May 18, 1937. A. V. MULLEN ET AL 2,081,015

AUTOMATIC CHANGE-OVER

Filed May 10, 1934 2 Sheets-Sheet 1

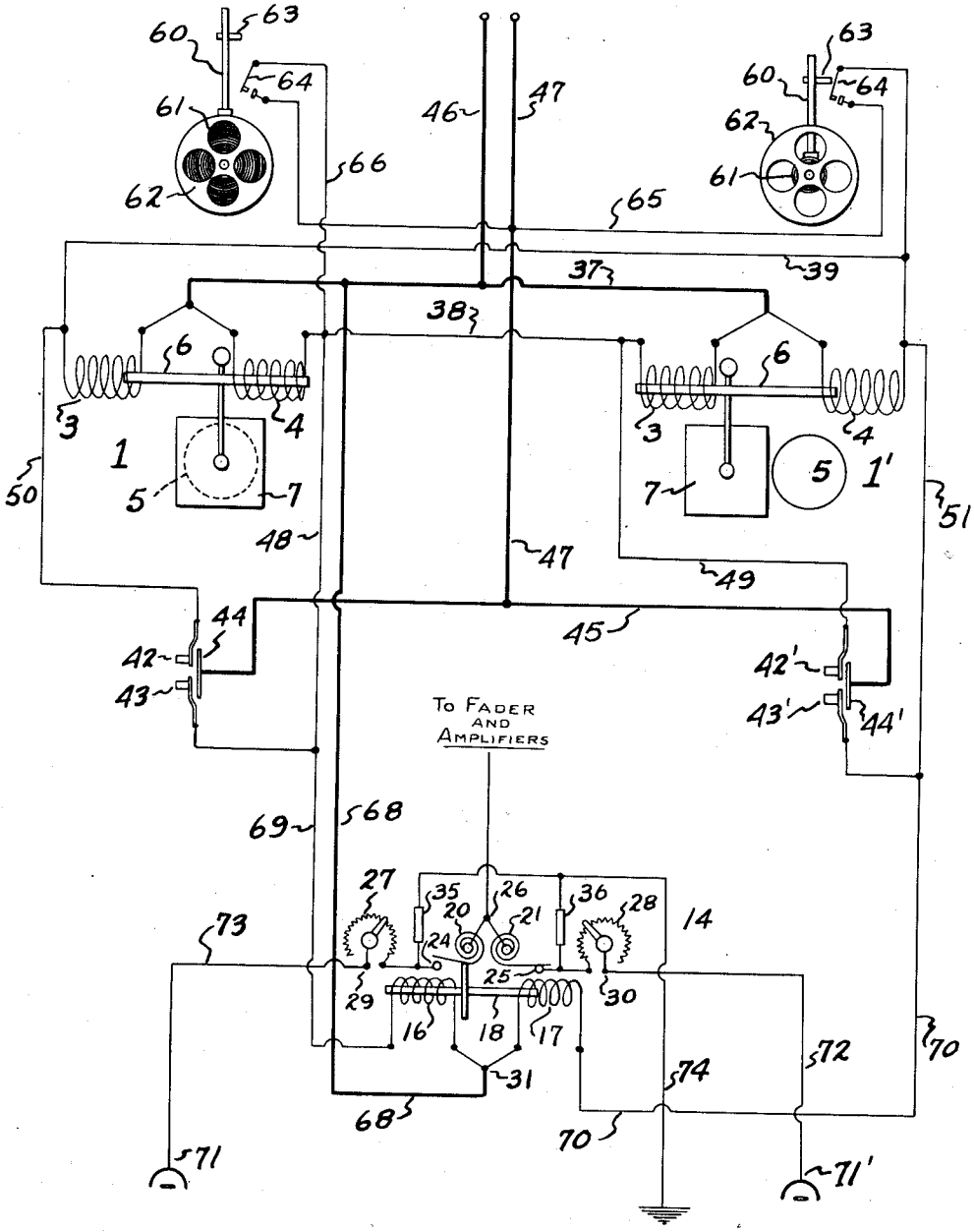


FIG. 1.

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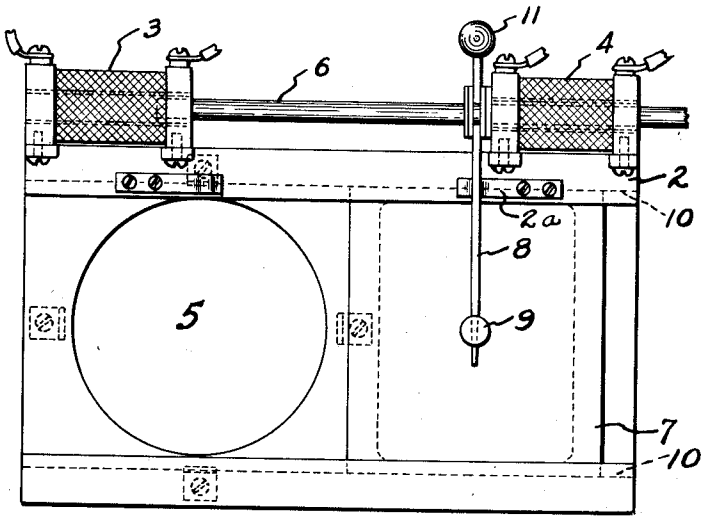


FIG. 2.

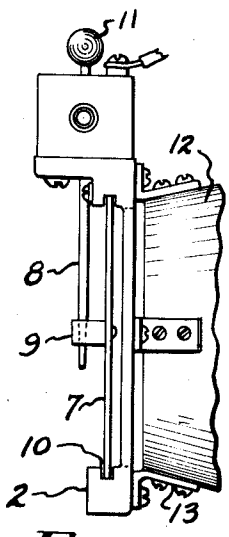


FIG. 3.

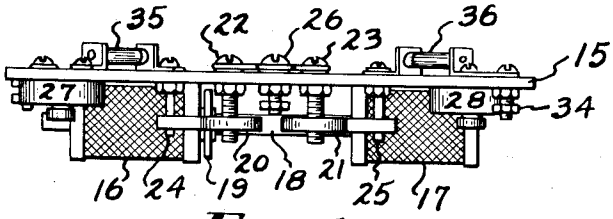


FIG. 5.

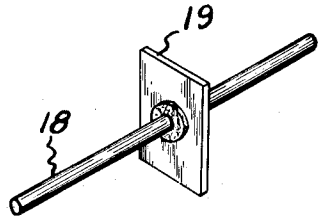


FIG. 6.

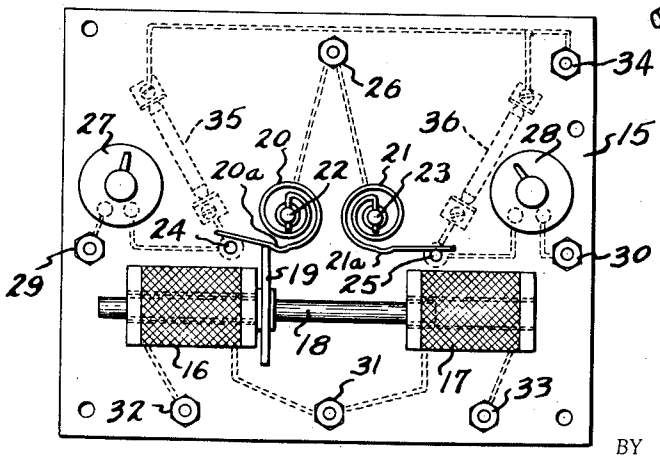


FIG. 4.

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UNITED STATES PATENT OFFICE

2,081,015

AUTOMATIC CHANGE-OVER

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Application May 10, 1934, Serial No. 724,926

6 Claims. (Cl. 179—100.3)

Our invention relates to change-overs for use with two moving picture projectors using sound film, when showing a film in a moving picture theatre or other appropriate place. It is the usual procedure when showing moving pictures comprising more than one reel, to use two machines. One machine is loaded with the first reel, and the other machine with the succeeding reel. When the first reel has been shown, the first machine is stopped and the second machine is started. In order to accomplish this so that there is no apparent pause or break in the sequence, this change-over must be made very quickly and at the correct instant. The fact that the modern moving picture film also carries a sound track on the edge of the film greatly complicates this procedure, since the change-over must be made of both the picture and the sound at the same instant so that there is no apparent pause or delay in the continuity of the sound, as well as the picture, and so that there is no extraneous noise in the operation of changing over. The method of making this change heretofore has been for the operator to get the second machine in readiness, and then when the first machine has reached the end of the film it is showing, to quickly douse the light on the first machine and open the douser on the second machine, and at the same time to disconnect the loud speaker from the first machine and connect it to the second machine. This, of course, being done by hand, necessitated a rather apparent delay in the continuity, and especially so in the sound projection. Another difficulty encountered in the use of sound film is that the sound projected into the auditorium is produced in most instances by the use of a photo-electric cell which is energized by light shining through a sound track in the side of the film. In some films the sound track is more opaque than in others, and therefore does not permit the same amount of light to shine through onto the photo-electric cell.

In other instances the light source of one machine is brighter than the light source on the other machine, due to the use of a new photo-electric cell or to numerous other causes. Inasmuch as the volume of the sound projected into the auditorium is determined by the brightness of the light shining on the photo-electric cell, a change over from one machine to the other carrying a film of equal density, under these conditions, often causes a decided change in the volume of the sound. This is, of course, very objectionable, and in order to avoid this change in volume adjustable potentiometers are placed between the output leads of the photo-electric cells and the amplifiers which operate the speaker unit of the apparatus. The apparatus for adjusting the volume and tone of the respective machines, as determined by the amount of light shining through the film on the cell, is called a "fader." There are numerous faders on the market which in most cases comprise the two potentiometers as described above. These potentiometers are calibrated so that when the change-over is made from a film of one density to another, the potentiometer setting on the machine which carries the new film may be made before the change-over. The operator knows the general setting on the fader for the different types of commercial film; and if the machines are in balance as regards the intensity of the light source shining on the photo-electric cell, he may set the fader before the change-over and thus obviate any change in volume of the sound when the actual change-over is made. However, as heretofore stated, one machine may have a new photo-electric cell, while the other machine has an old cell which is not so sensitive to light; therefore the setting on the fader will be changed and the calibrations thrown out. This is a decided disadvantage, and the only thing that the operator has been able to do heretofore was to make his change-over as best he could and then adjust his fader by ear so that the sound would be adjusted to the given volume.

In order for an operator to make a change-over in the old manner it was necessary for him to shut off the light from the first projector by placing a screen between the light and the projection screen. It is not possible to merely turn off the light in one projector, since the light is usually furnished by a carbon arc, and the turning off of the electricity does not at once cut off the light since the hot carbons continue to glow. Therefore the operator uses what is called a douser, which is in reality an opaque screen which he places over the front end of the lamp house. This douser is also used to start the second machine in regard to projecting the beam of light, since carbon lights must be started and allowed to burn a short time in order to heat up the carbons.

From the above, it may be seen that the average moving picture operator, when making a change-over, must douse the light of the first machine and at the same time remove the douser from the second machine. While

doing this he must at the same time change over the sound projection by breaking the connection from the first photo-electric cell and the speaker and connecting the second photo-electric cell to the same speaker, and at the same time adjust the fader. In order to get smooth action and smooth sound this must be all done at one and the same time.

It is an object of our invention to provide a set up which will permit the operator to press one button, which will automatically and completely change over both the moving projection and the sound projection at one and the same time.

It is an object of our invention to accomplish the above without any appreciable stop or pause between the showing of each succeeding film, so that to the audience it will appear and sound like one continuous film with nothing whatever to indicate to them that a change-over is being or has been made.

Another object of our invention is to provide a means whereby the changing of the contacts from the outlet of one photo-electric cell to another all will be accomplished without the usual click or noise incident to throwing the switch.

A further object of our invention is to provide means which will eliminate the usual complicated adjustment of the fader in devices of this kind, and substitute for this adjustment a very simple device which will accomplish the same purpose, and which is very much more flexible in its control.

A still further object of our invention is to provide means which will automatically change over the projection of both the pictures and the sound from one machine to the other without the necessity of any manual labor or action at all, thereby making the change-over truly automatic.

These and other objects of our invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, we accomplish by that certain construction and arrangement of parts of which we shall now describe a preferred embodiment. Reference is now made to the drawings which form a part hereof, and in which:—

Figure 1 is a schematic diagram of the set up and the wiring of our invention.

Fig. 2 is a front elevation of our douser.

Fig. 3 is an end view of our douser as illustrated in Fig. 2.

Fig. 4 is a front elevation of our novel sound change-over.

Fig. 5 is a plan view of our sound change-over illustrated in Fig. 4.

Fig. 6 is a portion of the armature used in our novel sound change-over.

Generally, our invention comprises three parts: An electrically operated douser on the lamp house of each machine, an electrically operated change-over for the sound, and means for operating the two at one and the same time. The douser is operated by the use of electric solenoids acting upon a common armature, and the sound change-over, which in reality is in its simplest aspect a double throw single pole switch, is also actuated by solenoids having a common armature. Placed in the circuit from each of the photo-electric cells and the contacts on the sound change-over are two potentiometers; that is, one in each circuit. These potentiometers are used merely to balance the output from the photo-electric cells as determined by their efficiency to the exciter light. By adjusting these potentiometers it is possible to balance the two machines so that when the same type of film is run through them it will not be necessary to adjust the fader at all, and the only time the fader needs adjustment is when changing from one type of film to another. This permits the using of only one side or one of the potentiometers in the fader itself, since the compensation for the efficiency of the photo-electric cell is made in the potentiometers in the sound change-over. The means for operating the douser and the sound change-over together is by the completion of electric circuits, which may be done manually by the use of push buttons, or by means actuated by the film itself as it runs through the machine.

Briefly, we provide a douser as shown in Fig. 2, and generally shown by 1 and 1' in Fig. 1. The douser consists of a supporting frame 2, on the top of which are mounted two solenoids 3 and 4. The frame 2 has a cut out portion 5 to permit the light from the lamp house to shine through and upon the aperture plate of the projector. The cores of the solenoids 3 and 4 are in a horizontal position and are in line with each other. There is an armature 6 common to both solenoids and journaled in their core. The douser screen 7 itself is attached to the armature 6 by means of a projecting arm 8 journaled in the armature 6 and fastened to the douser screen 7 by means of a bracket 9, or by any other convenient means. The douser screen 7 rides horizontally in tracks 10 formed in the frame portion 2, and there are stops 2a on the frame to insure the correct positioning of the screen. The arm 8 may be carried up through the armature 6 a short way and mounted with a nob 11, which acts as a handle to manually actuate the douser screen. The douser frame is mounted on the housing 12 of the lamp house by brackets 13 and in such a manner that the light from the machine will shine through the cut out portion 5. It is now apparent that if the solenoid 3 is energized it will pull the armature 6 within its core and thus draw the douser screen 7 over the cut out portion 5, until it hits the stop and prevents the light from the machine shining on the moving picture screen. If, on the other hand, solenoid 4 is energized it will act to draw the douser screen 7 away from the aperture 5 and thus permit the light from the projector to shine on the screen.

We will now describe our preferred sound change-over which is illustrated in Fig. 4, and generally shown at 14 in Fig. 1. Mounted on a non-conductive panel 15 are two solenoids 16 and 17 which are placed with their cores in a horizontal position and in line with each other. Slidably journaled within these two cores is an armature 18, common to both solenoids and carrying at its mid point a non-conductive collar 19. Mounted on the panel 15, above the solenoids, are two flat springs 20 and 21, wound in a spiral with flat ends, which are fastened to the panel by means of conductive posts 22 and 23 in such a way that the flat ends of the springs are urged against contacts 24 and 25. The ends of the springs 20 and 21 at their flattened portion contain a slight bulge. These springs 20 and 21 are mounted in such a manner above the solenoids 16 and 17 that the collar 19 will lift the ends of the springs from the contacts 24 and 25 when the armature 18 is at its limit to the right or to the left. The conductive posts 22 and 23, on which the springs are mounted, are connected to a common terminal 26, which in turn is connected to the main amplifiers of the speaker. The contacts 24 and 25 are connected through the po-

tentiometers 27 and 28 to terminals 29 and 30, which are connected to the out-put of the two photo-electric cells, as will be described later. One end of the windings on the solenoids 16 and 17 are connected to a common terminal 31, and the other ends to terminals 32 and 33. There is a ground terminal 34, which in turn is connected to the two terminals 24 and 25 through grid leaks 35 and 36. It is now apparent that if solenoid 16 is energized, the armature 18 will be pulled over to the left, the position shown in Fig. 4, and the collar 19 will lift the end of the spring 20 from the contact 24, and thus break the connection between the terminal 29 and the amplifier terminal 26. The bulged portion 20a will maintain the armature in the position shown in Fig. 4 until solenoid 17 is energized, at which time the armature 18 will be pulled over to the right and the spring 20 will contact the contact terminal 24, and there will be a closed circuit between terminal 29 and 26. At the same time the collar 19 will lift spring end 21 from the contact 25, and the connection between terminal 30 and the terminal 26 will be broken. The grid leaks 35 and 36 are a very important part of our invention, since it has been found that they entirely eliminate any click or noise in the speaker when the connections are made or broken when the change-over of the sound is made.

We will now describe the wiring of our invention and explain its operation.

As has been heretofore stated, a douser is mounted on the front portion of each of the two lamp houses. In Fig. 1, we have indicated generally the two dousers 1 and 1'. 1' represents the douser on the first machine, or the machine which is about to run out of film, while 1 represents the douser on the second or succeeding machine, which is to be started up when the first machine has completed its film, and then carry on both the picture and the sound. The solenoids of the dousers are so wound that when one of them is energized it will pull the armature 6 into the core, which in turn will pull the douser screen 7 toward the energized solenoid. In Fig. 1 the dousers are so depicted that the screens 7 will cover the openings 5 when the screens 7 are to the right, and will leave a clear opening for the light from the lamp house when the screens are to the left. One end of the windings of solenoids 3 and 4 are connected together in each of the dousers, and in turn these are connected by wire 37 with each other. The other end of the winding of solenoid 3, in douser 1, is connected to the other end of the winding 4, in douser 1', by wire 39. Positioned near each machine is a bank of push buttons comprising two buttons 42 and 43 near machine 1, and buttons 42' and 43' near machine 1'. Pressing these buttons depresses a contact, which in turn contacts a plate 44 common to each set of two buttons. The plates 44 and 44' are connected together by the wire 45. Lead wires 46 and 47 from a source of either A. C. or D. C. electricity are connected to the wires 37 and 45. The contact from button 43 on douser 1 is connected by wire 48 to wire 38, while the contact under button 42' of douser 1' is also connected by wire 49 to wire 38. The contact under button 42 of the second machine, and button 43' of the first machine are both connected to wire 39, by wires 50 and 51, respectively. It is now apparent that if button 42 or button 43' is depressed, the douser screen 7 in douser 1 will slide to the left, and at the same time the screen 7 in douser 1' will slide to the right. Thus the light from the second machine will be permitted to shine on the screen and the light from the first machine will be blocked out. If, on the other hand, button 42' or 43 is pushed, the reverse will happen, and the light from the first projector will shine on the moving picture screen and the light from the second projector will be blocked out.

We have shown a manner in which our circuits for changing over may be accomplished automatically. Over the supply reel or top magazine on each machine is a vertical bar 60, which rides on top of the film 61 in the reel 62. As the film 61 is used up, the bar 60 rides down on the film with the diminishing of the diameter of the roll of film. There is a projection or arm 63 on the bar 60 which actuates a switch 64 when the film has almost reached the end and the bar has consequently lowered to the necessary point. The switch 64 on the first machine closes a circuit 65, connecting the lead wire 47 and the wire 39, which is a shunt around the button 43'. This acts just the same as if the button 43' or 42 were pushed and the light from the first machine is blocked off and the light from the second machine allowed to shine on the moving picture screen. The switch 64 on the second machine closes a circuit 66 between the lead line 47 and the wire 38, which shunts around the button 43. This reverses the process just as if the button 43 or 42' had been depressed. There are a number of ways in which the film itself may be made to actuate these switches, and we have described one method as merely illustrative. We do not intend to limit ourselves to this exact construction shown in this application, since there are numerous ways known in the art for accomplishing this purpose.

The sound change-over is connected in this circuit in the following manner: The terminal 31, which is common to both of the solenoids 16 and 17, is connected by wire 68 to the wire 46, which is one of the leads from the source of electricity. The other end of the winding of solenoid 16 is connected by wire 69 to the push button circuit 48 and contact 43. The other end of the winding of solenoid 17 is connected by wire 70 to the contact of push button 43'. Thus it is apparent that when the push buttons are actuated to douse the light of the first projector, the solenoid 17 on the sound change-over will be energized and the armature 18 will move to the right, thus lifting the contact spring 21 off of the contact 25, and permitting contact spring 20 to contact terminal 24. If, on the other hand, the push buttons are actuated to douse the light in the succeeding projector, the solenoid 16 will be energized and the contact between the spring 20 and the terminal 24 will be broken, and the contact between spring 21 and terminal 25 made. The terminal 30, which is connected to the terminal 25 through the potentiometer 28, is connected by the wire 72 to the output terminal of the photo-electric cell 71', which is located in the first machine. The terminal 29, on the other side of the sound change-over, is connected by wire 73 to the output terminal of the photo-electric cell 71, which is located in the succeeding machine. The terminal 34, which runs from the two grid leaks 35 and 36, is grounded by means of wire 74. The terminal 26, which is connected to the two springs 20 and 21, runs to the head amplifier, fader, or main amplifiers of the speaker. It is therefore apparent that when the light projected from the machines is changed over from one machine to

the other, that at the same time the sound is changed over by connecting the different photo-electric cells in the different machines to the amplifiers of the speaker. The grid leaks **35** and **36**, in series between the circuits and the ground, entirely eliminate any click or foreign sound being heard in the speaker when this change is made. By adjusting the two potentiometers **27** and **28** in regard to the strength of the two light sources acting on the photo-electric cells in the two machines and the quality of the film used, it is possible to make this change-over without any increase or decrease in the volume of sound at all. When using our automatic change-over the audience observing the moving picture will not be able to tell when a change-over is being made.

As has been heretofore stated, it is possible to make this change-over entirely automatic, controlling it by the amount of film run through the machines. One method of doing this, we have shown and illustrated in the drawings. It is, of course, to be understood that when we referred to the first machine and the second machine, we merely used this phraseology for the purpose of illustration, since it makes no difference whatever which machine is used as the first machine. The procedure will be to load one machine with the first reel to be shown, and the other machine with the succeeding reel. When the film has run out on the first machine, the change-over will be made to the second machine. The first machine is now loaded with the third reel, and when the film on the second machine is run, the change-over will be made back to the first machine, and so on, going back and forth between the two machines. It may be desirable to use more than two machines, and it will be apparent that our invention will work just as well with any number of machines; therefore we do not wish to limit ourselves to our invention as applied to only two machines.

It is to be understood that different forms of our preferred form may be made without departing from the spirit of our invention.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. A sound change-over for motion picture projectors comprising two solenoids with their cores in line with each other, an armature common to both solenoids and slidably journaled in their cores, a collar on said armature, two switches comprising a coiled spring urged against a contact positioned above said armature and in such position that the collar will alternately lift the springs from their contacts when the armature is slid in one direction or the other, the two springs being connected to a loud speaker unit and the contacts being connected to the sound output terminal of two projectors, and means for energizing each solenoid separately so as to shift the armature from one side to the other.

2. A sound change-over for motion picture projectors comprising two solenoids with their cores in line with each other, an armature common to both solenoids and slidably journaled in their cores, a collar on said armature, two switches comprising a coiled spring urged against a contact positioned above said armature and in such position that the collar will alternately lift the springs from their contacts when the armature is slid in one direction or the other, the two springs being connected to a loud speaker unit and the contacts being connected to the sound output terminal of two projectors, and means for energizing each solenoid separately so as to shift the armature from one side to the other, said energizing means actuated by the amount of film on the loading reel in the two projectors.

3. A sound change-over for motion picture projectors comprising two solenoids with their cores in line with each other, an armature common to both solenoids and slidably journaled in their cores, a collar on said armature, two switches comprising a coiled spring urged against a contact positioned above said armature and in such position that the collar will alternately lift the springs from their contacts when the armature is slid in one direction or the other, the two springs being connected to a loud speaker unit and the contacts being connected to the sound output terminal of two projectors, means for energizing each solenoid separately so as to shift the armature from one side to the other, and a grid leak connected between the contacts and the ground, so as to eliminate any outside noise when the contacts are made and broken.

4. In a sound changeover for motion picture projection comprising a speaker and at least two sound projectors alternately electrically connected to said speaker, said electrical connection of said projectors to said speaker being permanently grounded through a very high resistance.

5. In a sound changeover for motion picture projection consisting of a speaker unit and at least two sound projector units having electrical connections adapted to be alternately connected to said speaker, said electrical connections being permanently grounded through a very high resistance.

6. In a motion picture sound projector having an electrical connection to a speaker, said electrical connection being grounded through a very high resistance to eliminate extraneous noise in said speaker when said electrical connection is broken and made.

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