June 7, 1955 R. D. NELSON 2,709,940

DYNAMOTOR DRIVEN MUSIC BOX AMPLIFIER

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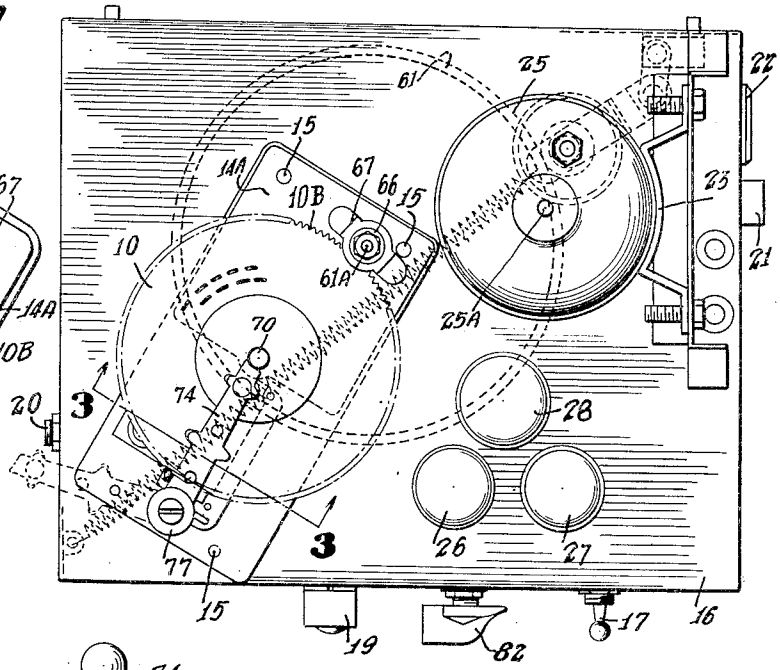
FIG. 1



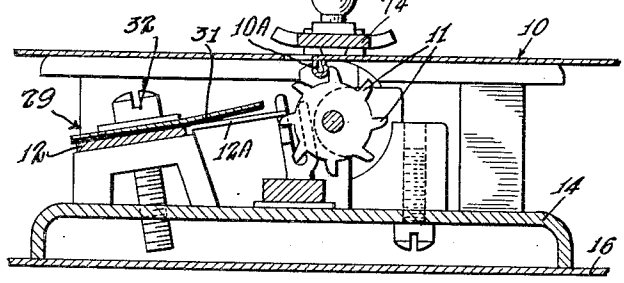


FIG. 4

FIG. 3

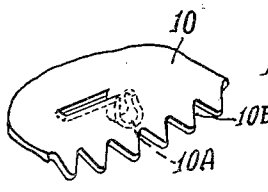


FIG. 5

FIG. 2

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FIG 6

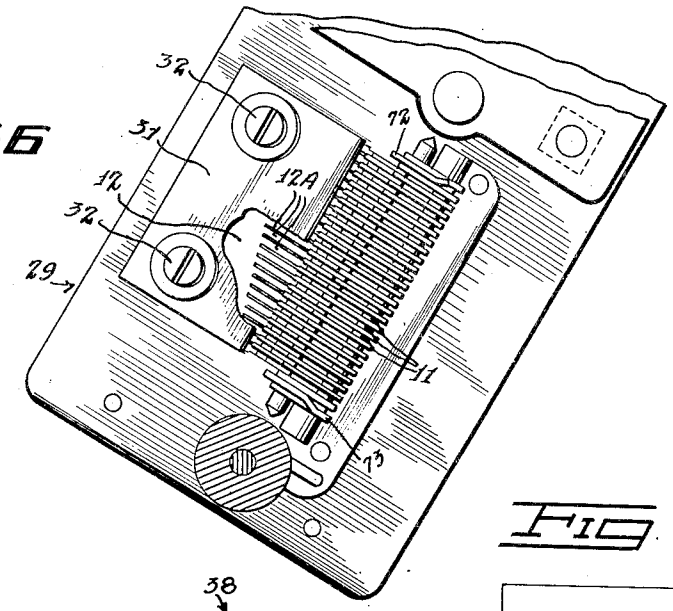

FIG 7

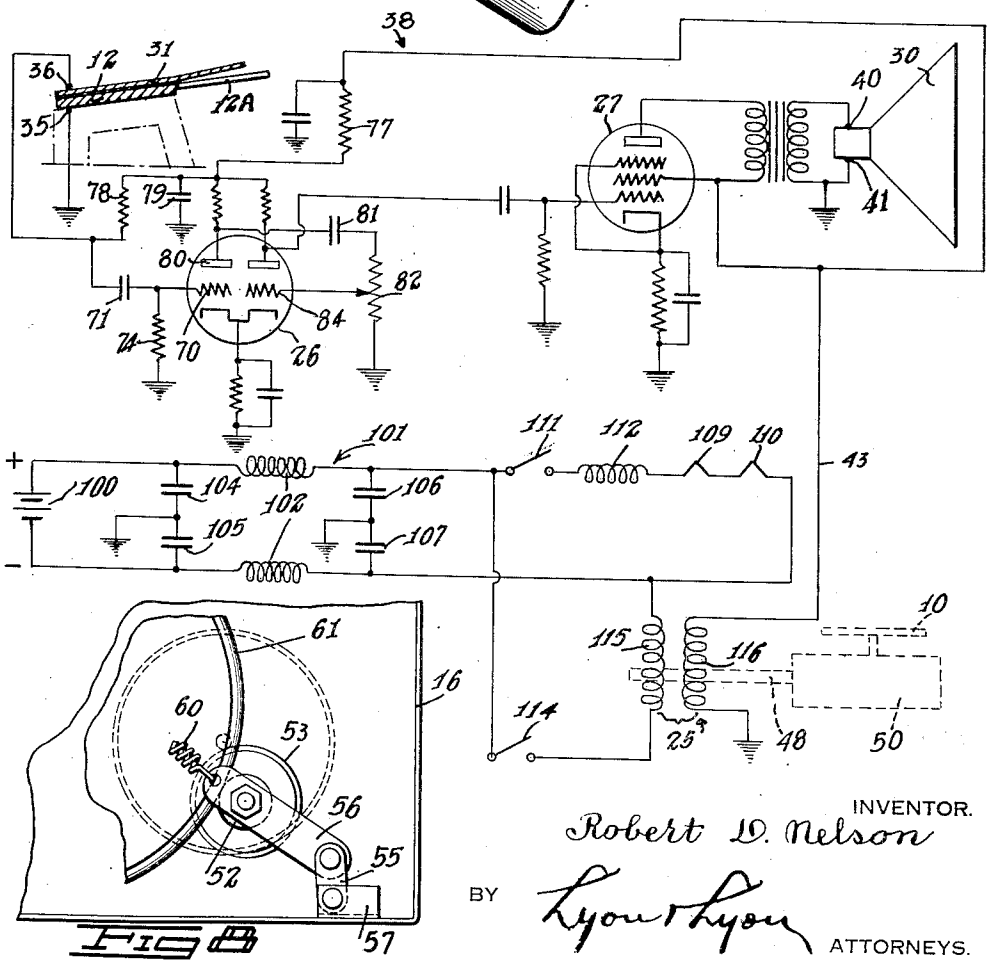

FIG 8

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DYNAMOTOR DRIVEN MUSIC BOX AMPLIFIER

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4 Claims. (Cl. 84—1.14)

The present invention relates to an improved device for reproducing music especially useful on automobiles, trucks and the like, wherein the only convenient source of electrical energy is a low voltage battery.

An object of the present invention is to provide an improved phonograph, characterized by its simplicity, ruggedness and its requirement of only a low voltage storage battery to operate the same.

Another object of the present invention is to provide an improved phonograph especially adapted for use on motor vehicles, characterized by the fact that it employs a dynamotor not only to deliver the high voltages required for supplying current to the amplifying tubes of the amplifier associated with the phonograph, but also for driving the record of the phonograph.

Another object of the present invention is to provide an improved phonograph incorporating a dynamotor having an output shaft coupled in a novel manner to drive the phonograph record.

Another object of the present invention is to provide an improved phonograph and associated amplifier especially useful in vehicles and characterized by its ruggedness, simplicity and ease of operation by inexperienced persons.

Yet another object of the present invention is to provide an improved electro-mechanical transducer adapted especially for use with a "soundbox" phonograph for converting mechanical vibrations into corresponding electrical variations.

Still a further object of the present invention is to provide an improved phonograph of the character described, which includes a novel coupling between the amplifier stage and the phonograph record.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a top plan view of a phonograph and associated amplifier embodying features of the present invention,

Fig. 2 is a view in side elevation of the same,

Fig. 3 is a sectional view taken substantially on the line 3—3 of Fig. 1,

Fig. 4 is a view taken substantially on the line 4—4 of Fig. 2,

Fig. 5 is a perspective view showing a portion of the sound record,

Fig. 6 is a sectional view taken substantially on the line 6—6 of Fig. 2,

Fig. 7 is an electrical circuit diagram showing in schematic form the apparatus of Fig. 1 connected in a complete system to achieve desired objects of the present invention, and

Fig. 8 is a view taken substantially in the direction indicated by the arrows 8—8 in Fig. 2.

The phonograph shown in the drawings incorporates a conventional metal phonograph record 10 with projections 10A (Fig. 5) extending from the bottom thereof at predetermined spaced points, the phonograph record 10 being adapted to be rim driven and is provided with a toothed rim 10B for that purpose. In general, the phonograph record 10 and associated reproducer comprising a plurality of revolvable spaced fingers or dogs 11 (Fig. 6) and cooperating tone plate 12 is of the conventional "Thorens" music box type. This music box phonograph, comprising the record 10 and the plurality of spaced dogs 11 adapted to be moved upon engagement with the record extensions 10A (Figs. 3 and 5) to move a corresponding one of the integrally formed fingers 12A of the tone plate 12, is mounted as a unit on a base plate 14, which in turn is secured by means of bolts 15 (Fig. 1) or the like to the chassis 16.

This chassis 16 has mounted thereon an "on-off" switch 17, a volume control 82, an indicating lamp housing 19 containing a lamp which is energized when the apparatus is energized, speaker output jack 20, a fuse holder 21 and a receptacle 22 for a 6-volt power plug.

As further shown in Fig. 1, the chassis has mounted thereon an upstanding bracket 23 for supporting the dynamotor 25 with its shaft 25A extending normally vertical, a pair of amplifying tubes 26, 27 and a condenser 28.

In accordance with one of the features of the present invention, there is provided an electro-mechanical transducer having the general reference numeral 29, for converting mechanical vibrations of the fingers 12A of the tone plate 12 into corresponding electrical variations which are subsequently amplified in an electronic amplifier before being impressed on the speaker 30. This electro-mechanical transducer 29 comprises simply an insulated plate 31 mounted by means of a pair of screws 32 onto the base 14, the plate 31 being bent slightly upward as indicated in Fig. 3, so that its right-hand end extends a spaced distance above the tone arm fingers 12A, so as to produce a variable distance air gap therebetween. In other words, the tone arm fingers 12A and the plate 31 comprise a variable condenser, one plate of such condenser comprising the plate 31 and the other plate of the condenser comprising the series of tone arm fingers 12A. It is apparent that the capacity of this condenser 31, 12A varies as the corresponding toothed dogs 11 are rotated in accordance with movement of the record disk 10.

The tone plate 12 is electrically connected to the chassis 16 which is the ground potential, whereas the insulated plate 31 is connected, as indicated in Fig. 7, to the input terminals 35, 36 of an amplifier 38 sensitive to changes in magnitude of the capacity 31, 12A. The output terminals 40, 41 of such amplifier 38 are connected to corresponding terminals of the speaker 30.

The amplifier 38 incorporates the electron discharge devices 26, 27, which are supplied with space current at high voltage from the lead 43. The cathodes or cathode heaters of devices 26, 27 are supplied with heating current from the low voltage battery 44, which is connected to drive the dynamotor 25, to in turn generate and deliver a high voltage to the lead 43. The battery 44 may be the 6-volt battery of the automobile upon which the phonograph amplifying system is mounted.

In accordance with another feature of the present invention, the dynamotor 25 not only supplies a high voltage to the lead 43 to supply space current to the discharge devices 26, 27, but is also provided with an output shaft 48, which is coupled through a suitable frictional drive and gear reduction unit, indicated generally by the refer-

ence numeral 50 in Fig. 7, to drive the phonograph record 10. The specific form of the drive between the shaft 48 and the phonograph record 10 is described in detail hereinafter.

Specifically, the dynamotor 25 mounted on the upstanding bracket 23, has its output shaft 48 extending below the top level of the chassis 16 for cooperation with the rubber grommet 53 mounted on the spindle 52 of increased diameter. The spindle 52 is journaled for rotation at its ends in the U-shaped pivoted bracket 55, the bracket 55 being pin-connected to one end of the link 56, with the other end of the link 56 pin-connected to the stationary bracket 57 mounted on the chassis 16. This bracket 55 is biased by the coil tension spring 60 having one of its ends attached to the pivoted bracket 55 and the other one of its ends attached to the chassis 16, so as to bias the rubber grommet 53 into engagement with the dynamotor shaft 48, and also to press the spindle 52 into engagement with the rubber rim mounted on the disk 61. It is noted that the axis of the spring 60 passes through a line joining the axis of shaft 48 and the axis of shaft 61A upon which the disk 61 is mounted for rotation therewith. This assures a positive driving connection between the shaft 48 and the rubber rimmed disk 61.

The disk 61 has its shaft 61A rotatably mounted in bearing 62 on the base plate 14 which, as mentioned previously, is bolted to the chassis 16. The upper end of the shaft 61A has mounted thereon the toothed gear 64 for edge driving the phonograph disk 10. To additionally support the shaft 61A for rotation there is provided a bearing 66 mounted on the bent U-shaped strap 67 which partially encircles the gear 64 and has its ends secured, as for example, by riveting to the upper plate 14A of the base 14. This upper plate 14A is bolted to the bottom base plate 14 as a spaced distance thereabove.

The phonograph disk 10 revolves about the center post 70 mounted on the upper base plate 14A, with the bottom projecting portions 10A thereof for cooperation with the revolvable toothed fingers or dogs 11. To support and to hold such portions 10A of the phonograph record 10 in predetermined spaced relationship to the dogs 11, there is provided a pair of upstanding extended plates 72, 73 (Fig. 6) which are adapted to engage the flat underside of the phonograph record. To prevent the disk 10 from tending to move upwardly, there is provided the pivoted arm or boom 74, which is held in adjusted position by a frictional connection between the end of such arm and the post 77, upon which such arm is supported. Thus, in order to remove the record it is simply necessary to move the arm 74 to the position shown in Fig. 1 and to then raise the phonograph record upwardly. It is apparent that another record may be substituted so as to be played upon following the reverse procedure.

Referring to Fig. 7, the amplifier generally is of conventional type, with the exception of the input circuit to amplifying device 26, 27. Amplifying device 26, 27 is, in fact, a twin triode and is of the RCA type 7F7. The plate 31 is connected to the main control electrode 70 through a condenser 71 having a magnitude of .05 microfarad. Grid 70 is grounded through resistance 74 having a magnitude of approximately 5 megohms. This condenser 71 is normally charged with potential from lead 43, and for that purpose lead 43 is connected to the plate 31 and to one terminal of the condenser 71 through the resistances 77 and 78. The resistance 77 may be in the order of 40,000 ohms and the resistance 78 is in the order of 20 megohms. The junction point of resistances 77 and 78 is grounded through a condenser 79 of 10 microfarads capacity. Thus, as the capacity between plates 31, 12A varies in accordance with the recordings on the record 10, the potential of control grid 70 varies accordingly to produce corresponding voltage variations on its anode 80. Such voltage variations on anode 80 are

transferred through coupling condenser 81 to the volume control potentiometer 82, the variable tap on which is connected to the control electrode 84. The voltage variations thus appearing on control grid 84 are amplified in the second triode stage of device 26, 27 and then applied to the control grid of the electron discharge device 26, 27 for further amplification before being applied to the speaker 30.

The apparatus shown in Figure 7 is intended to require only a 6-volt battery 100 for its operation, opposite terminals of the battery 100 being connected to a filter network 101 comprising a pair of radio frequency chokes 102 and bypass condensers 104, 105 and 106, 107. The junction point of condensers 104, 105, on the one hand, and the junction point of condensers 106, 107, on the other hand, are both grounded.

It is thus noted that the serially connected filaments 109, 110 for the devices 26, 27, respectively are supplied with a filtered voltage from source 100 through the filament switch 111 and the radio frequency choke coil 112. Further, opposite terminals of the primary or low voltage winding 115 of the dynamotor 25 are connected across opposite terminals of the source 100 through the dynamotor switch 114, closure of which results in operation of the dynamotor 25 and the development of a relatively high voltage in the output winding 116 of the dynamotor. The switches 111, 114 in Figure 7 correspond, in fact, to a single switch structurally, as indicated at 17 in Figure 1. One terminal of the output winding 116 is grounded and the other terminal is connected to the lead 43 to supply space current to the device 26, 27. As mentioned previously, the high voltage potential on lead 43 is utilized to charge the condenser 79, which is in parallel with the condenser formed by the plates 12A, 31. It has been observed that the voltage on condenser 79 varies in accordance with the movement of the tone fingers 12A to change the potential on the grid 70.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. In a phonographic reproducing system of the character described, a chassis, a dynamotor having a low voltage input winding and a high voltage output winding and an output shaft, said dynamotor being mounted on said chassis with a first shaft extending generally vertically with respect thereto, a second phonograph driving shaft, means mounting said second shaft for rotation about a vertical axis on said chassis, a tone plate having a plurality of fingers movable in accordance with reproducing means driven by said second phonograph driving shaft, an insulated plate, means mounting said insulated plate adjacent said fingers to form a variable capacity therewith, an electronic amplifier having a high voltage terminal, means connecting said high voltage terminal to said high voltage winding, means connecting said capacity formed by said plate and said fingers to the input circuit of said amplifier, an idler spindle coupling said first and second shafts, means rotatably supporting said idler spindle on a pivoted bracket, a link, means pivotally connecting one end of said link to said bracket, means pivotally connecting the other end of said link to said chassis, a coil tension spring having one of its ends connected to said pivoted bracket and the other one of its ends connected to said chassis with the axis of said spring intersecting a line passing between the axes of said first and second shafts.

2. In a sound reproducing system of the character described, a single low voltage source, a recording, sound reproducing means for producing sound vibrations from said recording, recording driving means, amplifying

means, means connecting said amplifying means to said sound reproducing means to amplify sound variations produced in accordance with playing of said recording driven by said driving means, said amplifying means including an amplifying discharge device, said amplifying discharge device having an anode and a cathode, a dynamotor connected to said low voltage source and driven thereby, said dynamotor including a relatively high voltage generator, means connecting said generator between said anode and said cathode to deliver space current to said discharge device, and said dynamotor having an output shaft coupled to said driving means.

3. In a sound reproducing system of the character described, a dynamotor having a generator winding, said generator winding having a positive terminal and a negative terminal, sound reproducing means including a variable condenser and an electron discharge device, said condenser having a pair of relatively movable elements, said discharge device having an anode, a cathode and a control grid, first resistance means connected between said anode and said positive terminal, said negative terminal being connected to said cathode to produce a flow of space current through said device, second resistance means connected between said positive terminal and one element of said condenser, a second condenser serially connected between said one condenser element and said control grid, third resistance means connected between said control grid and said cathode, the other condenser element being connected to said cathode, said dynamotor having an output shaft, means coupling said output shaft to said variable condenser for varying said condenser in accordance with rotational movement of said dynamotor output shaft.

4. In a sound reproducing system of the character described, a voltage source having a positive terminal and a negative terminal, sound reproducing means including a variable condenser and an electron discharge device, said condenser having a pair of relatively movable elements, said discharge device having an anode, a cathode and a control grid, first resistance means connected between said anode and said positive terminal, said negative terminal being connected to said cathode to produce a flow of space current through said device, second resistance means connected between said positive terminal and one element of said condenser, a second condenser serially connected between said one condenser element and said control grid, third resistance means connected between said control grid and said cathode, the other condenser element being connected to said cathode, said voltage source comprising the generator section of a dynamotor, said dynamotor having an output shaft, means coupling said output shaft to said variable condenser for varying said condenser in accordance with rotational movement of said dynamotor output shaft, a second rotational shaft, a rubber-rimmed disk mounted on said second shaft, a spindle, said spindle having concentrically mounted thereon a relatively small grommet and a relatively large grommet, said relatively small grommet engaging the periphery of said rubber-rimmed disk, said relatively large grommet being rubber-rimmed, with its periphery contacting said dynamotor output shaft, a U-shaped support, means rotatably supporting said spindle for rotation on opposite parallel legs of said U-shaped support, a bracket, a link, means pivotally mounting one end of said link on said bracket, means pivoting said other end of said link on said support, a coil tension spring having one of its ends attached to said support, the axis of said spring passing through a line connecting the rotational axis of, on the one hand, said dynamotor output shaft and, on the other hand, said last-mentioned shaft.

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