Nov. 25, 1930. A. S. HOWELL 1,782,570

STRIP PERFORATING MACHINE

Filed July 6, 1927 4 Sheets-Sheet 1

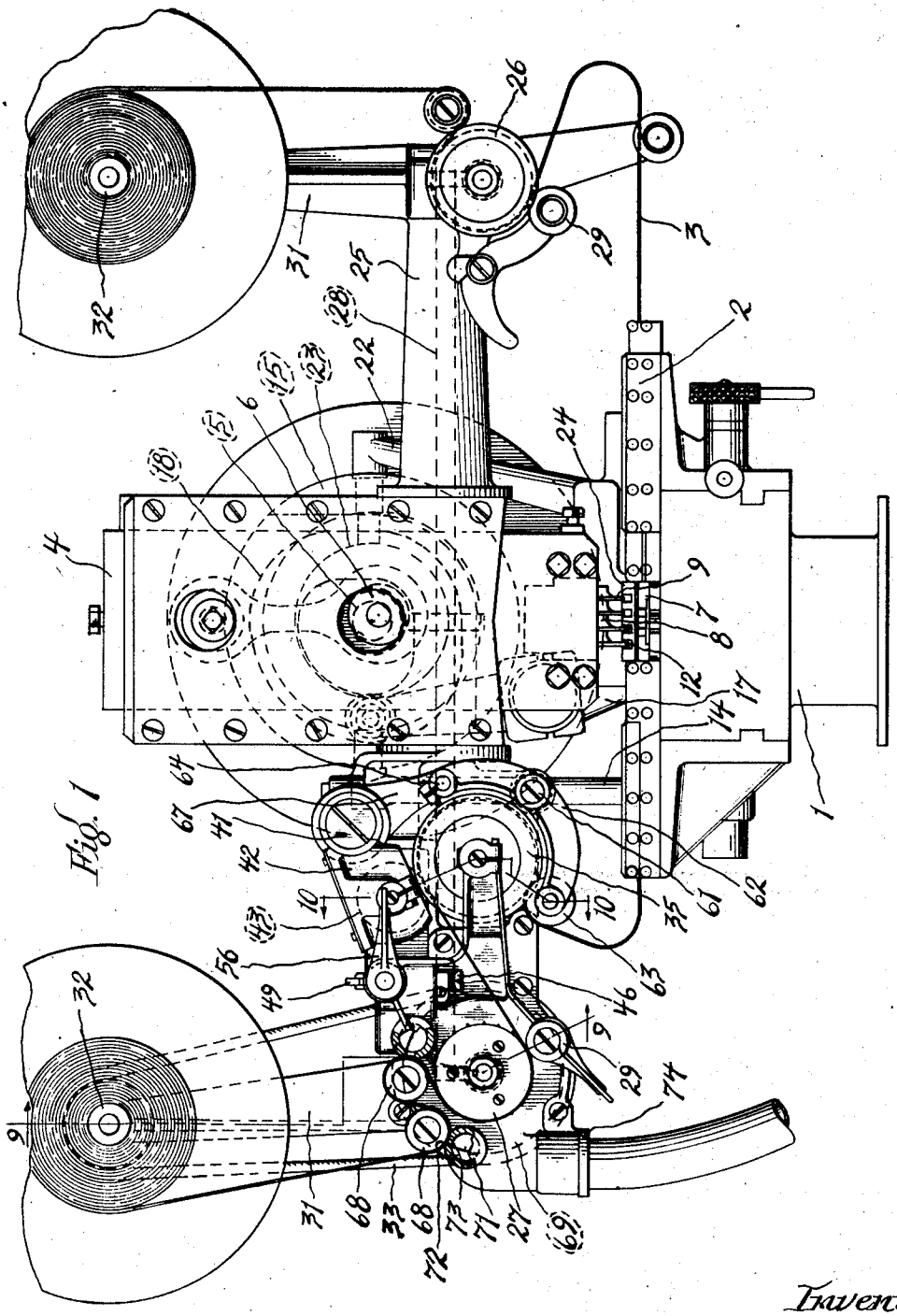


Fig. 1

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Filed July 6, 1927 4 Sheets-Sheet 2

Fig. 2

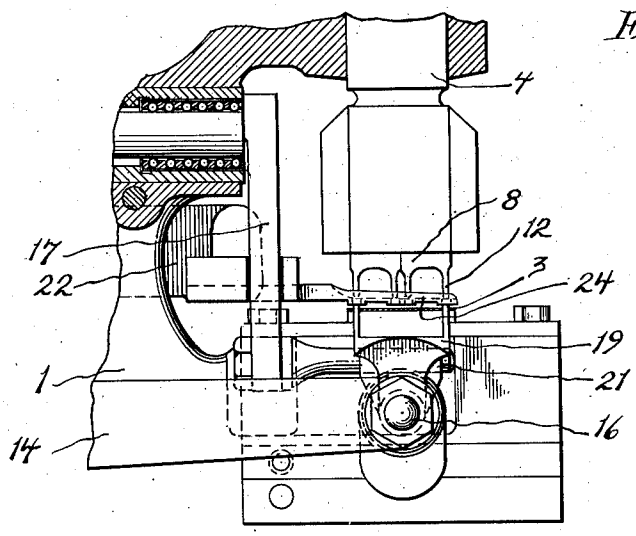
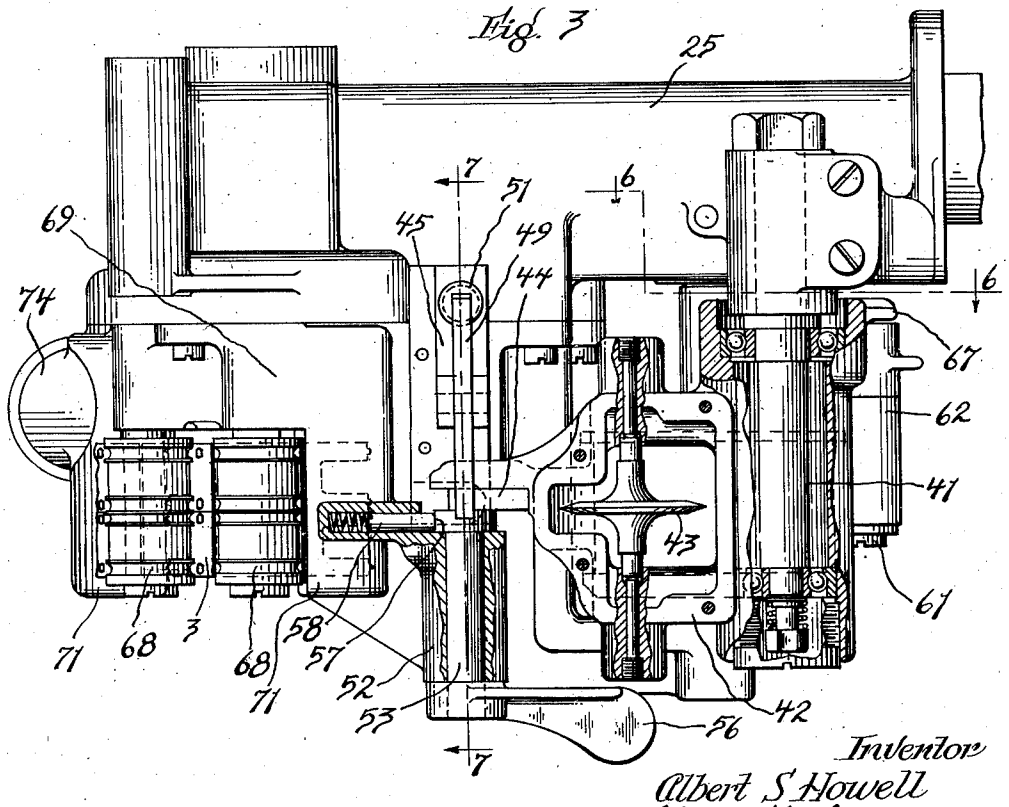


Fig. 3



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STRIP PERFORATING MACHINE

Filed July 6, 1927 4 Sheets-Sheet 3

Fig. 4

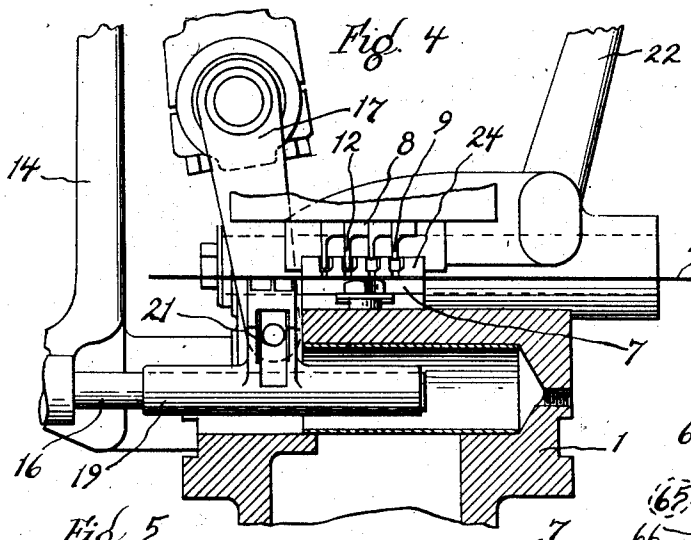


Fig. 5

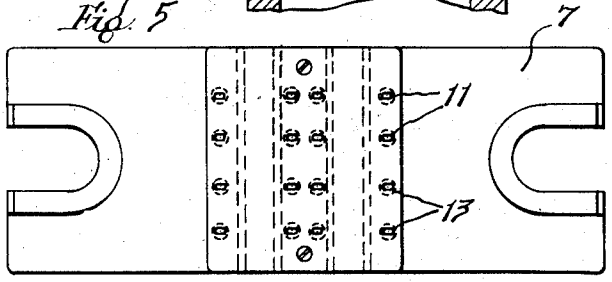


Fig. 6

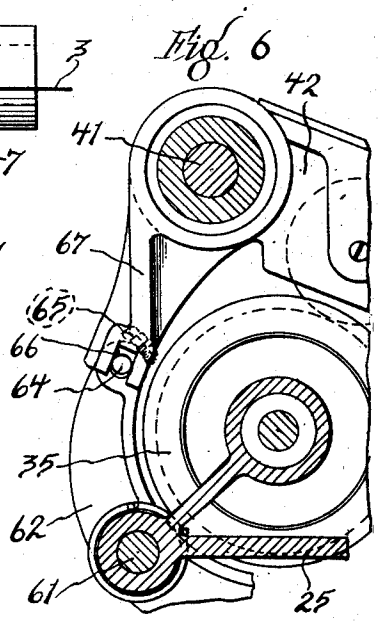


Fig. 7

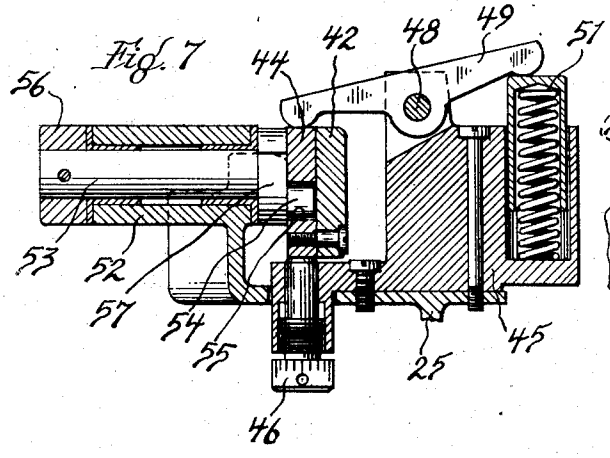
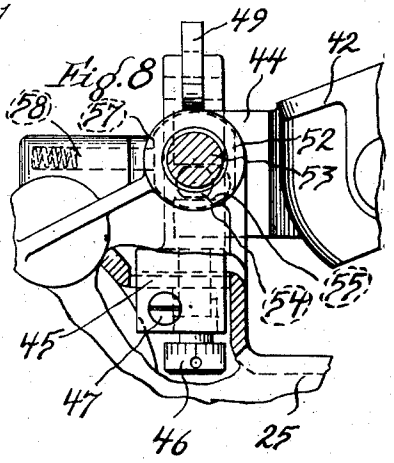


Fig. 8



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Nov. 25, 1930. A. S. HOWELL 1,782,570

STRIP PERFORATING MACHINE

Filed July 6, 1927 4 Sheets-Sheet 4

Fig. 9

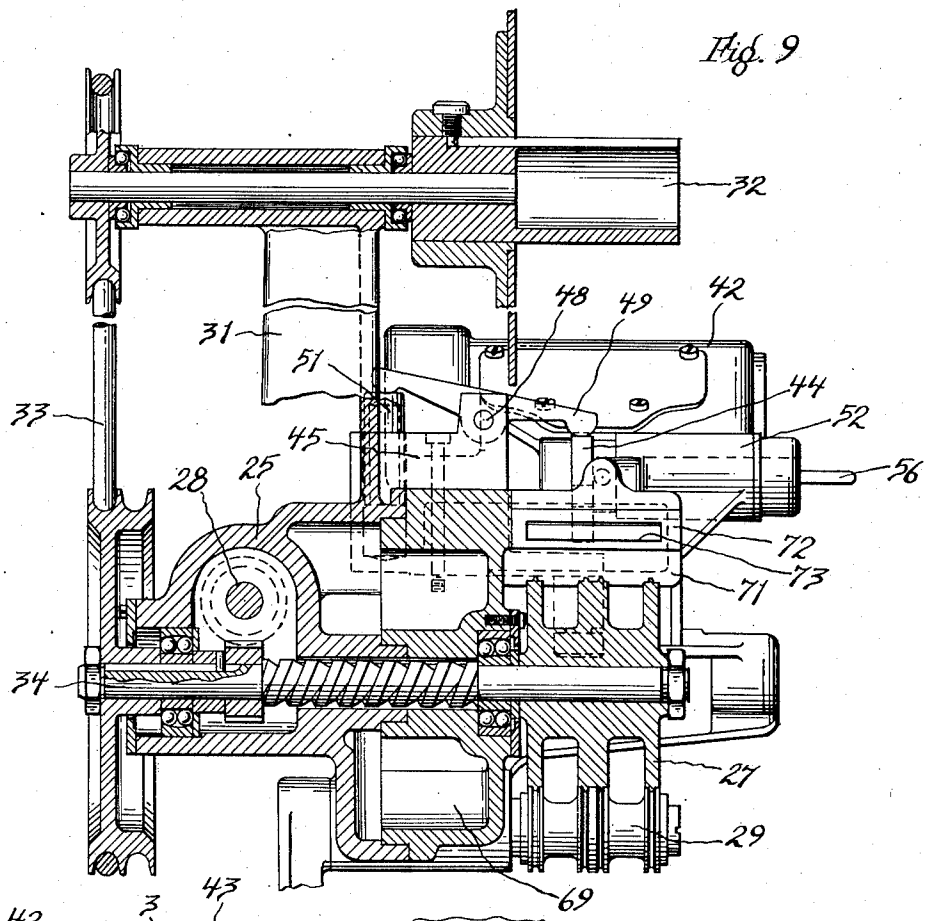
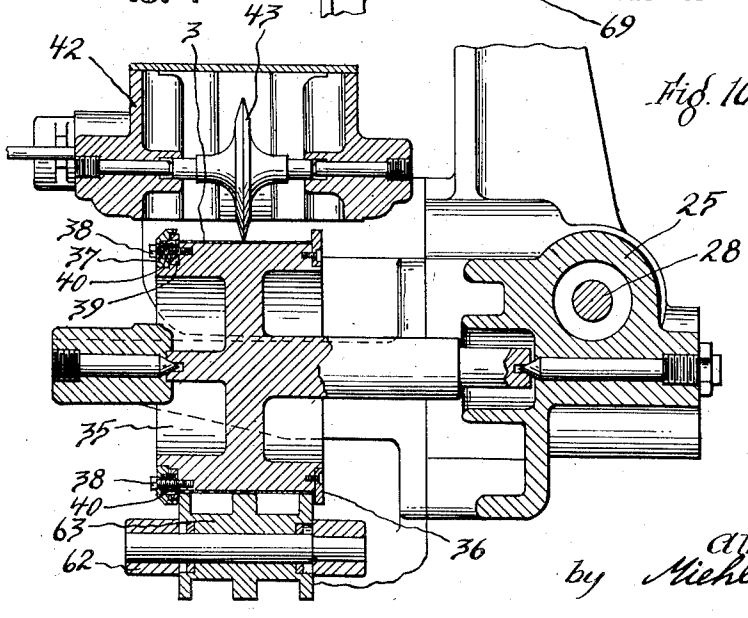


Fig. 10



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UNITED STATES PATENT OFFICE

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STRIP-PERFORATING MACHINE

Application filed July 6, 1927. Serial No. 203,789.

My invention relates particularly to machines for perforating motion picture film although not limited to this use alone.

My invention has for its main object the provision of a strip perforating machine which perforates simultaneously a plurality of strips in a convenient and efficient manner all with a view toward economy and high production.

With this object in view my invention consists in certain features of novelty in the construction, combination, and arrangement of parts by which the said object and certain other objects, hereinafter appearing, are effected, all as fully described with reference to the accompanying drawings and more particularly pointed out in the appended claims.

In the said drawings—

Figure 1 is a partial front elevation of a motion picture film perforating machine embodying my invention;

Figure 2 is a fragmentary end elevation of a portion of the machine with parts broken away;

Figure 3 is a partial top plan view of the machine with parts removed, broken away and in section;

Figure 4 is a fragmentary front elevation of the machine with parts removed, broken away and in section;

Figure 5 is a top plan view of the perforating die of the machine;

Figure 6 is a partial section on the line 6—6 of Figure 3;

Figure 7 is a partial section on the line 7—7 of Figure 3;

Figure 8 is a front elevation of the structure shown in Figure 7 with parts removed, broken away and in section;

Figure 9 is a vertically condensed section on the line 9—9 of Figure 1;

Figure 10 is a section on the line 10—10 of Figure 1.

Like characters of reference indicate like parts in the several views.

Referring to the drawings, 1 designates a main frame and mounted on the lower forward portion of this frame is a horizontal laterally extending bed 2 adapted for accurately guiding a double width motion film strip 3 for longitudinal movement. See Figure 1. The frame 1 extends upwardly at the rear of the bed 2 and then extends forwardly and overlies the bed intermediate the ends thereof. A ram 4 is mounted for vertical sliding movement above the bed 2 on said overlying portion of the frame 1. A primary shaft 5 is rotatably mounted on the upper portion of the frame 1 on a forwardly and rearwardly extending axis, and this shaft is connected for reciprocating the ram by means of an eccentric and connecting rod device 6.

The bed 2 is intermediately interrupted below the ram 4, and releasably secured to the frame 1 between the two portions of the bed 2 and underlying the ram is an upwardly facing die 7 having its upper die face engageable with the lower face of the film strip 3 on said bed. See Figures 1, 2, 4, and 5. A downwardly facing pilot and punch structure 8 is secured on the lower end of the ram 4 and is provided with a plurality of punch pins 9 alined with corresponding perforations 11 of the die 7 for perforating the film with downward movement of the ram and a plurality of pilot pins 12 alined with corresponding perforations 13 of the die for engaging perforations previously made in the film strip by the punch pins 9 to register accurately the film strip during perforation thereof. The punch pins 9 and pilot pins 12 and the perforations 11 and 13 are arranged for simultaneously perforating the two longitudinal sections of the double width film strip 3, these punch and pilot pins and perforations being arranged in rows of four transversely of the film strip to provide marginal perforations at each side of the two longitudinal sections of the double width film strip. See Figures 2 and 5.

Thus is provided perforating means for perforating simultaneously the several longitudinal sections of the double width film strip 3 step by step along the same, and step by step feeding means engageable with perforations previously made in the strip by said perforating means for feeding the strip therethrough for progressive perforation

along the strip is provided and will now be described.

Pivotally mounted on the frame 1 to the rear of the bed 2 and disposed on a horizontal axis parallel with the bed 2 is a bell crank lever 14, one arm of which extends upwardly for operation by an axial cam 15 fixed with the shaft 5 for oscillation of this lever with rotation of this shaft, and the other arm of which extends forwardly underneath the bed 2 and has a spindle 16 attached to its outer end and extending in parallelism with the bed 2. See Figures 1, 2 and 4. A lever 17 is pivotally mounted on the frame 1 to the rear of the bed 2 on a horizontal axis normal to the bed 2 and has its upper end arranged for oscillation with rotation of the shaft 5 by a grooved radial cam 18 fixed with this shaft. A toothed shuttle 19 is slidably mounted on the spindle 16, and the lower end of the lever 17 is connected to reciprocate the shuttle on the spindle 16 with oscillation of this lever by a suitable connection 21 which maintains the shuttle with the teeth thereof facing upwardly for engagement with perforations of the film strip 3 on the bed 2 and which permits vertical movement of the shuttle effected by oscillation of the lever 14. The arrangement is such that, when the shaft 5 is rotated, the shuttle is given a rectangular movement in a vertical plane whereby it is moved upwardly to engage the film, then horizontally to move the film strip, then downwardly to disengage the film, and then horizontally in the direction opposite the first mentioned horizontal movement thereof preparatory to re-engaging the film.

Another bell crank lever 22 is pivotally mounted on the frame 1 to the rear of the bed 2 on a horizontal axis parallel with the bed 2, one arm of which extends upwardly for operation by an axial cam 23 fixed with the shaft 5 for oscillation of this lever with rotation of this shaft, and the other arm of which extends forwardly and is provided with a perforated stripper plate 24 above the die 7 and the film strip 3 thereon and through which the punch pins 9 and the pilot pins 12 operate. The stripper plate 24 strips the film strip from the punch pins 9 and the pilot pins 12, and the cam 23 effects vertical movement of the stripper plate into and out of position clamping the film strip on the die 7 in timed relation with the movements of the ram, so that the stripper plate clamps the film strip on the die during operative action of the punch pins 9 and pilot pins 12 on the film strip and releases the film strip during intermittent movement thereof across the die as hereinbefore described.

Secured to the rearward portion of the frame 1 and extending oppositely therefrom in axial alinement and in parallelism with the bed 2 are two hollow supports 25, and mounted at the outer ends of said supports in film feeding alinement with the bed 2 is a rotatable flanged constant feed film roller 26 and a rotatable constant feed film sprocket 27, the roller 26 being disposed outwardly beyond the end of the bed 2 at which the film strip 3 enters the bed and the sprocket 27 being disposed outwardly beyond the end of the bed from which the film strip leaves the bed. See Figures 1, 3, 9, and 10. The roller 26 and the sprocket 27 are driven from the primary shaft 5 in timed relation with the hereinbefore described step by step feeding mechanism by means of a spiral gear and shaft driving mechanism generally indicated at 28 which extends through the alined bores of the hereinbefore mentioned supports 25, and the roller 26 and the sprocket 27 are provided with rotatable retaining rollers 29 for retaining the film strip thereon for the driving thereof by said roller 26 and sprocket 27, these retaining rollers being mounted for release for lacing of the film strip in a suitable manner unnecessary to be described. See Figure 1.

The supports 25 are provided at their outer ends with upwardly extending arms 31 upon the upper ends of which are mounted film spools 32 disposed in film feeding alinement with the roller 26 and the sprocket 27. The film strip 3 is drawn from the spool 32 adjacent the roller 26 to this roller and then leads to the adjacent end of the bed 2 through a compensating loop. See Figure 1. The film strip 3 is fed from the sprocket 27 to the other film spool 32 adjacent thereto, and this spool is driven to wind the film strip thereon by means of a belt and pulley driving device 33, the driving pulley of which is fixed on the rear end of a rotatable shaft 34 upon the front end of which the sprocket 27 is fixed and which is driven by the hereinbefore described spiral gear and shaft driving device 28, the belt and pulley driving device slipping to accommodate different diameters of the roll of film on this spool.

The above described mechanism is fully described and claimed in U. S. Letters Patent No. 1,291,524, granted January 14, 1919, on application filed by me for improvement in Apparatus for perforating cinematographic films, and requires no further description for the present purposes.

As the double width film strip 3 leaves the bed 2 both longitudinal sections thereof are perforated, and interposed between the constant feed sprocket 27 and the intermittent feeding mechanism, hereinbefore described, is a constant slitting device which slits the film strip 3 into the two longitudinal sections thereof progressively along the perforated portion of the strip, as fed therethrough by the sprocket 27, simultaneously with the perforation of the film strip. This slitting device will now be described.

A support roller 35 is rotatably mounted,

in film feeding alignment with the bed 2 and sprocket 27, on the intermediate portion of the support 25 upon which the sprocket 27 is mounted. See Figures 1, 3, and 10. The roller 35 is provided at its inner end with a circumferential flange 36 engageable with the inner edge of the film strip 3 thereon. See Figure 10. The roller 35 is provided at its outer end with a circumferential flange structure consisting as follows. A circumferential flange member 37 is secured at the outer end of the roller 35 by means of headed screws 38 spaced about the roller and passing through holes in the flange member 37 and screwthreaded into the roller. The portion of the roller 35 adjacent the flange member 37 is reduced to a diameter inwardly of the screws 38, and an annular flange member 39 is disposed in the groove formed by this reduced portion and the flange member 37, and is provided with apertures through which the screws 38 pass, the engagement of these apertures with these screws permitting movement of the flange member 39 axially of the roller. Coiled compression springs 40 encircle the screws 38 between the flange members 37 and 39 and yieldably urge the flange member 39, which projects above the periphery of the roller to engage the outer edge of the film strip 3 on the roller, toward the flange 36 to closely confine the film strip 3 axially of the roller for the slitting thereof as hereinafter described.

Pivotally mounted on the support member 25, upon which the roller 35 is mounted, by means of a suitable bearing 41 disposed on an axis parallel to that of this roller is an arm 42 overlying this roller, and rotatably mounted on the intermediate portion of the arm 42 on an axis parallel to that of this roller is a slitting wheel 43. See Figures 1, 3, and 10. The slitting wheel is movable with the arm 42 into and out of position for slitting the film strip 3 fed on the roller 35 between the flanges thereof, and the following means is provided for controlling the movement of this arm. Secured on the outer end of the arm 42 is a vertical plate 44. Disposed below the plate 44 and screwthreaded through a bracket 45 secured on the adjacent support 25 is a vertically disposed stop screw 46 which is releasably secured in adjusted position by a suitable clamp screw 47. See Figures 1, 3, 7, and 8. The plate 44 is adapted to engage downwardly upon the upper end of the adjustment screw 46 to predeterminately position the arm 42 and the slitter wheel 43 with the slitting wheel in slitting relation with the roller 35.

The bracket 45 extends upwardly to the rear of the outer end of the arm 42, and intermediately pivoted upon the upper end of the bracket 45, on a horizontal axis normal to the axis of the arm 42, by means of a stud 48 is a lever 49. The front end of the lever 49 is adapted to engage downwardly upon the plate 44, and a comparatively strong compression spring device 51 carried by the bracket 45 bears upwardly upon the rear end of the lever 49 to yieldably urge the arm 42 downwardly and to normally maintain the plate 44 engaged downwardly upon the adjustment screw 46 with slitting wheel 43 in slitting relation with the roller 35. Thus is provided adjustable means for predeterminately positioning the arm 42 with the slitting wheel in slitting relation with the roller 35, the spring device 51 automatically accommodating for the adjustment of the stop screw 46 to maintain an effective engagement between the plate 44 and the stop screw 46 and at the same time permitting movement of the arm 42 and slitting wheel 43 out of slitting relation with the roller 35.

Means is provided for the convenient manual manipulation of the arm 42 and slitting wheel 43 out of slitting relation with the roller 35 and consists as follows. See Figures 1, 3, 7, and 8. The support 25 carrying the bracket 45 is provided with an arm providing a bored hub portion 52 disposed in front of the plate 44 on a horizontal forwardly and rearwardly extending axis. Journaled in the bore of this hub portion 52 is a shaft 53 upon the inner end of which is formed a crank stud 54 engaged in a slot 55 in the plate 44 for vertically operating the plate 44 and the arm 42 with angular movement of the shaft 53. The crank stud 54 is flattened as indicated in Figure 8 to accommodate for adjustment of the stop screw 46. A handle 56 is secured on the forward end of the shaft 53 for the convenient manipulation thereof.

In order that the shaft 53 may be held in the positions it assumes when the arm 42 is at the ends of its movement, the inner end thereof, which is enlarged, is flattened at diametrically opposite points, as designated at 57, and a spring plunger device 58 engages against said enlarged portion of the shaft 53 for engagement with said flattened portions 57 for releasably maintaining the shaft 53 in said positions thereof. See Figures 3, 7, and 8.

Pivotally mounted at an intermediate point thereon, on the support member 25, upon which the roller 35 is mounted, by means of a suitable bearing 61 disposed on an axis parallel to that of the roller 35 and the arm 42 and spaced below the bearing 41, is an arm 62. See Figures 1, 6, and 10. One portion of the arm 62 underlies the roller 35, and rotatably mounted on the corresponding end of this arm is a roller 63 which is disposed on an axis parallel to that of the roller 35 and is spaced from the slitting wheel 43 and is adapted for movement with the arm 62 into and out of position to engage the film strip 3 on the roller 35 as it feeds to the

roller 35, the roller 63 effecting a wrap of the film strip 3 on the roller 35 preceding the slitting of the strip to effect a relatively long engagement of the film strip between the flanges of the roller 35 and to prevent lateral curving of the film.

The other portion of the arm 62 extends upwardly from the bearing 61 and is provided with an eccentric stud 64 which is mounted for angular adjustment in a split bore at the corresponding end of this arm, a clamp screw 65 being provided on this arm for releasably securing the eccentric stud 64 in adjusted position with respect to this arm. See Figures 1 and 6. The eccentric stud 64 engages for movement in a radial slot 66 formed in the outer end of an extension arm 67 fast with the arm 42, so that the slitting wheel 43 and the roller 63 are moved together into and out of functioning relation with the roller 35. It will be observed that the slitting wheel 43 is predeterminately positioned in slitting relation with the roller 35 by an adjustable means, and that arm 62 may be adjusted with respect to the arm 42 by the adjustable connection therebetween including the eccentric stud 64, so that after adjustment of the stop screw 46 to properly position the slitting wheel 43, the arm 62 may be adjusted with respect to the arm 42 to properly position the roller 63, the movement of both of the arms 42 and 62 being conveniently controlled by a single means for the lacing of the film strip 3.

The perforated film as it leaves the discharge end of the bed 2 leads to the rollers 35 and 63 in the form of a compensating loop. It then passes between the rollers 35 and 63 and around the roller 35 to the slitting wheel 43 where it is slit. See Figure 1. From the slitting wheel and roller 35 the perforated and slit film leads to the sprocket 27 which is a double sprocket and which draws the film through the slittling device including the roller 35 and the slitting wheel 43.

Interposed between the sprocket 27 and the corresponding film spool 32 is a cleaning device which will now be described. See Figures 1, 3, and 9. Disposed immediately above the sprocket 27 and rotatably mounted on the corresponding support 25 are two adjacently spaced rollers 68 disposed in film feeding alignment with this sprocket, and the perforated and slit portion of the film strip leads over one and under the other of these rollers 68 between the sprocket 27 and the corresponding film spool 32, thus disposing opposite faces of the firm strip outwardly on these rollers. The portion of the corresponding support 25 adjacent the sprocket 27 forms an air chamber 69 and communicating with this air chamber at their inner ends and extending forwardly therefrom in adjacent parallelism with the rollers 68 are two hollow cylindrical formations 71 the outer ends of which are closed. These formations are provided with exterior concave surfaces 72 conforming with and lying closely adjacent the outer surface of the film strip 3 on the rollers 68, and slots 73 are formed in the walls of said formations at said concave surfaces and communicate with the interior of these formations, so that, as air is exhausted from the air chamber 69, a suction is created at the slots 73 which removes matter loosely adhering to the film strip, such as small cuttings resulting from the perforating and slitting operations. It will be observed that both sides of the film are subjected to the said suction by this arrangement. The air chamber 69 is provided with an air outlet 74 which is connected to a suitable air exhauster, not shown.

It will be observed that, by simultaneously perforating and slitting progressively the plural width film strip 3 a comparatively high production is attainable, and that, by feeding the strip first through said perforating means and then through the slitting means for progressive operation along the strip simultaneously by said perforating and slitting means, the control of the strip during the perforation thereof is comparatively simple in that the strip is in one piece as it is fed through the perforating means.

While I have herein shown and particularly described the preferred embodiment of my inventon I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention, but having thus described my invention I claim as new and desire to secure by Letters Patent the following:—

1. In a machine of the character described the combination with a revoluble roller, of spaced circumferential flanges on said roller, resilient means yieldably urging one of said flanges toward the other flange, a revoluble slitting wheel disposed on an axis parallel to that of the roller and adapted for slitting a strip on the roller between said flanges, a driven revoluble sprocket engageable with perforations in both sections of the strip for longitudinally drawing the strip on the roller for the slitting of the strip by said slitting wheel, and a second revoluble roller disposed in parallelism with said first mentioned roller and spaced from said slitting wheel and adapted to engage the strip on said first mentioned roller as it feeds to said first mentioned roller.

2. In a machine of the character described the combination with a revoluble roller, of an arm pivoted on an axis parallel to that of the roller, a slitting wheel rotatably mounted on the intermediate portion of said arm in axial parallelism with said roller for movement with the arm into and out of position for slitting a strip fed on said roller,

an adjustable stop operative upon the outer end of said arm to limit movement of the arm into said position, spring means operative upon the outer end of said arm for yieldably urging said arm into said position, and manually actuated means for operating said arm away from said stop.

3. In a machine of the character described the combination with a revoluble roller, of a pivoted arm, a slitting wheel rotatably mounted on said arm for movement therewith into and out of position for slitting a strip fed on said roller, a second pivoted arm, a second revoluble roller mounted on said second arm for pivotal movement therewith into and out of position for retaining the strip on said first mentioned roller, and means whereby said arms are operated together for moving said slitting wheel and said second roller into and out of said positions thereof together.

4. In a machine of the character described the combination with a revoluble roller, of an arm pivotally mounted on an axis parallel to that of said roller, a slitting wheel rotatably mounted on said arm for movement therewith into and out of position for slitting a strip fed on said roller, a second arm pivotally mounted on an axis parallel to that of said first mentioned arm, a second revoluble roller mounted on said second arm for movement into and out of position for retaining the strip on said first mentioned roller, adjustable means for predeterminately positioning said first mentioned arm with the slitting wheel in slitting relation with said first mentioned roller and an adjustable connection between said arms whereby said slitting wheel and said second roller are moved into and out of said positions thereof together.

5. In a machine of the character described the combination with a frame, cooperating step by step strip feeding and perforating mechanism on said frame, a horizontally extending arm mounted on said frame, a constant feed sprocket on said arm, and means for driving said sprocket with said feeding and perforating mechanism, of a slitting device carried by said arm and operative upon a strip between said step by step and perforating mechanism and said sprocket.

6. In a machine of the character described the combination with a frame, cooperating step by step strip feeding and perforating mechanism on said frame, a horizontally extending hollow arm mounted on said frame, a constant feed sprocket on the outer end of said arm, and means for driving said sprocket with said feeding and perforating mechanism including a shaft extending within said arm and correspondingly therewith, of a slitting device carried by said arm and including a revoluble roller and cooperating slitting wheel operative upon a strip between said step by step and perforating mechanism and said sprocket.

In witness whereof I hereunto affix my signature this 30th day of June, 1927.

ALBERT S. HOWELL.