June 25, 1935. W. D. FOSTER ET AL 2,005,737

FILM HANDLING AND SOUND REPRODUCING APPARATUS

Filed April 30, 1929

Fig. 1

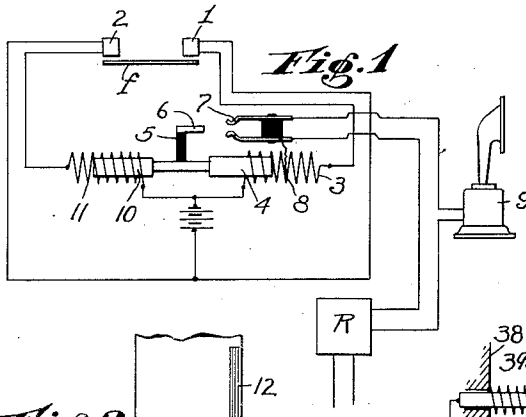


Fig. 2

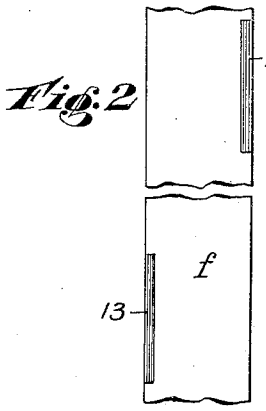


Fig. 3

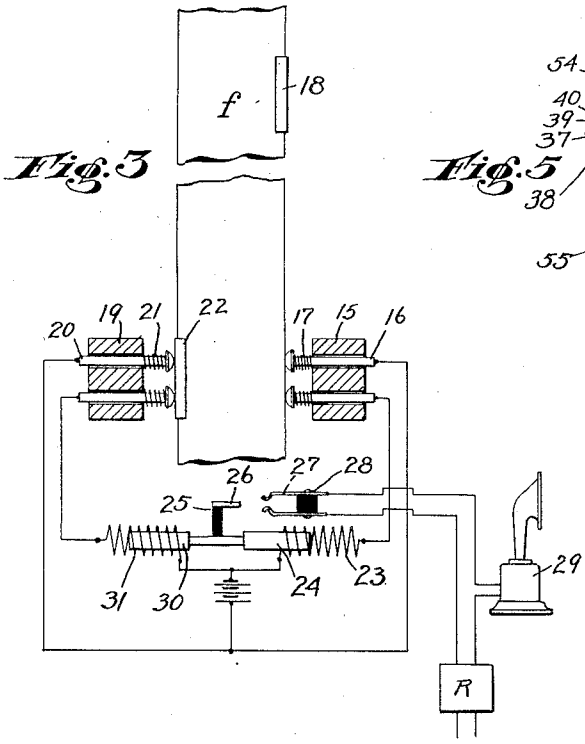


Fig. 4

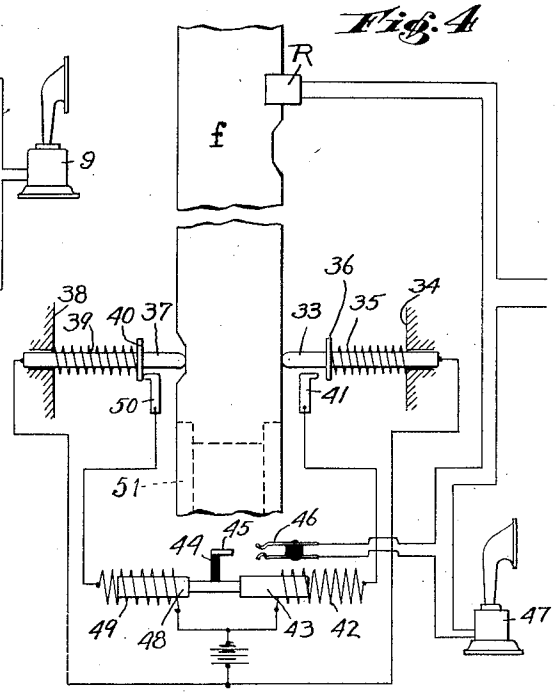
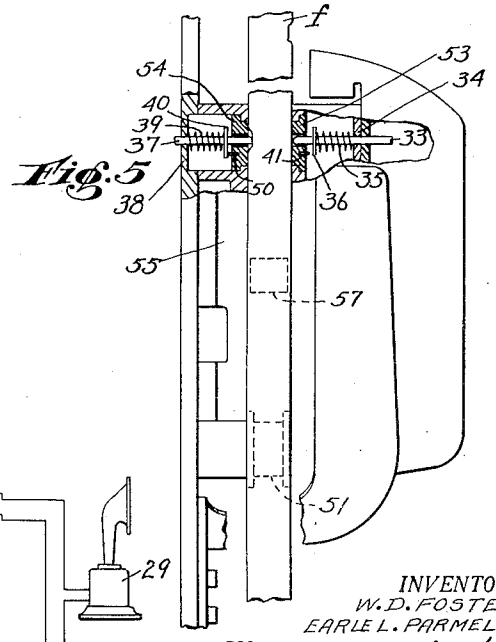


Fig. 5



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FILM HANDLING AND SOUND REPRODUCING APPARATUS

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Application April 30, 1929, Serial No. 359,346

12 Claims. (Cl. 88—16.2)

The present application is a continuation in part of our application, Serial Number 105,159, filed April 28, 1926. In said parent application we showed and claimed method and means whereby an apparatus for the reproduction or recordation of sound may be controlled by a film handling apparatus, such control being exercised preferably by means of the film itself, acting through photo-electric, electric, or other means. An object of the present invention is to apply such method and means to the control of a sound amplifying or other sound apparatus under particular conditions.

In the art of so-called "talking pictures", it is often desired to accompany only certain selected and pre-determined portions of a motion picture with sound. In many motion pictures which are synchronized with sound there are many portions of the film with which it is desired to have no sound whatever. Under present practice, the sound reproducing apparatus, whether of the type employing sound symbols engraved upon a disk, cylinder, or film, or of the type employing symbols printed upon a film, is necessarily operated continuously, both during the periods in which there are sound symbols to be reproduced and during the periods in which there are no such symbols to be reproduced. During the periods during which silence is desired, the continued operation of sound reproducing and amplifying apparatus results in the dissemination of various sounds and noises, including those known as "ground noises" and "needle scratch". Such noises are generally not noticeable when sound symbols are being reproduced but are high objectionable when no sound symbols are being reproduced.

A principal object of the present invention is to provide means whereby automatically such unwanted noises are eliminated, without destroying the synchronization between the pictures upon the film and the symbols upon the sound record. To accomplish this object, we preferably permit the sound reproducing apparatus to run continuously and interrupt the operation of the loud speaker or other amplifying device for such periods as silence is wanted.

It has been proposed to render a loud-speaker inoperative if a film synchronized with sound should break and to provide manual means whereby after the delay incident to the manual rethreading of the film and a manual operation to secure resynchronization, the sound and picture may again proceed together. The object of the present invention is quite different, since it relates to the interruption of a sound instrument as desired at pre-determined intervals throughout the regular projection of the film.

A further object of the present invention is the provision of means whereby a sound instrument may be automatically controlled in the manner desired by means of the film itself, such control being exercised either through the light passing through the film or preferably by electrical means alone. When using such electrical means we prefer to make use of both side edges of the film by providing sallow predeterminedly positioned control notches in each edge of the film and arranging a lightly urged contact member for pressing against each edge of the film and engaging said notches. By positioning these members opposite each other across the film, the objectionable tendency of one member to push the opposite edge of the film out of alignment and against the adjacent gate structure is counter balanced and obviated by the other member.

A further object is to provide an attachment, whereby the objects of the invention may be realized, which may be used with standard types of film handling and sound reproducing apparatus without involving any material change in such apparatus.

Other advantages and characteristics are apparent in the following description, the attached drawing, and the subjoined claims. Although we are showing one preferred embodiment of our invention, it will be readily understood that we are not limited to this particular construction as changes can readily be made without departing from the spirit of our invention or the scope of our broader claims.

In the drawing:

Figure 1 is a representation, largely diagrammatic, of means for controlling a circuit of the sound instrument by means of the light passing through the film;

Figure 2 is a section of the film adapted for cooperation with apparatus of the type illustrated in Figure 1;

Figure 3 shows a preferred modification in which the control is exercised by the film through purely electrical means;

Figure 4 shows another preferred modification in which electrical control means are employed;

Figure 5 shows a film gate adapted for use with that embodiment of our invention shown in Figure 4.

In carrying out our invention, we may provide a photo-electric cell 1 which cooperates with

one edge of the film *f*, and a photo-electric cell 2 which cooperates with the other edge of such film. In circuit with the photo-electric cell 1 is a solenoid 3 to the core 4 of which, by means of the insulated T shaped plate 5, is attached a contacting block 6 which cooperates with the spring contact points 7, supported as by the fiber block 8, such contact points being in a circuit which controls the loud speaker or other similar device 9. In Figure 1, such circuit is illustrated as one which connects the loud speaker 9 with the sound reproducing instrument R, which may be of the disc, cylinder or photo-electric type operated in synchronism with the mechanism which feeds the film *f*, such mechanism being of any desired type. Likewise attached to the plate 5 is the core 10 of the solenoid 11 which is in circuit with the photo-electric cell 2. Various sections of the right hand edge of the film *f*, as viewed in Figure 2, may be blackened or otherwise rendered opaque, as indicated by 12, for cooperation with the photo-electric cell 1 and various sections 13 of the left hand edge of the film *f*, as so viewed, may be rendered opaque for cooperation with the photo-electric cell 2. The user renders the left hand margin of the film opaque at that point at which he desires silence and the right hand margin of the film opaque at that point at which he wishes the reproduction of the sound again to reach the audience, as shown in Figure 2. Such markings may be placed upon the film when it is printed, or may be added at any time. It will of course be understood that if desired relatively transparent portions of the film may be used for signaling purposes.

By reason of such construction it will be evident that when the opaque portion 12 of the film passes by the photo-electric cell 1 the solenoid 3 will be energized, the core 4 and the contact block 6 moved to the right, as viewed in Figure 1, and the circuit of the loud speaker 9 rendered operative. When an opaque portion 13 passes by the photo-electric cell 2, the solenoid 11 will be rendered operative whereby the core 10 and the contact block 6 will be moved to the left, as viewed in Figure 1, thereby breaking the circuit to the loud speaker 9 and rendering it completely silent. It will be readily understood by those skilled in the art that the provision of separate photo-electric cells whereby a controlling circuit of the loud speaker is positively broken and re-established, such circuit being for example the one which connects the loud speaker with the sound reproducing device, is quite different from depending upon the photo-electric cell which is a part of the sound reproducing device for securing the desired periods of silence. In the former case, the controlling circuit is positively broken, the loud speaker rendered inoperative, and all possibility of sound reaching the audience from the film positively destroyed. In the latter case, the loud speaker remains fully operative, although the sound which is presented to it for amplification is limited to various unwanted and accidental noises.

To secure the necessary light for cooperation with the photo-electric cells 1 and 2, small apertures may be made in the regular projection gate of the film handling apparatus, or, if desired, a separate gate and light source may be provided.

Figure 3 illustrates a modification of our invention which employs electrical signalling mechanism.

Set in the fiber block 15 there may be provided the contact fingers 16 urged against one edge of the film by the light springs 17 and adapted to cooperate with metal strips 18 placed on the edge of the film. Cooperating with the other edge of the film and set in the fiber block 19, there are the contact fingers 20 likewise urged against the edge of the film by the relatively light springs 21 and adapted to cooperate with the metal strips 22 placed upon the film. In circuit with the contact fingers 17 is the solenoid 23, the core of which 24 is mounted upon the insulated T shaped plate 25 which supports the contact block 26 adapted for cooperation with the spring contact fingers 27 mounted in the block 28 and controlling the circuit for the loud speaker 29. Likewise mounted upon the plate 25, is the core 30 of the solenoid 31 which is in circuit with the contact fingers 20.

By reason of such construction, it is evident that when the metal signalling strip 22 is in the position shown in Figure 3, the circuit of the solenoid 31 will be energized and the contact block 26 removed from cooperation with the circuit of the loud speaker 29. When the signalling strip 18 is in contact with the fingers 17, however, the solenoid 23 will be energized, thus moving the core 24 and the block 26 to the right as viewed in Figure 3 and completing the circuit to the loud speaker 29.

As is clearly shown in Figure 4, notches *n* and *n'* in the film may be used instead of the previously described metal signalling strips. Such notches in one side edge of the film are preferably arranged in staggered relation to the notches in the other side edge of the film. This staggered arrangement provides a distinct advantage. The distance between two notches in one side of the film edge can be made twice as great as would be possible if the notches were all placed on one side. For example, when the notches are employed to interrupt an electric current very rapidly they would have to be placed very close together if they were all positioned in one side edge of the film and the intervening portion of the thin film between two notches would be so narrow that its strength would be dangerously decreased. Another advantage obtainable by having the film notched on both sides is that it can actuate two entirely different and unconnected control devices exactly simultaneously or with a very small predetermined amount of time intervening therebetween. As can be readily seen, the ends of the members 33 and 37, which engage the edges of the film *f*, can, when desired, be provided with anti-friction means such as rollers.

The pin 33 may be mounted in the fiber block 34 and urged against one edge of the film by the light spring 35. Upon the pin 33 may be mounted the collar 36. For cooperation with the other edge of the film the pin 37 may be mounted in the fiber block 38 and urged against the edge of the film by the light spring 39. Upon the pin 37 may be mounted the collar 40. For cooperation with the collar 36 there may be provided the contact point 41 which is in circuit with the solenoid 42 the core 43 of which is attached to the T shaped insulated plate 44 which bears the contact block 45 adapted to cooperate with the spring contact plates 46 in circuit with the loud speaker 47. Likewise attached to the plate 44 is the core 48 of the solenoid 49 which through the contact point 50 is adapted to cooperate with the collar 40 of the pin 37. The film may be fed as by the feeding sprocket 51, and the sound reproducing means may include an element R in-

cluding a photo-electric cell which is operated by sound symbols upon the film and controls the loud speaker 47.

By reason of such construction, it is evident that when the notches of the film are in the position shown in Figure 4, the collar 40 will be in contact with the contact point 50, the solenoid 49 energized and the block 45 out of operative contact with the plates 46 thus destroying the circuit to the loud speaker 47. When the notch in the right hand side of the film as viewed in Figure 4 reaches the pin 33, such pin will move to the left as so viewed and complete the circuit to the solenoid 42 which in turn will move the block 45 to the right thus completing the circuit to the loud speaker 47. In the meantime, the pin 37 will have been moved to the left as viewed in Figure 4 thus having deenergized the circuit for the solenoid 49.

A preferred form of mounting the pins 33 and 37 is shown in Figure 5, the blocks 34 and 38 as well as the blocks 53 and 54 being mounted in a fixed section 55 of the gate through which and past the aperture 57 the film *f* is fed as by means of the sprocket 51.

Throughout the foregoing specification, reference has been made to the control of a circuit controlling a loud speaker. It will readily be understood, however, that if desired the sound reproducing apparatus itself may be so controlled, for example, through the circuit of the motor which drives a phonograph. It will likewise be understood that many features of our invention may be utilized in the simultaneous recordation of images representing sound and images representing things, or in the separate recordation thereof, or in the printing of films which include images representing things and images representing sounds, or in the reproduction of sound records for use with motion pictures.

Many of the advantages of our invention have been set forth in the preceding portion of this specification. Other advantages include the provision of improved means for the control, preferably by means of the film itself, of a sound apparatus used in connection with a film handling apparatus. Other advantages include the provision of means whereby unpleasant and distracting noises of a sound reproducing or a sound amplifying instrument may be completely eliminated at such times as it is desired to have silence. Other advantages of our invention result from the use of a film having control signals in each of its side edges. The employment of such a film permits a usual control device individual to each side edge of the film to be actuated by the film in addition to the control device disclosed hereinbefore. Furthermore, each of these three control devices may be predeterminedly actuated by the film without interference, one with another. A film with notches in each side edge is more convenient and less confusing to prepare in such cases as those in which the successive notches are for opposite purposes. Notches in the left side, for example, may all be for the purpose of stopping the operation of an associated apparatus and those in the right for restarting it.

We claim:

1. In combination, an apparatus for feeding a film, an instrument for amplifying sound, and means controlled by the film for rendering said instrument successively inoperable and operable in accordance with the amount of film which has been fed through said apparatus, said instrument including an operating circuit with a gap formed therein, and said means comprising a member movable from a first position wherein it bridges such gap whereby said circuit is closed and said instrument rendered operative to a second position wherein it is disposed relatively distantly to such gap whereby said circuit is opened and said instrument rendered inoperative, a first magnetic means for moving said member from such first to such second position, a first photo-electric cell disposed in such circuit, a first marking so disposed upon a pre-determined portion of the film fed by said apparatus that the translucency thereof varies relatively to other corresponding portions thereof, a second magnetic means for moving said member from such second to such first position, a second photo-electric cell disposed in the circuit of said second magnetic means, a second marking so disposed upon a predetermined and succeeding portion of the film that the translucency thereof varies relatively to the corresponding portions thereof, and means for passing light through both of such predetermined and other portions corresponding respectively thereto and upon said cells as the film is fed by said apparatus whereby first said first cell activates the circuit of said first magnetic means whereby said member is moved to such second position and said instrument is rendered inoperative and thereafter said second cell activates the circuit of said second magnetic means whereby said member is moved to such first position and said instrument is again rendered operative.

2. In combination, an apparatus for feeding a film bearing thereupon symbols representing sound and pictorial images, an instrument for amplifying sound translated from such symbols, and means controlled by light which passes through the film whereby said instrument is rendered successively operable and inoperable in accordance with the amount of film which has been fed through said apparatus, said instrument including a circuit with a gap formed therein, and said means comprising a member movable from a first position wherein it bridges such gap whereby such gap is closed and said instrument rendered operative to a second position wherein it is disposed relatively distantly to such gap whereby said circuit is opened and said instrument rendered inoperative, magnetic means for moving said member from such first to such second position, a circuit for such means, a photo-electric cell disposed in such circuit, a marking so disposed upon a pre-determined portion of the film that the translucency thereof varies relatively to other corresponding portions thereon, and a source for passing light through such predetermined and other portions of the film and upon said cell as the film is fed by said apparatus whereby said cell permits the passage of current to said means whereby said means moves said member from such first to such second position whereby said instrument is rendered inoperative.

3. In combination, an apparatus for feeding a film, an instrument for amplifying sound, and means controlled by the film fed by said apparatus for making or breaking the circuit of said instrument, said instrument including a circuit with a gap disposed therein and said means comprising a solenoid formed with two cores, an element for bridging said gap mounted upon said solenoid, a winding for each of said cores, means for activating one of said cores whereby said sole-

noid is moved in one direction and said gap bridging element introduced into said circuit whereby said circuit is closed, a first photo-electric cell for actuating said activating means, a second means for activating the other of said cores whereby said solenoid is moved in the other direction and said gap bridging element removed from said circuit whereby said circuit is opened, a second photo-electric cell for actuating said activating means, and a source for passing light through the film and onto each of said cells whereby differences in translucency of succeeding portions of the film successively actuate each of said cells.

4. In combination, a film handling apparatus, said apparatus including means for feeding a film and a source for passing light therethrough, and a sound instrument, said instrument including an operating circuit, and means controlled by such light passed through the film as it is being so fed for making or breaking said operating circuit, said means comprising a switch for said operating circuit, a solenoid, a circuit closing element for said switch mounted upon said solenoid, said solenoid comprising two cores connected with each other, a winding for each of said cores, said solenoid and said cores being so arranged that when one of said windings is energized said solenoid is moved in one direction and said element moved to circuit opening position and when the other of said cores is energized said solenoid is moved in another direction and said elements is moved to circuit closing position, a first photo-electric cell positioned under the influence of light from said source which has passed through one section of the film fed by said feeding means and disposed in the circuit of one of said windings whereby changes in the translucency of succeeding portions of such section of the film activate said first cell whereby said solenoid is moved in such first mentioned direction whereby said operating circuit is broken, and a second photo-electric cell positioned under the influence of such light which has passed through another section of the film so fed by said feeding means and disposed in the circuit of the other of said windings whereby changes in the translucency of succeeding portions of such last mentioned section of the film activate said second cell whereby said solenoid is moved in such second mentioned direction whereby said operating circuit is closed.

5. In combination, a film handling apparatus, said apparatus including a pathway for the film, and means for feeding the film through said pathway, a sound instrument, said instrument including an operating circuit, and means controlled by the film fed through said pathway for making or breaking said circuit, said means comprising a switch for operating said circuit, a solenoid, a circuit closing element for said switch mounted upon said solenoid, said solenoid comprising two cores connected with each other, a winding for each of said cores, said solenoid and said cores being so arranged that when one of said windings is energized said solenoid is moved in one direction and said element moved to circuit opening position and when the other of said cores is energized said solenoid is moved in another direction and said element is moved to circuit closing position, an open circuit for each of said windings, a terminal for each side of the circuit for one of said cores disposed adjacent said pathway, a terminal for each side of the other of the circuits for the other of said cores disposed adjacent the other side of said pathway, an element formed of conducting material and attached to a pre-determined portion of one edge of the film fed through said pathway and so constructed and arranged as to form contact with both of said terminals of said first mentioned core circuit for closing the same, and a second element formed of conducting material and attached to a pre-determined portion of the other edge of the film and so constructed and arranged as to form contact with both of said terminals of the other of said core circuits for closing the same.

6. In a film handling apparatus, in combination, an electric sound producing means, a guiding structure through which may be fed an image bearing film having notches formed in each side edge at predetermined intervals for starting and stopping said means, an electric switch mechanism including two spring-urged members mounted on said guiding structure directly opposite each other, one member pressing against each side of said film, two electric switch devices, one device associated with each of said members, the engagement of each member in the notches of said film being effective to operate its associated switch device, a solenoid including two cores connected with each other, a winding for each of said cores, said solenoid and said cores being so arranged that when one of said windings is energized said solenoid is moved in one direction and when the other of said cores is energized said solenoid is moved in another direction, a circuit-closing member on said solenoid, an open circuit for said sound producing means including a switch arranged for engagement by said circuit-closing member upon movement by said solenoid in one direction, and an open circuit for each of said solenoid windings, each of such circuits including one of said switch devices.

7. In a film handling apparatus, means for feeding a film, a circuit including a switch, means associated with one side edge of the film for closing said switch, and means associated with the other side edge of said film for opening said switch, said closing means including predeterminedly-positioned light-retarding marks extending along that side edge of said film which is associated with said closing means and a light responsive device cooperating with said marks, said opening means including predeterminedly-positioned light-retarding marks extending along the other side edge of said film and a light responsive device cooperating with said last named marks.

8. In combination, a motion picture apparatus having film guiding means, an image-bearing film arranged with one or more predeterminedly positioned control elements carried by each side edge portion of the film, and means for projecting pictures from said film, an electric sound producing device, two operable electric circuit controlling means, one of said means being associated with the control elements carried by one of said side edge film portions and the other of said controlling means being associated with the control elements carried by the other of said side edge film portions, two circuits to be opened and closed, one of said circuits being operatively connected to each of said circuit controlling means, two oppositely acting solenoid coils, one of said coils being operatively connected in each of said circuits, cores for said solenoid coils, a connection for said cores, a circuit for operating said sound producing device, a switch for said last named circuit, a switch operating member mounted on said core connection and operative upon movement in

one direction for closing said switch and operative upon movement in the opposite direction for opening said switch, means cooperating with the control elements carried by one side edge film portion for operating the said circuit controlling means associated with said last named side edge film portion, means cooperating with the control elements carried by the other side edge film portion for operating the said circuit controlling means associated with the other side edge film portion, and a source of electricity operatively connected to each of said solenoid coils, said control elements on one side edge portion of said film being arranged in staggered relation to the control elements on the other side edge film portion, whereby the passage of any of said control elements carried by one side edge portion past said guiding means may operate the solenoid associated with said side edge film portion for closing said switch and producing sound, and the passage thereafter of any of said control elements carried by the other side edge film portion past said guiding means will operate the other of said solenoids to open said switch and stop the production of the sound.

9. In combination, an image bearing film arranged with a plurality of predeterminedly positioned control elements carried by each side edge portion of the film, means for projecting pictures from said film, said means including a film guiding structure, an electric sound producing means, a circuit for said sound means, an operable switch in said circuit, means actuated by the passage of one of said control elements on one side of said film past said guiding structure for closing said switch and rendering said sound producing means effective, and means actuated a predetermined period of time thereafter by the passage of one of said control elements on the other side of said film past said guiding structure for opening said switch and rendering said sound producing means ineffective so that a predetermined period of projection of pictures from said film is in silence, the end of said silent period being determined by the passage of a control element on the first named side edge of said film past said guiding structure.

10. In combination, a motion picture apparatus having a film guiding means, an image-bearing film arranged with one or more predeterminedly positioned control areas carried by each side edge of the film, each of said control areas having a degree of translucency different from the translucency of ordinary portions of said film, and means for projecting pictures from said film, an electric sound producing device, two operable electric circuit controlling means, one of said means being associated with the control areas carried by one of said side edge film portions and the other of said controlling means being associated with the control areas carried by the other of said side edge film portions, two circuits to be opened and closed, one of said circuits being operatively connected to each of said circuit controlling means, two oppositely acting solenoid coils, one of said coils being operatively connected in each of said circuits, cores for said solenoid coils, a connection for said cores, a circuit for operating said sound producing device, a switch for said last named circuit, a switch operating member mounted on said core connection and operative upon movement in one direction for closing said switch and operative upon movement in the opposite direction for opening said switch, means cooperating with the control areas carried by one side edge film portion for operating the said circuit controlling means associated with said last named side edge film portion, means cooperating with the control areas carried by the other side edge film portion for operating the said circuit controlling means associated with said other side edge film portion, and a source of electricity operatively connected to each of said solenoid coils, said control elements on one side edge portion of said film being arranged in staggered relation to the control elements on the other side edge film portion, whereby the passage of any of said control elements carried by one side edge portion past said guiding means may operate the solenoid associated with said side edge film portion for closing said switch and producing sound, and the passage thereafter of any of said control elements carried by the other side edge film portion past said guiding means will operate the other of said solenoids to open said switch and stop the production of the sound.

11. In combination, a motion picture apparatus having film guiding means, an image-bearing film arranged with one or more predeterminedly positioned metallic control members carried by each side edge portion of the film, and means for projecting pictures from said film, an electric sound producing device, two operable electric circuit controlling means, one of said means being associated with the control members carried by one of said side edge film portions and the other of said controlling means being associated with the control elements carried by the other of said side edge film portions, two circuits to be opened and closed, one of said circuits being operatively connected to each of said circuit controlling means, two oppositely acting solenoid coils, one of said coils being operatively connected in each of said circuits, cores for said solenoid coils, a connection for said cores, a circuit for operating said sound producing device, a switch for said last named circuit, a switch operating member mounted on said core connection and operative upon movement in one direction for closing said switch and operative upon movement in the opposite direction for opening said switch, means cooperating with the control members carried by one side edge film portion for operating the said circuit controlling means associated with said last named side edge film portion, means cooperating with the control members carried by the other side edge film portion for operating the said circuit controlling means associated with said other side edge film portion, and a source of electricity operatively connected to each of said solenoid coils; said control elements on one side edge portion of said film being arranged in staggered relation to the control elements on the other side edge film portion, whereby the passage of any of said control elements carried by one side edge portion past said guiding means may operate the solenoid associated with said side edge film portion for closing said switch and producing sound, and the passage thereafter of any of said control elements carried by the other side edge film portion past said guiding means will operate the other of said solenoids to open said switch and stop the production of the sound.

12. In combination, a motion picture apparatus having film guiding means, an image-bearing film arranged with one or more predeterminedly positioned control notches carried by each side edge portion of the film, and means for projecting pictures from said film, an electric sound producing device, two operable electric circuit controlling means, one of said means be-

ing associated with the control notches carried by one of said side edge film portions and the other of said controlling means being associated with the control notches carried by the other of said side edge film portions, two circuits to be opened and closed, one of said circuits being operatively connected to each of said circuit controlling means, two oppositely acting solenoid coils, one of said coils being operatively connected in each of said circuits, cores for said solenoid coils, a connection for said cores, a circuit for operating said sound producing device, a switch for said last named circuit, a switch operating member mounted on said core connection and operative upon movement in one direction for closing said switch and operative upon movement in the opposite direction for opening said switch, means cooperating with the control notches carried by one side edge film portion for operating the said circuit controlling means associated with said last named side edge film portion, means cooperating with the control notches carried by the other side edge film portion for operating the said circuit controlling means associated with said other side edge film portion, and a source of electricity operatively connected to each of said solenoid coils; said control notches on one side edge portion of said film being arranged in staggered relation to the control notches on the other side edge film portion, whereby the passage of any of said control notches carried by one side edge portion past said guiding means may operate the solenoid associated with said side edge film portion for closing said switch and producing sound, and the passage thereafter of any of said control notches carried by the other side edge film portion past said guiding means will operate the other of said solenoids to open said switch and stop the production of the sound.

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