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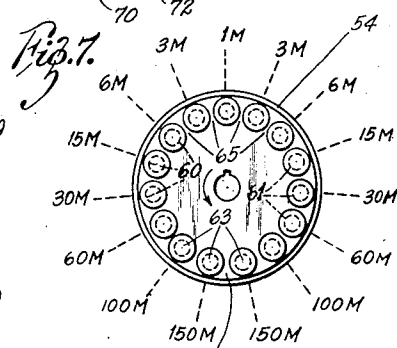
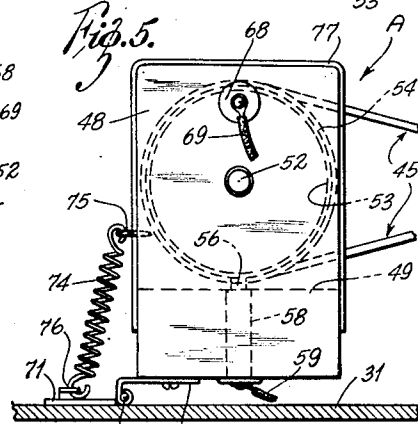
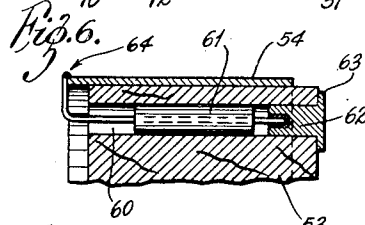
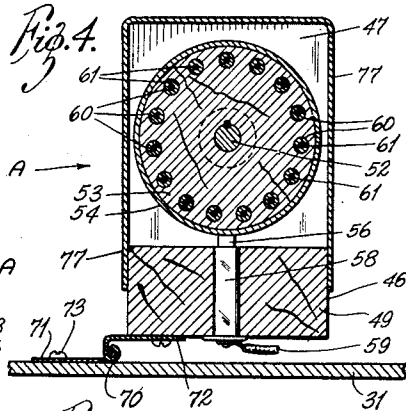
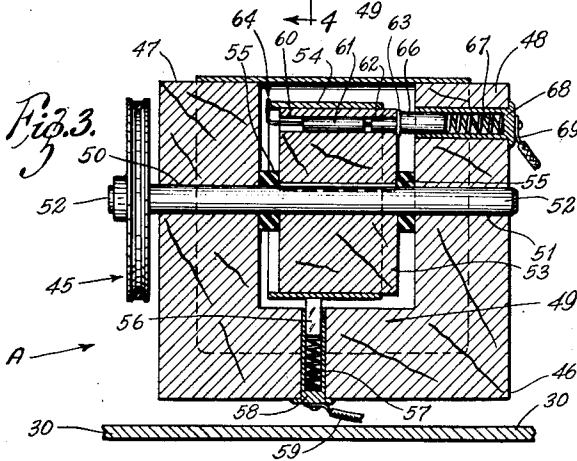
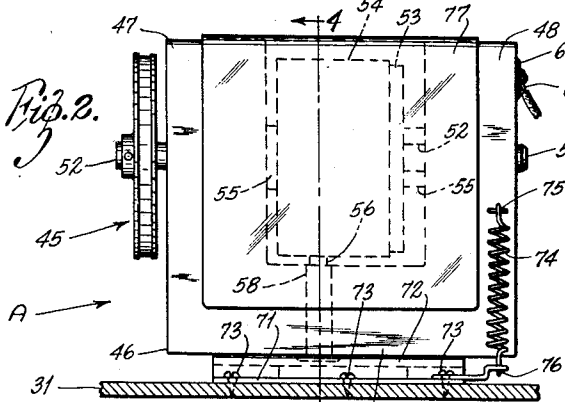
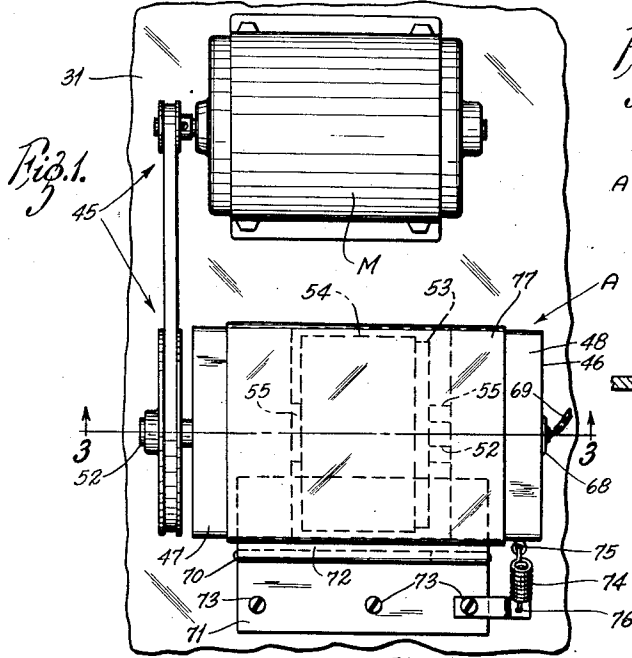
A. L. APPEL

2,460,868

TREMOLO PRODUCING DEVICE

Filed June 13, 1946

2 Sheets-Sheet 1



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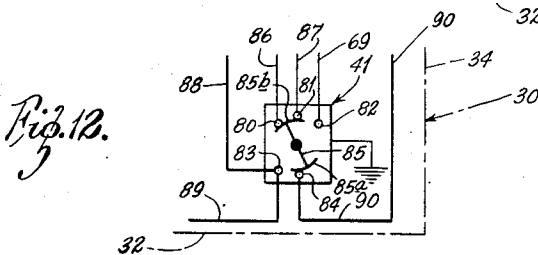
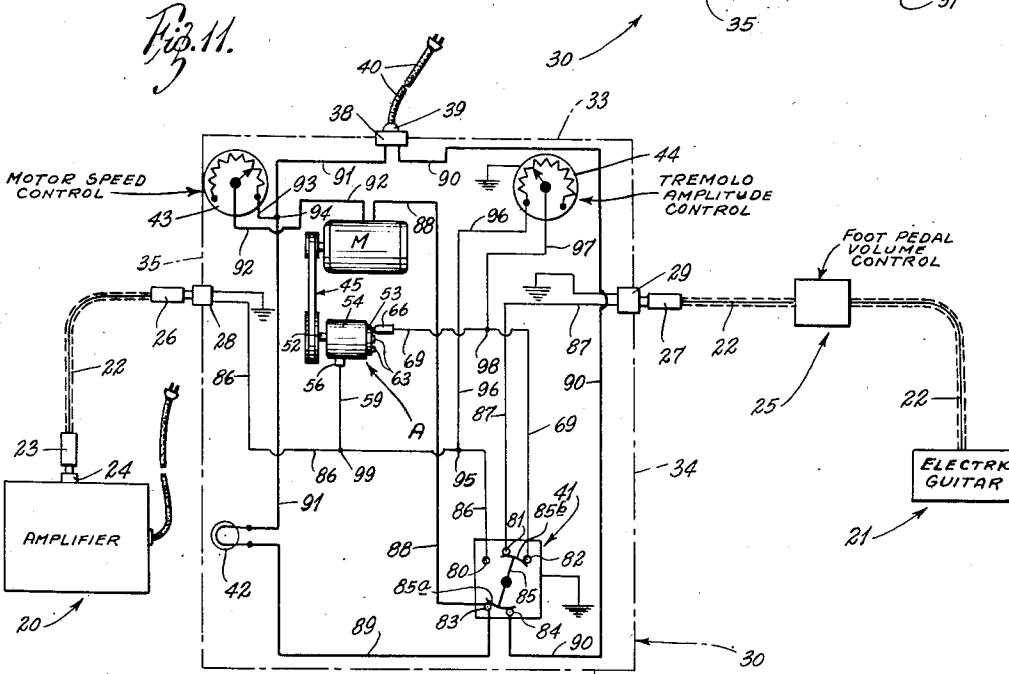
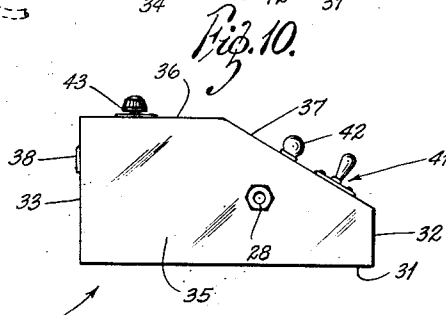
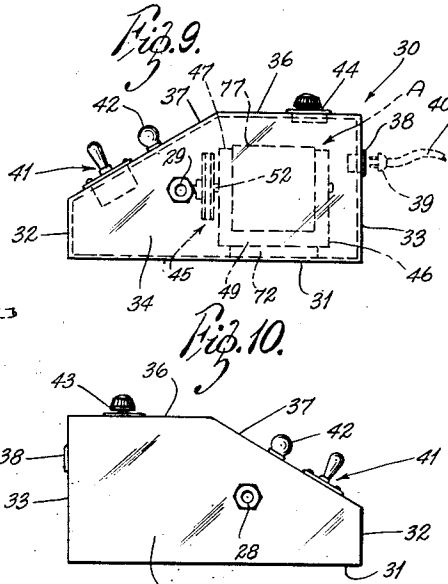
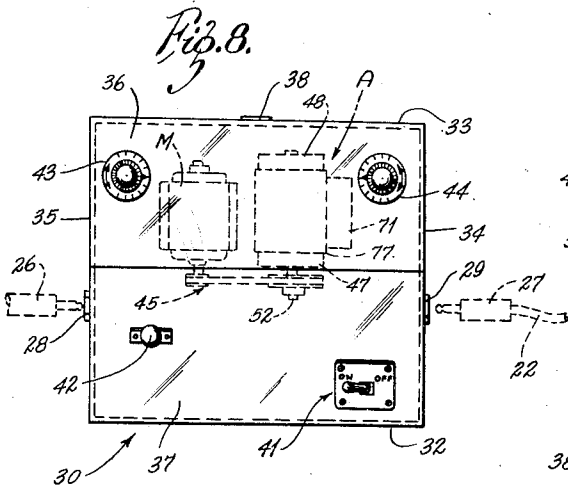
A. L. APPEL

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TREMOLO PRODUCING DEVICE

Filed June 13, 1946

2 Sheets-Sheet 2



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TREMOLO PRODUCING DEVICE

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Application June 13, 1946, Serial No. 676,512

5 Claims. (Cl. 84—1.25)

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The present invention pertains to a device adapted to produce tremolo or vibrato effects in conjunction with an electric type stringed musical instrument, and a conventional amplifier system associated therewith.

While the invention is not limited to use, for example, with an electric type guitar and amplifier system, its application thereto provides an ideal basis for its explanation. Accordingly, it will be so treated, it being expressly understood that the invention is not to be limited there-

by. Heretofore, tremolo effects have been attainable only by skilled players dexterous in manipulating the steel. In other words, in order to produce a tremolo or undulatory effect, it has been necessary for the player to reciprocate the steel manually and quickly within the confines of approximately one-quarter of an inch, otherwise discordant or false tones would be injected into the melody.

Furthermore, since such manipulation of the steel requires not only skill but stamina on the part of the player, tremolo effects in electric guitar playing have been difficult to produce. Also, even when manually produced by a skilled performer, the tremolo effect tends to be discordant at times, and, as a general rule, is rather faint at best.

Thus, the general object of this invention is the provision of a device which will produce such tremolo effects automatically at the option of the player.

A further object is the provision of such a device which will insure harmonious modulation in the production of tremolo effects, which is adapted to produce tremolos with clarity, and which is adapted to have the amplitude of the produced tremolos increased or diminished as desired.

Another object of the invention is the provision of means whereby the speed of the driving means therefor may be regulated so that the tremolos may be produced in more, or less, rapid succession.

Yet another object is the provision of a manual control whereby the amplitude of the tremolo produced or to be produced may be regulated.

There are other objects and features not specifically recited hereinbefore, to which attention will be directed in the description to follow, reference being had also to the accompanying drawings which form part of this specification.

The embodiment illustrated and to be described in detail is a preferred and practical one, but

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obviously admits of modifications without departing from the spirit of the invention.

Similar reference characters designate identical parts throughout the various views illustrated in the drawings, in which:

Fig. 1 is a top plan view of my invention mounted in position on a suitable base plate;

Fig. 2 is a side elevational view thereof, the base plate being shown in vertical section;

Fig. 3 is a vertical longitudinal sectional view taken on the line 3—3 in Fig. 1;

Fig. 4 is a similar transverse sectional view taken on the line 4—4 in Fig. 2;

Fig. 5 is an end elevational view thereof, the base plate being shown in section;

Fig. 6 is an enlarged fragmentary sectional view particularly illustrating the manner in which each resistor element is mounted.

Fig. 7 is an end elevational view of a rotor in which a plurality of resistor elements and their associated contact plugs are imbedded, the view also representing diagrammatically the ohms resistance in thousands of each individual resistor element;

Fig. 8 is a top plan view of a casing or control box in which and upon which all the components related to my invention are mounted;

Fig. 9 is a right side elevational view of the casing shown in Fig. 8;

Fig. 10 is a left side elevational view thereof;

Fig. 11 is a schematic view of a complete system including my invention together with a wiring diagram, the control switch being shown in the "on" position;

Fig. 12 is a reproduction of a portion of Fig. 11, the control switch being shown in the "off" position.

With particular reference to Fig. 11, it may be seen that the present invention can be used with a conventional electric type stringed musical instrument and amplifier system.

Such a system includes an amplifier with self-contained speaker indicated at 20, a musical instrument, indicated at 21, whence the melody emanates, a shielded conductor 22 to transmit the melody from the instrument to the amplifier, a shielded metal plug 23, adapted to engage a suitable socket 24 of the amplifier, forming the terminus of said conductor, and a foot pedal volume control indicated at 25.

Obviously, in the conventional arrangement, the shielded conductor 22 is continuous from the device 25 to the plug 23, as is understood. It should also be noted that the device 25 is optionally employed. It may be, and frequently

is, dispensed with. In other words, it is an accessory that may be interposed between the instrument and the amplifier for volume regulation, and whether or not incorporated in the system, it has no bearing on the tremolo effects that may be obtained by the inclusion of my invention in the system.

In order to include the present invention, it is merely necessary, so to speak, to sever the conductor 22 and provide the severed ends with shielded metal plugs 26 and 27, adapted to enter socket members 28 and 29 provided therefor on a casing or control box generally designated 30.

The configuration of such casing is immaterial, provided it embodies all of the elements of my invention, so that preferably, but not necessarily, it is constructed to provide a compact, portable unit.

By way of example, a control casing 30 of the contour illustrated in Figs. 8, 9 and 10, has been found practical. It includes a horizontal base portion 31, front and rear vertical walls 32 and 33, respectively, right and left vertical side walls 34 and 35, respectively, and a top wall composed of a horizontal portion 36 and a sloping portion 37.

Means, such as a handle or the like, (not shown) may be secured to said casing, or to a cover for said casing, to facilitate portability. It is also to be understood that suitable provision for access to the interior of the casing may be provided, and that the casing may be constructed in any feasible manner.

It should now be apparent that a portable control casing or box 30 provided with sockets 28 and 29, and having incorporated therein the present invention, may be interposed in the line between the musical instrument and the amplifier unit, by inserting the plugs 26 and 27 into the said sockets 28 and 29 respectively. Thus, the invention is connected in series with the "pick-up" leads of the system.

Assuming that the portable control box employed is of the configuration illustrated, a socket 38 is secured in the rear wall 33 for the reception of a plug 39 on one end of a common chord 40 whose other end may be connected to a source of electrical energy as is understood. The plug 39 may be dispensed with if desired, the chord 40 being connected to the socket 38 direct. Sockets 28 and 29 are illustrated as mounted in the side walls of the casing. A control switch 41 and a pilot light 42 are supported on the sloping portion 37, and a motor speed control device 43 in addition to a tremolo amplitude control device 44 are mounted on the horizontal portion 36 of the top wall.

The motor speed control device 43, it should be noted, is not critical and may be dispensed with without impairing the value of this invention. It is a manually adjustable rheostat and may be employed to obtain refined modulation. However, the tremolo control device 44, also a rheostat, is of greater importance in that amplitude changes are attainable by manual adjustment thereof.

Within the housing 30, and mounted on the base 31, is the device which actually produces the tremolo effects. This device is generally indicated by the reference character A, and is illustrated in detail in Figs. 1 to 7, inclusive. It is preferably driven by a motor M, having a belt and pulley connection 45 therewith, as shown. It is noted, however, that the driving means may

be varied, the means shown being by way of example only.

The device A preferably comprises a substantially U-shaped frame member 46 including vertical legs 47 and 48, and a connecting web or base portion 49. The frame 46 is of nonconductive material, preferably of oil-treated wooden composition, so that the apertures 50 and 51 which form bearings for the driven shaft 52 will serve their purpose indefinitely without wear or further lubrication.

Press-fitted or keyed on the shaft 52 and located within the bight of the frame 46 is a rotor 53, which may be of wooden composition as shown, or of any insulation material. A bronze ring 54 is press-fitted onto the rotor in such manner as to extend a slight distance beyond the left face thereof, as best seen in Figs. 3 and 6. Spacer members 55, in the form of insulation washers or the like, obviate lateral movement of the rotor and shaft.

As seen to best advantage in Fig. 3, a negative brush element 56, which may be of carbon, is constantly maintained in firm contact with the ring 54 by a spring 57 under compression in a brush holder 58. The holder 58 is removably imbedded in the web portion of the frame, and a conductor 59 is soldered or otherwise secured to the cap end thereof.

With particular reference to Figs. 4 and 6, it is seen that the rotor 53 is provided with a circular series of spaced horizontally disposed apertures 60, extending from face to face thereof. The number of apertures or holes 60 may vary, but in each is disposed a resistor element 61, and a plug 62, the latter having an integral contact portion 63 projecting beyond the right hand face of the rotor. Each resistor element may be permanently secured in place by soldering or otherwise fastening one end of its wire to the plug 62, and the other end to the ring 54, as indicated at 64.

The number of resistor and plug assemblies built into the rotor may vary, depending on the diameter of the rotor, the radial location of the holes 60, and so on. The configuration of the contacts 63 also is not critical, providing a small gap is present between each contact of a circular series and its adjacent counterparts.

As exemplified in Fig. 7, an ideal arrangement for carrying out the invention includes an annular series of fifteen contact and resistor assemblies, the projecting contact portions 63 being circular and so spaced as to leave a slight gap 65 between adjacent ones.

Regardless of the shape of the contacts 63, the gaps 65 should be sufficiently narrow to insure that at all times the contacting face of a metal brush element 66 can pass smoothly from one contact to another as the rotor revolves. In addition, as will appear, a more perfect tremolo is thus obtainable.

In regard to the brush element 66, it is preferably of steel or other wear resistant metal, rather than of carbon, and the peripheral portion of its flat contact face may be slightly rounded. The brush is maintained firmly in contact with the series of revolving contacts 63 by means of a spring 57 under compression in a brush holder 68, the latter being removably imbedded in the leg 48 of the frame 46. The holder 68 terminates in a cap portion as shown, and a positive conductor 69 is soldered or otherwise secured thereto.

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The device A, as now understood, may be affixed to the base plate 31 of the casing in any desired manner. The arrangement illustrated, however, has many advantages, and comprises a metal hinge member 70 including a stationary portion 71 and an upwardly offset free portion 72. The stationary portion 71 is secured to the plate 31 by screws or the like 73, and the free portion 72 is secured to the underside of the web member of the frame.

A relatively heavy coil spring 74 with one end attached to the frame as at 75, and the other end to a stationary bracket as at 76, biases the frame A away from the stationary motor, thus serving to maintain the driving connection taut and to take up belt wear. A removable inverted channel-shaped cover member 77 is provided to protect the rotor and its associated parts from dust or similar extraneous matter.

Attention is now directed to Fig. 7, wherein the resistance value of each resistor 61 is diagrammatically represented in thousands of ohms.

As previously stated, there are fifteen resistors in this arrangement, but the number may be increased or diminished without departing from the principle involved.

According to the teachings of this invention, beginning with a first resistor of low value, each succeeding resistor in a clockwise direction has an increased value until a point approximately diametrically opposite said first resistor is reached.

Likewise, beginning again with said first resistor of low value, each succeeding resistor in a counterclockwise direction has an increased value until a point approximately diametrically opposite said first resistor is reached.

In other words, the first resistor referred to in the preceding paragraphs may have a resistance value of approximately one thousand ohms, and the final resistor of the series in either direction may have a resistance value of approximately one hundred and fifty thousand ohms.

Referring again to Fig. 11, wherein the electrical circuit associated with my invention is portrayed by heavy lines, and the sound circuit by lighter lines, it is noted that the control switch 41 includes five contacts or points designated 80, 81, 82, 83, 84, and a switch arm 85, manually operable to an "on" or "off" position. The switch arm 85 carries a pair of contact segments 85^a and 85^b insulated from one another.

From the contact point 80, a positive conductor 86 leads to the socket 28. From the contact 81, a positive wire 87 connects into the socket 29. Both said sockets are grounded to the casing 30. Positive conductor 69 from brush 65 is connected to contact 82. The casing of the switch 41 is also grounded.

From the contact point 83, there is a first lead 88 to the motor M, and a second lead 89 to the pilot light 42. From the contact 84, a lead 90 connects into the socket 39, as does a lead 91 from the pilot light 42.

There is a lead 92 from the motor M to the motor speed control device or rheostat 43, and a lead 93 from the latter is joined into the line 94 at point 94. From a point 95 in the line 96, there is a lead 95 to the amplitude control device or rheostat 44, the circuit being completed through a lead 97 connected into the line 69 at point 98. Conductor 59 connects into the line 86 at point 99.

While the operation of the device has been briefly treated at points in the foregoing descrip-

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tion where it was considered germane, a more detailed summary thereof follows.

Assuming that the chord 40 has been plugged into a wall socket, and that the control switch 41 is in the "on" position, as in Fig. 11, the electrical circuit from the source of power is in operation, by way of lead 90, contact 84, switch segment 85^a, contact 83, leads 89 and 91, causing the pilot light 42 to glow. At the same time, motor M is energized by way of contact 83, line 89, line 92, rheostat 43, and lines 93 and 91.

Assuming further that the motor M is operating at the desired speed, then the rotor 53 with its associated bronze ring 54 is revolving about the axis of the shaft 52 continuously causing successive contacts 63 of the circular series to engage the brush element 65, with the ring 54 in constant engagement with the brush 56.

The tones of the melody being plucked on the stringed musical instrument are transmitted to the amplifier after first passing through the device A by way of shielded conductor 22, shielded plug 27, socket 29 whose negative side is grounded to the casing 31, line 87, contact point 81, switch segment 85^b, contact 82, conductor 69, brush 65, contacts 63, resistors 61, ring 54, brush 56, conductor 59 and line 86 to socket 28, whose negative side is also grounded to the casing.

The manner in which the invention produces a tremolo should now be apparent. Should, for instance, the arrangement of resistor values portrayed in Fig. 7 be employed, it is assumed that the rotor 53 is revolving in a counterclockwise direction, and that the contact 63 of the resistor element 61, whose value is one thousand ohms, is at the moment in engagement with the brush 65.

At this time the tone transmitted to the amplifier is of high resonance. Momentarily later, as the next contact 63 of the resistor 61 whose value is three thousand ohms engages the brush 65, the tone is of slightly decreased resonance, and so on, until one half revolution of the rotor brings the contact of a resistor whose value is one hundred and fifty thousand ohms into engagement with said brush. The low point of the tremolo has now been reached, and may be sustained momentarily by the presence of another resistor having the same value.

Thereafter, as the rotor continues its revolution, the tone again swells gradually until the first named contact engages the brush, whereupon the cycle is repeated, thus creating the tremolo or vibrato effect in successively increasing and diminishing waves.

The rheostat for regulating the amplitude of the tremolo is connected by a line 95 into the line 86 at 95, its contact arm by a line 97 into the conductor 69 at 98.

Assuming now that the switch 41 is in the "off" position, as in Fig. 12, the electrical circuit is not in operation, the pilot light 42 is consequently not glowing, and the motor is inoperative, as is understood. At such time the melody plucked on the stringed musical instrument is transmitted to the plug 29 as before, thence by way of line 87, contact 81, switch segment 85^b, contact 80 and line 86 to the plug 28, thence to the amplifier.

It is thus seen that the objects of the invention are attained. Tremolo effects may be had or not by the player while playing through the simple expedient of throwing the switch 41 "on" or "off" with the foot, thus leaving the hands free.

The narrow gaps or spaces 65 between adjacent contacts 63 insure the brush 66 being in continuous engagement with at least one contact of the series so that the tremolo produced is smooth and uninterrupted. The amplitude of the tremolo may be regulated by turning the knob of the rheostat device 44, and the succession of tremolo effects may be accelerated or retarded by manipulating the knob associated with the rheostat device 43.

Since, as previously stated, only a particular embodiment of the invention has been illustrated and described, obviously many modifications could be made therein without departing from its principle. For example, an arrangement wherein the contacts 63 are mounted on a stationary member 53, while the brush or means equivalent thereto is caused to revolve, is contemplated as within the purview of the invention.

I claim:

1. In a device for producing tremolos in conjunction with an electric stringed musical amplifier system, a U-shaped frame of non-conductive material, horizontally aligned bearings in the leg portions thereof, a rotatable transverse shaft mounted in the bearings, a motor and a belt connection for rotating said shaft, a rotor of insulating material affixed to the shaft, a circular series of spaced resistor elements imbedded in said rotor, a contact member secured to one end of each resistor element and projecting beyond one vertical face of the rotor, a slight gap between adjacent contacts, a horizontally disposed brush assembly in engagement with at least one of said contacts, a bronze ring mounted on the periphery of said rotor with a portion of the ring projecting laterally beyond the other face of the rotor, a permanent connection between the projecting portion of said ring and the other end of each resistor element, a vertically disposed brush assembly in the bight portion of said frame, and a spring for maintaining the brush of said assembly in constant engagement with the outer periphery of said ring.

2. The device of claim 1 wherein the circular series of spaced resistor elements comprises a first semi-circular series progressively increasing in value and a second semi-circular series progressively decreasing in value.

3. The device of claim 1 wherein the U-shaped frame of non-conductive material is supported on the upwardly offset free portion of a hinge member the other portion of which is stationary, and in which the rotor and its associated parts are protected from dust and similar extraneous matter by a removable inverted channel-shaped cover member.

4. In a device for producing tremolos in conjunction with an electric stringed musical instrument amplifier system, a U-shaped frame of oil-treated wooden composition, aligned bearing openings in the upwardly extending leg portions of the frame, a shaft supported therein, a first brush assembly removably secured in the web portion of the frame, a second brush assembly removably secured in one leg portion thereof, a rotor of nonconductive material secured to said shaft for rotation therewith within the bight of said frame, a semicircular series of resistor ele-

ments of progressively increasing value and a semicircular series of resistor elements of progressively decreasing value imbedded in a circular series of spaced holes in said rotor, a separate contact projecting beyond one vertical face of the rotor secured to one end of each resistor, a gap between adjacent contacts, spring means included in the first brush assembly to maintain the brush thereof in constant engagement with at least one of the projecting contacts, a bronze ring press-fitted onto the peripheral portion of said rotor with a portion thereof projecting beyond the other vertical face of the rotor, means for securing the other end of each resistor to the projecting edge portion of said ring, spring means included in the second brush assembly to maintain the brush thereof in constant engagement with said ring, means for rotating said shaft from a suitable source of power, and a protective cover for said rotor and ring removably secured to said frame.

5. Apparatus adapted to be interposed between the sound source and the amplifier of a stringed musical instrument of the electric type, said apparatus including a casing with top, bottom, side, front and rear walls, a socket in one side wall to receive a plug on one end of a shielded conductor leading from said sound source, a socket in the opposite side wall to receive a plug on one end of a shielded conductor leading to said amplifier, and a tremolo-producing device of the character described mounted on the bottom wall of said casing interiorly thereof, said device including a U-shaped frame member, aligned bearing openings in the legs thereof for supporting a transverse rotary shaft, a brush assembly in the web portion of the frame, another brush assembly in one of said legs, a rotor of non-conductive material secured to said shaft between said legs, a circular series of resistor elements each imbedded in a hole provided in said rotor, a contact projecting beyond one face of the rotor secured to one end of each resistor, spring means included in the first-named brush assembly for maintaining the brush thereof in engagement with at least one of said projecting contacts, a bronze ring press-fitted onto the periphery of said rotor with a portion of the ring projecting beyond the other face of the rotor, a permanent connection between the other end of each resistor and said ring, spring means included in the last-named brush assembly to maintain the brush thereof in engagement with said ring, means including a motor for rotating said shaft, and means for manually regulating the speed of said motor.

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