July 21, 1942. J. A. LINKS ET AL 2,290,287

MOTION PICTURE PROJECTION APPARATUS

Filed Sept. 5, 1939 2 Sheets-Sheet 1

FIG. 1.

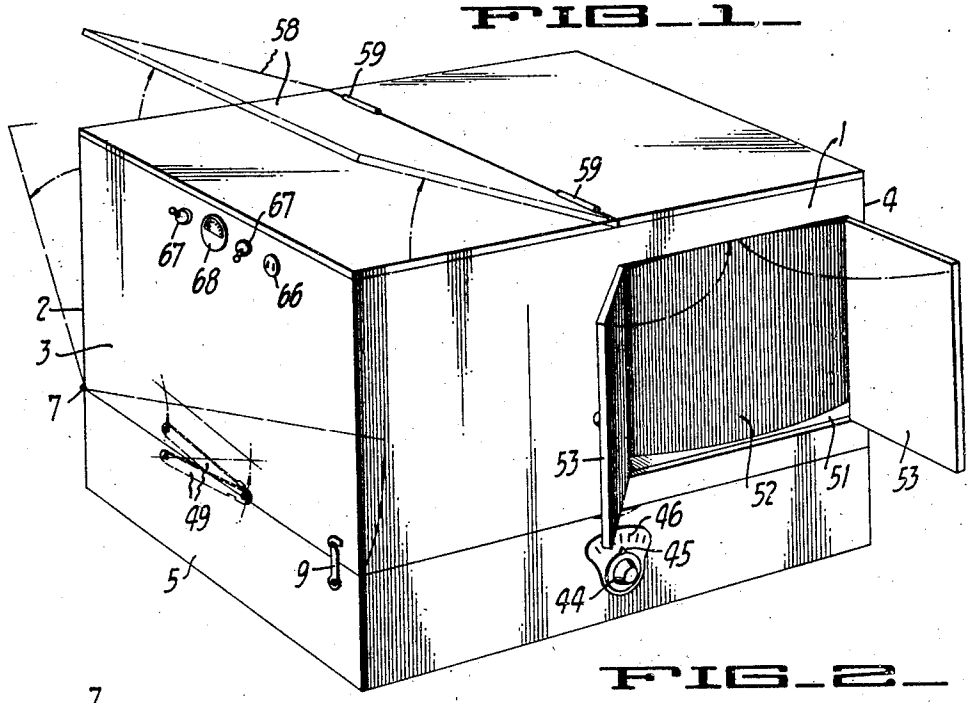
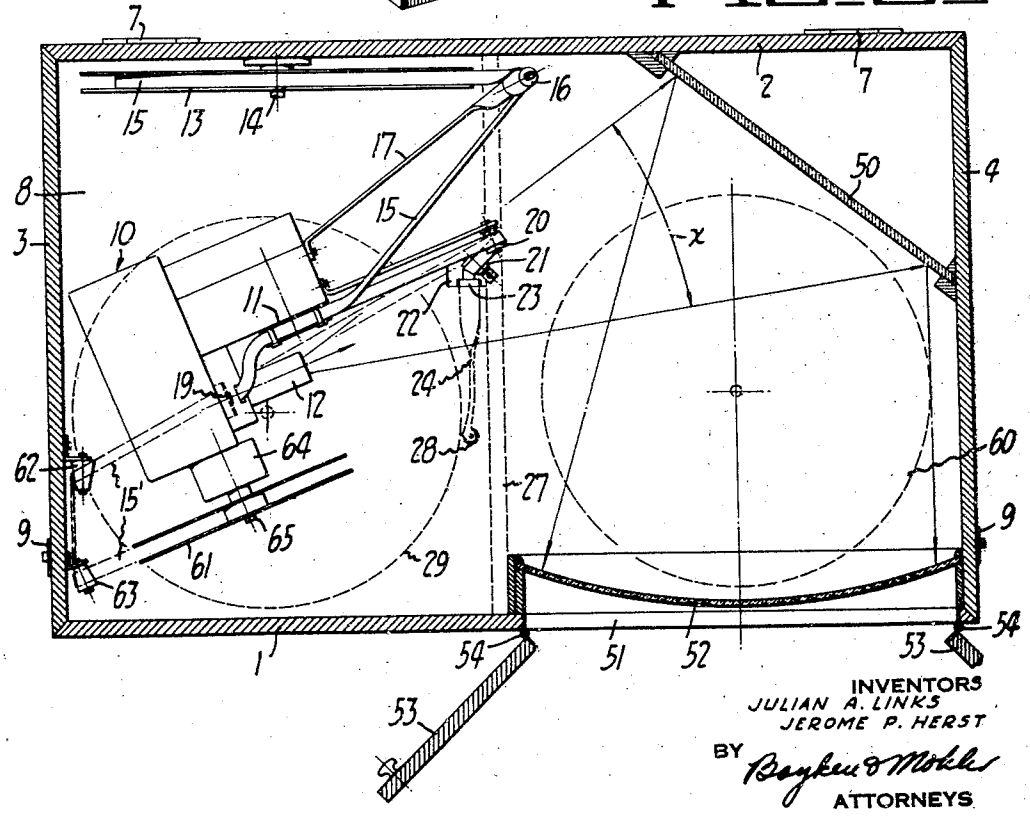


FIG. 2.



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Filed Sept. 5, 1939 2 Sheets-Sheet 2

FIG. 3

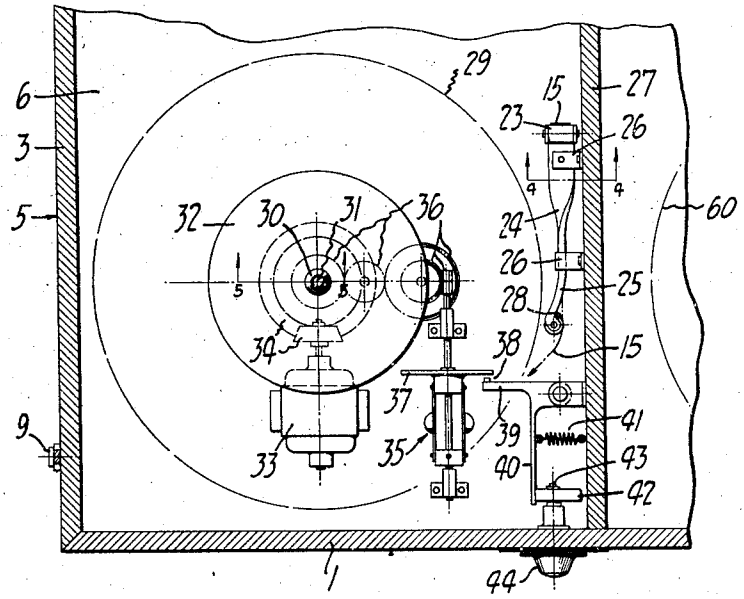
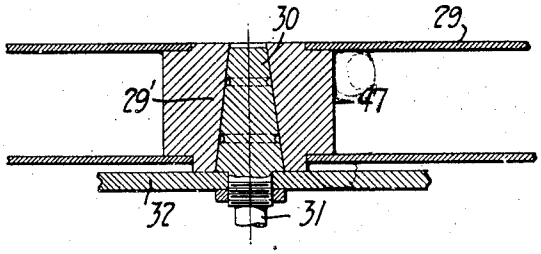


FIG. 5



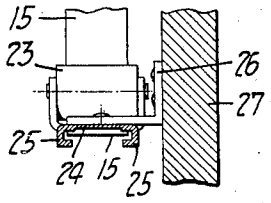


FIG. 4

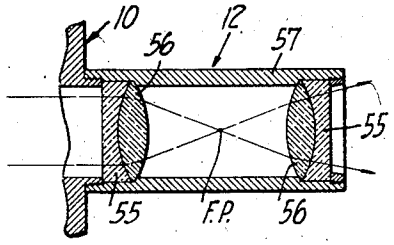


FIG. 6

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Patented July 21, 1942 2,290,287

UNITED STATES PATENT OFFICE

2,290,287

MOTION PICTURE PROJECTION APPARATUS

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Application September 5, 1939, Serial No. 293,348

6 Claims. (Cl. 88—24)

This invention relates to a moving picture projection apparatus and has for one of its objects a more compactly arranged moving picture projector and reels therefor than heretofore. Another object of the invention is a complete projector, reels and screen, all arranged compactly in a portable cabinet with the reels disposed adjacent two of the sides of the projector in positions at a lower elevation than heretofore, and in which they are more nearly within the projected area of the said sides than in the conventional projectors. Still further objects of the invention are improved means for projecting a larger image on a screen positioned relatively close to the projector, without noticeable distortion, and an improved screen for such image. Other objects and advantages will appear in the specification and drawings.

In the drawings, Fig. 1 is a perspective view of the cabinet containing all the essentials for projection of a relatively large image from either eight or sixteen millimeter film.

Fig. 2 is a horizontal sectional view of the apparatus of Fig. 1 taken just below the top of the cabinet and through the screen and mirror.

Fig. 3 is a horizontal, fragmentary sectional view of a portion of the lower part of the cabinet showing the take-up reel therein in dotted line, and the means for guiding the film thereto and also the means for regulating the speed of the take-up reel.

Fig. 4 is a sectional view of one film guide as seen along line 4—4 of Fig. 3.

Fig. 5 is an enlarged sectional view through the reel mounting shaft for the take-up reel as seen along the line 5—5 of Fig. 3.

Fig. 6 is a sectional view through the improved projection lens of the projector.

In detail, the apparatus as illustrated in the drawings comprises a generally oblong cabinet having a front side 1, rear side 2, ends 3, 4, and a bottom section 5, which bottom section is relatively shallow, vertically, and carries a bottom 6 (Fig. 3) with short vertically extending sides and ends in substantially downward continuation of the sides and ends of the main body of the cabinet. The said bottom section is hinged to the lower edge of the rear side 2, as at 7 (Fig. 1), for tilting the body of the cabinet at its forward side, upwards, away from the lower section. The main body section carries a bottom portion 8 (Fig. 2) wholly or partially covering the lower section. The bottom section and the main body portion of the cabinet are releasably secured together by hooks 9 at opposite ends of the cabinet, as indicated in Fig. 2, thus permitting the entire cabinet to be lifted and moved about as a unit without danger of the bottom swinging open.

On the bottom 8 of the main body section, is a conventional, vertically disposed projector 10, the one indicated generally in the drawing being a projector for home motion pictures, such as for 8 mm. or 16 mm. film. The film drive is conventional, hence is not shown in detail, it being sufficient to state that the drive pulley indicated at 11 is connected, by conventional drive connections with the motor, for driving the film from the feed reel past the projection lens, indicated at 12.

Heretofore the feed reel and take-up reel have been mounted one above the other at the forward end of the projector, and since these reels are from five to ten inches in diameter, and larger, considerable space is required to accommodate the reels in this position. Also, in the projectors for 8 mm. film, only relatively small reels can be used, hence only short pictures can be shown, and the reels must be frequently changed. The arrangement of the feed and take-up reels in this invention enables long reels or short reels to be used with the minimum of space required for the same.

Referring to Fig. 2, the feed reel is indicated at 13, rotatably mounted for rotation on a horizontal shaft 14 supported on the rear side 2 of the cabinet. The position of this reel is substantially alongside one side of the projector 10, so that the bottom of the reel is substantially opposite the base of the projector 10 when a reel, say of about 15 inches in diameter, is on the shaft.

From said reel 13 the film 15 is fed around a guide pulley 16 supported forwardly of the projector from a bracket 17 that is carried on said projector. The film passes over the conventional drive pulley 11, then between the lens 12 and the light aperture 18 and below drive pulley 11 to a guide pulley 20 over which pulley the film passed downwardly to engagement with another guide pulley 21. From said guide pulley 21 the film passes through an opening 22 in the bottom 6.

A roller 23, guide channel strip 24, and roller 26 are secured to partition 27 in the bottom 5 of the cabinet guide film 15 to reel 28, the rollers 23, 26 being at the ends of the strip and the strip being given a half turn (Fig. 3) to change the direction of the film. The sides 25 of the channel strip have inturned flanges to retain the film in the channel and the base of the channel is

recessed to prevent contact between the emulsion on the film and strip in the event the emulsion is facing the strip (Fig. 4). Brackets 26 support the strip on the partition with the roller 23 adjacent opening 22 and roller 28 adjacent the periphery of conventional take-up reel 29 (in dotted line Figs. 2, 3). This take-up reel 29 is horizontally disposed, and carries a tapered central bearing 29' (Fig. 5) adapted to frictionally fit over the tapered upper end 30 of a vertical shaft 31. Secured at the lower end of said end 30 is a horizontal disk 32 adapted to support the reel 29 against any tendency to wobble.

The shaft 31 is driven by a motor 33 through gearing 34 and the speed of shaft 31 is controlled by a centrifugal governor 35 that is in driving connection with the drive shaft 31 through gearing 36. Disk 37, connected with the axially movable hub of the governor, is adapted to be engaged by a felt or leather brake 38 supported on one arm 39 of a modified ball crank, the other arm 40 of which crank is held by a spring 41 against a cam 42 secured on a shaft 43 that rotatably extends through the forward wall of the bottom section 5. A knob 44 is secured to the end of shaft 43 that projects outwardly of said section 5, which knob carries a pointer 45 adapted to scan indicia, indicated at 46 in Fig. 1, for indicating the desired control for the speed of the take-up reel 29. Upon rotating the knob 44 in one direction, the low side of cam 42 will engage arm 40, thus decreasing the resistance on motor 33, and increasing the speed of reel 29 for driving say 34 frames per second, or by turning the cam so its high side engages arm 40 the speed may be reduced for driving, say 15 frames per second. By turning the cam to positions where the arm 40 is engaged between the high and low sides, other speeds between the fastest and slowest speeds may be procured. In fact any desired speed between high and low can be accurately and positively obtained.

In order to compensate for the difference in the speed of the film on the take-up reel at the hub and adjacent the periphery, the said hub is nicely fitted on the end 30 of shaft 31 to permit slippage between the hub and end 30 when the tendency of the reel is to draw the film from the drive pulley 11 on the projection at a rate of speed faster than that at which said pulley draws the film from the feed reel. The desired speed of driving the reel 29 at the circumference of the film supporting portion 47 of reel 29 (Fig. 5) is substantially equal to the speed at which the pulley 11 feeds the film past the projector. Thereafter, as the film winds on reel 29 to a sufficient degree, which is only noticeable in the larger diameter reels, the slippage between portion 30 and hub 29' will occur.

In order to remove and to replace a reel in the bottom section 5, it is only necessary to tilt the main body upwardly, and conventional pivotally stop links 49 (indicated in dotted line in Fig. 1), that connect between the body of the cabinet and the bottom, will support the main body against accidental tilting at too great a degree, and such links will likewise support the cabinet in tilted position against falling, until the links are collapsed in the usual manner.

Forwardly of the lens 12 and across the corner of the cabinet at the juncture of end 4 and rear side 2, we position a flat mirror 50, which mirror is disposed in a vertical plane at a subtsantially 45° angle to the central axis of the lens. In the forward side 1 of the cabinet is an opening 51, and just inside said opening is a flat, translucent, or frosted screen 52, which screen may be of glass or Celluloid, or the like. This screen 52 is planar sided, but is curved in the direction of its horizontal width, the degree of said curvature being substantially that of the curvature of the field projected by lens 12, indicated in Fig. 2 at X. The area of screen is of course larger than the area of the mirror 50, and is approximately 10 x 12 inches, which is substantially the actual size of the image projected from an 8 mm. film positioned a total of only about 24 inches from the projection lens 12 to said screen by way of the mirror. The size of the main body of the cabinet itself is only about 15" x 24" x 15". Thus it will be seen that a greatly enlarged image is produced on the screen 52 (which image is viewed from the front of the cabinet), although the actual distance of the film from the projector is appreciably less than is usual for even a smaller image.

The opening 51 is adapted to be closed by swinging doors 53 hinged at 54 to opposite lateral edges of the opening.

One of the features that enables the large image on screen 52 within the short distance of the latter from the projector, is the lens assembly 12. This assembly comprises a pair of plano-convex lens 55 each with a bi-convex lens 56 cemented in the usual manner in the concave side of one of the plano-convex lens. The plano-sides of the plano-convex lens face outwardly in the barrel 57 with one of the convex sides of the bi-convex lens facing toward each other. This type of lens is generally known as a wide angle lens, and provides for an appreciably enlarged image, with inappreciable distortion, which is less as the distance between the lens and the screen is increased. The short distance between the screen and lens, in our cabinet, makes it desirable, however, to curve the screen, as already described.

In order to provide access to the projector and feed reel, in the cabinet, the top of the cabinet is cut away and a hinged lid 58 is provided (Fig. 1), which lid may be swung on hinges 59 to over the remainder of the top 2. Thus all the working parts of the projector, as well as the reel 13 are accessible to an operator.

The bottom section 5 also provides ample space at the side of the partition 27 opposite reel 29 for storing extra reels, indicated in dotted line at 60, in Fig. 2.

Where small 8 mm. film is used, the take-up reel is, of course, relatively small as compared with the reels 13, 29, in which case, the body portion of the cabinet is complete in itself for the take-up reel, in which case, said reel, indicated at 61 is mounted alongside the projector 10, opposite the side facing the reel 13. The film 15, upon leaving pulley 28 in this latter instance, is conducted over pulley 62, that is secured to the lower portion of end 3, and from pulley 62 said film is carried upwardly and over pulley 63 secured to the same side 3 near the top and adjacent front wall 1. From pulley 63 the film (indicated in dotted line at 15') is passed over reel 61 for winding on the latter. The reel 61 is driven by a motor 64, the said reel being a friction fit on shaft 65, but capable of slipping relative to said shaft in the event of excess tension on the film.

It is accordingly seen from the foregoing that provision is made in our device for extra large reels as well as for the smaller reels, and yet the entire projection equipment, including the

screen, is contained within a small cabinet. Also, our arrangement enables the projection on said screen of a much larger image than heretofore considering the size of the film.

The power for the light and motors may be supplied through the usual plug 66, to the apparatus controlled by suitable switches 67 and a rheostat 68 on the end 3 or in any other desired location, but preferably accessible outside the cabinet.

Having described our invention, we claim:

1. Apparatus of the character described, comprising an elongated, oblong cabinet with vertical lateral sides having therein a substantially vertical, flat, reflector and a substantially vertical, rectangular screen of light transmitting material respectively disposed at opposite sides of said cabinet at one end thereof; a motion picture projector within said cabinet at the opposite end having a projection lens arranged to project rays of light forming a picture generally horizontally directly onto said reflector for reflection from the latter generally horizontally directly onto said screen, said screen and said reflector and said projector being positioned at generally the same horizontal level whereby said screen and said reflector are horizontally offset relative to said projector to positions entirely removed from heat rising from said projector; a rectangular opening formed in the side wall of said cabinet opposite said reflector substantially the width of said latter wall in direction of its shorter dimension and said screen being substantially the same size as said opening and being secured in the latter; a horizontal reel for receiving motion picture film from said projector after movement of such film past said lens; said reel being positioned below said projector and within the confines of said cabinet.

2. A device of the character described, comprising, a cabinet having lateral side walls, a motion picture projector in said cabinet having a projection lens arranged to project rays of light generally laterally across the interior of said cabinet and formed to project said rays substantially divergently therefrom, one of said lateral side walls being formed with an opening therein, and a generally rectangular, substantially vertical screen positioned in said opening, a flat light reflector positioned within said cabinet to receive said rays directly from said lens and to directly reflect said rays onto the side of said screen facing into said cabinet, said screen being a sheet of light transmitting material curved horizontally with the said side thereof facing into said cabinet being the concave side of said screen and the curvature of said screen corresponding to the curvature of the field of said lens whereby the horizontal distortion of the picture resulting from the divergence of said rays, and observable only on the opposite convex side of said screen outside said cabinet by an observer outside said cabinet will be materially rectified, the relation between said lens, reflector and screen and the refractive characteristics and form of lens being such that the horizontal dimension of the image received on said screen is equal to substantially one-half of the total length of travel of the rays from said lens to said screen.

3. A device of the character described, comprising, a cabinet having lateral side walls, a motion picture projector adjacent one of said lateral sides and having a projection lens arranged to project rays of light generally horizontally across the interior of said cabinet, said lens being a wide-angle lens whereby the opposite outside rays, relative to the central axis of said lens, are projected from said lens at a relatively wide angle, one of said lateral side walls being formed with an opening therein, and a substantially rectangular, substantially vertical screen positioned in said opening, a light reflector positioned within said cabinet adjacent the side wall opposite the said one of said lateral sides to reflect said rays transversely across the interior of said cabinet and onto the side of said screen facing into said cabinet, said screen being a sheet of light transmitting sheet material curved horizontally with its concave side being said side facing into said cabinet, the degree of said curvature of said screen being such that the rays of light in a medial plane horizontally dividing the field of rays projected from said lens and reflected by said reflector will be of substantially equal length from said lens to said screen thereby rectifying the distortion of the picture on said screen when the latter is observed from outside said cabinet in viewing the convex side of said screen, and also materially equalizing the brilliancy of said picture at all points thereof.

4. In motion picture apparatus of the character described including a cabinet enclosing a motion picture projector having a projecting lens, a strip of motion picture film movable past each lens, a screen positioned to receive rays of light projected by said lens, a reel positioned to receive the said film in the form of a coil upon movement of said film through the projector and past said lens, and means for so moving said film and for revolving said reel; a film guide extending from said reel for guiding film thereto, said guide comprising a channel strip slidably supporting said strip of film between the sides of said channel for longitudinal movement longitudinally of said channel, the bottom of said channel being longitudinally recessed a width to clear the portion of said strip of film between the opposite longitudinally extending margins thereof while slidably supporting said margins at opposite sides of the recess in said bottom, whereby the portion of the film carrying the image to be projected by said lens will be free from engagement with said channel strip during sliding movement along said strip, and the sides of said channel strip having flanges secured thereto, said flanges extending toward each other and over only the opposite longitudinally extending margins of said strip of film.

5. In a construction as defined in claim 2, said reel being positioned horizontally below said projector and lens, and rollers rotatably supported on opposite ends of said channel strip for supporting said film upon its entering and leaving the latter, said channel strip being curved longitudinally with one of its end portions extending upwardly toward said lens and with its opposite end portion substantially horizontal and planar with said reel whereby the said strip of film carried thereby will be curved corresponding with the curve of said channel strip during its longitudinal movement along said strip, and means supporting said channel strip stationary relative to said projector and said reel.

6. A device of the character described comprising, a cabinet enclosing a motion picture projector having a wide-angle projection lens with respect to ordinary motion picture projection lens and one reflector, a horizontally curved

screen of light transmitting sheet material secured in an opening in one of the lateral walls of said cabinet positioned with its concave side facing into said cabinet and its convex side facing outwardly; said reflector being the only reflector in said cabinet, and said projection lens, reflector and screen being positioned relative to each other for projection of the image from said projector directly onto said reflector and for reflection of the said image directly from said reflector onto said screen with the said image so projected and reflected substantially covering said screen.

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