Nov. 17, 1925. 1,561,452

C. R. ALDEN

SPEED MEASURING DEVICE

Filed Jan. 28, 1925 2 Sheets-Sheet 1

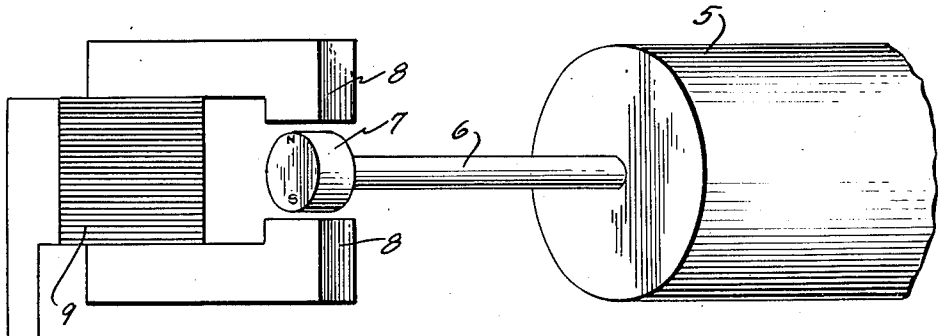


Fig. 1

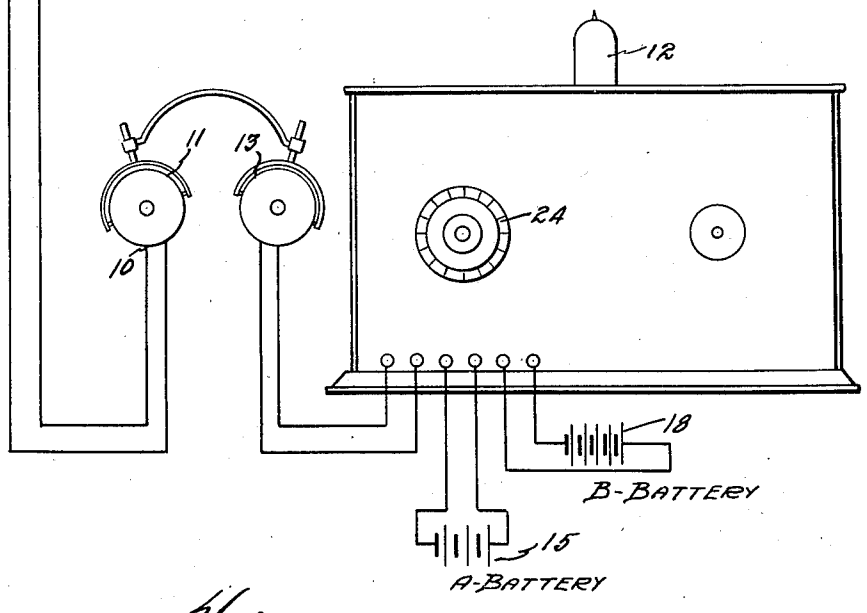


Fig. 2

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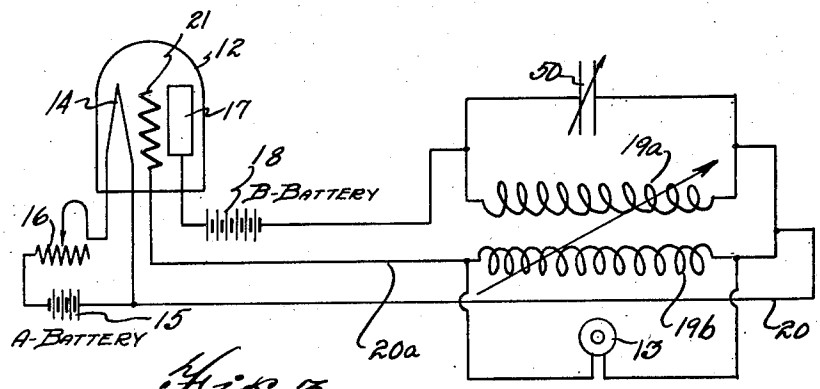


Fig. 3

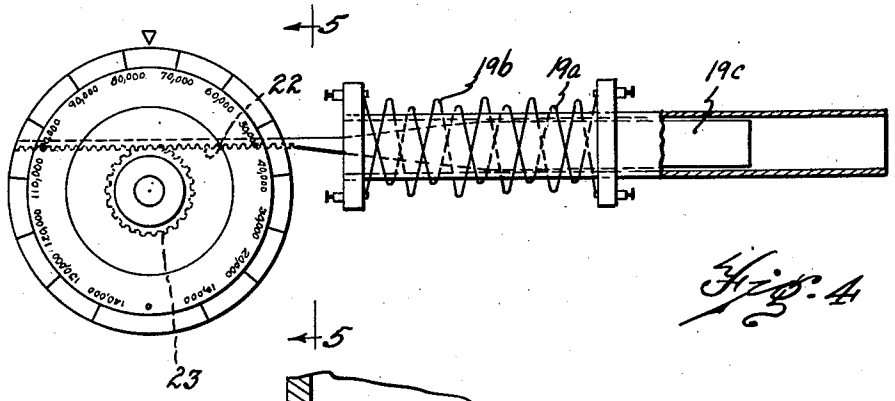


Fig. 4

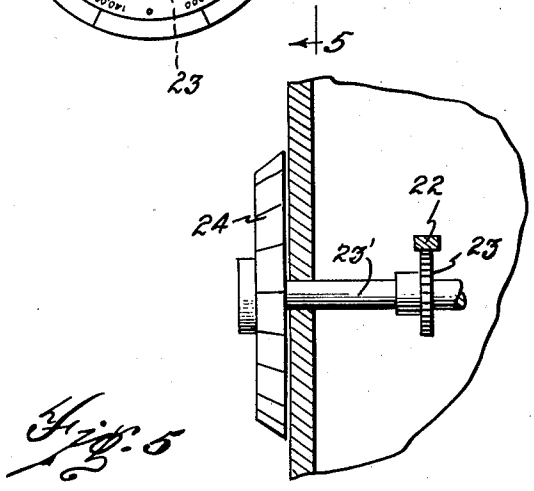


Fig. 5

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1,561,452

UNITED STATES PATENT OFFICE.

CARROLL R. ALDEN, OF DETROIT, MICHIGAN, ASSIGNOR TO EX-CELL-O TOOL AND MANUFACTURING COMPANY, OF DETROIT, MICHIGAN.

SPEED-MEASURING DEVICE.

Application filed January 28, 1925. Serial No. 5,410.

To all whom it may concern:

Be it known that I, CARROLL R. ALDEN, a citizen of the United States, and resident of Detroit, in the county of Wayne and State of Michigan, have invented new and useful Improvements in Speed-Measuring Devices, of which the following is a specification.

This invention relates to means for measuring relatively high speeds of rotation.

The primary object of my invention is the mounting of means upon the rotating mechanism to be measured for developing electrical current alternations capable of producing musical notes audible in an ordinary head-set ear phone, such notes varying according to the frequency of such alternations, and then developing a similar note in an adjacent ear phone by means of an apparatus under manual control and adjustable to secure various notes corresponding to those developed by known rotative velocities.

It has long been known that a bipolar magnetized rotor rotating at 15660 R. P. M. and controlling the magnetic flux linking with an inductor coil will generate in this coil electrical alternations of a frequency of 261 cycles per second. These alternations, when impressed on an ordinary head-set ear phone will engender 261 vibrations per second thus setting up the musical note corresponding to middle C of the musical register. And other notes have been developed by the same device rotating at appropriate speeds. In practice, however it is extremely difficult to recognize the notes developed at different rotative speeds and comparison has had to be made with tuning forks or musical instruments, or with the musical note engendered by a multipolar alternator driven at a known or measurable speed. Very few musical instruments are fitted for the use, and even when the best are used only highly skilled workmen can be used for accurately comparing the respective notes. The apparatus required for making such comparison is not readily portable nor is suitable electric current for driving certain apparatus above mentioned always available. A leading object of my invention is the arrangement of simple, and readily portable means engendering musical notes by electricity with provisions for varying the notes at will and for securing a multiplicity of vibrations to effect sounds intermediate the usual musical notes of the register.

A further object of my invention is the provision of electrical apparatus under manual control for developing a plurality of sounds audible in an ear phone adapted to overlie one ear while an ear phone adapted to overlie the other ear receives sounds developed by electrical alternations in accordance with the speed of the mechanism to be measured.

Other objects and advantages will be apparent from the following description, wherein reference is made to the accompanying drawings illustrating a preferred embodiment of my invention and wherein similar reference numerals designate similar parts throughout the several views.

In the drawings:

Fig. 1 is a perspective view of the mounting on the device to be measured of my improved means for securing electrical alternations.

Fig. 2 is a front elevation of the manually controlled electrical means for developing sounds to be compared with the sounds developed by the alternations under the control of the device to be measured.

Fig. 3 is a diagrammatic view of the electrical apparatus for developing the comparable sounds, and

Fig. 4 is an enlarged detail view of the manually controlled mechanism for controlling the frequency of the alternations by which the comparable sounds are secured.

Fig. 5 is a cross-sectional view on the line 5—5 of Fig. 4.

Referring now to the drawings, the numeral 5 designates the extremity of the rotating member of a turbine or other device capable of being rotated at relatively high speeds. It will be understood that turbines driven by steam or compressed air, engines, motors and the like may all be measured by my improved speed measuring device, and since the turbine, etc. forms no essential part of the measuring device, no attempt is made herein to illustrate or describe a complete turbine structure, merely

sufficient being illustrated to depict a preferred manner of mounting the driven portion of my improved speed measuring device. Clamped or otherwise secured at the extremity of the rotating member 5 is a stub shaft 6 carrying a magnetized disc 7, preferably of hardened steel. The rotor disc 7 is so magnetized that its north and south poles are diametrically opposed to each other, substantially as illustrated in Fig. 1. The rotor disc 7 is adapted to rotate between the spaced extremities of a laminated core 8 of an inductor coil 9, the ends of which coil are respectively connected to the proper terminals 10 of an ordinary ear phone 11, such as is used with the usual telephone head set. By virtue of this arrangement the rotation of the rotor disc 7 will effect alternations of current in the inductor coil 9 in conformity with the speed of rotation of the rotor disc, and the alternations thus engendered will develop sounds in the ear phone 11 varying according to the frequency of the alternations. It will, therefore, be apparent that sounds will be devepoped in the ear phone 11 that are comparable with similar sounds developed by known rotative speeds and that, accordingly, the speed of rotation of the rotor disc 7 may be determined.

The apparatus for developing the sounds with which the sounds developed in the ear phone 11 are compared will now be described: An oscillatory circuit including the usual three-electrode vacuum tube 12 is arranged to actuate the ear phone 13 so that the sounds engendered in the ear phone 13 varies in accordance with the frequency of the oscillatory circuit. As best illustrated in Fig. 3 the filament 14 of the vacuum tube is connected with the terminals of an A-battery 15, a suitable filament rheostat 16 being interposed between the battery and the filament. The plate 17 of the tube is connected to the positive terminal of a B-battery 18, the negative terminal of which is connected with one extremity of a condenser 50 and variable inductance 19^a, preferbly constructed with a coil surrounding a tapered core 19^c adjustable relatively to the coil to vary the frequency of the oscillatory circuit by varying inductance of the circuit, while the opposite extremity of the condenser 50 and inductance coil 19^a are connected by a wire 20 with the filament 14 of the vacuum tube. Coil 19^b is superimposed upon 19^a and magnetically linked therewith. One extremity of coil 19^b is connected by a wire 20^a to grid 21. The other extremity of coil 19^b is connected to filament 14 by wire 20. The ear phone 13 is arranged in the circuit with one of its terminals connected to one extremity of the coil 19^b and its other terminal connected with the other extremity of coil 19^b. By virtue of this arrangement the oscillatory circuit will produce sounds in the ear phone 13 in accordance with the variations of the frequency of the oscillatory circuit, such variations being secured by manually adjusting the position of the tapered core 19^c of the inductance coil 19^a. As herein shown, I have connected the tapered core 19^c with a rack 22 meshing with a pinion fixed on the shaft 23 of a dial 24 so that the rotation of the dial in the proper direction will longitudinally move the tapered core 19^c relatively to the coil 19^a to increase or diminish the inductance of the coil 19^a and thereby vary the frequency of the oscillatory circuit. I preferably mark upon the face of the dial 24 the number of revolutions per minute needed to produce the note engendered in the ear phone 13 by the oscillatory circuit at varying positions of the tapered core 19^c. This must be determined empirically. Reference to various authoritative tables, however, will show that a note corresponding to the middle C of the musical register is developed when the alternations of a bipolar alternating current generator driven at 15660 R. P. M. are impressed upon the ordinary head-set ear phone, and that the C of the next octave requires twice as many R. P. M. as the middle C, and so forth for the other notes. The dial may, accordingly, be graduated by a series of marks placed when the adjustment of the tapered core has been such as to develop the middle C in the oscillatory circuit, then the middle D, and so on, or if desired the half notes can be also marked. By marking the number of revolutions per minute required to develop the note in place of the note itself, it makes it much easier for the operator to quickly determine the rotative speed of the device being measured. It will be apparent that graduations can be made on the dial between the various points marked during the experimental setting above described, and that, accordingly, sounds intermediate the notes of the musical register can be compared with sounds developed under the control of the device to be measured, whereby practically any rotative speed can be quickly determined through the agency of my improved device.

While it will be apparent that the illustrated embodiment of my invention herein disclosed is well calculated to adequately fulfill the objects and advantages primarily stated, it is to be understood that the invention is susceptible to variation, modification and change within the spirit and scope of the subjoined claims.

Having described my invention, I claim:

1. In a speed measuring device, means under the control of the mechanism to be measured for electrically producing a musi-

cal note, and manually controlled means for electrically producing a corresponding note adjacent the first mentioned note for comparison therewith.

2. In a speed measuring device, means under the control of the mechanism to be measured for electrically producing a musical note, and an oscillatory circuit for electrically producing a corresponding note adjacent the first mentioned note for comparison therewith, including manually operative means for varying the frequency of the circuit.

3. In a speed measuring device, means under the control of the mechanism to be measured for electrically producing a musical note including an ear phone, manually controlled means for electrically producing a corresponding note adjacent the first mentioned note for comparison therewith, and an ear phone connected with the last mentioned means to localize the audibility of the note produced thereby.

4. In a speed measuring device, means under the control of the mechanism to be measured for electrically producing a musical note, an oscillatory circuit for electrically producing a corresponding note adjacent the first mentioned note for comparison therewith, including manually operative means for varying the frequency of the circuit, and a three-electrode vacuum tube having its plate and grid connected to the manually operative means.

5. In a speed measuring device, a pair of head-set ear-phones, and separate electric mechanisms for producing in each ear phone substantially the same musical note, one of the said mechanisms being under the control of the device whose speed is being measured, and the other being under manual control.

6. In a speed measuring device, a pair of head-set ear-phones, and separate electric mechanism for producing in each ear phone substantially the same musical note, one of the said mechanisms being under the control of the device whose speed is being measured, and the other including an oscillatory circuit having manually operative means for varying the frequency of the circuit.

7. In a speed measuring device, a pair of head-set ear-phones, and separate electric mechanisms for producing in each ear phone substantially the same musical note, one of the said mechanisms being under the control of the device whose speed is being measured, the other including an oscillatory circuit having manually operative means for varying the frequency of the circuit, and a three-electrode vacuum tube whose grid and plate are connected to such manually operative means.

8. In a speed measuring device, a magnetized rotor disc secured to the mechanism whose speed is being measured, an inductor coil having the ends of its core adjacent the rotor disc, an ear phone connected with the inductor coil, an oscillatory circuit having manually operative means for varying the frequency of the circuit, and an ear phone connected to the oscillatory circuit.

9. In a speed measuring device, a magnetized rotor disc secured to the mechanism whose speed is being measured, an inductor coil having the ends of its core adjacent the rotor disc, an ear phone connected with the inductor coil, whereby musical notes will be audible in the ear phone according to the frequency of rotations of the rotor disc, an oscillatory circuit for producing musical notes comparable with the first mentioned musical notes, including a three-electrode vacuum tube, and manually operative means for varying the frequency of the oscillatory circuit.

10. In a speed measuring device, a magnetized rotor disc secured to the mechanism whose speed is being measured, an inductor coil having the ends of its core adjacent the rotor disc, an ear phone connected with the inductor coil, whereby musical notes will be audible in the ear phone according to the frequency of rotations of the rotor disc, an oscillatory circuit for producing musical notes comparable with the first mentioned musical notes, including a three-electrode vacuum tube, an A-battery connected to the filament of such tube, a B-battery connected between the plate and filament of the tube, a variable inductance also connected between the plate and filament of the tube and having manually operative means for varying the frequency of the circuit, and an ear phone connected with the circuit to render audible the musical notes produced thereby.

11. In a speed measuring device, a magnetized rotor disc secured to the mechanism whose speed is being measured, an inductor coil having the ends of its core adjacent the rotor disc, an ear phone connected with the inductor coil, whereby musical notes will be audible in the ear phone according to the frequency of rotations of the rotor disc, an oscillatory circuit for producing musical notes comparable with the first mentioned musical notes, including a three-electrode vacuum tube, and manually operative means for varying the frequency of the oscillatory circuit comprising a pair of superposed coils, a core movable within said coils, and means for moving the core.

12. In a speed measuring device, a magnetized rotor disc secured to the mechanism whose speed is being measured, an inductor coil having the ends of its core adjacent the rotor disc, an ear phone connected with the inductor coil, whereby musical notes will be audible in the ear phone according to the frequency of rotations of the rotor disc, an

oscillatory circuit for producing musical notes comparable with the first mentioned musical notes, including a three-electrode vacuum tube, manually operative means for varying the frequency of the oscillatory circuit comprising a variable inductance arranged between the plate and filament of said tube and including a pair of superposed coils, a tapered core movable within said coils and carrying a rack, and a dial carrying a pinion meshing with the rack.

In witness whereof I hereunto set my hand.

CARROLL R. ALDEN.