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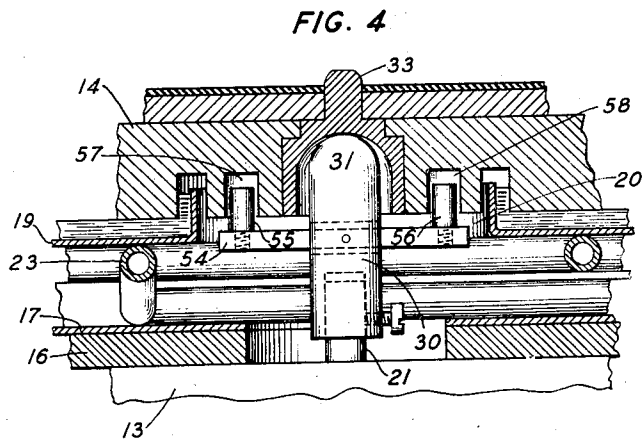
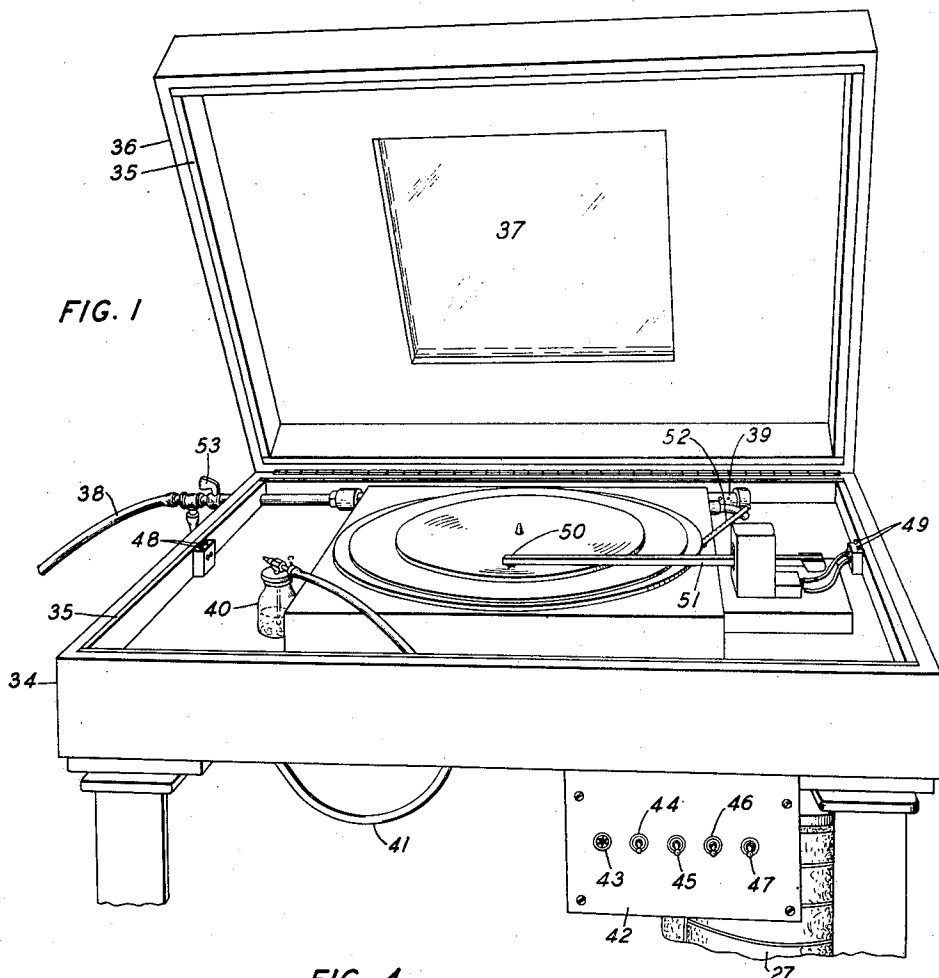
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2,115,148

SOUND REPRODUCING SYSTEM

Filed Dec. 21, 1935

2 Sheets-Sheet 1



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FIG. 2

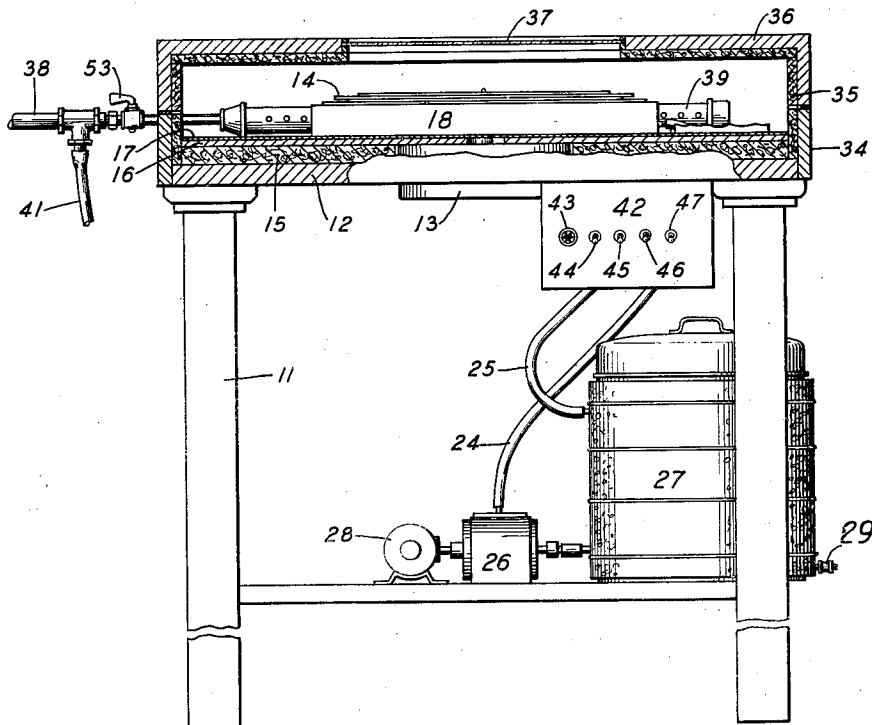
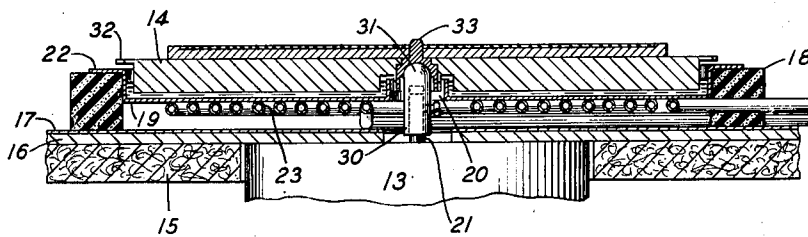


FIG. 3



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SOUND REPRODUCING SYSTEM

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5 Claims. (Cl. 274—9)

This invention relates to the reproduction of original records and the object of the invention is a method of and apparatus for giving high quality reproduction of such records without impairing them for subsequent use.

It has been proposed heretofore to reproduce recorded sound directly from an original record in wax or other relatively soft materials. This procedure is often desirable as an immediate check on the quality of the record to avoid the delay and expense of processing inferior records. It is also sometimes advantageous to make duplicates or other modified records on wax or film directly from the original wax record.

The reproducers ordinarily used for playback purposes are much lower in mechanical impedance than ordinary reproducers but it has been found difficult to reduce this impedance sufficiently to avoid some injury to soft wax recording during the playback process. Any deformation of the groove undulations will not only impair the quality of pressings made from the original record but will also produce corresponding distortion in the playback reproduction. It is also important that the angular velocity of the playback turntable be kept constant and that the turntable be free of any tendency to wobble since either of these types of irregularity of motion will also distort the reproduction.

According to this invention, the records to be played back are chilled to a temperature considerably below ordinary room temperature and then sprayed with cold water to lubricate the stylus of the reproducer during the playback operation. Due to the increased hardness of the wax at the lower temperature and to the lubricating effect of the water, it is found that by this method records may be reproduced repeatedly without materially impairing them for subsequent use as master records.

Since the waxes ordinarily used are slightly water soluble at room temperatures, care must be taken to avoid condensation on the record surface while chilling the wax and to dry the surface thoroughly and keep it dry while restoring it to room temperature after the reproduction.

The preferred apparatus for the playback operation according to the invention comprises a very heavy metal turntable in frictional, pivotal contact with the spindle of a driving unit. The spindle projects up through a recessed cooling platen containing a small quantity of water which provides a supporting film for the turntable and prevents it from wobbling during the reproducing operation. Since the turntable is

very heavy and slip can occur at the frictional driving contact, high frequency irregularities in the angular velocity of the spindle are not transmitted and the thin film of water between the turntable and the platen provides a frictional resistance load which substantially eliminates the irregularities of lower frequency such as those of the once-per-revolution type.

In the drawings Fig. 1 is a perspective view of the playback reproducing apparatus according to the invention.

Fig. 2 is an elevation of the apparatus partly in section;

Fig. 3 is a detailed section of the turntable and cooling platen; and

Fig. 4 is a modification of the turntable drive which is suitable for use in sound picture systems.

Referring now to the drawings a metal frame 11 supports a baseboard 12 under which is mounted a suitable motor driving unit 13 for the turntable 14. The baseboard carries a thick layer of felt 15, a steel plate 16 and a second thin layer of felt 17 to cover the metal and improve the appearance of the machine. Above the felt 17 is a piece of sponge rubber 18 or other suitable material having a large central opening for receiving the cooling platen 19.

This platen is preferably an annular copper pan having a central flanged opening 20 for the shaft 21 of the driving motor and an outer flange 22 engaging the rubber piece 18. Secured to the under side of the pan is a spiral coil 23 of copper tubing the ends of which are brought out and connected to the hoses 24 and 25 leading to the outlet of a pump 26 and to the inlet of a cooling unit 27 respectively. The unit may be an automatic refrigerator but good results can be obtained with the unit shown which comprises a metal container having a drain 29 and a flat spiral coil of tubing similar to the coil 23 mounted near the bottom of the container and supporting a quantity of cracked ice. One end of the coil connects with the hose 25 and the other end with the pump intake so that when the pump is driven by the motor 28 the chilled water in the cooling unit coil is circulated through the coil 23 of the cooling platen.

The shaft or spindle 21 of the turntable motor is fitted with a brass end piece having a semi-spherical bearing surface 31 for supporting the turntable. The turntable is preferably of aluminum about one inch in thickness with a flange 32 projecting out over the flange 22 of the cooling platen and a cold rolled steel insert 55

33 at its center having a semispherical surface engaging the end piece 30 on the motor shaft. For stable operation the bearing surface of the insert 33 should be near the upper surface of the turntable as shown so that the turntable is supported above its center of mass. While it is desirable for reasons already mentioned to have a very heavy turntable, it will be understood that if its inertia is excessive the turntable will be too slow in coming up to speed. Ideally, from the standpoint of eliminating turntable wobble, the bearing surface should be made very small by tapering the drive shaft to a point but if this is done the frictional driving force is also very small. It is found in practice that a very good compromise is obtained for a seventeen inch turntable by making the brass piece 30 of five-eighths inch diameter with a semispherical end as shown. A thick aluminum turntable is preferable to a thinner one of a heavier metal in that it permits the use of a deeper cooling pan in the platen 19.

To illustrate the construction more clearly, the turntable is shown spaced some distance above the cooling platen but in practice this clearance should be only of the order of one-sixteenth inch so that there is room for only a thin film of water which will provide considerable frictional resistance to the motion of the turntable. With the construction described the turntable comes up to full speed of $33\frac{1}{3}$ revolutions per minute in three or four seconds after which no further slipping occurs between the brass piece 30 and the insert 33. The film of water provides an automatically levelling surface for the turntable which adjusts itself to the level position on its bearing and any tendency to wobble is quickly suppressed by the force necessary to displace the water laterally under the turntable. By partially supporting the turntable on a film of water and connecting it to the drive shaft by a frictional pivot mounting in the manner described very smooth operation is obtained without resorting to complicated constructions which require very accurate machining to produce comparable results.

The turntable is preferably inclosed in a wooden casing 34 lined with fibre board 35 and having a similarly constructed hinged cover 36 with a window 37 through which the operation of the machine may be observed with the cover closed. Dry air is admitted to the casing from a supply line 38 through a perforated pipe 39 at the back of the turntable. The sprayer 40 for lubricating the record surface is also operated from the line 38 by means of a connecting hose 41.

The control panel 42 has a light 43 to indicate when the pump motor 28 is running and switches 44 and 45 for controlling this motor and the turntable driving unit 13. The switches 46 and 47 are connected to short-circuit the reproducer terminals 48, 48 and 49, 49, respectively. In Fig. 1 only one reproducer 50 and arm 51 is shown but it is frequently desirable to provide a second reproducer which may be connected to the terminals 49.

When a record is to be played back, it is first thoroughly cleaned to remove all surface dust and dirt particles and then placed on the turntable, the temperature of which has been lowered to 38 to 40 degrees F. by operating the pump 26 for thirty minutes or more as required. A thermometer 52 embedded in the rubber piece 18 in contact with the cooling platen indicates when operating temperature has been reached. The cover is then closed and dry air under about five

pounds gauge pressure is admitted by the valve 53 to prevent condensation of moisture on the record surface while it is cooling. After about three minutes the record has been cooled to about 40 degrees, the air is turned off and the surface is sprayed with water by means of the sprayer 40 until the entire record surface is covered with globules of water of about one-sixteenth to one-eighth inch diameter. A few pieces of recording wax are preferably kept in the jar of the sprayer so that the water used has already dissolved as much wax as it will readily dissolve at room temperature and any tendency of the water to etch the record surface is reduced to a minimum. In some cases improved results may be obtained by adding glycerine or other lubricants to the water used in spraying the record.

The pump is preferably operated to maintain the 40 degrees temperature while the record is played in the usual manner by means of a suitable playback reproducer 50 which is connected to amplifiers and a loud-speaker or some other translating device. When the playing is completed the record is immediately removed from the chilled turntable and placed on a second turntable at room temperature. A filtered air blast is applied to the rotating record until it is thoroughly dry and above the dew point of the surrounding air. This usually takes about two minutes after which time the recording may be stored or used for processing in the usual way. While the air blast method is preferred other drying methods may be used. For example, the record may be rotated at high speed in warm dry air. In this case most of the water is thrown off by centrifugal force and the dry air absorbs the remainder and prevents it from recondensing on the record while it is below the dew point temperature.

When the apparatus described is to be used in a sound picture system or with other apparatus requiring synchronous operation, the turntable may, of course, be rigidly mounted on the shaft of the driving unit. If this is done a larger driving motor is required, and other means for preventing turntable wobble must be provided. Alternately, the frictional pivotal contact may be retained and cumulative slip between the motor shaft and the turntable may be prevented as shown in Fig. 4 by fitting to the motor shaft a bar 54 having pins 55, 56 extending upwardly into somewhat larger holes 57, 58 in the turntable. With this construction, or an equivalent keying means, the starting load on the motor will be somewhat greater than for the structure of Fig. 3, but the turntable is positively driven and it is at the same time free to pivot about the end of the motor shaft and assume a true horizontal position.

Other modifications of the method and apparatus will occur to those skilled in the art but the invention is intended to be limited only by the scope of the following claims.

What is claimed is:

1. In a turntable drive, a recessed member, a driving unit having a spindle extending upwardly through the member, a turntable mounted in close spaced relation to the member in pivotal frictional contact with the spindle and a liquid in the space between the turntable and the member.

2. In a turntable drive the combination with a turntable and a driving unit therefor of a recessed cooling platen, a spindle on the driving unit projecting up through the platen into piv-

otal contact with the turntable and liquid in the platen supporting the turntable in a horizontal position on the spindle.

5 3. In a turntable drive, a recessed member containing a liquid, a driving unit having a spindle extending upwardly through the member, a turntable pivotally supported above its center of mass on the end of the spindle and in contact with the liquid in the member.

10 4. A turntable drive according to claim 1 in combination with means for limiting the slip between the turntable and the spindle.

5. Apparatus for reproducing wax records comprising a cooling platen, means for controlling the temperature of the platen, a driving unit having a spindle extending upwardly through the platen, a turntable in pivotal contact with the spindle and in close spaced relation to the platen, a liquid resistance medium between the turntable and the platen, and means for producing a drying atmosphere at the turntable. 5

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