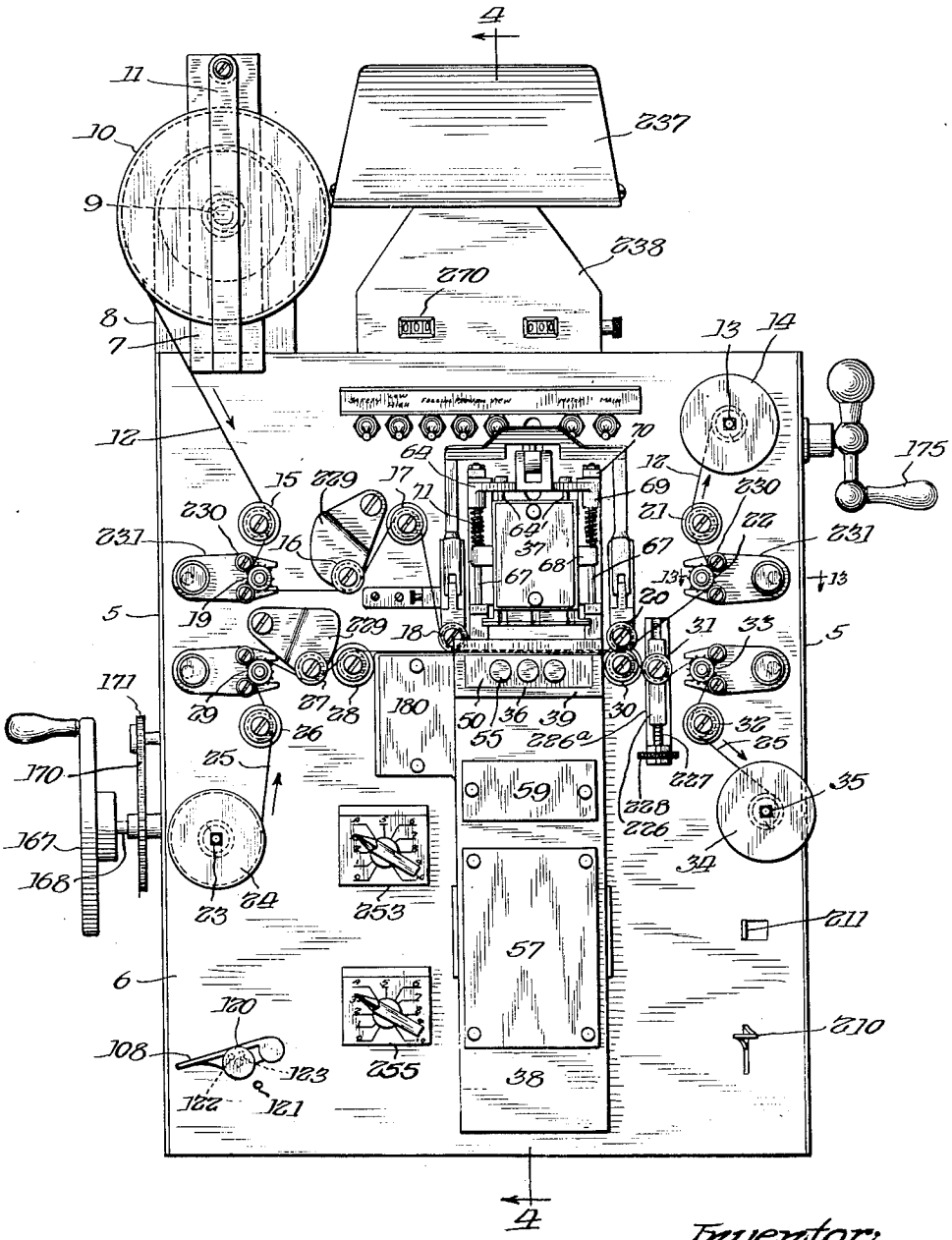
July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 1

Fig. 1.



Inventor:
Frederic E. Oakhill.

By: Hice & Hice
Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 2

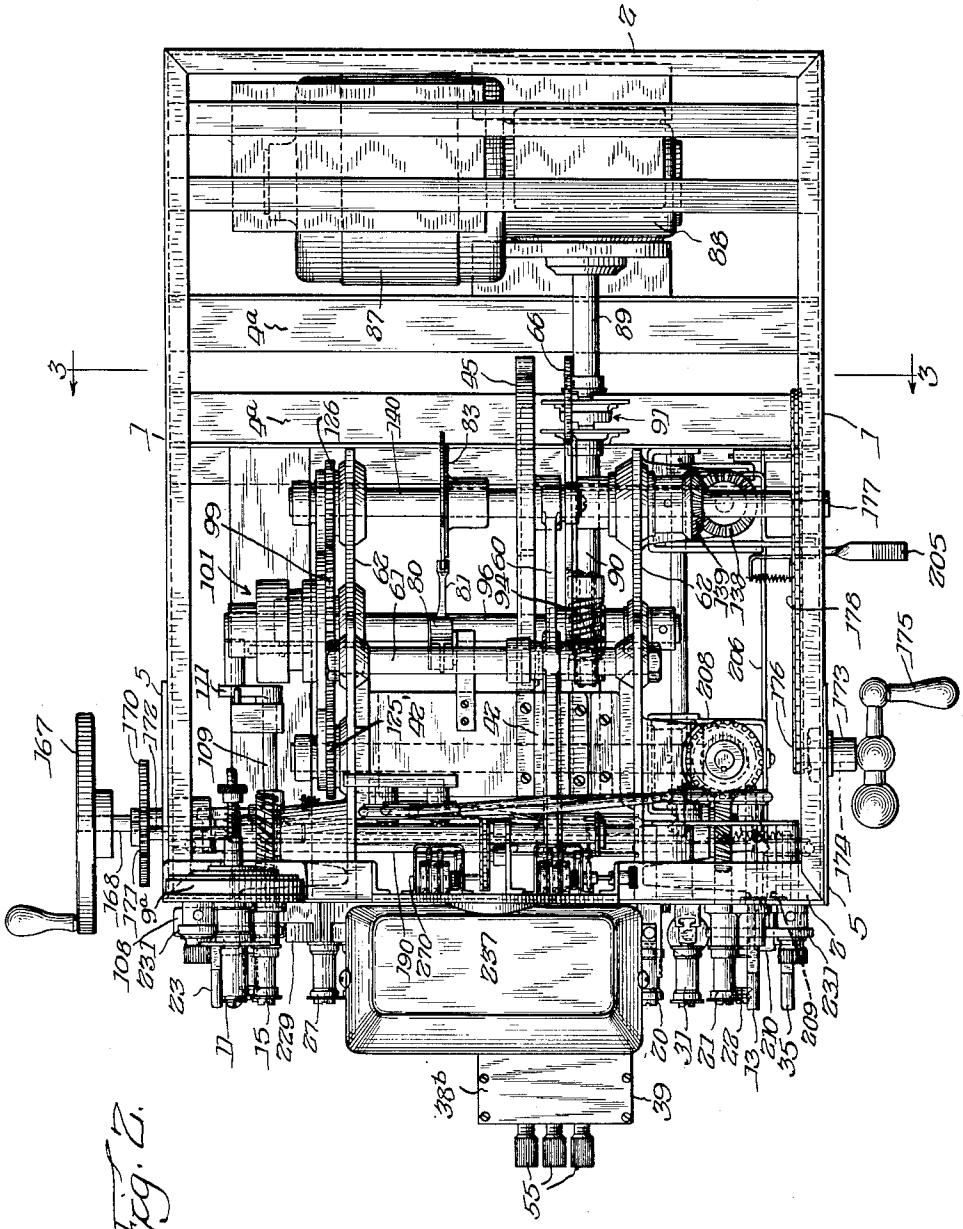


Fig. 2.

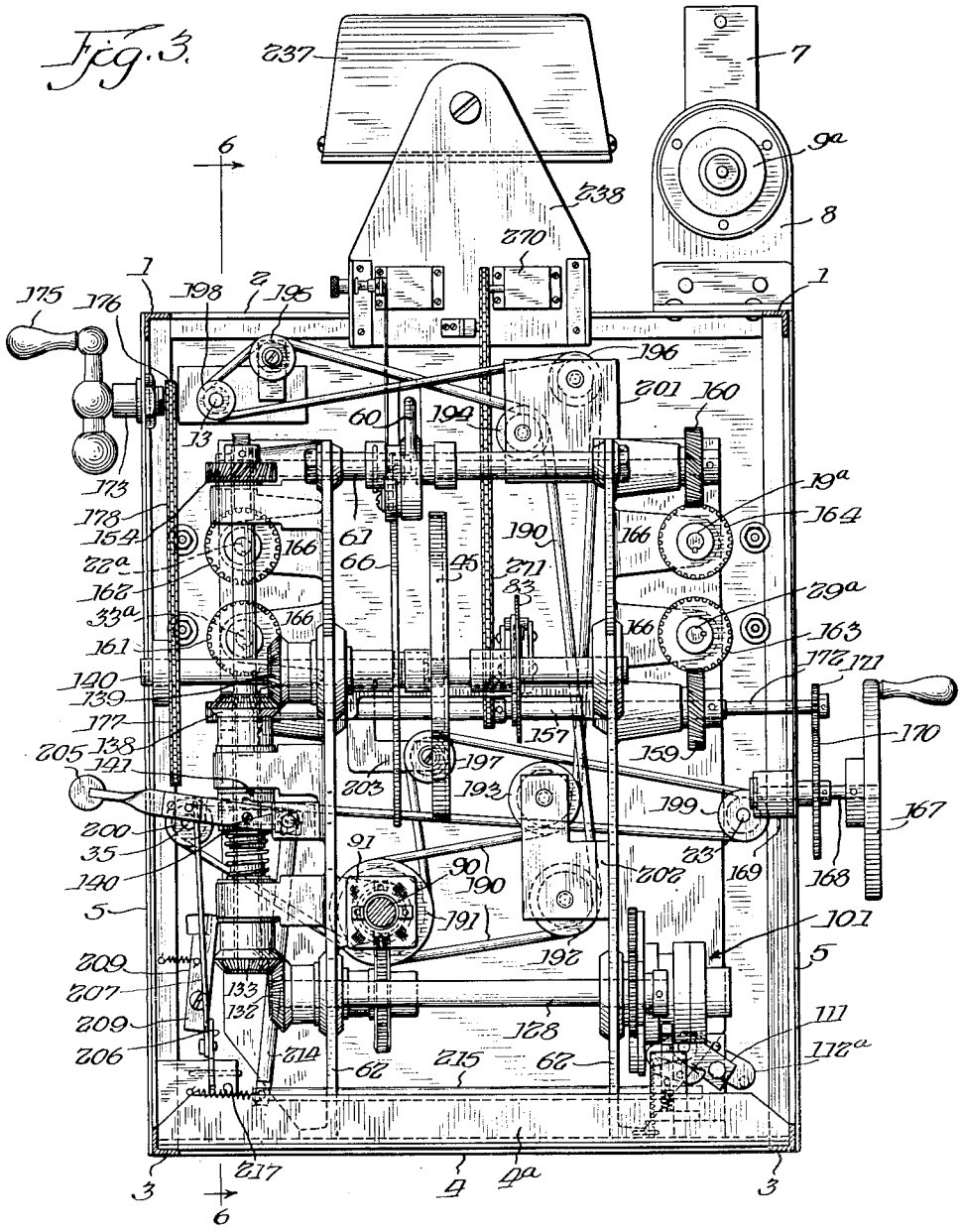
Inventor:
Frederic E. Oakhill:
By: Sheetsheet
Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 3

Fig. 3.



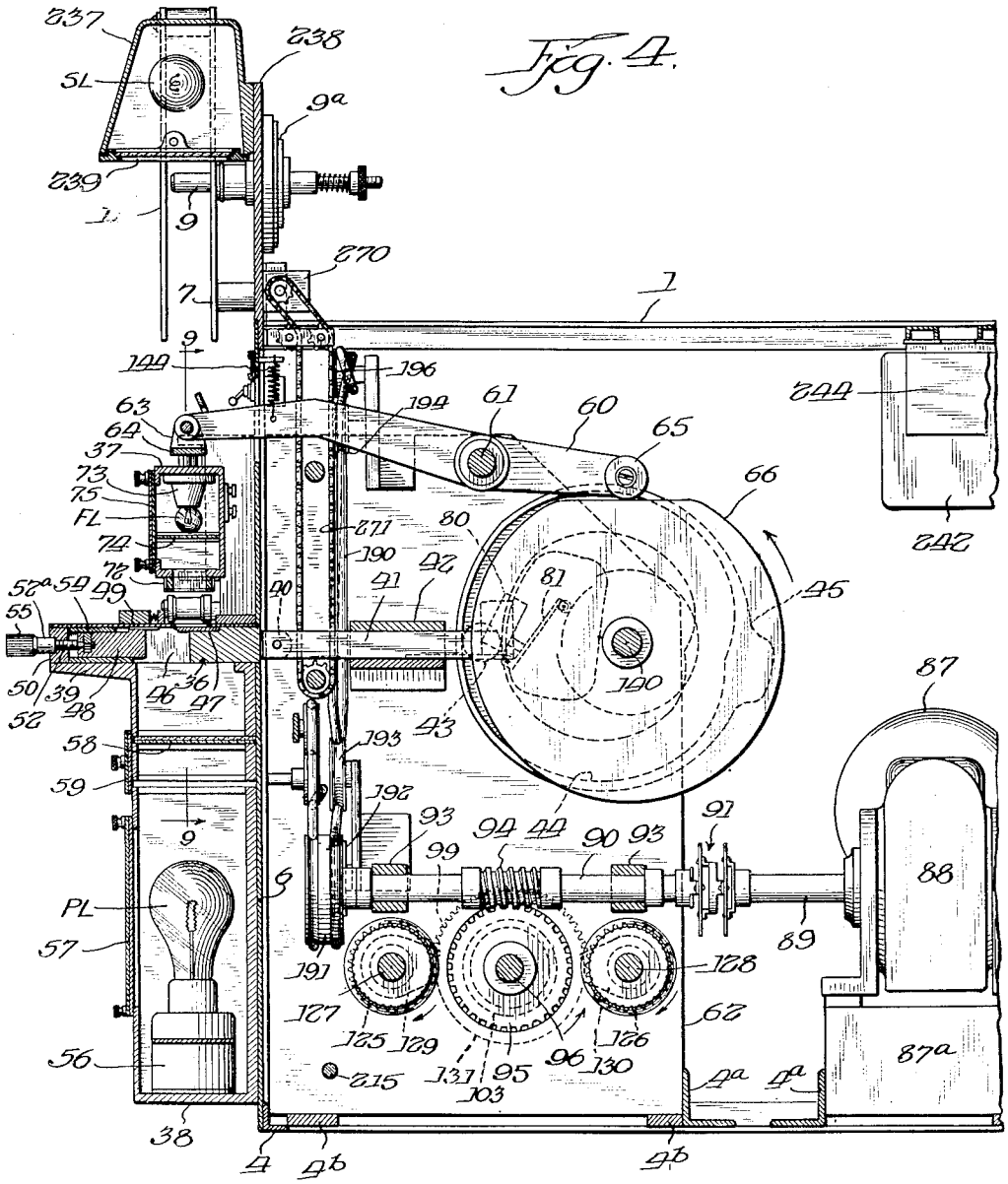
Inventor:
Frederic E. Oakhill:
By: Hoie & Hoie
Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 4

Fig. 4.



Inventor:
Frederic E. Oakhill:

By: Shee & Shee

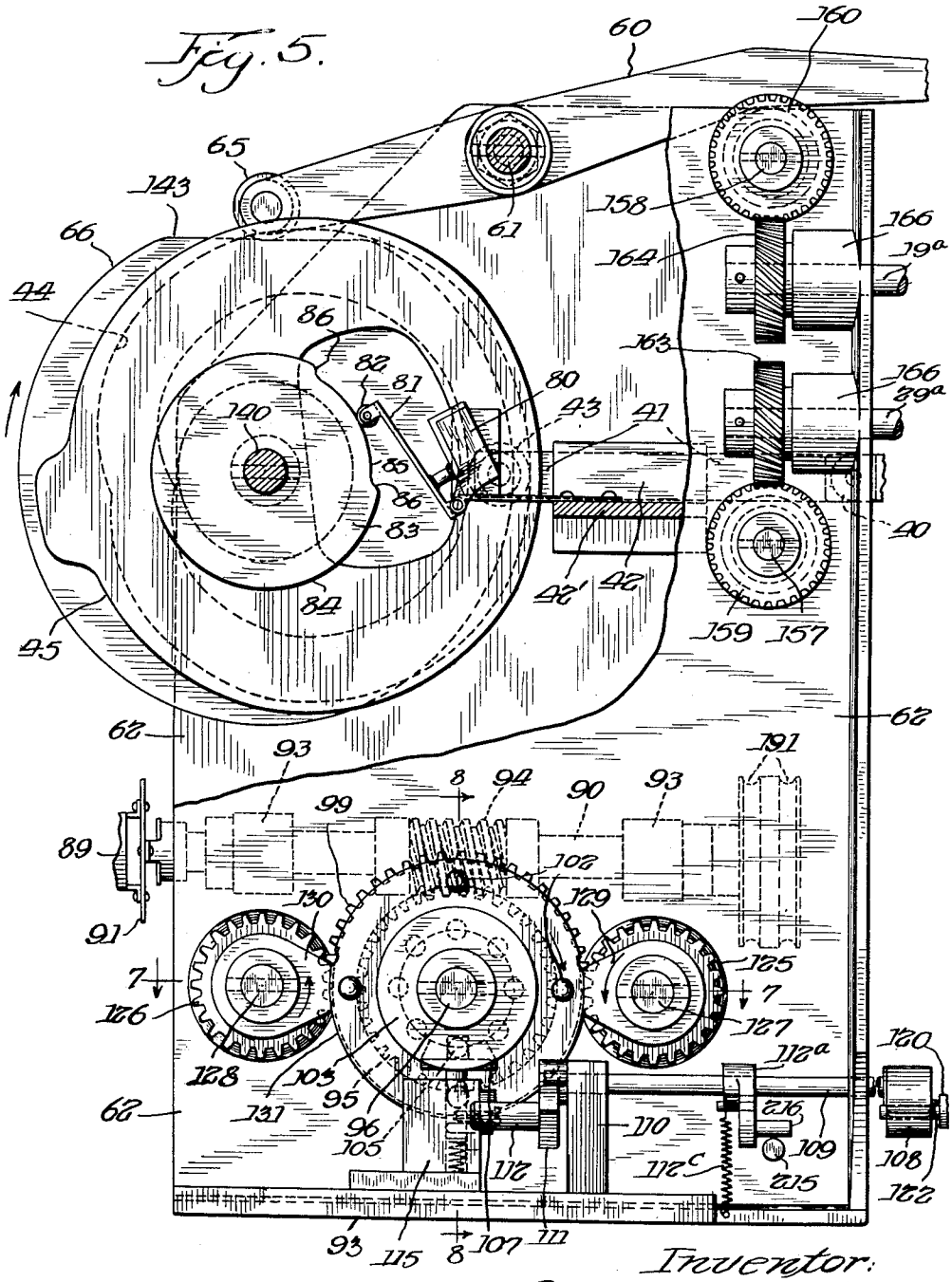
Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 5

Fig. 5.



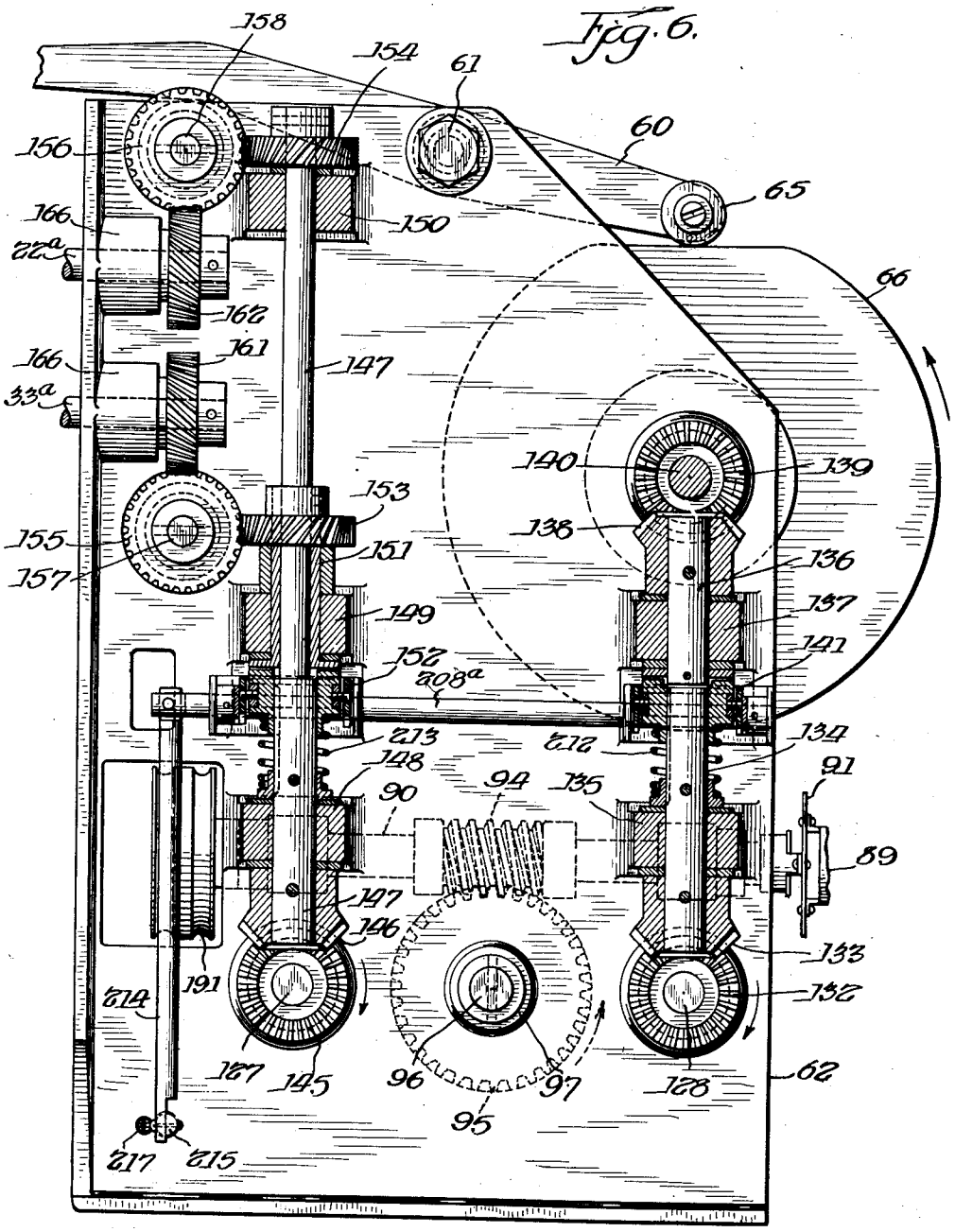
Inventor:
Frederic E. Oakhill:
By: Shea & Shea
Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 6

Fig. 6.



Inventor:
Frederic E. Oakhill.

By Hill & Hill Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 7

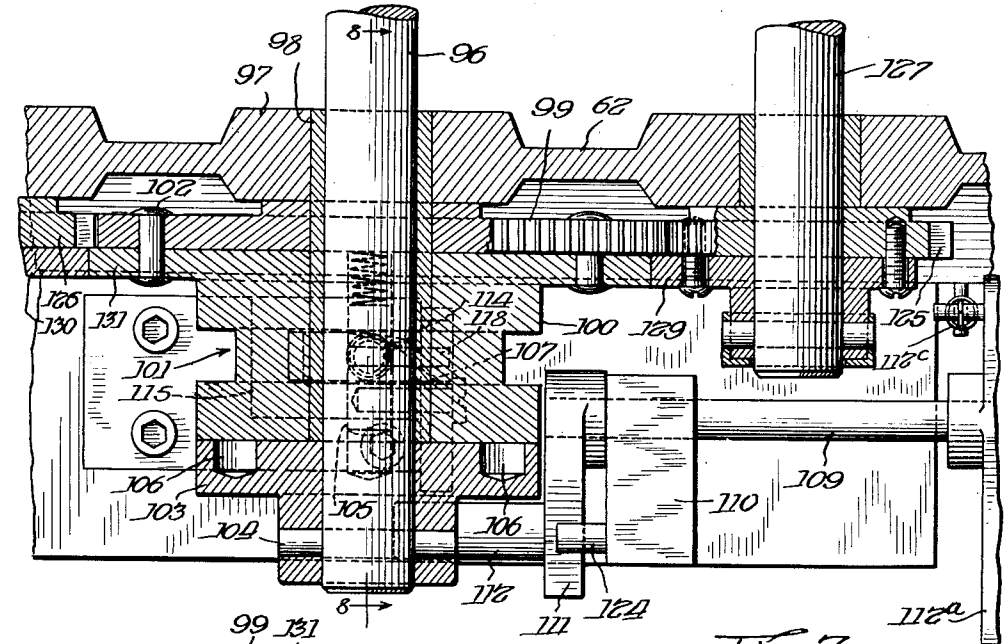


Fig. 7.

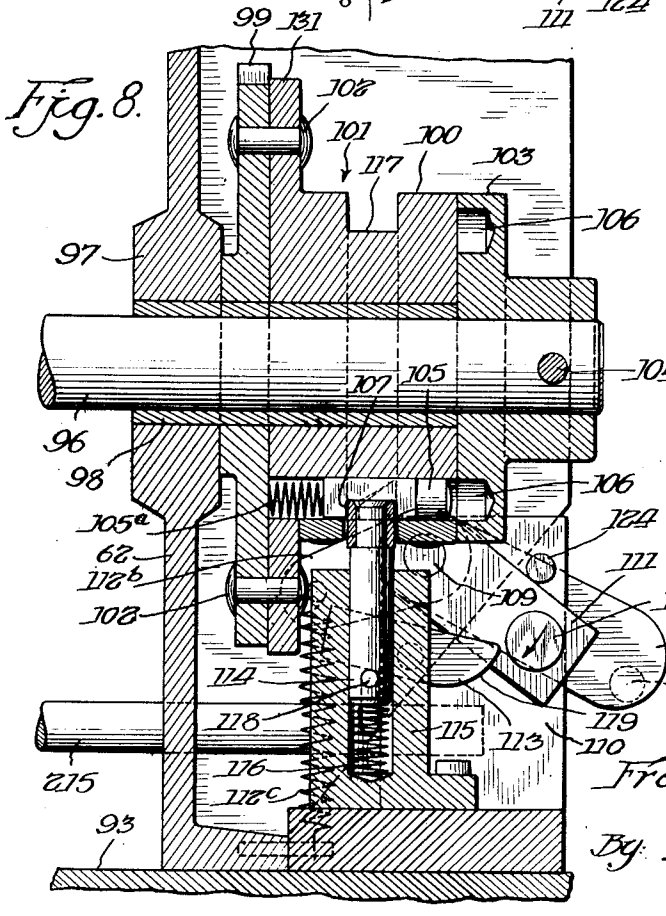


Fig. 8.

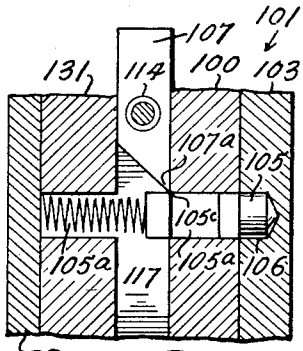


Fig. 8a

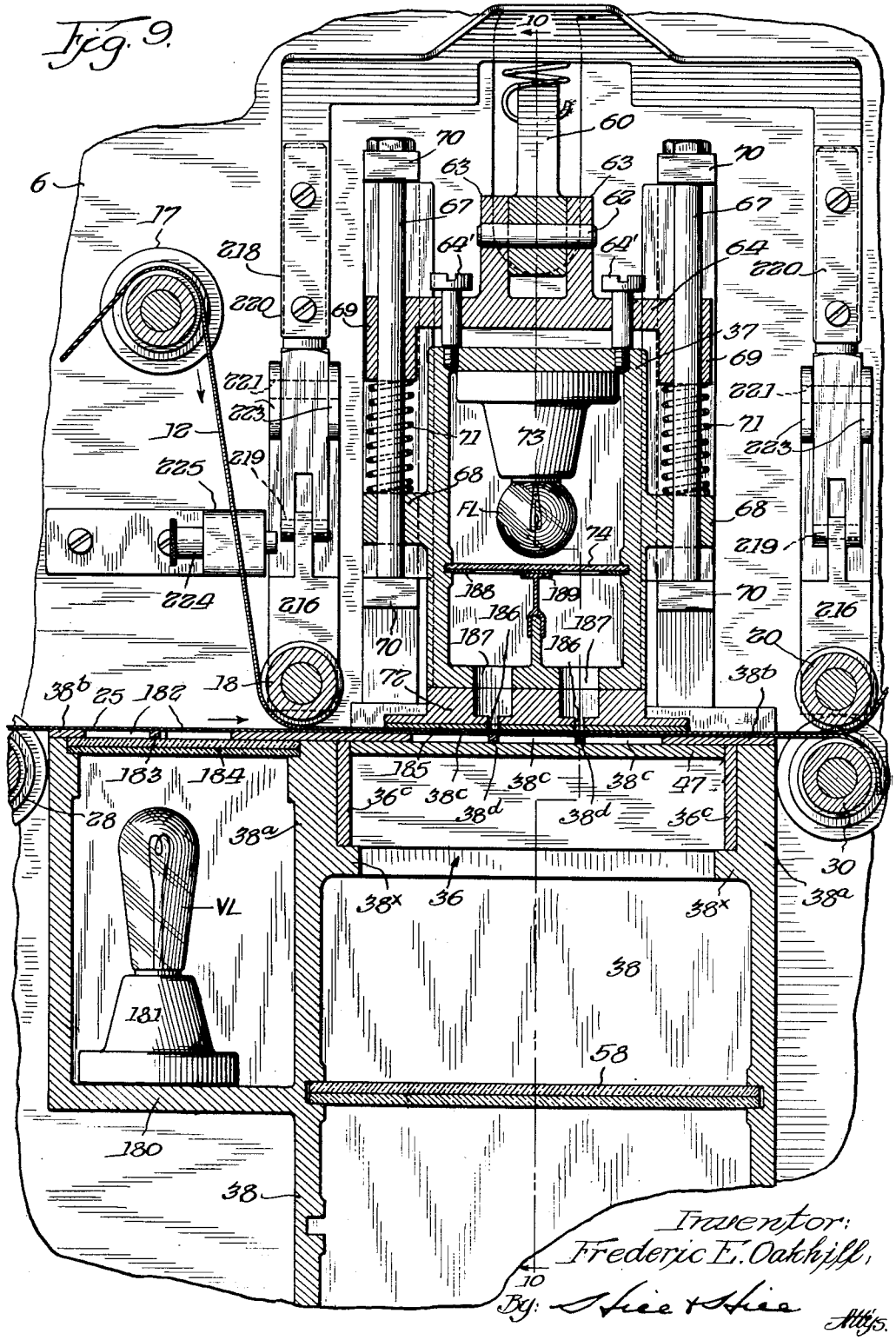
Inventor:
Frederic E. Oakhill.
By Hise & Hise
Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 8

Fig. 9.



July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 9

Fig. 11.

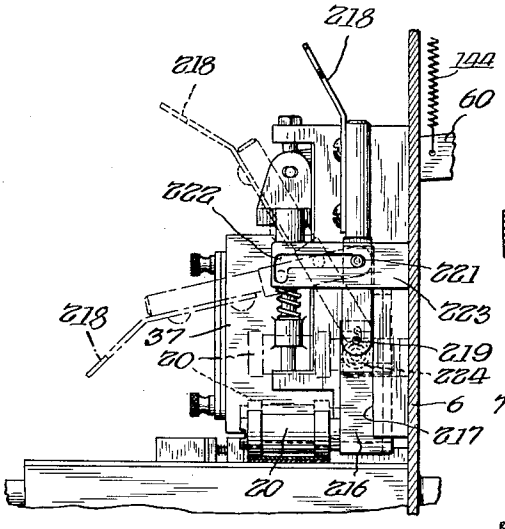
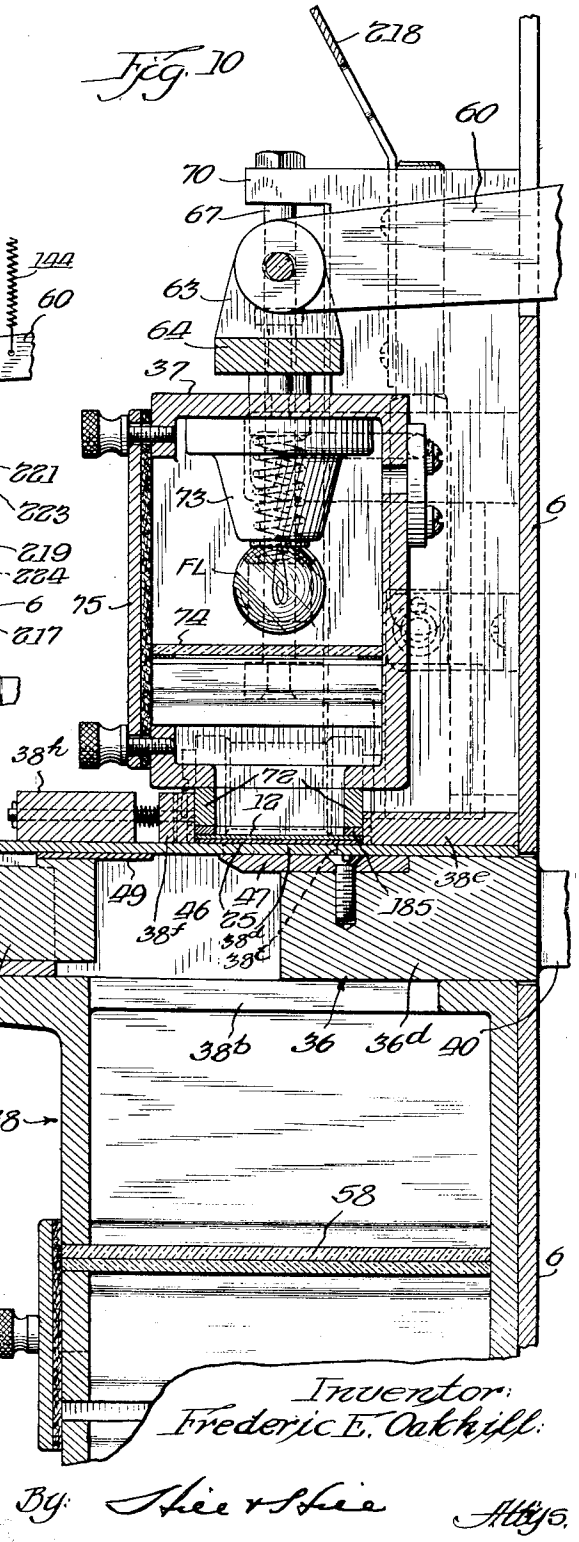


Fig. 10



Inventor:
Frederic E. Oakhill.

By: Shier & Shier Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 10

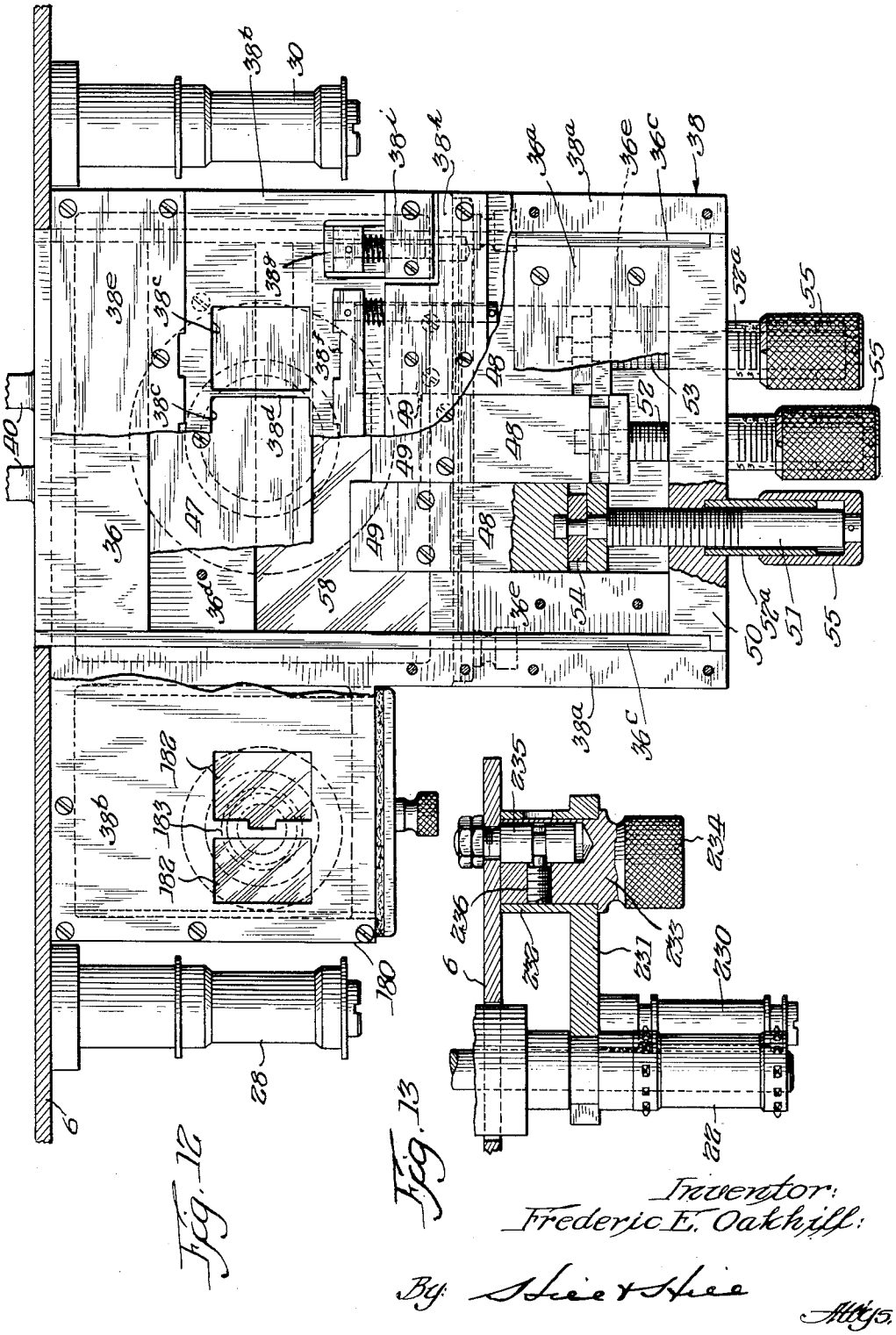


Fig. 12

Fig. 13

Inventor:
Frederic E. Oakhill:
By Shee & Shee
Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 11

Fig. 14.

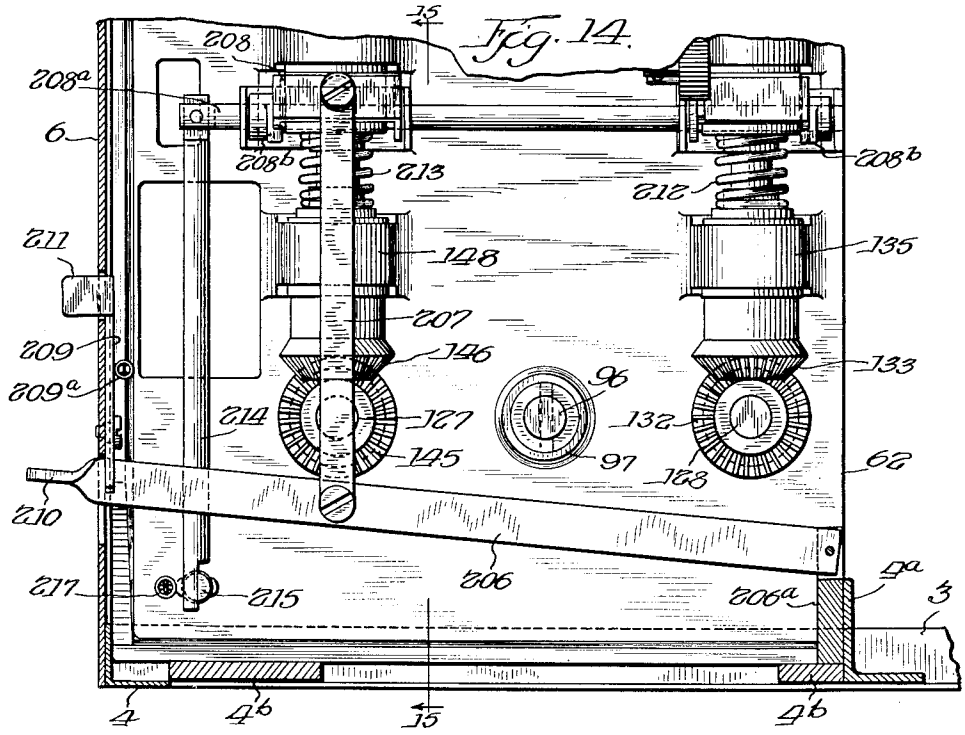
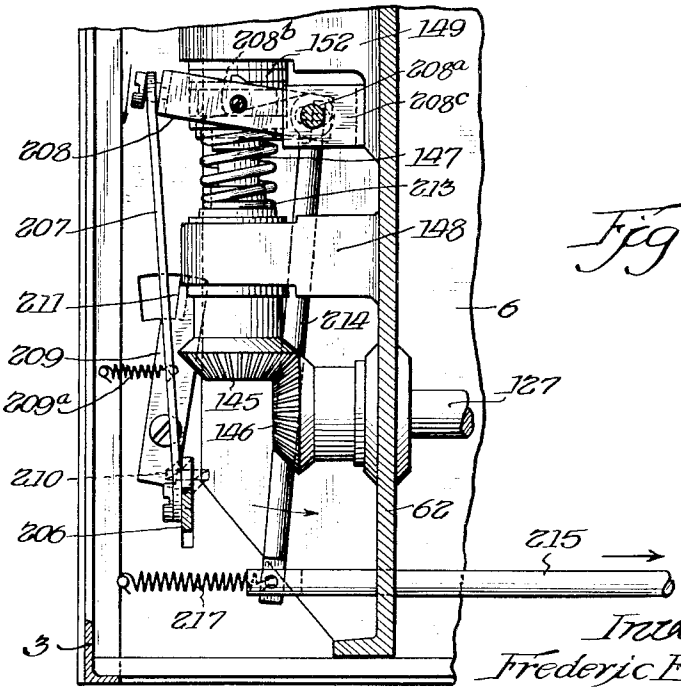


Fig. 15.



Inventor:
Frederic E. Oakhill:

By: Hice & Hice Attys.

July 18, 1950 F. E. OAKHILL 2,515,420

FILM PRINTING MACHINE

Filed Dec. 2, 1944 12 Sheets-Sheet 12

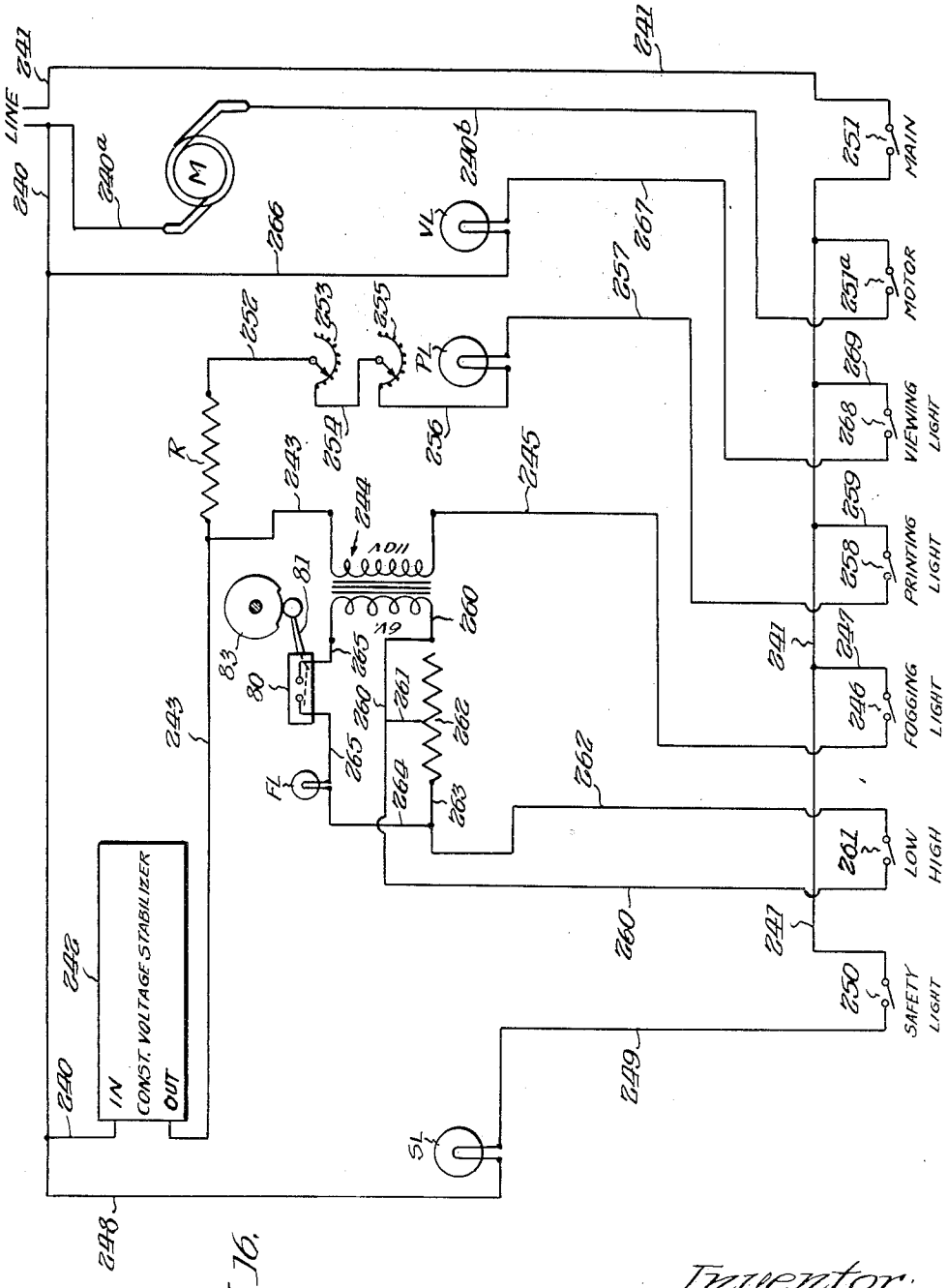


Fig. 16.

Inventor:
Frederic E. Oakhill:
By: Hiee & Hiee
Attys.

Patented July 18, 1950 2,515,420

UNITED STATES PATENT OFFICE

2,515,420

FILM PRINTING MACHINE

Frederic E. Oakhill, Wilmette, Ill., assignor to Prismacolor, Inc., Chicago, Ill., a corporation of Illinois

Application December 2, 1944, Serial No. 566,310

18 Claims. (Cl. 95—75)

1

This invention relates to improvements in photographic film printing machines, and more particularly to machines for printing groups of impressions carried by a negative film which has been exposed in what may be called a three-color camera, although two-color or other multi-color films may be printed with the present machine with slight changes.

Upon the negative film are photographed groups of black and white images of an objective or many objectives. The individual images of each group are called "frames" since the images of each group are equally spaced apart by more or less opaque bars and likewise the groups of frames are equally spaced apart by opaque bars. These bars are desirable but not absolutely necessary. Films printed with the present machine are permanent, fixed and a true record.

The present machine provides means for simultaneously exposing each frame of each group of impressions or images to a light source, and one of the objects of the present invention is to control the amount of light to which each frame of the group shall be exposed.

Another object is to control the intensity of the printing light, in accordance with the density of the negative.

Another object is the provision of manually operated means for advancing and retracting the negative through the printing zone. It is often desirable to have certain groups of pictures follow in regular sequence. These groups of pictures may have been taken at various places on the negative, and the present manual film advancing and retracting means enables the attendant to move any desired group of frames into printing position.

Another object is the provision of control means whereby the machine may be set to run continuously for the purpose of printing a test film or for printing films for exhibition, and suitable automatically operating clutch mechanism is provided for stopping the machine at the conclusion of each cycle of operation for printing one group of impressions. When a test strip has been run through the machine and has been developed the attendant may observe the various frames of the groups of impressions thereon and make notes of the densities thereof. In order that the projected pictures may show the true colors of the photographed objects it is necessary that the densities of the frames of each group comprising each picture have a definite relation to each other. In three-color photographs the density of the red, blue and green frames must have definite relations. This is accomplished for a given light condition by the use in the camera with suitable filters. However, due to changes in light conditions while the photographer is at work with a camera loaded with a film and selected filters, the frames of each group frequently do not have the proper relative densities. It is frequently the case that a single film is successively exposed in the camera under a great variety of light conditions because it is undesirable or impractical to change the filters. In accordance with the present invention, the attendant may increase or decrease the area of the exposure opening for each frame of the group so as to admit more or less light as may be required to give the best results.

2

Another object is the provision of individual micrometer adjustment means for varying the widths of the exposure openings to vary the quantity of light to the several frames of a group, whereby to simultaneously expose the several frames of each group to light rays from a printing lamp so that each frame will receive the required amount of light.

Another object is to provide a manually operated clutch in the driving mechanism for the film advancing means, whereby said film advancing means may be disconnected from the driving mechanism, whereby the negative film may be manually advanced or retracted, and one of the objects is the provision of safety means between said clutch and the clutch for starting and stopping the main drive means of the machine except when said clutch for the film driving mechanism is in fully clutched position.

Another object is the provision of means whereby to facilitate the threading of the positive and negative films through the film guiding devices and film advancing devices.

Another object is the provision of manually operated means for actuating the light controlling gate.

With these and other objects and advantages in view, this invention consists in the several novel features of construction, arrangement and combination of parts hereinafter fully set forth and more particularly defined in the appendant claims.

The invention is clearly illustrated in the drawings accompanying this specification, in which:

Fig. 1 is a front elevation of a film printing machine embodying a simple form of the present invention;

Fig. 2 is a plan thereof;

Fig. 3 is a vertical cross section thereof taken on the line **3—3** of Fig. 2;

Fig. 4 is a vertical longitudinal section taken substantially on the line **4—4** of Fig. 1;

Fig. 5 is a detail side elevation of certain members of the drive mechanism of the machine with one of the upright supporting plates of the frame structure partly broken away to illustrate parts that would be otherwise hidden from view;

Fig. 6 is a detail view partly in side elevation

and partly in vertical longitudinal section taken substantially along the line 6—6 of Fig. 3;

Fig. 7 is a detail horizontal section taken substantially on the line 7—7 of Fig. 5;

Fig. 8 is a detail vertical cross section taken substantially on the line 8—8 of Fig. 7;

Fig. 8a is a sectional view of the clutch shown in Fig. 8 looking in an upward direction and illustrating a certain shoe and lock bolt seen in Fig. 8.

Fig. 9 is a detail view partly in front elevation and partly in vertical cross section of the printing light housing and fogging light housing taken substantially on the line 9—9 of Fig. 4.

Fig. 10 is a detail vertical longitudinal section taken substantially on the line 10—10 of Fig. 9;

Fig. 11 is a view partly in side elevation and partly in vertical longitudinal section illustrating means for raising and lowering certain film guiding idlers;

Fig. 12 is a view partly in plan and partly in section illustrating the light controlling gate, certain plates being broken away in this view to illustrate parts therebelow;

Fig. 13 is a detail horizontal section taken substantially on the line 13—13 of Fig. 1;

Fig. 14 is a detail side elevation of certain clutches and a clutch actuating means with the frame structure of the machine shown in section;

Fig. 15 is a detail vertical cross section taken on the line 15—15 of Fig. 14, and,

Fig. 16 is a diagrammatic view illustrating the electric circuits of the machine.

Briefly the machine comprises means for guiding and advancing the negative and positive films through a printing zone where the positive film is printed from the negative one, and it embodies a printing light to which the frames of each group are simultaneously exposed. Manually adjustable light control slides are provided for controlling the amount of light projected upon the film so that each frame of each group may be exposed to more or less light as is required to obtain the best results.

Cam actuated mechanism is provided for reciprocating a light controlling gate in timed relation to the advancement of the films, and a fogging light actuating means is provided for raising the fogging light housing during the intervals that the films are being advanced, and an electric switch mechanism is provided for closing the circuit to the fogging light lamp during the printing intervals whereby certain strips or bars between successive frames are made more or less opaque.

Manually operated mechanism is provided whereby the negative film may be advanced or retracted to bring any desired group of frames into printing position, and means is also provided for manually manipulating the cams which actuate the light controlling gate, the fogging light housing and the electric switch for the fogging light. Means are also provided for the continuous operation of the machine from one end of the film strip to the other end, and automatic clutch mechanism is provided for stopping the operation of the machine at the conclusion of each cycle of operation for printing a group of frames.

Referring now to said drawings which are merely illustrative of one embodiment of the invention, a frame structure is provided upon which the several instrumentalities are mounted and, as shown, said frame comprises upper horizontal, longitudinal and transverse frame members 1, 2 (see Figs. 2 and 3) and lower horizontal, longitudinal and transverse frame members 3, 4 with the upper and lower frame members connected at their corners by upright frame members 5. These frame members are rigidly secured together at the corners to provide a substantial frame structure.

Mounted upon the front end of the frame structure is a panel 6 (see Fig. 1) upon which various instruments are mounted. Secured to and extending up from the front upper frame member 2 is a bracket 8 which supports an upright bar 7 in which bracket and bar is journaled a spindle 9 that carries the positive film reel 10. A swingable arm 11 depends in front of the spindle 9 and prevents the reel from becoming disengaged from the spindle. The reel 10 carries the unprinted positive film 12. Suitable friction means 9a is provided for the spindle so as to prevent the film from being unwound too rapidly. Removably mounted upon a driven spindle 13 is a reel 14 upon which the printed positive film is rewound. As shown, the film 12 runs from the reel 10 over suitable idlers 15, 16, 17, 18 and over a drive sprocket 19 and thence through the printing zone of the machine and around idlers 20, 21 and a driven sprocket 22 to the reel 14.

Removably mounted on a driven spindle 23 is a reel 24 which carries the negative film 25. The negative film passes around idlers 26, 27, 28 and a driven sprocket 29 and thence through the printing zone underneath the positive film; thence around idlers 30, 31, 32 and a driven sprocket 33 to a reel 34 which is removably mounted upon a driven spindle 35.

As will be hereinafter explained, the sprockets 19, 22 and 29, 33 are driven synchronously at equal speed by suitable gearing, so that the positive and negative films are advanced simultaneously in an intermittent manner and permitted to remain stationary during the printing intervals.

The superimposed portions of the positive and negative films pass between a light controlling gate 36 (see Figs. 1, 4, 9, 10 and 12) and a fogging lamp housing 37, the latter being reciprocated vertically to clamp the positive and negative films together during the printing intervals and to release them when they are to be advanced. Figs. 1 and 4 show the fogging lamp housing in raised position, and Figs. 9 and 10 show it in lowered position. Below the gate 36 is a printing light lamp housing 38 which is mounted on the panel 6 and contains a light source here shown as comprising an incandescent electric lamp PL.

The upper end of the lamp housing 38 is formed with a hollow forwardly extending boss 39, and slidably mounted in the upper end of the lamp housing and in the boss is a reciprocating light controlling gate 36, the inner end of which is connected by ears 40 to a rod or bar 41 which is slidably mounted in a bearing box 42, mounted on a frame bar 42', carried by upright plates 62, which are secured to and extend up from lower members of the frame structure. The rod or bar 41 has a roller 43 journaled upon its rear end, which roller cooperates with a cam groove 44 of the hereinafter described cam block 45 to reciprocate the gate 36. Rotation of the cam block 45 through one complete revolution causes the light controlling gate to be reciprocated back and forth once, whereby the films are exposed to the printing light PL during the greater portion of the period of reciprocation of the gate.

The gate has an exposure opening 46 inter-

mediate its ends which opening is partially covered by a fixed shield 47 fastened to the gate as by screws. Slidably mounted in the gate are several slides 48 (three being shown). These slides are disposed side by side and to each is secured a shield 49 which projects partially over the exposure opening 46 and cooperates with the fixed shield 47 to define the width of the effective exposure opening between the shields, whereby more or less light may pass from the printing light lamp to the individual frames of each group on the negative film which is in printing position.

In Figs. 9 and 12 the reference characters 38*a* designate side walls of the printing light housing, and 38*x* inwardly projecting flanges upon which the gate 36 slides; 36*a* designates the front top wall of the gate; 36*b* the front bottom wall thereof; 36*c* the side walls of the gate, and 36*d* the rear or main body of the gate. The side walls are screwed or otherwise fastened to the front wall 50 and the body 36*d*, and to the side walls are screwed or otherwise fastened filler blocks 36*e* that are interposed between the side walls and the outermost slides 48. The top and bottom walls are fastened to the filler blocks as by screws.

Secured to the tops of the side walls 38*a*, and covering the entire cavity containing the gate 36, is a plate 38*b* of generally rectangular form which is formed with exposure openings 38*c*, three being shown and separated by narrow cross bars 38*d*. The margins of the openings 38*c* provide "frames" for framing the frames of each group of impressions on the negative film.

Secured to the plate 38*b* at one side of the exposure openings 38*c* is a guide bar 38*e* against one edge of which one edge of the films run, and adjacent the opposite side of the exposure openings are spring pressed film guide members 38*f* and 38*g* that bear against the opposite edges of the films. The guide members 38*f*—38*g* are carried by a bar 38*h* and a block 38*i* fastened to the plate 38*b* as by screws. The plate 38*b* (see Fig. 10) and fogging light housing 37, together with the guides 38*e*, 38*f* (see Fig. 12), serve as a film gate through which the films are advanced in superimposed position.

At one side the printing lamp housing is formed with a viewing light housing 180, in which is contained an electric lamp VL, mounted in a lamp socket 181 fastened in the housing. The plate 38*b* extends above the open top of the housing 180 and is formed with viewing openings 182 spaced by a bar 183 and below the opening 182 is or are one or more red or green transparent plates 184 through which the negative film may be viewed. The last frame of one group and the first frame of another group are visible through these openings.

Threadedly mounted in the front wall 50 of the gate are adjustment screws 51, 52, 53, one for each slide, and connected thereto by blocks 54 that lie in grooves in the slides and engage in reduced neck portions of the screws. On the outer ends of the screws are secured knurled knobs 55 by which they are manipulated. Secured in the front wall 50 are sleeves 52*a*, through which the screws extend and on the cylindrical faces of the sleeves are graduation marks which cooperate with pointers or arrows on the knobs 55 to indicate the widths of the exposure openings between the fixed and movable shields. The screw connections with the slides provide a micrometer adjustment whereby the attendant may know with certainty the exact widths of the effective exposure openings between the fixed and movable shields.

The printing light PL is mounted in a suitable socket 56 contained in the lamp housing and a door 57 is provided in one wall of the lamp housing in order to obtain access thereto. A translucent light diffusing plate 58 extends across the interior of the lamp housing and serves to diffuse the light projected from the printing lamp. A door 59 is provided in a wall of the lamp housing for the purpose of obtaining access to the light diffusing plate.

Above the lamp housing is the fogging light housing 37 which is raised by a lever 60 when the films are to be advanced and is lowered into contact with the positive film when the exposures are made. The lever 60 is rotatably mounted upon a rod or shaft 61 carried by upright supporting plates 62, and one arm of said lever is connected to the fogging light housing unit by a pin which extends through ears 63 formed on a cross bar 64 which is connected with the lamp housing, as will be hereinafter described.

The other arm of the lever 60 has a roller 65 journaled thereon, which roller cooperates with the hereinafter described cam block 66 to raise and lower the fogging light housing.

The fogging light housing is mounted upon two upright rods 67 by ears 68 and said rods are secured to, and extend between, lugs 70 that extend out from the panel 6. The cross bar 64 is provided with bosses 69 through which the rods 67 extend, and coiled compression springs 71 are interposed between the bosses 69 and ears 68 and function to yieldingly depress the fogging light housing. The fogging light housing is suspended from the crossbar 64 by headed pins 64′ secured to the housing with their heads resting on the cross bar. At its bottom the fogging light housing is formed with a rectangular flanged neck 72, the width of which neck corresponds with the width of the film, and its length is slightly greater than a group of frames.

The fogging light FL is mounted in a lamp socket 73 supported in the lamp housing 37 and a light diffusing plate 74 is interposed between the lamp and the opening in the neck to diffuse the light rays. A door 75 provides access to the interior of the lamp housing.

To the bottom face of the flange is secured a fogging plate 185 which is of the same dimensions as the flange and contains transverse slots 186 that register with the bars 38*d* of the plate 38*b*. In the neck are wider slots 187 through which light rays from the fogging light pass to the slots 186. If desired an aperture plate 188 supported by this lamp housing and by a T-shaped bar 189 may be employed below the diffusing plate 74 to divide the lower part of the housing into two separate light chambers.

When the films have been advanced to bring a group of frames into printing position, and the fogging light housing has been lowered, the circuit to the fogging light FL is closed, the lamp is illuminated and the rays of light are projected through the slots 186 and upon the parts of the positive film therebelow, whereby when the positive film has been developed, more or less opaque strips or bars will appear between the several frames.

The purpose of this is to aid an attendant in framing the positive film in a projector and also to prevent the edge portions of the projected pictures from having a halo about them.

A cam operated electric switch 80 (see Fig. 5) is provided for controlling the timing of the illumination of the fogging light. The contacts of said switch are opened and closed by a pivoted switch arm 81 that has a roller 82 on its free end that runs on the cam edge of a cam block 3. The major portion of the cam edge is composed of two concentric circular faces 84, 85, but of different radii and connected by cam edges 86, the construction and arrangement being such that while the roller 82 runs on the circular edge 84 the contacts of the switch are closed and the circuit to the fogging light is closed, and when the roller runs on the circular edge 85 the contacts are open and the fogging light is extinguished. The timing is such that during the printing intervals the fogging light is illuminated and when the films are being advanced the fogging light is extinguished.

Fig. 5 illustrates the three cam blocks with the parts in neutral position; namely, with the fogging light housing raised, the fogging light switch in "off" position and the light controlling gate at the end of its outward stroke with the light from the printing lamp cut off by the fixed shield 47 of the light controlling gate.

Mounted on a base 87*a* carried by lower frame members 4*a* of the frame structure is an electric motor 87 (see Figs. 2 and 4) having a suitable speed reducing gearing 88 from which extends the main drive shaft 89 of the machine. To the main drive shaft is coupled a drive shaft 90 as by a shaft coupling 91. The drive shaft 90 is journaled in bearing brackets 93 mounted on one of the two upright supporting plates 62.

Mounted on the drive shaft 90 is a worm pinion 94 which meshes with a worm gear wheel 95 that is mounted on a countershaft 96 which is journaled in bearing bosses 97 carried by the upright supporting plates 62. Secured in one bearing boss is a bearing bushing 98 (see Figs. 7 and 8) which extends outward from the boss toward the adjacent side of the machine and on said bearing bushing are rotatably mounted a mutilated gear wheel 99 and one member 100 of a clutch 101 which is interposed between the counter-shaft 96 and the mutilated gear wheel 99. This mutilated gear wheel alternately drives the film advancing mechanism and reciprocates the light controlling gate mechanism and the fogging light housing. The clutch member 100 is rigidly fastened to the mutilated gear wheel 99 by rivets 102 or their equivalents and cooperates with a coacting clutch member 103 fastened upon the countershaft 96 as by a pin 104. The clutch 101 is of the conventional unidirectional clutch construction which may be set for continuously driving the mutilated gear wheel or for rotating the same through one complete revolution and then unclutching the clutch, whereby the mutilated gear wheel and all of the mechanisms driven by it will remain idle until the clutch is again reclutched. One purpose of this clutch is to permit the mechanism to feed the two films through the printing zone and permit printing from the entire negative film or to run off a test or trial positive film so as to enable the attendant to observe what corrections in the light intensity for the frames of the various groups of images are necessary in printing the finished positive film. During the operation of the machine the clutch may be clutched to drive the operating mechanism of the machine through one cycle of operation for printing a group of frames, and then automatically unclutched at the conclusion of the cycle of operation.

The clutch member 100 carries a notched retractable bolt 105 which is arranged to be thrust into any one of a number of sockets 106 in the clutch member 103. A retractable shoe 107, having a tapered edge 107*a*, cooperates with the bolt 105 to withdraw it from engagement in the socket in which it is engaged to thereby unclutch the clutch. The bolt is urged into the socket 106 by a coiled compression spring 105*a* seated in a recess in the clutch member 100 and bearing against the rear end of the bolt.

The shoe 107 is mounted upon an upright stem 114 slidably mounted in a post 115 secured to and extending upward from lower members of the frame structure. A coiled compression spring 116 seated in a recess in the post bears against the lower end of the stem 114 and yieldably urges it in an upward direction, which upward movement is limited by the bottom face 117 of a circumferential groove formed in the clutch member 100. Projecting from the stem 114 is a pin 118 which extends out through a slot in the post and is arranged to be depressed by the hereinafter described rocker lever 113 whereby to retract the shoe from engagement with the bolt 105.

The shoe 107 may occupy an operative position in which it retracts the bolt from the socket at the completion of a single rotation of the mutilated gear wheel, or it may stand in an inoperative position wherein the bolt passes freely by the shoe and permits continued rotation of the mutilated gear wheel and the parts driven thereby. The bolt is formed with a notch 105*b* in one side (see Figs. 8 and 8*a*), and when the shoe has been set into position for unclutching the clutch 101, the shoe is held against the bottom 117 of the circumferential groove as seen in Fig. 8, and the edge 105*c* of the notch encounters the tapered edge 107*a* of the shoe during the rotation of the clutch, and as a result the edge 105*c* rides along the tapered edge of the shoe and the bolt is thereby retracted and withdrawn from the socket 106 in which it was engaged. If the shoe is set for continuous operation, the stem 114 has been lowered sufficiently to move the shoe partly out of the groove and the bolt then merely passes above the shoe and is not affected thereby.

The shoe is set into its operative or inoperative position from a hand lever 108 disposed adjacent the panel 6 (see Fig. 1). The hand lever 108 is fastened to a rod 109 rotatably mounted in the panel 6 and in a post 110 secured to and extending up from lower frame members of the frame structure (see Figs. 5 and 7). On the end of the rod 109 is secured a crank arm 111 from which projects a stud or pin 112 which cooperates with the rocker lever 113 to depress the shoe 107. The stud or pin 112 is arranged to engage a cam end 119 of the rocker lever 113 when swung downward to thereby swing upward said cam end of the lever and thereby swing downward the other end of the lever, thereby depressing the pin 118 and therewith the stem 114 and shoe 107, and disengaging the shoe from the bolt 105. When the bolt is released the spring urges it towards the clutch member 103 and into one of the sockets 106 therein, thereby clutching the two clutch members together and causing the countershaft 96 to rotate the mutilated gear wheel.

If the crank arm 111 is held in its down position with the cam end of the rocker lever raised,

the clutch will remain clutched and the mutilated gear wheel and all of the mechanism driven therefrom will continue to operate until the crank arm is raised. This is done while running the positive and negative films through the machine for continuous operation.

However, the arm 108 may be swung down to retract the shoe 107 and immediately thereafter permitted to be raised, thereby allowing the spring 116 to lift the stem 114 and place the shoe 107 in a position to engage and retract the bolt 105 at the conclusion of a complete rotation of the mutilated gear wheel, thereby stopping the operative mechanism of the machine.

The hand lever 108 is provided with a spring pressed bolt 120 which engages in a hole 121 in the panel 6 (see Fig. 1) whenever the hand lever is swung into its down position for a continuous operation of the machine. The bolt is held in its retracted position by a pin 122 (see also Fig. 5) which strikes against the face of the hand lever when the machine is to be operated intermittently and thereby prevents the bolt from engaging in the hole 121. A hole 123 in the hand lever is arranged to receive the pin when the bolt is turned into registry with the hole. When in this position the spring projects the bolt and when it is in registry with the hole in the panel, the end of the bolt is thrust into the hole and the hand lever is positively held in down position.

On the rod 109 is mounted a rock lever 112*a*, one arm 112*b* of which is connected by a coiled tension spring 112*c* with a stationary element and functions to yieldably hold the rod 109 and the parts carried thereby in inoperative position as is seen in Figure 8, with the crank arm 111 swung against a stop pin 124. Safety means is interposed between the rod 109 and certain clutch mechanism which will be hereinafter described.

The mutilated gear wheel 99 has teeth upon 180 degrees of its circumference which teeth are arranged to mesh alternately with the teeth of two pinions 125, 126 so that during one complete revolution of the mutilated gear wheel, in one half of its revolution it rotates one pinion while the other pinion remains idle, and in the other half of its revolution it rotates the previously idle pinion and permits the other one to remain idle. Thus the pinions 125, 126 are each given one complete revolution each time they are rotated.

The pinions 125, 126 are mounted on countershafts 127, 128 journaled in bearing bosses carried by the upright plates 62 and are bolted or otherwise fastened to detents 129, 130 rigidly fastened to the countershafts 127, 128 by pins or the like which pass through hubs formed on said detents and through the shafts. The end edges of the detents are concaved along circular lines struck from the center of the countershaft 96 (see Fig. 5) and are arranged to engage the circular edge of a disc-like member 131 formed on the clutch member 100 and thereby positively prevent accidental rotation of the pinions 125, 126 and their shafts except when driven by the mutilated gear wheel.

The countershaft 128 actuates the light controlling gate mechanism and the fogging light housing actuating mechanism, and the countershaft 127 drives the film advancing mechanism through gearing and drive mechanism which will be presently described.

Mounted on one end of the countershaft 128 is a mitre pinion 132 (see Fig. 6) which meshes with a mitre pinion 133 mounted upon an upright shaft 134 journaled in a bearing bracket 135 carried by the upright plate 62. Coupled to the shaft 134, as by a shaft coupling 141, is an upright shaft 136 which is journaled in a bearing bracket 137 carried by the upright plate 62. Rigidly secured to the shaft 136 is a mitre pinion 138 which meshes with a mitre pinion 139 fast on the cam shaft 140 which is journaled in bearing bosses on the upright plates 62. Mounted on said cam shaft 140 are the three cam blocks 45, 66 and 83. The cam block 45 has the cam groove 44 which cooperates with the roller 43 carried by the rod or bar 41 to reciprocate the light controlling gate. The cam groove is shaped to reciprocate the light controlling gate back and forth once during each complete revolution of the cam shaft 140.

The cam block 66 raises and lowers the fogging light housing once during each revolution of the cam shaft. Its cam face is circular throughout its greatest extent and has a flattened portion 143 which cooperates with the roller 65 of the lever 60 to permit the roller 65 to move downward, thereby permitting the spring 144 to raise the forward end of the lever 60. The spring 144 is secured at one end to the forward end of the lever 60, and at its other end to a pin fastened in the frame structure of the machine (see Figure 4). The timing of the cam 66 is such that the fogging light lamp housing is raised during the intervals that the films are being advanced.

Film advancing mechanism

On one end of the countershaft 127 is a mitre pinion 145 which meshes with a mitre pinion 146 pinned, or otherwise rigidly secured to an upright shaft 147 which is journaled in bearings 148, 149, 150 carried by one of the plates 62.

Rotatively mounted in the bearing bracket 149 is a sleeve 151, the lower end of which is provided with a coupling member of a shaft coupling 152 for coupling the sleeve 151 to the shaft 147. To the sleeve 151 is pinned, or otherwise rigidly secured a spiral gear 153, and to the upper end of the shaft 147 is rigidly secured a spiral gear 154. Meshing respectively with the spiral gears 153 and 154 are spiral gears 155, 156 mounted respectively on shafts 157, 158 journaled in bearing bosses carried by the upright plates 62. On the other ends of the shafts 157, 158 are spiral gears 159, 160 (see Figs. 3 and 5).

The spiral gears 155, 156 mesh respectively with spiral gears 161, 162 pinned or otherwise rigidly secured to the shafts 33*a*, 22*a* for the negative film advancing sprockets 33, 29 (see Figs. 3 and 6), and the spiral gears 159, 160 mesh respectively with spiral gears 163, 164 pinned or otherwise rigidly secured to the shafts 29*a*, 19*a* for the positive film advancing sprockets 22, 19.

The film advancing sprockets are thus provided with drive gearing which rotates all four sprockets in unison and at the same peripheral speed. The several sprocket shafts are journaled in bearing brackets 166 which project laterally from the upright supporting plates 62.

Manual film advancing means

Means are provided for manually advancing and retracting the negative film 25 to bring any selected group of impressions thereon into register with the part of the positive film contained in the printing zone. Sometimes it is desirable to have certain pictures follow in sequence on the positive film and these impressions may be

variously located along the negative film, but with the present manual film strip advancing and retracting means any desired group may be readily placed in the printing zone.

In Figs. 1, 2 and 3 is shown a crank wheel 167 mounted on a shaft 168 journaled in a bearing boss 169 carried by one of the upright frame members. On the shaft 168 is mounted a gear wheel 170 which meshes with a pinion 171 fast on an extension 172 of shaft 157. By first unclutching the shaft 147 from the sleeve 151 the crank wheel may be turned, thereby rotating the negative film driving sprockets 29, 33 through the shaft 157, intermeshing spiral pinions 155, 161 and intermeshing pinions 159, 163. With the sleeve 151 for the pinion 153 unclutched from shaft 147, the sleeve with its pinion rotates freely on the shaft 147.

Manual drive means for the cams

It may be found convenient at times to manually operate the cam shaft 140 and therewith manually actuate the light controlling gate, the shifting mechanism for the fogging light housing and the fogging light electric switch, and means has been provided for this purpose which will now be described.

Rotatively mounted in a bearing boss 173 (see Figs. 2 and 3), carried by one of the upright frame members is a crank shaft 174, on one end of which is a hand crank 175 and on the other end a sprocket wheel 176. On one end of the cam shaft 140 is a sprocket wheel 177 driven from the crank shaft 174 by a sprocket chain 178 trained over said sprocket wheels 176, 177. By first unclutching the clutch 141 between the shafts 134, 136, the attendant may rotate the cam shaft 140 by turning the hand crank 175 and therewith rotate the several cam blocks and the mechanism actuated thereby.

Drive for the reels

The reels 14, 24 and 34 are rotated by a belt 190 (see Fig. 3) trained around a double sheave 191 mounted upon the shaft 90 and trained around idler sheaves 192, 193, 194, 195, 196, 197, and around a sheave 198 fast on the spindle 13 of the reel 14, and around a sheave 199 fast on the spindle 23 of the reel 24, and around a sheave 200 fast on the spindle 35 of the reel 34. The idler sheaves are carried by suitable brackets 201, 202, 203. The spindles for the reels extend through the panel 6 and are journaled in suitable bearings. The belt merely functions to prevent any slack in the two films while being paid out or rewound.

Clutch actuating mechanism

The clutch 141 is operated by a clutch lever 205 (see Fig. 3) and the clutch 152 is operated by a clutch lever 206 pivotally mounted on a support 206*a* (see Figs. 14, 15), a link 207 and a yoke-like member 208 connecting said lever with the shiftable member of the clutch. A dog or detent 209 pivotally mounted on the panel 6 above the lever 206 is arranged to be swung by a spring 209*a* over said lever whenever the lever is depressed, to thereby hold it down with the clutch unclutched until the dog is swung back from its engagement with the lever. Both the lever and dog have finger pieces 210, 211 extending through slots in the panel 6 whereby they may be actuated.

The shiftable clutch members of both clutches 141 and 152 are urged into clutching position by springs 212, 213 interposed between the bearing brackets 135, 148 and the shiftable clutch members. When the clutch lever 206 is released from the dog 209 the spring 213 moves the shiftable clutch member toward the other clutch member of clutch 152 so that the teeth thereof may become engaged with each other.

Safety means for the clutches

Safety means is provided for preventing actuation of the hand lever 108 for the main clutch 101 except when the clutches 141 and 152 are fully clutched. As shown, said safety means comprises an arm 214 (see Figs. 3, 6, 14 and 15) secured to a rod 208*a* upon which the yoke-like members 208 are fulcrumed, fingers 208*b* that undertie the yoke-like members 208 and are depressed thereby whenever the yoke-like members are swung down, a horizontally extending rod 215 pivotally connected to the lower end of the arm 214 and extending therefrom through holes in the upright plates 62 to a position slightly below the rod 109, and arranged, when in one position, to be struck by a pin or stud 216 carried by the bell crank lever 112*a* (see Fig. 5). A coiled tension spring 217 connected to the arm 214 and to a member of the frame structure serves to yieldingly draw the rod 215 toward the left, as viewed in Figs. 3 and 8. The rod 208*b* is rotatively mounted in brackets 208*c* carried by the plate 62.

When the clutches 141 and 152 are fully clutched, the end of the rod 215 adjacent the rod 109 occupies the position illustrated in Figs. 3 and 8, permitting the bell crank lever 112*a* to be swung down and thereby permitting the hand lever 108 to be swung down so as to retract the shoe 107 and permit the clutch 101 to couple the shaft 96 with the mutilated gear 99.

When, however, either clutch 141 or 152 is unclutched, the arm 214 is swung to the right and the rod 215 is moved to the right, as viewed in Figs. 3 and 8, bringing the end of the rod 215 underneath the pin or stud 216 of bell crank lever 112*a* and blocking the downward movement of said bell crank lever and consequently preventing an attendant from moving the hand lever 108, starting the mutilated gear wheel 99 and the mechanisms actuated thereby, while the clutch 141 or 152 remains unclutched.

Film guiding means

Referring now to Fig. 1, means are provided for facilitating the threading of the films through the printing zone and for accurately and precisely registering the opaque strips or bars of the negative film with the bars 38*d* of the plate 38*b*.

As has been explained, the positive film passes underneath idlers 18, 20 (see also Fig. 9). These idlers are carried by vertically movable slides 216 guided in vertical guideways 217 (see Fig. 11), and to said slides 216 is connected a yoke-like lever 218, by pins 219. Projecting laterally from each arm 220 of the lever 218 is a pin 221 which travels in L-shaped slots 222 (see Fig. 11) formed in plates 223 carried by the panel 6. When the lever 218 stands in the solid line position shown in Fig. 11 the slides 216 are in their down position and consequently the idlers 18, 20 are in their lowermost position. When it is desired to raise the idlers, as for instance when threading the films through the printing zone, the lever 218 is swung forward to one of the dotted line positions indicated in Fig. 11, thereby raising the

idlers. A stop pin 224 (see Fig. 9) mounted in a lug 225 carried by the panel 6 lies in a position to be engaged by one of the slides 216 to thereby limit the upward movement of the idlers 18, 20. When this stop pin is retracted out of the path of movement of the slide 216, the hand lever may be swung into the lowermost dotted line position seen in Fig. 11 with the idlers raised considerably above their down position.

For accurately locating the opaque strips or bars of the negative film in register with the bars 38*d*, the idler 31 is mounted on a slide 226 (see Fig. 1) which is slidably mounted on a guide 226*a*. A threaded rod 227 rotatively mounted in suitable bearings extends through the slide and has a knurled wheel 228 at one end whereby the threaded stem 227 may be rotated to raise or lower the slide 26 and therewith the idler 31. By lowering the idler, the negative film is drawn towards the right, as viewed in Fig. 1, and by raising the idler, the film is drawn towards the left by the hereinafter described weighted arm 229. By viewing the negative through the openings 182 (see Fig. 12) the attendant may observe when the opaque strips or bars of the negative film are in register with the bar 183 which occupies a definite location relative to the bars 38*d*.

The idlers 16, 27 are mounted upon weighted arms 229 pivotally mounted upon the panel 6, and these weighted arms serve to hold the positive and negative films in a fairly taut condition.

Associated with the sprockets 19, 22, 29, 33 (see Fig. 1) are idlers 230 which positively hold the films in engagement with the sprockets. To facilitate threading the films between the sprockets and idlers 230, the idlers for each sprocket are mounted upon a retractible arm 231 (see also Fig. 13) which is provided with a hub 232 that is rotatably mounted on a stud 233 which is provided with a knurled knob 234 and is rotatively mounted upon a pin 235 eccentrically disposed with respect to the axis of the stud 233 and secured to the panel 6. A threaded pin 236 is secured in the stud and has a reduced end which engages in a groove in the pin 235 and prevents accidental disconnection between the arm 231 and the pin 235. By rotating the knurled knob 234 upon the eccentric pin, the arm 231 and therewith the idlers 230 are retracted from the sprocket permitting the film to be readily trained around the sprocket.

Safety light

The safety light SL is mounted in a housing 237 carried by a bracket 238 secured to and extending up from the panel 6. In the lower open side of the housing 237 is contained a red or green panel 239. This safety light furnishes the only illumination for the attendant, since the machine is operated only in a dark room.

The electric circuits

The electric circuits for the several electric lamps and electric motor are illustrated diagrammatically in Fig. 16. In this figure the safety lamp is shown at SL, the printing lamp at PL, the fogging lamp at FL, the viewing lamp at VL, and the motor at M.

The main electric conductors seen at 240, 241 run from a suitable source of electric energy. The conductor 240 leads to a constant voltage stabilizer 242 and from the same, conductor 243 leads to a transformer 244; conductor 245 leads from the transformer to a fogging light switch 246, and from the switch, lead 247 runs to the return conductor 241.

From the conductor 240 a conductor 248 leads to the safety lamp SL and from the safety lamp, conductor 249 leads to the safety light switch 250, from which the return conductor 241 leads back through main switch 251 to the main line.

In the main return conductor 241 is the main switch 251 which controls all of the circuits. This main switch must be closed before any of the other switches can close the circuits to the various electrical devices. The conductor 243 also leads to a resistance coil R and from said coil, a conductor 252 leads to a rheostat 253, and from said rheostat a conductor 254 leads to a second rheostat 255, from which a conductor 256 leads to the printing light lamp PL, and from said lamp a conductor 257 leads to the printing light switch 258, and from thence a lead 259 runs to the return conductor 241. With the two rheostats in series the intensity of the printing light PL can be minutely regulated.

From one terminal of the secondary winding of the transformer 244 a line 260 leads to the movable contact 261 of a variable resistance coil 262, and from said coil a line 263, 264 runs to the fogging light FL and from thence a lead 265 runs to the fogging light switch 80, and from said switch a lead 265 runs to the other terminal of the secondary winding of the transformer. The conductor 260 also runs to a high-low switch 261, and from said switch through conductors 262 and 264 to the fogging light FL, and from said light through conductor 265, fogging light switch 80 and conductor 265 to a terminal of the secondary winding of the transformer.

When the low-high switch 261 is open, the circuit for the fogging light lamp is from the secondary winding of the transformer, through the variable resistance 262 leads 263, 264, the fogging light FL, the fogging light switch 80 and back to the secondary winding of the transformer. The amount of resistance may be varied at will and when this resistance is cut in, the intensity of the fogging light is reduced. When, however, the high-low switch is closed, the circuit from the secondary winding of the transformer is shorted by the closed switch and the circuit is directly through the conductor 260, low-high switch 261, conductors 262, 264, to the fogging light FL, through switch 80 and back to the secondary winding of the transformer. From the above it is apparent that the intensity of the fogging light may be regulated from a bright light to a very dim one, depending upon how opaque the stripes or bars which divide the frames shall be.

The circuit for the viewing light runs from the main conductor 240 through conductor 266 to the viewing light lamp VL, and from said lamp, conductor 267 runs to the viewing lamp switch 268, and from thence by lead 269 to the return conductor 241. The circuit for the motor runs from conductor 240 through conductor 240*a* to the motor M, thence through conductor 240*b* to the motor switch 251*a* and back to the conductor 241.

A suitable register 270 (see Figs. 1 and 3) is provided for registering the number of groups of frames printed on the positive film, which register indicates the numerical order of the groups of frames printed. The register may be driven from the shaft 157 of the negative film driving mechanism by a sprocket chain 271

trained around sprocket wheels on said shaft and the drive shaft of the register.

Operation

Referring now to Fig. 5, in a cycle of operation of the machine and starting with the light controlling gate located at the end of its outward stroke and the fogging light housing in its up position; the cams 45, 66 and 84 are then idle.

At this point the teeth of the mutilated gear wheel 99 run off the teeth of the pinion 126, leaving said cams stationary and the teeth of the mutilated gear wheel 99 run into mesh with the teeth of the pinion 125, thereby starting the film advancing mechanism and simultaneously advancing the positive and negative films one step. At that point the multilated gear wheel runs out of mesh with the pinion 125 and into mesh with the pinion 126 which then begins to rotate the cam shaft 140 and therewith the cams thereon, thereby lowering the fogging light housing, closing the fogging light switch and reciprocating the light controlling gate once, thereby exposing the films to the printing light, opening the fogging light switch and returning the fogging light housing to its raised position, when the clutch pin, seen at 105 in Fig. 5 encounters the shoe 107 and is retracted unclutching the clutch 101 and stopping the machine, except when the machine is set to run continuously in which case the same cycle of operation is repeated until the machine is stopped.

The operation of the film printing machine has been explained in connection with the description of its construction. Briefly the positive and negative films are threaded from the reels 10, 24, through the guiding means and film advancing means and through the printing zone, as is indicated in Fig. 1, and the ends attached respectively to the reels 14 and 34.

The main switch is closed and the switches for the motor and various lamps are closed. To run a test film through the machine the hand lever 108 is swung down and the bolt 120 thereof allowed to be projected into the hole 121 in the panel 6, thereby starting the machine and permitting it to run continuously until the entire positive film has been printed. The motor may then be stopped or the hand lever 108 swung back into inoperative position.

The positive film is then developed and the attendant examines the many groups of frames on the film strip and may make notations of the necessary corrections for exposure of the individual frames. These notations may be made on a chart containing numbers of the individual groups of frames.

The negative film may then be manually rewound upon the reel 23 and an unprinted positive film is threaded through the machine as before. In printing the positive film for exhibition purposes the machine may be set for continuous operation, or only one group of frames may be printed at a time and then the machine stopped. Before printing each group the attendant observes the notations with respect to the group and sets the individual slides 48 by means of the micrometer adjustment so as to provide the exact widths of exposure opening between the fixed shield 47 and the movable shields 49 (see Fig. 12) to obtain the required amount of exposure for each individual frame. When the machine is set to run continuously the attendant sets the movable shields to obtain the proper amount of exposure for each frame.

To have the machine run through one complete cycle of operation for printing a group of frames the hand lever 108 is swung down and immediately released, thereby permitting the clutch 101 to be clutched and automatically unclutched at the conclusion of a single cycle of operation for printing one group of frames.

If it is desirable to have certain of the groups follow each other in sequence the attendant notes the number of the group or groups on his chart and unclutches the clutch 152, by depressing the lever 206 (see Fig. 15). The attendant advances or retracts the negative film by manipulating the crank wheel 167, thereby bringing the selected group of frames into printing position in the printing zone. The attendant then reclutches the clutch 152 and swings down the hand lever 108 and releases it causing the machine to operate through one complete cycle of operation for printing a group of frames.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In a film printing machine for printing films for displaying multi-colored pictures from negatives having groups of impressions thereon displayed in individual frames, the combination of a light source to which said films are exposed while stationary, a reciprocable light controlling gate disposed between the films and the light source, said gate having adjustable exposure opening shields therein, one for each frame of a group of impressions, means exteriorly of the machine for adjusting said shields and means to reciprocate the gate to simultaneously expose several frames of the films through said sections to the source of light.

2. In a film printing machine for printing films for displaying multi-colored pictures from negatives having groups of impressions thereon, the combination of a light source to which said films are exposed while stationary, a reciprocable light controlling gate disposed between the films and the light source, said gate having an exposure opening divided into sections through which light rays from said source are simultaneously projected upon several frames of the films, means having exteriorly located manually actuatable members to vary the sizes of the various sections of said exposure opening, and means for reciprocating said gate to bring the exposure opening into the path of the light rays projected on the films, and manually operated actuating means to operate said gate.

3. In a film printing machine for printing films for displaying multi-colored pictures from negatives having groups of impressions thereon displayed in individual frames, the combination of a film gate through which superimposed positive and negative films are advanced in a step by step manner, a source of light to which the films are exposed while stationary, a reciprocable light controlling gate for exposing several frames of the films to the light source, gate reciprocating mechanism, said light controlling gate having exposure sections, one for each frame of a group of impressions, and means exteriorly of the machine to

individually adjust said sections to admit more or less light to any frame.

4. In a film printing machine for printing films for displaying multi-colored pictures from negatives having groups of impressions thereon, a film supporting plate having several rectangular openings therein divided by transverse bars, a light source disposed at one side of said plate, a fogging light housing, means to retract said housing and to contact it with the positive film, a fogging light in said fogging light housing, said housing having a face adapted to cover all the openings in said plate and being provided with transversely extending slots which register with the bars that separate the openings in the plate, said slots exposing the positive film to rays of light from said fogging light, whereby to render the exposed portions of the positive film more or less opaque.

5. In a film printing machine for printing films for displaying multi-colored pictures from negatives having groups of impressions thereon, a film supporting plate having spaced rectangular openings therein separated by transverse bars, means for advancing a positive and a negative film over said plate in a step by step manner, a fogging light housing having an end face adapted to be contacted with said positive film, a fogging light in said housing, means for retracting and projecting said housing in timed relation to the movements of the films, said end face being provided with transverse slots of substantially the same width as the bars of said plate, through which slots, rays of light from the fogging light may pass to the positive film, whereby to render the parts of the film exposed to the light through said slots more or less opaque.

6. In a film printing machine and in combination, means for guiding positive and negative films through a printing zone, a printing lamp disposed at one side of the negative film, pressure means to hold the two films in close contact, a reciprocable light controlling gate having a plurality of adjustable shields providing variable exposure openings interposed between the printing lamp and the negative film, means exteriorly of the machine to individually adjust said shields and means for reciprocating said gate across the light rays projected from the printing lamp to the film.

7. In a film printing machine and in combination, means for guiding positive and negative films through a printing zone, a printing lamp disposed at one side of the negative film, pressure means to hold the two films in close contact, a reciprocable light controlling gate having a plurality of adjustable shields providing exposure openings interposed between the printing lamp and the negative film, individual means exteriorly of the machine to vary several effective areas of said exposure openings, and mean to reciprocate the gate across the light rays projected from the lamp to the film.

8. In a film printing machine and in combination, means for guiding a positive and a negative film through a printing zone in superimposed position, a printing lamp disposed at one side of the negative film, pressure means to hold the two films in close contact, a reciprocable light controlling gate interposed between the printing lamp and the films, said gate having variable exposure sections through which several frames of the films are simultaneously exposed to the light rays projected by the lamp, means to individually vary the exposure openings of individual sections of the gate including actuating means exteriorly of the machine, and means to reciprocate said gate during the printing intervals.

9. In a film printing machine and in combination, means for guiding a positive and a negative film through a printing zone in superimposed position, a printing light disposed at one side of the negative film, pressure means to hold the two films in close contact, a reciprocable light controlling gate interposed between the printing light and the films, said gate having a single exposure opening with individual exposure sections, one for each frame of a group of impressions on the negative film, means exteriorly of the machine to individually adjust each section, whereby to increase or diminish the amount of light projected by the printing light upon the films and means to reciprocate said gate during the printing intervals.

10. In a film printing machine for simultaneously printing a group of impressions from a negative to a positive film and in combination, means for guiding a positive and a negative film through a printing zone in superimposed position, a printing light disposed at one side of the negative film, pressure means to hold the two films in close contact, a reciprocable light controlling gate interposed between the printing light and the films, said gate having a stationary shield and several adjustable shields cooperating with said stationary shield to provide exposure openings of different widths, means exteriorly of the machine to adjust said adjustable shields to regulate the widths of said exposure openings, and means to reciprocate the gate during the printing intervals.

11. In a film printing machine and in combination, film guiding and advancing means for intermittently advancing a positive and a negative film is superimposed position through a printing zone, a light controlling gate, an intermittently rotated cam shaft, a cam block thereon having a cam groove therein a roller traveling in and actuated by said cam groove, operable connections between said roller and the gate for reciprocating the light controlling gate, a reciprocating fogging light housing disposed on the positive side of the films, a cam block on said cam shaft, a roller actuated by said cam block and operable connections between said last mentioned roller and the fogging light housing, for reciprocating the fogging light housing.

12. In a film printing machine and in combination, a power driven shaft, a mutilated gear wheel thereon, a clutch between said shaft and mutilated gear wheel for rotating the latter, automatic means to unclutch said clutch at the end of each complete revolution of the mutilated gear wheel, pinions, one disposed diametrically opposite the other on opposite sides of the mutilated gear wheel and adapted to be rotated thereby in alternate fashion, film advancing mechanism driven by one of said pinions for intermittently advancing positive and negative films in unison one step at a time, a light source disposed on the negative side of said films, a reciprocating light controlling gate for exposing a section of the films to said light source, and actuating mechanism for said gate driven from the other pinion for actuating said gate during the idle periods of the film advancing mechanism.

13. In a film printing machine and in combination, a power driven shaft, a mutilated gear wheel thereon, a clutch between said shaft and mutilated gear wheel for rotating the latter, clutch releasing means and a manually operated

means for holding said clutch, a releasing means inactive whereby the machine is operated continuously, pinions, one disposed diametrically opposite the other on opposite sides of said mutilated gear wheel and adapted to be rotated thereby in alternate fashion, film advancing mechanism driven by one of said pinions for intermittently advancing a positive and a negative film in unison one step at a time, a light source disposed on the negative side of the films, a reciprocating light controlling gate for exposing a section of the films to said light source, and actuating mechanism for said gate driven from the other pinion for actuating said gate during the idle periods of the film advancing mechanism.

14. In a film printing machine and in combination, a power driven shaft, a mutilated gear wheel thereon, a clutch between said shaft and mutilated gear wheel for rotating the latter, automatic means to unclutch said clutch at the end of each complete revolution of the mutilated gear wheel, pinions, one disposed diametrically opposite the other on opposite sides of said mutilated gear wheel and adapted to be rotated thereby in alternate fashion, countershafts driven by said pinions, upright shafts and gearing between each countershaft and an upright shaft, a pair of sprockets for a positive film and a pair of sprockets for a negative film, gears for rotating said sprockets, and other gears meshing with said first mentioned gears, and driven from one of said upright shafts.

15. In a printing machine and in combination, a film supporting plate having exposure openings therein separated by cross bars, film guiding and advancing means for advancing a negative film strip over said plate, a weighted idler under which said film is trained, said idler being disposed at one side of said plate and a vertically movable idler on the other side of said plate under which the negative film is trained, and a vertically movable slide carrying the vertically movable idler for raising and lowering said last mentioned idler whereby to position the negative film over the plate with respect to the bars which separate the exposure openings.

16. In a film printing machine, a film supporting plate having exposure openings therein, means for advancing a positive and a negative film across said plate, idlers, one disposed at each side of said exposure openings for guiding the positive film across said exposure openings and vertically movable slides carrying said idlers, and levers, one connected to each slide for raising said idlers to facilitate the threading of the film thereunder.

17. In a film printing machine and in combination, a power driven drive shaft, power driven film advancing means for intermittently advancing a positive and a negative film through a printing zone, means to expose the films to a printing light while the films are stationary, a manually operated main clutch between the drive shaft and said power driven film advancing means and said film exposing means, a clutch in the film advancing means to render said film advancing means active or inactive, manually operated means to advance and retract the negative film while said power driven film advancing means is inactive, an oscillatory arm actuated by the clutch of the film advancing means, a reciprocatory rod actuated by said arm, a rotatory rod for actuating the main clutch and having a crank arm thereon, said reciprocatory rod and crank arm cooperating to prevent actuation of the main clutch while the clutch of the film advancing means is in unclutched condition.

18. In a film printing machine for printing films for displaying multicolored pictures from negatives having groups of impressions thereon displayed in frames, the combination of a printing light housing having a plate at its upper end, provided with a plurality of exposure openings separated by narrow bars, a printing light in said housing, a light controlling gate slidably mounted in said housing immediately below said plate, means for reciprocating said light controlling gate, said gate having an exposure opening divided into sections corresponding with the exposure openings in the plate, means exteriorly of the machine to individually control the sizes of said sections whereby more or less light in each section may pass through its associated exposure opening, and means to hold a positive and negative film in close contact with said plate.

FREDERIC E. OAKHILL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
708,303	Bianchi	Sept. 2, 1902
731,282	Casler	June 16, 1903
849,184	Auld	Apr. 2, 1907
970,199	Dyer et al.	Sept. 13, 1910
1,161,910	Ulyssee	Nov. 30, 1915
1,260,590	Stineman	Mar. 26, 1918
1,283,087	Comstock	Oct. 29, 1918
1,335,860	Shapiro	Apr. 6, 1920
1,409,628	Wescott	Mar. 14, 1922
1,425,450	Chanier	Aug. 8, 1922
1,425,461	Evans	Aug. 8, 1922
1,567,543	Forten	Dec. 29, 1925
1,583,108	Ball	May 4, 1926
1,591,118	Friess	July 6, 1926
1,614,241	Howell	Jan. 11, 1927
1,634,297	Miller	July 5, 1927
1,738,095	Carleton	Dec. 3, 1929
1,805,768	Howell	May 19, 1931
1,840,524	Peck	Jan. 12, 1932
1,863,051	Howell	June 14, 1932
2,008,904	Fishback et al.	July 23, 1935
2,019,260	Howell	Oct. 29, 1935
2,019,929	Papke	Nov. 5, 1935
2,045,549	Freedman	June 23, 1936
2,047,474	Howell	July 12, 1936
2,073,224	Ross	Mar. 9, 1937
2,074,139	Adler	Mar. 16, 1937
2,077,486	Lootens	Apr. 20, 1937
2,098,602	Threadgold	Nov. 9, 1937
2,119,200	Campbell	May 31, 1938
2,122,689	Jones	July 5, 1938
2,153,214	Tondreau	Apr. 4, 1939
2,158,001	Dazey	May 9, 1939
2,164,748	Loomis et al.	July 4, 1939
2,173,866	Terwilliger	Sept. 26, 1939
2,231,470	Hausman	Feb. 11, 1941
2,241,462	Kadel et al.	May 13, 1941
2,260,530	Ludwig	Oct. 28, 1941
2,271,572	Rackett	Feb. 3, 1942
2,341,889	Wittaker	Feb. 15, 1944
2,380,962	Garraway	Aug. 7, 1945

FOREIGN PATENTS

Number	Country	Date
17,605	Great Britain	Aug. 31, 1905