Aug. 2, 1932. A. M. CURTIS 1,869,884

TESTING DEVICE

Filed July 9, 1930

FIG. 1

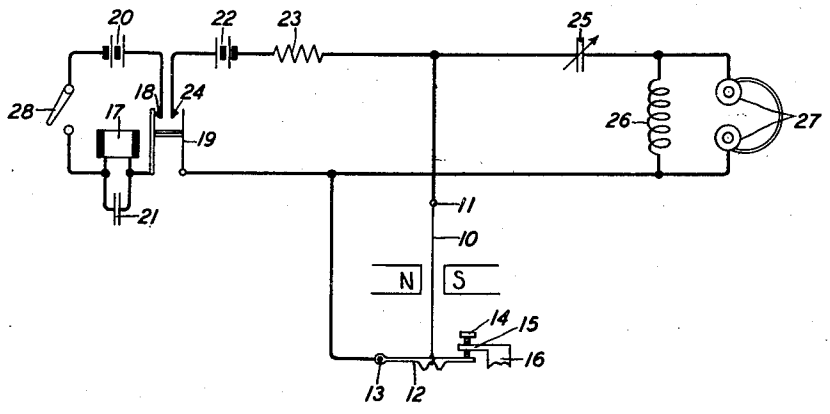
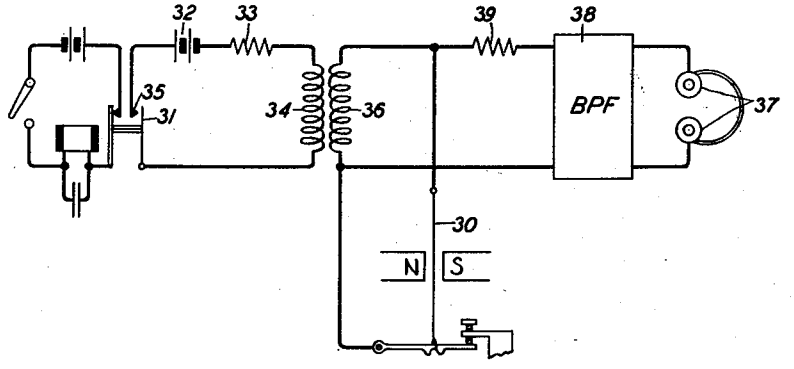


FIG. 2



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UNITED STATES PATENT OFFICE

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TESTING DEVICE

Application filed July 9, 1930. Serial No. 466,732.

This invention relates to testing devices, and more particularly to a device and method for testing the stress in a member under tension.

In many instances it is desirable to adjust the stress in a member under tension and unless there is some guidance as to the amount of tension in the member during this adjustment the member may very easily become overstressed. As an example, in string galvanometers and in light valves the tension in the strings must frequently be adjusted in order to compensate for changes in the temperature, etc.

In providing a device for determining the amount of stress in a member under tension, advantage is taken of the fact that a metallic string when plucked and subsequently allowed to vibrate in a magnetic field generates an alternating E. M. F. the frequency of which is the natural frequency of the string's vibration. By utilizing this alternating E. M. F. it is possible to give an audible signal in a pair of telephone receivers without at the same time damping the string so severely that the musical character of the note is lost.

In accordance with the preferred form of this invention the string to be tested is vibrated in a magnetic field and the alternating E. M. F. thus produced is translated by any suitable means into a musical note. The tension in the string is then adjusted until the musical note produced corresponds to a standard musical note.

In accordance with another form of this invention the E. M. F. produced by the vibrating string is applied to the input of a narrow band pass filter, the output of which contains a pair of telephone receivers. In this embodiment of the invention a musical note will be produced in the telephone receivers only when the string is adjusted to vibrate at a frequency within the transmission band of the filter.

A clearer understanding of this invention may be had by reference to the accompanying drawing wherein Figs. 1 and 2 represent various embodiments of this invention.

Referring to Fig. 1 a metallic string 10 such as the string ordinarily used in string galvanometers, or in light valves is mounted between the poles N and S of a permanent magnet thus maintaining the string in a constant magnetic field. One end of string 10 is secured to a stationary support 11 and the other end of the string is fastened to lever arm 12, one end of which is pivoted at 13 and the other end of which terminates under the end of adjustable screw 14 which screw is in threaded engagement with the extending portion 15 of a stationary supporting member 16. The tension of the string 10 may be varied by simply raising or lowering the screw 14. A relay 17 carrying armatures 18 and 19 is arranged to vibrate at a comparatively low frequency by power supplied from battery 20 through an ordinary bell ringing circuit the rate of vibration being controlled by condenser 21 which is shunted around the winding of relay 17. Armature 19 in vibrating opens and closes a circuit from battery 22, through resistance 23, string 10, lever arm 12, armature 19, contact 24, back to battery. The current in passing through string 10 causes it to be attracted and repelled by the stationary poles N and S, the rate of attraction and repulsion being controlled by the natural period of vibration of armature 19. This causes the string 10 to vibrate in the steady magnetic field which exists between these poles, the vibration being effectively damped by resistance 23. This vibration of string 10 in a magnetic field sets up an alternating E. M. F. which is translated into audible signals by means of an A. C. detecting circuit. This detecting circuit comprises a variable condenser 25 and an inductance coil 26 shunted around the terminals of the string, the inductance coil 26 being in turn shunted by a pair of telephone receivers 27. This circuit is chosen so as to be relatively high in impedance for all frequencies, but is tuned approximately to the frequency to which it is desired to adjust the string, the tuning being accomplished by properly proportioning the relation between the condenser 25 and the inductance coil 26.

In operation the procedure is simply to start the vibration of armature 19 by closing switch 28. This opens and closes the circuit

through the string under adjustment and causes it to vibrate in the steady magnetic field which exists between the poles N and S. This vibration of the string in the magnetic field generates an alternating E. M. F. which is translated into a musical note in the telephone receivers 27. The tension in the string is then varied until the tone produced by the vibrating string is the same as that of a tuning fork or similar device used as a reference standard.

Referring to Fig. 2 there is shown a slightly different arrangement for accomplishing the same result. In this arrangement a string 30 is mounted between the poles N and S of a permanent magnet in a manner similar to that in which string 10 is mounted in the previous embodiment of this invention. An armature 31 is arranged to vibrate in a manner similar to the manner in which armature 19 of relay 17 is vibrated and this armature in vibrating opens and closes a circuit from battery 32, through resistance 33, primary winding 34, armature 31 contact 35, back to battery. This generates short impulses in the secondary winding 36 and string 30 is vibrated accordingly in the magnetic field which exists between poles N and S. The note produced by the vibration of the spring is also detected by an A. C. detecting circuit. This circuit comprises a pair of telephone receivers 37 connected to the output of a narrow band pass filter 38 which is connected across the terminals of spring 30. The input circuit of the narrow band pass filter and the secondary circuit of the transformer are protected by resistances 33 and 39 respectively, which resistances are sufficiently high to avoid appreciable electrical damping of the string. In this embodiment of the invention a musical note is heard in the telephone receivers only when the string is adjusted to vibrate at a frequency within the transmission band of the filter 38.

In operation the procedure is to adjust the band pass filter and to start armature 31 vibrating. The tension on string 30 is then adjusted until a musical note is heard in the telephone receivers.

From the foregoing it is obvious that when greater accuracy of adjustment is required the method of test might be extended by connecting a vacuum tube amplifier between the string terminals and the A. C. detecting circuit, which circuit might consist of sharply tuned resonant circuits with rectifier-detectors thus permitting the accuracy of adjustment to be made as great as might be desired.

What is claimed is:

1. The method of determining the stress in a member under tension which consists in vibrating said member in a constant magnetic field to generate an alternating E. M. F., transmitting certain frequencies while suppressing all other frequencies of said E. M. F., translating the transmitted frequencies into a musical note and comparing said note with a musical note of a given frequency.

2. The method of adjusting a member under tension so that the stress in said member is within predetermined limits which consists in vibrating said member in a constant magnetic field to generate an alternating E. M. F., transmitting a narrow band of frequencies while suppressing all other frequencies of said alternating E. M. F., translating the transmitted frequencies into a musical note and varying the tension of said vibrating member until its natural period of vibration is substantially equal to the transmitted frequency of the alternating E. M. F.

3. A device for testing the stress in a member under tension comprising means for producing a steady magnetic field, means for vibrating said member in said field to generate an alternating E. M. F. and a tuned detecting circuit to measure the frequency of said generated alternating E. M. F.

4. A device for testing the stress in a number under tension comprising means for vibrating said member in a constant magnetic field to produce an alternating E. M. F., means including a tuned detecting circuit for translating said alternating E. M. F. into a musical note, and means for varying the tension of said member to bring the frequency of said note within predetermined limits.

5. A device for testing the stress in a member under tension comprising means for producing a steady magnetic field, means for vibrating said member in said field to generate an alternating E. M. F., an A. C. detecting circuit to measure the frequency of said generated alternating E. M. F., and means included in said detecting circuit to tune said circuit to a desired frequency.

6. In a device for adjusting the stress in a member under tension, a permanent magnet for producing a steady magnetic field, a vibratory circuit comprising a source of power and a relay for vibrating said member in said field to generate an alternating E. M. F., means for adjusting the tension in said member to vary the frequency of said alternating E. M. F., means included in said circuit for damping the vibration of said member, an alternating current detecting circuit to measure the frequency of said generated alternating E. M. F., and means included in said detecting circuit to tune said circuit to a desired frequency.

7. In a device for adjusting the stress in a member under tension, a permanent magnet for producing a steady magnetic field, means for mounting said member in said field, a vibratory circuit comprising a source of power, and a double contact relay for vibrating said member in said field to generate an alternating E. M. F., means for adjusting the tension in said member to vary the fre-

quency of said alternating E. M. F., means included in said current for damping the vibration of said member and an alternating current detecting circuit to measure the frequency of said alternating E. M. F., said circuit comprising a variable resistance and an inductance coil shunted across said member and a pair of telephone receivers shunted across said inductance coil.

In witness whereof, I hereunto subscribe my name this 8th day of July, 1930.

AUSTEN M. CURTIS.