July 12, 1938. F. CONRAD ET AL 2,123,624

MOTION PICTURE APPARATUS

Original Filed May 14, 1930 3 Sheets-Sheet 1

Fig. 1.

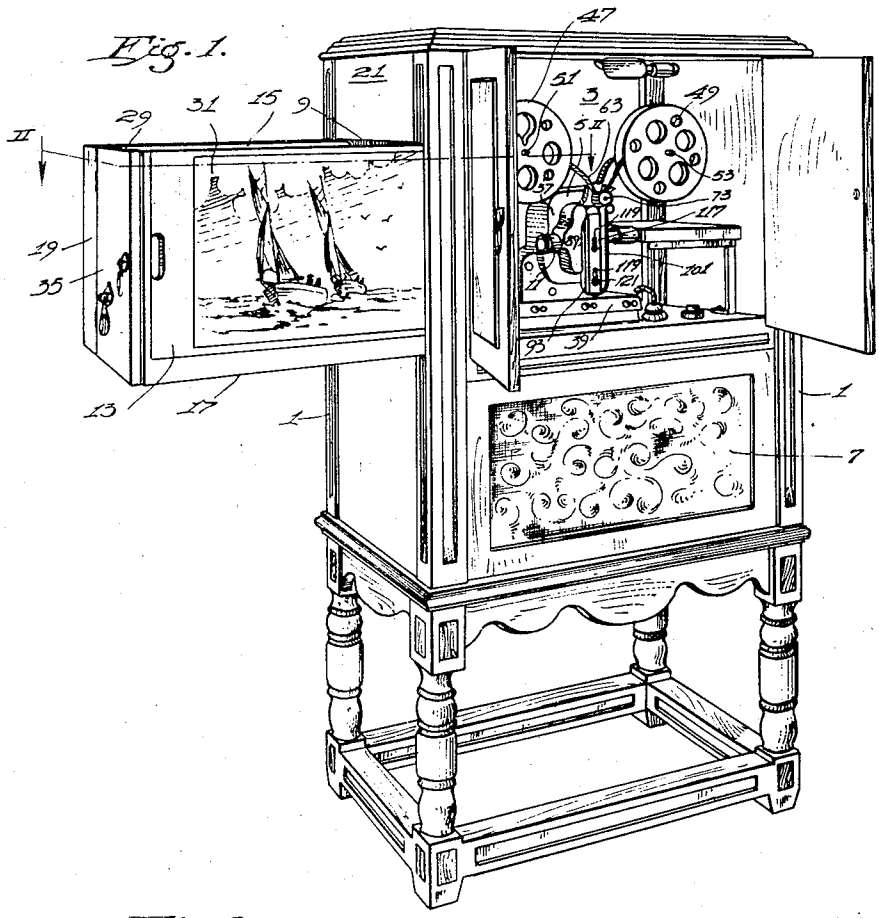
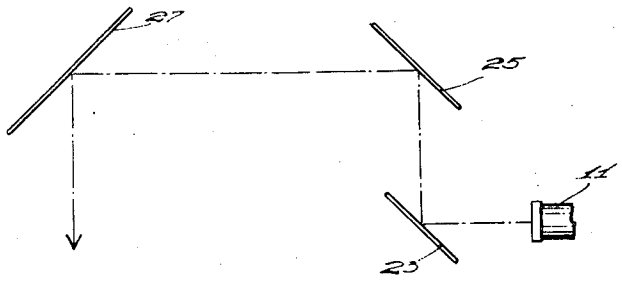


Fig. 2.



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July 12, 1938. F. CONRAD ET AL 2,123,624

MOTION PICTURE APPARATUS

Original Filed May 14, 1930 3 Sheets-Sheet 2

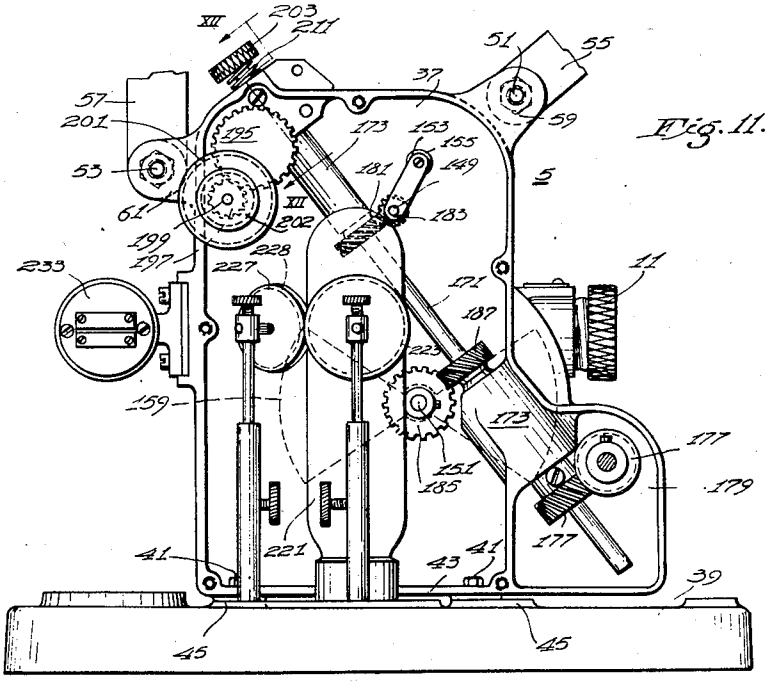

Fig. 11.

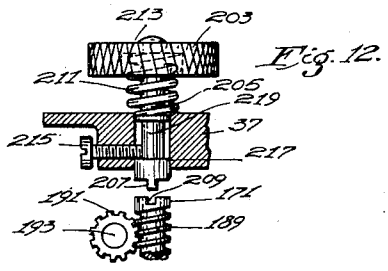

Fig. 12.

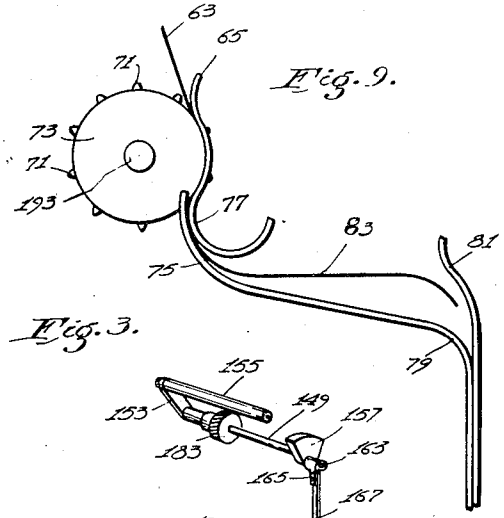

Fig. 9.

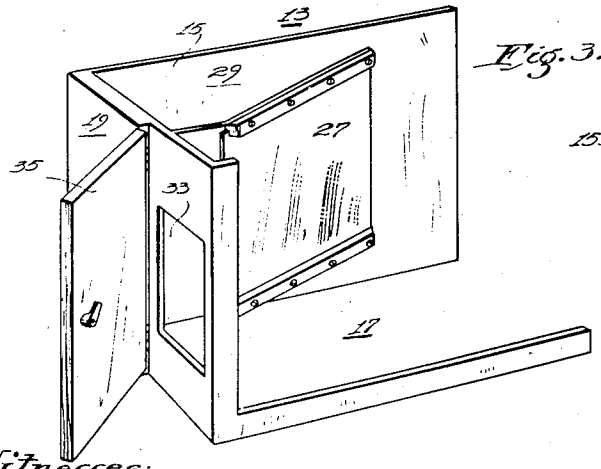

Fig. 3.

Fig. 10.

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July 12, 1938. F. CONRAD ET AL 2,123,624

MOTION PICTURE APPARATUS

Original Filed May 14, 1930 3 Sheets-Sheet 3

Fig. 4.

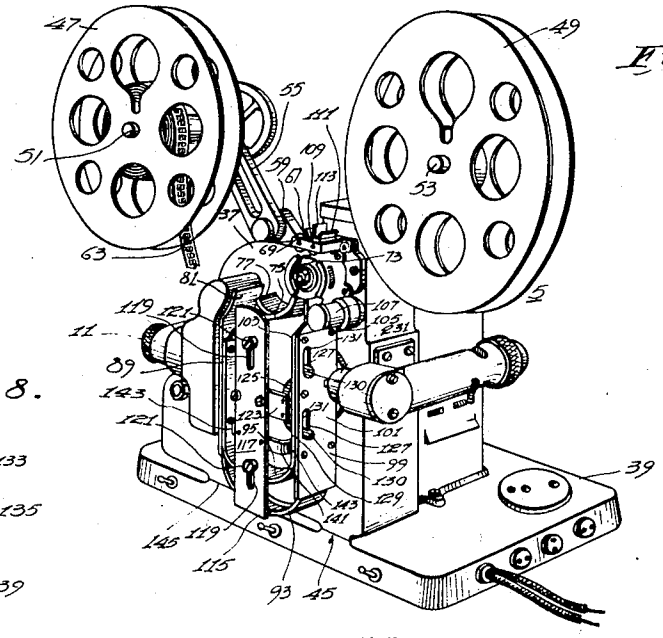


Fig. 8.

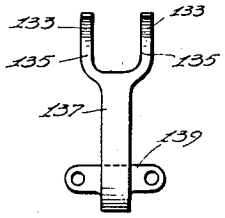


Fig. 5.

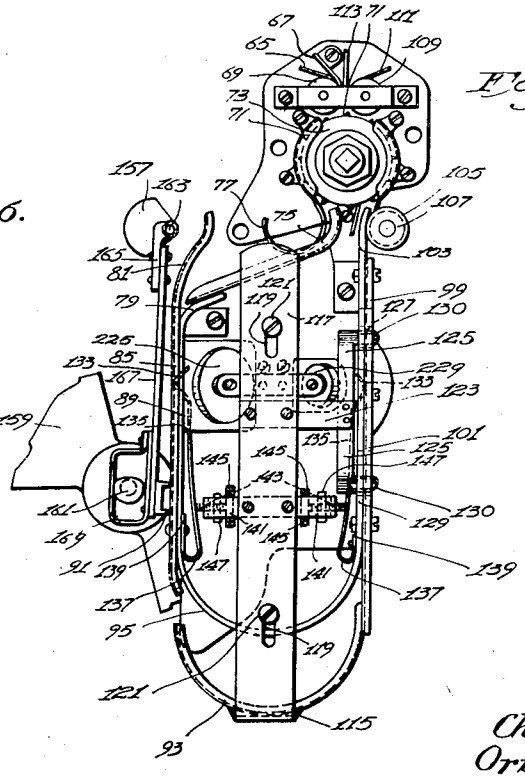


Fig. 6.

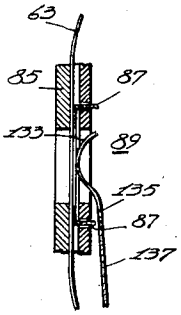
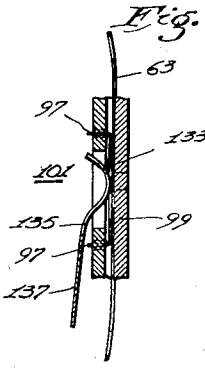


Fig. 7.



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UNITED STATES PATENT OFFICE

2,123,624

MOTION PICTURE APPARATUS

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Original application May 14, 1930, Serial No. 452,252, now Patent 2,032,116, dated February 25, 1936. Divided and this application November 16, 1935, Serial No. 50,110

2 Claims. (Cl. 88—16.2)

Our invention relates to acousto-cinematographic apparatus and has particular relation to domestic equipment, the present application being a division of our copending application, Serial No. 452,252, filed May 14, 1930, which on February 25, 1936, matured into Patent No. 2,032,116.

In apparatus of this type, constructed according to the teachings of the prior art with which we are familiar, the screen and loud-speaker constitute a separate unit from the projector and its appurtenances. This arrangement of the equipment has the serious disadvantage that it necessitates the use of lead wires that extend from the machine on one side of the audience to the loud-speaker on the other side of the audience.

The state of affairs thus occasioned by the two-unit system is not only undesirable from an aesthetic viewpoint but, in a room darkened for motion-picture projection, it materially increases the possibility of a mishap.

The provision of equipment avoiding this difficulty not only involves the construction of a suitable cabinet but also involves the construction of a machine that may be satisfactorily accommodated in a normally small cabinet.

It is, accordingly, an object of our invention to provide acousto-cinematographic equipment completely contained in a single unit.

It is an ancillary object of our invention to provide acousto-cinematographic apparatus which, while constituting a complete single unit, may be used in a two-unit system.

An additional ancillary object of our invention is to provide an acousto-cinematographic machine of small and compact structure that shall be smooth and silent in its operation.

Still another object of our invention is to provide means for increasing the throw of a light beam from the projection lens of a cinematographic machine without materially increasing the distance from the lens to a screen associated with said machine.

A further object of our invention is to provide, for a cinematographic machine, a simple automatic threading device that shall be inexpensive to manufacture.

More specifically stated, it is an object of our invention to provide simply operable acousto-cinematographic equipment wherein the machine is disposed in a collapsible cabinet equipped with a removable translucent screen and with a plurality of reflectors that coact to decrease the ratio of the geometeric distance between screen and projection objective to the optical distance between screen and objective.

According to our invention, we provide, for acousto-cinematographic apparatus, a cabinet having a plurality of compartments. The machine and a plurality of mirrors are disposed in one compartment and a loud-speaker in a second compartment separated therefrom. Adjacent to the machine compartment and movable relative thereto is an enclosure wherein additional mirrors and a screen are contained. The picture-projection light beam is reflected successively from one mirror to the other before it impinges on the screen. By thus bending the light beam, the optical throw is materially increased, and the dimensions of the cabinet remain unchanged.

We further provide a machine with a simple automatic threading device and with an intermittent movement that operates smoothly and has a high ratio of film-rest time to film-moving time.

The novel features that we consider characteristic of our invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in connection with the accompanying drawings, in which—

Figure 1 is a view, in perspective, of acousto-cinematographic equipment constructed according to our invention;

Fig. 2 is a schematic view of the mirror arrangement in the equipment;

Fig. 3 is a view, in perspective, of the bracket whereon the screen is mounted;

Fig. 4 is a view, in perspective, showing the acousto-cinematographic machine that is used with the equipment;

Fig. 5 is a view, in front elevation, showing the automatic threading arrangement and the intermittent movement of the machine;

Fig. 6 is a view, in longitudinal section, of the picture gate;

Fig. 7 is a view, in longitudinal section, of the sound gate;

Fig. 8 is a view, in front elevation, of the springs that cause the gate shoes to exert a resilient pressure on the film;

Fig. 9 is a view, in front elevation, showing a novel feature of the threading arrangement;

Fig. 10 is a view, in perspective, showing the intermittent movement of the machine in detail;

Fig. 11 is a view, in rear elevation, showing the power-transmission elements of the machine, and

Fig. 12 is a view, in section, taken along the line XII—XII of Fig. 11, and showing the knob whereby the power-transmission elements may be manually operated.

The apparatus shown in the drawing comprises a cabinet 1 equipped with an upper chamber 3, in which are mounted an acousto-cinematographic machine 5 and an amplifier (not shown), and with a lower chamber 7, in which a loud-speaker (not shown), electrically coupled to the amplifier, is supported.

The cabinet 1 is provided with an opening 9 in the side facing the picture-projection objective 11, and an enclosure 13 which is open at the top 15 and at the bottom 17 projects from the opening 9. The enclosure 13 is slidably supported within the upper chamber 3, and, when it occupies its innermost position, it forms a compartment within which the machine 5 is contained. The end wall 19 of the enclosure 13, in this position, closes the opening 9 in the cabinet and constitutes a section of the end wall 21 of the cabinet.

In addition to the amplifier and the machine 5, a plurality of reflectors 23 and 25 are mounted in the upper stationary chamber 3. The smallest mirror 23 reflects the light from the projection objective 11 to the larger mirror 25, which, in turn, reflects it to a still larger mirror 27 mounted on the walls 19 and 29 of the movable enclosure 13. The latter reflects the light to a translucent screen 31 that forms the front wall of the movable enclosure 13 and is slidably removable therefrom.

By thus bending the projection light beam, a picture of normal size may be obtained in a cabinet that is only slightly larger than a radio cabinet. It is to be noted that, with the present prevalence of efficiency apartments, the dimensions of an entertainment device of the nature herein discussed are a serious consideration.

It may, at times, be desirable to project a picture larger than the one that is available in the cabinet. We have, therefore, provided an opening 33, in the end wall 19 of the movable enclosure 13, that is normally closed by an internally hinged door 35, constituting a section of the wall 19. When it is desired to project a large picture, the smallest mirror 23 is removed or turned to an inactive position and the door 35 is opened. The light from the projection lens 11 is projected through the opening 33 and may be focused on a reflection screen disposed at any convenient distance from the cabinet.

The machine 5 comprises an upright bracket 37, cast in the form of a comparatively deep box, on the base of which are externally supported a plurality of film guides and film-advancing elements and within which are mounted a plurality of power-transmission elements. The upright plate is fastened to a shallow base plate 39 by bolts 41 traversing a lower side 43 of the box 37 and screwed into a plurality of bosses 45 in the base 39. The conducting leads that bring up the necessary electrical power to the energy consuming elements of the machine are fastened within the base.

A feed reel 47 and a take-up reel 49 are keyed to spindles 51 and 53 rotatably supported on brackets 55 and 57 fastened to bosses 59 and 61 projecting from the upright box 37.

The end of a film-roll 63 wound on the feed reel 47 is thrust into a channel formed between two guides 65 and 67 where it passes over a roller 69 and presents its perforations to the teeth 71 of a sprocket wheel 73. The sprocket wheel 73 grasps the film 63 and projects it through a passage between a long inner guide 75 and a short outer guide 77 that is curved upwardly at the end.

As the film 63 is propelled through the mouth of the passage, it bends under its own weight and advances into a pocket formed between a continuation of the inner guide 79 and a long guide 81, that is also curved upwardly at the end. The two sections 77 and 81 of the outer guide are separated and a free loop-reservoir 83 is thus formed between them above the inner guide 75.

Still reacting to the thrust of the sprocket wheel 73, the film 63 advances in the space provided between the aperture plate 85 and the shoes 87 of a picture gate 89. It is then grasped by a plurality of intermittently actuated claws 91 and thrust against the inner surface of the lower loop forming guide 93 that is movable relative to an inner stationary guide 95, as will be hereinafter described.

The film 63 is constrained by the guide 93 to reverse its motion and it is advanced upwardly from the end thereof into the opening provided between the shoes 97 and the aperture plate 99 of a sound gate 101.

It is to be noted that, in a loop-reservoir formed of two vertical legs moving in substantially opposite directions, and a central horizontal portion, the impulses introduced by the intermittent claws are not transmited into the vertical leg most remote from the claws. This feature is of considerable value in the present machine, since it eliminates the necessity of an insulating sprocket wheel between the intermittent claws and the picture gate.

After traversing the sound gate 101, the film 63 advances between an inner guide 103 and the flanges 105 of a power-drven roller 107, and its perforations are thrust into the path of the unoccupied teeth 71 of the original feed sprocket wheel 73. Its end is grasped by the sprocket wheel and projected over a second idler 109, situated above the sprocket wheel, and through a channel provided between two guides 111 and 113. The machine is then stopped while the end of the film is fastened to the take-up reel 49.

As has been explained hereinbefore, the upper loop 83 is automatically formed. The lower loop, on the other hand, requires a manual operation for its formation.

The lower loop-forming guide 93 is supported on a tongue 115 that is bent over from the lower end of an elongated flat plate 117. The plate 117 is equipped with a plurality of slots 119 and is supported on a plurality of studs 121 that traverse the slots 119 and are fastened to the upright casting 37 of the machine.

A strip 123, fastened to the plate 117 above its center, supports, on its end, a double-end spring 125 that extends into a plurality of slots 127 milled in the outer margin of the guides 99 and 129 of the sound gate 101. The ends 130 of the spring coact with notches 131 in the upper edges of the slots 127 to lock the plate 117 that supports the loop former 93 in its uppermost position. The notches 131 and the ends of the spring 125 that coact therewith are so related to each other that, by the exertion of a small vertical force on the plate 117 the ends 130 of the spring are removed from the notches 131 and the loop-forming guide

93 settles to its lowermost position under the action of gravity.

It is interesting to note that the inner guides 79, 95, 129 and 103 may be made in one piece by bending a single metallic strip substantially into a U-shaped configuration.

The shoes 87 and 97, in both the picture gate 89 and the sound gate 101 are compressed against the film by a plurality of buttons 133, bent into the ends of a plurality of fingers 135 of fork-shaped flat springs 137. The springs 137 are flanged at their lower ends and are bent over to form flanged tongues 139, whereby they are fastened to the inner guides 95 and 129 adjacent to the gates.

Centrally disposed on the plate 117 that supports the lower loop former 93 is a bar 141 of longitudinal channel section. The flanges 143 of the bar 141 are drilled and tapped to accommodate the threads of a plurality of thumb screws 145 that may be held rigidly in any predetermined position in the flanges 143 by a plurality of locknuts 147.

When the loop-forming guide 93 is in its lowermost position, the ends of the screws 145, projecting through the flanges 143, coact with the lower surface of the forked spring 137 and cause the buttons 133 to exert a pressure on the film 63 in the gates. When the loop-forming guide 93 is in its uppermost position, the screws 145 are not in contact with the springs 137, and the channels in the picture gate 89 and the sound gate 101, being no longer obstructed by the shoes 87, permit the passage of the leading end of the film that is being threaded into the machine.

The intermittent movement comprises a plurality of horizontal shafts 149 and 151 the axes of which determine substantially a vertical plane. The shafts 149 and 151 are rotatably supported in bosses (not shown) projecting from the upright casting 37 and the end of the upper shaft 149, which rotates at twice the angular velocity of the lower shaft, is borne up by a bracket 153 fastened to a boss 155 projecting inwardly from the surface of the casting 37.

A counterbalanced crank 157 is mounted on the end of the upper shaft 149 that projects through the casting 37 and is rotatable therewith, while a shutter 159 and a cam 161 are similarly supported on the lower shaft 151.

Pivotally supported on a pin 163 projecting from the crank 157, is a short arm 165, and rigidly fastened to the arm 165 is a long lever 167. A plurality of claws 91 project substantially at right angles from one lower surface of the lever 167, while a yoke 169, fastened to the remaining lower surface of the lever, engages the cam 161 supported on the lower shaft.

The claws 91 are moved in a vertical direction by the action of the crank 157 and in a horizontal direction by the coaction of the cam 161 and the yoke 169. It is seen that, by reason of the rapid reciprocation of the crank 157, the film 63 is moved during a rather small fraction of the total interval occupied by the projection of a single frame. In this connection, it should be noted that it is within the scope of our invention to provide for the rotation of the crank at a greater angular speed than twice the speed of the cam if such a procedure is found to be desirable.

Furthermore, we may add that the counterbalanced crank 157 tends to equalize the load that is sustained by the prime mover and, consequently, tends to eliminate vibrations of the system that are ordinarily introduced by irregularities in the motion thereof.

The main shaft 171 is obliquely mounted in bosses 173 cast integral with the upright bracket 37. The shaft 171 is driven from the prime mover (not shown) through a pair of one-to-one gears 177 situated in a chamber 179 in a lower end of the bracket. It transmits the necessary power to drive the crank shaft 149 and the cam shaft 151 through a plurality of gears 181, 183, 185 and 187, properly dimensioned for the purpose.

Milled integral with the shaft, at its upper end, is a worm 189 that coacts with a gear wheel 191 to drive a horizontal shaft 193 on one end of which the sprocket wheel 73 is mounted. On the remaining end of the shaft, a large gear wheel 195 is supported to coact with a small gear wheel 197, adjacent to it, to drive the shaft 199 on which the power-driven roller 107 is mounted. The pulleys 201 and 202, through which the take-up reel 47 and the rewind are driven, are mounted on the remaining end of the shaft 199.

The main shaft 171 may be manually rotated by a knob 203 of longitudinal C-section. The knob 203 is fastened to a stud 205 traversing the upright casting 27 and from the lower end of which there projects a key 207 adapted to engage a slot 209 in the upper end of the main shaft 171. A compression spring 211, interposed between the internal face of the cavity 213 in the knob 203 and the surface of the casting 37, normally holds the stud 205 out of engagement with the shaft 171. On the other hand, the stud is prevented from being entirely ejected from the casting by the end of a set screw 215 that engages a shoulder 217 produced by an attenuation 219 in the stud 205.

The film in the picture and sound apertures is illuminated from a single source 221. Direct light from the filament of the source 221 is projected through a lens 223 mounted in the upright bracket 37 and is deflected to the picture aperture by a spherical reflector 225. The reflector 225 and the lens 223 form an efficient condensing system.

To illuminate the sound aperture, light from the filament is gathered by a spherical mirror 227 and reflected, through a lens 228 in the plate 37, to a second spherical mirror 229 that brings it to a focus near the aperture. The two curved reflectors 227 and 229, together with lens 228, in this case, also form an efficient condensing system.

The sound track illuminated in the aperture is magnified by an objective 231 and imaged on a slit 233 behind which a photocell (not shown) is situated.

Although we have shown and described certain specific embodiments of our invention, we are fully aware that many modifications thereof are possible. Our invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

We claim as our invention:—

1. In film-handling apparatus, a plurality of film gates, each of said gates including means for exerting a force of compression on the film within said gates, means for supporting said gates at substantially the same elevation in such manner that the film transmitted therethrough moves with its surface in substantially parallel planes, a U-shaped strip mounted between said plates, a U-shaped plate, means for supporting said U-shaped plate in a plurality of positions at

varying distances from said U-shaped strip, means for sliding said U-shaped plates from one of said positions to another of said positions, and means, supported on said U-shaped plate and cooperating with said means for exerting a force of compression on said film strip, for releasing said force when said U-shaped plate is in a position nearest to said U-shaped strip and for impressing said force when said U-shaped plate is in a position displaced at least a predetermined distance from said U-shaped strip.

2. In film-handling apparatus, a plurality of film gates each of said gates, including means for exerting a force of compression on the film within said gates, means for supporting said gates at substantially the same elevation in such manner that the film transmitted therethrough moves with its surface in substantially parallel planes, a U-shaped strip mounted between said plates, a U-shaped plate, means for supporting said U-shaped plate in a plurality of positions at varying distances from said U-shaped strip, means for sliding said U-shaped plates from one of said positions to another of said positions, means, supported on said U-shaped plate and cooperating with said means for exerting a force of compression on said film-strip, for releasing said force when said U-shaped plate is in a position nearest to said U-shaped strip and for impressing said force when said U-shaped plate is in a position displaced at least a predetermined distance from said U-shaped strip, means for locking said U-shaped plate in the position nearest to said U-shaped strip to permit the automatic threading of a film strip between said plate and strip, and means for supporting said U-shaped plate in a position further displaced from said U-shaped strip to permit the formation of a loop reservoir in the film strip between said plate and strip.

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