March 31, 1936. H. C. HARRISON 2,035,473

PHONOGRAPH

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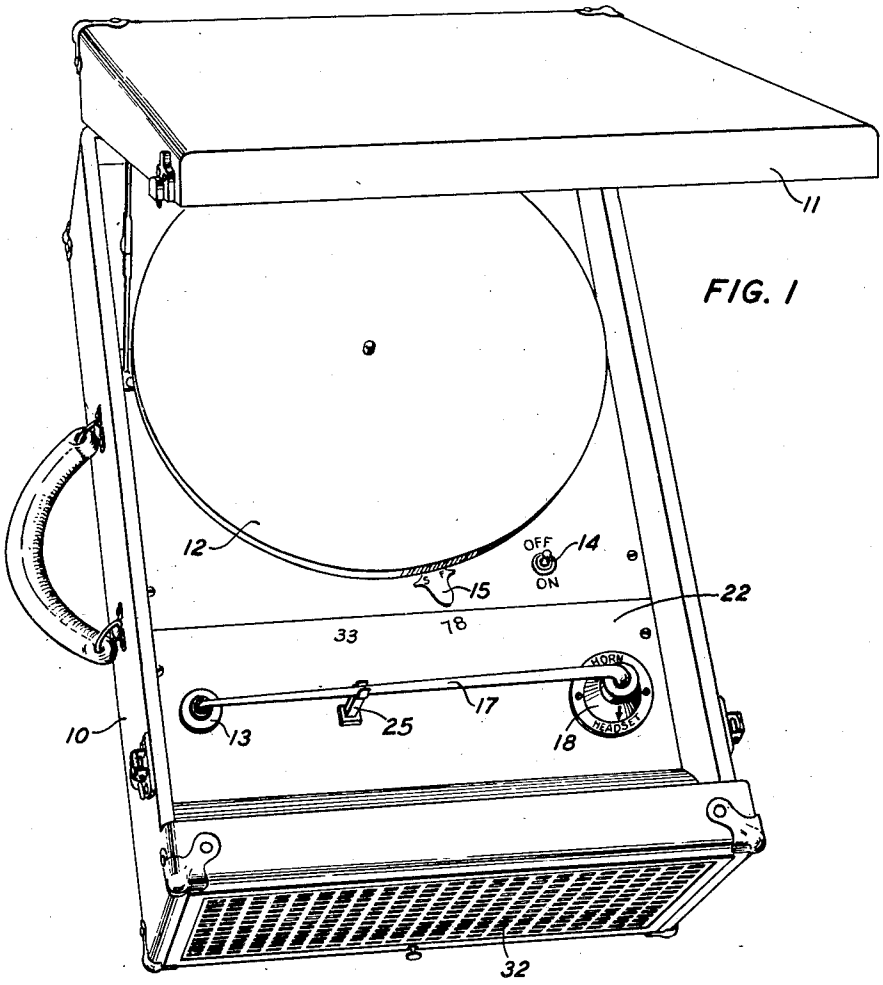

FIG. 1

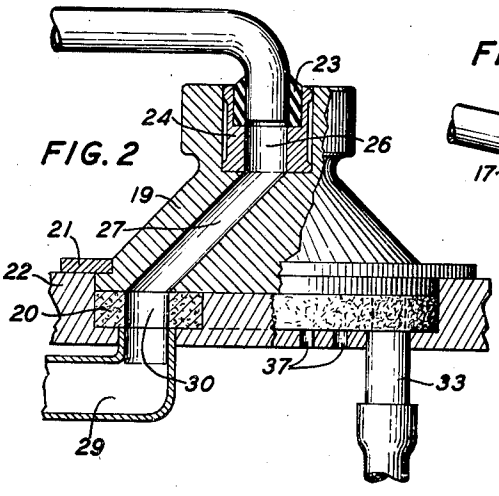

FIG. 2

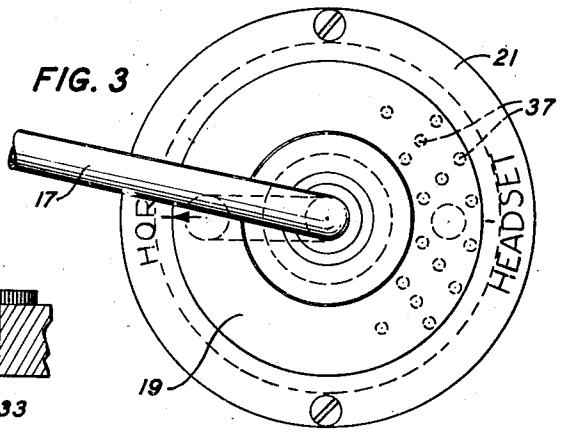

FIG. 3

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FIG. 4

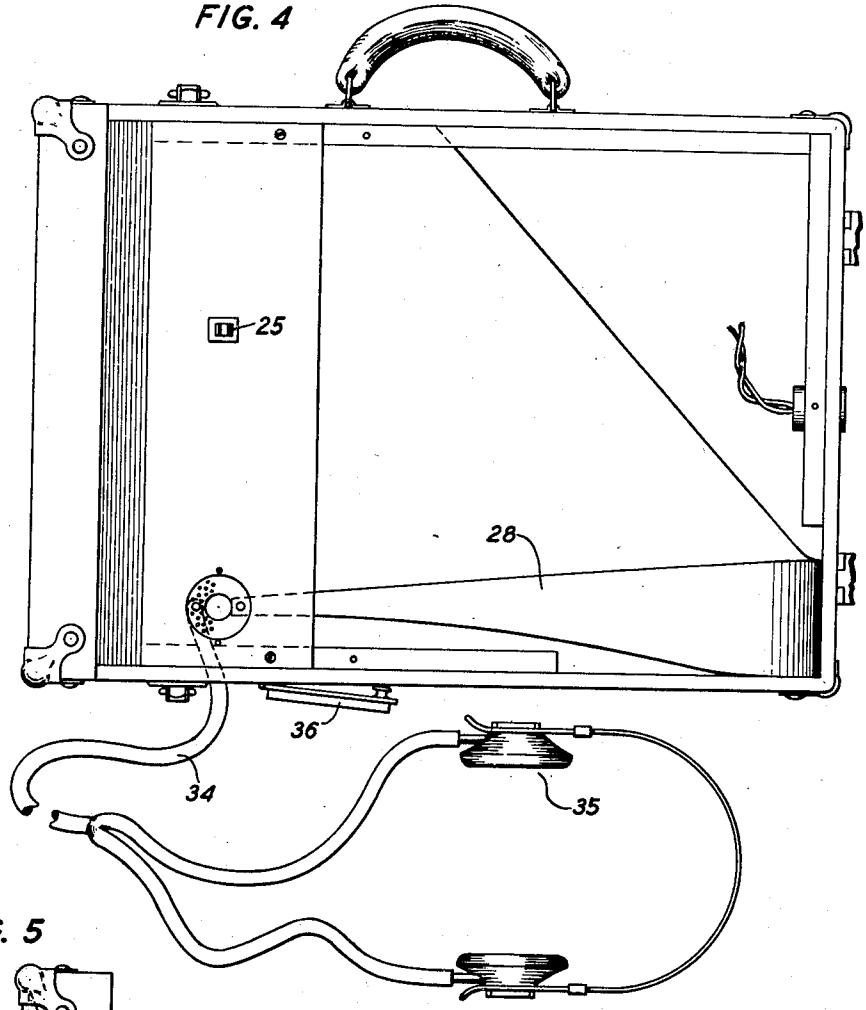
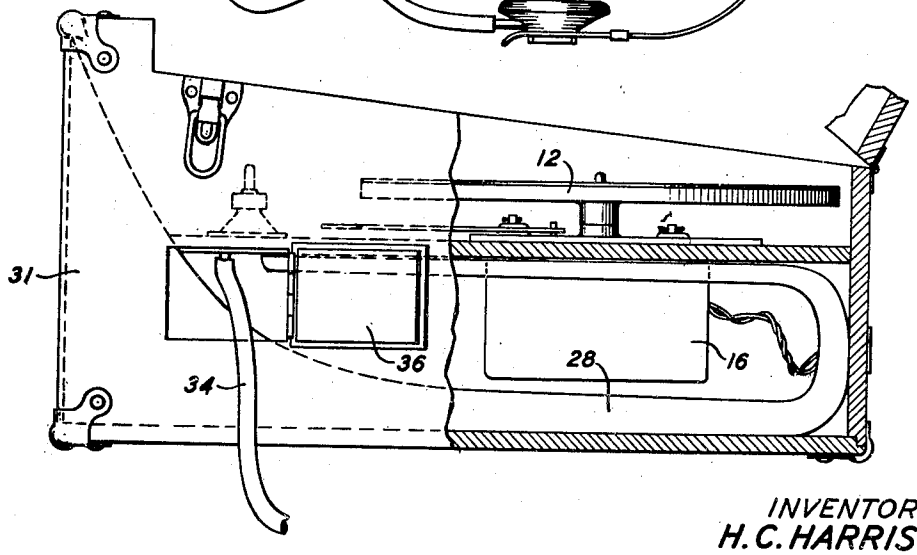


FIG. 5



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UNITED STATES PATENT OFFICE

2,035,473

PHONOGRAPH

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Application May 14, 1935, Serial No. 21,356

8 Claims. (Cl. 274—2)

This invention relates to acoustic phonograph reproducing sets and the object of the invention is an inexpensive phonograph of this type which is compact, readily portable and capable of good quality reproduction of speech and music.

There are many applications for a phonograph of this kind where only moderate acoustic output is required. For example books may be recorded on long playing records and played on such a machine for the benefit of a single person or small groups, particularly of blind persons or those with defective eyesight.

A phonograph according to this invention is preferably equipped with a two-speed turntable driven either electrically or by means of a spring motor capable of running for a considerable period without rewinding. The reproducer is of the vibrating diaphragm type in which the mechanical impedance of the diaphragm is properly matched to the acoustic impedance of the tone arm and to an associated, folded exponential horn mounted in the casing of the machine. An important feature of the machine is an acoustic headset, the tubing of which plugs into a receptacle on the machine which may be acoustically connected to the tone arm of the reproducer when earphone reception is desired as, for example, when loud-speaker reproduction would be annoying to others. For convenience in switching between the horn and the headset the tone arm is flexibly connected by a rubber sleeve to an eccentrically pivoted tubular member which in one position leads into the throat of the horn and in the other into the headset receptacle.

Volume control of the sound in the headset is obtained by means of an acoustic resistance which may consist of a felt pad of suitable dimensions interposed in the sound path leading to the headset receptacle. By disposing the resistance in the frame on the machine so that the proportion of its length traversed by the sound wave varies as the tone arm and its pivoted member are moved toward the headset position, the volume of sound can be adjusted to suit the requirements of the operator in each case. Since the acoustic energy requirements for the headset are normally less than for horn operation, the resistance is preferably disposed so that a portion of it is always effective when the headset is being used.

According to a further feature of the invention there are provided adjacent the headset receptacle a number of leakage paths which serve to keep the acoustic impedances matched as the resistance of the felt pad is decreased by moving the tone arm toward the headset position.

These and other features of the invention will be more clearly understood from the following detailed description and the drawings in which:

Fig. 1 is a perspective view of a reproducer set according to the invention;

Fig. 2 is a side view partly in section of the acoustic switch and volume control;

Fig. 3 is a plan view of the acoustic switch and volume control;

Fig. 4 is a plan view of the reproducer set with the turntable removed to show the horn and the acoustic headset connected to the acoustic switch; and

Fig. 5 is a side view of the set showing the arrangement of the turntable and its drive within the casing.

Referring now to the drawings the reproducer set is preferably housed in a portable casing 10 having a hinged lid 11 which can be left open as shown in Fig. 1 when the set is in use to give access to the turntable 12, the acoustic reproducer 13, the motor control switch 14 and the turntable feed adjusting switch 15.

The turntable driving unit 16 (Fig. 5) may be a spring motor or an electric motor but it is preferably arranged to drive the turntable at either 78 or 33 R. P. M. so that either standard or slow speed long-playing records may be used. The latter type of record is particularly well suited for the reproduction of books in recorded form since by using slow speed records with closely spaced grooves only a few record changes are necessary while listening to an entire book of average size.

The reproducer may be of any suitable type but for the reproduction of hill and dale records it is preferably designed in accordance with the general theory of Patent 1,981,793 granted to Keller November 20, 1934, with its acoustic impedance matched to that of the tone arm 17 which terminates in the acoustic switch 18. As shown in Fig. 2 this switch comprises a conical brass piece 19 held in contact with an annular felt pad 20 by a ring 21 secured to the base board 22. The tone arm is set in a soft rubber bushing 23 in the brass piece 24 which is removable from the switch 18. The bushing is sufficiently resilient to permit the tone arm to be lifted from its holder 25 and turned to playing position on a record and has a channel 26 connecting the tone arm to the channel 27 in the piece 19.

The horn 28 extends from its throat portion 29 opposite the opening 30 in the pad 20 to the

back of the casing and then forward to the front again as shown in Figs. 5 and 6. The horn increases in cross-section logarithmically throughout its length and terminates in a mouth 31 extending over substantially the whole front portion of the casing where there is provided a suitable perforated screen 32. Under the front portion of the pad 20 the base board is fitted with a short tube or receptacle 33 to which the tubing 34 of the acoustic headset 35 may be attached by opening the door 36 in the side of the casing.

When reproducing through the horn the maximum volume level will ordinarily be required and the switch 18 will be set in the position shown in Fig. 2 so that the sound waves can pass without attenuation through the opening 30 in the pad to the horn throat 29. It will be understood, however, that when desired the volume level can be reduced by turning the piece 19 of the switch in either direction so that the sound waves must pass through a portion of the pad to reach the horn.

When reproducing through the headset 35 some attenuation will ordinarily be required. In the embodiment of the invention shown the minimum attenuation is obtained when the switch is turned to the positon in which the channel 27 is above the tube 33 so that the sound waves pass vertically through the pad. For persons of very defective hearing the pad may be perforated at this position so that the entire reproducer output is delivered to the headset.

In either case, as the switch is moved from this position away from the tube 33 in either direction, the sound waves must traverse a portion of the pad to reach the tube. This acoustic resistance attenuates the sound waves in a manner analogous to the attenuation produced in an electrical circuit by a series resistor but at the same time it also impairs the matching of the acoustic impedances of the tone arm and headset. One convenient way of controlling the volume at the headset without also varying the frequency response characteristic is to provide a second acoustic resistance in shunt to the circuit which is reduced in value as the volume level is attenuated in such a way that their combined impedance remains substantially unchanged.

In the preferred embodiment shown in Figs. 2 and 3 there are a number of small holes 37 in the base board beneath the pad. These holes are grouped about the tube 33 and decrease in number or increase in spacing, or both, with their distance from the tube 33. When the channel is directly over the tube 33 the series resistance is a minimum and the shunt resistance of the holes is a maximum but as the switch is turned to increase the series resistance of the pad more sound energy passes through the holes 37. In other words, as the number of holes between the channel 27 and tube 33 increases their combined shunt resistance decreases. Hence it will be seen that by proper choice of the size of the holes and their number and spacing the impedance match between the tone arm and the headset may be maintained for all settings of the volume control switch.

In an acoustic headset the attenuation of the higher frequencies is likely to be greater than for the low frequencies and hence it may be desirable to provide compensatory frequency distortion in some other part of the acoustic path. For example, a leakage path may be provided around the diaphragm of the reproducer to reduce its response at low frequencies to compensate for all or a part of the high frequency attenuation in the headset.

It will also be understood that the size, number and spacing of the holes 37 may be chosen empirically to give any desired frequency response characteristic at the various volume levels to compensate for the non-linearity of the human ear or to suit the taste of the particular user.

What is claimed is:

1. An acoustic phonograph comprising a casing, a turntable mounted in the casing, driving means therefor, an acoustic reproducer and a tone arm for mounting the reproducer in operative relation to the turntable, an acoustic headset, a headset receptacle and an exponential horn within the casing and a pivoted connection for switching the tone arm between the receptacle and the horn.

2. In an acoustic phonograph the combination with a producer a headset and a loud-speaking horn, of a tone arm for switching the reproducer between the headset and the horn and means for decreasing the effective acoustic output of the reproducer when connected to the headset.

3. In an acoustic phonograph the combination with an acoustice reproducer, a loud-speaking horn acoustically coupled thereto and a headset, of an acoustic resistance and means for connecting the reproducer to the headset through the acoustic resistance.

4. In an acoustic phonograph, the combination with a horn, an acoustic headset receptacle, and a mounting plate having openings therein leading to the horn and the receptacle, of an acoustic reproducer and an eccentrically pivoted tone arm for acoustically connecting the reproducer with either of said openings.

5. In an acoustic phonograph the combination with a reproducer and an acoustic outlet receptacle device, of a base board having an annular recess forming in acoustic connection to the receptacle, acoustic resistance material in the recess, a tone arm and a supporting member therefor pivoted on the plate for varying the amount of acoustic resistance between the reproducer and the receptacle.

6. An acoustic phonograph in accordance with the preceding claim in which the recess in the base board has a plurality of small leakage holes adjacent the receptacle.

7. In an acoustic phonograph the combination with a reproducer, a tone arm therefor, an outlet receptacle and a pivoted member having an acoustic path for connecting the tone arm to the receptacle, of an acoustic resistance pad interposed between the member and the receptacle and a plurality of leakage paths spaced along the pad for diverting from the receptacle a portion of the sound energy being transmitted through the pad.

8. In an acoustic phonograph, a reproducer, a receiving device, an acoustic impedance matching path between the reproducer and the device, acoustic resistance means in series with and in shunt to the path, and means for simultaneously increasing the effective resistance of one of said means and decreasing the effective resistance of the other to vary the amount of acoustic energy transmitted to the device without substantially impairing the impedance matching properties of the path.

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