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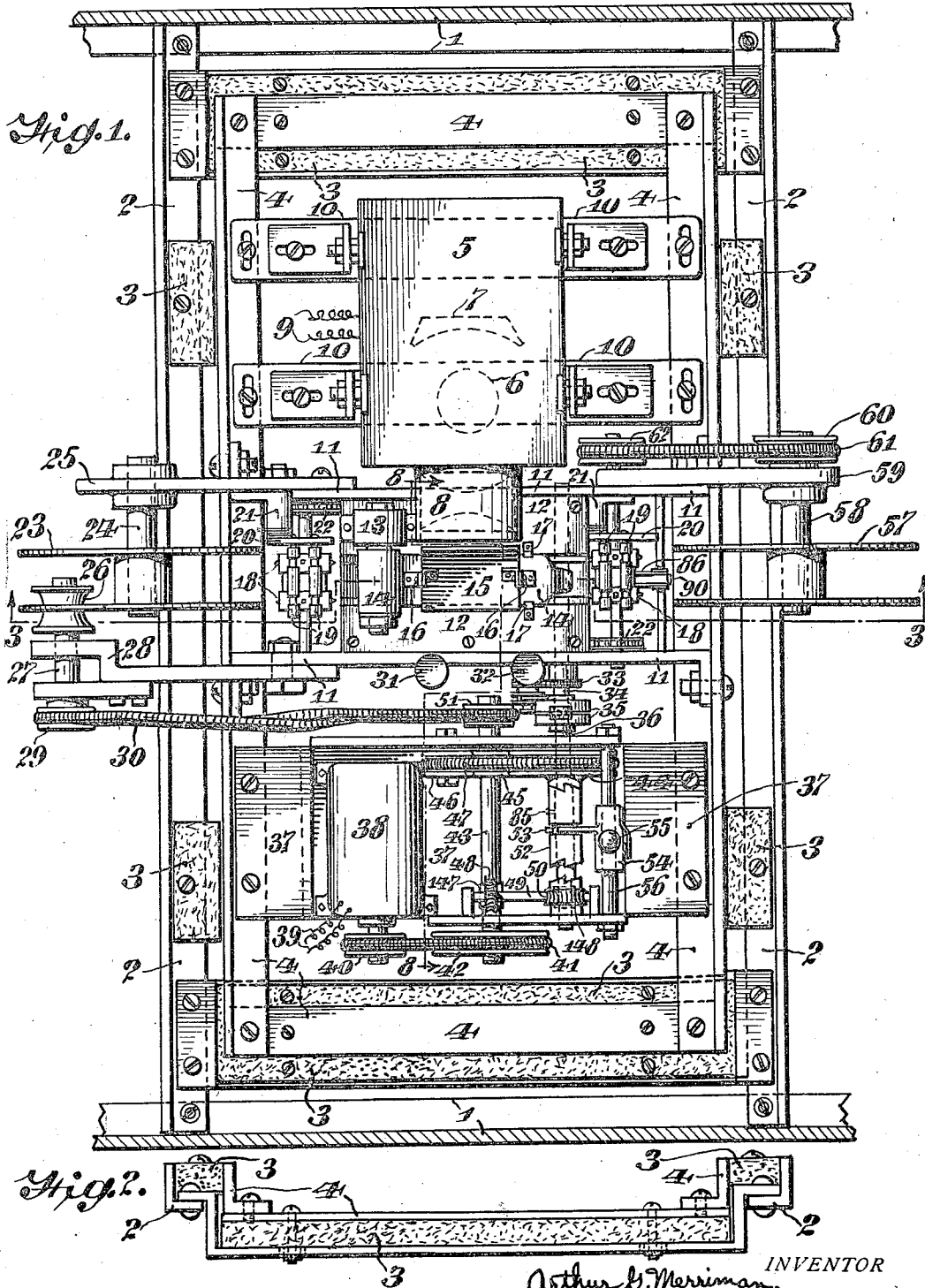
A. G. MERRIMAN

1,773,594

MOVING PICTURE MECHANISM

Filed May 2, 1928

4 Sheets-Sheet 1



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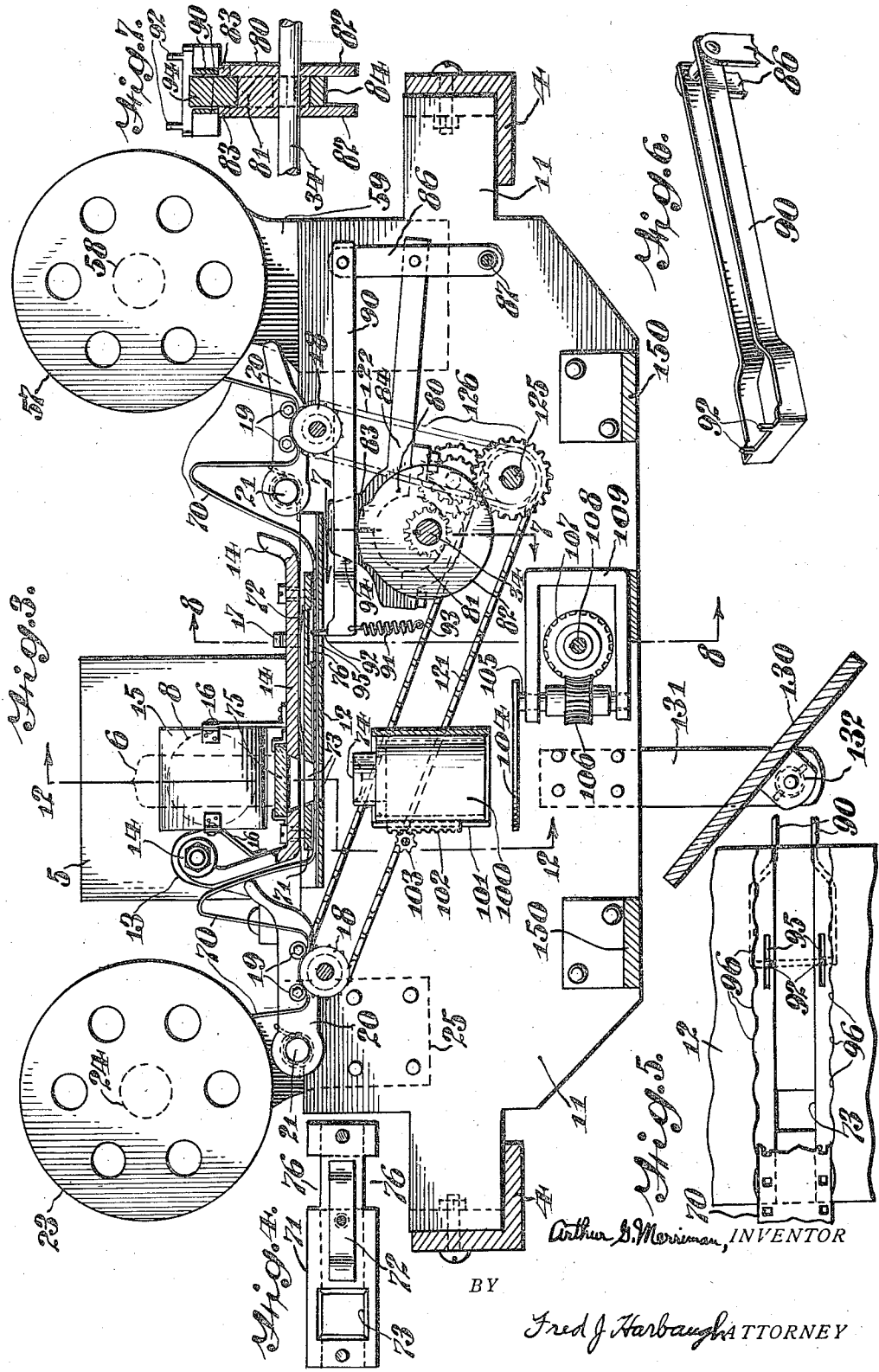
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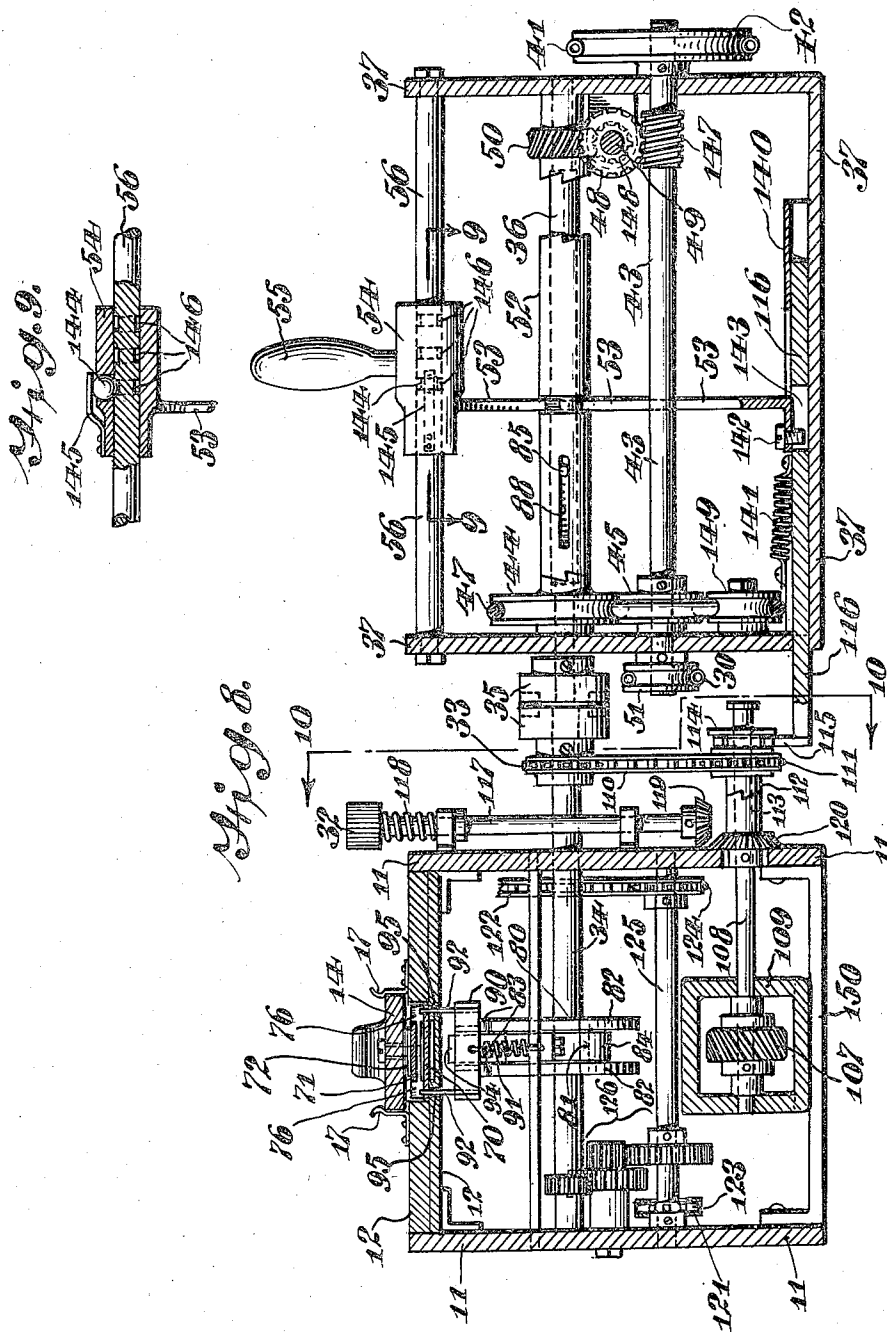
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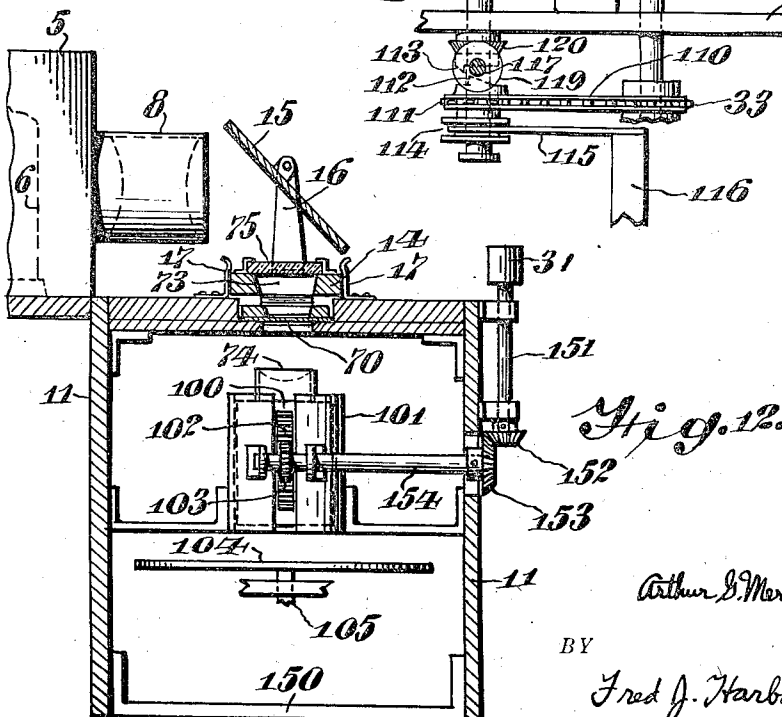
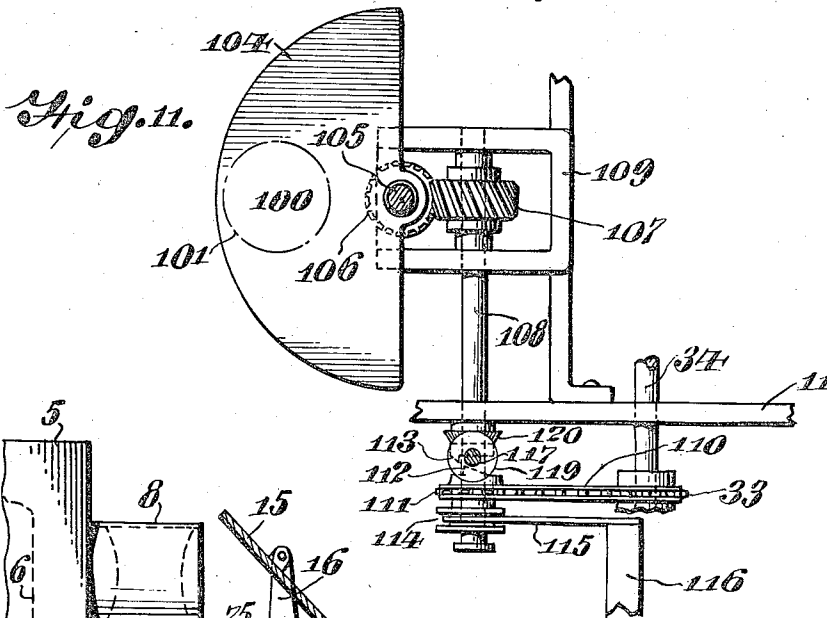
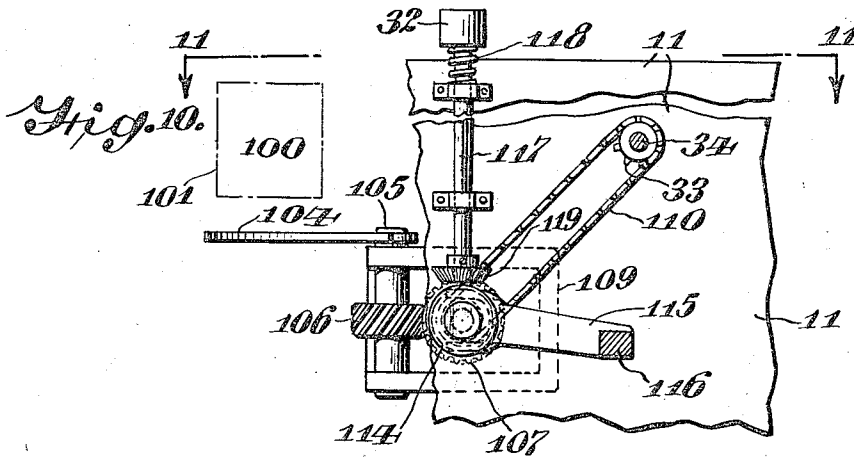
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MOVING PICTURE MECHANISM

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4 Sheets-Sheet 4



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MOVING-PICTURE MECHANISM

Application filed May 2, 1928. Serial No. 274,472.

My invention relates to improvements in motion picture apparatus for use in motion picture cabinets, and it consists in the combinations, constructions, and arrangements herein described and claimed.

The present invention contemplates the provision of an improved motion picture apparatus used in combination with a cabinet which is the subject matter of a co-pending application, Serial #274,473, filed May 2, 1928, for a cabinet having certain novel arrangements of partitions and picture mechanism therein, as well as a novel association of the projecting screen therewith.

An object of the present invention is to provide a motion picture mechanism having a minimum of noise, vibration, and wear.

A further object of the invention is the construction of an improved intermittent motion of marked simplicity, giving great smoothness of operation, a minimum of wear with age, greatly diminished noise and vibration, and having substantially the ideal rectilinear movement and speeds necessary to such a motion for moving picture apparatus.

In accordance with my invention the film is actuated by a combined eccentric, cam, and link motion which is an improvement over the harmonic cam and Geneva movements, known to the prior art particularly in connection with intermittent movements for motion picture projectors. These movements of the prior art are difficult of manufacture, requiring great accuracy, and, during subsequent use, a slight amount of wear produces considerable vibration and noise due to their inherent construction. In the case of Geneva movements it was necessary to overcome these disadvantages by providing housings for running the movements in oil. In the case of the harmonic cam a take-up adjustment for wear was frequently used. An important advantage of the present invention is that the contact between follower and cam is maintained by resilient means, thereby constituting an automatic take-up for wear between the follower and cam. Another advantage from the standpoint of simplicity and compactness is that the eccentric and cam are combined in a single unit, the cam

being so shaped and positioned relative to the eccentric as to maintain the eccentric follower in position on the eccentric, in addition to its main function as a cam, and the eccentric follower is so shaped as to maintain the cam follower or tooth fork in position on the cam. The eccentric and cam are dynamically balanced about the shaft.

Further, in accordance with my invention the best rectilinear movement and speeds necessary for moving picture work are obtained by the combined action of the link motion and the eccentric-cam combination.

Further, in accordance with my invention, the film is protected from being scratched or punctured by the tooth fork due to the construction of the portion of the apparatus where the teeth of the tooth fork operate to move the film.

Other objects and advantages will be apparent from the following description, considered in conjunction with the accompanying drawings, in which:

Figure 1 is a plan view showing the assembly of the complete apparatus and its supports.

Figure 2 is a side elevation of the supports shown in Figure 1.

Figure 3 is a cross section taken through the apparatus on the line 3—3, Figure 1.

Figure 4 is a detail view in plan of the upper film guide plate with its spring attached.

Figure 5 is a detail view in plan of the film trough, showing the film in place, the picture opening, the slots for the film teeth, showing a position of the teeth and the tooth fork.

Figure 6 is a detail view in perspective, showing the tooth fork and the method of attaching it to the link motion.

Figure 7 is a detail view, being a cross section taken along the line 7—7 and showing the combination eccentric and cam in its relation to its follower and to the tooth fork. This is thus a cross sectional view of the intermittent motion.

Figure 8 is a cross section taken through the apparatus on the line 8—8, Figures 1 and 3.

Figure 9 is a detail view in cross section showing the sleeve of the speed change lever.

Figure 10 is a fragmentary cross section view taken through the apparatus on the line 10—10, Figure 8, and showing the detail of the shutter mechanism.

Figure 11 is a cross section of the shutter mechanism taken along the line 11—11, Figure 10.

Figure 12 is a fragmentary cross section taken along the line 12—12, Figure 3, and showing the relation of lamp house, condensing lens, mirror, film gate and trough, and projecting lens and shutter.

In Figure 1, I show the sides 1, of a motion picture cabinet to which is fastened a supporting metal framework 2, made of angle pieces. This framework 2 is the outer supporting framework and it has cushions 3, made of sponge rubber, attached to it. These cushions 3 support the inner metal framework 4, in such manner that practically no vibration from the inner frame work is transmitted to the outer framework when the mechanism is in operation. This inner framework is attached to the cushions 4 so that it is held in a fairly firm position.

The lamp house 5 of the apparatus, having the electric lamp or light emitting element 6, the reflector 7, the condensing lenses 8, and the wires 9, supplying the electric current to the lamp approximately in the positions shown, is supported by the metal framework 10. This framework 10 has its component elements slotted as shown so that the lamp house is adjustable in any of three directions, vertically, horizontally, or longitudinally.

The motion picture mechanism is supported by the plates 11, which are bolted to the inner supporting framework. Only the upper edges of these plates are visible in the plan view, Figure 1. These plates contain the bearings for the motion picture apparatus. Fastened to the plates 11 at their upper edges is the plate 12. This plate contains the film trough in its center. The plate is made up of three elements and is best seen in cross section in Figure 12. A bracket 13, is fastened to the plate 12 as shown, and hingeably mounted on this bracket is the film gate 14. A mirror 15, set at approximately an angle of 45 degrees, is hingeably mounted by supports 16 so that its 45 degree angle can be varied slightly in either direction. The film gate 14 snaps down into place and is held there by small spring catches 17. The construction of these catches is shown in Figure 12, and it is obvious that the film gate is easily lifted from the catches for insertion of the film in the film trough. As the gate is lifted it turns up on its hinge, and is held up by a spring which is not shown, but which is attached to the bracket 13.

The film feeding sprockets 18, feed the film steadily toward one side of the film trough

and take it up at exactly the same speed from the other side of the film trough. The film is held in place on the sprockets 18 by two small rollers 19 which are supported by bearing pins attached to the lever arms 20. These lever arms 20 are hingeably mounted on the brackets 21 and springs attached to these brackets keep a tension on the lever arms 20, and thereby cause the rollers 19 to press the film firmly down on the film feed sprockets 18.

The film feed sprockets are mounted on shafts having bearings in the plates 11. These shafts are driven by chain sprockets and chains 122. The means of driving these chains from the main shaft by gears and sprockets on an auxiliary shaft is shown in Figure 3. Returning to Figure 1, the film is wound on the film supply reel 23, prior to being run through the apparatus. This reel is mounted on the hub 24 in such manner that it is easily removed and another reel put in its place. The hub 24 is mounted in a bearing on the bracket 25, and this bracket is attached to the side plate 11 as shown. To permit of winding the film on the reel 23, a friction drum 26 (having a rubber periphery in this case) is attached to a shaft 27, and the shaft is so mounted in bearings on a movable arm 28, that by lifting this arm 28 upward the pulley 26 is brought in contact with one of the flanges of the reel 23. The pulley 26 is then driven by means of the elastic belt 30, through the pulley 29, and shaft 27. The pulley 26 then drives the reel 23 by friction contact and the film can be wound on the reel 23.

A knurled knob 31 permits of the focusing of the projection lens, and the means by which this is accomplished is better seen in Figure 12.

Another knurled knob 32 is provided for the purpose of moving the motion picture shutter out of the path of the beam of light from the projection lens when the apparatus is used for displaying single pictures and the shutter is not needed. The means of accomplishing this is best shown in Figures 10 and 11.

A sprocket 33, mounted on the main shaft 34, drives a chain which, in turn drives the mechanism of the motion picture shutter. This is also best seen in Figures 10 and 11.

A flexible coupling 35 connects the main shaft 34 of the motion picture mechanism to the main shaft 36 of the power box 37.

The power box 37 contains a motor 38 mounted as shown, with electric lead wires 39. This motor 38 drives the shaft 43 by means of the pulleys 40 and 42 and the elastic belt 41. The shaft 43 drives the pulley 44 by means of the pulley 45 and the elastic belt 47. The belt 47 is of necessity wrapped around two idler pulleys, one of which is shown at 46. This is necessary to give the correct direction of rotation to the pulley 44 in the

actual model built, and is best shown in Figure 8, but by reversing the direction of rotation of the motor 38, and redesign of the worm gears and shaft 48—50, the idler 46 and its twin idler 149, Figure 8, will not be needed.

The pulley 44 is not fixed to the main shaft 36, but is free to revolve thereon, and is held in place by a shoulder on the main shaft. At the opposite end of the main shaft, and also free to revolve on the main shaft and held in place thereon by a shoulder is the worm gear 50, which is driven by a worm on the shaft 49. At the other end of the shaft 49 is a worm gear 48, which is driven by a worm on the shaft 43. The shaft 49 is mounted in bearings which are suitably mounted on the side of the power box 37 as shown. The shaft 43 has its bearings in the sides of the power box as shown, and has a pulley 51 for driving the belt 30.

A sleeve 52 is free to slide on the main shaft but is made to revolve with the shaft by a pin 85 fixed to the shaft and operating in a slot 88 in the sleeve. The sleeve has clutches at each end which engage with mating clutches attached to the pulley 44 and the worm gear 50 respectively, when the sleeve is pushed toward the wheel 44 or the worm gear 50. Thus when the sleeve is engaged with the clutch on the pulley 44, the sleeve and main shaft are driven at the speed of that pulley (about 960 R. P. M. which is motion picture speed). When the sleeve is in mid-position and neither of its clutch ends are engaged, it is at a standstill and so is the main shaft. When the sleeve is engaged with the clutch on the worm gear 50, it is driven, together with the main shaft at the speed of the worm gear which is an extremely slow speed (about 10 R. P. M.) for the purpose of showing single pictures.

To push the sleeve 52 forward and back a fork 53, attached to a second sleeve 54, operates in a groove on the sleeve 52. The sleeve 54 is mounted on the fixed shaft 56 and is pushed forward and back by the handle or lever 55. As the sleeve 54 is pushed forward and back, the fork 53 also pushes the sleeve 52 forward and back.

For taking up the film after it has been displayed, the take-up reel 57 is provided. It is known as the take-up reel and is removable from the hub 58 on which it is mounted. Interchangeable reels 57 and 23 are similar and so are their hubs 58 and 24. The reels are easily placed and removed from their hubs. The hub 58 is mounted in a bearing on the bracket 59, which, in turn is attached to the plate 11. The take-up reel 57 is driven through its hub 58 and pulley 60 by an elastic belt 61 and pulley 62, the latter being attached to the shaft of the take-up sprocket 18.

The elastic belts 30 and 61 in the model

built are made of coiled spring wire. This is due to the fact that little power is transmitted by these belts and it is important that they should slip somewhat to allow for the change of speed in the parts which are driven. The elastic belts 41 and 47 must transmit more power, operate quietly and slip very little, hence they are made of rubber. They are round belts, though that is not necessary, and they are about one-quarter inch in diameter.

Referring to Figure 3, the film 70 passes from the reel 23 over the left film sprocket 18 where it is held in contact by the rollers 19. It then makes a loop upward as shown, and then passes between the upper film guide plate 71 and the lower film slide plate 12. The film is now in what I call the film trough. It is free to slide in either direction, but is pressed down in a fairly firm manner by the spring 72, Figure 4, attached to the plate 71. The opening 73 permits the light which is thrown downward from the mirror 15 to pass to a single picture on the film, and then to the projection lens 74. When single pictures are shown, the concentrated light must be on the picture for some time, and this might scorch the film except for the protective screen 75 which is mounted as shown. This screen 75 in the present model is of a transparent, greenish glass which blocks or absorbs the heat, and prevents scorching film. To prevent scratching the picture on the film the plates 71 and 12 are recessed lengthwise their entire length. These recesses form troughs as wide as the pictures on the film and only a fraction of an inch deep. This tends to prevent the pictures in the central part of the film from rubbing on the plates 12 and 71. That is, the perforated edges of the film ride on a kind of track and are held down by a duplicate track elastically pressing on the upper side of the perforated edges. The plate 71 is also recessed at 76 to allow for the action of the teeth of the intermittent movement which will be described later. After leaving the film trough, the film makes a second loop as shown at the right. It then passes over the right film sprocket 18 where it is held in contact by the rollers 19. It is then wound up by the reel 57. When the film has run to its end it is easily re-wound by running it in a line directly and nearly horizontally from the reel 57 back on to the reel 23. The film is inserted in the film trough for a new run by lifting the levers 20 and the plate combination 14 and 71, inserting the film, and replacing them.

The intermittent motion shown in cross section in Figure 7, is as follows: Attached to the main shaft 34 is combination eccentric and cam 80, dynamically balanced. This is made of a single piece of hardened steel and consists of a pure eccentric central portion 81 and flanges 82, having matched cir-

cumferential offset portions 83 which makes them, in effect, cams. The eccentric follower 84 is pivoted to a link member 86, which is pivoted at 87 to a horizontal shaft attached to front and back plates 11. The upper end of the link 86 is pivoted to the film engaging member or tooth fork 90, which is also a cam follower as is better shown in Figure 6. The tooth fork rests on the flanges 82, and is held firmly but elastically in contact with the flanges by the spring 91. This spring is fastened at its lower end to a shaft 93, the latter being horizontal and attached to the plates 11. Though a spring is used in this case to maintain the tooth fork in contact with the flanges, any other known means may be used to maintain this contact.

The tooth fork 90 is made of hardened steel and has two teeth 92, suitably shaped for engaging the perforations of the film. The fork is kept in position on the flanges 82 and prevented from slipping off of them by an extension lug 94, on the eccentric follower 84.

The action of the intermittent motion is as follows: As the shaft 34, rotates clockwise, the follower 84 moves to the right, and, through the link 86 pushes the tooth fork to the right. The tooth fork is now in contact with the flange offsets 83, which raise it high enough to keep the teeth 92 engaged with the perforations in the film. These teeth pass up through slots in the plate 12 and their tops are cleared by the recess 76 in plate 71. The motion of the fork 90 to the right is now carrying the film to the right and when the amount of this motion has equalled the distance of one picture, the flange offsets 83 have turned so as to allow the spring 91 to pull the tooth fork 90 down and disengage the teeth from the film, thereby allowing it to stop with a picture in position in the opening 73. The continued clockwise rotation of the shaft 34 now moves the follower 84 and fork 90 to the right to the end of the stroke and then back to the left until the teeth 92 are in position for engagement with the next perforations in the film. By this time the offsets 83 have turned so as to push the fork 90 upward and push the teeth 92 into engagement with the perforations of the film, and the process is repeated. The arc of the offsets 83 and the position of the middle pivot of the link 86 are so adjusted that the film moves during one sixth of a revolution of the shaft 34, and remains stationary during the remainder of the revolution. This matches the shutter action which cuts off the light during one sixth of a revolution as will be described later. In case the perforations of the film should not be in the right position so that the teeth can engage them, the film is not punctured but is protected by the recess 76 in the plate 71. This recess allows the teeth 92 to push the film upward until

they move to the right far enough to engage the film perforations, and the natural elasticity of the film then brings it down again with the teeth in engagement with the perforations. The adjustment of the arc of the flanges 83 is of necessity very accurate so that the engagement and disengagement of the teeth with the perforations is just spaced by one picture.

Figure 5 shows a fragmentary plan view of the film in the film trough, the picture opening 73, the film slots 95, the tooth fork 90 and the teeth 92. Friction of the film in the film trough is reduced all that is necessary by the recessing of the plates 12 and 71 as described previously, and by having the edges of the film trough scalloped as shown at 96, Figure 5. A further reduction of friction on the film can be attained by placing rollers in the plates 71 and 12, but this is not carried out in the present model of the invention.

The projection lens 74 is mounted in a cylindrical mounting 100, which slides in another cylinder 101, the latter being attached to the front plate 11 by suitable means so that the lens 74 is kept in position before the opening 73. To focus, the rack 102 and pinion 103 are provided and are operated by the knurled knob 31 by means shown in Figure 12.

The shutter 104, mounted on the shaft 105, is driven from the main shaft 34 by means of the sprocket 33 and 111, the chain 110, the shaft 108 and the helical gears 107 and 106. This is best shown in Figures 10 and 11. When single pictures are shown it is necessary to disconnect the shutter and turn it out of the way of the light beam or it would cut off the light three times during the showing of a single picture as it is adjusted to do in the case of motion pictures. For this purpose, a clutch 112 is provided on the sprocket 111, which engages with a clutch on the shaft 108. A grooved wheel 114 attached to the clutch 112 enables it to be thrown in or out by means of a fork 115 attached to a member 116. This member 116 is attached to the sleeve 54, Figure 1, as will be described later. When the clutch 112 is thrown out, the shutter 104 can be turned out of the way of the light beam by the knurled knob 32. The knob 32 attached to the shaft 117 is normally held up by the spring 118, thus keeping the bevel gears 119 and 120 out of mesh. When the knob 32 is pressed down and turned the gears 119 and 120 mesh and act so that the shutter 104 can be turned as desired. The frame 109, attached to the plates 11, provides the bearings for the shafts 105 and 108.

Returning again to Figure 3, the film sprockets 18 are driven by chains 121 and 122 running on sprockets 22, Figure 1, on the film sprocket shafts, and running on

sprockets 123 and 124, Figure 8, on the intermediate shaft 125. This intermediate shaft 125 is driven from the main shaft 34 by a set of gears 126 as shown. These gears give the correct speed and direction of rotation to the shaft 125 so that the integral of the sprocket movement of the film equals the integral of the intermittent movement of the film.

The mirror 130 is pivotally mounted so that its angle can be adjusted. The brackets for mounting this mirror are attached to the front and back plates 11. The bracket attached to the back plate is shown at 131. At 132 is shown the pivot which can be tightened by a knurled knob or wing nut. The mirror 130 reflects the beam projecting the picture to the right in a substantially horizontal direction.

Referring to Figure 8, I have a cross section of the motion picture apparatus and power box which gives an advantageous view of much of the apparatus already described, and particularly shows the action of the sliding member 116, the vertical member 53, the sleeve 54, and the high and low speed means of transmitting power from the shaft 43 to the main shaft 36.

The member 116 is slidably mounted in guides 140 attached to the bottom of the power box 37. A spring 141 keeps the member 116 as far to the left as possible, and this member 116, acting through the fork 115, which in turn acts on the grooved wheel 114, keeps the clutches 113 and 112 engaged. When the sleeve 54 is pushed to the right by the lever 55, the member 53 also moves to the right when them and a screw or stud 142 attached to the member 53 moves in a slot 143 in the member 116. When the stud 142 reaches the right end of the slot 143, it pushes the member 116 to the right, and the clutches 113 and 112 are disengaged. The shutter is now disconnected and can be turned out of the path of the light beam by pressing down and turning the knob 32 as before described. The spring 141 and slot 143 are necessary because the lengthwise movement of the sleeve 54 and its attached member 53 are greater than the lengthwise movement of the member 116. This happens in the model now in use, but might be dispensed with in another model by making the two mentioned lengthwise movements the same.

When the sleeve 54 is pushed as far as possible to the right the clutches on the worm gear 50 and the right end of the sleeve 52 are engaged and the main shafts 36 and 34 are driven at the very slow speed for the showing of single pictures. The clutches 113 and 112 are now disengaged and the shutter remains stationary.

When the sleeve 54 is pushed as far as possible to the left the clutches on the pulley 44 and the left end of the sleeve 52 are engaged

and the main shafts 36 and 34 are driven at the high speed for the showing of motion pictures. The clutches 113 and 112 are now engaged and the shutter 104, Figures 10 and 11, is driven at a speed three times as fast as the speed of the main shafts, cutting the beam of light three times during the stationary period of each picture in the motion picture series on the film. This high speed revolution of the shutter gives motion pictures which are practically free from any flickering.

When the sleeve 54 is in its mid-position neither of its clutches are engaged and the main shafts are stationary. The pulley 51 then drives the reel 23 through the belt 30, pulley 29, shaft 27, and friction pulley 26, all of the latter being shown in Figure 1. This is for the purpose of rewinding the film on the reel 23.

To hold the sleeve 54 in its various positions, a ball 144 is pressed by a spring 145 into a hole in the sleeve 54, and this ball engages with grooves 146 in the shaft 56 as shown.

The slow speed of the worm gear 50 is obtained by a double worm reduction. Worm 147 drives worm gear 48 which is on the same shaft with another worm 148 and this latter worm drives the worm gear 50.

The pulley 149 is one of the idlers over which the belt 47 travels.

The member 150 is the lower part of the framework of the motion picture mechanism and serves to hold the plates 11 in place.

Figure 12 shows the method by which the condensing, reflection and focusing of the light is accomplished. The light from lamp 6 is condensed by the lenses 8, reflected downward through the opening 73 and through the picture on the film 70 to the projection lens 74. This lens is mounted as before described and is focused by the knurled knob 31 acting through the shaft 151, the bevel gears 152 and 153, the shaft 154, the pinion 103, and the rack 102, as shown. The shutter 104 is directly below the lens mounting 100, and it cuts off the light at extremely rapid intervals for motion pictures as before described.

I claim:—

1. In an intermittent movement for a film in a motion picture machine, a drive shaft, a flanged eccentric thereon, a follower driven by said eccentric, a link arm attached to said follower, a link pivoted at one end to said machine, said link arm pivotally attached to said link intermediate the ends thereof, a second follower pivotally attached at one end of said link, flanges on said eccentric having circumferential offsets, said flanges engageable with said second follower, resilient means for maintaining said engagement, tooth structure at the other end of second named follower for engaging the perfora-

tions of a motion picture film, said offsets so proportioned as to maintain last named engagement during the passage of one picture of said motion picture film.

2. In an intermittent movement for a film
5 in a motion picture machine a driving mechanism comprising a shaft and a flanged eccentric thereon, a link motion driven by said eccentric and comprising a link member pivoted at one end to said machine, a second link
10 member pivoted at one end to said first link member intermediate between the ends thereof, a cam follower attached to said second link at the other end, and engaging said eccentric, a third link member pivotally at-
15 tached at one end to the other end of said first link member, and adapted to slidably engage the flanges of said eccentric at a portion of said link member some distance from its
20 said end, a tooth structure on said third link member adapted to periodically engage perforations in said film, circumferential offset portions on said flanges for giving motion to said last named link member for said periodic
25 engagement with film perforations.

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