Sept. 4, 1956 J. W. QUITMEYER 2,761,994

TUNING DEVICES

Filed May 7, 1952 5 Sheets-Sheet 1

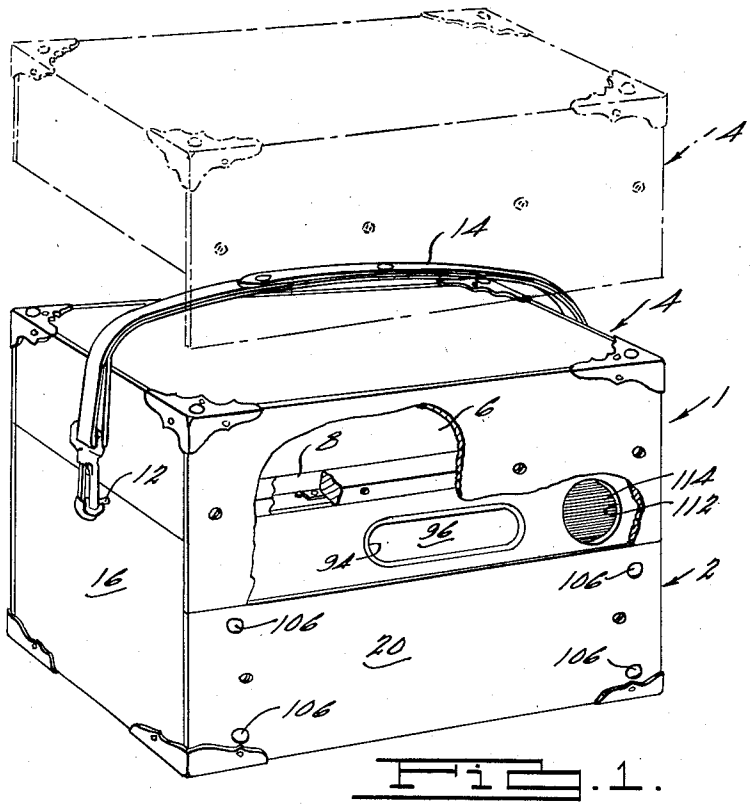


Fig. 1.

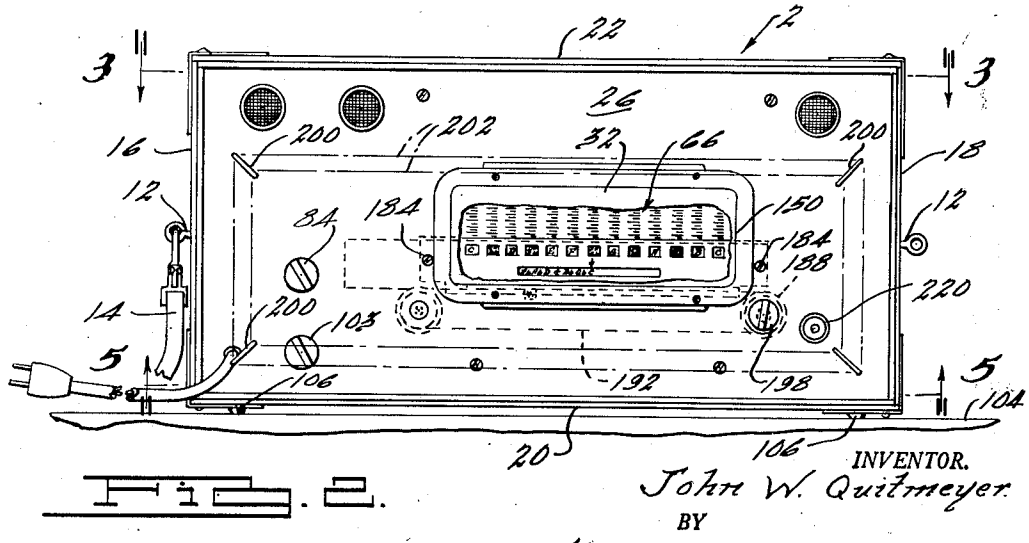


Fig. 2.

INVENTOR.
John W. Quitmeyer
BY
Harness, Dickey & Pierce.
ATTORNEYS.

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TUNING DEVICES

Filed May 7, 1952 5 Sheets-Sheet 2

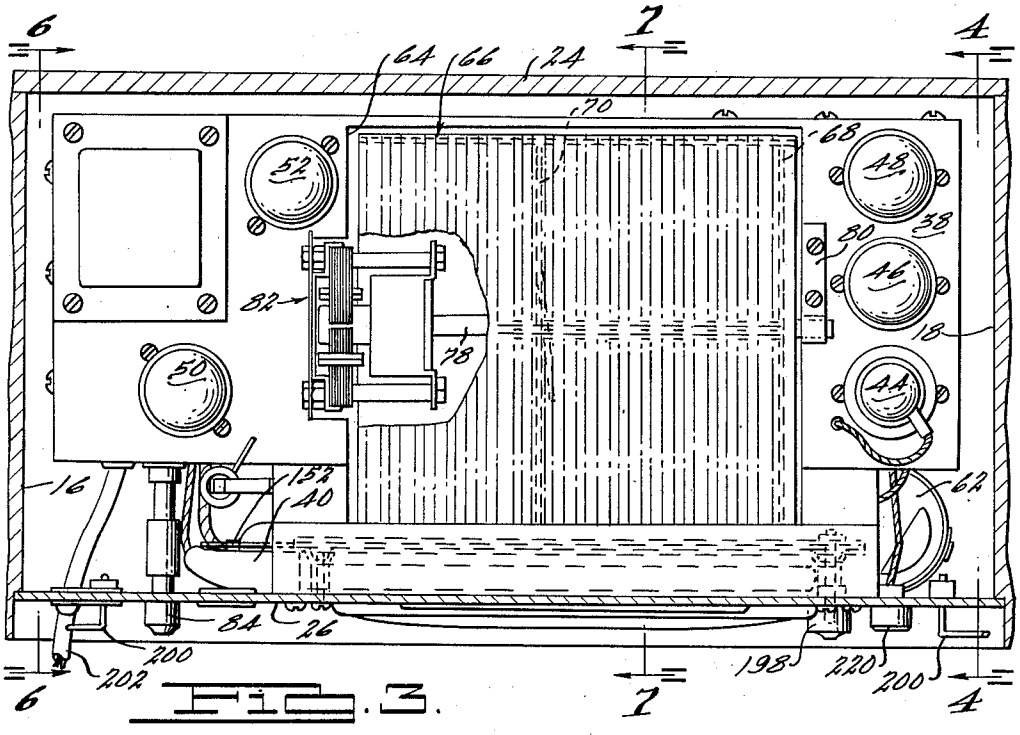


Fig. 3.

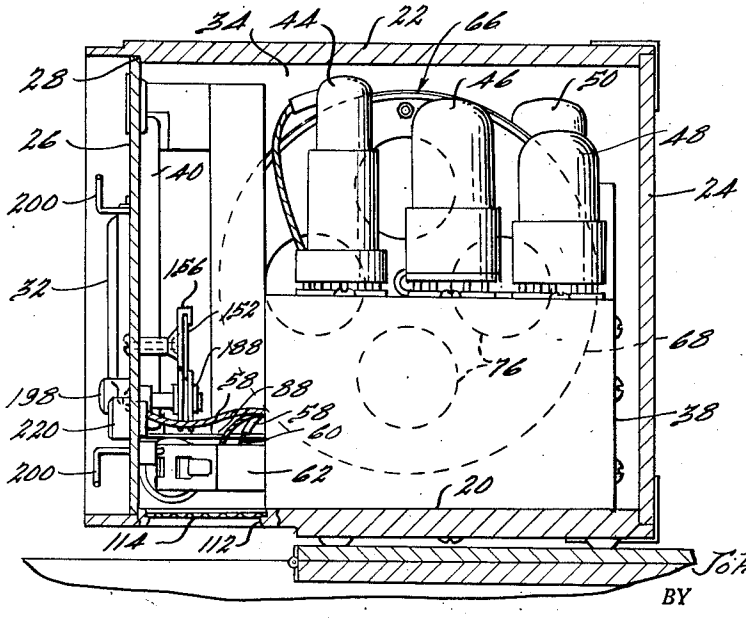


Fig. 4.

INVENTOR.
John W. Quitmeyer
BY
Harness, Dickey & Pierce
ATTORNEYS.

Sept. 4, 1956 J. W. QUITMEYER 2,761,994

TUNING DEVICES

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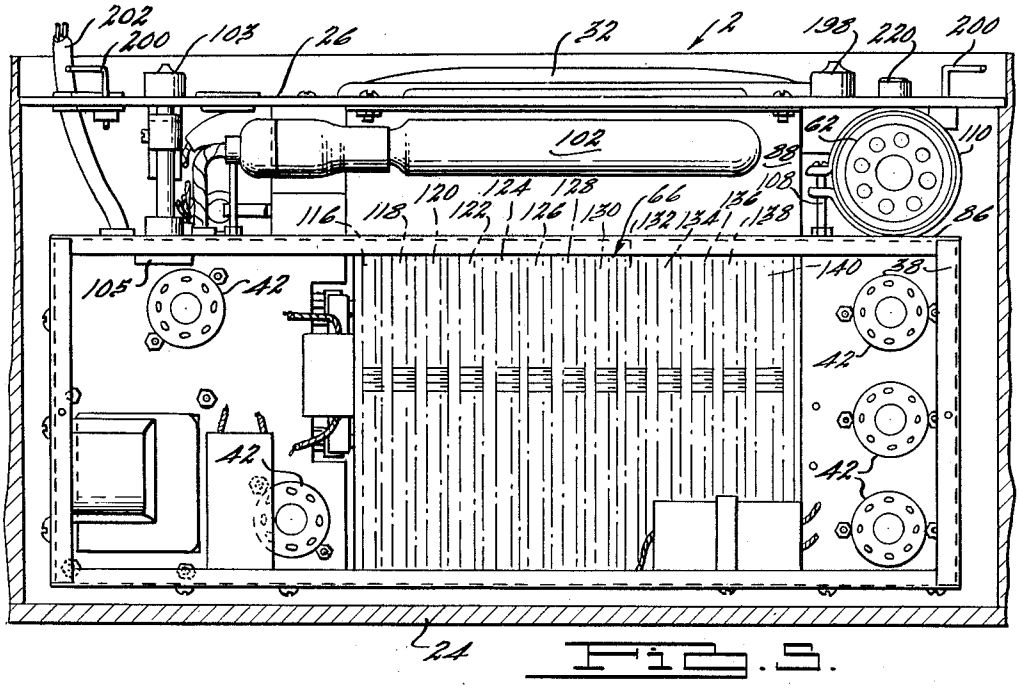


Fig. 5.

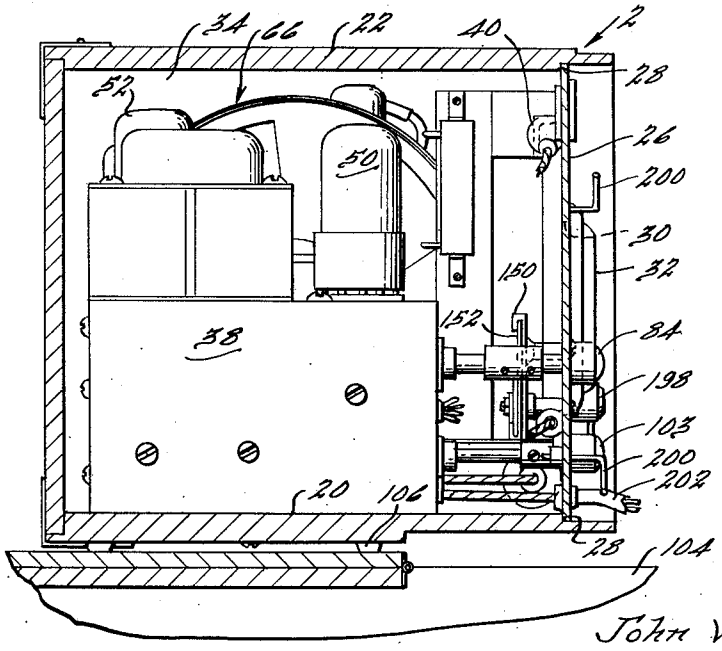


Fig. 6.

INVENTOR.
John W. Quitmeyer.
BY
Harness, Dickey & Pierce.
ATTORNEYS.

Sept. 4, 1956 J. W. QUITMEYER 2,761,994

TUNING DEVICES

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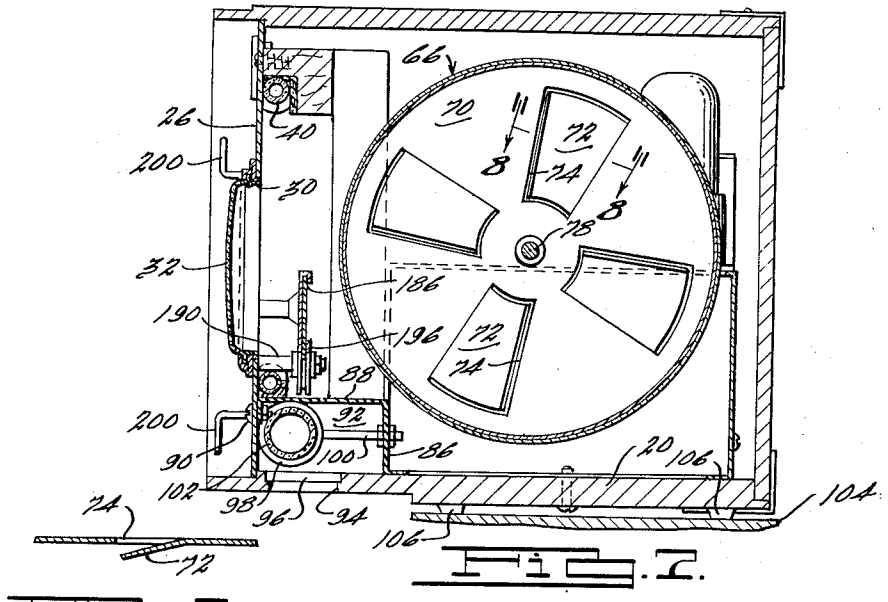


FIG. 1.

FIG. 8.

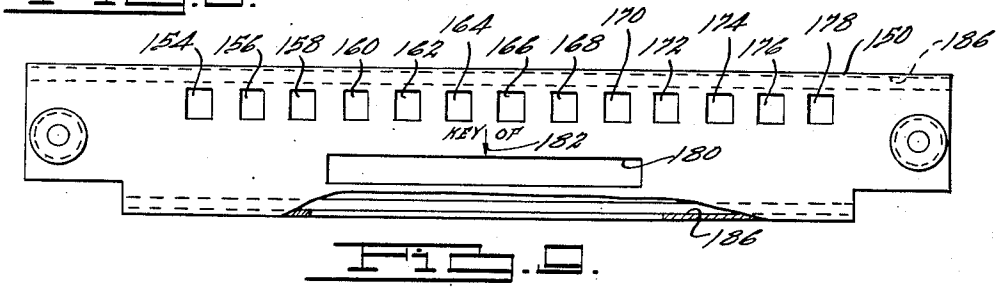


FIG. 9.

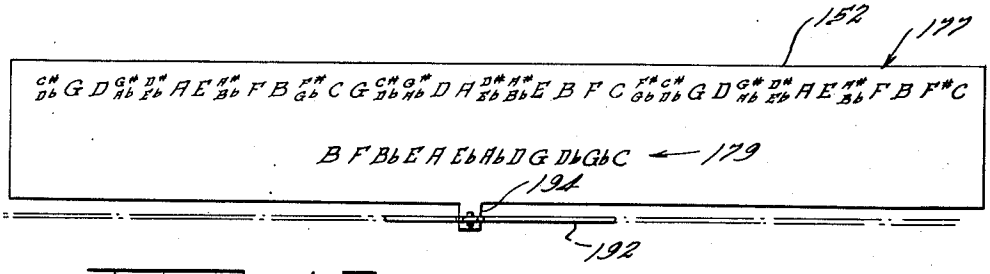


FIG. 10.

INVENTOR.
John W. Quitmeyer.
BY
Harness, Dickey, & Pierce.
ATTORNEYS.

Sept. 4, 1956 J. W. QUITMEYER 2,761,994

TUNING DEVICES

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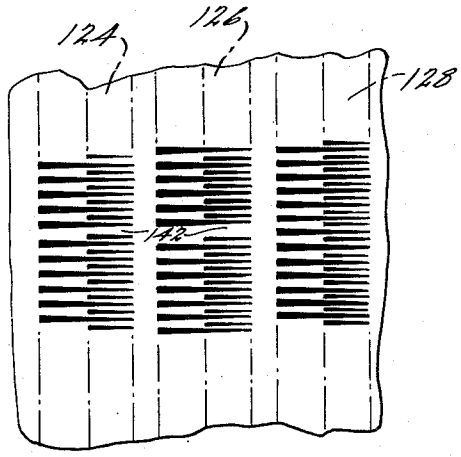


Fig. 11.

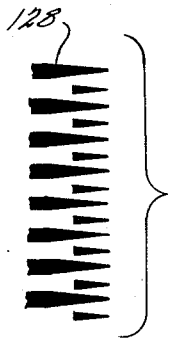


Fig. 12.

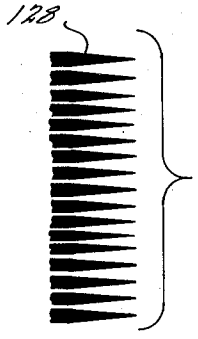


Fig. 13.



Fig. 14.

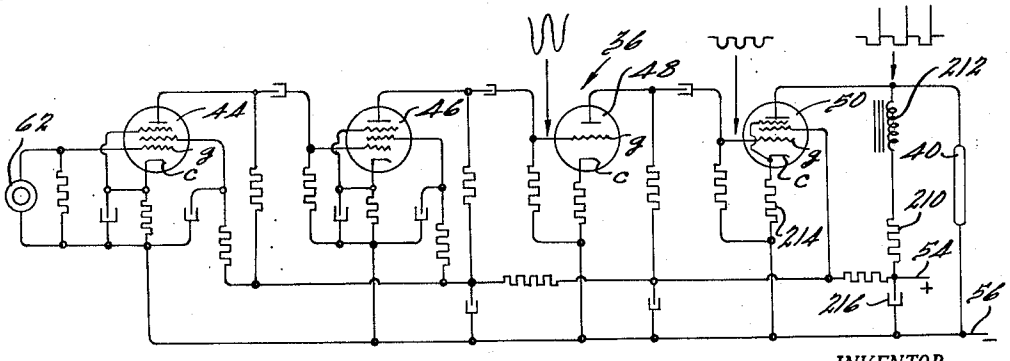


Fig. 15.

INVENTOR.
John W. Quitmeyer.
BY
Harness, Dickey & Pierce,
ATTORNEYS.

United States Patent Office

2,761,994

Patented Sept. 4, 1956

2,761,994

TUNING DEVICES

John W. Quitmeyer, Rochester, Mich.

Application May 7, 1952, Serial No. 286,480

12 Claims. (Cl. 315—76)

This invention relates generally to tuning devices which are particularly adapted, among other uses, for tuning musical instruments playing the chromatic tempered scale of notes.

An object of this invention is to provide an improved device of the character described.

Another object of this invention is to provide such a device which is readily transportable and usable by a musical instrument service man such as a piano tuner.

Another object of this invention is to provide such a device in which the usual piano tuning tools may be carried in the same container.

Another object of this invention is to provide such a device which may be placed in a desired location on a piano during the tuning operation and which will provide light for iluminating the works of the piano and a signal which will indicate when the struck note of the piano is in tune.

Another object of this invention is to provide such a device in which, when a note is being struck, the intermittently illuminated lamp will illuminate the stroboscopic disk at the frequency of the played note and will illuminate the disk at a high frequency when no note is being played.

Another object is to provide such a device in which a "sound-to-electrical" converting pick-up device such as a microphone receives the sound from the played note to normally control the frequency of illumination of the light source and in which feed back means controls the illumination of the stroboscopic disk when the strength of the received sound wave is below a predetermined minimum value.

Another object of this invention is to provide a stroboscopic disk which may be rotated at constant speed and which will indicate the correct tuning of any note in any octave of the chromatic tempered scale of notes.

Another object is to provide such a disk in which the pattern will be varied, depending upon the octave in which the struck chromatic tempered note occurs.

Another object of this invention is to provide suitable indicia means for indicating which of the rows of rotating indicia marks correspond to the various chromatic notes when played by instruments in various keys.

Other objects of this invention will be apparent from the specification, the appended claims and the drawings, in which drawings:

Figure 1 is a perspective view, with certain of the parts broken away, showing the form the invention takes when it is being transported;

Fig. 2 is a side elevational view of the portion of the apparatus shown in Fig. 1 with the cover removed;

Fig. 3 is a view taken substantially along the line 3—3 of Fig. 2 and looking in the direction of the arrows;

Fig. 4 is a view taken substantially along the line 4—4 of Fig. 3 and looking in the direction of the arrows;

Fig. 5 is a view taken substantially along the line 5—5 of Fig. 2 and looking in the direction of the arrows;

Fig. 6 is a view taken substantially along the line 6—6 of Fig. 3 and looking in the direction of the arrows;

Fig. 7 is a view taken substantially along the line 7—7 of Fig. 3 and looking in the direction of the arrows;

Fig. 8 is a view taken substantially along the line 8—8 of Fig. 7 and looking in the direction of the arrows;

Fig. 9 is a view showing one of the indexing members for determining which row corresponds to which note of the chromatic scale;

Fig. 10 is a detail of the second member which cooperates with the member of Fig. 9;

Fig. 11 is a detailed view of the rotatable member showing the type of indicia marks utilized and the way in which any unevenness in the number of marks is compensated for;

Figs. 12, 13 and 14 are detailed views showing the patterns formed by the indicia as the same note is played in three different octaves; and,

Fig. 15 is a schematic view of the circuit diagram for controlling the light source.

Different types of stroboscopic apparatus have previously been suggested for use by tuners of musical instruments for accurately determining when the instrument is in tune. These instruments have not come into general use by piano tuners who must, of necessity, go from house to house, because they have been such that they could not be easily transported.

Referring to the drawings by characters of reference, the numeral 1 indicates generally a stroboscopic type of piano tuning device comprising a first housing portion 2 and a second housing portion 4 which cooperate together to provide a compact, not easily damaged, portable stroboscopic piano tuning instrument. The portion 4 is removable from the portion 2 as shown by its position shown in dot dash line of Fig. 1. The portion 4 contains a tool compartment 6 in which may be carried the usual piano tuning tools. A hinged cover 8 is provided for the compartment 6. The lower housing portion 2 is provided externally with screw eyes 12 to which may be hooked a carrying strap 14 which serves as a handle for transporting the device 1.

The first housing portion 2 has end walls 16 and 18, a bottom wall 20, a top wall 22, a rear wall 24, and a removable front wall or panel 26 to which panel the internal working parts for the housing portion 2 are secured. The walls 16, 18, 20 and 22 are provided with an internal shoulder 28 against which the removable front 26 seats. The wall 26 is provided with a viewing aperture 30 which may be closed with a transparent shield 32 to prevent entrance of foreign material into the interior cavity 34.

The electrical network 36 schematically shown in Fig. 15 is carried by a sheet metal chassis 38 which is suitably and rigidly attached to the removable wall 26. The chassis 38 shields the circuit wires of the network 36 from the radiation produced by the ionization of a suitable gas, such as neon, located within a U-shaped glass tube 40 carried on the inside surface of the removable wall 26. The tube 40 extends around three sides of the substantially rectangular aperture 30. The chassis 38 carries tube sockets 42 opening through the upper surface thereof for receiving the vacuum tubes or valves 44, 46, 48 and 50 and for receiving the full wave rectifier valve 52 which supplies the direct current voltage between the positive bus 54 and the negative bus 56 (Fig. 15).

The circuit wires forming the network shown in Fig. 15 externally of the chassis 38 are shielded by means of shielded cables of the usual type in which the external shielding conductor 58 is grounded and completely shields the inner conductor except for a short length 60 extending from the microphone pick-up device 62 to the control grid of the valve 44 which unshielded portion picks up

radiation from the ionized neon gas in the tube 44. The chassis 38 is provided with a central aperture 64 which permits a portion of the rotatable hollow cylinder or drum 66 to extend within its interior to permit a compact assembly. The cylinder 66 is provided with internal webs or supports 68 and 70 which are spaced axially thereof as shown in Fig. 3.

The support 70, shown in detail in Figs. 7 and 8, is provided with fan blades 72 and apertures 74 and the support 68 with apertures 76 to circulate air through the interior of the drum and over the tubes 44—52 while it is being rotated. The supports are provided with aligned apertures at the axial center of the drum 66 for snugly receiving an axle shaft 78 which is supported at one end in a self-oiling bearing carried by a support 80 mounted on the upper surface of the chassis 38 and at its other end by the shaft of a synchronous electric motor generally designated 82 and which may be of the type used for driving electric clocks. The motor 82 is mounted on the chassis 38 and rotates the drum one revolution per second.

The energization of the motor 82 is controlled by means of a usual switch not shown carried within the chassis 38 and controlled by a knob 84 on the front face of the removable panel 26. This switch also controls in a suitable manner not shown the energization of the network 36 so that the motor 82 and the network 36 are energized concurrently.

The front vertical wall 86 of the chassis 38 is provided with a forwardly, outwardly extending portion 88 which is suitably secured as by the bolts 90 to the inner surface of the removable wall 26 to define an open ended chamber 92 adjacent the bottom wall 20. The bottom wall 20 adjacent the chamber 92 is provided with an aperture 94 which may be closed, if desired, as by means of a transparent panel 96. A socket 98 is supported by the casing wall 86 by a bolt 100 for positioning a light bulb 102 below the wall portion 88 and above the aperture 94. Light radiating from the bulb 102 passes through the aperture 94 so that when the device 1 is placed on top of a piano, fragmentarily shown at 104, it will light its interior works. Preferably the wall 20 is provided with a plurality of rubber supports 106 to prevent any scratching of the piano by the device 1 when it is being rested thereon. The wall portion 88 prevents the light from the bulb 102 from illuminating the drum 66. A control knob 103 is provided to control a switch 105 controlling the bulb 102.

The microphone pick-up 62 is supported on the front wall 86 of the casing 36 by a bolt 108 which has one end rigidly secured to the wall 86 and its other end clamping an encircling band 110 about the microphone 62. The microphone 62 has its sensitive surface facing downwardly for receiving sound energy through an aperture 112 in the bottom wall 20. The aperture 112 may be closed by suitable sound transmitting screen 114 to prevent foreign objects from directly touching the microphone 62.

The outer surface of the drum 66 is provided with 13 rows of wedge-shaped indicia marks 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138 and 140. The rows of indicia 116 and 140 are similar and represent the same chromatic note except that there are twice as many marks in the row 140 as in the row 116.

In the chromatic scale some of the notes are represented by an integral number of vibrations per second and the number of indicia marks placed around the periphery of the drum corresponding to these notes will be an even number and will be equally laid out completely around the drum.

Since the 12 tones of the octave of the chromatic tempered scale are separated from one another by the ratio of the 12th root of 2, or by a factor of 1.05946, the pitches of A, F-sharp and G will be 220, 370 and 392 vibrations per second respectively and integral multiples thereof depending upon the octaves in which they appear. The remainder of the chromatic scale notes will have a fractional number of vibrations per second. With a cylinder rotating at one revolution per second it is a relatively simple matter to divide the periphery of the cylinder into an integral number of parts so that as the cylinder is rotated at one revolution per second and is illuminated by the neon tube 40, at the corresponding number of vibrations per second, the eye will view the indicia representing this note as a stationary set of indicia marks due to the stroboscopic effect. With respect to the indicia marks corresponding to notes having a nonintegral number of vibrations per second, I provide a space equal in length to this fraction of vibration between two of the marks so that the indicia marks may be placed in a single straight line lying in a plane normal to the axis of rotation of the cylinder. This results in a slight shifting of the location which the indicia marks take in each complete revolution of the cylinder; however, this apparent shifting is small and the lines or indicia continue to remain, during substantially the entire rotation of the cylinder, in a fixed position and the slightly different position of the marks each revolution is not objectionable to the piano tuner and permits the single straight line arrangement.

As shown best in Fig. 11, the indicia marks are of wedgeshaped formation and arranged in two groups portions of which are offset with respect to each other and other portions of which are aligned. When the note being played is of a frequency equal to, or a submultiple of the number of large wedgeshaped marks around the periphery of the disk, the pattern appears as shown in Fig. 12. When the number of vibrations per second of the note being played is double the number of the large wedgeshaped indicia marks, the pattern visible to the eye will look like the pattern shown in Fig. 13. The pattern of the next higher octave will look like the pattern in Fig. 14. Still higher octave notes produce a pattern similar to Fig. 14 but with the spacing between the points being less and less. It may, therefore, be seen that with my particular offset pattern, the octave of the note being played can easily be distinguished on the stroboscopic device. With the wedgeshaped pattern a higher and higher octave note may be distinguished and until the space between the points become so small that the spacing is not apparent to the human eye.

If the device were to be used only with musical instruments tuned to a particular key such as the key of C, to which most, if not all, pianos are tuned, a single set of identifying indicia A to G-sharp could be inscribed in a suitable manner beneath the rows of indicia 118–140 because these sets of indicia 118–140 would always represent the same note. Some instruments, especially wind instruments, such as the saxophone, are often tuned to the other keys such as, for example, the key of B-flat, and when so tuned the corresponding number of vibrations of the various notes are changed.

For example, in the key of C the frequency of vibration of the scale is A, 220 vibrations per second; A-sharp, 233.08; B, 246.95; and the remainder of the notes in the aforesaid ratio of the 12th root of 2. In the key of B-flat, B would have a vibration frequency of 220 cycles per second, C a frequency of 233.08, C-sharp a frequency of 246.95 and so on through the remainder of the scale.

In order to provide a simple means for indicating the correct relationship between the notes and the indicia 116–140 with instruments of various keys, I provide a pair of relatively movable indexing members 150, 152 shown in detail in Figs. 9 and 10 respectively. The indexing member 150 is rigidly mounted on the panel 26 and is provided with a plurality of apertures 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176 and 178 corresponding in number to the sets of indicia 116–140 and which are individually aligned with the rotating marks. The second indexing member 152, suitably carried behind the first indexing member 150, is provided with two series of indicia marks 177 alternately arranged with respect to each other.

One series goes from C-sharp to F-sharp seventeen notes above and the other series goes from G to C also seventeen notes higher. Upon movement of the member **152** relative to the member **150**, the groups will be alternately aligned with and be viewable through the apertures **154–178** to indicate which of the rows of indicia **116–140** represent which of the notes in accordance with the key being used. This arrangement makes it possible to considerably reduce the length of the movable member **152**. The member **152** also has a row of letters **179** thereon which register with an aperture **180** in the member **150** and which are cooperable with an indexing mark **182** carried by the member **150** for determining the relative positions of the indexing members **150** and **152** so that the proper letters appear through the apertures **154–178** to identify the indicia marks **116–140** in accordance to the desired key.

For example, if the members **150** and **152** are relatively positioned so that the letter C of the key determining row of letters **179** appears beneath the indexing mark 182, the letters C, C-sharp, D, D-sharp, E, F, F-sharp, G, G-sharp, A, A-sharp, B and C will appear respectively through the apertures **154–178**. If, however, the relative position of the members **150** and **152** are changed, such that the B-flat letter of row **179** lies under the indexing mark **182**, the device **1** is arranged to tune an instrument of the key of B-flat and the letters D, D-sharp, E, F, F-sharp, G, G-sharp, A, A-sharp, B, C, C-sharp, and D will appear through the apertures **154–178**.

The relatively movable indexing members **150, 152** may be mounted in any desired manner intermediate the opening **30** through the panel **26** and the cylinder **66** whereby it is in the operator's line of vision as the operator views the rotating disk **66**. The member **150** is rigidly mounted to the wall or panel **26** by screws **184** extending through the opposite ends of the aperture **30**. The fixed member **150** as shown in Figs. 7 and 9 is provided with guide channels **186** in which the relatively movable member **152** is guided for sliding movement relative to the member **150**. A pair of pulleys **188** are mounted for rotation upon stub shafts **190** carried by the panel **26** and an endless cord **192** extends about the pulleys **188** and has a portion attached to a downwardly extending projection **194** of the movable member **152**. The member **194** extends through an elongated slot **196** in the lower guide channel **186**. The left hand pulley **188** is journaled for rotation about the left hand stub shaft which is held rigid by the panel **26**. The right hand pulley is fixedly mounted on the right hand stub shaft which is journaled for rotation in the panel **26** and has a portion extending outwardly of the panel **26**. A control knob **198** secured to the right hand stub shaft is manually rotatable to rotate the right hand pulley for moving the endless cord **192** and thereby the movable member **152** to index the member **152** relative to member **150** in accordance with the key to which the musical instrument is to be tuned.

As shown, the aperture **180** is elongated. It could, however, be of a size similar to that of the apertures **154–178** so that it is just wide enough to receive one of the key determining letters. The elongated arrangement makes it easier to determine which way to move the member **152**. If desired, the key determining indicia could be placed below the elongated aperture on the member **150** and the indexing mark **182** could be carried by the movable member **152** and moved along the elongated aperture **180** to register with the proper one of the key determining letters. Other modified arrangements will be apparent from the foregoing examples.

Electrical energy for operating the device **1** is obtained from a commercial electrical source by means of a single cord which, when not in use, may be wrapped around the cord receiving hooks **200** as indicated diagrammatically by the dot dash lines **202**.

In order to provide sharp clear stroboscopic effects of the wedge-shaped indicia which terminate in sharp points, it is desirable that the neon tube **40** be made to flash brilliantly for extremely short periods of time so that the ends of the wedge-shaped indicia will remain sharp and not appear as blurs due to the distance the drum rotates while the neon tube **40** is emitting light. To do this, I have developed an extremely efficient electrical controlling network **36** which is schematically shown in Fig. 15. This network comprises the aforesaid valves **44, 46, 48** and **50** and is controlled by the electrical signal placed between the controlling grid *g* and cathode *c* of the valve **44**. The network **36** is supplied with direct current potential of approximately 300 volts between the positive bus **54** and negative bus **56** by any suitable source of direct current supply which may be, for example, alternating current rectified through a suitable rectifying network including the rectifying valve **52**. Valves **44** and **46** are connected together by various resistors and condensers to provide a conventional resistance coupled amplifier of high amplification. Upon excitation of the microphone **62** a sine wave will be impressed between the grid *g* and cathode *c* of valve **44** which will be amplified in the valves **44** and **46** and applied between the grid *g* and cathode *c* of the valve **48** as a high amplitude sine wave. The valve **48** is resistance coupled to the valve **50** and, due to the high amplitude of the sine wave applied between grid and cathode of the valve **48**, its output wave will be of clipped wave shape since the amplitude of the control signal to the valve **48** quickly renders the valve **48** fully conductive and nonconductive. This clipped wave is applied between the grid *g* and cathode *c* of the power controlling pentode valve **50**, which may be of the 6K6 type. This valve type provides a substantially constant current flow irrespective of the voltage applied between its anode and cathode so that the current flow between its anode and cathode in response to the clipped wave shape signal applied thereto will be substantially square shaped.

The positive bus **54** is connected through a current limiting resistor **210** and an inductance **212** to the anode of the valve **50**. The cathode of the valve **50** is connected through a resistor **214** directly to the negative bus **56**. The neon tube **40** has one of its terminals directly connected to the anode end of the inductance **212** and its other terminal connected to the negative bus **56** and through a capacitor **216** to the end of the resistor **210** which is connected to the positive bus **54**.

Upon conduction of the valve **50**, current flows through the resistor **210** and the inductance **212** to build up a magnetic flux storage of energy in the inductance **212**. When the valve **50** is rendered nonconductive, the flow of current to the inductance **212** is terminated and the flux therein tends to collapse inducing a high voltage pulse of short duration which is applied between the terminals of the neon lamp **40** to cause a high intensity short duration ionization of the neon gas in the tube **40** which illuminates the rotating cylinder **66** for a very short interval. The voltage required to cause ionization of the neon tube **40** is substantially higher than direct current voltage applied between the busses **54** and **56** so that the neon lamp **40** will not ionize and cause a light emission except during this short interval in which the rapid collapse of flux in the inductance **212** causes the high voltage to be applied between the terminals of the neon light **40**. The voltage induced by the rapidly collapsing flux is greatly in excess of the applied direct current voltage to the busses **54** and **56** and great enough to cause ionization of the neon tube **40** and may well rise to magnitude in excess of 1500 volts.

A more detailed description of the network **36** schematically shown in Fig. 15 is believed unnecessary since from the above description of operation the relative values of the resistors, capacitors, etc. can be readily determined in the usual manner by those skilled in the electronic art. I do recommend, however, that the valve **44** be of the 6J7 type, the valve **46** be of the 6SJ7 type, the valve **48**

be of the 6SF5 type and the valve **50** be of the 6K6 type.

In view of the foregoing description of the elements entering into my improved stroboscopic device **1**, a detailed description of its operation is not believed to be necessary. However, I would like to emphasize certain features. When it is desired to use the tuning device **1**, the top casing section **2** is removed to expose the apertures **30**, **94** and **112** and the knob **198** is tuned to adjust the member **152** for the key of the piano or other instrument to be tuned. If it is a piano the lower casing section is set on the piano with the aperture **94** unobstructed to permit the light from the aperture **94** to illuminate the works of the piano. The connecting wire is connected to a convenient power receptacle and the switches controlling the illumination of the lamp and of the stroboscope are turned on. After a short warm-up time the valves **44–52** will be in operating condition and the neon tube **40** will being to flash at a high frequency due to the energy feed back arrangement in which energy radiated by the neon tube is picked up by the short exposed wire portion **60**. When the note to be tuned is struck the sound picked up by the microphone **62** will overcome the feed back energy and the light will be flashed at a frequency which is in direct proportion to the frequency of the sound wave reaching the microphone to provide stroboscopic effects on the drum **66**. The change between the controlling of the neon light **40** by the microphone and by the feed back circuit is practically instantaneous so that as far as the operator is concerned the neon lamp **40** is continuously supplying pulses of light and the drum **66** is always being illuminated. This considerably reduces the fatigue to the musical tuner's eyes.

The motor **82**, controlling rotation of the drum **66**, is a constant speed motor and preferably a synchronous motor and is energized concurrently with the network **36** so that the drum **66** will be rotating. If the note is of proper pitch the corresponding indicia marks on the drum **66** will appear stationary while, if it is slightly out of pitch, they will appear to rotate slightly in one direction or the other, the rate of which will depend upon the amount of off-pitch of the note.

In the device **1**, the microphone **62** is shown built in, however, I have provided a connection **220** by which an external microphone can be connected to control the network **36**. In using such an external microphone its connecting cable should be of the shielded type and the connection **220** is of the shielded type in which the outer sheath of the shielded cable and the outer exposed parts of the connection **230** are grounded to prevent energy radiating effects from the neon tube **40** from supplying an energizing signal to the network **36**.

While I have shown one single embodiment of my invention it will be apparent to those skilled in the art that many changes may be made therein and still come within the previews of this invention which are to be determined only by the permitted scope of the hereinafter appended claims.

What is claimed and is desired to be secured by United States Letters Patent is as follows:

1. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a power controlling circuit including an electric valve having an anode and a cathode and a controlling electrode, an inductor connected to store and discharge energy as a consequence of changes in the conductive condition of said valve, a light source connected to said inductor to receive energy from said inductor as a consequence of the discharge of said inductor, a capacitor, said light source being connected to said inductor through said capacitor, and means for controlling the conductive condition of said valve.

2. In an electrical system for controlling the supply of light for stroboscopic purposes, an amplifier network including an electric valve having a cathode and a control electrode, a power controlling valve, circuit means connecting said network to said power valve whereby said power valve is rendered conductive as a function of the conducting condition of said amplifier network valve, a reactor associated with said power valve and arranged to store and discharge energy as a consequence of changes in the conductive condition of said power valve, an energy radiating light source connected to receive energy from said reactor as a consequence of said energy discharge, a control circuit for said amplifier network valve and including means responsive to an externally produced input signal for controlling the conduction of said amplifier network valve and further including means responsive to the energy radiated from said radiating light source for controlling the conduction of said amplifier network valve.

3. The combination of claim 2 in which said amplifier is of the high gain type, said radiated energy responsive means is ineffective to control said amplifying network valve when said externally produced signals are above a predetermined minimum magnitude.

4. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a power controlling circuit including an electron-discharge device having two electrodes, an output circuit for said device including said electrodes, a source of energy and an inductor, a light source, a capacitor, and means serially interconnecting said light source, said capacitor and said inductor.

5. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a power controlling circuit including an electron-discharge device having two electrodes, an output circuit for said device including said electrodes, a source of energy, a resistor and an inductor, a light source, a capacitor, and means serially interconnecting said light source, said capacitor, said resistor, and said inductor.

6. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a light source, electron-discharge means for controlling said source, and means including said light source for controlling said electron-discharge means.

7. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a light source, electron-discharge means for controlling said source, a source of audio-frequency signals, means comprising a microphone responsive to said signals for controlling said electron-discharge means, and means including said light source for controlling said electron-discharge means.

8. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a power controlling circuit including an electron-discharge device having two electrodes, an output circuit for said device including said electrodes, a source of energy and an inductor, a light source, a capacitor, means serially interconnecting said light source, said capacitor and said inductor, a source of audio-frequency signals, means comprising a microphone responsive to said signals for controlling said electron-discharge device, and means including said light source for controlling said electron-discharge device.

9. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a power controlling circuit including an electron-discharge device having two electrodes, an output circuit for said device including said electrodes, a source of energy and an inductor, a light source, and means serially interconnecting said light source and said inductor.

10. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a power controlling circuit including an electron-discharge device having two electrodes, an output circuit for said device including said electrodes, a source of energy and an inductor, a light source, means serially interconnecting said light source and said inductor, and means for periodically abruptly changing the condition of conductivity of said device.

11. In an electrical network for controlling the supply of light to a stroboscopic apparatus, a power controlling circuit including an electron-discharge device having two

electrodes, an output circuit for said device including said electrodes, a source of energy and an inductor, a light source, means serially interconnecting said light source and said inductor, said light source and said device being connected in parallel with one another, and means for periodically abruptly changing the condition of conductivity of said device.

12. In an apparatus for tuning notes of a musical instrument, a rotatable member having a group of equally spaced indicia marks arranged to pass a fixed point upon rotation of said member, means for rotating said member at a predetermined speed, said indicia marks being so spaced that when moved by said rotatable member at said speed said marks of said first group pass said fixed point at an integral multiple of the frequency of vibration of a note to be tested, said speed being such that during one rotation of said member said note to be tested vibrates a fractional number of times, said indicia marks being equally spaced from a first point on said member to a second point on said member and unevenly spaced between the first point and said second point to compensate for the fractional vibration, a light source positioned at said fixed point, means for causing said light source to periodically illuminate said rotatable member at a first audio frequency rate comprising an electron-discharge device, and feedback means including said light source and said electron-discharge means for causing said light source to periodically illuminate said rotatable member at a different rate than said first rate.

References Cited in the file of this patent

UNITED STATES PATENTS

1,819,494	Aronoff	Aug. 18, 1931
1,857,422	Worrall	May 10, 1932
1,864,771	Sparkes	June 28, 1932
1,977,095	Spielman	Oct. 16, 1934
2,014,741	Lesti	Sept. 17, 1935
2,174,176	Journeaux et al.	Sept. 26, 1939
2,449,651	Hathaway	Sept. 21, 1948
2,521,141	Allan	Sept. 5, 1950