 1 maintaining this steady state, amplifier 12 is adjusted so that the pick-up of microphone 11 is just insufficient to hold relay 14 in its operated position.

The output of oscillator 1 is then increased; the room is again brought to a steady state, this time at the highest practical acoustic density, and the corresponding milliammeter reading is again noted. To avoid error in the result, particular care should be taken at this juncture not to overload the speaker for when overloaded its output is no longer proportional to the milliammeter reading. At the higher value chosen the energy picked up by microphone 11 will, of course, hold relay 14 operated and switch 3 being in the position shown, batteries 16 and 17 will circulate current in their respective circuits.

Switch 3 is then moved to the right. The sudden interruption of the current in the primary of transformer 19 will by induction cause a spark to pass between contact 9 and the metal disc 5 and mark the rotating recording surface 6. The speaker is now short-circuited so that the energy level of the room will begin to decrease at a rate depending upon the total absorption of the room. In accordance with the adjustment already described, relay 14 will release when the lower value of acoustic density is reached. The release of the relay 14 interrupts the current in the primary of transformer 18 and as in the previous case a spark is produced to mark the record, this time between contact 8 and the disc 5. During the interval between these sparks the table 4 has been revolving at a constant known speed, so that when

the angular displacement between the marks on the recording surface 6 has been measured, the interval may easily be calculated.

When it is impractical to use upper and lower limits differing by 60 TU other values may be used and their ratio determined from the ratio of the milliammeter readings at those values. When the time of decay over this range is known the "time of reverberation" or time of decay over a 60 TU range may be determined by simple proportion.

The relative value of the acoustic densities may also be determined by adjusting the amplification through amplifier 12 so that the relay 14 releases at the lower level chosen and then noting the decrease in amplification necessary to make the relay release at the higher level. It will be evident to those skilled in the art that many other modifications may be made without departing from the spirit and scope of this invention.

What is claimed is:

1. In a device for measuring time of reverberation, a source of sound, a sound detector for translating sound from the source into electric currents, and chronograph means responsive to the currents upon the deenergization of the sound source for recording the rate of decay of sound.

2. In a device for measuring time of reverberation, a source of sound of known intensity, a sound pick-up system for translating

sounds from said source into electric currents, means for deenergizing said source, relay means operative when said currents have decayed to a predetermined value, and means for recording the time elapsing between the deenergization of said source and the operation of said relay means.

3. In a measuring device the combination with a source of wave energy and a pick-up device of means responsive to wave energy for determining the time interval during which the wave energy from the source decays from one predetermined value to another.

4. In a measuring device, the combination with a source of sound energy, a sound pick-up device and other means of automatic means responsive to the deenergization of the source and to the other means for determining the rate of decay of the sound energy.

5. In a measuring device, a source of sound, means for deenergizing the source, a sound pick-up, an amplifier and a rectifier associated with the sound pick-up, electromagnetic means responsive to the output of the rectifier, recording means, and means associated with the deenergizing means and the electromagnetic means for operating the recorder.

In witness whereof, I hereunto subscribe my name this 11th day of January, 1928.

EDWARD C. WENTE.