

March 20, 1934.

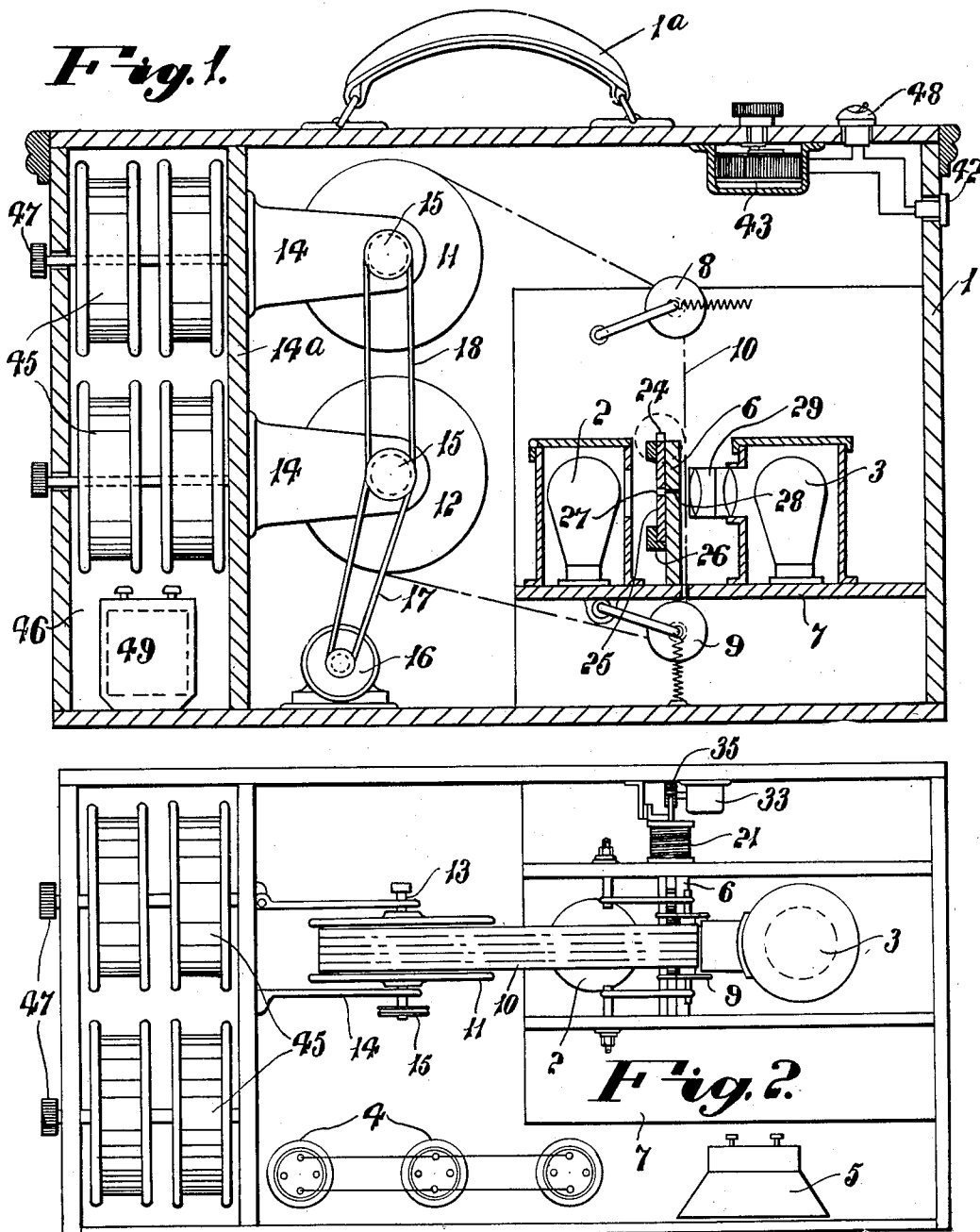
W. A. HENDERSON ET AL

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SOUND REPRODUCING APPARATUS

Filed Dec. 7, 1932

2 Sheets-Sheet 1



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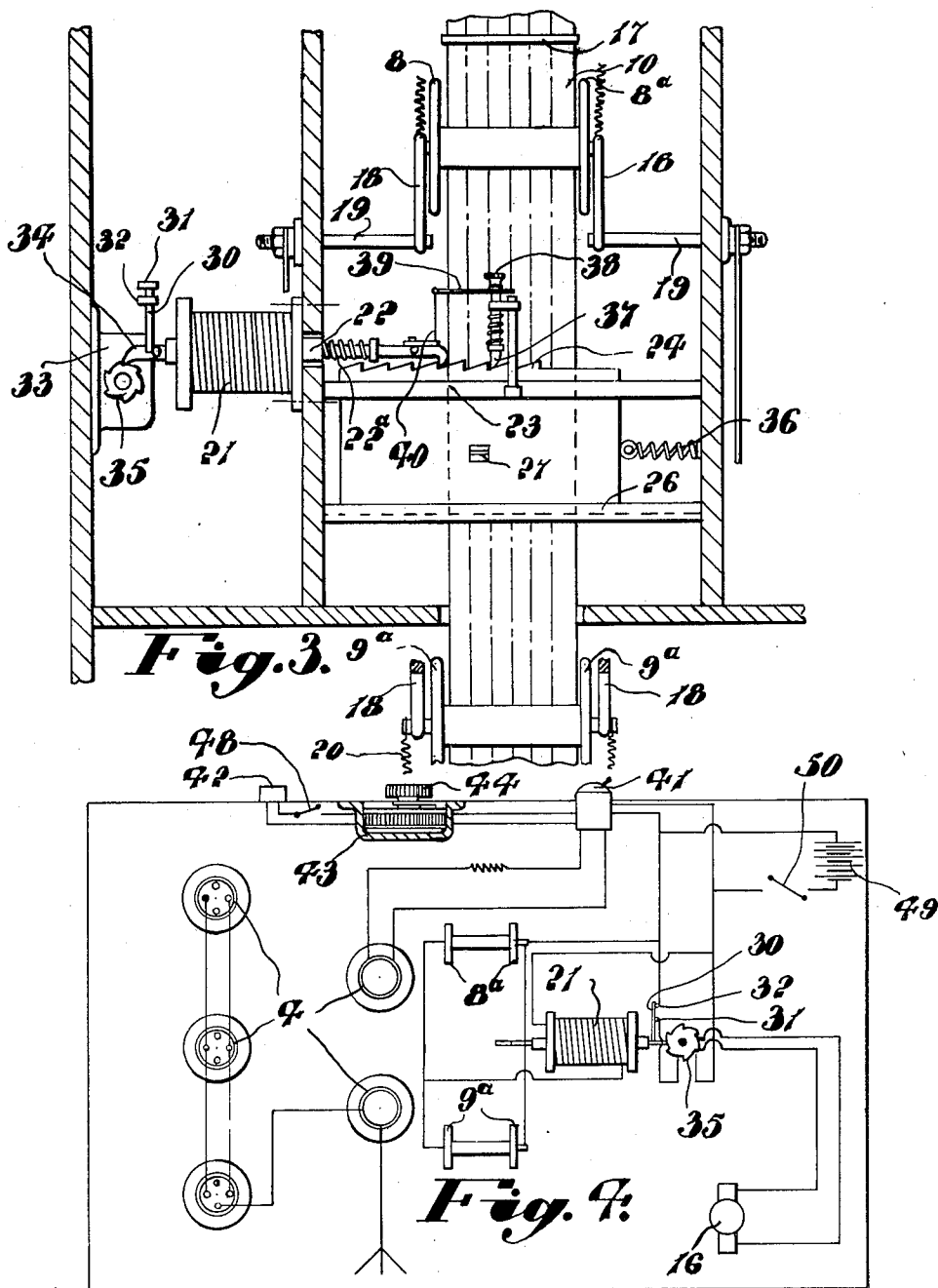
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UNITED STATES PATENT OFFICE

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SOUND REPRODUCING APPARATUS

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In Great Britain December 17, 1931

2 Claims. (Cl. 179—100.3)

The present invention relates to the reproduction of sound from records and the object of this invention is to provide sound reproducing apparatus suitable for use in the same circumstances as the ordinary gramophone but capable of playing records considerably longer than the ordinary gramophone record and/or capable of providing a plurality of records in a smaller space than is normally occupied by a disc gramophone record.

It is well known to reproduce sound in conjunction with cinematograph films by forming along one edge of the film a sound track constituted in some cases by successive marks or lines of varying transparency or density and in other cases constituted by lines which vary in area. One of the objects of the present invention is to make use of this method of sound reproduction as a means of reproducing sound with gramophones for use in ordinary domestic circles.

According to the present invention, means for reproducing sound from photographic sound records bearing a number of sound tracks comprises means to receive a pair of spools on which the record film is wound, a gate through which the film is fed, a light sensitive cell and source of light associated with said gate, a valve circuit and a loud speaker with said cell, a prime mover for driving said spools, means for positively connecting the prime mover to said spools successively and automatically for reversing the direction of drive of the spools at the completion of the playing of one track, and means for changing from one track to another at the completion of the playing of a sound track.

In carrying our invention into practice, it is preferred to provide a pair of spools, one at each side of a light sensitive cell and to carry the film from one spool to the other through a gate located in alignment with a lens adapted to concentrate light projected through the gate from a lamp on to a light sensitive cell connected to a suitable thermionic amplifying circuit. Located above and below the gate are suitable guide sprockets or pulleys for directing the film through the gate and one of these can be connected to a suitable electric or clockwork motor having associated with it a governor for regulating the speed of travel of the film through the gate. The valves appropriate to the amplifying circuit can be located each side of the motor and the winding spools for the film can be located above these valves.

When the film has travelled completely from one spool to the other, means may be provided

for automatically reversing the direction of rotation of the means which feeds the film. Any suitable mechanical or electrical device can be provided for this purpose. For example each end of the film may be formed with a short flexible strip of copper or other suitable material adapted to be bridged by a pair of contacts carried by a spring loaded arm pressed lightly against the periphery of the unwinding reel of film so that when the thin copper strip becomes exposed it closes a circuit containing an electromagnet or solenoid which is energized so as to operate a switch to stop the motor and practically simultaneously bridges a pair of contacts which reverse the direction of flow of current to the motor and thereby drives the motor in the opposite direction. The movement of the armature of the electro-magnet or the solenoid is also utilized to displace the gate through which the film passes the required extent to bring the next line of sound track in alignment with the small aperture in the gate through which the light is projected, or alternatively the gate can be provided with a slit longer than the width of the sound track and a shutter with a small opening is moved along this slit by successive operations of the electromagnet or solenoid.

The required tension on the film passing through the gate can be obtained by suitable friction rollers on one side of the gate and the pull of the driving sprocket wheel on the other side of the gate and the take-up spool and the supply spool can be rotated in unison from the motor to obviate any slack of the film around either of said spools.

The complete apparatus may be contained in a portable box and can be provided with suitable connecting devices for readily connecting the circuit appropriate to the light sensitive cell to an amplifying circuit of a wireless receiving set, whereby a wireless receiving set can be employed with sound records in a novel and compact manner.

If required a carriage supporting the source of light with a suitable reflector, the gate and the light sensitive cell can be adapted to be adjusted translatably relative to the film when it is required to change the record.

The strip of film preferably has its different lines of records so arranged that when the last record has just been played the first record is ready to commence being replayed subject to the required slight lateral adjustment of the film in the gate or equivalent lateral adjustment being effected. For example the successive records are

preferably arranged in reverse directions to obviate having to rewind the whole of the film back to a starting position.

In order that this invention may be clearly understood and readily carried into effect two sheet of drawings are appended hereto somewhat diagrammatically illustrating an embodiment thereof and wherein,

Fig. 1 is a sectional side elevation view.

Fig. 2 is a sectional plan view.

Fig. 3 is a part sectional front elevation view of the gate mechanism.

Fig. 4 is a diagrammatic view showing a suitable circuit for changing the direction of travel of the sound track and for changing from one sound track to another.

Referring to the drawing, in the embodiment shown a suitably decorated casing 1 which can be of a portable nature fitted with a handle 1a accommodates the sound reproducing apparatus which in a simple form comprises a light sensitive or photo-electric cell 2, a source of light 3, a suitable valve circuit 4 connected in known manner to the light sensitive cell 2 and a loud speaker 5 mounted in one side of the casing 1.

A film gate 6 is mounted on a suitable base plate 7 preferably disposed above the bottom of the casing 1 as shown in Fig. 1, and suitable pulleys 8 and 9 disposed above and below the gate guide a film 10 through the gate from one of a pair of spools 11 and 12 to the other. The spools 11 and 12 are removably mounted on spindles 13 rotating in anti-friction bearings in a pair of brackets 14 secured to a wall 14a and base of the casing 1, and pulleys 15 mounted on the spindles 13 are adapted to be driven from an electric motor 16 by means of endless belts 17 and 18 or alternatively chains and sprocket wheels can be employed. The pulleys 15 are provided with one way drive friction clutches or free wheel devices adapted when one is driven in one direction to be positively coupled to its spindle 13 and the other pulley rotating idly or with slight friction relatively to its spindle so that when the film 10 has been nearly completely drawn from one spool to the other the direction of rotation of the motor 16 can be reversed and the previously idly rotating or unwinding spool 15 driven from the motor whilst the previously winding or driven spool 15 is free to rotate to allow the film 10 to be drawn off it.

A suitable method of automatically reversing the direction of rotation of the motor is shown somewhat diagrammatically in Figs. 3 and 4 in which the film 10 is provided near each end with a very thin transverse copper strip 17 and the end flanges 8a and 9a of the pulleys 8 and 9 are also of copper but insulated from each other. A pair of arms 18 carrying each pulley 8 act as conductors and can radiate from terminal pins 19 and be spring loaded by springs 30 to act as jockey pulleys to put the desired tension on the film as it passes through the gate 6. When a pair of flanges of a pulley 8 or 9 are bridged by the thin copper strip 17 on the film 10 a circuit is closed to a solenoid or electro-magnet 21 which is consequently energized and its armature 22 moved axially against the influence of a coiled compression spring 22a. As the armature 22 thus moves, a pawl 23 on one end thereof operatively engages one of a series of ratchet teeth 24 on a plate 25 slidable in guides 26 across the gate 6 and moves a small square light aperture 27 in the plate 25 a short distance along a restricted light slit 28 whereby

the spot of light from the lamp 3 on to the film 10 is displaced the required extent to bring into operation the next in succession of a number of sound tracks on the film 10, it being understood that the reflector casing 28 of the lamp 3 and its lens system 29 produces a beam of light sufficiently wide for this purpose. Alternatively of course the plate 25 with its square aperture 27 could be part of the holder for the lamp 3 and such holder traversed intermittently in the same manner but it is preferred to reduce as much as possible the amount of material to be moved. The movement of the armature 22 when the solenoid 21 is energized moves a suitable contact maker which merely for simplicity of illustration is shown as a simple conductor strip 30, carried by an extension of the armature from a pair of contacts 31 and 32 and thereby breaks the circuit to the motor 16 and to the solenoid. Simultaneously the armature 22 turns a rotary switch member 33, for example by a pawl 34 on the armature extension and a ratchet wheel 35 on the rotary switch member and reverses contacts in the switch whereby upon the armature being moved back under the influence of its spring 22a as soon as it is deenergized the circuit is again closed by member 30 and the direction of flow of current to the motor reversed and the film wound in the reverse direction with a new sound track exposed by the opening 27. This sequence of operations is repeated when the film brings the other contact strip 17 into contact with the other pulley 8 or 9.

The sliding screen plate 25 is preferably loaded with a spring 36, a spring loaded detent member 37 normally restraining return of the plate 25 under the influence of its spring until the last record has been played, when the member 37 can be raised with the pawl 23 by a knob 38 to allow the plate 25 to be pulled back by the spring 36 to its starting position. Alternatively the plate 25 can, when moved by the armature 22 after playing the last record on the film, act as a contact maker across a pair of contacts and close a circuit of an electromagnet taking the plate of the member 38 which is energized and its armature comprising the spring loaded detent 37 raised so as to obtain an automatic operation. The member 37 can be connected by a lateral rod 39 and a depending cord or flexible wire 40 to the pawl 23 to raise the pawl 23 with the member 37.

A switch 41 can enable a change from the motor 16 to a wireless receiving aerial to be made so that the same thermionic circuit can be used selectively for sound reproduction from a record or from wireless waves. The set can be connected to the source of current by a plug-in connector 42 and if required a rheostat 43 mounted on the casing 1 and operated by an external slidable knob 44 can adjust the set to different voltages.

A reserve supply of filled spools 45 can be carried in a compartment 46 at one end of the casing, pull-out retaining pins 47 holding the reserve spools in place. A main switch 48 can be fitted to connect and disconnect from the main supply.

If desired a battery 49 can be provided in the casing as a supplementary or alternative source of current, a suitable switch 50 bringing this battery into operation, the main switch 48 if desired having a set of contacts connected in the circuit of the battery 49 so that only when

the main switch 48 is off from the main supply can the circuit of the battery 49 be closed.

What we claim is:—

5 1. In apparatus for reproducing sound from photographic sound records bearing a number of sound tracks, the provision on the film itself of an electrical conductor, and a pair of spaced contacts in the path of travel to said film, the said conductor being adapted to bridge said contacts, and thereby to close a circuit and electrically
10 operated means energized by the flow of current in said circuit adapted to reverse the direction of drive of the film.

15 2. In apparatus for reproducing sound from photographic sound records bearing a number of sound tracks, the provision on the film of an electrical contact, and a pair of contacts located

in the path of travel of the film and adapted to be bridged by the said contact on the film, a light sensitive cell and a source of light between which the film travels, a movable light slit carrying member, an electric motor driving rotary members on which the film is wound and unwound, a switch adapted to make and break the circuit to the motor and reverse the flow of the current to the motor, the arrangement being that when the said contact of the film engages
80 said pair of contacts the said electrically energized member is energized and simultaneously operates said switch and moves said light slit carrying member.

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