This invention relates to a photographic film printing apparatus.

The object of the invention is the production of a motion picture film printing apparatus, wherein one motion picture film can be printed from another with either a reduction or enlargement in size.

The second object of the invention is the production of a printing apparatus for motion picture films having a photographic sound record thereon, wherein the film produced has photographed thereon the pictures and sound record in the same relation to each other as the pictures and the sound record of the film from which the photographs are made.

The third object of the invention is the production of a motion picture film printing apparatus for photographing from standard 35 mm. motion picture films, 16 mm. films, with or without a sound record, so that the small film produced is adapted to exhibit the usual 1440 pictures per minute.

The fourth object of the invention is the production of apparatus for photographing a picture film with both pictures and a photographic sound record of a reduced size from a film of standard size, and in which the sound produced when the reduced film is projected, will equal the pitch and sequence of the sound record on the original film.

The fifth object of the invention is the production of an apparatus for photographing a picture film with only the picture or only the sound record from a film having both thereon.

The sixth object of the invention is the production of apparatus for producing from a standard motion picture film having a series of pictures and a synchronized sound record thereon, a motion picture film of reduced dimensions having photographed thereon the pictures and sound record of the standard film, to reproduce the sound characteristics of the standard film when projecting from the reduced film, at the equivalent sound pitch speed of the standard film.

In the accompanying drawings, Fig. 1 represents a side elevation partly broken away of an exemplification of the photographic film printing apparatus. Fig. 2 shows a top view of Fig. 1, partly broken away; Fig. 3 indicates a section of Fig. 1 on the line 3, 3; Fig. 4 is a partially enlarged section of Fig. 1 on the line 4, 4, showing one of the film guide plates; Fig. 5 shows a top view of some of the elements of said film guide plate; Fig. 6 indicates a section of Fig. 5 on the line 6, 6; Fig. 7 represents a right hand side view of a portion of Fig. 4; Fig. 8 shows a section of Fig. 7 on the line 8, 8; Fig. 9 is a section of Fig. 8 on the line 9, 9; Fig. 10 represents a fragmentary portion of a motion picture film, with a photographic light sound record and Fig. 11 indicates a wiring diagram of the apparatus.

The photographic film printing apparatus in this embodiment, is indicated to comprise the table 20 supported on four legs 21, two of which latter are shown. A main supporting wall is indicated at 25, which has integral therewith the vertical extension 26 and the inclined extension 27. A journal hub 28 extends from the front face of the extension 26 and a journal hub 29 extends from the front face of the extension 27. A journal hub 30 extends from the rear face of the extension 27, which is axially in line with the hub 28. A journal hub 33 extends from the rear face of the supporting wall 25.

Brackets 43 and 44 connect the table 20 and the supporting wall 25. A supplemental supporting wall is indicated at 45, which is spaced to the rear of the main supporting wall 25, and is held in position by the support bolts 46.

A dark chamber is indicated in its entirety by the numeral 50, and comprises the bottom wall 51, the top wall 52, the side walls 53, rear wall 54 and the hinged front cover 55. The rear wall 54 is fastened to the wall 25. Journal hubs 56 and 57 extend from the wall 54.

A lamp house 58 is secured to the main supporting wall 25 and is indicated with a source of light, in this instance the electric light bulb 59. A condenser lens 61 is provided for the lamp house 58.

A film guide plate is designated in its entirety by the numeral 62 and a similar parallel film guide plate is designated in its entirety by the numeral 63.

The film guide plate 62 comprises the supporting member 64 having the flange 65, which latter is fastened to the wall 54 of the dark chamber 50. The member 64 has formed thereon the horizontal light opening or slot 66. Vertical spacing and guide strips 67 are positioned over the front face of the member 64. A stationary light plate 68 is positioned between the face of the member 64 and the strip 67, one of which latter has indicated thereon the mark 67a. A vertically adjustable light plate 70 is positioned below the plate 68 and is also located between the face of the member 64 and the strip 67. A scale 71 is indicated on the plate 70. Clamping plates 72 bear on the guide strips 67. Screws 73 and 74 clamp the strips 67 and the plates 68 and 70 in place. To locate the plate 70 in different positions to vary the width of the opening between it and the plate 68, the screws 74 are unscrewed and the plate 70 can be located in a required position, with the assistance of the scale 71 and the mark 67a.

Horizontally adjustable cross light plates 75 and 76 are positioned below the plates 68 and 70.
and in the slight depression in the member 64. A scale 80 is indicated on the plate 76, and a scale 80 is indicated on the plate 74. The said scales 78 and 80 coacting with the outer edges of the plates 72 provide means to locate the plates 75 and 76 in proper position.

Scrows 52 and 83 respectively bear on and clasp the plates 75 and 76 in operative position.

A pressure plate 85 has the light opening 86 in which is secured a translucent plate of glass.

Wings 88 extend from the pressure plate 85 and have extending therefrom the pins 89. A block 90 is adjustably supported on the shank of the screw 91 which latter is in threaded engagement with the member 54 of the guide film plate 62. A vertical plate 92 extends from the block 90 and has fastened thereon the two angle shaped arms 93. The pins 89 extend through openings in the arms 93. Springs 94 bear between the wings 88 and the arms 93. Projections or strips 97, similar to 77, extend from the sides of the inner face of the pressure plate 85.

The film guide plate 63 is the same in construction as the film guide plate 62 with the exception that the light plates 65, 70, 75, and 76 are omitted. In the drawings of the film guide plate 63, the pressure plate 85, the supporting member 64 and the pins 89 are indicated with their numerals. The presser plate 85 has an opening similar to 86, but which is not covered with a plate of glass.

A light tube 95 is located between and has its ends connected to the supporting members 64 of the film guide plate 62 and 63. A lens casing 96 is slidably located in the light tube 95 and at its lower portion has formed therewith a rack teeth 97. A spindle 99 is journaled in the wall of the tube 95 and has fastened thereon to the spur gear 99 which meshes with the teeth 97. An operating wheel 100 is fastened to the spindle 99.

A projecting lens 101 is supported in the lens casing 96.

A diaphragm support 102 encircles the light tube 95 and has adjustably extending therefrom the diaphragms 103. The diaphragms extend through slots in the tube 95. The diaphragms 103 are clamped in different positions by means of the screws 104. The diaphragms 103 may have scales indicated thereon to enable them to be located in proper position, to obtain the proper light opening between their inner edges.

An electric motor 106 is fastened to the inclined supporting block 107 extending from the table 20. A shaft 108 has one end coupled to the armature shaft of the electric motor 106, and has its other end journaled in the journal bracket 109 extending from the wall 25. Worms 110 and 111 are fastened to the shaft 108. A shaft 112 is journaled in the walls 25 and 45 and at one end thereof is fastened the worm wheel 113, which meshes with the worm 110 and at its other end is fastened the film sprocket wheel 114. A spur gear 115 is fastened to the shaft 112. An idler pinion 116 is fastened to the shaft 117 journaled in the walls 25 and 45 and meshes with the pinion 115. A pinion 118 is fastened to the shaft 119 journaled in the walls 25 and 45. A film sprocket wheel 120 is fastened to the shaft 119. An arm 121 has one end adjustable fastened to the wall 25 and in its other end is journaled the film presser roller 122. An arm 123 has one end adjustable fastened to the wall 25 and in its other end is journaled the film presser roller 124. A spur gear 125 is fastened to the shaft 126 journaled in the walls 25 and 45 and meshes with the pinions 116 and 118. A shaft 128 is journaled in the walls 45 and the journal 5 hub 26 and has fastened thereto the pinion 129, which meshes with the spur gear 125. The shaft 128 has also fastened thereto at one end the film sprocket wheel 130, and at its other end is fastened the sprocket chain wheel 131.

A shaft 133 is journaled in the journal hub 29 and 30 and at one end thereof is fastened the sprocket chain wheel 134. A sprocket chain 135 connects the sprocket chain wheels 131 and 134.

A take-up film reel 136 is adjustably supported on the shaft 135. A cap 137 is pinned to the shaft 133, and a helical spring 138 encircles the shaft 133 and bears between the reel 139 and the cap 137.

In the hub 29 is fastened a shaft 145, which has journaled thereon a feed film reel 146 similar to 136. Film guide rollers 147 and 148 extend from the wall 25. Velvet covered normally stationary cleaning rollers 149 and 150 are adjustably supported on pivots 151 that extend from the wall 25.

An arm 152 has one end adjustably fastened to the wall 25 and has pivoted thereto the film presser rollers 153 and 154.

A standard 35 mm. negative motion picture film in this instance is indicated in its entirety at 155, and has indicated thereon as usual a plurality of pictures 157 and the photographic light sound record 158. The film 156 leads from the feed reel 146, under the film sprocket wheel 135 between the cleaning rollers 149 and 150 through the film guide plate 63. From the film guide plate 63, the film 156 bears under the film sprocket wheel 114, from which latter it leads over the film sprocket wheel 120. The said standard film 156 next bears under the film guide rollers 147 and 148 and finally is wound up on the take up reel 136.

A shaft 165 is journaled in the walls 25 and 45 and has fastened thereto the spur gear 166.

A shaft 167 has its ends journaled in the walls 25 and 45 and has fastened thereto the pinion 168, which meshes with the spur gear 166.

A film sprocket wheel 170 is fastened to the shaft 167. An arm 172 has one end adjustably fastened to the wall 54, and in the other end of the arm 172 is journaled the film presser roller 172.

A pair of velvet covered normally stationary cleaning rollers 174 and 175 are supported on the pins 176 and 177 extending from the wall 54. The latter rollers as well as the rollers 149 and 150 can be located in different angular positions on their pins. A shaft 180 is journaled in the walls 25, 29, and 54. A worm wheel 181 is fastened to one end of the shaft 180 and is in mesh with the worm 114. A pinion 188 and the film sprocket wheel 190 are also fastened to the shaft 180. A shaft 191 is journaled in the walls 25, 45 and 54 and has fastened thereto the pinion 192, which is in mesh with the spur gear 166 and the pinion 198.

A shaft 194 is journaled in the walls 25, 45, and 54 and has fastened thereto the pinion 195, the film sprocket wheel 196, and the sprocket chain wheel 197. An arm 200 is adjustably fastened to the wall 54 and has journaled thereto the film presser roller 201. An arm 203 is adjustably fastened to the wall 54 and has journaled thereto the film presser roller 204. A support 206 is fastened to the wall 54 and has journaled thereto the film guide roll-
ers 221 and 208. A shaft 210 similar to the shaft 123 is journaled in the journal hubs 33 and 56. The sprocket chain wheel 212 is fastened to one end of the shaft 210. A sprocket chain 213 connects the sprocket chain wheels 212 and 117. A take-up film reel 216 is supported on the shaft 210. A cap 223 is fastened to one end of the shaft 210, and a helical spring 221 surrounds the shaft 210 and bears between said cap 223 and the reel 210. A shaft 223 extends from the hub 27 and supports the film feed reel 224.

An unexposed 16 mm. motion picture film is indicated at 225, which leads from the feed reel 224, passes over the film sprocket wheel 170 and then between the cleaning rollers 174 and 175. The film 225 then passes upwardly through the film guide plate 62 from the latter over the film sprocket wheel 100. The film 225 then passes under the film sprocket wheel 100, and over the roller 208 and under the roller 207 to the take up reel 218.

Referring to Figs. 1 and 11 an electric switch 230 and a pair of rheostats 234 and 235 are fastened to the table 29. A pair of wires 246 and 237 lead from a source of electric current. The wire 246 has the switch 230 connected thereto. An electric plug is shown at 240 and a second electric plug 241 is detachably connected thereto. The wires 230 and 237 lead into the plug 240 and respectively connect with the wires 243 and 244. The rheostat 234 is in connection with the wire 243. A wire 245 leads from the rheostat 234, to the electric motor 106. Wires 246 and 247 lead from the plug 240. The wire 246 leads to the electric light bulb 59. The wire 247 joins with the rheostat 235, and a wire 248 leads from the rheostat 235 to the electric light bulb 59.

To operate the photographic film printing apparatus, the motion picture films are positioned in said apparatus as already described. The diaphragms 103 are adjusted to produce the required light opening in the light tube 68. If both the pictures 157 and the photographic light sound record 159 are to be photographed on the unexposed film 225, the adjustable light plate 70 is moved in position to obtain the required opening between the upper edge of said plate 70 and the lower edge of the stationary light plate 69 to secure the required width of the light slot or opening through the film guide plate 62. The adjustable cross-light plates 75 and 78 are positioned outwardly so as not to obstruct the light. The rheostat 234 for the electric motor circuit is first kept in its off position so that the electric motor 106 remains stationary. The switch 230 is next closed and the rheostat 235 is adjusted to energize the light circuit of the apparatus. The operator next focuses the photographic apparatus located by locating the lenses 101 in proper position. Next the rheostat 234 is adjusted and the electric motor is started. The films 156 and 225 will then move in the direction indicated by the arrows in Fig. 1. The film 225 is continuously moved upwardly in a direction opposite to the direction of the continuously moving film 156, which latter moves downwardly. The opposite directions of the movements of the films are necessary because the pictures and the light sound record of the film 156 are inverted by the lenses. If it is required to only photograph the light sound record 159 on the film 225, the light sound plate 75 is positioned in place to prevent the photographing of the pictures 157, and if only the pictures are to be photographed on the film 225 the light plate 70 is positioned in place to prevent photographing of the light sound record 156.

It will be noted that the speed transmitted by the shaft 108 and the transmission gearing for the unexposed film 225, transmitted to said unexposed film a less speed of time than is transmitted to the standard size film 156, by the said shaft 108 and the transmission gearing for said standard film in the same 10 interval of time. The opening 66 in the support 64 for the standard size film 156 may be larger than the opening or the slot 66 in the support 64 for the unexposed dimensionally reduced film 225. The translucent plate of glass 67 in the pressure plate 85 for the reduced film, provides a means for properly focusing the projecting lens 181.

Various modifications may be made in the invention and the present exemplification is to be taken as illustrative and not limiting thereof.

Having described our invention what we desire to secure by Letters Patent as our claim is:

1. In a photographic film printing apparatus the combination of a light tube, means to project beams of light through said tube, a film guide plate at the entrance end of the tube and a film guide plate at the exit end of said tube, the film guide plate at the entrance end of the tube comprising a supporting member having a light slot, a presser plate having a light slot coacting with said supporting member, the film guide plate at the exit end of the tube comprising a supporting member having a light slot, a presser plate having a light slot coacting with the latter supporting member, a translucent plate covering the slot in the latter presser plate, a stationary light plate fastened to the latter supporting member and extending partly over the light slot therein, a vertically adjustable light plate on the latter supporting member coacting with the first light plate thereon, horizontally adjustable cross plates on the latter supporting member coacting with the light slot therein, means to continuously move a standard size picture film through the film guide plate at the entrance end of the light tube, means to continuously move an unexposed film of less than the standard size through the film guide plate at the exit end of the light tube at a speed varying from the speed of travel of the standard size film, a condenser lens spaced from the inlet end of the tube, a projecting lens within the light tube adjacent to its exit end and means to project beams of light through said lenses.

2. In a photographic film printing apparatus the combination of a light tube, means to project beams of light through said tube, a film guide plate at the entrance end of the tube and a film guide plate at the exit end of said tube, the film guide plate at the entrance end of the tube comprising a supporting member having a light slot, a presser plate having a light slot, coacting with said supporting member, the film guide plate at the exit end of the light tube comprising a supporting member having a light slot, a presser plate having a light slot coacting with the latter supporting member, a stationary light plate fastened to the latter supporting member and extending partly over the light slot therein, a vertical adjustable light plate on the latter supporting member coacting with the other light plate thereof, means to continuously move a picture film through the film guide plate at the entrance end of the light tube, means to con...
4. In an apparatus of the character described in the combination of a film guide plate for a standard negative motion picture film, pictures and a sound record on said standard film, a second film guide plate for an unexposed film, pictures and a sound record on said standard film, a second film guide plate for a standard negative motion picture film, pictures and a sound record on said standard film, a second film guide plate for an unexposed film of a size at variance with the negative film, the film guide plate for the negative standard film comprising a supporting member having a light slot, a presser plate having a light slot coating with said supporting member, the film guide plate for the unexposed film comprising a supporting member having a light slot, a presser plate having a light slot coating with the latter supporting member, a stationary light plate bearing on the supporting member of the film guide plate for the unexposed film and extending somewhat over the unexposed film and extending somewhat over the light slot therein, a vertical adjustable light plate bearing upon each of said light slots, a scale indicated on the adjustable light plate, vertical guide strips bearing upon each of said light slots, one of said strips having a mark thereon coating with the scale on the adjustable light plate, to properly adjust the distance between the edges of the light plates to obtain the required width of light opening therethrough, means to move the standard motion picture film through its film guide plate, means to move the unexposed film through its film guide plate at a speed varying from the speed of travel of the standard film and in a direction opposite thereto, horizontally adjustable cross light plates bearing on the supporting member of the film guide plate for the unexposed film and extending below the other light plates thereon, a scale on each of the horizontally adjustable cross light plates coating with an edge of the vertical strip of the supporting member adjacent thereto, to cover or uncover either the pictures or the sound recording on the standard motion picture film and means to photograph the exposed portion of the standard film on the unexposed film, the sound record if photographed adapted to produce the same sound and pitch as that adapted to be produced with the standard film.

5. In an apparatus of the character described in the combination of a film guide plate for a standard negative motion picture film, pictures and a sound record on said standard film, a second film guide plate for an unexposed film of a size at variance with the negative film, the film guide plate for the negative standard film comprising a supporting member having a light slot, a presser plate having a light slot coating with its supporting member, the film guide plate for the unexposed film comprising a supporting member having a light slot, a presser plate having a light slot coating with the latter supporting member, a stationary light plate bearing on the supporting member of the film guide plate for the unexposed film and extending somewhat over the light slot therein, a vertical adjustable light plate bearing on the latter supporting member coating with the stationary light plate, vertical guide strip bearing upon each of said light slots, horizontally adjustable cross light plates bearing in a depressed portion of the supporting member of the unexposed film and below the other light plates of said supporting member, means to simultaneously move the films in opposite directions, cleaning rollers contacting with said standard film before entering its film guide plate, cleaning rollers contacting with the unexposed film before entering its film guide plate and means to photograph the sound record of the standard film on the unexposed film.

6. In a photographic film printing apparatus the combination of a table, a main supporting wall extending from the table, an electric motor supported in an inclined position above said table, a shaft having one end coupled to the armature shaft of the motor, a worm fastened to said shaft, a supplemental wall spaced from the main supporting wall, spacer bolts interposed between said walls, a second shaft journaled in said walls, a worm wheel fastened to one end of the second shaft in mesh with said worm, a film sprocket wheel fastened to the other end of the second shaft, a spur gear fastened to the second shaft between its worm wheel and said idler pinion, a third shaft journaled in said walls, an idler pinion fastened to the third shaft in mesh with the spur gear on the second shaft, a fourth shaft journaled in said walls, a pinion fastened to one end of the fourth shaft in mesh with worm wheel fastened to the other end of the fourth shaft, a fifth shaft journaled in said walls, a spur gear fastened to the fifth shaft, the latter spur gear in mesh with said idler pinion and with the pinion of the fourth shaft, a sixth shaft journaled in said walls, a pinion fastened to the sixth shaft in mesh with the spur gear on the fifth shaft, a sprocket chain wheel fastened to the sixth shaft, a seventh shaft journaled in said walls, a sprocket chain wheel fastened to the seventh shaft, a sprocket chain connecting the sprocket chain wheels, a take up film reel fastened to the seventh shaft for a motion picture film and a feed film reel journaled in said wall for extension of said main supporting wall, said picture film leading from said feed reel, contacting with said film sprocket wheels and wound up on said take up film reel.