March 5, 1963 A. J. McMASTER ETAL 3,079,840

AUTOMATIC SLIDE PROJECTOR

Filed March 7, 1960 11 Sheets-Sheet 1

Fig. 1.

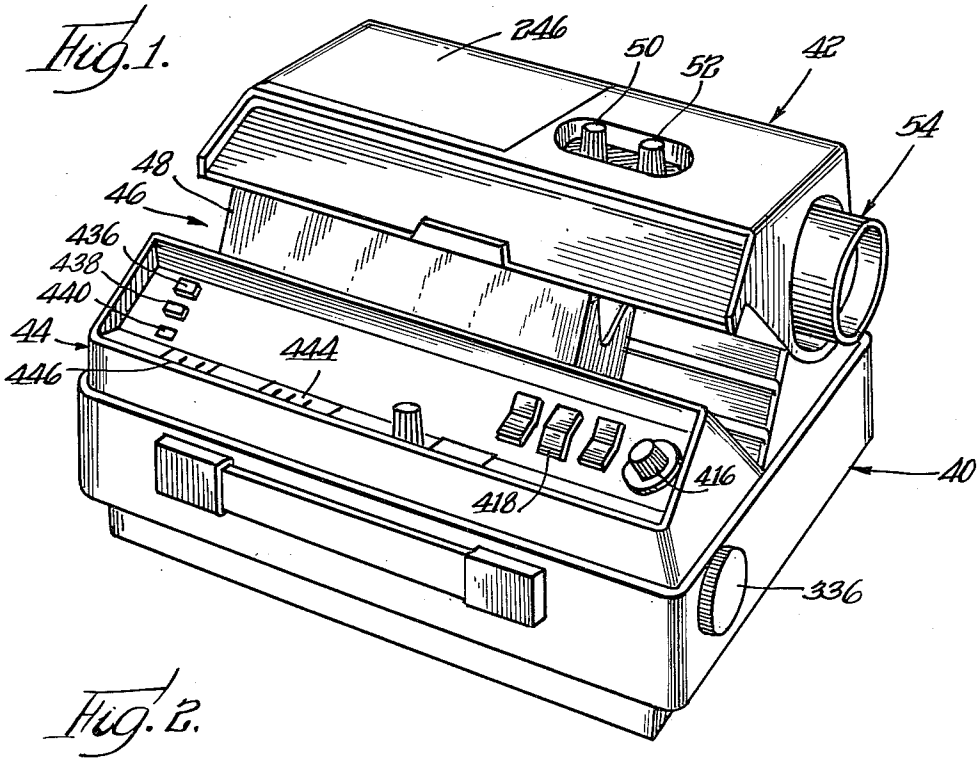
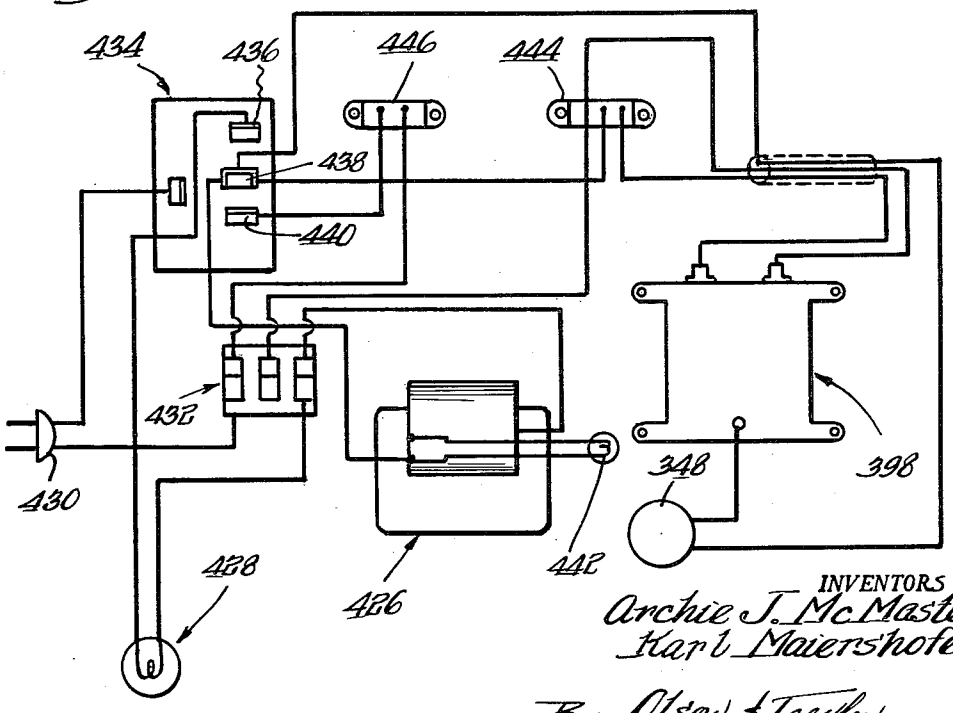


Fig. 2.



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AUTOMATIC SLIDE PROJECTOR

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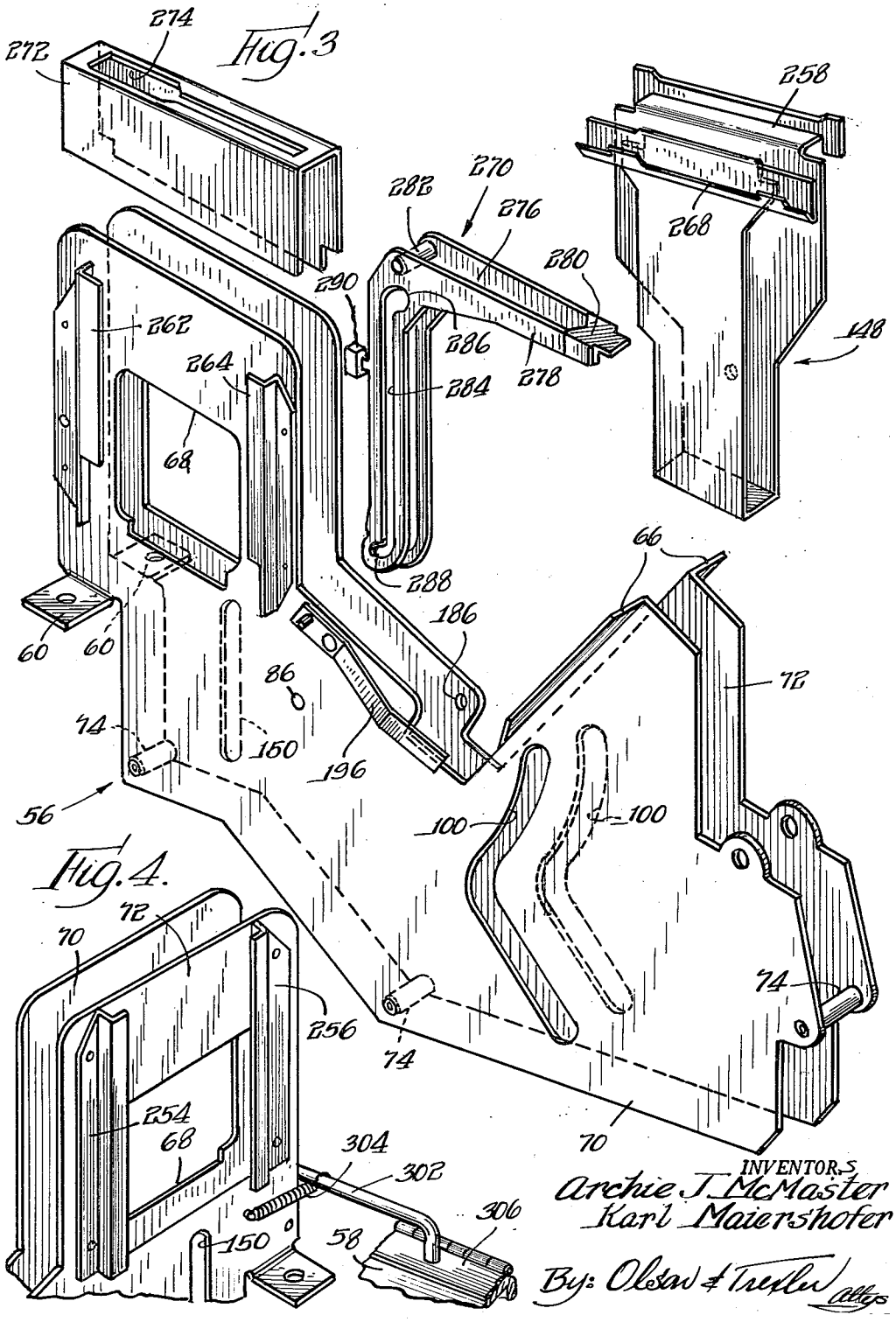

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AUTOMATIC SLIDE PROJECTOR

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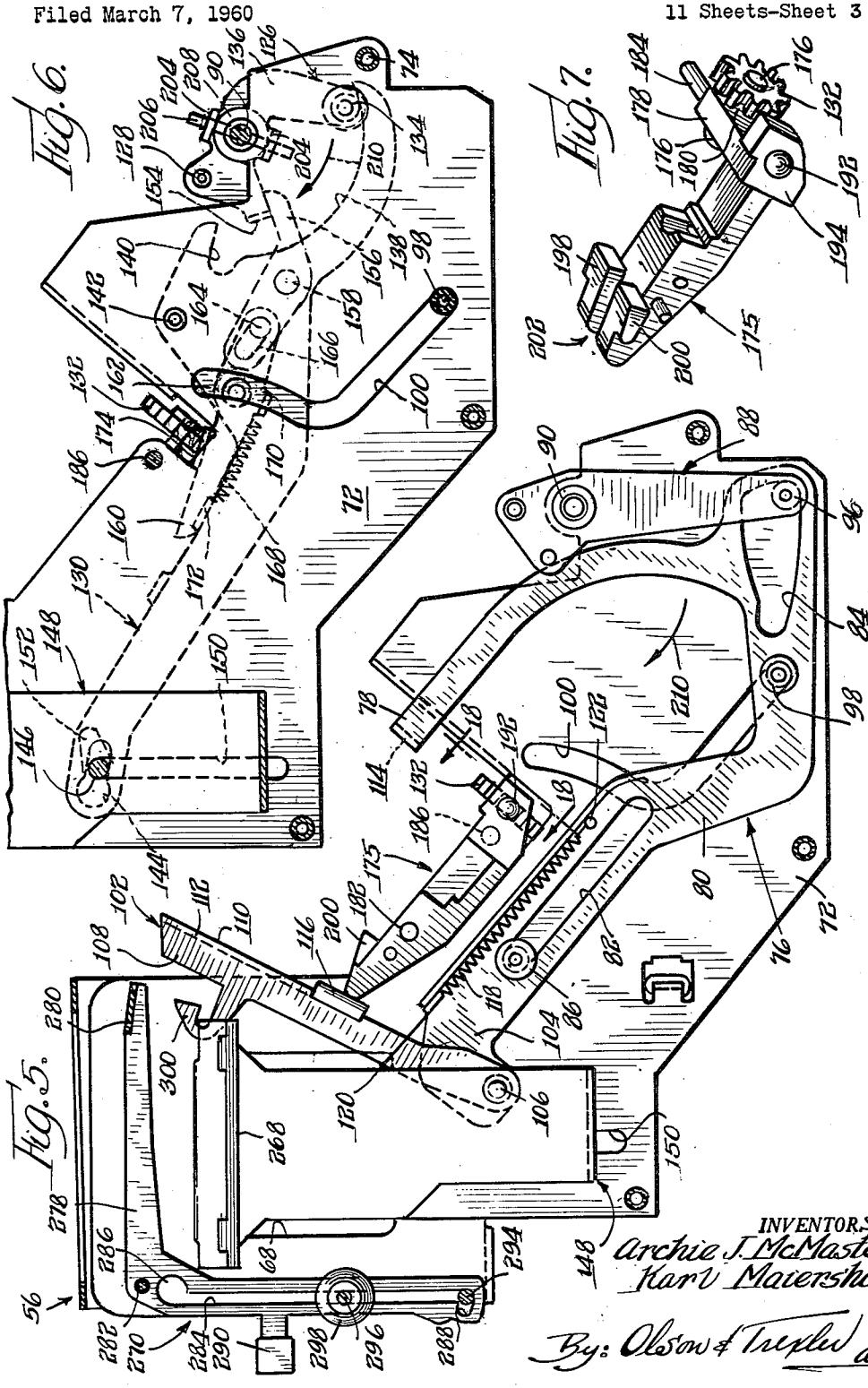

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March 5, 1963 A. J. McMASTER ETAL 3,079,840

AUTOMATIC SLIDE PROJECTOR

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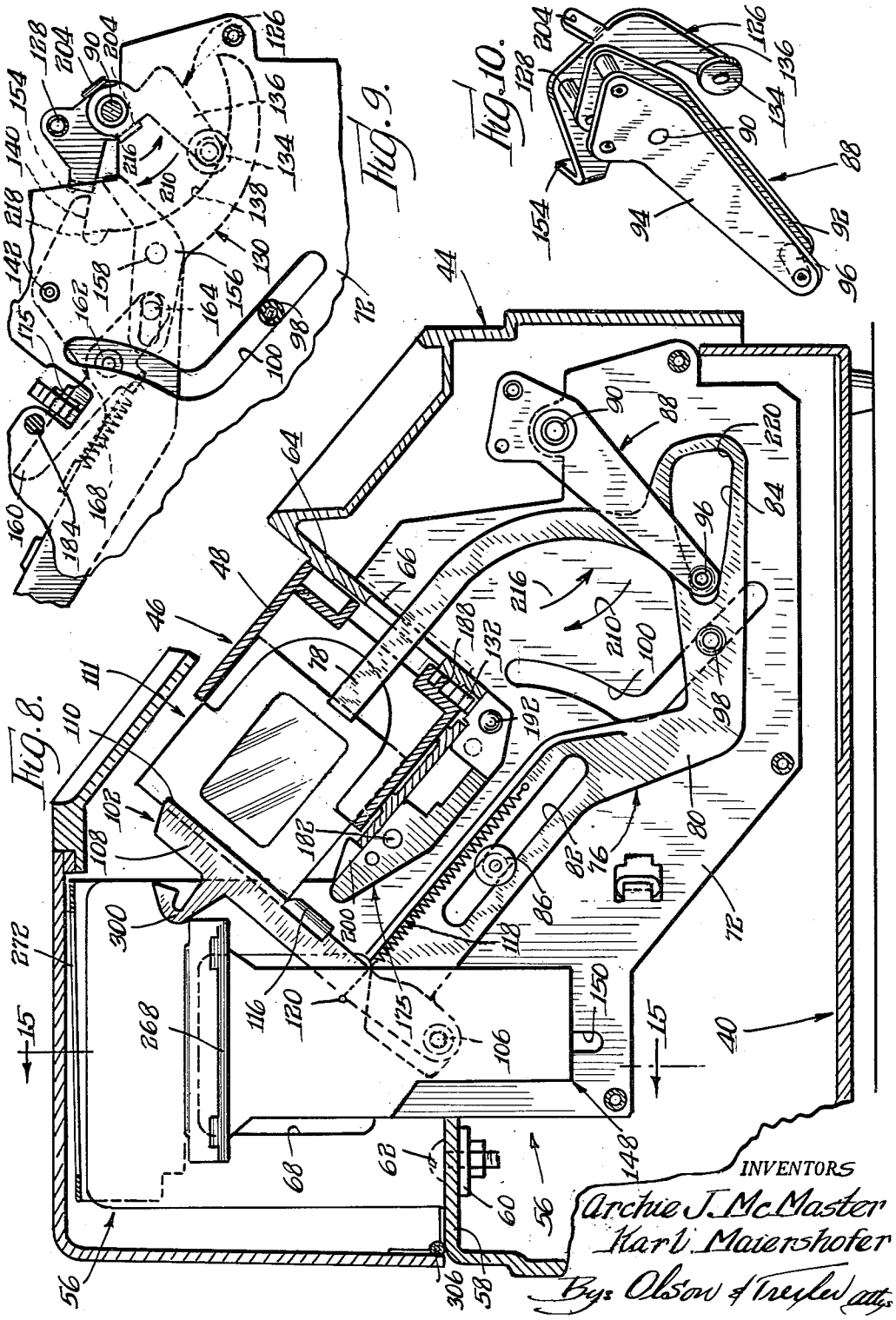

Fig. 8.

Fig. 9.

Fig. 10.

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AUTOMATIC SLIDE PROJECTOR

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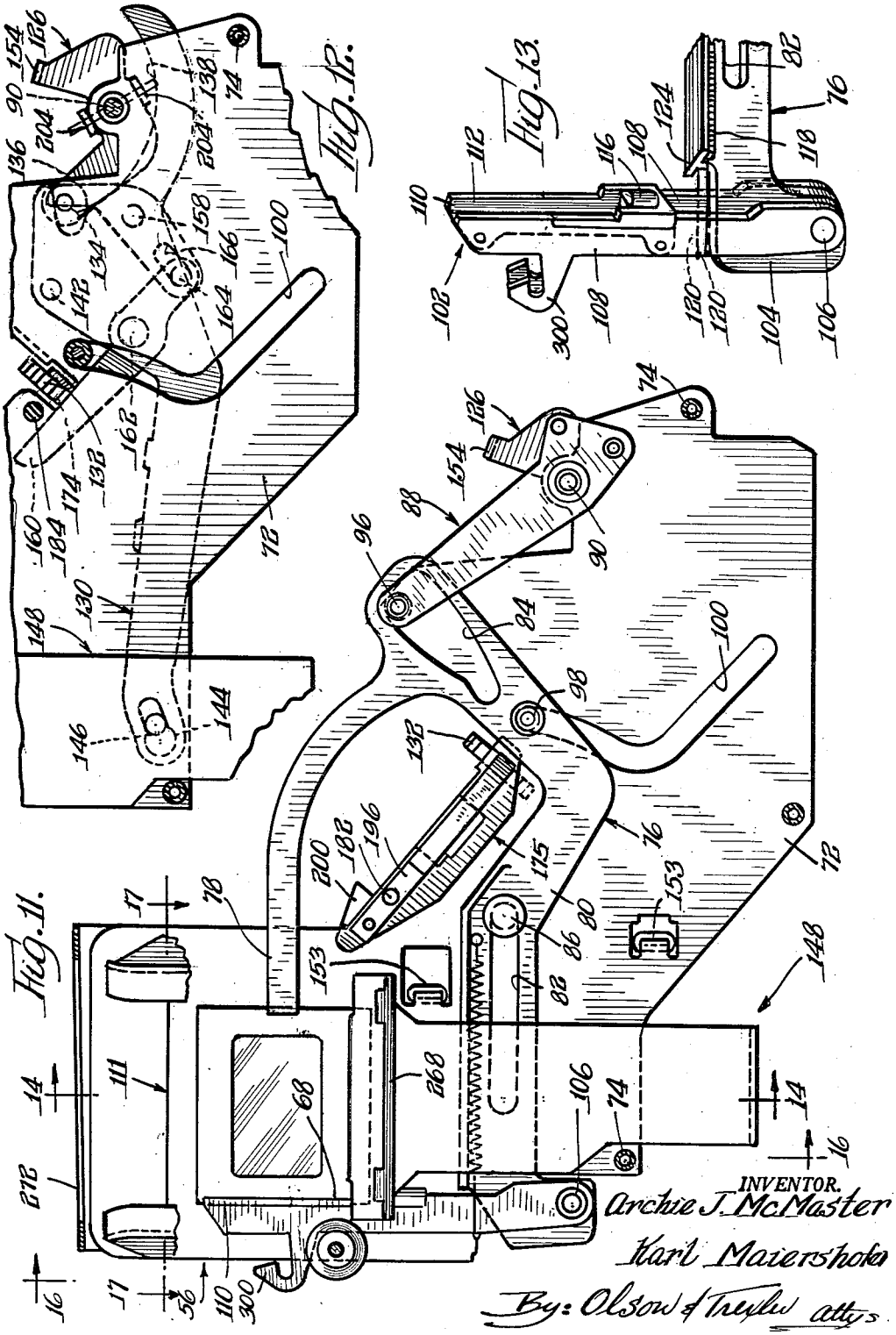

Fig. 12.

Fig. 13.

Fig. 11.

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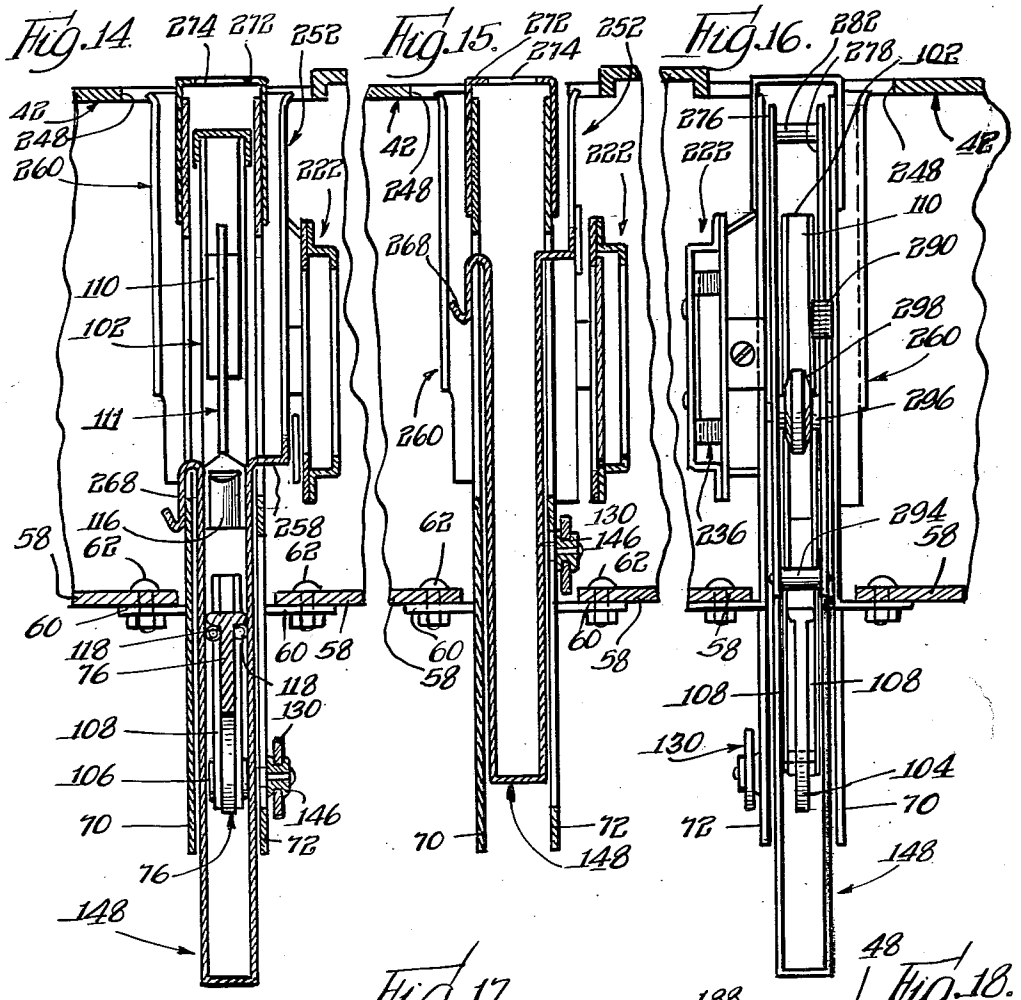

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AUTOMATIC SLIDE PROJECTOR

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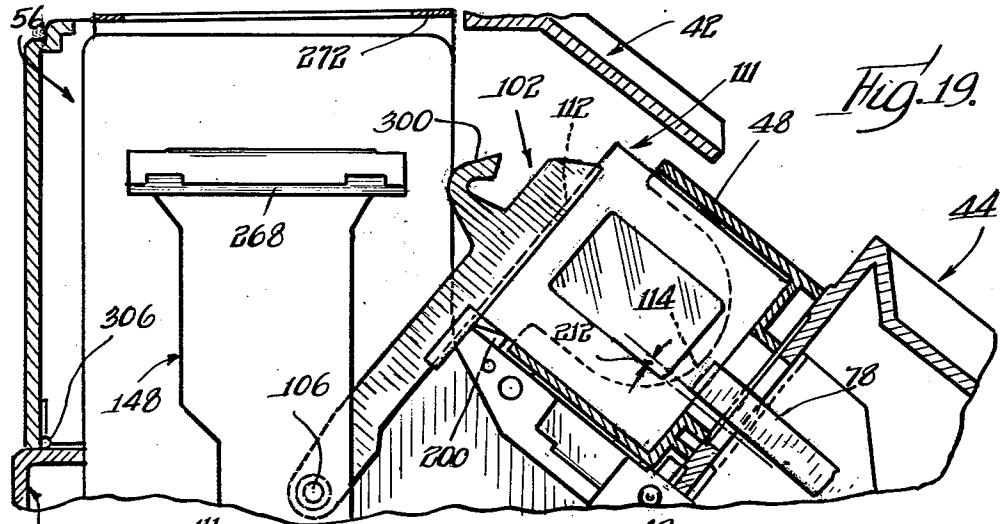

Fig. 19.

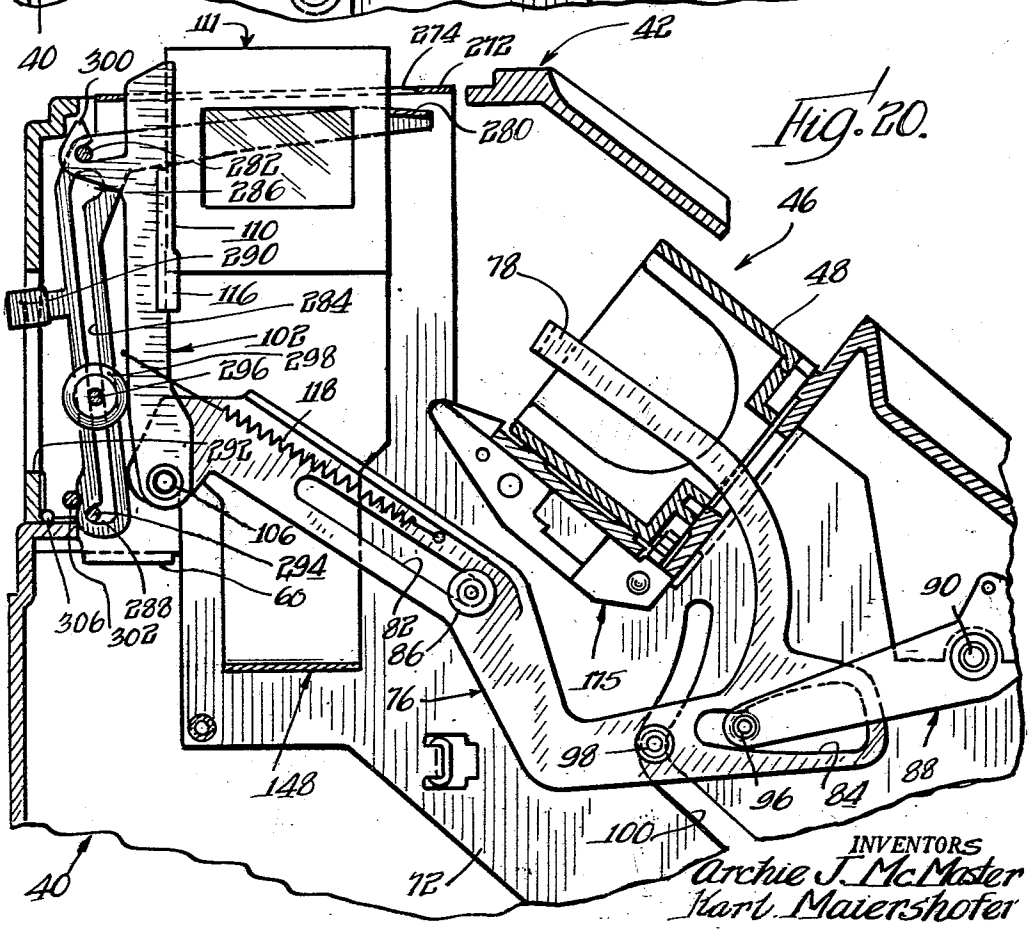

Fig. 20.

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AUTOMATIC SLIDE PROJECTOR

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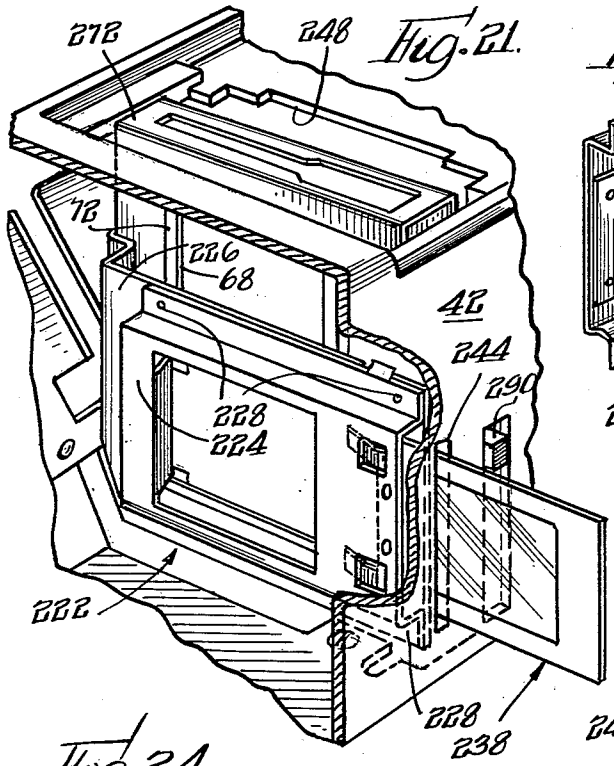

Fig. 21.

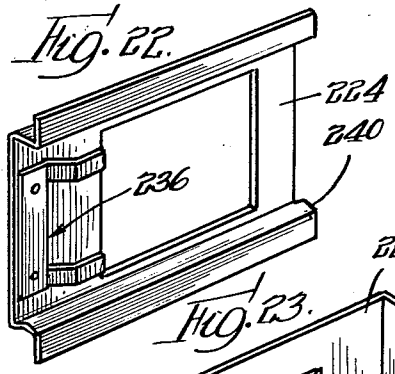

Fig. 22.

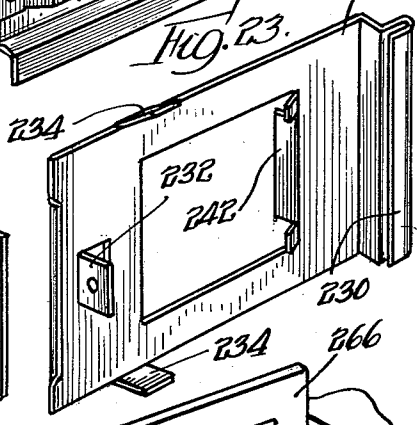

Fig. 23.

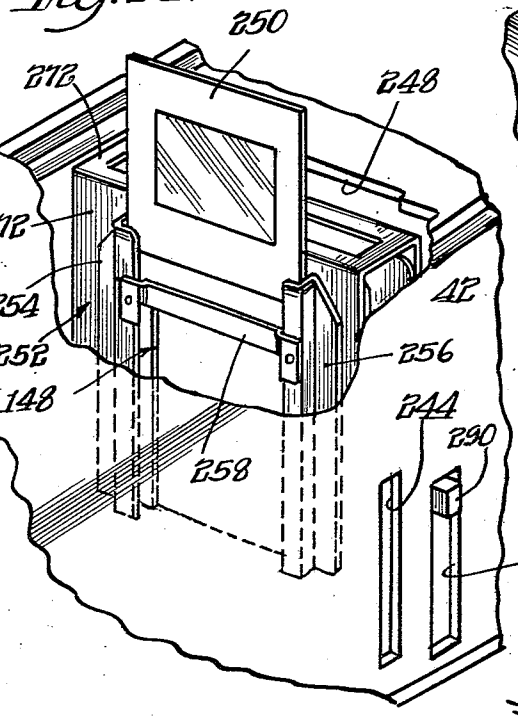

Fig. 24.

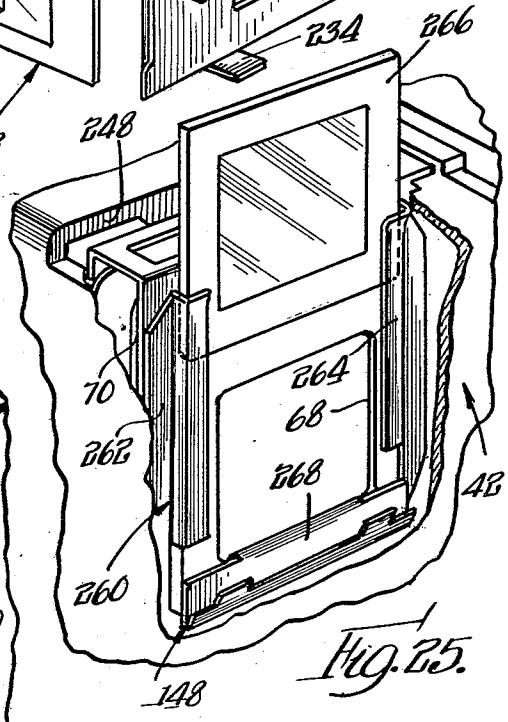

Fig. 25.

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AUTOMATIC SLIDE PROJECTOR

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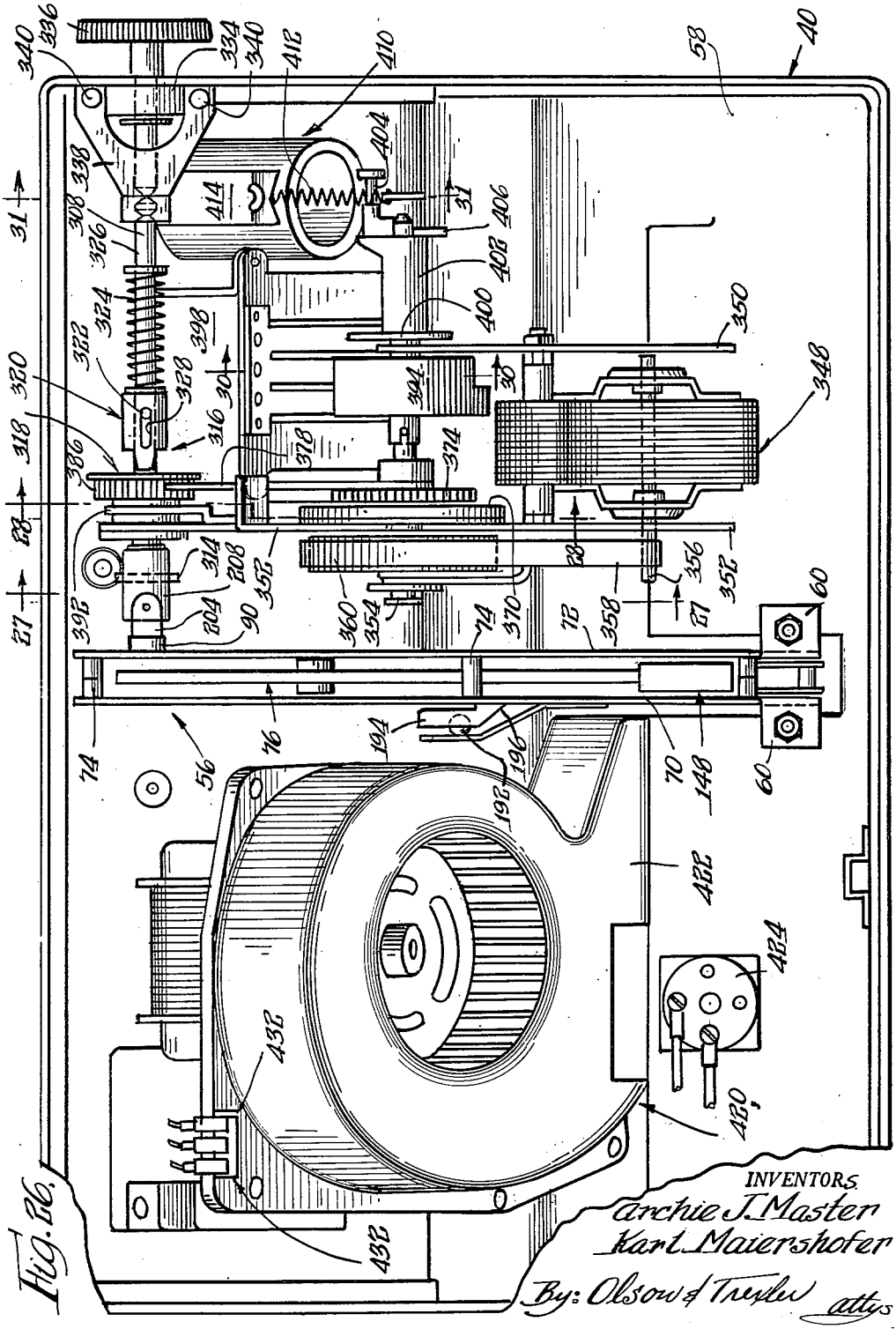

Fig. 26.

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AUTOMATIC SLIDE PROJECTOR

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Fig. 27.

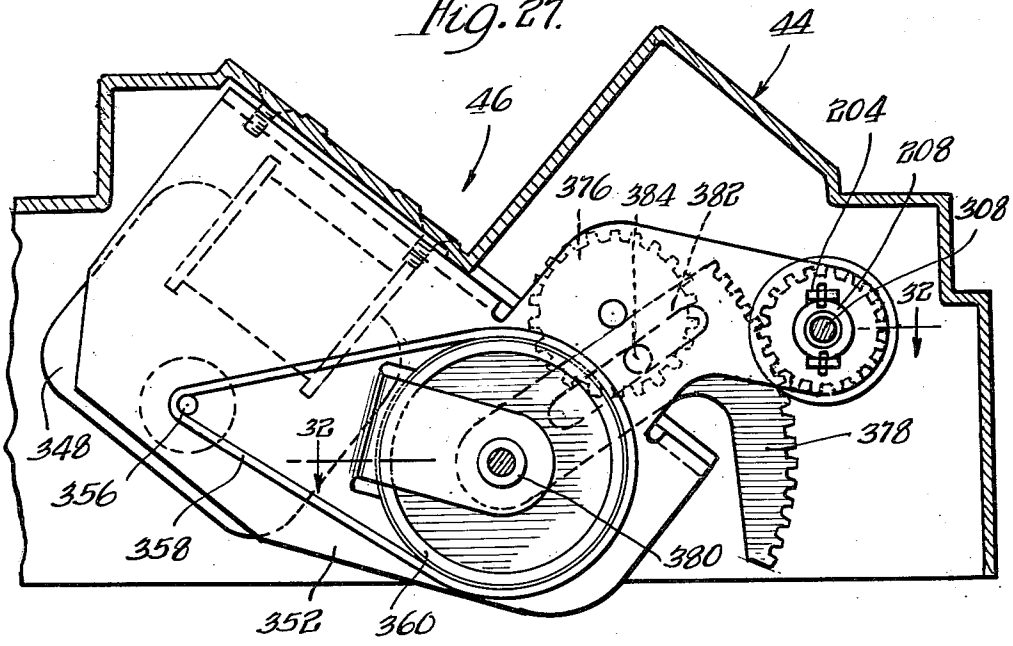
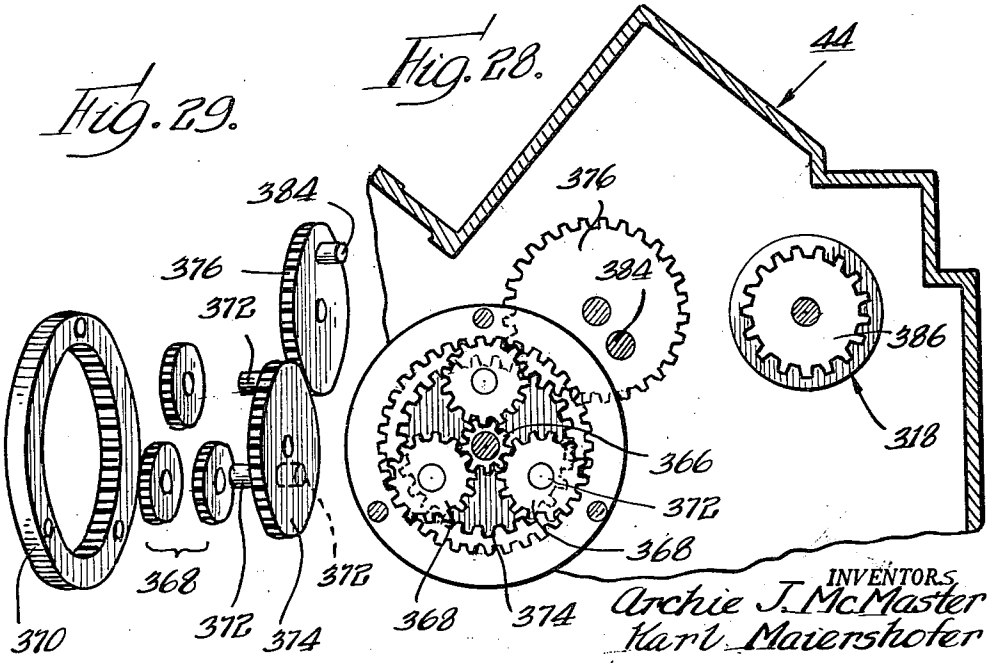


Fig. 28.

Fig. 29.



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March 5, 1963 A. J. McMASTER ETAL 3,079,840

AUTOMATIC SLIDE PROJECTOR

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Fig. 30.

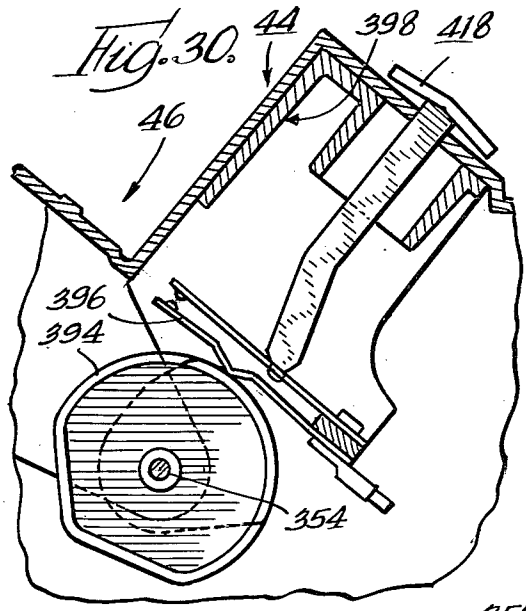


Fig. 31.

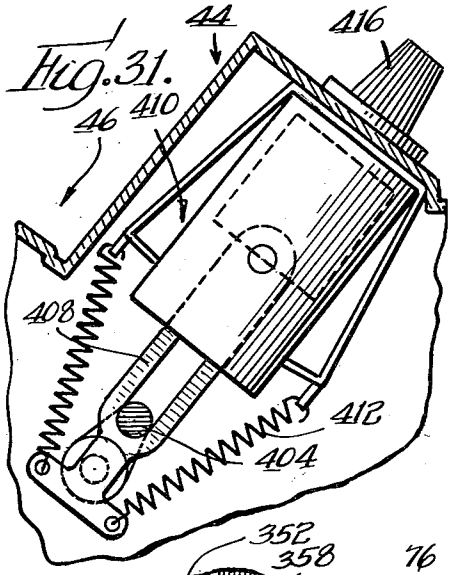


Fig. 32.

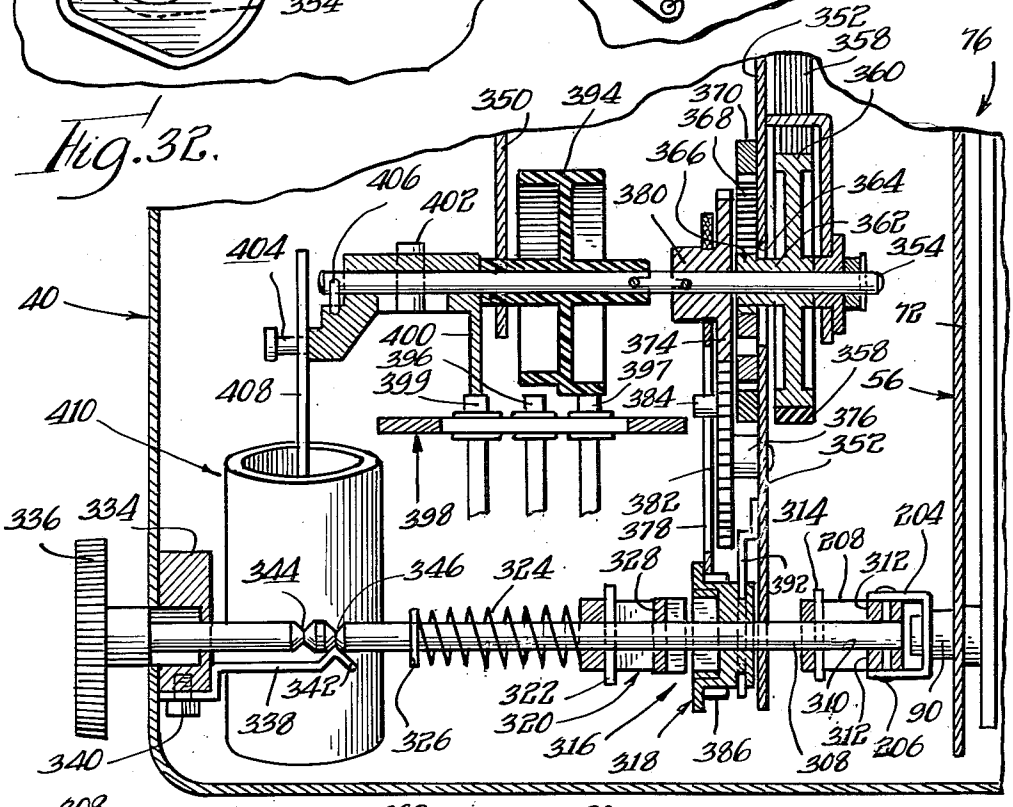
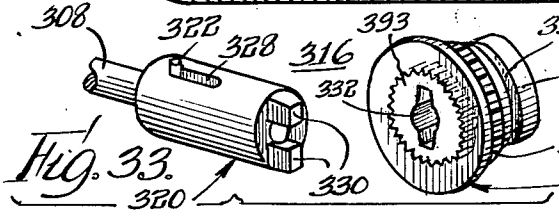


Fig. 33.



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United States Patent Office 3,079,840 Patented Mar. 5, 1963

3,079,840
AUTOMATIC SLIDE PROJECTOR

Archie J. McMaster, Bannockburn, and Karl M. Maiershofer, Norridge, Ill., assignors to G-M Laboratories Inc., Chicago, Ill., a corporation of Illinois

Filed Mar. 7, 1960, Ser. No. 13,179
18 Claims. (Cl. 88—28)

This invention relates generally to projection apparatus for photographic slides and especially to automatically operated slide projectors.

Slide projectors heretofore constructed for automatic operation have been commonly adapted to receive quantities of photographic slides grouped together in a desired sequence and carried by trays devised for that purpose. These prior art slide projectors of the automatic type ordinarily drag or skid the photographic slide from the tray, subsequently levering it into position for projection. However, in the process of dragging or skidding cardboard-mounted slides from and back to the trays, wearing of the edge of the slide takes place; and upon repeated use of any particular slide, substantial wearing and concomitant fraying of the edge of the slide develops. Slides so worn and disfigured are known to jam in the tray or in the projector itself, resulting in disruption of the slide show and inconvenience to both the machine operator and the audience.

When glass-mounted slides are used, the dragging or skidding causes the slides to score or groove the tray; and eventually, this damage may progress to the point that the tray is no longer suitable for its purpose.

Accordingly, an important object of the present invention is to provide an improved slide projector which overcomes the limitations of the prior art by lifting the individual slides from the tray.

A more general object of the invention is to provide a new and improved slide projector of the automatic type.

A slide projector of the kind exemplified herein must necessarily be suitable for different styles of photographic slides; otherwise, its use would be strictly limited. Hence, it is another object of the present invention to provide a slide projector which is suceptible of projecting substantially all commercially available styles of photographic slides.

Yet another object of the invention is to provide an automatic slide projector which incorporates a compact drive.

A further object of the invention is to provide an automatic slide projector which is arranged to facilitate the editing of slides carried in trays.

A still further object of the invention is to provide a slide projector which is capable of both manual and automatic operation.

Additional objects and features of the invention pertain to the particular structure and arrangements whereby the above objects are attained.

A structure in accord with the invention includes support plate means defining a viewing frame; pusher arm means arranged with the support plate means for arcuately transferring a slide to and from the viewing frame; clamp means confronting the pusher arm means in variably spaced-apart relationship; mechanical means operably connecting the pusher arm means and the clamp means for permitting a slide to be gripped selectively therebetween so as to implement tiltable lifting of the slide from a slide tray and subsequent tiltable replacement thereof; indexing means on the support plate means adapted to advance the slide tray incrementally, the indexing means defining a stop abuttable with the clamp means for cocking apart the clamp means and the pusher arm means in order to release the slide; control means pivotally

mounted to the support plate means for operating the indexing means; axially movable shaft means for operating the mechanical means and the control means; clutch means on the shaft means engageable and disengageable by axial movement thereof; a cam shaft rotatably mounted parallel to the operatiing shaft means; a reversibly oscillatory member pivotally mounted about the cam shaft and adapted to mesh with a portion of one of the clutch elements in toothed engagement; planetary gear means arranged to be driven by the cam shaft; cam follower means arranged with the gear means and adapted to ride in a cam slot defined in the oscillatory member in order to oscillate that member in response to the rotation of the cam shaft whereby to drive the shaft means when the clutch means is engaged and whereby not to drive the shaft means when the clutch means is disengaged; motive means for the cam shaft; switch means for slide projector means disposed adjacent the cam shaft; and a plurality of cams on the cam shaft adapted to operate the switch means selectively.

The invention, both to its structure and mode of operation, will be better understood by reference to the following disclosure and drawings forming a part thereof, wherein a single embodiment of the invention is shown and wherein:

FIG. 1 is a perspective view of an automatic slide projector constructed in compliance with the invention;

FIG. 2 is a schematic wiring diagram for the slide projector shown in FIG. 1;

FIG. 3 is an exploded perspective view of the structure comprising the support plate assembly, the editing lever assembly, the shutter assembly and the slide carrier bracket;

FIG. 4 is another perspective view of the support plate assembly showing in particular its relation with the means for biasing the editing lever assembly into a locked position;

FIG. 5 is a side-elevational view, taken through a central section of the slide projector of FIG. 1, illustrating the support plate assembly with the pusher arm and the slide clamp unit being spaced-apart as to release a slide;

FIG. 6 is a side-elevational view, taken through a central section of the slide projector of FIG. 1, illustrating, in invisible outline, the main drive lever and the shutter and index control lever positioned in compliance with the showing of FIG. 5;

FIG. 7 is a perspective view of the drive pinion and its support member;

FIG. 8 is a side-elevational view, taken through a central section of the slide projector of FIG. 1, showing the pusher arm means and the slide clamp means lifting a slide from the slide tray;

FIG. 9 is a side-elevational view similar to FIG. 8 illustrating, in invisible outline, the drive lever and the shutter and index control lever positioned in compliance with the showing of FIG. 8;

FIG. 10 is a perspective view showing the arrangement of the pusher arm drive lever and the main drive lever;

FIG. 11 is a side-elevational view, taken through a central section of the slide projector of FIG. 1, illustrating the pusher arm means and the slide clamp means positioned as they would be when they have transported a slide into the viewing frame;

FIG. 12 is a side-elevational view similar to FIG. 11 illustrating, in invisible outline, the main drive lever and the shutter and index control lever positioned as they would be when the pusher arm means and the clamp means are disposed as shown in FIG. 11;

FIG. 13 is a perspective view of the slide clamp means and the pusher arm means;

FIG. 14 is a view through the section 14—14 of FIG. 11;

FIG. 15 is a view through the section 15—15 of FIG. 8;

FIG. 16 is a view through the section 16—16 of FIG. 11;

FIG. 17 is a view through the section 17—17 of FIG. 11;

FIG. 18 is a view through the section 18—18 of FIG. 5;

FIG. 19 is a side-elevational view similar to FIG. 8 showing the configuration of the pusher arm means and the slide clamp means as they initially grasp a slide for tiltably lifting the same from the slide tray;

FIG. 20 is a side-elevational view similar to FIG. 5 but showing the operation of the editing lever;

FIG. 21 is a perspective view of the support plate assembly and stereo slide guide means, a stereo slide being shown in projection position;

FIG. 22 is a perspective view of the front plate of the stereo slide guide means;

FIG. 23 is a perspective view of the back plate of the stereo slide guide means;

FIG. 24 is a perspective view of the support plate assembly and the 2 x 2 slide guide means, a 2 x 2 slide being shown entering the guide means;

FIG. 25 is a view of the support plate assembly and the 2¼ x 2¼ slide guide means, a 2¼ x 2¼ slide being shown entering the guide means;

FIG. 26 is a bottom plan view of the automatic slide projector of FIG. 1, showing the drive means of the invention;

FIG. 27 is an enlarged view taken through the section 27—27 of FIG. 26;

FIG. 28 is an enlarged view taken through the section 28—28 of FIG. 26;

FIG. 29 is an enlarged, exploded perspective view showing portions of the planetary gear train employed in the drive means of the invention;

FIG. 30 is an enlarged view taken through the section 30—30 of FIG. 26;

FIG. 31 is an enlarged view taken through the section 31—31 of FIG. 26;

FIG. 32 is an enlarged view taken through the section 32—32 of FIG. 27; and

FIG. 33 is a further enlarged, perspective view showing the dog clutch that is utilized in the drive means of the invention.

Referring now in detail to the drawings, specifically to FIG. 1, an automatic slide projector is shown to include a projector structure 40 to which a lamphouse 42 is swingably mounted. A control panel element 44 upstands from the projector structure 40 confronting the lamphouse 42 so as to define therebetween a tray tunnel 46. The tray tunnel 46 is adapted to receive slide trays, such as slide tray 48, in a glidable manner.

The lamphouse 42 is provided with a lamphouse lock knob 50 and a focusing knob 52, the latter of which is adapted to operate a projection lens assembly 54. However, since the lamphouse and its immediately associated elements comprise no part of the present invention, they are not illustrated in detail nor described further hereinbelow.

Turning now to FIG. 8, a support plate assembly 56 will be seen mounted at one location to a platform portion 58 of projector structure 40 by means of integral, laterally extending flanges 60 and suitable fasteners, such as bolt fasteners 62. Support plate assembly 56 is mounted at another location beneath the floor 64 of slide tray tunnel 46 by means of integral, laterally extending flanges 66 and suitable fasteners, not shown. The support plate assembly 56 also defines an aperture or viewing frame 68 which extends into the optical path of the projection system carried in lamphouse 42.

As will be seen from an inspection of FIG. 3, the support plate assembly 56 is comprised of a first support plate 70 and a second support plate 72 which is arranged to be substantially a mirror image of plate 70. The support plates 70 and 72 are spaced-apart as by tubular spacer arrangements 74.

A number of elements are advantageously arranged in cooperating relationship between the support plates 70 and 72; and as shown in FIGS. 5, 8 and 11, among these elements is a pusher arm unit 76 which includes a pusher arm 78 and a pusher arm link 80. The pusher arm link 80 defines a guide slot 82 and a cam slot 84. A pusher arm spacer roller 86 is mounted between the support plates 70 and 72 and includes a suitable groove that receives the pusher arm link 80 at the guide slot 82.

In order to provide motive force to the pusher arm unit 76, a pusher arm drive lever 88 is rotatably mounted between the support plates 70 and 72 as by means of a suitably arranged hub 90. As shown in FIG. 10, the drive lever 88 is comprised of two plates 92 and 94 which are advantageously spaced-apart in order to permit the pusher arm unit 76 to operate therebetween. Adjacent one end of the drive lever 88 is a cylindrical cam follower 96 which is adapted to ride in the cam slot 84 and thereby incur appropriate movements of the pusher arm unit 76.

On either side of the pusher arm unit 76, between guide slot 82 and cam slot 84, there is mounted a pusher arm slide bearing 98. Each of the slide bearings 98 is adapted to ride in a corresponding cam slot 100 fashioned in the juxtaposed support plate. The cam slots 100 are aligned and cooperate with the guide slot 82 and the cam slot 84 in defining the path and trace of movement realized by the pusher arm unit 76.

Continuing now with particular reference to FIG. 5, a slide clamp unit or back-up member 102 is swingably mounted in sandwiching relationship to the end 104 of pusher arm unit 76 by means of a slide clamp bearing 106. The slide clamp unit 102 resides between the support plates 70 and 72 in confronting relationship with the end of pusher arm 78.

As will be seen in FIG. 13, the slide clamp unit 102 includes a pair of spaced-apart slide clamp plates 108. A slide receiver 110 is advantageously affixed between these plates 108 away from the bearing 106. Since the slide clamp unit 102 and the pusher arm 78 are adapted to grasp a photographic slide 111 therebetween, the receiver 110 and the end of the pusher arm 78 are desirably fashioned with V-shaped slots, slots 112 and 114 respectively, opening towards each other. As a further aid in properly positioning the photographic slide 111 between the slide clamp unit 102 and the pusher arm 78, a guide element 116 is appropriately positioned adjacent the bottom end of the V-shaped slot 112.

In accordance with a feature of the invention, the slide clamp unit 102 confronts the pusher arm 78 in variably spaced-apart relationship; and means which cooperate with the rotatable manner in which the unit 102 is mounted are provided for this purpose. These means include a pair of tension springs 118 which extend between mounting tabs 120 fashioned on the slide clamp unit 102 and a suitable bore 122 provided in the pusher arm unit 76. The springs 118 bias the slide clamp unit 102 generally toward the pusher arm 78; and as is best shown in FIG. 13, the pusher arm unit 76 is fashioned to provide a stop 124 which positively restricts the movement of slide clamp unit 102 in the general direction toward pusher arm 78.

Referring now to FIG. 10, the pusher arm drive lever 88 will be seen fixed to a main drive lever 126 in spaced-apart relationship by means of the hub 90 and a tubular spacer arrangement 128, the drive lever 126 being disposed adjacent the outer side of support plate 72. As is shown in FIGS. 6, 9 and 12, the main drive lever 126 is adapted to operate a shutter and index control lever 130 and to index a slide tray drive pinion 132 by means which will be described hereinbelow.

In order to operate the shutter and index control lever

130, the main drive lever 126 is provided with a headed cam follower 134 mounted to an arm portion 136, a cam surface 138 on shutter and index control lever 130 being adapted to be contacted by the shaft portion of cam follower 134 between the arm portion 136 and the head of the cam follower 134.

The major portion of the cam surface 138 is arranged to coincide with the arc traversed by the cam follower 134. However, at its terminus 140, the cam surface 138 defines a stop which confronts the cam follower 134 whereby further rotation of the main drive lever 126 causes the shutter and index control lever 130 to rotate about a pivot 142.

Since the shutter and index control lever 130 extends a slot 144 into receiving relationship with a shutter guide bushing 146, this pivoting of the shutter and index control lever 130 incurs a vertically downward movement of a shutter assembly 148 which is secured to the shutter guide bushing 146. In order to incur proper movements of the shutter assembly 148, the shutter guide bushing 146 rides in a guide slot 150 fashioned in the support plate 72. A small stop plate 152 is advantageously fixed to the free end of shutter guide bushing 146 in order to prevent disengagement of the slot 144 and the bushing 146; and stop elements 153 are desirably formed outwardly from plate 72, as shown in FIG. 11, to establish limits for the movement of lever 130.

Returning to FIGS. 6, 9 and 12, it is to be recognized that vertically upward movement of the shutter assembly 148 will be incurred by rotation of the cam follower 134 away from the terminal stop 140 and down the cam surface 138. The main drive lever 126 also includes a laterally extending tongue 154 which is radially spaced from hub 90 and which is adapted to confront one end of a pawl drive lever 156, the drive lever 156 being rotatable about a pivot 158 that is mounted, as shown, to the shutter and index control lever 130.

A drive pinion pawl 160 is rotatably mounted to the shutter and index control lever 130 by means of a pivot 162 which is spaced-apart from the pivot 158. The drive pinion pawl 160 is connected to the pawl drive lever 156 by means of a rivet 164 which is affixed to one end of the pawl 160 and which is adapted to slide freely in a slot 166 which is fashioned in the pawl drive lever 156. A tension spring 168 advantageously extends between a tab 170 provided on drive pinion pawl 160 and a tab 172 provided on the shutter and index control lever 130. Spring 168 establishes proper bias for the pawl drive lever 156 and the drive pinion pawl 160.

As is best shown in FIG. 18, the drive pinion pawl 160 is provided with a feed pawl 174 which extends laterally inwardly to be engageable with the drive pinion 132 for purposes of indexing. As best shown in FIG. 7, the drive pinion 132 is rotatably mounted to a support member 175, preferably fabricated from nylon. A rivet 176 extends through the drive pinion 132 and a shoulder portion 178 of the support member 175. Advantageously, a washer 180 is interposed between the drive pinion 132 and the shoulder 178. The member 175 is suitably mounted between the support plates 70 and 72 as by a bolt fastener 182, shown in FIG. 5, and a stop extension 184 which extends from the shoulder portion 178 through an appropriate aperture 186 provided in support plate 72. In addition to cooperating in the attachment of the support member 175, the stop extension 184 is arranged to limit that movement of pinion pawl 160 which is urged by the bias of tension spring 168.

Considering FIG. 8 once again, the slide tray 48 will be seen to include a rack 188 which is adapted to mesh with the drive pinion 132 in toothed engagement. Thus, it will become apparent that, as the drive pinion 132 is stepped or rotated incrementally by action of the feed pawl 174, slide tray 48 will be stepped or re-situated incrementally through the tray tunnel 46.

As can be seen in FIG. 18, a detent arrangement 190 is provided to insure proper incremental stepping of the drive pinion 132. The detent arrangement 190 includes a ball 192 which is slidably disposed in a bore provided in an extension 194 of the shoulder 178. A leaf spring 196 is provided to bias the ball 192 in the general direction of the drive pinion 132; and as is best shown in FIG. 3, leaf spring 196 is suitably fastened to the support plate 70.

Referring to FIG. 7, the support member 175 is fashioned with opposing, spaced-apart guides 198 and 200 which define therebetween a slide groove 202 which aids in guiding the slide 111 to and from the tray 48 under the influence of pusher arm unit 76 and slide clamp unit 102.

The main drive lever 126 additionally includes a pair of laterally extending bracket arms 204; and as is best shown in FIG. 6, the bracket arms 204 receive a mounting pin 206 which is employed in securing a drive coupling 208 to the main drive lever 126. The drive coupling 208 is utilized in applying motive force from a drive mechanism to be described hereinbelow to the main drive lever 126. It suffices to say at this juncture that drive coupling 208 is adapted to be rotated approximately a half revolution in one direction and subsequently reversibly rotated to its starting position.

For purposes of providing an easy understanding of the invention, it is appropriate to provide at this point a functional description of the mode in which the component parts thus far identified cooperate. The position of the parts which is indicated generally in FIG. 5 can be designated the starting position. It is to be noted, in this position, that the pusher arm 78 is substantially retracted from the tray tunnel 46; and furthermore, the slide clamp unit 102 is clocked apart from the pusher arm 78 by virtue of the guide element 116 being abutted by the guides 198 and 200 whereby the motion of the unit 102 has been arrested whereas the pusher arm unit 76 has been withdrawn into the configuration shown. This cocking apart of the slide clamp unit 102 is opposed by the tension springs 118 and desirably spaces the unit 102 from the pusher arm 78 by a distance greater than the corresponding lateral dimension of photographic slide 11. It is also to be noted, that in this starting position, the shutter assembly 148 obstructs the aperture or viewing frame 68. Thus, the light source is prevented from casting a white spot on the viewing screen during the interlude when no photographic slide is positioned in the viewing frame.

During the normal course of automatic operation of the slide projector, a rotation of the drive coupling 208 will be initiated in the general direction indicated by arrow 210. As this rotation is initiated, hub 90 will also be rotated in the direction of arrow 210, and the pusher arm drive lever will likewise rotate in that direction. As the pusher arm drive lever 88 so rotates, the cam follower 96 will tend to ride along the cam surface 84 whereby to permit movement of pusher arm unit 76. This movement relieves tension on spring 118 and releases the slide clamp unit 102 from its cocked position. As this occurs, the pusher arm 78 will protrude slightly into the slide tray 48 contacting photographic slide 111 which will be simultaneously contacted by the slide clamp 102, the confronting grooves 112 and 114 cooperating in a proper positioning or grasping of the slide. It is also important to point out that the pusher arm and clamp unit are preferably moving rapidly when the slide is grasped in order to forcefully grasp the slide and prevent the slide from hanging up off-center on the clamp unit. As is indicated in FIG. 19, movement of the pusher arm 78 is not quite parallel to the bottom surface of the slide tray, but diverges slightly therefrom at a small acute angle 212. This angle preferably is on the order of 1 to 5 degrees. This movement results in a slight lifting of the slide rather than dragging thereof along the bottom (or side) surface of the slide tray. The lifting is not sufficient to cause the top edge of the slide to engage the opposite surface of the slide tray.

This lifting of the slide prolongs the use-life of slides by preventing damage to its holder when cardboard-mounted

slides are employed. Conversely, when slides having metal frames are employed, this lifting of the slide from the slide tray precludes the slide holder from damaging the tray. As will be understood, the slides when returned to the tray are lowered into position free of any substantial sliding movement.

After the slide has been grasped between the pusher arm 78 and the slide clamp unit 102, continuing rotation of pusher arm drive lever 88 by means of the rotation of drive coupling 208 will bring the cam follower 96 into the position shown in FIG. 8. In the process of this movement of the pusher arm drive lever 88, a corresponding rotation of the main drive lever 126 will have relocated the tongue 154 from its position as shown in FIG. 6 to its position as shown in FIG. 9. This relocation of tongue 154 allows tension spring 168 to alter the configuration of pawl drive lever 156 and drive pinion pawl 160 from the position shown in FIG. 6 to that shown in FIG. 9. This latter relocation of the drive pinion pawl 160 brings the feed pawl 174 into contact with one of the teeth on drive pinion 132, this contact being on the underside of the tooth.

Continued rotation of the pusher arm drive lever 88 from the position shown in FIG. 8 causes the cam follower 96 to abut the end of the cam slot 84 whereby to drive pusher arm unit 76 in the slantingly upward direction established by guide slot 82 and the lower end portion of cam slot 100. When the guide slot 82 abuts the pusher arm spacer roller 86, the pusher arm slide bearing 98 will be disposed at the transition point of cam slot 100. Subsequent rotation of the pusher arm drive lever 88 in the direction of arrow 210 will cause pusher arm unit 76 to be rotated about the spacer roller 86 and eventually the pusher arm slide bearing 98 will have traversed the upper end portion of cam slot 100 into the position indicated generally in FIG. 11.

During this rotation of the pusher arm unit 76, the cam follower 96 will have ridden the upper portion of cam surface 84 and the photographic slide 111 will have been levered into proper position in the viewing frame 68, as shown in FIG. 11.

While the slide is being levered into position in the viewing frame 68, cam follower 134 rides up the cam surface 138 as is shown in FIG. 9; and approximately at the time the slide is positioned, follower 134 will abut the stop 140 whereby to rotate the shutter and index control lever 130 about the pivot 142 as is indicated in FIG. 12. This action lowers the shutter assembly 148 from its position obstructing the viewing frame 68 so as to allow light from the illumination source to pass through the slide, projecting the image of the slide onto an appropriately positioned viewing screen. It is important to point out that the slide has come to rest before lowering of the shutter begins.

As the shutter assembly 148 is being lowered, the drive pinion pawl 160 will be retracted so as to withdraw the feed pawl 174 from its position contacting a tooth of the drive pinion 132. As the feed pawl 174 is relieved of abutment with the tooth of the drive pinion, the tension spring 168 will act to draw the drive pinion pawl 160 into abutment with the stop extension 184. This movement permits the feed pawl 174 to pass from a position beneath the tooth which it was contacting to a position aligned above but spaced away from that same tooth.

These operations complete the half cycle of rotation in the general direction of arrow 210. Subsequent driving of the drive coupling 208 and concomitantly of the hub 90 will be incurred in the general direction indicated by arrow 216. This reverse driving will cause a reversal of the above sequence of steps to take place.

In this reverse sequence, the shutter assembly 148 will be raised into position obstructing the viewing frame 68 while the feed pawl 174 is being urged upwardly over the appropriate tooth on drive pinion 132, this being achieved under the action of cam follower 134 on the step portion 218 of cam surface 138.

After the shutter assembly 148 closes off the aperture 68, the pusher arm unit 76 will be directed to withdraw the slide from the viewing frame; and once again the configuration of FIG. 8 will be realized. A continued rotation of the drive coupling from this position into the general direction of arrow 216 will cause tongue 154 to abut the pawl drive lever 156 causing it to rotate about the pivot 158. Correspondingly, drive pinion pawl 160 will be caused to rotate about the pivot 162 whereby feed pawl 174 will be urged downwardly against the tooth of drive pinion 132 so as to rotate the drive pinion 132 against the action of detent 190 whereby to step the slide tray 48 forwardly by the distance required to position a different slide in alignment with the pusher arm 78.

Immediately prior to the indexing of drive pinion 132, the rotation of hub 90 and correspondingly the rotation of pusher arm drive lever 88 in the general direction of arrow 216 will have caused the cam follower 96 to abut the corner 220 of cam slot 84 whereby to retract the pusher arm 78 from the path of the slide tray 48. Simultaneously, the action of follower 96 on pusher arm unit 76 will cause the slide clamp unit 102 to be cocked-apart from the pusher arm 78 because of its abutting or stopped relationship with the ends of the support member 175. Thus the mechanism is returned to its starting position, and a full cycle of operation is completed. During this cycle, it is important to note, the pusher arm and the clamp unit maintain the same positional contact with the slide that was achieved on initial grasping, there being no rubbing of these members along the edge of the slide for adaptation to the various positions taken.

While the specific embodiment of the slide changer mechanism hereinabove described is intended for automatic projection of 2 x 2 slides, the invention is also arranged to permit manual projection of 2 x 2 slides, 2¼ x 2¼ slides and standard stereo slides. The means for such manual projection will now be described with particular reference to FIGS. 21–25.

As will be seen in FIG. 21, a stereo slide guide assembly 222 is affixed to the side of support plate 72 away from support plate 70. The assembly 222 comprises a front plate 224, shown in FIG. 22, which is secured to a back plate 226, shown in FIG. 23, as by spot welding at appropriate positions such as are indicated at 228. The back plate 226 is mounted to the support plate 72 by means of a formed, gripping portion 230, which defines a channel for receiving the edge of support plate 72, and a mounting tab 232 which is adapted to be disposed adjacent a corresponding flange formed in the support plate 72. A suitable fastener, for example a sheet metal screw, is employed in joining the tab 232 to this corresponding flange in the support plate 72. Advantageously, spacer flanges such as flanges 234 are also provided on the back plate 226 in order to maintain a uniform spacing between support plate 72 and the stereo slide guide assembly 222, as would be desired when another slide guide was to be mounted between the assembly 222 and the support plate 72.

The front plate 224 is provided with a double-pronged spring clip 236 which is adapted to urge a stereo slide, such as the slide 238, against the back plate 226. The front plate 224 is preferably fashioned with a channel 240 which cooperates with a stop 242 formed on back plate 226 in further insuring proper positioning of the slide 238 against the back plate 226.

As will become apparent, when shutter assembly 148 is lowered under manual direction in the manner to be described hereinafter, the stereo slide 238 may be readily projected by insertion through a slot 244 which is fashioned in lamphouse 42 in alignment with the slide guide assembly 222. Either one of the stereo pair included in

slide 238 may thus by manually projected. Other views of the stereo slide guide assembly 222 are shown in FIGS. 14–17.

Referring for the moment to FIG. 1, the lamphouse 42 will be seen to include a cover plate 246 removably fastened over one portion thereof. When this cover plate 246 is removed, an aperture 248 is revealed. This aperture is shown in FIGS. 21, 24 and 25 as exposing that portion of the slide changer mechanism immediately above the viewing frame 68. The aperture 248 facilitates manual projection of 2 x 2 slides, such as slide 250 shown in FIG. 24; and as is indicated, a slide guide assembly 252 comprises opposing channel elements 254 and 256 for guidably receiving the slide 250. Channel elements 254 and 256 are fastened to the side of support plate 72 away from support plate 70 in some suitable manner, such as by spot welding. The slide 250 is raised and lowered from the viewing frame 68 by manually operating the shutter assembly 148, the shutter 148 being advantageously provided with a shelf portion 258 upon which the slide 250 rests. As will become apparent, guide assembly 252 can be conveniently positioned between the stereo slide guide assembly 222 and the support plate 72.

In somewhat similar manner, a guide assembly 260, comprising two channel elements 262 and 264, may be appropriately secured to the side of support plate 70 away from support plate 72. The guide assembly 260 is arranged to receive a 2¼ x 2¼ slide, such as slide 266. This combination of elements is shown in FIG. 25.

As will be seen with reference to FIG. 3, shutter assembly 148 is provided with a shelf or receiver 268 spaced-apart from the shelf 258; and returning to FIG. 25, the receiver 268 will be seen to cooperate with the guide assembly 260 in accepting the 2¼ x 2¼ slide 266. As will be recognized, manual operation of the slide changer mechanism will cause vertical movements of shutter assembly 148; and these movements will raise and lower slide 266 from the viewing frame 68. Other views of the guide assembly 260 are shown in FIGS. 14–17.

In accordance with a feature of the invention, means are provided for correctively editing slides being automatically projected. These means for rearranging or replacing slides during automatic projection include an editing lever assembly 270 and a slide carrier bracket 272, shown in FIG. 3. The slide carrier bracket 272 is adapted to be affixed to the support plates 70 and 72 above the viewing frame 68 as is shown in FIG. 14. The slide carrier bracket 272 additionally is provided with an aperture 274 which permits access to the space between the plates 70 and 72 and which allows extension therethrough of a slide to be edited.

As shown in FIG. 3, the editing lever assembly 270 includes two right angularly shaped arms 276 and 278, these arms being appropriately spaced-apart by means of a cross member 280 and a tubular spacer arrangement 282. The arms 276 and 278 have elongated, aligned slots 284 fashioned in the generally vertically extending portions. The slots 284 terminate at one end in an inwardly extending enlargement 286 and at the other end in an outwardly extending enlargement 288. An editing handle 290 is desirably affixed to the arm 278 in order to extend through an appropriate slot 292 in lamphouse 42 in order to allow manual operation of the assembly 270. This arrangement of the handle 290 and the slot 292 is shown in FIG. 24.

The editing lever assembly 270 is adapted to be mounted in the support plate assembly 56 with the arm 276 disposed between plate 72 and slide clamp unit 102 and with the arm 278 disposed between the support plate 70 and the slide clamp unit 102. FIG. 16 shows this arrangement.

A tubular spacer 294 extends between support plate 70 and support plate 72 and is appropriately grooved to receive the arms 276 and 278 at the slots 284. The editing lever assembly 270 is also secured in the support plate assembly 56 by means of an editing lever guide roller 296 which extends between the support plates 70 and 72 spaced-apart from the tubular spacer 294, as is shown in FIG. 5. The editing lever guide roller 296 is advantageously combined with a diplo-conical stop 298 which is adapted to arrest the motion of slide clamp unit 102 and to hold it centered and in alignment.

When the slide changer mechanism hereinabove described is being operated for automatic projection of a quantity of photographic slides, the editing lever assembly 270 may be manipulated as follows for purposes of editing.

When a photographic slide has been levered into the position shown generally in FIG. 11 and it is discovered that this slide is upside down or otherwise improperly arranged, or if it is desired to replace the particular slide with another, the slide changer mechanism will first be released from the drive in a manner to be described hereinbelow. Subsequently, the editing handle 290 will be manually lowered from its normal position in the upper reaches of slot 292 as shown in FIG. 24; and when the handle 290 has been directed to the lower reaches of slot 292, the assembly 270 will have been lowered a corresponding distance. At this time, the arm portions carrying the cross member 80 will be seen obstructing the viewing frame 68. In this position, the photographic slide 111 will be held between the end of pusher arm 78 and slide clamp unit 102. Additionally, the spacer 282 of editing lever assembly 270 will be in contact with the rearwardly extending hook portions 300 of slide clamp unit 102.

A subsequent manual operation of the slide changer mechanism will cause the shutter assembly 148 to be upraised in its normal manner. However, as pusher arm 78 is retracted slide clamp unit 102 will be unable to follow freely because of the engagement of hook portions 300 with the spacer 282. The springs 118 will, nonetheless, act on the slide clamp unit 102; and sufficient freedom is allowed to cause a grasping of the slide between the slide clamp unit 102 and the cross member 280, as is shown generally in FIG. 20.

Further manual operation of the slide changer mechanism will incur a lifting of the slide through the aperture 274 in slide carrier bracket 272, the pivoting of pusher arm unit 76 about pusher arm spacer roller 86 incurring a vertical movement of the slide clamp unit 102 in accordance with the arcuate movement of bearing 106.

When the slide 111 is projecting above carrier bracket 272, it may be easily grasped by hand; and because of the resiliency of springs 118, the slide 111 may be easily withdrawn, rearranged and replaced or substituted for by a different slide. When the slide is being returned, it is to be urged with a slight pressure against the unit 102, pressed downwardly into contact with the receiver 116 and then released to be grasped against the cross member 280 by the action of springs 118 on unit 102. Subsequent manual operation of the slide changer mechanism will lower the shutter assembly 148 as well as the editing lever assembly 270. Simultaneously, the pusher arm 78 will be positioned confronting the edge of the slide opposite the pusher arm unit 102.

Next, the editing lever assembly 270 may be directed upwardly into its normal position by manually urging the handle 290 into the upper reaches of slot 292. As the assembly 270 reaches this normal position, the enlargement 288 will come into alignment with the spacer 294. Advantageously, engagement of the spacer 294 and the enlargement 288 is incurred by suitable means biasing the lower end of the editing lever assembly 270 in the general direction of tray tunnel 46.

In one specific embodiment of the invention, this biasing means has included a crank 302 and a tension spring 304. As shown in FIG. 4, the crank 302 enters aligned bores in the platform portion 58 and in the piano hinge 306 by which the lamphouse 42 is swingably mounted to

the projector structure 40. Being rotatably mounted in these aligned bores, the crank 302 may be adapted to confront the outer edge of editing lever assembly 270 whereby the tension spring 304 connected between plate 72 and crank 302 can develop the desired bias. As will be recognized, engagement of the spacer 294 and the enlargement 288 effectively locks the editing lever assembly 270 in its normal position wherein it is arranged to clear viewing frame 68 and avoid interference with the automatic operation of the slide changer mechanism.

Considering now FIGS. 2 and 26–33 for a description of the drive mechanism of the invention, the drive coupling 208, referred to hereinabove, will be receiving an operating shaft 308 within an axial bore 310 (FIG. 32). Advantageously, coupling 208 is provided with axially elongated, radially extending, diametrically disposed slots 312 in which a pin 314 is adapted to ride. The pin 314 is secured to shaft 308 adjacent one end; and the slots 312 provided in coupling 208 are arranged to be of sufficient length to permit engagement and disengagement of a dog clutch 316.

The operating shaft 308 extends freely and slidably through a female member 318 of the clutch 316, while the shaft 308 is advantageously keyed to the male member 320 by means of a pin 322. A compression spring 324 is located between the male member 320 and a washer 326 which is affixed to shaft 308. Spring 324 biases the member 320 in the general direction of member 318. Additionally, the member 320 is fashioned with axially elongated, radially extending, diametrically disposed slots 328 through which the pin 322 passes.

Thus, the operating shaft 308 may be urged in the general direction of support plate assembly 56; and if the tongue portions 330 of member 320 fail to engage the slot 332 in member 318, the slots 328 will permit movement of the shaft 308 whereby subsequent relative rotation between the member 320 and the member 318 will align the tongues 330 and the slot 332. In this alignment, spring 324 will cause an engagement of the clutch.

The operating shaft 308 extends slidably and rotatably through a bush 334 provided in the sidewall of projector structure 40 to have an editing knob 336 fastened to its otherwise free end. Knob 336 is preferably knurled in order to facilitate its use in manually engaging and disengaging the clutch 316. A shaft detent bracket 338 is also secured to the bush 334, as by self-tapping screws 340. Detent bracket 338 carries a formed end-portion 342 which cooperates with the spaced-apart, circumferential grooves 344 and 346 which are fashioned in shaft 308 in order to provide positive location of clutch 316 into the engaged, or imminently engaged, position and into the disengaged position.

As will be recognized, a disengagement of clutch 316 permits rotation of the drive coupling 208 under manual rotation of editing knob 336. This manual rotation of drive coupling 208 is desired in the manual projection of 2 x 2 slides and the manual projection of 2¼ x 2¼ slides as well as in the editing operation, according to the descriptions given hereinabove.

Beneath the platform portion 58 of projector structure 40, juxtaposed with the operating shaft 308 and the support plate assembly 56, a drive motor 348 is secured to the lower surface of the floor of tray tunnel 46 as by motor support brackets 350 and 352. This arrangement is best shown in FIG. 26. The brackets 350 and 352 also support a cam shaft 354 in rotatable relationship parallel to the operating shaft 308 and the output shaft 356 of drive motor 348.

The output shaft 356 is provided with circumferential grooves which are adapted to mesh with corresponding ridges provided on a drive belt 358 which connects the shaft 356 with a drive gear and pulley 360.

As is best shown in FIG. 32, with secondary reference to FIGS. 28 and 29, the drive gear and pulley 360 is rotatably mounted on shaft 354 and extends a hub portion 362 through an aperture 364 provided in the support bracket 352. A sun gear 366 is integrally formed with hub 362 and is adapted to mesh with and drive a number of planet gears 368, the planet gears 368 meshing with a ring gear 370 which is fixed to the support bracket 352. The planet gears 368 rotate freely on stub shafts or axles 372 which are molded to extend axially from the face of a rotating planet gear carrier 374. Thus, the rotation of pinion 366 is suitably reduced and transmitted to the gear carrier 374.

Gear carrier 374 is fixed in driving relationship to cam shaft 354, as by pinning or other suitable means, and is adapted to mesh with an intermediate spur gear 376 which is rotatably mounted to the support bracket 352 at a location spaced-apart from cam shaft 354.

A segment gear 378 is mounted to rotate freely about the hub 380 of planet gear carrier 374 and is fashioned with a cam slot 382. A follower 384 which is eccentrically disposed in axially extending relationship on intermediate spur gear 376 is arranged to ride in the cam slot 382 in order to incur an oscillatory rotation of the segment gear 378. The segment gear 378 advantageously meshes with an auto drive pinion 386 which is molded integrally with the female element 318 of dog clutch 316. This engagement allows drive motor 348 to rotate the operating shaft 308 and concomitantly the coupling 208. Because of the arrangement of the gear drive and the segment gear 378, motor 348 incurs the cyclic, reversibly rotatable movement of drive coupling 208 which has been referred to hereinabove as necessary to the proper operation of the slide changer mechanism.

The integral formation of drive pinion 386 and the female clutch member 318 is shown in FIG. 33. Also indicated in FIG. 33 is an elongated portion 388 which carries a circumferential groove 390. A back-up member 392 is secured to bracket 352 in offset relationship in order to ride in the groove 390 and thereby support member 318 against the force involved in engaging the clutch. Female clutch member 318 is preferably made with a serrated insert 393 that permits precise adjustment of the oscillatory motion of segment gear 378 with the reciprocating motion necessary for operating shaft 308. After proper adjustment, the member 318 and insert 393 are connected or fused together to form a single assembly.

Turning now to FIGS. 26 and 32, a multiple switching cam 394 is shown fixed to the cam shaft 354 in order to operate switch blades 396 and 397 included in a cycling unit assembly 398. Assembly 398 is suitably mounted to the control panel element 44. Another switch blade 399 is included in the assembly 398 to be operated by a timer cam 400. The cam 400 is rotatably mounted to the cam shaft 354 by means of a collar portion 402, the portion 402 terminating in an eccentric arm 404 which is adapted to be engaged by a pin 406. Pin 406 is fixed to the shaft 354 in radially extending relationship.

Arm 404 passes through an appropriate slot in a link 408 which is pivotally connected to the piston of a dash pot 410. Referring to FIGS. 26 and 31, tension springs 412 are stretched between the link 408 and a timer spring bracket 414 in order to bias the piston of dash pot 410 in the general direction of the bottom of the dash pot cylinder; and as is best shown in FIG. 31, the dash pot 410 extends into the interior of control panel element 44 to be regulated by a timer adjusting knob 416 thereby altering the speed at which the projector will be operated.

The slide projector of the invention is advantageously controlled for automatic operation through the rotation of multiple switching cam 394 and timer cam 400, the action of these cams being realized on the corresponding switch blades in the cycling unit assembly 398. When it is desired to operate the projector semi-automatically, suitable control elements such as manual change knob 418 may be employed to alter the manner in which the several switches operate. For example, as is shown in FIG. 30, the manual change knob 418 is adapted to close the switch contacts associated with switch blade 396

under manual direction. Each depression of change knob 418 results in a half-cycle operation of the projector. Thus, a first press of the knob can result in moving a slide into position whereas the next press of the knob can result in returning of the slide to the tray.

As will be seen from an inspection of FIG. 26, a squirrel cage fan 420 is advantageously disposed within the projector structure 40 with an outlet portion 422 emptying through the roof of structure 40 adjacent the light source whose socket is indicated at 424. The fan and the light source are operated in conjunction with drive motor 348 in accordance with the circuitry illustrated in FIG. 2. There, the motor of fan 420 is indicated generally at 426, and the lamp or light source for the projection system is shown at 428.

Continuing with reference to FIG. 2, a wall plug 430 will be seen provided for connecting the electrical system of the invention to a source of electrical energy, conveniently the customary household source. The leads from plug 430 are coupled respectively to a connector block 432 and to a master switch panel 434, panel 434 being supplied with switch buttons 436, 438 and 440 which extend slidably through the control panel element 44 for facility in their operation.

The switch 436 is adapted to energize lamp 428 and the connector block 432. Through energization of block 432, a circuit is completed to fan motor 426 and to a panel light 442 which is arranged in parallel with/or on a tap of the fan motor. Energization of block 432 also conditions the circuit to drive motor 438 for its operation in compliance with the operation of the switches contained in assembly 398 under the influence of switching cam 394 and timer cam 400. If desired, a remote control means, not shown, may cooperate with the assembly 398 in the operation of drive motor 348 as by being connected into the circuit at a receptacle 444. In addition, there may be provided a receptacle 446 by the use of which room lighting may be inserted in the circuitry of the projector whereby switch 436 may be operated to deenergize the room lights when the lamp 428 of the projector is energized.

Operation of switch 438 is directed to deenergize lamp 428 and energizing the room lights while leaving fan motor 426 and drive motor 348 operating. Moreover, switch 440 is adapted to energize the room lights connected through receptacle 446 while simultaneously deenergizing fan motor 426 and drive motor 348, motors 426 and 348 being arranged for operation in unison.

When the assembly 398 is conditioned for operation by switch 436, a complete cycle of operation will be incurred as follows from the starting position of the slide changer mechanism which has been described hereinabove with reference to FIGS. 5 and 6. In this position, the switch contacts associated with blades 397 and 399 will be closed to energize motor 348 whereas the contacts associated with blade 396 will be open.

Subsequently, a rotation of cam shaft 354 will cause pin 406 to pick up arm 404. Continued rotation of the cam shaft will cause cam 394 to close the contacts associated with blade 396. Shortly thereafter, the photographic slide will be positioned in the viewing frame 68; and as the operating shaft 368 continues to be driven under the influence of segment gear 378, cam 394 will be directed to open the switch contacts associated with blades 396 and 397. Thereupon, arm 404 will overcenter cam shaft 354 whereby springs 412 will urge the piston into the bottom of the cylinder of dash pot 410.

As timer cam 400 is being thus rotated under the influence of springs 412 and dash pot 410, motor 348 will have been brought to a halt while the photographic slide is in the viewing frame and while the shutter assembly 148 is lowered into its non-obstructing position.

Finally under the influence of dash pot 410 and springs 412, cam 400 will engage blade 399 to close the contacts associated therewith in order to energize drive motor 348 and drive segment gear 378 in the reverse direction. The multiple switching cam 394 will thereafter assume control of drive motor 348 through the contacts associated with switch blades 396 and 397 to complete the cycle and return the various elements to their starting position.

While a particular embodiment of the invention has been shown, it is to be understood, of course, that the invention is not limited thereto since many modifications may be made; and it is, therefore, contemplated to cover any such modifications as fall within the true spirit and scope of the appended claims.

The invention is claimed as follows:

1. In a slide projector, the combination comprising: support plate means defining cam slot means and a viewframe; pusher arm means arranged with said support plate means, including slide bearing means adapted to ride in said cam slot means, to cooperate in arcuately transferring a slide receivable in a slide tray to and from said viewing frame; clamp means confronting said pusher arm means in variably spaced-apart relationship transversely of said slide tray for selective gripping of a slide therebetween; mechanical means operably connecting said pusher arm means and said clamp means for transporting said pusher arm means and said clamp means as a relatively rigid unit when a slide is gripped thereby and for tiltable lifting of said slide from said slide tray and tiltable replacement thereof; indexing means on said support plate means adapted to advance said slide tray incrementally, said indexing means defining a stop abuttable with said clamp means for cocking-apart said clamp means and said pusher arm means whereby to release said slide; shutter means slidably affixed to said support plate means for selectively obscuring the aperture of said viewing frame; control means pivotally mounted to said support plate means for operating said shutter means and for stepping said indexing means; and cyclically operable drive means for reversibly operating said mechanical means and said control means.

2. In a slide projector, the combination comprising: support plate means defining a viewing frame; pusher arm means arranged with said support plate means to cooperate in arcuately transferring a slide receivable in a slide tray to and from said viewing frame; clamp means confronting said pusher arm means in variably spaced-apart relationship transversely of said slide tray for selective gripping of a slide therebetween, said clamp means having offset means defining a hook; mechanical means operably connecting said pusher arm means and said clamp means for transporting said pusher arm means and said clamp means as a relatively rigid unit when a slide is gripped thereby and for tiltable lifting of said slide from said slide tray in tiltable replacement thereof; a manually operable editing lever assembly for manipulating a slide positioned in said viewing frame, including pin means releasably engageable by said hook for directing said clamp means to eject a slide from said viewing frame; and cyclically operable drive means for selectively and reversibly operating said mechanical means.

3. In a slide projector, the combination comprising: support plate means defining a viewing frame; pusher arm means arranged with said support plate means to cooperate in transferring a slide receivable in a slide tray to and from said viewing frame; clamp means confronting said pusher arm means in spaced-apart relationship transversely of said slide tray for selective gripping of a slide therebetween; mechanical means operably connecting said pusher arm means and said clamp means for transporting said pusher arm means and said clamp means as a relatively rigid unit when a slide is gripped thereby and for tiltable lifting of said slide from said slide tray and tiltable replacement thereof; slot-and-guide means associated with said support plate means for manual reception of photographic slides; shutter means slidably affixed to said support plate means for selectively obscuring the aperture of said viewing frame, said shutter means

defining shelf means cooperable with at least a portion of said slot-and-guide means in projecting slides contained therein; control means pivotally mounted to said support plate means for operating said shutter means; and cyclically operable drive means for selectively and reversibly operating said mechanical means and said control means.

4. In a slide projector, the combination comprising: support plate means defining cam slot means and a viewing frame; pusher arm means arranged with said support plate means, including slide bearing means adapted to ride in said cam slot means, to cooperate in arcuately transferring a slide receivable in the slide tray to and from said viewing frame; clamp means confronting said pusher arm means in variably spaced-apart relationship transversely of said slide tray for selective gripping of a slide therebetween; mechanical means operably connecting said pusher arm means and said clamp means for transporting said pusher arm means aid said clamp means as a relatively rigid unit when a slide is gripped thereby and for tiltable lifting of said slide from said slide tray and tiltable replacement thereof; indexing means on said support plate means adapted to advance said slide tray incrementally, said indexing means defining a stop abuttable with said clamp means for cocking-apart said clamp means and said pusher arm means whereby to release said slide; shutter means slidably affixed to said support plate means for selectively obscuring the aperture of said viewing frame; control means pivotally mounted to said support plate means for operating said shutter means and for stepping said indexing means; and cyclically operable drive means for reversibly operating said mechanical means and said control means, said pusher arm means and said clamp means having V-shaped grooves confronting each other for the gripping of said slide.

5. In a slide projector, the combination comprising: a slide changer mechanism; axially movable, operating shaft means for said slide changer mechanism; clutch means on said operating shaft means, including two clutch elements, engageable and disengageable by axial movement of said operating shaft means; a driven shaft rotatably mounted parallel to said operating shaft means; a reversibly oscillatory member pivotally mounted about said driven shaft and adapted to mesh with one of said clutch elements in toothed engagement, said member defining a cam slot; gear means arranged to be driven by said driven shaft; cam follower means arranged with said gear means and adapted to ride in said cam slot to oscillate said member in response to the rotation of said driven shaft whereby to drive said operating shaft means when said clutch means is engaged; and motive means for said driven shaft.

6. In a slide projector, the combination comprising: a slide changer mechanism; operating shaft means for said slide changer mechanism; gear means on said operating shaft means; a cam shaft rotatably mounted parallel to said operating shaft means; a reversibly oscillatory member pivotally mounted about said cam shaft and adapted to mesh with said gear means in toothed engagement, said member defining a cam slot; planetary gear means arranged to be driven by said cam shaft; cam follower means arranged with said gear means and adapted to ride in said cam slot to oscillate said member in response to the rotation of said cam shaft; motive means for said cam shaft; slide projector means associated with said changer mechanism; switch means for said slide projector means disposed adjacent said cam shaft; and a plurality of cams and on said cam shaft adapted to operate said switch means selectively.

7. In a slide projector, the combination comprising: a slide changer mechanism; operating shaft means for said slide changer mechanism; gear means on said operating shaft means; a cam shaft rotatably mounted parallel to said operating shaft means; a reversibly oscillatory member pivotally mounted about said cam shaft and adapted to mesh with said gear means in toothed engagement, said member defining a cam slot; planetary gear means arranged to be driven by said cam shaft; cam follower means arranged with said planetary gear means and adapted to ride in said cam slot to oscillate said member in response to the rotation of said cam shaft; motive means for said cam shaft; slide projector means associated with said changer mechanism; switch means for said slide projector means disposed adjacent said cam shaft; a plurality of cams on said cam shaft, at least one of which is fixed to said cam shaft and at least one of which is partially free to rotate thereabout, said cams being adapted to operate said switch means selectively; and escapement means arranged with said partially free cam to time operation of the corresponding switch means.

8. In a slide projector, the combination comprising: a slide changer mechanism including a pusher arm and a back-up member arranged in spaced-apart, spreadable, confronting relationship; axially movable, operating shaft means for said slide changer mechanism; clutch means on said operating shaft means, including two clutch elements, engageable and disengageable by axial movement of said operating shaft means; a cam shaft rotatably mounted parallel to said operating shaft means; a reversibly oscillatory member pivotally mounted about said cam shaft and adapted to mesh with one of said clutch elements in toothed engagement, said member defining a cam slot; planetary gear means arranged to be driven by said cam shaft; cam follower means arranged with said gear means and adapted to ride in said cam slot to oscillate said member in response to the rotation of said cam shaft whereby to drive said operating shaft means when said clutch means is engaged and whereby not to drive said shaft means when said clutch means is disengaged; motive means for said cam shaft; slide projector means associated with said changer mechanism; switch means for said slide projector means disposed adjacent said cam shaft; a plurality of cams on said cam shaft at least one of which is fixed to said cam shaft and at least one of which is partially free to rotate thereabout, said cams being adapted to operate said switch means selectively; and escapement means, including a dash pot arranged with said partially free cam to time operation of the corresponding switch means.

9. In a slide projector, the combination comprising means defining a viewing frame, slide supporting means displaced laterally from said viewing frame for supporting a slide in a position to be transferred to said viewing frame, said slide supporting means having a substantially flat slide supporting surface, pusher arm means movable between said slide supporting means and said viewing frame to transfer a slide from one to another thereof, backup means operatively connected to said pusher arm means for cooperation with said pusher arm means clampingly to support a slide for edgewise movement thereof substantially in its own plane, said pusher arm means and said backup means coacting as a relatively rigid unit when a slide is gripped thereby, and guide means for said pusher arm means, said guide means at least in part being disposed to effect movement of said pusher arm means at a small acute angle relative to said slide supporting means supporting surface, whereby a slide clamped between said pusher arm means and said backup means is lifted slightly from said supporting surface and is moved divergingly relative thereto upon transfer from said supporting means to said viewing frame and vice versa.

10. In a slide projector, the combination comprising base means, means on said base means providing a projecting station, pusher arm means movably mounted from said base means for movement toward and away from said projecting station to transfer a slide to and from said projecting station, clamp means disposed substantially opposite to said pusher arm means in spaced apart confronting relation thereto for selective gripping of a slide therebetween, means operatively connecting said pusher

arm means and said clamp means to move said clamp means and said pusher arm means relatively toward one another to grip a slide therebetween and for thereafter maintaining said pusher arm means and said clamp means as a relatively rigid unit when a slide is gripped thereby, means operatively connected between said unit and said base means for moving said unit in a direction away from the direction of said clamp means and back again, and cyclically operable drive means for operating said moving means.

11. In a slide projector, the combination set forth in claim 10 and further including spring means urging said clamp means toward said pusher arm means, and stop means engaged by said clamp means upon movement of said pusher arm means and said clamp means away from said projecting station, said stop means effecting movement of said clamp means away from said pusher arm means to release a slide.

12. In a slide projector, the combination comprising base means, means on said base means providing a projecting station, pusher arm means movably mounted from said base means for movement toward and away from said projecting station to transfer a slide to and from said projecting station, clamp means disposed substantially opposite said pusher arm means in spaced apart confronting relation thereto for selective gripping of a slide therebetween, means operatively connecting said pusher arm means and said clamp means for gripping a slide between said pusher arm means and said clamp means and for holding said pusher arm means and said clamp means as a substantially rigid unit, means for moving said unit relative to said base means first rectilinearly and then pivotally to said projecting station in a direction away from the direction of said pusher arm means and in the direction of said clamp means and back again, and cyclically operable drive means for operating said moving means.

13. In a slide projector, the combination comprising base means, means on said base means providing a projecting station, pusher arm means movably mounted from said base means for movement toward and away from said projecting station to transfer a slide to and from said projecting station, clamp means disposed substantially opposite said pusher arm means in spaced apart confronting relation thereto for selective gripping of a slide therebetween, means operatively connecting said pusher arm means and said clamp means for gripping a slide between said pusher arm means and said clamp means and for holding said pusher arm means and said clamp means as a substantially rigid unit, means for moving said unit along a path which is at least in part nonlinear, to said projecting station in a direction away from the direction of said pusher arm means and in the direction of said clamp means and back again, and cyclically operable drive means for operating said moving means.

14. In a slide projector, a combination comprising base means, means on said base means providing a projecting station, slide carrying means for carrying a slide along a predetermined path to and from said projecting station, said slide carrying means incluning a first clamp member disposed remotely of said projecting station and generally facing toward said station and a second clamp member disposed intermediate the first clamp member and the projecting station and confronting the first clamp member, said clamp members being relatively movable toward and away from one another alternately for gripping and for releasing or receiving a slide, means coacting between said two clamp members for moving said two clamp members relatively toward one another to grip a slide and thereafter to retain said clamp members as a relatively rigid unit, and means for moving said unit toward and away from said projecting station.

15. In a slide projector, the combination set forth in claim 14, the coacting means comprises means pivotally interconnecting the two clamp members.

16. In a slide projector, the combination comprising base means, means on said base means providing a projecting station, means on said base means providing a slide supplying station spaced from said projecting station, slide transporting means mounted for movement between said supplying station and said projecting station and back again, cooperating guide means on said base and on said transporting means for guiding said transporting means initially with a rectilinear movement and subsequently with a pivotal movement to transfer a slide from said supplying station to said projecting station, and drive means acting between said base means and said transporting means for moving said transporting means from said supplying station to said projecting station and back again.

17. The combination set forth in claim 16 wherein the guiding means comprises a pair of guide tracks one of which is straight and terminated by a positive stop, the other of which has a portion which is straight and substantially parallel to the first guide track, and a second portion which is angularly disposed relative to the first portion.

18. In a slide projector, the combination comprising base means, means on said base means providing a projecting station, means on said base means providing a slide supplying station spaced from said projecting station, said slide supplying station having a slide supporting surface, slide transporting means mounted for movement between said supplying station and said projecting station and back again, means coacting between said base and said transporting means for guiding said transporting means initially and substantially along said slide supporting surface and at a shallow angle to said surface and away therefrom and drive means acting between said base means and said transporting means for moving said transporting means from said supplying station to said projecting station and back again.

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