

Dec. 27, 1938.

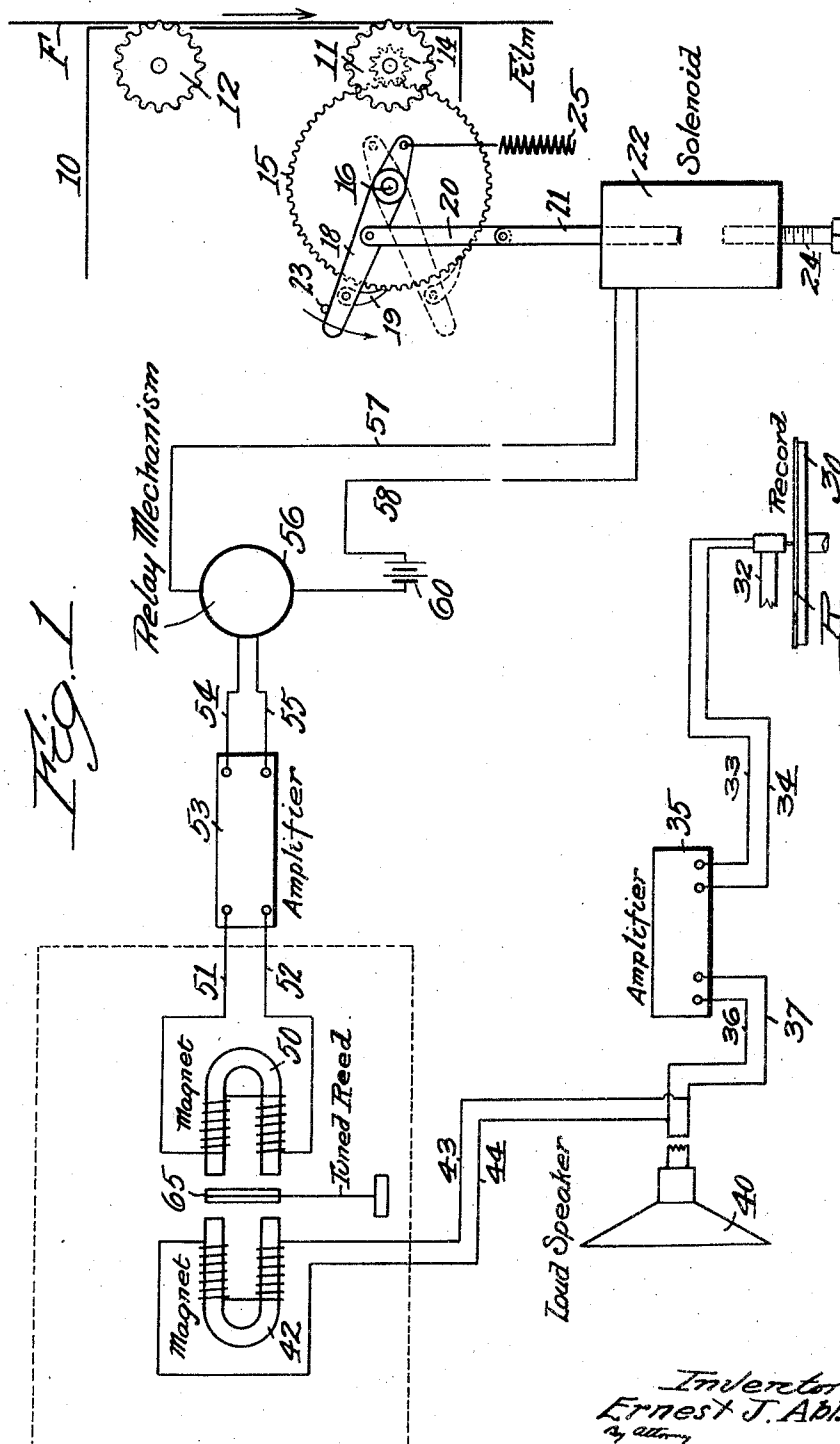
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2,141,203

CONTROL AND OPERATING MECHANISM FOR SLIDE FILM PROJECTORS

Filed Aug. 5, 1936

2 Sheets--Sheet 1



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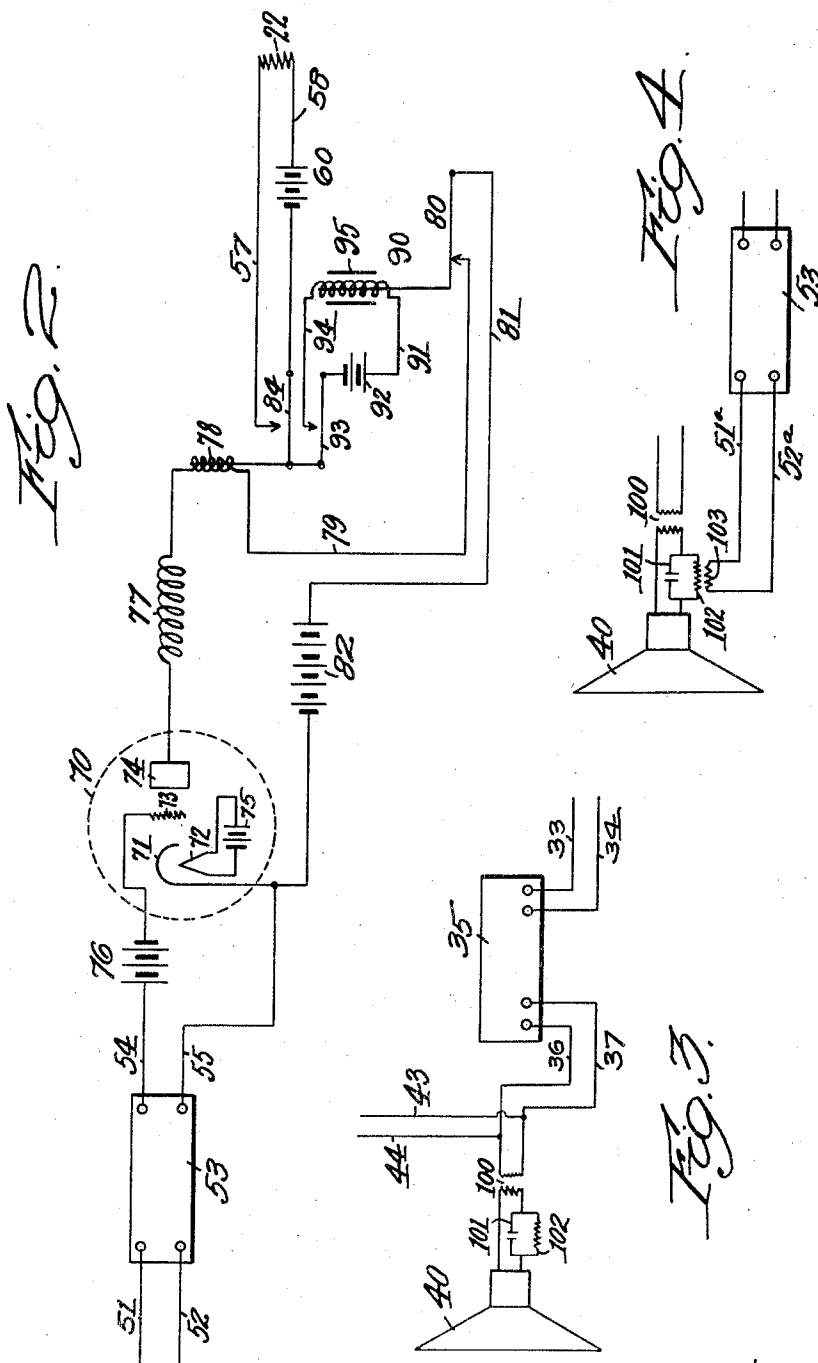
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UNITED STATES PATENT OFFICE

2,141,203

CONTROL AND OPERATING MECHANISM
FOR SLIDE FILM PROJECTORSErnest J. Abbott, Ann Arbor, Mich., assignor of
one-half to William E. De Voe and Edwin W.
De Voe, both of Detroit, Mich.

Application August 5, 1936, Serial No. 94,486

3 Claims. (Cl. 179—100.3)

This invention relates to the exhibition of slide films in conjunction with a recorded lecture or other sound record. It has been customary to provide an audible signal on the record to indicate to the operator when the film was to be advanced, the signal commonly being the sound of a gong. This audible signal distracted and annoyed the audience and frequently was not correctly followed by the operator.

It is the general object of my invention to provide automatic control for a slide film projecting apparatus which will be responsive to a sound signal outside of the easily audible range of the human ear. When my invention is in use, the projecting apparatus will automatically advance the film in accordance with sound signals from the record reproducer, but these signals will not be noticed by the audience.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of my invention is shown in the drawings, in which

Fig. 1 is a diagrammatic front elevation of apparatus embodying my invention;

Fig. 2 is an enlarged diagrammatic view of a portion of the apparatus shown in Fig. 1; and Figs. 3 and 4 are diagrammatic views of modified constructions.

In Fig. 1 I have indicated a portion 10 of a projecting apparatus through which a slide film F is guided and advanced by sprockets 11 and 12, one or both of which are positively driven. I have indicated the sprocket 11 as provided with a pinion 14 engaged by a large gear 15 mounted on a supporting shaft 16. A feed lever 18 is loosely pivoted on the shaft 16 and is provided with a pawl 19 adapted to engage the teeth of the gear 15.

The lever 18 is connected by a link 20 to a plunger 21 slidable in a solenoid coil 22. A stop pin 23 limits the idle return movement of the feed lever 18 and a screw 24 forms an adjustable stop to limit the feeding movement. A spring 25 returns the feed lever to initial position after actuation by the solenoid 22.

The gear ratio and the length of the feeding stroke are so proportioned that each downward movement of the solenoid plunger 21 and feed lever 18 will advance the film F one space in the projecting apparatus 10.

A sound record R, such as a phonograph disc, may be mounted on a rotating table 30 and may be engaged by a phonograph needle, the

usual supporting arm therefor being indicated at 32. The phonograph needle is connected through wires 33 and 34 to an amplifier 35, from which wires 36 and 37 extend to a loud speaker 40. As the disc R is rotated, the lecture or other sound record will be reproduced by the loud speaker, all in the usual manner.

In order to control the film-feeding apparatus, I provide an electro-magnet 42 having a winding connected to wires 43 and 44 which form a branch circuit in parallel with the loud speaker 40. A second electro-magnet 50 is provided with coils connected by wires 51 and 52 to an amplifier 53, which in turn is connected through wires 54 and 55 to a relay and amplifying mechanism 56 which controls the flow of current through the wires 57 and 58 which connect the solenoid 22 to a battery or other source of power 60.

The relay mechanism 56 is of the type which permits a relatively heavy momentary flow of current through the solenoid circuit whenever the relay is excited through the operation of the electromagnets 42 and 50. A tuned reed 65 is mounted to vibrate between the poles of the magnets 42 and 50, and is responsive only to a note of such frequency that it is not easily audible to the human ear, the common frequency being about forty cycles.

The coils of the magnet 42 (Fig. 1) should be wound for a sufficiently high impedance so that when bridged across the output of the amplifier 35 it will have no appreciable effect on the operation of the loud speaker 40.

The details of construction of the relay mechanism 56 may be substantially varied, but I have shown diagrammatically in Fig. 2 a form of relay mechanism well adapted for use in my improved control and operating mechanism.

The relay mechanism as shown includes a gas-filled relay tube of commercial form indicated generally by the numeral 70 and comprising a cathode 71, a heater element 72, a grid 73 and a plate 74. A suitable battery or transformer 75 is provided for the heater element 72, and the grid 73 is biased with a suitable battery 76 so that the tube 70 normally passes a negligible current only.

The plate 74 is connected through a ballast resistor 77 to one end of a relay or solenoid coil 78. The circuit is continued from the other end of the coil 78 through a wire 79, a normally-closed switch 80, a wire 81 and a plate battery 82 back through the return wire 55 to the amplifier 53.

The feed-operating solenoid 22 previously described has a normally-open switch 84 interposed in the wire 57, so that its energizing circuit through the battery 60 is normally open.

Another solenoid coil 90 is connected through a wire 91 and battery 92 to one side of a normally-open switch 93, and the other side of the switch 93 is connected through a wire 94 back to the solenoid coil 90. A damper shield or sleeve 95 of the time-delay type well known in the art is provided for the relay or solenoid coil 90.

When the positive swings of the voltage passing the amplifier 53 become large enough to overcome the bias of the battery 76, the tube 70 "strikes" and causes a heavy current to pass through the plate circuit. This causes the relay or solenoid coil 78 to close the switches 84 and 93, it being noted that the circuits controlled by these switches are entirely separate and insulated from each other.

Closing of the switch 84 completes the circuit through the operating solenoid 22 and actuates the feeding mechanism as previously described.

Closing of the switch 93 completes the circuit through the relay coil or solenoid 90 and battery 92, thus energizing the solenoid 90 and causing the same to open the switch 80. This operation is somewhat delayed, however, as the eddy currents in the shield 95 cause the operating current in the coil 90 to increase slowly, so that there is an appreciable time interval, often as much as one full second, between the closing of the switch 93 and the opening of the switch 80.

This delay gives the solenoid 22 time to operate.

As soon as the switch 80 is opened, however, the plate circuit is broken, which immediately stops the tube current and allows the switch 84 to open, deenergizing the solenoid 22.

The duration of the original actuating impulse transmitted by the amplifier 53 is adjusted so that the impulse will stop by the time the switch 80 is opened, thus preventing the system from oscillating or repeating its feeding operation.

When the switch 84 is opened to deenergize the solenoid 22, the switch 93 is simultaneously opened to deenergize the relay coil or solenoid 90, thus allowing the switch 80 to close and reset the circuit for reception of another feeding signal.

Having described the construction of my improved apparatus, and the detailed operation of the relay mechanism 56, the general method of operation of my invention is as follows:

The film F having been mounted in the projector 10 in correct relation to the record R, the record is started in motion and the lecture or discourse is reproduced through the loud speaker until a low cycle note is sounded to which the tuned reed 65 will respond. The sounding of this note does not interfere in any way with the continued delivery of the lecture by the loud speaker 40, but the low note, acting through the magnet 50, amplifier 53 and relay mechanism 56, causes an operating current to flow through the solenoid 22, which in turn actuates the feed lever and advances the slide film one space. As soon as the low note ceases, the relay mechanism 56 is deenergized and the feed lever 18 is returned to initial position by the spring 25.

It will thus be evident that the film is advanced step-by-step in correct response to the low cycle notes on the phonograph record, so that the films are changed in strict timed relation to the lecture or discourse and without stopping the lecture or

introducing a noticeable foreign or annoying note in the record reproduction.

While a forty-cycle note is not entirely inaudible to the human ear if the intensity is sufficiently great, it is substantially inaudible under operating conditions, because the human ear is much less sensitive to low cycle notes than to the higher frequency sounds of speech and music, and also for the reason that the loud speakers commonly used in such amplifying systems are very insensitive to frequencies in the low cycle range and do not produce appreciable sound at this low pitch.

If it is desired, however, to entirely eliminate all reproduction of the low cycle notes, means may be provided to trap the voltage of these low pitch notes so that it does not reach the loud speaker 40. Such a construction is shown in Fig. 3 in which a branch circuit is introduced between the usual transformer 100 and the loud speaker 40. This branch circuit has a capacitance 101 in one-half of the circuit and an inductance 102 in the other half of the circuit. By adjusting these branch circuits in accordance with their well known properties, the inductance may be made so high at the low pitch frequency that very little current of this frequency will flow through the loud speaker circuit, while negligible impedance is offered at all higher frequencies.

In Fig. 4 I have indicated an alternative selective method for controlling the feeding mechanism. For this purpose I include the branched circuit with the capacitance 101 and inductance 102 in series with the loud speaker as above described, and on the same core with the inductance coil 102 I place a secondary winding 103 directly connected through wires 51^a and 52^a to the input of the amplifier 53 by which the operating impulse is given to the relay mechanism 56. When this construction is used, the timer reed 65 and associated magnets 42 and 50 may be omitted, as the tuned branch circuit selects the critical frequency and applies it to give the desired operating impulse to the amplifier 53.

While I have shown my invention embodied in apparatus for advancing a film step-by-step through a single projecting unit, it will be understood that the invention in its broad features is not restricted to any particular type of projecting apparatus and that the control mechanism may be used for example in connection with a duplex dissolving apparatus such as is shown in the prior application of William E. De Voe, Serial No. 84,919, filed June 12, 1936.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:—

1. Control and operating mechanism for a slide film projector comprising a sound reproducing apparatus, an electric circuit therefor, feeding means for the film, an electromagnetic device to operate said feeding means, a relay controlling said device, an electro-magnet controlling said relay, a second electro-magnet connected to the sound reproducing circuit, and a vibration tuning element interposed between said two last-named electro-magnets, said tuning element being responsive only to a substantially inaudible note produced by said apparatus.

2. Control and operating mechanism for a slide film projector comprising a sound reproducing apparatus including a loud speaker and an electric circuit therefor, feeding means for the

film, actuating mechanism for said feeding means, means to render said mechanism operative on the sounding of a low cycle note by said reproducing apparatus, and means to prevent
5 said low cycle note from being reproduced by the loud speaker, said latter means including a capacitance and an inductance in parallel branch circuits and in series with said loud speaker, said
10 capacitance and inductance being relatively adjusted to substantially prevent current of said low cycle frequency flowing to said loud speaker, and said inductance comprising a primary winding and a secondary winding associated therewith, which secondary winding is directly con-
15 nected to and controls the means which renders said actuating mechanism operative.

3. Control and operating mechanism for a slide film projector comprising a sound-reproducing apparatus, an electric circuit therefor, feeding

means for the film, and a control device for said feeding means including an element responsive only to a low cycle note produced by said apparatus, said feeding means including a feeding solenoid and an operating circuit therefor, and
5 said control device including electro-magnetic means to close said operating circuit and energize said feeding solenoid, a circuit for said electro-magnetic means closed at one point by said responsive element, separate and additional elec-
10 tro-magnetic means effective to thereafter open said latter circuit at a different point and to thereby cause said feeding solenoid to be deenergized, and means to delay the action of said
15 additional electro-magnetic means for a predetermined time interval after the closing of said feeding circuit by said first-named electro-magnetic means.

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